

SPECTRUM ULTRAVIOLET TELESCOPE (170-cm)

[ SUVT-170 ]

ITALIAN PARTICIPATION  
IN THE MISSION

TECHNICAL ANNEX

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## Chapter 5

# Mission Operation and Ground Segment

The SUVT-170 mission is to be an international facility accessible to scientists from participating Countries as well as from the whole international community.

### 5.1 Possible Schemes for Mission

#### Management

The following is a description of alternative schemes, which are being discussed within the Italian SUVT Consortium and with the Soviet partners, regarding the overall conduct of the mission.

The first case considered is that of a totally unconstrained observatory, similar to IUE : this means that the observer is given a fixed amount of observing time for a particular program, with an approved list of targets. This time will be allocated in one or more slots, as agreed with Mission Planning (taking into account the observers' requests and the mission constraints). During one of these slots, the observer may make use of the time as it suits him : select which targets to observe from his list (or even adding new objects; provided, of course, he has sufficient information for pointing and has verified that no spacecraft constraints

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exist), select the exposure time and the instrument configuration, and alter those in real time according to the outcome of the observations (i.e. cut short or extend an exposure, drop and replace a target, etc.).

The second case is similar to the first, but does not allow the insertion at short notice of targets not previously approved (this depends on the modality for validation of a pointing request, the feedback time for checking constraints, etc.). The observer has still the freedom to choose the sequence, the exposure times and the instrument configuration, and interact in real time.

The third case introduces more constraints, as not only the insertion of new targets is not allowed, but also the sequence of pointings within a time slot is fixed (e.g. if there are needs to optimize spacecraft resources or minimize maneuver time). The observer is however allowed to change the exposure times, and the instrument configuration in real time (and possibly even to drop a pointing or to extend or truncate the total time on one pointing at the expenses of the next one, provided no spacecraft constraints forbid it).

A final case is suitable for automated or semi-automated operations, in which the sequence of pointings, exposures and instrument configuration is pre-planned, and no pointings can be removed or changed (eventually instrument configuration could be altered if real time contact is available).

The high Earth elliptic orbit selected allows in line of principle continuous contact with a single ground station for a very large fraction of the orbital period.

An high Earth orbit offers therefore notable advantages with respect to low Earth orbits, both in terms of longer uninterrupted observing time, and of simpler and more efficient operations, allowing a real time control and interaction. We plan to take full advantage of this, configuring the SUVVT mission as an "observatory-class mission", similar to the successful experiences of IUE and Exosat.

On the grounds of the successful experiences of the IUE and EXOSAT missions the common-user real-time "Observatory" concept is adopted as a baseline. In order to guarantee availability of all common-user facilities to astronomers without technical expertise in the particular

methods being used, the existence of a coordinating team of resident astronomers as advisors to observers is fundamental.

## 5.2 Prerequisite Information from Other Mission Areas

For the detailed definition of the SUVVT Ground Segment and Science Operations, we must await for the results of the Assessment Study phase in other mission areas:

### 1. Payload instrument complement.

The exact definition of the payload complement will be defined during the Assessment Study phase, in particular concerning which other instruments are present besides the prime (1500-3500 Å. High and Low Dispersion) spectrometer.

In particular for each instrument a definition, constituting an essential input for the Ground Segment activities, will be given of

- (a) science telemetry requirements,
- (b) housekeeping parameter requirements, and
- (c) telecommand requirements.

An important element for the definition of Science Operations, which is also dependent on the definition of the payload, is the possibility that more than one instrument are to be operated simultaneously.

Another important element which derives from the choices made for the detectors, is whether a photon counting or an integrating instrument is used. In fact a photon counting system produces a continuous, low rate telemetry (consisting of event-by-event information like photon position and arrival time) and leaves the accumulation of images etc. as a ground activity. On the other hand images may be integrated (and stored) on board, and downlink occur in bursts at a higher rate (or diluted in a suitable interval). The first case (photon counting devices) simplifies the immediate

- The calibration analysis and the associated updates of the standard calibration files used by the pipeline processing will also be running at I-SOC. This will make easier the distribution of up-to-date calibration data to observers (again via electronic link), and the communications with the instrument teams in Italy in the case of non-routine calibrations which require expert intervention.

- The feasibility and constraint verification in support to proposal selection, and a preliminary scheduling (eventually up to the submission of command lists) of approved observations, for the Italian share of observing time. This is considered even if it has to be finalised later at SOC for integration with the Soviet program.

The feasibility of a remote control observing (for the Italian share of observing time) will be evaluated, in the sense that the Guest Observer may perform some quick look directly from I-SOC, being in contact with an RA at SOC, or even that the Italian RAs may be located at I-SOC and perform their action from there.

#### 5.6.7 Data Transfer between USSR and Italy and Data Dissemination

The modalities of the data transfer between MCC and I-SOC will be evaluated during the Assessment Study phase, in conjunction with the better definition of the data format and rate.

For what the physical link is concerned, one may consider in line of principle the following alternatives :

- data exchange using standard magnetic tapes (suitable for large datasets, although bulky, uncomfortable and subject to delays);
- data exchange using other large capacity storage supports (e.g. cassettes or optical disks ; may be less bulky, but still subject to delays);
- data exchange over a leased phone line (which may be used for any electronic communication between SOC and I-SOC, including interactive sessions); depending on the allowed line capacity, this

may not permit the exchange of the larger datasets (i.e. science telemetry or raw images), but still be used for quick transfer of smaller ones (i.e. HK subset, auxiliary data, observation log, etc.);

- data relaying over a satellite link, using the Soviet Intersputnik service and a Soviet-supplied receiving station, which will allow near real-time monitoring from I-SOC (while command generation will still pass through SOC and ultimately MCC).

The feasibility of the different alternatives will be evaluated in terms of mission requirements, technical constraints, costs and export regulations.

Concerning the types of data to be exchanged one may consider what follows :

1. HK subset and auxiliary data (including the updates to the observation log) shall be sent to Italy with priority and in their totality (i.e. for all observations irrespective of the data rights) and with a minimum delay (possibly making use of a computer link).
2. The raw data (telemetry or raw images) of all the calibration observations shall also be sent to Italy as soon as possible at the next priority level.
3. The raw data of the observations belonging to the Italian share of time shall also be sent to Italy, at the next priority level, and as the type of link allows. These data will be processed through the reduction pipeline at I-SOC, and the results archived there and delivered to the GO. On the other hand the raw data could also be archived in the Soviet Union (and the usage of such data will be subject to the agreements on data rights).
4. The raw data of the observations belonging to the Soviet share of time should also be sent to Italy at low priority, to be archived at I-SOC and eventually subject to standard reduction for the creation of an uniform archive. The usage of such data in Italy will be subject to the general agreements on data rights (i.e. cannot be used for analysis before the expiration of the deadline for public release, although it is possible that the data transfer occur in advance of that date).