

Integrate RCS, OMS, MPS, Thermal Management, and  
Power Generation

Space Propulsion Technology  
Assessment Workshop

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# Current Baseline

## Integrate RCS, OMS, MPS, Thermal Management, and Power Generation

- Currently vehicles have separate RCS, OMS, MPS, thermal management, and power generation systems
- Currently vehicles have multiple fluids
- See “Integrate RCS and OMS” for RCS and OMS baseline
- See “Integrate RCS, OMS, and MPS” for MPS baseline
- See “Use same propellants in all stages” for Vehicle propellant system baseline
- Integrated Propulsion, Power and Thermal Control Systems
  - Common propellants for all systems (LOX/LH2, LOX/RP, storable)
  - One main oxidizer tank and one main fuel tank for all systems
  - Autogenous pressurization of propellant tanks
  - Reactant Storage and Distribution (PRSD) supplied from main tanks
  - Electric Power Generation - Fuel Cell Power Plant use main propellants

# Goal

## Integrate RCS, OMS, MPS, Thermal Management, and Power Generation

- Desired gains
  - Single vehicle propulsion system
  - Reduce design to one propellant system to develop, certify, produce and maintain.
  - Reduce processes and manufacturing specifications
  - Reduce logistics train
  - Minimize feed system modules
  - Use main engine for OMS
  - Use main engine propellants for RCS and Power System
- Drawbacks
  - More complex interconnect plumbing and control system
  - Increased system operating dynamics and interaction

## Potential Solutions

### Integrate RCS, OMS, MPS, Thermal Management, and Power Generation

- Use same propellant for all systems
- Use autogenous propellant tank pressurization
- Use vapor cooled shields for cryogenic propellants
- Use of liquid or gaseous propellants for secondary propulsion and power
  - Compressed gas for high pressure storage
- Use vent free flight vehicle system with self contained ground flare stack device
- Use LOX/LH2 system as baseline



## Technology to Implement Solutions (TRLs)


### Integrate RCS, OMS, MPS, Thermal Management, and Power Generation

- Ignition System for gaseous secondary propulsion propellant option
- Lightweight low power compressor for power and/or secondary propulsion
- Residual propellant capture concept for system usage
- Passive thermal pumping for vent free thermal control
  - Reduce ullage pressure by cooling ullage gas
- On board ground operations residual gas disposal system, i.e., flare stack
- Vent free (launch and on-orbit system operation) system design
- Integrated common propulsion/power system design

# Cost to Mature Technology

## Integrate RCS, OMS, MPS, Thermal Management, and Power Generation

\$100K	
\$500K	
\$1M	
\$5M	
\$10M	
\$30M	
\$50M	
\$100M	
\$500M	

6 Mo	
1 Yr	
18 Mo	
2 Yr	
3 Yr	
4 Yr	
5 Yr	
5 Yr+	