Propellant Depots Enable New Missions

Large Missions Enabled without Developing Brand New Rocket
Depots Can Enhance CxP Ares V Architecture

Propellant Depots Provide Exploration Flexibility to Accommodate Performance Needs

Lunar Payload Increase With Cryo Transfer (mT)

EDS Propellant Mass Beyond ESAS Baseline (mT)
Depots Enable Alternate Architectures

Propellant Depot 80% of Launch Mass

Propellant Transfer

Lunar Orbit Rendezvous

Altair

Atlas V
Delta IV
Scorpius
Falcon 9

Commercial Orion

110t Competitive Propellant Launch
Propellant Depots Can Revolutionize Launch Market

- Exploration Represents Vast New Launch Market
- Depots Stimulate Competitive Launch Market
- Supports Robust Healthy US Launch Industry

![Diagram showing LEO Launch Mass (mT) vs Annual Lunar Missions]

- CxP Propellant
- CxP Hardware
- Historic Non-Shuttle/Exploration Launch Market
Upper Stage Experience Enables Depots

- Depots Derived from Existing Upper Stages Support Near-Term Application

Centaur-Derived “Disposable” Depot

Historic Space Station Depot Paradigm

Single Fluid Depot
Depot Technologies are Mature

- Upper Stage Cryo-Fluid Management Directly Applicable to Propellant Depots

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Summary

- Propellant Depots Create Vast New Launch Market
  - Stimulate Commercial Space Flight Capability
  - Increased Launch Demand Supports Healthy Robust Launch Industry
- Joint Utilization of Flight-Proven Systems by NASA, DoD & Commercial Provides a Safe, Affordable & Sustainable Approach to Exploration
  - Leverages Existing Investments & Reduces Annual Standalone Lien
- Atlas V & Delta IV Provide Proven Foundation for Reliable, Affordable & Sustainable Launch
  - Reduced Launch Vehicle Investment Allows Enhanced Investment in Innovation
- ULA is Prepared to Support the NASA & the Nation