Solar Imaging Radio Array (SIRA)

Propulsion

Mark Underdown

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Competition Sensitive

Propulsion Subsystem

Upper Stage

Provide Delta –V for Injection into Distant Retrograde Orbit

- Moderate delta –V (500 m/sec) required for transfer
- Relatively small Bi-propellant system required
  - Mature Technology
  - Mass and volume constraint prohibits use of monopropellant
  - Spin-up spin down via cold-gas for coast period

Microsat

Provide station keeping delta-V and 3-axis control

- 64 m/s delta-v required to maintain spherical constellation (4 year)
- Use ST-5 technology cold-gas system

Propulsion Subsystems

Propulsion Module

- **High Performance Bipropellant System**
  - 445N Main engine
  - 4 22N Attitude control
- **4 x 12” COPV PMD tanks**
- **250 kg total propellant**

Microsat Propulsion

- **High pressure helium cold gas**
  - 4 micro cold gas thrusters
  - Ultra-light COPV pressurant tank
  - 4.5 kg GHe

Propulsion Module Cost and Mass

Integrated Mission Design Center

Component	quantity	Mass(kg)	Total Mass	cost (k)	Total
MMH Tank	2	6	12	350	700
OX Tank	2	6	12	350	700
Press Tank	1	10	10	200	200
22N biprop	4	1.5	6	200	800
445N	1	4	4	500	500
2N	4	0.072	0.288	20	80
gas filter	1	0.5	0.5	8	8
fuel/ox filter	4	0.5	2	8	32
low pressure p-ducer	2	0.08	0.16	12	24
high pressure p-ducer	1	0.08	0.08	12	12
pressure reg	1	1	1	30	30
gas f/d	2	0.1	0.2	5	10
f/d valve	4	0.1	0.4	5	20
latch valve	4	0.5	2	25	100
tubing	1	5	5	0	0
			55.6		3216

Microsat Propulsion Mass and Cost

Integrated Mission Design Center

Component	quantity	Mass(kg)	Total Mass	cost (k)	Total
Press Tank	1	2	2	350	350
2N	4	0.072	0.288	20	80
gas filter	1	0.5	0.5	8	8
high pressure p-ducer	1	0.08	0.08	12	12
gas f/d	1	0.1	0.1	5	5
tubing	1	0.5	0.5	0	0
			3.5		455

Propulsion Summary

- **Option 1**
  - Biprop Mature Technology
  - Cold Gas based on ground test of ST-5 system
  - Low to moderate risk for both systems
- **Further Investigation**
  - Explore use of Surrey Space nitrous oxide (160 sec isp vs 70 sec)
  - Lighter COPV Fuel/Ox tanks