

DRAGON IN SUPPORT TO HARMONIZING EUROPEAN AND CHINESE MARINE MONITORING FOR ENVIRONMENT AND SECURITY

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with support from the remaining DRAGONESS project team**

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ABSTRACT

The DRAGONESS project will assess and establish an inventory of European and Chinese capacities in marine monitoring for environment and security. It capitalizes on achievement from recently completed and ongoing projects undertaken in Europe and in Peoples Republic of China. Notably this include the joint European Space Agency (ESA) and the Ministry of Science and Technology (MOST)/National Remote Sensing Center of China (NRSCC) Dragon program, the outcome of the European Union (EU) Framework Program (FP5) Marine Environment and Security for the European Area (MERSEA) Strand-1 project, the ongoing EU FP6 MERSEA IP project, and the ESA Global Monitoring for Environment and Security (GMES) Service Element project MarCoast. DRAGONESS will in particular take stock of the definitions and implementation of the joint European Union (EU) and European Space Agency (ESA) GMES Marine Core Services and Downstream Services. Likewise, it will take into account the inter-connection between GMES and the 2007 to 2009 work plan provided by the Group on Earth Observations (GEO).

1. INTRODUCTION

For the development of a global environmental monitoring system and information services it is of utmost importance to agree on common standards, harmonize methods, document the methods in form of protocols, as well as assess the performance under various conditions. Within the Dragon program, which was jointly established by ESA and MOST in April 2004, monitoring systems are studied, which are mainly based on Earth observing satellite data. The Dragon program sets the frame; it provides Earth observation data, training courses, support to young scientists and a forum for discussions. The scientific work has primarily to be based on complementary funds.

At the Dragon kick-off meeting in Xiamen, China in April 2004 the scientists working on the oceanography projects (Project ID 2566) and Climate and Ocean project (Project ID 2615) initiated a cooperation on the development of a project to complement the Dragon Programme. This was only possible thanks to the

network established through the ESA-MOST DRAGON initiative. In July 2005 a project proposal was submitted to the EC FP6, with the title "DRAGON in support to the development and integration of a Chinese marine monitoring for Environment and Security System - DRAGONESS". The project proposal was approved for funding by the European Commission in 2006, and after a long negotiation phase the kick off meeting was successfully held in Beijing in October 2007.

2. OBJECTIVES

The primary objective of the DRAGONESS project is to make an inventory of Chinese and European capacities in marine monitoring for environment and security. In so doing harmonization of methods and approaches in the frame of international programs such as GOOS, GEO and GMES will be considered.

The specific objectives of the proposal are:

- to assess current Chinese and European services and information products arising from integrated use of networks of remote-sensing, in-situ observations, models and data assimilation methods against the GEOSS requirements;
- to identify service/data gaps and barriers, such as for instance restrictive data dissemination and availability and re-use policies;
- to develop activities to disseminate and implement products and services derived or customized from existing development and operational activities;
- to study and identify the potential for existing and foreseen European GMES services (both funded through EU FP6 and ESA) to be transferred to P.R. of China and provide the building blocks for the EU contribution to the Chinese marine monitoring for environment and security, and hence to GEOSS;
- to stimulate exchange and initiation of new partnership in Earth Observation science and technology in support to global environmental monitoring by bringing together scientists from Europe and China.

The main result of the DRAGONESS project shall highlight strengths and weaknesses, identify gaps and

inconsistencies, and provide recommendations for a strategy to develop harmonized monitoring activities and system which meet the requirements of international standards and monitoring programs.

3. WORKPLAN

The duration of the DRAGONESS project is 36 months. It is divided into seven distinct work packages with the aim to assess the state-of-art and recommend further harmonization of European and Chinese capacity within marine and coastal monitoring for environment and security. The work packages include:

- WP0: Management and Coordination;
- WP1: Review and utilization of in-situ observing systems;
- WP2: Review and utilization of spaceborne observing systems;
- WP3: Review of level of data integration and information management;
- WP4: Review of ocean and coastal information products and services;
- WP5: Capacity building in view of gaps and eventual European capabilities;
- WP6: Workshop, Summer School and Symposium.

The work packages 1 to 4 are related to the four corners of the GMES diamond (clockwise from left; WP1, 4, 2 and 3), while the Capacity Building (WP5) will improve the core diamond of the illustration (Figure 1).

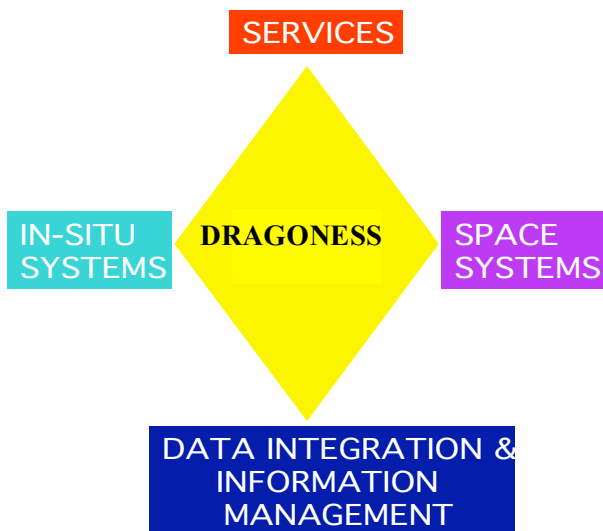


Figure 1. The DRAGONESS key work packages and functionalities emphasized in the context of the GMES diamond.

Integrated marine observing systems and numerical models are capable of producing a large range of information products of physical biological and chemical quantities. The reliability and utilization of

these types of information products depend not only upon the performance of the models and assimilation tools, but also on the availability and quality of the observing systems, telecommunication networks, data processing and distribution, data access, and rapid information integration, flow and services. It will in essence not perform better than the weakest link in the chain (or corners in the diamond shown in Figure 1).

The DRAGONESS project is moreover expected to identify major knowledge gaps and how they may be filled or gaining expertise by capacity building and effort in marine GMES as planned in WP 5. In this respect it is anticipated that new advanced knowledge and expertise evolving within both GODAE (2004-2008) and the MERSEA IP (2004-2008) as well as from the MyOcean project (under FP7) can support WP 5.

Specification of the strengths and weaknesses of existing oceanographic data assimilation methods and systems and their capacity to deliver harmonized and quality-controlled information and services to intermediate and downstream users (see Figure 2) will be based on:

- **Skill Assessment:** There is a need for systematic examinations of the performances of forecasting models, which quantify their dependence on the availability, timeliness and quality of measured ocean data from satellites and in-situ systems.
- **Downscaling:** The regional high resolution forecasting systems improve with systematic and reliable information on the open boundaries from global and basin scale systems.
- **Marine GMES:** The ocean monitoring and modeling system will not be adequate for several major applications (e.g. provision of high quality and accurate 3D current field for oil spill and pollution monitoring, search and rescue applications, boundary conditions for coastal models and their applications, etc) without a high-inclination altimeter to complement Jason-2 beyond 2007.
- **Coastal Models:** Coastal models are far from being developed and operated at the adequate resolution for applications to pollution monitoring from offshore installations, ships land sources. Moreover, the information flow from global and regional scale systems to the local coastal models have not been unified, quality controlled and nor have communication protocols been identified.
- **Ecosystem modelling:** There is a strong need to develop and advance the maturity of ecosystem modelling, in particular in the direction of species-specific properties, trophic interactions and a tighter coupling to biogeochemical cycles.

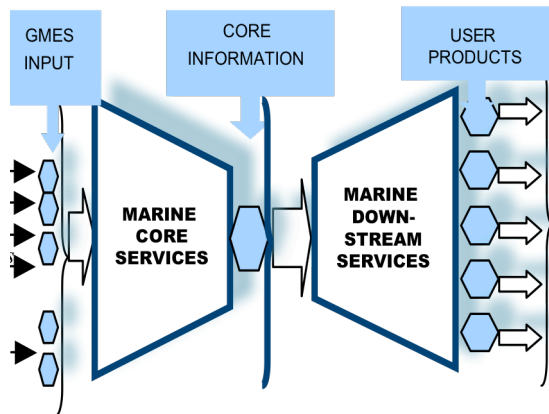


Figure 7.2. Illustration of the role of Marine Core Services feeding information, products and services to the Marine Downstream Services. GMES input include satellite data, in-situ data and other relevant data like atmospheric forcing field.

4. PROJECT PARTNERS

There are 13 partner institutes involved in the project (5 European and 8 Chinese) as listed in the table below. The project is coordinated by Nansen Environmental and Remote Sensing Center (NERSC) with Ocean Remote Sensing Institute, Ocean University of China (ORSI, OUC) acting as co-coordinator. Several of these partners are also participating in the Dragon program.

Participant organisation name	Country
Nansen Environmental and Remote Sensing Center	Norway
GKSS Furchungszentrum	Germany
Ocean Remote Sensing Consulting	Germany
Institut Francais De Recherche Pour L'exploitation De La Mer	France
Collecte Localisation Satellites	France
The Nansen-Zhu International Research Center	P.R.China
Ocean Remote Sensing Institute, Ocean University of China	P.R.China
Institute of Atmospheric Physics, Chinese Academy of Sciences	P.R.China
National Satellite Ocean Application Service	P.R.China
Beijing Normal University	P.R.China
National Remote Sensing Center of China, MOST	P.R.China
National Marine Environmental Forecasting Center	P.R.China
Second Institute of Oceanography, State Oceanic Administration	P.R.China

The DRAGONESS work package co-leaders include:

- WP1: Z. S. Liu (ORSI/OUC) and J. A. Johannessen (NERSC)
- WP2: W. Alpers (ORS-Consulting) and M.-X. HE (ORSI/OUC)
- WP3: Ge Chen (ORSI) and J.-F. Piolle (IFREMER)
- WP4: Xuejia Song (NMEFC) and G. Larnicol (CLS)
- WP5: Liqin Shao (NRSCC/MOST) and Roland Doerffer (GKSS)
- WP6: J.A. Johannessen (NERSC) and M.-X. HE (ORSI/OUC).

5. RELEVANCE OF DRAGONESS

Through DRAGONESS international cooperation between Europe and the Peoples Republic of China is enabled in the GMES and GEOSS context of ocean modeling, marine security and environmental monitoring systems. From execution of the DRAGONESS project, relevant expertise and knowledge gained in Europe can be transferred, merged and exchanged with Chinese expertise and knowledge in marine monitoring for environment and security.

Environmental policy includes elements relating to (i) the identification and assessment of issues, (ii) the formulation of policy, (iii) the policy implementation, and (iv) to the subsequent monitoring and review. Each step in this cycle may draw upon data from operational survey and monitoring, and upon information from research. The policy cycle thus encloses, and interleaves with, a related cycle of monitoring, scientific investigation and reporting. It needs to be recognized that the operation of the interleaved cycles, from monitoring and early awareness of a problem, via policy development and implementation to full policy review, may take several years. Following the introduction of the International Convention of the Law of the Sea in 1982, the International Convention for the Protection of Pollution by Ships (MARPOL 73/78), and the Framework for prevention of dumping of pollutant material (London Dumping Convention 72) a growing number of regional and national legislation and declarations is now existing.

In the wake of the Erika and Prestige oil tanker accidents, for instance, the set up of the European Maritime Safety Agency (EMSA) under Regulation (EC) N° 1406/2002 of 27 June 2002 is one of the key EU policy level initiatives. EMSA's main objective is to provide technical and scientific assistance to the European Commission and Member States in the proper development and implementation of EU legislation on maritime safety, pollution by ships and security on board ships. To do this EMSA has the operational tasks in oil pollution preparedness, detection and response.

DRAGONESS is strongly linked with the joint ESA-MOST DRAGON program that was established in April

2004 and that will end its first phase and May 2007. A second phase - Dragon 2 is approved to run from April 2008 to March 2012. The Dragon program focuses on promoting and activating science and applications development in China using mainly data from the ERS and Envisat missions targeted towards land, ocean and atmospheric monitoring (<http://earth.esa.int/Dragon>). In Dragon 2 the goal is extend this to other ESA missions that approved for launch (e.g. GOCE, SMOS, Cryosat). Moreover one expect to get gradual access to data from Chinese ocean research and monitoring satellites such as the HY-1B that operates an ocean color spectrometer and a infrared SST radiometer. The possible synergy that can be achieved from this is very promising and expected to be highly beneficial for both DRAGONESS and Dragon 2.

In addition complementary partnerships to EC and ESA funded projects (e.g. MERSEA, MarCoast, BOSS4GMES, ECOOP, MyOcean etc.), equivalent Chinese program and projects and their relevance with regards to GMES and GEOSS ensure that the DRAGONESS project will make a clear link to the GEO work plan for 2007-2009.

The relevance of the DRAGONESS can also be considered in the context of GMES Space Component program, which builds upon user requirements for satellite observations supporting operational information services as specified in the GMES EC Action Plan 2001-2003 (COM (2001) 609 final), the Final Report for the GMES Initial Period 2001-2003 (COM (2004) 65 final), the EC Communication on GMES, and the European Space Policy White Paper (COM (2003) 673). Similarly, the contribution of the P. R. of China to the space segment of GEOSS is of utmost importance since P.R. of China is now planning to initialise a 10-year implementation plan of an integrated Earth observation system. P.R. of China has launched already 30 Earth observation satellites since 1990. Their future satellite program and plans up to 2020 are also impressive and comprehensive with 12 satellites of the HY-n series, 5 satellites of the FY-n series and 12 satellites dedicated to disaster monitoring. China will therefore ensure a significant contribute to the space segment of GEOSS. A world-wide harmonisation of Earth observing satellites, which must include incorporation of Chinese Earth observing satellites, is indispensable. The DRAGONESS project, in complement to Dragon 2, are therefore constituting an essential step in this direction.

6. SUMMARY AND POTENTIAL IMPACT

China and Europe established a collaboration in remote sensing in 1991 when the European Remote-Sensing Satellite, ERS-1, was launched. In April 2004, the European Space Agency (ESA) and the Ministry of Science and Technology (MOST) of China made green

light to a joint Dragon program for 4 years, with focus on Earth observation from satellites. The Dragon program covers atmosphere, ocean and land remote sensing and offers data, capacity building, networking and support to young scientists through advanced training courses, workshops and symposium. Recently the Dragon program reached approval for an extended Dragon 2 phase from April 2008 to March 2012.

Funded by the European Commission (EC) under the European Union's (EU) Framework Programme (FP6), the DRAGONESS project will run from September 2007 to August 2010. More than 30 participants attended the DRAGONESS kick-off meeting that was held in Beijing, China from 11-12 October 2007. An official welcome was received from the director of the National Remote Sensing Center of China (NRSCC), Dr. Guocheng Zhang. The first annual progress meeting is planned to be held in Norway in September 2008, while an interim meeting is considered to be held in parallel with the Dragon Symposium in China in April 2008.

Harmonization of methods and approaches in the frame of international programs such as GOOS (Global Ocean Observing System) and GMES (Global Monitoring for Environment and Security), and GEOSS ((Global Earth Observation System of Systems) lay the backbone for DRAGONESS project. Researchers from Europe and China will in DRAGONESS provide an inventory and compare common procedures in operational ocean monitoring and services including data accessibility and management approaches. Although appearing straightforward, this is indeed a very challenging task. The measurement platforms, protocols, data format, metadata format, quality assurance/quality control protocols, data integration and data portal infrastructure may vary substantially among different programs and research groups. One of the main goals of the DRAGONESS project is therefore to assess and compare the standards used in ocean observing systems covering a variety of platforms in both Europe and China, and then make recommendations on how to make them consistent to better facilitate data sharing and information exchange.

For more information please contact the project coordinators Prof. Johnny Johannessen (NERSC, Bergen, Norway) and Prof. Ming-Xia HE, (ORSI/OUC, Qingdao, China).

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