CGMS-XXX EUM-WP-18
Prepared by EUMETSAT
Agenda Item: II.3
Discussed in WG II

ACTIVITIES TOWARDS USER REQUIREMENTS FOR POST-MSG

This paper provides a summary of the activities undertaken by EUMETSAT to identify user/service needs to be satisfied by measurements taken from the geostationary orbit in the time frame 2015-2025. The approach taken by EUMETSAT and its partner ESA provides an example of a structured framework for the complex process towards new meteorological satellites. As such this new approach should be of interest to CGMS members.

ACTIVITIES TOWARDS USER REQUIREMENTS FOR POST-MSG

1 INTRODUCTION

In the context of prospective activities related to the preparation of future geostationary programmes, the Council of EUMETSAT has agreed to initiate a User Consultation Process. The key objective of the User Consultation Process is to establish European user requirements expected to serve as a reference for further technical and scientific studies and, ultimately, for deriving End User Requirements applicable to the definition of future EUMETSAT geostationary systems. According to the current planning such systems could start operations in the 2015-2025 timeframe.

2 GENERAL APPROACH

The ultimate objective of the process is to establish agreed user requirements and priorities to serve as a basis for deriving performance, functional and other high level technical specifications for a post-MSG system. Such specifications could in turn be used to seek proposals from industry on possible concepts and design studies.

The User Consultation Process as agreed by EUMETSAT Council is structured into two phases each leading to an open workshop. The first phase concentrates on the identification of end user requirements, while the second phase will assess mission/system architecture concepts proposed in response to identified requirements. The workshop at the end of each phase will present and discuss the results.

The general approach taken was to rely on leading experts from within and outside EUMETSAT Member States, whilst leaving full responsibility to Delegate Bodies on the endorsement of requirements and related decisions. In this regard it was considered necessary that:

- EUMETSAT Council be given the opportunity to provide a “qualified” endorsement of the user requirements and priorities established by the so-called Application Expert Groups (taking into account recommendations of the Scientific Technical Group (STG), a Delegate Body supporting Council) and guidance on programmatic constraints

- The operational applications (e.g. nowcasting, NWP, climate monitoring), and not technology should drive the formulation of user requirements and priority in the first phase of the Consultation process.

- Feasibility, technology and technical should only be addressed in the second phase, namely when mission concepts and system architectures will be proposed and assessed against user requirements and priorities on the one hand and programmatic constraints on the other hand.

In the overall process particular account is taken of:

- WMO requirements;
- Current plans of other meteorological operators;
- Tentative/proposed mission concepts and observing techniques

- Existing and emerging technology and R&D in Europe.

3 FIRST PHASE OF THE USER CONSULTATION PROCESS

The first phase of the post-MSG User Consultation Process started in January 2001. Two Application Expert Groups (AEGs) of leading meteorological scientists have been formed and tasked to analyse and prioritise user requirements from an application perspective:

- an Application Expert Group on Medium Range and short Range /Mesocale Numerical Weather Prediction (NWP-AEG)
- an Application Expert Group on Nowcasting and Very Short Range Forecasting (NWC-AEG).

These two groups have been supported by satellite and remote sensing experts from Member States, EUMETSAT, ESA, and international partners, advising them on the relevance of observing techniques for the user requirements under examination. They have been tasked to address as far as possible the needs of emerging applications, like seasonal forecasting or polution monitoring.

Under the guidance of EUMETSAT in a first step the AEGs have been tasked to establish and prioritise user requirements (or more general user/service needs) in light of state of the art and prospective of their respective application areas. This means that the AEGs had to establish a vision and possible scenarios for the evolution of applications like NWP and associated user needs. It was agreed to capture all identified prospective user/service needs for the timeframe targeted, independent of what kind of observation technique, surface or space based, is necessary and to characterise them (e.g. resolution/sampling, coverage, accuracy) in terms of – threshold, breakthrough, and goal. Threshold thereby represents the minimum performance making an observation regarding that specific user/service need of some interest, while goal on the other hand characterises the maximum performance beyond that no additional value is provided. The 'breakthrough level' was introduced as the most important information, characterising the performance at which an observation is expected to provide a major improvement for the corresponding user/service need. A major improvement is defined as making a difference for the end-user of the final information. The 'breakthrough-level' is essential to prioritise new user requests. The result of this task has been summarised in three position papers on '*Observation Requirements for Nowcasting and Very Short Range Forecasting in 2015-2025*', '*Requirements for Observations for Regional NWP*', and '*Requirements for Observations for Global NWP*'.

In a next step the user/service needs and their requirements in terms of threshold, goal and breakthrough level as formulated by the two AEGs were confronted with conceptual observing techniques from polar orbiting and geostationary satellites, potentially available in the time frame 2015-2025. A group of satellite and remote sensing experts supported this process. Following the user/service needs to be satisfied by measurements to be taken from instruments placed in a geostationary orbit have been identified and priority ranked. This was achieved in 'projecting' the needs on the geostationary orbit, i.e. in assessing the user requirements that can only be achieved from this orbit with an appropriate time sampling.

According to the EUMETSAT Council decision EUMETSAT's First Post-MSG User Consultation Workshop was conducted on 13-15 November. At this open workshop, the state of the global observing system (space and in-situ measurements) was presented as background in session 1. Session 2 presented the user requirements and their priority ranking in the areas of 'Nowcasting', Regional Numerical Weather Prediction' and 'Global Numerical Weather Prediction', as they have

been described in the three corresponding position papers. Session 3 presented the response of the Remote Sensing Experts (RSEs) to the user requirements formulated by the two AEGs. Both sessions were closed by an extensive discussion, where rapporteurs were asked to summarise the comments and recommendations. The workshop was closed with session 4, presenting the summary of the rapporteurs, the open issues and the need for consolidation studies and recommendations for next steps.
Based on the presented status of the Post-MSG User Consultation Process the RSEs suggested and the workshop recommended to initiate and implement without delay a consolidation phase of typically a year with the support of ESA. The rationale for the consolidation phase is to create within this bridging period the conditions for starting the agreed phase 2 of the User Consultation Process, when mission concepts will be identified and evaluated against user priorities and programmatic constraints.

After an in-depth discussion, STG supported the results of the first open workshop on Post-MSG User Consultation and recommended unanimously to Council to endorse the three position papers on user requirements and the initiation of a consolidation phase.

EUMETSAT Council at its 49th meeting unanimously endorsed the views and recommendation of STG on the output of the first workshop on the Post-MSG User Consultation.

4 CONSOLIDATION PHASE OF THE USER CONSULATION PROCESS

Following the EUMETSAT Council decision, a one year consolidation phase of the post-MSG User Consultation Process have been started with the support of ESA in January 2002. Starting from the activities and recommendations endorsed by STG and EUMETSAT Council, EUMESAT discussed and agreed with ESA to follow two main lines of activities:

- consolidation of User requirements and priorities;
- consolidation of technical and Remote Sensing Experts assessment.

Within the first line of activities it was identified that in some cases it is necessary to interpret the requirements beyond targeted products, namely to establish a more explicit correlation between product requirements and observation requirements. This was recognised to be essential for nowcasting applications. Also it is necessary to trade-off the merits of different products giving access to the same targeted information. Overall, three main studies have been identified in this regard:

- Determination of the optimum spatial resolution for IR sounding from the geostationary orbit;
- Trade-off of respective merits of observations of surface pressure and surface winds over ocean;
- Assessment of the maximum useful resolution of imagery for winds extraction from atmospheric tracers.

As a first step towards the consolidation of the operational user requirements in the area of Atmospheric Chemistry, the Secretariat has initiated an external study. Additional external experts with operational experience in pollution monitoring and warning will be consulted to provide additional inputs and to determine possible breakthrough levels and assess in more depth the case for a specific geostationary capability. In addition, the requirements associated with major international Conventions will be analysed, capitalising on some studies underway at ESA. This will provide inputs to a dedicated seminar in Autumn 2002.

To establish the relevance of the identified requirements to climate monitoring and to identify the measurements for which a clear case could be established for a geostationary capability the Secretariat started to consult external experts. The results will be presented at an expert seminar in Autumn 2002.

Future DCP needs have to be formulated to fully scope the requirement for the Post-MSG missions. In order to collect the relevant requirements, the Secretariat has issued a questionnaire addressed to EUMETNET, WMO and STG Delegates representing national NMSs. A technical note has been produced to reflect the current situation and the concepts of regional and international DCP channels that are essential in the WMO context.

Concerning the second line of activities, these will concentrate on the assessment of the relevance of:

- O2 A- Band Absorption;
- Lightning Imagery;
- Imagery for aerosols;
- Microwave imagery.

The approach will be identical for the first three observing techniques:

- consult experts and place short studies to document existing capabilities, experimental results, suitability of spaceborne systems, science and technical issues;
- organise a seminar with a wider audience of experts, including Application Experts;
- consolidate results in a report to STG.

In the more complex case of microwave imagery the following activities have been initiated:

- Document potential issues related to International Telecommunications Union (ITU) frequency co-ordination;
- Capture and document existing knowledge relative to relevant frequencies and capabilities, target products, retrieval methods and algorithm;
- Document results of related airborne experiments;
- Organise a meeting of experts involving AEG participation to discuss the potentials of microwave imagery and its associated technical issues;
- Present the consolidated results in a workshop involving AEGs, STG and other users.

In addition, ESA will focus on the potential of the candidate observation techniques to meet the user requirements, capitalising on the outputs of the first open workshop and the results of the activities described above. These activities will also include the preliminary identification of associated technical concepts and preliminary assessment of their feasibility.

The planned activities will address the main following techniques and tentative sensor classes:

1. Cloud / surface imaging (visible and infrared radiometers)
2. Aerosols observation (UV-VIS-SWIR)
3. Atmospheric sounders (interferometers / spectrometers)
4. Surface pressure and cloud top height by differential absorption (e.g. oxygen A-band spectrometer)

5. Lightning monitoring (fast imager)
6. Microwave imaging and sounding instruments
7. Atmospheric composition and chemistry monitoring (e.g. UV-VNIR spectrometers)

5 PHASE 2 OF THE USER CONSULTATION PROCESS

Concerning phase 2 of the user consultation process it has been discussed with ESA and endorsed by the EUMETSAT Council to involve Industry as early as possible by releasing a phased invitation to tender funded by ESA.

Under this phased procurement process:

- EUMETSAT will prepare the Mission Requirements;
- ESA will issue an open invitation to tender (ITT) for studies to derive mission/system architecture concepts;
- ESA and EUMETSAT will select proposals for full pre-phase A studies, based on pre-agreed evaluation criteria;
- The selected bidders will perform a first phase of the work, until a mid-term review (MTR), including requirement analysis, trade-off of possible mission concepts, leading to mission concepts proposed for further pre-phase A study in the second phase of the study;
- At MTR ESA and EUMETSAT will evaluate the outcome of this first phase with the support of independent experts and propose on that basis a selection of a reduced number of concepts for the second step;
- The proposed selection of mission concepts will be presented, as planned, at a second Open Workshop;
- The mission concepts selected would then be further studied in a second step of the procurement up to finalisation of pre-phase A activities;
- At completion of this second step, fully documented mission concepts and preliminary system architecture, traceable to mission requirements and performance will be available.

Upon completion of this process, ESA and EUMETSAT will produce a consolidated evaluation and derive/propose detailed plans for phase A and related R&D activities.

6 TENTATIVE SCHEDULE

Considering the schedule of the phase 1 consolidation activities, addressed in section 4, the tentative schedule of the preparation and implementation of the Meteosat Third Generation Programme is as follows:

- 2001-2005 “User Consultation”/Pre-Phase A Studies
- 2001- 2003: Phase 1: High Level/User Requirements & Priorities Agreed, inputs to ITT available.
- 2003 – 2005: Phase 2: Phased ITT for Pre-Phase A Studies. Evaluation/Selection of mission concepts, completion of Pre-Phase A Studies.
- 2005 – 2007 Parallel MTG Phase A Studies for selected mission concepts.
- 2007 – 2009 Coordinated MTG Preparatory Programmes (Phase B) and Programme Approval Processes
- 2009 – 2014 Development/Test of MTG System

This schedule is consistent with a need date of MTG in 2015.