

Use Tank Residual Gas and Plumbing

Space Propulsion Technology
Assessment Workshop

April 2001

Current Baseline

Use Tank Residual Gas and Plumbing

- There is significant gas in the propellant tanks at Main Engine Cut Off (MECO) due to pressurization of the tanks with heated propellants from the engines
- There is significant volume in the propellant feed lines between the tanks and the engines

Background

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- Main propellant tanks returned to earth must have a pressure in them to be structurally sound at sea level on a cold day
 - Probably no more than a couple psia above sea level pressure
 - Engine NPSP requirements produce pressures of 32 psia in the hydrogen and 36 psia in the oxygen tanks at MECO
 - These are at a temperature below earth ambient
- The excess gases would have to be vented before earth return
- If accumulators are used they will probably be regulated for OMS/RCS operation in the low hundreds of psia
- There is significant volume in the propellant lines
 - About 30 ft³ in lines from lower tank
 - About 170 ft³ in lines from upper tank

Approaches and Technologies (TRLs)

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- The amounts of gases together with liquids in lines is not sufficient to perform OMS maneuvers
- Could be used for some, or possibly most, RCS maneuvers (4)
- Could be used for purges during reentry to avoid water vapor ingestion (4)
- Fuel cell power production (4)
- Thermal management (4)
- Design integrated vehicle/engine system to utilize these gases and liquids

Cost to Mature Technology

Use Tank Residual Gas and Plumbing

\$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+	