

## FRENCH SPACE WEATHER INITIATIVES

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### ABSTRACT

The Director General of CNES has set up a working group on « Space Weather » in January 1998. The purpose was to establish the need for new initiatives to meet specific requirements in Europe for independent information on « Space weather » forecast and restitution.

The working group was composed of individual coming from the scientific community, ONERA and CNES. Many people were interviewed, mainly in France, and there was a mission to the USA to get acquainted with the « National Space Weather Programme ». The final report on the assessment of needs was issued in late October, following a one-day seminar (Paris, Sept. 17) during which preliminary conclusions were presented and discussed.

The paper underlines the principal issues at stake with solar weather, the main products which would be required by the users, and discusses a few questions pending on the way Europe could stimulate coherent initiatives.

### 1. THE FRENCH « SPACE WEATHER WORKING GROUP »

The Director General of CNES has asked for a report on the question of « Space Weather » in January 1998.

The purpose was to assess which issues were at stake in this question, and to establish the need, if any, for new initiatives to meet specific requirements in Europe for independent information on « Space weather » forecast and restitution.

The working group was constituted a few weeks later, and received its mandate in March 1998. It was composed of individual coming from the scientific community (Observatoire de Meudon), ONERA and CNES. Many people were interviewed, mainly in France, and there was a mission to the USA to get acquainted with the « National Space Weather Programme ». The final report on the assessment of needs was issued in late October, following a one-day seminar (Paris, Sept. 17) during which preliminary conclusions were presented and discussed.

### 2. INVESTIGATIONS

The following questions were submitted to special investigations :

1. Launches
2. Orbiting spacecrafts

3. Orbital manoeuvres
4. Manned spaceflights
5. Space to Earth wave propagation
6. Earth to Earth wave propagation
7. Airline crews
8. Terrestrial effects : electrical power distribution networks
9. Terrestrial effects : pipelines
10. Geophysical campaigns
11. Earth's Climate
12. Data for scientific Research

For each of these issues, there was an attempt to describe the need, quantify the risk, assess the prejudice, and determine the nature of the useful information that would be requested from an ideal "Space Weather forecast and restitution operational Center": physical quantities of interest, temporal requirement on the determination of these quantities, ...

### 3. FINDINGS

What is at stake, in these issues, belongs to the world of general worldwide public service, or of economical competition, or of strategical interests. If the first action line is a common cause for mankind, it is fair to recognise that the two last action lines are related to interests which are, in general, shared at European level.

Obviously, Europe, through a series of initiatives, should :

- Acquire a certain degree of independence in the determination of those data related to its strategic or economic interests
- Contribute, at its place, (i.e. in the front line, which is where Europe stands, in terms of global GDP, population, scientific and technological level,...) to the development and operation of an ever-improved open worldwide public service.

To our group, for European needs, the main issues belonging to the first category are, today :

- Monitoring of the exposure of airline crews
- Satellite-aided navigation
- Determination (i.e. forecast and restitution) of orbits
- Spacecraft's environment

The above list is seen from the user's side. It is a list of tasks that the operators will have to perform. To succeed, they will have to be helped by the communication of the value of a certain number of physical quantities.

Our group reached the following synthesis in terms of the most critical physical quantities requested and the associated time delay of their determination :

- Atmospheric density and exospheric temperature  
*Forecast : a few hours, a few days, a few months.*
- Total electronic content of the ionosphere  
*Forecast : a few minutes*  
*Restitution : a few hours*
- Proton flux  
*Forecast : a few hours, a few days*

#### 4. INITIATIVES TO BE TAKEN AND QUESTIONS

The « building bricks » of such a service in Europe have to be set up, or improved, or consolidated. These « building bricks » are : ground instruments, space borne instruments, dedicated spacecrafts, models, scientific expertise,.....

There must be then a commitment to provide an operational service.

And, there must be a continuing scientific research feeding the service with permanent improvement (as was the case, decades ago, with the atmospheric weather forecast service, fed with satellite data coming from Nimbus, Tiros and, in fine, NOAA).

The issues at stake are of importance to many European countries and to many private entities in Europe : airlines, satellite operators, electrical power distribution companies,...

Accordingly, the European Union should naturally be involved in the programme to be defined.

A global roadmap, describing the scientific rationale and the possible implementation of operational services, and covering the next ten years should be established to give a reference frame to European initiatives. **By whom ?**

Individual scientific groups and operational centers should be invited to make proposals coherent with this reference frame. **RFP issued by whom ? Evaluated by whom ? Funding by whom ?**

The labelling of groups and/or centers would facilitate their recognition and support by national or multilateral sources. The labelling should be of limited duration (but renewable) in order to facilitate the emergence of new initiatives.

Apart from their relations with customers belonging to the worlds of defence, agencies, operators, these groups and centers would contribute, too, to the global worldwide public service in Space Weather, and to the progress of the scientific understanding of the Solar-Terrestrial relationships.