

	EUROPEAN COMMISSION RESEARCH AND INNOVATION DG	Periodic Report
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Project No: 263506

Project Acronym: AFFECTS

Project Full Name: Advanced Forecast For Ensuring
Communications Through Space

Periodic Report

Period covered: from 01/03/2012 to 28/02/2013

Start date of project: 01/03/2011

Project coordinator name:
Dr. Volker Bothmer

Version: 1

Date of preparation: 18/01/2013

Date of submission (SESAM): 29/04/2013

Project coordinator organisation name:
GEORG-AUGUST-UNIVERSITAET GOETTINGEN
STIFTUNG OEFFENTLICHEN RECHTS

Periodic Report

PROJECT PERIODIC REPORT

Grant Agreement number:	263506
Project acronym:	AFFECTS
Project title:	Advanced Forecast For Ensuring Communications Through Space
Funding Scheme:	FP7-CP
Date of latest version of Annex I against which the assessment will be made:	09/02/2011
Period number:	2nd
Period covered - start date:	01/03/2012
Period covered - end date:	28/02/2013
Name of the scientific representative of the project's coordinator and organisation:	Dr. Volker Bothmer GEORG-AUGUST-UNIVERSITAET GOETTINGEN STIFTUNG OEFFENTLICHEN RECHTS
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Project website address:	www.affects-fp7.eu

Declaration by the scientific representative of the project coordinator (1)

I, Dr. Volker Bothmer GEORG-AUGUST-UNIVERSITAET GOETTINGEN STIFTUNG OEFFENTLICHEN RECHTS , as scientific representative of the coordinator of the project AFFECTS and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

The project has fully achieved its objectives and technical goals for the period.

The attached periodic report represents an accurate description of the work carried out in this project for this reporting period.

The public website is up to date.

To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 6) and if applicable with the certificate on financial statement.

All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 5 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

Name	Dr. Volker Bothmer GEORG-AUGUST-UNIVERSITAET GOETTINGEN STIFTUNG OEFFENTLICHEN RECHTS
Date	29/04/2013

This declaration was visaed electronically by Volker BOTHMER (ECAS user name nbothmvo) on 29/04/2013

1. Publishable summary

Summary description of project context and objectives

Solar storms are a consequence of sudden eruptions of magnetised gas in the Sun's outer atmosphere. Often such storms start with a sudden release of electromagnetic energy lasting for some minutes, accompanied by an eruption of a giant cloud of magnetised plasma – a coronal mass ejection (CME). The fastest of these “space hurricanes” are accelerated to speeds of ten million kilometres per hour and, if heading in the direction of Earth, reach our home planet at a distance of 150 million km in less than a day. Figure 1 provides a generic sketch of the phenomenon.

The impact of the coronal mass ejection on the Earth's magnetosphere causes a geomagnetic storm if the magnetic field of the coronal mass ejection is oriented antiparallel to the direction of the Earth magnetic field. Through the reconnection of the magnetic fields large-scale current systems are driven in the Earth magnetosphere causing severe space weather: Polar lights become visible even at equatorial latitudes, astronauts and airline crews and passengers become exposed to enhanced radiation doses in form of energetic particles up to GeV energies, satellites in low Earth orbit experience enhanced orbital drag and can loose hundred of meters in height, navigation and telecommunication systems are affected or may be even become completely disrupted locally, power grid transformers can be severely damaged causing power outages, such as in Quebec 1989 or in Malmö 2003. For an overview on the subject the reader is referred to the book “Space Weather – Physics and Effects” by Bothmer and Daglis (eds., Springer/Praxis, 2007).

Solar activity affects the entire Earth environment from the magnetosphere down to the ionosphere, and even to the lower atmosphere climate system. The natural hazards of space weather do not only modify the atmosphere. They also have the potential to catastrophically disrupt the operations of many technological systems, such as communication systems and power grids on Earth. Figure 2 summarises the different effects of space weather on the Earth's environment. Hence the impact of space weather for people's lives and jobs is very real, and as we approach solar maximum around end of 2012, such risks increase. In the AFFECTS project, European and US scientists are developing an advanced prototype space weather warning system to help mitigate space weather effects on the operation of telecommunication and navigation systems. The following institutions and enterprises in Germany, Belgium, Norway, Ukraine and the United States are collaborating in the AFFECTS project coordinated by the University of Göttingen, Germany:

- Institute for Astrophysics, Georg-August-University Göttingen, Germany (Project Coordination)
- Solar Influences Data Analysis Center, Royal Observatory of Belgium, Brussels, Belgium
- Space Research Institute of National Academy of Sciences of Ukraine and National Space Agency of Ukraine, Kyiv, Ukraine
- Fraunhofer Institute for Physical Measurement Techniques Freiburg, Germany
- Tromsø Geophysical Observatory, University of Tromsø, Norway
- Institute of Communications and Navigation, German Aerospace Center Neustrelitz, Germany
- Astrium GmbH Friedrichshafen, Germany
- NOAA Space Weather Prediction Center, Boulder, U.S.A., as AFFECTS EU-U.S. research collaborator
- Planetarium Hamburg, Hamburg, Germany, as AFFECTS public outreach centre

Description of work performed and main results

Based on state-of-the-art analysis and modeling of the Sun-Earth chain of effects on the Earth's ionosphere and their subsequent impacts on communication and navigation systems provided by multipoint space observations and complementary ground-based data reliable space weather forecast services have been developed. The developed space weather models facilitating the forecast allow the analysis of a solar storm in near real-time and prediction of its arrival time and potential impact at Earth half a day to several days in advance.

Expected final results and potential impacts

AFFECTS will establish an early space weather warning system providing alerts for perturbed conditions and developed services for forecasting quantitatively space weather parameters, such as the geomagnetic indices and perturbed TEC (total electron content). A Forecast System Ionosphere (FSI) will provide specific forecasts of expected ionospheric perturbations for end users to help

mitigate communication and navigation disruptions caused by space weather effects. AFFECTS will provide Europe with the first advanced early warning and space weather forecast system to help European citizens mitigating the impact on its modern technology.

Project public website address:

www.affects-fp7.eu

2. Core of the report

Project objectives, Work progress and achievements, and project management during the period

The Project Summary Pdf document contains the core of the report.

3. Deliverables and milestones tables

Deliverables (excluding the periodic and final reports)										
Del. no.	Deliverable name	Version	WP no.	Lead beneficiary	Nature	Dissemination level	Delivery date from Annex I (proj month)	Actual / Forecast delivery date	Status	Comments
1	Definition of internal document templates	1.0	GEORG-AUGUST-UNIVERSITAET	GOETTINGEN STIFTUNG OEFFENTLICHEN RECHTS	Report	CO	3	17/02/2012	Submitted	
2	Kick-Off Meeting documentation	2.0	GEORG-AUGUST-UNIVERSITAET	GOETTINGEN STIFTUNG OEFFENTLICHEN RECHTS	Report	PU	6	31/07/2012	Submitted	
3	Provision of online Wiki-Interface	1.0	GEORG-AUGUST-UNIVERSITAET	GOETTINGEN STIFTUNG OEFFENTLICHEN RECHTS	Report	PU	6	17/02/2012	Submitted	
4	Report on formation of Steering Committee, Advisory Board and UIRT	2.0	GEORG-AUGUST-UNIVERSITAET	GOETTINGEN STIFTUNG OEFFENTLICHEN RECHTS	Report	PU	10	31/07/2012	Submitted	
1	Provision of a dedicated Web-Interface for EUV data	2.0	2	KONINKLIJKE STERRENWACHT VAN BELGIE	Report	PU	10	31/07/2012	Submitted	
2	Online provision of solar activity proxies and solar activity data base	1.0	2	KONINKLIJKE STERRENWACHT VAN BELGIE	Report	PU	24	28/02/2013	Submitted	
3	Online provision of SEPS EUV and plasma data	0.0	FRAUNHOFER-GESELLSCHAFT	ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V	Report	PU	36	28/02/2014	Not submitted	
4	Online provision of L1 so	2.0	2	DEUTSCHES	Report	PU	3	31/07/2012	Submitted	

	lar wind, geomagnetic indices data base			ZENTRUM FUER LUFT - UND RAUMFAHRT EV						
5	Provision of a Web-interface for AE activity monitor and local indices data base	2.0	2	UNIVERSITETET I TROMSOE	Report	PU	6	31/07/2012	Submitted	
6	Online provision of GNSS based ionospheric data base	1.0	2	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	Report	PU	10	19/04/2012	Submitted	
7	SPIS model	1.0	2	ASTRIUM GMBH	Report	PU	24	28/02/2013	Submitted	It is proposed to rename the deliverable to "Analytical Model for SEPS sensor", which is more specific than the original title. A detailed explanation of this proposition can be found in the corresponding deliverable report.
1	Provision of online operational integration of software packages in full operational chain	0.0	3	KONINKLIJKE STERRENWACHT VAN BELGIE	Report	CO	33	30/11/2013	Not submitted	
2	Provision of layout for a n early warning system for GNSS users	1.0	3	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	Report	PU	10	19/04/2012	Submitted	
3	Provision of final version of Early Warning System	1.0	3	KONINKLIJKE STERRENWACHT VAN BELGIE	Report	CO	18	31/08/2012	Submitted	
4	Report on Quality Control and User Feedback	1.0	3	KONINKLIJKE STERRENWACHT VAN BELGIE	Report	PU	24	28/02/2013	Submitted	

1	Provision of software tool for forecasting indices	2.0	4	##### ##### ##### ##### ##### ##### ##### ##### ##### #####	Report	PU	18	31/08/2012	Submitted	
2	Report on solar EUV characteristics	1.0	4	FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V	Report	CO	18	31/08/2012	Submitted	
3	Online provision of auroral alert and tracking system	1.0	4	UNIVERSITETET I TROMSOE	Demonstrator	PU	18	31/08/2012	Submitted	
4	Provision of software tool for forecasting perturbed TEC	1.0	4	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	Report	CO	18	31/08/2012	Submitted	
1	System architecture document	1.0	5	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	Report	PU	8	20/04/2012	Submitted	
2	Report on product generation test	0.0	5	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	Report	CO	26	30/04/2013	Not submitted	
3	Report on quality control checks	0.0	5	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	Report	PU	30	31/08/2013	Not submitted	

4	Report on overall functionality test	0.0	5	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	Report	PU	32	31/10/2013	Not submitted	
5	Establishment of continuous online operation system at DLR/SWACI	0.0	5	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	Report	PU	32	31/10/2013	Not submitted	
1	Establishment of continuous online operation system at ROB/RWC	0.0	6	KONINKLIJKE STERRENWACHT VAN BELGIE	Report	PU	32	31/10/2013	Not submitted	
2	International user workshop documentation	1.0	6	KONINKLIJKE STERRENWACHT VAN BELGIE	Report	PU	24	28/02/2013	Submitted	
3	Report on User Workshop R results	0.0	6	KONINKLIJKE STERRENWACHT VAN BELGIE	Report	PU	30	31/08/2013	Not submitted	
4	Report on Long-Term Product Sustainability	0.0	6	KONINKLIJKE STERRENWACHT VAN BELGIE	Report	PU	34	31/12/2013	Not submitted	
5	Space Weather Multimedia Show	0.0	GEORG-AUGUST-UNIVERSITAET	GOETTINGEN STIFTUNG OEFFENTLICHEN RECHTS	Other	PU	34	31/12/2013	Not submitted	
6	AFFECTS Space Weather Mobile Phone App	0.0	GEORG-AUGUST-UNIVERSITAET	GOETTINGEN STIFTUNG OEFFENTLICHEN RECHTS	Other	PU	34	31/12/2013	Not submitted	

Milestones

Milestone no.	Milestone name	Work package no	Lead beneficiary	Delivery date from Annex I	Achieved Yes/No	Actual / Forecast achievement date	Comments
1	Dedicated	2	ROB	31/12/2011	Yes	31/12/2011	

	Web-Interface for EUV data						
2	Provision of GNSS based ionospheric data	2	DLR	31/12/2011	Yes	31/12/2011	
3	Completion of final version of operational chain and transit to operation	3	ROB	31/10/2012	Yes	31/10/2012	
4	Empirical TEC forecast model	4	DLR	31/10/2012	Yes	31/10/2012	

4. Explanation of the use of the resources

The **explanation on the use of resources** was removed from the scientific periodic reports in SESAM. These details now have to be entered in the cost statement forms in FORCE instead.

Attachments	Periodic report_AFFECTS_year2_30042013.pdf
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Name of the scientific representative of the project's coordinator and organisation:	Dr. Volker Bothmer GEORG-AUGUST-UNIVERSITAET GOETTINGEN STIFTUNG OEFFENTLICHEN RECHTS
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This declaration was visaed electronically by Volker BOTHMER (ECAS user name nbothmvo) on 29/04/2013