SEVENTH FRAMEWORK PROGRAMME

THEME [Ocean.2010-1]
[Quantification of climate change impacts on economic sectors in the Arctic]

Grant agreement for: Collaborative project*

Annex I - "Description of Work"

Project acronym: ACCESS

Project full title: " Arctic Climate Change, Economy and Society "

Grant agreement no: 265863

Date of preparation of Annex I (latest version): 2011-01-24

Date of last change: 2011-01-24

Date of approval of Annex I by Commission:

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Part A

Workplan Tables

A1:
Project summary

Project Number [1]	265863	Project Acronym [2]	ACCESS

One form per project

General information

Project title [3]	Arctic Climate Change, Economy and Society		
Starting date [4]	01/03/2011		
Duration in months [5]	48		
Call (part) identifier [6]	FP7-OCEAN-2010		
Activity code(s) most relevant to your topic [7]	Ocean.2010-1: Quantification of climate change impacts on economic sectors in the Arctic		
Free keywords [8]	Arctic climate change resource extraction oil spill economy shipping impact tourism fisheries sustainability governance geopolitics marine spatial planning pollution EU policies indigenous		

Abstract [9]

The Arctic is engaged in a deep climatic evolution. This evolution is quite predictable at short (year) and longer scales (several decades), but it is the decadal intermediate scale that is the most difficult to predict. This is because the natural variability of the system is large and dominant at this scale, and the system is highly non linear due to positive and negative feedback between sea ice, the ocean and atmosphere.
Already today, due to the increase of the GHG concentration in the atmosphere and the amplification of global warming in the Arctic, the impacts of climate change in the region are apparent, e.g. in the reduction in sea ice, in changes in weather patterns and cyclones or in the melting of glaciers and permafrost. It is therefore not surprising that models clearly predict that Artic sea ice will disappear in summer within 20 or 30 years, yielding new opportunities and risks for human activities in the Arctic.
This climatic evolution is going to have strong impacts on both marine ecosystems and human activities in the Arctic. This in turn has large socio-economic implications for Europe. ACCESS will evaluate climatic impacts in the Arctic on marine transportation (including tourism), fisheries, marine mammals and the extraction of hydrocarbons for the next 20 years; with particular attention to environmental sensitivities and sustainability. These meso-economic issues will be extended to the macro-economic scale in order to highlight trans-sectoral implications and provide an integrated assessment of the socio-economic impact of climate change. An important aspect of ACCESS, given the geostrategic implication of Arctic state changes, will be the consideration of Arctic governance issues, including the framework UNCLOS (United Nations Convention for the Law of the Sea). ACCESS dedicates a full work package to integrate Arctic climate changes, socioeconomic impacts and Arctic governance issues.

A2:
List of Beneficiaries

Project Number [1]	265863	Project Acronym [2]	ACCESS

List of Beneficiaries

No	Name	Short name	Country	Project entry month[10]	Project exit month
1	UNIVERSITE PIERRE ET MARIE CURIE - PARIS 6	UPMC	France	1	48
2	O.A. SYS - OCEAN ATMOSPHERE SYSTEMS GMBH	Oasys	Germany	1	48
3	NATURAL ENVIRONMENT RESEARCH COUNCIL	NERC	United Kingdom	1	48
4	INSTITUT FUR WELTWIRTSCHAFT	Kiel IfW	Germany	1	48
5	THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE	UCAM	United Kingdom	1	48
6	ALFRED-WEGENER-INSTITUT FUER POLAR- UND MEERESFORSCHUNG	AWI	Germany	1	48
7	SCHWARZ JOACHIM REINHOLD FRANZ	JSC	Germany	1	48
8	NOFIMA MARIN AS	NOFIMA	Norway	1	48
9	HAMBURGISCHE SCHIFFBAU-VERSUCHSANSTALT GMBH	HSVA	Germany	1	48
10	NORSK POLARINSTITUTT	NPI	Norway	1	48
11	METEOROLOGISK INSTITUTT	Met.no	Norway	1	48
12	FASTOPT GMBH	FastOpt	Germany	1	48
13	THE SCOTTISH ASSOCIATION FOR MARINE SCIENCE	SAMS	United Kingdom	1	48
14	KUNGLIGA VETENSKAPSAKADEMIEN	Beijer Institute	Sweden	1	48
15	P.P. SHIRSHOV INSTITUTE OF OCEANOLOGY OF RUSSIAN ACADEMY OF SCIENCES	SIO	Russian Federation	1	48
16	IMPAC OFFSHORE ENGINEERING GMBH	IMPaC	Germany	1	48
17	UNIVERSITAT POLITECNICA DE CATALUNYA	UPC	Spain	1	48
18	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	DLR	Germany	1	48
19	ARCTIC AND ANTARCTIC RESEARCH INSTITUTE	AARI	Russian Federation	1	48
20	ECONOMIC AND SOCIAL RESEARCH INSTITUTE	ESRI	Ireland	1	48
21	LAPIN YLIOPISTO	UoL	Finland	1	48

A2:
List of Beneficiaries

No	Name	Short name	Country	Project entry month[10]	Project exit month
22	SINTEF FISKERI OG HAVBRUK AS	SINTEF F&H	Norway	1	48
23	CICERO SENTER KLIMAFORSKNING STIFTELSE	CICERO	Norway	1	48
24	STIFTELSEN SINTEF	SINTEF	Norway	1	48
25	GESELLSCHAFT ZUR FORDERUNG DES ENERGIEWIRTSCHAFTLICHEN INSTITUTS AN DER UNIVERSITAT ZU KOLN GGMBH - EWI	EWI	Germany	1	48
26	LE CERCLE POLAIRE ASSOCIATION	LCP	France	1	48
27	BELUGA SHIPPING GMBH	BELUGA	Germany	1	48

A3:
Budget Breakdown

Project Number [1]	265863	Project Acronym [2]	ACCESS

One Form per Project

Participant number in this project [11]	Participant short name	Fund. % [12]	Ind. costs [13]	Estimated eligible costs (whole duration of the project)					Total receipts	Requested EU contribution
				RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D		
1	UPMC	75.0	T	2,001,792.40	0.00	227,479.00	222,200.00	2,451,471.40	0.00	1,741,023.00
2	Oasys	75.0	A	377,350.00	0.00	36,450.00	43,060.00	456,860.00	0.00	362,522.00
3	NERC	75.0	A	703,772.00	0.00	6,000.00	0.00	709,772.00	0.00	533,829.00
4	Kiel IfW	75.0	T	377,487.65	0.00	0.00	0.00	377,487.65	0.00	283,115.00
5	UCAM	75.0	T	716,719.42	0.00	1,500.00	0.00	718,219.42	0.00	539,039.00
6	AWI	75.0	S	362,816.28	0.00	0.00	0.00	362,816.28	0.00	272,112.00
7	JSC	75.0	F	150,972.00	0.00	0.00	0.00	150,972.00	0.00	113,229.00
8	NOFIMA	75.0	A	1,033,964.37	0.00	1,230.00	0.00	1,035,194.37	0.00	776,703.00
9	HSVA	75.0	A	550,134.00	0.00	1,500.00	0.00	551,634.00	0.00	414,100.00
10	NPI	75.0	A	491,810.00	0.00	0.00	0.00	491,810.00	0.00	340,033.00
11	Met.no	75.0	A	1,083,500.00	0.00	4,921.50	196,000.00	1,284,421.50	0.00	964,546.00
12	FastOpt	75.0	A	355,275.00	0.00	0.00	0.00	355,275.00	0.00	266,456.00
13	SAMS	75.0	T	735,403.04	0.00	1,500.00	0.00	736,903.04	0.00	553,052.00
14	Beijer Institute	75.0	T	888,777.50	0.00	0.00	21,600.80	910,378.30	0.00	688,183.00
15	SIO	75.0	F	146,640.00	0.00	0.00	0.00	146,640.00	0.00	109,980.00
16	IMPaC	75.0	A	410,301.70	0.00	0.00	0.00	410,301.70	0.00	307,726.00
17	UPC	75.0	A	462,200.21	0.00	1,500.00	25,000.00	488,700.21	0.00	366,900.00
18	DLR	75.0	A	468,107.00	0.00	0.00	0.00	468,107.00	0.00	351,080.00
19	AARI	75.0	F	180,396.00	0.00	0.00	0.00	180,396.00	0.00	135,297.00
20	ESRI	75.0	A	456,296.00	0.00	0.00	0.00	456,296.00	0.00	342,222.00
21	UoL	75.0	T	478,798.13	0.00	0.00	0.00	478,798.13	0.00	359,098.00

A3:
Budget Breakdown

Participant number in this project [11]	Participant short name	Fund. %[12]	Ind. costs[13]	Estimated eligible costs (whole duration of the project)					Total receipts	Requested EU contribution
				RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D		
22	SINTEF F&H	75.0	A	363,749.00	0.00	0.00	0.00	363,749.00	0.00	272,811.00
23	CICERO	75.0	A	352,304.00	0.00	0.00	0.00	352,304.00	0.00	264,228.00
24	SINTEF	75.0	A	501,725.00	0.00	22,757.00	0.00	524,482.00	0.00	399,050.00
25	EWI	75.0	S	73,595.00	0.00	0.00	0.00	73,595.00	0.00	55,196.00
26	LCP	50.0	F	205,800.00	0.00	0.00	0.00	205,800.00	0.00	102,900.00
27	BELUGA	50.0	F	128,076.00	0.00	0.00	0.00	128,076.00	0.00	64,038.00
Total				14,057,761.70	0.00	304,837.50	507,860.80	14,870,460.00	0.00	10,978,468.00

Note that the budget mentioned in this table is the total budget requested by the Beneficiary and associated Third Parties.

*** The following funding schemes are distinguished**

Collaborative Project (if a distinction is made in the call please state which type of Collaborative project is referred to: (i) Small of medium-scale focused research project, (ii) Large-scale integrating project, (iii) Project targeted to special groups such as SMEs and other smaller actors), Network of Excellence, Coordination Action, Support Action.

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project, and it cannot be changed. The project number **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

2. Project acronym

Use the project acronym as indicated in the submitted proposal. It cannot be changed, unless agreed during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry info force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a detailed justification on a separate note.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Activity code

Select the activity code from the drop-down menu.

8. Free keywords

Use the free keywords from your original proposal; changes and additions are possible.

9. Abstract

10. The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

11. The number allocated by the Consortium to the participant for this project.

12. Include the funding % for RTD/Innovation – either 50% or 75%

13. Indirect cost model

A: Actual Costs
S: Actual Costs Simplified Method
T: Transitional Flat rate
F :Flat Rate

Workplan Tables

Project number

265863

Project title

ACCESS—Arctic Climate Change, Economy and Society

Call (part) identifier

FP7-OCEAN-2010

Funding scheme

Collaborative project

WT1
List of work packages

Project Number [1]	265863	Project Acronym [2]	ACCESS

LIST OF WORK PACKAGES (WP)

WP Number [53]	WP Title	Type of activity [54]	Lead beneficiary number [55]	Person-months [56]	Start month [57]	End month [58]
WP 1	Climate Change and the Arctic Environment	RTD	6	360.60	1	48
WP 2	Marine Transportation and Tourism in the Arctic domain	RTD	7	246.90	1	48
WP 3	Fisheries	RTD	8	136.10	1	48
WP 4	Ressource Extraction	RTD	4	261.40	1	48
WP 5	Governance, Sustainable Development and Synthesis	RTD	3	150.00	1	48
WP 6	Project dissemination and exploitation of knowledge	OTHER	1	65.30	1	48
WP 7	Management	MGT	1	18.50	1	48
WP 8	Scientific coordination	RTD	1	32.00	1	48
			Total	1,270.80		

WT2:
List of Deliverables

Project Number [1]	265863	Project Acronym [2]	ACCESS

List of Deliverables - to be submitted for review to EC

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.11	Report on successful test of Quantitative network design	1	12	19.60	R	PU	30
D1.21	Assessment of the accuracy of OSI SAF ice products	1	11	11.00	R	PU	22
D1.22	Report on Aug/Sep 2011 melt pond statistics and thermodynamics, fed to WP1 modelling for use in pred	1	10	33.00	R	PU	26
D1.23	Report on analysed data from IMBs	1	13	28.00	R	PU	34
D1.24	Integrate additional satellite sensors into daily ice drift map production to improve summer (melt s	1	11	12.00	D	PU	14
D1.25	Completed analysis on previous submarine voyages and delivery of report on single-beam thickness dis	1	5	18.00	R	PU	27
D1.26	Report on ridge shapes and distributions for extreme value analyses in WP2, WP4 and under-ice ecos	1	5	18.00	R	PU	34
D1.27	Report on 2012 and 2013 AUV missions re.altimetry validation, ridge	1	5	19.00	R	PU	38

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	permeability analysis for oil in						
D1.28	Regional distribution of melt onset and freeze up on an annual basis.	1	1	8.00	R	PU	28
D1.29	Report on altimeter sea-ice thickness errors due to ice type, geometry and snow pack effects	1	1	27.00	R	PU	26
D1.31	Report on historical analysis of change in Russian Arctic ocean conditions 1920/40 versus 1990/2010	1	15	18.00	R	PU	34
D1.34	Report from AARI on analysis of recent oceanographic voyages in Russian Arctic	1	19	23.00	R	PU	31
D1.41	User guide containing quality assessment of Arctic weather station and buoy data	1	11	12.00	D	PU	14
D1.42	Monthly evolution of the FDD integrated all over the Arctic and redistributed over subarctic areas f	1	1	7.00	R	PU	25
D1.51	Results of Arctic ocean-sea ice downscaling runs validated and documented	1	6	37.00	R	PU	38

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.52	Assessment of inter-annual variability in Arctic pollutant sources and impact of soot deposition	1	23	7.00	D	PU	47
D1.61	Climate response analysis of improved model processes (sea-ice and soot) and from higher resolution	1	11	10.00	D	PU	47
D1.71	Radiative forcing estimates for perturbation in the Arctic of short lived climate compounds	1	23	7.00	R	PU	36
D1.72	Model output from CTM studies of the impact of composition changes from changes in emission	1	23	7.00	D	PU	30
D1.81	Report on forecast quality and assessment of state and impacts of the components of the Arctic obser	1	11	12.00	R	PU	26
D1.82	Future scenarios for evolution of the observing system for Arctic short-range forecasting	1	11	12.00	R	PU	42
D1.83	Report on assessment of forecast skill	1	2	15.00	R	PU	46
D2.11	Historical ice conditions and its influence on	2	19	8.00	R	CO	12

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	navigation on NSR						
D2.12	Navigation efficiency on NSR and in difficult shipping zones as affected by Climate Change	2	19	7.00	R	CO	24
D2.13	Recent ice conditions in the Arctic + recommended navigation routes	2	19	8.00	R	CO	36
D2.14	Assessment of current monitoring and forecasting requirements from users and international providers	2	11	3.00	R	PU	12
D2.15	Assessment of future monitoring and forecasting requirements based on scenarios supplied by WP1	2	11	2.00	R	PU	44
D2.16	Report presenting results of ICEROUTE calculations of traveling time for different scenarios and ro	2	9	5.00	R	PU	36
D2.21	Review of rules and regulations for Arctic shipping/ recommendation for changes due to Climate Chang	2	9	7.00	R	PU	42
D2.31	Infrastructure needs according to AMSA	2	5	3.00	R	CO	20

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	and other investigations						
D2.41	Air pollution and surface deposition related to present and future Arctic shipping	2	18	56.40	R	CO	48
D2.42	Calculation of fuel consumption per mile for various ship types and ice conditions in past,present a	2	9	5.00	R	PU	37
D2.43	Investigation of the decrease of ice by Arctic shipping and an assessment of potential governance s	2	18	7.00	R	CO	24
D2.44	Noise propagation from commercial fishing and vessel traffic in the Arctic today and in the future	2	17	21.00	R	PU	25
D2.45	Modelling, measuring and mitigating noise pollution in the Arctic	2	17	13.00	R	PU	36
D2.51	Design and fabrication of lateral stress sensor and measuring lateral stresses in Arctic ice	2	9	9.00	R	PU	45
D2.52	QND analysis of future Arctic Observing System for safe marine transport under changing climate	2	2	16.50	R	PU	48

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D2.53	Threat by icebergs and ice massifs to Arctic Shipping	2	27	2.30	R	PU	36
D2.61	Socio-economic costs and benefits of Arctic transport	2	20	23.00	R	PU	36
D2.62	Results of downscaled and adjusted HTM 1,4 model runs under various tourism scenarios of socio-econo	2	20	24.00	R	PU	48
D2.63	Comparison of transport costs and time for sailing from Hamburg to Yokohama via Northern Sea Route	2	27	4.00	R	PU	48
D2.71	Evaluation of ACCESS Arctic shipping research in view of a shipping company	2	27	4.00	R	CO	48
D2.72	User requirements for shipping in the Arctic	2	27	4.00	R	PU	45
D2.81	Identification of governance challenges facing MarineTransport on all Arctic Routes	2	5	5.70	R	CO	40
D2.82	Identification of WP2 governance related issues on Arctic Shipping and Tourism	2	7	6.00	R	CO	42

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D2.91	Indicators for sustainable development of Marine Transport and Tourism in the Arctic	2	7	3.00	R	CO	45
D3.11	Economic impacts of global warming on fisheries	3	8	19.00	R	PU	37
D3.21	Climate change and Arctic aquaculture	3	8	24.10	R	PU	37
D3.31	Market responses to climate change	3	8	19.00	R	PU	48
D3.41	Economic settings, societal and cultural priorities in the fishery and aquaculture sectors Past and	3	21	11.00	R	PU	30
D3.42	International and national fishery management, adaptation practices and strategies to climate-relate	3	21	10.00	R	PU	48
D3.51	Results from field experiments in the Arctic	3	14	28.00	R	PP	48
D3.52	Yearly report on ethical issues	3	17	1.00	R	PU	13
D3.53	Yearly report on ethical issues	3	17	1.00	R	PU	25
D3.54	Yearly report on ethical issues	3	17	1.00	R	PU	37
D3.55	Yearly report on ethical issues	3	17	1.00	R	PU	48
D3.61	Climate change impacts, and human responses, affecting	3	17	10.00	R	PU	37

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	traditional whaling						
D3.71	Indicators for sustainable development in the Arctic fisheries sector	3	8	11.00	R	PP	37
D4.11	The impact of Arctic energy supply	4	4	29.00	R	PU	42
D4.12	Implications of Arctic energy supply for European policies	4	4	14.00	R	PU	47
D4.21	Report on fixed as well as floating offshore structure concepts	4	9	14.60	R	PU	37
D4.22	Report on the use of subsea systems	4	16	14.00	R	PU	37
D4.23	Winterization of structures in arctic regions	4	9	10.00	R	PU	42
D4.31	Report on rescue and evacuation systems	4	16	16.00	R	PU	31
D4.41	Oil spill response capabilities and technologies in ice-free and ice-covered water	4	13	7.00	R	PU	11
D4.42	The behaviour of oil types in cold water	4	13	11.00	R	PU	30
D4.43	Iceberg remote detection, trajectory forecasting, and tracking	4	11	9.00	R	PU	40
D4.44	Report on oil flow under ice	4	24	10.00	R	PU	43

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D4.45	Recommendations on future Arctic observing systems	4	12	16.80	R	PU	47
D4.51	Interactive noise maps of exploration/ exploitation sites	4	17	7.00	R	PU	18
D4.52	Simulator of the effects of noise from oil industry operations on marine mammals	4	17	13.00	O	PU	25
D4.53	Emissions of a large set of atmospheric compounds in gas/oil extraction facilities	4	1	10.00	R	PU	25
D4.54	Identification of ecologically vulnerable areas	4	17	8.00	R	PU	25
D4.55	Report on the ocean properties of the Barents Sea region	4	1	13.00	R	PU	30
D4.56	Design and conceptual implementation of a real-time acoustic architecture	4	17	16.00	R	PU	37
D4.57	Safety zones and noise exposure criteria for marine mammals exposed to anthropogenic noise	4	15	14.00	R	PU	37
D4.58	Report on the impact of emissions from oil/gas wells	4	1	13.00	R	PU	42
D4.61	Report covering potential	4	3	8.00	R	PP	30

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	cross-sectoral governance options						
D4.71	Indicators for sustainable development	4	4	8.00	R	PP	43
D5.11	Analysis and synthesis of extant and developing regulatory frameworks	5	3	12.00	R	RE	13
D5.12	NEAFC enlargement project review	5	26	5.00	R	CO	37
D5.21	Production of current governance options for ACCESS sectors/themes	5	3	12.00	R	RE	14
D5.31	Assessment of inputs regarding climate change effects and impacts on extant regulatory systems – der	5	3	13.00	R	RE	18
D5.41	Production of summary of governance options over ACCESS time period (ca 30 years)	5	3	13.00	R	RE	48
D5.51	Scientific and ethical evaluation of the impact of indigenous seal hunting	5	26	6.00	R	PU	37
D5.61	Operational conditions of an effective participation of Arctic indigenous people in the future Arcti	5	26	8.00	R	PP	24

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.71	Conditions for integrated ecosystem based management in the Arctic	5	14	42.00	R	RE	48
D5.81	Development of Marine Spatial Planning concept and principal framework	5	3	13.00	R	RE	13
D5.82	Final test and delivery of Marine Spatial Planning tool	5	3	13.00	R	RE	37
D5.91	Report on Cross-sectoral synthesis of economic, policy and governance options for sustainable develo	5	3	13.00	R	PU	48
D6.11	Annual dissemination and exploitation report and plan	6	1	2.80	R	RE	13
D6.12	Annual dissemination and exploitation report and plan	6	1	3.00	R	RE	25
D6.13	Annual dissemination and exploitation report and plan	6	1	3.00	R	RE	37
D6.14	Annual dissemination and exploitation report and plan	6	1	3.00	R	RE	48
D6.21	Creation of the dedicated website	6	1	2.00	R	PU	6
D6.22	Updated list of ACCESS related interested parties of the	6	1	2.00	R	PU	8

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	four target groups and list of participants						
D6.23	ACCESS contribution to ACIA report	6	1	2.00	R	PU	48
D6.24	Dedicated Policy Briefs	6	1	2.00	R	PU	12
D6.25	Dedicated Policy Briefs	6	1	2.00	R	PU	24
D6.26	Dedicated Policy Briefs	6	1	2.00	R	PU	36
D6.27	Dedicated Policy Briefs	6	1	2.00	R	PU	48
D6.31	Creation and updating of a data management system - climate	6	11	8.00	R	PU	6
D6.32	Creation and updating of data management system – non-climate	6	3	5.50	R	PU	6
D6.211	Newsletter quarterly issue	6	1	2.00	R	PU	6
D6.212	Newsletter quarterly issue	6	1	2.00	R	PU	10
D6.213	Newsletter quarterly issue	6	1	2.00	R	PU	14
D6.214	Newsletter quarterly issue	6	1	2.00	R	PU	18
D6.215	Newsletter quarterly issue	6	1	2.00	R	PU	22
D6.216	Newsletter quarterly issue	6	1	2.00	R	PU	26
D6.217	Newsletter quarterly issue	6	1	2.00	R	PU	30
D6.218	Newsletter quarterly issue	6	1	2.00	R	PU	34
D6.219	Newsletter quarterly issue	6	1	2.00	R	PU	38

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.220	Newsletter quarterly issue	6	1	2.00	R	PU	42
D6.221	Newsletter quarterly issue	6	1	2.00	R	PU	46
D6.251	1st ACCESS summer school	6	2	1.00	R	PU	18
D6.252	International workshop	6	17	1.00	R	PU	24
D6.253	2nd ACCESS summer school	6	14	1.00	R	PU	36
D6.254	Stakeholders' workshop	6	21	1.00	R	PU	25
D7.01	Gender Action Plan	7	1	2.00	R	RE	6
D7.02	Steering Committee meeting minutes	7	2	1.00	R	RE	7
D7.03	Steering Committee meeting minutes	7	2	1.00	R	RE	14
D7.04	Steering Committee meeting minutes	7	2	1.00	R	PP	19
D7.05	Steering Committee meeting minutes	7	2	1.00	R	PP	26
D7.06	Steering Committee meeting minutes	7	2	1.00	R	PP	31
D7.07	Steering Committee meeting minutes	7	2	1.00	R	PP	38
D7.08	Steering Committee meeting minutes	7	2	1.00	R	PP	43
D7.09	Steering Committee meeting minutes	7	2	1.00	R	PP	48
D7.10	Report on Stakeholders/ End-users	7	2	1.00	R	PU	13

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.11	Report on Stakeholders/ End-users	7	2	1.00	R	PU	25
D7.12	Report on Stakeholders/ End-users	7	2	1.00	R	PU	37
D7.13	Advisory Board meeting minutes	7	1	1.00	R	PU	13
D7.14	Advisory Board meeting minutes	7	1	1.00	R	PU	25
D7.15	Advisory Board meeting minutes	7	1	1.00	R	PU	37
D7.16	Implementation of the Gender Action Plan	7	1	2.50	R	PU	48
D8.01	final report on the conclusions/ perspectives of the External Boards about the ACCESS activities	8	1	30.00	R	PU	48
D8.02	Composition of the advisory board	8	1	2.00	R	PU	6
			Total	1,270.80			

WT3:
Work package description

Project Number [1]	265863	Project Acronym [2]	ACCESS

One form per Work Package

Work package number [53]	WP1	Type of activity [54]	RTD
Work package title	Climate Change and the Arctic Environment		
Start month	1		
End month	48		
Lead beneficiary number [55]	6		

Objectives

1. Building an infrastructure for quantitative network design for observing the Arctic system
2. Provide the project with information on the current status and changes of the Arctic sea ice during the duration of the project
3. Analysing past changes and current state of the Arctic Ocean
4. Mapping atmospheric circulation changes over the Arctic
5. Provide the other WPs with projections and estimates of uncertainties for future developments on time scales of up to several decades
6. Evaluation of the impact of airborne and deposited soot aerosols on climate, of improved sea-ice representation and increased atmospheric model resolution
7. Assessment of the contribution of local and remote anthropogenic and natural sources on air pollution, acidification and climate in the Arctic
8. Assessment of future short-term forecasting capabilities.

Description of work and role of partners

Description of work (broken down into tasks , and role of participants)

Task 1.1 Building of an infrastructure for quantitative network design (FastOpt, OASys)
An open question is how to best use the available financial resources for observing the Arctic system. What is a cost efficient way to monitor the physical environment relevant for the four economic sectors (WPs 2-4)? How much effort should be put, for instance, into improving remote sensing data and how much effort should be put into the improvement of in-situ observational networks? Such questions can be only addressed by modelling and quantitative network design for which a tight interaction with “observers” is essential.
Objective: Building of a computational infrastructure for quantitative network design, i.e. the mathematically rigorous evaluation of observational networks in terms of the constraint they provide on simulated 'target quantities' of interest. The specification of the target quantities depends on the application, e.g. sea ice cover affecting rigid technical structures. The constraint will be quantified in terms of the probabilistic uncertainty (1-sigma range) of the target quantity.
Input: The variational assimilation system NAOSIMDAS of FastOpt and OASys.
Output: A tested quantitative Arctic Observational Network Design (AOND) system. The system will be applied in WP2 (task 2.5.2) and WP4 (task 4.3.4) in configurations relevant for questions in the respective economic sectors.
Tasks: The activities involve
• generation of 2nd derivative (Hessian) code by automatic differentiation of NAOSIMDAS
• implementation of a framework for propagating uncertainties (induced by observational and model errors) from observations to the control variables and then for projecting them onto the target quantities.
• running the system for test cases.
Task 1.1 addresses objective 1 of WP1. The system to be built in WP1 will be applied in WP2 and WP4 in configurations relevant for questions in the respective economic sectors.

Task 1.2 Developments in Arctic sea ice
Task 1.2 addresses objective 2 of WP1.

Task 1.2.1 Monitoring ice extent and type using satellite data (met.no)
Daily maps of Arctic-wide sea ice extent (concentration and ice edge), type, and drift will be automatically produced by the EUMETSAT Ocean and Sea Ice Application Facility (OSI SAF) High Latitude Processing Centre at Met.no. The passive microwave satellite data used to generate these products have recently undergone reprocessing to standardize and remove inconsistencies between different satellites covering the period 1978 to present. The sea ice type product has also been updated to utilise ASCAT scatterometer data. This OSI SAF Reanalysis data will be used for the analysis in ACCESS.
Validation statistics will be generated through comparison with gridded data from the high resolution operational analysis ice charts of the European Arctic sector (East Greenland to the Kara Sea) produced by the Norwegian Ice Service at Met.no, and for the rest of the Arctic by equivalent charts from the Canadian and U.S. ice services. Operational ice charts are generated manually by experienced ice analysts interpreting all the available satellite data including high resolution optical, Envisat ASAR, and Radarsat-1/2, and are considered the closest equivalent to ground truth by the climate modelling community. Met.no will report on the accuracy of the OSI SAF automated products which will include data determining the level of inaccuracy during the period 1978 to present. Other experienced partners will also contribute observational information to improve the assessment.

Task 1.2.2 Monitoring snow, sea ice thermodynamics and sea ice drift (met.no, NPI, SAMS, UPMC-LOCEAN);
Sea ice thermodynamics in changed climatic conditions will be mapped over the critical area of the Russian Arctic by implanting 20 IMBs (ice mass balance buoys) over this sector, 10 in autumn 2011 and 10 in autumn 2012. The IMBs measure snow and ice thickness and upper ocean structure, and hence show the spatial and temporal evolution of sea ice and near-surface ocean properties. The information will be supplied to WP2 for ship routing analyses and WP4 for oil exploitation analysis, as well as used in testing the WP1 models. 10 of the buoys will be supplied by SAMS and a further 10, of a different type, by LOCEAN.
The motion field given by the buoys will enable us to examine the role of dynamics, including transient motions, in the sea ice evolution, and also the data will be used by the WP1 OGCMs (task 1.5). On a coarser scale, the motion field is also given by the OSI SAF low resolution ice drift product, provided by met.no. The OSI SAF drift product will be extended to cover the summer season as it is currently not reliable from the onset of melting (May) through to the start of freezing (October). This seasonal gap in the data production is quite a serious issue for ingestion and assimilation in geophysical models, since it might strongly reduce the seasonal forecasting skills of summer sea ice conditions. Met.no aims to enhance the OSI SAF sea ice drift product for reliable estimates during summer by using other satellite sensors. The new data will be applied in NAOSIMDAS (see subtask 1) and is intended as a direct input to such a system.
Melt ponds substantially alter the properties of sea ice, reducing its albedo, accelerating melting, increasing light availability under the ice for phytoplankton and altering its mechanical properties. Melt pond characteristics (area fraction, size) vary significantly between firstyear (FY) and multiyear (MY) ice. The increasing fraction of FY ice may thus accelerate the melt due to ponding. NPI will study melt pond properties on small (cm, m) to regional scales (1-100 km), combining in situ instrumentation at ponded/not ponded neighbouring sites with aerial photography and EM bird surveys, using helicopter flights from the Lance and/or from land (Svalbard).
In situ work will measure fluxes (radiation, heat, salt) above and below the ice. Work will focus on the NE Svalbard/Barents and Fram Strait regions in summer/late summer 2011 and 2012.

Task 1.2.3 Improving ice thickness measurement using radar or laser altimeters. (UPMC-LOV)
The European CryoSat-2 satellite is held as the future for basin-scale sea ice thickness monitoring, transforming the radar-measured freeboard into ice thickness. This transformation is fraught with problems which have not been resolved, however. Errors centre on the effects of inhomogeneous ice type, roughness or the presence of open water within the radar footprint. In addition, the radar reflection has been shown to occur within the overlying snowpack, instead of the ice-snow interface, as assumed. These errors will be estimated using a combination of additional satellite instruments, field measurements and modelling. We will also investigate the transformation between surface elevation and ice draft on the scale of the radar footprint using co-incident 3D maps of the underside (using AUV sonar) and above (using airborne laser).
UPMC-LOV will re-assess Cryosat ice thickness values on a regional and seasonal basis, providing improved thickness estimates to all WPs, with appropriate error-bars. This will have a significant impact on, for instance, the modelling effort, which may otherwise attempt to match model output to inappropriately-constrained figures from the satellite.

Task 1.2.4 Monitoring ice underside topography in detail using AUVs and submarines equipped with multibeam sonar (UCAM)
The only method available to measure both the full probability density function of ice thickness and the actual three-dimensional shape of the ice underside is sonic profiling from below, notably with 3-D multibeam sonar.

2-D profiling using single-beam sonar has been done in Europe since 1971 using UK submarines, with P Wadhams (UCAM) being responsible for scientific data gathering and analysis. This yielded the first evidence of Arctic ice thinning. In ACCESS UCAM will complete the analysis, interpretation and databanking of all recently past (1991 - 2007) upward sonar profiles of ice draft generated by UK submarines, linking the results with a similar databank being constructed by the US Unified Sea Ice Thickness Data Record project. The ACCESS databank will be held in the European Environment Agency, Copenhagen. The submarine chart records are scanned, corrected and reduced, and are used to generate statistics of the distributions of ice draft; pressure ridge depths, spacings and slope angles; lead widths and spacings; and ice thicknesses in leads. UCAM will ensure that newly-analysed recent ice data is fed in a timely way to the modelling groups in ACCESS. A substantial addition to the dataset will be obtained in March 2013 when a UK submarine crosses the Arctic to the Beaufort Sea and back, with extensive work in the MY ice region north of Greenland and Ellesmere Island. UCAM will collect upward sonar data along the entire length of the track, and will also install a Kongsberg EM2040 multibeam sonar to obtain high-quality 3-D imagery of the ice underside. The multibeam sonar is vital; the mosaicking of the 3-D ice bottom structure enables the volume of oil contained by unit area of ice cover to be modelled in Monte Carlo simulations (for WP4); the extreme MY ridge dimensions (depth, slope, length) and the resulting design load to be modelled for offshore structures (WP4) and ships designed for autonomous or escorted transits (WP2); and ice roughness to be used as a variable in the estimation of under-ice ecosystem composition (WP3).
UCAM will complement this important dataset by two ice camp experiments using a small through-ice AUV to obtain high-resolution 3-D multibeam imagery of limited regions of the underside which are covered by a careful surface programme of snow and ice properties studies. The direct purposes are: (i) to improve our confidence (and obtain realistic error bars) in the derivation of ice thickness from freeboard as generated routinely by the CryoSat-2 altimeter (to assist WP1 task 1.2.4, and involving help by NPI and UPMC-LOV); (ii) to study at high resolution the along-crest depth variability and the across-crest liquid permeability of pressure ridges, to improve the representation of ridges as an oil-confining feature in the oil spill containment model of WP4; (iii) to improve the representation of MY ridges in ice strength calculations (for structure design in WP4 and ship design in WP2), given that recent 3-D observations in 2007-8 have suggested that under conditions of faster melt MY ridges break up into individual blocks rather than retaining a continuous structure, allowing for the possibility of reduced maximum strengths; (iv) to more accurately represent the texture, i.e. small scale roughness characteristics, of the undeformed FY and MY ice as a contribution to ecosystem analysis in WP3, since under-ice plankton populations are seen to vary as a function of roughness and undeformed ice depth. .The higher resolution of a low-speed vehicle operating close to the ice enables the block structure of a ridge to be fully delineated. The experiments will be done in spring 2012 from the SATICE camp north of Ellesmere Island and in spring 2013 from the APLIS-2013 camp in the Beaufort Sea (the second to be funded from non-ACCESS sources).

Task 1.3 Analysing past ocean change and present conditions
Task 1.3 addresses objective 3 of WP1 by providing the project partners with oceanic observations of currently occurring transformations. The task also contains an assessment of past changes in the oceanic conditions in the Arctic. Over the time horizon of the project, natural variability will play an important role in the Arctic climate system. Natural variability can still be as large as anthropogenic changes and is the largest obstacle for reliable projections over the next 10 to 20 years. The uncertainty is especially large in the case of the ocean because it is governed by processes on longer intrinsic time scales than the atmosphere or sea ice. Observed anomalies must be put into the perspective of past observed changes, especially those that took place before anthropogenic effects were noticeable. Specifically, we shall analyse the most recent warm period of the Atlantic Multidecadal Oscillation (AMO) which happened during the period 1920 – 1940 in the Arctic. Due to the periodicity of approximately 60 to 70 years of the AMO, we are currently in another warm phase which accelerated the Arctic warming in recent years. Comparison of past and current changes in the ocean will allow a better assessment of the anthropogenic contribution to recent changes. It will also help to assess the changes to be expected in the next decades.

Task 1.3.1 Past change (SIO)
The Arctic warming 1920-1940 was recognized and discussed intensively in Russian publications in the middle of the previous century. We can not find a comparable volume of facts related to that event within publications in others languages. The previous Russian analyses and, more importantly, observations, are still unknown to the international community. Moreover, most of the observations are only available as maps and tables and need to be transferred into digital form. SIO will access the longest archived ocean datasets related to the ocean structure of the Arctic and sub-Arctic, particularly in the Eurasian sector. These datasets will be made accessible by digitizing the oceanographic and sea ice data from nearly 100 Russian reports, papers, and books issued

before 1960. The collection of source materials is already available as e-copies. SIO will perform a comparative analysis of observed ocean and sea ice conditions during the 1920-1940 Arctic warm period and recent data to better understand how the recent warm period differs from earlier ones. This analysis contains a reconstruction of the position of the ice margin in the Barents Sea, Barents Sea water mass properties including heat content, and other physical parameters of water and sea ice of the Barents Sea. Historical data will be prepared for use by numerical models of other ACCES

Task 1.3.2 Present conditions (UPMC-LOCEAN, AARI)
LOCEAN (UPMC) will deploy acoustically navigated floats which are developed as part of the EU ACOBAR FP-7 project to monitor the ocean structure under ice in the Alpha Ridge region North of Canada (Eureka). This allows ACCESS to use this new technology in an appropriate and relevant manner at minimal cost (logistic costs for deployments only). The floats are also equipped with ULS and will thus also contribute to task 2.5, monitoring ice thickness. Using Sea glider technology, LOCEAN (UPMC) will concentrate on the Barents Sea and the seasonal sea ice zone that is undergoing the largest variation as far as sea ice, ocean and atmosphere is concerned. LOCEAN (UPMC) will perform these investigations for ACCESS in close cooperation with modelling activities and WP4 Task 4.5.2.
AARI will carry out processing and analysis of oceanographic data from “Akademik Fedorov’s” 2007 and 2008 cruises and oceanographic data from manned station drifts in 2007-2009. There will be a continuation of monitoring studies along the Eurasian continental margin between Franz Joseph Land and East Siberian Sea and at manned drifting stations, including probable mooring deployments and deployments of e.g. IMBs and thermistor chains.
The 2007-2009 data will be compared with statistical analyses of collected new data to feed process modelling: heat/salt fluxes from Atlantic Water to the pycnocline/mixed layer/ice; joint analyses of satellite-based and ship-based ice data (concentration and thickness) and thermohaline data; application of bulk models, 1D mixing models and simplified process models for flux estimation and hypotheses testing; testing of parameterization of fluxes used in numerical models; and preparation of information arrays for models validation/tuning. The specific structure of the arrays chosen will be discussed with modellers on the basis of the needs of WP2-5.

Task 1.4 Mapping atmospheric circulation changes from weather stations and data buoys (met.no) and model data reanalysis (UPMC/LOCEAN).
All available data from weather stations and data buoys over the Arctic will be quality controlled and made available to other WPs in coordination with the data management task of WP6. Met.no has its own archive of weather station data from stations in Norwegian territory, including Svalbard. These will be reprocessed to the standard data format suitable to be used in the ACCESS databank and combined with records we are able to obtain from other nations (Russia, Denmark, Canada and USA). Buoy data will be obtained from the International Arctic Buoy Programme (IABP). Some of these data will also be used in an assessment of Arctic atmospheric forecasting capabilities in subtask 3.4. Task 1.4 contributes to objective 4 of WP1.LOCEAN (UPMC) will continue the work initiated during DAMOCLES and taking advantage of the atmospheric data reanalysis (ERA Interim) for estimating the Arctic winter index based on the Freezing Degrees Days (FDD) concept. This work will be done in close cooperation with task 1.8

Task 1.5 Climate model scenarios
Task 1.5 addresses objective 5 of WP1 by evaluating current climate model results regarding their ability to reproduce Arctic processes and recent observed changes in the Arctic. Results of such an evaluation are estimates of uncertainties in climate model projections and the identification of superior climate model results that can be used as input to tasks in other workpackages.
Task 1.5.1 Assessment of existing and upcoming climate results (CMIP3, CMIP5 and STORM) regarding recent trends and variability (AWI)
To determine the capability of current climate models we will undertake a comprehensive assessment of coupled climate model results for the last decades. We will use historical data and observational data from the project (tasks 1.2, 1.3, and 1.4) as well as results from models constrained by observations (especially ocean-sea ice hindcasts). Climate model results will be taken from public databases (like PCMDI) and from efforts partners are involved in (like STORM). The evaluation will focus on the representation of sea ice, on near surface ocean conditions, and atmospheric parameters, their seasonal and internannual variability, and their trends. Because of the importance of extreme events for the feasibility and safety of socio-economic activities, we will assess the ability of the models to reproduce late 20th century observed variability on interannual to sub-seasonal scale over the next 30 to 50 years; changes in the frequency, locality, and intensity of extreme weather events like cyclones; potential changes in oceanic current systems and hydrography; changes in the exchanges between

the Arctic Ocean and the Pacific and Atlantic oceans through various gateways; as well as changes in impacts on the coastal zone due to changed ice conditions, and oceanic and atmospheric flows.

Task 1.5.2 Evaluation of future scenarios in the Arctic domain to provide parameters of importance to economic systems as input to WPs 2 – 5 (AWI).
We will analyse results of selected climate models for future scenarios. These models will also be used to provide boundary conditions of dedicated high-resolution ocean-sea models for downscaling and simulation regarding specific scenario simulations for the next decades. Besides scenario calculations, we will utilize the upcoming decadal predictions of CMIP5 to achieve estimates that also incorporate a better representation of the phase of natural long-term variability of the climate system. This is especially important on the relatively near future (two to three decades) ACCESS will focus on.

Task 1.5.3 Application of dedicated high-resolution ocean-sea models for downscaling and simulation regarding specific scenario simulations for the next decades. (AWI)
Depending on the results of sub-task 1.5.2, atmospheric variables from climate scenario simulations will be used to force the detailed ocean-sea ice model NAOSIM. Simulations will be carried out for the next decades. This downscaling will result in improved ocean and sea ice simulations compared to the much coarser resolution coupled climate models. Many oceanic and sea ice processes that are influenced by details of the bottom topography and coast line will be better represented and thus provide potentially improved assessment of the impact of climate change especially in the shallow shelf seas and regarding the exchanges between the shelf seas and the interior Arctic ocean.

Task 1.6 Scenarios and process impacts in a comprehensive earth system model (met.no)
The Norwegian Earth System Model (NorESM) is a comprehensive global climate and earth system model. The model is preparing CMIP5 production runs for the IPCC AR5 to be finished during spring 2011. The multi-model evaluations in task 1.5 will probably include these NorESM results. In task 1.6 this will be supplemented and elaborated further by employing NorESM to address processes pertaining to the Arctic, or process descriptions which are prone to cause large uncertainties in the modelled Arctic climate. Thus, task 1.6 contributes also to objective 5 of WP1.
Three such items are planned to be studied in depth: increased atmospheric resolution, improved sea-ice representation, and the climate effects of airborne and deposited soot aerosols. With this, task 1.6 addresses objective 6 of WP1. Depending on the understanding gained from task 1.5, one of these items may be exchanged for another if appearing scientifically more interesting as well as computationally feasible.
The experiments will be firmly based on the CMIP5 data provided to IPCC AR5, and will all start from states (a single, or an ensemble of three if computer resources permit) calculated by NorESM with standard resolution. Bias-corrections relative to observations and re-analyses will be evaluated. Spin-up producing redundant data over the first 2-3 decades is expected, in order to minimize unphysical shock effects. These experiments will start after the regular CMIP5 production, and after experience from Task 1.5 is gained (2012 and later).

1.6.1 High-resolution time slices
The CMIP5 production runs with NorESM are made with a mesh width of approximately 1.9x2.5 degrees in the atmosphere. Experience from preliminary experiments with NorESM and with the CCSM4 and CESM1 models run at NCAR, USA, indicates considerably reduced systematic errors when the resolution is doubled. This in itself provides a valid reason for doubled resolution for selected experiments. Furthermore, many impact studies needs data of higher geographical resolution, but the considerable uncertainty associated with sea-ice and snow cover renders regional downscaling by dynamical or statistical methods of limited value. In stead we propose to use NorESM with double resolution (1.0 by 1.2 degrees) for selected multi-decadal time-slices. The experiments will partly be made for climate forcing valid for the later half century and partly for a selection of CMIP5 RCP scenarios for the coming century. Some emission data will be based on scenarios for new economic activities inside the Arctic estimated in ACCESS (WP2).

1.6.2 Effects of soot aerosol
NorESM is particularly well suited to study the climate impacts of anthropogenic (and natural) aerosols. In the Arctic, the light-absorbing properties of aerosols are in particular important due to the natural high albedo of sea-ice, snow and glaciers. Soot and dust will drive the regional contribution to the radiative forcing in the positive direction. New emissions in the Arctic region due to new economic activities are particularly potent, and NorESM is ready to be applied for such studies, as well as general studies of the effects

1.6.3 Improved sea-ice model

The sea-ice module in NorESM is basically the CICE model imported from NCAR, USA. Parts of this model will be developed further emphasizing a better separation between multi-year ice from recently formed ice. This will include a better description of the effects of melt-water ponds during summer. Together with soot on snow and sea-ice, these improvements may yield a better sea-ice extent under present climate conditions and presumably more realistic future scenarios.

Task 1.7 Impacts of aerosols, greenhouse gases, and contaminants in global models (UPMC-LATMOS, CICERO, met.no)
Task 1.7 is the major effort to address objective 7 of WP1. The NorESM studies in task 1.6 will be complemented by a quantification of the distribution of long-lived greenhouse gases (GHGs) using the Simple Climate Model (SCM). Radiative forcing calculations due to the various climate forcing mechanisms from emissions influencing the Arctic region will be performed in a consistent way for the short-lived and long-lived gases CO2, CH4, N2O, and ozone. An analysis of several aerosol components will be considered in the calculation of the radiative forcing of the direct aerosol effect, including sulphate, organic carbon (primary and secondary), black carbon (soot), and nitrate. This work will be done together with met.no also using the Earth System model NorESM which has a comprehensive scheme for aerosols including interaction with clouds. We will calculate the radiative forcing of surface albedo change due to emissions of soot in the Arctic region. Spatial distribution of all climate forcing mechanisms will be provided and sensitivity experiments on how changes in ice/snow cover impact the radiative forcing mechanisms. The work will include a detailed comparison of surface albedo of snow and ice from the model with satellite observations (MODIS, MISR, GlobAlbedo products). A detailed determination of the surface albedo and its changes is essential for the radiative forcing calculations in the Arctic region.
Inter-annual variability in pollutant transport from lower latitudes into the Arctic will be analyzed using multi-year runs of global chemistry-aerosol models including 2 offline models (MOZART, Oslo CTM2) as well as the chemistry-climate model, NorESM. This task will also examine changing contributions of remote and local sources given changes in air pollution legislation (related to updates in the Convention on Long-Range Transport of Air Pollutants, CLRTAP) in source regions (Asia, Europe, North America) and possible increases in local pollution sources in the future. CO-like tracers will be used to examine the evolving contribution of different source regions. Changes in future transport patterns, possibly related to, for example changes in the North Atlantic Oscillation (NAO) will also be analysed using simulations of the Oslo CTM.

Task 1.8 Monitoring and forecasting for a short time range
This task directly addresses objective 8 of WP1 by assessing the forecasting capabilities on a short time range (hours to days) which is of importance for performing Arctic economic activities. Particular emphasis will be on Numerical Weather Prediction (NWP), because weather is an important environmental factor in itself, but also because numerical sea ice and ocean forecasting depend strongly on NWP input. The analysis will be performed applying the operational NWP system of the Norwegian Meteorological Institute including a state-of-the-art variational assimilation system. This serves as an example of a system in operational use for Arctic atmospheric forecasting.

Task 1.8.1 Describe present monitoring and forecasting capabilities on the above environmental factors and how these capabilities are likely to evolve in the future (met.no)
We will describe present monitoring and forecasting capabilities and identify key factors limiting the monitoring and forecasting capabilities, including an assessment of the various components of the present Arctic observing system (both satellite and in situ data). We will perform observation denial experiments in data assimilation to assess the effect of individual observation types and quantify the impact of the observation types and geographical locations on forecast quality using diagnostic tools in the data assimilation system and traditional forecast score statistical measures. This will lead to an overview of relative contributions of the components of the system to forecast capability, including the role of remote sensing data in our present observing system. Such a knowledge is a prerequisite to design a future system in task 1.8.2, and helps identify gaps in the forecasting system.

Task 1.8.2 Identify key factors limiting the monitoring and forecasting capabilities, and give recommendations for key areas to improve the capabilities (met.no)
The forecast quality and the observation impact on it will be compared to user needs, in particular those which are assessed as a part of WP2.
We will propose and analyse scenarios for how forecasting capabilities are likely to evolve in the future and give recommendations for key areas to improve the capabilities. We will consider uncertainties coming from model tools and limitations in the observing system. Future observing systems scenarios will be studied in observing

system simulation experiments. The aim is to give a good picture of our short-range forecasting capabilities in a changed Arctic given the known components of the future observing system as well as knowledge on how to fill gaps in a cost efficient way. The analysis will be complementary to activities in Task 1.1 and 1.8.3, dealing with network design for longer scale prediction of the coupled Arctic system. These tasks will together constitute a basis for increased knowledge of the contributors to forecast quality in the Arctic and help provide recommendations on design of cost-effective extensions of the observing system to support user needs.

Task 1.8.3 Evaluation of present monitoring and forecasting capabilities for two economic sectors (WP2 marine transport and WP4 resource extraction) (OASys, FastOpt)
Rationale: On climate time-scales, ocean sea-ice variability including extreme events have an important impact on economic activities. Forecasting ocean sea-ice variability on climate time-scales is still in its infancy. The forecast quality depends crucially on the accuracy of the system's initial state. The variational data assimilation systems NAOSIMDAS is designed to initialise forecasts on climate time-scales such that a high degree of consistency with available observations is achieved.
Objective: Systematically assess the forecast skill of the Arctic coupled ocean sea-ice system.
Input: Observations of ocean hydrography and currents, observations of the sea ice state, atmospheric reanalysis data, and the variational assimilation system NAOSIMDAS of FastOpt and OASys.
Output: A report on the assessment of the forecast skill, feeding into WP2 (task 2.7.2 and 2.8), WP4 (task 4.6 and 4.7) which in turn feed into WP5.
Tasks:
NAOSIMDAS will be run with an assimilation window of up to six months to initialize 10 ocean-sea ice hindcasts (starting twice a year over a period of five years, e.g. 2007-2011). Each hindcast consists of an ensemble produced by atmospheric forcing data from a set of previous years. The ensemble will be analyzed regarding the likely range of ocean-sea ice variability and the probability of extreme events.The focus of the analysis will lie on forecast aspects that are particularly relevant to safe transportation (WP2) and resource extraction (WP4), namely the ice pressure on the hull of the ships (WP2) and the forecast of extreme ice events which bear a high risk for off-shore facilities (WP4). Also the forecasting period of a few weeks is oriented towards these applications.
• The assimilation system NAOSIMDAS is set up
• Observational data sets and atmospheric reanalyses are prepared
• NAOSIMDAS is run to estimate initial conditions for 10 hindcasts
• 10 ensemble hindcasts are performed
• the forecast skill is assessed by comparing hindcasted with observed states

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UPMC	74.00
2	Oasys	18.00
5	UCAM	49.00
6	AWI	35.00
10	NPI	36.00
11	Met.no	56.50
12	FastOpt	15.50
13	SAMS	25.00
15	SIO	15.00
19	AARI	24.00
23	CICERO	12.60
	Total	360.60

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.11	Report on successful test of Quantitative network design	12	19.60	R	PU	30
D1.21	Assessment of the accuracy of OSI SAF ice products	11	11.00	R	PU	22
D1.22	Report on Aug/Sep 2011 melt pond statistics and thermodynamics, fed to WP1 modelling for use in pred	10	33.00	R	PU	26
D1.23	Report on analysed data from IMBs	13	28.00	R	PU	34
D1.24	Integrate additional satellite sensors into daily ice drift map production to improve summer (melt s	11	12.00	D	PU	14
D1.25	Completed analysis on previous submarine voyages and delivery of report on single-beam thickness dis	5	18.00	R	PU	27
D1.26	Report on ridge shapes and distributions for extreme value analyses in WP2, WP4 and under-ice ecos	5	18.00	R	PU	34
D1.27	Report on 2012 and 2013 AUV missions re.altimetry validation, ridge permeability analysis for oil in	5	19.00	R	PU	38
D1.28	Regional distribution of melt onset and freeze up on an annual basis.	1	8.00	R	PU	28
D1.29	Report on altimeter sea-ice thickness errors due to ice type, geometry and snow pack effects	1	27.00	R	PU	26
D1.31	Report on historical analysis of change in Russian Arctic ocean conditions 1920/40 versus 1990/2010	15	18.00	R	PU	34
D1.34	Report from AARI on analysis of recent oceanographic voyages in Russian Arctic	19	23.00	R	PU	31
D1.41	User guide containing quality assessment of Arctic weather station and buoy data	11	12.00	D	PU	14
D1.42	Monthly evolution of the FDD integrated all over the Arctic and redistributed over subarctic areas f	1	7.00	R	PU	25
D1.51	Results of Arctic ocean-sea ice downscaling runs validated and documented	6	37.00	R	PU	38

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.52	Assessment of inter-annual variability in Arctic pollutant sources and impact of soot deposition	23	7.00	D	PU	47
D1.61	Climate response analysis of improved model processes (sea-ice and soot) and from higher resolution	11	10.00	D	PU	47
D1.71	Radiative forcing estimates for perturbation in the Arctic of short lived climate compounds	23	7.00	R	PU	36
D1.72	Model output from CTM studies of the impact of composition changes from changes in emission	23	7.00	D	PU	30
D1.81	Report on forecast quality and assessment of state and impacts of the components of the Arctic obser	11	12.00	R	PU	26
D1.82	Future scenarios for evolution of the observing system for Arctic short-range forecasting	11	12.00	R	PU	42
D1.83	Report on assessment of forecast skill	2	15.00	R	PU	46
		Total	360.60			

Description of deliverables

D1.11) Report on successful test of Quantitative network design: Full Title: Report on successful test of quantitative network design framework [month 30]

D1.21) Assessment of the accuracy of OSI SAF ice products: [month 22]

D1.22) Report on Aug/Sep 2011 melt pond statistics and thermodynamics, fed to WP1 modelling for use in pred: Full Title: Report on Aug/Sep 2011 melt pond statistics and thermodynamics, fed to WP1 modelling for use in predicting accelerated decay [month 26]

D1.23) Report on analysed data from IMBs: [month 34]

D1.24) Integrate additional satellite sensors into daily ice drift map production to improve summer (melt s: Full Title: Integrate additional satellite sensors into daily ice drift map production to improve summer (melt season) accuracy [month 14]

D1.25) Completed analysis on previous submarine voyages and delivery of report on single-beam thickness dis: Full Title: Completed analysis on previous submarine voyages and delivery of report on single-beam thickness distributions from submarine , fed to WP1 modelling, WP2-4 for reduced ice assessment [month 27]

D1.26) Report on ridge shapes and distributions for extreme value analyses in WP2, WP4 and under-ice ecos: Full Title: Report on ridge shapes and distributions for extreme value analyses in WP2, WP4 and under-ice ecosystems in WP3 [month 34]

D1.27) Report on 2012 and 2013 AUV missions re.altimetry validation, ridge permeability analysis for oil in: Full Title: Report on 2012 and 2013 AUV missions re.altimetry validation, ridge permeability analysis for oil in ice (WP4), mechanical strength of ice for design load modelling (WP2, HSVA), ridge geometry for ice ecosystem modelling (WP3) [month 38]

D1.28) Regional distribution of melt onset and freeze up on an annual basis.: Leader: LOCEAN [month 28]

D1.29) Report on altimeter sea-ice thickness errors due to ice type, geometry and snow pack effects: Leader : LOV [month 26]

D1.31) Report on historical analysis of change in Russian Arctic ocean conditions 1920/40 versus 1990/2010: [month 34]

D1.34) Report from AARI on analysis of recent oceanographic voyages in Russian Arctic: [month 31]

D1.41) User guide containing quality assessment of Arctic weather station and buoy data: [month 14]

D1.42) Monthly evolution of the FDD integrated all over the Arctic and redistributed over subarctic areas f: Full Title: Monthly evolution of the FDD integrated all over the Arctic and redistributed over subarctic areas for each year. Leader: LOCEAN [month 25]

D1.51) Results of Arctic ocean-sea ice downscaling runs validated and documented: [month 38]

D1.52) Assessment of inter-annual variability in Arctic pollutant sources and impact of soot deposition: [month 47]

D1.61) Climate response analysis of improved model processes (sea-ice and soot) and from higher resolution: Full Title: Climate response analysis of improved model processes (sea-ice and soot) and from higher resolution in NorESM calculations [month 47]

D1.71) Radiative forcing estimates for perturbation in the Arctic of short lived climate compounds: [month 36]

D1.72) Model output from CTM studies of the impact of composition changes from changes in emission: [month 30]

D1.81) Report on forecast quality and assessment of state and impacts of the components of the Arctic obser: Full Title: Report on forecast quality and assessment of state and impacts of the components of the Arctic observing system [month 26]

D1.82) Future scenarios for evolution of the observing system for Arctic short-range forecasting: [month 42]

D1.83) Report on assessment of forecast skill: [month 46]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS181	Forecasting system set up and tested	2	38	
MS121	Field data processing (2011 and 2012 data) completion	10	26	
MS122	Implementation of improved	1	25	Leader: LOV
MS123	Submarine transect of Arctic	5	18	
MS124	First AUV experiment	5	18	
MS125	Second AUV experiment	5	30	
MS131	Monitoring studies from ships	19	26	
MS132	Estimation of the contribution	19	46	
MS133	ACOBAR acoustic floats	1	20	Leader: LOCEAN
MS151	Ocean-sea ice downscaling	6	38	
MS161	High-resolution NorESM runs	11	38	
MS162	NorESM-runs with improved	11	45	

WT3:
Work package description

Project Number [1]	265863	Project Acronym [2]	ACCESS

One form per Work Package

Work package number [53]	WP2	Type of activity [54]	RTD
Work package title	Marine Transportation and Tourism in the Arctic domain		
Start month	1		
End month	48		
Lead beneficiary number [55]	7		

Objectives

The objective of WP2 is to investigate and define the necessary actions for the implementation of Marine Transportation and Tourism in the Arctic in view of the impacts of the climate change on the economic opportunities and the protection of the sensitive environment.
Specific objectives of this work package are investigations and conclusions on the following issues:
• Impact of climate change on Arctic Shipping
• Rules and regulations for marine Arctic transport in view of the changing ice conditions
• Infrastructure needs for increased shipping
• Pollution in the Arctic Ocean by increased shipping
• Improvements of safety and economy of Arctic shipping
• Socio-Economic aspects of Arctic transport and tourism
• Arctic shipping governance under climate change conditions

Description of work and role of partners

Task 2.1 Effect of Climate Change on Arctic Shipping
Ice conditions in the Arctic in the 20th century will be analyzed focussed on the conditions for navigation in ice infested waters. The analysis will cover natural variability as well as superposed climate change effects. For this purpose historical data sets will be used to study regimes and their variability of the most important sea ice parameters along the long-explored navigational routes and to find new perspectives (safely and economically) for navigation routes in the Arctic taking into account recent climate changes. Consequently, sea ice influence on the navigation efficiency in the Arctic under the different scenarios of climate change will be estimated.

Task 2.1.1 Analysis of historical sea ice data and their influence on the navigation along the Northern Sea Route in the 20th and the beginning of the 21st century (AARI)
(a) Method: Statistical analysis of ice charts/arrays stored in AARI archives
(b) New knowledge. Estimation of change in the ice conditions along the NSR during time interval (1930-2009). Estimated parameters: size of ice fields and floes, pack ice concentration, fast ice area and thickness.
(c) Relevance to overall goal. This activity is required to get background information on the importance of ice conditions in the Arctic shipping.

Task 2.1.2 Estimation of the navigation efficiency on the Northern Sea Route in past climate situations in comparison to various future scenarios under climate change (AARI)
(a) Method. Expertise of historical data on navigation along the NSR in different years
(b) New knowledge. Information on the ice-linked navigation problems along the NSR, in particular in the areas difficult for navigation (during XX and beginning of the XXI centuries)
(c) Relevance to overall goal. This activity will provide benchmark information for making predictions of ice-navigation in the warmer Arctic

Task 2.1.3 Variability of sea ice conditions in specific regional areas that are specifically challenging for navigation in past and future climate regimes and recommendations for navigation based on present sea ice conditions along the Northern Sea Route and other navigational routes in the Arctic (AARI, JSC)

(a) Method. Calculation of probable scenarios of ice conditions along the NSR in the coming decade
(b) New knowledge. Recommendations on the optimal navigation routes in the warmer Arctic

(c) Relevance to overall goal. The outcome of this task provides practical application of expected climate change consequences for navigation.

Task 2.1.4 Evaluation of user requirements and needs for forecasting of ice conditions (MET.NO)
The Ice Service of MET.NO will determine from its users and international marine information service contacts what monitoring and forecasting products are requested and needed for present day high latitude activities (D2.4). This part of the task will also review the current international activities to standardize sea ice and iceberg information services, for example the IMO/IHO/WMO/MET/NAVAREAs. The data on ice information requirements will be used to guide the assessment of current ice hazard monitoring and forecasting capabilities (WP4 Tasks 4.4.1 and 4.4.5)
With the changing climate in the Arctic it is likely that these information requirements will also change. Based on the future climate scenarios delivered by WP1 (Tasks 1.5.1 and /or 1.5.2, D1.5.1) MET.NO will then assess how its contacts envisage that their needs will change in the future (D2.5).

Task 2.1.5 Calculation of the travelling time needed on the North-East and North-West Passage in the past (1960-2000), present (2000-2010) and in the years to come (HSVA)
While traveling in ice infested waters the required actual power is very much depending on the actual ice condition. The conditions can vary from open water to severe ice features resulting in huge difference of time needed per traveled mile. The aim of this task is to (1) analyse the variability of various sea-ice parameters provided by AARI (Task 2.1.1)(terms of ice formations and melting, ice thickness, ice extent, presence and positions of ice massifs, fast ice etc.) for the 20th and the beginning of the 21st century and (2) to develop scenarios of the most probable changes of the ice conditions for the future. The Routing Software, ICEROUTE, developed by the Hamburg Ship Model Basin (HSVA) and verified in different EU funded projects (ARCDEV and ARCOP) will be used to calculate the traveling time needed for a passage in arctic waters from location A to destination B. The model uses data on seaway, ice features (level ice, pressure ridges, rubble fields and pack ice), ice & snow thickness, ice strength and lateral ice pressure. Simulations will be carried out for different ship types optimized for different environmental conditions including, for example, open water, level ice, deformed ice as well as different operation areas and different time horizons. The time horizon covers the past (1960 to 2000), the present (2000 to 2010) as well as future ice data predictions (scenarios). Ship routes to be investigated are the North-East-Passage as well as the North-West-Passage, if information on ice conditions can be provided. Results from this work will be fed into Task 2.4.1 determining atmospheric pollutant emissions.

Task 2.2 Rules and Regulations for Marine Arctic Transport in view of the changing ice conditions
The aim of this task is to (1) review existing rules and regulations for shipping in the Arctic, (2) identify gaps and shortcomings with respect to environment impact and risk assessment and(3) provide suggestions for adjustments and consequences from the impact of climate change (D2.7). HSVA will use its long experience in full scale trials of different type of vessels in arctic and subarctic regions (more than 20 expeditions in ice invested waters). During these trials not only the icebreaking capability of the vessels was determined but also the load on the hull of the vessel and the propulsion system was observed in different ice conditions and features.
HSVA together with the partners UCAM and JSC will collect and compile available public information regarding those ice trials and benchmark this against the existing rules and regulations of different classification societies and national and international organizations and authorities to identify weaknesses and gaps. Reports of incidents and accidents with vessels in arctic and subarctic regions will also be reviewed, analyzed and taken into consideration in this subtask. The results of this study will be updated for the predicted ice scenarios in the Arctic.
The results will be transmitted to WP5 for further use in governance actions. (HSVA, UCAM, JSC)

Task 2.3 Identification of Infra-Structure Needs (UCAM)
The impact of expanded use of the marine Arctic on Arctic communities and on the broad requirements for the marine infrastructure will be identified including the priorities of needed infrastructure and the near-term investments necessary to achieve acceptable levels of risk and safety. The AMSA information developed from a series of Town Hall meetings held in Arctic communities will be used to highlight the key concerns and opportunities expressed by the local residents. This information will be used to develop strategies to mitigate selected impacts and limit potential user conflicts in local and regional Arctic waterways (D2.8).

Task 2.4 Pollution in the Arctic Ocean from increased Shipping
Task 2.4.1 Air pollution and surface deposition related to today's and future Arctic shipping (UPMC (LATMOS), University of Oslo and DLR)

The aim of this task is to quantify the impact of different types of shipping on the air quality and deposition in the Arctic. For this purpose measurements of the various components of the exhaust of different types of ships in the Barents Sea will be carried out by a 2-week aircraft mission (DLR). The set of measurements will include CO2, CO, CH4, O3, NO, NOy, HNO3, PAN, HCs, aerosol size and number, non-volatile aerosol fraction, and meteorological data (temperature, wind, humidity). Ship emissions of concern include a) ozone precursors, b) particle precursors, and c) particulate matter (PM).
ad a) Ozone is an effective greenhouse gas. Precursors that form ozone include NOx, CO, and unburned hydrocarbons (HC). NOx can be oxidized to HNO3 and PAN during transport and dispersion of the exhaust plumes from shipping. Thereby the NOx-catalyzed ozone formation is reduced. Therefore these reservoir gases need to be measured as well. NOy, the total reactive nitrogen includes many compounds and is defined as

NOy=NO+NO2+NO3+N2O5+HNO2+HNO3+HNO4+PAN+particulate nitrogen.
To assess the impact of ship emissions on the ozone budget, all of these key species need to be measured.
Ad b) Ship fuel includes a high content of SO2. Emitted SO2 is converted to H2SO4 during aging of the emission plumes. In turn, H2SO4 condenses to sulphuric acid droplets (sulphate aerosol). These droplets can modify the optical properties of low level clouds and thus their radiative impact. We need to measure SO2 und the formed sulphate aerosols to assess this effect on the climate.
Ad c) We will measure PM in great detail. Particulate matter (PM) from shipping includes soot particles with diameters in the µm range and secondary particles formed from emitted SO2 and hydrocarbons. The newly formed secondary particles with diameters of only a few nm are not covered by legislation yet, but are considered to be an important contributor to air pollution. In order to cover all modes of PM we will study the entire particle size distribution.

Emission factors measured in the wake of ships and the trace gas and particle observations obtained during the ACCESS survey flights in the Arctic will be reported with measurement uncertainties. The modeling results will also be reported with information on the associated uncertainties.

There will be a close interaction with the ship crew during the preparation and execution of the field measurements. The measurement aircraft will intercept the exhaust plume of the source ship a distances to the stack from 100 m to about 70 km. The measured emissions will be quantified relative to CO2 enhancements. Initial CO2 emissions from the ship can be calculated from the fuel composition and consumption. Thus measurements on board the ship will not be needed to calculate the emission factors of primary and secondary emissions. Results of these measurements will be used to improve the different simulation models and to quantify the global and regional changes resulting from different shipping activities. The impact of ships on ozone, black and organic carbon, sulfates and nitrates will be quantified. A combination of data analysis (DLR) and global (MOZART, Oslo CTM2) and regional modeling (Polar-WRF) will be used (LATMOS, CICERO). Potential impact on soot deposition in the Arctic will also be examined in terms of estimating deposition rates. These results together with those of Task 2.4.2 will be used to examine how the increasing Arctic shipping may contribute to the acceleration of seasonal ice melt through the reduction of ice albedo and subsequent heat absorption. Updated emissions produced in the project will be utilized (Tasks 2.1.5, 2.4.2).

Task 2.4.2 Calculation of fuel consumption per mile for various ship types as a function of power and speed in various ice conditions in the past, at present and in future. (HSVA)
The routing software, ICEROUTE, will be used to calculate the fuel consumption as a function of power, ice conditions and speed for various ship types traveling on different ice routes in the Arctic. The result of this simulation is the basis for an exhaust gas emission value calculated from the actual power consumption per mile for each leg and for the total voyage. In addition to the gas emission the discharge of warm engine cooling water can be determined. Calculations will be carried out using existing data from the past (1960 to 2000), the present (2000 to 2010) and ice data as predicted (scenarios). This task is the continuation of Task 2.1.6 with respect to air pollution. The results of the calculation for the past and present periods will be benchmarked against measured values as obtained in 2.4.1; hereby adjustments will be made to improve the predictions of emission values of future Arctic shipping.

Task 2.4.3 Noise propagation from commercial fishing and vessel traffic in the Arctic environment today and in future (SIO)
There are gaps in our understanding of the scale of noisy activities within the Arctic maritime area. The available data indicate, however, that pressures on high latitude marine mammals due to underwater noise emissions might be relatively high in the Barents Sea and along the Northern Sea Route due to the comparably high amount of human activities here. The warming in the Arctic area will undoubtedly enlarge the extension of the regions of commercial fishing and enlarge vessel traffic due to sea ice cover reduction in thickness and

extent. Most likely by this reason the negative impact from ship noise on high latitude marine mammals will be increased. To understand to what extent this increase in noise can be harmful on marine mammals, we plan to estimate the trend in changing of the averaged noise levels from increasing fishing and vessels traffic (in relation with the start of construction work at Shtokman gas field) in the Barents Sea. The trend of underwater noise levels in the area of cetacean habitats close to commercial shipping routes in the Barents Sea would be estimated for the first time. This work will be done in close collaboration with WP1 delivering estimates on the range of climate changes of the temperature-salinity structures of water masses that have significant influence on noise propagation in the sea. Up-to-date Pseudo Differential Parabolic Equation acoustic model will be used for estimation of the noise levels. The possibility to generalize the results of modeling for the Northern Sea Route at whole will be considered as well. The output generated by this work will include the diagrams of estimating trend of the noise levels for some regions. Model estimation of noise levels from commercial fishing and vessel traffic give us in fact the noise background that will be used in WP 4 (Task 4.4.3) for defining the safety-zones to provide recommendation to limit the impact of noise on feeding and migrating marine mammals (D2.12).
In case availability of additional funding (from the sources which are not included in ACCESS) SIO will upgrade their own autonomous passive hydro-acoustic buoys, used on regular base within the other seas, for specific Arctic conditions and on site experimental validation of the predicted levels by will be carried out.

Task 2.4.4 Modeling the propagation of noise from increasing ship traffic in the Arctic (UPC)
The aim of this task is to develop and apply mathematical models describing the relationships between shipping noise disturbing factors as inputs, and behaviour/well being of mammals.
•Analysis of the effects of different noise sources and identification/ranking of the most critical ones.
•Development of models for noise exposure and sound dosage of mammals
The models that will be developed will be Arctic-specific since the particular oceanographic configuration of the water column will introduce considerable propagation loss and variations compared to other regions of the world.

Task 2.4.5 Design, manufacture and full scale testing of a low cost autonomous buoy for recording under-ice noise from ice going ships (UPC)
Based on the existing technology already implemented in deep-sea observatories (European Sea-floor Obervatories Network of Excellence, ESONET) by the task leader (listentothedeep.com), the objectives are:

- to develop a specific acoustic system for
a) the real-time monitoring of noise radiatd by ships and determine areas of acoustic impact;
b) the real-time monitoring of the presence of cetaceans in the area of interest
- to develop a standard protocol for the measurement and computation of the emitted sound levels that allows comparison between different marine regions
- to integrate the above developments in a low cost autonomous unit that can be deployed in series in areas of interest and radio linked/cabled to shore for the real-time display of the analysis.

Task 2.4.6 Noise pollution in the Arctic: Mitigation procedures and policies. (UPC, JSC)
In addtion to the task 2.4.5. objectives, task 2.4.6. will develop an alert service aimed at allowing immediate mitigation actions in the areas of interest.
The proposed activities of Task 2.4.4 to 2.4.6 try to understand, model and reduce the effects of noise pollution on marine mammals caused by shipping in ice covered waters. After modeling the propagation of noise from increased shipping in the Arctic, it is intended to verify these modeling results by full scale measurement of the propagation of shipping noise under ice in the surrounding of shipping routes (D2.13). For these measurements an autonomous noise recording buoy for Arctic conditions will be built. A concept will be created to mitigate and minimize acoustic impacts from shipping in the Arctic and to incorporate this in the governance section. All these activities of UPC will be carried out in close cooperation with partner SIO in Task 2.4.3.

Task 2.5 Improvement of Safety and Economy of Arctic Shipping
Task 2.5.1 Measurement of lateral stresses in Arctic ice by a purposely designed and built stress sensor buoy deployed in the Arctic Ocean (HSVA, SAMS, JSC)
HSVA together with SAMS will develop a buoy which will be taken to the Arctic and frozen in level or pack ice during the WP1 expedition organised by SAMS. The measured pressure data together with environmental information, temperature, wind speed and direction, current etc. and position of the buoy will be transmitted via satellite onshore. Available meteorological and oceanographic data and satellite pictures will be used to gather information on the dependence of the pressure on environmental parameters. The collected data will be used to improve the ICEROUTE- transit model. In WP1 the data will be used to benchmark the ice prediction models with respect to ice pressure.

Task 2.5.2 Design of the future Arctic Observing System for safer shipping. (OASYS, FASTOPT)
Rationale:
The accessibility of Arctic passages depends on the sea-ice conditions and their accurate forecasts via numerical models. The forecast accuracy depends on the model's initial state. Assimilation Systems estimate this initial state from observational data. In turn, the quality of this estimate depends on the observing system. Today, it is not at all clear how to best configure an observing system to achieve the best possible forecast skill for the Arctic passages. This assessment is substantially complicated by the changing ice conditions due to climate change.
Objective:
The objective of this task is to assess via quantitative network design methods the relative usefulness of a set of observational networks in terms of the forecast skill for a selected target area. This contributes to the WP2 objectives: -Infrastructure needs for increased shipping, Improvements of safety and economy of Arctic shipping and -Arctic shipping governance under climate change conditions.
Input:
Quantitative Arctic Observational Network Design (AOND) framework (including the assimilation system NAOSIMDAS and the forecasting system) developed in WP1 (task 1.1).
Output:
Report on recommendations for the design of the future Arctic Ice Observing System for safe marine transport under changing climate conditions, feeding into WP1 tasks 2.7.2 and 2.8, which feed into WP5.
The subtasks are:
• 2.5.2.1 set-up of a forecasting system for times scales and spatial resolution appropriate for ice forecasting in the Arctic passages relevant for ship-routing, i.e. prepare the land-sea mask for the coupled sea-ice ocean model, acquire and prepare atmospheric forcing fields for model grid and time step, acquire and prepare lateral oceanic and ice boundary conditions, spin up model and produce restart files containing the initial condition.
• 2.5.2.2 extending the model to simulate additional observational data types relevant for the task but not yet handled by the assimilation system in its default configuration (e.g. ice thickness estimates delivered by Cryosat) definition of uncertainty fields, extending the cost function code that evaluates the model-data misfit, evaluation and verification of the model-data misfit, regeneration of the entire tangent linear code to adapt to the modified cost function code, verification of the updated tangent linear code against finite differences of model runs, regeneration of the entire adjoint code for to adapt to the modified cost function code, verification of the updated adjoint code against finite differences of model runs and against tangent linear code, performance enhancement of tangent and adjoint code, and, again, verification against finite differences and tangent linear vs adjoint.
• 2.5.2.3 extending the forecasting system to simulate the target quantities relevant to shipping, in particular ice cover and ice thickness in relevant target areas on an Arctic-wide scale, regeneration of the entire tangent linear code to adapt to the modified cost function code, verification of the updated tangent linear code against finite differences of model runs, regeneration of the entire adjoint code for to adapt to the modified cost function code, verification of the updated adjoint code against finite differences of model runs and against tangent linear code, performance enhancement of tangent and adjoint code, and, again, verification against finite differences and tangent linear vs adjoint.
• 2.5.2.4 to evaluate/assess a set of candidate networks consisting of currently available and possible future remote-sensing data in conjunction with a set of in-situ observations for a range of potential sampling locations and times for the potential observations. Extraction of the structure of the required/recommended future observing system in terms of aspects/components that are particularly relevant for safer ship-routing. Such aspects/components are defined by observational data streams, spatial coverage, sampling frequency and duration and by accuracy.

Task 2.5.3 Threat by icebergs and ice massifs to Arctic Shipping (Beluga)
The danger from icebergs, growlers and ice massifs (large accumulation of very close pack ice) will be investigated by Beluga in cooperation with AARI and Met.no specially for the Northern Sea Route (the Barents Sea is covered by WP4). Special areas of high potential iceberg occurance along the Northern Sea Route will be defined. Countermeasures such as satellite observing systems with high resolution and ice monitoring and forecasting systems will be evaluated in order to reduce the danger of iceberg-ship collision.

Task 2.6 Socio-economic Impact of Arctic Transport and Tourism (ESRI, Beluga)
Task 2.6.1 Socio-economic costs and benefits of Arctic transport
The aim of this task is to (1) review the literature on the demand for marine transport to and from Europe, East Asia, the West Coast of North America, and its East Coast – and thus the potential demand for shipping in the North East Passage and the North West Passage. We will (2) distinguish between the value and the volume of transport. We will (3) conduct a meta-analysis of the price and income elasticities of intercontinental shipping,

and (4) combine this with a number of long-term scenarios of economic development to construct a set of scenarios of the demand for intercontinental marine transport.
Elsewhere in the work package (Task 2.1) the effects of climate change are estimated on the transport possibilities in the northern passages. Reinterpreting as scenarios of supply, we will (5) build scenarios of the transport flows through the North West and the North East Passage. We will (6) also estimate the welfare gains (consumer surplus plus producer surplus) that result from having alternative routes to the Panama Canal / Cape Hoorn and the Suez Canal / Cape of Good Hope, as well as the lost producer surplus along the displaced shipping routes (D2.16).

Task 2.6.2. Socio-economic developments of Arctic tourism
ESRI will use the Hamburg Tourism Model (HTM) to estimate the effects of climate change on tourism in the Arctic. HTM is one of three models of the supply and demand of domestic and international tourism, the only one that includes the effect of climate change on the supply and demand for tourism services. HTM operates at the country level, but downscaling methods have been developed and successfully applied. For this project, we will use the downscaled version.
Climate change has a number of different impacts on tourism in the Arctic. On the one hand, the Arctic will become less forbidding and more accessible. On the other hand, the Arctic may well lose some of its unique characteristics. Such threats may lead to a temporary surge in the number of tourists, who would want to experience the Arctic before it is gone.
In order to capture these effects, we will (1) adjust the generic characterisation of the demand and supply of tourism services that is currently in the model to reflect aspects that are particularly important to Arctic tourism. The adjusted, downscaled version of HTM will then be used to (2) estimate tourist numbers, length of stay, total expenditure, consumer surplus, and producer surplus for the period 2010-2030 for a number of alternative socio-economic and climate scenarios.(D2.17)

Task 2.6.3 Comparison of transport costs and time for sailing from Hamburg to Yokohama via Northern Sea Route in ice conditions as effected by Climate Change without and with using the Ice-Route-Optimization IRO.(Beluga)
Beluga will carry out the calculation of transport costs and time savings, when sailing from Hamburg to Yokohama along the Northern Sea Route (NSR) by using the Ice-Route-Optimization IRO. This ice forecast system is under development by a joint German-Russian research project. Beluga is partner in this IRO research project, in which the calculation of the economic benefit is not on the program. In 2013 IRO will be full-scale tested in the Kara Sea. These full scale test results of IRO will be available and used for this ACCESS-calculation of time and cost savings, when sailing the entire NSR under climate change affected average spring and winter ice conditions and using IRO. This calculation will consider also transit and icebreaker fees as well as insurance and administrative costs and in addition the IRO-service fee. The results will provide the cost and time savings, when sailing the NSR with and without using an ice-forecast system for optimizing the ice route.

Task 2.7 Arctic Maritime Transport Research in View of a Shipping Company (Beluga)

Task 2.7.1 Evaluation of ACCESS Arctic shipping research
Beluga will accompany the various task groups of WP2, which are working on
• the improvement of safety and economy of Arctic shipping (Task 2.5 and Task 2.6) and
• investigations on environmental protection of the Arctic while developing maritime transport systems (Task 2.4)
• the rules and regulations which will change with the decrease of ice in the Arctic. These rules have to protect the environment and to provide safe and economic Marine Arctic Shipping (Task 2.2).
Beluga will evaluate their research results considering environmental protection, navigation, communication, infrastructure, logistics, safety and economy in view of a shipping company with Arctic experience ((Deliverable D.2.7) and will correlate these results with the user requirements in Arctic shipping.

Task 2.7.2 User requirements for shipping in the Arctic
Beluga Shipping Company will correlate the user requirements in Arctic Shipping with the relevant research tasks and results of WP2. Beluga is interested in the effect of climate change on the development of ice conditions in the Arctic and general improvements of safe and economical shipping especially on the Northern Sea Route and will provide user needs (one opinion) for ice forecasting developments (Task 2.1 and 2.5).
In order to use the Northern Sea Route successfully from an economical point of view, it is necessary to establish a framework for requirements. Beluga will provide for this task user requirements for shipping in the Northern Sea Route. The first step in this process will be to establish a status-quo analysis on shipping on the

NSR. This includes the Infrastructure, Communication, Legal Framework Conditions, Application Procedures for Shipping on the NSR, and Technical Conditions for Transit Shipping on the NSR. The evaluation of these topics will finally define requirements for improvements. . The work will build on the information available with IMO (e.g. Arctic Guidelines) and the Arctic Council (cf. Arctic Marine Shipping Assessment 2009 Report). Consultation with relevant stakeholders will be organised.

Task 2.8 Identification of Governance related issues of maritime transport and shipping
Task 2.8.1 Evaluation of governance related results in WP2 for consideration in WP5 (JSC ,UCAM, Beluga).
In this task all governance related issues and recommendations, which have been defined in the various tasks of WP2 will be compiled, analyzed for their immediate or longer term importance and provided for considerations in WP5 (D2.19-D2.20)

Task 2.8.2 Identification of governance challenges facing Marine Transport on all potential Arctic routes (UCAM)
WP2 will evaluate elements of AMSA recommendation themes with a view to how they may impact on the future use of the Arctic Ocean for trans-Arctic navigation and voyages. Particular attention will be devoted to the timing of future regulations from the International Maritime Organization (IMO); the potential development of an Arctic marine traffic aware system (with expansion/improvement of tracking and monitoring of Arctic marine activity); the enhancement of oil spill prevention from Arctic ships; the development of uniform governance of Arctic shipping including the possible harmonization of Arctic marine regulatory regimes; and, addressing concerns for invasive species, stack emissions of greenhouse gasses, and impacts on marine mammals

Task 2.9 Indicators for a sustainable development of Marine Transport and Tourism in the Arctic
Task leader: JSC ; Partner: UCAM, UPC, DLR, AARI, ESRI
Indicators will be defined, in order to evaluate their potential to influence the economy, the environmental impact and the sustainability of the Marine Transport and the Tourism in the Arctic environment as it is affected by climate change. (D2.21)

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UPMC	40.00
2	Oasys	8.80
5	UCAM	10.00
7	JSC	6.00
9	HSVA	18.00
11	Met.no	5.00
12	FastOpt	7.70
13	SAMS	5.00
15	SIO	10.00
17	UPC	24.00
18	DLR	18.00
19	AARI	24.00
20	ESRI	47.70
23	CICERO	8.40
27	BELUGA	14.30
	Total	246.90

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D2.11	Historical ice conditions and its influence on navigation on NSR	19	8.00	R	CO	12
D2.12	Navigation efficiency on NSR and in difficult shipping zones as affected by Climate Change	19	7.00	R	CO	24
D2.13	Recent ice conditions in the Arctic + recommended navigation routes	19	8.00	R	CO	36
D2.14	Assessment of current monitoring and forecasting requirements from users and international providers	11	3.00	R	PU	12
D2.15	Assessment of future monitoring and forecasting requirements based on scenarios supplied by WP1	11	2.00	R	PU	44
D2.16	Report presenting results of ICEROUTE calculations of traveling time for different scenarios and ro	9	5.00	R	PU	36
D2.21	Review of rules and regulations for Arctic shipping/ recommendation for changes due to Climate Chang	9	7.00	R	PU	42
D2.31	Infrastructure needs according to AMSA and other investigations	5	3.00	R	CO	20
D2.41	Air pollution and surface deposition related to present and future Arctic shipping	18	56.40	R	CO	48
D2.42	Calculation of fuel consumption per mile for various ship types and ice conditions in past,present a	9	5.00	R	PU	37
D2.43	Investigation of the decrease of ice by Arctic shipping and an assessment of potential governance s	18	7.00	R	CO	24
D2.44	Noise propagation from commercial fishing and vessel traffic in the Arctic today and in the future	17	21.00	R	PU	25
D2.45	Modelling, measuring and mitigating noise pollution in the Arctic	17	13.00	R	PU	36
D2.51	Design and fabrication of lateral stress sensor and measuring lateral stresses in Arctic ice	9	9.00	R	PU	45
D2.52	QND analysis of future Arctic Observing System for safe marine transport under changing climate	2	16.50	R	PU	48

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D2.53	Threat by icebergs and ice massifs to Arctic Shipping	27	2.30	R	PU	36
D2.61	Socio-economic costs and benefits of Arctic transport	20	23.00	R	PU	36
D2.62	Results of downscaled and adjusted HTM 1,4 model runs under various tourism scenarios of socio-econo	20	24.00	R	PU	48
D2.63	Comparison of transport costs and time for sailing from Hamburg to Yokohama via Northern Sea Route	27	4.00	R	PU	48
D2.71	Evaluation of ACCESS Arctic shipping research in view of a shipping company	27	4.00	R	CO	48
D2.72	User requirements for shipping in the Arctic	27	4.00	R	PU	45
D2.81	Identification of governance challenges facing MarineTransport on all Arctic Routes	5	5.70	R	CO	40
D2.82	Identification of WP2 governance related issues on Arctic Shipping and Tourism	7	6.00	R	CO	42
D2.91	Indicators for sustainable development of Marine Transport and Tourism in the Arctic	7	3.00	R	CO	45
		Total	246.90			

Description of deliverables

D2.11) Historical ice conditions and its influence on navigation on NSR: (a) Method: Statistical analysis of ice charts stored in AARI archives (b) New knowledge. Estimation of change in the ice conditions along the NSR during time interval (1930-2009). Estimated parameters: size of ice fields and floes, pack ice concentration, fast ice area and thickness. (c). Relevance to overall goal. This activity is required to get background information on the importance of ice conditions in the Arctic shipping [month 12]

D2.12) Navigation efficiency on NSR and in difficult shipping zones as affected by Climate Change: (a) Method. Expertise of historical data on navigation along the NSR in different years (b) New knowledge. Information on the ice-linked navigation problems along the NSR, and in particular in the areas difficult for navigation (during XX and beginning of the XXI centuries) (c). Relevance to overall goal. This activity will provide benchmark information for making predictions of ice-navigation in the warmer Arctic [month 24]

D2.13) Recent ice conditions in the Arctic + recommended navigation routes: (a) Method. Calculation of probable scenarios of ice conditions along the NSR in the coming decade (b) New knowledge. Recommendations on the optimal navigation routes in the warmer Arctic (c). Relevance to overall goal. The outcome of this task provides practical application of climate change consequences for navigation. [month 36]

D2.14) Assessment of current monitoring and forecasting requirements from users and international providers: Full Title: Assessment of current monitoring and forecasting requirements from users and international providers of services [month 12]

D2.15) Assessment of future monitoring and forecasting requirements based on scenarios supplied by WP1: [month 44]

D2.16) Report presenting results of ICEROUTE calculations of traveling time for different scenarios and ro: Full Title: Report presenting results of ICEROUTE calculations of traveling time for different scenarios and routes on NSR and NWSR in past,present,and future [month 36]

D2.21) Review of rules and regulations for Arctic shipping/ recommendation for changes due to Climate Chang: complet title: Review of rules and regulations for Arctic shipping/ recommendation for changes due to Climate Change [month 42]

D2.31) Infrastructure needs according to AMSA and other investigations: [month 20]

D2.41) Air pollution and surface deposition related to present and future Arctic shipping: [month 48]

D2.42) Calculation of fuel consumption per mile for various ship types and ice conditions in past,present a: Full Title: Calculation of fuel consumption per mile for various ship types and ice conditions in past,present and in future [month 37]

D2.43) Investigation of the decrease of ice by Arctic shipping and an assessment of potential governance s: Full Title:Investigation of the decrease of ice by Arctic shipping and an assessment of potential governance solutions [month 24]

D2.44) Noise propagation from commercial fishing and vessel traffic in the Arctic today and in the future: [month 25]

D2.45) Modelling, measuring and mitigating noise pollution in the Arctic: [month 36]

D2.51) Design and fabrication of lateral stress sensor and measuring lateral stresses in Arctic ice: [month 45]

D2.52) QND analysis of future Arctic Observing System for safe marine transport under changing climate: Report on (i) the test integration with the extended model, (ii) evaluation of the extended cost function and verification of the updated derivative code, (iii) evaluation of the additional target quantities and verification of the extended derivative code, (iv) assessment of candidate networks in terms of their capability to reduce uncertainties in physical target quantities that are key to safer ship-routing, (v) requirements/recommendations on the structure of the future Arctic Ice Observing System (defined as the superset of all observational data streams) for safe marine transport under changing climate conditions [month 48]

D2.53) Threat by icebergs and ice massifs to Arctic Shipping: [month 36]

D2.61) Socio-economic costs and benefits of Arctic transport: [month 36]

D2.62) Results of downscaled and adjusted HTM 1,4 model runs under various tourism scenarios of socio-econo: Full Title: Results of downscaled and adjusted HTM 1,4 model runs under various tourism scenarios of socio-economic and climate change [month 48]

D2.63) Comparison of transport costs and time for sailing from Hamburg to Yokohama via Northern Sea Route: Full Title: Comparison of transport costs and time for sailing from Hamburg to Yokohama via Northern Sea Route in ice conditions as effected by Climate Change without and with using the Ice-Route-Optimization IRO. [month 48]

D2.71) Evaluation of ACCESS Arctic shipping research in view of a shipping company: [month 48]

D2.72) User requirements for shipping in the Arctic: [month 45]

D2.81) Identification of governance challenges facing MarineTransport on all Arctic Routes: [month 40]

D2.82) Identification of WP2 governance related issues on Arctic Shipping and Tourism: [month 42]

D2.91) Indicators for sustainable development of Marine Transport and Tourism in the Arctic: [month 45]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS211	Navigation efficiency on NSR effected by Climate Change	19	36	
MS212	Solicit user requirements	11	6	
MS213	Solicit future requirements from users based on scenarios	11	39	6 months after WP1 scenarios are delivered
MS251	Design and fabrication of lateral stress sensor	9	15	
MS252	Report on the results of lateral stress sensor measurements in the Arctic	9	42	
MS253	Report on recommendations for the design of the future Arctic Ice Observing System for safe marine t	2	42	Full Title: Report on recommendations for the design of the future Arctic Ice Observing System for safe marine transport under changing ice conditions
MS241	Design and manufacture of low cost autonomous buoy for measuring under ice noise from ice going ship	17	12	
MS242	Report on full scale measurements of under-ice noise from ship traffic with the manufactured buoy	17	45	
MS291	Indicator Report on Marine Transportation and Tourism in the Arctic Domain	7	45	

WT3:
Work package description

Project Number [1]	265863	Project Acronym [2]	ACCESS

One form per Work Package

Work package number [53]	WP3	Type of activity [54]	RTD
Work package title	Fisheries		
Start month	1		
End month	48		
Lead beneficiary number [55]	8		

Objectives

The main objective of this work package is to estimate and quantify how climate changes impact Arctic fisheries and aquaculture, and the livelihood of communities and economic actors depending of these industries. The work will focus on the fisheries, aquaculture and livelihood in the European Arctic sector, and how governance can support the fisheries industries under climate change influence.
The specific objectives of this work package are to:
3.1 quantify and illustrate how climate changes impact the fishing activities within the Arctic environment, due to biological and regulatory constraints
3.2 review effects from climate change on aquaculture production within the Arctic, including the environmental feed-back effects on the socio-ecological system
3.3 assess the effect from climate change on input and output markets of the Arctic fishing industry
3.4 evaluate the regional and local effects of climate-related environmental changes on fisheries, focusing on the adaptive strategies in commercial and subsistence fishery
3.5 review how fisheries management options are influenced by climate changes, given national policies, the legal fishery framework, environmental legislation and national perspectives on integrated ocean management
3.6 elucidate the behavioural responses from different economic actors involved in Arctic fisheries, to ecosystem changes and policy interventions as results of climate change
3.7 map the distribution of marine mammal populations in the Arctic, and assess the influence from climate, and human activity, changes on traditional whaling
3.8 develop indicators for sustainable development in the Arctic fisheries sector, by emphasising the economic development which is subject to trajectory uncertainties.

Description of work and role of partners

Description of work (broken down into tasks, and role of participants)
WP3 will apply various methodological strategies – dependent of the nature of each task – in order to reveal the impact from anticipated climate changes to biomasses, economic actors, societies, governance agencies and stakeholders.

Task 3.1: Quantification of economic effects of climate change in a fisheries system
Task leader: NOFIMA partner: SINTEF F&H
Objective 3.1 will be met by applying bioeconomic modelling of idealised fisheries, incorporating ecological system dynamics and spatial distribution. The main focus will be to evaluate the performance of different management strategies based on indicator based Harvest Control Rules (HCR). NOFIMA will by means of continuous cellular automata modelling describe Arctic ecosystems with special reference to the Barents Sea, and quantify economic effects of climatic changes. SINTEF F&H, and their SINMOD model, will provide important input to this task, taking IPCC scenarios into account and employ outputs from WP1. The model will rely on historical catch data and employ current knowledge on the field, suggesting that management constraints may have greater impact than the effect of climate change in highly fluctuating ecosystems like this. The output from this task will feed in task 5.7 and also generate policy recommendations.

Task 3.2: Aquaculture in the Arctic – implications from climate change
Task leaders: BEIJER, partner: NOFIMA

Objective 3.2 will be met by a substantial and thorough assessment Arctic aquaculture. The aquaculture industry has been expending recently all over the world. Climate change opens the door for new opportunities within this sector with economic impacts that are still to be determined. NOFIMA and BEIJER will: a) map current aquaculture production within the Arctic and the regulations and government systems in place. This will primarily be investigated through literature review and interviews with key personnel from the industry and authorities. b) review climate change effects on Arctic aquaculture, and, finally c) review the effects from Arctic aquaculture production on the larger socio-ecological system, based on an ecosystem management framework. Some effects, such as productivity and location changes will be studied through analysis of available data and modelling of likely scenarios. Employment will be studied through input-output models. Output from this task will extend knowledge on the eco and socioeconomic systems related to aquaculture and how climate change will influence the industry. This will provide the authorities with knowledge on stakeholder issues and key tradeoffs and form the basis for policy options.These will be used as inputs in task 3.7, 5.1.2 and 5.7. Task 3.2 will build, partially, on inputs from WP1.

Task 3.3: Climate change effects on factor and product markets for capture fisheries
Task leader: NOFIMA
Objective 3.3 will be met by NOFIMA, who will elucidate knowledge on how climate changes will spur governmentally or consumer induced price changes in factor or product markets. How these may alter the activity at sea, and the catch composition of the fishing fleet will also be investigated. Earlier work at NOFIMA has suggested that changes in fishing activity are heavily impacted by the level of input costs in the industry, and how they change. Further, the market price of fish determines the relative attractiveness of specific species. Examples of such changes can be how increased fuel oil taxation can make some specific fisheries unprofitable or how consumer awareness on the climate friendliness of single fisheries can shift demand from one species to another. In order to address these issues, we will study fishing vessels' input structure and analyze which are likely to be climate affected. We will employ forecasting methodology to develop relevant development scenarios in relation to the climate scenarios selected. Analysis of vessel responses will be undertaken through interviews with vessel owners and economic models of vessel operations.
Analysis of consumer responses will be done by reviewing the available literature on environmental awareness and consumer decisions. Supporting these, we will carry out own consumer surveys. Along with foresight techniques, these will form the basis of scenarios. The effects of these on fisheries operations will be studied in the aforementioned economic vessel models. Input from WP1 will guide the scenarios to be discussed.
Expected key output from this task is improved understanding of the consequences of climate change induced shifts in demand and supply structures, as well as their responses to these changes. Especially government taxation/subsidy policy on fuel may benefit from better knowledge in these fields. Results will input in task 5.7.

Task 3.4: Socio-economic impact of climate change on fishery sector
Task leader: UoL
Objective 3.4 and 3.5 will be addressed by this task. The relationship between climate change and fisheries is complex and depends on generalisations derived from case-by-case assessments of past and present. Task 3.4 will evaluate what might be the regional and local effects, and responses of fisheries to climate-related environmental changes. This issue will be considered in the context of national approaches in the resource governance and adaptive strategies in the fishery. The fishery sector's climate sensitivity will be assessed using relevant measurements within regional institutional economics.
To do so it is needed to clarify the links between biophysical models and 'human systems' in the reflexive context of ways in which changes in distribution, location and abundance of fish stocks may correlate with fishing efforts, management decisions and national legislation. The proposed analysis will also consider the socio-political context of existing discourses in the fishery governance. In order to understand how fisheries negotiate with consequences of changing biophysical ecosystems cultural aspects of the societies will be evaluated. For this purpose, cultural values of the societies such as traditional food chain, consumption patterns, and images of jobs in the sector will be integrated into research and their role in shaping regional and national adaptive strategies will be evaluated.
UoL will assess the impact of climate change and propose adaptation measures in relation to the sustainability and management of fisheries and aquaculture in the Russian – Norwegian Arctic. The research problems will be solved by anthropological field work in Arctic areas, in-depth interviews and data collection together with a literature review.
Task 3.4 will provide statistics to task 3.7 and inputs to tasks 5.1.2, 5.5 and 5.6.

Task 3.5: Eliciting behavioural responses from relevant user groups and stakeholders
Task leader: BEIJER

Objective 3.6 will be met by this task. Behavioural responses of stakeholders may lead to outcomes that are not necessarily encompassed in traditional economic models of resource exploitation, which often rely on individual rationality only. Such deviations may lead to inefficient policy. Eliciting behavioural responses from relevant groups is a way to assess whether one can expect such deviations and try to quantify their effects. BEIJER will, by utilising experimental and empirical methods combined with theory, establish knowledge on how stakeholders (mainly fishermen) respond to policy interventions induced by climate changes and abrupt, climate induced ecosystem changes that may result in substantial decreases in fish stocks. In addition, stakeholders like fishermen could be uncertain about current and future stock levels or future polity interventions. We aim to test how some of these kinds of uncertainties may affect the behaviour of stakeholders. The advantage of experimental methods is the creation of exogenous variation in the variable of interest, allowing the establishment of causality rather than mere correlation. By addressing various commercial and subsistence (indigenous) fishermen, response differences among groups as well as individuals can be identified. We expect results in the form of distributions of behavioural responses for different scenarios tested. The results will serve as input for task 5.7.

Task 3.6: Marine mammals in the Arctic
Task leader: UPC

Objective 3.7 will be met by literature surveys and field studies carried out by UPC. Climate change will pose a variety of threats to marine mammals. While some species may adjust to changing food availability, others may be handicapped by their very specific food requirements and hunting techniques. By mapping the current distribution of the Arctic populations of marine mammals, conservation measures may be able to address the secondary effects of climate change, thereby help to understand how circulation, stratification, sea-ice dynamics, and marine mammal utilization of arctic shelves will change in response to a diminishing ice cover. Also, climate changes might alter Eskimo whaling traditions, mediating through loss of ice coverage, reduced bowhead whale biomass, other ecosystem changes or increased human activity like transportation and exploration. The aim of this task will be to identify the threats this traditional whaling is facing as well as the conservation status of their main preys, particularly the endangered bowhead whale. The results of this study will permit to project the sustainable use of traditional whaling in the coming years. In addition, maps of seasonal marine mammal distribution will be built associated to the acoustic behaviour of relevant species. This data will be of relevance for WP3 and WP4, to understand the interaction of shipping and energy extraction noise sources with cetacean sounds. The maps will be interactive, allowing the introduction of environmental parameters to determine their influence on the distribution of key species. The output will be programmed in flash to allow the online display of the analysis. This will be used for exemple in task 5.7. Finally, these maps will be locally and completed once the acoustic buoys in WP4 are implemented.

Task 3.7: Indicators for a sustainable fisheries development in the Arctic
Task leader: BEIJER, partners: NOFIMA, UoL, UPC, ESRI

To reach objective 3.7, indicators for the Arctic fisheries sector will be developed in order to determine the effect of fisheries on the marine ecosystem and the impact of changes in economic activities and whether it corresponds to a sustainable development. In the revised version of the EU Commission Data Collection Framework (see Appendix EC Commission Decision 2008/249 of November 2008) environmental indicators have already been established (indicators of the state of the marine environment and indicators of the pressure that affects state). Their relevancy for the Arctic region will be investigated and adapted to the context of Arctic where relevant. Possible routine implementation of their monitoring will be also considered. Additional indicators will be defined and develop to measure the impact of changes in economic activities (e.g. value creation, employment and welfare).
The risks for ecosystems and local communities will be addressed. To take into account uncertainties about future development, indicators will be provided for different scenarios (developed under WP1). The outcomes from this task will provide a sound basis for the integrated discussion under WP5.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
8	NOFIMA	33.40
14	Beijer Institute	32.30

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
17	UPC	3.00
20	ESRI	2.00
21	UoL	50.90
22	SINTEF F&H	14.50
	Total	136.10

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D3.11	Economic impacts of global warming on fisheries	8	19.00	R	PU	37
D3.21	Climate change and Arctic aquaculture	8	24.10	R	PU	37
D3.31	Market responses to climate change	8	19.00	R	PU	48
D3.41	Economic settings, societal and cultural priorities in the fishery and aquaculture sectors Past and	21	11.00	R	PU	30
D3.42	International and national fishery management, adaptation practices and strategies to climate-relate	21	10.00	R	PU	48
D3.51	Results from field experiments in the Arctic	14	28.00	R	PP	48
D3.52	Yearly report on ethical issues	17	1.00	R	PU	13
D3.53	Yearly report on ethical issues	17	1.00	R	PU	25
D3.54	Yearly report on ethical issues	17	1.00	R	PU	37
D3.55	Yearly report on ethical issues	17	1.00	R	PU	48
D3.61	Climate change impacts, and human responses, affecting traditional whaling	17	10.00	R	PU	37
D3.71	Indicators for sustainable development in the Arctic fisheries sector	8	11.00	R	PP	37
		Total	136.10			

Description of deliverables

D3.11) Economic impacts of global warming on fisheries: [month 37]

D3.21) Climate change and Arctic aquaculture: [month 37]

D3.31) Market responses to climate change: [month 48]

D3.41) Economic settings, societal and cultural priorities in the fishery and aquaculture sectors Past and: Full Title: Economic settings, societal and cultural priorities in the fishery and aquaculture sectors Past and present impact of biophysical changes on fisheries [month 30]

D3.42) International and national fishery management, adaptation practices and strategies to climate-relate: Full Title: International and national fishery management, adaptation practices and strategies to climate-related changes in fisheries [month 48]

D3.51) Results from field experiments in the Arctic: [month 48]

D3.52) Yearly report on ethical issues: [month 13]

D3.53) Yearly report on ethical issues: [month 25]

D3.54) Yearly report on ethical issues: [month 37]

D3.55) Yearly report on ethical issues: [month 48]

D3.61) Climate change impacts, and human responses, affecting traditional whaling: [month 37]

D3.71) Indicators for sustainable development in the Arctic fisheries sector: [month 37]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS341	Field interviews finished	21	25	
MS361	Literature review and report on distribution finished	17	37	
MS371	Fisheries indicator report	14	37	
MS321	Review of Arctic aquaculture, governance issues and impacts of climate change	8	18	
MS342	Report on Russian aquaculture infrastructure and legislative status	21	30	
MS311	Ecosystem model built and parameterised	8	25	
MS322	Scenario model Arctic aquaculture economics and employment	8	25	
MS333	Journal publication submitted	8	42	
MS351	Field experiments done	14	37	

WT3:
Work package description

Project Number [1]	265863	Project Acronym [2]	ACCESS

One form per Work Package

Work package number [53]	WP4	Type of activity [54]	RTD
Work package title	Ressource Extraction		
Start month	1		
End month	48		
Lead beneficiary number [55]	4		

Objectives

The main objective of the Workpackage is to provide a detailed assessment of the impact of economic activities related to the extraction of oil and gas in the Arctic.
Specific objectives are:
4.1 Analyzing the socio-economic impacts of (a) resource extraction activity on European and world markets and economies as well as (b) an assessment of the impact of Arctic resource extraction on European policy objectives;
4.2 Assessing existing technologies including (a) fixed and floating structures (b) subsea- systems for a safe extraction of energy resources under Arctic conditions with minimal impact on the Arctic environment. Including the identification of technological gaps that hinder Arctic development as well as providing pathways for future technological development including the removal and disassembling of offshore facilities and (c) problems related to winterization;
4.3 Assessing existing rescue and evacuation crafts or vessels and identifying requirements for adjustments to account for the special situation in the Arctic;
4.4 Assessing the risks of resource exploration, extraction and transportation in Arctic waters regarding (a) oil spill response capabilities and technologies in ice-covered waters including contingency planning, (b) the behaviour of different types of oil and gas products in cold environment, (c) the impact of present and future oil spill scenarios for different climate change predictions and extreme event scenarios regarding the spread of oil, (d) providing recommendations for the design of an observing system tailored to a safe resource extraction, (e) accuracy of iceberg remote detection, trajectory forecasting, and tracking;
4.5 Assessing potential environmental pressures with respect to (a) the impact of gas and oil drilling on air quality, (b) health of the environment, (c) noise pollution, (d) identification of ecologically vulnerable areas and existing conservation plans for the most rare species in the areas of possible oil and gas development;
4.6 Developing legal and institutional solutions to new challenges and elaboration of possible institutional and legal conflicts.
4.7 Assessing the impact on sustainable development taking into account of future uncertainties.

Description of work and role of partners

Description of work (possibly broken down into tasks), and role of participants
Task 4.1 Socio-economic impacts of resource extraction
Task 4.1.1 Development of quantitative scenarios for the additional supply of Arctic oil and gas based on an assessment of non-renewable resources. Model based assessments of the impact of the scenarios on global oil and gas flows including, consequences for other gas producing regions and markets, the demand for energy including changes in trade flows, exchange rates, welfare and employment with a particular focus on the EU. Analysis of the interaction of additional supply and changes in demand through iteration of different types of models. (Task leader: IFW, partners: EWI, IMPaC)
Objective 4.1a will be met by the economics subgroup by framing scenarios how, where and when Arctic energy resources will be produced and delivered to which markets. Apart from varying assumptions about the development of international oil and gas markets and economies, these scenarios will be based on sea ice projections from WP1, complemented by estimates of production costs and local employment effects depending on different technologies, as provided by IMPaC. A minimum of six scenarios will be investigated taking into account different assumptions about production costs, resource availability and future climate conditions in the Arctic. The scenarios will be evaluated and consequences for import composition and quotas of European

economies and beyond as well as European and global transport routes and modes will be determined. We will also evaluate the consequences for substitute fuels and non-energy economic sectors including distributional implications within Europe and beyond, such as implications for welfare and trade.
Modelling work will be carried out using EWI's global gas markets model MAGELAN and IfW's global computable general equilibrium (CGE) model DART. The use of both models ensures a balance between sufficient detail and necessary scope. The models will be iterated to cover and quantify repercussions between energy supply from the Arctic and according demand from European and other markets as well as between gas markets and the rest of the economy (D4.1.1).
From the found results of task 4.1.1, policy recommendations will be derived and directly fed into WP5.

Task 4.1.2 Evaluation of the impact of Arctic resource extraction on European policy objectives. One special focus will be on the implications for European security of energy supply, via the construction, and evaluation of a suitable set of indicators (Task leader: IFW)
Objective 4.1b will be met by assessing implications for Europe's security of energy supply, constructing, using and evaluating an according set of suitable indicators and finally derive policy recommendations on European and national levels concerning all described aspects (D4.1.2). Single indicators such as measures of import-dependence, diversification, concentration, political stability in exporting countries and security implications of a changing energy mix will be applied. In addition, aggregate indicators will be constructed to provide an integrated assessment of the above taking into account the special conditions in the Arctic regarding aspects of property rights and political stability. The analysis will be mainly based on results from task 4.1.1. Relevant public sources will be considered including rankings of political stability and energy statistics. This inter-sectoral analysis will take into account the energy sector (meso-economic perspective) but also all relevant downstream sectors (macro-economic perspective).
From the found results of task 4.1.2, policy recommendations will be derived and directly fed into WP5.

Task 4.2 Assessment of technological issues
Task 4.2.1 Assessment of existing offshore structure concepts (including fixed and floating structures for exploration, production, storage, off-loading and transport, and land-based infrastructure), as well as the removal and disassembling of facilities after drilling. This assessment will be based on future ice conditions and identification of requirements for adjustment to account for the special situation in the Arctic (Task leader: HSVA, partner: IMPaC)
Objective 4.2a will be achieved by comparing and assessing the current state-of-the-art technology which can be applied for the different phases of the offshore and sub-sea field development under Arctic conditions with the future requirements following from climate change scenarios. For example an important design criterium of any marine structure is the 100 year probability of occurrence of a special event. These values are normally derived from measured data (past and present), however in this task forecast data will be used to benchmark existing structure concepts against future Arctic environmental conditions.
Systems and components considered during the study work will include seismic survey, exploration drilling, production, storage, transfer and transport as well as land-based receiving plants for hydrocarbons. To assess the behaviour of offshore structures under the changing Arctic conditions various computer programs are available (e.g. ANSYS, ANSYS AQWA, PLAXIS, AUTOHYDRO, SACS) to simulate the reaction of the structure to ice and non-ice loads and to model the interaction of the structure with the seabed. Application of the Software depends on the type of structure to be investigated. ANSYS will be used primarily for structural analyses (stress and deformations of fixed and floating structures under e.g. ice loads), ANSYS AQWA will be used to determine loads caused by waves and current, PLAXIS will be used to simulate the interaction of fixed structures with the seabed, AUTOHYDRO will be used to analyze the floating stability of floating structures.
Also various ice model test results are available to assess and predict the behaviour of fixed and floating offshore structures. In many cases the interaction with sea ice features (level ice, rafted ice, pressure ridges, icebergs) will represent the dominating load scenarios. Depending on the type of structure and expected future wind, wave and current situations in the Arctic also non-ice conditions may become important for the structural integrity and overall stability of an offshore structure. The extreme ice and non-ice load scenarios will be considered for the structural design of offshore facilities while scenarios with lower probability will be important for the operation of the structures under Arctic conditions.
Future environmental scenarios may lead to wind, wave, and ice loads that are very different to those currently used to design Arctic offshore structures. The wind, wave and ice loads expected to occur in the future will be used to assess fixed and floating offshore Arctic structures presently in use or planned to be used in near future in Arctic areas.
As a major outcome of the assessment a set of matrices will be delivered providing the basis for recommendations of technical concepts and for identifying gaps in the design of offshore facilities for Arctic

areas under the changing environmental conditions. This work will be conducted in close cooperation with WP1 providing information on ice extent, ice thickness, ice coverage, floe size, ridge density (no. / unit length) and occurrence of hummock and icebergs. HSVA will concentrate on floating offshore structures IMPaC will focus on fixed structures (D4.2.1).
The assessment of the above technologies includes considerations regarding the removal and disassembly of all sorts of offshore facilities after a drilling or production phase. Any offshore installation needs to be removed after the field has been exploited. Especially in Arctic areas the removal method for a platform or pipeline may have technical, commercial and environmental impacts. In many cases it can be more difficult to remove than to install a platform, for example fixed platforms and artificial islands.
As a result of these activities within Task 4.2 recommendations will be made to WP5 regarding governance issues.

Task 4.2.2 Assessment of existing sub-sea systems and possible future developments including onshore infrastructure as well as removal and disassembling of facilities after drilling. This will be based on future ice conditions and identification of requirements for adjustment to account for the special situation in the Arctic (Task leader: IMPaC)
Existing offshore facilities might not be suitable to withstand the wind, wave, ice and current conditions which are expected to occur in future due the climate change. As a result it is very likely that in future complete sub-sea systems for production, storage, off-loading and transport of hydrocarbons will be used in the Arctic in addition to conventional above-water systems. Also, platforms may need quick removal in case of extreme environmental situations. Depending on the environmental conditions in future other platform or pipeline concepts may need to be developed. To achieve objective 4.2b IMPaC will assess the existing sub-sea systems and possible future developments will be taken into consideration. The assessment of the above technologies includes considerations regarding the removal and de-assembling of all sorts of offshore facilities after drilling or production phase. The systematic consideration of these relatively new techniques is important as future facilities will more intensively include process modules for separation, compression or pumping of the produced fluids. These modules are normally very heavy and must be accessible from the sea surface for maintenance and replacement every three to five years or in emergency. Nevertheless, these remotely operated production plants begin to play a very important role in the resource extraction strategies of the arctic surrounding countries since technical and environmental risks could be lower. The assessment will be based on considerations how such future concepts could look like including logistic chains, accessibility, oil and gas onshore receiving plants. It will also describe the associated technical and environmental risks when platforms and other facilities are removed (D4.2.2).
As a result of all these activities recommendations will also be made to WP5 regarding governance issues.

Task 4.2.3 Assessment of climate change impact on winterization problems, guidelines and rules for offshore structures operating in Arctic regions (Task leader: HSVA)
Concepts for year around offshore operations in cold climate have to solve the winterization challenge. This subtask of this WP concerns the investigation of the impact of the future Arctic climate on the winterization issues like icing/de-icing, heating of water and fuel lines, thermal expansion and stress in the selected materials, fire fighting and rescue equipment etc. Existing recommendations and guidelines with respect to winterization problems are available from different organisations like CSA, DNV and others. They will be reviewed and evaluated considering present Arctic environmental conditions. On the basis of this knowledge HSVA will analyse the applicability of these recommendations and guidelines in the context with climate change and predicted future Arctic environmental climate conditions to achieve objective 4.2c (D4.2.3). This work task will be conducted in close cooperation with WP1 providing met-ocean and ice data for different locations and times of the year. Results from WP2 work task 4.1.6 will be used to determine the probability of occurrence of winterization problems on the six different shipping routes on the north-east and north-west passage.
As a result of all these activities recommendations will also be made to WP5 regarding governance issues.

Task 4.3 Assessment of existing rescue and evacuation crafts and vessels as well as suggestions for alternative concepts based on future ice conditions and identification of requirements for adjustment to account for the special situation in the Arctic (Work to be done in closed cooperation with WP2) (Task leader: IMPaC, partner: HSVA)
At present only a limited number of vessels and offshore oil and gas exploration and production platforms are operating in arctic marine environment. The decrease in the extent of the arctic sea ice in the summer period together with the reduction in ice thickness will increase the shipping and offshore exploration and production activities in the arctic regions making rescue and evacuation issues extremely important. These are currently not well explored.

All activities associated with exploration, production and transport of hydrocarbons in the Arctic require reliable evacuation and rescue systems for the persons on board of the different floating or fixed platforms and other offshore facilities. These evacuation and rescue systems have to work under extreme conditions as e.g. sea ice or open water conditions, under extremely low temperatures, during low visibility due to darkness, smoke, snowfall and fog. Also in case of any marine transportations including tourism in Arctic areas evacuation and rescue systems need to be available. This also applies to research or fishing vessels when they operate under ice conditions. Presently available evacuation and rescue systems have been developed primarily for non-Arctic conditions. For Arctic conditions some approaches to develop improved evacuation and rescue systems have been started including e.g. 'Arctos' vehicles and other crawler type vehicles as well as archimedes type evacuation craft and floating crafts like the so called IBEEC and IBEEV vessels developed for the Caspian Sea. IMPaC and HSVA were involved in the development of some of these systems.
Objective 4.3 will be met by assessing presently available evacuation and rescue-systems considering the future climate conditions under which evacuation and rescue operations will need to be carried out in the Arctic. Since existing systems and those presently under development may not be suitable for the environmental conditions which are expected to occur in future, gaps will be identified and proposals will be made how to overcome shortcomings of these systems (D4.3). IMPaC will concentrate on evacuation systems for offshore platforms, while HSVA will focus on lifeboats and rescue equipment for vessels in cooperation with WP1, WP2 and WP3. Information on ice extent, ice thickness, ice coverage, floe size, ridge density (number/unit length) and occurrence of hummock and icebergs coming from WP1 and shipping routes determined in WP2 are influencing the evacuation procedures, type of rescue vessels and evacuation crafts. Extended operation areas of fishing boats have an impact on their life boats and rescue equipment. Information from WP3 regarding future operation areas in combination with met-ocean and ice data are needed to assess this equipment.
As a result of all these activities recommendations will also be made to WP5 regarding governance issues.

Task 4.4 Assessment of environmental risks related to resource exploration, extraction, and transportation, and contingency planning for mitigation of risk
Task 4.4.1 Assessment and recommendations regarding oil spill response capabilities and technologies in ice-covered waters (Task leader: SAMS, partners: SINTEF, HSVA, UCAM, Met.no)
Objective 4.4a will be met by comprehensively reviewing the state-of-the-art technologies presently available to mitigate the environmental and socio-economic impacts of an Arctic oil spill (D4.4.1). The review is to encompass all response capabilities and technologies up to the start of ACCESS (2011). Results of the review will be used by Task 4.4.2 in order to guide the tank experiments which in turn will reduce the levels of uncertainty that are presently inherent in oil spill models (Task 4.4.3)
Oil spill contingency and response strategies vary considerably between open water and areas with a sea ice cover. The temporal and spatial variability of the Arctic sea ice means that we need strategies that are tuned to the appropriate ice and weather conditions at the time of a spill. This task brings together knowledge that has been amassed over many decades, including the significant review papers that have been prepared. In particular we will draw information from the recently conducted reviews by the Joint Industry Project (JIP) in which ACCESS partner SINTEF were a key participant.
Recent events in the Gulf of Mexico have led to a moratorium on drilling in federal waters of the US Arctic. This could be perceived as an admission that this region presents unique environmental challenges that need to be addressed by all stakeholders. Task 4.4.1 will provide an objective assessment of the strengths and weaknesses of the present oil spill response capabilities and technologies in ice-covered waters by performing a simultaneous up-to-date assessment of the four main areas. These areas are:
(1) oil detection,
(2) oil fate, behaviour and weathering,
(3) oil modelling and
(4) oil response techniques / countermeasures.
This review goes beyond the remit of previous studies as the final chapter of the review process will be recommendations for further technological developments, as well as suggestions on improvements to the delivery of a key (European based) Arctic oil spill contingency planning service. In addition we will suggest a programme for the development of the improvements we recommend in order for spin-off proposals to be developed. Close ties with WP1 (e.g. Partner AWI) and WP2 (e.g. Partner UCAM and Met.no) will ensure that issues associated with a changing Arctic climate as well as the techniques associated with the transportation of hydrocarbons are well integrated within this review.
A thorough understanding of the environmental risks (and their limitations) related to resource exploration, extraction, and transport will allow for a better and a more comprehensive contingency planning system to be developed for the mitigation of risk. This in turn leads to a better and more responsive regulatory regimes

and thus governance. As a result of all these activities recommendations will also be made to WP5 regarding governance issues.

Task 4.4.2 Assessment of the behaviour of different types of oil and gas products in a cold water environment based on experiments and modelling (Task leader: SAMS, partner: SINTEF, UCAM, Met.no)
Objective 4.4b is tackled by aiming to understand and parameterise oil behaviour in a cold water (sea ice) environment through a series of repeatable and controllable tank experiments. At present complex oil spill models are used to assess the spread, behaviour and fate oil from a spill. For example the Oil Spill Contingency And Response model OSCAR (developed by Partner SINTEF) uses oceanographic and atmospheric variables to compute the surface spreading, slick transport, entrainment into the water column, evaporation, emulsification, and shoreline interactions to determine trajectory and fate of the oil. Such models are well established and in open-ocean conditions and given accurate wind and current input data their predictions are reasonably reliable. However modelling of oil spread in the presence of sea ice is much more uncertain, as shown by the results of the oil spread model developed for sea ice by Partner SAMS. These uncertainties originate from our lack of understanding of the behaviour of oil/gas products in a cold water environment combined with an inadequate knowledge of the 3D shape of the ice bottom. By addressing these limitations we can better parameterise the variables that influence behaviour of oil in cold water and therefore provide more accurate simulations oil spills in ice covered seas (Task 4.4.3).
In order to achieve these ground-breaking results small scale and repeatable tests will be performed in dedicated cold room facilities. Parameters to be monitored include: viscosity, oil density, ice bottom roughness, oil spreading rate and the influence of currents on this rate. Additional knowledge of the 3D under ice topography of different ice types will be obtained from the Autonomous Underwater Vehicle operations of WP1.
Our tests will be performed on three relevant hydrocarbon products
• Gas Condensate: A by-product of gas extraction i.e. the Shtockman field.
• Heavy fuel oil: The type of oil that may be spilt should there be a shipping accident and ,
• A medium North Sea crude: This is one of the oil types used in the JIP experiments and thus direct comparisons can be made to the large scale spills performed within the JIP project.
The experiments will be conducted in two sessions, each separated by 8 months. This separation allows for the knowledge gained from the analysis of data from the first set of experiments to be fully utilised for the benefit of the second set. With this methodology, we expect to deliver a step change in our understanding of the behaviour of oil in a cold water environment.
An important parameter affecting the direction of the flow of oil under ice is the under-ice topography. However, there is no way of determining this directly except by AUV or submarine multibeam sonar. This task will evaluate the possibility of determining sea ice surface roughness from satellite measurements as several studies have indicated that it may be possible to use synthetic aperture radar (SAR) backscatter as a proxy for the underside roughness. In this task met.no will determine statistical measures of the correlation between the roughness as derived from AUV multibeam sonar (WP1.2.5, Deliverable 1.2.7), and the roughness from multi-polarisation SAR images. If successful this will provide a significant leap forward as satellite derived ice roughness would provide a realistic means of providing almost synoptic wide area coverage of ice covered areas for both detecting and assessing the flow of oil spills. The results will be reported (D4.4.2) and then applied to the modelling work of Task 4.4.3.

Task 4.4.3 Assessment of the impact of both present and future oil spill scenarios for different climate change, extreme event scenarios regarding the spread of oil (Task leader: SINTEF, partner: SAMS, UCAM, Met.no)
Objective 4.4c will be met by aiming to build on the results of Task 4.4.2 in order to understanding the environmental consequences of an oil spill in the ‘pristine’ Arctic environment which may be large. Locally an oil spill may impact the ecosystem and the livelihoods of local communities that depend on them for a living. Regional and global impacts may be much more substantial. Citizens, governments, NGOs, industry and policy makers will react to an Arctic spill, especially if it cannot be cleaned-up quickly and efficiently. This will influence future economic activities across the Arctic. In order to provide a sound scientific foundation for our understanding of these issues and how they will change with the changing environmental conditions of the Arctic marine environment we will perform both present and future oil spill scenarios (D4.4.4). We suggest representative oil spill scenarios for each of the following events, (1) seabed pipeline rupture, (2) loss associated with a tanker loading and transport, and (3) loss of well control (blowouts) during exploration and/or production. The selected scenarios will be simulated under present, 10 years future and 30 years future environmental conditions. This gives a total of nine scenario events.
These scenarios will concentrate on probable shipping routes (linked to results from WP2, Task 2.1, Partner AARI) and production sites. We will provide an ensemble of different oil spill scenarios based around subtle changes in the forcing parameters (e.g. ocean currents, oil viscosity etc) will be performed. This will enable the

influence/sensitivity each parameter has on the temporal and spatial evolution of oil dispersal under sea ice to be determined – these are crucial steps for the synthesis of model output and will further our understanding of oil flow under ice. In addition the responses of different under-ice topographies to identical spill experiments will enable an understanding of how the under-ice topography influences oil movement.
Operational short- to medium range forecasting capability will be provided by coupling the OSCAR oil spill model to the outputs of the TOPAZ Arctic Ocean model provided by the EC GMES Marine Core Service project MyOcean (http://www.myocean.eu.org) run by Met.no. This will create the capability to assist oil spill contingency planning within an environmental information framework already being developed by the EC. Input data for the long range forecasts will be provided from WP1 (Task 1.3.1 Partner OASys). This work will be done in close collaboration with WP2, WP3 and WP5.

Task 4.4.4 Design of an observing system (Task leader: FastOpt, partner: OASys)
This task relates to objective 4.4.d: providing recommendations for the design of an observing system tailored to a safe resource extraction.
Safe extraction of resources relies on forecasts of the coupled ocean sea-ice system around offshore structures. Such forecasts are produced by numerical forecasting systems which have to be initialised with the most 'realistic' state of the coupled ocean sea-ice system. This initialisation is carried out via assimilation of observational data into the forecast model. Today, it is not clear how to best configure an observing system to achieve the best possible forecast skill around a given (set of) offshore platform(s).
Objective 4.4.d will be achieved via quantitative network design methods applied to optimise forecast skill around the Shtokman field as a test case. The Quantitative Arctic Observational Network Design (AOND) framework (including the assimilation system NAOSIMDAS and the forecasting system) will be developed in WP1.
The sub tasks to be carried out in close collaboration by FastOpt and OASys are:
• setup of the forecasting system for time scales of a month to a few years and fine spatial resolution of the entire Arctic basin
• extending the model to simulate all relevant observational data types not yet handled by the assimilation system (e.g. ice mass buoys to be deployed in WP1) and adaptation of the model's derivative code
• extending the forecasting system to predict target quantities relevant to the Shtokman field, e.g. its distance to the ice edge
• evaluate a set of candidate networks consisting of currently available and possible future remote-sensing data in conjunction with a set of in situ observations e.g. acoustic floats equipped with upward looking sonar and EM-Bird measurements for a number of potential sampling locations and times (cooperation with WP1 will be pursued)
Based on these analyses recommendations (D4.4.5) on the design of a future Arctic observing system for safe resource extraction are derived, feeding into WP4 tasks 4.6 and 4.7 which feed into WP5.

Task 4.4.5 Assessment of the accuracy of iceberg remote detection, trajectory forecasting, and tracking (Task leader: UPMC, partner: met.no)
The aim of Objective 4.4e is to assess and make recommendations for improving the detection and tracking of icebergs within the ice covered seas of the Arctic. For many offshore drilling and production structures, as well as ships and tankers, a major threat to their safety comes in certain areas of the Arctic from icebergs. This is due to a combination of factors including their size and the erratic nature of their drift. In areas of high social economic interest, such as the Barents Sea, where there is high and increasing levels of resource exploitation both from the fishing and the offshore oil and gas extraction activity the risk of an iceberg collision poses a serious threat to the safety of personnel as well as an economic and environmental threat. It is therefore important to quantify our ability to detect, track and predict the movement of icebergs so that the necessary actions can be taken to avoid collision.
User needs for iceberg information will be determined as part of WP2 Task 2.1.5 Evaluation of user requirements and needs for forecasting of ice conditions. However, the oil and gas industry are looking at range of timescales, for example a 3-day warning period will allow the mobilisation of the necessary support vessels to attempt to manoeuvre a potential ice hazard away from a production area whilst a of 6 hour (minimum) warning period is needed for the ‘planned’ disconnection and moving of a Floating Production Unit (FPU).
Within Task 4.4.5 met.no will assess the current techniques for the detection and tracking of icebergs using synthetic aperture radar (SAR) satellite data. These techniques include the application of a Constant False Alarm Rate (CFAR) and morphological filters either to raw SAR images or those that have been processed for Power Mean Ratio (PMR) or Gamma-PDF. Evaluation has been limited due to lack of available data on iceberg target morphologies and tracks, and it has only been applied routinely to single polarisation SAR (e.g. for the International Iceberg Patrol on The Grand Banks off Newfoundland, Canada). The recent increase in the

availability of multi-polarisation SAR images provides additional information that could be used to reduce the CFAR and this also needs to be assessed.
For the assessment of our current ability to predict iceberg tracks, met.no has, in collaboration with the Canadian Hydraulics Centre, developed a prototype iceberg trajectory model for use in the Barents Sea (Broström et al, 2009a). The forecasting system for this model has been validated with historical observations of icebergs and ocean current measurements. Within the Task we will assess the strengths and weaknesses of present iceberg forecasting systems, and recommendations will be made to ensure a more reliable and tailored service for activities in the offshore sector for the future.
Ground-truth data for quantifying the temporal and spatial errors in the satellite tracking and model prediction capabilities will come from the deployment of 6 GPS tracker buoys by UPMC. This will enable direct comparisons between observations and with SAR detection and trajectory forecasting algorithms. In particular the aim is to determine the levels of uncertainty in the predictions (e.g. how far from the predicted iceberg's position does it end up and over what time), starting from 72 hours (3 days) and following with 48, 24, 12, 6, 3, 1 and 0.25 hours. Positional and rotational data from the buoys situated on the icebergs will provide, in conjunction with observation of the iceberg size and shape at the time of deployment, additional data to determine how much factors such as satellite sensor look direction and target angle affect the detection capability.
D4.4.3 will report on the current state-of-the-art in iceberg detection and tracking by SAR satellite data, and quantify the potential for new SAR products (e.g. multi-polarisation) to improve these techniques. It will also describe the strengths and weaknesses of the present iceberg forecasting systems, and through the use of the GPS tracker buoy data, determine how reliable these predictions are. Finally, it will make recommendations for future activities, such as improved ground truth data, needed to make such a service more reliable and tailored for activities in the off-shore sector and to WP5 regarding governance issues.

Task 4.5 Assessment of other environmental pressures
Task 4.5.1 Quantification of the impact of gas and oil drilling on chemical composition, regional air quality, deposition and on the distribution on radiatively active compounds in the Arctic (Task leader: UPMC, partner: CICERO, DLR, IMPaC)
With the prospect of an increase in Arctic off-shore oil and gas extraction and related on-shore petroleum facilities a more detailed characterization of the effective emissions near the sources is needed. This characterization should include a detailed understanding of their impact on local and regional air quality and climate for the present state and future emissions scenarios.
In order to achieve objective 4.5a the aim of this task is to (1) evaluate the emissions of different atmospheric chemical compounds at oil and gas facilities and (2) use the regional and global models available in ACCESS (MOZART, NorClim, Oslo CTM2, SCM, Polar-WRF) to quantify the impact of the oil/gas Arctic extraction sites on the pollution and climate at northern latitudes.
A compilation of available data on the emissions of different atmospheric compounds by existing oil/gas extractions facilities will be performed by UPMC-LATMOS and CICERO (D4.5.3). The focus of this study will be on methane, volatile organic compounds, carbon monoxide, nitrogen oxides, black and organic carbon and sulfur compounds. This will result in emission inventories for chemical species emitted by oil and gas platforms. Uncertainties in emissions will be assessed based on comparison with other available estimates and use of aircraft data collected in the project (see below).
The flights performed to quantify ship emissions in WP2 (D2.4.1) will also be used, if possible, to fly past existing facilities off the northern coast of Norway or other facilities in the Barents Sea in order to measure trace gas and aerosol concentrations in emission plumes downwind (DLR). The measurements will include CO2, CO, CH4, O3, NO, NOy, HNO3, PAN, HCs, aerosol size and number, non-volatile aerosol fraction, and meteorological data (temperature, wind, humidity). These data will be used to validate calculated emission factors for the off-shore facilities probed and to study the production of secondary emissions downstream of the facilities.
The planning of the aircraft flights will be based on forecasts of emission dispersion using FLEXPART (DLR). These data will be used to validate calculated emission factors for the off-shore facilities probed and to study the production of secondary emissions downstream of the facilities and to assess uncertainties in current emission inventories.
The new data and data generated as part of D4.5.8 will also be used by UPMC-LATMOS and CICERO to estimate emissions for the future Shtokman site. Global models (MOZART, NorClim, Oslo CTM2) will be used by UPMC-LATMOS and CICERO in order to determine the impact of these emissions on the oxidizing capacity of the atmosphere, i.e. the hydroxyl radical (OH) distribution and the methane budget. These models will also be used to assess the impact of these emissions on distributions of ozone and aerosols in the Arctic. A regional model (Polar-WRF) will be used for case studies during the period of the aircraft campaign to investigate impacts on local and regional scales (UPMC). The sensitivity of model results to different assumptions in the emission

estimates and levels of oil/gas extraction activities will be explored and used to estimate uncertainties in the results. During installation, operation and removal of fixed or floating offshore platforms and other facilities required for the oil and gas industry Arctic emissions are produced. These are in form of exhaust gases, light or noise will have impacts on the environment. The quantity of emission depends on a number of parameters as e.g. on the type and function of the offshore facility. The quantities of exhaust gases will be determined by IMPaC on basis of typical design data of the offshore facilities. This data will be used as input for the simulations with the chemistry-climate models. The predicted quantities of exhaust gases will be compared with measured data collected during flight performed down-stream the similar facilities as a means of estimating uncertainties (D4.5.9).
As a result of all these activities recommendations will also be made to WP5 regarding governance issues.

Task 4.5.2 Assessment of the impact of gas and oil extraction on the health of the ocean environment (Task leader: UPMC; partner SIO)
Objective 4.5b aims at identifying a baseline set of parameters and techniques that are needed to monitor the health of the ocean environment (UPMC). Before oil and gas can be extracted at any given site, a baseline understanding of the ocean environment needs to be established. Then during the exploitation phase of the gas or oil field, the environment would need to be continuously monitored to ensure the ocean environment stays within acceptable limits. The continuous monitoring of the ocean environment can be expensive as historically it has involved both ship-time (e.g. CTD casts) and scientific personnel. Recently however there has been a shift towards the monitoring of the ocean environment using autonomous platforms. The maturing of technologies such as sea gliders with the operational experience of these instruments by the scientific community has driven a change in perception of Sea Gliders from high-risk technology towards operational instrumentation. Gliders now operate in all oceans of the world.
Our Gliders will operate during the time frame of ACCESS on North-South transects (about 1000kms long from 70° up to 80°N approximately) from the Kola Peninsula up to the northern edge of the Barents Sea in the Russian EEZ (and /or from Vardo to Svalbard in Norwegian waters). The data collected will be essentially temperature and salinity at all depths along dedicated transects with sea gliders and/or vertical profiles at given locations taken from ships of opportunity engaged in the Shtokman consortium. In addition horizontal currents will also be measured with Sea Gliders and/or LADCP (Lowered Acoustic Doppler Current profiler) installed on ships. Water samples will be taken in addition to the CTD (conductivity, temperature, depth) casts for water mass analysis (iodine 129 will also be sampled, in addition to oxygen, Ph, alkalinity; nutrients and chlorophyll). These data will be analysed (temperature/salinity diagram, water masses volumetric census, geostrophic current calculations) and compared with the very well documented historical data since 1920 see task 1.3.1) for the Barents Sea. This will be an efficient way to control the evolution of water masses contents in this sensitive area in the context of climate change and future gas and oil extraction (D4.5.5). This ocean data set will also be used for anticipating icebergs drifts (Task 4.4.5) based on a better knowledge of ocean currents influencing icebergs drifts and ocean temperature and salinity influencing icebergs melting and sea ice conditions in conjunction with weather conditions (WP1).
As a result of all these activities recommendations will also be made to WP5 regarding governance issues.

Task 4.5.3 Assessment of the impact of gas and oil drilling on marine mammals due to noise pollution including seismic surveys development of an acoustic data management architecture, installation of monitoring equipment and mitigation procedures and policies as well as recommendation for guidelines on safety zones (Task leader: UPC, partner: SIO)
Objective 4.5c will be met by investigating the effect of noise pollution on marine mammals. The negative effects caused by noise pollution can induce various levels of damage among marine mammal species and even intraspecific differences including, for example, the inhibiting the ability to migrate at a given time or the ability to use sound for the vital activities like foraging. The most harmful impact of noise on marine mammals and fish is seismic surveys associated with oil/gas exploration. To protect marine mammals against potential physical injuries and undue disturbance some countries have implemented specific safety zones with varying radii. They differ according to noise levels for injury threshold (for cetaceans 180 dBrms re 1 µPa, pinnipeds 190 dBrms re 1 µPa) and disturbance threshold (160 dBrms re 1 µPa). For a better understanding of how an optimal safety zone should be defined for Arctic condition an acoustic model should be used that accounts for site-specific seismic air gun arrays and environmental conditions for transmission loss. Accurate modelling by SIO will include a description of:
• the seismic source (Fairfield source signature, guns array directionality, source array composition),
• the input site-specific environmental data (water and bottom sound speed profile with the bottom relief and sound attenuation in bottom sediments),

• the computation of the impulse response and transfer function for input environmental data by using a Pseudo Differential Parabolic Equation acoustic model (PDPE code) and
• a computation of the necessary size of a Monitoring-Safety Zones by a pulse Transmission Loss graph.
The radius of a zone depends on the specific environmental conditions (as well as modifications necessary to account for seasonal variability) as well as the local species of marine mammals. Special attention will be paid to species listed in the IUCN Red List of Threatened Species. For example Humpback, Fin and Minke whales have a low frequency hearing and therefore are very susceptible to seismic noise. The modelling efforts will, as a proposed test case, be carried out for the Barents Sea. This work will be performed in close collaboration with WP1 delivering estimates on the impact of climate change on the temperature-salinity structures of water masses and shifting of the position of the ice margin of the Arctic Seas. Based on the results of the above activity, SIO will provide guidelines for the implementation of safety-zones of the Barents Sea as well as preliminary estimations of such zones for others Arctic Seas to limit the impact of noise on feeding and migrating marine mammals (D4.5.7).
Currently, no standardized measures of noise exist. Another objective of this task is therefore to give advice on how to standardize protocols and units of measurements at an international level taking into account the problems related to measurements in underwater environments in the specific case of the Arctic (see WP3).
Three activities will be carried out by UPC in close collaboration with WP2 (effects from shipping noise on marine mammals, D2.4.4 and D2.4.5) and WP3 (mapping of the marine mammal populations and effects of climate change on traditional whaling, D3.6.1):
• We anticipate conducting a survey of the oil/gas exploration and exploitation in the Arctic, including a map of the potential noise contribution from the current and future exploration/exploitation sites (D4.5.1). This will also include the development of an online simulator to predict noise interactions (associated to seismic surveys, offshore platform construction and exploitation, including on site measurements) with marine mammals, i.e. their effects on the capacities of the marine mammals to find preys and orientate. This simulator will serve both governance decisions and marine mammal conservation.
• Design of a real-time architecture for the monitoring of noise from offshore platforms and cetacean vocalizations including the development of the acoustic data management architecture (hardware and software), the development and implementation of the real-time acoustic event (artificial and biological sources) detection and classification software as well as the development of a user-friendly application for online access of the acoustic data. This task will be Arctic specific and will include software development based on on-site measurements conducted in the WP, following a standardized protocol. No installation of acoustic devices is necessary at this stage. This task implies the modelling of the cetacean acoustic signal propagation and the real-time access of the data once it is available, independently of the location. It means the design of an interface to allow future end-users (governments, scientists, public, etc.) to access it. Depending on the necessity, the access will be restricted by password or directly open (D4.5.2).
• Conceptual implementation of the real-time architecture for the monitoring of noise from offshore platforms including the virtual installation and management of a passive acoustic monitoring system in the area around a platform and a real-time connection to the platform to transmit analysis results (D4.5.6). This activity will synthesise the output of WP2 (noise from shipping) and WP3 (marine mammal population distribution.
The output of the above activities will provide all the necessary data for best practice recommendation on marine mammals and noise to WP5.

Task 4.5.4 Identification of ecologically vulnerable areas in the regions where potential oil and gas fields are as well as recommendations for protection (Task leader: UPC)
The vulnerable nature of the Arctic ecosystem coupled with the extreme operating environment for the extractive industry call for a significant assessment of both operational hazards, and the sensitivity of the marine environment to potential spills. Some areas of the Arctic are considered to be more vulnerable to spills either due to a high concentration of wildlife, or because such areas are of integral importance to other industries such as fisheries that are reliant upon a healthy marine ecosystem.
It's important the identification of the ecologically vulnerable areas where the oil and gas fields extraction can be a risk. The Norway government has chosen some of these areas in the Barents sea but there is no consensus on the rightness of these areas since some NGOs and other institutions had made other proposals. UPC will undertake a set of criteria for identificating ecologically sensitive areas, and mapping them. To do it UPC will review the proposed indicators, selecting the most apropiated. In doing it, ACCESS will also identify conflicts where spatial overlaps exist between fisheries areas (WP3) and the areas of interest to the oil and gas sector.
The project will provide guidelines to include on the current management plans and conservation plans , for all marine mammal population at risk for affected areas, both in the context of the Barents Sea and the broader

Arctic area (D4.5.4).s a result of all these activities recommendations will also be made to WP5 regarding governance issues.

Task 4.6 Provide legal and institutional solutions to new challenges (Task leader: NERC)
Today, overhauls of regulatory frameworks are undertaken usually only when faced with inadequate conditions, or a crisis. ACCESS aims at providing recommendations for a systematic overhaul of regulatory frameworks, and how to mitigate against them before they happen.
Objective 4.6 will be reached by critically evaluating existing regulatory instruments (such as UNCLOS, OSPAR, as well as those dealing with offshore installations, emergency operations and pollution prevention conventions and protocols) relevant to the Arctic Region and to mineral/hydrocarbon extraction, and to assess whether they can sustain the variations and pressures (such as increased iceberg occurrence, extreme weather conditions) brought to bear from climate change on the ocean environment. In addition is it to provide a governance foundation, integrating an overview of the needs of the changing industry with the demands on resources in the region capable of supporting and sustaining human activities in the Arctic region (D4.6).
Task 4.6 is contributing to the overall aim of identifying the areas of governance (potential) shortfall through a two-way dialogue between the WPs 2, 3, & 4, and WP 5. Each individual WP will work on its own speciality, but in a coordinated manner with WP5. WP 4 will provide assessments of the efficiency of regulatory systems, level of compliance, incidence of sanctions, etc related to resource extraction in the Arctic Region. Based on this information WP5 will assess the interaction between sectors, and what is the most effective way of integrating these into a single system (if considered viable).
As a result of all these activities recommendations will be made to WP5 regarding governance issues.

Task 4.7 Provide information based on indicators for sustainable development (leader: IFW, partner: UPMC, NERC, SAMS, IMPaC, UPC)
Objective 4.7 will be met by using indicators that are able to determine the impact of changes in economic activities in the Arctic associated with resource extraction on sustainable development. These indicators can be classified into four categories. Indicators measuring changes in pollution levels (e.g. air pollution, greenhouse gas emissions and noise), energy availability and dependency, economic development (e.g. employment, investment and welfare) as well as the associated risk for ecosystems and local communities. To take into account uncertainties about future development, these indicators will be provided for different scenarios.
As a result of all these activities a report will be compiled (D4.7) and delivered to WP5 as input to a final report on indicators for sustainable development covering all aspects of ACCESS (D5.7).

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UPMC	48.00
2	Oasys	9.00
3	NERC	4.00
4	Kiel IfW	35.00
5	UCAM	3.00
9	HSVA	15.00
11	Met.no	6.00
12	FastOpt	7.80
13	SAMS	18.00
15	SIO	17.00
16	IMPaC	34.00
17	UPC	31.00
18	DLR	4.00

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
23	CICERO	6.90
24	SINTEF	17.70
25	EWI	5.00
	Total	261.40

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D4.11	The impact of Arctic energy supply	4	29.00	R	PU	42
D4.12	Implications of Arctic energy supply for European policies	4	14.00	R	PU	47
D4.21	Report on fixed as well as floating offshore structure concepts	9	14.60	R	PU	37
D4.22	Report on the use of subsea systems	16	14.00	R	PU	37
D4.23	Winterization of structures in arctic regions	9	10.00	R	PU	42
D4.31	Report on rescue and evacuation systems	16	16.00	R	PU	31
D4.41	Oil spill response capabilities and technologies in ice-free and ice-covered water	13	7.00	R	PU	11
D4.42	The behaviour of oil types in cold water	13	11.00	R	PU	30
D4.43	Iceberg remote detection, trajectory forecasting, and tracking	11	9.00	R	PU	40
D4.44	Report on oil flow under ice	24	10.00	R	PU	43
D4.45	Recommendations on future Arctic observing systems	12	16.80	R	PU	47
D4.51	Interactive noise maps of exploration/exploitation sites	17	7.00	R	PU	18
D4.52	Simulator of the effects of noise from oil industry operations on marine mammals	17	13.00	O	PU	25
D4.53	Emissions of a large set of atmospheric compounds in gas/oil extraction facilities	1	10.00	R	PU	25
D4.54	Identification of ecologically vulnerable areas	17	8.00	R	PU	25

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D4.55	Report on the ocean properties of the Barents Sea region	1	13.00	R	PU	30
D4.56	Design and conceptual implementation of a real-time acoustic architecture	17	16.00	R	PU	37
D4.57	Safety zones and noise exposure criteria for marine mammals exposed to anthropogenic noise	15	14.00	R	PU	37
D4.58	Report on the impact of emissions from oil/gas wells	1	13.00	R	PU	42
D4.61	Report covering potential cross-sectoral governance options	3	8.00	R	PP	30
D4.71	Indicators for sustainable development	4	8.00	R	PP	43
		Total	261.40			

Description of deliverables

D4.11) The impact of Arctic energy supply: A comprehensive report on the impact of Arctic energy supply on the European energy system and macroeconomic implications, taking into account validated and quantified economic feedback effects. [month 42]

D4.12) Implications of Arctic energy supply for European policies: Report assessing the implications of Arctic energy supply for European policies, with special consideration of the implications for a low-carbon economy in the EU and European energy security. [month 47]

D4.21) Report on fixed as well as floating offshore structure concepts: Report assessing existing and new fixed as well as floating offshore structure concepts regarding future ice conditions. [month 37]

D4.22) Report on the use of subsea systems: Report on possible use of subsea systems under arctic conditions as well as impacts due to platform removal and decommissioning actions. [month 37]

D4.23) Winterization of structures in arctic regions: Report on climate change impact on the winterization of structures in arctic regions. [month 42]

D4.31) Report on rescue and evacuation systems: Report assessing existing rescue and evacuation systems and recommendations for future systems. [month 31]

D4.41) Oil spill response capabilities and technologies in ice-free and ice-covered water: Report covering a state-of-the-art assessment and recommendations regarding oil spill response capabilities and technologies in ice-free and ice-covered water (detection, fate, modelling, response and recommendations). [month 11]

D4.42) The behaviour of oil types in cold water: Report on the behaviour of oil types in cold water with new parameterisations for ice bottom roughness and oil behaviour. [month 30]

D4.43) Iceberg remote detection, trajectory forecasting, and tracking: Assessment of the accuracy of iceberg remote detection, trajectory forecasting, and tracking. [month 40]

D4.44) Report on oil flow under ice: Report on the model and our improved understanding of oil flow under ice (three oil types). The scenario runs will bring an improved understanding of the impact of an oil spill in both open water and sea ice and from these suggestions to substantially enhance oil spill contingency planning will be made. [month 43]

D4.45) Recommendations on future Arctic observing systems: Report on recommendations on future Arctic observing system for save resource extraction. [month 47]

D4.51) Interactive noise maps of exploration/exploitation sites: Development of interactive noise maps of exploration/exploitation sites. The results of this report serve as an input to D4.52 and D4.56. [month 18]

D4.52) Simulator of the effects of noise from oil industry operations on marine mammals: Development of a simulator of the effects of noise from oil industry operations on marine mammals. The results of this report serve as an input to D4.56. [month 25]

D4.53) Emissions of a large set of atmospheric compounds in gas/oil extraction facilities: Report on the compilation of available emissions of a large set of atmospheric compounds in gas/oil extraction facilities. [month 25]

D4.54) Identification of ecologically vulnerable areas: Report identifying ecologically vulnerable areas in the regions where potential oil and gas fields are as well as recommendations for marine mammal conservation action. [month 25]

D4.55) Report on the ocean properties of the Barents Sea region: Report on the ocean properties of the Barents Sea region including seasonal variability to control the evolution of water masses contents in the context of climate change and future oil and gas extraction. [month 30]

D4.56) Design and conceptual implementation of a real-time acoustic architecture: Report on the design and conceptual implementation of a real-time acoustic architecture including PAM software at offshore platforms with a user-friendly interface for online access of acoustic data. This report will include a standardized protocol to measure noise and cetacean sounds in the Arctic. [month 37]

D4.57) Safety zones and noise exposure criteria for marine mammals exposed to anthropogenic noise: Report on recommendations for guidelines on safety zones and noise exposure criteria for marine mammals exposed to anthropogenic noise. [month 37]

D4.58) Report on the impact of emissions from oil/gas wells: Report on the impact of emissions from oil/gas wells on the atmospheric oxidizing capacity and on the methane budget. [month 42]

D4.61) Report covering potential cross-sectoral governance options: Internal report covering potential cross-sectoral governance options (with WP2, 3, 5) for analysis and review by ACCESS partnership. [month 30]

D4.71) Indicators for sustainable development: Report providing information based on indicators for sustainable development. [month 43]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS411	First estimates of oil and gas production costs for different ice scenarios	16	6	
MS412	Estimation of oil and gas production costs for different ice scenarios completed	16	16	
MS441	Begin integration of new oil behaviour, ice roughness algorithms into model and testing accuracy ver	13	30	Full Title: Begin integration of new oil behaviour, ice roughness algorithms into model and testing accuracy verses tank experiments.
MS442	Completed all representative oil spill scenarios related to seabed pipelines, tanker loading and tra	24	39	Full Title: Completed all representative oil spill scenarios related to seabed pipelines, tanker

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
				loading and transport, and loss of well control (blowouts).
MS444	Evaluation of the comparison of in situ iceberg drift data with detection and trajectory models comp	1	37	Full Title: Evaluation of the comparison of in situ iceberg drift data with detection and trajectory models completed.
MS451	Emissions data for existing and future gas/oil extraction facilities in the Arctic	16	25	
MS452	Gridded dataset, providing estimates of the emissions of the different oil/gas extraction facilities	1	25	Full Title: Gridded dataset, providing estimates of the emissions of the different oil/gas extraction facilities in the Arctic, with a focus on the Shtokman facility if possible
MS453	Simulator of the effects of noise from oil industry operations on marine mammals	17	25	
MS461	Synthesis of regulations, agreements, legislation relating to oil and gas extraction sector. Report	3	13	End of the title: [...]sector. Report to carry analysis of shortfalls and evaluation of options to address these, as well end-user evaluat
MS443	First successful evaluation of an observational network with a target quantity relevant to the Shtok	12	40	Full Title: First successful evaluation of an observational network with a target quantity relevant to the Shtokman field

WT3:
Work package description

Project Number [1]	265863	Project Acronym [2]	ACCESS

One form per Work Package

Work package number [53]	WP5	Type of activity [54]	RTD
Work package title	Governance, Sustainable Development and Synthesis		
Start month	1		
End month	48		
Lead beneficiary number [55]	3		

Objectives

The objective of WP 5 is to provide an overview of each of the sectoral components of ACCESS in respect of their relevant regulatory systems, legislation and agreements, and to critically assess the strengths and weaknesses of these systems as they might respond to a significant period of climate change in an integrated manner with regard to diverse natural and human impacts. WP5 effort will be focused on the governance requirements, which derive from the science-based assessments relating to human activities under changing climate conditions that are accelerated in the Arctic as developed in the three thematic work packages, WP 2, 3 and 4. These specific sectors of maritime shipping, tourism, fisheries and oil and gas extraction will be assessed for shortfalls, conflicts and lacunae in regulations with recognition that there are adaptation and mitigation strategies and infrastructures that have yet to be considered. WP5 will propose governance/stewardship strategic options and elements of integrated policy in line with future sustainable development of the region to balance economic prosperity, environmental protection and social equity. Such strategies, or infrastructures, help to define the gaps, overlaps and inefficiencies in current institutional arrangements. The assessment of human activities will benefit from effective integration with the assessment of Arctic climate change as derived from WP1.

Description of work and role of partners

Description of work

WP5 will analyse the governance issues and evaluate the solutions most appropriate to ensuring the sustainable development of human activities in the Arctic region on the basis of the robust scientific foundation provided by the other Work-packages in ACCESS. WP5 will review regulations of fisheries, the marine transportation sector and oil and gas extraction related activities to identify gaps, shortfalls and conflicts, and evaluate potential amendments which might be required in governance over a protracted period of climate change affecting the Arctic region. WP5 will ensure that within ACCESS an appropriate balance is maintained in the appreciation of the rights, responsibilities, interests and obligations of relevant states, Arctic populations and in particular indigenous peoples and the international community.

To create the necessary basis for action, the international information exchange on research projects must be broadened, to facilitate coordination and to ensure open access to information from Arctic monitoring and research. Arctic cooperation in research projects remains crucial to raise awareness and to strengthen policy inputs. This is particularly needed because effective prevention and mitigation policies in the Arctic depend on the understanding of global and trans-boundary processes of both geophysical and socio-economic nature and it is necessary to establish multi-sector frameworks for integrated ecosystem management.
Policies in areas such as environment, climate change, energy, research, transport and fisheries have a direct bearing on the Arctic. Policy responses should be based on assessments using the best available scientific knowledge and understanding of the processes affecting the Arctic.

The ACCESS programme, by focusing on three main sectors of Maritime Transport, Fisheries and Resource Extraction, will address core elements of the Arctic activity of regional and global significance, as they respond to climate change effects over a thirty-year period. This independent overview, developed from input from more than 30 research institutions, commercially interested stakeholders, non-governmental organisations, and regional peoples will allow informed strategic direction and policy choices within the EU and other interested organisations. International policy developments need to be closely followed throughout the proposal duration.

Arctic governance is still an elusive concept, open to be interpreted in different ways in different contexts and in relation to changing priorities. This work package will also review levels of consistency among national implementation strategies, recognizing that impacts in a dynamic system will cross national boundaries. The stakeholder group and the advisory board components of ACCESS have been identified to reflect the necessity to address relevant multi-sector frameworks, expanded to include legal institutions, regulatory systems, insurance frameworks and associations of operators.

WP5 will recognise that there are areas in the Arctic Ocean that fall within national jurisdictions (e.g., territorial sea and continental shelf) and areas that will continue to be unambiguously international space (i.e., high seas, the Area) whatever happens to the delimitation of continental shelf areas. This distinction also defines current rights and responsibilities of the European states within the Arctic Ocean, based on membership within UNCLOS.

This work will lead to; (1) a better understanding of the political, economic and social impact of climate changes in the Arctic region; (2) a clearer assessment of the risks and opportunities in relation to climate change, and (3) their effect on legislative and other regulatory frameworks for key sectors in the region.

The work will be subdivided into the following key tasks:

Task 5.1 Overview and assessment of regulatory instruments, framed on UNCLOS, but taken so as to include all relevant binding and non-binding agreements, at various levels, as well as international multilateral and national practice and law. Particular focus will be brought to the ACCESS sectors analysed in WPs 2, 3 and 4, and include an overview of and success of compliance with extant regulatory frameworks of Arctic Ocean users (NERC, Beijer, LCP, UCAM, UPC, AWI, Met.no)
The focus of the task will be to provide a comprehensive overview and assessment of regulatory instruments, framed on UNCLOS, but taken so as to include all relevant binding and non-binding agreements, international, multilateral and national practice.
This task will focus on specific existent rules and regulations, at all levels, for ACCESS sector activities, and cross-sector regional governance issues. As indicated by the sub-task framework described below, this work will review and compare more closely existing rules, guidelines and recommendations in the economic activities studied in ACCESS; define gaps and shortcomings with respect to environment impact and risk assessment; evaluate the impact of the Climate Change on the rules and regulations and suggest consequences, requiring comprehensive integration and interaction between work packages. It will be carried out in WP5 in close cooperation with the relevant WP expert groups.
Considering the (non evolving) status and role of the EC in the Arctic Council, we propose to examine the participation (or admission) of the EU in different regional cooperation bodies, in particular the Barents Euro-Arctic Council, to determine where the participation of the EU could be reinforced (or initiated). While the Arctic Council is recognized as a high-level forum with all Arctic states and indigenous peoples organizations, the roles and responsibilities of the EU will be further examined with regard to the other institutions and organizations that involve all of the Arctic states, namely: Arctic Ocean Science Board, Forum of Arctic Research Operators, International Arctic Science Committee, North Atlantic Coast Guard Forum, Spistbergen Treaty and the Standing Committee of Arctic Parliamentarians.

Task 5.1.1 Shipping – Review of rules, Guidelines and Recommendations with respect to Arctic Shipping available from different organizations and institutions from the Arctic Council member countries such as Russia, Canada, Finland and IMO. (J.Schwarz, UCAM, NERC, LCP)
Although current efforts and strategies are focused on summer shipping activities, it is clear that during the period of time envisaged by ACCESS an Arctic trade route with winter shipping through stable first-year sea ice will become a reality. Supporting shipping activity through technology and regulatory framework will thus be a key issue in this task.
Arctic shipping and sea-ice zoning is an outstanding issue for vessel safety and shipping activity planning. Guidelines for ships operating in Arctic ice covered waters concerning levels of sea-ice and the sea-ice zoning includes a need for development of the legal notion of “ice covered waters” on a scientifically based understanding. This work will be a specific target for task 5.1.1 within ACCESS.

Each of these specific activities are set within a context of overall governance requirements established in WP2, and as is the case with all of the sector WPs, an open and effective dialogue will be maintained between WP5 and WP2 throughout the life of the project

Recognising that climate change has a number of different impacts on tourism in the Arctic, (an evaluation to be delivered by WP2), and that the characterisation of demand and supply of tourism services will itself change with time, WP5 will address these issues of particular importance to Arctic tourism, their governance and safe management. Estimation of tourist numbers, length of stay, total expenditure, consumer surplus, and producer surplus for the period of this study will provide essential parameters for developing appropriate strategic options within ACCESS.

Furthermore task 5.1.1 will conduct a comparative and critical analysis of the IAATO (International Association Antarctica Tour Operators), and the AECO (Association of Arctic Expedition Cruise Operators) by-laws and guidelines, in order to build a list of recommendations, which would ensure a sustainable development of tourism in the Arctic Ocean. This would be provided in cooperation with task 2.6.

It is of vital importance that activities which generate acoustic pollution in the oceans, be monitored. WP5 will review the results of these monitoring processes (as covered in Task 2.4.4 of WP2) and establish their compliance with current legislation and the potential modification which may be required within the time period of the ACCESS project. It is proposed that a compilation of protocols be made as an initiative which could adapt to changes in maritime transportation over time, including in protected marine areas.

Task 5.1.2 Fisheries - a Summary of extant legislation as it applies to a wide range of fisheries issues, including increased access for fishing vessels, increased potential for aquaculture, and Management of Marine Preservation Areas (MPAs). (Beijer, UPMC, NERC, LCP, UCAM, Nofima)
Our current understanding of large marine ecosystems and marine communities may be completely changed along with the environmental state-change in the Arctic Ocean. One of the boundary conditions of this marine system, the permanent sea-ice cap is transitioning into seasonally ice-free sea, implying that a new system will emerge with new dynamics and maybe even new components, which will impact on dependent systems as well. Task 5.1.2 will gather inputs from WP3 and include an assessment of the needs to improve protection and reserve area, and of competition with transport routes for fishing vessels coming from oil and gas exploitation, transport and tourism. A comparison of different policy options w.r.t. acceptance and feasibility will also be incorporated.

In addition the enlargement of the regulatory areas of the North East Atlantic Fisheries Commission (NEAFC) where EU is a contracting party to Arctic fisheries will also be considered. This work will be related to migratory fish stocks trends and predictions covering the ACCESS predictive period of 30 years.
Each of these specific activities are set within a context of overall governance requirements established in WP3, and as is the case with all of the sector WPs, an open and effective dialogue will be maintained between WP5 and WP3 throughout the life of the project.

Task 5.1.3 Oil and gas extraction - Synthesis of regulations as climate change provides for increased access for extraction programmes in the oil and gas industry. (NERC, LCP, UCAM, SIO, IfW)
Task 5.1.3 will focus on regulations regarding oil and gas extraction, in particular as regards increased potential threat for infrastructures – pipelines, shore-based installations, assessment of extant legislation required/specific to the region: including - UNCLOS, IMO, AC, CLC, SAR, OPRC, MARPOL, SOLAS, Hazardous wastes; Management of MPAs and planning of protection and reserve areas
In addition to the evaluation of the regulatory systems in place to cover oil and gas extraction activities, this area of WP5 will address the effectiveness of oil spill controls, Some overview will focus on the consequences of the Gulf of Mexico oil spill and requirements for new technological approaches to limit risks of accidents.

Task 5.2 Identification of gaps in governance within this framework, and development of strategic options for addressing these gaps (NERC, UCAM, Beijer, LCP, UPC)
Task 5.2 will use inputs from task 5.1 to identify shortfalls in governance, and review options for addressing these gaps as they become stressed during the period under study in this project (ca 30 years).
Furthermore the task will assess how the envisaged changes in governance requirements may affect Arctic users/stakeholders/regional bodies, with particular attention to indigenous peoples.
This task will consider the status and role of the EU in the Arctic Council, and examine the participation (or admission) of the EU in different regional cooperation bodies, in particular the Barents Euro-Arctic Council, to determine where the participation of the EU could be reinforced (or initiated).
Recognising the importance and the different approaches of regional bodies, this task will review the constraints to full cooperation between Arctic coastal states and non arctic coastal states covering the four main sectors of Maritime Transport, Fisheries, Tourism and Resource Extraction

We recognise that there have been, and are still ongoing, a number of reviews and assessments made of Arctic governance. A range of governance options for the Arctic is presently being discussed on the international scene (Arctic Council [www.arctic-council.org]; The Arctic Governance Project [www.arcticgovernance.org]; among others). WP5 will work on a parallel track with such debate, building on these extant analyses both within and beyond national jurisdiction– with a view to providing the optimum basis for EU consideration and gradual formulation of a EU Arctic policy, and allow for efficient and continued cooperation and coordination between governments and stakeholders in the region.

Work in the different sectors covered by WPs 1, 2, 3 and 4 will allow to refine the gap analysis in governance in the sectors concerned, and to better assess options for filling those gaps. Governance will be assessed against a number of criteria, particularly
• Attitude to the new opportunities from the expected intensification of economic activities in the Arctic.
• Awareness of associated risks, taking into account security aspects (environmental and military) but also risks of triggering tipping elements in the Arctic social-ecological systems or in the linked Arctic-rest of the world.
• Developments in bilateral multilateral or international contexts.
• Existing initiatives in place or in development (see above).
• Economic and game theoretical aspects of international agreements.

Further analysis will be addressed to review levels of success of extant regulatory systems, following indicators such as degree of policy coherence, along with an evaluation of their effectiveness, degree of participation within the region as well as potential engagement by other concerned entities (such as, for example, the EU or those with observer status to the Arctic Council), and some assessment of compliance and enforcement/sanction requirements would be completed.

This task will also consider a set of governance options for Arctic protection policy, considering, as minimum, three options, each one of which will be assessed in terms to develop the corresponding scenario; Option 1 “Continue and Improve Current Approach”, with or without a systematic monitoring system. Option 2 “The mandatory agreement", analysing the feasibility and the possible impact of this instrument. Option 3 “Open Method of Coordination”, suggesting amendments and changes.

While it is necessary to identify gaps in governance in the Arctic Ocean system - and to some extent this has already been started but work is by no means at an end - identification of conflicting or stressed regulations is equally important. Furthermore, the extant system/systems need to be model-tested and this has to be performed taking into account the temporal changes – for the ACCESS project our time scale of study is for a period over the next 30 years.

Task 5.3 Modelling of how areas (1) and (2) above become stressed by effects of climate change as identified from sectors of WP2. WP3 and WP4 during the ACCESS study period (30 years), (NERC, UPMC, UCAM, Beijer, LCP)
This task area will establish a system of strategic monitoring indicators of pressure points on regulations over period under study and beyond. The task will also evaluate the applicability of binding and non-binding, scale-specific (i.e. regional, local or global) agreements, and provide overview of, and success of compliance of Arctic Ocean users with extant regulatory frameworks.
The activities in the Arctic social-ecological system are linked to the rest of the world through a number of different feedback routes. Economic activities in the rest of the world have an impact on the Arctic activities, and in the same way climatic changes in the Arctic will inevitably impact on the world’s climate system. There is a need to maintain awareness of global coupled modelling and connections between the Arctic and other oceans (Atlantic and Pacific). Similarly, atmospheric interaction, such as air pollution and meteorological crossover, provides linkage of systems beyond the regional. There are indications that some of these feedbacks are likely to intensify in the near future due to climate change implying that the Arctic could potentially gain a more central role for monitoring and development of mitigation activities than in the rest of the world. These changes will also impact activities in the Arctic to a large extent. For these reasons there is an urgent need for a legal framework taking into account the specificity of the Arctic regions. While international governance and the regulation of the marine Arctic area is a focus for a number of recent studies by research groups (the PAME working group of the Arctic Council for instance), there is no consensus on effective consolidation or modification of extant regulatory systems – nor is there agreement as to the appropriateness of the effectiveness of a single, encompassing regime for the region. Above all, there are no predictions as to how effectively the regulatory system/systems will operate over a time period, which will see significant effects of climate change. There is also a need for the international scientific community to maintain the required high level of engagement in the Arctic, and this initiative is a catalyst and an attractant for additional scientific input.

Task 5.4 Development of “instrument amendment options’, to reform and/or enhance existing legal controls as necessary, (by means of implementation agreements, for example) so as to capitalize on existing systems (NERC, UPMC, Beijer, UCAM, LCP)
This task will develop a set of options to modify and improve existing legal instruments, “instrument amendment options’ These instrument amendment options will aim to allow enhancement of existing legal controls as necessary with time, for example, in the form of implementation agreements, so as to capitalize on existing systems. In this regard, it would be important to recall that the Ottawa Declaration that established the Arctic Council was not a legally-binding agreement. This understanding could be helpful in addressing the effects of changes on the activities and mandates of the Arctic Council (e.g., consideration of peace or environmental security), which could be considered for adoption without cumbersome approval by legislative systems within nations.
The task will base this assessment from findings derived in work packages 1-5 as well as from an assessment of the potential for provision of ecosystem services in the region and how some of them might be affected by climate change and changes in some economic activities.

Task 5.5 Assessment of how these changes in governance requirements may affect Arctic users/stakeholders/regional bodies/indigenous peoples. (NERC, LCP, UCAM)

Under this task, particular attention will be given to proposals on Arctic governance coming from important EU players such as the European Parliament and from civil society (indigenous peoples associations, NGOs,). Existing institutions and organizations involved in any aspect of Arctic Ocean governance will be approached and invited to participate in the assessment – the impact and significance of each of these interested parties will be carefully assessed and balanced to the projects needs, and where appropriate, views taken on whether such institutions justify reinforcement and support over the time period studies by ACCESS. In particular task 5.5 should compare and contrast European Parliament resolution, European Commission communication and European Council decision, as well as monitor responses to and effects of European Union policy statements.

Furthermore, international policy developments need to be closely followed throughout the proposal duration, as consensus approaches to Arctic issues through cooperation with Arctic states and territories outside the EU should be a fundamental feature of EU action. To this end, it is important that governance solutions considered aim at accommodating the legitimate interests of all States involved as well as of non-State actors, recognizing that the Arctic is not only in an environmental state change, but also in an economic state change, perceived by most states and many non-state actors mainly as increasing opportunities. There will also be a need to take into account security aspects. Strategic importance and strong military presence in the Arctic are facts, which will have to be taken into account, as they affect research and economic activities.

In addition, task 5.5 will focus on indigenous people and their rights and responsibilities in the Arctic region. A particular aspect of study regards their use of marine mammals like seal hunting. Task 5.5 will perform a scientific evaluation of the impact of seal hunting by indigenous people and assessment of this practice in view of the EU Community Action Plan on the Protection and Welfare of Animals 2006-2010 and current discussions on a second Action Plan (2011-2015). This work would develop jointly with task 3.6.

As part of the continuing review and appraisal of the understanding of issues related to this (and other topics within the governance remit of WP5), it is proposed that this particular theme is identified as a topic for one of the workshops proposed for inter-sessional (i.e., between General Assembly meetings) of partners. included as Milestones of WP8 which is supervising these meetings together with WP5.

Task 5.6 Identification of ways and means to ensure full participation of indigenous peoples in the consideration and development of governance solutions affecting their way of living and their economic conditions and interests (LCP)
This task aims at engaging Arctic indigenous peoples in a regular dialogue and at guaranteeing their participation in accordance with the stated EU principles on indigenous peoples rights, with a view to ensuring the respect of their needs and rights in the formulation of rules and policies. This work seeks to ensure that indigenous peoples’ representatives have the capacity to participate effectively in arctic decision-making, and ensures that indigenous knowledge is incorporated in the process of decision-making.
Furthermore, in collaboration with the INALCO (Institut National des Langues et Civilisations Orientales) and the Centre National de la Recherche Scientifique (CNRS), LCP will develop its detailed study on the varying status and rights of the indigenous people in the 8 Arctic States. This preliminary work will be expanded within

the ACCESS project, defining criteria on the basis of the EU principles on indigenous people rights to evaluate a degree of “Indigenous Partnership” which could be quantified across the region.
This task will be conducted in collaboration with the work of UoL in task 3.4.

Task 5.7 Ecosystems services - Building a framework for integrated ecosystem based management (Beijer)

There is a recognised need to explore the possibility of establishing multi-sector frameworks for integrated ecosystem management for ensuring the sustainable exploitation of resources in the Arctic region; this requires a serious and sustained multi-disciplinary, multinational effort. We aim at building a framework to analyse how economic activities within ACCESS and the provisioning of ecosystem services in the Arctic impact on each other. This framework will be useful to analyze the impacts of climate change in the region by focusing not only on the direct impacts on each activity but also on indirect impacts due to feedbacks from changes in the environment or in other ACCESS economic activities. By synthesizing outputs of all the other WPs1-4, through placing the results in a social ecological systems context, this task will provide a holistic scientific basis necessary for a constructive analysis of economic impact, governance and uncertainty issues and the evaluation of possible solutions to ensure the sustainable development of human activities in the Arctic Region.

Task 5.7.1: Impact of climate change on the provisioning of ecosystem services (Beijer)
The ecosystem service approach provides a framework for tracking and quantifying the effects of climate change and the impacts of the activities in individual economic sectors on the Arctic ecosystems. The approach focuses on the impacts of changes in climate and economic activities on the generation of intermediate services that generate final ecosystem service (benefits) that in turn feed into the different economic sectors. Through identifying, quantifying and comparing key intermediate and final ecosystem services or benefits the essential links between different economic sectors can be identified. We will use available knowledge about the relevant ecosystems, including existing indicators, available data and earlier studies. We will complement this knowledge with relevant outputs from WP 1-4 throughout the project.

Task 5.7.2: Building a framework for integrated ecosystem based management (Beijer)
The activities in the Arctic social-ecological system are linked to the rest of the world through a number of different feedback routes. We will map how the different activities seem to be connected to each other using information from WP 2-4 and from tasks 5.7.1 and 5.8. This mapping exercise is a good starting point for building ecosystem models in collaboration with WP 3 and linking them to models of the social part of the system. We will identify and to some extent quantify some links between the activities and the resulting potential economic impacts. We do not intend to exactly map and quantify all these activities and links. After a rough overview of the major links we aim to identify, which of them are the potentially most important ones for human well being. In particular we would like to focus on possible “inconvenient feedbacks” between the different activities and show more in detail for one or two of them what the dynamics involved look like and try to quantify them using comprehensive, integrated models of the feedbacks between climate, economy and ecosystems built for this purpose. This exercise will provide a meaningful synthesis and an instrument for highlighting important trade-offs. To deal with the multiple uncertainties involved we use a scenario approach.

Task 5.8 Development and delivery of an integrated Marine Spatial Planning system (NERC)
This task will provide the core requirement of a marine spatial planning (MSP) system, enabling the integrated study of information from all of the sectors under review in ACCESS, and each of the associated human activities related to and within these sectors.

The MSP tools will be developed at the National Oceanography Centre, Southampton, where data/analyses input/output involving all partners, stakeholders and advisory groups would be managed and maintained using a variety of software. The MSP would develop as a tool with which interdisciplinary planning could be effected and made available to policy makers, and strategic levels of the EU and other appropriate and relevant bodies. The MSP will act as a coordination tool, receiving inputs from all WPs 1-4.It will also be one of the permanent core subjects of each annual general assembly, in order to ensure all partners and stakeholders can engage with the process and review the tool development annually and in a logical progression. The process of establishing a robust MSP is an organic and develops over time. We anticipate inputs from the different WPs during each of the four years of the ACCESS project, and these will be reflected in the annually presented revisions -these will be represented as milestones accordingly as indicated in MS581, 582 and 583. It is also proposed that governance aspects of ACCESS will be the topic for one of the inter-General Assembly focussed group sessions (to be placed each year in between the yearly General Assembly).

Marine spatial planning is a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that usually have been specified through a political process. Marine spatial planning crosses sectoral boundaries. Marine spatial planning is not an end in itself, but a practical way to create and establish a more rational use of marine space and the interactions between its uses, to balance demands for development with the need to protect the environment, and to achieve social and economic objectives in an open and planned way.
The sub-tasks identified for marine spatial planning system will include:
- The development a work plan, the definition of boundaries; definition of timeframe; setting of a series of principles to follow; the identification of goals and estimation of financial and environmental costs. (WPs 1, 2, 3, 4, 5 and 6)
- Comprehensive application of specialised software, including ArcGIS, GMT, Fledermaus, to gather, analyse, integrate, manage and visualise data, as well as outputs of statistical analysis which directly affect the socioeconomic and environmental factors. (WP 5)

- Providing a management structure and analysis tool for the Arctic region, facilitating development of strategies of governance for the marine environment, balancing the need to exploit the marine resources in a context of sustainable development whilst at the same retaining a healthy environment so that future generations may benefit. (WPs 1, 2, 3, 4, 5 and 6)

Task 5.9 Cross-sectoral synthesis of policy and governance options for sustainable development (All WP5 partners, including J.Schwarz, Beijer and IfW)
This task will bring together all of the outputs from the key sectors under study, ensuring fullest integration and consistency between the scientific base and the system(s) which will need to be implemented to ensure sustainability of development of the region and use of the natural resources over the multi-decadal (30 year) period for the ACCESS project study of climate change effects. The cross-sectoral synthesis of the analysis based on indicators for sustainable development that take into account the impact of changes in economic activities in the Arctic will synthesize related information collected in/from WP1, 2.8, 3.7 and 4.7 and will be led by IfW. In practical terms, this task is the key to balancing national interests and common interests in a manner that promotes consistent stewardship (over tie mans space) for sustainable development to mature in the Arctic Ocean

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UPMC	15.00
3	NERC	44.00
4	Kiel IfW	3.00
5	UCAM	8.00
6	AWI	5.00
7	JSC	2.00
8	NOFIMA	2.00
11	Met.no	1.00
14	Beijer Institute	46.00
15	SIO	6.00
17	UPC	2.00
26	LCP	16.00
	Total	150.00

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.11	Analysis and synthesis of extant and developing regulatory frameworks	3	12.00	R	RE	13
D5.12	NEAFC enlargement project review	26	5.00	R	CO	37
D5.21	Production of current governance options for ACCESS sectors/themes	3	12.00	R	RE	14
D5.31	Assessment of inputs regarding climate change effects and impacts on extant regulatory systems – der	3	13.00	R	RE	18
D5.41	Production of summary of governance options over ACCESS time period (ca 30 years)	3	13.00	R	RE	48
D5.51	Scientific and ethical evaluation of the impact of indigenous seal hunting	26	6.00	R	PU	37
D5.61	Operational conditions of an effective participation of Arctic indigenous people in the future Arcti	26	8.00	R	PP	24
D5.71	Conditions for integrated ecosystem based management in the Arctic	14	42.00	R	RE	48
D5.81	Development of Marine Spatial Planning concept and principal framework	3	13.00	R	RE	13
D5.82	Final test and delivery of Marine Spatial Planning tool	3	13.00	R	RE	37
D5.91	Report on Cross-sectoral synthesis of economic, policy and governance options for sustainable develo	3	13.00	R	PU	48
		Total	150.00			

Description of deliverables

D5.11) Analysis and synthesis of extant and developing regulatory frameworks: Full Title: Analysis and synthesis of extant and developing regulatory frameworks – Marine transportation, tourism, fisheries, and oil and gas extraction [month 13]

D5.12) NEAFC enlargement project review: [month 37]

D5.21) Production of current governance options for ACCESS sectors/themes: [month 14]

D5.31) Assessment of inputs regarding climate change effects and impacts on extant regulatory systems – der: Full Title: Assessment of inputs regarding climate change effects and impacts on extant regulatory systems – derived from WP1, 2, 3, 4 – and overview and review of predicted stress on these systems. [month 18]

D5.41) Production of summary of governance options over ACCESS time period (ca 30 years): [month 48]

D5.51) Scientific and ethical evaluation of the impact of indigenous seal hunting: [month 37]

D5.61) Operational conditions of an effective participation of Arctic indigenous people in the future Arcti:
Full Title: Operational conditions of an effective participation of Arctic indigenous people in the future Arctic governance [month 24]

D5.71) Conditions for integrated ecosystem based management in the Arctic: [month 48]

D5.81) Development of Marine Spatial Planning concept and principal framework: [month 13]

D5.82) Final test and delivery of Marine Spatial Planning tool: [month 37]

D5.91) Report on Cross-sectoral synthesis of economic, policy and governance options for sustainable develo:
Full Title: Report on Cross-sectoral synthesis of economic, policy and governance options for sustainable development. Lead beneficiary: All [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS561	Level of participation of arctic indigenous peoples in the present Arctic governance process	26	12	
MS512	Legal/administrative process of the NEAFC enlargement project	26	25	
MS511	Overview of existing regulatory instruments	3	13	
MS521	Identification of gaps in governance within this framework	3	13	
MS572	Integrated climate-economy-ecosystem models developed	3	30	
MS581	Development of MSP concept and principal framework – presentation of model, and subsequent versions	3	13	
MS582	Development of MSP concept and principal framework – presentation of model, and subsequent versions	3	25	
MS583	Development of MSP concept and principal framework – presentation of model, and subsequent versions	3	37	
MS584	Delivery of final MSP	3	48	
MS591	Links between main economic activities studied in WP2-4 identified	3	18	
MS571	Most important links assessed	3	25	

WT3:
Work package description

Project Number [1]	265863	Project Acronym [2]	ACCESS

One form per Work Package

Work package number [53]	WP6	Type of activity [54]	OTHER
Work package title	Project dissemination and exploitation of knowledge		
Start month	1		
End month	48		
Lead beneficiary number [55]	1		

Objectives

This WP will establish an effective and efficient dissemination of the project results and conclusions regarding the Arctic climate change impacts on socio economic sectors together with an exploitation of the developed knowledge. The dissemination and exploitation plan will adapt the different dissemination tools to the four identified target groups: policy makers, academic stakeholders, industrial stakeholders and society including indigenous people. Specific attention will be given to the communication and engagement with policy makers as the results of the project should help them to identify, interpret, coordinate and define strategies for good governance. The website will be an essential tool to present and circulate the information inside and outside the ACCESS consortium.

Description of work and role of partners

Description of work (possibly broken down into tasks), and role of participants

For the sake of clarity, we make in this description of work a distinction between internal dissemination (i.e. dissemination within the partners of ACCESS) and external dissemination (i.e. between partners and stakeholders, policy makers and up to large public). The former being part of WP8 will not be detailed in this section. The WP6 description of work will then be limited to external dissemination purpose.
Complementary to the dissemination package, we have included education activities that will incorporate ACCESS-specific approaches, topics and products. Progress with the educational activities will be shared among the ACCESS project partners, beyond the institutions where specific programs will be offered to broaden the scope, relevance and interdisciplinary dimensions of these activities. Additionally, experts from the ACCESS program will be invited to share insights and materials across institutions in these education activities. It is recognized that the education activities will be mostly supported by the organizations offering them, which is a cost-effective advantage to integrate education and outreach across the ACCESS project.

The ACCESS steering committee will have a major responsibility regarding external dissemination. It will act as an editing board for all large-scale communications issues to: thoughtfully plan and improve the external dissemination strategy each year; facilitate effective integration and dissemination of ACCESS project results from the work packages; and prevent any misconduct in communicating ACCESS sensitive results to stakeholders and the public at large.

Task 6.1 - Coordination of dissemination and exploitation activities (UPMC, OASys)

• Define and supervise the implementation plan of the Dissemination and Exploitation of knowledge acquired during the project duration and after its termination. The external dissemination plan will be reviewed regularly (once a year). Appropriate formative and summative assessment metrics, defined in relation to ACCESS project objectives, will be utilized.
• Keep track of the dissemination of activities performed by partners and ensure that all aspects of Arctic climate change impact scenarios on economic sectors are publicized in an appropriate way. To guarantee complete coverage of the dissemination activities performed by each partner, including at national and local levels, the Project Office will contact partners on a regular basis. An annual report from each partner should indicate the progress made regarding their contributions to the website; production of dissemination materials to target groups; training activities; conferences, workshops and other meetings; press relations; and data management.

• Coordinate among all project partners the preparation of a list of ACCESS related interested parties belonging to the four target groups: policy makers; academic stakeholders; industrial stakeholders; and society, including indigenous people.
• Coordinate the preparation of general dissemination and communication tools, with identification of best practices among the project partners, which will continuously refine specific tools and actions to reach each of the four categories mentioned above.
• Coordinate the organization of Summer Schools/workshops for academics researchers and students, but also for ACCESS partners and stakeholders.
• Networking activities that involve: organisation of seminars and meetings to coordinate with other Arctic projects; coordination with relevant communication outlets, especially libraries among the partner institutions (as with the polar libraries colloquy); implementation of activities to communicate and exchange information with experts outside the project.

Task 6.2 - Dissemination activities (general and specific) (UPMC, OASys, UCAM, ESRI, NERC, BEIJER, UPC, AWI, UoL)

To demonstrate the innovative side of the project and increase the public, policy-maker and industry awareness of the ACCESS project results, the project partners will disseminate project results through: dedicated sections of the ACCESS website; videos; printed materials, including publications and dedicated briefs to the attention of policy makers; workshops, conferences and other meetings; training sessions; and other effective means. General and specific actions will be carried out to reach all interested parties in a manner that contributes to their ongoing activities.

Task 6.2.1 – Create, maintain and improve the ACCESS official website

The Project website (coordinated by UPMC) will serve as a central point for gathering, redistributing, disseminating and enhancing project-related information. By doing so, the website will facilitate synergies to share information appropriately from the project partners in a meaningful manner for others to use.. As mentioned earlier, all the information made available on the ACCESS website will be screened by the steering committee. The website will be structured into sections providing detailed information on the different activities in the various sectors of ACCESS.
Some examples are given below:

• Project website setup will be on month 6 and maintenance will be under UPMC.
• The ACCESS website will be composed of two sections. One will be accessible by the public at large and the other one will be protected and only accessible to the ACCESS partners. Dedicated sections will give access to specific topics as well as crosscutting issues, taking into consideration the target groups.
• The official electronic ‘ACCESS Newsletter’ starting M6 - will be produced quarterly and disseminated electronically via the website after being approved by the steering committee (UPMC). The electronic ‘ACCESS Newsletter’ also will be sent to individuals and institutions, which are compiled in a growing list throughout the project. Every year, after each annual General Assembly, a composite printed ‘ACCESS Overview’ will be produced as a synthesis of ACCESS results and activities from the previous year. The printed ‘ACCESS Overview’ will be broadly disseminated as well as archived in electronic form for future retrieval (cf Task 6.2.3).
• Dedicated Policy Briefs (M12, 24, 36, 48).
• Activities in new media e.g. set up an ACCESS blog and twitter account (ESRI).
Regularly updated video download from the site will be made available (short video from various field works and special ACCESS events). The videos will include hyperlinks to publicly broadcast interviews with project partners, which will be compiled and uploaded on a regular basis. The public video broadcasts will be supplemented with public audio broadcasts with the project partners (UPMC).

Moreover, ACCESS will work in close cooperation with the Arctic Centre of the University of Lapland and the Scott Polar Research Institute at the University of Cambridge (ACCESS partners) to enhance general outreach and communication on ACCESS crosscutting issues, building on existing information-exchange networks such as the polar libraries colloquy. The information exchange and dissemination strategy will be developed in collaboration with the Arctic Center and Scott Polar Research Institute in an inclusive manner to facilitate outreach activities that will best reach the target groups. A section of the website will be related to indigenous, with photos and videos.
• An ACCESS related website at the Arctic Center focussing on indigenous people’s aspects. (UoL)

ACCESS will also develop a close cooperation with the EU-Arctic Forum. This will allow the ACCESS consortium to disseminate, inform and discuss ACCESS results to and with EU policy makers.

Task 6.2.2 – Production of ACCESS movies and videos

• Training courses on shooting videos aimed at the researchers about to go on campaigns (UPMC). One or two sessions will be scheduled during the first few months of the project, depending on the number of researchers willing to attend. The researchers will be trained to shoot short movies during field works to show how they do it and why. The videos will be a means of explaining what is going on in the project. It has been deemed important to train the researchers to shoot videos in order to have more films available since professional cameramen will not always be able to join the campaigns. This is a new and innovative method for providing visible information on a research project. These training videos will be downloadable by the wider community on the ACCESS website.
• Realisation of short videos illustrating the field work progress. The shooting locations foreseen are the following : onboard the icebreakers during field work on melt-pond and icebergs surveillance and onboard airplanes according to the schedule and technical feasibility. These videos will be available on the ACCESS website after each new field work has been completed and via the Arctic Center in order to provide information to decision makers, researchers, industries and the general public and to enhance their understanding of what is going on in the Arctic regarding climate change and its various impacts on transport, tourism, oil and gas extraction as well as governance. These short movies may also be screened during conferences, summer schools, workshops and will serve as educational tools. This is a new and innovative method for providing visible information on a research project. The exact timing and number depend on both the schedule of the field campaigns and the shooting feasibility (by professional cameramen preferably or trained researchers otherwise). (UPMC)
• Movies on field work related to indigenous peoples (UoL in cooperation with Arctic center).
• Realisation of a long movie on the main ACCESS activities and results. This movie will aim at the general public and will be used as an educational tool, the movie will be used as means of dissemination and in order to explain the project and its results. (UPMC) M36
• Videos from public media broadcasts with project partners also will be utilized on the ACCESS website.

Task 6.2.3 – Production and distribution of printed material

The production and distribution of printed material on ACCESS project will be an ongoing process.
Examples are given:
• Official ‘ACCESS Flyer’ (UPMC) M1 – Two flyers will be printed: one targeting researchers and policy makers and another one aimed at a broader public.
• Composite ‘ACCESS Overview’ will be printed for broad dissemination and then archived on the website at the end of each year (UPMC) M13, 25, 36, 48.
All the information available in the electronic ACCESS newsletter will be made available for ACCESS partners institutional sites, as for example:
• NOC monthly newsletter ACCESS special edition (NERC)
• Stockholm Resilience Centre and albaeco, annual report
• BEIJER annual report in September every year, M9, 21, 33, 45
• Contribution of articles to emerging pan-European media e.g., http://www.voxeu.org/ (ESRI)

Task 6.2.4 - Organize workshops and summer schools on ACCESS topics

The following summer schools and workshops will be opened to researchers and stakeholders.
• 1st summer school on cross-sectoral ACCESS topics in BREMEN (OASys, AWI) M18 - The summer school is intended for a duration of one week. There will be no admission fee, but travel and lodging will have to be covered by the students. Lectures will be given by ACCESS partners, stakeholders and external experts. An ACCESS cross-sectoral workshop will be organized in parallel, involving ACCESS partners and stakeholders. Dissemination work on the ACCESS topics, the workshop and the summerschool will be done, including an exhibition organized at the House of Sciences ('Haus der Wissenschaft') in Bremen.
• International workshop on noise impacts of the foreseeable increase of activities in the Arctic and on the mitigation measures that would be needed. The workshop will be cross-sectoral and also attract stakeholders from the various sectors and not only people involved in nature protection. This workshop will take place in Barcelona, on month 24 and will be organized by UPC.

• 2nd summer school dedicated to cross-sectoral ACCESS activities in STOCKHOLM (BEIJER) M36 - Beijer may run the summer school within the EAERE auspices, for probably a one week course with about 20 participants. The financing of the students is still an open question.
Parallel to the two summer schools, a workshop will be organized on ACCESS topics and dissemination work for the public presenting the crosscutting ACCESS activities.
• Stakeholders' workshop. "Sharing the Sea: Coexistence and Challenges of Coastal Economies". The ocean as a larger natural commons, where different human activities take place, is in a dynamic, competitive system. Actors in this system constantly have to balance their activities. The workshop aims to bring together different groups of stakeholders to balance national interests and common interests in the resources of the ocean. International, interdisciplinary and inclusive representation from the fishing, shipping, tourist, energy, regulatory, insurance, non-governmental and policy-making sectors related to the marine environment will openly share their perspectives, concerns and strategies , with the Arctic Ocean among the specific case studies (UoL, UCAM) M 25

Task 6.2.5 – Press

Active press releases will be part of the dissemination activities during ACCESS. All press offices of the ACCESS partners will be involved in this effort, assisted by the central WP6 leadership at UPMC.

Examples are given:
• Organisation of press conferences once a year, during each General assembly organised by local hosts.
• The ACCESS cross-sectoral approach dealing with 'Changing climate conditions in the Arctic and changed human activities' will be a key topic for the dissemination work of the AWI press office over the entire duration of ACCESS (AWI).
Incidental media interviews, both video and radio broadcasts, with project partners are anticipated throughout the project. These media interviews will be integrated with the ACCESS website as described above.

Task 6.2.6 – Organize conference sessions targeting stakeholders and scientists

Specific ACCESS sessions will be opened to ACCESS's partners, researchers and stakeholders in the following conferences attended by:
- NERC:
• International Ocean Stewardship Forum: one of the forums will be devoted to ACCESS topics.
• ACCESS meeting back-to-back with the Arctic Council M24.
- BEIJER:
• Yearly Global Dynamics and Resilience workshops: The Arctic case. A cross-sectoral approach to disseminate ACCESS results to several networks of researchers from a vast range of disciplines.
• Yearly Behavioural Economics and Nature Networks workshops. It will be used to disseminate the results from the experiments performed in ACCESS.
• ARCTIC Issues Meetings. Regular meetings once or twice a year with two other groups working on Arctic issues in the Stockholm Region led by Garry Peterson (terrestrial ecology) and Sverker Sörlin (history).
• ACCESS special sessions at the EAERE annual conferences and at the next World Congress for Environmental and Resource Economists 2014 (BEIJER, IfW) M40.
- HSVA:
• Presentation of ACCESS results at the next gmec-conferences (Global Maritime Environmental Congress) (JSchwarz, HSVA)
• ACCESS special sessions "The Ocean of Tomorrow" during the international ice conferences.
• IAHR (International Association of Hydro-Environment Engineering and Research) (every second year the next ones will be in 2012 and 2014).
• POAC (International Conference on Port and Ocean Engineering under Arctic Conditions) (every second year the next ones will be in 2011 in Montreal and 2013 and 2015).
• ICETECH (International Conference on Performance of Ships and Structures in Ice) (every second year the next ones will be in 2012 and 2014).
• OMAE (International Conference on Ocean, Offshore and Arctic Engineering) (yearly).

-UCAM
• Continuation of the NATO Advanced Research Workshop programme on 'Environmental Security in the Arctic Ocean' that began in 2008

• Coordination with the American Association for the Advancement of Science (AAAS) to elaborate on an ongoing basis the 'White-Blue Arctic: Promoting Cooperation and Preventing Conflict' symposium that will be convened at the 2011 annual AAAS meeting.
• Integration with the international, interdisciplinary and inclusive dialogues that are being planned with the Carnegie Endowment for International Peace at the Bellagio facility in Italy and with Wilton Park in the United Kingdom.
• Special ACCESS involvement in the workshop 'Oil Spills in Sea Ice' at the Zavatti Istituto Polar. Fermo, Italy, (December 2011).

Task 6.3 - Exploitation of knowledge (NERC, met.no)

To support communication within the project as well as to inform external users of the data sets generated by the project a data management system will be set up. This will ensure that data generated by the project is well documented and online available (unless specifically restricted) both for internal and external users within the project period and taken care of after the project end. The availability to the external users will have to be approved by the steering committee necessarily.

Two parallel, but wholly integrated data management locations are proposed – one by met.no for all climate related data and one by NERC, for all other data and records. UCAM will assist with coordinating best practices from the ICSU Committee on Data for Science and Technology (CODATA), the Polar Information Commons (PIC), and related information management and discovery activities.

A data management system for all climate related data is similar to the one set up for DAMOCLES and is implemented for climate data with support for uploading, searching and exposing datasets. This is maintained during the project duration and merged into other databases and data management systems after the project ends.

For the non climate data, a data management system specifically designed to handle and oversee sectoral data and inputs from WP2, 3, 4 and 5 will be established with access parameters agreed between partners/stakeholders and advisory associates. Portal and data access options will be established to enable seamless integration of all ACCESS and related materials.

In situ operational data sets received through WMO GTS will be reformatted to the selected file format and made available within the data management system. All non-climate data and materials to be overseen by NERC Data Management Office, to include input/output for all non-climate sectors (Maritime Shipping and Tourism, Fisheries, Oil and Gas Extraction). Complementary and linked to the met.no, operation, this system will allow secure access via portal and/or anonymous ftp (dependent on file sizes). Options for scaled/differential access between range of partner/stakeholder/advisory board/associated organization can be implemented. Metadata links to met.no holdings will be options available.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UPMC	39.00
2	Oasys	4.20
3	NERC	5.90
11	Met.no	10.00
14	Beijer Institute	3.20
17	UPC	3.00
	Total	65.30

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.11	Annual dissemination and exploitation report and plan	1	2.80	R	RE	13
D6.12	Annual dissemination and exploitation report and plan	1	3.00	R	RE	25
D6.13	Annual dissemination and exploitation report and plan	1	3.00	R	RE	37
D6.14	Annual dissemination and exploitation report and plan	1	3.00	R	RE	48
D6.21	Creation of the dedicated website	1	2.00	R	PU	6
D6.22	Updated list of ACCESS related interested parties of the four target groups and list of participants	1	2.00	R	PU	8
D6.23	ACCESS contribution to ACIA report	1	2.00	R	PU	48
D6.24	Dedicated Policy Briefs	1	2.00	R	PU	12
D6.25	Dedicated Policy Briefs	1	2.00	R	PU	24
D6.26	Dedicated Policy Briefs	1	2.00	R	PU	36
D6.27	Dedicated Policy Briefs	1	2.00	R	PU	48
D6.31	Creation and updating of a data management system - climate	11	8.00	R	PU	6
D6.32	Creation and updating of data management system – non-climate	3	5.50	R	PU	6
D6.211	Newsletter quarterly issue	1	2.00	R	PU	6
D6.212	Newsletter quarterly issue	1	2.00	R	PU	10
D6.213	Newsletter quarterly issue	1	2.00	R	PU	14
D6.214	Newsletter quarterly issue	1	2.00	R	PU	18
D6.215	Newsletter quarterly issue	1	2.00	R	PU	22
D6.216	Newsletter quarterly issue	1	2.00	R	PU	26
D6.217	Newsletter quarterly issue	1	2.00	R	PU	30
D6.218	Newsletter quarterly issue	1	2.00	R	PU	34
D6.219	Newsletter quarterly issue	1	2.00	R	PU	38
D6.220	Newsletter quarterly issue	1	2.00	R	PU	42
D6.221	Newsletter quarterly issue	1	2.00	R	PU	46
D6.251	1st ACCESS summer school	2	1.00	R	PU	18
D6.252	International workshop	17	1.00	R	PU	24
D6.253	2nd ACCESS summer school	14	1.00	R	PU	36

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.254	Stakeholders' workshop	21	1.00	R	PU	25
		Total	65.30			

Description of deliverables

D6.11) Annual dissemination and exploitation report and plan: The annual report of the dissemination and exploitation indicates the progress made regarding the activities of all partners. The annual dissemination and exploitation plan sets the activities planned for the following year. At the end of the project, the final version of the dissemination and exploitation plan (to be applied after the end of the project) will be presented. [month 13]

D6.12) Annual dissemination and exploitation report and plan: The annual report of the dissemination and exploitation indicates the progress made regarding the activities of all partners. The annual dissemination and exploitation plan sets the activities planned for the following year. At the end of the project, the final version of the dissemination and exploitation plan (to be applied after the end of the project) will be presented. [month 25]

D6.13) Annual dissemination and exploitation report and plan: The annual report of the dissemination and exploitation indicates the progress made regarding the activities of all partners. The annual dissemination and exploitation plan sets the activities planned for the following year. At the end of the project, the final version of the dissemination and exploitation plan (to be applied after the end of the project) will be presented. [month 37]

D6.14) Annual dissemination and exploitation report and plan: The annual report of the dissemination and exploitation indicates the progress made regarding the activities of all partners. The annual dissemination and exploitation plan sets the activities planned for the following year. At the end of the project, the final version of the dissemination and exploitation plan (to be applied after the end of the project) will be presented. [month 48]

D6.21) Creation of the dedicated website: [month 6]

D6.22) Updated list of ACCESS related interested parties of the four target groups and list of participants: [month 8]

D6.23) ACCESS contribution to ACIA report: [month 48]

D6.24) Dedicated Policy Briefs: [month 12]

D6.25) Dedicated Policy Briefs: [month 24]

D6.26) Dedicated Policy Briefs: [month 36]

D6.27) Dedicated Policy Briefs: [month 48]

D6.31) Creation and updating of a data management system - climate: Progress reports will be integrated in the exploitation report. [month 6]

D6.32) Creation and updating of data management system – non-climate: Progress reports will be integrated in the exploitation report [month 6]

D6.211) Newsletter quarterly issue: [month 6]

D6.212) Newsletter quarterly issue: [month 10]

D6.213) Newsletter quarterly issue: [month 14]

D6.214) Newsletter quarterly issue: [month 18]

D6.215) Newsletter quarterly issue: [month 22]

D6.216) Newsletter quarterly issue: [month 26]

D6.217) Newsletter quarterly issue: [month 30]

D6.218) Newsletter quarterly issue: [month 34]

D6.219) Newsletter quarterly issue: [month 38]

D6.220) Newsletter quarterly issue: [month 42]

D6.221) Newsletter quarterly issue: [month 46]

D6.251) 1st ACCESS summer school: 1st summer school on cross-sectoral ACCESS topics in BREMEN (OASys, AWI) M18 [month 18]

D6.252) International workshop: International workshop on Noise impacts of the foreseeable increase of activities in the Arctic and on the mitigation measures that would be needed in BARCELONA. [month 24]

D6.253) 2nd ACCESS summer school: 2nd summer school dedicated to cross-sectoral ACCESS activities in STOCKHOLM. [month 36]

D6.254) Stakeholders' workshop: Stakeholders' workshop. "Sharing the Sea: Coexistence and Challenges of Coastal Economies". The ocean as a larger natural commons, where different human activities take place, is in a dynamic, competitive system. Actors in this system constantly have to balance their activities. The workshop aims to bring together different groups of stakeholders to balance national interests and common interests in the resources of the ocean. International, interdisciplinary and inclusive representation from the fishing, shipping, tourist, energy, regulatory, insurance, non-governmental and policy-making sectors related to the marine environment will openly share their perspectives, concerns and strategies , with the Arctic Ocean among the specific case studies [month 25]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS621	ACCESS web-site	1	6	
MS631	Data management system - climate and non climate	11	6	
MS622	1st summer school on cross-sectoral ACCESS topics in BREMEN	2	18	
MS623	International workshop on on Noise impacts of the foreseeable increase of activities in the Arctic	17	24	Full Title: International workshop on on Noise impacts of the foreseeable increase of activities in the Arctic and on the mitigation measures that would be needed.
MS624	2nd summer schools dedicated to cross-sectoral ACCESS activities in STOCKHOLM	14	36	

WT3:
Work package description

Project Number [1]	265863	Project Acronym [2]	ACCESS

One form per Work Package

Work package number [53]	WP7	Type of activity [54]	MGT
Work package title	Management		
Start month	1		
End month	48		
Lead beneficiary number [55]	1		

Objectives

The objectives are to ensure the administrative management of the project in conformity with the planned allocation of resources, and along the rules and procedures contractually agreed and to deal with the issues related to the intellectual property rights.

Description of work and role of partners

The management include the activities mentioned under Article II.2 of ECGA, namely :
• Administer the financial contribution of the European Union regarding its allocation between beneficiaries and activities, in accordance with this grant agreement and the decisions taken by the consortium. The coordinator shall ensure that all the appropriate payments are made to the other beneficiaries without unjustified delay
• Keep the records and financial accounts making it possible to determine at any time what portion of the financial contribution of the European Union has been paid to each beneficiary for the purposes of the project.
• Inform the Commission of the distribution of the financial contribution of the Union and the date of transfers to the beneficiaries, when required by this grant agreement or by the Commission
• Review the reports to verify consistency with the project tasks before transmitting them to the Commission

Moreover, the management activities will also include :
☐ Designing and maintaining partner specific templates for collecting input to the required EC documents
☐ Implementing and maintaining of a project-specific database for reporting and controlling, including the adaptation of the structure after changes in the work plan and the consortium
☐ Preparing and post-processing of EC reviews from the consortium-side including support in the implementation of recommendations from the EC and reviewers
☐ Preparing, executing and post-processing of major project meetings such as Steering Committee meetings, General Assemblies and meetings with the Steering Committee (Tasks: agendas, invitations, location of meeting places, organization of rooms and equipment, preparation and distribution of materials, minutes and actions list)
☐ Implementing and maintaining the project infrastructure, e.g., the internal platform for information exchange and email lists
☐ Handling of legal issues, IPR issues and maintenance of the consortium agreement, if obligatory- The Intellectual Property Rights (IPR) Manager based at UPMC will deal with all IPR issues in conformance with IPR initial description and all members of the consortium. She will be in charge of following up publications, licensing, patents and other exploitation of results. She will advise the Steering Committee and the General Assembly about these issues and the management of the Background. When needed, she will contact her homologues at the Partners legal offices.The IPR and confidentiality issues have been well developed in the letter of Intent signed by all partners during the submission phase and will be developed in the Consortium Agreement from the beginning of the negotiation phase.
☐ Handling of the project correspondence and the day-to-day requests from partners
☐ Implementing the Gender Action Plan

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UPMC	15.00
2	Oasys	3.00
24	SINTEF	0.50
	Total	18.50

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.01	Gender Action Plan	1	2.00	R	RE	6
D7.02	Steering Committee meeting minutes	2	1.00	R	RE	7
D7.03	Steering Committee meeting minutes	2	1.00	R	RE	14
D7.04	Steering Committee meeting minutes	2	1.00	R	PP	19
D7.05	Steering Committee meeting minutes	2	1.00	R	PP	26
D7.06	Steering Committee meeting minutes	2	1.00	R	PP	31
D7.07	Steering Committee meeting minutes	2	1.00	R	PP	38
D7.08	Steering Committee meeting minutes	2	1.00	R	PP	43
D7.09	Steering Committee meeting minutes	2	1.00	R	PP	48
D7.10	Report on Stakeholders/End-users	2	1.00	R	PU	13
D7.11	Report on Stakeholders/End-users	2	1.00	R	PU	25
D7.12	Report on Stakeholders/End-users	2	1.00	R	PU	37
D7.13	Advisory Board meeting minutes	1	1.00	R	PU	13
D7.14	Advisory Board meeting minutes	1	1.00	R	PU	25
D7.15	Advisory Board meeting minutes	1	1.00	R	PU	37
D7.16	Implementation of the Gender Action Plan	1	2.50	R	PU	48
		Total	18.50			

Description of deliverables

D7.01) Gender Action Plan: This plan will also take into consideration the activities proposed in the "Considerations on gender aspects" chapter that are linked to the tasks described in the WP6. [month 6]

D7.02) Steering Committee meeting minutes: [month 7]

D7.03) Steering Committee meeting minutes: [month 14]

D7.04) Steering Committee meeting minutes: [month 19]

D7.05) Steering Committee meeting minutes: [month 26]

D7.06) Steering Committee meeting minutes: [month 31]

D7.07) Steering Committee meeting minutes: [month 38]

D7.08) Steering Committee meeting minutes: [month 43]

D7.09) Steering Committee meeting minutes: [month 48]

D7.10) Report on Stakeholders/End-users: And delivery dates according to the work plan [month 13]

D7.11) Report on Stakeholders/End-users: And delivery dates according to the work plan [month 25]

D7.12) Report on Stakeholders/End-users: And delivery dates according to the work plan [month 37]

D7.13) Advisory Board meeting minutes: [month 13]

D7.14) Advisory Board meeting minutes: [month 25]

D7.15) Advisory Board meeting minutes: [month 37]

D7.16) Implementation of the Gender Action Plan: This deliverable will present how the gender action plan has been implemented. [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments

WT3:
Work package description

Project Number [1]	265863	Project Acronym [2]	ACCESS

One form per Work Package

Work package number [53]	WP8	Type of activity [54]	RTD
Work package title	Scientific coordination		
Start month	1		
End month	48		
Lead beneficiary number [55]	1		

Objectives

The main goal of this work package is to ensure the scientific coordination of the project in conformity with the objectives, methods and quality standards described in the contract.

Description of work and role of partners

The activities in this WP will include:

☐ Scientific coordination and monitoring of sub-projects and work-packages
☐ The supervision of project progress milestones and project global critical path
☐ The scientific review of the work performed by the partners including scientific deliverables
☐ Research risk management
☐ The preparation of the scientific part of the reports to be submitted to the EC

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UPMC	10.00
2	Oasys	2.00
3	NERC	2.00
4	Kiel IfW	2.00
5	UCAM	2.00
6	AWI	2.00
7	JSC	2.00
8	NOFIMA	4.00
11	Met.no	2.00
13	SAMS	2.00
14	Beijer Institute	2.00
	Total	32.00

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D8.01	final report on the conclusions/perspectives of the External Boards about the ACCESS activities	1	30.00	R	PU	48
D8.02	Composition of the advisory board	1	2.00	R	PU	6
		Total	32.00			

Description of deliverables

D8.01) final report on the conclusions/perspectives of the External Boards about the ACCESS activities: [month 48]

D8.02) Composition of the advisory board: [month 6]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS801	External Boards engagement	2	6	

WT4:
List of Milestones

Project Number [1]	265863	Project Acronym [2]	ACCESS

List and Schedule of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS341	Field interviews finished	WP3	21	25	
MS181	Forecasting system set up and tested	WP1	2	38	
MS361	Literature review and report on distribution finished	WP3	17	37	
MS371	Fisheries indicator report	WP3	14	37	
MS561	Level of participation of arctic indigenous peoples in the present Arctic governance process	WP5	26	12	
MS512	Legal/administrative process of the NEAFC enlargement project	WP5	26	25	
MS321	Review of Arctic aquaculture, governance issues and impacts of climate change	WP3	8	18	
MS342	Report on Russian aquaculture infrastructure and legislative status	WP3	21	30	
MS121	Field data processing (2011 and 2012 data) completion	WP1	10	26	
MS311	Ecosystem model built and parameterised	WP3	8	25	
MS322	Scenario model Arctic aquaculture economics and employment	WP3	8	25	
MS333	Journal publication submitted	WP3	8	42	
MS801	External Boards engagement	WP8	2	6	

WT4:
List of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS211	Navigation efficiency on NSR effected by Climate Change	WP2	19	36	
MS212	Solicit user requirements	WP2	11	6	
MS213	Solicit future requirements from users based on scenarios	WP2	11	39	6 months after WP1 scenarios are delivered
MS251	Design and fabrication of lateral stress sensor	WP2	9	15	
MS252	Report on the results of lateral stress sensor measurements in the Arctic	WP2	9	42	
MS253	Report on recommendations for the design of the future Arctic Ice Observing System for safe marine t	WP2	2	42	Full Title: Report on recommendations for the design of the future Arctic Ice Observing System for safe marine transport under changing ice conditions
MS241	Design and manufacture of low cost autonomous buoy for measuring under ice noise from ice going ship	WP2	17	12	
MS242	Report on full scale measurements of under-ice noise from ship traffic with the manufactured buoy	WP2	17	45	
MS291	Indicator Report on Marine Transportation and Tourism in the Arctic Domain	WP2	7	45	
MS511	Overview of existing regulatory instruments	WP5	3	13	
MS521	Identification of gaps in governance within this framework	WP5	3	13	

WT4:
List of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS572	Integrated climate-economy-ecosystem models developed	WP5	3	30	
MS581	Development of MSP concept and principal framework – presentation of model, and subsequent versions	WP5	3	13	
MS582	Development of MSP concept and principal framework – presentation of model, and subsequent versions	WP5	3	25	
MS583	Development of MSP concept and principal framework – presentation of model, and subsequent versions	WP5	3	37	
MS584	Delivery of final MSP	WP5	3	48	
MS591	Links between main economic activities studied in WP2-4 identified	WP5	3	18	
MS571	Most important links assessed	WP5	3	25	
MS621	ACCESS web-site	WP6	1	6	
MS631	Data management system - climate and non climate	WP6	11	6	
MS622	1st summer school on cross-sectoral ACCESS topics in BREMEN	WP6	2	18	
MS623	International workshop on on Noise impacts of the foreseeable increase of activities in the Arctic	WP6	17	24	Full Title: International workshop on on Noise impacts of the foreseeable increase of activities in the Arctic and on the mitigation measures that would be needed.
MS624	2nd summer schools dedicated to cross-sectoral ACCESS activities in STOCKHOLM	WP6	14	36	

WT4:
List of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS411	First estimates of oil and gas production costs for different ice scenarios	WP4	16	6	
MS412	Estimation of oil and gas production costs for different ice scenarios completed	WP4	16	16	
MS441	Begin integration of new oil behaviour, ice roughness algorithms into model and testing accuracy ver	WP4	13	30	Full Title: Begin integration of new oil behaviour, ice roughness algorithms into model and testing accuracy verses tank experiments.
MS442	Completed all representative oil spill scenarios related to seabed pipelines, tanker loading and tra	WP4	24	39	Full Title: Completed all representative oil spill scenarios related to seabed pipelines, tanker loading and transport, and loss of well control (blowouts).
MS444	Evaluation of the comparison of in situ iceberg drift data with detection and trajectory models comp	WP4	1	37	Full Title: Evaluation of the comparison of in situ iceberg drift data with detection and trajectory models completed.
MS451	Emissions data for existing and future gas/oil extraction facilities in the Arctic	WP4	16	25	
MS452	Gridded dataset, providing estimates of the emissions of the different oil/gas extraction facilities	WP4	1	25	Full Title: Gridded dataset, providing estimates of the emissions of the different oil/gas extraction facilities in the Arctic, with a focus on the Shtokman facility if possible
MS453	Simulator of the effects of noise from oil industry operations on marine mammals	WP4	17	25	
MS461	Synthesis of regulations, agreements, legislation relating to oil and gas extraction sector. Report	WP4	3	13	End of the title: [...]sector. Report to carry analysis of shortfalls and evaluation of options to address these, as well end-user evaluat

WT4:
List of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS122	Implementation of improved	WP1	1	25	Leader: LOV
MS123	Submarine transect of Arctic	WP1	5	18	
MS124	First AUV experiment	WP1	5	18	
MS443	First successful evaluation of an observational network with a target quantity relevant to the Shtok	WP4	12	40	Full Title: First successful evaluation of an observational network with a target quantity relevant to the Shtokman field
MS125	Second AUV experiment	WP1	5	30	
MS131	Monitoring studies from ships	WP1	19	26	
MS132	Estimation of the contribution	WP1	19	46	
MS133	ACOBAR acoustic floats	WP1	1	20	Leader: LOCEAN
MS151	Ocean-sea ice downscaling	WP1	6	38	
MS161	High-resolution NorESM runs	WP1	11	38	
MS162	NorESM-runs with improved	WP1	11	45	
MS351	Field experiments done	WP3	14	37	

WT5:
Tentative schedule of Project Reviews

Project Number [1]	265863	Project Acronym [2]	ACCESS

Tentative schedule of Project Reviews

Review number [65]	Tentative timing	Planned venue of review	Comments, if any
RV 1	13	Paris	
RV 2	25	Paris	
RV 3	37	Paris	
RV 4	50	Paris	

WT6:
Project Effort by Beneficiary and Work Package

Project Number [1]	265863	Project Acronym [2]	ACCESS

Indicative efforts (man-months) per Beneficiary per Work Package

Beneficiary number and short-name	WP 1	WP 2	WP 3	WP 4	WP 5	WP 6	WP 7	WP 8	Total per Beneficiary
1 - UPMC	74.00	40.00	0.00	48.00	15.00	39.00	15.00	10.00	241.00
2 - Oasys	18.00	8.80	0.00	9.00	0.00	4.20	3.00	2.00	45.00
3 - NERC	0.00	0.00	0.00	4.00	44.00	5.90	0.00	2.00	55.90
4 - Kiel IfW	0.00	0.00	0.00	35.00	3.00	0.00	0.00	2.00	40.00
5 - UCAM	49.00	10.00	0.00	3.00	8.00	0.00	0.00	2.00	72.00
6 - AWI	35.00	0.00	0.00	0.00	5.00	0.00	0.00	2.00	42.00
7 - JSC	0.00	6.00	0.00	0.00	2.00	0.00	0.00	2.00	10.00
8 - NOFIMA	0.00	0.00	33.40	0.00	2.00	0.00	0.00	4.00	39.40
9 - HSVA	0.00	18.00	0.00	15.00	0.00	0.00	0.00	0.00	33.00
10 - NPI	36.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00
11 - Met.no	56.50	5.00	0.00	6.00	1.00	10.00	0.00	2.00	80.50
12 - FastOpt	15.50	7.70	0.00	7.80	0.00	0.00	0.00	0.00	31.00
13 - SAMS	25.00	5.00	0.00	18.00	0.00	0.00	0.00	2.00	50.00
14 - Beijer Institute	0.00	0.00	32.30	0.00	46.00	3.20	0.00	2.00	83.50
15 - SIO	15.00	10.00	0.00	17.00	6.00	0.00	0.00	0.00	48.00
16 - IMPaC	0.00	0.00	0.00	34.00	0.00	0.00	0.00	0.00	34.00
17 - UPC	0.00	24.00	3.00	31.00	2.00	3.00	0.00	0.00	63.00
18 - DLR	0.00	18.00	0.00	4.00	0.00	0.00	0.00	0.00	22.00
19 - AARI	24.00	24.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00
20 - ESRI	0.00	47.70	2.00	0.00	0.00	0.00	0.00	0.00	49.70
21 - UoL	0.00	0.00	50.90	0.00	0.00	0.00	0.00	0.00	50.90
22 - SINTEF F&H	0.00	0.00	14.50	0.00	0.00	0.00	0.00	0.00	14.50

WT6:
Project Effort by Beneficiary and Work Package

Beneficiary number and short-name	WP 1	WP 2	WP 3	WP 4	WP 5	WP 6	WP 7	WP 8	Total per Beneficiary
23 - CICERO	12.60	8.40	0.00	6.90	0.00	0.00	0.00	0.00	27.90
24 - SINTEF	0.00	0.00	0.00	17.70	0.00	0.00	0.50	0.00	18.20
25 - EWI	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	5.00
26 - LCP	0.00	0.00	0.00	0.00	16.00	0.00	0.00	0.00	16.00
27 - BELUGA	0.00	14.30	0.00	0.00	0.00	0.00	0.00	0.00	14.30
Total	360.60	246.90	136.10	261.40	150.00	65.30	18.50	32.00	1,270.80

WT7:
Project Effort by Activity type per Beneficiary

Project Number [1]	265863	Project Acronym [2]	ACCESS

Indicative efforts per Activity Type per Beneficiary

Activity type	Part. 1 UPMC	Part. 2 Oasys	Part. 3 NERC	Part. 4 Kiel If	Part. 5 UCAM	Part. 6 AWI	Part. 7 JSC	Part. 8 NOFIMA	Part. 9 HSVA	Part. 10 NPI	Part. 11 Met.no	Part. 12 FastOpt	Part. 13 SAMS	Part. 14 Beijer
1. RTD/Innovation activities														
WP 1	74.00	18.00	0.00	0.00	49.00	35.00	0.00	0.00	0.00	36.00	56.50	15.50	25.00	0.00
WP 2	40.00	8.80	0.00	0.00	10.00	0.00	6.00	0.00	18.00	0.00	5.00	7.70	5.00	0.00
WP 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.40	0.00	0.00	0.00	0.00	0.00	32.30
WP 4	48.00	9.00	4.00	35.00	3.00	0.00	0.00	0.00	15.00	0.00	6.00	7.80	18.00	0.00
WP 5	15.00	0.00	44.00	3.00	8.00	5.00	2.00	2.00	0.00	0.00	1.00	0.00	0.00	46.00
WP 8	10.00	2.00	2.00	2.00	2.00	2.00	2.00	4.00	0.00	0.00	2.00	0.00	2.00	2.00
Total Research	187.00	37.80	50.00	40.00	72.00	42.00	10.00	39.40	33.00	36.00	70.50	31.00	50.00	80.30
2. Demonstration activities														
Total Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Consortium Management activities														
WP 7	15.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Management	15.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Other activities														
WP 6	39.00	4.20	5.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	3.20
Total other	39.00	4.20	5.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	3.20
Total	241.00	45.00	55.90	40.00	72.00	42.00	10.00	39.40	33.00	36.00	80.50	31.00	50.00	83.50

WT7:
Project Effort by Activity type per Beneficiary

Activity type	Part. 15 SIO	Part. 16 IMPaC	Part. 17 UPC	Part. 18 DLR	Part. 19 AARI	Part. 20 ESRI	Part. 21 UoL	Part. 22 SINTEF	Part. 23 CICERO	Part. 24 SINTEF	Part. 25 EWI	Part. 26 LCP	Part. 27 BELUGA	Total
1. RTD/Innovation activities														
WP 1	15.00	0.00	0.00	0.00	24.00	0.00	0.00	0.00	12.60	0.00	0.00	0.00	0.00	360.60
WP 2	10.00	0.00	24.00	18.00	24.00	47.70	0.00	0.00	8.40	0.00	0.00	0.00	14.30	246.90
WP 3	0.00	0.00	3.00	0.00	0.00	2.00	50.90	14.50	0.00	0.00	0.00	0.00	0.00	136.10
WP 4	17.00	34.00	31.00	4.00	0.00	0.00	0.00	0.00	6.90	17.70	5.00	0.00	0.00	261.40
WP 5	6.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	0.00	150.00
WP 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.00
Total Research	48.00	34.00	60.00	22.00	48.00	49.70	50.90	14.50	27.90	17.70	5.00	16.00	14.30	1,187.00
2. Demonstration activities														
Total Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Consortium Management activities														
WP 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18.50
Total Management	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18.50
4. Other activities														
WP 6	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.30
Total other	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.30
Total	48.00	34.00	63.00	22.00	48.00	49.70	50.90	14.50	27.90	18.20	5.00	16.00	14.30	1,270.80

WT8:
Project Effort and costs

Project Number [1]	265863	Project Acronym [2]	ACCESS

Project efforts and costs

Benefi-ciary number	Beneficiary short name	Estimated eligible costs (whole duration of the project)						Total receipts (€)	Requested EU contribution (€)
		Effort (PM)	Personnel costs (€)	Subcontracting (€)	Other Direct costs (€)	Indirect costs OR lump sum, flat-rate or scale-of-unit (€)	Total costs		
1	UPMC	241.00	839,000.00	385,329.00	452,339.00	774,803.40	2,451,471.40	0.00	1,741,023.00
2	Oasys	45.00	291,540.00	0.00	19,550.00	145,770.00	456,860.00	0.00	362,522.00
3	NERC	55.90	323,123.00	6,000.00	25,213.00	355,436.00	709,772.00	0.00	533,829.00
4	Kiel IfW	40.00	229,330.09	0.00	6,599.69	141,557.87	377,487.65	0.00	283,115.00
5	UCAM	72.00	366,615.14	69,400.00	38,897.00	243,307.28	718,219.42	0.00	539,039.00
6	AWI	42.00	193,036.52	0.00	4,000.00	165,779.76	362,816.28	0.00	272,112.00
7	JSC	10.00	112,500.00	0.00	13,310.00	25,162.00	150,972.00	0.00	113,229.00
8	NOFIMA	39.40	393,152.75	1,230.00	54,312.00	586,499.62	1,035,194.37	0.00	776,703.00
9	HSVA	33.00	234,729.00	29,500.00	28,506.00	258,899.00	551,634.00	0.00	414,100.00
10	NPI	36.00	222,000.00	12,500.00	182,310.00	75,000.00	491,810.00	0.00	340,033.00
11	Met.no	80.50	603,750.00	4,921.50	72,000.00	603,750.00	1,284,421.50	0.00	964,546.00
12	FastOpt	31.00	223,200.00	0.00	9,315.00	122,760.00	355,275.00	0.00	266,456.00
13	SAMS	50.00	290,740.20	1,500.00	168,886.70	275,776.14	736,903.04	0.00	553,052.00
14	Beijer Ins	83.50	515,810.88	0.00	53,175.56	341,391.86	910,378.30	0.00	688,183.00
15	SIO	48.00	103,200.00	0.00	19,000.00	24,440.00	146,640.00	0.00	109,980.00
16	IMPaC	34.00	252,643.00	0.00	23,000.00	134,658.70	410,301.70	0.00	307,726.00
17	UPC	63.00	283,942.62	1,500.00	49,869.00	153,388.59	488,700.21	0.00	366,900.00
18	DLR	22.00	146,859.00	0.00	224,000.00	97,248.00	468,107.00	0.00	351,080.00
19	AARI	48.00	125,130.00	0.00	25,200.00	30,066.00	180,396.00	0.00	135,297.00
20	ESRI	49.70	263,512.73	0.00	21,500.00	171,283.27	456,296.00	0.00	342,222.00
21	UoL	50.90	259,702.83	13,520.00	31,096.00	174,479.30	478,798.13	0.00	359,098.00

WT8:
Project Effort and costs

Benefi-ciary number	Beneficiary short name	Estimated eligible costs (whole duration of the project)						Total receipts (€)	Requested EU contribution (€)
		Effort (PM)	Personnel costs (€)	Subcontracting (€)	Other Direct costs (€)	Indirect costs OR lump sum, flat-rate or scale-of-unit (€)	Total costs		
22	SINTEF F&H	14.50	123,457.00	12,500.00	21,000.00	206,792.00	363,749.00	0.00	272,811.00
23	CICERO	27.90	165,209.00	0.00	13,977.00	173,118.00	352,304.00	0.00	264,228.00
24	SINTEF	18.20	224,979.00	13,750.00	58,976.00	226,777.00	524,482.00	0.00	399,050.00
25	EWI	5.00	52,500.00	0.00	2,696.00	18,399.00	73,595.00	0.00	55,196.00
26	LCP	16.00	144,000.00	0.00	27,500.00	34,300.00	205,800.00	0.00	102,900.00
27	BELUGA	14.30	95,030.00	0.00	11,700.00	21,346.00	128,076.00	0.00	64,038.00
	Total	1,270.80	7,078,692.76	551,650.50	1,657,927.95	5,582,188.79	14,870,460.00	0.00	10,978,468.00

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It cannot be changed unless agreed so during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

53. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

54. Type of activity

For all FP7 projects each work package must relate to one (and only one) of the following possible types of activity (only if applicable for the chosen funding scheme – must correspond to the GPF Form Ax.v):

• **RTD/INNO =** Research and technological development including scientific coordination - applicable for Collaborative Projects and Networks of Excellence

• **DEM =** Demonstration - applicable for collaborative projects and Research for the Benefit of Specific Groups

• **MGT =** Management of the consortium - applicable for all funding schemes

• **OTHER =** Other specific activities, applicable for all funding schemes

• **COORD =** Coordination activities – applicable only for CAs

• **SUPP =** Support activities – applicable only for SAs

55. Lead beneficiary number

Number of the beneficiary leading the work in this work package.

56. Person-months per work package

The total number of person-months allocated to each work package.

57. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

58. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

59. Milestone number

Milestone number:MS1, MS2, …, MSn

60. Delivery date for Milestone

Month in which the milestone will be achieved. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

61. Deliverable number

Deliverable numbers in order of delivery dates: D1 – Dn

62. Nature

Please indicate the nature of the deliverable using one of the following codes

R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

63. Dissemination level

Please indicate the dissemination level using one of the following codes:

• **PU =** Public

• **PP =** Restricted to other programme participants (including the Commission Services)

• **RE =** Restricted to a group specified by the consortium (including the Commission Services)

• **CO =** Confidential, only for members of the consortium (including the Commission Services)

• **Restreint UE =** Classified with the classification level "Restreint UE" according to Commission Decision 2001/844 and amendments

• **Confidentiel UE =** Classified with the mention of the classification level "Confidentiel UE" according to Commission Decision 2001/844 and amendments

• **Secret UE =** Classified with the mention of the classification level "Secret UE" according to Commission Decision 2001/844 and amendments

64. Delivery date for Deliverable

Month in which the deliverables will be available. Month 1 marking the start date of the project, and all delivery dates being relative to this start date

65. Review number

Review number: RV1, RV2, ..., RVn

66. Tentative timing of reviews

Month after which the review will take place. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

67. Person-months per Deliverable

The total number of person-month allocated to each deliverable.

Arctic Climate Change, Economy and Society

"ACCESS"

Part B: Narrative information

Table of contents

B.1 Concept and objectives, progress beyond the state-of-the-art, S/T methodology and work plan

B 1.1 Concept and project objectives

A previously largely inaccessible ocean is opening up to commercial and recreational activities. The retreat of sea ice in the Arctic Ocean promises economic benefits but at the same time reminds us of the workings of manmade climate change that is especially pronounced at high northern latitudes. Economic opportunities and environmental risks characterize the dichotomy that the Arctic nations and the global community of states face in the Arctic. Allowing the unregulated exploitation of Arctic resources, limitless development, and the consequential environmental damage to a so far relatively pristine region is not an option. Severe restrictions on commercial development and tourism, however, may also seem unrealistic considering the unprecedented opportunities which could develop with climate change. A multilateral agreement like the Antarctic Treaty is thus much less feasible for the Arctic. The Arctic is more accessible to economically important markets with respect to distance, countries have overlapping and in many cases, conflicting interests in the region and there is a large population in the Arctic that will be affected both by climate change and economic development. The interests and life circumstance of the indigenous peoples must be considered and respected in any planned development of the region.

Clearly, the observed recent changes and those anticipated in the near future for the Arctic region demand decisive political action. However, political decisions are still hampered by the lack of necessary scientific information in all relevant fields from climate sciences, to jurisdiction and socio-economic implications. ACCESS aims at a better understanding of environmental changes in the Arctic and at quantifying the impact of climate change on macro and meso-economic levels and in key economic sectors using an integrated and trans-sectoral approach. Based on this understanding it is possible to assess the related risk and opportunities in a broader context and to provide a foundation for the sustainable development of economic activities with a minimal impact on this sensitive environment. Therefore, the general objectives of ACCESS for "Quantifying climate change impacts on economic sectors in the Arctic" are threefold:

- to improve our understanding and the predictive capacity of how Arctic climate and Arctic marine ecosystems respond to a combination of natural and anthropogenic factors
- to improve our understanding of how rapid environmental changes might affect human activity in the arctic and impact on sectors and regions
- to evaluate which risks to humans and the environment at large will result from expected economic changes and which measures could be developed to address these risks.

The Arctic environment in the context of climate change.

Quantification of climate change impacts on economic sectors and the evaluation of associated risks requires a profound knowledge of the state and the expected changes of sea ice, the atmosphere and the Arctic ocean. The main aspect to be considered are a better prediction of sea ice extent and properties as sea-ice is impacting on all domains related to human activities. Other important aspects are iceberg drift, the regional and temporal changes in weather patterns as well as in extreme weather events like polar lows.

The Arctic has experienced substantial changes in recent years. These changes are most likely caused by a combination of natural variability of the high-latitude climate system, anthropogenic changes in the radiation balance and subsequently in atmospheric and oceanic heat transports, and feedbacks of the air-sea ice-ocean coupled system triggered by a thinning Arctic sea ice cover. Most prominent among these rapid and strong changes was the minimum Arctic sea ice extent in summer 2007. It far exceeded the previous minimum observed in September 2005. There is much evidence that the rapid retreat of the summer Arctic sea-ice cover from 2005 onwards was a response to at least three decades of thinning, resulting in a cover which was

unable to cope with the summer melt period, broke up and allowed increased heat absorption by near-surface water. Absorption of solar radiation in the oceanic mixed layer and later release of the heat to the atmosphere in fall significantly delays the freeze up of sea ice. This direct effect of the surface ocean mixed layer absorbing more and more solar radiation at the expense of a decreasing sea ice cover reflecting less and less solar radiation back into space, is a main factor explaining the polar amplification of global warming, enhanced bottom melting of sea ice and sea ice thinning.

The 4th International Polar Year provided a unique opportunity to collect a large amount of key observations taken simultaneously in the atmosphere, the ocean and sea ice. The young ice (first and second year ice), was expanding surprisingly fast at the expense of the old (multi-year) ice. Mean sea-ice drift velocities increased by a factor of 2 or 3 in extreme cases. In the atmosphere, the Arctic Oscillation known as the dominant mode of sea level pressure variability in the Arctic during the 1980s and 1990s, has been replaced by a dipole characterized by a low pressure system extending over Siberia and the Aleutians and a high pressure system extending over North America and Greenland. Other Arctic cryospheric components such as Greenland ice and permafrost appeared to be largely influenced by Arctic Ocean warming and retreating sea ice. The Greenland ice melting accelerated during recent years due to a warmer coastal ice free ocean enhancing ice surges, glaciers melting and icebergs calving. The extended warming of permafrost over large regions of Siberia appeared to be correlated with sea-ice starting to melt earlier in spring and retreating more and later in summer and fall.

Climate scenarios and current climate models are unable to reproduce these recent changes in the Arctic environment. Sea ice is vanishing faster than in all coupled climate model scenario calculations. None of those calculations anticipated the 2007 drastic sea ice retreat. Models that feature sudden sea ice extent reductions put them later in the 21st century. To improve scenarios and climate models, a number of measures are necessary. In ACCESS, we will monitor the current status and changes of the Arctic sea ice to provide a baseline against which to compare projected future changes and to maintain the critical measurements that are needed to confirm and determine the trends in ocean, ice and atmospheric change. Projections and estimates of uncertainties for future developments on time scales of up to several decades will be provided by own simulations as well as from other sources. This includes regionally differentiated scenarios for the development of sea ice and its variability on interannual to sub-seasonal scale; changes in the frequency, locality, and intensity of extreme weather events; and potential changes in oceanic current systems and hydrography. Furthermore, ACCESS will develop improved scenarios for environmental changes that could result from increased economic activity in the Arctic and feed them into Earth System Models to produce enhanced climate projections as a basis for European policies and actions. These analyses will feed directly into key sectors of core Arctic activities, namely maritime transport, fisheries and oil and gas extraction.

The Arctic environment in the context of climate changes, the WP1 of ACCESS, is an overarching activity for the ACCESS project since all the other activities of ACCESS including the economic sectors of fisheries, oil and gas extraction and marine transportation, are depending on WP1. It is indeed very important to realize that all the other activities of ACCESS are preempted in the context of Arctic climate changes. The ACCESS WP1 is materialized by 20 deliverables distributed among 8 tasks and 2/3 of those deliverables will be released during the year 2 and 3 of the 4 year ACCESS program, guaranteeing some main results and goals of ACCESS will be reached for this task before the end of the project. This timing is very important and critical since there is a strong need for the other WPs of ACCESS to benefit from WP1 overarching activities.

The Marine transportation including tourism in the Arctic domain.

For hundred of years, mariners have dreamt of an Arctic shortcut that would allow them to increase the efficiency of trade between Asia and the West. In 2009, two cargo ships navigated the Northern Sea Route, aided by the retreat of Arctic ice that scientists have linked to global warming. The two German ships (Beluga Fraternity and Beluga Foresight) left South Korea late July and completed their voyage in Rotterdam at the end of September on a route more than 7000km shorter than the Suez canal. The two ships were accompanied by nuclear Russian icebreakers as a precaution, although they encountered only scattered ice floes in the Vilkitsky Strait, the northernmost part of the route near Cape Tcheliouskine.

There is also growing interest by the tourism industry in the Arctic waters. A German liner, the Bremen, is currently carrying thousands of passengers along the Northwest Passage through the Canadian archipelago from Europe to Alaska. The German company Hapag Loyd is in charge of chartering this German liner each summer along this route.

The main task of the proposal would be to consider all the necessary preparatory work involved for these shipping marine activities in ice-infested waters and to take into account all the climate, weather, sea-ice variables impacting on these activities in order to optimize the kind of necessary scientific, technical and operational information needed for such activities. In addition there will also be a main task dedicated to the potential impacts these shipping activities would have on the sensitive marine environment including air pollution and long range transport pollutants by the atmospheric circulation, soot and black carbon deposition on sea-ice, ocean and arctic lands, oil spill, ballasting and deballasting ships tanks in subarctic seas.

The marine transportation activities in the Arctic domain including Arctic tourism is materialized by 21 deliverables distributed over 8 tasks. Half of these deliverables will be released during the year 2 and 3 of the project. The other half will be released during the last year and this is a typical characteristic of ACCESS socio economic activities. This timing is consistent with the fact that most of the outcomes for WP2 marine transportation activities will be analyzed and gauged in the context of WP1 arctic climate changes results.

Fisheries industry.

The Barents Sea is one of the most active fishing areas in the world. It is located in Norwegian and Russian waters. This is also one of the most dynamic areas for ocean and atmospheric circulation connecting the North Atlantic and Europe with the Arctic regions. The Norwegian Atlantic current transporting salty water masses from the subpolar gyre of the North Atlantic mixes with the Norwegian coastal current carrying fresh water masses from the Baltic Sea. The northern Barents Sea is largely influenced by Arctic currents (the East Spitsbergen current), Arctic sea-ice and icebergs originating from the Islands bordering the Barents Sea (Svalbard, Franz Josef Land, Novaya Zemlya, Svernaya Zemlya). Marine mammals are very abundant in this region and the increasing human activities creating noise and other pollution in the Barents Sea are threatening this population. In the context of climate changes in the Arctic, the Barents Sea is certainly one place where we can foresee radical changes that will affect the fish stocks. In the Arctic, physical constraints are essential for understanding the ecosystem evolution. In this proposal we will not set up another marine ecosystems model in addition to many others but rather we will carefully look at the sensitivity of these ecosystems to essential climate variables. The analysis of socio- economic aspects of fisheries industry in its reponse to Arctic climate change will be a major task for the proposal.

Like WP2 marine transportation of the ACCESS project, the fisheries industry activities of the ACCESS project (WP3) will be strongly dependent on the ACCESS WP1 activities since 7 out of 8 deliverables distributed among 7 tasks of WP3, will be produced during the last year of the ACCESS project. Milestones for WP3 are more evenly distributed during the 4 year ACCESS project. Number of deliverables for WP3 is significantly less than WP1, WP2 and WP4 but comparable to WP5. The main reason being that as for WP5, there are much less subtasks division in WP3. But still one deliverable at least will be produced for each task of WP3 garanteeing the main goals and objectives for WP3 activities will be fulfilled. Much like WP2 of ACCESS 3 deliverables will be produced at the very end of the project.

Resource Extraction

The melting of the Arctic sea ice is increasing the accessibility of deposits of oil, natural gas and nonferrous metals on and below the seafloor. While the offshore production of minerals is still in the prototypical phase, offshore production of energy resources is widely established around the globe. I In the European Arctic, offshore energy production occurs in the Barents Sea.

Tapping the huge reserves in the Arctic Ocean has the potential of relieving European and global concerns regarding a secure, extensive and carbon-effective (via cross-fuel substitution), supply of energy. Nevertheless, the special conditions in the Arctic, namely low temperatures, extensive dark periods in winter, the presence of icebergs, sea ice and associated environmental risks, make the extraction of energy resources more hazardous and expensive. Eventually, these challenges will be addressed, and the extraction of Arctic hydrocarbons (crude oil, condensate, natural gas) will become economically viable . It is the aim of the ACCESS project to assess the opportunities and multiple risks of resource extraction related to oil and gas in the Arctic Ocean, to highlight potential environmental pressures, provide pathways for technological, legal and institutional solutions to known problems, and to analyze the socio-economic impacts of resource extraction activity on European and world markets and societies.

To better assess the opportunities and risks of resource extraction in the Arctic, information is needed with respect to the present and predicted meteorological and oceanographic conditions in this region. For example, information is needed on extreme wind and wave events in addition to knowledge of the threat of sea- ice ridges and icebergs to expensive assets and personnel. It is our objective to respond to these challenges by providing pathways that eventually lead to new concepts for offshore platforms and other equipment.

The resource extraction (oil and gas) activities for the ACCESS project is composed of 22 deliverables distributed among 7 tasks and the reason is much like for WP1 and WP2, the more developed subdivision in subtasks for WP4 than for WP3 and WP5. In particular task 4 and task 5 of WP4 dealing with environmental pressure caused by increasing oil and gas exploitation in the Arctic domain, will produce 5 and 9 deliverables respectively and mainly during the last 2 years of the ACCESS project. WP4 much like WP2 and WP3, will be subjected to WP1 results and analysis.

Arctic Governance

Long-term monitoring, coordination and data availability remain insufficient for Arctic research. Arctic cooperation is crucial to raise awareness and to strengthen policy input. We need to broaden the international information exchange on research projects, to facilitate coordination and to ensure open access to information from Arctic monitoring and research.

The wide range of legislative instruments, agreements, conventions at national and international level provide a complex, often overlapping and in some areas, conflicting, system of regulation in an area requiring special, integrated overview. ACCESS is uniquely positioned to provide this reflection process, to identify lacunae in the system and offer strategic policy options for the medium and long term future.

Prevention and mitigation concern global and trans-boundary processes with negative impacts in the Arctic such as long-range transport of pollutants by the atmosphere and ocean, ocean acidification etc. We need to strengthen international long-term cooperation to identify areas where support for adaptation has to be provided.

There is also a need to explore the possibility of establishing multi-sector frameworks for integrated ecosystem management including network of marine protected areas, navigational measures and rules for ensuring the sustainable exploitation of resources in the Arctic region.

All this points to the necessity of enhancing the present governance system,on the basis of reliable scientific, economic and social analyses resulting from international cooperation.

The 4th IPY, the EU IP¨Damocles and an extensive and intensive international cooperation provided a unique opportunity for all scientists from all countries interested in Arctic research to cooperate actively and successfully for a better knowledge of the Arctic regions. This effort should be maintained specially at a time when environmental changes are altering the geo-strategic dynamics of the Arctic with potential consequences for international stability calling for the development of an Arctic policy protecting and preserving the Arctic, promoting sustainable use of resources and contributing to enhanced Arctic multilateral governance. In order for the international scientific community to maintain the required high level of engagement in the Arctic, there is an urgent need for a legal framework taking into account the specificity of the Arctic regions.

ACCESS will build on work in scientific and socio-economic fields to identify how the governance system in the Arctic can be made more effective and coherent.

Recognising the particular vulnerability of the Arctic region and its crucial importance to the world climate system, ACCESS will contribute to formulating and implementing EU actions and policies that impact on the Arctic with respect for its uniqueness, the sensitivities of ecosystems and their biodiversity as well as the needs and rights of Arctic residents, including indigenous peoples. ACCESS will promote a permanent dialogue with NGOs on the state of the environment in the Arctic.

ACCESS will contribute towards assessing the state and outlook for the Arctic environment and to put forward initiatives to contribute to the SAON process (Sustainable Arctic Observing Network).

The Arctic governance, ACCESS WP5 is much like WP3, characterized by 9 deliverables distributed among 9 tasks (at least one deliverable for each task). But in contrast with WP3, WP5 deliverables will be released during year 2 and year 4 of the ACCESS project. This is because Arctic Governance issues are less subjected to Arctic climate changes than the thematic WPs of ACCESS. Still this dependency of WP5 relative to WP1 exists but as important will be the interactions between WP5 and WP2, WP3 and WP4 respectively.

An important issue for ACCESS will be the new ACIA report scheduled for 2015 that is just after the end of the ACCESS project. ACIA stands for the Arctic domain more like the IPCC report for the entire Globe and it will be very important for ACCESS to contribute significantly to the new ACIA report. This is going to be a major outcome of ACCESS as far as communication, dissemination and exploitation of knowledge is concerned. During the course of the ACCESS project the quarterly ACCESS newsletter will act as a pacemaker for ACCESS and will greatly contribute to the achievement of ACCESS goals and objectives

ACCESS will heavily rely on intense cooperation with other EU Arctic funded projects presenting a strong interest for ACCESS general and specific goals.

A few examples are given: ATP (Arctic Tipping Point) addressing the impact of climate change on Arctic ecosystems. ACOBAR is a continuation of Damocles for what concerns the development and proven capabilities of new technology for ocean monitoring. In this framework a new autonomous and automatic network (the cluster) using extensively underwater acoustics for fixing and ranging and transmitting data via acoustic modems, will be capable of sending inshore ocean, sea ice and atmospheric Essential Climate Variables (ECV) in near real time. The use of a cluster at no cost for ACCESS besides logistics will be tested in order to provide important information regarding sea ice thickness distribution, surface meteorological parameters and ocean characteristics (temperature and salinity). ARCRISK is another project that will be of interest for ACCESS and vice verca. MyOcean would also be connected to ACCESS for operational services and mutual interest. In North America and following a very successful cooperation developed between Damocles and Search for Damocles, there will be a continuing interest to link ACCESS and SEARCH and ISAC (International Study for Arctic Change). The same link will be maintained with ARCTICNET (Canada). An advisory board gathering all the coordinators of these arctic projects will be set up by the steering committee of ACCESS. Due to the diversity of topics characterizing ACCESS a forum will be created encompassing all the stakeholders participating to the ACCESS activities. The advisory board will meet at least once a year during the ACCESS General Assembly. On other occasions during workshops and/or summer schools, exchanges between advisory board members and ACCESS partners will mutually benefit to the participants and to the program in particular. The interaction of ACCESS with the stakeholders in the stakeholder/end-users forum will be an ongoing process, most direct on the level of an ACCESS partner with the relevant stakeholder.

B 1.2 Progress beyond the state-of-the art

Climate change and the associated changes in the Arctic environment affect all human activities in the Arctic. Especially pronounced are the effects of changes in sea ice extent and properties as they are arguably the most important climate variables in terms of their **impact** on commercial activities like **maritime transport, tourism, fisheries, and resource extraction.**

WP1 'Climate Change and Arctic Environment'.

To provide a scientific foundation for the quantification of climate change impacts on economic sectors and the evaluation of associated risks a profound knowledge on the state and expected change of sea ice, as well as atmosphere and oceans, is an essential prerequisite. This duty will be in the hands of **WP1 'Climate Change and Arctic Environment'**. It will rely on modelling and observational elements which are necessary to provide scientifically based optimal information of the **WPs 2 – 5** which deal with the different economic sectors as well as governance issues.

A main aspect of WP1 thus concerns a better prediction of sea ice extent, thickness and concentration, as sea ice has probably the largest impact on all domains of economic activity. Other important factors are iceberg drift affecting shipping and resource extraction, as do extreme weather events such as polar lows and the increase of of low pressure systems along the northern coast of Siberia (Simmonds and Keay, 2009). Ocean changes also affect fisheries and have a feedback effect on the ice itself. Any evaluation of climate change on socio-economic aspects in the Arctic must rely on predictions of the development of Arctic climate

parameters over the next decades.

State of the Art/Baseline:

Existing climate models have to be analysed and evaluated with respect to their performance in the Arctic. In **ACCESS**, we will **assess climate model results for the last 30 – 40 years** (1971 – 2010) regarding the representation of sea ice, ocean, and atmospheric parameters, their seasonal and inter-annual variability, and their trends. Such assessments have been done only focussing on large scale ice and ocean conditions, and using older climate simulations. It is essential, though, that such assessments are done tailored for the needs of each of the four economic sectors and based on the most recent climate simulations.

Arctic observational data have been gathered over the last decades, including huge activities of Russian scientists starting early in the last century, up to the most recent **International Polar Year (IPY)**, of which **DAMOCLES** was a strong European component. For **ACCESS** the participation of observational experts who have been involved in many of these previous and in ongoing observational programs will ensure the best observational knowledge and understanding of Arctic change.

The third major activity of **WP1** concerns the **impact of increased commercial activity on climate**. For these no **integrated study** giving an overall assessment of changes in pollutants and climate components exists.

Advance and aims to be achieved:

- Climate model results to be used will recruit from the current 'Climate Model Intercomparison Project 3' (CMIP3) (Meehl et al., 2007) while more recent CMIP5 results will be used as soon as they become available. In addition, high-resolution climate model results will be available (planned for the end of 2010) from the German STORM initiative. At a high atmospheric resolution of T250 (about 50 km) and 150 vertical levels and oceanic resolution of 10 km this represents a new class of climate model with possible vast improvements in Arctic climate and climate change description as well as in the simulation of weather and extreme events. **ACCESS** will collaborate with existing and planned projects that aim at improved **decadal predictions** by taking into account the current state and trajectory of the climate system. **ACCESS** will evaluate relevant aspects CMIP3 and CMIP5 coupled climate scenario **simulations for the next 30 years** (until 2040). **Downscaling** simulations with the regional ocean-sea ice model NAOSIM will allow us to represent sea ice and ocean circulation details and processes that are important for environmental, economic and societal impacts of climate change but which cannot faithfully be reproduced by the global climate models. This is especially the case for the shallow shelf seas of the Eurasian Arctic but also for the exchanges between the Arctic and subpolar oceans and the coastal regions everywhere in the Arctic.

- A further major goal of **WP1** is to provide **WPs 2- 5** with **projections and estimates of uncertainties** for future developments on time scales of up to several decades. This includes regionally differentiated scenarios for the development of sea ice and its variability on interannual to sub-seasonal scale over the **next 30 to 50 years**; changes in the frequency, locality, and intensity of extreme weather events like cyclones; potential changes in oceanic current systems and hydrography; changes in the exchanges between the Arctic Ocean and the Pacific and Atlantic oceans through various gateways; and changes in impacts on the coastal zone due to changed ice conditions, and oceanic and atmospheric flows. It is a considerable scientific challenge to evaluate the impacts of Arctic climate change on economic sectors. Many impact studies will need data of higher geographical resolution than provided directly by global climate models. However, due to the considerable sea ice uncertainty, regional downscaling of global scenarios by regional climate models or by statistical methods will be of limited value. Instead the global coupled climate and earth system model **NorESM** will be employed with increased resolution for selected decadal time-

slices.

- **WP1** of **ACCESS** will rely on existing Arctic data and the understanding of experts for the different data types to provide the best possible information on Arctic change and variability to best serve the needs of the **WPs 2 – 5**. In addition to the use of existing datasets and those gathered by ongoing activities/projects, significant gaps have to be closed by focussed observational activities as part of ACCESS. A natural focus of observational data related activities as part of **WP1** will be on sea ice, complemented by some essential ocean measurements. These analyses will allow ACCESS e.g. to gain information on important indicators necessary for commercial activities treated in **WP 2 – 4**.
- Here, another major goal of **WP1** will be to provide **ACCESS** throughout its duration with information on the current status and changes of the Arctic sea sea ice. This is meant on one hand as a baseline against which to compare projected future changes and to maintain the critical measurements that are needed to confirm and determine the trends in ocean, ice and atmospheric change.
- The current state of Arctic sea ice has been seen to be vulnerable to atmospheric and oceanic anomalies (Kauker et al., 2009). Sudden changes can occur, similar to the dramatic retreat in sea ice extent of the summer 2007 or the observed loss of old and thick ice in 2008 (Kwok et al., 2009). It will be important to document and analyse any such changes and to take advantage of them to be able to assess the possible future development of sea ice, not only in terms of its extend, but also regarding its changing properties, which are essential for the **quantification and prediction of its impact on the economic sectors**. Furthermore, the documentation will enable us to validate and improve models so that confidence in the forecasts of near-term and medium-term changes will be enhanced. The activities of **WP1** will on the one hand focus on the Barents Sea and the Siberian shelf seas as they are the main regions of anticipated commercial activities and thus the main concern of the other WPs of ACCESS. On the other hand, Arctic-wide monitoring is also necessary because of the impact of large changes in thick ice in the western Arctic on sea ice transport, fresh water transport in the ocean (e.g. Holland et al., 200) and in the form of sea ice, and the atmospheric and oceanic conditions in the Arctic (e.g. Gerdes, 2006).
- **The modelling activities** will provide technological and scientific support of Arctic governance aiming at a sustainable use of the Arctic resources. A necessary prerequisite is the most accurate estimate of the physical state of the Arctic. It is thus essential to observe those aspects of the physical environment that are most relevant for the economic sectors dealt with in **WP 2-4** in a most cost efficient way. Such questions will be systematically addressed by modelling and **quantitative observational network design** (Kaminski and Rayner, 2009) for which a tight interaction with observers is essential. The optimal design of a network depends on the exact definition of the target quantity, i.e. an observational network for ship routing will be different from an observational network optimized for resource extraction. The network design modelling infrastructure, developed and tested in WP1, will therefore be applied in **WPs 2** and **4**. For **marine transportation** (**WP2**) the sea ice conditions in the **North-East** and **North-West-passage** are relevant targets for the next decades. An optimal observation network for **resource extraction**, e.g. in the Shtokman gas field in the Barents Sea, (**WP4**) will be a prerequisite for **impact minimization**. In **ACCESS** the variational data assimilation system **NAOSIMDAS** will be used for the first time to evaluate candidate networks consisting of currently available and possible future remote-sensing data in conjunction with a set of in-situ observations. **NAOSIMDAS** will also be used to initialize hindcasts and to assess **forecast skills**. We will set up a continuous seasonal probabilistic forecast of ocean and sea ice conditions in the Arctic. This will support the monitoring tasks by providing hints for most useful in-situ measuring sites. This work will provide scenarios for ocean and sea ice evolutions that are consistent with available observations. The **probabilistic forecasts** will also be used to identify and quantify the probability of imminent sudden changes and dramatic events in the ocean-sea ice system.
- Also with respect to weather predictions an increased need for monitoring and forecasting can be foreseen with Arctic climate change allowing greater access to the region. **Monitoring and forecasting capabilities** set the frame for which economic activities can take place under **acceptable risk**. Because monitoring and forecasting capabilities affect **safety**, they have potential impacts on adaptation and safety management in Arctic governance. Present short-range forecasting capabilities

concerning Arctic weather, ocean and sea ice conditions will be investigated with emphasis on how that affects Arctic economic activities and operations. Particular emphasis will be on **numerical weather forecasting**, as numerical sea ice and ocean forecasting depend strongly on that. Main gaps in the observing system will be identified. We will perform an assessment of the relative contributions of the components of the present observing system. This comprises both in situ observations and satellite observations. To aid design and assessment of the future observing systems we use observing system simulation experiments, which yield a more accurate knowledge about the impact of observations on forecasting capability. This will give a good picture of our **forecasting capabilities** in a changed Arctic given the known components of the future observing system as well as knowledge on how to fill gaps in a **cost-efficient** way.

- The third major activity of **WP1** concerns the **impact of increased commercial activity on climate**. Here we focus on air pollution in the Arctic due to increasing ship traffic, black carbon and soot deposition on snow and sea ice. To assess and possibly quantify impacts of economic changes on climate, we will evaluate how radiatively active pollutants, including short-lived ones, will drive climate change in the Arctic, e.g. reduced sea ice and snow cover and their impact on the environment. We will evaluate the impact of soot deposition in the Arctic on future climate and how transport of pollution from lower latitudes into the Arctic changes with changing climate and what impact those pollutants have on the Arctic environment. New emissions in the Arctic region due to new economic activities will be quantified and taken into account in new decadal time-slice scenario calculations. We will give a synthesis of the model simulations of **substantial growth in Arctic ship traffic**, with estimates of the climate impacts and their implications for policymaking. Ship emissions have the potential to significantly reduce air quality in coastal regions and lead to acidification. This will be the **first integrated study** giving an overall assessment of changes in pollutants and climate components. Specific studies will be performed where the overall effect of lower fuel consumption due to a shorter route between Europe and Asia, is considered. Defining **indicators** for comparison will be done, taking into account the various atmospheric lifetimes of the forcing agents (spanning from days to several centuries) and estimates of climate sensitivity will be performed based on results from the EU Integrated project QUANTIFY and from other published data. The calculations will provide estimates of whether emissions occurring in the Arctic region will be more harmful for climate than emissions occurring at lower latitudes and give overall estimates of climate effect of shift of activities from other regions to the Arctic.

Performance Indicators:

- Provide the project with information on the current status and changes of the Arctic sea ice, ocean and atmosphere during the duration of the project
- Provide the other WPs with tailored projections and estimates of uncertainties for future developments on time scales of up to several decades
- Setup and testing of a framework for quantitative design of observational networks for marine transportation and resource extraction.
- Provision of information on changing ice properties specific to revised criteria for Arctic shipping operations, marine ecosystem mapping, offshore structure design and oil spill protection.
- Assessment of the contribution of local and remote anthropogenic and natural sources on air pollution, acidification and climate in the Arctic
- Evaluation of the impact of soot deposition on surface albedo and on climatic change.
- Assessment of future short-term forecasting capabilities and recommendations for future Arctic observing systems.

WP 2a 'Marine Transportation'

One of the key human activities which is expected to change significantly as a consequence of climate change in the Arctic is **marine transportation. ACCESS** will provide a base for a **beneficial development**

of increased shipping in changed Arctic ice conditions, considering **risks and opportunities**. It will develop supporting information for the required international cooperation and **governance** in the various sectors of Marine Transport and Tourism. The development of an **Arctic Policy** in order to combine the **environmental protection** of the Arctic with a sustainable use of the shipping opportunities is an issue which must be combined with the existing rules and regulations. This will be provided in close cooperation with **WP5.**

State of the Art/Baseline:

- ACCESS work in this are will be based on but progressing far beyond previous assessments in this area, **ACCESS** will apply a cross-sectoral approach to tackle this important topic. Key information on the expected changes in sea ice cover and properties, projections of forecasting capabilities on short-term (weather) and long-term (decadal) and requirements for observational network design will stem from **WP1** and will be developed in close cooperation. One of the possible Arctic seaways, the Northern Sea Route (NSR), came into the focus of the western marine transport industry and governments in 1988, when the Russian President Gorbachev declared the NSR open for international shipping. The reason for the attraction is its 40% shorter distance between Europe and East Asia compared with the Suez Canal route as well as the possibility of shipping hydrocarbons out of the Arctic to the European market. Studies on the commercial, technical and environmental implications of the usage of the NSR, carried out in the 1990s including INSROP (INSROP Programme Report 1993-1998, ISBN 82-7613-358-4) and the EU-Project ARCDEV (Arcdev Final Report, 2000, WP-16, European Commission, DG-TREN, Contract No.WA-97-SC.2191) showed that, with the help of the powerful Russian atomic icebreakers Arctic shipping was technically feasible but not economically justified. Results of the ARCDEV-Expedition recommended a number of research actions in order to improve environmental, economic, and safety aspects.

Advance and aims to be achieved:

- Climate change has led to decreased ice coverage and thickness by about 50% over the last three years. More importantly for Arctic shipping, the coverage of the very thick and strong multi-year ice has decreased by more than 50%. This process, which creates more open leads for higher velocity navigation, has implications for marine transportation and tourism in the Arctic, which will be analysed regarding the technological, economic, and environmental consequences.
- The rapid changes of the ice conditions have not yet affected the shipping activity in the Arctic. One reason is that the new Arctic ice conditions require **new technological solutions** but developments take time. This delay is, however, favourable for combining the issues regarding development of technical transport with the proposed ACCESS-investigations on the **socio-economic impact** of the expected increase of Arctic Marine Transport and Tourism on the sensitive Arctic environment and how these impacts can be minimized.
- While travelling in ice infested waters the required actual power is very much depending on the existing ice condition. The conditions can vary from open water to severely deformed ice, resulting in huge differences of time needed per travelled mile. Within **WP2**, **ACCESS** will investigate the impact of climate change on **navigation efficiency** in the Arctic Ocean. This will be based on forecasts of future sea-ice conditions in the Arctic as well as an analysis of the ice conditions in the Arctic with respect to ice navigation in close cooperation with **WP1. Historical data sets** will be used to study regimes and variability of the most important sea ice parameters focussed on navigating along Arctic routes. This will included known routes as well as safe and economically feasible routes. **WP2** will analyse the influence of sea ice conditions on the **navigation efficiency** in the Arctic under the different climate change scenarios. In addition **WP2** will investigate **lateral ice pressure** as a function of wind and current data, a most important set of information for shipping, including even icebreakers.
- The increase of maritime transport requires the improvement of the **infrastructure**. The identification of the requirements include such parameters as **search and rescue, ports, communications, charting, spill response and cleanup, salvage, aids to navigation, traffic schemes, icebreakers**, among others. **WP2** will examine the impacts on Arctic communities of

expanded Arctic marine use, focusing on identifying the priorities of the needed infrastructure and the near-term **investments** necessary to achieve **acceptable levels of risk** with the expansion of marine traffic. This includes the development of strategies to mitigate selected impacts and limit **potential user conflicts** in local and regional Arctic waterways which are expressed. All these results will be incorporated in the governance **WP5** and will be made available to the relevant authorities in governments.

- Increased shipping in the Arctic leads to **air and noise pollution** and increases the risk of **oil spills.** The use of the NSR reduces the global fuel consumption due to shorter northern shipping routes. However, emissions in the Arctic region are more harmful for the environment than emissions occurring at other latitudes. The overall effect might be positive or negative**. Indicators** for different **environmental effects** such as impacts on regional air quality and acidification in the Arctic will be investigated, which will be essential for policymakers to define future policies.
- The **risk** associated with the **transport of heavy fuel oils** in the Arctic will be investigated as well, closing a significant gap in the evaluation of environmental risks. This study will focus upon examining the environmental, social and financial implications, covering various geographical scales (e.g. pan-Arctic, coastal, sensitive areas). Also **noise propagation** from **commercial marine transport** in the Arctic environment, primarily in the Barents Sea, will be investigated in **WP2**. This includes the estimation of averaged noise levels and their trend in area of cetacean habitats close to commercial shipping routes. For this purpose also autonomous passive hydro-acoustic buoys for Arctic conditions will be adapted. On site experimental validation of the predicted noise levels by using long time passive acoustic bottom buoys measurements will be carried out without costs for **ACCESS**. Save navigation through the Arctic relies on forecasts of the coupled ocean sea-ice system along the shipping route. Such forecasts are produced by numerical forecasting systems which have to be initialised with a most accurate state of the coupled ocean sea-ice system. This initialisation is carried out via assimilation of observational data into the forecast model. It is not clear how to configure an observing system to achieve the best possible forecast skill for a shipping route. **Quantitative network design** will be applied to answer this question (see **WP1**).

Performance Indicators
see below ('Performance Indicators for Arctic Shipping and Tourism')

WP2b 'Tourism':
Arctic tourism has increased in the last 10 years mainly mainly due to the effect of climate change, in spite of the risk involved in navigating in Arctic waters with cruise ships. For the further development of Arctic tourism the effect of climate cha
nge on this widely spread industry branch will be estimated, which will also cover the effect on supply and demand of tourism services. ACCESS will assess and evaluate existing rules and regulations for Arctic shipping and Arctic tourism which serves as input to the governance WP (WP5).

State of the Art/Baseline:

- Work will start from the existing Hamburg Tourism Model (HTM) (Hamilton et al. 2005;Mayor et al. 2010). HTM is one of three models of the supply and demand of domestic and international tourism, the only one that is maintained at a research institute, and the only one that includes the effect of climate change on the supply and demand for tourism services. HTM operates at the country level, but downscaling methods have been developed and successfully applied (Hamilton et al. 2007).

Advance and aims to be achieved:

- In **ACCESS** for the first time the **Hamburg Tourism Model (HTM)** (Hamilton et al. 2005;Mayor et al. 2010) will be used in an Arctic context to estimate the **effects of climate change on tourism** in the Arctic. HTM operates at the country level, but downscaling methods have been developed and successfully applied (Hamilton et al. 2007). For ACCESS the downscaled version will be applied.

- Climate change has a number of different **impacts on Arctic tourism**. On the one hand, the Arctic will become more accessible. On the other hand, the Arctic may well lose some of its unique characteristics. Such threats may lead to a temporary surge in the number of tourists, who would want to experience the Arctic before it is gone. In order to capture these effects, the generic characterisation of demand and supply of tourism services of **HTM** will be adjusted to reflect aspects that are particularly important to Arctic tourism (Haase et al. 2009). The new version of HTM will then be used to estimate tourist numbers, length of stay, total expenditure, consumer surplus, and producer surplus over a period of decade for a number of alternative socio-economic and climate scenarios.
- To further increase the power of the HTM predictions and to further strengthen the links to the Arctic ecosystems, quantitative spatially explicit information on key ecosystem benefits, such as polar bears and whales, will be provided. Through the quantification of change in essential supporting ecosystem services, such as food availability and spawning grounds, change in the densities and spatial distribution of these key species, under the different climate change scenarios assessed in WP1, can be estimated. This will be an integrated activity of WP2 with WP5.

Performance Indicators for Arctic Shipping and Tourism:

- Investigation and definition of the necessary actions for the implementation of Marine Transportation and Tourism in the Arctic in view of the impacts of the climate change on the economic opportunities and the protection of the sensitive environment.

Specific aspects are:

- Assessment of the Impact of climate change on Arctic Shipping, including lessens from historic ice conditions and influence on shipping, climate change impact on navigation efficiency, recommendations for future routing
- Rules and regulations for marine Arctic transport in view of the changing ice conditions
- Assessment of Infrastructure needs for increased shipping, including forecasting requirements and improvement under climate change,
- Air Pollution, noise and other environmental effects in the Arctic Ocean by increased shipping
- Improvements of safety and economy of Arctic shipping, including ice routing, fuel efficiency
- Sociological and Economic aspects of Arctic transport and tourism
- Arctic shipping and tourism governance under climate change conditions
- Indicators for sustainable Marine Transport and Tourism in the Arctic

WP3 'Fisheries'

Climate change is likely to change the properties of physical and biological systems in the Arctic and hence the economic activities related to these systems. WP3 will focus on enhancing knowledge related to bioeconomic and socioeconomic aspects of fish resources and aquaculture. The contributions aim to improve the understanding of both biological responses to climate change and the corresponding human responses. Such knowledge is essential for the design of governance systems taking into consideration risks, opportunities and societal effects of climate change.

State of the Art/Baseline:

- Fisheries management in the Arctic has always been challenged by biological systems characterised by significant fluctuations and poorly understood dynamics. The new concept of Harvest Control Rules (HCR) based on system indicators represents a new and promising approach towards

management of such systems. Previous model studies on the basis of IPCC's SRES scenario B2 suggest that management constraints may have a greater impact than climate change on a highly fluctuating system (Eide, 2008). Possible effects of less predictable systems and other climate scenarios are however still unknown.

- **Aquaculture** in the Arctic is dominated by salmonids along the Norwegian coast. This industry is likely to be influenced by climate change in a number of ways. Present studies have focused mainly on generalized effects and site-specific temperature effects (Lorentzen 2008).
- Knowledge on how stakeholders, primarily fishermen, respond to ecosystem changes and governance interventions are vital for predictions of socioeconomic implications of climate change and for the design of successful management interventions. Empirical studies reveal that "rational choice" might be a poor assumption for environmental problems and policy in particular, and calls for behavioural economics theory (Shogren and Taylor 2008). Until now, few or no attempts have been made to analyze fishermen's responses to climate change and to link individual behaviour to collective outcomes.

Advance and aims to be achieved:

- Large scale integrated bioeconomic models are complex and exhibit significant limitations. WP3 will investigate new modelling principles (through the use of cellular automata modelling techniques) which facilitate important features of the system which are poorly understood. The cellular automata model will be based on simple behavioural rules, both for biological and economic systems, and provide an efficient inclusion of the important spatial component in Arctic fisheries. Furthermore, the model will be employed to analyze impacts of climate change on the biological and economic system and by that develop knowledge relevant for the management of fish stock resources in this situation.
- In addition to more direct food-web and physical links, it is likely that fisheries will experience feedback effects from climate change through both **input and product markets**., e.g. fuel is likely to be taxed significantly higher giving increased operating costs and "green" consumers are likely to have altered demand structures. These areas are less explored and how these effects will influence **fisheries operations and sustainability** is little known. **WP3** will expand knowledge on these subjects for fisheries and thus contribute information relevant for governance.
- In WP3 we will review climate effects on Arctic aquaculture and establish scenarios for climate change and management responses. The Norwegian coast lies along a north-south axis with lower temperatures in the north. Climate change may thus give strong incentives for moving current sea-based aquaculture farms northwards. Within the task we will model this **re-localization**, **productivity effects** and **implications for regional value adding** and **employment** for each scenario. This model may also be helpful for management, as available sites may become a scarce factor and the effects on local ecosystems need to be evaluated.
- Knowledge on how **stakeholders**, primarily **fishermen**, **respond** to **ecosystem changes** and **governance interventions** are vital for predictions of socioeconomic implications of climate change and for the design of successful management interventions. Empirical studies reveal that "rational choice" might be a poor assumption for environmental problems and policy in particular, and calls for behavioural economics theory (Shogren and Taylor 2008). In **WP3** experiments and behavioural theories are employed to study **fishermen's responses** to climate change and to link individual behaviour to collective outcomes
- The most sensitive Arctic **marine mammals** to climate change appear to be the **hooded seal, polar bear**, and the **narwhal**, primarily due to their reliance on sea ice and specialized feeding. Loss of ice will open the Arctic to new levels of shipping (**WP2**), oil and gas exploration (**WP4**), fishing, hunting, tourism, and coastal development, and will add new threats to marine mammal populations, including ship strikes, contaminants, noise and competition for prey. Mapping the current distribution of Arctic marine mammals will increase knowledge on how marine mammal utilization of Arctic shelves will change in response to a diminishing ice cover. In addition, **WP3** will assess how **Inuit whaling** for bowhead whales is impacted by the rapid warming of the Arctic, which influences both ecosystems and livelihood, due to ice loss and the conservation status of the main

prey.

Performance Indicators:

- Estimation and quantification how climate changes impact Arctic fisheries and aquaculture, and the livelihood of communities and economic actors depending of these industries. The work will focus on the fisheries, aquaculture and livelihood in the European Arctic sector, and how governance can support the fisheries industries under climate change influence.

Specifically:

- Quantification and illustration how climate changes impact the fishing activities within the Arctic environment, due to biological and regulatory constraints
- Review of effects from climate change on aquaculture production within the Arctic, including the environmental feed-back effects on the socio-ecological system
- Assessment the effect of climate change on input and output markets of the Arctic fishing industry
- Evaluation of the regional and local effects of climate-related environmental changes on fisheries, focusing on the adaptive strategies in commercial and subsistence fishery
- Review how fisheries management options are influenced by climate changes, given national policies, the legal fishery framework, environmental legislation and national perspectives on integrated ocean management
- Elucidation of the behavioural responses from different economic actors involved in Arctic fisheries, to ecosystem changes and policy interventions as results of climate change
- Mapping of the distribution of marine mammal populations in the Arctic, and assess the influence from climate, and human activity, changes on traditional whaling
- Development of indicators for sustainable development in the Arctic fisheries sector, by emphasising the economic development which is subject to trajectory uncertainties

WP4 'Resource Extraction':

To be able to provide a foundation for the sustainable development of resource extraction, with a minimal impact on the sensitive Arctic environment, research on quantification of climate change effects on the economic level have to be combined with research on risks and consequences, pollution, noise effects on marine mammals, at a technical, environmental and governance level. This is ensured and enhanced by the cross-sectoral approach taken within the WPs of ACCESS.

State of the Art/Baseline:

- Existing studies of the economic impacts of extended energy supply from onshore and offshore sources have mainly focused on non-Arctic regions. The Arctic has until now only been subject to very shallow investigation from an economic point of view. Existing economic assessments widely rely on anecdotal evidence and speculation.
- With regard to impacts of Arctic resource supply on key economic indicators like terms of trade, structural change or welfare, existing work is also poorly structured. Analyses are usually limited to

the potential economic impacts on the producing countries themselves and abstain from providing quantitative and attestable evidence on consumer markets.

- At present we do not have an understanding of how resource extraction in the Arctic could improve European energy security.
- Before oil or gas can be supplied to any market, the technology necessary for exploration and exploitation needs to be available and provide acceptable **environmental impact limits**. However the changing climatic conditions we are witnessing in the Arctic means that previous design loads may not be appropriate for the future Arctic conditions.
- There currently exists substantial expertise in the response to spills in the open-water environment, however this is not the case when sea ice is involved (ARCOP, 2005).
- It is unclear at present wether existing **rescue** and **evacuation** plans as well as existing rescue and evacuation equipment like craft, vessels and launching systems are appropriate under the specific conditions of Arctic climate change.
- Existing studies do not quantify the direct **emissions** of **oil/gas extraction** facilities into the atmosphere and its impact on air quality at regional and global scales. Observational data on these emissions and in-situ observations as well as the **impacts** of these emissions on trace gases and aerosols are absent. Dedicated flights in the exhaust plumes in the lee of facilities have been done only once before by **NOAA** in the plumes of the Alaskian facilities around Prudhoe Bay in 2008.
- There are currently no scientific tools for prevention/suppression of the impact of these noise sources in the marine environment, reagarding future development of human activities in Arctic waters.

Advance and aims to be achieved:

- **ACCESS** will provide a solid scientific foundation for a number of important aspects related to the impact of climate change on the economic sector of resource extraction. Explicitly, **WP4** of **ACCESS** will incorporate up-to-date information on the present and predicted development of sea ice as provided by the climate expertise from WP1 in conjunction with other Arctic specific risks (covered within **WPs 1 – 4** of **ACCESS**). By doing so **ACCESS** delivers an **integrated examination of economic risks and benefits** from Arctic Energy supply, including for the first time inter-linkages between economic, technological, environmental and legal aspects.
- With regard to impacts of Arctic resource supply on **key economic indicators** like terms of trade, structural change or welfare, existing work is also poorly structured. Analyses are usually limited to the potential economic impacts on the producing countries themselves and abstain from providing quantitative and attestable evidence on consumer markets. However, this information is essential when investigating the impact of resource extraction on the (world / European) economy. Based on the activities in **WP4**, **ACCESS** will provide the **first global and European** focused study of the possible economic impacts of Arctic energy supply. This ground-breaking inter-sectoral study takes into account not only the energy sector (meso-economic perspective), but also all relevant downstream sectors (macro-economic perspective). In order to achieve a holistic and global scope, we use a unique optimisation model of world gas markets, the **MAGELAN** model (Lochner and Bothe 2009). This model allows us to quantify the transmission of Arctic gas flows in unprecedented detail. In addition the use of the global computable general equilibrium CGE model, **DART** (Klepper et al. 2003)**,**, ensures the inclusion of all relevant economic repercussions. This will enable ACCESS and to deliver an understanding of the ramifications of Arctic energy supply in unprecedented detail.
- **ACCESS** will not only enhance our understanding of how resource extraction in the Arctic could improve European energy security, but also contribute in a conceptual way to the discussion about the quantification of energy security, namely by including insights from the **energy markets** and **transportation routes analyses**.
- Due to the sensitive nature of the Arctic marine environment, existing and future offshore oil and gas

developments need to ensure that all **possible precautions** are taken into account. In addition to threatening the basic integrity of the marine environment, petroleum spills have the potential to impact other marine industries dependent upon healthy ecosystems, as well as local and indigenous user groups that rely upon the sea. **WP4** will contribute significantly to the spatial planning and sensitivity mapping of the Arctic and in particular the Barents Sea and other key oil exploration areas such as the Beaufort Sea and Baffin Bay, and will specifically outline an effective approach to cross-sectoral management to ensure that sensitive areas are clearly identified, and that fisheries dependent upon a healthy marine ecosystem are considered when planning lease developments. Additionally, the project will consider the interaction of oil developments with rare and endangered marine species, and will outline best practices to ensure that critical habitat and behavioural characteristics are given consideration in the management of petroleum activities, forming a contribution to the **governance** option tackled in **WP5**.

- Before oil or gas can be supplied to any market, the technology necessary for exploration and exploitation needs to be available and provide acceptable **environmental impact limits**. However the changing climatic conditions we are witnessing in the Arctic means that previous design loads may not be appropriate for the future Arctic conditions. Therefore a full understanding of probable and possible Arctic climate change scenarios along with their impact on the offshore sector, including platform design different phases of environmental load scenarios etc. needs to be considered and factored into revised design load criteria for platform design and for oil transport methods (tanker export or seabed pipelines). ACCESS delivers this understanding.
- The design of a structure to resist a maximum ice pressure at a given return period depends on a number of parameters; these include the function of the platform of the platform as well as the risk levels (**health, safety and environment**) during **installation**, **operation** and **removal** of the **offshore facilities**. As a consequence, existing structure concepts need to be re-assessed with respect to realistic and informed scenarios of future ice conditions, as developed in **WP1**. This includes **recommendation** for the removal and disassembly of offshore facilities after the drilling or production phase. In order to obtain the largest economic return year-around offshore operations are favourable and it is therefore very likely that in the future complete subsea systems for production, storage, off-loading and transport of hydrocarbons will be used in the Arctic. This means that conventional above-water systems will be in the minority. These subsea systems are less vulnerable to sea ice / iceberg impact; however they do require further technical improvements. If this is to be realised new concepts and techniques need to be developed to address the changing environmental conditions of the Arctic. WP4 will address these challenges.
- Health, safety and environment aspects and procedures play a dominant role in offshore operations. Increasing offshore oil and gas activities are associated with the **risk of various types of pollution**, in particular by **spilled oil** from both operational and accidental releases. Drilling wastes during exploration, and water discharges during production are associated with the former category. Accidental **oil well blowouts** can occur during both exploration and production. These tend to be large volume releases with potential for huge impacts, mitigated by a low probability of occurrence. Accidents during production can also occur during loading/off-loading, due to pipeline breaks, or tanker accidents during transport. There currently exists substantial expertise in the response to spills in the open-water environment, however this is not the case when sea ice is involved (ARCOP, 2005). We address this shortfall within WP4. Representative spill events from this range of possibilities will be identified and simulated using complex oil spill models that are tuned to the present and predicted environmental conditions. These model runs will provide environmental impact and risk data which serve as an important input to develop oil spill and prevention strategies as well as for Environmental Impact Assessments. For this reason existing contingency plans as well as **oil spill recovery systems** and **combat methods** / procedures currently used in ice free waters need to be assessed regarding their applicability for operations in ice covered regions.
- To reduce the risk for the crews operating the offshore facilities **ACCESS** will re-assess existing **rescue** and **evacuation** plans as well as existing rescue and evacuation equipment like craft, vessels and launching systems under the specific conditions of Arctic climate change.
- Increased energy supply from onshore and offshore sources in the Arctic involves a number of activities, each of which represents a potential source of local and regional pollution in the Arctic

such as **volatile organic compounds (VOCs) emissions.** These emissions are involved in the formation of secondary greenhouse gases, like ozone. Ozone levels are currently very low in the Arctic but increased emissions from oil/gas extraction combined with NOx emissions from shipping could lead to significant increases and potentially episodes of local air pollution. Organic **aerosols** may also be formed which can be deposited in the sea, on particles, or on snow/ice where they can affect **surface albedo,** which in turn influences the melt rate of sea ice and Arctic climate. Already today, this source is a considerable contribution to the total national emissions for some countries in northern Europe. In Norway, for example, offshore oil and gas production currently contributes as much as 30% to the country's total VOCs. In contrast to previous studies, **ACCESS** will quantify the direct **emissions** of **oil/gas extraction** facilities into the atmosphere and its impact on air quality at regional and global scales. ACCESS will remedy the absence of observational data on these emissions and in-situ observations as well as the **impacts** of these emissions on trace gases and aerosols. In order to provide information for new modelling studies to assess the impact of these facilities on local and regional air quality, dedicated flights in the exhaust plumes in the lee of facilities off the north coast of Norway have been scheduled. This has been done only once before by **NOAA** in the plumes of the Alaskian facilities around Prudhoe Bay in 2008. These data will be compared with emissions data calculated for existing and future gas and oil extraction facilities in the Arctic.

- **Sound** produced by geophysical exploration and the construction and operation of **oil platforms**, represents the highest intensity source of any anthropogenically generated in the sea, reaching more than 250 dB re 1 μPa at 1m from the source. These sounds can have **physical, physiological and behavioural effects** on the marine fauna (**mammals, reptiles, fish and invertebrates**), in the area of action, and at various levels depending on the distance to the sound source. These impacts can be many and varied, for example studies have shown that we could see up to 50% reduction in the abundance of fish species in areas of exploration, **changes in behaviour** and **migratory routes** of cetaceans as well as damage of various ranks, including physical injuries, in vertebrates and marine invertebrates. In addition there may be further long-term effects due to chronic sound exposure as it can affect the animals indirectly due to changes in the accessibility of their prey, which also suffer from the effects of noise pollution. This damage may significantly affect the conservation of populations of threatened species of marine life that use acoustically polluted areas as migration routes, breeding and feeding areas. Economically speaking noise pollution can have a direct impact on economic activities such as fisheries in the concerned areas. There is therefore an urgent need to provide scientific tools for prevention/suppression of the impact of these noise sources in the marine environment if we are to optimise the future development of human activities in Arctic waters. **WP4** will address these questions with several activities related to the modelling, simulation and real-time monitoring of the possible effects of noise associated to oil and gas extraction on **marine mammals. WP4** will also provide recommendation on how to best protect these animals.
- An important aspect of resource extraction in Arctic waters is how it can be done in a **sustainable** way, with a **minimal impact on the environment**. This has **safety implications** with respect to the extraction structures, as well as implications for the potential consequences if the strategy fails. To find the best solution with respect to an observational strategy which is most effective, the case of the Shtokman gas field in the Barents Sea provides a unique opportunity. This is due to the fact that **ACCESS** was able to win the Shtokman Development AG as a member of the stakeholder forum, and the Shtokman Development AG has agreed to a very close cooperation with regards to observational activities in the area. Thus, in close cooperation with **WP1**, **WP4** will use the unique opportunity to provide observations on the eastern Barents Sea which are essential for the development of strategies to minimize the impact on the environment. These will nicely feed into the **optimal network design** activities undertaken in **WP1** and applied to the Shtokman gas field in **WP4**.
- Information on sensitive biological areas in the Arctic is a critical limiting factor in the implementation of sound management practices for the petroleum industry. **WP4** will provide essential information to inform decision makers when assessing the risk of potential developments, and will provide guidance on designing operating protocols that effectively take into account impacts to sensitive environments, and also how such impacts may affect other sectors such as fisheries.

Sensitivity maps produced in the course of this work package will represent an **innovative** and new tool for **cross-sectoral decision making** in the Arctic.

Performance Indicators:

- Analysis of the socio-economic impacts of (a) resource extraction activity on European and world markets and economies as well as (b) an assessment of the impact of Arctic resource extraction on European policy objectives;
- Assessment of existing technologies including (a) fixed and floating structures (b) subsea- systems for a safe extraction of energy resources under Arctic conditions with minimal impact on the Arctic environment. Including the identification of technological gaps that hinder Arctic development as well as providing pathways for future technological development including the removal and disassembling of offshore facilities and (c) problems related to winterization;
- Assessment of existing rescue and evacuation crafts or vessels and identifying requirements for adjustments to account for the special situation in the Arctic;
- Assessment of the risks of and recommendations w.r.t. resource exploration, extraction and transportation in Arctic waters regarding (a) oil spill response capabilities and technologies in ice-covered waters including contingency planning, (b) the behaviour of different types of oil and gas products in cold environment, (c) the impact of present and future oil spill scenarios for different climate change predictions and extreme event scenarios regarding the spread of oil, (d) providing recommendations for the design of an observing system tailored to a safer resource extraction, (e) accuracy of iceberg remote detection, trajectory forecasting, and tracking;
- Assessment of potential environmental pressures with respect to (a) the impact of gas and oil drilling on air quality, (b) health of the environment, (c) noise pollution, (d) identification of ecologically vulnerable areas and existing conservation plans for the most rare species in the areas of possible oil and gas development;
- Development of legal and institutional solutions to new challenges and elaboration of possible institutional and legal conflicts.
- Assessment of the impact on sustainable development taking into account of future uncertainties.
- Development of indicators for sustainable development

WP5 'Arctic Governance, Sustainable Development and Synthesis':

Long-term monitoring, coordination and data availability remain insufficient for Arctic research. Arctic cooperation is crucial to raise awareness and to strengthen policy input. We need to broaden the international information exchange on research projects, to facilitate coordination and to ensure open access to information from Arctic monitoring and research. The wide range of legislative instruments, agreements, conventions at national and international level provide a complex, often overlapping and in some areas, conflicting, system of regulation in an area requiring special, integrated overview. ACCESS is uniquely positioned to provide this reflection process, to identify lacunae in the system and offer strategic policy options for the medium and long term future.

State of the Art/Baseline:

- A large number of agreements and legislative instruments, binding and non-binding, national and regional, multi-lateral and bilateral, contribute to the governance system currently in operation in the Arctic Ocean. These instruments range from over-arching international conventions such as the **United Nations Convention on the Law of the Sea**, which provides a general framework for most activities, to highly specific agreements such as those dealing with conservation of specific fish species. It is widely recognised that existing instruments are insufficient, to address all the aspects of governance required for the Arctic, and more importantly that the integrated regulation of key sectors is largely unaddressed. Attempts have been made to identify these shortfalls (Koivurova and

Molenaar, 2009; The Arctic Governance Project, 2009) but no consensus has been reached on how to address specific lacunae in legislation.

- The most noticeable shortfalls are that there are no institutions with the power to establish regional legislation – the Arctic Council has no regulatory powers, and UNCLOS, while a useful general instrument, has only a few articles specific to the Arctic. Several legal or guidance global frameworks exist for sectoral activities, such as **IMO** or **MARPOL** for shipping, but there are few, if any frameworks specific to Arctic Ocean maritime activities. Regional fisheries management is not unified or comprehensive, and there is no comprehensive instrument covering the particular aspects of oil and gas extractive industries in the Arctic. Above all, there is often a major gap in the requirements for compliance and enforcement.
- Coupled with this situation is the recognition that the physical effects in the Arctic which are occurring as a result of climate change, such as seasonal ice reduction, proliferation of floating ice, and increase in extreme weather conditions, will in time place additional strain on this incomplete governance system.

Advance and aims to be achieved:

- **ACCESS** addresses the temporal aspects of governance requirement in the context of climate change, with a view to developing **options** for **strategic policies** supporting **sustainable development** of the region, the exploitation of its natural resources while **protecting** and **preserving** its environment in unison with the **Arctic inhabitants,** particularly **indigenous peoples**.
- The identification of **policy options** enhancing governance will be facilitated by the development of modelling tools and planning tools. We will use modelling tools that better **integrate indirect effects** of climate change on economic activities going through impacts on the provision of ecosystem services (Daily, 1997). Such tools will be developed based on existing models (e.g. Nordhaus and Boyer, 2000, Stern, 2007) to better incorporate the impacts on ecosystem services and the representation of the specific features characterizing the Arctic.
- These tools will constitute an important instrument to analyse **trade-offs** between activities thereby improving the ground for **policy decisions** in the region. We will also use planning tools, such as marine spatial planning, which can directly and effectively help **public authorities and stakeholders** to coordinate their action and optimise the use of marine space to benefit economic development while preserving the marine environment. **ACCESS** will develop new **multi-sectoral regional planning processes and tools** – with a time horizon of up to thirty years.

Performance Indicators:

- Provide an overview of each of the sectoral components of ACCESS in respect of their relevant regulatory systems, legislation and agreements
- Critical assessments of the strengths and weaknesses of these systems as they might respond to/be stressed by a significant period of climate change in an integrated manner with regard to diverse natural and human impacts.
- Determination of and recommendations regarding governance requirements, which derive from the science-based assessments relating to human activities under changing climate conditions that are accelerated in the Arctic as developed in the three thematic work packages, WP 2, 3 and 4.
- Propositions for governance/stewardship strategic options and elements of integrated policy in line with future sustainable development of the region to balance economic prosperity, environmental protection and social equity.
- Definition of the gaps, overlaps and inefficiencies in current institutional arrangement. The

assessment activities will benefit from effective integration with the assessment of Arctic climate change as derived from WP1.

- Development of a Marine Spatial Planning tool
- Development of integrated ecosystem based management in the Arctic
- Development of effective participation concepts for indigenous people in future Arctic governance
- Cross-sectoral syntheses of economic, policy and governance options for sustainable development

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B 1.3 S/T methodology and associated work plan

B 1.3.1. Overall strategy and general description

The basic structure of **ACCESS** is grouped around three thematic WPs which are targeting the main economic and human activities specified in the call 'Quantification of climate change impacts on economic sectors in the Arctic' (Ocean of tomorrow). For these WPs the main concern will be the impact of Climate Change in the Arctic on human activities and the respective socio-economic sectors at a meso and macro-scale but also how these activities will potentially impact on the Arctic environment. The multi-disciplinary ACCESS approach will ensure a truly multi-sectoral partnership, including an intense interaction with stakeholders.

Of the three thematic WPs, Workpackage (**WP2**) is concerned with **marine transportation** along the northern sea routes including **tourism** in the high Arctic. This will be done by a group of partners which will identify necessary actions for sustainable marine transportation and tourism in the Arctic in view of the impacts of climate change on the economic opportunities and the necessity to protect the sensitive environment. Aspects which will be dealt with are related to general questions of impacts of climate change on Arctic shipping as well as specific aspects related to economy and safety, infrastructure needs, socio-economic consequences, legal regulations and governance.

Workpackage 3 (**WP3**) focuses on **fisheries** related issues. WP3 will estimate and quantify how climate changes impact Arctic fisheries and aquaculture and the livelihood of communities and economic actors depending on these industries and how governance can support fishery industries under climate change. Specific aspects concern biological and regulatory constraints, socio-ecological feedbacks, input and output markets, exposure and social vulnerability of the sector, related national policies, marine mammals, traditional whaling, integrated ocean management and behavioural responses from economic actors.

Workpackage 4 (**WP4**) concerns **oil and gas extraction**. It will provide an assessment of the impact of economic activities related to the extraction of oil and gas in the Arctic on the economy as well as the environment. Specific aspects of this workpackage will be related to the assessment of socio-economic impacts on the European and world markets and economies, existing technology, existing rescue and evacuation crafts and vessels, risks related to oil spills, additional environmental pressure with respect to air pollution, noise effects on mammals, conservation plans, as well as legal and institutional aspects. Part of this work will deal with the Shtokman gas field in the central Barents Sea, making best use of the fact that the Shtokman consortium (Gasprom, Total and Statoil) agreed to cooperate with ACCESS.

Specific attention will be given to the expected impacts of the call with respect to the support of **governance, geopolitics, ecosystem conservation and socio-economic issues**. This will be provided by **WP5** (Governance, sustainability and synthesis) which will synthesise the results of the **WP 1-4**, merging all aspects concerning border states, regulations, EEZ access, specific human activities, indigenous people geopolitical and strategic issues. This will be achieved by close coupling of the activities with **the other WPs**, Specific aspects will concern a critical assessment of the relevant regulatory systems and legislation regarding their strengths and weaknesses as they might respond to climate change. The specific sectors of maritime shipping, fisheries and oil and gas extraction will be assessed for shortfalls in regulation, conflict and lacunae. **WP5** will provide governance options and elements of strategic policy in line with future sustainable development of the region and these resources. ACCESS is all about these three sectors and the governance related issues for the next 20 to 30 years in the context of **Climate Change in the Arctic**. The change is an ongoing process that started 20 to 30 years ago. **WP1** is entirely devoted to deliver the best available climate data and climate change predictions in the Arctic during the next 20 to 30 years based on advanced modelling, data reanalysis and new data acquisition. Numerous partners have been involved in the FP6 project DAMOCLES, which focussed on the sea ice development in the Arctic.

In addition to the first five workpackages, ACCESS will be equipped with a further **WP6** entirely devoted to **dissemination** and **internal communication**. **WP6** will be active to disseminate project results, organize workshops for and with the respective partners in the **other WPs**, and provide the public outreach for the project. Thus **WP6** will work in two directions: external and internal. In addition to classical outreach methods e.g. dedicated workshops, summer schools, measures to improve the exploitation of knowledge and public ACCESS days will be organized. **WP6** will also be responsible for the data storage of the project data. Specific actions will be taken to take care for all aspects related to exploitation of knowledge.

WP7 will contain all the **management** elements of ACCESS, which will ensure a smooth, productive and cost effective work of the project. Finally, WP8 will deal with the scientific coordination of the project.

Interaction of the WPs:

A strong, cross-sectoral interaction between the thematic workpackages 1-5 is a central issue of all partners involved in the different activities of ACCESS. The climate scenarios developed by WP1 in interaction will be driven by the necessities defined by the thematic WPs 2-5. The sectoral work in WP 2, 3 and 4 will be linked to each other and to the WP5 by cross-sectoral research, namely regarding uncertainty and economic impact, economic development indicators, environmental risks and governance issues.
A more detailed description on the interaction between the WPs can be found in the task descriptions and at the end of each WP description.

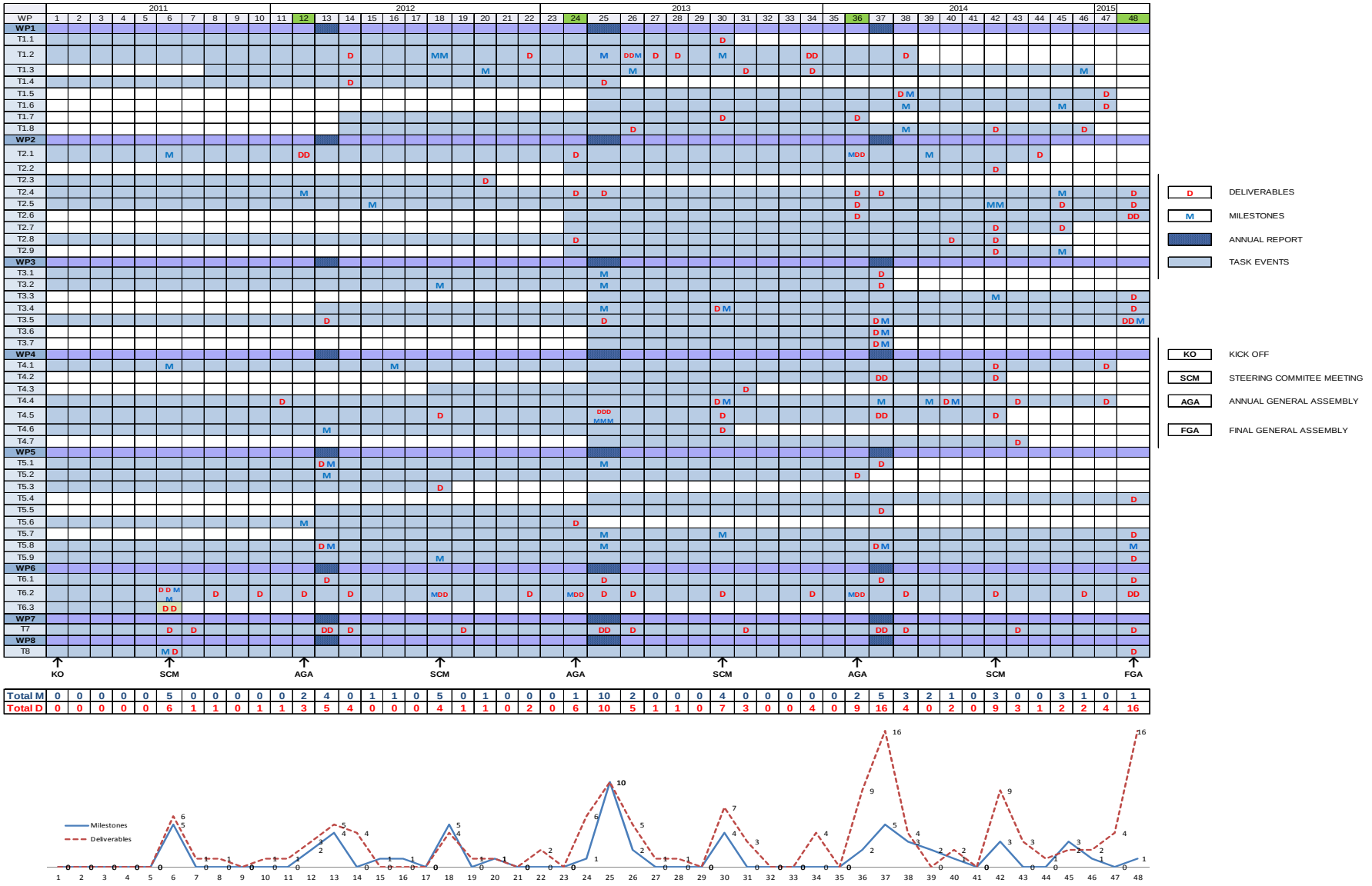
Risks and contingency plans

ACCESS has no higher risk than other large EU integrative projects and has well developed contingency plan to mitigate any negative impacts on the program. Risks to ACCESS can be broadly divided into (1) research field works failure, (2) lack of coordination and delay between different WP's, and (3) lack of international collaboration. The well integrated coordination and management structure will allow minimizing risk (2) and (3). The main risk factors and contingency actions are listed in the table below.
It is worth noticing that the possible management risks (parties or people leaving the Consortium or the External Boards, defaulting parties, settlement of disputes, etc.) are discussed in the Consortium Agreement, the DESCA model is chosen.
Any eventual problem, as soon as arisen, will be notified to the EC Project Officer.

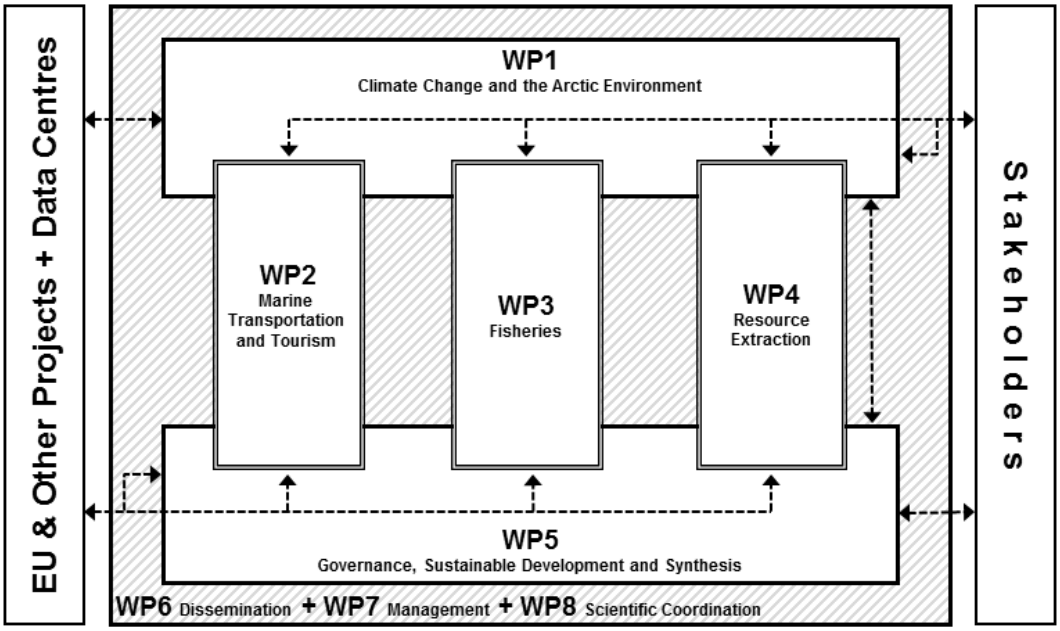
Risk factor		Contingency action
WP1	a. if the 2011 ice camp is aborted by bad weather or ice dynamics or equipment malfunction	there will be a second ice camp in spring 2012 off Alaska, APLIS-2012 (to be funded from outside sources and not charged for in ACCESS) which will permit the necessary work to be completed
	b. if the 2012 submarine voyage fails, due to changes in planning, vehicles or equipment malfunction,	we will depend on a full analysis of earlier datasets up to 2007, to yield the ice roughness and ridge shape characteristics required. The information will not be so up to date.
WP2	a. Measuring exhaust emissions from ships by air craft for two weeks	In case the foreseen measurement aircraft is not available another aircraft of the DLR fleet will be used
	b. see WP1a	See WP1a
WP3	a. Field experiments conditional on the availability of stakeholders willing to participate	We will conduct classroom experiments instead.
	b. Aquaculture task dependent on the aquaculture industry's willingness to release data	We will use existing available data.
WP4	a. Analyses conditional on the approval of a particular government	We will focus on a different region in the Arctic where governmental approval is easier to achieve.
	b. see WP1b	See WP1b
WP5	a. Assessment of ecosystem services dependent on information from WP1	We will use existing data of poorer quality

	on ice extension and quality	
	b. Building a framework dependent on information from WP 2-4	If the information is delayed we will use information on links between activities that we can retrieve from the literature to build and run the models and update the results when information becomes available.
WP6	No risk	
WP7 & WP8	a. delay in deliverable delivery	The Scientific and Technical Project Manager, together with the administrative Project Manager and the WP leader, will pay attention to the deliverables delivery date and remind concerned partners every 2 weeks 2 months before the dead-line. In case of further delay, the Managers will contact daily. Should the partner notify a technical problem, the WP leader will decide if it will be necessary to convene a conference call of the Steering Committee to solve the problem, or, in case of a delay beneath 3 months, only notify the delay to the Steering Committee and to the EC Project Officer. However, the Managers will always notify any delay or problem to the EC Project Officer.

B 1.3.2. Timing of different WP s and their components



Graphical presentation of the components



Graphical representation of the major components of ACCESS.

The sectoral workpackages WP2 (Marine Transport and Tourism), WP3 (Fisheries)and WP4 (Resource Extraction) are embedded in parts into WP 1 (Climate and Environment) and WP5 (G overnance, sustainable development and synthesis). This symbolizes the intense interaction with WP1 and WP5 as overarching workpackages. The principle flow of information will be such, that scientifically founded information on all relevant sea ice and climate aspects will be provided by WP1 and fed into WPs 2-5. All WPs will be feed into the overarching WP 5 to elaborate the concrete response to the expected impacts.

The intense interaction in a cross-sectoral and multi-disciplinary fashion is highlighted also by the fact that all arrows are bi-directional.At the same time the communication between the Stakeholders and external projects is expressed by arrows.

The project WPs are binded together by the management (WP7) and the scientific coordination (WP8) and will all contribute to the dissemination activities (WP6).

B 1.3.3. Project effort form – Indicative efforts per beneficiary per WP and tasks

Workpackage/ Task [1]	WP1	Task 1.1	Task 1.2	Task 1.3	Task 1.4	Task 1.5	Task 1.6	Task 1.7	Task 1.8	WP2	Task 2.1	Task 2.2	Task 2.3	Task 2.4	Task 2.5	Task 2.6	Task 2.7	Task 2.8	Task 2.9
UPMC	74		40	20				14		40				40					
OASYS	18	10							8	8,8					8,8				
NERC	0									0									
IfW	0									0									
UCAM	49		49							10		3	3,5					2,5	1
AWI	35					35				0									
JSC	0									6	1	1		0,5	0,5			2	1
NOFIMA	0									0									
HSVA	0									18	4,5	4		5	3,5				1
NPI	36		36							0									
MET.NO	56,5		11,3		11,3		11,3	11,3	11,3	5	5								
FASTOPT	15,5	9							6,5	7,7					7,7				
SAMS	25				25					5					5				
BEIJER	0									0									
SIO	15			15						10				9,5					0,5
IMPAC	0									0									
UPC	0									24				22					2
DLR	0									18				17					1
AARI	24			24						24	23								1
ESRI	0									47,7						46,7			1
UOL	0									0									
SINTEF F&H	0									0									
CICERO	12,6							12,6		8,4				8,4					
SINTEF MET	0									0									
EWI	0									0									
LCP	0									0									
BELUGA	0									14,3					2,3	4	7,5	0,5	
Total	**360,6**									**246,9**									

Workpackage/ Task [1]	WP3	Task 3.1	Task 3.2	Task 3.3	Task 3.4	Task 3.5	Task 3.6	Task 3.7	WP4	Task 4.1	Task 4.2	Task 4.3	Task 4.4	Task 4.5	Task 4.6	Task 4.7
UPMC	0								48			5	21	21		1
OASYS	0								9				9			
NERC	0								4						3,5	0,5
IfW	0								35	34						1
UCAM	0								3				3			
AWI	0								0							
JSC	0								0							
NOFIMA	33,4	11	10	11				1,4	0							
HSVA	0								15		8	4	3			
NPI	0								0							
MET.NO	0								6				6			
FASTOPT	0								7,8				7,8			
SAMS	0								18				17			1
BEIJER	32,3		8			21		3,3	0							
SIO	0								17					17		
IMPAC	0								34	9	8	8		8		1
UPC	3						2,5	0,5	31				26	4		1
DLR	0								4					4		
AARI	0								0							
ESRI	2							2	0							
UOL	50,9				49			1,9	0							
SINTEF F&H	14,5	14,5							0							
CICERO	0								6,9					6,9		
SINTEF MET	0								17,7				17,7			
EWI	0								5	5						
LCP	0								0							
BELUGA	0								0							
Total	**136,1**								**261,4**							

ACCESS

Workpackage/ Task [1]	WP5	Task 5.1	Task 5.2	Task 5.3	Task 5.4	Task 5.5	Task 5.6	Task 5.7	Task 5.8	Task 5.9	WP6	Task 6.1	Task 6.2	Task 6.3	WP7	WP8	Total per beneficiary
UPMC	15	2,5	2,5	2,5		2,5			3	2	39	19,5	19,5		15	10	**241**
OASYS	0										4,2	2,1	2,1		3	2	**45**
NERC	44	4	4	10	8				10	8	5,9			5,9	0	2	**55,9**
IfW	3									3	0				0	2	**40**
UCAM	8	2	2	1	1	1				1	0				0	2	**72**
AWI	5	1	1	1	1					1	0				0	2	**42**
JSC	2	2									0				0	2	**10**
NOFIMA	2	2									0				0	4	**39,4**
HSVA	0										0				0	0	**33**
NPI	0										0				0	0	**36**
MET.NO	1									1	10			10	0	2	**80,5**
FASTOPT	0										0				0	0	**31**
SAMS	0										0				0	2	**50**
BEIJER	46	1	2					42		1	3,2		3,2		0	2	**83,5**
SIO	6	6									0				0	0	**48**
IMPAC	0										0				0	0	**34**
UPC	2		2								3		3		0	0	**63**
DLR	0										0				0	0	**22**
AARI	0										0				0	0	**48**
ESRI	0										0				0	0	**49,7**
UOL	0										0				0	0	**50,9**
SINTEF F&H	0										0				0	0	**14,5**
CICERO	0										0				0	0	**27,9**
SINTEF MET	0										0				0,5	0	**18,2**
EWI	0										0				0	0	**5**
LCP	16	4				5	7				0				0	0	**16**
BELUGA	0										0				0	0	**14,3**
Total	**150**										**65,3**				**18,5**	**32**	**1270,8**

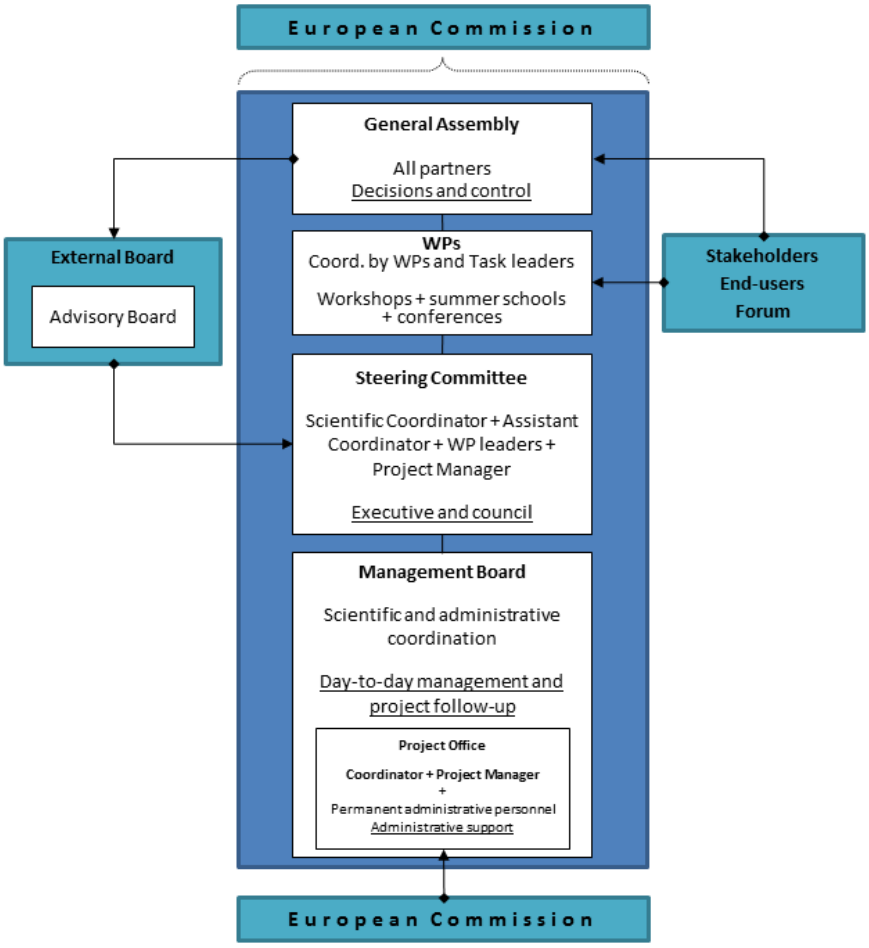
B2 Implementation

B2.1 Management structure and procedures

This is a large research project, responding to a complex topic, with a high degree of multidisciplinarity and intensive well thought-out interactions among the different activities. Its management structure therefore must then address the dual need to:

- Ensure that all research activity is conducted and adheres to its dedicated work plan.
- Guarantee that the integration process between activities is effectively and efficiently implemented, and that it concretely generates the expected added value.

This calls for a multi-layer management structure, with precise and consistent responsibilities assigned to each layer, and with the appropriate provision to achieve a seamless integration process for all parties. This approach has proven to be very successful in similar sized EU projects as it clearly integrates the scientific objectives and deliverables with stakeholder involvement. This provides research results and knowledge that is accessible and available to all. A schematic of the management system with ACCESS can be seen below.



The management functions are under the shared responsibility of

2. the Scientific Coordinator (SC)
3. the three Scientific Co-coordinators (SCC),
4. the assistant to the coordinator and
5. the Administrative (AC) - UPMC

To summarize:

⇒ The main duty of the AC, UPMC, is to ensure that the project is fully implemented in line with the planned allocation of resources, and along the rules and procedures contractually agreed between ACCESS and the EU.

⇒ The main duty of the SC and SCC (helped by the assistant to the coordinator) is to ensure that the work plan is implemented in conformity with the objectives, methods and quality standards described in the contract. Should legal or ethical issues arise during the programme the SC and SCC, through EU policy, will address them clearly and transparently.

The General Assembly

The General Assembly (GA) is composed of all the partners. It is chaired by the AC or one of the SC, depending on the issues to be discussed. The GA will meet at least once a year.

- It takes the decisions on scientific and technical management, makes propositions and gives advice on the overall scientific policy, direction and management of the project.
- It takes all the decisions concerning the project management, namely updating of and contributions to the project tasks, budget, ownership and management of collective equipment during and after the contract etc.

The General Assembly receives advices from the Intellectual Project Rights (IPR) Manager (see below), legal counsellor at UPMC (AC), according to the Consortium Agreement and from the External Boards (see below) if needed. The General Assembly tasks will be detailed in the Consortium Agreement.

The Management Board

The Management Board is constituted by the Scientific Coordinator, based at UPMC, the two scientific Co-coordinators, one in IfW, one in NERC. In addition O.A.Sys as the assistant to coordinator and the AC via the Project Office (administrative team at UPMC) complement the management Board.

UPMC has a wide experience of EU contracts through numerous previous framework programmes. UPMC is also the Coordinator of the very successful DAMOCLES project (018509, FP6 Integrated Project, Priority 6.3 "Global Change and Ecosystems") and the SEARCH for DAMOCLES project (037111, FP6 Specific Support Action, Priority 6.3 "Global Change and Ecosystems").
The Kiel Institute for the World Economy at the Christian-Albrechts University of Kiel is hosting the young researchers group "Valuing the Ocean" within the cluster of excellence initiative "The Future Ocean" funded by the German government. IfW has experience in managing considerable funding including EU contracts through previous framework programmes. The Natural Environment Research Council is hosting the Law of the Sea (UNCLOS) Research Group at the National Oceanography Centre, Southampton, UK. This expert team provides technical advice to the UK government (and a number of other non-UK states) on maritime space issues, delimitation, dispute resolution, resource evaluation and management.

Assistant to the coordinator

The scientific company O.A.Sys (Ocean Atmosphere Systems) has a long standing experience in research project participation and management, including the EU funded projects DAMOCLES, SEARCH for DAMOCLES and ArcRisk and a number of national and international projects. It is co-leading the international Arctic/Subarctic Ocean Flux Study (ASOF).
The Assistant to the coordinator, role in the ACCESS consortium is to:

(1) Assist the Scientific Coordinators to follow up the implementation of the project according to the work plan,
(2) Organise dissemination activities and workshops,
(3) Ensure, with the coordinator UPMC, that deliverables are accurate and delivered on time,
(4) Provide synthetic reports for the EU and other stakeholders
(5) Ensure the scientific information on the project website is accurate and up-to-date.

Administrative Coordinator

The Administrative Coordinator, UPMC, assures the link with the European Commission (Project Officer), the day-to-day management of the project (except for the day-to-day scientific management)the budget reception and sharing according to the EC Rules for Participation, Article 25, Coordinator. The administrative personnel of UPMC available to the project are: 1 part- time manager, and 5 permanent personnel, when needed (1 supporting manager, 1 legal counsellor, 2 financial officers, 1 secretary). This administrative personnel has a wide experience of EU contracts through previous and actual work programmes, i.e. UPMC coordinated the cited projects DAMOCLES and SEARCH for DAMOCLES and the ACCESS part-time manager is the DAMOCLES project manager. UPMC will use a web management platform to help him in his management tasks, this will enable the Project Office to provide professional and efficient project management.

The Intellectual Property Rights

The Intellectual Property Rights (IPR) Manager is based at UPMC and is in charge of following up publications, licensing, patents and other exploitation of results. She will advise the Steering Committee (see below) and the General Assembly about these issues and the management of the Background. When needed, she will contact her homologues at the Partners legal offices.

The IPR and confidentiality issues have been well developed in the letter of Intent signed by all partners during the submission phase and has been developed in the Consortium Agreement from the beginning of the negotiation phase.

To summarise, the Management Board activities are:

- Day-to-day management
- Coordination of the overall scientific and technical activities
- Follow-up of the deliverables and milestones
- Handling financial matters, in particular payments received from the EC for European partners
- Transmitting documents and information between the consortium and the EC
- Supervising the Consortium Agreement implementation by each partner (under the supervision of the IPR Manager)

Work Packages (WP)

The ACCESS activities are organized in 8 WP, which are sub-divided in tasks. Each WP has a leader who is responsible for the coordination of the work assigned to a WP, and a co-leader. The WP leaders will report to the Steering Committee. The co-leaders help the leader and can join the Steering Committee when and if needed. The table below lists the names of the organisations leading and co-leading the WPs.

WP	Leaders & Co-leaders	WP	Leaders & Co-leaders
1	AWI	5	NERC
	UCAM		BEIJER
2	JSC	6	UPMC
	UCAM		Met.no
3	NOFIMA	7	UPMC
	NOFIMA	8	UPMC
4	IfW		OASys
	SAMS		

The Steering Committee

The Steering Committee is composed of the Scientific Coordinators, the assistant to the coordinator and the Work Packages (WP) leaders. It is chaired by the Scientific Coordinators and is convened twice a year, with additional ad hoc meeting available when and if needed.

It is the executive body responsible for

- Preparing the decisions on which the General Assembly (GA) deliberates
- Implementing the decisions of the GA
- Advising on the overall scientific policy
- Coordinating and integrating the activities of the WP
- Assessing scientific progress against the objectives and where necessary making recommendations
- Receiving advice and recommendations from the External Boards and IPR Manager.
- Gender issues

The Steering Committee has a key role in the governance of the Consortium and thus allows a core group of contractors to monitor the project, approving all reports and plans to be addressed to the EC . The ACCESS steering committee will also have an important responsibility regarding ACCESS dissemination to a large public. Indeed, the ACCESS steering committee will act as an editing board for all large scale communications issues in order to prevent any misconduct in communicating ACCESS sensitive results to a large public.

External boards

The high degree of multidisciplinarity of this project combined with the will to solve real problems has lead ACCESS to establish one external board and a forum. These bodies will assure synergy and build close link to Stakeholders / End-users. The external board/ forum participants are listed in the "Consortium as a whole" chapter.

Stakeholders/End-users Forum: this Forum will be constituted by end-users and other stakeholders (industrial, academic and governmental) that will benefit from the project's results. The consortium deems it to be very important to continuously inform the key actors on the advancement of the project. In addition the Forum can advise the consortium on practical solution for any problems the project encounters. This Forum ensures that the project is realized in close connections with the the main actors working in the fields associated, or impacted on, the results of the project. It is intended as a non-fixed struture to allow flexibility to react on the project needs.

STAKEHOLDERS / END USERS FORUM BOARD

Name	**Description**	**Country**	**Expected interaction**
ATOMFLOT	Service base for nuclear icebreakers	**RU**	Cooperation on regulatory and safety related topics regarding Arctic shipping (WP2 and 5)
BP	Wide interest in the Arctic and Arctic Ocean region, active operations in Sakhalin, Alaska, Beaufort Sea. Developing operation in Arctic margins to be in extraction mode within 10 years	**UK**	Will serve both side for all aspects of oil and gas exploration related activities in the Arctic, strongest link to WP4 and 5
GOIA	Greenland Oil Industry Association (comprising DONG E&P Grønland A/S, Esso Exploration Greenland Ltd, Chevron Greenland Exploration A/S, Husky Oil Operations Ltd, Capricorn Greenland Exploration Ltd. (Cairn Energy PLC), PA Resources AB and Nunaoil A/S)	**DK/GL**	Will serve both side for all aspects of oil and gas exploration related activities in the Arctic, strongest link to WP4 and 5
Hurtigruten	Shipping Company	**NO**	Direct contact with active Arctic shipping opertor (WP2 and 5)
ICC	Inuit Circumpolar Council	**DK/GL**	Direct contact with needs of indigenous peoples (WP2-5)
IMO	International Maritime Organisation	**Int**	The international perspective on governance (WP2-5)
Det Norske Veritas	Risk management organization	**NO**	Cooperation on all aspects of Arctic operations (WP2-5)
North Norwegian Vessel Owner Association	Fishing Vessel Owners Association, dept. Tromsø	**NO**	Will help achieve contacts for experiments in task 3.5 (WP 3)
OGP	International Association of Oil & Gas producers (with its ACTF-Arctic Coordination Task Force). OGP includes NunaOil, Shtokman, Dong Energy (Chair of GOIA) and BP, among other Arctic operators	**int**	Will serve both side for all aspects of oil and gas exploration related activities in the Arctic, strongest link to WP4 and 5
Royal Greenland Sisimiut	Fisheries expert	**DK/GL**	Will help achieve contacs for experiments in task 3.5 (WP 3)
Sami Council Parliament		**DK/GL**	Direct contact with needs of indigenous peoples (WP2-5)

Shtokman Development AG	Joint venture established in 2008 for financing, design, construction and operation of the first phase Shtokman gas condensate field development. Participation: OAO "Gazprom" (Russie), Total S.A. (France), StatoilHydro ASA (Norway)	**R/N/F/CH**	Will serve both side for all aspects of oil and gas exploration related activities in the Arctic, focus on the Barents Sea,strongest link to WP4 and 5
TUNING	Tunu (i.e. East Greenlandic) In coming Agency Greenland	**DK/GL**	All aspects of Arctic Tourism (WP2 and 5)
VDR	German Ship-owners Association	**DE**	Close contact with perspective of ship-owners (WP2 and 5)
YASAVEI - association of Nenets people	Nenets Autonomous District	**RU**	Direct contact with needs of indigenous peoples (WP2-5)
LLOYD's register	Ship classification and risk management	**UK**	Cooperation on all aspects of Arctic operations (WP2-5)
Arctic Development centre Archangelsk	Russian Arctic Activities coordination centre in planning status	**RU**	As soon as the centre is set up it will be an important contact point for ACCESS to russian Arctic plans and activities.
Assoc. of Arctic Expe Cruise Operators		**NO**	Will help with point of view of Arctic Cruise Operators (WP2 and 5)
HAPAG-LLOYD	Arctic cruise operator	**DE**	Provides interaction with actual Arctic Tourism company (WP2 and 5)
Sami Parliament	Inge Are Eriksen also holds a seat in the Regulation Board of the Norwegian Director of Fisheries	**GL/NO**	Will help achieve contacts for experiments in task 3.5. Also his knowledge would be valuable for other tasks within WP 3.
WWF	World Wide Fund for Nature	**NO**	Will provide the view of the most active NGO in the Arctic via WWF's Arctic programme and Climate programme to all WPs
Marine Stewardship Council	Responsible Fishing certification	**UK**	This will feed into fiheries related aspects of governance in WP3 and 5

Advisory Board (AB): this Board will be constituted by experts and Scientific Coordinators working in the Arctic domain. They will advise the consortium and assure a wide and varied communication of our results. In addition ACCESS participants will build links with other Arctic based programmes thus ensuring a cross-feeding of results. This board will assess the progress of the project and provide advice on new directions and opportunities for innovation in order to ensure the relevance of the project's results to actual policy formulation needs. Common activities between the identified other RTD projects, funded by the European Commission and others, could be foreseen where appropriate. Such project interaction is intended to be formalised through the exchange of major scientific and technical deliverables as well as through common 1/dissemination activities, 2/summer schools, 3/indicators (see the "Dissemination and/or exploitation of project results" chapter).

The Advisory Board and the stakeholders/end users Forum are consulted at least once a year using mainly e-mail and teleconference in order to reduce the project costs, but some representatives will be invited to join some WP or General Assembly meetings, if useful.

The composition of the Advisory Board will be specified during the first six months of the project. This Board will be cross-sectoral, and related to the different themes present within ACCESS. The composition will be defined to take into account the ultimate aim of the project, i.e to assess and quantify the climate change impacts for key sectors : transport, fisheries, tourism and resource extraction.

For the best possible support of ACCESS by large research projects and important institutions we identified candidates for each thematic area. During the first 6 months of the project, the steering committee will finalize this list.

Ecosystem
ATP (EU FP7 Arctic Tipping Points, Paul Wassmann co-ordinator)

Pollution
AMAP (including EU FP7 ArcRisk, Lars-Otto Reiersen co-ordinator)

Economy
London School of Economics and Political Science, (Grantham Research Institute on Climate Change and the Environment, Sam Fankhauser)

Shipping
Northern Sea Route Commison (Noncommercial Partnership of the Coordination of Northern Sea Route Usage, Russia, Captn Vladimir Mikhailichenko, Executive Director)

Interdisciplinary
SEARCH (Study of Environmental Arctic Change USA)
ArcticNet Canada
AOSB (Arctic Ocean Science Board)

Socio-economy
ISER (Institute of Social and Economic Research, University of Alaska)

Climate
MyOcean (EU-FP7 Project)
Fisheries
Norwegian Fisheries College (Claire Armstrong, resource economist)
Governance
Arctic Council

Communication policy

The Communication Policy we intend to develop in the framework of this project aims to keep all the partners and the EC fully informed about the project status, but also to communicate with a larger public. This activity will be based on the successful communication policy of DAMOCLES, i.e. a dedicated website with an Intranet accessible only to members, news events and other dissemination activities. Any official document, presentation, papers and publications and information that could be of interest for any of the partners will be attached in the Intranet and they will be invited to check it periodically. The ACCESS steering committee will have an important responsibility regarding ACCESS dissemination to a large public. Indeed, the ACCESS steering

committee will act as an editing board for all large scale communications issues in order to prevent any misconduct in communicating ACCESS sensitive results to a large public.
The Administrative Coordinator will ensure the website is up to date and will work closely with the assistant to the coordinator to follow up recommendations.
A real dissemination and/or exploitation of project results policy is established: this issue is treated in more details in the “Dissemination and/or exploitation of project results” chapter.

B 2.2 Beneficiaries

P.1 Université Pierre et Marie Curie (UPMC)

The Laboratoire d'Océanographie et du Climat: Expérimentation et Approche Numérique (**LOCEAN**) is part of the reknown Pierre et Marie Curie University (UPMC) based in Paris, France. **UPMC** represents 5000 permanent staff members and 20000 students. LOCEAN is a research laboratory of 80 scientists, engineers and administrative staff. It is a leading laboratory in France for studying world-wide general oceanic circulation and physical oceanic processes based on observations and numerical modelling. In the past, studies have been conducted at all latitudes, equatorial and tropical, mid-latitudes and Polar Regions as well. LOCEAN has been involved in international programs such as TOGA, WOCE, JGOFS and IGBP. Most of LOCEAN senior scientists have been engaged as PIs and/or coordinators in several European Union projects of the 3rd, 4th, 5th, 6th and 7th framework programs. LOCEAN has been deeply involved in the past in deep convection studies in the Mediterranean Sea and the Greenland Sea. Currently LOCEAN is investing a lot of efforts into developing new autonomous observational techniques to be used world-wide in situ as well as remotely from space.

Tasks attributed: 1) Artcic data reanalysis (ERA interim). Validation of winter index for predicting Arctic sea ice retreat in summer 2) Sea ice thickness distribution in the Arctic prenial sea ice north of Canada and Greenland 3) Sea ice and icebergs drifts in the Northern Barents Sea 4) Kola Peninsula to cental Barents sea section for monitoring physical and biogeochemical tracers of the Atlantic inflow toward the Arctic. 5) Via work of Adele Airoldi, to offer support to governance analyses in WP5.

6) Leader of WP6 Dissemination, WP7 Management and WP8 Scientific coordination.

Short profile of the staff members who will be undertaking the work:

Jean-Claude Gascard, Senior scientist at CNRS (Centre National de la Recherche Scientifique) and coordinator of the Damocles Integrated Project (2005-2010) and Search for Damocles SSA (2006-2010), he also participates in the European projects ATP and ACoBAR. Jean-Claude Gascard started working in polar oceanography in 1976 in the Labrador Sea in cooperation with the Bedford Institute of Oceanography (Dartmouth, Canada) and contributed to the Marginal Ice Zone international Experiment (MIZEX) in 1983-1984. He has contributed to several major polar programs funded by the European Union such as the European Subpolar Ocean Program (ESOP 1 and ESOP 2) from 1993 until 1998, MAIA (Monitoring the Atlantic Inflow towards the Arctic) from 2000 until 2002 and ASOF (Arctic- Subarctic Ocean Fluxes) which started in 2003 and ended in 2005. He is past chairman of the Arctic Ocean Sciences Board (AOSB) and was member of the IASC steering committee in charge of the preparation of the International Conference for Arctic Research Program ICARP II in 2005. He was convenor of a polar session dedicated to Pan-Arctic long term variability at the European Geophysical Union (EGU) General Assembly in 2003, 2004 and 2005.His main interest concerns the interactions between subtropical and polar water masses leading to the formation of deep and abyssal waters (deep convection), thermohaline circulation, air-sea-ice interactions and the implication of the Arctic Ocean in Climate variability and Global Changes.

Nathalie Sennechael graduated from ENSTA ("Ecole Nationale Superieure de Techniques Avancees") in 1989 and got a Ph.D. in Physical Oceanography from UPMC ("Université Pierre et Marie Curie") in 1994. She joined the MNHN ("Museum National d'Histoire Naturelle") in 1998. She is "Maitre de Conference" at LOCEAN, Institut Pierre Simon Laplace. She is interested in air-sea interactions and climate change and performs data analysis (in situ data, satellite data, model outputs) using statistical methods. She has been involved in a few oceanographic expeditions at high latitudes with a CLIVAR and IPY project in the Drake Passage on board RV Polarstern. These last years she has developped increasing interest in public outreach and has been involved in several actions during the "Fete de la science" event.

Elena Billi-Rizza is responsible for the environment EU projects at UPMC. She participates to the French working groups on this domain and to the management of about 40 EC contracts involving UPMC. She has been working in European projects since FP4. She is the managers of SEARCH for DAMOCLES project and collaborated to the management of DAMOCLES. She also collaborateswith the UPMC Culture and Communication departments for some outreach events linked to the EC priority "Science in Society" and local events.

Laetitia Nitkiewicz is the DAMOCLES project manager. She has also taken care of the dissemination activities in Damocles in cooperation with Tara and the communication services of UPMC: organization of the Damocles exhibition in Le Grand Palais, Paris in Nov. 2008, screening of Tara movie in Brussels followed by a debate with

the public in Nov.2009, among others. Between 2002 and 2004, she worked in the Chinese News Agency, Xinhua, as a journalist and contributed to reports for Reporters Without Borders.
Consultants for UPMC :
Adele Airoldi, during her career inside the Secretariat of the EU Council of Ministers (1981-2004), she worked on a variety of policy questions (research, health,resources,etc…). After her retirement in 2004, she has co-operated on an ad hoc basis with Greenland's Representation in Brussels (attending ACIA in 2004 and advising in the negotiations of the Community-Greenland partnership agreement in 2006) and with the Danish Polar Center (preparation of ICARP II in 2005). In 2008, she wrote on commission by the Nordic Council of Ministers the report "The European Union and the Arctic – Policies and actions" , used as the background document for the Conference "Common concern for the Arctic" held in Ilulissat in September 2008.
UPMC the coordinator of ACCESS will greatly benefit from advices, knowledge and expertise of Adele Airoldi in sensitive fields of the Arctic Governance taking into account the actual European Union vision regarding these important issues.
Paul Arthur Berkman is Head of the Arctic Ocean Geopolitics Programme at the University of Cambridge through the Scott Polar Research Institute and Judge Business School as well as a Research Professor at the University of California Santa Barbara through the Donald Bren School of Environmental Science & Management. He is an interdisciplinary oceanographer establishing connections between science, policy and information technology to promote cooperation and prevent discord for good governance of the Arctic Ocean, Antarctica and international spaces more generally. Among his books are: Science into Policy: Global Lessons from Antarctica (Berkman, Academic Press, 2002); Environmental Security in the Arctic Ocean: Promoting Co-operation and Preventing Conflict (Berkman, RUSI, 2010); Science Diplomacy: Antarctica, Science and the Governance of International Spaces (Berkman et al., eds. Smithsonian Institution Scholarly Press, in press) and Environmental Security in the Arctic Ocean (Berkman and Vylegzhanin, eds. Springer, 2011). He has received the Antarctic Service Medal from the United States Congress; NASA Faculty Fellowship at the Jet Propulsion Laboratory, California Institute of Technology; Byrd Fellowship at Ohio State University; Japan Society for the Promotion of Science Fellowship at the National Institute of Polar Research in Japan; Erskine Fellowship in the Gateway Antarctica, University of Canterbury in New Zealand; and Fulbright Distinguished Scholarship at the University of Cambridge in the United Kingdom. He has a master's degree and doctorate in biological oceanography from the University of Rhode Island, where he was a National Science Foundation Graduate Fellow.

Publications

Gascard J.-C., A.J. Watson, M.-J. Messias, K.A. Olsson, T. Johannessen and K. Simonsen (2002). Long-lived vortices as a mode of deep ventilation in the Greenland Sea. Nature, Vol 416, 4 April 2002, pp 525-527.
Gascard J.-C., G. Raisbeck, S. Sequeira, F. Yiou and K.A. Mork (2004). The Norwegian Atlantic current in the Lofoten basin inferred from hydrological and tracer data (Iodine 129) and its interaction with the Norwegian Coastal current. Geophysical Research Letters, 14 january 2004.
Gascard J.-C, M. Doble, P. Wadhams, and 23 others, Exploring Arctic Transpolar Drift During Dramatic Sea Ice Retreat, EOS, Transactions, American Geophysical Union, Vol.89, No.3, 15 January 2008, Pages 21-22.
Harpaintner J. **J.-C. Gascard** and P.M. Haugan (2001). Ice production and brines formation in Storfjorden. Journal of Geophysical Research, Vol 106, C7, 14001-14013.

The LATMOS (Laboratoire Atmospheres, Milieux, Observations Spatiales) has a long experience in the study of dynamical, radiative and chemical processes in the Earth and planetary atmospheres using combined experimental and theoretical approaches, including various observation systems. The laboratory is also part of the Institute Pierre Simon Laplace (IPSL) which plays a leading role in chemistry-climate research at national and international level. The LATMOS has considerable expertise in the field of atmospheric chemistry and aerosol research, ranging from development and application of trajectory, regional and global chemistry models, assimilation, analysis of airborne and satellite data, and study of chemistry-climate interactions. It is supported by the Centre National d'Etudes Spatiales (CNES) as one of the leading laboratory for the development and exploitation of satellite-borne atmospheric remote sensors.
Tasks attributed: WP1: Key factors affecting climate and transport of pollutants in the Arctic; WP2: Air pollution and surface deposition related to arctic shipping; WP3: Air pollution and climate impact related to Arctic gas/oil extraction; WP5: Local and remote pollution impacts on Arctic air quality and climate

Previous experience relevant to those tasks: K. Law has a long experience in numerical modelling and analysis of observations from campaigns. She is a coordinator of International Polar Year (IPY) project POLARCAT on the study of long-range transport of pollutants to the Arctic. C. Granier has a long experience in the development and evaluation of surface emissions inventories and she is the co-chair of the GEIA (Global Emissions Inventory Activity) international project. She has been working for the past 5 years on the impact of ships emissions on the chemistry of the atmosphere, more particularly in polar regions.

Short profile of the staff members who will be undertaking the work:

Dr. Claire Granier is a "Directeur de Recherche" at LATMOS/IPSL in Paris. She has over 25 years research experience in atmospheric sciences. For the past 20 years, she has worked on the development of three-dimensional global chemistry-transport models which have been used for the study of the composition of the lower atmosphere and its evolution. She is the co-coordinator of the GEIA (Global Emissions Inventory Activity) project of the AIMES/IBGP program. She has coordinating the activities on emissions within the ACCENT European Network of Excellence for the past five years. Since 2005, she is the Deputy Coodinator of the MACC (Monitoring Atmospheric Composition and Climate) FP7 Integrated Project. She is a member of the steering committee of the AIMES/IGBP Project. She is author or co-author of more than 60 peer-reviewed scientific papers.

Dr. Kathy Law is a CNRS Directeur of Research at the LATMOS/IPSL since 2003. She has 20 years experience in atmospheric science working on numerical modelling, data analysis, campaigns related to atmospheric trace gases, long-range transport etc. and is author of more than 55 peer-reviewed scientific papers. She is co-chair of International Global Atmospheric Chemistry (IGAC), member of IGAC and IGBP SCs and has previously been the IGAC representative on SPARC SSG and member of Commission for Atmospheric Chemistry and Global Pollution (CACGP) (1998-2006). She is a coordinator of International Polar Year (IPY) project POLARCAT on the study of long-range transport of pollutants to the Arctic. She is a PI on EU FP6 funded projects SCOUT-O3, AMMA, GEMS and FP7 CITYZEN. She was PI on many past EU/nationally funded projects (e.g. MOZAIC, TACIA, MAXOX, POET, EXPORT) including coordinator of French ITOP (Intercontinental Transport of Ozone and its Precursors) project contribution to IGAC-ITCT and ICARTT. She has been co-author, contributor and reviewer of numerous international assessments organised by WMO/UNEP, IPCC, IGAC.

Relevant publications:

Granier, C., U. Niemeier, J.H. Jungclaus, L. Emmons, P. Hess, J.F. Lamarque, S. Walters, et G. Brasseur, Ozone pollution from future ship traffic in the Arctic northern passages.Geophysical Research Letters.2006.33.L13807, 2006.

Kim, S.-W., A. Heckel, G. J. Frost, A. Richter, J. Gleason, J. P. Burrows, S. McKeen, E.-Y. Hsie, **C. Granier** and M. Trainer, NO2 columns in the western U.S. observed from space and simulated by a regional chemistry model and their implications for NOx emissions, 114, D11301, doi:10.1029/2008JD011343, 2009.

P.S. Monks, **C. Granier**, S. Fuzzi, A. Stohl, et al., Atmospheric Composition Change – Global and Regional Air Quality, Atmospheric Environment, doi:10.1016/j.atmosenv.2009.08.021, Vol. 43, 33, 5268-5350, 2009.

Isaksen, I.S.A., **Granier, C**., Myhre, G., Berntsen, T.K., et al., Atmospheric composition change: Climate–Chemistry interactions, Atmospheric Environment, 43, 5351–5414, 2009.

Real, E., E., **K.S. Law**, H.Schlager, A. Roiger, H. Huntreiser, J. Methven, M. Cain, J. Holloway, J.A. Neuman, T. Ryerson, F. Flocke, J. de Gouw, E. Atlas, S. Donelly and D. Parrish, Lagrangian analysis of low level anthropogenic plume processing across the North Atlantic, Atmos. Chem. Phys, 8, 7509-7554, 2008.

The Laboratoire d'Océanographie de Villefranche (UPMC-LOV)

The Laboratoire d'Océanographie de Villefranche (LOV) is one of three institutions making up the Observatoire Océanologique de Villefranche-sur-Mer (OOV), a leading centre for multidisciplinary oceanographic research in France. There has been a marine research laboratory at this site since 1882, initially run by the St. Petersburg Academy of Sciences and with French control since 1931, making this one of the oldest marine research stations in the world. LOV comprises 5 research teams with 130 research personnel including 35 PhD level scientists from a variety of disciplines in oceanography: biology, biogeochemistry, geochemistry, and physics, and 25 PhD students. LOV is world-renowned for oceanographic research and its scientists are involved in programmes at the national, European and international level.

Tasks attributed:

WP1: Understanding the relation between satellite altimeter freeboard and ice thickness.

Previous experience relevant to those tasks:
The task builds on experience gained during the DAMOCLES project, where top and bottom surfaces of sea ice were imaged co-incidently for the first time using AUV-mounted upward-looking sonar and overflights by an airborne scanning laser profilometer and helicopter-borne electromagnetic induction systems. This work itself built on previous experience measuring ice draft using AUV sonar, first with the Maridan Martin in 2002, then with Autosub in 2004 (Wadhams et al., 2004b, 2006).

Short profile of the staff members who will be undertaking the work:
Dr. Martin Doble has over 12 years experience in sea ice research and has become one of Europe's most experienced sea ice researchers, having carried out 12 field experiments in the Arctic and Antarctic, all but one as Lead Scientist with responsibility for the project in hand. He is a Category-1 PI for the Envisat RA-2 Radar Altimeter full mission archive (ESA project C1P.7228). His research has focused on the measurement of sea ice thickness, both directly (using upward-looking AUV-mounted sonar) and indirectly, exploiting the alteration of wave propagation by an ice cover. His previous work has demonstrated the combination of scientific, technical and practical skills required for the proposed work.

Relevant publications:
Doble, M.J., Skourup, H., Hutchings, J., Forsberg, R., Wadhams, P. (2010). The relation between sea ice freeboard and draft in the Beaufort Sea: results from high resolution mapping using AUV sonar and a scanning laser profilometer. Submitted to GRL.
Doble, M.J., Forrest, A.L., Wadhams, P. and B.E. Laval (2009). Through-ice AUV deployment: operational and technical experience from two seasons of Arctic fieldwork. Cold Reg. Sci & Tech. **56**, 90-97
Wadhams, P. & **M.J. Doble** (2008). Digital terrain mapping of the underside of sea ice from a small AUV, Geophys. Res. Lett. **35**, L01501, doi:10.1029/2007GL031921
J. Hutchings, C. Geiger, A. Roberts, J. Richter-Menge, **M. Doble**, R. Forsberg, K. Giles, C. Haas, S. Hendriks, C. Khambhamettu, S. Laxon, T. Martin, M. Pruis, M. Thomas, P. Wadhams, J. Zwally (2008) Exploring the role of ice dynamics in the sea ice mass balance. Eos, Trans. Amer. Geophys. U. **89**(50), 515-516

P.2 O.A.Sys – Ocean Atmosphere Systems GmbH (OASys)

The scientific company O.A.Sys-Ocean Atmosphere Systems GmbH (www.oasys-research.de) works with a wide range of numerical and analytical tools in the field of earth system modelling. The three senior scientists in the OASys team each have more than fifteen years of experience in numerical modelling and analysis of parts of the climate system gained as research in renowned scientific institutions like the Max-Planck-Institute for meteorology, Hamburg, the Alfred Wegener Institute for Polar and Marine Research, the GKSS Research Centre, Geesthacht and the University of Hamburg and OASys GmbH.
Main tasks attributed: In **ACCESS** OASys will work on the quantitative network design, developing schemes on how to set up efficient observational networks needed for better forecasts in Marine transportation and in oil and gas exploration activities. This work will contribute to WP1, 2 and 4. In addition OASys will be involved in the consortium management in providing the Scientific and Technical Project Manager (STPM).
Previous experience relevant to those tasks: OASys is partner in several national and international projects. Among them is the EU funded **FP6 IP DAMOCLES** (Developing Arctic Modeling and Observing Capabilities for Long-term Environmental Studies) where it is concerned with state estimation and adjoint sensitivity analysis with respect to the Arctic sea ice and **AOMIP** (the Arctic Model Intercmparison Project) in which OASys plays a key role. Presently OASys is participating in the **FP7 EU Project ARCRISK** (Impacts on health in the Arctic and Europe owing to climate-induced changes in contaminant cycling). Also, O.A.Sys is co-coordinator of the **FP6 EU-SSA "SEARCH for DAMOCLES"** where it helps to coordinate IPY related activities of SEARCH in the US and DAMOCLES in the EU.

Short profile of the staff members who will be undertaking the work

Dr. Michael Karcher is a physical oceanographer with a focus on numerical modelling of high-latitude coupled ice-ocean systems. Together with the Arctic modelling team at AWI, he and OASys participate in the multi-national Arctic Model Intercomparison Project (AOMIP). Michael Karcher is active in the data assimilation with NAOSIMDAS and the impact assessment studies in the EU project DAMOCLES and pollutant transport studies in the EU project ARCRISK. He also is co-chairing the international Arctic Subarctic Ocean Flux Study (ASOF)
Dr. Frank Kauker is a physicist with a focus on numerical modeling of high-latitude coupled ice-ocean systems and the statistical analysis of climate data. He and OASys participate in the multi-national Arctic Model Intercomparison Project (AOMIP). Frank Kauker is active in the data assimilation with NAOSIMDAS in the EU project DAMOCLES and acts on behalf of OASys as STPM in the 6th FP SSA 'SEARCHforDAMOCLES'. He has been responsible for the contribution of OASys and DAMOCLES to the SEARCH/S4D Sea Ice outlooks 2008 and 2009.
Relevant publications:
Kauker, F, Kaminski, T, **Karcher, M**, Giering, R, Gerdes, R, and Vossbeck, M (2009)., Adjoint analysis of the 2007 all time Arctic sea-ice minimum, Geophysical Research Letters 36(L03707)
Karcher, M, Gerdes, R, **Kauker, F**, and Köberle, C (2003)., Arctic warming: Evolution and spreading of the 1990s warm event in the Nordic seas and the Arctic Ocean, J. Geophys. Res. 108(C2).
Kauker, F, Gerdes, R, **Karcher, M**, Kaminski, T, Giering, R,Vossbeck, M, Sea ice outlook(SIO) 2009–AWI/FastOpt/OASys contribution, June1,2009,http://www.arcus.org/SEARCH/seaiceoutlook/index.php
Kauker, F, Koeberle, C, Gerdes, R, and **Karcher, M** (2008). Modeling the 20th century Arctic Ocean/Sea ice system: Reconstruction of surface forcing, Journal of Geophysical Research-Oceans 113(C9).
Karcher, M, Gerdes, R, and **Kauker, F** (2008). Long-term variability of Atlantic water inflow to the Northern Seas: insights from model experiments In: Arctic-Subarctic Ocean Fluxes: Defining the role of the Northern Seas in Climate, edited by B. Dickson, J. Meincke and P. Rhines. Springer, chapter 5, pages 111-130.

P.3. Natural Environment Research Council represented by National Oceanography Centre Southampton (NERC)

NERC is the UK's main agency for funding and managing research, training and knowledge exchange in the environmental sciences. The National Oceanography Centre, Southampton (NOCS; www.noc.soton.ac.uk) was established in 1995 as a collaborative centre between the Natural Environment Research Council and the University of Southampton. NOCS is the UK's focus for oceanography and represents an unparalleled investment in marine and earth sciences and technology in the UK. Its key scientific mission is to deliver scientific excellence and understanding of the earth and its oceans as a dynamic interdisciplinary system. NOCS has a long and successful track record of involvement in projects funded by the European Commission, having been involved in more than 30 previous and current EC contracts and has co-ordinated several of these, including the highly successful FP6 HERMES and FP7 HERMIONE projects.

The Law of the Sea (UNCLOS) Group at NOCS is commissioned by the UK government to carry out research on the delineation of the continental shelf areas of the UK mainland and overseas territories. The Group also provides technical advisory services and support to other coastal states on issues related to the continental shelf maritime space, marine resource exploration and exploitation as well as maritime governance and policy.

Main tasks in ACCESS and relevant experience: The NOCS team will assist with co-ordination of ACCESS, will lead WP5 and participate in WP4.The UNCLOS Group delivers independent, high-quality scientific advice on territorial sovereignty, marine scientific research, resource management, and the preservation of the marine environment. Much of this advice focuses on continental shelf and margin settings, where demand for both living and non-living resources pushes exploration and exploitation into increasingly deeper waters. Specific issues include: advice on the limits of the legal UK continental shelf; support for technical negotiations with neighbouring coastal states on overlapping territorial claims; and advice to the UN International Seabed Authority relating to the deep seabed beyond national jurisdiction. The Group has a number of highly experienced research staff, many of whom have had direct experience of preparation, submission and defence of cases to the Commission on the Limits of the Continental Shelf. While a core group of staff work full-time on UNCLOS issues, other staff with expertise in geophysics, seafloor surveying and benthic biology, are able to provide independent, policy-relevant advice on deep-sea biodiversity, bio-prospecting, bio-harvesting and marine environmental protection.

Short profile of the staff members undertaking the work and publications:

Dr Lindsay Parson is Head of UNCLOS Group at the National Oceanography Centre, Southampton. A marine geologist by training, he conducts research and teaching at NOCS and also leads the expert team providing technical advice to the UK government (and a number of other non-UK states) on maritime space issues, delimitation, dispute resolution, resource evaluation and management, and marine policy.

Dr Rosemary Edwards is a Senior Geophysicist at NOCS, and is a technical advisor to the UK government on continental shelf issues (UNCLOS Article 76). Dr Edwards has worked on numerous research projects funded by the hydrocarbon industry, and works closely with seismic acquisition companies, government departments and other academic groups.

Mr Alan Evans is a Marine Geoscientist and one of the key members of UNCLOS Group at NOCS. He is a technical advisor to the UK's Foreign & Commonwealth Office and the Department of Trade & Industry on UNCLOS Article 76 continental shelf issues and leads the UNCLOS software and spatial planning areas.

Carleton, C., Shipman, S., Monahan, D. and **Parson, L.M**. 2000. The practical realisation of the Continental Shelf Limit. In: Cook, P. and Carleton, C. (Eds) Continental Shelf Limits – The Scientific and Legal Interface. Oxford Press. Pp 268-281

Murton, B.J., **Parson, L.M**., Hunter, P. and Miles, P.R. 2001. Global Non-Living Resources on the Extended Continental Shelf: Prospects at the year 2000. Proceedings of the meeting on "Non-living marine resources beyond 200 nautical miles" – International Seabed Authority Technical Report No. 1. 65pp, 40 Tables, 25 Figures

Parson, L.M. 2010. Non-living resources of the continental shelf beyond 200 nautical miles: Consideration of the Implementation of Article 82 of the United Nations Convention on the Law of the Sea. International Seabed Authority Technical Report No. 5 - In press.

Edwards, R.A. 1998. Integration of seismic reflection, physical properties and downhole logging data. Proc. ODP, Scientific Results, 159, 225-240.

P.4 The Kiel Institute for the World Economy (IfW)

The Kiel Institute for the World Economy (IfW) at the University of Kiel is an international centre for economic policy research and documentation. The Institute's main activities are economic research, economic policy consulting, and the documentation and provision of information about international economic relations. Activities in the research area "The Environment and Natural Resources" focus on the allocation of environmental and natural resources. We investigate the factors influencing the increasing scarcity of natural resources. Moreover, we assess their impact on the allocation of production factors and on the changes they bring to the world economy. The research focuses especially on the evaluation of international and national aspects of environmental policy measures leading to proposals for a rational and efficient use of environmental policy instruments. The IfW has a long tradition in environmental-economic modeling. In particular, computable general equilibrium (CGE) models have been used for more than two decades, analyzing issues such as stabilization and structural adjustments programs in developing countries, environmental taxes and, in the last 10 years, climate policy. In the late 1990ies the group developed the DART model that is especially designed for the analysis of international climate policies.

The research area has been and is at present engaged in several projects funded by the European Commission, by the German Research Foundation DFG and by various German federal ministries. It is in particular part of the large interdisciplinary Kiel Cluster of Excellence "The Future Ocean", The target of this inter-disciplinary group is to jointly investigate climate and ocean change, to re-evaluate the opportunities and risks of global change for the oceans and develop a sustainable system of resource management of the world's oceans and marine resources. Since 2007 the research area has been awarded two grants under the 7th European Framework Programme, POEM and PASHMINA.

Main Tasks: Within WP4 of ACCESS, IfW will contribute by assessing the direct and indirect impacts of additional Arctic energy supply on European and World energy markets as well as economies as a whole. This includes the development of meaningful scenarios, based on findings of other partners within and outside WP4 as well as the evaluation of those scenarios with respect to meso- and macroeconomic key indicators. IfW will furthermore assess the energy security implications of additional Arctic energy supply for the EU.

Short profile of the staff members who will be undertaking the work

Gernot Klepper is a senior researcher at the IfW with a long experience in environmental economic research and the speaker of the Kiel Earth Institute. He holds an M.S. in Economics from the University of Heidelberg, and a Ph.D. from the University of Kentucky. His main areas of research are Climate Change and Climate Policies, Environmental Policy Instruments, Sustainable Development, Alternative Energy Sources and Global Environmental Problems. He is Chairman of the German National Committee on Global Change Research (NKGCF) and a member of the Scientific Committee of the International Human Dimensions Programme (IHDP).

Katrin Rehdanz is an assistant professor for environmental and resource economics at the Christian-Albrechts University of Kiel associated with the Kiel Institute for the World Economy. She holds a diploma and a PhD in economics from the University of Hamburg. Her main areas of research are environmental and climate policies research, global environmental problems, sustainable development, energy economics, computable general equilibrium modeling. She is leading the young researchers group "Valuing the Ocean" within the cluster of excellence initiative "The Future Ocean" funded by the German government.

Sonja Peterson is Head of the Research Area "The Environment and natural resources" at the IfW. She holds an MA in economics from the University of Colorado at Boulder and a diploma in Mathematical Economics from the University of Hamburg as well as a Ph.D. in Agricultural Economics from the University of Kiel. Her main research interests are international climate policy and computable general equilibrium modeling.

Relevant recent publications:

- Petrick, S., **K. Rehdanz** and R.S.J. Tol (2010): The Impact of Temperature Changes on Energy Consumption 21 pp., mimeo.
- **Rehdanz, K**. (2007): Determinants of Residential Space Heating Expenditures in Germany. Energy Economics, 29 167-182
- **Klepper, G**. and S. Peterson (2006): Marginal Abatement Cost Curves in General Equilibrium: the Influence of World Energy Prices. Resource and Energy Economics 28(1) 1-23.

P.5 University of Cambridge (UCAM-DAMTP)

The Department of Applied Mathematics and Theoretical Physics (DAMTP) carries out research of world class excellence in many areas of theoretical physics which include oceanography, atmosphere-ocean dynamics, theoretical and experimental fluid dynamics, computational dynamics, wave theory, quantum computing, high-energy physics, elementary particles, quantum field theory, astrophysics and cosmology. Such research has developed over more than 300 years through the great traditions of scientists such as Newton, Larmor, Rayleigh, Eddington and Dirac, and, in fluid dynamics, Stokes, G I Taylor, Lighthill, Gill and Batchelor. The Polar Ocean Physics Group is led by Peter Wadhams, the UK's most experienced sea ice scientist, with 40 years of research in sea ice and ocean processes in the Arctic and the Antarctic. The current main topics of research in the group are sea ice properties, dynamics and distributions (thickness and concentration), and the role of sea ice and polar oceans in climate change. DAMTP possesses a state of the art fluid dynamics laboratory and a set of cold rooms.

DAMTP role and contribution to ACCESS: (1) Leader of WP1, based on long experience of measuring sea ice thickness and topography in the Arctic Basin. (2) Organiser of field experiment to use AUV in joint studies with airborne systems to validate altimeter algorithms and supply input on high-resolution under-ice ridge structure to WP2,3,4. (3) Organiser of data gathering on submarine transect of Arctic Ocean to collect multibeam sonar data. (4) Via work of Lawson Brigham, to offer support to shipping analyses in WP2 (5) WP5 via work of Paul Berkman

Short profiles of staff members: **Peter Wadhams,** Professor of Ocean Physics (research leader), has published on dynamics and thermodynamics of sea ice, sea ice thickness, waves in ice, icebergs, ocean convection and kindred topics. He has led 42 research expeditions to the polar seas and has worked extensively from Arctic submarines, most recently HMS Tireless (2007) using multibeam sonar to measure ice topography. He was a pioneer in the use of AUVs under sea ice, with successful missions using Maridan, Autosub II and Gavia (2002-2008) vehicles. He was coordinator of the EU FP5 GreenICE and CONVECTION projects and is currently in the EU FP6 DAMOCLES and on the Scientific Committee of the European Environment Agency. He was winner of the 1990 Italgas Prize for Environmental Sciences.

Dr Joao Rodrigues (research associate), after a PhD in particle physics, has worked for the Polar Ocean Physics group since 2002. His research has included the thickness distribution of sea ice, from submarine and AUV data; the suppression of oceanic convection by sea ice retreat; changes in sea ice occurrence in the Russian Arctic; and the use of impulse radar for ice thickness determination. Current projects include the use of flexural gravity waves as a means of determining basin-scale ice thickness by wave dispersion measured by tiltmeters, and the interpretation of AUV multibeam sonar data in relation to surface truth.

Nick Toberg, research associate, is an expert in the use of multibeam sonar data from submarines and AUVs, and was responsible for the logistics of the group's experiments from Arctic ice camps in 2007 and 2008. He is experienced in all aspects of the Group's work, and has helped design much of our recent equipment, including wave buoys and tiltmeter buoy systems.

Paul Arthur Berkman is Head of the Arctic Ocean Geopolitics Programme at the University of Cambridge through the Scott Polar Research Institute and Judge Business School as well as a Research Professor at the University of California Santa Barbara through the Donald Bren School of Environmental Science & Management. He is an interdisciplinary oceanographer establishing connections between science, policy and information technology to promote cooperation and prevent discord for good governance of the Arctic Ocean, Antarctica and international spaces more generally. Among his books are: Science into Policy: Global Lessons from Antarctica (Berkman, Academic Press, 2002); Environmental Security in the Arctic Ocean: Promoting Co-operation and Preventing Conflict (Berkman, RUSI, 2010); Science Diplomacy: Antarctica, Science and the Governance of International Spaces (Berkman et al., eds. Smithsonian Institution Scholarly Press, in press) and Environmental Security in the Arctic Ocean (Berkman and Vylegzhanin, eds. Springer, 2011). He has received the Antarctic Service Medal from the United States Congress; NASA Faculty Fellowship at the Jet Propulsion Laboratory, California Institute of Technology; Byrd Fellowship at Ohio State University; Japan Society for the Promotion of Science Fellowship at the National Institute of Polar Research in Japan; Erskine Fellowship in the Gateway Antarctica, University of Canterbury in New Zealand; and Fulbright Distinguished Scholarship at the University of Cambridge in the United Kingdom. He has a master's degree and doctorate in biological oceanography from the University of Rhode Island, where he was a National Science Foundation Graduate Fellow.

Dr. Lawson W. Brigham is Distinguished Professor of Geography & Arctic Policy at the University of Alaska Fairbanks. He is also a Visiting Researcher at the Department of Applied Mathematics & Theoretical Physics

(DAMTP) where he is working on Arctic issues. Dr. Brigham was Deputy Director of the U.S. Arctic Research Commission. His research interests include Arctic marine transport, the Russian marime Arctic, ice navigation, remote sensing of sea ice, polar geopolitics, and Arctic & Antarctic climate change.

Publications :

Wadhams, P. and G. Amanatidis, eds. (2007). Arctic Sea Ice Thickness: Past, Present and Future. European Commission, Climate Change & Natural Hazards Srs., EUR22416, 409pp. (book)

Wadhams, P. (2007) et al. Planet Earth We Have a Problem – Feedback Dynamics and the Acceleration of Climate Change. UK House of Commons, All Party Parliamentary Committee on Climate Change, 128pp (book).

Wadhams, P. 2000. Ice in the Ocean. Taylor and Francis, New York,. 368pp. (book)

P.6 Alfred Wegener Institute for Polar and Marine Research (AWI)

The **Alfred Wegener Institute for Polar and Marine Research (AWI)** is Germany's leading institute for polar and marine research. The Institute's research mission is to improve the understanding of ocean-ice-atmosphere interactions, the animal and plant kingdoms of the Arctic and Antarctic, and the evolution of the polar continents and seas. Given the major role played by these regions within the Earth's climate system, global change is a central focus of the research effort at AWI. AWI researchers conduct surveys and numerical simulations related to oceanic circulation, transport of substances and energy in the polar seas and the polar atmosphere, and to the influence of these processes on the global climate system. AWI coordinates polar research in Germany and provides both the necessary equipment and the essential logistic back up for polar expeditions. It operates research vessels, airplanes, and land stations in the Arctic and Antarctic. The AWI has 780 employees and a total budget of 100 million Euro in 2005.

Main tasks attributed: The Alfred Wegener Institute for Polar and Marine Research is co-leader of WP1 and will contribute with an assessment of existing and upcoming climate scenario calculations regarding the future development of ocean, sea ice, and near surface atmosphere in the Arctic domain. Furthermore, AWI will conduct dedicated high-resolution ocean-sea ice model calculations to downscale climate model results for sensitive regions like the Canadian Archipelago and the Siberian shelf seas. In collaboration with OASys, AWI will set up a system for probabilistic seasonal ocean-sea ice forecasts based on the NAOSIM/NAOSIMDAS model system.

Previous experience relevant to those tasks: The AWI group has long-term experience in Arctic ocean-sea ice modeling, in climate modeling, in assessing climate model results, as well as in remote sensing and in-situ observation of sea ice properties. As partner in the EU FP7 projects DAMOCLES and ArkRisk, the group is working on hindcast simulations of the Arctic ocean-sea ice system and on downscaling climate model results to the Arctic. AWI has taken part in the sea ice outlook of Search for DAMOCLES with probabilitstic forecasts of summer sea ice extent in the Arctic.

Short profile of the staff members who will be undertaking the work:
Dr. Rüdiger Gerdes is a senior scientist in AWI's climate sciences division and professor of oceanography at Jacobs University Bremen. He is the head of the sea ice physics section at AWI. He has been PI in several EU projects (VEINS, ASOF-N, CONVECTION, DAMOCLES, Intas NORDIC SEAS) and German national projects, including STORM, High-resolution community climate change simulations. He is also PI in the Arctic Ocean Model Intercomparison Project and a long time member of the CLIVAR working group on ocean model development. Prof. Gerdes is co-editor of a recent AGU monograph on "The Nordic Seas: An Integrated Perspective" and has authored or co-authored more than 60 papers in the peer-review literature. He has over 20 years of experience in ocean, sea ice, and coupled modelling. The AWI model hierarchy NAOSIM was developed in his working group.

Relevant publications:
Gerdes, R., Köberle, C. (2007).Comparison of Arctic sea ice thickness variability in IPCC Climate of the 20th Century experiments and in ocean-sea ice hindcasts, Journal of Geophysical Research, 112, C04S01., doi:10.1029/2006JC003616
Gerdes, R., Karcher, M., Köberle, C., Fieg, K. **(**2008) Simulating the long term variability of liquid freshwater export from the Arctic Ocean, The Role of the Northern Seas in Climate, Editors: B. Dickson, J. Meincke and P. Rhines, Springer, Dordrecht, 405-426.
de Steur, L., Hansen, E., **Gerdes, R.,** Karcher, M., Fahrbach, E., Holfort, J. (2009). Freshwater Fluxes in the East Greenland Current: A decade of observations, Geophysical Research Letters, 36, L23611., doi:10.1029/2009GL041278.
Fieg, K.**, R.Gerdes,** E. Fahrbach (2009) Simulation of oceanic volume transports through Fram Strait 1995-2004 (Ocean Dynamics, in press)

Kauker, F., T. Kaminski, M. Karcher, R. Giering**, R. Gerdes,** and M. Voßbeck (2009) Adjoint analysis of the 2007 all time Arctic sea-ice minimum, Geophys. Res. Lett., 36, L03707,doi:10.1029/2008GL036323.

P.7 JS Consultant (JSC)

JS-Consultant is a private Consultant for Arctic Engineering since 2001.
Registered under 62023 at Local Administration of D-22927 Grosshansdorf

Main Tasks attributed:

Leader of WP 2, Marine Transportation and Tourism in the Arctic Domain
Partner in Task 5, Arctic Governance

Previous experience relevant to those tasks:

J. Schwarz has been Director for Ice and Environmental Technology at the Hamburg Ship Modal Basin from 1974 until 2001. In this position he was in leading positions in the following EU-projects:
1. INCATS – WA-96-CA 1073; DGVI-E3. Coordinator
2. ARCDEV –WA-97-SC.2191; Arctic Demonstration and Exploratory Voyage (initiator and leader of WP16 ; Overall evaluation and definition of R&D needs)
3. LOLEIF- MAS3-CT-97-0098. Coordinator. Validation of Low Level Ice Forces on Vertical Structures
4. STRICE- EVG1-CT-2000-00024.Coordinator. Measurements on Structures in Ice
5. STANDICE – TREN/04/FP6/S07.31041/503721. Coordinator
Besides these EU-Projects J. Schwarz has been the scientific leader of seven icebreaker expeditions (POLARSTERN and others) in the Arctic, sponored by the German Government

Short profile of the staff members who will be undertaking the work:

Joachim Schwarz has studied Civil Engineering/Hydraulics at the Technical University of Hannover, where he received 1970 the Dr.-Ing.- degree with the dissertation on „Ice Forces on Structures". In the same year he accepted an invitation from the University of Iowa, Iowa City, USA to continue studies on ice for three years as Adjunct Professor. Meanwhile the Hamburg Ship Model Basin (HSVA) had built an ice model basin (30m x 6m) and established an Ice Engineering Department, of which J. Schwarz 1974 became the director.
J. Schwarz was the scientific leader of 7 icebreaker expeditions to Arctic regions, and member of the 1st German Antarctic expedition in 1979/80. He organized two International Ice Conferences in Hamburg (1984 IAHR and 1993 POAC) and had built the new large ice model basin in 1984, which some years later became a Large Scale Facility of the EU. In 2001 he retired and is working since then as Ice Technology Consultant. As such he is representing Germany in an ISO-Working Group on Standardizing Offshore Structures in Arctic and other Cold Regions. Since 2006 J. Schwarz is the Co-leader of the „German-Russian Working Group Northern Sea Route". He received the IAHR- Ice Research and Engineering Award 2005 and in 2006 the Federal Cross of Merrit of Germany

P.8 Nofima Marin AS (Nofima)

Nofima Marin (Marine) is a business oriented research group working in research and development for the aquaculture and fisheries industry, with it's main office in Tromsø. Total turnover in 2008: € 33.480.000. Number of Employees: 262 (of which 162 scientific).

Nofima Marked provides economic analyses, consumer research, foresight analyses, market analysis and strategic consultancy. It is located in Tromsø with 28 employees.

Main tasks attributed: Nofima Marin will be (co-)responsible for carrying out different tasks under WP 3: Fisheries: Task 3.1 Quantification of economic effects of climate change in a fisheries system, Task 3.2 Aquaculture in the Arctic - implications from climate change, Task 3.3 Climate change effects on factor and product markets for fisheries and aquaculture

Previous experience relevant to those tasks:

Arne Eide is one of two project leaders in the project Fisheries Management under Global Warming (FIMAGLOW, see http://fimaglow.maremacentre.com). He has also participated in in the EU-programmes BASIC, BALANCE and CEVIS (terminated) and ATP (running). John Isaksen and Øystein Hermansen recently fulfilled an evaluation for the Norwegian Ministry of Fisheries on the potential effects from a withdrawal of the mineral oil tax reimbursement scheme for the Norwegian fishing fleet.

Short profile of the staff members who will be undertaking the work:

Arne Eide (dr. philos), external scientific advisor Nofima Marked, Tromsø (associate professor in economics at Norwegian College of Fishery Science, University of Tromsø since 1998) .He is also responsible of the international Master programme in Fisheries Management (IFM). He has more than 40 publications as first author. He has participated in the EU-programmes BASIC, BALANCE and CEVIS (terminated) and ATP (running).

Edgar Henriksen (M.Sc.),has been working as consultant in several consultancy companies in fishery for more than 20 years. Since 2007 he is working as a scientist for Nofima. His research is focused on the bioeconomy and the impact of management structures on the regulation of fish stocks.

Øystein Hermansen (M.Sc.), got his Masters degree in fisheries science from the Norwegian College of Fisheries Science in 2002. After a few years as a researcher in the University of Tromso, he is working as a scientist in Nofima since 2006 where he became an expert in behavioural patterns in fisheries and evaluation of fisheries management instruments.

John Isaksen, (PhD) has been working as a researcher in NOFIMA since 1998. His research interests are the industry specific challenges in the seafood value chain. More specifically, he has been studying the interaction between actors in the value chain (catch, production and marketing) as well as the influence of regulatory interventions.

Relevant publications:

Isaksen, JR and Ø Hermansen (2009) Reimbursement of mineral oil tax in the Norwegian fishing fleet, (in Norwegian). Report no. 9, Nofima Marked, Tromsø

Eide, A (2009) Economic Principles: An Economic Perspective on Fishing. In KL Cochrane & SM Garcia *(eds) A Fishery Manager's Guidebook*. Wiley-Blackwell Publishing. 30 pg.

Eide, A (2008). An integrated study of possible economic effects of global warming on the Barents Sea cod fisheries. *Climatic Change* (DOI 10.1007/s10584-007-9338-0)

Eide, A (2007). Economic impacts of global warming: The case of the Barents Sea fisheries. *Natural Resource Modeling*, 20(2): 199-221

Eide, A and K Heen (2002). Economic impacts of global warming. A study of the fishing industry in North Norway. *Fisheries Research,* 56(3), pp. 261-274

Eide, A and O Flåten (1998) Bioeconomic Multispecies Models of the Barents Sea Fisheries. In Rødseth, T (ed) *Models for Multispecies Management*, Physica-Verlag, New York, pp.141-172

P.9 Hamburgische Schiffbau-Versuchsanstalt GmbH (HSVA)

The Hamburgische Schiffbau-Versuchsanstalt GmbH (HSVA) is a private self-supporting, non-profit research organisation. The main task is to advise the maritime industry (world-wide) in the fields of hydrodynamics and ice technology (ships, structures). HSVA is especially experienced in computer fluid dynamics computations (CFD), waterborne transport systems and in model test experiments in open water and in ice. HSVA has 86 employees.HSVA has established an Ice Technology Department in 1974, when a second generation ice model basin (30 m long / 6 m wide) became operational. In 1984 a third generation ice model basin was inaugurated, which is today with its 78 m length, 10 m width and 2.5 m/5.0 m depth one of the largest in the world. In 1990 the small ice test basin was rebuilt to an Arctic Environmental Test Basin. This facility with its installations (e.g. wave maker) is unique world-wide and allows environmental research under arctic conditions. In 1995 HSVA's ice and environmental test facilities became a Large Scale Facility (ARCTECLAB) within the EU TMR-Program. This contract was continued in the period 2000 to 2010 by the HYDRALAB I, II and III projects. With the quality of the ice testing facilities and its scientific staff HSVA belongs today to the leading ice engineering research institutes in the world.

Previous relevant experiences: The Ice and Offshore Department of HSVA was involved in numerous projects concerning hull form optimization and design regarding vessels operating in ice covered waters as well as the design and testing of marine structures in ice infested waters. Different types of vessels, such as icebreakers, research vessels, cargo ships, supply vessels etc., were optimized by HSVA staff with respect to icebreaking performance, ice clearing ability and propeller efficiency. Of special concern for this proposed project was HSVA's participation in the European funded projects ARCDEV, **ARC**tic **D**emonstration and **E**xploratory **V**oyage, and ARCOP, **ARC**tic **O**perational **P**latform. Both projects were dealing with environmental friendly and safe ship operations in Arctic regions. Within these projects HSVA was concentrating on the topics: ice navigation, ice routing, environmental protection, as well as oil recovery and combat systems, risk assessment and compilation of requirements for contingency plans.

Multi-leg platforms, fixed or moored drilling and production units as well as artificial islands were investigated by HSVA researchers in model and full scale. During the last two years HSVA was strongly involved in model test investigations with respect to the development of the Shtokman Gas Field in the Barents Sea. Full scale measurements were carried out on a jacket platform in the Bohai Bay, PR China, and ice forces were determined on the Lighthouse Norströmsgrund in the Gulf of Bothnia. The latter one was funded by the EU within the 5th Framework Programme. During several expeditions in artic and sub-artic regions HSVA gathered ridge profile data, which can be of special importance to this proposed project. Rescue vehicles for platforms operating in ice infested waters were tested in HSVA's facilities and HSVA scientists were involved in the development of the icebreaking emergency evacuation craft, IBEEC, for the North Caspian Sea. HSVA was involved in the design and development of different types of oil recovery systems, which were investigated at low temperatures in HSVA's Arctic Environmental Test Basin.

HSVA's activities in the proposed project will be coordinated by the head of the department, Dipl.- Ing. Peter Jochmann.

Peter Jochmann is the Head of the Ice & Offshore Department at HSVA. He is since 1977 with HSVA and has long year experience in ice force determination both in the model basin and the field. Peter Jochmann was project leader of numerous model test projects and several field campaigns.

Dr. Karl-Heinz Rupp is a senior scientist in the Ice and Offshore Department at HSVA. Dr. Rupp has a PhD in Naval Architecture and holds a German Master License for all ships. He has expertise in ship hull form design as well as ice navigation and ice routing. Dr. Rupp was project manager in innumerable projects in the model basin and the field.

Jens-Holger Hellmann is a senior scientist in the Ice and Offshore Department at HSVA. Mr. Hellmann has a Diploma in Naval Architecture. He has expertise in ship hull form design and propulsion systems for ice going vessels. Jens Hellmann was project manager in innumerable projects in the model basin and supervised several full scale trials in Arctic regions.

Karl-Ulrich Evers is a senior scientist in the Ice and Offshore Department at HSVA and has his Diploma in Civil Engineering. He has expertise in cold region technology and ice engineering. Karl-Ulrich Evers main area of research is hydraulics civil engineering and ice mechanics.

P.10 Norwegian Polar Institute, Tromsø, Norway (NPI)

The Norwegian Polar Institute is a Norwegian governmental institute under the Norwegian Ministry of Environment. The Norwegian Polar Institute is Norway's central institution for research, environmental monitoring and mapping of the Polar Regions. The Institute is the Norwegian authorities' adviser and supplier of knowledge, and contributes to the best possible administration of Norwegian polar areas. The Norwegian Polar Institute has about 150 employees. The research department in the Norwegian Polar Institute consists of the sections Polar Climate, Ecotoxicology, Biodiversity and Geo-Mapping. In Polar Climate, fields as glaciology, sea ice oceanography and marine geology are included.

Main tasks attributed: WP1. Sea ice surface energy balance, melt ponds, snow and ice properties, oceanography, freshwater balance.

Previous experience relevant to those tasks: NPI is working and has been working in various research and management projects that are related to ACCESS, for example DAMOCLES, iAOOS, SWIPA, NorClim, Black Carbon effects on Albedo, AMORA. Longterm monitoring studies in the Arctic and on Svalbard. Permanent research bases, other logistical facilities and a research ship (RV Lance). Competence in research, environmental management and polar logistics.

Short profile of the staff members who will be undertaking the work:

Dr. Sebastian Gerland**,** research scientist, sea ice and climate. Sea ice and snow optical properties, sea ice and snow thickness changes, freezing and melting of sea ice, cryosphere assessments and reviews.

Dr. Mats Granskog, research scientist, sea ice and oceanography. Physical properties of sea ice and snow, melting and freezing, small scale processes in sea ice, sea ice – ocean interaction, tracer studies.

Dr. Edmond Hansen, research scientist, oceanography. Freshwater fluxes through Fram Strait, sea ice thickness, sea ice – ocean interaction from shelf to deep sea.

Dr. Christina A. Pedersen, research scientist, snow and atmosphere. Snow and sea ice optical properties, effect of black carbon on snow albedo, melt pond parameterizations in GCMs

Relevant publications:

Forsström, S., Ström, **J., Pedersen**, C.A., Isaksson, E. and **Gerland, S**. (2009): Elemental carbon distribution in Svalbard snow. Journal of Geophysical Research, Atmosphere. 114, D19112, doi:10.1029/2008JD011480.

Gascard, J.C., and 31 others, among them **S. Gerland** and M. Nicolaus (2008): Exploring Arctic transpolar drift during dramatic sea ice retreat. Eos Transactions, American Geophysical Union, Vol. 89 (3), 15 January 2008, pp.21-22.

Gerland, S., and 12 others (2007). Ice in the Sea. Chapter 5 of *Global Outlook for Ice and Snow*. UN Environment Program (UNEP), pp. 63-96.

Gerland, S., Renner, A.H.H., Godtliebsen, F., Divine, D., & Løyning, T.B. (2008): Decrease of sea ice thickness at Hopen, Barents Sea, during 1966-2007. Geophysical Research Letters. Vol. 35, L06501, doi: 10.1029/2007GL032716.

Granskog, M. A.,T. Vihma, R. Pirazzini and B. Cheng. 2006. Superimposed ice formation and surface energy fluxes on sea ice during the spring melt-freeze period in the Baltic Sea, Journal of Glaciology, 62(176), 119-127.

Pedersen, C.A., E. Roeckner, M. Luthje and J.-G. Winther. *A New Sea Ice Albedo Parameterization including Melt Ponds for ECHAM5 GCM*. Journal of Geophysical Research., 114, D08101, doi:101029/2008JD010440, 2009.

Pedersen, C.A., R. Hall, **S. Gerland**, A. H. Sivertsen and T. Svenøe. *Advanced Airborne Profiling over Fram Strait Sea Ice*. Cold Regions Science and Technology, 55: 23-32, 2009.

Scharien, R.K., J. Yackel, **M. Granskog** and and B.G. Else. 2007. Coincident high resolution optical-SAR image analysis for surface albedo estimation of first-year sea ice during summer melt. Remote Sensing of Environment, 111, 160-171.Spreen, G., S. Kern, D. Stammer, and **E. Hansen** (2009), Fram Strait sea ice volume export estimated between 2003 and 2008 from satellite data, Geophys. Res. Lett., 36, L19502, doi:10.1029/2009GL039591.

P.11 Norwegian Meteorological Institute (met.no)

The Norwegian Meteorological Institute (**met.no**) was founded in 1866 and is a governmental agency. **met.no** has 420 employees in addition to about 600 observers including staff at the Arctic stations Bjørnøya, Hopen and Jan Mayen. The main office is in Oslo with regional offices in Tromsø and Bergen. The institute operates the 24/7/365. **met.no** is responsible for the public weather service in Norway, covering both civilian and military purposes. The institute provides information that supports public authorities, businesses and the general public to safeguard life and property, and societal planning and environmental protection. This includes operational forecasting for North Atlantic and Arctic areas. R&D at **met.no** is supported directly by the government and by projects from research councils, EU, ESA, EUMETSAT and others.

met.no R&D is related to operational numerical modeling. Atmospheric, oceanographic and sea-ice forecasting is continuously improved. In situ and remote sensing observations and data assimilation techniques are used in the work on forecast modeling. Considerable R&D is also centred on environmental models (air pollutants, oil spills, etc.). In recent years development and running of a full-scale global Earth System Model (NorESM) is done as a part of a national initiative. Climate research thus includes global scenario calculations, as well as downscaling to finer resolution over Norway and adjacent seas using regional climate models and statistical-empirical techniques. Research is carried out in collaboration with national and international research institutions.

met.no represents Norway in many international conventions (WMO, ECMWF, EUMETSAT). The institute educates PhD's and hosts postdocs on a regular basis thanks to its close collaboration with, and proximity to, the University of Oslo through CIENS (Oslo Centre for Interdisciplinary Environmental and Social Research). The **Norwegian Ice Service** is part of **met.no**'s Forecasting Division for Northern Norway in Tromsø. The Ice Service provides daily (working day, Monday-Friday) ice charts for the European sector of the Arctic, with an emphasis on Spitsbergen (Svalbard) which is covered in detail using SAR. The analysts study the current conditions primarily from satellite data and provide ice charts, ice-edge information and an overview of sea surface temperatures.

Main tasks attributed: **met.no** will demonstrate monitoring tools for the Arctic environment, assess environmental forecasting capabilities in support of Arctic operations, and provide and adapt Arctic climate scenarios.

Short profile of the staff members who will be undertaking the work

Prof. Trond Iversen is Assistant Research Director at met.no and Adjunct Professor at University pf Oslo. His research history from 1979 onwards within Fluid Earth dynamics and physics is broad, and includes many aspects of numerical weather prediction, modelling atmospheric dispersion and transport of pollutants, short-range predictability and probabilistic forecasting, modelling aerosol physics and chemistry and their interactions with climate in global climate models, and regional climate modelling. He is project manager for probabilistic forecasting in the HIRLAM consortium, former leader and present member of the SRNWP Expert Team on ensemble prediction under EUMETNET, member of the ECMWF SAC, and PI for the development of NorESM (Norwegian Earth System Model as a national resource under the virtual "Norwegian Climate Centre"

Nick Hughes is Leader of the Norwegian Ice Service based in Tromsø and is responsible for the daily operation of the Ice Service and for project management including the development of new data processing algorithms and information services. Hughes has 12 years experience in Arctic and Antarctic research with 13 field campaigns including the UK Royal Navy expeditions of HMS *Tireless* in 2004 and 2007. In previous EC projects he was responsible for management of the remote sensing algorithm development in EUROCLIM (2001-5) and IRIS (2003-5). He is Norway's representative on the WMO JCOMM Expert Team on Sea Ice.

Harald Schyberg is Senior Scientist in the Remote Sensing Section of the R&D department. Fields of expertise comprise use of satellite observations in data assimilation for numerical weather prediction (NWP) and for extraction of sea surface and sea ice information as well as observation impact studies in NWP. Member of ESA ADM (Atmospheric Dynamic Mission) Science Advisory Group, SRNWP (the Short-Range Numerical Weather Prediction programme of the European meteorological services) Expert Team on Data Assimilation and EUCOS (EUMETNET Composite Observing System) Science Advisory Team.

P.12. FastOpt GmbH (FastOpt)

FastOpt is a company founded at Hamburg in February 2000 by Drs. Ralf Giering and Thomas Kaminski. Both are experts in inverse modelling, data assimilation, quantitative network design and Automatic Differentiation (AD) and are working full time as senior consultants. Staff includes further consultants, Michael Voßbeck and Dr. Simon Blessing, working full time. FastOpt specialises in two lines of business: First, they provide AD tools. Second, they carry out scientific projects for/with their customers. Their customers/partners include agencies and research institutes such as NASA-GSFC, NASA-JPL, the NOAA, Harvard University, the Max-Planck-Institutes in Hamburg and Jena, or the MIT as well a industrial companies such as The Boeing Company, Renault Formula 1, or Volkswagen AG. FastOpt are experienced in seting up and operating advanced inverse modelling/assimilation systems for various components of the Earth System.

Main tasks attributed: FastOpt will be working on variational assimilation and quantitative design of observational networks.

Previous experience relevant to those tasks: FastOpt have set up and operated a number of variational data assimilation systems. Together with AWI and OASys FastOpt have worked on variational assimilation into a coupled ocean-sea ice model within the FP6 IP DAMOCLES. Within the FP6 I3 IMECC they set up a network design tool around a terrestrial assimilation system.

Short profile of the staff members who will be undertaking the work:

Dr. Ralf Giering is a managing director and co-owner of FastOpt. He has been working in oceanographic data assimilation (DA) for almost 20 years. He took a key role in building a number DA systems. He has developed compiler tools for automatic generation of adjoint models, for which he was awarded the Max-Planck-Society's Heinz-Billing Price.

Dr. Thomas Kaminski is a managing director and co-owner of FastOpt. He is an expert in the set up and operation of DA and observational network design systems. Dr. Kaminski worked on methodological aspects of DA and network design. He leads the DA task within DAMOCLES and the quantitative network design activity within IMECC. He is contributing author to the IPCC TAR and won, together with Dr. Giering, the NASA group achievement award for generating the adjoint of GMAO's general circulation model.

Michael Voßbeck is a mathematician and with FastOpt since 2002. He is an expert in adjoint code generation and development of automatic differentiation software.

Dr. Simon Blessing is an atmospheric scientist and with FastOpt since 2007. He is an expert in set up and operation of data assimilation systems.

Relevant publications:

F. Kauker, **T. Kaminski**, M. Karcher, **R. Giering**, R. Gerdes, and **M. Voßbeck**. Adjoint analysis of the 2007 all time arctic sea-ice minimum. *Geophysical Research Letters*, 2009.

T. Kaminski and P. J. Rayner. Assimilation and network design. In H. Dolman, A. Freibauer, and R. Valentini, editors, *Observing the continental scale Greenhouse Gas Balance of Europe*, Ecological Studies, chapter 3, pages 33-52. Springer-Verlag, New York, 2008.

T. Kaminski, S. Blessing, R. Giering, M. Scholze, and **M. Voßbeck**. Testing the use of adjoints for estimation of GCM parameters on climate time-scales. *Meteorol. Z.*, 16(6):643-652, 2007.

Kaminski, T. and Heimann, M., Inverse Modeling of carbon dioxide, Science, 294, 5541, 2001.

Giering, R., and T. Kaminski. Recipes for Adjoint Code Construction. ACM Trans. Math. Software, 24(4):437-474, 1998. (**208** times cited in ISI/**447** times cited on Google Scholar)

P.13 Scottish Association for Marine Science (SAMS)

The Scottish Association for Marine Science (SAMS) is one of the oldest oceanographic research organizations in the world, and is the leading marine research and education institution in Scotland. The central aims of SAMS, which is a NERC Collaborative Centre, are to undertake long-term and fundamental strategic research, to contribute to and support the national and international marine science community, and to underpin the societal and educational needs of the UK and the wider community. Arctic marine science and technology innovation are key missions of SAMS. SAMS consists of approximately 130 academic and technical staff and about 30 affiliated Phd students. SAMS is the sole UK institution whose core focus is the Arctic and is full partner in the Marine Laboratory at Ny Alesund, Svalbard. SAMS is experienced in large multi-disciplinary programmes.
Wilkinson is head of the Sea Ice Group and Ivanov is a senior member of the Marine Physics Group.

Main tasks attributed: SAMS will participate in the observational programme of WP1 as well as the modelling of the flow of oil under sea ice (WP2).

Previous experience relevant to those tasks: SAMS is presently at the leading-edge of oil-spill modelling under sea ice through the development of an under-ice oil trajectory model based around the bona fide 3-D shape of the under-ice of sea ice. SAMS are one of the world-leaders in the development of scientific equipment of sea ice research. Over the past 5 years we have developed and deployed over 30 platforms including automatic weather stations, drifting buoys, tilt-meters and sea ice mass balance buoys

Short profile of the staff members who will be undertaking the work:
Jeremy Wilkinson has studied climate related processes in the polar oceans such as sea ice dynamics and thermodynamics, deep convection and water mass modification in the polar seas for almost 15 years. His expertise also extends through a broad range of techniques, from the remote sensing and *in-situ* monitoring of sea ice, through to the modelling of oil spills under sea ice. He has participated in over 20 polar field expeditions and his observational work has been performed on many different platforms, including, ship, helicopter, aeroplane, and ice camps. He has substantial experience in large EU funded multidisciplinary programmes e.g. ESOP-1, ESOP-2, CONVECTION, SITHOS and works to a high scientific standard. Over the past few years he has published widely in high impact journal. He is presently PI on the 47 partner EU funded DAMOCLES programme and was co-ordinator of the 20 partner EU funded RECARO programme. Wilkinson is head of the Sea Ice Group at SAMS.

Vladimir Ivanov has worked in the field of polar oceanography since 1990. He participated in 11 Arctic expeditions onboard of Russian, German and Norwegian ships. He has additional experience in sea ice research and buoy deployment and analysis. His overall research interests are the water masses and circulation in the Arctic Ocean. In particular his research is focused on Atlantic water transformation in the Arctic Ocean and its heat influence on the mixed layer and ice, water mass transformation due to shelf-basin exchange, dense water formation and cascading. He has 23 publications in peer reviewed journals.

Recent relevant publications:
Ivanov V.V., + 8 others I.V., Seasonal Variability in Atlantic Water off Spitsbergen, **2009**, *Deep Sea Research* I, 56, 1-14
Wilkinson, J.P.+15 others (2009), Ice tank experiments highlight changes in sea ice types, Eos Trans. AGU, 90(10), doi:10.1029/2009EO100002. (Featured *Nature*: http://www.nature.com/news/2009/090323/full/news.2009.183.html)
Lenn, Y. D., **V. Ivanov**, +10 others , **2009**, Vertical mixing at intermediate depths in the Arctic boundary current, Geophys. Res. Lett., 36, L05601, doi:10.1029/2008GL036792
*Polyakov I.V., , **V.V. Ivanov**, + 8 others, Variability of the Arctic freshwater content over the last 100 years, **2008**, J.of Climate, 21, 364-384*
Gascard, J.-C.,**Wilkinson. J** and 24 others (2008). Exploring Arctic transpolar drift during dramatic sea ice retreat. EOS, 89 (15 Jan. 2008), p. 21-22
Wilkinson, J. P., P. Wadhams, and N. E. Hughes (2007), Modelling the spread of oil under fast sea ice using three-dimensional multibeam sonar data, *Geophys. Res. Lett.*, 34, L22506, doi:10.1029/2007GL031754. (Feature article published in the popular scientific journal *New Scientist*. Date: 14/12/07, Issue No:2634)

P.14. The Beijer Institute of Ecological Economics, Royal Swedish Academy of Sciences

The Beijer Institute of Ecological Economics is an international research institute under the auspices of the Royal Swedish Academy of Sciences. Its major objective is to carry out research and stimulate cooperation between scientists, university departments, research centers and institutes to promote a deeper understanding of the interplay between ecological systems and social and economic development.
Main tasks attributed: Main contributions in WP 3 and 5, minor contribution to 4.
Previous experience relevant to those tasks: The Beijer Institute has produced world leading science at the frontier between economics and ecology, with focus among other aspects on complex adaptive social- ecological systems, global change, tipping points in natural systems and their implications for economic systems and ecosystem services. The institute's research emphasizes the role that living systems at different scales play in social and economic development and how to govern and manage for resilience in integrated social-ecological systems. The institute also disposes of a large network of well-established researchers and fellows who support the mission of the institute.

Short profile of the staff members who will be undertaking the work

Anne-Sophie Crépin, Project leader, PhD in economics, Deputy Director of the Institute. Works on resources with complex dynamics and threshold. Lead author of the chapter Polar Systems in the Millennium Ecosystem Assessment. Project leader and member of the steering committee for the 7th Framework EU project Arctic Tipping points (ATP) and co-director of the Beijer research program Global dynamics and resilience in the face of multiple shocks.
Scott Barrett, Lenfest Professor of Natural Resource Economics at the School of International and Public Affairs and The Earth Institute at Columbia University, works on game theoretical analysis of climate change treaties.
Gustav Engström, PhD student in economics focuses on climate economy modelling and sustainability.
Carl Folke, Professor in natural resource management, Director of the Beijer Institute, Science Director of the Stockholm Resilience Centre, has extensive experience in transdisciplinary collaboration between natural and social scientists, and has worked with ecosystem dynamics and services as well as the social and economic dimension of ecosystem management.
Michael Hoel, Professor of Economics at the University of Oslo focusing among other issues on environmental and resource economics and international agreements
Åsa Jansson, PhD in natural resources management has specialised in quantification the provision of ecosystem services in many different kinds of ecosystems.
Therese Lindahl, PhD in economics, focuses on behavioral aspects of natural resource management, where she employs both theoretical and experimental methods. She is the Co-director of the newly created Behavioral Economics and Nature Network (BENN) of leading international scholars.
Max Troell, Associate professor in systems ecology, co-theme leader "Governance and ecosystem management of coastal and marine systems" at the Stockholm Resilience Centre. Research focus on resource needs and environmental problems associated with aquaculture.
Aart de Zeeuw, Professor in economics and Science director of the Tilburg Sustainability Center, Netherlands, adviser to the Netherlands Environmental Assessment Agency, works among other issues on the stability of international environmental agreements. He is part of the ATP project.

Relevant publications

Barrett, Scott, 2003, Environment and Statecraft: The Strategy of Environmental Treaty Making, Oxford.
Chapin, Berman, Callaghan, Convey, **Crépin**, Danell, Ducklow, Forbes, Kofinas, McGuire, Nuttall, Virginia, Young, Zimov, Christensen, Godduhn, Wall, and Christoph Zockler, 2005, Polar Systems, Chapter 26 in Millenium Ecosystem Assessment, *Ecosystems and Human Well-Being: Current State and Trends*, Vol 1.
Crépin, 2007, Using Fast and Slow Processes to Manage Resources with Thresholds, *Environmental and Resource Economics*, 36:191-213.
Walker, **Barrett**, Polasky, Galaz, **Folke, Engström**, Ackerman, Arrow, Carpenter, Chopra, Daily, Ehrlich, Hughes, Kautsky, Levin, Mäler, Shogren, Vincent, Xepapadeas, de Zeeuw, ***Looming global-scale failures and missing institutions*****,** Science, vol 325:1345-1346 (2009)
De Zeeuw, 2008, Dynamic effects on the stability of international environmental agreements, *Journal of Environmental Economics and Management*, 55, 2, 163-174.

P.15. P.P. Shirshov Institute of Oceanology of Russian Academy of Sciences (SIO-RAS)

P.P.Shirshov Institute of Oceanology of the Russian Academy of Sciences (SIO RAS) is the oldest and the largest Russian research centre in the field of oceanology. The Institute was established in 1946.Its main objectives lie in a complex study of the World Ocean and the Russian seas based on the idea of entirety of physical, chemical, biological and geological processes observed in them, laying scientific foundations for forecasting the Earth's climate variability, rational use of marine resources and safeguarding ecological security in the interests of stable development of mankind. Today, SIO-RAS is an ensemble of 1,300 employees of various disciplines. It affiliates the Atlantic Department in Kaliningrad, the Southern Department in Gelendjik, a branch in St.-Petersburg, the North-Western Department in Arkhangelsk and the Caspian branch in Astrakhan (www.ocean.ru/eng/).

The Polar oceanography group of SIO RAS was established in 2004 to concentrate IPY related activity of institute. Group members participate annually in marine field experiments in Arctic and Antarctic on drifting ice and ships. Arctic data archaeology activity is one of the group's tasks as well.

Main tasks attributed:

Reconstruction of the position of the ice margin and water characteristics within the Barents Sea for the period of first Arctic warming 1920-1940 on a base of information containing in numerous of old Russian reports, papers and books; comparison of physical maritime parameters first and modern Arctic warming;

Previous experience relevant to those tasks:

TAPEX 1994 (TransArctic Acoustic Propagation Experiment) and ACOUS 1998-2000 (Arctic Climate Observation using Underwater Sound); PAICEX 2007-2010 (Pan Arctic Ice Experiment); FP6 EC DAMOCLES(Developing Arctic Modeling and Observing Capabilities for Long-term Environment Studies) 2005-2010; GODAR (Global Data Archeology) project 2002 -2004 and 2008 – 2010.

Short profile of the staff members who will be undertaking the work:

Dr. Sergey Pisarev, head of polar oceanography group, expertise - large-and meso scale oceanographic process in the Arctic Ocean, short-period variations of the Ocean Climate in the Arctic, multidisciplinary oceanographic measurements from the ships and ice platforms, oceanographic data processing.

Vadim Fedulov and Maria Pisareva, students of oceanographic department of Moscow State University now and PhD student of SIO RAS in 2011; expertise – oceanographic data processing and analyses, Arctic oceanography.

Relevant publications:

Pisarev S. (2008) "Characteristics of water masses of the Amundsen Basin in 2007-2008. The changes started in 1990th are continued". In Polar region of the Earth ed. by akad. Kotliakov. Moscow, RAS publishers, pp.228-254 (in Russian)

Schauer, U., Rudels, B., Karcher, M., Fer, I., Harms, I., **Pisarev, S.**, Skogseth, R., Björk, G., Winsor, P., Haugan, P. (2004). "Ocean convection in Arctic shelf polynyas". Proceedings of ACSYS Final Science Conference "Progress in Understanding the Arctic Climate System: The ACSYS Decade and Beyond", 11-14 November 2003, AARI St. Petersburg, Russia. WCRP-118(CD), WMO/TD No. 1232. September 2004.

E. G. Morozov and, **S.V. Pisarev** (2004), "Internal Waves and Polynya Formation in the Laptev Sea", Doklady Earth Sciences, v.398, No.7, pp. 983-987.

E. G. Morozov , **S.V. Pisarev** , V. G. Neiman , and S. Yu. Erofeeva (2003). "Internal Tidal Waves in the Barents Sea", Doklady Earth Sciences, v.393, N8, pp. 1124-1127.

The Ocean Noise laboratory of P.P.Shirshov Institute of Oceanology of the Russian Academy of Sciences (SIO RAS) has been founded in 1978 by academician L. Brekhovskikh. Early models of Autonomous Bottom Buoys have been designed and manufactured by request of the USSR Navy and served for their scientific researches. Today experimental researches of the laboratory are related mainly to academic tasks and ecological monitoring of noise in ocean.

Main tasks attributed:
Modeling of the noise propagation in shallow water of Arctic environment. Estimation of acoustic impact on marine mammals from ships traffic, pulse signals of seismic survey, and industrial noise at offshore oil/gas platform construction and exploitation.

Previous experience relevant to those tasks :
Development of criteria, methods and equipments for real time acoustic monitoring of anthropogenic noise impact on sea mammal, in particular on an endangered Western Gray Whales population off Sakhalin island. Expedition activity on real time acoustic monitoring of the industrial noise on Sakhalin shelf.

Short profile of the staff members who will be undertaking the work

Dr. Alexander Vedenev, Head of Ocean Noise Laboratory, expertise - Noise criteria for Marin mammal, Acoustic modelling of noise propagation in shallow water. Construction of the autonomous bottom buoys with satellite transmitting of acquired data to Internet.

Dr. Constantine Avilov, Senior scientist, expertise - Large experience in developments of the algorithms, CDPE/PDPE computer cod and modeling of sound propagation in shallow water of Arctic area.

Relevant publications:
Vedenev, A. I. 2007. Acoustic monitoring of endangered GW feeding area near oil and gas activity off Sakhalin island: New techniques and noise exposure criteria, 21 Annual Conference of the Europe citation Society**,** p. 27-28, Donostia – San Sebastian, Spain

Vedenev, A. **I., Avilov**, C. 2008. Model Prediction of a Size of Monitoring Safety Zones for Endangered Western Gray Whales Feeding Area During Forthcoming 2008-2009 Seismic Surveys off Sakhalin Island. 22nd Annual Conference of the European Cetacean Society, p. 93-94, Egmond aan Zee, Netherlands

Vedenev, A. I., Nowacek, D.P. 2009. Development and application of noise exposure criteria for gray whale monitoring off Sakhalin Island, Russia. 23 Annual Conference of the European Cetacean Society, p. 89-90, Istanbul, Turkey

Avilov, C., Vedenev, A. I. 2009. About adequacy of a numerical estimation of the acoustic fields level at seismic survey in shallow water environments. Ocean Acoustics, Proceedings of the 12 Brekhovskih's conference, p.17-19, Moscow, Nayka, GEOS

Vedenev, A. I., Ivanov, V.N., Kochetov, O.Y. 2009. Autonomous hydro acoustic stations for the control of an industrial noise levels and signals of seismic survey on the sea shelf. Ocean Acoustics, Proceedings of the 12 Brekhovskih's conference, p.361-364, Moscow, Nayka, GEOS

Vedenev, A. I. 2009. Criteria and results of acoustic monitoring of gray whale feeding area near pipeline construction at the sea shelf. Ocean Acoustics, Proceedings of the 12 Brekhovskih's conference, p. 228-233, Moscow, Nayka, GEOS

P.16 IMPaC Offshore Engineering GmbH (Impac)

IMPaC Offshore Engineering, Hamburg specializes in engineering & design services to the upstream oil & gas industry and the construction industry for maritime projects. The independent company with limited liability is privately owned. Since more than 25 years IMPaC contributes to international projects. The services comprise concept development and feasibility studies, front end engineering design and detail design, procurement of equipment & services, construction & installation management. The multi-discipline project teams work in a state-of-the-art hard- & software environment.

Main tasks attributed:

IMPaC will contribute to the study by assessing technical concepts for the exploration, production and transport of oil and gas under Arctic conditions. The expected climate changes will have impact on existing concepts presently in use or under discussion for Arctic areas. IMPaC will also contribute to the subjects socio-economic impacts and risks related to resource extraction under Arctic conditions.

Previous experience relevant to those tasks:

Since more than 20 years IMPaC is working as engineering consultant for projects related to sea ice problems. The experience covers both fixed and floating structures as platforms, jackets, artificial islands, grounded barges, ice resistant sponsons, wellhead protection structures, ice barrier barges, jack-ups. The primary investigations focus on interaction of structures and ice, and HSE aspects especially the evacuation of personnel.

IMPaC worked for projects and is presently involved in projects located in the North Caspian Sea, Barents Sea, North Sea, Baltic Sea, Bohai Bay. IMPaC also contributed with its experience to the development of ISO 19906 - Arctic Offshore Structures by leading the Working Group responsible for developing design regulations for Arctic Steel Structures.'.

Short profile of the staff members who will be undertaking the work:

Joachim Berger: He is Technical Advisor and Advisor to the Board of IMPaC Offshore Engineering in Hamburg. He studied Civil and Coastal engineering at the Technical University in Hannover. Since 1979 he is continuously involved in platform design and other design issues related to the development of oil and gas fields in particular for Arctic and sub-Arctic areas.

Sven Hoog (PhD): Since 2004 he is Project Manager for Naval and other Marine Systems for IMPaC Offshore Engineering. He studied Naval Architecture and Ocean Engineering at the Technical University of Berlin, where he also received his Doctoral degree in ocean engineering. He is involved in numerous projects for the oil and gas industry, the scope ranging from developments for floating drilling structures, (offshore) LNG transfer systems to production control systems for ultra-deepwater. He is head of the department 'civil, structural and naval' at IMPaC and he leads the research activities.

Relevant publications:

Hoog, S., Koch, H., Huhn, R., Frohne, C., Homann, J., Clauss, G.F., Sprenger, F., Testa, D.: *LNG Transfer in Harsh Environments - Introduction of a New Concept*, Offshore Technology Conference, OTC-19866-PP, Houston, Texas, May 2009

Berger, J.: Ice Protection Structures, Schiff & Hafen, June 2008

Evers, K.-U., Weihrauch, A.: *Design and Model Testing of Ice Barriers for the Protection of Offshore Structures in Shallow Waters during Winter*, 17th International Symposium on Ice, June 2004

P.17 Technical University of Catalonia (UPC)

The Universitat Politècnica de Catalunya (UPC) is a public institution dedicated to higher education and research that specializes in the fields of architecture, science and engineering. The UPC develops an intense activity aimed at transferring technology and knowledge to private companies and to society in innovation, research and technical development.

The Laboratory of Applied Bioacoustics (LAB) of the UPC holds expertise in: Signal Modelling and Analysis; 3D Numerical simulations; Acoustic Propagation Model & Acoustic Target Model; Biosonar and Communication Mechanisms; Control of Marine Noise Pollution; Measurement and monitoring of anthropogenic sound sources; Development of passive techniques to explore the ocean Assessment of noise pollution effects on marine organisms; Automatic identification and classification of biological and anthropogenic sound sources; Tracking of marine mammals with passive techniques and Ambient Noise Imaging; Ethical and Legal Aspects of Marine Mammal Research; Cross-disciplinary approach to help creating policies towards underwater anthropogenic noise control.

Main tasks attributed: *Activity 1*: shipping routes in the Arctic & monitoring of noise radiated by ships; *Activity 2*: Marine mammals in the Arctic. Interaction and effects of the Arctic anthropogenic noise with identified marine mammal populations **;** *Activity 3*: scientifice and public outreach ; *Activity 4*: seismic surveys and oil/gas exploration and exploitation in the Arctic; *Activity 5*: Design of the real-time architecture for the monitoring of noise from offshore platforms ; *Activity 6*: noise pollution in the Arctic : mitigation procedures and policies; *Activity 7* : Implementation of the real-time architecture for the monitoring of noise from offshore platforms

Previous experience relevant to those tasks: The LAB-UPC brings a variety of expertise in underwater acoustics, bioacoustics and marine mammal science.

Short profile of some of the staff members who will be undertaking the work:

Michel André is a Professor at the Technical University of Catalonia (UPC) and the Director of the Laboratory of Applied Bioacoustics (LAB). He is an Engineer in Biotechnologies graduated from the Institut National des Sciences Appliquées, INSA, Toulouse, France; He holds a Master degree in Bioquemistry and Animal Physiology from the Université Paul Sabatier de Toulouse, France; His PhD Dissertation that he defended at the Universidad de Las Palmas de Gran Canaria was on sperm whale
acoustics and noise pollution.

Mike van der Schaar obtained a master degree in applied mathematics at the University of Delft in 2002, specialising in algebraic encoding and especially cryptography. Since 2008 he works on the design and implementation of a system for real-time detection and identification of sound sources for the LIDO project (Listening to the Deep-Ocean Environment), part of the European Sea Floor Observatory (ESONET) Network.

Serge Zaugg is a research associate of the LAB. He holds a Master in ecology at the Swiss Federal Institute of Science in Zürich (ETHZ) and a Postgraduate master in statistics at the University of Neuchâtel. At the LAB he develops methods for the processing and automatic classification of hydrophone recordings. The aim is to automatically detect biological signals (e.g. cetacean's clicks or whistles) and anthropogenic signals (e.g. shipping, drilling) in large data series.

Publications:

M. Van der Schaar, E. Delory, J. van der Weide, C. Kamminga, J.C. Goold, N. Jaquet and **M. André** "A comparison of model and non-model based time-frequency transforms for sperm whale click classification" Journal of the Marine Biological Association of the United Kingdom vol 87, issue 1, 27-34, 2007

André, M., Johansson, A.T., Delory, E. and **van der Schaar** "Foraging on Squids: the Sperm Whale Mid-Range Sonar" Journal of the Marine Biological Association of the United Kingdom. 2007

Evans, P.G.H., Pierce, G.J.,

André, M. "Twenty years of marine mammal research in Europe." Journal of the marine Biological Association of the United Kingdom vol 87, issue 1, 1-4 2007

André, M., E. Delory, E, Degollada, J.M. Alonso, J. del Rio, **M. van der Schaar**, J.V. Castell and M. Morell "Identifying Cetacean Hearing Impairment at Stranding Sites. "Aquatic Mammals 33(1), 100-109, 2007

P.18 Deutsches Zentrum fuer Luft- und Raumfahrt e.V. – Institut für Physik der Atmosphäre (DLR-IPA)

The Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) is the German national research establishment for aeronautics, astronautics, and energy technology within the Helmholtz-Gemeinschaft der Forschungszentren (HGF).

The Institut für Physik der Atmosphäre (DLR-IPA) has long-term experience in in-situ airborne measurements of chemical species, aerosols, and meteorological quantities, large-scale modeling of atmospheric dynamics and chemistry, radiative transfer modeling, development and application of tools for passive and active remote-sensing. DLR-IPA has many years experience in co-ordinating international research projects (e.g. ATTICA, ECATS, METRIC, QUANTIFY, TROCCINOX) and participated in numerous national and international research projects, including many EC funded projects (e.g. PARTEMIS, SCOUT-O3, AMMA, IAGOS, EUCAARI, RECONCILE, SHIVA).

Tasks attributed:

Experimental investigations on emissions of shipping and oil/gas extraction at northern high latitudes and their regional impact. This will include measurements of emission factors and analysis of dispersion and transformation of the primary pollutants for Arctic summer conditions.

Previous experience relevant to those tasks:

DLR-IPA has extended experience in measurements and characterisation of emissions from aircraft and ship engines. In the frame of the recent EU-IP QUANTIFY aircraft measurements in the exhaust plume of dedicated source ships and in shipping corridors were performed successfully.

Short profile of the staff members who will be undertaking the work:

Hans Schlager is the head of the DLR-IPA department "Atmospheric Trace Species" since 1991. His experiences cover atmospheric physics and chemistry, development of airborne instruments, in situ trace gas measurements from balloons, rockets, and aircraft, as well as coordination of field campaigns. He participates presently in the IAGOS and CARIBIC projects and coordinates the airborne measurements in the new EU projects RECONCILE and SHIVA. He is author of more than 120 publications in peer-reviewed journals.

Andreas Petzold is leading the aerosol research group at DLR-IPA. He has more than 15 years experience in experimental aerosol research focusing on combustion aerosol, aerosol optical properties, measurement techniques, and atmospheric variability and distribution of aerosols. He has published more than 80 articles in peer-reviewed journals. At present, he coordinates projects on particle emissions from shipping (BIOCLEAN), aviation (SAMPLE), and a field experiment on the aviation impact on cirrus (ML-CIRRUS).

Selected most relevant recent publications

Eyring, V**.**, I. S. A. Isaksen, T. Berntsen, W. J. Collins, J. J. Corbett, O. Endresen, R. G. Grainger, J. Moldanova, **H. Schlager**, and D. S. Stevenson, Transport impacts on atmosphere and climate: Shipping, *Atm. Env.*, doi:10.1016/j.atmosenv.2009.04.059, 2009.

Engvall, A.-C., J. Ström, P. Tunved, R. Krejci, **H. Schlager**, A. Minikin. The Arctic radiative effect of an aged, internally-mixed aerosol originating from lower-latitude biomass burning, Tellus B, 61 (4), 677, 2009.

Huntrieser, H., **H. Schlager**, Air Pollution Export from and Import to Europe: Experimental Evidence. In: Stohl, A. [Ed]: The Handbook of Environmental Chemistry, Air Pollution: Intercontinental Transport of Air Pollution, 4, Springer-Verlag, Heidelberg, S. 69 - 98, ISBN 3-540-20563-2, 2004.

Petzold, A.; J. Hasselbach, P. Lauer, R. Baumann, K. Franke, C. Gurk, **H. Schlager**, E. Weingartner(2008): Experimental studies on particle emissions from cruising ship, their characteristic properties, transformation and atmospheric lifetime in the marine boundary layer. Atmospheric Chemistry and Physics, 8, S. 2387 – 2403

Real E., K. S. Law, **H. Schlager**, et al.: Lagrangian analysis of low altitude anthropogenic plume processing across the North Atlantic, *Atmos. Chem. Phys.*, 8, 7737-7754, 2008.

P.19 Arctic and Antarctic Research Institute (AARI)

The AARI is the leading Russian institution in the Polar Regions. AARI performs the complex investigations in the Arctic and Antarctic in the field of oceanography, physics of ice ocean, and in- land water, meteorology, ocean/air interaction, geophysics, sea ice studies, glaciology, polar geography, hydrochemistry, hydrology of river mounts and water resources, ecology, interaction of the ship's hull and other engineering constructions with ice, polar medicine. The AARI has comprehensive scientific, technical and informational resources and high-skilled scientific staff. The activity of the AARI is based on the large data sets on ice, ocean, atmosphere, geophysical and other processes, which have been collected since the early 20th century. The AARI is well-known in the world that allows it to mutually cooperate with the centers and institutions of the USA, Canada, Norway, Germany etc. and participate in the international projects, expeditions, symposia, working groups, committees and commissions engaged in the investigations of the Polar Regions

Three AARI departments will contribute to the WP1 and WP2 of ACCESS proposal. Their area of expertise related to proposal activities ids the following. Oceanography department: (i) studies of the Arctic Ocean water masses origin and transformation; (ii) study of the Arctic Ocean circulation. Ocean-air interaction department: (i) field studies of the exchange processes in the ocean-ice-atmosphere system; (ii) model studies of sub-grid scale processes affecting climate variations. Sea Ice Regime and Forecasts department: (i) study of sea ice extent variability and sea ice conditions forecast for the future; (ii) development of methods of optimal using of ice information for operational support of navigation in the freezing seas.

Main tasks attributed: WP1: (i) Statistical and process-model analyses of contemporary oceanographic data (AARI IPY expeditions) in conjunction with historical data; (ii) Monitoring studies along the Eurasian continental margin and at manned drifting stations, including mooring deployments. WP2: (i) Estimation of navigation efficiency on along the Northern Seas Route during XX and beginning of the XXI centuries up to 2010 (terms if the non-icebreaking navigation); (ii) Analyses of variability of sea-ice conditions in the areas those are difficult for navigation during XX and beginning of the XXI centuries.

Previous experience relevant to those tasks: The project members have a long-standing research experience in the study of climatic changes in the Arctic. They participated in several international projects such as Greenland Sea (1990-1996), ACSYS (1994-2003), INSROP, ARCDEV, NABOS (2002-2009), DAMOCLES (2005-2009), and in international scientific endeavours during the International Polar Year (2007-2009). Within the recent 5 years project participants published about 80 scientific papers including 3 scientific monographs. Their scientific results are permanently presented at the world wide International conferences related to their research area.

Short profile of the staff members who will be undertaking the work:

Dr. I. Ashik is the leader of the AARI team, head of the oceanography department. Scientific expertise: oceanographic regime of the Arctic Ocean, ocean currents, level variations in the Arctic seas, numerical modelling of ice and ocean, development of forecast methods of currents ice drift and sea level variation

Dr. V. Sokolov is the head of the AARI Arctic expeditions. Scientific expertise: oceanographic regime of the Arctic Ocean, logistical support of research studies in the Arctic Ocean, including manned drifting stations, mooring operations

Dr. S. Pryamikov is the head of the AARI international office. Scientific expertise: water masses in the Arctic Ocean, international cooperation in science and logistics

Dr. L. Timokhov is the main research scientist. Scientific expertise: oceanographic regime of the Arctic Ocean, water masses, ocean currents, statistical data analysis of ice and ocean, climate variability

Dr. B. Ivanov is the head of Ocean-air interaction laboratory. Scientific expertise: energy and mass exchange at the ocean-ice-air interface, dynamics of boundary layers in the ocean and atmosphere

Prof., Dr. Z. Gudkovich – leading research scientist in the AARI. Scientific expertise: ice cover dynamic, ice forecasts, climate variability.

Dr. V. Karklin – leading research scientist in the AARI. Scientific expertise: external influences on the hydrometeorological conditions, ice forecasts, climate variability.

Dr. S. Frolov – leader of the Ice navigation laboratory Scientific sea ice cover as a navigational environment, modelling the vessel's motion in the sea ice, informational support of the navigation in the Arctic Seas and the Arctic Basin.

P.20. The Economic and Social Research Institute (ESRI)

The Economic and Social Research Institute (ESRI) was founded in 1960. ESRI research has made a vital contribution to the Irish national debate on economic and social issues, including environment and energy, over the past 40 years. The ESRI enjoys full academic independence and has a statutory obligation to publish all research results. The fundamental aim of the ESRI is to bring the latest thinking in economics and the social sciences to the actual and potential problems of Irish society. The ESRI's goals are academic excellence, objectivity, relevance to policy, and widespread dissemination of results. The Standing Committee for the Social Sciences of the European Science Foundation, in its submission to the European Commission on future policy towards the European Research Area, cites the ESRI as one of *six* "internationally renowned centres for advanced research in the social sciences" in Europe. The ESRI is widely recognised as the foremost research institute in applied economics in Ireland, and indeed economics in general (Ruane and Tol, 2007, *Economic and Social Review* **38**). IDEAS/RePEc includes the ESRI in its Top 20 Economic Think Tanks in the world. The ESRI's publications are widely cited by policy makers.

Main tasks attributed: Socio-economic aspects of Arctic Transport and Tourism, Socio-economic costs and benefits of Arctic Transport (or Shipping), Socio-economic developments of Arctic Tourism

Previous experience relevant to those tasks: As demonstrated by the publication list below, the ESRI has a long-standing experience with the methods required for the tasks (scenarios, meta-analysis, and partial and general equilibrium analysis) and with the fields of application (socio-economic impacts of climate change, international trade, transport, tourism).

Short profile of the staff members who will be undertaking the work:

Richard S.J. Tol is a Research Professor at the Economic and Social Research Institute, Dublin; and the Professor of the Economics of Climate Change, Institute for Environmental Studies and Department of Spatial Economics, Vrije Universiteit, Amsterdam, the Netherlands. Formerly, he was the Michael Otto Professor of Sustainability and Global Change at Hamburg University and an Adjunct Professor, Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA, USA. He received an M.Sc. in econometrics (1992) and a Ph.D. in economics (1997) from the Vrije Universiteit Amsterdam. He has had visiting appointments at the Canadian Centre for Climate Research, University of Victoria, British Colombia, and the Centre for Social and Economic Research on the Global Environment, University College London, and the Princeton Environmental Institute and the Department of Economics, Princeton University. He is ranked among the top 200 economists in the world, and has 162 publications in learned journals (with 108 co-authors), 3 books, 5 major reports, 37 book chapters, and many minor publications. He specialises in the economics of energy, environment, and climate, and is interested in integrated assessment modelling. He is an editor for *Energy Economics*, and an associate editor of *Economics*. He is advisor and referee of national and international policy and research. He is an author (contributing, lead, principal and convening) of Working Groups I, II and III of the Intergovernmental Panel on Climate Change, shared winner of the Nobel Peace Prize for 2007; an author and editor of the UNEP Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies; and a GTAP Research Fellow. He is actively involved in the European Climate Forum, the European Forum on Integrated Environmental Assessment, and the Energy Modeling Forum.

Relevant publications:

Berrittella, M., A. Bigano, R. Roson and R.S.J. Tol (2006), 'A General Equilibrium Analysis of Climate Change Impacts on Tourism', *Tourism Management*, **27** (5), 913-924.

Bigano, A., J.M. Hamilton and R.S.J. Tol (2006), 'The Impact of Climate on Holiday Destination Choice', *Climatic Change*, **76** (3-4), 389-406.

Bigano, A., J.M. Hamilton, M.A. Lau, R.S.J. Tol and Y. Zhou (2007), 'A Global Database of Domestic and International Tourist Numbers at National and Subnational Level', *International Journal of Tourism Research*, **9**, 147-174.

Hamilton, J.M., D.J. Maddison and R.S.J. Tol (2005), 'The Effects of Climate Change on International Tourism', *Climate Research*, **29**, 255-268.

Hamilton, J.M. and R.S.J. Tol (2007), 'The Impact of Climate Change on Tourism in Germany, the UK, and Ireland: A Simulation Study', *Regional Environmental Change*, **7** (3), 161-172.

Kuik, O.J., L. Brander and R.S.J. Tol (2009), 'Marginal Abatement Costs of Greenhouse Gas Emissions: A Meta-Analysis', *Energy Policy*, **37** (4), 1395-1403.

Link, P.M. and R.S.J. Tol (2009), 'Economic Impacts on Key Barents Sea Fisheries Arising from Changes in the Strenght of the Atlantic Thermohaline Circulation', *Global Environmental Change*, **19**, 422-433.

The ESRI has considerable experience with modelling transport (Commins and Nolan, forthcoming; Hennessy and Tol, forthcoming; Nolan, 2010) and international trade (Berrittella et al. 2008; Bosello et al. 2007; Morgenroth, 2009).

Berrittella, M., K. Rehdanz, R.S.J. Tol and J. Zhang (2008), 'The Impact of Trade Liberalisation on Water Use: A Computable General Equilibrium Analysis', /Journal of Economic Integration/, *23* (3), 631-655.
Bosello, F., R. Roson and R.S.J. Tol (2007), 'Economy-wide Estimates of the Implications of Climate Change: Sea Level Rise', /Environmental and Resource Economics/, *37*, 549-571.
Commins, N. and A. Nolan (forthcoming), The Determinants of Mode of Transport to Work in the Greater Dublin Area, Transport Policy
Hennessy, H. and R.S.J. Tol (forthcoming), 'The Impact of Climate Policy on Private Car Ownership in Ireland', Energy Policy.
Morgenroth, E.L.W. (2009), A Gravity Model Approach to Estimating the Expected Volume of North/South Trade, InterTradeIreland, Newry.
Nolan, A. (2010), A Dynamic Analysis of Household Car Ownership <http://www.esri.ie/publications/search_for_a_publication/search_results/view/index.xml?id=3039>,Transportation Research Part A: Policy and Practice, 44 (6), 446-445

P.21. Arctic Centre, University of Lapland (UoL)

The **Arctic Centre** is Finland's national institute for Arctic expertise. The multidisciplinary research centre is based at the University of Lapland. The researcher team (around 40 scientists) working at the Arctic Centre, combine perspectives from natural and social sciences in order to understand societal and environmental changes in the Northern regions. The research also contributes to Finland's arctic policy with the goal of a sustainable future. Research focuses on three main themes: Sustainable development, global change and environmental and minority laws.

Presentation of the department: The **sustainable development research group** draws on perspectives from social sciences in order to address international environmental politics, human dimensions of climate change, community adaptation and vulnerability to climatic and social changes as well as social impact assessments of industrial developments. The regionally oriented research also focuses on the national and regional relevance of climate change, the concept of the North in politics, economics and culture, indigenous and local knowledge and mobility and viability in industrial, northern communities. The group participates in three IPY, pan-Arctic initiatives: DAMOCLES (Developing Arctic Modelling and Observing Capabilities for Long-term Environmental Studies), CAVIAR (Community Adaptation and Vulnerability in Arctic Region), and BOREAS: Histories from the North, Environments, Movements, and Narratives.

Task attributed: In WP3 : assess past, present and potential implications of climate variability for the fisheries. Within the context of vulnerability we will evaluate where impacts on fishery have greatest social and economic significance. The consideration of societal and cultural components in responses to changes that are associated with climate change can greatly contribute to understanding of existing discourses in the fishery management and governance, and factors encouraging development of planning frameworks in the fishery. This study can serve the theoretical thoughts about possible ways of coupling the global to the national and regional, and ways of integrating models of biogeophysical systems with those of social systems.

Previous relevant experiences: In 2006 – 2007. Research on human dimension of climate change: Coastal fishery of the Barents region. (Case studies: Kola Peninsula, Murmansk region, Russia and Finnmark, Northern Norway, DAMOCLES ((Developing Arctic Modelling and Observing Capabilities for Long-term Environmental Studies). In 2007 – 2010: Research on community vulnerability and adaptation to climate change (Case studies: Nenets Autonomous District (North West Russia) and Republic of Sakha Yakutia (North East Siberia, Russia), CAVIAR (Community Adaptation and Vulnerability in the Arctic regions)

Anna Stammler-Gossmann

- 1995 - PhD. social anthropology, University of Cologne (Germany)
- 1995 – 2003 Research projects: Social, economic and political processes in the Russian North, Institute for East European Studies, University of Cologne, Germany
- 2004 – 2005 December – June. Visiting scholar, Research: Indigenous studies, Scott Polar Research Institute, Cambridge, UK
- 2009, January – July. Visiting scholar, Research: Community adaptation and vulnerability studies, Tohoku University, Japan
- 2005 – 2010 Research projects: sustainable development in the North, climate change and northern communities; fishery and climate change, Arctic Centre, University of Lapland, Finland

Publications:

2007. The challenge of human dimensions in climate change research. Polar environment and climate: The challenges. European research in the context of the International Polar Year. Cardinal, D., Lipiatou, E. (eds.) Brussels: EU, pp. 154-156

2010 (forthcoming). Book chapter 'Translating' vulnerability and adaptation at the community level in the Russian North. Hovelsrud, G.K., Smit, B. (eds.) Community adaptation and vulnerability in the Arctic region.

2010 (forthcoming). Coastal economies and climate change in the Barents region (Case studies: Northern Norway and North West Russia) Arctic & Antarctic International Journal of Circumpolar Sociocultural Issues 5.

P.22 SINTEF Fiskeri og havbruk (SINTEF F&H)

SINTEF is a multidisciplinary organisation that finds intelligent, profitable solutions for the public and private sectors' needs based on research and development in technology, the natural sciences, medicine and the social sciences. The SINTEF Group is structured into six strategic areas and is Scandinavia's largest independent research organisation. There are about 1800 employees of whom around 85% are R&D personnel.

SINTEF collaborates closely with the Norwegian University of Science and Technology (NTNU) and the University of Oslo (University of Oslo). Personnel from NTNU work on SINTEF projects, while SINTEF staff teaches at NTNU. The SINTEF-NTNU community involves the widespread joint use of laboratories and equipment. A similar program of cooperation is being developed with the Faculty of Mathematics and Natural Sciences at the University of Oslo.

SINTEF Fiskeri og Havbruk AS (SINTEF FH) is one of the institutes in SINTEF. SFH is owned by SINTEF by 97% and is a part of the strategic area **SINTEF Marine**. The institute comprises five main research sections in the fields of Processing Technology, Fisheries Technology, Aquaculture Technology, Marine Resource Technology and International Projects & Consulting. SFH possesses a wide range of expertise and know how in exploiting renewable marine resources. As we enter 2010 there are about 115 employees and the turnover in 2008 was NOK 117 million. SFH has participated in many European Framework Programs both in FP5, FP6 (e.g. ICOS, TASC, OMEX, BASIS, BALANCE) and FP7 (ATP).

Main task attributed : Contributor to WP 3 and WP 4. Carry out environmental modeling to be in Fisheries economic models and oil effect models

Experience relevant to above tasks: SFH has long experience in development and use of 3D coupled numerical hydrodynamic and biological models through projects funded by EU and the Norwegian Research Council. Most of the projects have been in connection with the Arctic.

Short profile of the staff members
Dag Slagstad is a Chief Scientist with long experience in developing 3D coupled models of hydrodynamic-ice-marine ecology. The focus has especially been on Barents Sea region.
Ingrid Ellingsen is a Scientist which is experienced in running and development of 3D coupled models.

Relevant publications
Ellingsen, I.H., Slagstad, D., & Sundfjord, A. (2009) Modification of water masses in the Barents Sea and its coupling to ice dynamics: a model study. *Ocean Dynamics*. DOI 10.1007/s10236-009-0230-5.
Ellingsen, I.H., Dalpadado, P., **Slagstad, D.**, & Loeng, H. (2008) Impact of climatic change on the biological production in the Barents Sea. *Climatic Change*, 87, 155-175.
Slagstad, D. & McClimans, T. A. (2005). Modeling the ecosystem dynamics of the Barents Sea including the marginal ice zone: I. Physical and chemical oceanography. *Journal of Marine Systems*, *58* (1-2), 1-18.
Slagstad, D. & Tande, K. (2007). Structure and resilience of overwintering habitats of *Calanus finmarchicus* in the Eastern Norwegian Sea. *Deep-Sea Research II*, *54*, 2702-2715.
Wassmann, P., **Slagstad, D**., Riser, C. W. & Reigstad, M. (2006). Modelling the ecosystem dynamics of the Barents Sea including the marginal ice zone: II. Carbon flux and interannual variability. *Journal of Marine Systems*, *59* (1-2), 1-24.
Slagstad, D. & Wassmann, P. (2001). Modelling the 3-D carbon flux across the Iberian margin during the upwelling season in 1998. *Progress in Oceanography*, *51* (2-4), 467-497.

P.23 Center for International Climate and Environmental Research - (CICERO)

CICERO is a research institution affiliated with the University of Oslo. CICERO participates in a broad network of research communities and decision- makers, both nationally and internationally. With expertise in both the natural and the social sciences, it conducts interdisciplinary research on a wide range of environmental issues. CICERO's five main areas of research are (1) Atmospheric and climatic effects of emissions and emissions reductions (2) Impacts on human health and environment of air pollution, (3) Impacts of climate change: vulnerability, adaptation and costs, (4) Climate agreements: design, implementation and costs, and (5) Climate policy: Instruments for national implementation. EU projects in which CICERO has participated include METRIC, APMoSPHERE, ENSEMBLES, DAMOCLES, ADAM and MOSUS. Recent projects that focus on the transport sector are the EU FP6 SSA ATTICA and IP QUANTIFY. CICERO also leads or participates in several projects with national funding.

Tasks attributed: Calculation of chemical and climate responses due to new activities in the Arctic.

Previous experience relevant to those tasks: M. Isaksen was responsible (together with Veronica Eyring, 2009, Atm. Environment) for writing the assessment report on composition and climate impact of ship emissions in the Attica project, with broad coverage of both climate and air quality impact. Furthermore, he was the WP leader in the QUANTIFY project on global scale impact of the transport sector (ACP paper on comparison of the impact of from different subsectors includin ship traffic, Hoor et al, 2009). He was also the WP leader of the network project ACCENT on global chemical modeling, and main author of the climate-chemistry assessment article (Atm. Environment; Isaksen et al., 2009) with ship traffic as one focal point. WP leader on Norwegian project on impact of ship emissions at northern latitudes, focus on air quality and RF.

Prof. Ivar S.A. Isaksen is professor in meteorology at the University of Oslo. He has 30 years of experience in research and teaching in atmospheric sciences. He has published more than 120 peer reviewed papers. Research emphasis is on modelling of ozone depletion, changes in greenhouse gas concentrations and the impact of man made emissions of pollutants on regional and global scales. He has coordinated several EU projects dealing with the impact of aircraft emissions, and is currently participating in the projects QUANTIFY, ECATS and ATTICA dealing with studies and assessments of aircraft emissions. He has been lead author of IPCC climate and WMO/UNEP ozone assessments. He is currently president of the International Ozone Commision (IO3C). He has obtained the National Oceanographic and Administration (NOAA) Award for outstanding scientific achievement and the Norwegian Ministry of Environment award for Environmental Research**.**

Dr. Jan Sigurd Fuglestvedt is a research director at CICERO. He holds a PhD degree in atmospheric chemistry. He has published more than 30 peer reviewed papers, and participated in several EU projects including QUANTIFY and ATTICA. His main research activities have been in numerical modelling of atmospheric chemistry and aerosol processes. He has also been extensively involved in development of metrics for comparing emissions of different climate agents**.**

Dr. Gunnar Myhre is a senior research fellow at CICERO with a PhD in meteorology from the University of Oslo. His major research areas include atmospheric radiative transfer and radiative forcing of climate change. He has been a lead author of the chapter on radiative forcing in the IPCC TAR and lead author for the chapter on atmospheric constituents and radiative forcing in IPCC AR4. Dr. Myhre is author of more than 75 peer-reviewed scientific papers.

Dr. Stig B. Dalsøren is a senior research fellow at CICERO. He holds a PhD degree in meteorology. He has published 10 peer reviewed papers, and participated in the EU projects POET, RETRO and HYMN. His main research activities have been in numerical modeling of pollution and chemical active greenhouse gases like methane and ozone. The main topics have been changes in oxidation capacity, effects from emissions in the transport sector and emission changes in Asia.

Relevant publications

Isaksen, I. S. A., C. Granier, G. Myhre, T. Berntsen, S. B. Dalsøren, M. Gauss, Z. Klimont, R. Benestad, and 23 others, 2009. Atmospheric Composition Change: Climate-Chemistry interaction. *Atmospheric Environment*, 43 (33): pp. 5138-5192.

Fuglestvedt, J. S., K. P. Shine, J. Cook, T. Berntsen, D. Lee, A. Stenke, R. B. Skeie, G. Velders and I. Waitz, 2009. Transport Impacts on Atmosphere and Climate: Metrics. *Atmospheric Environment*

Berntsen, T. and **J. S. Fuglestvedt**, 2008. Global temperature responses to current emissions from the transport sectors. *Proceedings of the National Academy of Sciences (PNAS)*, 105 (49): 19154-19159.

Myhre, G., 2009. Consistency between satellite-derived and modelled estimates of the direct aerosol effect. *Science*, 325: pp. 187-190.

P.24. Stiftelsen SINTEF, (SINTEF)

SINTEF is a private, non-profit research foundation with headquarters in Trondheim, Norway and a secondary office in Oslo. With 2200 employees, SINTEF is the largest independent research organisation in Scandinavia, and one of the largest in Europe. SINTEF seeks intelligent solutions for public and private sector needs based on research and development in technology, medicine, and the natural and social sciences. **SINTEF** collaborates closely with the Norwegian University of Science and Technology (NTNU) and the University of Oslo (University of Oslo). Personnel from NTNU work on SINTEF projects, while SINTEF staff teaches at NTNU. The SINTEF-NTNU community involves the widespread joint use of laboratories and equipment.

SINTEF Marine Environmental Technology (SINTEF MET) is a division in the Materials and Chemistry Institute in **SINTEF**. The division is a national and international leader in research and development related to oil spill fates, effects, response, weathering of oil at sea, and numerical simulation tools for oil spill decision support. **SINTEF** has just completed a 3-year, 7 million Euro R&D Joint Industry Program focussed on response to oil spills in Arctic conditions. A related 6-year on-going program focuses on the behaviour, biological effects, and development of response strategies for oil spills in coastal Arctic environments.

SINTEF has participated in several European Framework Programs, including ARCOP (Arctic Operations Platform) and SPREEX (Spill Response Experience and Research for Preparedness)

Main task attributed : Contributor to WP 4. Carry out environmental environmental risk analysis for potential releases of oil in Arctic conditions.

Experience relevant to above tasks

MET has long experience in development and use of 3D coupled numerical hydrodynamic and biological models through projects funded by industry, the EU and the Norwegian Research Council. Many of the projects have been in connection with the Arctic.

Short profile of the staff members

Dr. Mark Reed is a Senior Scientist and Research Manager with over 30 years' experience in development of software for decision support in oil spill fates, effects, environmental risk and response strategy analyses.

Per Daling, Ivar Singsaas, and Per-Johan Brandvik are Senior Scientists specializing in hydrocarbon chemistry, fate and behavior related to marine oil spills at sea and ice-covered water. They have been responsible for development of a protocol for laboratory weathering to simulate weathering of spilled oil at sea This protocol is now internationally recognized and widely adopted. They have also been involved in testing and development of oil spill response countermeasures for use in Arctic and ice-covered area including mechanical recovery, oil spill dispersants and *in-situ* burning

Relevant publications

Singsaas, I., Rye, H., Frost, T, Smit, Garpestad, Bakke,Veiga, Buffagni, Follum, Johnsen, Moltu, Reed, 2008. Development of a Risk-Based Environmental Management Tool for Drilling Discharges. Summary of a Four-Year Project. SETAC Integrated Environmental Assessment and Management — Volume 4, Number 2—pp. 171–176.

Reed, M. and J. Price, Guest Editors. (2006). Selected Papers from the 2004 International Marine Environmental Modeling Seminar, Washington, DC. Estuarine Coastal and Shelf Science, Elsevier. Vol 70, Issue 4, pp 523-710.

Reed, M., M. H. Emilsen, B. Hetland, Ø. Johansen, S. Buffington and B. Høverstad (2006). Numerical model for estimation of pipeline oil spill volumes. Environmental Modelling & Software. Volume 21, "Progress in Marine Environmental Modelling", Issue 2, Pages 178-189

Reed, M., Guest Editor (2006). Selected papers from the Sixth International Marine Environmental Modelling Seminar (IMEMS 2002). Environmental Modelling and Software, Elsevier. Volume 21, "Progress in Marine Environmental Modelling", Issue 2, Pages 135-282

Price, J. M., **M. Reed,** M. Howard, W. Johnsen, Z. Ji, C. Marshall, N. Guinasso, G. Rainey, 2006. Preliminary Assessment of an Oil Spill Trajectory Model Using Satellite-tracked Oil Spill Simulating Drifters. Environmental Modelling and Software, Elsevier. Volume 21, "Progress in Marine Environmental Modelling", Issue 2, Pages 258-270.

Reed, M., **P. S. Daling**, A. Lewis, M. K. Ditlevsen, B. Brørs , J. Clark , D. Aurand, 2004. Modelling of dispersant application to oil spills in shallow coastal waters. Environmental Modelling and Software. Elsevier. 19 (7-8): 681 – 690.

Reed,M., and R. LaBelle, 2004. Guest Editors. Environmental Modelling and Software, Special Issue. Selected Papers from the 2001 International Marine Environmental Modelling Seminar. Vol 19, Nr. 7-8, 2004.

P.25. Institute of Energy Economics (EWI)

The Institute of Energy Economics at the University of Cologne (EWI) carries out education, research and consultancy activities in all areas of energy economics and energy policy. The institute is affiliated to the University of Cologne. The institute's research and consulting activities include sector specific energy industry studies, modelling of European as well as global energy markets, institutional and regulatory issues, outlooks of short, medium- and long-term price development, integration of energy markets in the EU and energy-environment interactions. EWI also maintains versatile, complex models designed for quantitative analysis of problems relating to energy policy and environmental policyService in ACCESS: Within ACCESS' WP4, EWI will provide irreplaceable model support regarding the diffusion of market shocks from newly introduced Arctic natural gas into European and world markets. EWI's global natural gas market model MAGELAN will be used to calculate various quantitative scenarios for the additional supply of Arctic gas and the impact on global gas flows including consequences for other gas producing regions as well as selected downstream markets (development of shares in the global gas market, shift of trade flows). MAGELAN is one of the few existing models that represent all relevant production and consumption nodes of natural gas as well as the relevant transport routes, including both pipeline based transport and LNG transport.

Short profile of the staff members who will be undertaking the work:

PD Dr. Dietmar Lindenberger is a lecturer of Energy Economics at the University of Cologne and Director Applied Research of the Institute of Energy Economics at the University of Cologne (EWI). He has more than 15 years of experience in research and consulting for private and public entities, including the European Commission, State- and Federal level ministries in Germany, national and international utilities, various international research institutions and other public clients as well as industry associations. Dr. Lindenberger holds a PhD in Economics from the University of Karlsruhe.

PD Dr. Christian Growitsch is a lecturer of Energy Economics at the University of Cologne and Director Applied Research of the Institute of Energy Economics at the University of Cologne (EWI). He has several years of experience in research and consulting for public and private entities, amongst others as senior economist at Halle Institute for Economic Research and Head of Department at WIK Institute. His fields of research and consulting are focused on Economics of energy markets and regulation, applied industrial organisation and econometrics.

Stefan Lochner is a research associate and senior consultant at EWI. He works as a gas market expert and has performed consulting projects for a wide range of clients in several European countries, including ERGEG, Électricité de France (EdF), RWE, Essent and others. These projects usually focused around model-based analyses of the European gas infrastructure and the development of global natural gas supply. He holds a degree in Economics from the University of Warwick (UK) and Dresden University of Technology (Germany).

Jan Richter is a research associate and consultant at EWI. He studied mathematics and economics at the University of Münster (Germany). His field of interest is modelling energy markets where he focusses on natural gas and electricity. He has conducted several studies for industry partners as well as NGOs and the German government.

Relevant recent publications:

-Lochner, S. and J. Richter (2010): The impact of Recent Gas Market Development on Long-Term Projections for Global Gas Supply. Zeitschrift für Energiewirtschaft, 34 (1), pp. 61-69.

- Lochner, S. and D. Bothe (2009): The development of natural gas supply costs to Europe, the US and Japan in a globalizing gas market - Model-based analysis until 2030. Energy Policy, 37 (4) pp. 1518-1528.

- Seeliger, A. (2006): Development of Global Gas Supply until 2030: A model-based Projection of Global Production, Transport and International Trade as well as an Analysis of Import Costs of Selected Countries. (Diss.)

P.26 Le Cercle Polaire (LCP)

Le Cercle Polaire (LCP) is a non-profit-making organisation (loi de 1901) registered "intérêt général" whose activites are devoted to spreading scientific knowledge and improving governance of the polar regions, the Arctic and the Antarctic. LCP's activities are carried out with or under the control of an international and multidisciplinary Scientific Committee (www.lecerclepolaire.com). LCP runs a quaterly review of scientific vulgarisation on polar regions called "Pôles Nord & Sud" and organises an annual international seminar on the polar regions. Since 2007, LCP has been leading a "Working group on arctic governance" which includes academics and experts from France, Greenland, Canada... In 2008, LCP was scientific advisor toeurodeputy Michel Rocard, for the writing of the Arctic governance resolution (October, 9th, 2008).

Main Tasks attributed: **task 5.1**: Overview and assessment of regulatory instruments, framed on UNCLOS, but taken so as to include all relevant binding and non-binding agreements, at various levels, as well as international multilateral and national practice and law. Particular focus will be brought to the ACCESS sectors analysed in WPs 2, 3 and 4, and include an overview of and success of compliance with extant regulatory frameworks of Arctic Ocean users; **task 5.1.2** (Fisheries - a Summary of extant legislation as it applies to a wide range of fisheries issues, including increased access for fishing vessels, increased potential for aquaculture, and Management of Marine Preservation Areas (MPAs)) and **task 5.6**: Identification of ways and means to ensure full participation of indigenous peoples in the consideration and development of governance solutions affecting their way of living and their economic conditions and interests

Short profile of the staff involved:
Laurent Mayet is founding-president of the NGO le Cercle Polaire (LCP). Senior lecturer in International Relations at Sciences Po Paris University, he is also Consultant on arctic affairs at the geopolitics forecasting Department, Ministry of foreign affairs of France. He was the chair of the "Arctic governance working group"which included academics from France, Grenland, Canada.. and which lead to the draft of the "Arctic governance resolution" voted by the european deputies on October, 9th, 2008. He is currently a special advisor to Michel Rocard, Ambassador of France in charge of the international negotiations on polar regions, the Arctic and the Antarctic.
Michèle Therrien is a specialist in Inuit ethno-linguistics. She is in charge of teaching the Inuit language and culture at the Paris National Institute of Oriental Languages and Civilisations (INALCO). This charismatic professor has trained many students following the precept that the Inuit language and culture cannot be dissociated. She became an honorary member of the NGO Le Cercle Polaire in 2007.
Anne Choquet teaches law at the University of Western Brittany (Brest, France). Having written a doctoral thesis on the protection of the environment in Antarctica, she has been participating in the Antarctic Treaty Consultative Meetings within the French delegation since 2001. As legal advisor to NGO Le Cercle Polaire, she has prepared a draft Arctic Treaty. She is currently an associate researcher of CEDEM-AMURE working on Arctic governance.
Boris Chichlo is a major expert in Siberian issues. Holder of a doctorate in ethnography from the University of Leningrad, his first field trips were in the 'forbidden zones' of the Yakutia and Chukotka (1971-1976) to study the fate of minorities in the Soviet Arctic. Doctor of the Sorbonne, he is pursues in France his research into the transformation of indigenous societies in the Siberian Arctic at France's National Centre for Scientific Research.
Henriette Rasmussen is a well-known political figure in Greenland. A municipal councillor in Nuuk, she has served as minister in two governments (1991-1995, 2003-2005) and was an early supporter of the rights of women and indigenous peoples. She participated in the creation of the United Nations Permanent Forum on Indigenous Issues. She works as a radio journalist and is an honorary member of le Cercle Polaire.
Pierre Taverniers is a meteorologist at Météo France and a graduate of the Paris Institute of Oriental Languages and Civilisations (INALCO), where he majored in Canadian Arctic language and culture. He has been studying the impact of global warming on the Inuit of Greenland and Nunavut for 20 years. A member of International Polar Year's Sea Ice Knowledge and Use (SIKU) programme, he is also a scientific expert of NGO Le Cercle Polaire.

Alain A. Grenier teaches at the Université du Québec in Montréal. He completed his PhD at the University of Lapland in Rovaniemi, Finland. His work focuses on the contradictory relations between humans and nature. He has spent the last twenty years travelling in the Arctic and Antarctica. He has written several articles and books on polar tourism

P.27 Beluga Shipping GmBH (Beluga)

Wind energy, power, oil and gas, infrastructure – those are the core business areas for project and heavy lift carrier Beluga Shipping GmbH. The innovative transportation specialist, based in Bremen (Germany) at the banks of River Weser, is the world market leader in the niche segment project and heavy lift shipments according to the Institute of Shipping Economics and Logistics. A state-of-the-art fleet comprising about 70 powerful multipurpose heavy lift project carriers with up to 1400 tons crane capacities, 1500 professional seafarers, an international network of 14 affiliates around the globe, plus more than 500 highly qualified specialists in departments such as chartering, fleet management, technical engineering or research and innovation to the administrative rear cover frame Beluga Shipping.

Main tasks attributed: Beluga Shipping Company will correlate the user requirements in Arctic Shipping with the relevant research tasks and results of WP2. The work will mainly concentrate on the following issues in view of a shipping company:
a) Comments on the various research tasks in WP2 with the option for possible suggestions for modifications
b) Consultation during the execution of the research work in WP2 by a potential user
c) Evaluation of the research results considering environmental protection, navigation, infrastructure, safety and economy of Arctic Shipping in view of a Shipping Company
d) Cooperation with the WP2-Leader and Co-Leader in identifying governance related issues of Arctic Shipping to be used in WP5

Previous experience relevant to those tasks: It was only recently when in September 2009 Beluga Shipping wrote some chapters of World Trade History as a pioneer when the multipurpose heavy lift project carriers MV "Beluga Fraternity" and MV "Beluga Foresight" fully transited the legendary Northern Sea Route from Asia to Europe for commercial purposes. This innovative route – subject to weather situation and approval – now is among the tramp shipping routes Beluga Shipping tries to sail regularly. The short cut through the Arctic Ocean not only resulted in saving a distance of some 3000 nautical miles and reducing the voyage time by about ten days. The direct water connection between Asia and Europe – in comparison to the traditional way round south through the Suez Canal – consequently leads to reduced bunker consumption of some hundred tons, meaning significantly fewer costs and simultaneously less environmentally harmful emissions.
Beluga is involved in several national and international projects:
WINTECC: Demonstration of an innovative wind propulsion system for cargo ships
EU project started 01.01.2006, ends 31.12.2009
SEMICS: Development of an electronic information and communication system for data transfer on cargo ships
national project, started 01.09.2008
HAI-TECH: Low-resistance coatings for ship hulls based on the shark skin effect
national project, started 01.09.2008
SatMeS: Satellite supported ocean current analysis for the optimisation of sea routes and fuel savings on ships
funded by the EU/Bremen's Support Program for Applied Environmental Research, started 01.02.2009

Short profile of the staff members who will be undertaking the work:
Dr. Ralf Wöstmann is head of the department "Research & Innovation" at Beluga Shipping GmbH and managing director of the maritime research centre in Elsfleth.
Ralf Wöstmann studied marine environmental sciences at the University of Oldenburg. During his studies he already followed his strong interests, the marine and environmental chemistry. He wrote his thesis and PhD dissertation on marine chemistry.
As a scientist in the field of marine environmental chemistry Ralf Wöstmann worked in a lot of research projects.

B2.3 Consortium as a whole

The ACCESS consortium is composed of 27 partners coming from 8 member states of the European Union: Germany, Norway, United Kingdom, France, Finland, Sweden, Ireland and Spain, as well as the Russian Federation.
11 partners are covering the climate changes activities in the Arctic (ACCESS WP1). Most of them were partners of the Damocles EU project. 15 partners out of 27 are participating to ACCESS WP2 (marine transportation) including 9 partners from the climate group (WP1) and 6 partners specialized in marine transportation. WP3 (fisheries) is composed of 6 partners distributed over 5 different European countries: Nofima and Sintef in Norway, Beijer in Sweden, University of Lapland in Finland, University of Catalonia in Spain and ESRI in Ireland. The peculiarity of WP3 (in contrast with WP2 and WP4) is that there is no WP1 partners listed in WP3 but there are the same number of thematic partners involved in WP3 as in WP2 (6 partners). Of course all the necessary information regarding climate change in the Arctic as far as fisheries are concerned will be provided by WP1 to WP3 as well as for all the other ACCESS WPs. WP4 is composed of 16 partners (very similar to WP2) including 8 partners from WP1 and 8 partners from WP1. WP5 (Arctic Governance) is mainly composed of 5 major partners (NERC, Beijer, UCAM, LCP and UPMC) and 7 additional partners. WP6 (communication) is covered by 6 partners with a major role plaid by the ACCESS coordinator (UPMC). WP7 is dedicated to the management and WP8 to the scientific coordination spread over 10 partners + the ACCESS coordinator. The number of PM varies from 360 PM for WP1 to about 250 PM for both WP2 and WP4, down to 150 PM for WP3 and WP5. WP6 (communication) is equal to 65 PM, WP7 (management) is equal to 18 PM and WP8 (scientific coordination) is equal to 32 PM.The consortium has been chosen as to best cover the enormous spectrum of competence required for answering the call on 'Quantification of climate change impacts on economic sectors in the Arctic'.
It encompasses expertise on economy, governance, marine transportation, oil and gas extraction, fisheries, socio-economy and tourism, plus a number of environmental and climate science disciplines (glaciology, forecasting, atmosphere physics and chemistry, oceanography).
The respective partners do not only represent key players in these fields of expertise, but also have a long-standing experience in EU projects as well as national and international projects. They have experience in the necessary application and development of methods to reach the objectives of the project.

A number of partners are renowned academic institutions including the UniversityPierre et Marie Curie with its three laboratories LOCEAN, LATMOS and LOV, the Natural Environment Research Council represented by National Oceanography Centre Southampton, the Kiel Institute for the World Economy, the University of Cambridge, the Alfred Wegener Institute for Polar and Marine Research, the research group Nofima Marin, the Norwegian Polar Institute, the Scottish Association for Marine Science,the Beijer Institute of Ecological Economics at the Royal Swedish Academy of Sciences, the Norwegian Meteoro logical Institute, the P.P. Shirshov Institute of Oceanology of the Russian Academy of Sciences, the Technical University of Catalonia, the Deutsches Zentrum fuer Luft- und Raumfahrt, the Arctic and Antarctic Research Institute, the Arctic Centre at the University of Lapland, SINTEF Fiskeri og havbruk, the Center for International Climate and Environmental Research, and the research foundation Stiftelsen SINTEF.

The consortium has six SME partners: FastOpt, HSVA, Impac, Joachim Schwarz, ESRI and OASys. These cover a broad range from software solutions for science and industry, ice technology (ships, structures), engineering and design for oil and gas industry, Shipping consultancy, advanced research in the social sciences, and high latitude ice-ocean science.
One of the partners is Le Cercle Polaire, an NGO dedicated to the polar regions.
The wide ranging expertise and integration of ACCESS partners is documented by the following tables listing ACCESS related projects.

I. Non -EU funded national and international projects and programmes

Project/Programme	Funded by/for	ACCESS partners	Comments
AMORA	Research Council of Norway	NPI, AWI	Norwegian-Chinese collaboration on sea ice physics related work. There are also partners in it from Germany, Finland and the USA
Arctic Marine Shipping Assessment (AMSA)	Arctic States	UCAM	Comprehensive assessment of current and future Arctic marine activity.
AOMIP (Arctic Model Intercomparion Project)	NSF	OaSys, AWI	An international project to intercompare and mprove Arctic ice and ocean models
ArcAct	Norway	CICERO	Dealing with with ship emissions
ArcOD, Arctic Ocean Diversity		NERC	An international collaborative effort to inventory biodiversity in the Arctic sea ice, water column and sea floor
BENN, Behavourial Economics and Nature Network		BEIJER	
BIOCLEAN		DLR	on particle emissions from shipping
Black carbon effects on Albedo		NPI	
BORAS : Histories from the North, Environments, Movement and Narratives		UoL	
CARIBIC, Civil Aircraft for the Regulation of the Atmosphere Based on an Instrument Container		DLR	CARIBIC is an innovative scientific project to study and monitor important chemical and physical processes in the Earth´s atmosphere. Detailed and extensive measurements are made during long distance flights.
CAVIAR, Community Adaptation and Vulnerability in Arctic region		UoL	
COMARGE, Continental Margin Ecosystems		NERC	International project
Cryosat-2	EU: ESA	SAMS	PI on Cryosat-2 data as well as participant in ESA's CalVal programme
European Climate Forum		ESRI	
European Forum on Integrated Environmental Assessment		ESRI	
FIMAGLOW, Fisheries Management under Global Warming	Nordic program	Nofima	Effects of climate change on fisheries in the arctic region of the Nordic countries
Fram Strait Ocean and Sea Ice Monitoring of the Norwegian Polar Institute		NPI	Longterm project
From the Deep to the Judgements of the Crowds, OCEAN 2.0	CANARIE, University of Victoria, Canada	UPC	
GEIA (Global Emissions Inventory Activity)		UPMC	
GEOENGENEERING	Germany	IfW	Assesses chances and risks of geoengeneering to influence global warming from an economics point of view.
GLOSS, Global Sea Level Observing System		AARI	
GODAR, Global data Archeology	2002-2004 and 2008-2010	SIO	
High-resolution community climate change simulations	Germany	AWI	
HIRLAM		met.no	
HYDRALAB I,II and III		HSVA	
IAGOS		DLR	
iAOOS	Research council of Norway.	NPI, met.no	IPY project
ICARTT		UPMC	
ICE: Inuit Climate Experiment	UK (NERC)	SAMS	Project to demonstrate the feasibility of. an operational system for measuring ice thickness that can be mounted on an Inuit sledges.
ICE-Fluxes (Center for ice, climate and ecosystem at the NPI).	Norway	NPI	Project dealing with the fluxes between atmosphere, sea ice and ocean in the Arctic.
IGAC-ITCT		UPMC	

IRO, ice routing optimization	BMWi (GER)	AWI, FastOpt, HSVA, J.Schwarz, OASys, Beluga	Arctic ice ship-routing optimization
ISO 19906 - Arctic Offshore Structures		IMPaC	Development of Regulation of Artic Offshore Structures
ISUP Integrated Systems for Underwater Production of Hydrocarbons	Germany	IMPaC	Development of certain major components for underwater production of hydrocarbons
JIP Oil in Ice	2006 - 2010	SINTEF	Joint industry R&D program on oil spill contingency for Arcti and Ice-covered waters
JIPCoastal Oil Spill	2007 - 2012	SINTEF	Joint industry R&D program to document possible consequences in case of oil spills close to the coast
Kashagan Field Development	Industry	IMPaC	Oil field development in the shallow waters of the North Caspian Sea.
MAR-ECO		NERC	International exploratory study of the animals inhabiting the northern mid-Atlantic.
MATRA (Maritime Transport system for the Arctic) WP5 Offshore Structures in Ice	Germany	IMPaC	Ice barriers and ice resistent exploration platforms
ML-CIRRUS		DLR	Field experiment on the aviation impact on cirrus
NABOS	2002-09	AARI	
NAMI	Norway	CICERO	dealing with climate/air quality processes in the Arctic
NEPTUNE & VENUS	University of Victoria, Canada	UPC	
NorClim	Research council of Norway.	NPI, met.no	Improvement of climate modelling, with the NorESM as the central GCM
PAICEX PanArctic Ice Experiment	Russia (2007-2010)	SIO	
POLARCAT	international	UPMC	On the study of long-range transport of pollutants to the Arctic
SAMPLE		DLR	On particle emissions from aviation
SATICE: Arctic Ocean Sea-ice and Ocean Circulation Changes Using Satellite Methods	EU: ESF	SAMS	SATICE will estimate spatio-temporal variations of ocean dynamic topography in the Arctic Ocean, ocean circulation, ocean tides, sea-ice freeboard heights, ice thickness and ice mass balance.
SEA ICE OUTLOOK	NSF (USA)	OASys	The SEARCH Sea Ice Outlook is an international effort to provide a community-wide summary of the expected September arctic sea ice minimum.
Social Cost of Carbon	US EPA	ESRI	Impact of climate change
STORM	Germany	AWI	
SWIPA, Sea, Water, Ice and Permafrost in the Arctic	Arctic Council 'Cryosphere Project' in Cooperation with IASC, CliC and IPY	NPI, UoL	The objectives of the project are to provide the Arctic Council with timely, up-to-date, and synthesized scientific knowledge about the present status, processes, trends, and future consequences of changes in Arctic sea ice, melting of the Greenland ice sheet, and changes in Arctic snow cover, permafrost, mountain glaciers and ice caps, and related hydrological conditions in the Arctic
The Energy Modeling Forum	internatinal	ESRI, IfW	
The Future Ocean	Germany	IfW	The Kiel Cluster of Excellence "Future Ocean" comprises researchers from a large variety of professions to jointly investigate climate and ocean change, to re-evaluate the opportunities and risks of global change for the oceans and develop a sustainable system of resource management of the world's oceans and marine resources.
WCRP, World Climate Research Programm of WMO	international	AARI, AWI, UPMC	

B.2.3.1 Sub-contracting

A/ Partner 1: Université Pierre et Marie Curie (UPMC)

RTD subcontracting

In WP1 - The subcontracting is mainly for rental and installation, from Kongsberg, of a multibeam sonar on a submarine; and rental and mobilisation, from WHOI, of an AUV for an ice camp experiment. These subcontracts are assigned to UPMC-LOV because UPMC-LOV will be in charge of the data processing and to conduct field work experiment. The breakdown of the costs is the following:

1.KONGSBERG MARITIME LTD, BRIDGE OF DON, ABERDEEN, UK: Quotation for an EM2040 rental for a submarine mission is £4750 per day, including technical services for fitting and demounting. Assume 28 day mission. Total is 146,300 euro.
2. WOODS HOLE OCEANOGRAPHIC INSTITUTION. Dr Hanumant SinghPartial cost of mobilization of Sea-Bat AUV for Arctic deployment. Total is 86,500 euro.

Total cost: 232,800€

In WP 5 and WP6 : The activities of Adele Airoldi (WP5) and Paul Berkman (WP6) will be funded by UPMC (123,650 € in total). Adele Airoldi and Paul Berkman will be providing advice and help mainly to WP5 and WP6, although, as detailed in the original description of work, their range of skills is such that they will be contributing to several of the work packages. They will work intensively for short periods, either from their base or by attending meetings with other relevant partners. Thus extensive travel is required, not just to specified ACCESS meetings, but also on an ad hoc basis, as required by exigencies of the project work (especially for Paul Berkman in the WP6 to attend the summer schools, workshops and conferences and frequent visits to paris for the newsletter). In the subcontract the approximate division of the resources allocated to these consultants will be specified, although the consultant will have to fund their own travel out of the total sum.
A copy of the contracts will be attached to the first Management report of ACCESS to the EC.

In WP5:
Adele Airoldi: During her career inside the Secretariat of the EU Council of Ministers (1981-2004), she worked on a variety of policy questions, including research, health and consumer protection. From 1984 to 2000, she worked for the Secretariat's Environment Directorate General as the official responsible for internal Community legislation in many specific subjects, as well as for EU participation in a number of international fora (Rio 1992, Montreal Protocol, CITES, the Climate Change Convention from the very beginning to the adoption of the Kyoto Protocol). She was seconded from the Council Secretariat for six weeks to assist the Danish Government and the Greenland Administration in the organisation of the 2002 Ilulissat Conference.
After her retirement in 2004, she has co-operated on an ad hoc basis with Greenland's Representation in Brussels (attending ACIA in 2004 and advising in the negotiations of the Community-Greenland partnership agreement in 2006) and with the Danish Polar Center (preparation of ICARP II in 2005).
In 2008, she wrote on commission by the Nordic Council of Ministers the report "The European Union and the Arctic – Policies and actions" , used as the background document for the Conference "Common concern for the Arctic" held in Ilulissat in September 2008.
For the purposes of the project, on the basis of her knowledge and experience, as well as of her continuing inside contacts with the EU system, including the European Parliament, she will concentrate on analyzing aspects of the emerging policy and governance Arctic state-changes with particular attention to the EU-Arctic interface.
UPMC the coordinator of ACCESS will greatly benefit from advices, knowledge and expertise of Adele Airoldi in sensitive fields of the Arctic Governance taking into account the actual European Union vision regarding these important issues.

Total cost : 43,650€ , which is equivalent to 8 months of work on the project (2 months per year for 4 years) at 4800 euros per month plus 5250 euros in European travel to attend meetings.

In WP6:
Paul Arthur Berkman is Head of the Arctic Ocean Geopolitics Programme at the University of Cambridge through the Scott Polar Research Institute and Judge Business School as well as a Research Professor at the University of California Santa Barbara through the Donald Bren School of Environmental Science & Management. He is an interdisciplinary oceanographer establishing connections between science, policy and

information technology to promote cooperation and prevent discord for good governance of the Arctic Ocean, Antarctica and international spaces more generally. Among his books are: Science into Policy: Global Lessons from Antarctica (Berkman, Academic Press, 2002); Environmental Security in the Arctic Ocean: Promoting Co-operation and Preventing Conflict (Berkman, RUSI, 2010); Science Diplomacy: Antarctica, Science and the Governance of International Spaces (Berkman et al., eds. Smithsonian Institution Scholarly Press, in press) and Environmental Security in the Arctic Ocean (Berkman and Vylegzhanin, eds. Springer, 2011). He has received the Antarctic Service Medal from the United States Congress; NASA Faculty Fellowship at the Jet Propulsion Laboratory, California Institute of Technology; Byrd Fellowship at Ohio State University; Japan Society for the Promotion of Science Fellowship at the National Institute of Polar Research in Japan; Erskine Fellowship in the Gateway Antarctica, University of Canterbury in New Zealand; and Fulbright Distinguished Scholarship at the University of Cambridge in the United Kingdom. He has a master's degree and doctorate in biological oceanography from the University of Rhode Island, where he was a National Science Foundation Graduate Fellow.
ACCESS will greatly benefit from Paul Berkman expertise and knowledge in the field of Arctic Ocean Geopolitics and environmental security in the Arctic Ocean for promoting co-operation and preventing conflict in this sensitive area. In particular his skill for bridging all the elements including climate changes impacting on socio economic sectors and Arctic governance issues would be greatly appreciated at the coordination level in Paris for helping in the organisation of the ACCESS quarterly newsletters, the ACCESS annual reporting on dissemination and exploitation of knowledge and last and not least the ACCESS contribution to the new Arctic Climate Impact Assessment (ACIA) report scheduled for 2014 at the end of the ACCESS project.
The primary role of Paul Berkman will be to craft the quarterly ACCESS Newsletter that will be distributed electronically as an integrated expression of the discoveries, insights and developments across the entire project. This key dissemination activity will be conducted in close collaboration with the ACCESS steering committee, the coordination team in Paris and all of the work packages to promote international, interdisciplinary and inclusive dialogues with diverse stakeholders who are contributing to the future of the Arctic external to the project. In addition, the role of Paul Berkman will involve contributing substantively to tasks in each of the work packages, especially in relation to integrated assessments of natural and anthropogenic impacts associated with Arctic governance for the lasting benefit of all.

Total cost: **75,000 €,** which is equivalent to 12 months of work for the project (3 months per year for 4 years) at 5000 euros per month plus 15,000 euros in travels : Trips to Paris to work on the newsletter, participation to the project general assemblies and work packages meetings and to the summer schools and workshops).

In WP7: management: UPMC, the WP leader, will have to subcontract the following service: management software access and coaching
Subcontractor: The choice of sub-contractor will be made on the basis of competitive offers.
Cost: 27,849 €

B/ Partner 6 : The Chancellor, masters and Scholars of the University of Cambridge (UCAM)

The activities of Lawson Brigham (WP2 co-leader) will be funded by UCAM (67,900 € in total).
Lawson Brigham will be providing advice and help mainly to WP2 (Brigham), although, as detailed in the original description of work, his range of skills is such that he will be contributing to several of the work packages. He will work intensively for short periods, either from his base or by attending meetings with other relevant partners. Thus travel is required, not just to specified ACCESS meetings, but also on an ad hoc basis, as required by exigencies of the project work. In the subcontract the approximate division of the resources allocated to this consultant will be specified, although the consultant will have to fund their own travel out of the total sum.

1.3. BRIGHAM has a subcontract of 67,900 euros, which is equivalent to 10 months of work on the project at 4790 euros plus 20,000 euros of travel. The travel comprises 8 visits from Alaska to Europe during the 4 years of the project (2 per year), at 2500 euros per journey.

Lawson Brigham is a very well known expert in the respective scientific domains, as it is well detailed thereafter.
His personnel costs are included in the subcontracting activities, because he is UCAM in house- consultant and his contract with UCAM belongs to the category "contract for provision of charges" which is a subcontracting activity. All the intellectual property rights issues, together with any issue linked to confidentiality and the precise role of this consultant in ACCESS, will be taken into account in the contract between UCAM and Lawson Brigham.
A copy of the contract will be attached to the first Management report of ACCESS to the EC.

Dr. Lawson W. Brigham is Distinguished Professor of Geography & Arctic Policy at the University of Alaska Fairbanks. He is also a Visiting Researcher at the Department of Applied Mathematics & Theoretical Physics (DAMTP) where he is working with the Ocean Physics group on Arctic issues. During 2005-09 he was chair of the Arctic Council's Arctic Marine Shipping Assessment (AMSA) and vice chair of the Council's working group on Protection of the Arctic Marine Environment (PAME). A career U.S. Coast Guard officer (1970-95), he was captain of a polar icebreaker on voyages to the Arctic and Antarctic. Dr. Brigham was Deputy Director of the U.S. Arctic Research Commission and has served as a researcher at Woods Hole Oceanographic Institution and the U.S. Naval Postgraduate School. His research interests include Arctic marine transport, the Russian marime Arctic, ice navigation, remote sensing of sea ice, polar geopolitics, and Arctic & Antarctic climate change. Captain Brigham received his PhD from Cambridge University in the UK.
In ACCESS project, Dr Brigham will be the co-leader of the WP2.

C/ Partner 9 : The Hamburgische Schiffbau-Versuchsanstalt (HSVA)

WP2 Development and fabrication of lateral stress sensor: HSVA has to subcontract the fabrication of the sensor. HSVA's workshops are not able to handle workparts of this size Bernd und Heino Grimm GmbH Bergstücken 8 22113 Oststeinbeck Germany , Cost: 8,000€
WP2 Oil spill prevention and combat: HSVA will subcontract the cleaning of the basin after finishing the oil spill test in the environmental test basin.
Cost : 10,000€
WP2 Ice Route Optimization: The software ICEROUTE needs statistically prepared ice and environmental data; this data have to be purchased.
Cost : 10,000€

D/ Partner 10: Norsk Polar Institutt (NPI)
Helicopter hours- This service will be arranged with a competitive call. NPI makes a public call and then a contract with the winner of the concurrence following the standard procedures with such calls is set into place. The call is for the helicopter work for NPI in one season or year, so it includes also other flying (for other projects) that what would be needed in ACCESS.
Cost : 12,500€

E/ Partner 21: Arctic Centre University of Lapland (UoL)

Subcontractor: Marine Informatics Company, Murmansk, Russia

The Marine Informatics Company specialises in the supply of innovative, reliable, cost-effective solutions and data processing for the Russian fishing fleet as well as the installation of on-board information and analytical computer systems. Established in 1993, this research and production company bases its activities on its database of the biology of commercial species and hydro-meteorological characteristics of fishing grounds. There are also based on the experiences of fishing in several basins since the 1960s.

The Marine Informatics Company offers a range of products and services including: The recommendation of high biological productivity zones, the forecasting of fishing conditions, comparative analysis of fleet activities in selected areas, analysis of the temperature regime, the evaluation of fishing grounds and the estimation of commercial species' biomass using data of operational hydro-acoustics; the mapping and interpretation of integrated data to solve operational tasks of fishery management.

Service from Marine Informatics Company:
- Providing of available data: activities of all Russian trawlers (within the last 25 years), spatial changes
- Providing of maps, tables and graphs (geographical trawlers activities, technological capacities, size, time, intensity, catch)
- All characteristics can be illustrated on the base of long-term temperature/ice and other dynamics in Norwegian and Barents Seas
- Risk assessment (impact of Stockman field: loss of fishing grounds due extraction activities)

Cost: 13,520€

F/ Partner 22: SINTEF F&H
Institution: University of Tromsø

Name: Paul Wassmann (Professor)

Reliable model simulations depend on data both for model validation and model improvements. Dr. Wassmann will prepare the biological data obtained at University of Tromsø and ensure that the qualities of the data are high. He will also provide the latest findings regarding increased temperature effect on plankton productivity, contribute to publications and participate in workshops. As Wassmann is a skilled person in Marine Arctic Biology research at University of Tromsø, he is needed to evaluate the coupled hydrodynamic-ecological model output. His participation is clearly defined and specific.

Cost: 12,500€ (85 hours of work foreseen)

G/ Partner 24: Stiftelsen SINTEF
Institution: Alun Lewis - Oil Spill Consultant -121 Laleham Road Staines, Middx, TW18 2EG, UK
The subcontracting is focussed on summarising the state of the art in remote sensing of oil spills, and the behavior of oil in ice-covered waters. These are most efficiently carried out by specialists in these fields.
Cost: 12,500€ (160 hours of work foreseen)

B2.3.2 Third parties

French public research is organized and carried out inside laboratories that are very often Joint Research Units (Unités Mixtes de Recherches, UMR). This means that different Institutions, Universities and Research Centers, put together, in the same physical place, the lab, resources and personnel. The management and organization of the different UMR are detailed and agreed in the quadrennial plans and, eventually, in ad-hoc bilateral agreements.

Therefore, the following third parties are linked to Université Pierre et Marie Curie – Paris 6 :

-MUSEUM NATIONAL D'HISTOIRE NATURELLE (MNHN)
The laboratory LOCEAN, involved in the ACCESS project, also include MNHN personnel, namely Nathalie Sennechael, professor experienced in public outreach of the UPMC partner in ACCESS. Her involvement will be essentially in WP6, Dissemination. In order to let UPMC declare Ms Nathalie Sennechael participation to the project, UPMC needs to add MNHN in the special clause 10: her participation to the ACCESS project will be in this way declared in the Form C of the Third party MNHN, linked to the beneficiary UPMC.

- CENTRE NATIONALE DE LA RECHERCHE SCIENTIFIQUE (CNRS)
The laboratory LATMOS, involved in the ACCESS project, includes also CNRS personnel, namely Ms Kathy Law and Claire Granier, researchers of the UPMC partner in ACCESS. Their involvements are distributed among WP1 in which they will work on key factors affecting climate and transport of pollutants in the Arctic; in WP2, they will work on air pollution and surface deposition related to arctic shipping; in WP3, on air pollution and climate impact related to Arctic gas/oil extraction; in WP5, on local and remote pollution impacts on Arctic air quality and climate.

In order to let UPMC declare Ms Kathy Law and Claire Granier participation to the project, UPMC needs to add CNRS in the special clause 10: their participation to the ACCESS project will be in this way declared in the Form C of the Third Party CNRS, linked to the beneficiary UPMC.

The two third parties will not request any funds from the European Commission on the project, the persons mentioned above are permanent personnel and the CNRS and MNHN did not want to request any EC funding for them in the ACCESS project.

B2.4 Resources to be committed

The ACCESS research, covering very different but strictly interconnected subjects, according to the EC call requires high level of funding for the involved personnel and with regard to running costs, in particular transport field measurements, field and laboratory research in remote and partly ice covered regions. The details per category and per partner are given in the table below.

Personnel

	Partner									
	1	2	3	4	5	6	7	8	9	10
	UPMC	Oasys	NERC	IfW	UCAM	AWI	JSC	Nofima	HSVA	NPI
Effort										
PM total	221	45	55,9	40	62	42	10	39,4	33	36
PM Emeritus	32									
PM senior scientist	28	45	10,8	8	8	10	10	13,2		12
Pm Scientist	37		8,9			32		26,2	33	
PM PhD				32						
PM junior	48									24
PM post-doctoral fellow	52		36,2		54					
PM Manager	24									
PM Technician										
Average personnel rates per PM without indirect costs										
Emeritus	0,00									
Senior	6 250,00	6 450,00	9 124,00	7 355,48	6 250,00	4 879,71	11 250,00	10 375,00		7 546,50
Scientist	5 600,00		5 844,00					9 775,00	7 113,00	
PhD				5 327,70		4 507,48				
Post-doctoral fellow	3 400,00		4 773,00		5 863,24					5 476,75
Junior	3 750,00									
PM Manager	4 166,66									
Technician										
Indirect costs/MM	60% transitionnal flat rate	3 225,00		3 538,95	60% transitionnal flat rate	3 947,13	2 250,00	14 882,00	7 845,42	2 083,33

	Partner										
	11	12	13	14	15	16	17	18	19	20	21
	met.no	FastOpt	SAMS	Beijer	SIO	IMPAC	UPC	DLR	AARI	ESRI	UoL
Effort											
PM total	80,5	31	50	83,5	48	34	63	22	48	49,7	50,9
PM senior	80,5		41	66,8	36	14	16	22	18	3,6	50,9
Professor TEU							23				
Professor TU							12				
PM PhD						14			15	6,6	
PM junior			9		12	4			15	39,5	
PM post-doctoral fellow				16,8		2					
PM Technician							12				
Average personnel rates per PM without indirect costs											
Senior	7 500,00	7 200,00	6 126,70	6 394,27	2 345,45	8 278,00	5 000,00	6 675,41	3 510,00	16 796,52	5 102,20
Professor TEU							4 500,00				
Professor TU							5 000,00				
PhD						7 816,00			2 080,00	8 049,06	
Junior			4 394,00		1 563,64	5 188,00			2 050,00	3 795,48	
Post-doctoral fellow				5 283,45							
Technician						3 287,50	3 500,00				
Indirect costs/MM	7 500,00	3 960,00	3488 (60% transitionnal rate)	60% transitionnal rate	20% on all indirect costs (509,16 on MM)	3 960,00		4 420,37		65% of personnel costs	3061,32 (60% transitionnal rate)

	Partner					
	22	23	24	25	26	27
	Sintef F&H	CICERO	Sintef	EWI	LCP	BELUGA
Effort						
PM total	14,5	27,9	18,2	5	16	14,3
PM senior/Professor	8	2,8	18,2	2	16	6
PM Researcher I		3,1				
PM Researcher II		22				
PM PhD	6,5					5,7
PM junior				3		2,6
PM Technician						
Average personnel rates per PM without indirect costs						
Senior/Professor	9 492,60	7 507,00	12 360,00	13 500,00	9 000,00	7 455,00
Researcher I		6 636,00				7 000,00
Researcher II		5 619,00				
PhD	7 371,00					
Junior				8 500,00		4 000,00
Technician						
Indirect costs/MM (Professor)	14 377,30	7 902,00	12458,9 (100,8%)	3 679,80	1 800,00	1 333,05
Ind. costs /Researcher I		6 950,00				
Ind. Costs /Researcher II		5 884,00				

Subcontracting

This section provides a summary of the subcontracting costs included in the budget, the beneficiaries requesting subcontracted funding, a justification for the need of subcontracts and the detailed costs. All of these costs fall within the "RTD" activity unless indicated otherwise.

Beneficiary 1: UPMC		
Item	Description and justification	Amount (€)
1.1	Management software access and coaching- This will help the project office in its management tasks and will enable the Project Office to provide professional and efficient project management – this is a MNGT cost	27849
1.2	Rental and installation, from KONGSBERG MARITIME LTD, of a multibeam sonar on a submarine	146300
	Rental and mobilisation, from WOODS HOLE OCEANOGRAPHIC INSTITUTION, of Sea-Bat AUV for Arctic deployment	86550
	Consultant : Adele Airoldi- 8 months of work on the project (2 months per year for 4 years) at 4800 euros per month plus 5250 euros in European travel to attend meetings - For the purposes of the project, on the basis of her knowledge and experience, as well as of her continuing inside contacts with the EU system, including the European Parliament, she will concentrate on analyzing aspects of the emerging policy and governance Arctic state-changes with particular attention to the EU-Arctic interface. UPMC the coordinator of ACCESS will greatly benefit from advices, knowledge and expertise of Adele Airoldi in sensitive fields of the Arctic Governance taking into account the actual European Union vision regarding these important issues.	43650
	Consultant : Paul Arthur Berkman – 12 months of work for the project (3 months per year for 4 years) at 5000 euros per month plus 15,000 euros in travels : Trips to Paris to work on the newsletter, participation to the project general assemblies and work packages meetings and to the summer schools and workshops). The primary role of Paul Berkman will be to craft the quarterly *ACCESS Newsletter* that will be distributed electronically as an integrated expression of the discoveries, insights and developments across the entire project. This key dissemination activity will be conducted in close collaboration with the ACCESS steering committee, the coordination team in Paris and all of the work packages to promote international, interdisciplinary and inclusive dialogues with diverse stakeholders who are contributing to the future of the Arctic external to the project. In addition, the role of Paul Berkman will involve contributing substantively to tasks in each of the work packages, especially in relation to integrated assessments of natural and anthropogenic impacts associated with Arctic governance for the lasting benefit of all. This is a DISSEMINATION cost	75000
Beneficiary 5: UCAM		
Item	Description and justification	Amount (€)
	Consultant Lawson Brigham -10 months of work on the project at 4790 euros plus 20,000 euros of travel. The travel comprises	67900

	8 visits from Alaska to Europe during the 4 years of the project (2 per year), at 2500 euros per journey. In ACCESS project, Dr Brigham will be the co-leader of the WP2.	
Beneficiary 9: HSVA		
Item	Description and justification	Amount (€)
1.1	In WP2 Task 2.5.1 fabrication of Lateral Stress Buoy. Due to the size of the buoy this work can't performed at the HSVA workshop. This is RTD cost	8.000
	In WP2 Task 2.1.6 Delivery and formatting of ice data for the two periods 1960 to 2000 and 2001 to 2010. This is RTD cost	10.000
	In WP2 Task 2.4.2 Delivery and formatting of ship traffic data for the two periods 1960 to 2000 and 2001 to 2010. Delivery and formatting of ship ship machinery data for different type of ice going vessels. This is RTD cost	10.000
Beneficiary 10: NPI		
Item	Description and justification	Amount (€)
	Helicopter hours- Regarding helicopter, this service is arranged with a competitive call. NPI makes a public call and then a contract with the winner of the concurrence following the standard procedures with such calls is set into place. The call is for the helicopter work for NPI in one season or year, so it includes also other flying (for other projects) that what would be needed in ACCESS.	12500
Beneficiary 21: UoL		
Item	Description and justification	Amount (€)
1.1	Subcontractor: Murmansk Marine Informatics: research on Murmansk fishery sector, collection and analysis of statistical data, mapping. Travel to GA	13520
Beneficiary 22: SINTEF F&H		
Item	Description and justification	Amount (€)
1.1	In WP3:Universitet i Tromsø, This is a "bought in" research and test service which cannot be provided by SINTEF. This is a RTD cost. The consultant will only demand work hours for the sum that we have budgeted. No other costs are connected to his contribution to the project. Total sum for consultant is budgeted to: € 12500 – Total hours foreseen : 85 hours	12500
Beneficiary 24: Stiftelsen SINTEF		
Item	Description and justification	Amount (€)
4.3	The subcontracting is focussed on summarising the state of the art in remote sensing of oil spills, and the behavior of oil in ice-covered waters. These are most efficiently carried out by specialists in these fields. The consultant will only demand work hours for the sum that we have budgeted. No other costs are connected to his contribution to the project. Total sum for	12500

	consultant is budgeted to: € 12500 – Total hours foreseen : 160 hours	

All the other subcontracting costs listed under management are the ones related to the audit certificates.

Equipment resources

This table itemises the equipment resources included within the participants' direct cost budgets. Additional justifications follow the table where necessary. All of these costs fall within the "RTD" activity unless indicated otherwise.

Beneficiary 1: UPMC		
Item	Description	Amount (€)
	Laptop computer for use by researchers working on the project- LED Core i7 2-Core 2,66 GHz; 8 Go RAM. - UPMC-LATMOS is participating in the preparation and real-time analysis during the observational aircraft campaign which requires us to buy a specific powerful portable laptop computer. This computer will have a very large disk space with fast access to the files. The computer will be used for the development of the software required for the real-time analysis of the observations. It will be used during the campaign for better flight planning, and for the analysis of the results after the campaign.	2200
	As part of ACCESS the group at UMPC-LATMOS will be involved in modeling work for which the person employed on the project will need to use a workstation with specific characteristics (speed, memory) to treat the model output. UPMC also require specific storage facilities for the model output. In addition, we will participate in a field campaign in the Arctic for which a specific portable laptop computers are a necessity. They will be used in the field for flight planning and initial data analysis.	
Beneficiary 10: NPI		
Item	Description	Amount (€)
	Radiometer	30000
	Pyranometer	7000
	Snow humidity meter	7500
	Accessories (datalogger, stakes, camera, PC)- The laptop will be part of a measurement system. NPI work with optical radiometers, advanced digital cameras and electromagnetic measurement devices that are controlled by special laptops, and the dataflow is directly managed by the laptop. Apart from the laptop, accessories are as follows: Data loggers for receiving and storing data in the field Poles, frames, holders, wires, ice screws, ropes, for setting up optical instruments and camera on the field site Digital camera for documenting changes /variability at the field site Tools for setting up the instrumentation in the field	14850

	Cables that are not directly a part of the optical setup (for example for downloading data from data loggers, and for connecting to a generator during installation and maintenance) Basic equipment for snow inspection: magnifying glass, balance, metal tube, thermometer	
Beneficiary 19: AARI		
Item	Description	Amount (€)
2.1	High performing (dual core) computer for junior researchers (100% use on the project) in WP 1.3, 2.1-2.3 –High speed Dual Core PC (RAM 3.0Ghz and 2GB Cashe) for performing multiple data processing and modeling tasks.	2200

Consumables

This table itemises the major consumables resources included within the participants' direct cost budgets. All of these costs fall within the "RTD" activity unless indicated otherwise.

Beneficiary 1: UPMC		
Item	Description	Amount (€)
2.1	Consumables associated with design and build of tracker buoys targeted icebergs (5 trackers at 10,000€ each, equipped with two GPS)	50000
	Consumables associated with design and build of sea-gliders for in-situ measurements (CTD Seabird : 8,900€ ; Iridium and GPS: 2,800€; Lithium battery: 4,200€ ; Engine and glider's structure: 31,000€; Processors: 14,245€, Acoustic modems: 12,000€; RAFOS/ SOFAR, acoustic devices: 13,000€)	86145
	Publication costs	3000
	Software, graphics packages for analysis of model results	2000
	Software licenses for 3 years: GIS, Matlab, GeoSwath	4600
	Polar clothing for field expts & tank tests	1800
	Fieldwork consumables: electronics & drilling equipment	3750
	Satellite phone purchase and subscription charges	2650
	High-power PC for data analysis - a PC with specific characteristics (speed, specific storage facilities) to treat the model output is required. This computer will be used for nothing but data input and processing and thus will not be available for general use. This high-power PC computer will also be taken in the field.	2800
Beneficiary 5: UCAM		
Item	Description	Amount (€)
2.1	High power PC for sonar data processing - this computer will be used continuously for nothing but data input and processing	1833

	for the multibeam sonar data, so it will not be available for general use. This will also be the computer that UCAM will take into the field in March 2013 for data recording on board the under-ice submarine. The estimate of 1833 euros is in fact an under-estimate again.	
	Consumables for field experiments with AUV and submarine (tapes, disks, equipment boxes, polar clothing, flares, tent fittings)	4200
	Software licences - Matlab for three people plus two toolboxes, for statistics and image analysis. This actually costs £1950 for one year plus 20% for the second and third years, a total of 3276 euros (at 1.2 euros per pound) over 3 years. The request for 2000 euros is therefore an under-estimate of the cost.	2000
	Satellite (Iridium) phone fees for data transmission	1764
Beneficiary 8: Nofima		
Item	Description	Amount (€)
2.1	Acquisition of two versions for the Mathematica software to be used for carrying out the two task work (task 3.1/3.2).	4,312
	Electronic components	3,500
	Publication costs -	1,500
Beneficiary 9: HSVA		
Item	Description	Amount (€)
2.1	In WP2 Task 2.5.1 for Lateral Stress Buoy; steel plates, girders and sheet steel	2000
	In WP2 Task 2.5.1 for Lateral Stress Buoy; Pressure gauges and load cells	9000
Beneficiary 11: met.no		
Item	Description	Amount (€)
	Software and data storage for NorESM analysis in task 1.6	1000
	Printing of information and questionnaires to solicit information from marine users in task 2.1.5	1000
	Cold weather clothing for ice tank experiments and data storage for WP4	1000
	Hire of computer and storage for data management in WP6 - The computer and storage resources to be hired are related to the METNO contribution to task 6.3 - Exploitation of knowledge. To continuously expose these datasets to the scientific community a data management system utilising a database server for metadata with a public web interface is connected to a data repository served using a THREDDS Data Server on an application server while everything is connected to the backup system. The public interface for ACCESS allows project scientists to	10000

	upload and download data, while external scientists may search for what ACCESS has achieved in the sense of generated datasets. Integrated in this is automatic conformance control of data as well as machine interfaces towards global frameworks (e.g. WIS) and relevant scientific projects (e.g. CADIS in the US or Polar Data Catalogue in Canada). The hiring cost cover these public interfaces (computers and storage) throughout the project duration as well as preservation of the datasets after the project ends.	
Beneficiary 13: SAMS		
Item	Description	Amount (€)
1.1	Consumables associated with build and design of buoys - SAMS is responsible for the design and build of sea ice deployed buoys. The above mentioned costs are for the consumables associated with the building of these buoys. Consumables include: Thermistors, PCB manufacture, microprocessor, GPSs, batteries, Iridium modems, miscellaneous electronic components and wiring, pressure transducers, outer and inner housings. Taken together these components form the buoys	87400
1.2	Iridium data transmission charges	20000
1.3	Iridium monthly line rental charges	1800
1.4	High end spec computer for oil spill modelling - The PC is not an off-the-shelf PC but a highly-specified custom built PC. This hi-spec PC is needed by SAMS in order to run the oil spread model efficiently.	2600
1.5	Cold weather (safety) clothing	1500
1.6	Shipping Costs- This cost represents the shipping costs associated with collection (from SAMS) and shipping of equipment (mainly the buoys and associated equipment) to departure point for the Arctic field programmes.	3000
1.7	Consumables associated with oil tank experiments	7400
1.8	Material and build costs associated for the tanks that will be used for oil spill experiments	6300
1.9	Miscellaneous costs e.g. oil clean-up costs, purchase of hydrocarbon products, paper charges (i.e the costs associated with the publishing of scientific papers is 580 euros.)etc	5880
Beneficiary 14: BEIJER		
Item	Description	Amount (€)
	Task 3.5 requires licenses for specific data analysis software, as well as software to conduct experiments online. Task 5.7 requires specific softwares like e.g. Mathworks Matlab Software MATLAB	2839,58
Beneficiary 17: UPC		
Item	Description	Amount (€)

	Miscellaneous electronics and software, WP2 - Embedded board for computations, customised for the Detection, Classification and Localization (DCL) of acoustic events and noise monitoring, and the real-time transmission of data. Eurotech Proteus, Intel SSD harddisk X-25M, Shallow water housing, e.g. PREVCO P6.501, - Software: FFTW commercial license; FFTW not-for-profit; Adobe Audition, Financial contributions to open source software projects	7000
	Electronic/acoustics components for noise measuring buoys, WP4	10000
	Publication costs - – This is a dissemination cost	1500
Beneficiary 19: AARI		
Item	Description	Amount (€)
	Software upgrade(Lahey Fortran, Surfer, Grapher, Matlab.) for WP1.3,2.1-2.3 and two toolboxes, for statistics and image analysis.	1,000
Beneficiary 20: ESRI		
Item	Description	Amount (€)
	Licenses and maintenance for MATLAB (3 users)	6500
	WTO data	5000
Beneficiary 21: UoL		
Item	Description	Amount (€)
	Processing of fieldwork material (photos, tapes, posters), dissemination costs	1000

Travels

The following table itemises the travel costs included within the participants' direct cost budgets. All of these costs fall within the "RTD" activity unless they are specifically associated with WP6 and WP7 in which case they are "OTHER" costs.

The following principles have been applied in establishing the travel budgets:

- There will be a kick-off meeting.
- There will be 4 General Assemblies. Each year, a different beneficiary will host one of these meetings. Each beneficiary has to send at least one person to the kick-off and General Assemblies.
- There will be 8 Steering Committees during the lifetime of the project, that is one every six months. One will take place at the same time than the General Assembly to minimize the travel costs and one will be organized in between the General Assemblies.
- Specific working group meetings are also arranged like work packages workshops. In order to minimise travel costs, electronic or phone meetings may be organized.

- Additional activities: field work, participation to summer school and conferences.

Therefore, a beneficiary should expect to travel to a minimum of 5 meetings; the Steering Committee members to a minimum of 9 meetings.

All travels will be planned in order to minimise the number of travels and the travel costs during the duration of the project. Each organisation will make its best endeavour to limit the number of persons who attend meetings.

Beneficiary 1: UPMC		
Item	Description	Amount (€)
	Attendance to the Kick-off meeting, General Assemblies and Steering Committee for the project manager (average cost: 722€) – This is a MNGT cost	6500
	Participation to the travel costs of the people in charge of taking videos for ACCESS (for long movie and short videos)– This is a DISSEMINATION cost	4000
	Attendance to the kick-off meeting, General Assemblies and WP meetings of the scientific coordinator and the engineer	12000
	Steering Committees – participation of the coordinator	2500
	Attendance to international conferences to present results	4000
	Three field works of one week each for deployment of instruments (Ice mass Balance, floats and glider) and field experiments (2 people)- in the Barents sea region of the Arctic from ice camp Eureka (Canada) or Borneo (Russia)	30000
	Kick off meeting and General Assemblies (4 people)	14000
	Travel costs for participation in aircraft campaign (3 people x 2 weeks) plus site visit prior to campaign (2 people x 4 days)	16000
	Workshop on oil/gas and ship emissions plus meetings with groups working on air pollution tasks	8000
	Attendance at international meetings to present results (AGU, EGU, IGAC)	8000
	Kick-off meeting and General Assemblies-	5450
	2 Field experiments- (a) in the Beaufort Sea, north of Alaska; (b) Fram Strait or north of Svalbard.	6800
	1 HSVA (Hamburg ice tank) tank tests	1800
Beneficiary 2: OASys		
Item	Description	Amount (€)
2.1	One General Assembly and one scientific conference/WP meeting per year for two persons plus one kick-off meeting (606,25 Euro per person)	9700
	Two workshops 1212 Euro each in WP6 (OTHER)	2425

	Managing and networking 2 day visits 4/y in WP7 (MNGT)	7425
Beneficiary 3: NERC		
Item	Description	Amount (€)
2.1	Kick-off meeting and General Assemblies	11000
	Steering group meetings	10212
	Conferences	4000
Beneficiary 4: ifW		
Item	Description	Amount (€)
2.1	Kick-off meeting and General Assemblies (The average cost per person of a trip within Europe including accommodation for a maximum of 2 nights 549,97 €)	6599,69
Beneficiary 5: UCAM		
Item	Description	Amount (€)
2.1	Kick-off meeting and general assemblies, two attending each	11200
	Steering group meetings	4400
	Travel costs for 2 people to join and man submarine	5600
	Travel costs for 3 people and equipment transport to Arctic for AUV mission	7900
Beneficiary 6: AWI		
Item	Description	Amount (€)
2.1	Kick off meeting and annual general assemblies	4.000
Beneficiary 7: J.Schwarz		
Item	Description	Amount (€)
	Kick-off meeting and General Assemblies -5 meetings	5000
	Steering group meetings- 4 meetings	4000
	Work packages meetings and conferences	4310
Beneficiary 8: Nofima		
Item	Description	Amount (€)
The following principles have been applied in establishing the travel budgets for NOFIMA: The average cost per person from Nofima of a trip within Europe is estimated to € 650. Daily allowances (accommodation and cost) are on average estimated to € 187.5 per day, and travels are estimated to include two nights accommodation. Additional activities can include travels to international conferences		

2.1	Kick-off meeting and annual general assemblies meetings (3 persons attending each time)	15000
	Annual WP-meetings and meetings among different task participants (For each of the three tasks Nofima is engaged in, bi-annual meetings among the participants situated elsewhere is planned) and additional activities (participation to international conferences for instance)	26000
	Steering committee meetings (WP leader will attend)	4000
Beneficiary 9: HSVA		
Item	Description	Amount (€)
2.1	Kick-off meeting (2 persons) and General assemblies (4 meetings, 2 persons)	10500
	Work group meetings (4 meetings, 2 persons; WP2 & WP4)	7.000
Beneficiary 10: NPI		
Item	Description	Amount (€)
2.1	Kick off meeting and general assemblies, WP1 meetings and presentation (conference)	10000
Beneficiary 11: met.no		
Item	Description	Amount (€)
2.1	Average rate for one person to a meeting in Europe is approximately 1 500€. This will cover travels for 5 persons for kick-off meeting and each general assembly, 10 individual travels to WP meetings or workshops in WPs 1, 2, 3, 4 and 6 and 4 additional travels to steering committee meetings.	59000
Beneficiary 12: FastOpt		
Item	Description	Amount (€)
2.1	2 2-days meetings per year for two persons (i.e. 16 trips) on average 606.25 Euros each	9700
Beneficiary 13: SAMS		
Item	Description	Amount (€)
1.1	ACCESS meetings and hosting: Kick-off meeting, General assemblies, WP1, 2 & 4 meetings and Steering group meetings	12300
1.2	International and European workshops /conferences	5700
1.3	Travel and subsistence costs associated with fieldwork	11507
1.4	Travel and subsistence costs associated with dissemination activities	3500
Beneficiary 14: BEIJER		

Item	Description	Amount (€)
2.1	Kick-off meeting and General Assemblies –two to three persons (one for WP3, one for WP5 and the Beijer coordinator) attend each meeting	19178, 22
	Travel costs for experiments, two persons travel to two experiments location (probably Tromsö and Greenland) to conduct the experiment and for a follow up meeting with stakeholders	7440
	Steering committees and Conferences	6528
Beneficiary 15: SIO		
Item	Description	Amount (€)
2.1	Kick-off meeting and General Assemblies –two persons (one for WP1, one for WP2 or WP5) attend each meeting	13731,52
	Travel costs for experiments for Barents Sea investigation, two persons travel to two experiments location (probably Spitsbergen or Greenland) to conduct the experiment	5268,48
Beneficiary 16: IMPAC		
Item	Description	Amount (€)
2.1	Kick-off meeting and General assemblies (2 persons attend) - The average cost per person of a trip within Europe (outside Germany) including accommodation for a maximum of 2 nights is about 1400€	14700
	WP meetings	4900
	Conferences	3400
Beneficiary 17: UPC		
Item	Description - The average cost per person from UPC of a trip within Europe is estimated to € 650. Daily allowances (accommodation and cost) are on average estimated to € 170 per day, and travels are estimated to include two nights accommodation	Amount (€)
	Kick-off meeting and annual general assembly meetings (one to two persons will attend)	7000
	Annual WP-meetings and meetings among different task participants - For each of the four WPs where the UPC is engaged in, bi-annual meetings among the participants situated elsewhere are assumed.	9000
	Field work to measure noise and implement acoustic monitoring (WP2 & WP4), three people, four times.	15639
Beneficiary 18: DLR		
Item	Description	Amount (€)

2.1	Kick-off meeting, General Assemblies and WP meetings	14000
	Field work : measurement campaigns in the North of Sweden and Norway	10000
Beneficiary 19: AARI		
Item	Description	Amount (€)
2.1	Kick-off meeting, General Assemblies and WP meetings	10000
	Travel to international conferences and bi-lateral meetings with partners	3000
	Travel to field work in framework of WP3.1	2000
Beneficiary 20: ESRI		
Item	Description	Amount (€)
2.1	Kick-off meeting and General assemblies – (2 persons)	7500
	Additional Activities: Presentations at conferences, summer school attendance	2500
Beneficiary 21: UoL		
Item	Description	Amount (€)
2.1	Kick-off meeting, General Assemblies and WP meetings	13500
	Conferences	1300
	4-5 fieldworks 2-3 weeks each (Norway-Kirkenes, Vadso; Russia-Murmansk, Teriberka)	15296
Beneficiary 22: SINTEF F&H		
Item	Description -	Amount (€)
2.1	Kick-off meeting and General Assemblies (The average cost per person of a trip within Europe including accommodation for a maximum of 2 nights 1700€)	13000
	WP meetings	5500
	Conferences	2500
Beneficiary 23: CICERO		
Item	Description	Amount (€)
2.1	Kick-off meeting, General Assemblies and WP meetings	13977
Beneficiary 24: SINTEF		
Item	Description	Amount (€)
7	Travel and average cost. Kick-off and General Assembly- this is a MNGT cost	10000

4.3	Travel and average cost. WP-meetings and conferences	7250
Beneficiary 25: EWI		
Item	Description	Amount (€)
2.1	Kick-off meeting and General assemblies	2696
Beneficiary 26: LCP		
Item	Description	Amount (€)
	ACCESS kick-off meeting and annual general assembly	4500
	Field work : meetings with the Arctic Council Permanent Participants : Aleut International Association (AIA), Arctic Athabaskan Council, Gwich'in Council International, Inuit Circumpolar Council, Raipon, The Saami council. (task 5.6, task 5.1.2)	17000
	Field work: meetings with AECO and IAATO representatives.	6000
Beneficiary 27: Beluga		
Item	Description	Amount (€)
	Travel abroad: 6 times for 2 persons (Kick Off Meeting and General assemblies and one international conference)	10200
	Inland trips (e.g. Bremen to Hamburg): 4 times for 2 persons (e.g. working group meetings):	1500

Other direct costs

Beneficiary 1: UPMC		
Item	Description	Amount (€)
2.1	Costs associated with the field work logistics (expedition of instruments) – The costs are high since the field work takes place in remote places (Eureka ice camp in Canada or Borneo (Russia)	28000
	Air logistics (Twin otter) for field work campaign at Eureka or Borneo- The air logistics cannot be made via a competitive call since Ken Borek, (Canada) is the only company providing this kind of services (landing on sea ice with airplanes equipped with skis)	43820
	Taking videos during various field works (Eureka or Borneo, melt-ponds surveillance, during DLR campaigns) in order to realize the ACCESS movie–This is a Dissemination cost - The videos will be made by the department called " Le service Images" of CNRS, which is a third party of UPMC. It has been agreed with this department that one or two persons would be sent to shoot the images and the only thing UPMC should pay for is their travels and the transportation of the material they need. Thus, the solution found to make some videos is the most cost-effective one and the cheapest since our third party has agreed not to charge the time of its personnel on the	25000

	project.	
	Creation, edition and printing of the ACCESS brochure - This is a Dissemination cost	6000
	Edition of the printed newsletter- one every year - This is a Dissemination cost	4500
	UPMC, the WP 6 leader, will have to host, build and maintain the ACCESS web-site. This is a Dissemination cost	15000
	Organization of the kick-off meeting and General Assemblies (room renting, catering) This is a MNGT cost	20000
	Invitation of some members of the Advisory Board to the General Assemblies (about 4 to 5 for each assembly) - This is a MNGT cost	32000
Beneficiary 10: NPI		
Item	Description	Amount (€)
2.1	6 days shiptime RV Lance- The ship time is use of NPI's own vessel, the RV Lance.	99000
	Field compensation- Field compensation is a compensation NPI employees as participants of fieldwork campaigns are eligible to receive (on polar cruises and on fieldwork in the Polar regions). It compensates for very long working days, working at night and working in the weekends.	15000
	Publication costs	5000
Beneficiary 14: BEIJER		
Item	Description	Amount (€)
2.1	Rough estimations of costs associated with experiments in task 3.4 including show up fees and experiment pay-offs to the stakeholders involved, local rent, material, travels and accommodation for the persons conducting the experiments, and for follow up meetings to present results to the stakeholders.	7616
	Meetings organised at the Royal Swedish Academy of Sciences: 4 Workshops of three days calculated for 15 persons, lunch and dinner included, travel and accommodation excluded.	6528
	Accommodation resource persons (Aart de Zeeuw, Scott Barrett and Michael Hoel) to meet and work on a common paper, two meetings at 4-5 nights	3046
Beneficiary 18: DLR		
Item	Description	Amount (€)
2.1	Rental of an aircraft, or usage of a DLR aircraft including fees and expenses, for measurement campaigns - DLR can only use its own (DLR) aircraft for the measurements since their instruments are certified only for this aircraft. The costs for	200000

	certifying the instruments for use in another aircraft would be higher than the total funding DLR get in ACCESS for the aircraft measurements.	
Beneficiary 19: AARI		
Item	Description	
	Publication in peer reviewed journals	7000
Beneficiary 24: SINTEF		
Item	Description	Amount (€)
4.3	Software licensing - Names of the softwares to be licensed: 1. MEMW DREAM license no: 808093 2. MEMW OSCAR license no: 808092 By agreement with the organizations that funded the development of the models, a 15% fee is applied for all model applications. This fee is reserved for software maintenance. SINTEF as well as other users pay the same fee. The standard commercial license is €15,000 per year per license (OSCAR and DREAM); the standard non-commercial R&D license is 15% of project value. In this case we are assigning the project the minimum of these two options, assuming that the work with the model will not extend over more than 2 years. The model is a central tool in the planned performance of the project	30000
4.3	Publication costs	1726

Please note that the cost categories (equipments, consumables, other costs) are also indicative, just a way of grouping similar types of costs. The actual classification of the costs to be incurred depends on the normal business practice of each partner. What is needed is just a list of the costs with a justification, so that they can be checked.

B3 Potential Impact

B3.1 Strategic impact

In its December 2009 conclusions on Arctic issues, the EU Council approved the three main policy objectives proposed by the Commission in its 2008 communication on the European Union and the Arctic region:

Protecting and preserving the Arctic in unison with its population;
Promoting sustainable use of natural resources;
Contributing to enhanced governance in the Arctic through implementation of relevant agreements, frameworks and arrangements, and their further development.

The Council sets out the basis on which a gradual formulation of an EU policy on Arctic issues should be founded, *inter alia*, the formulation and implementation of EU actions and policies that impact on the Arctic with respect for its unique characteristics, in particular the sensitivities of ecosystems and their biodiversity and the needs and rights of Arctic residents. It further highlights the need for responsible, sustainable and cautious action in view of new possibilities for transport, natural resource extraction and other entrepreneurial activities linked to melting sea ice and other climate change effects.

ACCESS aims at contributing to the fulfilment of these tasks, in the framework of the systemic research approach advocated.

The basis for this work, providing a scientific foundation for subsequent action, will be a focused modelling and observational programme predicting environmental parameters of critical importance to the economic sectors being analysed in the project. This will provide essential input to the other core work packages of the project which will assess the impact of changes not only on the economic level but on the environmental level as well.
Information will be provided on the current status and changes of the Arctic sea ice, ocean and atmosphere during the duration of the project, establishing a baseline against which to compare projected future changes and allowing to confirm and determine the trends in those changes with some confidence. Projections and estimates of uncertainties for future developments on time scales of up to several decades will also be provided. Such projections and estimates will serve as the basis for a determination of prospects in the main economic sectors considered. For example, in Arctic shipping, model predictions of atmospheric and oceanic conditions, ice extent and ice properties in future years along anticipated shipping tracks will be developed. For fisheries, changes in the occurrence range of certain key species and populations will be assessed. For resource extraction, the evaluation of the risk associated with ice patterns and extreme weather condition, including revised design loads for offshore structures, will be significant for the determination of the competitiveness of resource extraction from an economic point of view. Additionally, the impact of increased commercial activity on climate will be analysed, particularly air pollution in the Arctic due to increasing ship traffic as well as gas and oil drilling from offshore facilities, black carbon and soot deposition on snow and sea ice.
With regards to marine shipping and arctic tourism, these are key human activities which are expected to develop significantly as a consequence of climate change in the Arctic. The decrease in coverage of the very thick and strong multi-year ice has led to increased economic interest in the region. The route between Europe and East Asia is 40% shorter compared with the Suez Canal route. In addition, there is the possibility of shipping hydrocarbons out of the Arctic to the European market which is economically very attractive. As the Arctic becomes more accessible, also Arctic tourism will be affected. However, the change in climate also poses a threat to the unique characteristics and might increase the number of tourists only temporarily. To tackle these important topics ACCESS will progress far beyond previous assessments in this area by applying an interdisciplinary and cross-sectoral analysis of relevant factors which bear on the tourism industry.
The rapid changes of the ice conditions have not yet affected the shipping activity in the Arctic. One reason is that the new Arctic ice conditions require new technological solutions regarding infrastructure including the identification of the requirements such as search and rescue, ports, communications, charting, spill response and cleanup, salvage, aids to navigation, traffic schemes, icebreakers - and significant developments inevitably take time. This delay is, however, favorable for combining the issues regarding development of technical transport with the proposed investigations within ACCESS on the socio-economic impact of the expected increase of Arctic Marine Transport and Tourism on the sensitive Arctic environment and how these impacts can be minimized.

Impacts that will be examined include those on Arctic communities by the expansion of use of the Arctic marine environment, *sensu latu*. This includes the development of strategies to mitigate selected impacts and limit potential user conflicts in local and regional Arctic waterways. Increased shipping in the Arctic leads to air and noise pollution as well as heightens the risk of oil spills. Indicators for different environmental effects such as impacts on regional air quality and acidification in the Arctic will be investigated as well as noise pollution from increased traffic. Another reason for concern is the risk associated with the transport of heavy fuel oils in the Arctic. This particular study will focus upon examining the environmental, social and financial implications, covering various geographical scales (e.g. pan-Arctic, coastal, sensitive areas). All these analyses are carried out to contribute to sustainable development in the region and to assess opportunities as well as risks. The information will be essential for policymakers to define future policies.
As regards fisheries, climate change will spur government- or consumer-induced price changes in factor or product markets that will alter both the activity at sea and the catch composition of the fishing fleet. Regulations can make some specific fisheries unprofitable. Also consumer awareness on the climate friendliness of single fisheries can shift demand from one species to another. The focus of the study on the assessment of the different activities' impacts on the Arctic environment in general, with a particular focus on protecting marine

biodiversity, will provide essential foundations for developing human activities in the region in a sustainable way. This will be achieved through the quantification of economic effects of climate change in a fisheries system through consequence analyses of combinations of different climate change scenarios and management regimes. ACCESS will also extend knowledge about climate change effects on aquaculture in the Arctic, aiming at better understanding the link between climate and productivity in aquaculture, assessing the potential for farming of other species in the area, and modeling the impact on the industry's economic performance, taking into account relocalization of existing farms and productivity changes. Regional employment impacts will be studied within this model as well. ACCESS will further evaluate the implications of climate change on the markets for input factors and final products, both in the case of fisheries (how fuel oil and fish prices will be influenced by climate change, and how behaviour in fisheries and economic performance will be affected) and in the case of aquaculture (how feed availability and prices are likely to be influenced by climate change, fish farmers responses and economic implications). Knowledge thus acquired will be valuable for individual industry participants, and will help to develop management regimes that utilise opportunities created and minimise the risk of large negative shocks. The results of the work on fisheries will be key inputs for work on governance and on the building of an integrated framework to promote sustainable management of fisheries in the Arctic, taking account of links with the rest of the world. Our aim is to provide the governing institutions, including the EU, with a foundation for sustainable fisheries management by identifying management options that minimize the risk and negative impacts of global warming. Furthermore, the study will contribute to the improvement of long-term management of ecosystems and ultimately to the formulation of optimal policies for the Arctic region.
With regard to oil and gas extraction industries, an interdisciplinary approach including not only ecological and environmental but also economic, technological and legal issues will ensure an integrated assessment of climate change impacts and the conditions under which resource extraction is possible and sustainable. The models and techniques applied in ACCESS will ensure an as precise as possible quantification of the effects of human activity in the Arctic, again both on environmental and on anthropogenic systems. The economic prospects in the course of melting Arctic ice and climate change will be explored not only with a local focus, but on a European and, in part, a global scale by application of, and iterations within a number of models. By this means, not only direct meso- and macro-economic effects will be covered, but also feedback effects from the interaction of other economic sectors on the energy system. Local employment effects and economic effects on the Arctic countries will be assessed, providing insights in the induced impact on local societies. Since the possible geopolitical implications of producing resources in the Arctic are immense, especially with regard to energy security, ACCESS will study possible changes in energy import dependence. The potential environmental impacts will be evaluated, with the assessment including, among others, oil spill response, the impact on marine mammals, possible air pollution from production facilities and risks from decommissioning installed equipment. To provide the foundations for a sustainable extraction of resources in the arctic and to minimization human impacts, ACCESS will suggest a number of recommendations with regard to applicable technologies, policy actions like the declaration of protection areas as well as legal implications thereof.
The projections and estimates mentioned above will thus contribute to quantifying climate change impacts at macro and meso-economic levels in key economic sectors in the Arctic.

For governance in the Arctic, the availability of a multisectoral analysis regarding the regulation options for Arctic regions and activities would provide the potential for local, regional and international regulatory systems to be integrated appropriately, and potentially developed into an efficient legislative system. For policymakers and all stakeholders in the region to be able to access and assess these options, is of enormous significance. The ACCESS generation of a marine spatial planning system for specific representative regions and sub-regions of the Arctic will allow these potential governance and policy models to be appraised and impacts evaluated more efficiently. The research foundation provided by the three main sector studies will provide the framework on which the increase in human activities and the sustainable development of resources of all types can be progressed.
Elements of governance from each of the sectors under study will be brought together allowing integration and consolidation of interests, rights and responsibilities. The stages through which this is reached will involve pan-European research of the legislative status quo, the examination of the ways in which the different instruments should, or could work together, and the assimilation of these existing parts with proposed amendments and reform options.

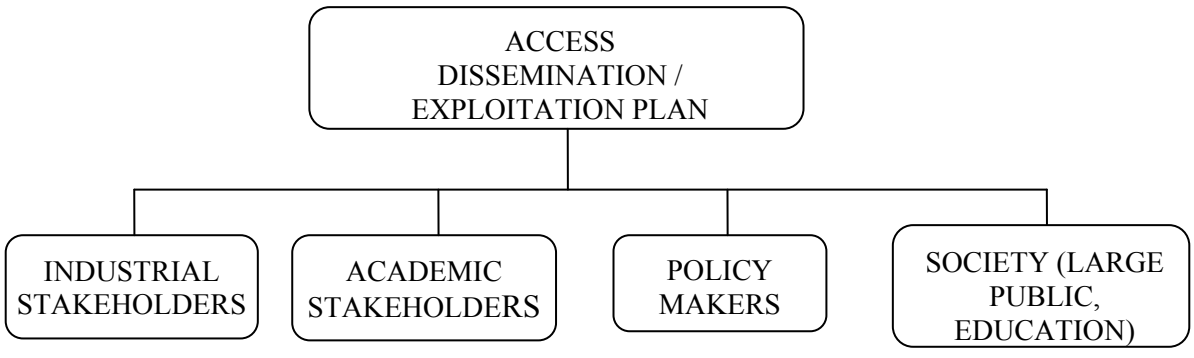
B3.2 Plan for the use and dissemination of foreground

As explained before, the main objective of the project is to assess and quantify climate change impacts on economy for key sectors (maritime transport, fisheries, tourism and resource extraction) and on how these sectors could affect the Arctic environment, including climate feedbacks. Consequently, it is extremely important to establish an effective and efficient dissemination of the project results and conclusions together with an exploitation of the developed knowledge, in order to reach all the concerned stakeholders in a two-ways information exchange.
The dissemination and exploitation plan will ensure that relevant information is available and delivered to the appropriate stakeholders in a suitable and easily accessible format. This will help the stakeholders to make decisions, set priorities and choose strategies from an informed position.
The dissemination plan will be reviewed regularly (once a year) and draw together the outcomes from all WPs and stakeholders meetings.
The dissemination and exploitation plan will focus on the following two different issues:

1. dissemination and public outreach: project results and other issues to be disseminated will be available. The project website will be an essential aspect of this activity: by simplifying technical language and placing the science in a wider context; it will allow wider public dissemination and thus reach an effective communication of scientific outputs to non-expert stakeholders and large public. The website will also be the platform for project participants to share data and results, inside the consortium.
2. exploitation of knowledge: data management will be the principal object of this activity, that will gather all the existent data in the different project domains in order to make them available for the concerned actors via databases, data portals, etc.

We give below:

- features that will guide our dissemination/exploitation detailed plan:
  - Target groups
  - Messages
  - Indicators
- a table presenting:
  - target groups description,
  - strategy to approach the targets with maximum effectiveness and efficiency
- feedbacks
- impact
- management of knowledge
- further exploitation beyond the project duration



Target groups

The consortium identified 4 target groups for dissemination/exploitation of the project results:

1. industrial stakeholders: strategies and recommendations for the sustainable management of the marine environment and marine key resources in the arctic region must be fully explained to stakeholders to

maximize understanding and the likelihood of implementation. This is fundamental to the success of the European Arctic Policy, the EU Marine Strategy, the future European Maritime Policy and associated policies;

2. academic stakeholders: international academic community and research actors can also be interested in the ACCESS results and will be associated to the project in order to establish a large, well structured network of exploitation/communication;
3. policy makers: since the ACCESS activity is closely associated with the objectives of the international climate change and sustainable development priorities, a close dialogue to inform these parties of the ACCESS results relevant to their policies and discussions will be maintained. Many outputs of ACCESS will be directly relevant to policy makers both within the EU, within individual Arctic States and within international fora (e.g. Arctic Council, IMO, etc.);
4. society (large public & education): much of the output will also be of direct relevance to general society, this is why large public and education (manly university students via summer schools and dedicated courses)universities will be approached with the appropriated tools.

Some of those actors have already been identified and are part of the Stakeholders/End Users Forum (see "Management structure and procedures" and "Consortium as a whole"-"Stakeholders/End Users Forum " chapters) but the actors' list will be finalized within the first year of the project, according to the defined indicators (see below).
These groups will also operate as high-level dissemination channels. In addition, the ACCESS dissemination will also take advantage of the numerous contacts the partners have within European and international networks, e.g. ArcticNet, etc., and European and national projects (see table in the "Consortium as a whole" chapter) that will aid to disseminate the results to the scientific, politic, and socio-economic stakeholders.

Messages

The objects of the ACCESS dissemination/exploitation plan are: 1/ supporting policy frameworks, public outreach, education, links to publications, events and web sites that are important for the ACCESS objectives; 2 / project results, models, databases.
The consortium will employ specialized personnel in order to adapt the messages to the identified target groups.
The strategy to efficiently reach the identified target groups (with alternative communication tools) is described in the Dissemination Table.

Indicators

1. The list of criteria to be used to identify the relevant actors of the three target groups to be contacted will be delivered during the first 6 months (D6.04, month 6);
2. the list of participants of the target groups will be delivered during the first year of the project (D6.05, month 12): they will all be part of a kind of open forum that will be in contact with the project through the website and a newsletter, in order to facilitate a two-ways exchange of ideas and information (D6.06, months 12, 16, 20, 24, 28, 32, 36, 40, 44, 48);
3. the External Boards / Forums (Advisory Board and Stakeholders/End Users Forum) will also advise the consortium about this issue

Dissemination Table: actors and strategy

Target groups	Description of the target group	Strategy to approach the target with the maximum effectiveness and efficiency
Industrial stakeholders	1) Stakeholders/End Users Forum: created inside the management structure to well reply to industrial needs; this Forum will be consulted regularly (see the management chapter) 2) other stakeholders: stakeholders potentially interested in the ACCESS	1) newsletter 2) invitation to the ACCESS General Assembly 3) presentations by key ACCESS representatives at selected international WP sector fora (e.g., for WP4, International AAPG oil and gas venue)

	results, divided into the following categories: a/ Offshore oil and gas industry b/ Fisheries and aquaculture c/ Ship operators and other maritime transport stakeholders d/ Security and surveillance companies e/ Tourism actors	4) video-linkage to other relevant sector meetings will be offered
Academic stakeholders	International academic community and research actors interested in the ACCESS results, associated to the project to establish a large, well structured network of exploitation of the ACCESS results. The following categories are concerned: a/ operational weather and ocean forecasting centres b/ marine institutes c/ climate research institutes d/ Universities with departments in the concerned domains	1) Conferences organisation and participation a/ ACCESS conferences b/ Arctic Frontiers Conference Series c/ Arctic Science Summit Week d/ ARCTICNET e/ SEARCH f/ international conferences in the ACCESS domains (AGU, EGU...) 2) Publications in scientific journals 3) relevant material into lecture packs for University Environmental / Economics/Law courses 4) Summer Schools
Policy makers	1) International organisations interested in ACCESS results: a/ European Commission b/ European Environment Agency c/ United Nations Environment Program 2) States of the Arctic region 3) national environmental authorities 4) regional conventions a/ Arctic Council b/ Nordic Council of Ministers c/ Inuit Circumpolar Conference d/ Sami parliament 5) regional networks 6) NGOs	1) Brochures and newsletter 2) short articles targeted to decision-makers, practitioners and other stakeholders (e.g. policy briefs) 3) handbook and recommendations for policy makers 4) thematic conferences and workshops for special interest groups
Society	1) Universities 2) Large public	1) Brochures 2) students workshops 3) targeted material for education, where it can complement national teaching curricula 4) adapted conferences 5) thematic conferences and workshops for special interest groups 6) comics and cartoons, 7) news and information distributed over social networks such as Facebook, Myspace, Google Earth and YouTube 8) optimise Google and other search engine linkages, getting ACCESS to the first line or two

		9) live streaming of the formal parts (presentations, etc) of consortia meetings/conferences/public events, etc 10) international press office links and releases 11) proposed special reportage to international environmental or economic popular publication (e.g., Economist, Nat Geographic, etc.)

Feedbacks

The ACCESS consortium is connected with other projects consortia, thanks to the Advisory board constituted by the coordinators of most of the projects concerning the Arctic region (ATP, ARKRISK, THOR, etc.) and partners related projects (see "Consortium as a whole" chapter). This will allow ACCESS to organise common activities/ joint outreach initiatives together with the other consortia and consequently, to benefit of this synergic effect and take advantage from the successful experience of the cited projects. These joint initiatives will allow the consortia to gather the optimal funding and to reach the largest public for higher profile exposures and events (cinema projections, cruises, etc.).

ACCESS will also take advantage of the large experience gained thanks to the numerous outreach activities developed in the frame of the DAMOCLES and SEARCH for DAMOCLES (S4D) projects, in which some of the ACCESS partners and the Coordinator have been working.
2 points in particular will be retained and easily applied in the ACCESS framework:

1. Summer Schools for students and researchers but also to disseminate among the partners the ACCESS consortium knowledge, concerning such different domains
2. for large public outreach activities (exhibitions, conferences, etc.), schools' pupils will be considerably involved, because of
    a. the importance to motivate these fellows to scientific research, girls in particular (see "gender issues" chapter), showing also other aspects of research and
    b. realise a more efficient communication, the large public approaching more easily school pupils than professors.

Exploitation of project knowledge

Data management will be the principal object of this activity that will gather all the existent data in the different project domains in order to make them available for the concerned actors via databases, data portals, etc.
Data management within ACCESS is based upon the data management system set up for the FP6 project DAMOCLES. The public end of this system is available at http://damocles.met.no/data_management/. The data management system will hold and provide online access to data and information submitted by project members and will ensure that all data are well documented and available in a standard format. A well managed data management system provides the project memory and acts as the project hub by link data providers and data users within the project, as well as offering a public presentation of the data collected by the project.

The data management system receives data from all project partners generating data. For the data management system to work properly, these data has to be documented both for potential users but equally important for management (handling the datasets). Within DAMOCLES this was solved using a standardized file format for submission of data. The file format selected was NetCDF/CF with additional metadata elements to ensure proper management. NetCDF/CF is a self describing file format which is supported by many scientific tools. The data management system will have a user interface including a test functionality for uploading data sets. Metadata (e.g. who measured, what, where and when along with any use or distribution restrictions on the data) are extracted from the uploaded data sets and data sets are made online available through a search engine. The search engine can also communicate with other computers using a machine interface (OAI-PMH) and the metadata profile of the International Polar Year. This interface may also be used to expose metadata through Global Change Master Directory. Communication between the data management system and data

providers/users will be provided through internet using the protocols FTP, HTTP and OpeNDAP. All metadata should available immediately.

Data management is however not only about managing datasets during the project, but also about managing them after the project. The data management system set up will host model data for at least 10years after the project ends, in situ observations longer.

Management of knowledge
IPR will be management according to the provisions of the Grant Agreement (GA) and of the Consortium Agreement.

B4 Ethical Issues

The ACCESS project will adhere to the ethical rules described in the Guide for Applicants. The proposed research raises no sensitive ethical questions related to animals, human beings, human biological samples, personal data and genetic information.

. Possible effects of scientific packages emitting, light (including lasers), or high energy acoustic will be evaluated for their impacts on marine organisms in accordance with the laws of littoral states, and international agreements.
In all these cases, the rules and recommendations of international bodies such as IUCN and ICES will be strictly followed. During fieldwork the disturbance to species and habitats will be restricted to the minimum required. For marine protected areas, permission for fieldwork will be requested where necessary.

Marine Mammals
There is no ethical issue in the project concerning marine mammals. On the contrary, the project aims at determining the possible impact of noise sources on their environment, behavior and skills to orientate and navigate in the Arctic.
European Cetacean Society (European Association gathering the 500 European scientists who study marine mammals) has created an ethical committee in 2004 (Science and Ethics Committee). This committee is, amongst other tasks, in charge of elaborating Best Practices in Marine Mammal Research. The president of this Committee, Michel André, is a partner of ACCESS (UPC). He will therefore act as an adviser to the project.

Social science
In the proposed work of the social science part, the ethical guidelines of IASSA (International Arctic Social Sciences Association) and AAA (American Anthropological Association) will be applied. Any informational data will be used only after prior and informed consent of the persons responsible for the information. These ethical guidelines will be followed even in cases where legislation in the local area of research does not exist for this particular sphere or does not require special action.

In cases where individuals or groups provide information of a confidential nature, their anonymity must be guaranteed in both the original use of data and in its deposition for future use. Research on humans should only be undertaken in a manner that respects their privacy and dignity. Subject to the requirements for anonymity, publications should always refer to the informed consent of participants and give credit to those contributing to the research project. Specific information gathered about economic data from governmental agencies or private enterprises can be especially sensitive and may require additional reassurances to informants and those closely connected to them.

A special attention should be paid to a set of ethical principles for conducting social science field work in the remote and small Northern settlements. Research in areas with local population necessarily requires a certain code of ethics with an emphasis on respect of local cultural traditions and values, presentation of the research to local community and sharing of the research results. While there is a vast range of informal interactions, encounters, observations and ‘participations’ involved in this form of research, it is to be noted that the research in small localities , where companies or persons could be identified easily, should be conducted with appropriate

confidentiality and anonymity. These particular ethical concerns include also mapping, video-taping and photographing.
As confidential data in our research we can consider:
- Statistical data to which researchers are given access and which, for example, a company can consider as confidential. It may be related to competing duties, obligations, conflicts of interest (e.g. statistics related to fish catch and landing, turnover etc.) or 'technical' practices (mapping of fishing grounds).
- Data on size and location of companies, data on occupation etc. in small localities where some employers could be identified individually.
- Data from employees reporting e.g. on their view on structural changes or management practices in the company or working conditions and occupational plans for future.

The experience in this field of Anna Stammler-Gossmann, UoL, (see her CV in partners' description chapter) is a guarantee for the respect of the described rules and procedures.

ETHICAL ISSUES TABLE

×	Does the proposed research involve human Embryos?		
×	Does the proposed research involve human human Foestal Tissues/Cells?		
×	Does the proposed research involve human Embryonic Stem Cells (hESCs)?		
×	Does the proposed research on human Embryonic Stem Cells involve cells in culture?		
×	Does the proposed research on Human Embryonic Stem Cells involve the derivation of cells from Embryos?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	×	

×	Does the proposed research involve children?		
×	Does the proposed research involve patients?		
×	Does the proposed research involve persons not able to give consent?		
×	Does the proposed research involve adult healthy volunteers?		
	Does the proposed research involve Human genetic material?		
	Does the proposed research involve Human biological samples?		
	Does the proposed research involve Human data collection?	×	See above
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL		

	Does the proposed research involve processing of genetic information or personal data (e.g health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	×	See above
	Does the proposed research involve tracking the location or observation of people?	×	See above
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL		

	Does the proposed research involve research on animals?		See above
	Are those animals transgenic small laboratory animals?		

	Are those animals transgenic farm animals?		
x	Are those animals non-human primates?		
	Are those animals cloned farm animals?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	x	

	Does the proposed research involve the use of local resources (genetic, animal, plant, etc.)?		
	Is the proposed research of benefit to local communities (e.g capacity building, access to healthcare , education,etc.?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	x	

	Research having direct military use		
	Research having the potential for terrorist abuse		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	x	

B5. Consideration of gender aspects

The coordinator in cooperation with leaders from each partner institution is responsible to oversee promotion of gender equality in the project.

All participant institutions are equal opportunity employers, and will follow up "the gender mainstreaming strategy by which each policy areas, including that of research, must contribute to promoting gender equality" as the Commission has adopted. The ACCESS consortium is composed by ¼ women project (co-ordination, steering committee, WP leaders and WP co-leaders). The female researchers are involved at all levels within the project: in the 7 WPs, ACCESS has a female co-coordinator, 3 WP are led and 2 co-led by females.

Therefore, the low representation of women at senior level in natural sciences (27% according to the She Figures 2009), which prevented gender equality in the number of involved scientists, is counterbalanced in the ACCESS project by the high degree of their responsibilities. Indeed, the ACCESS project advocates the conception of equality between men and women, according to which men and women should no longer be treated separately from decision-making, but simultaneously as an integrated part of the decision-making process.

The project will keep a strong focus on the promotion of research carriers for female scientist through a Gender Action Plan (D7.13), which deals with matters like recruitment and training, care of single parent's children to facilitate participation in cruises and courses etc. The plan will be delivered as a project deliverable at month 6 (D7.13).
The consortium has identified that women's participation in sciences has been hindered by practical issues such as availability and costs of child care, during fieldwork and cruises. Therefore, the Gender Action Plan will increase ACCESS' partners' awareness of this issue and will encourage them to see if they can develop a system for financial support to women and men with children, participating in fieldwork and cruises.
The project will also cover aspects like:
- promoting gender equality in recruitment (as reported by statistical indicators from the European Commission, proportion of women in research start to decrease at the PhD level. Therefore, particular attention will be given by all partners to promote female candidacies for positions created for the project.)
- promote participation of women in courses, seminars and conferences
- promote selection of working hours convenient for mothers
- inviting women to scientific/organizing committees

These provisions are to be interpreted as good practices since they facilitate women's employment but also as logical and essential measures to re-balance women's and men's opportunities. In this sense, these actions are crucial in facilitating women's professional careers.

Furthermore, female scientists and Ph. D. students will take part in the promotion of the project and the project results towards both scientific communities and for example towards the other important groups as children and undergraduate students. This last activity is very important for changing the low representation of women within science, but also to raise the general interest of science among young people. Thus, among the dissemination activities (see Dissemination chapter), the project plans initiatives in schools to raise girls 'awareness of sciences'. Indeed, it is necessary to go to schools and present examples of women who have succeeded in scientific jobs in research in order to prove that "it is possible, it exists". The project could be presented to promote jobs in research without putting forward the gender aspect. However, the presentation would be made solely by female researchers and scientists. The idea is that by proceeding in such a way it will become more natural that women are associated with scientific jobs.

A report on the implementation of the Gender Action Plan will be submitted at the end of the project.