On-Orbit Satellite Servicing (OOSS)

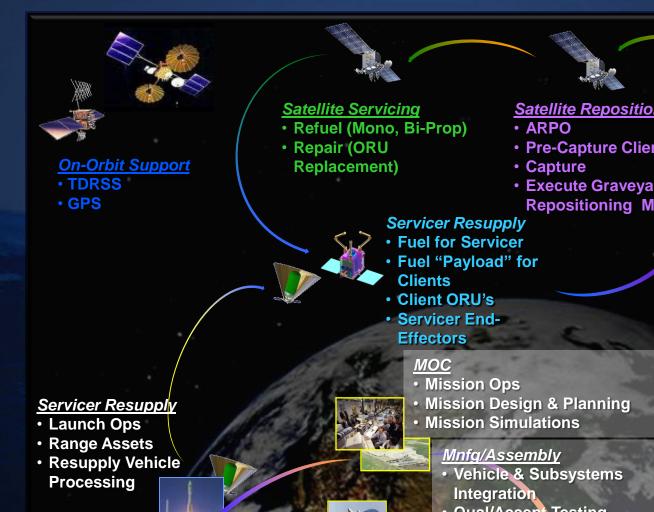
Overview of Lockheed Martin Satellite Servicing Capabilities and Products



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Servicing Concept Overview





TDRSS Ground Station

Satellite Repositioning Ops

- Pre-Capture Client Survey
- Execute Graveyard or **Repositioning Mission**

- Qual/Accept Testing
- Air Delivery to Launch Site

Deploy/Checkout

- **Spacecraft Deployments**
- System Checkout
- ARPOD Demo w/Upper Stage

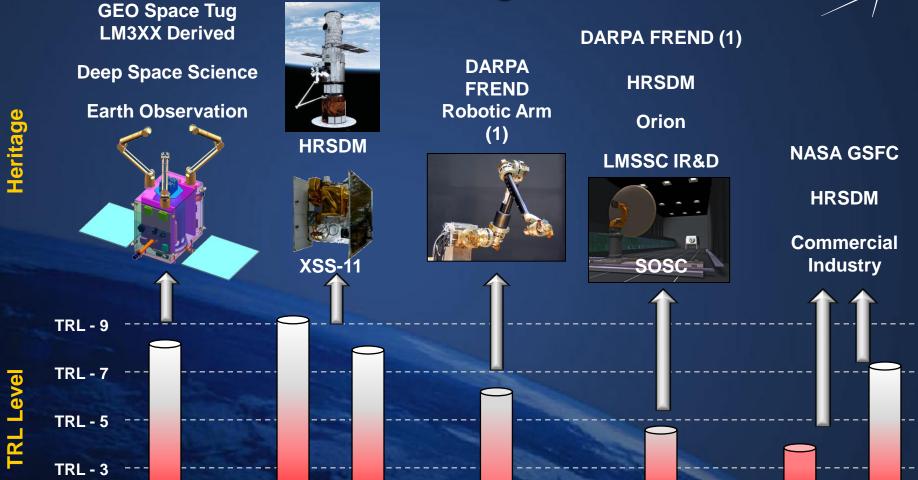
Launch Site

- Launch & Mission Control
- Range Assets
- Processing & Logistics **Facilities**
- LV Processing Facilities



On-Orbit Satellite Servicing Readiness





Key Technologies

Robotics &

Machine Vision

1 - "An Architecture for Autonomous Control of a Robotic Satellite Grappling Mission", Lennon and Henshaw, August 2008, AIAA 2008-7259

ARPO

GN&C

ARPO

Sensors

LMSSC Space Operations Simulation Center (SOSC)

Capture

GN&C

Refueling

Mech.

TRL-1

Spacecraft

Bus

ORU

Service

Flight System Addresses Mission Segments

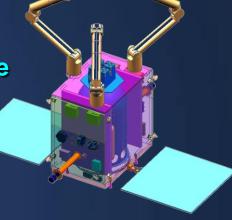


- Satellite cannot self-graveyard
- Uncontrolled
- Poses debris hazard to entire **GEO** belt
- Key Business Case Drivers
 - **Ideal Flight Demonstration Opportunity**
 - Significant Residual Delta-V **Capability for Follow-On Missions Offsets Development** Costs
 - **Low Development Costs/Risks**
 - Responsive
 - Do no harm

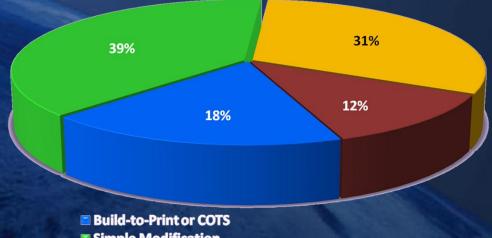
 Heritage S/C & Avionics **Derived from XSS-11**

 FREND Robotics Provide **Servicing Flexibility**

 2100 m/s Delta-V **Enables Multi-Mission** Capability



Spacecraft Dry Mass Breakout by Heritage



- **Simple Modification**
- **™** Modified Based on Heritage Materials and Processes
- **■** New Design

Summary



- On-Orbit Satellite Servicing technically feasible
- Technology maturation required for the "Last Meter"
- Lockheed Martin is confident that On Orbit Satellite Servicing, based on its high heritage spacecraft, can meet near-term servicing needs
- Lockheed Martin has a highly experienced team derived from decades of deep space science, earth observation, HST on-orbit servicing, and USG and commercial satellite communications missions

Thank You