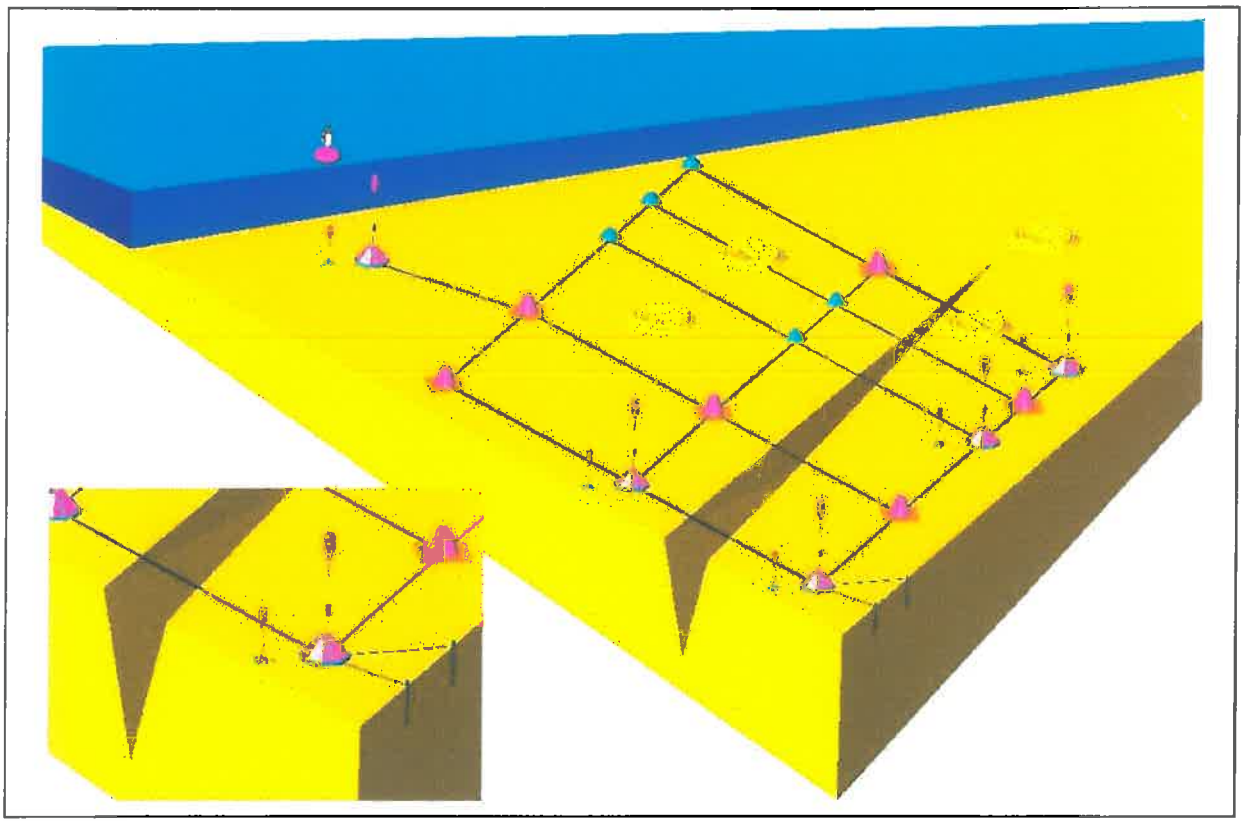
*A*rray of *S*ensors for long term *SE*abed *M*onitoring of geohazards

ASSEM



Etablissement public à caractère industriel et commercial

IFREMER
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object :
***ASSEM* proposal**

Encl. : 1

Our ref. : TMSI n° 2001.13

Brest, the 21st of February 2001

***ASSEM* partners**

Dear Partner,

Please find enclosed the ASSEM proposal as submitted to the EC on 15th of February, under Nr EVK3-2001-00038.

Thank you once more of your contributions; some of them have been modified in the final text in order to stay in the line of the EU call.

We hope that this beginning of co-operation between us will be fruitful. In fact, we actually have to wait for the season of fruits before we receive the results from Brussels.

Yours sincerely,

Jérôme Blandin

Jean-François Rolin

Mr John H.LØvholt
NGI
Sognsveien 72
PO Box 3930 Ullevaal Stadion
N-0806 Oslo (Norway)

Dr Pierre Briole
IPG
Dpt de Sismologie
4, place Jussieu
75005 Paris

Dr Giuseppe Etiope
Istituto Nazionale di Geofisica
e Vulcanologia (INGV)
Via Vigna Murata 605
00143 Roma
(Italy)

Dr Michel Masson
CAPSUM
Technologie GmbH
c/o GKSS-Tecnologiezentrum
Max-Planck-Straβe
21502 Geesthacht (Germany)

Dr Vassilis Lykousis
National Centre for Marine
Research (NCMR)
Aghios Kosmas
166 04 Athens (Greece)

Prof. George Ferentinos
University of Patras
Lab. of Marine Geology &
Physical Oceanography
26500 Rio-Patras (Greece)

Dr Cathie David
SAGE Engineering
18, ave Vandendriessche
B-1150 Bruxelles (Belgique)

EUROPEAN COMMISSION
RESEARCH DIRECTORATES
GENERAL
SHARED COST
RTD PROPOSAL FORMS

EN A 2 FP5RTD ☐☐

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For guidelines see in relevant "Guide for Proposers"

Proposal submission forms for financial support from the EC for shared-cost RTD actions: research and technological development projects, demonstration projects, and combined projects

If possible, these forms should be prepared using the Proposal Preparation Tool (ProTool), which is available via the Commission Internet site http://www.cordis.lu/fp5/protool or on CD-ROM. Use of the Proposal Preparation Tool is preferred by the Commission. However applicants may also use the forms in the Guide for Proposers. Using the ProTool, forms may be submitted electronically, or printed out and returned on paper.

Information on the Proposal [1]

Proposal Full Name	Array of Sensors for long term SEabed Monitoring of geohazards			
Proposal Acronym [5]	ASSEM	Proposal No [6]		
Call Identifier [3]	EESD-ESD-3			
Research Programme(s) [2]	EESD-1999			
Thematic priorities [2]	EESD-1999-3.2.3			

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Post stamp ☐☐ / ☐☐ / ☐☐☐☐ Reception date ☐☐ / ☐☐ / ☐☐☐☐

Shared Cost RTD Proposal Form – Form A1

EUROPEAN COMMISSION
RESEARCH DIRECTORATES GENERAL
SHARED COST RTD PROPOSAL FORMS

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A1. Proposal Administrative Overview [1]

Thematic priorities [2]	EESD-1999-3.2.3			
Type of Action [4]	RS			
Proposal Full Name	Array of Sensors for long term SEabed Monitoring of geohazards			

Contact person for the proposal(s) [7]

Title (Dr, Prof., ...)		Gender [8]	F		M	X
Family Name	ROLIN					
First Name	Jean-François					
Organisation Legal Name [9]	Institut Français de Recherche pour l'Exploitation de la Mer					
Department / Institute Name [10]	Direction de la Technologie Marine et des Systèmes d'Information					
PO Box [11]	BP 70					
Street Name and Number						
Post Code [12]	29 280	Cedex [13]				
Town/City	PLOUZANE					
Country Code [14]	F	Country Name [14]	France			
Telephone No [15]	(33-2)98224108	Fax No [15]	(33-2)98224135			
E-mail	Jean.Francois.Rolin@ifremer.fr					

Proposal abstract (maximum 1000 characters) [16]

Understanding the slopes instability phenomena or tectonically active areas requires the capacity to measure and monitor a set of geotechnical, geodesic and chemical parameters. Although this monitoring can be achieved on shore with conventional means, its implementation on subsea areas presents numerous difficulties. The project proposes to develop and evaluate an instrumentation set enabling this monitoring, on subsea areas of about 1 km2 during up to two years. It comprises a part devoted to improving and adapting a selection of sensors to their particular implementation conditions, a part dedicated to the networking of the sensors organized in a set of distributed subsea stations for data collection. The developed system will be implemented in the Ormen Lange oil field and Gulf of Corinth, selected for the important consequences of geohazard risks on the local population and industry.

Duration (in Months) [17]	36	Total Eligible Cost (in euro) [18]	3239262	EC Contribution requested (in euro) [19]	1992630
Keywords [20]	Seabed monitoring	Risk assessment	Slope stability		

Have you or any of your partners, previously or currently, submitted this proposal or one similar in content to any Community Programme? If yes, please give details of the proposal [21]	Y	X	N		
Programme Name	EESD	Year	2000	Proposal No	EVK3-2000-22056

Duly authorised by the consortium partners to send this proposal to the Commission, I certify that the description of this proposal and the information on forms A1, A2, A3 and A4 is accurate and agreed to by the consortium partners and that the consortium collectively agrees to carry out a project as described herein.

Date (DD/MM/YYYY)	12/01/2001
Signature of person authorised to submit a proposal in the co-ordinating organisation	Le Directeur Général Délégué J.-P. HEMMERY

Shared Cost RTD Proposal Form – Form A2

EUROPEAN COMMISSION
RESEARCH DIRECTORATES GENERAL
SHARED COST RTD PROPOSAL FORMS

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A2. Proposal Summary [22]

Objectives (maximum 1000 characters)

The project consists in developing the means to measure and monitor a set of geotechnical, geodesic and chemical parameters distributed on a seabed area in order to better understand the slope instabilities phenomena, to assess and possibly anticipate the associated risks. The means will be studied and realised to deploy a selection of adapted sensors on a seabed area (up to 1 km2) and transmit their data to shore for exploitation. The system will be implemented during twelve months on two sites presenting risks with high socio-economic impacts. The technological developments of the array of sensors for monitoring addresses the necessity in many fields to have access to both spatial and temporal variability of seabed parameters. It leads to the understanding of geohazards, their possible forecast and the specification of site monitoring equipments.

Description of the work (maximum 2000 characters)

The work comprises the following stages:
- The study and realisation of the monitoring system organising the sensors into a network of monitoring nodes distributed on a seabed area. It includes providing each node with energy and deployment means, specifying the functioning of the system, the default modes, the data acquisition strategy, the interfaces between subsystems. It ends by the integration and tests of the whole array.
- The search for and adaptation of the geotechnical, geodesic, chemical and environment sensors to their particular implementation conditions, including their long term operation and deployment process on the seabed surface.
- The enabling of the data flow throughout the system by
* Networking all monitoring nodes thanks to an underwater network interface that will enable each node to communicate with others through either a wire or the water (acoustic) medium, depending on the site configuration,
* Implementing a data telecommunication link between a given monitoring node and a computer station on shore,
* Processing the obtained data and merging them into a data base from the EU founded EMEWS project.
- Running pilot 12 months experiments on two sites presenting risks of slope instability (a deep sea oil exploitation, area Ormen Lange in Norway and a tectonically active area, Gulf of Corinth in Greece).

Scientific assessment, technical and price related evaluation and market study will be performed.

Milestones and expected results (maximum 500 characters)

In addition to the milestones attached to the work packages (end of design activity, of integration, of tests, first data acquired...), the two pilot experiments implementing and exploiting the ASSEM system in real conditions will constitute two major milestones. The result, widely enabled by the project partnership, will be the appropriation and dissemination of this monitoring technolology not only in the oil and gas industry but also in the world of monitoring networks for civil security.

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SHARED COST RTD PROPOSAL FORMS

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A3. Participant Profile/Information (1 form per participant) [23]

Legal Information on the participating organisation							
Participant Role [24]	CO	Participant No [25]	1	Assistant to Contractor No [26]			
Registration No with the European Commission's Research Programmes [27]							
Organisation Legal Name [28]	Institut Français de Recherche pour l'Exploitation de la Mer						
Short Name [29]	IFREMER			Legal Registration No [30]	33071536800297		
Activity Type [31]	REC	Legal Status [32]	PUC	If 'PRC', Specify [33]			
Business Area [34] (NACE)	73	User/Supplier [35] (U / S)	S	Cost Basis [36] (FC / FF / AC)	FF		
Organisation details [37]							
Annual turnover [38]	T3	Annual Balance Sheet Total [39]	B3	Number of employees [40]	S6		
Is Your Organisation independent [41]?				Y	X	N	
If No, please indicate legal name(s) of owner(s) who own 25 % or more [42]							
Is Your Organisation affiliated to any other participant(s) in the proposal [43]?				Y		N	X
If Yes, please indicate Participant No, Short Name(s) and character of affiliations(s) (D / I) [44]						I	
						I	
						I	

Address of the main department carrying out the work [45]			
Department/ Institute Name [10]	Institut Français de Recherche pour l'Exploitation de la Mer TMSI/TSI		
PO Box [11]	BP70		
Street Name and Number			
Post Code [12]	29 280	Cedex [13]	
Town/City	PLOUZANE		
Country Code [14]	F	Country Name [14]	France

Authorised person [46]							
Title (Dr, Prof., ...)	Directeur Général Délégué		Gender [8]	F		M	X
Family Name	HEMMERY						
First Name	Jean-Pierre						
Telephone No [15]	(33-1)46482292	Fax No [15]	(33-1)46482248				
E-mail	Jean.Pierre.Hemmery@ifremer.fr						
I certify that the above information is accurate and that my organisation has agreed to participate in this proposal.							
Date (DD/MM/YYYY)	12/02/2001	Le Directeur Général Délégué					
Signature of authorised person		J.-P. HEMMERY					

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RESEARCH DIRECTORATES GENERAL
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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A3. Participant Profile/Information (1 form per participant) [23]

Legal information on the participating organisation

Participant Role [24]	CR	Participant No [25]	2	Assistant to Contractor No [26]	
Registration No with the European Commission's Research Programmes [27]					
Organisation Legal Name [28]	Norwegian Geotechnical Institute				
Short Name [29]	NGI		Legal Registration No [30]	958254318	
Activity Type [31]	REC	Legal Status [32]	PNP	If 'PRC', Specify [33]	
Business Area [34] (NACE)	73L	User/Supplier [35] (U / S)	S	Cost Basis [36] (FC / FF / AC)	FC

Organisation details [37]

Annual turnover [38]	T2	Annual Balance Sheet Total [39]	B2	Number of employees [40]	S4

Is Your Organisation independent [41]?	Y	X	N	
If No, please indicate legal name(s) of owner(s) who own 25 % or more [42]				
Is Your Organisation affiliated to any other participant(s) in the proposal [43]?	Y		N	X
If Yes, please indicate Participant No, Short Name(s) and character of affiliations(s) (D / I) [44]				

Address of the main department carrying out the work [45]

Department/ institute Name [10]	Norwegian Geotechnical Institute		
PO Box [11]	3930 Ullevaal S		
Street Name and Number	Sognsveien 72		
Post Code [12]	N-0806	Cedex [13]	
Town/City	OSLO		
Country Code [14]	NO	Country Name [14]	NORWAY

Authorised person [46]

Title (Dr, Prof., ...)	Director		Gender [8]	F	M X
Family Name	Andersen				
First Name	Knut H.				
Telephone No [15]	+47 22 02 30 35	Fax No [15]	+47 22 23 04 48		
E-mail	kha@ngi.no				

I certify that the above information is accurate and that my organisation has agreed to participate in this proposal.

Date (DD/MM/YYYY)	01/02/2001
Signature of authorised person	Knut H. Andersen

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A3. Participant Profile/Information (1 form per participant) [23]

Legal information on the participating organisation

Participant Role [24]	CR	Participant No [25]	3	Assistant to Contractor No [26]	
Registration No with the European Commission's Research Programmes [27]					
Organisation Legal Name [28]	Institut de Physique du Globe de Paris				
Short Name [29]	IPGP			Legal Registration No [30]	19753428200011
Activity Type [31]	HES	Legal Status [32]	GOV	If 'PRC', Specify [33]	
Business Area [34] (NACE)		User/Supplier [35] (U / S)	U	Cost Basis [36] (FC / FF / AC)	AC

Organisation details [37]

Annual turnover [38]		Annual Balance Sheet Total [39]		Number of employees [40]	S5

Is Your Organisation independent [41]?	Y	X	N	
If No, please indicate legal name(s) of owner(s) who own 25 % or more [42]				
Is Your Organisation affiliated to any other participant(s) in the proposal [43]?	Y		N	X
If Yes, please indicate Participant No, Short Name(s) and character of affiliations(s) (O / I) [44]				

Address of the main department carrying out the work [45]

Department/ Institute Name [10]	Département de Sismologie - Institut de Physique du Globe de Paris		
PO Box [11]			
Street Name and Number	4 Place Jussieu		
Post Code [12]	75252	Cedex [13]	05
Town/City	Paris		
Country Code [14]	F	Country Name [14]	France

Authorised person [46]

Title (Dr, Prof., ...)	Prof.			Gender [8]	F	M X
Family Name	Jaupart					
First Name	Claude					
Telephone No [15]	(33-1) 44 27 68 73	Fax No [16]	(33-1) 44 27 24 01			
E-mail	jaupart@ipgp.jussieu.fr					

I certify that the above information is accurate and that my organisation has agreed to participate in this proposal.

Date (DD/MM/YYYY)	08/02/2001
Signature of authorised person	Claude JAUPART Directeur de l'Institut de physique du globe de Paris

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RTD PROPOSAL FORMS

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A3. Participant Profile/Information (1 form per Participant) [23]

Legal information on the participating organisation

Participant Role [24]	CR	Participant No [25]	4	Assistant to Contracter No [26]	
Registration No with the European Commission's Research Programmes [27]					
Organisation Legal Name [28]	ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA				
Short Name [29]	INGV		Legal Registration No [30]		
Activity Type [31]	REC	Legal Status [32]	GOV	If 'PRC', Specify [33]	
Business Area [34] (NACE)	73 I	User/Supplier [35] (U / S)	S	Cost Basis [36] (FC / FF / AC)	AC

Organisation details [37]

Annual turnover [38]	T3	Annual Balance Sheet Total [39]	B3	Number of employees [40]	S6

Is Your Organisation independent [41]?	Y	X	N	
If No, please indicate legal name(s) of owner(s) who own 25 % or more [42]				
Is Your Organisation affiliated to any other participant(s) in the proposal [43]?	Y		N	X
If Yes, please indicate Participant No, Short Name(s) and character of affiliations(s) (D / I) [44]				

Address of the main department carrying out the work [45]

Department/ Institute Name [10]	ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA		
PO Box [11]			
Street Name and Number	Via Vigna Murata, 605		
Post Code [12]	00143	Cedex [13]	
Town/City	Rome		
Country Code [14]	I	Country Name [14]	ITALY

Authorised person [46]

Title /Dr, Prof., ...)	Prof.			Gender [8]	F		M	X
Family Name	BOSCHI							
First Name	Enzo							
Telephone No [15]	+390651860462	Fax No [15]	+39065041181					
E-mail	PRESIDENTE@INGV.IT							

I certify that the above information is accurate and that my organisation has agreed to participate in this proposal.

Date (DD/MM/YYYY)	01/02/01
Signature of authorised person	Enzo Boschi

ISTITUTO NAZIONALE DI GEOFISICA

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A3. Participant Profile/Information (1 form per participant) [23]

Legal information on the participating organisation

Participant Role [24]	CR	Participant No [25]	5	Assistant to Contractor No [26]	
Registration No with the European Commission's Research Programmes [27]					
Organisation Legal Name [28]	CAPSUM Technologie GmbH				
Short Name [29]	CAPSUM			Legal Registration No [30]	HRB 596 (Geesthacht)
Activity Type [31]	IND	Legal Status [32]	PRC	If 'PRC', Specify [33]	GmbH
Business Area [34] (NACE)	73 L	User/Supplier [35] (U / S)	S	Cost Basis [36] (FC / FF / AC)	FC

Organisation details [37]

Annual turnover [38]	T1	Annual Balance Sheet Total [39]	B1	Number of employees [40]	S2

Is Your Organisation independent [41]?	Y	X	N	
If No, please indicate legal name(s) of owner(s) who own 25 % or more [42]				
Is Your Organisation affiliated to any other participant(s) in the proposal [43]?	Y		N	X
If Yes, please indicate Participant No, Short Name(s) and character of affiliations(s) (D / I) [44]				

Address of the main department carrying out the work [45]

Department/ Institute Name [10]			
PO Box [11]			
Street Name and Number	Max-Planck-Strasse		
Post Code [12]	21502	Cedex [13]	
Town/City	Geesthacht		
Country Code [14]	D	Country Name [14]	Germany

Authorised person [46]

Title (Dr, Prof., ...)	Dr.		Gender [8]	F	M X
Family Name	Masson				
First Name	Michel				
Telephone No [15]	(49-4152)871837	Fax No [15]	(49-4152)871888		
E-mail	masson@capsum.de				

I certify that the above information is accurate and that my organisation has agreed to participate in this proposal.

Date (DD/MM/YYYY)	31/01/2001
Signature of authorised person	MASSON

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SHARED COST RTD PROPOSAL FORMS

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A3. Participant Profile/Information (1 form per participant) [23]

Legal information on the participating organisation

Participant Role [24]	CR	Participant No [25]	6	Assistant to Contractor No [26]	
Registration No with the European Commission's Research Programmes [27]					
Organisation Legal Name [28]	NATIONAL CENTRE FOR MARINE RESEARCH				
Short Name [29]	NCMR			Legal Registration No [30]	
Activity Type [31]	REC	Legal Status [32]	GOV	If 'PRC', Specify [33]	
Business Area [34] (NACE)	73	User/Supplier [35] (U / S)		Cost Basis [36] (FC / FF / AC)	FC

Organisation details [37]

Annual turnover [38]	T1	Annual Balance Sheet Total [39]	B1	Number of employees [40]	S4

Is Your Organisation independent [41]?	Y	X	N	
If No, please indicate legal name(s) of owner(s) who own 25 % or more [42]				
Is Your Organisation affiliated to any other participant(s) in the proposal [43]?	Y		N	X
If Yes, please indicate Participant No, Short Name(s) and character of affiliations(s) (D / I) [44]				

Address of the main department carrying out the work [45]

Department/ Institute Name [10]	INSTITUTE OF OCEANOGRAPHY, NATIONAL CENTRE FOR MARINE RESEARCH		
PO Box [11]			
Street Name and Number	AGHIOS KOSMAS		
Post Code [12]	166 04	Cedex [13]	
Town/City	ATHENS		
Country Code [14]	EL	Country Name [14]	GREECE

Authorised person [46]

Title (Dr, Prof., ...)	Dr.	Gender [8]	F		M	X
Family Name	CHRONIS				
First Name	GEORGIOS				
Telephone No [15]	++30-1-9820214	Fax No	++30-1-9833095		
E-mail	gchronis@ncmr.gr				

I certify that the above information is accurate and that my organisation has agreed to participate in this proposal.

Date (DD/MM/YYYY)	30/1/2001
Signature of authorised person	

AUTHORIZATION TO SEND THE PROPOSAL

According to the Evaluation Manual

I, undersigned, Jean-François ROLIN from IFREMER, acting as co-ordinator of the ASSEM proposal for a research and technological development project in the framework of the Call EESD-ESD-3 (2000/C 324/09), hereby certify that I am duly authorised to send this proposal and that the latter is agreed by the UNIVERSITY OF PATRAS, as partner number 7.

Signed in Brest, France,
Date, 13 February 2001

Jean-François ROLIN

Jean-François ROLIN
Directeur du Département
Technologie des Systèmes Instrumentaux
TMSI/TSI

Shared Cost RTD Proposal Form – Form A3

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RESEARCH DIRECTORATES GENERAL
SHARED COST RTD PROPOSAL FORMS

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A3. Participant Profile/Information (1 form per participant) [23]

Legal information on the participating organisation

Participant Role [24]	CR	Participant No [25]	7	Assistant to Contractor No [26]	
Registration No with the European Commission's Research Programmes [27]					
Organisation Legal Name [28]	University of Patras				
Short Name [29]	UPAT			Legal Registration No [30]	
Activity Type [31]		Legal Status [32]	GOV	If 'PRC', Specify [33]	
Business Area [34] (NACE)		User/Supplier [35] (U / S)	U	Cost Basis [36] (FC / FF / AC)	AC

Organisation details [37]

Annual turnover [38]	NA	Annual Balance Sheet Total [39]	B1	Number of employees [40]	S6

Is Your Organisation independent [41]?	Y	X	N	
If No, please indicate legal name(s) of owner(s) who own 25 % or more [42]				
Is Your Organisation affiliated to any other participant(s) in the proposal [43]?	Y		N	X
If Yes, please indicate Participant No, Short Name(s) and character of affiliations(s) (D / I) [44]				I
				I
				I

Address of the main department carrying out the work [45]

Department/ Institute Name [10]	GEOLOGY, LAB OF MARINE GEOLOGY & PHYSICAL OCEANOGRAPHY / University of Patras		
PO Box [11]			
Street Name and Number			
Post Code [12]	26500	Cedex [13]	
Town/City	RIO-PATRAS		
Country Code [14]	EL	Country Name [14]	Greece

Authorised person [46]

Title (Dr, Prof., ...)	Professor		Gender [8]	F		M	X
Family Name	VAYENAS					
First Name	COSTAS					
Telephone No [15]	(30-61)991822	Fax No [15]	(30-61)991711			
E-mail	rector@patras.gr					

I certify that the above information is accurate and that my organisation has agreed to participate in this proposal.

Date (DD/MM/YYYY)	12/02/2001
Signature of authorised person	

AUTHORIZATION TO SEND THE PROPOSAL

According to the Evaluation Manual

I, undersigned, Jean-François ROLIN from IFREMER, acting as co-ordinator of the ASSEM proposal for a research and technological development project in the framework of the Call EESD-ESD-3 (2000/C 324/09), hereby certify that I am duly authorised to send this proposal and that the latter is agreed by SAGE-ENGINEERING SA / NV, as partner number 8.

Signed in Brest, France,
Date, 13 February 2001

Jean-François ROLIN

Jean-François ROLIN
Directeur du Département
Technologie des Systèmes Instrumentaux
TMSI/TSI

Shared Cost RTD Proposal Form – Form A3

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SHARED COST RTD PROPOSAL FORMS

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A3. Participant Profile/Information (1 form per participant) [23]

Legal information on the participating organisation

Participant Role [24]	CR	Participant No [25]	8	Assistant to Contractor No [26]	
Registration No with the European Commission's Research Programmes [27]					
Organisation Legal Name [28]	SAGE-ENGINEERING SA/NV				
Short Name [29]	SAGE			Legal Registration No [30]	579.188
Activity Type [31]	IND	Legal Status [32]	PRC	If 'PRC', Specify [33]	SA
Business Area [34] (NACE)		User/Supplier [35] (U / S)	U	Cost Basis [36] (FC / FF / AC)	FF

Organisation details [37]

Annual turnover [38]	T1	Annual Balance Sheet Total [39]	B1	Number of employees [40]	S3

Is Your Organisation independent [41]?	Y		N	X
If No, please indicate legal name(s) of owner(s) who own 25 % or more [42]	SAGE HOLDING A.G.			
Is Your Organisation affiliated to any other participant(s) in the proposal [43]?	Y		N	X
If Yes, please indicate Participant No, Short Name(s) and character of affiliations(s) (D / I) [44]				I
				I
				I

Address of the main department carrying out the work [45]

Department/ Institute Name [10]	SAGE-ENGINEERING		
PO Box [11]			
Street Name and Number	18 AVE VANDENDRIESSCHE		
Post Code [12]	B-1150	Cedex [13]	
Town/City	BRUSSELLS		
Country Code [14]	B	Country Name [14]	Belgium

Authorised person [46]

Title (Dr, Prof., ...)	Dr		Gender [8]	F		M	X
Family Name	CATHIE					
First Name	DAVID					
Telephone No [15]	(32-2)7760310	Fax No [15]	(32-2)7760319			
E-mail	dcathie@sage-be.com					

I certify that the above information is accurate and that my organisation has agreed to participate in this proposal.

Date (DD/MM/YYYY)	08/02/2001
Signature of authorised person	

Shared Cost RTD Proposal Form – Form A4 (1/2)

EUROPEAN COMMISSION
RESEARCH DIRECTORATES GENERAL
SHARED COST RTD PROPOSAL FORMS

EN E 2 FP5RTD

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A4. Cost Summary in euro [47] (part 1/2)

Participant Role [24]	Participant No [25]	Assistant to Contractor No [26]	Participant Short Name [51]	Number of person/months [52]	Personnel Costs [53]	Durable Equipment [54]	Consumables [55]	Travel and Subsistence [56]	Computing [57]	Subcontracting [58]	Subtotal part 1/2 [59]
CO	1	[48]	IFREMER	64	273072	13000	69000	38000	0	190000	583072
CO	1	[49]	Co-ordination	3	12489	0	0	4000	0		16489
CO	1	[50]	Total co-ordinator costs	67	285561	13000	69000	42000	0	190000	599561
CR	2		NGI	22	256098	132927	0	33537	0	30000	452562
CR	3		IPGP	57	120000	51000	15000	30000	0	0	216000
CR	4		INGV	50	105000	25000	55000	30000	0	80000	295000
CR	5		CAPSUM	17	82030	0	31250	2760	0	0	116040
CR	6		NCMR	54	103000	0	58000	42000	0	0	203000
CR	7		UPAT	48	39000	0	15000	12000	0	86200	152200
CR	8		SAGE	13	108000	0	0	27000	0	0	135000
TOTAL [66]				328	1098689	221927	243250	219297	0	386200	2169363

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Proposal Acronym [5]	ASSEM	Proposal No [6]	

A4. Cost Summary in euro [47] (part 2/2)

Participant Role [24]	Participant No [25]	Assistant to Contractor No [26]	Participant Short Name [51]	Subtotal of part 1/2 [59]	Other Specific project Costs [60]	Protection of knowledge [61]	Overhead Costs [62]	Total Costs [63]	Costs Basis : FC/FF/AC [37]	% Requested from the Community [64]	Requested Contribution from the Community [65]
CO	1	[48]	IFREMER	583072	30000	0	218458	831530			415765
CO	1	[49]	Co-ordination	16489	0	0	9992	26481			13240
CO	1	[50]	Total co-ordinator costs	599561	30000	0	228450	858011	FF	50	429005
CR	2		NGI	452562	158537	0	65000	676099	FC	50	338049
CR	3		IPGP	216000	0	0	43000	259000	AC	100	259000
CR	4		INGV	295000	0	0	32000	327000	AC	100	327000
CR	5		CAPSUM	116040	0	0	30712	146752	FC	50	73376
CR	6		NCMR	203000	276000	0	112000	591000	FC	50	295500
CR	7		UPAT	152200	0	0	7800	160000	AC	100	160000
CR	8		SAGE	135000	0	0	86400	221400	FF	50	110700
TOTAL [66]				2169363	464537	0	605362	3239262			1992630

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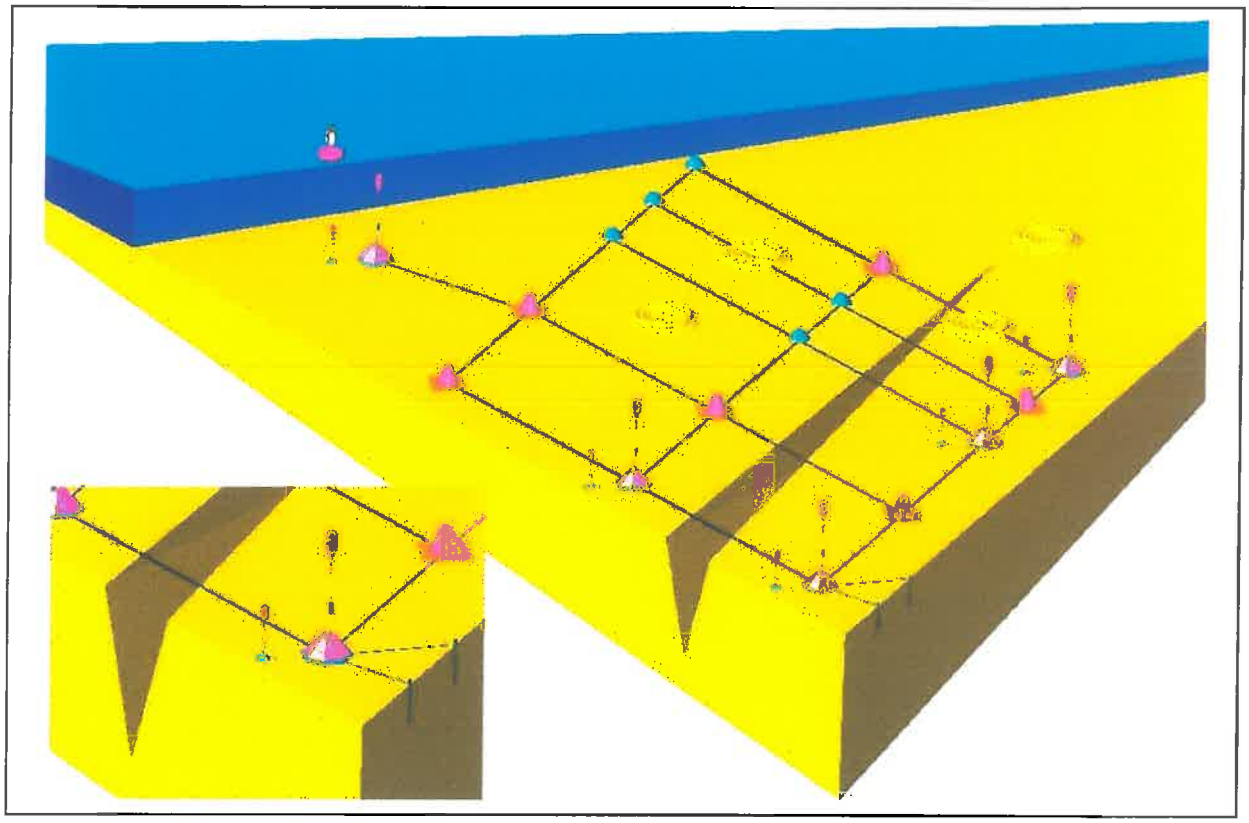
B

*A*rray of *S*ensors for long term *SE*abed *M*onitoring of geohazards

ASSEM



Energy Environment and Sustainable Development
Part A : Environment and Sustainable Development

Thematic priority:
3.2.3. Technologies for safe, sustainable and economic exploration and exploitation of marine resources

12/02/2001

Page

B3 Objectives

The European continental margins are the focus of increasing human activities that are moving towards deeper waters. They are witnessing the greatest technological advances in the world for deep-water development, in which European industries and academic institutions are at the forefront. Some of these margins are also a place where drastic phenomena like slope failures occur, hence questioning the safety of people, installations and environment.

In other respects, some shallow water areas in Europe, surrounded by densely populated belts and associated infrastructures are located in seismic zones where the seafloor is also unstable. The earthquakes are the most frightening geological events for the population, their prediction is a major trend for the next decades. In many cases, the faults and seismogenic zones are situated under the sea.

In both cases, there is a need to understand better the phenomena leading to these instabilities. This understanding can be widely enabled by measuring the *in situ* stress state and a set of geotechnical, geodetic or chemical parameters of the sediment and seafloor. A site must be surveyed in several locations along failure lines, near a fluid expulsion zone or on a line of change of slope or a possible presence of gas hydrates. In addition, long term slow variations of the measured parameters must be detected. This makes it necessary to have access to both their spatial and temporal variability.

ASSEM (Array of Sensors for long term SEabed Monitoring of geohazards) is a technological project enhancing some marine technologies allowing a real time monitoring of the seabed. The aim is to develop a permanent set of reliable sensors and their network nodes usable in any area threatened by geohazard. The project includes the design of the array, the evaluation and the conviction phases.

As techniques needing to be improved come from the offshore oil industry contractors and from academic marine geology instrumentation developers, the design is jointly performed by partners from both background. The evaluation will be done with respect to the needs to protect lives, constructions and exploitation equipment. This leads to the objective to convince through two targeted seabed problems: slope instability risks and seismic risks.

This project proposes to develop, deploy and assess a seafloor monitoring system, aiming at watching areas of up to one square kilometer, up to 200 meters down an existing borehole, during at most two years. The water depth may reach 4000 m. The proposed system will be modular in order to fit the particular topology of a given site of interest. It will allow near real time data retrieval.

ASSEM proposes a new mode of slopes stability investigation in real time using long term seafloor monitoring nodes (a "distributed" observatory).

This mode can potentially build on, and advance beyond, the surface ship expeditionary style that has dominated the marine sciences in the 20th century.

Two kinds of measurement were done:
- from the ship during cruises with cable launched instrumentation;
- from autonomous recording instruments, data being recovered only at the end of the deployment or from time to time by ROV.

This method presents many inconveniences and sources of errors:
- many parameters are collected only from time to time, during cruises, in the same area but not at the same place. Errors occur from the heterogeneity of the area ;
- events may occur between two survey, which are not detected ;
- autonomous recording instruments may fail during their deployment ;
- when they operate, they give only one parameter in one location.

ASSEM project aims to develop a more reliable and accurate method to collect geotechnical data in any site.

The intrinsic properties of the sediment which are not prone to time variations must be collected with specific means out of the scope of ***ASSEM*** during a previous survey. But there is a relation with survey because a methodology has to be determined in order to decide what are the best spots to be monitored. The project will be a pioneer in this deployment strategy.

The basic principle of the ***ASSEM*** project is to deploy instrument packages at different locations, the sensors being either installed in available boreholes, or pushed into the unconsolidated sediment, or simply laid down on the seafloor. The various sensors of a package are linked to a local data logging and communication unit, forming a monitoring node. The modularity induced by this architecture of "nodes" will be an asset to promote the use of the sensors in various configurations.

The various nodes distributed on the instrumented site are then interconnected through an underwater network using either acoustic communication or cable, depending on the topology. In the same way, a link depending on the site configuration will be implemented between one of the nodes and the shore, hence linking all the nodes to an exploitation station where the data are collected, processed and made available to users through the internet. This concept aims at promoting interoperability in the new field of benthic stations. A close co-operation with other projects is possible due to other commitments of the partners.

As a demonstration of the concept feasibility and interest, the project includes two pilot experiments of approximately twelve months implying close co-operation with the key local actors. One experiment will be carried out on a selected deep continental margin site, the other in a shallower water seismic area. In both cases, the monitoring system configuration will be adapted to the specific requirements, and the produced data carefully assessed and exploited by the concerned actors of the site. The double field demonstration is necessary in order to address the whole complexity of the geohazard monitoring, hence a step of conviction that a reliable long term instrumentation is mature.

B4 Contribution to programme/key action objectives

The proposed project addresses thematic priorities of the specific programme on *"Energy, environment and sustainable development"* especially the point 3.2.3 : *Technologies for safe, sustainable and economic exploitation of marine resources.*

A few decades ago, when man started the exploration and after a while the exploitation on the continental shelf, the safety of offshore structures was addressed with a major concern on soil properties. Offshore design, subsea technology, marine geotechnics, scientific sedimental geology have been developed tremendously in the meantime, especially in Europe. The exploitation of the North Sea resources has been stimulating the economy of Europe.

The new challenge is to succeed also in the exploitation of geohazard threatened areas. Major projects are concerned: oil and gas production, piles of bridges, harbours, airports on the shore, fisheries… The European national and local authorities, the investors and the oil companies agree on the need to exploit in a safe and sustainable way. But data is lacking from the deepwater seabed along continental margins where large submarine slides may occur, as well as from tectonic fault areas ; fluid seeps are involved in both cases.

The marine technology able to instrument the sediment is mature but needs improvements in order to perform a long term monitoring. Reliable systems must ensure a permanent follow-up of episodic or slowly drifting phenomena. It is complementary from cruises of observation (offshore survey or oceanographic cruises) but uses automated systems. They must be operated and bring back data through a near real time communication from the seabed to the shore. The link to a database and Internet allows dissemination of the data.

ASSEM is a technological project devoted to these improvements of oceanographic instrumentation well suited for the monitoring of 1 km² of seabed. In some cases, a subsea observatory can be one benthic station ensuring all the necessary measurements. But with spatially and time related seafloor phenomena, the variability induces a need for several measurement spots. It is true for fluid flux and chemical monitoring and for the following-up of strain and motion as well as for biological observation.

ASSEM technological solution is an underwater network of monitoring nodes including integrated sensors. The technical teams involved in the development will link their sensors and electronics together through Internet for the programming and testing phase. ***ASSEM*** will then benefit from Internet Technologies (IT) to shorten the integration and the technical co-ordination phase.

ASSEM exploits and implements a set of novel yet existing technologies to provide an integrated system, from permanent *in situ* measurement to a flow of formatted data feeding a monitoring data base.

In some respect, the proposed project contributes also to the point 7.1 *"The fight against major natural and technological hazards"* concerning "seismic risks" and "volcanic risks". ***ASSEM*** addresses the development of technologies for the underwater part of surveillance networks for earthquakes or volcanic disasters.

It contributes also to the point 3.1.2 *"Assessment of sedimentary systems for the sustainable management and use of the shelf, slope and deep sea floor"* in the way that the integrated studies addressed there will once need technological developments of the type proposed in ***ASSEM*** in order to improve the knowledge of spatial and time variation of fluids and slope stability.

B5 Innovations

ASSEM is one of the new modes of deep ocean investigation. It brings a lot of innovations:

- Near real time collection of data allows to detect any failure in the system and to adapt the sampling rate to observed phenomena. This contributes to the reliability and the accuracy of the data set.
- Modular design, standard connecting and installation interface allows to configure easily the system to the site to instrument and to add new sensors in the future.
- Networking sensors allows to monitor an array over 1 km² and collect data in 4 dimensions (3D and time).
- Long term time monitoring will be achieved by some modifications and qualification of pore pressure probes and gas rate sensors. ***ASSEM*** partners master the technology of these sensors which were developed for short deployment.
- Long term gas rate sensors deployed in the water column can detect any gas release in the area all along deployment time.
- Fibre optics sensors and geodesic developments will offer new prospects.

ASSEM will propose also format and management for geotechnical data at sea and hence contribute to the dissemination of the data and to the exchange between scientists in the geohazard field.

The oil companies have long experience with monitoring of their offshore installations. Many of the large oil and gas production platforms which are fixed to the seabed have instrumentation systems in touch with the soil or into and below the seabed surface.

Several of these systems have now been in service for more than 10 years. It proves that subsea monitoring is possible. It is now time to monitor geohazard threatened areas early before the exploitation and transmit data in near real time.

The ***ASSEM*** consortium join partners involved in all the technical aspects of this project and proposed innovations are in the continuity of their development.

Partner 1 has already built many autonomous landers and stations. He instrumented bore hole and presently develops local acoustic network.

Partner 2 is specialized in geotechnical measurement and their exploitation. He participates in ongoing projects of seabed monitoring.

Partner 8 has a long experience of integration of complex systems in geotechnics.

The following table gives a synthetic view of the innovative aspects brought by the partners in this project.

		Made available through EU project	Made available by project partners	Commer-cially available	Developed inside the project
System	Modular long term real time monitoring system over 1 km²				X
Monito-ring unit	Light autonomous monitoring subsea station		X		
	Long term monitoring multiprobe subsea observatory	X			
	Interoperable monitoring subsea node module				X
Sensors	Geotechnical probes for survey		X	X	
	Pore pressure probes for monitoring		X		
	Pore pressure probes for long term monitoring				X
	Geodesics on land	X	X		
	Permanent geodesics at sea				X
	Gas rate sensor short term		X	X	
	Gas rate sensor long term				X
	Distributed fiber optic sensor systems for subsea use			X	
	Long term subsea sensor using fiber optics				X
Data flow	Communication from seabed with operator on shore	X			
	Networking of subsea stations with acoustic links	X			
	Networking of subsea nodes in a distributed architecture				X
	Compliance with seismic onshore monitoring network including data format and management				X
Deploy-ment	Deployment tools to instrument deep and shallow seafloor		X		
	Standard connecting and installation interface				X

B6 Project workplan

a) Introduction

The ***ASSEM*** project consists in developing and implementing an underwater monitoring network and in exploiting not only its produced data but also the methods, know-how and technologies operated on this occasion. To achieve this, the effort is organised in three classes of interrelated tasks, the management of the whole coming under a fourth one.

The first class gathers all the tasks related to the development of the monitoring network (WP1 to 3):
WP1 deals exclusively with the *system* aspects, from the pre-design study to the integration of the subsystems and final tests. The emphasis will be placed on the modularity of the obtained system.
WP2 is devoted to the *sensors* upgrade, i.e. their adaptation to the particular ***ASSEM*** implementation conditions and requirements. It is divided into four parallel tasks corresponding to four types of sensors.
WP3 develops the subsystems and tools allowing the *data to flow* along the system, from the sensors output to the data exploitation base on shore.
As a guideline to the development phase, innovative technical solutions will be explored and their feasibility assessed, while backup solutions based on proven techniques will be kept available not to endanger the pilot experiments goals.
(WP1 to 3 = 48,8 % of the project budget).

The second class of tasks is the implementation of the monitoring network. It comprises two parallel work packages:
WP4 will carry out an implementation experiment on a deep water European *continental margin* site, where the gathered data and methods will interest oil operators in the first place.
WP5 will do the same in a *tectonically active* area, where a terrestrial surveillance network is already installed. The ***ASSEM*** experiment will be seen there as an undersea extension of this network.
Naturally, the pursuit of two distinct pilot experiments represents a challenge for it tends to scatter the global effort. However, this double experiment:
- is fundamental for the project balance between industrial and civil security applications,
- compels to design a really modular and versatile system, a major point of the ***ASSEM*** concept,
- is made financially possible through the use of industrial facilities on the WP4 site.

(WP4-5 = 37,1 % of the project budget).

The third class comprises the tasks related to the exploitation of the data and the experience acquired during the project. To avoid a split between scientific considerations on the one hand and industrial interests on the other hand, the tasks were grouped in a single work package (WP6) named "exploitation and data assessment", under the responsibility of an industrial partner (partner 8).
WP6 starts from the very beginning of the project with an *array deployment strategy* task, providing the engineering study (WP1) with the same scientific bases and criteria as the ones used to *scientifically assess* the project at its end.
On the industrial side, a *technical and price related evaluation* will be conducted as soon as the data are available, i.e. with the necessary hindsight regarding the exploitation costs reality. The results of this evaluation will be an input to the *industrial exploitation* task itself at the end of the project.
(WP6 = 6,7 % of the project budget).

Lastly, a whole work package (WP7) is devoted to the project management.
(7,3 % of the project budget).

The sequence of tasks and their interrelations are showed on the project PERT diagram in section B6c.

WP1: System design and integration

Objective:
To design and integrate a 3D seabed monitoring system - referred below as *system* -meeting the scientific requirements of the project: horizontal extension: 1000 m x 1000 m. (vertical extension: 200 m, using existing boreholes). Max water depth for design: 4000 m (for ***ASSEM*** experiments 2000 m). Data acquisition duration: 24 months (design value), with sampling frequencies, depending on detected events.

This work package exclusively addresses the system aspects guaranteeing a coherence between all the developments carried out in WP2 and WP3 and the compatibility of the subsystems. This work package is responsible for the modularity of the obtained system, especially through the selected architecture.

Task 1.1 **System technical specifications**

The objective is to settle the specifications of the system, from an analysis of the scientific requirements and the experience of the partners in monitoring devices. It will take into account the latest developments in undersea communication technologies as well as the available sea deployment techniques and corresponding means (output from task 1.2).
The main technological choices will be made so that subparts of the system can be re-used or operated with other sub-sea observatories; this interoperability will be sought through the choice of judicious data transmission protocols. A general analysis of the available undersea communication technologies will determine precisely in which cases it is preferable to chose the acoustic data transmission rather than deploy a cable taking into account the respective energy and deployment constraints of each technology.

Task 1.2 **Methodology of deployment at sea**

The relevant deployment means able to install the systems will be envisaged in a study taking into account the price and availability on the industrial offshore operation market and among the sea operation means of academic marine research.
The design of manipulation interfaces, connection/disconnection, standard mechanical interfaces for maintenance will be performed to ensure easy operations with a wide range of underwater vehicles (including those planned for the deployments in WP4 and WP5).
Deployment, maintenance and retrieval procedures will be established.

Task 1.3 **Detailed operating specifications of the system**

This task aims at describing the functioning of the system at a detailed level. It must be achieved early enough in the project to serve as an input to:
- the communication and storage front end specifications (task 3.2)
- the enhanced sensors (WP2)
- the telecommunication segment (WP3-4).

It will describe in particular:
- the system set-up, configuration and reconfiguration procedures
- the interactions between nodes
- the data acquisition, storage and recovery strategy
- the default modes.

Task 1.4 **Standard sensors interface specifications**

Objective:
To establish a common interface specification between all the *enhanced sensors* delivered by WP2 and the *communication and storage front-ends* delivered by WP3.
Task description:
Starting from the experience of previous attempts to standardise sensors interfaces, a study will be carried out to determine whether a field bus type interface is more suitable than conventional point to point links. A particular emphasis will be on the search for compatibility with sensors implemented in the framework of other EU funded projects and/or delivered by European sensors manufacturers.

Task 1.5 **Monitoring nodes integration and tests in laboratory**

Objective:
To mechanically integrate all the subsets of each monitoring node on their frame structure, and test each monitoring node as a whole.
Task Description:
Each monitoring node, that was electronically integrated in WP3.3, must be mechanically assembled on its frame structure, and the whole must be tested (environment tests and functional tests).

Task 1.6 **System tests, including basin tests**

Objective:
To validate the system made of several monitoring nodes.
Task description:
A test procedure of the system will be written. The monitoring nodes delivered by task 1.5 are interconnected through a wired network (test tool developed in task 3.1) to test their mutual interactions, as well as the general behaviour of the system.
Then the acoustic communication segments are really implemented and the various monitoring nodes are immersed into a test basin, taking into account that the acoustic transmission conditions (they are more constraining than on a real site).

WP2: Enhanced sensors. Leading partner: 2

Objective:
Improvement of seabed sensors for adaptation to long-term monitoring of physical properties related to geohazard surveillance and risk assessment. The enhanced sensor consists of an integrated sensor package communicating with the external world through the standard sensor interface.

The integrated sensor systems included in WP2 covers the most important geohazard monitoring requirements for deep waters as anticipated by the offshore oil industry and oceanographic scientists. The proposed sensor systems will accurately measure one or several of the following physical properties of the marine sediments and seabed environment:

- *In situ* pore pressure for stability assessment of seabed slopes, fluid migration and pressure build up in faulted zones, rapid fluid pressure changes associated with dissociating gas hydrates, or slow sediment deformation (creep).
- Geodesic parameters such as seabed movement due to seismic activity, faulting or unstable seabed slope. It addresses short-term seismic incidents and long term stationary deformations.
- Gas concentration and seepage from the seabed, especially near pockmarks, faults or in bore-holes.
- Environmental parameters such as temperature, with a "distributed fibre optic sensor", salinity, turbidity, current, static and dynamic water pressure.

The work will focus on integration and modification of existing technology and components with proven design, aiming at cost efficient and reliable solutions with respect to deployment and long term autonomous operation in deep waters. On each sensor type, an innovative solution or feature is promoted but a proven solution exists in back up.

The following points will be addressed:
- Required design modifications for long-term operation at large water depth.
- Design aspects related to down-hole sensors subjected to extremely tight design criteria with respect to dimensions, robustness and hook-up.
- How may they be deployed in a versatile and cost effective manner, minimise requirements for installation vessels and subsea support and allow multiple sensors in bore hole?
- How to increase their life duration with minimum drift in measurements, ensure accuracy, repeatability and determine the calibration protocols?

Pore pressure

Rationale: Excess of pore pressure may reduce the shearing resistance of the sediment and induce slope failure. This may happen if excess pore pressure has built up in critical failure zones. Overpressure in entrapped soil layers may occur after rapid sedimentation of impermeable sediments, increased pressure due to gas seepage, shaking during earthquake loading,... The pore pressure is consequently an important parameter for the modifications of the soil before and during a geohazard event.

Programme: Partner 2 masters the pore pressure instrumentation. An evaluation of the optimal sensor type (differential or absolute pressure sensors, fibre optic system) will be performed, including the calibration procedures.
He will enhance the techniques to improve the long term performances. The pore pressure will be measured at several levels, in bore holes down to 200m, in tubes of CPT probes inserted in the sediment down to 30m.

Ground deformation (geodesic) sensors

Rationale: The motions of the seabed are the direct measurement needed to understand the ground modifications. Geodesy is a basic instrumentation technique onshore but under sea it is still in its infancy. Similar sensors at sea would be: distancemeter, reference marks (benchmarks) for the distance measurement (horizontal degree of freedom), tiltmeter (rotation degree of freedom), depth (vertical degree of freedom).

Programme: Partner 2 brings a design in a long range taut wire distancemeter subsea system. It will be enhanced, integrated and used as a safe solution.
A promising development is to implement an acoustic distancemeter to measure acoustic travel time between two transponders set on the seafloor. This package will be built probably from principles developed at the Scripps Institution of Oceanography (San Diego, USA). Two high precision transponders will be installed on the seafloor in order to assess the system performances and the propagation media stability connected by sound velocity model. In the first phase, we will validate the measurement feasibility of acoustic distance measurements to the centimeter level between two fixed points, distant by 500-1000m; compatibility with the acoustic communication in WP3 will be addressed.

Partner 3 will also develop the precise tiltmeter and a precise pressure (tide gauge used for events of absolute pressure) package. The design and installation procedure of the reference points (benchmarks and basis for the tiltmeter) will be performed with task 1.2. The target vertical resolution is under 5 cm (possibly 2 or 3 cm) with 4000m water depth.

Gas sensor

Rationale: The natural occurrence and emission of gas on the sea floor (methane seeps) are increasingly recognised as an important marine process for its environmental and geo-hazard implications. Methane seeps are important for four main reasons (some of them being also true for H_2S lead to the conclusion to associate both measurements). They alter the properties of the sediment influencing ultimate load capacities of foundation or induce submarine landslides, they are source of greenhouse gas for the atmosphere, they influence biological activity, they may indicate oil resources.

Programme: A H_2S sensor will be evaluated with a target performance of 0.01 mg detection limit. The direct long term stability is doubtfull with existing integration. An integration in an analytical module will be designed and tested.

A methane sensor will be adapted specially for the purpose with a great confidence in the results. The basic device is available from partner 5 in a commercial version for short-term deployment such as profiling. It uses a semi-conductor as sensing element, integrated in a small gas volume in the sensor-head. Protection against the outside water and pressure is given by a special membrane. An international patent for this device is pending. It has been already sold to many scientific institutions and successfully deployed over the world.

The adaptation performed by partner 4 with partner 5 supports will focus on long-term operation, increased operation depth and increased sensitivity, according to the specifications as they will be set in WP 1.

The work will be carried out as follows:
1) Study of the drift behaviour and mechanical stability of the basic version during long-term operation. Laboratory and in-situ tests.
2) Modification of the patented antifouling-membrane to increase performance from presently 3 months to one year, in-situ tests.
3) development of the self-calibration capability (mostly modification of electronic), laboratory and short in-situ tests.
4) Increase of sensitivity: modification of semiconductor. Laboratory tests.
5) Increase of operation depth: structural modification of membrane, redesign of the sealing, pressure tests.
6) Development of interface to support system.
7) Prototype integration and tests, production of a batch of sensors for deployment (WP 4 and 5).

Environment sensors

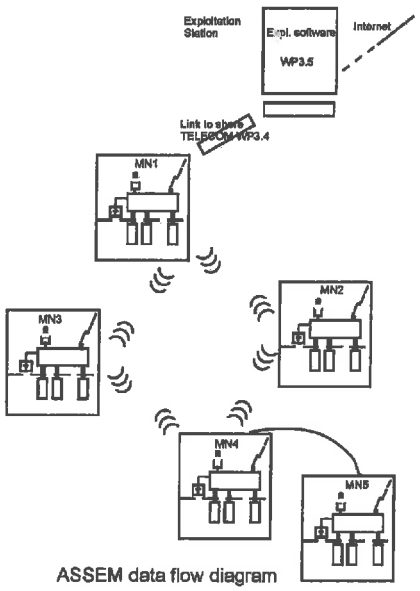
Rationale: The measurement of temperature, salinity, turbidity, current, static and dynamic water pressure is necessary in conjunction with pore pressure, distancemeter and gas sensors. They are off the shelf instruments to be integrated into ***ASSEM*** monitoring node. But a step forward to simplify sensor installation and increase data density horizontally or in bore holes will be necessary for a description over long distance.

Programme: Evaluate existing fibre optic technology and required modifications for long term subsea monitoring of temperature and pressure. It will be modified as an integrated sensor system according to the ***ASSEM*** requirements.
An integration and a sensor assembly for simplified installation and *in situ* protection will be performed based on existing sensor technology for temperature, salinity, turbidity, current, static and dynamic water pressure.

WP3: Data flow and communication. Leading partner: 1

This work package develops the means enabling the data to flow throughout the system and realises the electronic integration at the monitoring node level. The developments concern underwater networking, telecommunication between the underwater network and a shore exploitation station, data collecting and processing on shore.

The travel of a measurement datum from the seabed to the users:
Starting from a sensor output, attached to a particular monitoring node, a measurement datum flows digitally through the *standard sensors interface* to the local *communication and storage front-end.* From there, the datum is transmitted through the underwater network (the nodes of which are other monitoring nodes, each one comprising a similar *communication and storage front-end*) to the monitoring node which is linked to shore via the telecommunication segment. There, the datum can be accessed by the exploitation station, in charge of processing, archiving the incoming data and making them available to the users via the Internet.

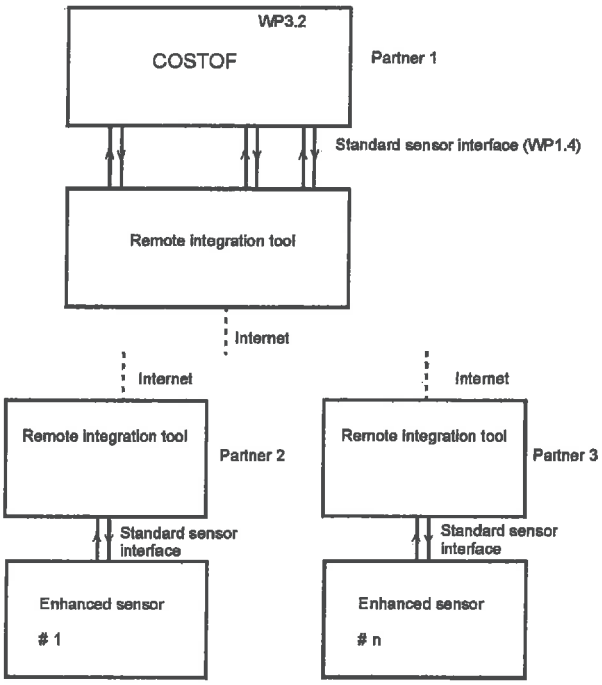


ASSEM data flow diagram

One may to distinguish tasks 3.2, 3.4 and 3.5 that are developing and implementing subsystems intended for the exploitation of ***ASSEM***, from tasks 3.1 and 3.3 that are providing or exploiting a tool for the integration stage of the project.

Task 3.1 **Development of a remote integration tool based on INTERNET**

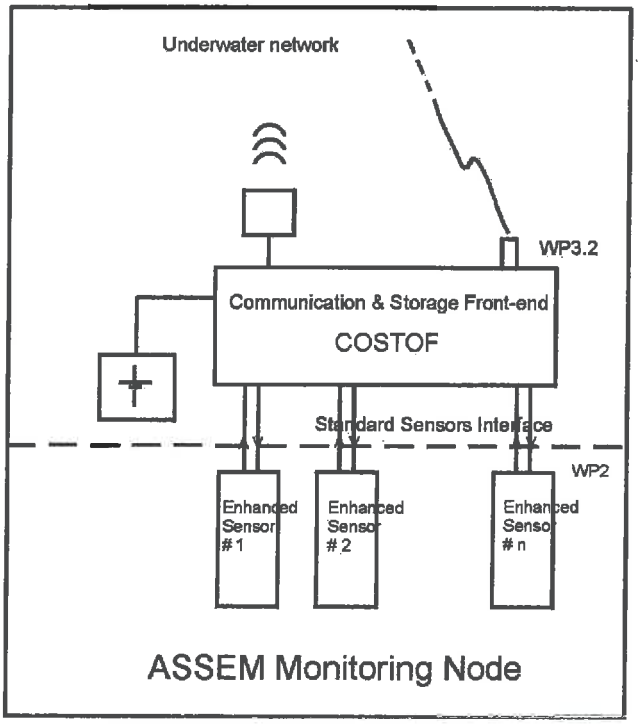
A crucial step in the system development process is the integration and tests of the *enhanced sensors* (WP2) on the COSTOFs (see definition in task 3.2). Task 3.3 is entirely devoted to it, but cannot require the continuous presence of all the sensors providers (from various countries). A remote integration tool will be developed and provided to all partners in charge of sensors, and to the COSTOFs manufacturer. It will consist in a bridge linking any enhanced sensor to the internet through its *standard sensors interface*. This will enable the sensor to be remotely plugged to its COSTOF (equipped with a similar bridge at the other end of Internet), both partners staying in their lab. This should greatly minimise the unavoidable tuning phase that takes place when subparts are plugged together for the first time, and provide substantial travel and time saving to the project.
This tool will be based on the adaptation of an industrial Ethernet board to the *standard sensors interface*. It will be re-usable in all systems where the *standard sensors interface* is used.



Remote Integration Principle via Internet

Task 3.2 **COmmunication and STOrage Front-end design and realisation (COSTOF)**

A *communication and storage front-end* (COSTOF) is an electronic unit providing a set of enhanced sensors (WP2) with the means to communicate with the external world through an underwater network, and to locally store the produced data. The aim of this task is to design, realise and test as many COSTOFs as required for WP4 and 5.



Basically, a *communication and storage front-end* will comprise:

-a communication processor,
-a memory unit for data storage,
-a *standard sensors interface*, specified in task 1.4, for communication with the *enhanced sensors*,
-an acoustic modem + transducers antenna for horizontal acoustic communication, with remote monitoring nodes (up to 2 km),
-a wire modem for communication with a neighbouring monitoring node (for instance less than 50 m away),
-a data port dedicated to communication with an ROV.
Among the various COSTOFs, one will ensure communication to shore and will receive additionally an acoustic modem + transducer or a wire modem, according to the site configuration (input from WP4.1, 5.1 and 3.4).

The software resources enabling a monitoring node to act as a network node (routing algorithms throughout the network, network configuration management, data transmission protocol and other network layers) are implemented in every COSTOF. The data transmission management will also take into account the quantity of energy necessary to transmit data acoustically and will be adapted to the limited energy resources of a monitoring node.

In order to ensure the interoperability of an ***ASSEM*** node with other subsea monitoring systems, it is **mandatory** that the specifications of the COSTOFs be settled in co-operation with other current European developments, especially in seismic benthic stations. The ***ASSEM*** partnership allows this co-operation.

Task 3.3 **Integration of the enhanced sensors on the communication and storage front-ends**

The enhanced sensors of each monitoring node are electronically integrated to their COSTOF.
-First with the tool described in 3.1
-Then locally.
3 months laboratory tests of the newly constituted monitoring nodes are performed.

Task 3.4 **Telecommunication (with operator on shore)**

The aim of this task is to provide the ***ASSEM*** monitoring network with a data link to shore, so that the measurement data can be retrieved in (at least near) real time, and commands transmitted to the underwater network. The telecommunication segment extends from the COSTOF of a particular monitoring node, chosen as the external communication port of the underwater system, to a computer on shore, allowing data dissemination.
This task relies on the use and implementation of existing and proven telecommunication technologies, for the underwater part as well as for the terrestrial segment. The necessity (or not) to moor a surface relay buoy will be assessed for each pilot experiment according to the selected site configuration.
For each pilot experiment (WP4 and 5), this task comprises the study of the most relevant data telecommunication solution, its realisation, implementation and maintenance along the experiment duration.

Task 3.5 **Management of the produced data (data processing and display)**

The data will be managed according to standards. Those standards have been defined during a previous EU project and can be found at the internet site of this project. The archiving and processing of the data acquired in the WP5 experiment (seismic hazard) will be performed together with an

ongoing EU training project ; it is aimed to perform the archiving and management of the data to be collected in the soil onshore. The offshore data could thus be merged to the other data.

This task includes the specifications, the writing, testing and running of the exploitation software in charge of the processing, display and merging into an existing data base (compatible with offshore and inland warning systems) of the produced data, on the exploitation station. The data are managed according to the standards for warning systems in geology, developed during a previous EU project.

WP4: Slope stability pilot experiment. Leading partner: 2

Objective:
A pilot experiment shall be executed at a deep-water European continental margin site during at least one year, with the whole system installed including several stations and data link to shore or sea surface.

Slope stability along the continental shelves is one of the major problems with respect to future exploration of hydro-carbons in deep waters. Severe slope stability problems are present along the continental slope, including areas evaluated for exploration. The consequences for a major slide event in the vicinity of a subsea installation for hydrocarbon production can be enormous both with respect to environmental and economic aspects.

Pore pressure is a paramount parameter for in-situ soil strength and required for assessment of slope stability. Sensors installed in bore holes, developed in WP2, are required for monitoring of critical failure surfaces within the slide area.

Hostile conditions and remote location from land relevant for the anticipated test site represents the upper bound design criteria for installation and operation within the ***ASSEM*** system specifications.

Subsea data recovery requires expensive field trips involving remote operated underwater vehicles (ROV's) as there is no subsea infrastructure developed prior to full exploitation of the field. Consequently, data flow and communication system as developed in WP3, allowing data from the seabed to be retrieved without subsea intervention is demanded from the oil industry.

Work description:
The experiment should include hook-up of integrated pore pressure sensors installed in bore-holes and installation of standard sensor interface and communication system for data transfer to the surface. The experiment should at least include one year monitoring with remote data recovery. The main objective is to verify installation and operation of the ***ASSEM*** system. In addition, by obtaining a validated data set of measurements on site, the importance of long-term seabed pore pressure data for slope stability assessment will be demonstrated.

The work shall be performed in close co-operation with field operators (oil industry). Consequently, ***ASSEM*** will benefit from the surrounding facilities such as ship operations, ROV operations, bore holes and requests a limited budget from the EU.

WP5: Tectonically active area pilot experiment. Leading partner: 6

Objective:
To demonstrate a typical ***ASSEM*** array of sensors in a very active seismic zone, through a one year deployment where it will be possible to monitor tectonic movement along faults, creeping and fluid flow.

Description of the survey area:
The shelf, slope and margin of the basin off the coast of a faulted area is selected for the deployment of the ***ASSEM*** array of sensors. The most active extensional basin in Europe is selected, with high rates of margin uplift, basin subsidence and opening during Late Quaternary.

The selected area is located thanks to global surveys and studies made available by the partners of the project. It has suffered 7 earthquakes of Ms>6 during the last two centuries. Methane expulsion form pockmarks has been observed on the shelf of the area. Tectonic movements, creeping and fluid flow is expected to take place along the submarine marginal fault, the trace of which coincides with the base of the slope.

Methodology / work description:
A detailed pre site survey will be carried out by partners No 6 and No 7 on the shelf, slope and basin of a part of the area, in order to determine the proper sites for the deployment of the ***ASSEM*** array of sensors. Proper sites for the deployment of the array are the ones on which triggering phenomena are likely to happen and on which a variability of the measured parameters should be observed during the pilot experiment duration.

Two sites, one on the shelf and one at the trace of the marginal fault of the basin, will be selected to deploy the monitoring nodes. Active fluid flow through pockmarks or other seeping areas will be monitored on the shelf. Pre site survey and deployment of the sensors on the shelf as well as follow-up of the results and evaluation of the node of sensors will be undertaken by Partner No 7.

Pore pressure, geodesic, environmental and fluid measurements will be carried out by an array of 5-8 nodes deployed at the margin of the basin. Seismic measurement will be available from other experiments. The pre site survey will be carried out by Partner No 6 and will include exploitation of all available data as well as new high-resolution seismic survey, swath bathymetry, side scan sonar and visual observation with a manned submersible, to be obtained during a 10 days campaign.

The precise locations of the monitoring nodes on the shelf and at the marginal fault of the basin will be determined in accordance with the scientific committee. A detailed preparation of the monitoring nodes layout shall be achieved.

The ***ASSEM*** array of 5 to 8 nodes of sensors will be deployed from a support vessel provided by Partner No 6. A manned submersible will control the landing of the nodes on the precise sites and make the necessary manipulations. The array will be maintained after six months and retrieved after one year. Geodesic benchmarks will be left for future use.

WP6: Exploitation and data assessment. Leading partner: 8

This work package groups all the tasks related to the exploitation of the project results.

Task 6.1 **Array deployment strategy**
This task will define the strategies suitable to cover an area with monitoring nodes in terms of technical limits and scientific requirements. It will define the level of performances required from the system. The results of this task are input to tasks 1.1 (system specifications) and 6.2.

Task 6.2 **Scientific assessment**
This task is in charge of assessing the system and its produced data on a scientific point of view. The data from tests and pilot experiments will be analysed by slope stability and seismic geohazard specialists. They will draw recommendations for future array deployments. The dissemination of these recommendations is addressed here.

Task 6.3 **Technical and price related evaluation**
This task is in charge of assessing the system on a technical and costs point of view. It will include a reliability analysis of the ***ASSEM*** deployments, a cost analysis including deployment and exploitation costs. The results of this task are input to task 6.4. Their dissemination is addressed here.

Task 6.4 **Industrial exploitation**
It includes:
-A market study for the developed system and subsystems: monitoring nodes, integrated sensors and array of sensors.
-An industrial exploitation plan.

WP7: Project management. Leading partner: 1

This project involving eight teams geographically scattered needs a rigorous management covered by this work package. A quality manual is issued for the month 3 meeting. The management will be based on the existence of two committees:

- The Technical Co-ordination Committee (TCC)

It will be composed of the project co-ordinator, a representative from every contractor and the scientific officer from the EC. It will constitute the main decision making structure, in charge of:
- the follow-up of project aiming at having the actual Gantt chart staying as close as possible to the provisional one;
- the edition of the periodic report, internal intermediary progress reports;
- the management of communication outside the consortium.

The TCC will also help in the execution of the technical tasks, e.g.: discuss technical, exchange information between the participants, propose technical solutions and actions to be undertaken.

- The advisory board, composed of:

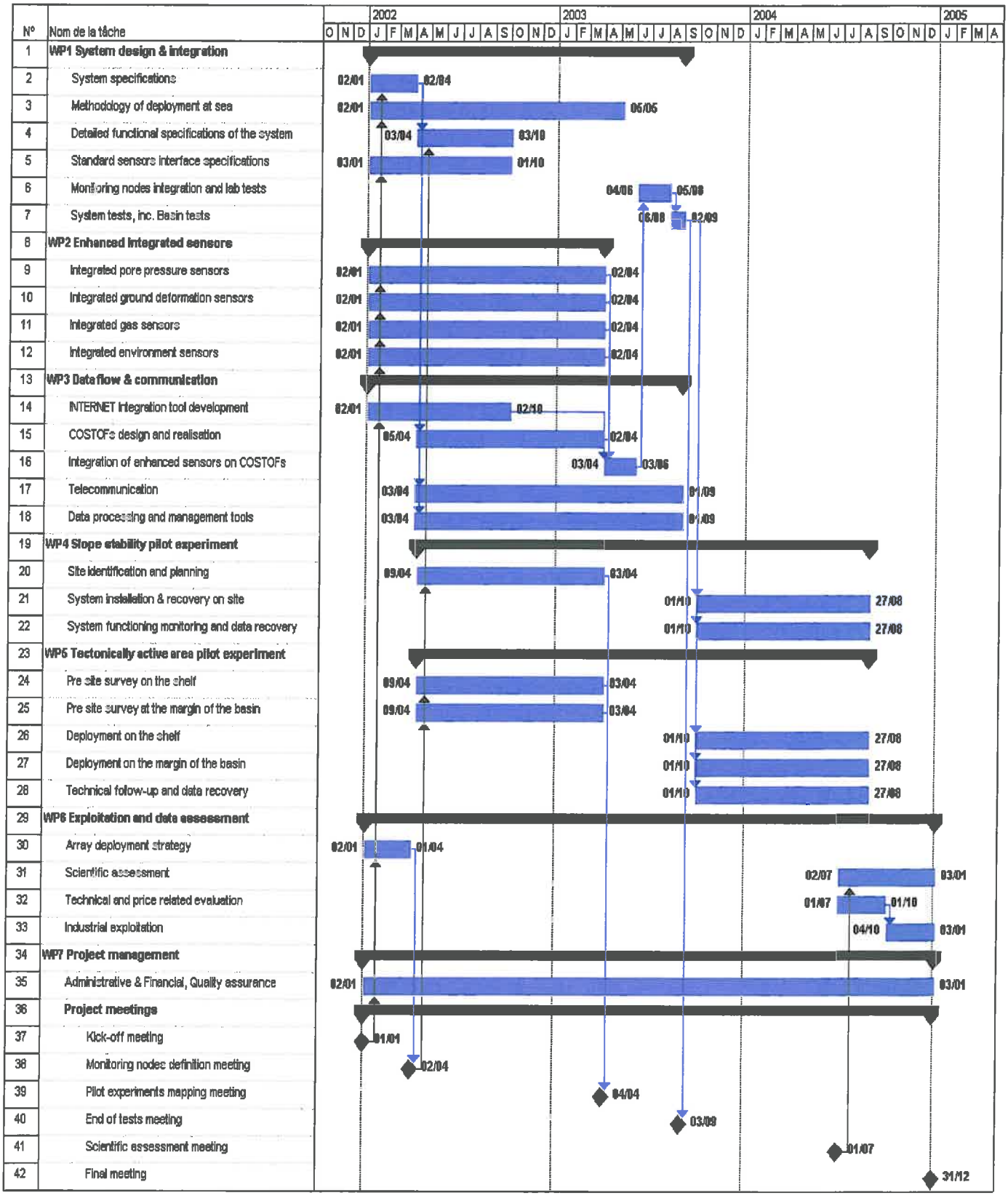
- scientists expert in geohazard from 8 European countries,
- representative of end users.

This committee will confirm at the start of the project the adequacy between needs and solutions provided by ***ASSEM***, approve the experiment mappings and evaluate results from the two experiments. The co-ordinator will consult it during the development phase if necessary.

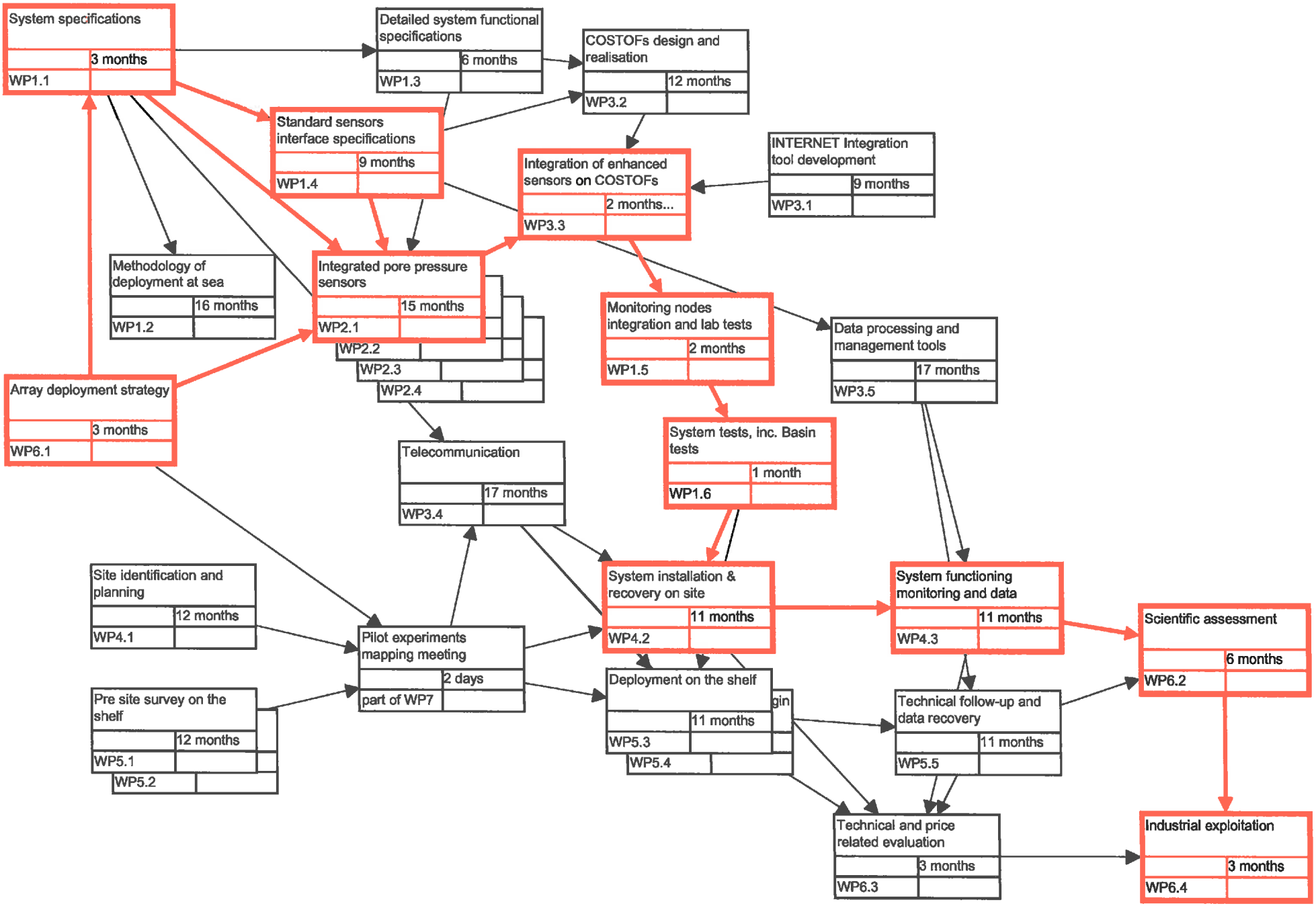
Meetings:
Co-ordination committee will take place at every main project milestone and at least twice a year, but also whenever needed.
WP meetings will be held between the partners involved in specific WP.

b) Project planning and time table

ASSEM Planning (GANTT diagram)



c) Graphical presentation of the project's components (see next page)


System specifications
3 months
WP1.1
Detailed system functional specifications
6 months
WP1.3
COSTOFs design and realisation
12 months
WP3.2
Standard sensors interface specifications
9 months
WP1.4
Integration of enhanced sensors on COSTOFs
2 months...
WP3.3
INTERNET Integration tool development
9 months
WP3.1
Methodology of deployment at sea
16 months
WP1.2
Integrated pore pressure sensors
15 months
WP2.1
WP2.2
WP2.3
WP2.4
Monitoring nodes integration and lab tests
2 months
WP1.5
Data processing and management tools
17 months
WP3.5
Array deployment strategy
3 months
WP6.1
Telecommunication
17 months
WP3.4
System tests, inc. Basin tests
1 month
WP1.6
Site identification and planning
12 months
WP4.1
Pilot experiments mapping meeting
2 days
part of WP7
System installation & recovery on site
11 months
WP4.2
System functioning monitoring and data
11 months
WP4.3
Scientific assessment
6 months
WP6.2
Pre site survey on the shelf
12 months
WP5.1
WP5.2
Deployment on the shelf
11 months
WP5.3
WP5.4
Technical follow-up and data recovery
11 months
WP5.5
Technical and price related evaluation
3 months
WP6.3
Industrial exploitation
3 months
WP6.4

d) Detailed project description broken down into workpackages

d-1) Work package list

WPL Workpackage list						
Work-package No.	**Workpackage Title**	**Lead Participant No:**	**Person-months**	**Start Month**	**End Month**	**Deliv-erable No:**
WP1	System design and integration	8	41	0	20	1.1 to 1.11
WP2	Enhanced integrated sensors	2	77.5	0	12	2.1 to 2.11
WP3	Data flow and communication	1	45.5	0	20	3.1 to 3.7
WP4	Slope stability pilot experiment	2	12.5	3	32	4.1 to 4.4
WP5	Tectonically active pilot experiment	6	92	3	32	5.1 to 5.6
WP6	Exploitation and data assessment	8	33.5	0	36	6.1 to 6.5
WP7	Project management	1	24	0	36	7.1 to 7.5
------	TOTAL	------	330	------	------	------

WPM									
man-months	Part. 1	Part. 2	Part. 3	Part. 4	Part. 5	Part. 6	Part. 7	Part. 8	Total
WP1	11	1	5	15	1	1	4	7	41
WP2	4	9	25	20	15	0	4	0,5	77,5
WP3	23	0	5	6	0	0	11	0,5	45,5
WP4	3	8	0	0	0	1	0	0,5	12,5
WP5	5	1	11	3	0	46	25	1	92
WP6	6	2	6	9	0,5	4	3	3	33,5
WP7	12	1	5	1	1	2	1	1	24
Total	64	22	57	54	17,5	54	48	13,5	330

d-2) Deliverables list

DL Deliverable list				
Deliverable No.	**Deliverable title**	**Delivery date**	**Nature**	**Dissemination Level**
1.1	System specifications	3	Re	PU
1.2	Report on deployment means	15	Re	PU
1.3	Set of drawings of mechanical deployment interface	15	Re	PU
1.4	Deployment, maintenance and retrieval procedures	15	Re	PU
1.5	Detailed system functional specifications	9	Re	PU
1.6	Standard sensors interface specifications	9	Re	PU
1.7	Set of tested monitoring nodes ready to be integrated in task 1.6	20	Pr	RE
1.8	System test procedures	21	Me	PU
1.9	Dry wired system test report	21	Re	PU
1.10	Wet tests report	21	Re	PU
1.11	Validated system, ready to be installed on site	21	Pr	PU
2.1	Report on the enhancement studies, including integration and design for each sensor group	9	Re	PU
2.2	Enhanced pore pressure sensors	15	Pr	RE
2.3	Acoustic ground deformation sensor	15	Pr	RE
2.4	Taut wire ground deformation sensor	15	Pr	RE
2.5	Enhanced accelerometer sensor	15	Pr	RE
2.6	Enhanced tiltmeter sensor	15	Pr	RE
2.7	Reference points design	15	Me	RE
2.8	Enhanced CH_4 sensors	15	Pr	RE
2.9	Enhanced H_2S sensors	15	Pr	RE
2.10	Integrated environment sensors	15	Pr	RE
2.11	Distributed fibre optic sensor	15	Pr	RE
3.1	Communication and storage front-ends specifications	9	Re	PU
3.2	Set of communication and storage front-ends	15	Pr	RE
3.3	A set of tools to remotely integrate sensors on *costofs*	9	Pr	RE
3.4	Test report of each monitoring node	17	Re	PU
3.5	Set of electronically validated monitoring nodes	17	Pr	RE
3.6	Two telecommunication systems, ready to be implemented	20	Pr	RE
3.7	Exploitation software	20	Pr	PU
4.1	Report with site plan and system description	15	Re	PU
4.2	Installation procedures	15	Me	PU
4.3	System properly installed on site	23	Eq	RE
4.4	Report on system performance and data evaluation for transmission to WP6	30	Re	PU
	Continued next page			

DL Deliverable list (continued)

Deliverable No.	Deliverable title	Delivery date	Nature	Dissemination Level
5.1	Report with shelf site plan and configuration description	15	Re	PU
5.2	Report with margin of the basin site plan and configuration description	15	Re	PU
5.3	Installation procedures	15	Me	PU
5.4	System installed on the shelf	23	Eq	RE
5.5	System installed on the margin of the basin	23	Eq	RE
5.6	Report on system performance and data evaluation for transmission to WP6	30	Re	PU
6.1	Report on array deployment strategy	3	Me	PU
6.2	Scientific assessment report	36	Re	PU
6.3	Technical and price related evaluation report	33	Re	CO
6.4	Market study	36	Re	CO
6.5	Industrial exploitation plan	36	Re	RE
7.1	Web site, running and updated	9	Da	PU
7.2	Quality manual	3	Me	PU
7.3	Periodic management reports	6, 12, 18, 24, 30, 36	Re	PU
7.4	Minutes of meetings and workshops	1, 3, 15, 21, 30, 36	Re	PU
7.5	Final report	36	Re	PU

d-3) Table DWP

WP1 Workpackage description	**System design and integration**							
Workpackage number:	**WP1**							
Start date or starting event:	**month 0**							
Participant codes:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Person-months per participant:	**11**	**1**	**5**	**15**	**1**	**1**	**4**	**7**

1. Objectives

To design and integrate a seabed monitoring system meeting the scientific requirements as regards the study of slopes instability and based on the implementation of recent technologies for the data communication and deployment at sea. Whereas WP2 and 3 are devoted to sub-systems design and realisation, this work package is exclusively devoted to the system aspects.

2. Methodology / work description

Task 1.1 System specifications

Includes: Analysis of the requirements, main technological choices, design of the system architecture, system breakdown, definition of interfaces, main dimensionings, reliability analysis.

Task 1.2 Methodology of deployment at sea

Price and availability study of the adapted deployment means, design of manipulation interfaces, of connection/disconnection means, of standard mechanical interfaces for deployment, maintenance and recovery, set-up of deployment, maintenance and retrieval procedures.

Task 1.3 Detailed functional specifications of the system

Settlement of the detailed functional specifications of the system describing:
the system setup, configuration and reconfiguration procedures, the interactions between monitoring nodes, the data acquisition, storage and recovery strategy, the defaults modes.

Task 1.4 Standard sensors interface specifications

Settlement of common interface specification between all the *enhanced sensors* delivered by WP2 and the *communication and storage front-ends* delivered by task 3.1. This document includes the electrical specifications, the mechanical specifications (underwater connector) and the data transmission protocol.

Task 1.5 Monitoring nodes integration and tests in laboratory

Writing of the monitoring node test procedures. Mechanical integration of all the subsets forming a monitoring node on their frame structure and test of each monitoring node as a whole.

Task 1.6 System tests, including basin tests

System test procedures writing. Dry tests of the system with monitoring nodes linked through a wire test tool. Wet tests of the system with acoustic links implemented.

3. Deliverables including cost of deliverables as percentage of total cost of the proposed project

System specifications document. (2.6 %)
Report on deployment means, set of drawings of a common design of mechanical interface, deployment, maintenance and retrieval procedures. (2.7 %)
Detailed system functional specifications. (1.0 %)
Standard sensors interface specifications. (0.9 %)
Set of tested monitoring nodes ready to be integrated in task 1.6. (2.2 %)
System test procedures. Dry wired system test report. Wet tests report. Validated system, ready to be installed on site. Acceptance trials report. (2.5 %)

4. Milestones including cost of the Milestone as percentage of the proposed project

End of system specifications (2.6 %)
End of interface definition (2.7 %)
End of system design activities (1.9 %)
End of laboratory test (2.2 %)
End of basin test (2.5 %)

WP2 Workpackage description								**Enhanced sensors**
Workpackage number:	**WP2**							
Start date or starting event:	**month 0**							
Participant codes:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Person-months per participant:	**4**	**9**	**25**	**20**	**15**	**0**	**4**	**0.5**

1. Objectives

Development of seabed sensor nodes for long-term monitoring of physical properties relevant for geohazard risk assessment and surveillance. The work shall focus on modification and integration of technology and components of proven design aiming at cost efficient and reliable solutions with respect to deployment and operation. The sensor nodes shall be integrated with the standard sensor interface and communication system defined in WP3 for external communication and data transmission.

2. Methodology / work description

Task 2.1. Integrated Pore pressure sensors

- Evaluation of optimal sensor type (differential or absolute pressure sensors, fibre optic system)
- Develop design for simplified bore-hole installation
- Develop design for multilevel down-hole installation
- Develop design for improved long term performance (accuracy and operational life)
- Develop design for integration with standard sensor interface to communication system as defined in WP3

Task 2.2. Integrated Geodesics sensors

- Develop design and integration of autonomous seabed movement sensors based on existing, pressure and inclinometer technology
- Evaluate and test accuracy for long term distance measurements using acoustic transponders and develop compatibility with acoustic communication system described in WP3
- Develop design for long range taut wire distancemeter system
- Develop design and installation procedures for datum (reference) points ensuring fixed sensor positions

Task 2.3. Integrated Gas sensors

- Enhance methane sensor
- Develop design and integration of H_2S sensor for long term and deep-water operation based on existing semiconductor technology
- Develop self-calibration and membrane anti-fouling systems for gas sensors
- Laboratory and test basin experiments and verification

Task 2.4. Integrated Environment sensors

- Develop design and integration of temperature, salinity, turbidity, current, static and dynamic water pressure sensors for long term and deep-water operation based on existing sensor technology
- Develop sensor assemblies for simplified installation and in-situ protection
- Evaluate existing Fibre optic technology and required modifications for long-term subsea monitoring of temperature and pressure
- Develop and test of local data acquisition unit with standard sensor interface to communication system as defined in WP3

3. Deliverables including cost of deliverable as percentage of total cost of the proposed project

-Report on the enhancement studies, including integration and design for each sensor group (4 %)
-Enhanced pore pressure sensors (3.9 %)
-Taut wire ground deformation sensors and acoustic ground deformation sensor (2.7 %)
-Enhanced tiltmeter and pressure sensor and reference points design (1 %)
-Enhanced methane sensors and enhanced H_2S sensors (9.7 %)
-Integrated environment sensors and distributed fibre optic sensor (2.1 %)

4. Milestones including cost of the Milestone as percentage of the proposed project

-End of evaluation and design specifications of all sensors (4 %)
-Delivery of enhanced integrated sensors (17.4 %)
-End of tests (2 %)

WP3 Workpackage description	**Data flow and communication**							
Workpackage number:	**WP3**							
Start date or starting event: month 0								
Participant codes:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Person-months per participant:	**23**	**0**	**5**	**6**	**0**	**0**	**11**	**0.5**

1. Objectives

The objective is to provide the system with the means to forward the data produced underwater to an on shore exploitation station and to design and provide the exploitation software. The data flow consists in: enhanced sensor, COSTOF *, shore linked COSTOF, exploitation station.

* communication and storage front-end

2. Methodology / work description

Task 3.1 Development of an Internet based integration tool

A remote integration tool, based on the use of the internet, will be developed, tested and delivered to all enhanced sensors and *costofs* providers. The aim is to widely shorten the costly stage of sensors integration on the *costofs*.

Task 3.2 Communication and storage front-ends

Specifications, design, realisation and tests of the communication and storage front-ends (costofs) enabling a set of sensors to communicate through an underwater network. The specifications will be derived from the system specs (tasks 1.1 & 1.3) and will mainly concern the adaptation of an existing underwater network technology to the ASSEM system.

Task 3.3 Integration of the *enhanced sensors* on the *communication and storage front-ends*

Electronic integration of the *enhanced sensors* on their *costofs*, first remotely thanks to the tool provided by 3.2, then locally. Long term laboratory tests of the newly constituted monitoring nodes.

Task 3.4 Telecommunication

For each pilot experiment (WP4 & 5), this task comprises the study of the most relevant data telecommunication solution, its realisation, implementation and maintenance along the experiment duration. This task relies on the use of existing and proven telecommunication technologies, for both the underwater and terrestrial segments.

Task 3.5 Management of the produced data

This task includes the specifications, writing, testing and running of the *exploitation software* in charge of the processing, display and merging into an existing data base (compatible with offshore and inland warning systems) of the produced data, on the exploitation station. The data is managed according to the standards for warning systems in geology, developed during a previous EU project.

3. Deliverables including cost of deliverables as percentage of total cost of the proposed project

-A set of remote integration tools for sensors and costof (1.6 %)
-Communication and storage front-ends specifications (1.0 %)
-A set of communication and storage front-ends (3.3 %)
-Test report of each monitoring node (1 %)
-A set of electronically validated monitoring nodes (2.1 %)
-Two (one per pilot experiment) telecommunication systems, ready to be implemented (3.7 %)
-Exploitation software (0.9 %)

4. Milestones including cost of the Milestone as percentage of the proposed project

-End of Internet integration tool development (1.6 %)
-Choice of the telecommunication technologies for each pilot experiment (4.3 %)
-COSTOFs ready for integration (3.1 %)
-Delivery of the electronically validated monitoring nodes (3.7 %)
-First data acquired and exploited by the exploitation software (0.9 %)

WP4 Workpackage description								**Slope stability pilot experiment**
Workpackage number:	**WP4**							
Start date or starting event:	**month 3**							
Participant codes:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Person-months per participant:	**3**	**8**	**0**	**0**	**0**	**1**	**0**	**0.5**

1. Objectives

To carry out a pilot experiment at a deep-water site with slope instabilities during at least one year, including some monitoring nodes and installation of data link to the surface. To obtain a validated data set of measurements on site, demonstrating the importance and use of long-term pore-pressure monitoring for assessment of slope stability.

2. Methodology / work description

Task 4.1. Site identification and planning

- Identification of site commercial interesting for exploration but with severe slope stability problems
- Liaison with field operators for planning of sensor positions and system layout
- Installation and operational planning in co-operation with field operators
- Develop installation and data recovery procedures

Task 4.2. System installation and recovery on site

- Interface and co-ordination of naval operations including required marine spread such as ROV and surface vessel
- Offshore Installation of monitoring (ASSEM) equipment
- Subsea completion and verification of equipment operation by ROV
- Verification of surface communication and start of recording period
- Recovery on site

Task 4.3. System functioning monitoring and data recovery

- Data recovery and evaluation
- Follow up on system operation (status) and maintenance
- Overall evaluation of system performance

3. Deliverables including cost of deliverable as percentage of total cost of the proposed project

-Report with site plan and system description (1.4 %)
-Installation procedures (1.4 %)
-System properly installed at site (8 %)
-Report on system performance and data evaluation for transmission to WP6 (1.3 %)

4. Milestones including cost of the Milestone as percentage of the proposed project

-Site identification, planning and procedures completed (2.8 %)
-Monitoring nodes received (0 %)
-System installed (4 %)
-Data evaluation report completed (1.3 %)
-Field experiment completed (4 %)

WP5 Workpackage description	**Tectonically active area pilot experiment**

Workpackage number:	**WP5**							
Start date or starting event:	**month 3**							
Participant codes:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Person-months per participant:	**5**	**1**	**11**	**3**	**0**	**46**	**25**	**1**

1. Objectives

To demonstrate a typical ***ASSEM*** array of sensors in a very active seismic zone, through an one year deployment where it will be possible to monitor:

- Fluid flow through pockmarks on the shelf and
- Tectonic movements, creeping and fluid flow along the active marginal fault of the deep basin.

2. Methodology / work description

Task 5.1: Pre site survey on the shelf and determination of deployment sites

Task 5.2: Pre site survey at the margin of the basin and determination of deployment sites (high resolution seismic profiling, swath bathymetry, visual observation with a manned submersible)

Task 5.3: Deployment of sensors on the shelf

Task 5.4: Deployment of the ***ASSEM*** array of sensors on the margin of the basin

Task 5.5: Array technical follow-up and data recovery

3. Deliverables including cost of deliverable as percentage of total cost of the proposed project

-Report with shelf site plan and system description. Layout map (1.5 %)
-Report with margin of the basin site plan and system description. Layout map (4.9 %)
-Installation procedure (1 %)
-System installed on the shelf (2.1 %)
-System installed on the margin of the basin (11.3 %)
-Report on system performance and data evaluation for transmission to WP6 (4.3 %)

4. Milestones including cost of the Milestone as percentage of the proposed project

-Site identification, planning and procedures completed (7.4 %)
-Monitoring nodes received (0 %)
-System installed (4.1 %)
-Data evaluation report completed (4.3 %)
-Field experiment completed (9.3 %)

WP6 Workpackage description	**Exploitation and data assessment**

Workpackage number: **WP6**
Start date or starting event: **month 0 (6.1) (other tasks) 30**

Participant codes:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Person-months per participant:	**6**	**2**	**6**	**9**	**0.5**	**4**	**3**	**3**

1. Objectives

Definition of the performances required and feasible. Scientific, technical, price and industrial analysis of the project.

2. Methodology / work description

Task 6.1: Array deployment strategy

The potential strategies to cover an area with monitoring nodes will be addressed in terms of technical limits and scientific requirements.

Task 6.2: Scientific assessment

Scientific assessment of the system and produced data. The data from tests and pilot experiments will be analysed by slope stability and seismic geohazard specialists. They will draw recommendations for future array deployments. Dissemination of these recommendation.

Task 6.3: Technical and price related evaluation

Reliability analysis of the ***ASSEM*** deployments. Cost analysis including deployments, data flow and data analysis. Dissemination of technical results.

Task 6.4: Industrial exploitation

Market study for monitoring nodes, integrated sensors and array of sensors. Industrial exploitation plan.

3. Deliverables including cost of deliverable as percentage of total cost of the proposed project

-Report on array deployment strategy (1.4 %)
-Scientific assessment report (1.8 %)
-Technical and price related evaluation report (1.8 %)
-Market study (1 %)
-Industrial exploitation plan (0.7 %)

4. Milestones including cost of the Milestone as percentage of the proposed project

-Meeting on array deployment strategy (1.4 %)
-Delivery reports from pilot experiments (0 %)
-End of technical and price related evaluation (1.8 %)
-Final meeting (3.5 %)

WP7 Workpackage description	**Project management**							
Workpackage number:	**WP7**							
Start date or starting event:	**month 0**							
Participant codes:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Person-months per participant:	**15**	**1**	**3**	**1**	**1**	**2**	**1**	**1**

1. Objectives

Management of the project.

2. Methodology / work description

Task 7.1: Administrative and financial

Task 7.2: Project meetings

Task 7.3: Quality management

Task 7.4: WEB site administration

3. Deliverables including cost of deliverable as percentage of total cost of the proposed project

-WEB site (0.2 %)
-Quality manual (0.3 %)
-Periodic management reports (2 %)
-Minutes of meetings and workshop (4 %)
-Final report (0.7 %)

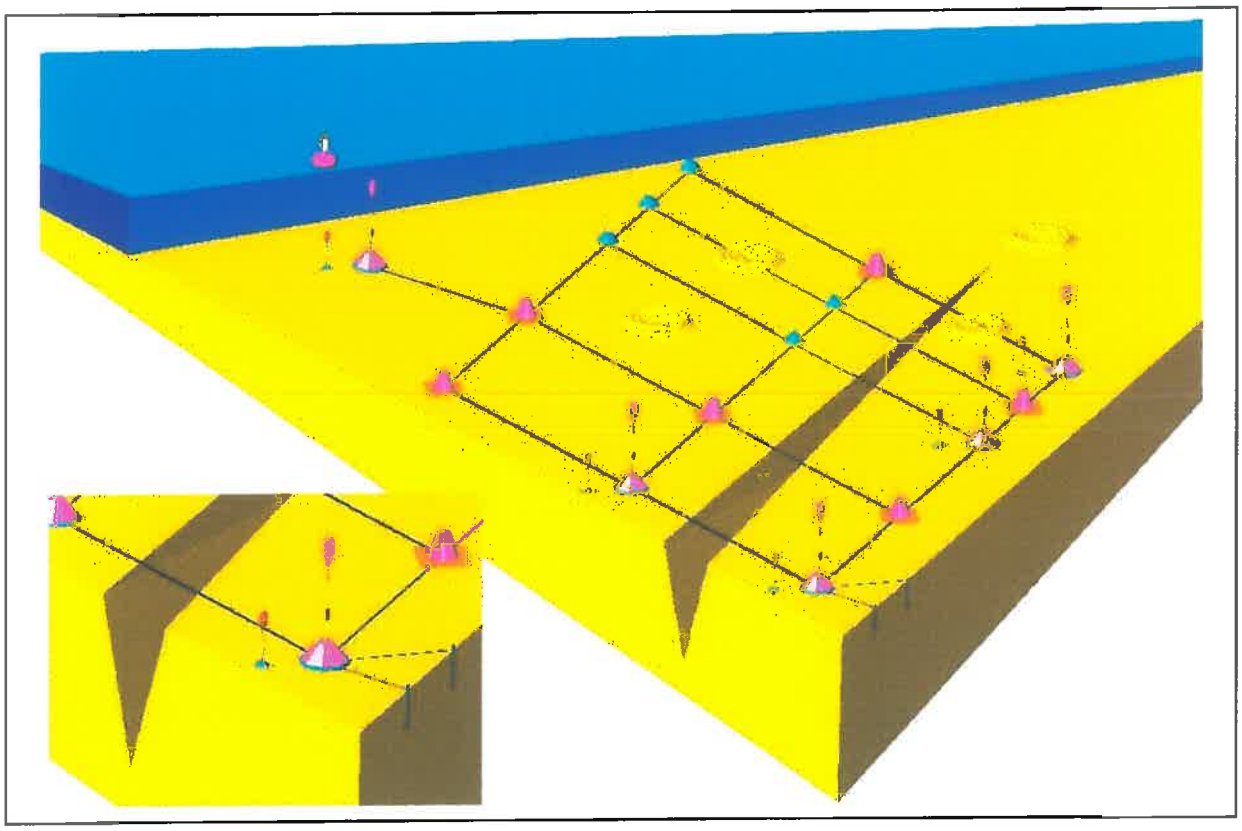
4. Milestones including cost of the Milestone as percentage of the proposed project

-Kick off meeting (0.5 %)
-Monitoring node definition meeting (0.75 %)
-Meeting on pilot experiment mapping (0.75 %)
-Basin test meeting (0.5 %)
-Meeting for the beginning of scientific assessment (0.75 %)
-Final meeting (0.75 %)

C

*A*rray of *S*ensors for long term *SE*abed *M*onitoring of geohazards

ASSEM



Energy Environment and Sustainable Development
Part A : Environment and Sustainable Development

Thematic priority:
3.2.3. Technologies for safe, sustainable and economic exploration and exploitation of marine resources

12/02/2001

Page

C3 Community added value and contribution to EU policies

ASSEM (Array of Sensors for long term SEabed Monitoring of geohazards) is a technological project enhancing some marine technologies to a level allowing a monitoring of the seabed. It addresses the production of reliable data for critical problems of safety for the population and for the equipments. These topics mobilise academic research and engineering in many countries and the critical mass to solve it can only reached in joining efforts at a European scale.

A new mode of ocean science investigation using long-term seafloor observatories to obtain in real time four dimensional (3D plus time) data sets has been proposed. Although this concept has been under development for some time and has been discussed in a number of places all over the world, a significant investment in infrastructure would clearly be required to achieve the scientific potential of seafloor observatory science.

In USA, the goal of NEPTUNE is to "establish a plate-scale (Juan de Fuca plate) submarine network of remote, interactive natural laboratories for real time, four dimensional experiment designed to quantify the linkage among oceanographic and plate related processes". The cost of the system design phase is 12.9 M$ in 2000-2003.

In Japan, the study of generation mechanism of earthquakes and the warning of population for geohazard is under way with the installation of networks and real time seafloor observatories : Hatsushima, Muroto, Venus Kushiro, Nankaï Trough, Nereid1 and 2... Each year JAMSTEC invests many M$ in this domain.

EU supports mainly GEOSTAR, a deep sea benthic station. ***ASSEM*** covers an other aspect of the deep seafloor monitoring: the instrumentation on a long period of all a site by deploying a local modular network of light interconnected instrumented packages. With the experience of Antares, a neutrino observatory in the sea, EU will master at the end of ***ASSEM*** all technical aspects of installation of seafloor observatories networks.

Marine technologies

Research projects supported by the EU in the past gave birth to a co-operation at European scale in marine technology. Some of the know-how developed will converge toward geohazard monitoring. ***ASSEM*** intends to ensure a step function improvement in these marine technologies.

INGV (partner **4**) is leader of the GEOSTAR (Mast3) long term monitoring multiprobe subsea station and Ifremer (partner **1** and leading partner in ***ASSEM***) is among the main developers. Geostar communicates with a land based operator through a near real time communication system designed by Ifremer including acoustics from ORCA (subcontractor in ***ASSEM***).
ASSEM will make a new step with the development of interoperable monitoring subsea node.

A reference for seismic monitoring is EU funded project CORSEIS Corinth. A compatible geodesic instrumentation at sea will be achieved in ***ASSEM*** with partners of CORSEIS-Corinth: IPGP (partner **3**), INGV.

IPGP has been the leader of EU project EMEWS for the data handling of warning systems, well suited for geohazards threatened areas. ***ASSEM*** will extend it to a sea network.

The EU gave support to many projects in the field of deployment of seabed tools with the participation of Ifremer: EDICS (Thermie) for the use of tools with industrial ROV, DESIBEL *(Mast2 n° CT94-0082 "new methods for DEep Sea Intervention on future BEnthic Laboratories")*, ALIPOR (Mast 3) for innovative field bus architecture on one year deployed lander, GEOSTAR (Mast 3), ARAMIS (Mast 3) for manipulation of oceanographic corers with ROV, SWIMMER (Thermie) for including docking and underwater connection procedures. Many results of these projects will find an application in ***ASSEM*** and through ***ASSEM*** to the seabed monitoring market.

Geohazards in continental margins

The new trend of oil industry exploitation and preservation of the European Continental Margins must be achieved with the major concerns of environment and sustainable industry, an improved scientific understanding, and the best sensor technologies available, providing a confidence level similar to what is achieved onshore.

The EU policy stresses the environment and sustainable development requirements of European citizens. Sedimental geology specialists all over Europe are willing to join their efforts to improve their knowledge of hazardous geological mechanisms threatening the European Continental Margin. Tromsϕ workshop on the 18th and 19th March 1999: "Challenges for academia and oil industry in deepwater margin studies" has highlighted this fact.
This was recognized by the EU which is funding the project "COntinental slop STAbility" (COSTA EW-CT-1999-00006) ; Ifremer is a partner of COSTA.

Areas of the seabed that need surveillance range in dimensions from several tens or hundreds of meters to a few kilometers. Specific equipment and procedures for surveillance installation and data flow are required. This is the scope of ***ASSEM***.

ASSEM will be demonstrated in the Norwegian sea in the area of Storegga Slide, a major geohazard which occurred 8000 years ago. More precisely, the slope stability of Ormen Lange oil field will be monitored using bore holes and sediment surface instrumentation constituting an array of sensors.

ASSEM purpose is to evaluate, convince and then exploit this concept of network between monitoring nodes. In the offshore oil industry market, often presented as conservative, cost effectiveness and reliability are needed also for the instruments. A long-term monitoring may demonstrate that the production does not involve any instability of slope and is consequently a safe, sustainable and economic exploitation process.

Earthquake areas

The earthquakes are the most frightening geological events for the population, their prediction is a major trend for the next decades. The continental rift motion, subduction, interplates seismic events, volcanic activity are influencing the seabed characteristics. In many cases, the faults and seismogenic zones are situated under the sea.

The monitoring of the motion, strain, seismicity and fluid pressure are well addressed onshore. A good example is given by the research projects funded by EU 3F (Fault, Fractures, Fluids) – Corinth, DG Lab (Deep Geodynamic Laboratory) – Corinth and Corseis (Corinth seismicity) – Corinth.

ASSEM will be demonstrated in the seafloor of the Gulf of Corinth were the monitoring network has no instrument at all. The most active fault seems to be under the sea and it will be instrumented during one of the field experiments.

ASSEM purpose is to evaluate, convince and then exploit the concept of a subsea network able to be inserted in a more global instrumentation including displacement with GPS, deep drilled wells and the correlated data management and warning system (a reference to the EU funded project EMEWS – European Mobile Early Warning System – ENV 4930728). Many tectonically active zones may benefit from this development in EU and countries candidate to EU (Marmara sea).

The complete set of data requires very often a seismic measurement. A subsea bottom seismic station was developed in the EU funded projects GEOSTAR 1 and GEOSTAR2 (MAST3-CT95007 – CT980183). They will ensure interoperability and compatibility between ***ASSEM*** and GEOSTAR, providing a wider potential for both systems and optimizing R&D budgets.

C4 Contribution to Community social objectives

Unexplained hazards are a challenge for the social objectives of quality of life and safety. EU inhabitants would like to discriminate natural phenomena from events generated by human activity. The European Continental Margins can not remain the border of the "unknown". After a phase of survey and description which is taking place now, their monitoring will be a step to inform the public (in a way validated by scientists and authorities) on environmental issues of these (up to now) remote sea bottoms, and contribute to increase confidence in coastal and offshore activities.

A goal of ***ASSEM*** is to develop the instrumentation for the measurement of stability and fluid equilibrium of the seabed. The project will contribute to the opening of a sustainable and safe exploitation of the economically promising oil and gas fields of the Continental margins. It is recognised by the oil companies who signed a letter of support (Appendix 1).

The information about the amount of fossil energy lying in European margins has a great value for the European Community, but it is also important to know that the production fields can be monitored in order to avoid degradation or geohazards. It is a concern for employment and safety at work.

The participation of the local authorities of the region of the Western Corinthiakos-Patraicos in the Advisory board of ***ASSEM*** comes from the need to communicate with the population daily threatened by earthquakes. The Gulf of Corinth is the most active continental rift in the world with an opening rate of up to 15 mm/year and an uplift of its southern shore at rates of up to 1 mm/year. This fast rifting is associated with a low-angle dipping seismic zone at a depth of 6 to 12 km. The most active fault is supposed to be under the sea. Five earthquakes of magnitude above 6 have been observed within the last 30 years. Several people were killed during the 1995 earthquake in Aigion (south coast of the Gulf of Corinth). The geology research community is concentrating efforts on the knowledge of this zone. But, although the most active faults are under the sea, no instrument is deployed there up to now.

The population has to know that a scientific process where the seafloor is not outside the scope is underway. And it is significant of solidarity inside the European Community if there is a wide participation from other European countries. It is all the more important since coastal equipment and harbours are facing problems of sediment stability. The communication roads ensuring the link between regions of Europe, Greece and Italy for instance, are threatened by geohazards. For example, a suspension bridge linking Peloponese with Greek mainland is under construction between Rion and Antiron and other industrial and touristic investments tend to promote this district of southern Europe. Their investors and operators would benefit from underwater monitoring.

ASSEM consortium does not intend to develop the array of sensors concept only for these sites. They are typical of geohazard threatened areas and the dissemination of ***ASSEM*** results will be directed towards other European regions (North-East Atlantic and Mediterranean sea). The Advisory board has key persons from these regions as members.

It appears that the Consortium of ***ASSEM*** is an opportunity to merge two technological cultures : the offshore industry and the academic oceanology and geology instrumentation. In addition to the improvement of competitiveness on both sides, it will demonstrate the potentialities to join economic exploitation and environmental exploration.

The employment in offshore activities and in marine services will be more permanent in Europe if the long term monitoring of the seabed is accepted by the oil companies and administrations. In addition to the "survey and market" the geotechnical community will create jobs for maintenance of the arrays and interpretation of results. The resulting competitiveness with respect to companies from USA and Japan will open opportunities for European companies including SMEs on the world market.

C5 Project management

This project involving eight teams geographically scattered will have a rigorous management covered by a specific work package (WP7) using Internet facilities.

It will be based on the existence of two committees:

- The **Technical Co-ordination Committee** (TCC)

It will be composed of the project co-ordinator, a representative from every contractor and the scientific officer from the EU. It will constitute the main decision making structure. In charge of:
- the follow-up of project aiming at having the actual Gantt chart staying as close as possible to the provisional one;
- the edition of the periodic report, internal intermediary progress reports;
- management of communication outside the consortium.

The TCC will also help in the execution of the technical tasks as stated in the work package description, e.g.: discuss technical aspects of the tasks, exchange information among the participants, propose technical solutions, propose actions to be undertaken.

- The **Advisory Board**

This committee is composed of:
- scientists expert in geohazard from 8 European countries;
- representative of end users: Western Greece region, industrials involved in coastal engineering, gas and oil industry representatives, national civil security from Greece and Italy.

This committee will confirm at the start of the project the adequacy between needs and solutions provided by ***ASSEM***, approves the experiment mappings and evaluate results from the two experiments. The co-ordinator will consult it during the development phase if necessary.

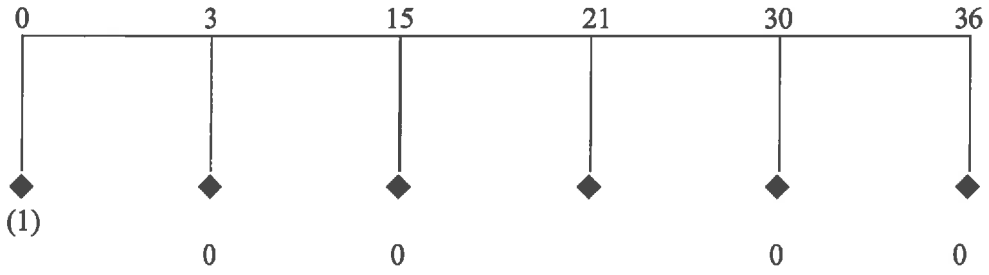
Co-ordinator:

The co-ordinator is responsible for:
- The general organisation of the project: follow up and adaptation of the project planning, organising, steering, checking and assuring that reports are submitted in due time, monitoring of the expenses and allocation of the budget, co-ordination meetings and full consortium workshops, the installation and maintenance of a dedicated ***ASSEM*** Web server.
- The assistance towards the partners concerning: the rules of the project, the outline of a consortium agreement, the project planning and individual partner planning, the advice on all kind of matters, e.g. how to fill in cost statements, full cost system, industrial property…

Meetings:

Co-ordination committee will take place at every main project milestone and at least twice a year, but also whenever needed.
WP meetings will be held between the partners involved in specific WP.

All meetings will be called and chaired by the co-ordinator. They will take place in the locations of the different partners in rotation. They will be supported by approved minutes written on the spot and signed by the WP co-ordinators. They will include a list of actions and due date for each of the partners. Decisions will be taken by consensus or in specific case by majority vote.



◆ Technical co-ordination committee meeting
(1) Kick off meeting
0 Advisory board meeting

Information flow:
All pertinent information as well as copies of all reports will be directly transmitted by the co-ordinator to all partners by adequate mailing (electronic or postal if needed).

The ***ASSEM*** Web site will deliver information on the project's life to the general public (open access) and restricted information to the members of the consortium.

The internal pages will include:
- administrative information
- meeting
- people locations
- quality manual
- technical notes and reports
- documentation
- collaboration structure
- geotechnical data (EMEWS access)
- integration tool software.

The co-ordinator is responsible for all communications with the commission. The following reports will be provided : six-monthly management and financial reports, yearly technical report and the final report.

The WP leader will update twice a year the work plan associated to his work package and communicate it to the co-ordinator.

Quality insurance:
Upon the acceptance of the ***ASSEM*** project by the EC, a detailed consortium agreement will be drafted to specify the project management rules and obligations and rights of the participating partners. Special attention will be devoted to the fair distribution of intellectual and industrial property rights.

A quality assurance manual will be approved at the first TTC 3rd month meeting. Quality assurance is of particular importance for sensor calibration protocols, standard interface design, data production and dissemination.

C6 Description of the consortium

The ***ASSEM*** consortium is constituted in order to bring together partners who own or have access to the latest technologies of measurement at sea and on shore of geotechnical properties and to deployment means at sea. The eight partners are covering a wide range of design and development capabilities from the offshore industry, oceanologic research and geological hazard monitoring. They bring to the consortium their commitments with several oil companies, engineering companies, local authorities and academic research. They are involved in EU research projects and wish to build a strong link between them, thus enabling with ***ASSEM*** to make a new step towards an European geohazard monitoring know-how competitive with those of USA and Japan.

* Partner 1 and co-ordinator, **Ifremer**, is a French research institute involved in all academic researches referring to the sea. Ifremer has been a world pioneer in deepsea bottom and borehole monitoring. It is also involved in R&D technological projects with the offshore oil industry and offshore contractors, including development of geotechnical tools and methods.
Ifremer has references in subsea deployment and manipulation with ROV and submersible through EU funded, joint industry or internal projects (task 1.2 – WP4 and 5).
Ifremer is developing the various links of the complete communication system between the in-situ sensor at sea and the data collecting center (Ifremer leads WP3). The subcontractor, **ORCA**, provides the acoustic communication equipment (reference to EU funded 5th framework project ACME).
Ifremer brings to the consortium an Internet integration tool (task 3.1), its equipment and standards in calibration and testing of subsea instruments (task 1.5, 1.6). Ifremer sedimentologists have programs in fluid flows and slope stability such as the EU funded 5th framework project COSTA (EUV-CT-1999-00006) which does not include sensor development (WP6).
Ifremer has an experience in the role of project manager in European research projects and in industrial R&D (WP7).

* Partner 2, **NGI**, is a Norwegian private foundation performing research and services in geotechnics. NGI is providing services to the oil industry companies and advice to the Norwegian authorities in charge of public safety.
NGI has a strong experience in instrumentation design qualification and operation. It is the reason why it will lead WP2. This experience includes land slide hazard monitoring in mountains, distance measurement in offshore contracting (task 2.2) and pore pressure geotechnical survey instrumentation (task 2.1). NGI is collecting data for Norsk-Hydro and Statoil in an attempt to monitor a seabed slope, the data is up to now retrieved during ship cruises.
NGI is involved in the geotechnic assessment of the Ormen Lange field situated in the area of the Storegga Slide. It is a major area for risk evaluation in the European margins and will be the place for the WP4 experiment with NGI as a leader. NGI brings its scientific expertise, its experience in reliable instruments compatible with the offshore industry rules and its commitments with local authorities in Norway (WP6).

* Partner 3, **IPGP**, is a French institute of geology. It has a recognized expertise in volcanic or seismic monitoring and develops instruments for this purpose. IPGP is the leader of a research cluster of projects funded by EU including CORSEIS-CORINTH, 3D-CORINTH, DG Lab.-CORINTH.
IPGP is co-ordinating the development of the geodesic equipment in task 2.2. They will contribute to the WP5 in order to ensure a coherence with the measurements strategy (geodesy, bore hole, seismology) in land and potentially in deep drilling under the Gulf of Corinth (project DG Lab – Corinth). IPGP is in charge of the task 3.5 for the management and display of geologic instrumentation data ; it will be compatible with the results of the project EMEWS (EU Nr ENV 4980728).

* Partner **4**, **INGV**,

INGV is the most important Italian scientific institution on geophysics and geochemistry. It has experience on the development of submarine observatories and geophysical and environmental monitoring from coastal areas to deep sea. It has expertise on quality checks of scientific sensors, as well as on the elaboration and interpretation of geo-environmental data (task WP6)
INGV will be in charge of the key problem of gas monitoring (task 2.3). It will ensure the interoperability with the Geostar benthic station which measures the complementary parameters with seismometer (WP1 and WP3).

* Partner **5**, **CAPSUM**, is a German SME. The company is manufacturing a first generation of gas sensor for measurement of methane and wishes to enhance its capabilities for long term monitoring purposes (task 2.3).

* Partner **6**, **NCMR**, is a Greek institute of marine research with an experience in ocean monitoring (POSEIDON network). The marine geology department of NCMR is experienced in marine sea floor surveys using multibeam, seismic profiling, sediment corer and laboratory analyses and deployments with their submersible named Thetis (tasks 5.2 – 5.4). NCMR owns marine data for the whole Gulf of Corinth, they will lead WP5. They will be a key partner for the academic evaluation (WP6).

* Partner **7**, **University of Patras**, is a Greek research and education body. Its geology department is involved in the Gulf of Corinth. They have expertise in the fluid flow occurring in conjunction with seismic activities, such as subsea pockmarks (tasks 5.1 – 5.3). Patras University is well situated to ensure the follow-up and collect data from the Gulf of Corinth monitoring experiment (task 5.5). University of Patras is the daily adviser of the local authorities (Mayor of Patras, Mayor of Aegion, harbour authorities, Western Greece Region) who are well representing the target end users of ***ASSEM*** project.

* Partner **8**, **SAGE Engineering**, is a Belgian geotechnical contractor involved in subsea measurements in the sediment, surveys and engineering of interfaces between offshore structures and the seabed. They will use this industrial know how and lead WP1. They develop the standard components of the ***ASSEM*** nodes taking benefits from the experiences of the research institutes and other partners. SAGE will participate to WP3. They will be a key partner for the technical evaluation and industrial evaluation in WP6 where they will ensure the competitiveness of the ***ASSEM*** concept in the geotechnical offshore contracting market. They lead WP6.

C7 Description of the participants

C7.1 Institut Français de Recherche pour l'Exploitation de la MER (Ifremer) (F)

IFREMER (1350 scientists, engineers, technicians and administrative staff) is a government agency involved in fundamental and applied oceanographic research, technological developments and industrial or commercial applications. Ifremer carries out fundamental studies in the field of active sedimentary processes and high-resolution stratigraphy on continental margins. Recently Ifremer conducted several important campaign devoted to geohazards for deep offshore industry in partnership with TotalFinaElf.

The marine geoscience department of Ifremer, has acquired an internationaly recognized expertise in sedimentary process along margins.

IFREMER TMSI carries out the development of geotechnical and geophysical tools in co-operation with the marine geoscience department inside Ifremer and with the oil industry.

From a geotechnical point of view, IFREMER has developed the geotechnical module which allows the penetration of an instrumented cone up to 2 meters. Several cone sensors can be adapted.

As the penetration is not enough, IFREMER develops in co-operation a new seabed penetrometer "Penfeld" which will penetrate up to 20 to 30 meters. A new cone is designed to be operated in deep sea and to measure in addition to the point resistance and the lateral resistance, the differential pore pressure and the density by gamma densimetry.

IFREMER has identified Acoustic communication as one of the key technology for underwater penetration. So, a lot of systems transmitting data between two points (for example TIVA) were developed and transfered to industrial partners. Today, studies are oriented toward communication between many locations and networking.

Short CV's for key personnel:

Jean-François Rolin, design engineer, is the head of the Department for Technology of Instrumental Systems. He is graduate from CESTI engineer school (1976). After an experience in the structural assessment of offshore platform in a classification society in France and Norway, he joined Ifremer as a head of the mechanical design team. He participated in the development of ten different landers or benthic stations and two bore-hole instrumentation systems. He co-ordinates the design of monitoring systems for coastal environment and deep sea. He has performed several studies on reliability of deep sea systems and co-ordinated a national standard on quality tests of oceanographic instruments.

Roland Person is graduate engineer from Ecole Supérieure d'Electricité and he received the degree of doctor engineer from the University of Paris VI in 1972 for contribution to the study of thermal exchange between ocean and atmosphere.
Since that time he has been working on instrumentation development at CNEXO and IFREMER more specially in the acoustic area. He has been involved in the project of the Institute applying underwater acoustic communication techniques as well on scientific aspect as industrial development. Since of July 1999, he is in charge of the ocean bottom monitoring program.

Jerome Blandin is a senior electronics engineer (Institut National des Sciences Appliquees de Lyon, 1987). After two years spent in the transportation industry as a test engineer for a high speed train project (the present Eurostar), and almost four years as a product development engineer in an SME specialised in instrumentation for geological purposes, he joined the oceanographic research world for six years, as an instrumental systems engineer within IFREMER. He participated in development

projects like the VICTOR ROV instrumental module, the messengers communication systems of the EC funded GEOSTAR project and a deep sea bed CPT "Penfeld". In the framework of the EC project ALIPOR, he designed and implemented a novel distributed architecture for a long term deep sea lander (MAP2). He was also responsible for the design and realisation of the Near Real Time Communication System of the GEOSTAR2 project. His main field of interest is systems design and the implementation of distributed architectures in oceanographic equipment.

Jacques Meunier is graduate engineer from Ecole Centrale de Paris (1971) and he received the degree of doctor-engineer from the University of Grenoble en 1974 for the contribution to the study of propagation of shock waves in soils.
Since that time, he has been working on soil mechanics research at CNEXO and at IFREMER. He has applied geophysical methods to the geotechnical surveys. He manages the project of new sea bed penetrometer "Penfeld". He has been involved in European projects in Rebecca, Sigma and VHR3D. Since July 1999, he is in charge of the new service "Acoustics-Seismics".

Jean-Paul Foucher is a geophysicist with a long-standing interest in fluid flow and heat tranfer phenomena in continental margins. As a scientist with the Departement de Geosciences Marines at Ifremer, he has been involved in several cruises and ODP drilling legs with such objectives as collecting temperature and heat flow data at the seafloor and in boreholes. He was the French co-ordinator of a successful French-American field experiment dedicated to long-term observations of temperature and pressure at ODP Sites 948 and 949 on the Barbados prism (project ODPNaut, 1995-97). He was recently the French co-ordinator of the joint dive French-Dutch dive expedition to several mud volcanoes of the eastern Mediterranean sea (project MEDINaut, 1998-99). He brings to this group a considerable experience in the design and achievement of field monitoring experiments in the deep sea.

Pierre Cochonat, Head of the "Environnements Sedimentaires" Laboratory. Experience: 24 years. Engineering geologist. Main field of scientific interest: the study of sedimentary processes and physical properties of slope sediments. He has been project manager on the scientific programme "Instability and Sedimentary Processes on Submarine Slopes" and of a scientific and industrial programmes (deepwater site surveys of oil exploration blocks in the Gulf of Guinea) in partnership with TotalFinaElf petroleum company. He is presently responsible for the work package devoted to the study of seabed stress condition in the 5FP COSTA (COntinental slope STAbility), including *in situ* measurements. He was chief scientist on several research cruises (about one per year since 1988).

Selected publications:

Foucher, J.P., X. Le Pichon, S. Lallemant, M.A. Hobart, P. Henry, M. Benedetti, G.K. Westbrook and M.G. Langseth, Heat flow, tectonics and fluid circulation at the toe of the Barbados accretionary prism, J. Geophys. Res., 95, 8859-8867, 1990.

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J.F. Rolin, L. Floury, Champ; Reliability of benthic stations : the Nadia II example – Oceans 94. IEEE publication. III, p. 594-599

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Cochonat P., Cadet JP, Huchon P., Lallemand S., Nouzé H and Foucher JP. 2001. Slope instability processes on the Nankai slope. French-japanese Kaiko-Tokai cruise April 96. C. R. Ac. Sc. (Marine Geology N° spécial Kaiko-Tokai en préparation).

Cochonat P. 1998. Seafloor mapping and imaging: characterisation of seafloor spatiotemporal variability. Keynote lecture. Session report Seafloor characterisation / mapping including swath bathymetry, side-scan sonar and geophysical surveys. Ed Gilles Ollier, Pierre Cochonat, Luiz Mendes Victor. Third european MAST Conference Lisbon, 23-27 May 1998, pp 7-18.

Cochonat P. and Piper D.J.W. 1995. Source area of sediments contributing to the "Grand Banks" 1929 turbidity current. In Atlas of Deep Sea Environments: Architectural style in turbidite systems. Edited by K.T. Pickering, R.N. Hiscott, N.H. Kenyon, F. Ricci Lucchi and R.D.A. Smith. Chapman & Hall, London, p. 12-13.

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C7.2 Norges Geotekniske Institut (NGI) (N)

Organisation:

NGI is private foundation for research and advisory services, located in Oslo, Norway. NGI was established in 1953 and currently employs a staff of 136 persons of which 95 have university degrees. In 1999 the turnover was NOK 127 millions.

Research and advisory services:

Design, instrumentation and analysis of foundations for buildings, bridges, offshore and harbour structures, evaluation of geotechnical aspects related to tunnels, rock caverns and reservoirs, dams, environmental sciences and engineering and landslide hazards are our major fields of expertise. NGI became early an international centre for geotechnical research. Trademarks of the research, now covering all aspects of geotechnical, rock and environmental engineering, are to meet the industry's needs for practical and reliable design tools and engineering solutions. R&D currently represent about 50% of NGI's activities.

Basic knowledge:

The strength of NGI lies in the vast experience and expertise of our personnel. The basic expertise covers three main areas: (1) properties and physical behaviour of soil rock and snow, (2) numerical modelling and analysis of soil rock and snow and their interaction with structures, and (3) instrumentation and performance monitoring. The working philosophy is to utilize, in an integrated approach, past experience and latest theories and techniques, backed up with full-scale measurements and performance monitoring. This ensures the soundness and reliability of the recommendations

Short CV's for key personnel:

Name: **John Harlad, Løvholt**, 27 June 1944, Norwegian
Division Director, Division for Instrumentation and Performance Monitoring, Norwegian Geotechnical Institute, Oslo
Chartered Engineer, Technical Physics (M.Sc.), 1970, Norwegian Technical University of Trondheim (NTNU)

Key Qualifications: 20 years of experience in design of instrumentation systems and components, field installation work related to consulting and research project.
Involvement in other EU-projects: Brite/EuRam Project: BE95-2109 "Subsurface Radar"

Name: **Per Sparrevik**, 23 April 1960, Swedish
Discipline Manager Subsea Instrumentation
1985 M.Sc. Civil Engineering Royal Institute of Technology, Stockholm, Sweden
1984 Thesis. University of California, Berkeley, USA

Key Qualifications: 3 years of experience within offshore geotechnical design and soil investigation. 12 years of experience within offshore and subsea instrumentation including R&D design, installation work and field operation of monitoring systems for platforms, and subsea structures, seabed and boreholes application and subsea installation operations.

C7.3 Institut de Physique du Globe de Paris (IPGP) (F)

Background experience and expertise of the institute:
IPGP is the largest centre for earth sciences in France. It has a long and wide background in seismology and geodesy including instrumentation, multi-parameter monitoring, fieldwork, international collaboration for monitoring and risk mitigation (Italy, Greece, Indonesia, Central-America,...). It has also s long background in marine geophysics. IPGP is the main actor in the European Corinth Rift Laboratory project.

Structure of the IPGP:
115 researchers, 120 technical people, 130 PhD students

Science team:
- Ing. Jérôme Ammann, CNRS
- Dr. Valerie Ballu, CNRS
- Dr. Pascal Bernard, IPGP
- Dr. Pierre Briole, CNRS
- Ing. Hugues Castarède, CNRS
- Dr. Christine Deplus, CNRS
- Dr. Michel Diament, IPGP
- Dr. Alexandre Nercessian, IPGP

Personnel involved in the project:

Jérôme Ammann, born on the December 22nd 1967, electronic engineer at CNRS, in charge of geodesy seafloor instruments development. He participated in two sea projects (NECRO5-RR from Scripps Institute of Oceanography and POLYNAUT from IFREMER) and trains 3rd degree students on the sea monitoring measurements. He developed continuous geodetic monitoring systems for the French volcano observatories and the north Chile seismic station. He participated in three EU projects (AVMS, TEKVOLC and EMEWS) aimed to the monitoring of the volcanoes. He has experience in GPS, E.D.M. systems, acoustic and radio waves propagation, data transmission, data acquisition, software and WEB. In the past, he was in charge of other instrumentation like the pool of GPS receivers from Institute National des Sciences de l'Univers (INSU), and geophysics experiments in the French Dumont d'Urville Antarctic Station from Institut Francais de Recherche et de Technologie Polaire (IFRTP).

Valérie Ballu, born on May, 8th, 1968, researcher of the french CNRS (Centre National de la Recherche Scientifique). Education : PhD thesis at IPGP/Université Paris 7 in 1996. Relevant research : seafloor and sea surface gravity studies in various spreading context (Mid-Atlantic Ridge, East-Pacific Ridge, Juan de Fuca Ridge and Hess Deep propagator). Participation in numerous cruises, including a seafloor geodesy cruise in November 2000 to monitor Kilauea South flank deformation. Temporal micro-gravity monitoring of an active spreading rift (Asal rift, Djibouti).

Pascal Bernard, born in 1958. Phd thesis in Seismology, Univ. Paris 6, 1983. Presently: Physicien du Globe IPGP. Director of the Seismogenesis Laboratory since 1994; Deputy-Director of IPGP since 1999. Associated Editor of Geophys. J. Int. (1992-1996); Member of the Scientific Advisory Board of the European Center for Geophysics and Seismology (ECGS); Scientific Advisory Board ot the CNES "DEMETER" satellite for monitoring earthquake related electro-magnetic signals; French Association for Earthquake Aseismic Design (AFPS). Development of tools for strong motion analysis and simulation; analysis and modeling of crack-induced anisotropy in the crust; theoretical models for electro-telluric precursors; multidisciplinary study of large earthquakes; development of a multiparameter observatory in the rift of Corinth (GAIA project).
About 30 refereed publications in International Journals. Coordinator of 3 European projects in seismic risk (EPOC-CT91-0042, EV5V-CT94-0513 ET GAIA, ENV4-CT96-0276).

Pierre Briole, born the 9 October 1961, Researcher of the French CNRS (Centre National de la Recherche Scientifique). Education: Agrégation de Physique, 1983, PhD thesis of the University Paris VI, 1990. Relevant research: Monitoring deformation of volcanoes (Etna, Campi Flegrei (Italy), Piton de la Fournaise (France)) and seismic zones (Asal Rift (Djibouti), Gulf of Corinth (Greece), North Chile) using various techniques including GPS, levelling, SAR and local continuous measurements (tiltmetry, micro-gravity measurement, ...). Modelling the short term deformation using analytic models (elastic medium) and numeric (finite element modelling). Interpreting the observed and modelled deformation by combining the geodetic information with tectonic and seismologic data. P. Briole has coordinated several past European project (MADVIEWS, EMEWS, TEKVOLC) and one ESA project (EMPEDOCLE).

Hughes Castarède, engineer CNRS. Expertise in soil mechanics (master of civil engineering) and mechanics (Ecole Nationale Supérieur des Arts et Métiers). Expertise in seismology: installation and maintenance of stations belonging to the Geoscope seismic network. Expertise in sea bottom seismology. Participation at the design of sea bottom sensors in the framework of a research program for sea bottom multidisciplinary geophysical observation (Panashe), in particular satellite data transmission systems, power supply and differential pressure sensor.

Christine Deplus, born the 17 May 1961. Chargé de Recherche CNRS (Centre National de la Recherche Scientifique), IPG Paris. Education: Agrégation de Physique, 1983, PhD in Geophysics, University of Paris-Sud, 1987. Research fields: oceanic spreading and rifting processes, intraplate deformation, volcanology (inner structure and flank collapse events). Experience in marine geophysics (swath bathymetry and imagery, seismics, gravity, magnetics), on-land field studies (GPS, gravity) and numerical modelling. C. Deplus has participated to many oceanographic cruises, including 2 as chief-scientist. Responsible for research projects supported by the French CNRS. Recent publications: *Earth Planet. Sci. Lett.*, 173, 257-269, 1999. *Geophys. Res. Lett.*, 26, n°8, 1053-1056, 1999. *J. Geophys. Res.*, 104, B10, 22 825 - 22 843, 1999. *Geology*, 26, n°2, 131-134, 1998. *J. Geophys. Res.*, 103, B2, 2615-2631, 1998. *Mar. Geophys. Res.*, 19/5, 481-503, 1997. *J. Volcanol. Geotherm. Res.*, 64, 23-52,1995.

Michel Diament, professor ("Physicien") at IPGP. Experience in marine geophysics (9 scientific oceanographic cruises since 1981) on board of French, U.S. and Indonesian research vessels and in the French submersible (NAUTILE). Gravity and microgravity surveys on the Krakatau, Merapi, Fournaise (Réunion Island) and Soufrière (Guadeloupe Island) volcanoes and in several other locations (France, Nepal, ...). Seismological surveys in Indonesia (Sunda Strait, Sumatra), Peru, Tunisia and Armenia. Head of the Gravimetry and Geodynamic laboratory of I.P.G.P. Chairman of the IRD (Overseas research institute) Geosciences scientific commission. Member of CNES (French space agency) scientific group (TOAB). Member of the IFREMER (French marine research institute) Geoscience scientific commission.

Alexander Nercessian, born on July 23th 1950. Physicient Adjoint at IPGP since 1983. Thesis in seismology at University Paris 6 in 1980. Experience in marine seismology and participation to various cruises (seismic reflexion, OBS-OBH deployement, sonobuoy desing). Experience in automated data collection and management in particular in the French volcanological observatories. Involved in the Corinth network of continuous GPS measurements.

C7.4 Istituto Nazionale di Geofisica e Vulcanologia (INGV) (I)

It was established in 1936 as ING to develop and promote geophysical researches. In 2000 it has been named INGV, becoming the most important Italian institution on seismic and volcanic hazard studies. The main fields of activity are addressed in seismology, seismotectonics, geodynamics, geomagnetism, aeronomy, geochemistry, volcanology and environmental studies. Since the beginning, the ING has installed and managed permanent observatories, and in the last fifteen years has in charge the seismic monitoring of Italy through a network of more than a hundred stations real time connected to the Acquisition Centre in Roma. The seismic monitoring has been extended to the Mediterranean basin (MEDNET).
The institute participated, in collaboration with other European Institutions, to oceanographic and geophysical cruises. Studies on gas geochemistry related to earthquakes, geodynamics and Earth degassing have been recently carried out. Specific studies have been performed on natural emissions of greenhouse gases (CO_2 and CH_4) from the seafloor and on lands, in geothermal and mud-volcano areas.
Since 1995 INGV is involved in environment and risk monitoring at sea. It has been co-ordinator of GEOSTAR Project (MAS3-CT95-0007) and is presently co-ordinator of GEOSTAR 2 Project (MAS3-CT98-0183). In these frameworks INGV acquired experience of development of automatic chemical analysers for deep-sea conditions and, in general, of marinisation of geophysical and environmental instrumentation.

Short CV's for key personnel:

Giuseppe Etiope: Geologist with specialisation (Ph.D.) on gas geochemistry, researcher at INGV. He worked in the framework of European Union research programmes on gas migration in the geosphere (PEGASUS and MIRAGE projects, Radioactive Waste Management) and development of submarine observatories (GEOSTAR 1 and GEOSTAR 2, MAST-III). He is studying gas occurrence and behaviour in natural systems (geosphere and oceans), methane and carbon dioxide emission from the ground and seafloor, with implications in tectonics, mineral exploration and global change. He has experience on gas and environmental analytical equipments. Presently he is coordinator of a NATO project on "Methane emission from mud volcanoes" and responsible for specific Working Groups of INQUA-Carbon Commission (International Union for Quaternary Research) and IGCP-UNESCO projects on "Carbon cycle". He published about 50 papers on International and Italian Journals, and Proceedings.
Paolo Favali: Geologist with specialisation on Geophysics, Research Director at ING. He has about 25 years of experience in Natural Hazards (mainly Seismic), Seismotectonics, Geodynamics and Applied Geophysics. Co-ordinator of Italian projects from 1979 to 1994. Consultant to Public and Private Companies since 1975. Member from 1999 for the European Science Foundation of the Detailed Programme Group SEIZE (Seismogenic Zone Experiment) of Ocean Drilling Programme. He is teaching «Physics of Solid Earth» and «Earth Physics» in Italian Universities since 1994. He published more than 100 papers on International and Italian Journals, and Proceedings. He has been co-ordinator of the Italian-French-German-English project GEOSTAR (MAS3-CT95-0007). He is co-ordinator of the Italian-French-German project GEOSTAR 2 (MAS3-CT98-0183).
Giuseppe Smriglio: Physicist with specialisation on Geophysics, First Research Scientist at ING. He has an experience in seismic data processing and analysis, seismic hazard evaluation, analysis of historical earthquakes. Since 1993 is Vice President of Euro-Mediterranean Seismological Centre in charge to collect and manage seismic data of the Mediterranean area. He published more than 75 papers on International and Italian Journals, and Proceedings. He has been Local Project Manager for Italy of European Project «Rapid Warning System for Earthquakes in Euro-Mediterranean Region» funded by the European Commission in the frame of «Environment» Programme (ENV4-CT96-0282). He has been also Co-ordinator of the Italian-French-German-English project GEOSTAR (MAS3-CT95-0007). He is Co-ordinator of the Italian-French-German project GEOSTAR 2 (MAS3-CT98-0183).

INGV selected publications:

Etiope G. (1997). Evaluation of a micro-gas chromatographic technique for environmental analyses of CO_2 and C_1-C_6 alkanes. J. Chromatography A, 775, 243-249.

Beranzoli L., De Santis A., Etiope G., Favali P., Frugoni F., Smriglio G., Gasparoni F. and Marigo A. (1998): GEOSTAR: a GEophysical and Oceanographic STation for Abyssal Research. Phys. Earth Planet. Int., 108, 175-183.

Etiope G. , P. Beneduce, M. Calcara, P. Favali, F. Frugoni, M. Schiattarella, G. Smriglio (1999). Structural pattern and CO_2-CH_4 degassing of Ustica Island, Southern Tyrrhenian basin. J. Volc. Geoth. Res., 88, 4, 291-304.

Etiope G. (1999). Subsoil CO_2, CH_4 and their advective transfer from faulted grassland to the atmosphere. J. Geoph. Res., 104 , D14 , 16,889.

Etiope G., Italiano F., Fuda J.L., Favali P. Frugoni F., Calcara M., Smriglio G., Marani M. (2000). Deep submarine gas vents in the Aeolian offshore. Phys. Chem. Earth., 25, 1, 25-28.

Beranzoli L., Braun T., Calcara M., Calore D., Campaci R., Coudeville J.M., De Santis A., Etiope G., Favali P., Frugoni F., Fuda J.L., Gamberi F., Gasparoni F., Gerber H., Marani M., Marvaldi J., Millot C., Palangio P., Romeo G., Smriglio G., (2000). European seafloor observatory offers new possibilities for deep-sea study. EOS, 81, 5, 45 and 48.

Etiope, G., Carnevale, P., Gasparoni, F., Calcara, M., Favali, P. and Smriglio, G., (2001). Offshore hydrocarbon leakage: hazard and monitoring. In: Developments in Marine Technology series, Elsevier, in press.

Morner N.A. and Etiope G. (2001). Carbon degassing from the lithosphere. Global and Planet. Change., in press.

Italiano F., Favara R., Etiope G., Favali P. (2001). Submarine emissions of greenhouse gases from hydrothermal and sedimentary areas. Water-Rock Interaction Symposium, June 2001, Balkema ed., in press.

C7.5 CAPSUM (Germany)

Capsum technologie GmbH was formed in 1999 by former employees of the german national research center GKSS. The company is a result of the outsourcing of research and development activities, in the frame of a programme of technology transfer aiming at the marketing of innovative technological solutions. The innovation capacities of CAPSUM are supported by numerous contacts and cooperations with research institutions developing basic technologies which can be transferred into commercial solutions. Together with several patents this build the solid technological background needed to keep pace with a demanding market.

The competence of CAPSUM's engineers reach from Oceanography, Environment and Underwater Technology to Electronic and Software. Together with our large experience of field campaigns, this is a guarantee for our customers and partners that we speak the same language and that we are able to propose an adequate answer to their needs.

A total of 6 persons work today for CAPSUM. 75% of the turnover is made outside Germany (Customers in Europe, Brazil, USA and Japan).

The team was directly involved in an European project, at the time when they were still employed at the GKSS research center (Project DUO, IN31034D, completed in 1998).

Managing Director and Project Leader for the CAPSUM's contribution to ***ASSEM***, Mr. Masson has a PhD in Biological Oceanography from the University of Paris. He worked since as expert and project leader, first for the french Navy and later for the research center GKSS in Germany. His field of activity was the development of new devices and methods for the measurement of various oceanographic parameters. He worked directly on acoustic, bioluminescence, underwater optics, whale behaviour and dissolved gasses.

Field experience: more than 40 campaigns at sea - 8 publications - 2 patents. He holds a degree in scuba-diving, and has also experience with submarines.

C7.6 NCMR (GR)

The National Centre for Marine Research (NCMR) is a large state research centre that belongs to the Ministry of Development. It is the main responsible for the Oceanographic, Fisheries and Internal Waters research in Greece constituted of three relevant institutes with 120 research staff, 110 technicians and 50 administrative and secretarial staff. The NCMR can provide and support technically the following advanced equipment.

Major field research facilities and equipment:
Multipurpose R/V AEGAEO (61m long) Submersible TETHYS (operational depth 610m), ROV, Multibeam echosounder (SEABEAM 2021), Oceanographic buoys (Oceanor, NR), sediment traps (16), Aanderaa current meters (20), transmissometers, 2 CTD (sea bird E-9 with additional dissolved oxygen probe and Sea-Tech transmissiometer of 10 cm path length), supported by 12 Niskin and 12 Go-flo bottles, 1 ADCP system, 2 ORE 3.5Khz subbottom profilers (4 and 12 transducer array fish), 1 SPARKER SIG (1-9Kj), 1 Air-Gun PAR BOLT (USA), Boomer (GeoAcoustics - UK), Side scan sonar (GeoAcoustics - UK), gravity corers, Multiple corer, box corers.

Major laboratory facilities and equipment:
SEM microscope with microanalysis (PHILIPS XL-20 EDAX), PW-2400 X-Ray Fluorescence, X-Ray diffraction (RIGAKU), Sedigraph (Micrometrics CS 5100), Atomic Absorption Spectrophotometer (Perkin Elmer 4100, equipped with Graphite Furnace), Nutrient Autoanalyser, gas-Chromatograph (VARIAN Star 3400 CS), EG&G Ortec total alpha counting system (^{210}Po,^{210}Pb), Gas chromatograph-mass spectrometer, high Performance Liquid Chromatograph, Atomic Absorption Spectrophotometer, Nutrient analyser, CHN elemental analyser, TOC Analyser, Dissolved Inorganic Carbon (TCO_2) analyser , Coulter counter, Sediment core logger of GEOTEK (UK) X-ray, sediment core X-ray imaging (Faxitron USA).

Participation in RTD projects:
MTP-II MATER (coordinator of E. Mediterranean part) (MAS3-PL 950401), METROMED (MAS3 - CT96 0049), KEYCOP (MAS3 - CT97 – 0148), PELAGOS (MAS2 - CT93 - 0059), OTRANTO (MAS2 - CT93 - 0068), CINCS (MAS2 - CT94 - 0092), MEDATLAS (MAS3 - N 98/2.210573), INTERPOL (coordinator) (EVK3 –CT- 2000 - 00526), ADIOS (EVK3 - CT - 2000 -00035), MARSAIS (EVG1-CT-2000-00029), BEEP (EVK-2000-000), STRATEGY(EVK-2000-00621)

Short CV's of key persons:
Dr. D. Sakellariou, born in 1962. Researcher in the N.C.M.R Main fields of interest: Geodynamics, neotectonics, active faults, geological hazards, marine geology, seismic-acoustic stratigraphy of sedimentary facies, quaternary sediment sequences, mass gravity processes, slope stability.
Publication record 40 papers in international Journals, Congresses and Conferences.

Dr. V. Lykousis, born in 1951. Senior Researcher. Main Field of interest: Seismic-acoustic stratigraphy of sedimentary facies, geological hazards, mass gravity processes, slope stability, marine geotechnics, quaternary sediment sequences and geotectonic evolution, slope-to-basin sedimentation processes and fluxes, biogeochemical processes, fluxes of suspended particulate matter.
Co-ordinator of a large-scale offshore facilities projects, like the submersible THETIS construction that was funded by the EU. Publication record 90 papers in international Journals, Congresses and Conferences.

Dr. S. Alexandri, born in 1963. Researcher in the N.C.M.R Main fields of interest: detailed mapping of the sea-bottom and the sea floor type identification via the acoustic backscattering, development of algorithms and mathematical techniques, integration of multi-frequency deep-tow sidescan sonar data, multibeam swath data and coincident acoustic imagery for sea floor type identification, in the Mediterranean ridge that have been affected by tectonic activity, mud diapirism and dissolution of evaporites (brine lakes).

Relevant recent publications:

1. Chamot Rooke N, Foucher J-P, Alexandri S, Lallemant S, Monti S, Pavlakis P (1993) : Structure of the Western Mediterranean Ridge from a multibeam bathymetric survey. *Europ. Union of Geosci. EUG VII (Strasbourg 1993), Terra Cognita, Vol. 5(1), p.277.*
2. Collier R., Pantosti D., D'Addezio G., De Martini P.M., Masana E. & Sakellariou D. (1998): Paleoseismicity of the 1981Corinth earthquake fault: seismic contribution to extensional strain in central Greece and implications for seismic hazard. Journal of Geophysical Research, 103, p. 30,001-30,019
3. Foucher J-P, Chamot-Rooke N, Alexandri S, Augustin J-M, Monti S, Pavlakis P, and Voisset M, (1993): Multibeam bathymetry and seabed reflectinity maps of the MEDRIFF corridor across the Western Mediterranean Ridge. *Europ. Union of Geosci. EUG VII (Strasbourg 1993), Terra Cognita Vol. 5(1), pp. 278-279.*
4. Lykousis V and Chronis G (1989): Mass Movements, Geotechnical properties and slope stability in the Outer Shelf Upper Slope, N.W. Aegean Sea. Marine Geotechnology, 8 (3): 231-247.
5. Lykousis V (1991): Submarine slope instabilities in the Hellenic Arc region, Northeastern Mediterranean Sea. Marine Geotechnology, 10: 83-96.
6. Lykousis V., Sakellariou D. & Papanikolaou D. (1998): Sequence stratigraphy in the northern margin of the Gulf of Corinth: Implications to Upper Quaternary basin evolution. Bull. Geol. Soc. Greece, 32/2, p. 157-165
7. Pantosti D., Collier R., D'Addezio G., Masana E. & Sakellariou D. (1996): Direct geological evidence for prior earthquakes on the 1981 Corinth fault (central Greece). Geophysical Research Letters, Vol. 23, No. 25, p. 3795-3798.
8. Lykousis V, Anagnostou C, Pavlakis P, Rousakis G, Alexandri M (1995): Quaternary sedimentary history and neotectonic evolution of the eastern part of Central Aegean Sea, Greece. Marine Geology 125: 59-71.
9. Papanikolaou D, Lykousis V, Chronis G, and Pavlakis P (1989): A comparative study of neotectonic basins across the Hellenic arc: The Messiniakos, Argolikos, Saronikos and S. Evoikos Gulfs. Ocean Basin Research 1: 167-176.
10. Papanikolaou D, Stoeckhert B and Sakellariou D (1999): Land-based Drilling Project in the Forearc of the retreating Hellenic Subduction Zone, Crete, Greece. CIESM Workshop Series, 6, "Mediterranean Scientific Drilling Prospectives", p. 109-115.
11. Papanikolaou D, Sakellariou D and Stoeckhert B (1999): A combined onshore/offshore drilling transect across the Forearc of the retreating Hellenic Subduction Zone. ICDP Newsletter 1, p. 21-23
12. Papoulia J., Lykousis V. & Sakellariou D. (1998): Neotectonic activity and seismic hazard in Central Greece. Boll. Geof. Teor. Applic. 39/2, p. 113-124.
13. Pavlakis P, Alexandri S, Foucher J-P, Chamot Rooke N (1994): Topographic fabric of the MEDRIFF corridor from a 2-D image processing on multibeam bathymetric data. *European Geophysical Society – Annales Geophysicae Part I, Solid Earth Geophysics & Natural Hazards, Supplement I, Vol., 12.*
14. Pavlakis P, Alexandri S, Chamot-Rooke N, Le Pichon X, Lallemant S (1999) : Sound Wave and electromagnetic (EM) microwave backscattering mapping across the southwestern Hellenic arc (Greece). Proc. of International Conference on 'Oceanography of the Eastern Mediterranean and Black Sea'. Athens 23-26 February 1999, Session VI, pp.310.
15. Sakellariou D., Lykousis V. & Papanikolaou D. (1998): Neotectonic structure and evolution of the Gulf of Alkyonides, Central Greece. Bull. Geol. Soc. Greece, 32/1, p.241-250

C7.7 University of Patras (GR)

Laboratory of Marine Geology and Physical Oceanography

The Marine Geology and Physical Oceanography Laboratory was established in 1989 within the Geology Department of Patras University. The Laboratory is at present by far the largest teaching and research University centre in its field in Greece. The aim of the laboratory is to train undergraduate geology students and to carry out fundamental and applied research in the fields of Marine Geology, Physical Oceanography, Coastal Geomorphology and Marine Pollution. The Laboratory also offers a two-year post-graduate course leading to a Master of Science (MSc) degree in Environmental Oceanography. Furthermore, every year one to two research posts are offered to students to carry out research in the above mentioned fields leading to Ph.D.degree.

Major research field:
The research field of the laboratory is slope stability processes and geotechnical properties of sediments, gas charged sediments, river delta sedimentation, Quaternary sea-level changes

Laboratory Facilities:
The laboratory has the following equipment for research in the field of Marine Geology, Physical Oceanography, Coastal Geomorphology and Environmental Oceanography

Navigation:
Magnavox 2000 Global Positioning System (G.P.S.) with differential capability

Marine Geology:
High resolution seismic profilers: 3.5 kHz ORE Pinger with 4 and 9 tranducers, S.I.G. Sparker (50 to 1500joules), Bolt Airgun (10 to 40 $inch^3$)
Recorders: E.P.C. 1600, 1650 and 1086 models.
Hydrophones:1 channel, 4 cells. 1 channel, 8 cells. 2 channels, 4, 8 and 12 cells.
E.G.G. 260 Side Scan Sonar with a 272 dual frequency (100 kHz and 500 kHz) towfish and 1000m double armoured tow cable capable of operating in water depth up to 600m.
Triton-Elics Digital recording system (DelphSeismic, IsisSonar, DelphMap)
Underwater Benthos MK R.O.V. with 300m umbilical cable capable of operating in water up to 250m.
Elsec Proton Magnetometre with 200m tow cable
3m gravity piston core and Day grab.
Complete set of equipment for determination of the physical and mechanical properties of sediments

Physical Oceanography:
Sensordata shelf recording current meters (6).
Aandera CM2 current meters (2)
Aandera CM9 current meters with turbidity, DO_2 , temperature and salinity sensors (2)
Temperature and Salinity probes, N.B.A. and Ocean Data.
Water Samplers (2).
Tide gauges Van Essen (5).

Environmental Oceanography:
Atomic Absorption Spectrometer Perkin Elmer 3100 for the determination of 16 elements: Al, Ca, Mg, Si, Fe, Ba, Ti, Cd, Pb, Zn, Mn, Co, Ni, Cu, Hg, Mo, Ag.

Services:
The laboratory offers to governmental agencies, local authorities, private companies and industry, a variety of high quality services in marine sciences for shallow inshore, shelf and deep water environments. The spectrum of services offered covers marine geological services:
- Echo-sounding
- Seafloor mapping
- High resolution seismic profiling
- Seabed sampling and coring
- Remote operated vehicle seabed inspection

Short CV's of key persons:
Dr G. Ferentinos. Professor, Director of the Laboratory. Mainfield of interest: slope stability processes, marine geotechnics, marine neotectonics. Publication record: 38 papers in major international journals.

Dr G. Papatheodorou. Lecturer. Mainfield of interest: Marine geohazards, gas charged sediments, multivariate analysis of geological data. Publication record: 15 papers in major international journals.

Recent Publications in International Journals:

Ferentinos G. (1992) : Recent gravitative mass movements in a highly tectonically active arc system: The Hellenic Arc. Marine Geology 104: 93-107.

Ferentinos, G. (1992) : Offshore geological hazards in the Hellenic Arc. Marine Geotechnology 9: 261-277.

Papatheodorou, G., Hasiotis, T. and Ferentinos, G. (1993): Gas charged sediments in the Aegean Sea. Marine Geology 112: 171-184.

Papatheodorou, G. and Ferentinos, G., (1994): Sedimenttion processes and basin-filling depositional architecture in an active asymmetric graben: Strava graben, Gulf of Corinth, Greece. Basin Research 5: 235-253

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C7.8 SAGE Engineering SA (B)

SAGE Engineering SA is part of the SAGE group which specialises in marine and offshore geotechnics. The SAGE group performs offshore site investigation contracts, cable and pipeline route surveys, and onshore geotechnical work. Particular areas of expertise within SAGE Engineering SA includes: seabed characterisation for pipeline and cable route design, assessment of geohazards, submarine resistivity testing, miniature cone penetrometer testing and interpretation, burial assessment, subsea construction activities (ploughing and jetting systems) and all types of shallow geotechnics associated with marine works. SAGE has also experience with soil dynamics problems which lead to soil instability (seismic induced liquefaction, mudslides) and seismic analysis of structures (EU Phare project). SAGE Engineering SA is also the software development centre for the SAGE group. The Brussels office employs 13 engineers including 3 to Doctorate level and the rest to MSc level.

Short CV's of Senior Staff:

Dr Christopher Golightly, (41 years old), Senior Engineer, has wide experience in all types of offshore geotechnics and in particular in geohazards. While working for BP, he project managed the whole geohazard assessment project in the Caspian sea for AIOC. This included mudslide analysis, mud volcano activity, seismicity, fault movement and risk analysis. Previously he worked with Fugro as Senior Engineer leading a team of geotechnical engineers and engineering geologists. His experience included offshore and onshore geotechnical investigations, engineering foundation analysis, interpretative and engineering reporting and project management. Prior experience to this included project and site engineering for geotechnical investigations and designs. He obtained his PhD based on work on carbonate sands which was followed by a 15 month post doctoral fellowship with IPF Paris.

Dr David Cathie, (50 years old), Principal, is specialised in shallow marine geotechnics, seabed characterisation, ploughing and trenching and pipeline engineering. Gaining his PhD on the finite element analysis of embankment dams in 1976 he began his career in university teaching and the development of boundary element methods. He then joined D'Appolinia, Brussels, and worked on soil structure interaction problems associated with seismic loading. He became interested in offshore engineering in 1983 and was one of the founders of SAGE in 1984, specialising in marine geotechnics. His experience includes site investigations, pile design, jack-up stability analysis, gravity base design but most recently with long seabed structures such as telecommunications cables and pipelines. He is Engineering Director of SAGE group and responsible for SAGE projects in burial assessment and seabed surveying.

C8 Description of the resources

Extra resources:
A remark to understand the proposed budget of ***ASSEM*** is to take into account that some major means necessary to achieve this kind of project are not charged to ***ASSEM***. The opportunity of this project comes from convergence of interest of the partners, end-users and other EU funded projects.

The slope stability experiment in continental margin in Ormen Lange field is only possible thanks to the infrastructure of ship cruises, offshore work ROV, site survey equipments, bore-hole drilling, land bases. Only the additional cost needed for the pilot experiment will be charged. This experiment is only feasible within a reasonable EU RDT budget thanks to the support of the field operators, ensured by NGI and proved by a letter of support.

The knowledge of the Gulf of Corinth required to determine the right area to experiment in a tectonically active place needs extensive studies. The additional survey is charged in the project. NCMR for the marine part, IPGP (other Corinth projects) for the inland and University of Patras give access to the complementary data. Other EU funded Corinth projects are providing a place in Aegion where IPGP can host the telecommunication onshore base of ***ASSEM***.

Other partners are owning marine instruments which will be deployed and in some cases modified by the project.

Durable equipment:
This budget is devoted to equip the teams in charge of developing the integrated sensors (acoustic distancemeter, fibre optic sensor, gas sensor, pore pressure) for their testing and calibration tasks of WP2. Ifremer and IPGP need to purchase some development means for the Internet integration tool, the « COSTOF » module and the data management in WP3. A part of the elements of the array needed for the Ormen Lange experiment are durable equipment.

Durable equipment	IFREMER	NGI	IPGP	INGV	CAPSUM	NCMR	UPAT	SAGE	Total
WP2 totall	0	53927	50000	25000	0	0	0	0	
Task 2.1		40000							40000
Task 2.2			50000						45000
Task 2.3				20000					20000
Task 2.4		13927		5000					18927
WP3 total	13000	0	1000	0	0	0	0	0	
Task 3.1	3000								3000
Task 3.2	10000								10000
Task 3.5			1000						6000
WP4 total	0	79000	0	0	0	0	0	0	
Task 4.2		79000							79000
Total	13000	132927	51000	25000	0	0	0	0	221927

Consumables:

Ifremer needs consumables for the prototype interfaces of connection and disconnection (WP1), the tests of the array, for the development tools, the COSTOF and the telecommunication.

IPGP, INGV and CAPSUM have to drive prototype experiments and tests with consumables in the WP2 for the sensors.

University of Patras and NCMR use consumables for their precise site surveys, and the deployments at sea: dead weight, cables, chains, coring, laboratory analysis, Multi beam, seismic profiling,…

Consumables	IFREMER	NGI	IPGP	INGV	CAPSUM	NCMR	UPAT	SAGE	Total
WP1 total	20000	0	0	0	500	0	0	0	
Task 1.2	10000								10000
Task 1.5	10000				500				10500
WP2 total	0	0	15000	55000	30750	0	0	0	
Task 2.2			15000						15000
Task 2.3				55000	30750				85750
WP3 total	49000	0	0	0	0	0	0	0	
Task 3.1	10000								10000
Task 3.2	10000								10000
Task 3.3	10000								10000
Task 3.4	19000								19000
WP5 total	0	0	0	0	0	58000	15000	0	
Task 5.1							5000		5000
Task 5.2						28000			28000
Task 5.3							5000		5000
Task 5.4						30000			30000
Task 5.5							5000		5000
Total	69000	0	15000	55000	31250	58000	15000	0	243250

Subcontracting:

IFREMER will need to subcontract to specialised companies a part of the work on mechanical interfaces (WP1), on electronic development of COSTOF and telecommunication (tasks 3.3 and 3.4) and acoustics with ORCA Instrumentation in task 3.2.

NGI and INGV will be helped by companies who master the technologies involved in the sensor techniques.

University of Patras must find a help by private companies, mainly from the region around the Gulfs of Corinth and Patras. The need is to have access to the shallow water where pockmarks are very active with divers and small ships

Subcontracting	IFREMER	NGI	IPGP	INGV	CAPSUM	NCMR	UPAT	SAGE	Total
WP1 total	40000	0	0	0	0	0	0	0	
Task 1.2	40000			0					40000
WP2 total	0	30000	0	80000	0	0	0	0	
Task 2.1		15000							15000
Task 2.3				60000					60000
Task 2.4		15000		20000					35000
WP3 total	150000	0	0	0	0	0	0	0	
Task 3.2	50000								50000
Task 3.3	50000								50000
Task 3.4	50000								50000
WP5 total	0	0	0	0	0	0	86200	0	
Task 5.1							43100		43100
Task 5.3							43100		43100
Total	190000	30000	0	80000	0	0	86200	0	386200

Other costs:
Ifremer needs budget for the testing and calibration phase. The pressure test tanks, the large sea water basin, the calibration metrologic devices will be used in order to follow the procedure for sea environment and functional tests.
NGI charges a limited part of the budget giving access to the survey equipment, the deployment ship and one ROV.
NCMR plans for cruises of oceanographic vessel R/V EAGAEO during 30 days: pre-site survey cruise (10 days), deployment cruise (10 days), checking cruise (5 days), recovery cruise (5 days). The submersible THETIS will be used during these cruises (with a limitation of 4 days during the first cruise) : 24 days.

Other costs	IFREMER	NGI	IPGP	INGV	CAPSUM	NCMR	UPAT	SAGE	Total
WP1 total	20000	0	0	0	0	0	0	0	
Task 1.5	10000								10000
Task 1.6	10000								10000
WP2 total	10000	0	0	0	0	0	0	0	
Task 2.3	5000								5000
Task 2.4	5000								5000
WP4 total	0	158537	0	0	0	0	0	0	
Task 4.1		58537							58537
Task 4.2		100000							100000
WP5 total	0	0	0	0	0	276000	0	0	
Task 5.2						76000			76000
Task 5.4						200000			200000
Total	30000	158537	0	0	0	276000	0	0	464537

Summary:

As a summary, the overall cost can be shown, it includes the cost of personnel for the partners under full cost basis, the cost of additional staff for the partners under additional cost basis, the travel and subsistance and the overhead. It is distributed according to the following table :

TOTAL COSTS	IFREMER	NGI	IPGP	INGV	CAPSUM	NCMR	UPAT	SAGE	Total /task	Percent.
WP1 total	165390	17595	24298	40140	6942	3981	8900	115800		
Task 1.1	23015	14595	8579	5480	0	0	0	31800	83470	2,6%
Task 1.2	66344	0	1430	0	0	3981	0	14400	86155	2,7%
Task 1.3	7672	0	0	2740	0	0	975	20400	31787	1,0%
Task 1.4	7672	0	1430	0	6442	0	0	14400	29944	0,9%
Task 1.4	35344	0	0	13700	500	0	1950	20400	71894	2,2%
Task 1.5	25344	3000	12860	18220	0	0	5975	14400	79798	2,5%
WP2 total	40687	222822	136491	214800	129146	0	5900	7200		
Task 2.1	15344	142572	0	0	0	0	0	0	157916	4,9%
Task 2.2	0	20132	125053	0	0	0	0	7200	147385	4,7%
Task 2.3	20344	2000	0	189800	129146	0	3950	0	345240	10,7%
Task 2.4	5000	58118	11439	25000	0	0	1950	0	101506	3,1%
WP3 total	390451	0	15298	16440	0	0	10725	7200		
Task 3.1	51359	0	0	0	0	0	0	0	51359	1,6%
Task 3.2	139046	0	0	0			0	0	139046	4,3%
Task 3.3	75344	0	0	16440			1950	7200	100934	3,1%
Task 3.4	117031	0	0	0			3900	0	120931	3,7%
Task 3.5	7672	0	15298	0			4875	0	32845	0,9%
WP4 total	27015	354300	0	0	0	3981	0	7200		
Task 4.1	3836	87728	0	0	0	0	0	0	91564	2,8%
Task 4.2	11672	237381				3981		7200	260235	8,0%
Task 4.3	11508	29191				0		0	40698	1,3%
WP5 total	49359	17595	41456	13220	0	547148	125575	16400		
Task 5.1	5836	0	2860	4740	0	0	51025	0	64461	2,0%
Task 5.2	6836	0	11579	0		141870	0	14400	174685	5,4%
Task 5.3	6836	0	0	5740		0	54925	0	67501	2,1%
Task 5.4	10672	17595	5860	2740		325648	0	2000	364515	11,3%
Task 5.5	19179	0	21158	0		79630	19625	0	139592	4,3%
WP6 total	56031	39191	22877	29660	3221	15926	2925	48200		
Task 6.1	12672	7298	8579	8220	0	7963	975	0	45706	1,4%
Task 6.2	15344	12298	2860	18700	0	7963	975	0	58139	1,8%
Task 6.3	20344	12298	11439	0	0	0	0	14400	58480	1,8%
Task 6.4	7672	7298	0	2740	3221	0	975	33800	55706	1,7%
WP7 total	129077	24595	18579	12740	7442	19963	5975	19400		
Task 7.1	88390	0	0	0	0	0	0	0	88390	2,7%
Task 7.2	25344	24595	15719	12740	7442	19963	5975	19400	131179	4,0%
Task 7.3	7672	0	2860	0	0	0	0	0	10531	0,3%
Task 7.4	7672	0	0	0	0	0	0	0	7672	0,2%
Total / partner	858010	676099	259000	327000	146752	591000	160000	221400	3239260	

C9 Economic development and scientific and technological prospects

A major scientific and technological impact for this proposal will be the establishment of a new area of convergence for the fight against geohazards between local authorities, civil protection authorities, ocean engineering, geotechnical engineering, oil industry, constructors of harbours or bridges, marine research and geoscience research.

Economic prospects thanks to versatility

Having all these interests working together would not seem realistic, but the topic of natural risk is serious enough to foster efforts. Moreover, the technical choice in ***ASSEM*** is by itself bringing opportunities of co-operation. The modular and interoperable concept is not inducing leadership of one instrument above others. It allows an investment step by step, a modification of the array of monitoring nodes, a possible modification of suppliers (choice between several deployment means, several marine contractors, several telecommunication technologies to shore). The decision to monitor one area or one spot in an area is reversible. The advice of the expert making the choice of the place to be instrumented may be iterative taking into account the first data. The decision is not risky because the benchmarks are positioned on the sea floor for future use.

The dissemination by the whole consortium will consist in the promotion of this versatile design. Individual efforts to promote the deliverables of ***ASSEM*** specific to each partner will show the interest of the ***ASSEM*** concept and benefit to all.

The partners will agree in the consortium agreement on background information, foreground information, patents, confidentiality, publication and commercialisation.

Exploitation strategy

The experiments in two sites will be references for the civil security or risk monitoring decision makers and for the industrial companies. Their assessment will be done in terms of:
- accurate contribution to the geologic problems by the scientific committee;
- reliability study of the sensors and the monitoring nodes and the whole array;
- cost efficiency study of the sensors, the monitoring nodes and the whole array.

A project meeting month 30 with the Advisory board will draw some conclusions and launch a market study. Criteria will come from the project and from the experience of the members of the Advisory board. The market will be evaluated in the field of instrumentation or component products, advisory and expertise, research studies, geotechnical contracting... It will provide some potential strategic directions to work with other partners or contractors who will find interest in the concept.

User groups

The Advisory board is including representatives from the contracting companies involved in coastal engineering, gas and oil companies, public directorates in charge of the safety of the population against geohazards, local authorities from the Western Greece Region including Corinth and Patras. They are representing a wider group of potential users which will be informed through the Internet site, exhibitions and scientific seminars.

Individual meetings or exchanges of mail will be encouraged in the final phase of the project (WP6) in order to benefit of the international aspect of the consortium and of the expertise of each partner in his own field. In the Patras/Aegion district, University of Patras will be able to provide advice before the end of the project. NGI will use the first results towards oil field developers.

Dissemination tools

ASSEM consortium believes in networking and will show it. An Internet site will be installed early in the project. In addition to its internal communication on a protected site, the open Internet site will show the various aspects of ***ASSEM***: technical, land slide hazard in margins, seismic hazard, fluid flow in the sediment. It will be cross linked to reference Website.

After month 23, the open Internet site will display news from the experiments. After month 30, it will be used for marketing assessment.

The consortium will participate to scientific seminars, especially in the field of slope stability and seismic risk. The geologists will benefit from the specialised displays and data interfaces of EMEWS (WP3.5).

ASSEM will be presented during year 3 at least in 3 exhibitions: one dedicated to natural hazard, one to marine technology and one to the offshore industry.

Scientific prospects

The data coming out from the project will be new in some respect: several nodes monitored during one year with several sensors, new generation of sensors. It will contribute to solve some scientific problems and also open new questions on the natural geologic phenomena. The marine geology fields are: slope stability, creeping, slope failure, fault opening, fluid migration and gas hydrates and more generally geotechnics and seismology.

International competitiveness of Europe in the domain of benthic laboratory network needs an improvement of the techniques ***ASSEM*** is addressing. With Geostar and Antares projects, the various ranges of technologies will be covered thus enabling to launch programs in the same way as Japan or USA (Neptune). This perspective is a multidisciplinary scientific challenge.

Additional markets:

The distributed network concept of ***ASSEM*** is a solution for several needs of seabed monitoring, using similar or different sensors. The time and spatial distribution of natural phenomena are not well instrumented with only one benthic station in: sediment biology, chemical (CO_2) processes in the sediment hydrothermal vent areas, cold seeps, deep coral sites, mud volcanoes…
Other human activities at sea such as major harbour modifications, cable or pipeline laying could benefit from the project.

Appendix 1

Letters of support

HELLENIC REPUBLIC
WESTERN GREECE REGION
GENERAL SECRETARY

Patras, 12-2-2001

SUBJECT : ARRAY OF SENSORS FOR LONG-TERM SEABED MONITORING OF GEOHAZARDS "ASSEM"

The above mentioned research project complements the three presently ongoing Corseis, DGLab-Corinth and 3F-Corinth projects financed by E.U.

This, like the other projects, is related to the predictions of geohazards like earthquakes and submarine landslides, therefore is considered of utmost importance for the industrial and touristic development of the coastal zone (harbours, marinas and other offshore constructions) of the Western Corinthiakos-Patraicos Gulf and for the safety of people's property. The proposal will be submitted to EU within the framework of the Sub-programme: Environment and Sustainable Development.

The General Secretary

Nikos Belivanis

Γ.Σ.

Our date	Our reference	Your date
2001-02-12	ngi-letter/assem/ttjelta/ttjelta	

STATOIL

Administrative officer	Your reference
Tor Inge Tjelta, ttjelta@statoil.com	

Norwegian Geotechnical Institute
Attn. John Løvholt
P.O.Box 3930 Ullevaal Stadion
0806 OSLO

Dear John,

EU Project "ASSEM" Array of Sensors for long term SEabed Monitoring of geohazards

The oil companies in the North Sea have long experience with performance monitoring of their offshore installations. Many of the large oil and gas production platforms which are fixed to the seabed have instrumentation systems in touch with the soil or actually into and below the seabed surface. We have and are still learning a lot of the seabed behaviour by this long-term monitoring programme. Several of these systems have now been in service for more than 10 years and are still active, e.g. the Gullfaks C Structural and Environmental Monitoring system. I am mentioning this since this background is very useful. It proves that subsea monitoring is possible, and it is solid evidence of long term reliability of the supplied equipment. For the oil industry, long term data from monitoring systems on major North Sea platforms which are subjected to difficult soil or environmental conditions has been very useful for performance control and verification as well as further development of design concepts.

The need for seabed instrumentation in our industry has now changed. Our recent interest is related to the stability of the continental slopes and other sites were so called geohazard risk is present. In conjunction with new discoveries, geohazards have become a new challenge for oil and gas exploration. We are at the same time observing a phenomenon which scientists have known for a long time; The slopes often show signs of once having been unstable. The challenge is now to investigate the risk for new sliding, and understand the mechanisms that triggered the initial slides. This is very important for planning of future subsea field development.

It is in this search for triggering mechanisms I see the presented proposal as an extremely important contribution. In 1999 and 2000 Statoil was involved together with Norsk Hydro in an attempt to monitor a seabed slope offshore Mid-Norway at a planned oil and gas development field in deep water. We are not entirely happy with the instrumentation developed in the very short time available. Significant improvements are required, some of which will take place in year 2001. We are currently collecting data from seabed monitoring stations installed last year. It is our experience such data are required to judge stability of continental slopes in areas like offshore Norway. If it is possible to combine this with the planned ASSEM project, there might be an opportunity to test equipment at a site of great interest to the offshore industry.

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The proposed project together with the wide experience available at the participating organisations makes it an interesting activity to follow. Statoil and Norsk Hydro are endorsing such an initiative and will be available to the project for further assistance and discussions.

Yours faithfully
Den norske stats oljeselskap a.s

Tor Inge Tjelta
ttjelta

CC: Petter Bryn, Norsk Hydro

TOTAL FINA ELF

Exploration & Production

Recherche et Développement

IFREMER
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TECHNOPOLIS 40
92138 ISSY LES MOULINEAUX
A l'attention de M. L. LEMOINE

Réf. : SCR/RD/CRD – JML/bm n°01-141
Objet : Projet ASSEM

Le 12 février 2001

Monsieur,

Nous vous confirmons notre intérêt pour ce projet de monitoring par grand fond.
En effet, la recherche des causes de phénomènes déclenchant les instabilités de pentes est une préoccupation majeure pour les pétroliers ayant à installer de façon pérenne des modules de production sur les fonds océaniques.

Nous restons dans l'attente de voir ce projet progresser et nous vous remercions de nous tenir informés des résultats au fur et à mesure de leur obtention. Nous resterons bien évidemment disponibles pour vous faire part de nos commentaires et de notre point de vue d'industriel tout au long de ce projet.

Nous vous prions d'agréer, Monsieur, l'expression de notre très grande considération.

T. HUYGHUES-DESPOINTES
Directeur Recherche et Développement

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