



Massachusetts Institute of Technology Center for Space Research

Coral Reef Mission

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The engineering team – Bob Goeke, Systems; Brian Klatt, R&QA; John Doty, Instrument Science – visited Astrium on the 12-13 September. We went through the design of the instruments and their accommodation at some length. Of general interest:

- We are currently baselined to have 15Mbps, QPSK encoded, downlinked on both I and Q channels of the X-band link for a total of 30Mbps. By EOS standards this is modest, indeed (TerraSAR-X uses 300Mbps). The current design seems adequate, though, and we'll stay with it for now.
- The current mass memory design is simply a board within the S/C command and data handling system; it has a capacity of 8GBytes. For the price of <20 watts, we could also use the redundant memory for 16GBytes total. Our original requirement was to store-and-forward 1Gbyte/day.
- It is useful to consider the instrument data rate in units of bytes per kilometer of ground track – we generate 2.5Mbytes/kilometer. The non-redundant 8Gbytes of storage then represents 3000 kilometers of (reef) image. It would take 4 ground station passes at 30Mbps to get this much data down.
- Astrium's power system design uses a **single** 16 A-Hr Ni-H battery with individual cell shunts. They believe that decreasing DOD is the best path to system reliability (as opposed to carrying a separate, cold battery).
- Contamination control will be handled by purging the focal planes as long as possible and using red-tag covers on the optics.
- Astrium proposed the use of Firewire instead of RS422 for the science data interface; MIT will investigate.
- Astrium suggested the possibility of operating the instrument optics in a cold environment, rather than running the CCDs at 50C below the optical bench ambient; Astrium will investigate.

MIT owes Astrium both an Electrical/Data ICD and a Mechanical ICD.

Brian Klatt audited the Astrium Reliability and Quality Assurance practices at some length and was taken for tours of their facilities. Their workmanship standards are, of course, all based on ESA standards and training. They have standard R&QA chapters written for inclusion in outside procurements. Although on many prior missions they have been generating flight code in Ada, they are now switching back to C. On the one hand their QC procedures for flight code is rather thin; on the other hand, by generating their ACS code with Simulink, they have little new code to generate. Historically they have found that their tools have about the same bug density as their hand written code.

Bob Goeke
MIT Mission Development