

INTERNATIONAL GEOSTATIONARY LABORATORY (IGEO LAB)

(Submitted by WMO)

Summary and purpose of document

The document reviews the events following the CGMS-XXXII decision to promote international cooperation for implementing demonstration missions according to the International Geostationary Laboratory concept (IGeoLab). It is an update to CGMS-XXXIII WMO WP-22 + add.1 + add.2 to incorporate events occurred in between CGMS-XXXIII and CGMS-XXXIV.

The Geostationary Imaging Fourier Transform Spectrometer (GIFTS), after sharp progress made with identifying a flight opportunity (Elektro-L2, 2009) and analysing the technical feasibility, is still waiting for financial resources to convert the available Engineering Demonstration Unit (EDU) into a flight model. Meanwhile, the EDU has been successfully tested on the ground.

The GEO-Microwave project made extensive progress both on the development of technical concepts and on clarifying scientific aspects. However, the proposal for the Geostationary Observatory for Microwave Atmospheric Sounding (GOMAS) failed to be selected by ESA as a potential Earth Explorer core mission, thus a leading R&D space agency is currently missing. However, there are other initiatives within CGMS membership that could lead to the identification of a new roadmap.

ACTIONS PROPOSED

CGMS to note the status report and discuss as appropriate. An articulated recommendation is provided in the concluding paragraph for both GIFTS and GEO Microwave. In the connected WMO WP-29 Rev 1, to be considered soon after this document (WMO WP-29 Add 1), some WMO views on the future of IGeoLab are put forward aiming at encouraging a more in-depth discussion on the IGeoLab concept.

Background

1. Since CGMS-32, there have been a continuing series of meetings or workshops or discussions for both the test proposals for GIFTS and GEO-Microwave including:

- IGeoLab Preparatory Task Team meeting (Geneva, 13-14 December 2004);
- 5th session of the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM-5, Geneva, 24-25 January 2005);
- 1st meeting of the IGeoLab Focus Group on GIFTS (Washington, DC, 6 June 2005);
- 1st meeting of the IGeoLab Focus Group on GOMAS (Washington, DC, 7 June 2005);
- Bilateral contacts USA-Russia for possible embarkation of GIFTS on Elektro-L (through the second part of 2005);
- 2nd GOMAS Focus Group meeting (Rome, 24-25 October 2005) (it is noted that, at that meeting, the initiative was renamed "GEO-Microwave" in order to avoid confusion with a specific mission configuration);
- CGMS-XXXIII (Tokyo, 1-4 November 2005);
- CM-6 in Buenos Aires, 16-17 January 2006;
- 3rd GEO-Microwave meeting held in Geneva, 28-29 August 2006, concurrent to the CGMS-WMO Workshop on Optimization of GEO and LEO satellite plans.

2. At CGMS-XXXIII (Tokyo, 1-4 November 2005) extensive reporting took place under WMO WP-22 + Add.1 + Add.2. In the following sections, a short recount of the situation of GIFTS and GOMAS as of September 2006 is provided.

Status of GIFTS

3. The scientific/technical situation with GIFTS can be summarized as follows:

- Both NOAA and EUMETSAT had identified strong support for the IGeoLab GIFTS mission as risk reduction for the GOES-R and Meteosat Third Generation missions. The introduction of hyperspectral sounding in GEO orbit has been indicated by WMO as one of the highest priorities for the development of the new generation of geostationary meteorological satellites (see WMO Technical Document No. 1267 issued in April 2005). (the other priorities are: advanced imagery and microwave precipitation measurements).
- The GIFTS Engineering Demonstration Unit (EDU) has been successfully submitted to Thermal Vacuum tests during summer 2006. However, a considerable amount of funding is required for the space qualification of the GIFTS instrument, particularly for the development of the spacecraft/instrument Control Module Interface.
- The Russian Elektro-L2 satellite (launch planned in 2009) is the prime candidate as a space vehicle to host the IGeoLab GIFTS mission. A preliminary analysis performed by the GIFTS Project Team and RosKosmos demonstrated that no critical issue exists as regard feasibility.

4. After CGMS-XXXIII, high-level correspondence took place among RosKosmos, NASA/NOAA and WMO, but so far the situation of financial resources to upgrade the EDU into a flight model has not been solved. NASA has stated that, at the end of the testing activity, they could release the EDU 'as it is' to other interested parties (provided that this does not conflict with governmental regulations on sensitive technology export). Thus, in principle, new opportunities exist for CGMS members to find solutions. It is worth noting that, once the 'core' activity on the

space segment finds its way, several CGMS members are ready to provide ancillary but necessary contributions (on the ground segment, on science, on campaigns, ...).

5. This situation was exhaustively discussed at CM-6 in Buenos Aires, 17-18 January 2006. CM-6 noted the progress in technical works and assessments, and the financial difficulties. Finally, the CM-6 Chairman, Dr Bedritsky, informed the session that the Russian Federation, as host to the next G-8 meeting to be held in July 2006 in St Petersburg, had the intention to include GIFTS within an IGeoLab Partnership as a discussion item between Presidents Putin and Bush. He expressed his wish that a positive solution could be found since it would result in a positive contribution to the world-wide community. However, there is no evidence that the GIFTS subject was actually discussed at G-8.

Status of GEO-Microwave (formerly GOMAS)

6. The scientific/technical situation with GEO-Microwave can be summarized as follows:

- Both EUMETSAT and NOAA had identified a strong requirement for frequent precipitation observation, in the framework of their respective process of defining user requirements for Meteosat Third Generation and GOES-R. The introduction of MW in GEO has been indicated by WMO as one of the priorities for the development of the new generations of geostationary meteorological satellites (see WMO Technical Document No. 1267 issued in April 2005) (the other priorities are: advanced imagery and hyperspectral sounding).
- Progress has been achieved in the development of the instrument concept based on filled-aperture antennae (GEM in the USA, GOMAS in Europe). Specifically, solutions have been designed for the critical areas of the antenna and the scanning mechanism. The radiometric performances have been evaluated, showing that it is possible to meet the most ambitious performances (including full temperature and humidity sounding). In addition, alternative concepts based on synthetic aperture antennas have been proposed and are being studied, both in USA and in Europe.
- Progress also has taken place in modelling the precipitation field in the mm-submm range. From the initial doubts on the possibility to relate submillimetre brightness temperatures, mostly controlled by ice scattering in the mid-high portion of the cloud, with the precipitation reaching the ground, the situation is now that, for any of the proposed bands or group of bands, enough evidence has been collected on the fact that the information content is there (different bands or combination of bands being sensitive to different precipitation types). In addition, amazing results of dynamical assimilation of mm-submm brightness temperature in cloud-resolving models are now available.

7. One basic issue, the identification of a 'lead space agency' to foster finalized progress of the initiative, was delayed waiting for the ESA selection of the candidate next Earth Explorer core missions. This took place in May 2006, but GOMAS was not selected, though ESA undertook a generic commitment to foster progress on the scientific aspect, including collection of experimental data through airborne campaigns. As consequence of the absence of any plan to actually implement a space mission, funding of airborne campaigns and scientific studies is virtually impossible (this is being practically experienced). Consequently, it will be very difficult to accumulate evidence in support of pressing for a space mission.

8. The Focus Group meeting held in Geneva on 29 August 2006, focused uniquely on identifying a new 'lead space agency' and defining a new roadmap. It was noted that, for the time being, the only known plan for a MW radiometer in GEO is in China, with the next generation of geostationary satellites, FY-4, specifically the 'M' (microwave) series to be parallel to the 'O' (optical) series. It was found that very preliminary thoughts on the FY-4M mission are fully

consisted with the GOMAS concept. However, the FY-4 planning is currently at a very early stage of defining objectives and instruments types. The timeframe of the FY-4M-1 launch is 2015.

Summary status of the two IGeoLab test projects

9. Objectively, the situation of both IGeoLab projects, GIFTS and GEO-Microwave, appears rather problematic:

- As for GIFTS:
 - there is an impasse on the financial situation, whereas the very limited time available to carry out the necessary technical activity to make possible a launch on Elektro-L2 in 2009 is rapidly elapsing;
- As for GEO-Microwave:
 - the initial candidate 'lead space agency' (ESA) did not materialize and another has not yet been found;
 - in the absence of a perspective space mission, funding of scientific studies is practically extinguished and experimental campaigns are difficult to be justified;
 - the technological activity, at least in USA and Europe, is at very low funding profile.

10. On the other hand, there are movements that could develop in a favourable direction:

- As for GIFTS:
 - the technical work with EDU testing is showing excellent performance;
 - several CGMS members are ready to contribute if the core space segment issue is solved;
 - movements in the USA in favour of solving the GIFTS issue are growing; for instance, the National Academy of Science is issuing a recommendation to NASA for a GIFTS flight demonstration in its "Decadal study of Earth science and applications from space".
- As for GEO-Microwave:
 - a GEO-Microwave mission is being considered at least in China and could be considered by other space agencies if CGMS iterates the case;
 - if a 'lead space agency' materialises, contributions from other space and user-oriented agencies for funding scientific studies and performing airborne campaigns would probably follow;
 - in the USA the National Weather Association has collected endorsement from the international community to promote a MW mission in GEO with NOAA and NASA.

Conclusion

11. On the basis of the status report and the discussion above, **CGMS is recommended to:**

(a) As for GIFTS:

- note that the technical work on the payload on ground is providing excellent results, and that it appears feasible to host the payload on Elektro-L2 in 2009;
- invite the main concerned parties to unblock the situation enabling EDU upgrading to flight model, thus also unblocking several CGMS members willing to contribute to the project once the core space segment issue is solved.

(b) As for GEO-Microwave:

- note that marked progress has taken place in setting the scientific background and developing several technical concept for a GEO-Microwave in the IGeoLab context;
- invite space agencies that are considering or may consider microwave missions in geostationary orbit to accelerate their decisional process and identify a 'lead space agency' as soon as possible;
- invite all Members, including user-oriented ones, to prepare contributions to the IGeoLab GEO-Microwave initiative following the identification of the 'lead space agency'. Essential contributions have already been indicated in previous CGMS sessions, as follows:
 - provision of experimental data by airborne campaigns (Action CGMS-32.16);
 - securing funds for scientific activities (Recommendation CGMS-33.01).