Project n° EVG1-CT-2000-00026 SESAME
European Commission – Research General Directorate

SESAME

Site Effects aSsessment using AMbient Excitations

First progress report

May 2001 – October 2001

SESAME Partnership

1	UJFG.LGIT	University Joseph Fourier	Grenoble
13	CNRS.LGIT	National Center for Scientific Research	Grenoble
14	LCPC	Central Laboratory for Bridges and Roads	Paris
2	RICSA	Résonance Ingénieurs-Conseils SA	Geneva
3	UPOTS.GEO	University of Potsdam -	Potsdam
4	ULGG.DG0.GIH	University of Liège	Liège
5	UIB.ISI	University of Bergen	Bergen
6	ETH.GEOP.SSS	Polytechnic School of Zürich	Zürich
7	IESEE	Institute of Engineering Seismology and Earthquake Engineering	Thessaloniki
8	ICTE.IGI	Institute of Earth and Space Sciences	Lisbon
9	INGV	National Institute of Geophysics and Volcanology	Roma
11	IGSAS.SD	Geophysical Institute – Slovak Academy of Sciences	Bratislava
10	CNR.GSAQ	National Research Counsil	Milano
12	CETEMED.LRE	Center of Technical Studies	Nice

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Introduction

For this first progress report presented after 6 months of work, the introduction will be a reminder of the work done in the project SESAME since the beginning of the contract.

April 2001	***signature of the contract between the partners and the European Commission***	
1 May 2001	beginning of the contract	**Work on the field and in the laboratories on the different Tasks**
May 2001		
June 2001		
26-27 June 2001	kick-off meeting in Grenoble, France	
July 2001		
August 2001		
29-30 August 2001	workshop for Task C in Zurich, Switzerland	
September 2001		
October 2001		
22-26 October 2001	workshop for Task A – WP02 in Bergen, Norway	
	Preparation of a first progress report	

In the following, we will present the minute of each meeting or workshop and a comparison between the work really done in the project and the work planned.

We remind that all the partners attended the kick-off meeting have decided not to have a Consortium agreement but have defined two rules concerning the SESAME project

1. **All the data lent by one of the SESAME project partners can only be used within the framework of the project SESAME. If one partner wants to use the data for an other purpose, it is essential that he asks for an utilization agreement to the data owner.**
2. **Each time the SESAME project partners make a presentation concerning the project SESAME, they must inform the co-ordinator of the project and as much as possible send a copy of the presentation. Moreover, each presentations on the SESAME project have the mandatory obligation to acknowledge the EC funding and mention the grant identification.**

MINUTES of the SESAME Kick-Off Meeting

Grenoble (France), June 26-27 2001

In addition to a first "get-together" of all partners, the basic objectives were:
- to recall the general administrative and scientific frameworks of this project,
- to recall the main objectives of each task and work packages,
- to agree on immediate actions (next months to first year),
- to establish a tentative schedule for the whole duration of the project (especially for meetings dates and locations).

The present minutes can not keep track of the richness of all the discussions that occurred during the meeting; their aim is basically to indicate all the decisions that were taken and are to be implemented by the corresponding task leaders, work package leaders and partners.

I Partners attending the meeting

All partners, except partner number 3 from Belgium, were present to the meeting.
Table 1 provides the name, address, phone and fax numbers of all the persons involved (at this date) in the project.

II Schedule of the meeting

See the attached file "kick-off schedule".

III Scientific matters

III.1 Task A – H/V Technique (Tuesday, June 26 PM)

The whole afternoon was dedicated to Task A - H/V technique. It started with an overview presentation by K. Atakan, which was followed by more detailed presentations of each work package by A.-M. Duval (WP02: Experimental aspects, measurements and stability), K. Atakan (WP03: Data processing) and N. Theodulidis (WP04: Experimental evaluation).

K. Atakan insisted upon the immediate actions to be taken:
- to send available data sets with description (WP04)
- to send available routines, algorithms, software (WP03)
- to make an inventory of sample equipment for testing (WP02)
- to agree the processing workshop: location and time (WP03)
- to agree the in-house testing : location and time (WP02)
- to agree on the free-field testing sites and times (WP04)
- to agree on the specific meetings schedule for Task A (group leaders)

- to establish sub-groups for individual tests within each WP
- to plan individual working / discussion meetings within each WP

III.1.1 WP02 (Experimental conditions : A-M Duval)

This work package is dedicated to investigations on the required experimental conditions for warranting the stability and reproduction of measurements.

The work thus basically consists on two distinct topics:

- instrument calibration and testing, both in an absolute and relative sense (i.e., to obtain the sensor – data acquisition system response and detection level, and to perform comparisons between all instruments that will be used in the project.
- assessing the actual effects of experimental conditions (soil/sensor coupling, wind, cable length, traffic, etc…)

The following decisions were taken:

- *A instrumental in-house testing of instruments will take place in Bergen from October22 to October 26. This experiment will be placed under the responsibility of the UiB team, who has a great experience in instrumental testing. In order to best organise this testing, AM Duval and K. Atakan will ask for a list of acquisition systems and sensors used in the consortium, so as to achieve an as comprehensive as possible test (an initial list has circulated during the meeting -* ***Table 2****).*
  The analysis of the tests will be performed in a uniform way by the Bergen team. This test will lead to the first deliverable at the end of the first year.
- *Concerning experimental conditions, a list of wished tests will be established under the supervision of* AM Duval *(****see the email send by Anne-Marie Duval on July, 21 to each partner****). Each category of test should be performed by at least two teams. It is not necessary to wait neither for the results of the in-house instrumental testing to start the work, nor for a common software to process the data: every partner having a presumably good instrumentation (24 bits acquisition, sensitive velocimetric sensor) can start performing these tests, and process the data with its own usual software as a first step.*
  However, in a second step, the same data will be reprocessed taking into account the calibration results and the common software. All information regarding these tests is to be sent to AM Duval.

III.1.2 WP03 (Data processing, K. Atakan)

This WP is devoted to investigations on the various data processing alternatives and is intended to produce a standard processing software based on the most robust alternative.

It will consist of the following steps:

- collecting existing algorithms for each processing step
- identifying the best (robustness – simplicity – resolution) solution based on comparisons with representative data sets
- designing and implementing this solution by a dedicated sub-group taking into account several criteria in relation with its expected wide distribution (flexibility, transportability, modularity, ...)
- distributing for evaluation and review within the consortium
- propose a final version for dissemination and user guidelines (WP12)

The following decisions were taken for the immediate future:

- *Every partner involved in this WP should send very rapidly (early September at the latest) to the WP leader some short information on the main characteristics of the software he is using. For safety, the WP leader should send an email call for collecting this information (an initial list has circulated during the meeting –* ***Table 3****)*
- *The core-group of partners for the analysis of existing software and design of the common one, will consist of the Bergen, Grenoble, Milano, Potsdam, Roma and Zürich teams. The Lisbon, Nice and Thessaloniki teams will actively participate in the evaluation and internal review step.*
- *A software meeting will be convened in Potsdam on December 3-5 or January 9-11, 2002 (in connection also with WP06)*

- *There exists a possibility of having the future software endorsed by the IASPEI "Commission of Practice". In that aim, it should be put on the agenda on its next meeting at the IASPEI General Assembly in Vietnam (August 2001). P-Y Bard will thus send a one-page summary to J. Havskov and K. Atakan, and to K.Kudo as well as the leader of the joint IASPEI/IAEE working group on the Effects of Surface Geology, and to W. Stephenson (New-Zealand geological Survey) who proposed a worldwide action on the H/V technique.*

Important remark

*An error has been noticed in the technical annex, which has to be indicated by the co-ordinator to the scientific officer in Brussels, and corrected: **there has been a swap between deliverables D04.03 and D09.04**. The deliverable of WP03 is indeed the "multi-platform H/V processing software" which should be denoted as D09.03.*

III.1.3 WP04 (Empirical evaluation, N. Theodulidis)

This WP is intended to perform an objective, purely experimental assessment of the reliability of the H/V technique, by comparing its results with those of other, well established experimental techniques. It will also compare H/V results with observed damage on recent earthquakes.

It will consist of the following steps:

- collecting existing data sets with both earthquake recordings on site/rock reference pairs, and microtremor measurements
- performing experimental measurements of ambient vibrations at a few selected sites
- processing all these data sets with the same softwares
- achieving a systematic and homogeneous comparison of H/V results with site-to-reference weak and strong motion data,
- comparing also the H/V results with damage observations for a few well documented cases
- comparing experimentally and theoretically estimated transfer functions with H/V ratios on very well constrained sites

The discussion revealed that there exist a lot of data sets (Italy, Greece, France, Switzerland), but a mandatory criterion for accepting one in the homogeneous collection, is the availability of the original time histories (to allow a re-processing with a common procedure).

The following decisions were taken for the immediate future:

- *Every partner involved in this WP should send very rapidly to the WP leader information regarding the existing data sets with either micro-tremor and earthquake recordings, or micro-tremor measurements and damage observations. The WP leader will send an email call for collecting this information with a common format .(**see the email send by Nikos Theodulidis on July, 5 to each partner**).*
- *Only a limited number of "test-sites" where specific micro-tremor measurements will be performed with this project will be selected. The preliminary list is Volvi (Greece), Colfiorito (Italy), Grenoble (France), Basel (Switzerland), and one site in Belgium (Uccle and/or Liège).*

Important remark

As indicated above, the first deliverable of WP04 is indeed an "homogeneous data set of noise and earthquake recordings at many sites" which should be denoted as D04.04.

III.2 Task B – Array measurement techniques (Wednesday, June 27 AM1)

F. Scherbaum presented first an overview of Task B (Array measurement techniques). He then detailed WP05 (Instrumental layout for array measurements) and WP06 (Derivation of dispersion curves). Only very brief information on WP07 (Inversion of velocity profile) was given, because of the absence of the WP leader (D. Jongmans). Three short presentations were then done by F. Scherbaum, D. Fäh and P-Y Bard, about the ongoing works related with this Task, respectively, in Germany, Switzerland and Grenoble,

III.2.1 WP05 (Instrumental layout, F. Scherbaum)

This WP is intended to assess the dependence of the array performance on the experimental conditions: array geometry, aperture, number of sensors, sensor types, timing accuracy.

It will address three main topics:

- testing the array performance with synthetic data: the goal here is to derive a kind of "quality function" for phase velocity determination
- testing the calibration accuracy using reference sensors (recent experience pointed out a very large sensitivity to phase uncertainties in the sensor response).
- performing field measurements at a few selected test-sites with an already existing, quantitative and reliable information on site conditions and structure. Investigations will focus on three specific items: (1) deployment strategies, (2) penetration depth and (3) test performance of overall processing (altogether with WP06 and WP07).

III.2.2 WP06 (Derivation of dispersion curves, F. Scherbaum)

This WP aims at developing a semi-automatic processing system for array analysis of ambient vibrations, based on frequency-wave number and spatial auto-correlation methods. Besides providing all the necessary facilities to obtain dispersion curves, the system should allow for rapid in-situ quality control of the array performance.

The main issues are:

- what is the optimum balance between resolution and robustness, and which is the processing technique that leads to that optimum (many versions of f-k analysis, SPAC) ?
- what is the array geometry required by each processing technique ?
- how to unambiguously identify the actual surface wave mode ?
- designing an automated signal processing (for rapid in-situ quality control)
- what kind of pre-processing is necessary ?

The work plan is:

- comparing different array processing methods; performance tests using synthetic data .
- modifying the already existing "MERAPI" software (Potsdam) based on f-k analysis developed for a volcano monitoring system, in order to include other processing techniques (SPAC), data pre-processing, and instrument equalization to correct for phase delay distortion.
- designing an automated signal processing (for rapid in-situ quality control of the array performance)

The needed input is:

- available array processing codes
- data from earlier array experiments
- choice of test-sites

III.2.3 WP07 (Inversion of velocity profile)

In the absence of D. Jongmans, it was simply recalled that the objective of this WP is the development of a flexible software allowing to retrieve the Vp and Vs velocity profiles from the dispersion curves in an easy and reliable way. A particular attention will be paid to the introduction of a priori information which can greatly help to constrain the model during the inversion process.

Post meeting important information: *the difficulties faced by D. Jongmans after his move to Grenoble are solved, a PhD student from Liège will actually work full time on this topic.*

III.2.4 Lessons from ongoing work

F. Scherbaum presented the ongoing projects in the Köln area (lower Rhine embankment). The Aggrippina project involves the Univ. of Potsdam group and a collaboration with ETH Zürich (D. Fäh), and concerns directly both the array measurements and H/V technique. Very interesting results were presented as to the correspondence between ellipticity and dispersion curves for Rayleigh waves, resulting in a combined inversion of dispersion curves derived from array measurements and H/V curve derived from single station measurements. Some problems remain to be solved however, especially as to the identification / separation of several surface wave modes. In addition, new instrumental layouts are being tested (roll-along profiles), and coupled with other array processing techniques (slant-stack), which look very promising.

Despite the fact that another much bigger project is run by GFZ in the same area, it will not be possible to propose the Köln area as a test site within the next 3-year period.

Two other local projects of the Potsdam group focus were shortly mentioned: the first concerns the study of the crustal structure from ocean generated micro-seims, and the second one investigates the theoretical relationships between the S-wave fundamental frequency, and the frequency where Rayleigh waves exhibit the larger horizontal ellipticity.

D. Fäh presented his recent work on an advanced analysis of the H/V curve. One one hand, he proposes a technique to isolate Rayleigh wavelets in the ambient vibration recordings, so as to concentrate the derivation of H/V ratios on these wavelets. On the other hand, he showed that for horizontally layered structures with high-enough impedance contrast, there exist a stable part in the H/V curve, corresponding to the frequency band between the first peak (minimum in V), and the following trough (minimum in H). The immediate consequence is the possibility to invert the velocity profile from single station H/V measurements.
The example applications in northern Switzerland are really impressive.

Other work is presently underway in Zürich concerning about array techniques, and meaning of H/V frequency in 2D valleys.

P.-Y. Bard presented the ongoing work on the SPAC technique, with applications to the Grenoble area. For this particular, very low frequency site (fundamental frequency around 0.25-0.3 Hz), SPAC technique seems to provide more reliable results (lower and more realistic phase velocities) than standard f-k analysis at low frequencies. The results it provides are consistent with the known structure of the site, based on a deep borehole drilling, seismic reflection and refraction experiments, and dense gravimetric survey. More work remains to be done, however, to use the information on the horizontal component, and for a robust inversion of the velocity profile (WP07).

III.2.5 Summary of decisions for Task B

The following decisions were taken for the immediate future:

- *The software meeting already planned in Potsdam (December 3-5 or January 9-11) from H/V processing will also address the array processing techniques. In order to prepare that meeting, all involved partners should send to the task leader (F. Scherbaum) information on their array processing codes (method, language, etc.).* ***(see the email "Array codes" sent by Frank Scherbaum on July 10)***
- *The specific additional array measurements will be organised on the various potential test-sites selected for the project (Basel, Colfiorito, Grenoble, Volvi, Uccle/Liège). For final decisions and preparation of experiments, F. Scherbaum requires from the respective teams (i.e., Zürich, Roma, Grneoble, Thessaloniki, Liège), as much logistical, geotechnical and geophysical information as possible.* ***(see the email "Array test sites" sent by Frank Scherbaum on July 10)***
- It was agreed upon that the advanced analysis of H/V curves (single or combined inversion of velocity profile) would be performed within the framework of Task B (and not Task A).

III.3 Task C – Physical background and noise simulation (Wednesday, June 27 AM2)

At first, P.Y Bard gave a rapid overview of Task C, which is on the upstream side of the project and is intended to provide background information to the three other tasks as to the real physical composition of noise wavefield, as well as a powerful numerical tool to generate realistic noise synthetics.

Then the three specific work packages were given more detailed presentations by P.-Y. Bard (WP08: Nature of noise wavefield), P. Moczo (WP09: Numerical simulation of seismic noise) and D. Fäh (WP10: Simulation for real sites)

III.3.1 WP08 [Nature of noise wavefield, P.-Y. Bard]

Its basic objective is to clarify – and as much as possible to improve - our knowledge about the physical nature of a noise wavefield, with special emphasis on urban areas.

The main issues to be addressed all concern the actual composition of noise wavefield:

- proportion between surface and body waves
- proportion between Rayleigh and Love waves

- porportion between fundamental and higher surface wave modes (*a very important issue*)

The workplan is:

- Update the literature survey
- selection of array data (already available, or obtained within WP05)
- specific data analysis in relation to the above mentioned issues
- analyse also the origin of those waves (azimuth, anthropic or natural origin, correlation with weather conditions)
- analysis of the site to site variability

The actions for the immediate future are:

- *Update the literature survey : F.Scherbaum offers the possibility of translation of Figure captions from a few selected Japanese papers, while N. Theodulidis outlines the importance of "Russian school" and the possibility of getting detailed information through P. Dimitriu.*
- *selection of available array data (same as WP05): only long records are useful for this WP*

III.3.2 WP09 [Numerical simulation of seismic noise, P. Moczo]

This WP focuses on the development and validation of numerical models producing realistic noise synthetics. It will mainly use Finite-Difference techniques (FD) with spatially and temporally random surface sources, and include parameter studies to investigate the ability of H/V and array techniques, applied on synthetics, to recover the information on the structure.

The main issues are:

- choosing an appropriate, powerful numerical technique allowing to consider realistic cases (3D geometry, large velocity contrasts, high Poisson ratio, large and non homogeneous damping)
- how to generate realistic noise in the chosen numerical schemes
- comparing the information retrieved from synthetics (H/V, array processing) and the input model for a representative set of geological structures.

The workplan is tightly related to these issues. The main numerical technique is nevertheless already chosen, it will be the Finite Difference code using a Displacement Velocity Stress formulation with combined Core Memory Optimization developed by the Bratislava team. For horizontally layered structures however, it may be complemented by other techniques such the discrete wavenumber, or modal summation approaches.

- definition of seismic noise sources and implementation in the code
- selection of representative, "canonical" models
- forward computations with parameter studies and derivation of "synthetic" H/V ratios and array recordings
- inverse analysis of synthetics and comparison with input model parameters

The actions for the immediate future are:

- *Organization of a WP meeting in Zürich on August 29-30 to discuss about noise generation and canonical models: all participants are asked to answer the forthcoming email request by P. Moczo.*
- *Implementing the choices made at that meeting in the Bratislava code.*

WP10 [Simulation for real sites, D. Fäh]

This WP is an extension of the previous one to real sites, where, in addition to the good knowledge of the structure, field measurements are already or will be available. It will thus allow a final cross-checking between actual noise observations, noise synthetics from numerical simulations, and the known geological structure and local site effects.
As it is scheduled to start on month 16, no immediate actions are to be taken.

III.3.3 Summary of decisions for Task C

- *A meeting will be organised in Zürich on August 29-30 to decide about a) the noise generation process in numerical codes, and b) on canonical models to be selected. Concerning the latter topic, Every partner is asked to answer P. Moczo's request on "most appropriate" canonical models before August 26.*
- *Every partner is asked to send his list of bibliographic reference on seismic noise (microtremors, microseisms, all kinds) to LGIT Grenoble in order a) to constitute an as comprehensive as possible*

bibliographic base and b) to feed the literature survey and synthesis that is to be performed at LGIT. In case the corresponding papers are not easily available, partners are kindly requested also to send a copy to Grenoble. Of course, once established, this list will be distributed amongst the consortium.

III.4 Task D – Practical implementation and guidelines (Wednesday, June 27 PM1)

This task is scheduled to start only at month 25. M. Koller thus made only a very brief overview.
Besides the objectives already listed in the technical annex, he also proposed to agree on a "glossary" of words and expressions to be used so as to also "standardize" the vocabulary and better understand each other. This has to be thought through in the coming year.

As it is planned to distribute a robust, flexible and transportable software for the H/V processing, J. Havskov made a brief presentation of the SEISAN software, which has been developed for many years in Bergen and already includes some of the functionalities that would be very useful for the H/V software (portability, database, web interface to process one's own data through internet, free access, comprehensive user manual).

All partners are thus invited to visit the SEISAN web pages at http://www.ifjf.uib.no (items "*Seismology pages*", then "*Software development*"). As this software package will be extensively used for the in-house testing, its use and the possibility of inclusion of the H/V software in the SEISAN general package.

IV Administrative and Financial Matters

Technical Annex / Description of work

The attention has been drawn on some aspects of the final version of the Technical Annex (Description of Work):

- the WP have been renumbered slightly differently from the original proposal: WP01 now corresponds to the co-ordination work, and all other WPnn have been shifted from n to n+1: the official numbering to be used throughout the project is the final one of the technical annex.
- There has been a mistake in the numbering of deliverables D04.03 and D09.04, which should be corrected as detailed in section III.

Financial follow-up

In order to facilitate the redaction of the Periodic Cost Statement, Laurence Bourjot will do the financial follow-up for each partner. For this, she will send to every partner a table (see the example below) where all the expenses concerning the project SESAME have to be noted. The partner has to send back this table every three months.
This information will also be entered into the netboard software. All partners have to indicate Laurence Bourjot whether they prefer to enter it by themselves, or to have her entering it.

Partner name: Gaston Currency used: French Francs Total Budget: 83 000,- FF

Date of purchase	Description of the expenses ***	Durable equipment	Sub-contracting	Travel	Consumables	Computing	Others
10 jan	air tickets for the meeting in Grenoble			7 564,60			
11 feb	BRUNER: small material for sampling				3 213,00		
5-marc	LENNARTZ: one MARS 88	15 645,00					
	Sub-total	*15 645,00*	*0,00*	*7 564,60*	*3 213,00*	*0,00*	*0,00*
	TOTAL	26 422,60 FF		Remind	56 577,40 FF		

*****: A copy of each expense has to be keep by the partner.**

Time sheet follow-up

As it is mentioned in the contract, time of work for each person working on the project SESAME has to be registered. For this, Laurence Bourjot will send to each partner a table or will send you instructions on how to use the time sheet which are in the Netboard software Vit@mib. This will be only at the beginning of September. At this date, Laurence will also explain, in particular, for each partner, who has to fill up the time sheet.

Project Website

The website for the SESAME project will be done by Philippe GUEGUEN (Grenoble) and Marco PAGANI (Milano) with the help of Bertrand Guillier from Grenoble. As a first step, it will include a simple page hosted at LGIT Grenoble with links to every partner.

Logo

Anne Marie Duval will ask the CETE of Aix-en-Provence to make some suggestions for a logo. Three points must feature in the logo:

- the acronym of the project (SESAME)
- the European stars,
- the notion of array and noise.

Consortium agreement

All the partners attended the meeting have decided not to have a Consortium agreement but have defined two rules concerning the SESAME project

3. **All the data lent by one of the SESAME project partners can only be used within the framework of the project SESAME. If one partner wants to use the data for an other purpose, it is essential that he asks for an utilization agreement to the data owner.**
4. **Each time the SESAME project partners make a presentation concerning the project SESAME, they must inform the co-ordinator of the project and as much as possible send a copy of the presentation. Moreover, each presentations on the SESAME project have the mandatory obligation to acknowledge the EC funding and mention the grant identification.**

Miscellaneous

Table 4 is a summary of all the important Dates (Task meeting, General meeting, Workshop,...)

Reminder of what has to be done by each partner in the next months (August – September).

Task A – H/V Technique: WP02 (Experimental conditions : A-M Duval)

see Table 2 "List of aquisition systems and sensors used in the consortium", make some corrections if necessary and send your remarks to A.-M. Duval
send to A.M. Duval a list of wished tests.

Task A – H/V Technique:WP03 (Data processing, K. Atakan)

see Table 3 "short information on the main characteristics of the software used by each partner", make some corrections if necessary and send your remarks to K. Atakan

Task A – H/V Technique : WP04 (Empirical evaluation, N. Theodulidis)

see the email send by N. Theodulidis on July, 5 to each partner and do not forget to give an answer if you have not already done it.

Task B – Array measurement techniques (F. Scherbaum)

all involved partners should send to F. Scherbaum information on their array processing codes (method, language, etc.), according to his email "Array codes" of July 10.
all involved partners should send to F. Scherbaum information on the test sites they are responsible for, according to his email "Array test sites" of July 10.

Task C – Physical background and noise simulation

all partner should send their list of bibliographic reference on seismic noise (microtremors, microseisms, all kinds) to P.-Y. Bard.

Financial follow-up and time sheet

Laurence Bourjot will send to each partner a table to register the expenses of the project and instructions on the table time sheet at the beginning of September.

TABLE 4 : SUMMARY of SESAME important dates (as of August 08, 2001)

	Months	**Week 1**	**Week 2**	**Week 3**	**Week 4**
1	*May 2001*				
2	*June 2001*				Kick-off Meeting-Grenoble
3	*July 2001*				
4	*Aug. 2001*				**Zürich – Aug 29-30** Task C
5	*Sept. 2001*				
6	*Oct. 2001*				**Bergen – Oct 22-26** Testing of instruments TaskA - WP02
7	*Nov. 2001*				
8	*Dec. 2001*		(AGU)		
9	*Jan. 2002*		**Postdam – Jan 9-11** Software & Array processing techniques TaskA-WP03 & TaskB-WP06		
10	*Feb. 2002*				
11	*March 2002*				
12	*April 2002*			EGS – Nice	D1, D2
13	*May 2002*				D3: Progress report 1
14	*June 2002*				D4
15	*July 2002*				
16	*Aug. 2002*				
17	*Sept 2002*	(ECEE London)			
18	*Oct. 2002*	General Meeting - Roma			D5, D6, D7, D8
19	*Nov. 2002*				
20	*Dec. 2002*		(AGU)		
21	*Jan. 2003*				D9
22	*Feb. 2003*				
23	*March 2003*				EGS – Nice
24	*April 2003*				D11, D12, D13,D14, D15
25	*May 2003*				D10: Progress report 2
26	*June 2003*				
27	*July 2003*	Scienitific Workshop - Bratislava			D16, D17, D18, D19
28	*Aug. 2003*				
29	*Sept. 2003*				
30	*Oct. 2003*				D20,D21
31	*Nov. 2003*				
32	*Dec. 2003*		(AGU)		
33	*Jan. 2004*				
34	*Feb. 2004*				EGS – Nice
35	*March 2004*				
36	*April 2004*			General Meeting - Nice	D22, D23, D24
37	*May 2004*				D25: Progress report 3
38	*June 2004*				D25; Final report

… And enclosed in attached files:

- **a presentation sheet on the SESAME project see in the ANNEXE**
- **the technical annex of the project ("Description of Work") with all the corrections** (not enclosed)
- **Table 1 (Address, tel and fax of the SESAME partners) see in the ANNEXE**
- **The schedule of the kick-off meeting** (not enclosed)

TABLE 2 : List of acquisition systems and sensors used in the consortium

Group	Sensors	Instrument (acquisition)
1 UJFG.LGIT	Le 3D Lennartz L22 CMG 5 Guralp CMG 30 Guralp CMG 40 Guralp	LEAS Cityshark REFTEK
2 Résonance		
3 Uni Potsdam	Le 3D 5sec KS2000 broadband	MARS lite
4 Uni Liège	? ?	? ?
5 Uni Bergen	LYC CMG 40 T 4,5 HZ RANGER FBA23	GEOSIG SEISLOG
6 ETH Zurich	Le 3D 5sec Le 3D 1sec	MARS 88 self-developed Noise Instrument
7 ITSAK Thessaloniki	FBA-23 FBA-11	K22 ETNA
8 Uni Lisbon	Le 3D 1sec Le 3D 5sec MARK 1sec	Reftek MARS Lite SSR – Kinemetrics
9 INGV Rome	CMG 5 CMG 40 Le 3D 5sec CMG 3 (?) Episensor (?) STS 2 (?)	Mars Lite Mars 88 REFTEK self-developed recorder
10 CNR.GSAQ Rome	Le 3D 5sec MARK L4C/3D	MARS 88 Lennartz M 24 Lennartz
11 Uni Bratislava		
12 CETEMED.LRE	Le 2D 5sec MARK L4C L 22 AP 4,5 HZ AP	MARS 88 Lennartz opt. disk MARS lite Lennartz LEAS Hathor 3

TABLE 3 : Characteristics of the software used by each partner

Group	Format	Platform
1 UJFG.LGIT	ASCII, SAC	Unix, Linux, Sun, MAC
2 Résonance	ASCII, SAC, FAMOS	Windows, Unix (IBM)
3 Uni Potsdam	ASCII, GSE, MSEED	Unix,, Linux
4 Uni Liège	????	??????
5 Uni Bergen	GSE, SEISAN	Windows, Unix, Linux
6 ETH Zurich	ASCII, GSE	Windows, Unix
7 ITSAK Thessaloniki	ASCII	Windows, Unix
8 Uni Lisbon	ASCII, SEISAN	Windows, DOS
9 INGV Rome	ASCII, SAC	Unix, Linux
10 CNR.GSAQ Rome	ASCII, SAC	Windows, Unix, Linux
11 Uni Bratislava		
12 CETEMED.LRE	ASCII, ISAM	Windows, Unix, Matlab

MINUTES of the SESAME Task C Meeting

Zurich (Switzerland), August 29-30 2001

Summary of Task C objectives:

Physical background and numerical modelling: on the upstream side, the project will try and fill the gap concerning the understanding of the real nature of noise, especially in urban areas, and develop and validate numerical tools to generate noise synthetics for arbitrary geological structures, which can in turn be used to assess the ability of the H/V and array techniques to provide relevant information on site conditions.

WP08[Nature of noise wavefield] is intended to increase our knowledge on the actual consistency of the noise wavefield, a key point in the deep understanding of the H/V and array techniques. It will be based on the analysis of noise data recorded with arrays at several sites, in order to identify the composition (nature, proportion and origin of surface and body waves) of noise wavefield in urban areas.

WP09 [Numerical simulation of seismic noise] focuses on the development and validation of numerical models producing realistic noise synthetics. It will mainly use Finite-Difference techniques (FD) with spatially and temporally random surface sources, and include parameter studies to investigate the ability of H/V and array techniques, applied on synthetics, to recover the information on the structure.

WP10 [Simulation for real sites] will consist in a final cross-checking between actual noise observations, noise synthetics from numerical simulations, and the known geological structure and local site effects for a few well-known test-sites.

I Partners attending the meeting

Pierre-Yves Bard	LGIT Grenoble;	*WP08*
Peter Moczo, Jozef Kristek, Miriam Kristekova	GPI SAS Bratislava;	*WP09*
Donat Fäh, Fortunat Kind, Ivo Oprsal	ETH Zurich;	*WP10*

II Programme of the meeting

1. Review of modelling experience and available numerical tools for modelling seismic noise
2. Available computing facilities
3. Defining seismic noise generation
4. Defining canonical models of local surface geological structures
5. Review of the available methods of the time-frequency analysis
6. Future meetings of TASK C

III Scientific matters

III.1 Review of modelling experience and available numerical tools for modelling seismic noise

Pierre-Yves Bard summarised his numerical experience and results obtained using 3D modelling of seismic noise in 1D layered surface structures by the discrete-wavenumber method. Similarly, Donat Fäh summarised his numerical experience and main results obtained using 2D P-SV modeling of seismic noise in 1D layered structures and 2D models of sediment-filled valleys by the finite-difference method. There is no previous experience with simulation of seismic noise in the Bratislava team.

Available numerical tools for simulating seismic noise:

- **Grenoble team**
  - code Axitra (by O.Coutant) based on the discrete-wavenumber method, 1D medium, 3D wavefield,
  - modified code Axitra (by Y.Hisada), sources much closer to the free surface,
  - code Cesar (by LCPC) based on the finite-element method, 3D medium, 3D wavefield,
- **Bratislava team**
  - code DVS5.0 (by J. Kristek and P. Moczo) based on the 4th-order staggered-grid displacement-velocity-stress finite-difference scheme, 3D medium, 3D wavefield, powerful memory optimization procedures applicable; this code is likely to be the most important in the planned 3D numerical simulations for both canonical models and real sites
- **Zurich team**
  - code by D. Fäh based on the 2nd-order staggered-grid velocity-stress finite-difference scheme, 2D medium, 2D P-SV wavefield,
  - code by I. Oprsal based on the 2nd-order displacement finite-difference scheme on conventional grid with varying size of grid spacings, 3D medium, 3D wavefield,
  - code by I. Oprsal based on the hybrid modeling combining the finite-diference method with the discrete-wavenumber or ray method.

III.2 Available computing facilities

Available computing facilities in LGIT Grenoble, GPI SAS Bratislava and ETH Zurich allow numerical modeling of seismic noise in canonical models. However, access to a multiprocessor computer would be important for speed-up of computations, especially for modeling of real sites. Therefore, Peter Moczo will inquire at INGV Rome (Antonio Rovelli) and University of Potsdam (Frank Scherbaum).

III.3 Defining seismic noise generation

An algorithm of seismic noise generation in numerical simulations was discussed in detail

Algorithm

- point sources (PS) regularly distributed in a “source volume” of the whole computational region (spacing approximately 10 m)
- miminum and maximum # of acting PS - MN and MX
- at each time level: rnd NS; MN =< NS =< MX
    if NS > MX: no selection of a PS
    if NS < MN: rnd of a PS ⇒ the PS is acting : find other PS
    ⇒ the PS is not acting : rnd of a time function
    rnd of a direction

Time function

- amplitude : <0,1>
- Gabor signal (harmonic carrier with the Gaussian envelope)

$$s(t) = \exp\{-[\omega(t - t_s)/\gamma]^2\}\cos[\omega(t - t_s) + \theta]$$

$\omega = 2\pi f_p$, $t \in \langle 0, 2t_s \rangle$, f_p is the predominant frequency, γ controls the width of the signal, θ is a phase shift and $t_s = 0.45\gamma / f_p$

- γ will be rnd generated over a range whose first half will correspond to pulses and second half to signals with dominant frequencies (“monochromatic” signals)

Source volumes

Five different depth intervals define five different source volumes in a model of a single layer (with thickness *h*) over half-space:

1. thin surface layer,
2. layer centred around half-depth of the sediment layer,
3. layer centred around a sediment-bedrock interface- <3*h*/4, 5*h*/4>,
4. layer below the sediment-bedrock interface - <2*h*, 3*h*>,
5. layer covering the interval <0, 3h>.

Implementation

This algorithm will be implemented in the Bratislava FD code DVS5.0, and tested within the next months, so as to deliver in due time the first deliverable of the task (D02.09, due at the end of first year, i.e., April 30, 2002)

III.4 Defining canonical models of local surface geological structures

The following set of basic canonical models has been defined:

Type of model	# of models
Homogeneous halfspace	1
Single layer over halfspace	9
Dipping layer	4
Semiinfinite layer over halfspace	2
Single layer with a rough layer-halfspace interface	6
Deep sediment valley	1
Shallow sediment valley	2
Single layer with a trough at the bottom	2
Burried fault	1
Two layers over halfspace	1
Low-velocity layer	2
Gradient layer	2

A detailed documentation of models will be prepared and made available for all SESAME partners.

III.5 Review of the available methods of the time-frequency analysis

Miriam Kristekova made a detailed presentation of several methods of the time-frequency analysis including her generalization of the MPD (Matching Pursuit Decomposition) method
For all methods there are computer codes written in programming language Fortran 95.

III.6 Future meetings of TASK C

Jozef Kristek and Miriam Kristekova will visit ETH for two weeks at the end of May 2002 in order to start preparation of models of real sites. Pierre-Yves Bard and Peter Moczo will join them for last three days. The visit will be concluded by a meeting of *WP08*, *WP09* and *WP10*.

MINUTES of the SESAME Instrument Workshop (WP02)

Bergen (Norway), October 22-26 2001

Summary of WP02 objectives:

WP02 [H/V technique, experimental conditions] is dedicated to investigations on the required experimental conditions (instrumental characteristics, data acquisition environment) for warranting the stability and reproducibility of measurements,

I Partners attending the meeting

Partner 1	Bertrand Guillier and Fabien Blarel	LGIT Grenoble
Partner 3	Matthias Ohrnberger and Daniel Vollmer	UP, Postdam
Partner 5	Kuvvet Atakan, Jens Havskov, Terje Utheim and Margaret Grandison and Gerardo Alguacil from the University of Granada (Spain)	UIB, Bergen
Partner 7	Stratos Zacharopoulos	ITSAK, Thessaloniki
Partenr 8	Antonio Borges	ICTE-UL, Lisbon
Partner 9	Riccardo Azzara, Fabrizio Cara, Sandro Rao and Catello Acerra	ING, Rome
Partner 12	Anne-Marie Duval and Sylvain Vidal	CETE, Nice

II Programme of the meeting

Monday, 22nd Oct. 2001

Introduction: Orientation on the planned activities and expected results.

***Task 0**:* Test data collection (Table 1)

Collection of test data (10 x 1 min. windows) by each 'system' independently.
Transfer of the data to mainframe computer (SUN/SOLARIS) for processing.
Preparation of calibration files for each system.
Processing the test data.

***Output**:* All systems deliver a calibration file and waveform files with 10 x 1 min. window. H/V ratios for the 10 windows and an average ratio (for both horizontal components).

Tuesday, 23rd Oct. 2001

***Task 1**:* Testing digitisers

Test of manufacturers specifications and a self-noise test, which is done by each group separately.

***Output**:* Output in µV values, response function, correlation with the Petterson's curves

***Task 2**:* Testing sensors

Test of one sensor at a time against a reference digitiser.

***Output**:* Correlation with Petterson's noise curves.

Wednesday, 24rd Oct. 2001

***Task 3**:* Continued and Possibly also test simultaneously against a reference sensor.

***Task 3.1**:* Testing each recording 'system' against the reference 'system'.

***Output**:* Correlation against the reference 'system' results.

Thursday, 25rd Oct. 2001

***Task 3.2**:* Simultaneous recording by each system in the lab.

Output: H/V curves for correlation.
Task 3.2: Simultaneous recording by each system in the free-field.
Output: H/V curves for correlation.

Friday, 26[rd] Oct. 2001

Task 4: Data processing
Processing of the data collected (both in the lab and in the free-field) during Task 3.2.
Output: Correlation results.
Report preparation.
Output: Individual reports from each group and a preliminary synthesis.

III Requests for the Preliminary Report:

We have to produce a preliminary report for the Workshop results before the end of the year. This report will consist of a summary which outlines the main tasks and the data collected followed by the individual reports of each group for different tasks. We will try to edit it such that it has some consistency in the way the individual reports are presented. This preliminary report will be the first synthesis of the data collected during the workshop, probably without the detailed correlations and processing.

Access to the 'sesame' account on the 'turmalin' will be kept open until the end of the next week. After this period, it is possible to transfer data through an anonymous ftp account (contact K.Atakan for details), or simply be e-mail. Regarding the reports, it is probably not a problem to send it by e-mail. The instrument codes are in the excel-file 'instrument-workshop.xls'

We have identified the contact persons from each group (team). These are:
B.Guillier (LGIT, Grenoble), S.Zacharopoulos (ITSAK, Thessaloniki), M.Ohrnberger (IGUP, Potsdam), F.Cara (INGV, Rome), A.M.Duval (CETE, Nice), A.Borges (UL, Lisbon), and K.Atakan (UiB, Bergen). In addition G.Alguacil (UG, Granada) and J.Havskov (UiB, Bergen) are the contact persons regarding the instrument response and the SEISAN calibration files. The e-mail addresses can be found in the 'instrument-workshop.xls'. Once the preliminary report is prepared, we will send you all the data and the reports in a new CD.

In order to be able to meet the deadline we request the following from each group:

- Please make sure that data corresponding to each task are collected, format converted and transferred to the Unix system under the relevant subdirectories of the 'sesame' account on the 'turmalin'.
- Please complete the short reports corresponding to each task in a word file including also the figures, and transfer to the corresponding sub-directory (or send by e-mail). Each report should include a standard header info indicating the group name (or participant names), the task name, the complete path and the name of the report file, the complete list of the files recorded (for the relevant task) with the path of the directory where these are stored.

Following is a short summary of the tasks and the expected output (please note that the task numbers are slightly different than those given earlier in the program):

III.1 *Task 0:* Test data collection (~/sesame/TESTDATA/……)

This is performed individually by each recording system. The aim was to test the equipment and provide the noise spectra for each system.
The report should include the description of each system (e.g. which digitizer-sensor combination), the output from the 'mulplt' program (i.e. a typical noise spectrum shown with the Peterson curves for each channel).
H/V ratios for each horizontal component using the 'spec' program. The output is the average spectral ratios for each horizontal channel.

III.2 *Task 1:* Testing digitizers (~/sesame/DIGITIZER/………..)

This is performed to test the manufacturers specifications and the self-noise level, which is done by each group separately. The work is divided into five sub-tasks outlined below.

- *Battery test* (sub-directory DC): Output is the waveform file (from 'mulplt'), with the polarity test and the number of counts per Volt.
- *Virtual sensor test* (e.g. subdirectory ET-VI): Noise measurements collected by short circuiting the sensor input on the digitizer. This data set is the same as the one collected under the subdirectory SHORT, however, this time with the corresponding correct channel labels (e.g. ET-VI S Z) , in order to be able to provide the virtual sensor (4.5 Hz geophone) response with the given digitizer. The output is the noise spectra with the Peterson curves for each channel.
- *Digitizer self-noise test* (sub-directory SHORT): The response is simulated with the standard sensor of each system (e.g. ET-KG S Z). The output is the noise spectra with the Peterson curves for each channel.
- *Stability test* (sub-directory STABILITY): Noise measurements with a cold start of the digitizer. Output is the comparison of the noise spectra with the previous measurements. If the results are the same it is ok. If different, each system should report the time required to stabilize the equipment.
- *Channel consistency test* (Sub-directory TRIANGLE): This is performed by recording a synthetic triangular signal to check if all channels have the same digitisation. Output is a plot of all channels waveform files with the triangular input signal. Here B.Guillier and M. Ohrnberger will perform additional computations for all.

III.3 *Task 2:* Sensor test (~/sesame/SENSOR/………)

Testing of one sensor at a time with the reference digitizer-sensor combination.
The data are stored under sub-directories corresponding to each sensor type (e.g. KG). The output is a comparison of the waveform files and the noise spectra with Peterson curves one channel at a time (e.g. comparison between NL-GS B Z vs NH-KG S Z). Here we should remember that the reference sensor is a broad-band Guralp (CMG 40T) and the digitizer (Nanometrics) is with low gain. The test sensor is connected to the first three channels of the digitizer with high gain.

III.4 *Task 3*: Simultaneous recording in the free-field (~/sesame/SIMFREE/………)

This task is performed in two parts, on the grass and on the concrete. Each system has collected, simultaneously one 5 min and 5 x 1 min windows for both parts. Some of the systems have used GPS timing and therefore are synchronized, whereas others have used internal timing. In each window we have a synchronization pulse given by a weight drop. It is therefore important that each system describe in the report, the details of the recording (the digitizer-sensor combination, continuous/long-window/short window lengths, GPS or internal timing etc.). The data is processed preliminary by Margaret Grandison (UiB, Bergen). Please also make sure that you note the instrument settings (e.g. if the gain is set differently than what is assumed in the instrument response file).
Further processing of the collected data will provide a comparison between the different recording 'systems'. This comparison should ideally be done by a single person (e.g. preliminary processing by Margaret Grandison from UiB, Bergen, and final processing and comparison by A.M.Duval and K.Atakan) and will be based on:
Comparing the absolute noise spectra for a common window for all systems (with Peterson curves).
Comparing the average H/V ratios for each horizontal component (in principle, all systems should give more or less the same average H/V ratio).
Comparing the differences between the two data sets from the grass and the concrete.

III.5 *Task 4*: Simultaneous recording in the lab (~/sesame/SIMLAB/………)

This experiment is in a way identical to the Task 3, this time with the recordings in the lab. The collected data should therefore be processed and reported in the same way as Task 3.

IV Requests for the Final Report

The final report is to be delivered in April 2002. It will consist of a synthesis of the results with reference to the preliminary report (in appendix), together with some additional processing on the comparisons between the different instruments. It should also include the recommendations regarding the performance of each system. All groups that are participated in the workshop should be involved in this report, even if the actual writing up of the report may be done by a few.
Following are the contact persons from each group (team):

- B.Guillier (LGIT, Grenoble)
- N.Theodulidis (?) and S.Zacharopoulos (ITSAK, Thessaloniki)
- M.Ohrnberger (UP, Potsdam)
- R.Azzara and F.Cara (ING, Rome)
- A.M.Duval (CETE, Nice)
- P.Teves-Costa and A.Borges (ICTE-UL, Lisbon)
- K.Atakan and J.Havskov (UiB, Bergen).

The time schedule for the final report will be:

- First meeting in Potsdam in January (preferably for two days 7-8 January, before the planned software workshop on 9-11 January).
- Final meeting during the EGS in March 2002 in Nice.

We will come back to you with some details before these meetings. In the meantime, it would be important for each group to do some independent processing. Following are some points to remember for each Task:

Task 0: Test data collection

- Comparison between the different systems of the noise spectra and the H/V ratios.

Task 1: Digitizer test

- Compare the results between the different digitizers for the data from the DC, SHORT, VIRTUAL, STABILITY and TRIANGLE (including also the additional comparisons by B.Guillier and M.Ohrnberger) tests.
- Compare the results between the virtual sensor and the standard sensor (i.e. SHORT and VIRTUAL) using the same digitizer.

Task 2: Sensor test

- Compare the results of each pair of data (i.e. test sensor against the reference sensor) with the noise spectra.
- Compare the H/V ratios for each pair of data.

Task 3: Simultaneous recordings in the free-field.

- Comparison of the absolute noise level between the different systems, conducted on a quiet time window.
- Comparison of the noise spectra with Peterson curves between the different systems on a common window.
- Comparison of the H/V ratios for both horizontal components between the different systems for a common time window.
- Comparison of the noise spectra H/V ratios between the 'grass' and the 'concrete' measurements individually for each system.
- Comparison between the SIMFREE (concrete) and the SIMLAB measurements.

Task 4: Simultaneous measurements in the lab.

- Comparison of the absolute noise level between the different systems, conducted on a quiet time window.
- Comparison of the noise spectra with Peterson curves between the different systems on a common window.
- Comparison of the H/V ratios for both horizontal components between the different systems for a common time window.

Task 5: Conclusions and final recommendations.

TABLE 1 : List of acquisition systems and sensors used in the consortium

Group	Acquisition system	Sensors
LGIT, Grenoble	City Shark Reftek	Lennartz Le3D L22 Guralp CMG5 Guralp CMG30 Guralp CMG40
ITSAK, Thessaloniki	K2 Kinemetrics Etna Kinemetrics	Kinemetrics FBA-23 Kinemetrics FBA-11 Episensor (?)
UP, Potsdam	Mars Lite Lennartz	Lennartz Le3D 5sec KS2000 Broadband
ETH, Zurich	Mars 88 Lennartz Self-developed	Lennartz Le3D 5sec Lennartz Le3D 1sec
INGV, Rome	Mars Lite Lennartz Mars 88 Lennartz Reftek 72A07 Reftek 72A08 Quanterra Q4126 Self-developed Lennartz 5800 Digital UHER	Guralp CMG5 Guralp CMG40 Guralp CMG3T Guralp CMG4 Lennartz Le3D 5sec Lennartz Le3D 20sec Strekeisen STS2 Mark L4C 3D Kinemetrics episensor
CNR-CSGAQ, Milano	Mars 88 Lennartz M24 Lennartz	Lennartz Le3D 5sec Mark L4C 3D
CETE, Nice	Mars 88 Lennartz Opt.disk Mars Lite Lennartz Leas HATHOR 3	Lennartz Le3D 5sec Mark L4C L22 M.P. 4.5Hz M.P.
ICTE-UL, Lisbon	Reftek Mars Lite Lennartz SSR Kinematics	Lennartz Le3D 1sec Lennartz Le3D 5sec Mark 1sec
University of Bergen	GeoSIG SEISLOG	Mark L4C CMG 40 Guralp 4.5Hz FBA-23 Kinemetrics Ranger 1Hz

SESAME planning

The following table shows the time table of the SESAME project. We have highlight in yellow the work which has to be in progress at the date of October, 31, 2001.

TABLE : Project planning and time table

Phases	WP	Tasks	Year 1	Year 2	Year 3
P01			**xxxxxxxxxxxx**	**xxxxxxxxxxxx**	**xxxxxxxxxxxx**
	WP01		xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
		T01.01	xxxxxxxxxxxx		
		T02.01		xxxxxxxxxxxx	
		T03.01			xxxxxxxxxxxx
P02			**xxxxxxxxxxxx**	**xxxxxxxxxxxx**	**xxxxxx**
	WP02		xxxxxxxxxxxx	xxxxxx	
		T01.02	xxxxxxxxxxxx		
		T02.02		xxxxxx	
	WP03		xxxxxxxxx	xxxxxxxxx	
		T01.03	xxxxxxxxx		
		T02.03		xxxxxxxxx	
	WP04		xxxxxx	xxxxxxxxxxxx	xxxxxx
		T01.04	xxxxxx		
		T02.04		xxxxxxxxxxxx	
		T03.04			xxxxxx
P03			**xxxxxxxxxxxx**	**xxxxxxxxxxxx**	**xxxxxxxx**
	WP05		xxxxxxxxxxxx	xxxxxx	
		T01.05	xxxxxxxxxxxx		
		T02.05		xxxxxx	
	WP06		xxxxxxxxxxxx	xxxxxxxxxxxx	xxx
		T01.06	xxxxxxxxxxxx		
		T02.06		xxxxxxxxxxxx	
		T03.06			xxx
	WP07		xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxx
		T01.07	xxxxxxxxxxxx		
		T02.07		xxxxxxxxxxxx	
		T03.07			xxxxxxxx
P04			**xxxxxxxxxxxx**	**xxxxxxxxxxxx**	**xxx**
	WP08		xxxxxxxxxxxx	xxxxxxxxxxxx	
		T01.08	xxxxxxxxxxxx		
		T02.08		xxxxxxxxxxxx	
	WP09		xxxxxxxxxxxx	xxxxxxxxxxxx	
		T01.09	xxxxxxxxxxxx		
		T02.09		xxxxxxxxxxxx	
	WP10			xxxxxxxxx	xxx
		T01.10		xxxxxxxxx	
		T02.10			xxx
P05					**xxxxxxxxxxxx**
	WP11				xxxxxxxxxxxx
		T01.11			xxxxxxxxxxxx
	WP12				xxxxxxxxxxxx
		T01.12			xxxxxxxxxxxx
	WP13				xxxxxxxxxxxx
		T01.13			xxxxxxxxxxxx

In the following, we remind the work which has to be in progress as stated in the submission report, and for each point, we will say what has already be done and if there is some problems.

I WP01 – T01.01: co-ordination – year 1

The co-ordination is followed by two persons. Pierre-Yves Bard for the scientific part and Laurence Bourjot for the administrativ and financial part.

Each month, Laurence Bourjot asks the partners to fill two kinds of tables:

- one table per partner for the expenses
- one table for each person working in the project for the time sheet

At the end of October, all the partners (except one) have sent me their expenses and their time sheets.

TABLE 1 : List of the persons working in the project since the beginning

Partners	Name of the person		Task or WP	Time spent
1	Bruno Bettig	*S*	WP 06	4 M
1	Fabien Blarel	*T*	WP 02	10 D
1	Sylvette Bonnefoy	*S*	WP 08	2 M
1	Laurence Bourjot		WP 01	8 D
1	Jean-Luc Chatelain	*R*	WP 02	5 D
1	Fabrice Cotton	*R*	WP 08	2 D
1	Bertrand Guillier	*R*	WP 02	10 D
1 (14)	Pierre-Yves Bard	*R*	WP01, Task A,B,C,D	3.25 M
1 (14)	Philippe Guéguen	*R*	WP01, Task D	5 D
2	Martin Koller	*R*	WP01	40 H
2	Corinne Lacave	*R*	WP 03	19 H
3	Frank Scherbaum	*R*	TaskB	AC
3	Matthias Ohrnberger	*R*	WP 02	AC
3	Daniel Vollmer	*T*	WP 02	
4	Denis Jongmans	*R*	TaskB	AC
5	Margaret Grandison	*S*	WP 02	10 D
5	Kuvvet Atakan	*R*		AC
5	Jens Havskov	*R*		AC
5	Terje Utheim	*T*		AC
6	Donat Fäh	*R*	Task A, C	5 D
6	Jens Havskov	*R*	Task A, C	25 D
6	Ivo Oprsal	*R*	Task C	3D
7	A. Anastasiadis	*R*	WP 02	0,5 D
7	P Dimitriu	*R*	WP 02	1 M
7	Nikos Theodulidis	*R*	WP 02	2,5 M
8	Paula Teves-Costa	*R*	WP 02	AC (27 D)
8	Antonio Borges	*S*	WP 02	AC
9	Antonio Rovelli	*R*		AC
9	Giovanna Cultrera	*R*		AC
9	Riccardo Azzara	*R*	WP 02	AC
9	Fabrizio Carra	*R*	WP 02	AC
9	Sandro Rao	*T*	WP 02	AC
9	Catello Acerra	*T*	WP 02	AC
10	Alberto Marcellini	*R*	WP 04	16 H
10	Alberto Tento	*R*	WP 04	21 H
11	Lucia Fojtikova	*S*	Task C	55 H
11	Josef Kristek	*R*	WP 09	100 H
11	Miriam Kristekova	*R*	Task C	70 H
11	Peter Moczo	*R*	Task C	175 H
12	Anne-Marie Duval	*R*	WP 02	10 D
12	Sylvain Vidal	*T*	WP 02	1 D

** R = Researcher, S = Student, T = Technician*

Up to now, a total of 41 persons, including researchers, students and technicians, has been involved in the project .

II WP02 – T01.02: H/V technique – experimental conditions – year 1

Regarding the decisions took during the kick-off meeting, an instrumental in-house testing of instruments has been done in Bergen in October 2001 (see The minutes of the Instrument Workshop, Bergen (Norway)). A preliminary report on Experimental conditions will be produced before the end of the year.

☺ Up to now, the time table is respected and there is no problem. The next step is a meeting in Postdam in January 2001 to review the report on instrumental in-house testing.

III WP03 – T01.03: H/V technique – data processing – year 1

Regarding the decision taken during the kick-off meeting, every partner involved in this WP has sent information on the main characteristics of the software he is using to Kuvvet Atakan and a software meeting is planned in Postadam in January 2001.
In parallel, Pierre-Yves Bard has sent a letter summarising the objectives of the project SESAME to K.Kudo, leader of the joint IASPEI/IAEE working group on the Effects of Surface Geology and to W. Stephenson (New-Zealand geological survey) who proposes a worldwide action on the H/V technique.

☺ Up to now, the time table is respected. The next step is a software meeting in Postdam in January 2001.

IV WP05 – T01.05: instrument layout for array measurements – year 1

The Postdam group (F. Scherbaum) has started thinking about different geometries (circular or linear). The same group is also gathering the existing information about the test sites selected for the project. Several experiments are being planned over various sites, including the selected project test sites (the first experiment will very porbably be in Belgium : Uccle and Liege.
A modification of the SPAC technique has been developped in LGIT Grenoble to allow the use of non-perfectly circular arrays (Bettig et al., 2001).
☺ Up to now, the time table is respected. The next step is a software meeting in Postdam in January 2001.

V WP06 – T01.06: array measurements – derivation of dispersion curves – year 1

Regarding the decision taken during the kick-off meeting, every partner involved in this WP has sent information on the main characteristics of the software he is using to Frank Scherbaum and a software meeting is planned in Postadam in January 2001.
Several programs used by different partners are being implemented in Potsdam so as to allow a direct comparison on the same data.
☺ Up to now, the time table is respected. The next step is a software meeting in Postdam in January 2001.

VI WP07 – T01.07: array measurements – inversion of velocity profile – year 1

After some difficulties linked with the leave of some scientific staff from Liege, a PhD student officially started his work on the topic on November 2nd. He is presently getting used with the standard “Herrmann’s” software, and will present a first review in Grenoble in early January

☹ There have been some delays. But the situation is now under control and on the right tracks ☺

VII WP08 – T01.08: nature of noise wavefield – year 1

VIII WP09 – T01.09: numerical simulation of noise – year 1

The minutes of the Sesame Task C meeting held in Zurich (Switzerland) in August 2001 explain the work undertaken. Jozef Kristek and Miriam Kristekova will visit ETH for two weeks at the end of May 2002 in order to start preparation of models of real sites. Pierre-Yves Bard and Peter Moczo will join them for last three days. The visit will be concluded by a meeting of *WP08*, *WP09* and *WP10*.

☺ Up to now, the time table is respected and there is no problem.

From a general viewpoint, the project has started nicely. The kick-off meeting clearly showed the dedication of all involved partners, as well as their enthusiasm.
Some difficulties have already been faced, but a solution could be found, and they are now over.
The general feeling is very good, the various groups are exchanging information, the relationship between scientists from different groups is smooth and friendly.

SESAME important dates *(revised October 31, 2001)*

	Months	Week 1	Week 2	Week 3	Week 4
1	*May 2001*				
2	*June 2001*				Kick-off Meeting-Grenoble
3	*July 2001*				
4	*Aug. 2001*				**Zürich – Aug 29-30** Task C meeting
5	*Sept. 2001*				
6	*Oct. 2001*				**Bergen – Oct 22-26** Instrument workshop TaskA - WP02
7	*Nov. 2001*	**First progress report**			
8	*Dec. 2001*		(AGU)		
9	*Jan. 2002*	**Postdam – Jan 7-8** Instrument workshop Preparation of report TaskA-WP02	**Postdam – Jan 9-11** Software & Array processing techniques TaskA-WP03 & TaskB-WP06		
10	*Feb. 2002*				
11	*March 2002*				Instrument workshop Finalisation of report TaskA-WP02
12	*April 2002*				EGS - Nice D1, D2
13	*May 2002*			**Zürich** Task C meeting	D3: Progress report 1
14	*June 2002*				D4
15	*July 2002*				
16	*Aug. 2002*				
17	*Sept 2002*	(ECEE London)			
18	*Oct. 2002*	**General Meeting - Roma**			D5, D6, D7, D8
19	*Nov. 2002*				
20	*Dec. 2002*		(AGU)		
21	*Jan. 2003*				D9
22	*Feb. 2003*				
23	*March 2003*				EGS – Nice
24	*April 2003*				D11, D12, D13,D14, D15
25	*May 2003*				D10: Progress report 2
26	*June 2003*				
27	*July 2003*				D16, D17, D18, D19
28	*Aug. 2003*				
29	*Sept. 2003*				**Scientific Workshop** : Modelling, Observation and Interpretation of seismic noise – September 22-24, **Smolenice Castle, Slovak Republik**
30	*Oct. 2003*				D20,D21
31	*Nov. 2003*				
32	*Dec. 2003*		(AGU)		
33	*Jan. 2004*				
34	*Feb. 2004*				EGS – Nice
35	*March 2004*				
36	*April 2004*			General Meeting - Nice	D22, D23, D24
37	*May 2004*				D25: Progress report 3
38	*June 2004*				D25; Final report

Project n° EVG1-CT-2000-00026 SESAME

European Commission – Research General Directorate

SESAME

Site Effects aSsessment using AMbient Excitations

SESAME Partnership

1	UJFG.LGIT	University Joseph Fourier	Grenoble
13	CNRS.LGIT	National Center for Scientific Research	Grenoble
14	LCPC	Central Laboratory for Bridges and Roads	Paris
2	RICSA	Résonance Ingénieurs-Conseils SA	Geneva
3	UPOTS.GEO	University of Potsdam -	Potsdam
4	ULGG.DG0.GIH	University of Liège	Liège
5	UIB.ISI	University of Bergen	Bergen
6	ETH.GEOP.SSS	Polytechnic School of Zürich	Zürich
7	IESEE	Institute of Engineering Seismology and Earthquake Engineering	Thessaloniki
8	ICTE.IGI	Institute of Earth and Space Sciences	Lisbon
9	INGV	National Institute of Geophysics and Volcanology	Roma
11	IGSAS.SD	Geophysical Institute – Slovak Academy of Sciences	Bratislava
10	CNR.GSAQ	National Research Counsil	Milano
12	CETEMED.LRE	Center of Technical Studies	Nice

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Key-words: earthquake, site effects, noise, urban areas

ABSTRACT

The project deals with the important issue of site effect estimation for seismic risk mitigation, with a special attention to urban areas. It focuses on two low cost techniques using ambient seismic vibrations, and aims at clarifying their actual ability to provide useful, direct or indirect, information for local amplification estimates.

The first technique, a very simple one, is the so-called H/V technique advertised by Nakamura; the second, more advanced, one uses noise array measurements to derive the dispersion curves of surface waves, and from that the velocity profile. The proposed work includes a theoretical and numerical part to better understand the nature of seismic noise, and to develop validated numerical tools to simulate seismic noise in arbitrary environments. It also includes thorough experimental and data processing investigations to clearly assess the stability, robustness, reliability and physical meaning of these 2 techniques. All the theoretical, experimental and numerical results will be used to propose user guidelines for the H/V technique (a drastic need at the European and world levels since this technique is very often misused), and practical recommendations for array measurements (not yet as developed), and corresponding software.

Duration : 36 months
Signature Date : April 11, 2001
Starting Date : May 1st, 2001

Total Budget : 1.57 ME
Contribution from EC: 889.648 kE

OBJECTIVES

After recent earthquakes, a priori estimations of site effects became a major challenge for an efficient mitigation of seismic risk. Unfortunately, the few methods known as reliable systematically appear as far too expensive for local and national authorities, especially in moderate seismicity countries or in developing countries. There is therefore a drastic need for reliable, low cost techniques. The objectives of the present proposal are to investigate the reliability of two techniques born in Japan using ambient noise recordings: the very simple H/V technique ("Nakamura"), and the more advanced array technique. They offer many advantages, especially in urban areas, and their use (perhaps misuse) is rapidly spreading world-wide; but their physical basis and actual relevancy for site effect estimates has never reached a scientific agreement. This project gathers experts in seismology, engineering geology, surface geophysics, data processing, numerical modelling and earthquake engineering, to tackle these methods under different viewpoints, understand their physical basis, assess their actual meaning in view of site effect estimation, and propose user guidelines and processing software to ensure a correct use, and thus improve significantly the mitigation tools.

WORK PLAN

The work will consist of 4 main, complementary tasks. On the upstream side, the project will try and fill the gap concerning the understanding of the real nature of noise, especially in urban areas. On the technical side, series of investigations will be carried out to clearly identify the key points in each of these techniques and their reliability, and to clearly assess the conditions under which they have to be performed: experimental conditions for the measurements, and processing techniques as well. Finally, on the downstream side, after - hopefully - having shown that these techniques do provide useful information when applied with care, we want to offer a framework for reliable measurements by proposing user guidelines that could form the basis for a quality label.
The scientific work will thus be separated into a total of 12 workpackages, three for each main task:

- ***H/V technique :*** experimental aspects for warranting the stability and reproducibility of measurements, investigations on the various data processing alternatives and choice of the most robust ones, and finally experimental assessment of the meaning of this ratio by a thorough comparison with instrumentally measured site effects, or damage distribution in several recent earthquakes.
- ***Array measurement technique :*** experimental aspects for an optimal adaptation of the instrumental characteristics and layout to the site under study, analysis of several multitrace signal processing techniques (f-k, spatial autocorrelation) and implementation of a robust software, and improvements in the inversion of velocity profiles with an optimum use of a priori information.
- ***Physical background and numerical modelling*** for cross-checks with observed data: data analysis at several sites to identify the composition of noise wavefield (nature, proportion and origin of surface and body waves) in urban areas, development and validation of numerical models (FD) with random surface sources, and numerical analysis of the H/V and array techniques on noise synthetics, and finally cross checking of observations, numerical simulations, and known structure and site effects for a few well-known test-sites.
- Finally, organisation of the ***dissemination of the scientific knowledge and technical know-how*** through special workshops and special issue in an international journal, redaction of user guidelines and realisation of a CD-ROM with validated processing software for the H/V technique to be advertised in international committees, and recommendations concerning the array measurements technique.

MILESTONES AND EXPECTED RESULTS

The main outcome will be a **clear, solid assessment** of the **meaning** of these methods, and **recommendations** as to their **practical implementation**. This will materialize through **user guidelines** for each technique, to be discussed in specialized committees of international bodies (joint IAEE/IASPEI working group on effects of surface geology), and thus **widely disseminated**, in order to provide the basis for a **quality label.**
The consequences will be two-fold: on one side, their wide dissemination will hopefully **prevent misuses**, wrong **microzonation** maps and misleading earthquake safety feelings. On the other side, for countries which till now have been reluctant to use them, it will offer a **validated**, **simple, low-cost tool** to contribute in **systematic, first-level evaluations** of **seismic risk in urban areas**.