

wasc 2032  
WAI 514

Least maneuvering  
engine for civil  
space dual mode  
propulsion systems  
incl. mono-propellant  
thrusters.



# Leros 1



**ROYALORDNANCE**

*Defence systems, sub-systems and components*



# Leros 1

## A 500N MON/Hydrazine orbital manoeuvring engine

The development of this engine represents the first phase of a planned expansion by Royal Ordnance into the area of civil space propulsion.

The long term aim of this expansion is the development of a comprehensive range of mono- and bi-propellant engines.

The Leros engine is designed to fulfill the orbital manoeuvring requirements of large telecommunication satellites utilising dual mode propulsion systems.

Dual mode propulsion systems utilise a bipropellant MON/Hydrazine thruster for orbital manoeuvring combined with mono-propellant hydrazine thrusters for attitude control and stationkeeping.

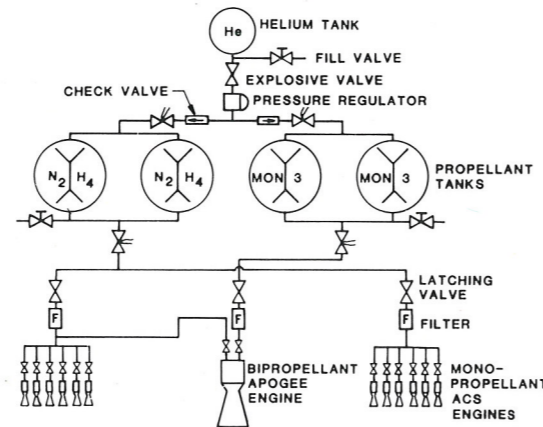
Dual mode represents state of the art in the evolution of satellite propulsion systems.

The advantages of such a system are:

- Retention of the full flexibility of the all bi-propellant unified propulsion systems.

- Reacquisition of the simplicity, reliability, cost and small impulse bit capabilities of the mono-propellant hydrazine thrusters utilised in first generation satellite propulsion systems.

### Dual mode propulsion system



### SPECIFICATIONS

Propellants	MON, Hydrazine
Thrust	500 ± 25N
Mixture ratio (O/F)	0.85
Nozzle area ratio	150
Specific impulse	≥310s.
Total impulse	7.0 x 10 <sup>6</sup> Ns
Inlet pressure	1.65MPa
Chamber pressure	0.71MPa
Combustion stability	± 12% >100Hz ± 3% <100Hz
Mass	<4kg

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## Design approach

A low risk approach to the design and development of Leros 1 was based upon:

- Use of proven design features

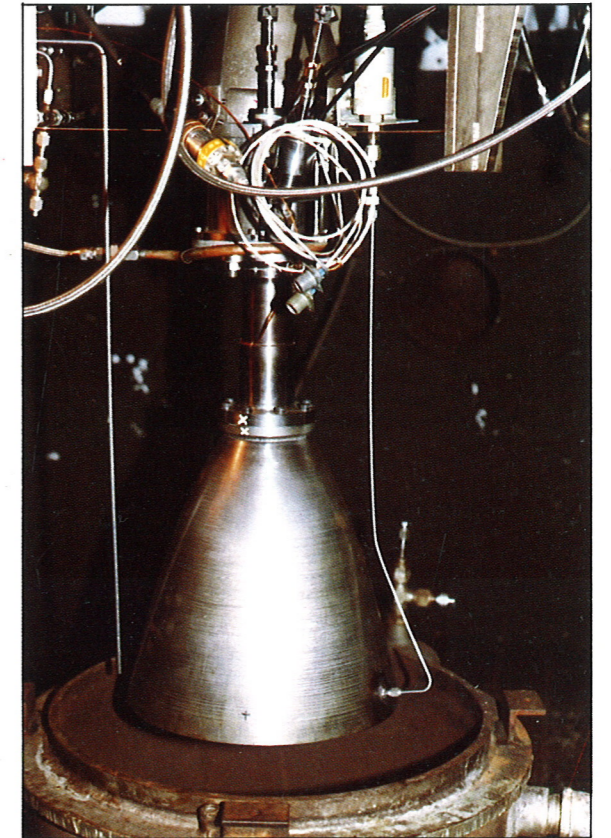
- Niobium C103 chamber and nozzle

- Disilicide coatings

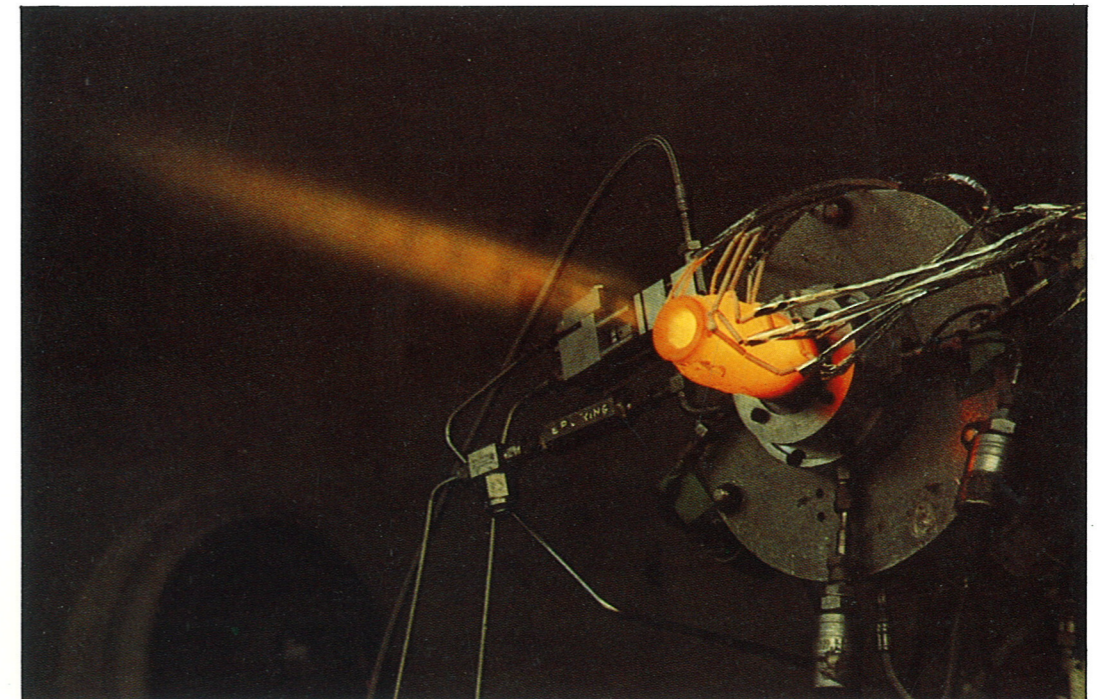
- Flight proven valves

- Extensive performance testing and characterisation at sea level and in vacuum

- Dual sourcing of major components



Leros 1 under test in Atlantic Research Corporation's altitude chamber.



Breadboard engine under test at sea level.



# Leros 1



Leros 1 engine using Moog valve for use in ESA test programme for dual mode apogee engine.

## Design Description

Component	Baseline Design	Backup
Injector	Royal Ordnance unlike doublet with fuel film cooling	
Propellant control valve	Moog torque motor valve	Wright Components dual coil, single seat solenoids
Expansion cone	MSR Niobium C103	J. S. Chin Niobium C103
Disilicide coating	Hitemco	BAJ

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