SSETI's Workshop report

9-13/10/00

University of Florence (Italy)

Group n.18

Subsystem :Instruments

Group members:

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Co-operative Universities: **University of Leicester.**

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Mission objectives.

The Mission objectives proposed during the workshop are:

1- Take picture of the earth and moon, to retrieve ozone concentration ,optimise the process of the on-board data analysis.(see details).
2- To develop a receiver in the V.L.F. band to get “sounds” of lightning’s to obtain a storm localisation from V.L.F. emission together with images. The above mentioned receiver could be used to investigate in the V.L.F. as seismic precursor.(see details)
3- A rudimental debris and meteoroids detector similar to the meteorological setup used for determination of rain drop size. This need further skill in developing (electro)mechanical parts for space environment. One could think that debris and meteoroids could generate electromagnetic emission due to ionisation (or other interaction) with residual atmospherical gas.

Cameras.

Due to the fact that taking pictures is one of the most important mission objectives we decided to use specific devices designed for space flights. This will bring higher costs but will increase,on the other hand, reliability and will give more probability of success.
Basically , depending on what kind of images we want we have to choose between these cameras:

-**Wide angle camera (WAP**).This camera are often fitted with near –I.R. optical filters to provide strong contrast between land ,sea and clouds. This should be not be confused with thermal infra-red imaging, where the sun energy is absorbed by the earth and then reradiated.
-**Narrow angle cameras (NAC),** this cameras are fitted with different optical filters , each sensing in a different part of the optical spectrum. These are NAC0 in the near –IR (810-890nm), NAC1 in the red (610-690 nm) and NAC2 in the green (510-590nm).
-High resolution camera. This camera is designed to have high spatial resolution . The mass of the lens is 6Kg ,supporting sway-braces and other mechanical items will bring the total system mass close to 10 Kg. The mass , and particularly the length, of the optics precludes the deployment of this camera on the SSETI satellite.

Other instruments to be used are:

-CMOS Video Camera .to have real time images**.**

-Ozone UV backscattered Instruments(OUBI).the role of OUBI is to record and retrieve the ozone concentration in the area image.

Each sensor should have an accompanying microcontroller board making up a modular camera. The processors currently used in already existing microsatellite missions are 32 bit-25Mhz devices with access to 4Mbyte of static memory, in some cases upgraded to 32 Mbyte.
During the workshop we did not have enough information to complete the evaluation of the microcontroller boards and of the Control Processing Units of the satellite.

In the table are listed few main features of different cameras:

	Coverage area	Optical band	Lens	Payload Power	Payload Storage	Image size
WAC	1500x1050 Km	350nm-750nm	4.8mm	45mA at 5V(225mW) peaking at 5,6W during image capturing.	330 KByte	568x560 pixels
NAC	250x150Km	510nm-890nm depending on the filter.	75mm	45mA at 5V(225mW) peaking at 5,6W during image capturing.	1 Mbyte	1020x1020 pixel
CMOS Video Camera	150x110Km	350nm-750nm	25mm	200mA at 5V(1W)	4 Mbyte (30 images)	382x287 pixels

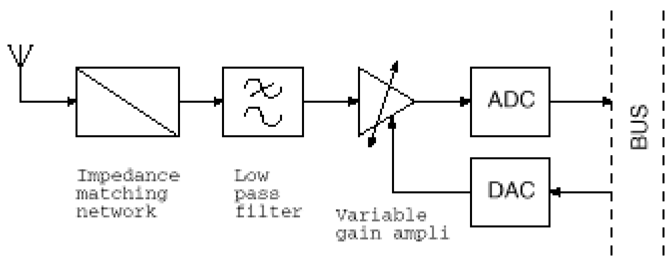
On-board image processing and compression.

We suggest to chose between this options,

- *Autonomous image analysis and selection* to reject images failing to meet specified interest\usefullness criteria. This on-board rejection process ensures no downlink time wasted in retrieving low-interest images.
- *Generation of image previews* to let ground control decide which images should prioritised for, or alternatively discarded from the downlink queue.
- *Image compression* to reduce size of the files retained for the downloading. Compression routines are implemented in many of the modern satellites. We suggest to use the so called AMPBTC routine to preserve fine details far more faithfully than many other popular routines (especially Jpeg).

VLF Receiver.

We propose this VLF receiver diagram:



The VLF Receiver is composed of:

1) Carpenter-rule antenna 1 to 5m long. [passive = no power needed]

2) Impedance matching network, realy a network that make the capacitive component of antenna impedance resonate so to get extravoltage at amplifier input. [passive = no power needed]

3) Low pass filter, integrated with 2) and useful to prevent amplifier overload and aliasing in sampling. [passive = no power needed]

4) Variable gain amplifier driven by a DC voltage to set the right gain for full scale operation of DAC, it must provide at least 100dB of gain and as low as 30-40dB. [no more than 20mA at 5V].

5) A/D converter with 8 to 10 bit resolution and sampling time greater than 30 KS/s to sample the received signal: data is delivered to microcontroller bus where signal process will take part. [no more than 10mA at 5V].

6) D/A converter 6 to 8 bit resolution, settling time is of no concerning, used to drive 4). [no more than 2mA at 5V].

Signal processing, data encoding, gain controlling is not part of this receiver, so power needs are not considered here.

Our impression of the workshop.

We would like to give a "schematic style" comments on the workshop:

	POOR	SUFFICIENT	GOOD	EXCELLENT
Conference Call discussion		X		
Chat Tools			X	
U.B.B:			X	
Outreach-staff				X

Final comments.
Although during the first sessions there was a bit of confusion at the end of the workshop we felt that most of the problems were fixed.
This thanks to the improved efficiency of the communications tools, the UBB and the "vote style" teleconferences.
We very appreciated all the efforts of the ESA Outreach Staff at the Estec and especially those of Eric Trottemant.
The challenging idea of designing and constructing a satellite, in our opinion, forced us to face some of the problems of producing something.

For the future we suggest to improve information's before the workshop sessions so that participants will come into discussions more actively and with a background that will permit them to optimise the time spent in the teleconference or videoconferences.
We also suggest to have " brainstorming" meetings between Universities involved to reach more efficiency in the design.