

## WORKING GROUP 1: DISCUSSION ON USERS & NEEDS

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This group attracted 19 attendees covering a wide range of nationalities and capabilities including solar physics, spacecraft, ionosphere, avionics and terrestrial phenomena. However all were scientists and, despite the title of the group, no users were present.

The absence of users was recognised as a major problem in advancing the science and application of space weather prediction. Clearly they need to be contacted, educated and asked for their requirements. This was seen as a role for ESA.

Despite the absence of users there was plenty of experience of effects which could be extrapolated to user needs and there was plenty of useful discussion. The major effects identified are listed below, starting at high altitudes and working downwards:

### 1. Spacecraft

- electrostatic charging
- solar particle events
- astronaut protection
- detector background and downtime
- meteorite showers
- atmospheric drag

### 2. Ionosphere

- space to earth communications
- earth to earth HF communications
- GPS location errors and scintillation-induced loss of phase lock
- altimetry

### 3. Aircraft

- use of HF communications
- aircrew dosimetry
- single event effects in avionics

### 4. Terrestrial

- geomagnetically induced currents leading to power line outages and corrosion of pipelines etc.

These all had common requirements, including space weather statistics for future design and the need for reliable warning and alert procedures. For warnings, timescales of days to hours were deemed useful, while for alerts even a few minutes could prove invaluable. One phenomenon that produced nearly all the above effects was considered to be coronal mass ejections, which produce the largest geomagnetic disturbances, outer belt enhancements and solar particle events.

It was considered that the report sponsored by CNES ("Space Weather- Final Report of the Group for Evaluation of Needs", CNES/DP/CM no 98-252, October 1998) provided an excellent summary of space weather effects and user needs. It would be useful if it could be translated into English and the group requested that ESA should consider performing this service.

Finally I would like to thank all members of the group for their participation and good humour.

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