

Ragnar Stefánsson  
Barði Þorkelsson

**PREPARED – Management and resource usage summary**  
Months 13-18: February 1 - July 31, 2004

1.1 Objectives of the reporting period and summary .....	5
1.2 Scientific/Technical progress made in different WPs according to the planned time schedule	5
1.3 Milestones and deliverables obtained .....	12
1.4 Deviations from the work plan and/or time schedule and their impact to the project .....	14
1.5 Communication between partners .....	14
1.6 Difficulties encountered at management and coordination level and proposed/applied solutions .....	14
Table 1 .....	15
Table 2 .....	16
Table 3 .....	17

## **1.1 Objectives of the reporting period and summary**

The central objective of the project is to apply large amount of geophysical and geological observations related to the two large earthquakes in the year 2000 in the South Iceland seismic zone to develop technology for improving earthquake preparedness and mitigating risk.

The start date of the project was February 1, 2003. The general objectives of the project are described in the 12 months Management and resource usage summary. A two days workshop, i.e. the PREPARED mid-term meeting was organized in Reykjavík, January 30-31, 2004, to sum up and discuss the first 12 months of the project.

The next 6 months of the project were a direct continuation of the previous work and based on the discussions at the mid-term meeting, to fulfill the general objectives of the project.

## **1.2 Scientific/Technical progress made in different WPs according to the planned time schedule**

Work on the project has been carried out during the last 6 months in accordance with plans. However, for scientific reasons and new discoveries, some further evaluations of basic data proved to be necessary during an early part of the project. This did cost some minor delays in some WPs. Also there were some delays caused by practical reasons. This was described in the 12 months Management and resource usage summary. Five of the WPs are, however, based on merging together results from all the other WPs. These five WPs are of basic significance for the outcome of the central objective of the project, i.e. to create technology directly applicable for mitigating risk. These WPs have started more slowly than anticipated because they are based on other WPs which are not yet at the stage that the results can be applied in the fusion work.

For this reason following application for a six months extension to the PREPARED-project has been sent to the programme officer:

“The PREPARED-project is based on applying results and experiences of former EC earthquake prediction research projects, and of the large earthquakes in the South Iceland lowland in year 2000, to produce practical methods and software tools for warnings, long- and short-term assessments, aiming at mitigating risks from large earthquakes.

The various parts of the project are carried out by cooperation of 16 institutions in 25 workpackages. It is hoped that the final results will be technology and tools for improving preparedness and for mitigating risks. The fusion of the results of 24 individual WPs will be carried out in five WPs where all the partners participate. The final directly applicable tools are produced in these 5 WPs based on cooperation of the front line scientists/institutions that are responsible for the results of the other WPs. Any delays in providing results from the individual WPs will delay the project as a whole.

Significant new findings during the course of this project revealed that some reevaluations and reconsiderations had to be done.

Most significantly, as detailed in Section 1 of the First periodic report, it became evident in the first part of the project that the potential significance of information carried by microearthquakes was larger than anticipated, which requested reevaluations of the microearthquake dataset up to a very high level. This reevaluation was made available by the coordinator IMOR in month 8 of the project. Although some WPs made preliminary use of the huge and high level seismic dataset from the start of the project, reevaluation to this higher level showed to be of basic significance for the majority of the WPs. The WPs 2.1, 2.2, 2.4, 3.1 and 4.1 had for this reason full start later than planned.

GFZ Potsdam, responsible for WP6.1, considers it most significant to wait for reevaluation of historical data of WP5.4 before finalizing significant parts of its modelling work. However, the results of WP5.4 are not expected until in month 24, as planned.

UNIVTS-DST, responsible for WP4.2, Inversion of strong motion data, has run into unforeseen problems in constraining final slip/moment distribution on the fault planes of the large earthquakes, indicating that a more complicated model has to be searched for.

Also some delays occurred in the work of two partners because of operational reasons. Partner 5, UIB (University of Bergen) in the original contract, was replaced by the University of Göttingen by a contract amendment, delaying work in WP5.5. This delays D87 which is carried out in close cooperation with UPMC and DF.UNIBO and thus interacting with WP6.2 and WP5.6. Interaction with UPMC on D89 is also more demanding than expected.

Also, as reported in the First Periodic Report, a very significant post doctoral student, could not be hired until 6 months later than planned by partner 8, UNIBO, delaying the start of some work items in WP6.2.

All partners have tried as far as possible to work faster in cases where delays have been in starting projects or in cases where new understanding demanded new approaches. This project as a whole is revealing and in many aspects provides a new and innovative understanding of crustal processes and earthquake release. A significant part here is the role of fluids in the crust in stress build-up and earthquake nucleation. New approaches involving more complicated models than conventionally applied have been necessary. This has involved more work, but it is also paving the road for new and innovative results.

All the five fusion WPs, i.e. WP2, WP3, WP4, WP5 and WP6 will be delayed because of sometimes minor but cumulative delays in several packages that are needed for merging the results towards final outcome of this project, i.e. methods that can be applied directly in work for mitigating earthquake risk.

On reasons detailed above the Icelandic Meteorological Office hereby applies for a six months extension to the PREPARED-project, i.e. to July 31, 2005, which it considers necessary to achieve a good result for this project. Revision of DOW as far as concerns planned outcome of the work and deliveries is enclosed.

September 16, 2004

Magnús Jónsson  
Authorized Administrative Official

Ragnar Stefánsson  
Project Scientific Leader

Table 1 shows a comparison between planned and executed efforts by workpackages. In this diagram we assume that a 6 months delay will be accepted. Table 2 and Table 3 show comparison between planned and used manpower.

In the following the progress of the various WPs is summarized shortly.

*1.2.1 WP1 – Coordination.* Scientific coordination and management is in the hands of IMOR and has been performed as planned in the DOW.

*1.2.2 WP2 – Analysis of multiparameter geophysical data approaching the June 2000 earthquakes, assessing state of stress.* The work which is lead by IMOR is ongoing. IMOR has carried out general analysis work on the 10 years of microearthquake data preceding the 2000 earthquakes. Among results of this work is participation in and the submission of a paper by Max Wyss and Ragnar Stefánsson to BSSA, and presentations of results at scientific meetings during the period. This WP is one of the WPs for fusion of the results from other WPs, carried out by 7 partners. Discussion have been ongoing between them, but results of the many basic WPs are not ripe enough to be a basis for a common special report (D9) which was planned for M16. It will be delayed for a few months. The final delivery of WP2 is delayed until M30.

*1.2.2.1 WP2.1 – Pattern search in multi-parameter seismic data.* There are no deplorable deviations from the workplan. All methods have been integrated into one coherent software package (D17). Future deliverables are expected to be on time.

*1.2.2.2 WP2.2 – Possible precursory seismic quiescence and b-value changes.* There are no deviations from workplan. D19, having deliverable time M24 is already partly delivered by submitting a paper to the BSSA based on its progress.

*1.2.2.3 WP2.3 - Long-term deformation in the SISZ inferred by joint interpretation of GPS, InSAR and borehole strain data.* There are no major deviations from the workplan. D22 has partly been finalized as published in an internal report, First periodic report and on the PREPARED website. Work has revealed strain concentration in the zone prior to the earthquakes on the long-term, however, no short-term precursors have been found in the strain field. Reanalysis of the GPS data is being done in collaboration with CNRS-UMR 5562. So D22 has only been partly fulfilled on time.

*1.2.2.4 WP2.4 – Space and time variations in crustal stress using microearthquake source information.* So far all deliverables have been delivered in planned time. Work is continuing and developing in discussion with WP5.6 and with IMOR staff. It can be foreseen already now that the final delivery (D27) has to be delayed until M27, because of scientific reasons and interaction with other partners.

*1.2.2.5 WP2.5 – Using shear-wave splitting above small earthquakes to monitor stress in SISZ.* Work is continuing according to plans. There were no expected new deliveries between M12 and

M18. However, publication of results in international journals (D35) scheduled at the end of the project has been ongoing with several published and submitted papers related to the WPs during the period.

*1.2.3 WP3 – Short-term changes/precursors.* This is a fusion WP lead by IMOR with participation of UU and SIUI. In this package results of WP2.1, 2.2, 2.3, 2.5, 4.1, 5.5 and 6.2 will be merged together to develop multidisciplinary short-term warning algorithm. IMOR has carried out analysis work with the seismic data during this period as reported in meeting. No delivery was expected during this period. The final deliverables of this package are delayed to M30 instead of M24 as originally planned.

*1.2.3.1 WP3.1 – Foreshocks and development of new warning algorithms.* Work is ongoing here lead by UU and with participation especially of IMOR. Deliverables D42, D43 and D44 are all well in progress. Work for the basic deliverable D42 had a late start because of late deliveries of the refined 10 years catalogue as earlier reported. D43 involves the “Slunga warning algorithm” that has been installed for testing in the warning procedures in Iceland at an early stage, but was taken down last year for refining, especially the methods calculating fault plane solutions. Ragnar Slunga is working on these refinements. As concerns D44 an article describing significant progress of the project was submitted before M15, but it needs major revisions which are worked on for the time being. It is expected that all these deliverables will be finished in M21, i.e. with 6 months delay. D45 and D46 will accordingly be delayed to M27, i.e. with 3 months delay.

*1.2.3.2 WP 3.2 – Radon anomalies/Development of warning algorithms.* The WP is well on schedule and all planned deliveries already finished. D49 which was scheduled for M20 has already been submitted to GRL ahead of planned time.

*1.2.4 WP4 – A model for the release of the two June 2000 earthquakes based on all available observations.* This WP is lead by IMOR with participation of 3 other partners, NVI, SIUI and UNIVTS-DST, based on results of WPs 4.1, 4.2, 4.3, 4.4, 5.5, 6.1 and 6.2. No deliverables were expected during the period. It is expected that the final delivery of WP4 will be delayed until M30.

*1.2.4.1 WP4.1 – Source mechanism and fault dimensions of the June 17 and June 21 earthquakes determined from the inversion of teleseismic body waves and from mapping of aftershocks.* Precise relocations of aftershocks of the 2000 earthquakes, which is basic for mapping of the faults and fault processes during the earthquakes, is finished. Further interpretations are progressing well. As in some other cases work was delayed in waiting for repeated high level evaluation of the SIL catalogue. D56 and D57 are both hit by this delay and it is proposed that these deliverables in final form will be postponed until M27 and M30 respectively. Significant parts of D57 were published in the First periodic report and on the PREPARED website.

*1.2.4.2 WP4.2 – Analysis, inversion and estimation of strong ground motion data from extended earthquake fault models of the two June 2000 Icelandic events.* Due to unforeseen problems arisen during the preliminary tests for slip inversion of the accelerometer data the final models here are not yet considered to be accomplished. In particular the second of the two earthquakes has not been tried yet. It is foreseen that D60 and D63 can be finished before M24. It is expected that the final deliverable of this WP will accordingly be delayed until M25. This is necessary in order to be able to discuss the final outcome of this WP with other project partners.

*1.2.4.3 WP4.3 – Surface fractures in the source region of the June 2000 events.* There are no deviations from the workplan and all deliverables planned before M18 have been accomplished.

*1.2.4.4 WP 4.4 – Deformation model for the June 2000 earthquakes from joint interpretation of GPS, InSAR and borehole strain data.* There are no deviations from the work plan and an M18 deliverable completed.

*1.2.5 WP 5 - New hazard assessment/New methods for improving assessment of probable earthquake effects.* This WP is lead by IMOR with participation of NVI, UPMC, UNIVTS-DST, UI, UGOE and also based on WPs 5.1-5.6, WP4.2 and WPs 6.1 and 6.2. Work is ongoing. No deliverables were expected during this period according to former plans. Final delivery is delayed from M24 to M30.

*1.2.5.1 WP 5.1 – Mapping of subsurface faults in southwestern Iceland with the microearthquakes induced by the June 17 and the June 21 earthquakes.* Preparation of a catalogue of relocated events (D79) is nearly finished, and will be delivered soon after M20, later than originally planned.

*1.2.5.2 WP 5.2 – Mapping and interpretation of earthquake rupture in the Reykjanes peninsula and other surface effects there and in the SISZ.* Progress has been made in gathering the data necessary to develop a geologically realistic model of plate boundary behavior in the area affected by the June 2000 earthquakes. A combination of field and remotely sensed data is being gathered to characterize the geological conditions along the traces of the three faults on the Reykjanes peninsula which experienced large triggered earthquakes on June 17, 2000. There is no deviation between the planned and used man-months in M13-18. There are no major deviations from the workplan. Cooperation is ongoing with partners at the IMOR. The updated catalogue of earthquakes has been added into our database and we are examining possibilities of how to best use the fault map data in IMOR’s early warning information system database.

*1.2.5.3 WP 5.3 – Study of the strong ground motion, acceleration and intensities of the two large earthquakes.* A theoretical ground motion model has been fit to the strong ground motion recordings from South Iceland earthquakes in June 2000. This model is also used for simulating realistic input records for computational structural models (contributions to deliverables D83 and D84). The model has been compared with data from other regions and the rate of attenuation studied. Source parameters and local-amplifications have been estimated based on the measured strong ground acceleration in South Iceland. No significant deviation from workplan.

*1.2.5.4 WP 5.4 – Reevaluation of historical earthquakes in light of the new observations.* This WP relies on results of several other WPs, and it was originally planned to start in M13. Preparation of the work has started. D86 which was planned in M24 will be delayed until M26.

*1.2.5.5 WP 5.5 - Hydrogeological changes associated with the June 2000 earthquakes.* The main progress during this period has to do with new numerical models related to strike-slip faults and their hydromechanical properties. The main new models concern (a) biaxial loading (tension and compression) of the SISZ as a whole, (b) loading of the SISZ with an extended “weakness zone” into the Reykjanes peninsula (some earthquakes occurred in the Reykjanes peninsula during the June 2000 events in the SISZ), and (c) effects of the hydromechanical zones around the strike-slip faults on their slips (displacement) for a constant driving (shear) stress (stress drop). So far,

the most important milestones reached in this project are the data analysis (fractures, push-ups, etc.) related to the June 2000 earthquakes and, in particular, the numerical model results indicating (a) the general tectonic environment of the SISZ and the nearby central volcanoes (Hekla, Hengill, and Eyjafjallajökull), and (b) the effects of hydromechanical properties of faults and fault zones on slip and fluid transport during seismogenic faulting. In addition to the papers mentioned in the First periodic report, several papers related to these new results have been submitted, or are in preparation. The main changes have had to do with delays (for various reasons) caused by transferring the WP from UIB, which was originally the WP leader, to UGOE. The analysis of the borehole and associated hydrological data (subcontractor) is also delayed, due to various reasons, but some important data will be analyzed soon, presumably partly in Göttingen. Close collaboration is maintained primarily with IMOR and UPMC.

*1.2.5.6 WP 5.6 – Paleo-stress fields and mechanism of faulting.* Scientific progress is according to the planned time schedule. Geometry and mechanics of faulting after selected fault traces measurements. Collection of fault slip datasets in the field, analysis in terms of stress tensors by inversion method. Inversion of focal mechanisms of earthquakes, evolution in time and depth based on study of volumes of uniform stress tensor. Milestones are in progress as planned and no deviation. Discussions and work of Magalie Bellou in collaboration with WP2.2. Work stay of Magalie Bellou planned in Italy in September 2004 in collaboration with WP6.2.

*1.2.6 WP 6 – Modelling and parameterizing the SW Iceland earthquake release and deformation processes.* IMOR leads this WP, with participation of SIUI, DF.UNIBO, GFZ and CNRS-UMR 5562. The WP takes to the modelling earthquake release in the SISZ as a whole as well as in its continuation in the Reykjanes peninsula. It is a fusion package based on progress and results of WPs 6.1 and 6.2 and on results of various other WPs parameterizing or modelling on basis of various observations. No deliverables were expected from this WP during the period. The final deliveries of this package are expected to be delayed from M24 to M30.

*1.2.6.1 WP 6.1 – Earthquake probability changes due to stress transfer.* A model of earthquake hazard was computed assuming Maxwell rheology. Partly, new information from the reevaluation of historical records of earthquakes in WP5.4 could already be included, more will be considered when WP5.4 has delivered its report. The main result is that the average shear stress in the visco-elastic model is higher compared to the elastic one. In general, the shear stress increase and decrease in time is very similar in both approaches. Only in the case of the June 2000 events the stress before them reaches distinctly higher levels. Concerning the Coulomb failure function, all models considered so far do not show a clear triggering effect that works for all events. The best correlation is found when looking for Coulomb stress transfer between the 1<sup>st</sup> event in a sub-series (e.g. 1784, 1896 or 2000) and the following ones in the same sub-series. There are no significant delays in the WP. Some deviations are as follows: As the final results of the reevaluation of historical records in WP5.4 will only be available after some time (see schedule of WP5.4), these might lead to more refined models later. We therefore have started with work on our second deliverable before finishing the first.

*1.2.6.2 WP 6.2 - Model stress in the solid matrix and pressures in fluids permeating the crust.* Model the joint action of stress in the solid matrix and pore pressure in fluids permeating the crust. Crack models were studied of strike-slip faults which unweld layer interfaces. Such models have important implications for the complexities in the fault system in the SISZ (D98 and also D89 in WP5.6). A thermo-poro-elastic model of a fault region was developed, which takes into



account the effects of pressure dependent permeability and temperature dependent viscosity (D100 and also D95 in WP6). Crack models were obtained in layered viscoelastic media (D99). We evaluated the response of a fault to either shear or normal stress changes, as modelled at the hypocenters of the early aftershocks of the June 17, 2000 earthquake in the SISZ in the first year of the project. The model fault was assumed to have a rate- and state-dependent rheology. A paper is in preparation (D101 and also D97 in WP6.1). Deviation from the workplan: Interaction with UPMC concerning D89 is more demanding than originally thought. Interaction on D87 delayed due to replacement of participant UIB with UGOE. Cooperation of information between partners: data and information exchanged with IMOR, UPMC, UNIVTS-DST, GFZ and UGOE.

## 1.3 Milestones and deliverables obtained

List of deliverables expected during the first 18 months and how they have been fulfilled:

D 1	Kick-off meeting for the project, minutes	M01 Re RE	<b>Finalized M01 Re RE</b>
D 2	Project website, internal, external	M03 Re PU	<b>Finalized M01 Re PU</b>
D 3	Brief progress report	M06 Re RE	<b>Finalized M06 Re RE</b>
D 4	First annual scientific report, including edited report and cost statements	M12 Re PU	<b>Finalized by current report M12 Re PU</b>
D 5	Brief progress report	M18 Re RE	
D 7	Sessions at regular project meetings	M01 Re RE	<b>Finalized M01 Re PU</b>
D 8	Sessions at regular project meetings	M10 Re RE	<b>Finalized M12 Re PU</b>
D 9	A special report describing various patterns observed by the different methods	M16 Re PU	<b>Delayed to M22</b>
D 13	Application of PCA to SIL-data, emphasizing computational statistics	M10 Re PU	<b>Finalized M12 Re RE</b>
D 14	Application of PCA to SIL-data, emphasizing computational statistics	M12 Re PU	<b>Finalized M12 Re RE</b>
D 18	Changes of seismicity rate	M12 Re PU	<b>Finalized by manuscript to submit M12 Re RE. Takes also partly to D19</b>
D 20	Three-dimensional displacement field in a time-period prior to the June 2000 earthquakes	M12 Re PU	<b>Finalized M12 Re RE</b>
D 21	Strain-field in the pre-seismic period	M12 Re PU	<b>Finalized M12 Re RE</b>
D 22	Strain-field in the pre-seismic period, evaluation of earthquake precursors	M18 Re PU	<b>Partly finalized M18 Re PU</b>
D 23	Estimates of the stress tensor in the SISZ during 1991 through 2001	M12 Re PU	<b>Finalized M12 Re RE</b>
D 24	SAG analysis in the SISZ during 1991 through 2001	M12 Re PU	<b>Finalized M12 Re RE</b>
D 25	Estimates of the stress regimes in the SISZ during the last 2-3 million years	M12 Re PU	<b>Finalized M12 Re RE</b>
D 26	Results from statistical analysis of source parameters of the earthquakes in the SISZ during 1991 through 2001	M12 Re PU	<b>Finalized M12 Re RE</b>
D 28	Plots of stress variations before earthquakes and volcanic eruptions	M12/24 Re PU	<b>Delivered to end user M08, M10, M11 Re PU</b>
D 29	Stress-forecasts of impending large earthquakes issued to IMOR	Re CO	<b>Delivered to IMOR, Re CO</b>
D 30	Report on stress changes estimates by SWS since 1996	M12 Re PU	<b>Finalized M12 Re RE</b>
D 31	Reports in collaboration with other partners of imaging stress variations	M12/24 Re PU	<b>Finalized M12 Re RE</b>
D 32	Reports on progress of ANN measurements of shear-wave splitting	M12 Re PU	<b>Finalized M12 Re RE</b>
D 33	Reports on experience of selecting training sets for ANN	M12 Re PU	<b>Finalized M12 Re RE</b>
D 36	Sessions at project meetings	M01 Re RE	<b>Finalized M01 Re PU</b>
D 37	Sessions at project meetings	M10 Re RE	<b>Finalized M12 Re PU</b>
D 42	Detailed documentation of the foreshock activity prior to the six largest earthquakes in Iceland during the last 10 years	M15 Re PU	<b>Delayed to M21</b>
D 43	New short-term warning algorithms will be introduced in the Early warning and information system for testing, during the project time	M15 O PU	<b>Delayed to M21</b>
D 44	An article describing the foreshock character, the statistical significance and relation to the various source information	M15 Re PU	<b>Delayed to M21</b>
D 47	Time series of radon at all radon stations in South Iceland since 1977	M12 Re PU	<b>Finalized M11 Re PU</b>

D 48	Presentation of the radon results at international meetings	M12 Re PU	<b>Finalized M12 Re PU</b>
D 49	Paper in a refereed journal on the radon anomalies identified	M20 Re PU	<b>Finalized M18 Re PU</b>
D 51	Sessions at regular project meetings	M01 Re RE	<b>Finalized M01 Re PU</b>
D 52	Sessions at regular project meetings	M10 Re RE	<b>Finalized M12 Re PU</b>
D 56	A point-source moment tensor solution and source-time function for the earthquakes of June 17 and June 21, 2000	M03 Re PU	<b>Delayed to M27</b>
D 57	Article on the fault dimensions and finer details of possible subfaults, as outlined by the microearthquake distribution. Post-seismic slip-direction as a function of location on the two main faults	M18 Re PU	<b>Delayed to M30</b>
D 58	Preliminary slip model of rupture on the fault of the first earthquake	M08 Re PU	<b>Finalized M08 Re RE</b>
D 59	Best slip model of rupture on the fault of the first earthquake.	M12 Re PU	<b>Finalized M18 Re PU</b>
D 60	Inversion for slip related to the second earthquake	M14 Re PU	<b>Delayed to M24</b>
D 61	Estimated acceleration field in selected localities for first event	M14 Re PU	<b>Finalized M12 Re RE</b>
D 62	Preliminary slip model of rupture on the fault of the second event	M18 Re PU	<b>Finalized M12 Re RE</b>
D 65	Map of surface fractures in the eastern source area.	M06 Re PU	<b>Finalized M06 Re RE</b> <b>Finalized M12 PU</b>
D 66	Map of faulting during the June 2000 events	M06 Re PU	<b>Finalized M06 Re PU</b> <b>Finalized M10 Re PU</b> <b>(paper accepted by Tectonophysics)</b>
D 67	Input into the general modelling of the June 2000 events	M06 Re PU	<b>Finalized M06 Re PU</b> <b>Input into published articles</b>
D 68	Map of fractures in the western source area	M12 Re PU	<b>Finalized M12 Re PU</b> <b>(for risk information)</b>
D 69	Presentations of results at international meetings	M12 Re PU	<b>Finalized M10 Re PU</b>
D 71	Three-dimensional co-seismic displacement field for June 17 and June 21, 2000 earthquakes	M06 Re PU	<b>Finalized M06 Re PU</b>
D 72	Deformation model for the earthquakes	M18 Re PU	<b>Finalized M18 Re PU</b>
D 74	Sessions during project meetings	M01 Re RE	<b>Finalized M01 Re PU</b>
D 75	Sessions during project meetings	M10 Re RE	<b>Finalized M12 Re PU</b>
D 79	Catalog of relocated earthquakes	M18 Re PU	<b>Delayed to M20</b>
D 83	Attenuation of strong ground motion of the large earthquakes	M12 Re PU	<b>Finalized M12 Re PU</b>
D 84	Near source effects, duration of ground shaking and soil amplifications	M18 Re PU	<b>Finalized M18 Re PU</b>
D 87	Results from ongoing analytical and numerical modelling	M12 Re PU	<b>Finalized M12 Re RE</b>
D 91	Sessions at project meetings	M01 Re RE	<b>Finalized M01 Re PU</b>
D 92	Sessions at project meetings	M10 Re RE	<b>Finalized M12 Re PU</b>
D 96	Inelastic model for the earthquake series ( $M \geq 6$ ) in the SISZ since 1706	M12 Re PU	<b>Partly finalized M12 Re PU (Oral meeting report M11, Mid-term report M12)</b>
D 98	Original mathematical solutions for crack models in trans-tensional environment	M06 Re PU	<b>Finalized M06 Re PU</b>
D 99	Crack models in viscoelastic media	M09 Re PU	<b>Finalized M18 Re PU</b>
D100	Crack model in poroelastic (12m) media	M12 Re PU	<b>Finalized M12 Re RE</b>

## **1.4 Deviations from the work plan or/and time schedule and their impact to the project**

For scientific and operational reasons it was considered necessary to apply for a six months extension for finalizing the project as a whole. The reasons for this are detailed in Chapter 1.2. A great majority of scheduled deliverables have so far been delivered on time as seen in Chapter 1.3. However, there have been some delays in key areas which will delay the work in WPs 2, 3, 4, 5, 6 where all the multidisciplinary results are merged together in tool directly applicable in earthquake watching and in efforts for mitigating earthquake risk. It is necessary to have some time for the consortium to evaluate the multidisciplinary results into well based warning tools.

## **1.5 Communication between partners**

The second year of PREPARED was kicked off by the PREPARED mid-term meeting in Reykjavík, January 30-31, 2004, and by smaller meetings between partners before and after the main meeting. All the WPs of the project are carried out through a cooperation of two or more partners. Communication between them is of course intensive through e-mail and on basis of information on the PREPARED website. Among special meeting between partners those can be mentioned: Ragnar Stefánsson visited scientists in Uppsala on February 26 to March 3, for discussing and working together on WP2 and WP3. During the EGU 2004 in Nice, France, on April 26-30, a meeting was arranged between participants attending the conference.

## **1.6 Difficulties encountered at management and coordination level and proposed/applied solutions**

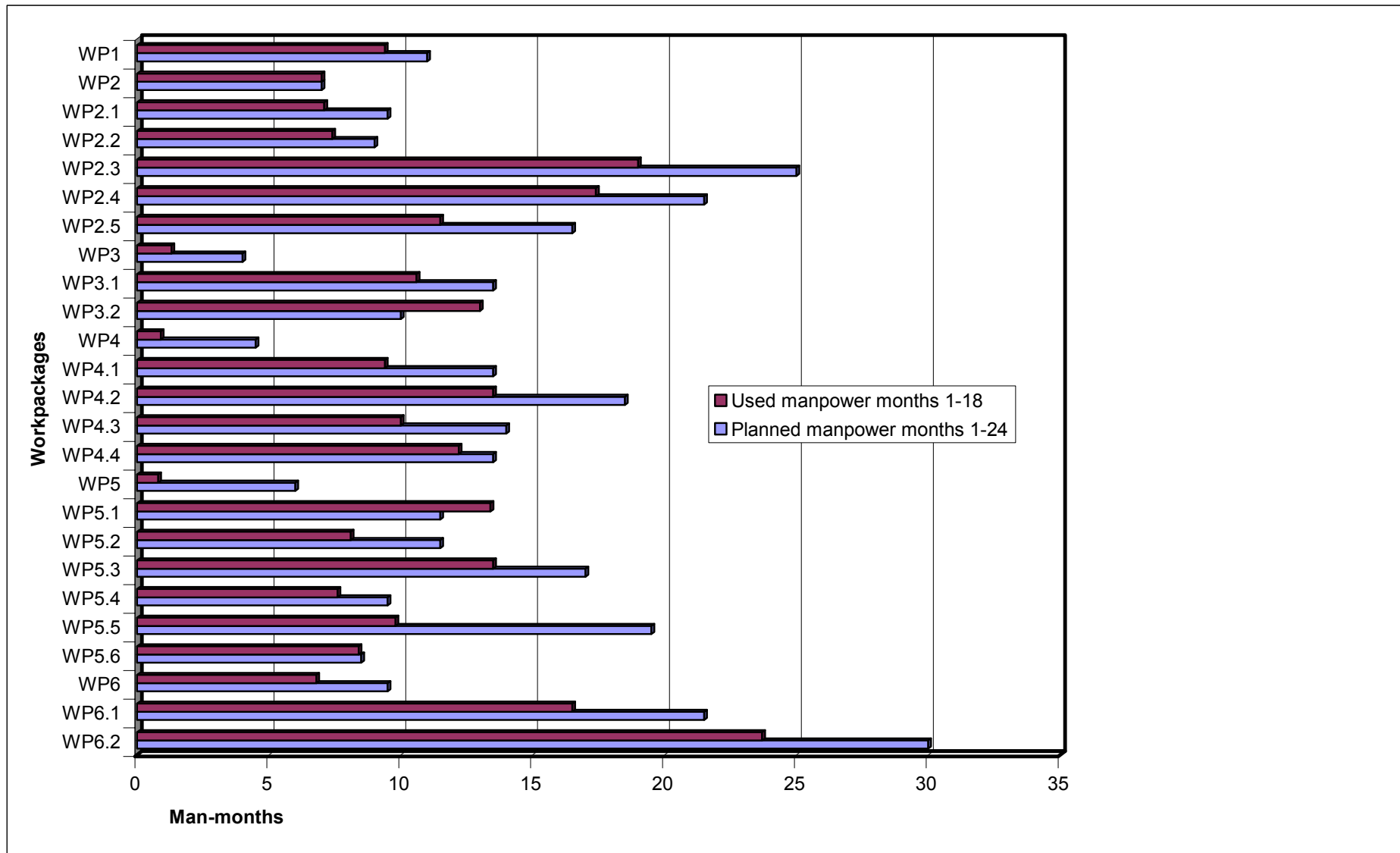
As was detailed in the 12 months Management and resource usage summary some problems arose related to the transfer of Águst Guðmundsson from his professorship at UIB to become a professor at the UGOE early in the first year of PREPARED. Ágúst leads WP5.5. Because of uncertainty of funding until decisions were taken in solving this ambiguity the most costly parts of this WP were delayed, waiting for a solution. The result was that UGOE is a formal contractor in the project from February 1, 2004. Nothing was paid by the commission for work of Gudmundsson or UGOE which was carried out before this date. This is one of the reasons for the application for a 6 months extension of the PREPARED project.

Workpackage number and name	Month																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
WP 1 Coordination.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 2 Analysis of trends in geophysical data approaching June 2000 earthquakes.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 2.1 Pattern search in multiparameter seismic data, PCA.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 2.2 Analysis of seismic catalogue, homogeneity, quiescence, b-values.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 2.3 Long-term deformation based mainly on GPS, InSAR and strain.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 2.4 Stress changes based on microearthquake sources and from geology.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 2.5 Shear-wave splitting above small earthquakes to monitor stress changes.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 3 Short-term changes before large earthquakes, short-term warning algorithms.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 3.1 Foreshocks. Detailed study and development of new warning algorithms.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 3.2 Radon anomalies. Detailed study and development of warning algorithms.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 4 Detailed model of the two large earthquakes. A group work.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 4.1 Focal mechanism, based on teleseismic and microearthquake information.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 4.2 Inversion of near field strong motion data. Slip distribution.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 4.3 Interpretation of surface fractures related to the two large earthquakes.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 4.4 Deformation associated with the two large earthquakes, GPS, InSAR, strain.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 5 New methods for improving assessment earthquake effects. A group work.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 5.1 Detailed mapping of distant faults by microearthquakes.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 5.2 Detailed geological mapping of surface effects in a large area.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 5.3 Study of the strong motion records, intensities, from the large earthquakes.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 5.4 Reevaluations of historical earthquakes in light of the new observations.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 5.5 Hydrological changes in a large area related to the earthquakes.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 5.6 Analysis of paleo-stress fields and mechanism.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 6 Integration of the modelling work. A new general model.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 6.1 Model stress changes in Iceland based on historical activity.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
WP 6.2 Model stress in the solid matrix and pressures in fluids permeating the crust.	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red

**Table 1.** Timetable for the first 18 months of the project. For each WP the red boxes show planned efforts and the yellow ones executed efforts.

Workpackage number	IMOR		UU		UEDIN		NVI		UGOE		SIUI		UPMC		DF.UNIBO		GFZ POTSDAM		CNRS-UMR 5562		UNIVTS-DST		CAU		WAPMERR		UI		
		%		%		%		%		%		%		%		%		%		%		%		%		%		%	
WP1	11	85																											
WP2	2,5	230	0,5	10	1	10	1	10															1	50	1	50			
WP2.1																							9,5	75	9	80			
WP2.2																													
WP2.3							21	70											4	100									
WP2.4			21	80									0,5	60															
WP2.5	1,5	0			15	75																							
WP3	2,5	45	0,5	10							1	10																	
WP3.1	1	0	12,5	85																									
WP3.2											10	130																	
WP4	2,5	25					0,5	20			1	10									0,5	10							
WP4.1	13	70	0,5	0																									
WP4.2	1	0																				15	80			2,5	60		
WP4.3							1	100			13	70																	
WP4.4	1	5					11	100			0,5	20							1	100									
WP5	2,5	10					0,5	10	1	10			1	30							0,5	20				0,5	10		
WP5.1	11,5	115																											
WP5.2	0,5	10					11	75																					
WP5.3	1	0																								16	85		
WP5.4	8,5	90																								1	0		
WP5.5									17	50			0,5	50	2	50													
WP5.6													7,5	95	1	100													
WP6	2	10									1,5	10			4	75	1	300	1	50									
WP6.1															2	75	15,5	85	4	50									
WP6.2															29	80			1	0									
Total	62	80	35	80	16	70	46	75	18	50	27	85	9,5	85	38	80	16,5	95	11	70	16	75	10,5	70	10	75	20	75	

**Table 2.** Planned and used manpower: The yellow columns show planned manpower for months 1-24 (both permanent and temporary) for each partner in individual WPs in man-months. The green columns show the used manpower in each case for months 1-18 as percentage of the planned one.



**Table 3.** Planned and used manpower (both permanent and temporary) in each WP.