WIDE FIELD-OF-VIEW TESTBED

CHALLENGES SCALING FROM SMALLSATS TO LARGE SATELLITES

ABSTRACT

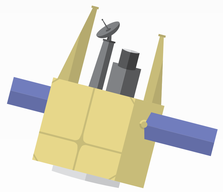
Can experience gained from designing, building and launching a smallsat be successfully leveraged to build larger satellites? Following the success of building smallsats, Millennium Space Systems was awarded a contract to develop the Wide-Field-of-View (WFOV) Testbed for the U.S. Space Force's Space and Missile Systems Center (SMC). This paper describes how challenges faced scaling from a smallsat to a larger-sized satellite were overcome. Topics include paradigm shifts in design and testing as well as unique programmatic approaches to enable rapid acquisition and development.

BACKGROUND

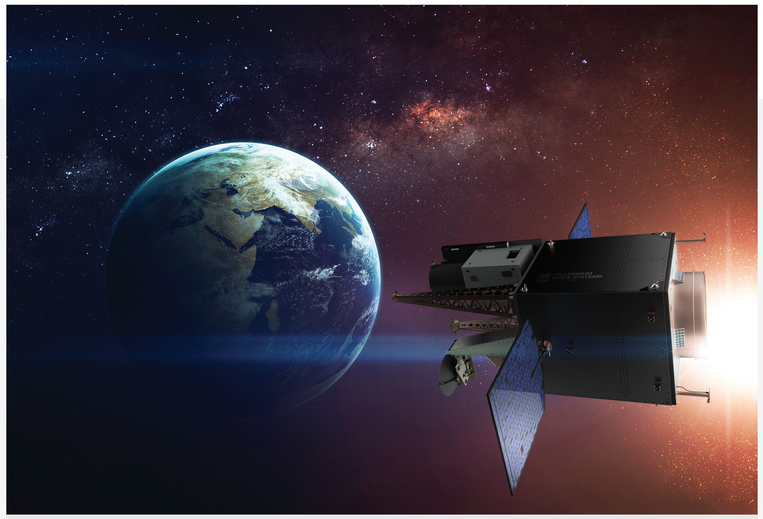
Typical smallsats are low cost, low SWaP (size, weight and power), and usually single-string with high risk posture. They are rapidly designed, built, and launched. Typical design life are only 1-2 years.

The WFOV Testbed Program was initiated by the SMC to demonstrate new Overhead Persistent Infra-Red (OPIR) technologies and techniques to improve OPIR mission capabilities. A new wide field-of-view infrared staring sensor was developed and will fly on a mid-sized spacecraft in Geosynchronous Orbit. Launch is planned for 2021.

Total cost: < $20m
Schedule: < 24 mos
Design life: < 2 yrs
Mass: < 200 kg
Risk Posture: Class C



Total cost: ~$120m
Schedule: 18-36 mos
Design life: 3-5 yrs
Mass: < 1000 kg
Risk Posture: Class D+



CHALLENGES

- Mission differences such as space environment, longer design life means new challenges, such as:
  - Component survivability
  - Prime or co-prime launch integration responsibility / ODMSP responsibility challenges
  - New elements and interfaces
- Additional policy and regulations requirements
  - Required persistent and continuous coordination with authorizing agencies
- Unique payload requirements, such as:
  - Contamination control
  - Thermal control
- Testing accommodation
  - Larger size means in-house facilities can no longer be used
- Transportation challenges
  - A new transportation approach needed to be developed

SUCCESSES & LESSONS LEARNED

- Leveraged Existing Core Bus Architecture.
  By utilizing the existing flight-tested architecture that was built to be expandable & extendable, development schedule was shortened.
- Dedicated payload power and interface control units for payload integration and operations
- FlatSat and EM simulator testing reduced payload interface issues
- Early establishment of interface requirements allow time for thorough testing and risk mitigation and resulted in near flawless payload integration
- Small team of highly experienced staff enables faster and more efficient decisions
- Build prototypes early then test, fix and test again vs. spending longer time in development.
- Utilized most efficient contract vehicle available, through NASA Ames contracts

The **Space and Missile Systems Center** is the U.S. Space Force's center of excellence for acquiring and developing military space systems. SMC's portfolio includes space launch, global positioning, military space vehicle communications, defense meteorological space vehicles, range systems, space vehicle control networks, space-based infrared systems, and space situational awareness capabilities.

Millennium Space Systems, A Boeing Company is America's 21st Century full service, end-to-end space mission solution provider.

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