Corvus-BC Manufacturing Lessons Learned

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Introduction

- **Company History**
  - Silicon Valley start up founded in 2015
  - Acquired Astro Digital in 2016 (Platform API for imagery data)
  - Decided to carry on *Astro Digital* brand for joint company in the future (transitioning now)

- **Mission**
  - Build a system to monitor the global economy of food production
  - Design, build, and operate small multi-spectral imaging satellites
  - Monitor commercially active land at a high frequency (22 m daily, 2.5 m weekly)

- **Methods**
  - System integrators
  - Develop sub-systems and components when necessary
  - Provide data over web-based imagery platform
  - Work with partners in agri-intelligence, precision agriculture, security, and environmental/disaster monitoring
  - Opening up our design to enable others’ missions
Our Background

• Team assembled from all areas of industry
• 100% of current team completed Perseus-M mission
• Now focusing on assembly, integration, and test of Corvus-BC constellation
Current Projects

• **Perseus-M**
  - Launched in June 2014
  - 2x 6U Automatic Identification System (AIS) CubeSat
  - On-orbit testbed: Hardware verification, ACS, Ka, etc.
  - Also used for Flight Ops plan development

• **Corvus-BC**
  - Launch Q3, 2016
  - 3x 6U remote sensing CubeSat
  - Multispectral: Red, Green, NIR
  - 22 m GSD

• **Corvus-HD**
  - Launch Q1, 2017
  - 1x 16U remote sensing CubeSat
  - Multispectral: Red, Green, Blue, NIR, Red Edge
  - 2.5 m GSD
Corvus-BC Overview

- Imaging solution: 22 m GSD at 600 km, Red, Green, NIR spectral bands
- Flight computer: ARM A8 running Linux
- Power system: Scalable 48Wh Li-Ion
- Communication: UHF transceiver running at 19.2 kbps for TT&C. Payload data is downlinked through Ka-band at up to 320 Mbps
- Solar panels: ARM M0+ processor, temperature, magnetometers, sun sensors, and magnetorquer coils
- Control: 3-axis with three reaction wheels, star tracker, GPS, and gyro
- Camera Storage: 1 TB
- Imaging capability: 100,000,000 km\(^2\) per day
Design for Manufacturability!

- Perseus-M and Lightsail were designed for optimum volume usage (i.e., tough to build)
- Corvus-BC is designed with easy assembly in mind
  - “Server Rack” style Data Power Module
  - Lots of parallel assembly prior to system integration
  - Easy access to all subsystems by removing one panel
  - Simplified procedures
Data Power Module

- DPM includes Flight Computer, EPS, UHF Radio, and GPS Receiver
- Each board is contained on a “Card”
- Easy to install and remove Cards with only 2 screws
- Allows for quick assembly and easy troubleshooting
Parallel Assembly

- Self-contained units that can be quickly integrated into S/C
- Simple interfaces between units limit system-level work
Simple System Assembly

• All internal units bolt onto one panel at the system level
• Easily accessible until the absolute latest stages of assembly
Simplified Procedures

• Pictorial procedures allow for better comprehension and quick assembly
• Easier for assembler to understand designer’s intentions
• Adapts well to changes
• Harness routing becomes much more of a science than an art
• A little more work to create the procedure initially, but it saves time where it counts
• Creating kits with all parts for a subassembly also speeds up the process
Software Testing

• For Aquila, software always seems to have to wait until final integration to run full-up tests

• We improved this time by integrating multiple development BenchSats early on
  • Imager BenchSat, Ka BenchSat, ACS BenchSat, etc.

• Perseus-M satellites also serve as on-orbit development platforms
General Observations

• Build early and often: If you can fit check something or connect two boards together early, do it
• No amount of analysis makes things work the first time (usually)
• Standardize your fasteners, connectors, parts, etc.
• Keep an eye out for upcoming bottlenecks
Questions?