



Worlds Space Programs & Prospects

A European Perspective

David J. Salt
13th April, 2012

- **Government systems**
 - Current *orbital* systems (Ariane, Soyuz, Vega)
 - Future *orbital* systems (Ariane 5 ME, Ariane 6, **NELS**)
 - Current *suborbital* systems (Maxus, Texus, Rexus)
- **Commercial systems**
 - *Orbital* (Reaction Engines)
 - *Suborbital* (Astrium Spaceplane, Copenhagen Suborbitals, Project Enterprise, Tranquillity Aerospace)
- **Commercial services**
 - *Orbital* (Arianespace, Starsem, Eurockot, ISIS)
 - *Suborbital* (Virgin Galactic, SXC, XCOR payload integrators)

- **Government systems**

- Funding unlikely to increase beyond past levels due to major financial constraints faced by all national governments
- Funding constraints mean new development/operational concepts are now being pursued by ESA
 - ITT just released for ***New European Launch Services***

- **Commercial systems**

- Reaction Engines heat exchanger tests are key to financing next phases of development
- Other concepts are too *immature* to judge (e.g. Tranquillity Aerospace, Copenhagen Suborbitals) or appear to be *moribund* (e.g. Astrium Spaceplane, Project Enterprise)

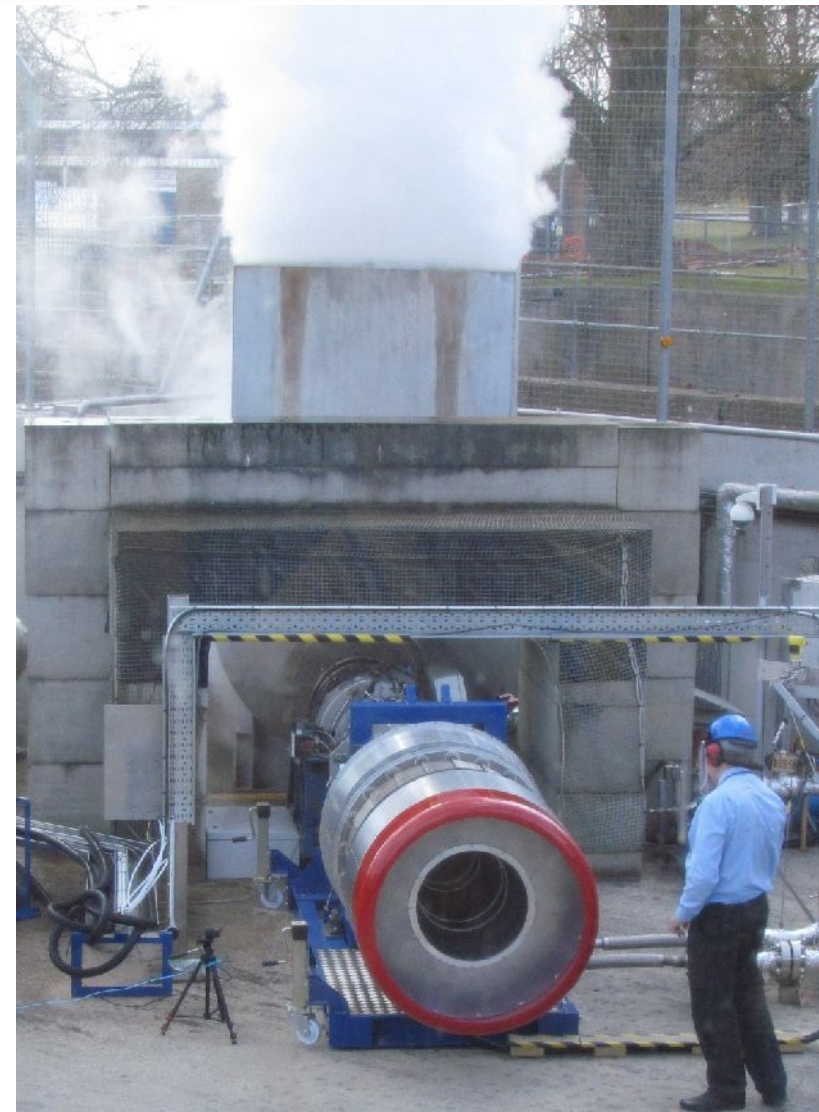
Reaction Engines – testing begins



Flight weight heat exchanger modules now under test to map out performance characteristics over full flight envelope

- Test pre-cooler has 50km of 1mm Diameter Inconel tubes with wall thickness of 20 microns

Note: steam is from the silencer system



- **Commercial services**

- Orbital services for **large** payloads seem likely to remain dominated by incumbents (Arianespace, Starsem, Eurockot) but **small** payloads may see growth through services offered by secondary sellers (e.g. ISIS)
- Suborbital services are likely to see **major growth**, driven by European ventures (e.g. SXC) operating US developed sRLV systems or brokering flights aboard them (e.g. XCOR payload integrators)

- **Conclusion**

- The *traditional* European launch systems and services face severe challenges and may see significant future decline!
- European ventures that exploit new US developed systems, by offering European industry improved access to the space environment, have **significant growth potential!**