INTERNATIONAL GEOSTATIONARY LABORATORY (IGEOLAB)

On behalf of EUMETSAT, NESDIS and WMO, and in response to action 31.17 from CGMSXXXI, this paper introduces an International Geostationary Laboratory (IGEOLab) concept. The concept aims at stimulating proposals and implementation of geostationary demonstration missions by Space Development Agencies, based on an approach that would facilitate transition to operational status and, ultimately, generalisation across the geostationary ring.

The approach is based on the early involvement of the international scientific and user community and assumes interagency consultation mechanisms aimed at creating opportunities for proposals and implementation of "IGEOLab" missions"

AN INTERNATIONAL GEOSTATIONARY LABORATORY (IGEOLAB) CONCEPT FOR GEOSTATIONARY DEMONSTRATION MISSIONS

1 INTRODUCTION

On behalf of EUMETSAT, NESDIS and WMO, and in response to action 31.17 from CGMSXXXI, this paper introduces an International Geostationary Laboratory (IGEOLab) concept. The concept aims at stimulating proposals and implementation of geostationary demonstration missions by Space Development Agencies, based on an approach that would facilitate transition to operational status and, ultimately, generalisation across the geostationary ring.

2 THE CASE FOR GEOSTATIONARY RESEARCH MISSIONS

Geostationary satellite have been extensively used by the operational meteorological community over the past decades and the need for coordinating the various missions distributed along the equator was the initial rationale for the establishment of CGMS.

CGMS then expanded its scope to all types of meteorological satellites, and, more recently, has extended its membership to Development Space Agencies, in recognition of the value of research satellites to the strategy of WMO and to the recently established WMO Space Programme.

This expansion has stimulated discussion and preparation for the use of a new generation of polar orbiting satellites, and is facilitating the early operational assessment innovative capabilities with a view to speeding up the transition to fully operational follow up missions.

In practice most of the research satellites are Low Earth Orbit satellites and Space Development Agencies have so far paid much less attention to the geostationary observatory, despite the considerable advantage of this orbit for very frequent observations of the Earth disk as required to support demanding applications like nowcasting.

One reason for this is undoubtedly the technical difficulty of observing the Earth from such a high altitude at the horizontal resolution and accuracy required by key applications. As a matter of fact, in many cases, at least in the atmosphere, the shortest time scales are associated with the shortest spatial scales, which makes observations extremely demanding. On the other hand, Low Earth Orbits are more attractive, offering a great variety of opportunities for the demonstration of new passive and active observing techniques and sensors, due to more favourable link budget constraints and observation geometry. Another important factor is that most research missions have scientific objectives related to climate and global change, which requires global coverage.

The ring of meteorological geostationary satellites forms an essential element of the space component of the WMO Global Observing System. It has become essential not only for local nowcasting, but also for the extraction of Atmospheric Motion Vectors and other products across the ring. These products are now recognised as global and widely used in Numerical Weather Prediction and it clear that new “across the ring” products such as Surface Albedo could also become essential for climate, subject to proper calibration, cross-evaluation and compliance with GCOS Climate Monitoring Principles. As a result, the interest of users for more advanced capabilities shared implemented across all geostationary satellites is expected to grow, if the relevance and value of such capabilities can be demonstrated to all CGMS members.

From a technological perspective, the situation has also evolved very significantly and will continue to evolve. As demonstrated by Meteosat Second Generation, the horizontal resolution achievable for visible/infrared imagery becomes comparable to AVHRR performances, paving the way for applications to management of renewable resources, e.g. over Africa. Likewise, the proposed Geostationary Infrared Fourier Transform experiment approved by NASA as part of its New Millenium programme show that infrared sounding could approach the performances of advanced sounders like AIRS, CrIS and IASI. Synthetic aperture techniques could also be considered in the infrared and microwave parts of the spectrum to increase ground resolution. When feasible, high resolution thermal infrared imagery from the geostationary orbit would provide the combination of time sampling and resolution required for fire monitoring and coastal oceanography. In the less critical UV and visible part of the spectrum, hyperspectral sounders and imagers could provide also unique contribution to pollution monitoring in the atmosphere and coastal ocean.

In summary, the recognition of the operational value of coordinated geostationary missions for global applications, the evolution of sensor technologies and the unique relevance of the geostationary orbit for monitoring rapidly evolving phenomena, when combined, call for a dedicated effort of development space agencies for considering geostationary research/demonstration missions.

EUMETSAT and NOAA are of the opinion that CGMS should encourage such an effort and propose concepts for sharing the assessment of such demonstration missions. A possible approach is the IGEOLab concept proposed hereafter.

3 PROPOSED IGEOLAB CONCEPT

The IGEOLab concept captures a flexible concept aimed at sharing the benefit of a geostationary demonstration mission across Space Development Agencies, operators of operational meteorological satellites and users.

A variety of implementation options are proposed, in recognition that financial and technical constraints may preclude the implementation of the full IGEOLab concept presented in section 3.1 hereafter.

3.1 THE FULL IGEOLAB CONCEPT

The full IGEOLab concept is inspired by and extrapolated from the initial approach considered by NASA, NOAA and the US Navy for the implementation of the GIFTS mission.

Assuming that a requirement and the potential value of a mission is recognised internationally, the full IGEOLab concept could include:

1) Early presentation of the mission concept and its possible applications and benefits to the international user community;

2) Early involvement of a group of international experts in the definition and assessment of the mission and the conduct of related scientific studies, and publications of the results of such studies;

3) International cooperation in the development of the mission, in particular as regards the instrument and the ground segment, with a view to:

   - Sharing costs and facilitating the generalisation of the demonstrated capabilities across the ring of satellites;

- Planning and establishing the real time and off line data and product services required for adequate pre-operational assessment of the new capabilities by committed users;

4) Definition and implementation of a phased mission profile enabling the new capabilities to be assessed across a representative sample of geostationary slots, with the involvement of "local" user communities;

5) After approval of the mission and related cooperations, declaration of the mission as a research element of the space component of the WMO Global Observing System, in the framework of the WMO Space Programme;

6) Free and open access to key data and products (real time and offline) to the worlwide user community;

7) Selection of an International Group of committed investigators for the calibration/validation, analysis, evaluation of the data and the demonstration of their value in research and applications, in relation with the agreed mission profile;

8) International workshops at key mission milestones, starting with commissioning results, and addressing demonstration results for each key application and/or each regional phase of the mission;

9) Presentation of results to CGMS and WMO, in the context of its Space Programme and formulation of relevant recommendations for transition to operational status and generalisation across the ring.

The concept would enable:

- Cooperation between several Space Development Agencies;

- Cooperation with and involvement of operational agencies (e.g. in the ground segment and real time services);

- International commitment to the scientific aspects of the mission;

- Involvement of the worldwide user community in the evaluation of the new capability in various geographical settings, based on the phased mission approach;

- Sharing and promotion of the results of the pre-operational assessment.

3.2 POSSIBLE DESCOPING OF THE CONCEPT, WHEN NECESSARY

It is recognised that the full IGEOLab concept may not be feasible or affordable in all cases.

In some cases, e.g. for very challenging demonstration and short-lived missions, the phased mission approach may not be optimum, and it could be more attractive to dwell on one geostationary slot to achieve a full, in depth demonstration.

In such a case, the approach could be tailored with step 4) eliminated. A flight of opportunity on a planned geostationary satellite should then be favoured, in order to minimise launcher and overall mission costs.

A flight of opportunity may also appear as the most attractive fall back solution in terms of affordability, if cooperation among Space Development Agencies cannot be developed to the level required to reduce costs down to the level of expected budgets.

4 CREATING OPPORTUNITIES

The proposed concept will not come to reality without a close coordination and consultation, first among the main Space Development Agencies.

Such consultations should take place on a regular basis or on an ad hoc basis to:

- Coordinate call for proposals;
- Review availability of critical technology and discuss plans for relevant R&D;
- Discuss and study preliminary mission concepts and identify cooperation opportunities;
- Establish joint proposals for IGEOLab missions, including possible involvement of operational agencies;
- Organise relevant presentations to CGMS.

In parallel, the operational agencies may identify spare capacities for additional instruments as part of their requirements, and release Announcement of Opportunities for instruments to be flown on their future satellites.

This was done in the past by ESA and EUMETSAT for Meteosat Second Generation, and by NOAA for some of its GOES satellites.

5 CONCLUSION

CGMS is invited to consider the proposed IGEOLab concept and its possible implications.