IRIS Working Document WD-213

Date: July 2010

IRIS Demonstration 2011 in Hungary V2 (July 2010)

Introduction:

A major demonstration on regional scale is planned for October 2011 in Hungary organized by the civil protection partner DTCDM with the help of the entire IRIS Consortium. The anticipated date is:

17. – 20. October 2011

A multiple crisis situation will be simulated and the neighbouring countries will be invited to join the exercise. The demonstration will function at a calibration for the IRIS development on society level.

Due to the large size of the exercise and the extent of data collection other projects will be invited to join. This particular applies to the iNTeg-Risk Project, which has already expressed interest in this collaboration. International participation all over the world will be invited.

Crisis Scenario:

A powerful earthquake (M 6,5) happened in Central Hungary which caused substantial damage to the countries infrastructure. The following hazards will be considered:

- An accident in the nuclear power plant Paks
- The collapse of an important bridge across the Danube
- An accident in a chemical plant
- Damage to housing on various scale
- Disruption of critical infrastructure

Detail preparation steps have been started with the Hungarian Civil Protection Authority in 2010 to allow sufficient time for data collection and management.

Methodology

Proper mitigation of damages following disastrous events highly depends on the available information and the quick and proper assessment of the situation. The framework for the IRIS demonstration 2011 comprises a large civil protection exercise based on innovative information collection and risk assessment. The civil protection exercise will react on the information received from the IRIS decision support system.

A comprehensive model of the area will be established. Every element to be assessed will be separately modeled based on the available data. The selection whether an entire structure or a small element of a structure represents one node has to be done based on the facts that every node requires a detailed data set. Data will be collected from the respective authorities and, if not available, created by field survey teams. The entire data sets will be managed by a GIS program. A simulation based on the MAEViz software will be performed. It allows setting an earthquake scenario and computing the consequences. The output is a map showing the expected extent of damage to the constructed infrastructure. With this information priorities for the civil protection forces can be set.

In an update phase fresh satellite images will be received showing the actual situation as seen from space. Several teams will simulate damage scenarios which should be detected on the satellite images. This updated information will create an updated emergency plan for the civil protection forces.

For the calibration of the simulation the triggering event will be simulated by an explosion. The emitted waves will be recorded by strong motion stations. The data will be evaluated and the model can be calibrated based on that. This particularly concerns the attenuation law applied (i.e. Ambraseys) between the epicenter of the earthquake and the position of the effected structures.

The model would then be fit for future assessment tasks.

Scientific Objectives

A major number of innovations will be applied in this demonstration. The purpose of large European Collaboration Projects is to provide a proof of concept. Innovative approaches shall be tested under realistic conditions and the experience made shall be considered in the subsequent development steps.

The proof of concept shall be made for the following IRIS innovations:

- Identification of the hazard using remote sensing technologies (WP7)
- Feasibility of the simulation of a large area with thousands of nodes (WP3)
- The computation of a damage scenario after a simulated event (WP8)
- Relevance for the Nuclear Power industry (WP1)
- Relevance for the Chemical industry (WP2)
- Relevance for the management of the constructed infrastructure (WP3)
- Eventual link to dam safety (WP4 in collaboration with Romanian partners)
- Check of the plausibility of the results
- Proof that the enhanced information is useful for the civil protection management
- Proof that the rapid eye space technology works on demand
- Proof that updated information can be usefully managed to improve the civil protection management
- Proof of the underlying attenuation relationships through synchronous measurement
- Proof that condition rating can be done within reasonable time after an event allowing quick re-opening and use of structures (i.e. bridges)
- Assessment of the usefulness of the applied technologies in the civil protection frameworks

Application of the IRIS Technologies

The applied technologies comprise **hazard** as well as **vulnerability** and **impact** which are the main risk decisive elements. Within each of these elements IRIS technologies will be allied.

Hazard Technologies

The following IRIS developments will be demonstrated:

Source identification by remote sensing technologies (refer WD-175)

This technology will identify the most probable locations for a relevant earthquake. The identified lineaments will be combined with the historic table of earthquakes. A correlation to the Hungarian hazard map will be made.

The use of rapid eye satellite images (refer WD-164 and WD-206)

This technology will provide updated information on the area each day after the event. Damages will be simulated and the images should identify them.

The use of additional information like aerial images from aircrafts for the update of the damage scenario

An offer has been made by the iNTeg-Risk project to apply their remote aircraft sensing technology where a given flight path is documented at various time slots. Changes in the environment shall be found by that. This technology should also be able to detect the simulated damages.

The application of case based reasoning systems for quick assessment (refer WD-203)

The case based reasoning system shall help to compute the large number of nodes and to limit the datasets required for assessment. Only representative data will be collected (for cost and time reasons) and they will be applied to the rest of the structures by this technology.

The calibration of the attenuation from monitoring results

The attenuation law used in the simulation is a standard equation. By monitoring the real wave speed and form this equation can be made fit for the local condition. This means that a methodology correctly applicable for Hungary will be available.

Vulnerability Technologies

The following IRIS developments will be demonstrated:

The VCLife Technology for bridges (refer WD-149)

This technology allows assessing the structural integrity of bridges using monitoring results from ambient vibration. Results after an event will be compared to pre-event results giving the differences (eventual loss of capacity) which can be computed to a remaining lifetime.

The IRIS lifecycle model for the constructed infrastructure (refer WD-151)

Every element of simulation (node) will be equipped with a theoretical lifecycle model. This means that changes over time (i.e. after an event) can be computed for every node separately. This technology allows computing various earthquake scenarios and comparing the respective results. Results will be available 30 minutes after the event and can be shown in a map for civil protection management.

The IRIS aftershock assessment routines (refer WD-158)

To show the safety of industrial facilities special tailored routines are applied to show that it is safe to use them. These routines are tailored for each industry separately (in our case this concerns the nuclear power industry, the chemical industry and the construction industry).

The IRIS lifecycle methodology and durability analysis (refer WD-187)

The lifecycle methodology can also be applied in a generalized way not only for entire structures but also for components. The durability of them is computed and the remaining lifetime expectation can be found. This methodology will be made fit for the industries participating in the exercise.

The IRIS risk paradigm definition (refer WD-200)

The new IRIS risk paradigm is a generic definition of risk in probabilistic manor. It allows assessing also cases where deterministic approaches fail. They are not directly used for the civil protection exercise but a basis for the assessment of their facilities in industry after an event.

Impact Technologies

The following IRIS developments will be demonstrated:

The monitoring quantification of the impact after lifecycle assessment

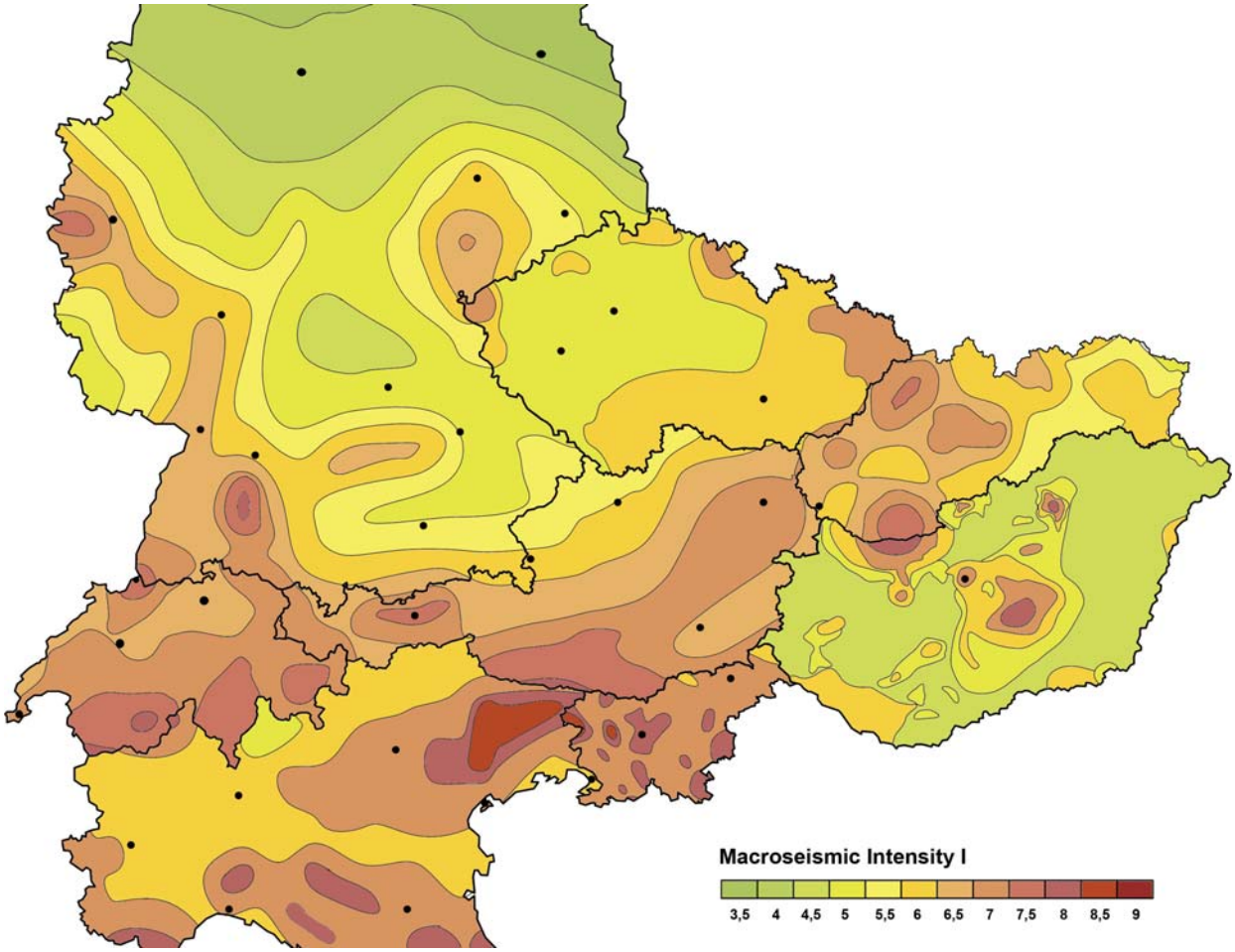
This technology shall give the basis for a quantification of damage which is to be used for further lifecycle assessment and decision making on retrofit or reconstruction. Furthermore this technology comprises the computation of losses of material and in material goods.

The IRIS Risk Governance Strategy (refer WD-172)

The new IRIS risk governance strategy will allow systematic widening of the approach to other industries and applications. It will be complimented by a standard data acquisition set that allows bringing in other facilities and infrastructures into the model.

Details are to be found in the respective documents.

Seismic Situation in Hungary



Application of IRIS Technology:

The following developments in the IRIS project shall be tested at this occasion:

- Fast online risk estimation based on the signals received. This comprises priority of civil defence and emergency action on regional scale
- Identification and assessment on the magnitude of the hazard
- Fast track observation on the scenario development
- Rapid assessment of the remaining bridge infrastructure
- Implementation of an emergency traffic plan (load limits, Detours, etc.)
- Decision making on eventual shut-down of a toxic chemical plant
- Coordination of the civil protection and emergency works
- Post-disaster learning exercise

This plan is a preliminary idea which has to be checked on feasibility with the local authorities.

Regional Scale:

It is anticipated that cross boarder information will be exchanged at this occasion. As a minimum, Austria will be engaged by partner VCE, and Romania to the eastside by partner ICEMENERG. The other neighbouring countries which do not have an IRIS partner are Slovakia (important), Ukraine, Serbia and Slovenia. Contacts will be made to generate interest and participation.

Schedule:

The Coordination Team of VCE and DTCDM have drafted a preliminary concept (WD-141) for the Executive Board Meeting in March 2010. A decision to step into this exercise has been made.

A 2 day meeting has been performed in Paks and Szekszard on 1st and 2nd of July 2010. In this meeting the IRIS conception has been explained and the data gathering together with the Hungarian partners has been discussed. Meetings with the authorities of the nuclear power plant, the county of Tolna and the city hall of Szekszard have been held in order to secure support from the official representatives. This support has been anonymously granted to the Project.

It has been agreed that a number of further meetings will be required. The following schedule has been confirmed:

- VCE will work out a draft V2 in July 2011
- A final discussion on this draft will be made during the IRIS Summer Academy on September 13 – 15 2010
- Collection of field data will immediately start after that in the area
- The demonstration shall be scheduled in October 2011 (tentatively 17. – 20.10.2011)

This schedule is to be further refined. A next version of this concept shall be issued after the Summer Academy in September 2010.

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