



MAXAR

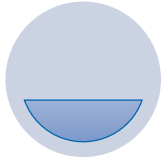
Key Technology, Programmatic Drivers, and Lessons Learned for Production of Proliferated Small Satellite Constellations

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SSC19-I-06



Satellite Constellations: Then and Now



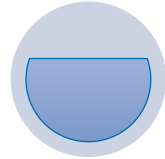
First Generation

GPS, GLONASS

- Value not defined by dollars
- Pre-dates smallsat concepts

Commercial: Iridium, Globalstar

Difficult to close business case



To-Date Evolution

Smallsat Risk Tolerance

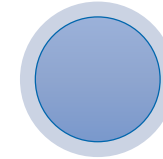
Constellation margins & redundancies

Smallsat Supply Base

- Higher performance
- Higher reliability
- Lower cost

Demand for Near Real-Time & Remote Data

Lower Launch Cost



Next Gen Proliferation

Evolving Analytics and Autonomy

Government Demand

- Distributed reliability
- Revolutionary agility
- Cost effective

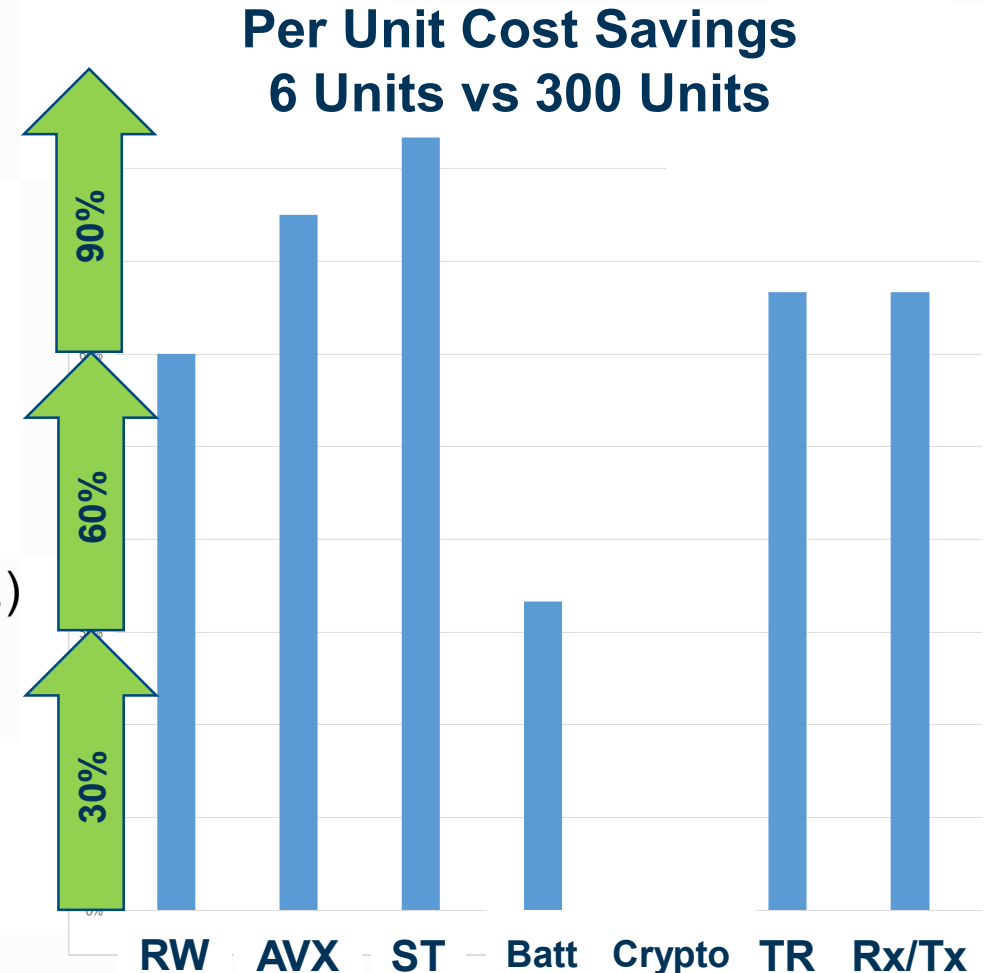
Industrialization

Dedicated Launchers

Mission Agnostic Nodes

Next Gen Enablers: Supply Base

- Equipment cost represents a significant portion of mission cost
- Significant opportunities as volume increases
- Volume is industry wide, not program specific
- Maxar Supplier Development Teams (SDT)
 - Multi-discipline team of Maxar specialists
 - Collaborate with suppliers to align program needs with product metrics (cost, schedule, reliability, perf.)
 - Typical results:
 - Non-traditional suppliers increase reliability
 - Traditional suppliers increase cost/schedule/capacity
 - Supplier IRAD is ideally focused



Next Gen Enablers: Scalable Modular Architecture

Propulsion Core

Options, Increasing ΔV

- None
- Low ΔV Monoprop
- High Thrust BiProp
- High Efficiency Electric

Power Core

Options, Increasing Power

- Low Power (to 2kW)
- High Power (2-60kW)

Mission Optimized Configuration & Structure



Custom Payloads

Scalable Payload Interface

Avionics Core

Options, Increasing Precision

- Standard Precision Pointing
- High Agility & Precision Pointing

Modularity must be both functional and physical

Next Gen Enablers: Industry Specific Industrialization

Volume Specific & Application Specific

- 20 is different than 200
- Units are different than Spacecraft

Volume Correlated Verification (VCV)

- Design vs Workmanship
- Prototype → Pilot → Production

Testing: Automate, Automate, Automate

- Self-reporting, self-executing
- Automation can offset VCV

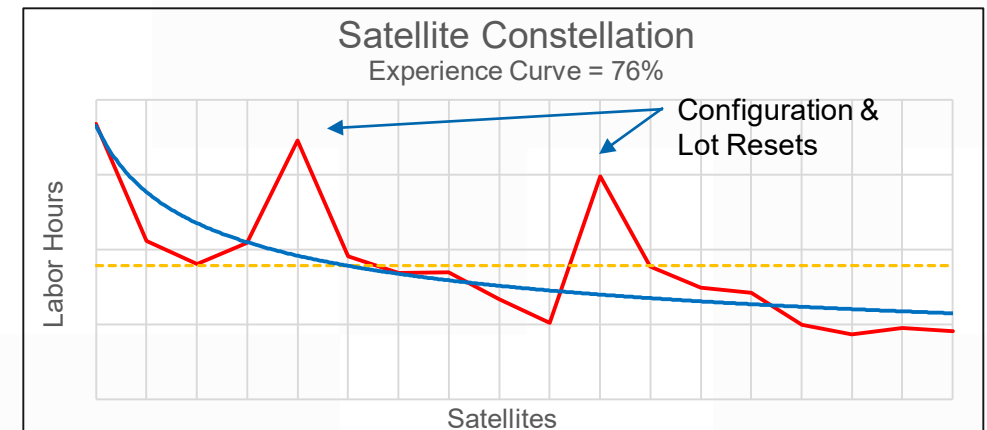
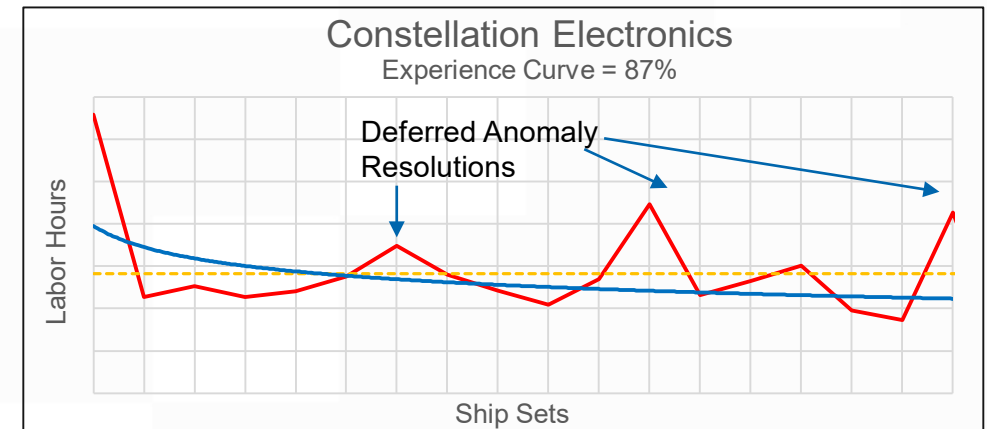
Design for Production (DFX)

- Do NOT design for rework

Bill of Process

- Aligns product design & production capability

Experience Curve Opportunities



Next Steps

Keep pushing technology limits

- Multi-task existing equipment (mass, processing power)
- Leverage adjacent technology (wireless sensors, wireless on-board protocols)
- Printing at volume
- Cloud based simulation
- Leverage software development concepts for mission development

Embrace both Smallsat *and* Legacy space concepts

- Cost and speed of Smallsat + Performance and reliability of Legacy Space
- Continue alignment of the Smallsat and Legacy Space supply base

How do we make data accessible and mutually understandable by all?