

## **Multi-Payload Adapter (MPA) Critical Design Review**

**Ogden, UT October 29, 1998**

The CDR convened at 10:30 AM. Introductory statements were made by Charles Bonsall of One Stop Satellite Solutions, Inc. (OSSS) and Maj. Steve Buckley, Chief of the SLV Division, TEBL. This meeting actually incorporated three meetings. (The attendee list is at the end of these minutes.)

The first was a business meeting between OSSS/CAST and TEBL. The principle agreements from that meeting were that OSSS (Mr. Wood) would prepare a milestone schedule, and that Major Buckley would establish a payment schedule in accordance with the milestone schedule.

The second meeting was the MPA Critical Design Review which is the primary subject of these minutes.

The third was a periodic Payload Integration Working Group (PIWG) meeting.

However, there is some commonality of these meetings and the resulting action item list...

Mr. Michael Wood, CAST/OSSS JAWSAT Project Manager, presented an overall review of the Mission Schedule and Milestones. He presented draft graphics showing the design of the MPA structure and the proposed location and orientation of the various payloads in the MPA.

One significant component location and orientation issue to be decided is that of the ASUSAT antenna.

A mission schedule critical item is the securing of FCC transmission frequency allocation authorizations for all appropriate payloads. (This was made an action item with a monthly reporting requirement to Major Buckley.)

Dr. Jay Smith, Director of CAST, presented the Systems Engineering Test Plan. He explained that the MPA has eight different tests or validation milestones. He described the acceleration test facilities, procedures and data reduction completed on the MPA Engineering model. He explained that these engineering model tests were done using the best available data on the mass properties of the other payloads. He described the tests to be conducted on the integrated MPA at OSSS/CAST.

It will be necessary for the payloaders to let CAST know what standards they designed to, and are testing to. CAST is using Mil Std 1540c.

It is important that high fidelity mass models for all payloads be submitted soon, including mass, center of gravity, attachment points and fit. (This was made an action item due 11/30/98.)

Payloaders are responsible for providing OSSS/CAST data that their articles will have the structural integrity to survive launch. Mechanical reliability of the separation systems need to be verified. This is a critical issue. The ejectable payloads absolutely must separate successfully and have a fail-safe mode which assures no damage to other payloads, the MPA or the launch vehicle.

A question was asked if transmitters can be tested at integration and the answer was yes at both payload integration at WSU and at launch vehicle integration site.

The MPA structural design, test results and test results analysis, were presented by Ms. Laurie Clark, OSSS consultant, Mr. Gary Shirey, CAST staff and Mr. Rick Smith, CAST staff. Ms. Clark described the changes made to the structure material (7075-T73 aluminum) and design based upon the results of the Preliminary Design Review (PDR) and subsequent tests. The basic design configuration is the same 5 bay, open isogrid design presented at the PDR. Only minor changes in the isogrid pattern and holes will be made to accommodate different payloads than were considered at the PDR. The buckling safety factor is 1.82 and would be expected to occur when axial acceleration exceeds 25.8g. Safety factors were determined using previously available launch loads. The results of the acceleration tests on the engineering model (first resonance at 40 Hz) correlated very closely with the original finite element analysis and other design calculations. This validated the design tools and procedures used and provided a high confidence that the fully integrated MPA will perform as design and analysis predicts.

For more accurate analysis Orbital will provide new launch load data to Mr. Wood.

Major Buckley asked that the fully integrated acceleration tests be done to maximum launch amplitudes and all agreed that the fully integrated MPA will be tested to these amplitudes.

MSFC/NASA asked if there was a specific bolt that had to be used, but Ms. Clark indicated they just had to be stainless steel, using a mechanical locking nut, and that the attachment hardware is installed from the payload side. Nylon is not an acceptable material to use.

Orbital is going to work with Ms. Clark to match up helicoils with their equipment. They will be providing a template to match up their mount with the MPA. OSSS/CAST wants the template soon so that the vendor can drill the holes by the end of November. It's also important that we get a template to match with FALCONSAT.

There will be bolt on and removable lifting points on each of the eight corners of the MPA.

The MPA electrical interface design was presented by Mr. Paul Chapman, CAST staff. The launch vehicle will provide 16 discrete ordinance signals and 16 instrumentation lines to the payloads. Orbital will provide a camera sequencing schedule to OSSS. The MPA cables will all be twisted pairs with Teflon insulation/jacket and silver copper braid shielding, grounded at only one common point. All connectors between the MPA and payloads will be mil grade DB 9 connectors with steel shell and crimp contacts. A cable clamp will be positioned to the MPA structure close to each payload connector, as well as, at increments along the structure. The cable electrical test plan was presented and approved.

Orbital questioned whether or not it might be easier to use some sort of a 3-conductor discrete addressing system in order to command the cameras. Mr. Chapman pointed out the programming team and they seem to agree that this might be a better way to go.

Mr. Chapman will be responsible for the MPA/payload electrical Interface Control Document (ICD) and an end-to-end MPA electrical diagram.. All payloads need to review the draft ICD and assure compliance and coordination with Mr. Chapman.

All payloads need to indicate the desired location of their electrical connector pigtail.

Mr. Chapman will coordinate with Orbital and payloads all pulse commands, amplitude, duration, timing, etc.

The payload presentations were made by the following individuals:

|                                  |  |
|----------------------------------|--|
| Attitude Control Platform (ACP): | Dr. Jay Smith, OSSS/CAST                   |
| MSFC payload:                    | Mr. Fred Berry, MSFC/NASA                  |
| Opal:                            | Mr. Jeff Williams, Stanford University     |
| ASUSAT I:                        | Mr. Shea Ferring, Arizona State University |
| OCSE:                            | Major Steve Buckley, USAF                  |
| FALCONSAT:                       | Capt. Michelle Idle, USAFA                 |

The main issues arising from these presentations and discussions were:

- Need to acquire frequency authorizations for appropriate payloads
- The need to expedite most schedules to assure on schedule deliveries of payloads.
- Coordination of all electrical interfaces
- Provision of accurate mass properties data to OSSS/CAST
- Exact component mounting footprints

The MPA data download concept design was presented by Mr. Randy Kohlwey, a consulting engineer to OSSS. Mr. Kohlwey presented an initial analysis of the proposed equipment configuration, satellite and the PACSAT communications protocol to be used. The primary issues to be resolved are frequency coordination with both the FCC and AMSAT, and determination of the separation picture taking sequence and image downloads which will drive many data rate parameters.

The deployment imaging concept design was presented by Mr. Eric Anderson, CAST staff. This was a very preliminary design discussion which afforded an exchange of views and information about camera control commands, separation and picture taking sequences, etc. Most of the needed information will have to be provided by Mr. Rich Madison who was not present.

The assembly, payload integration, shipping and final integration plan was presented by Mr. Evan Day, OSSS/CAST. The preliminary proposed schedule and flow charts were distributed at the meeting. The principle items were:

- Major Buckley suggested the use of discrepancy reports.
- MSFC/OSSS/CAST will coordinate shipment of critical components in nitrogen.
- TEBL will establish the shipping environment.
- OSSS will determine shipping processes (vehicles, insurance, protection, etc.).
- GFE air shipment may be provided by TEBL from HAFB. TEBL to report by 12/2/98 meeting.
- All stakeholders are to feedback changes to flow charts by 11/15/98.
- All payloads submit estimated integration time needed.

## MPA CDR Action Item List

1. Payloads with transmitters are to expedite the critical task of obtaining transmitting frequency authorizations. Progress and problems are to be reported at each PIWG meeting. (ASUSAT I is complete.)
2. OSSS and TEBL/SLV are to expedite funding and contract issues. OSSS to provide a milestone schedule by 11/13/98.
3. TEBL/SLV (Major Buckley) will finalize orbital parameters. The orbit will be approximately a 750 km sun-synchronous orbit.
4. All payloads to submit accurate mass models (mass, cg, attachments) to be submitted by 11/30/98.
5. Soft ride appliance integration test by 3/99.
6. FALCONSAT separation system performance review by 11/15/98.
7. All payloads to submit accurate mass properties lists by 11/6/98. These should include items like separation system bases, solar panels, cables and antennas as well. This data is needed both by OSSS/CAST, the payload integration contractor, and Softride for final design of that system.

NOTE: There were numerous other agreements and commitments made in the CDR and PIWG which the responsible individuals should have captured. These are the official MPA CDR Action items identified by Major Buckley. If any attendee wants more complete notes on other parts of the meeting please contact me.

Respectfully,

Charles A. Bonsall  
cabonsall@aol.com

## Multi-Payload Adapter (MPA) Critical Design Review Attendees

| NAME             | Telephone    | Email address                   | Organization - Code      | Position                       | Rank  |
|------------------|--------------|---------------------------------|--------------------------|--------------------------------|-------|
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