

# TASC Talk – British Rockets for Satellites

By Mr Adam Watts of Moog UK Westcott Ltd.

Mr Adam Watts is the BD & Project Manager at Moog UK Westcott Ltd, which is part of Moog Space and defence group (MSDG). MSDG are a large multinational company that provide motion and flow control solutions for space related, military and security industries.

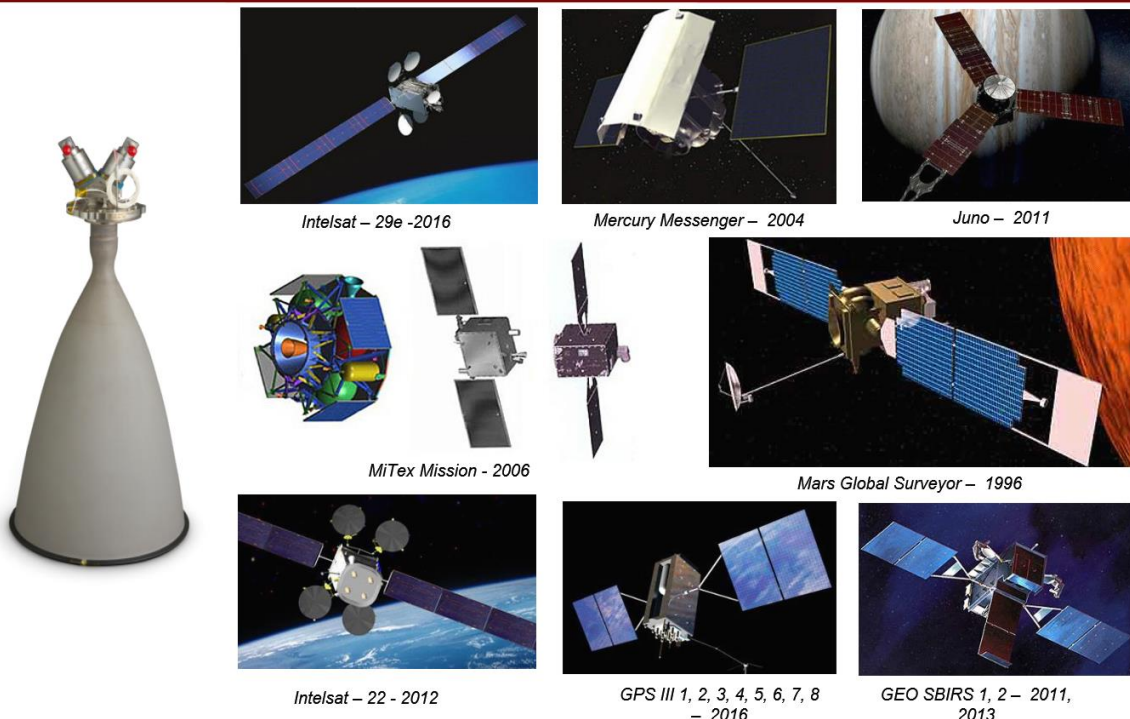
With regard to the space sector they provide –

- Systems, subassemblies and components for chemical, electric, and cold gas propulsion on satellites
- Positioning of antennas and solar array panels for spacecraft
- Space-rated electronics, avionics, thrust vector control actuation systems, primary flight control actuators, electronic controllers, and fluid control systems and components for launch vehicles

Adam’s talk concentrated on the work carried out at their Westcott facilities near Aylesbury where they are one of the few places in the world that design, develop, manufacture and test small to medium power rocket motors mainly used in GPS satellites. However, they have also developed rocket motors for NASA’s Juno mission to explore Jupiter. Some of their notable developments have included –

- Sea Wolf (Blackcap)
- Skylark Sounding Rocket
- Chevraline
- Falstaff Main Propulsion (Stonechat)
- Development of the LEROS product line
- and they are home to ESA’s High Thrust Apogee Engine (LEROS 4)

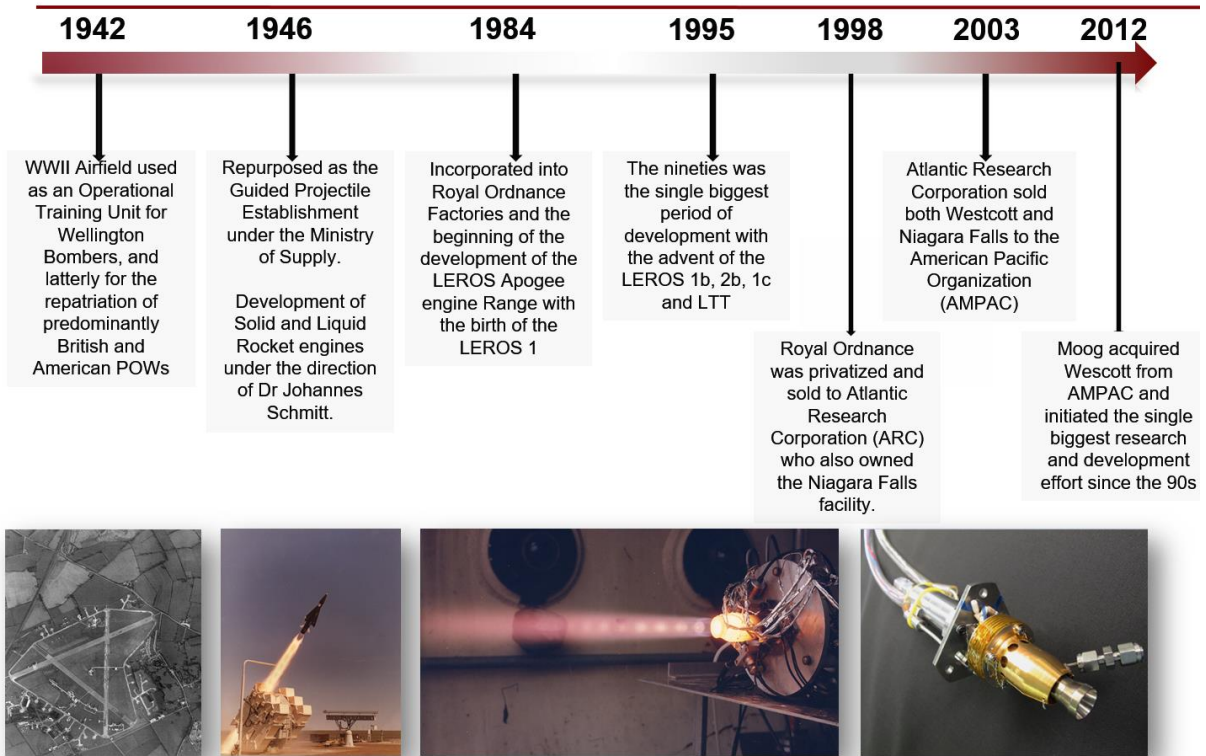
## LEROS Product Line Heritage



**LEROS APOGEE Engines – Over 90 Engines around the Solar System**

Originally the Westcott Centre was an operational training unit for Wellington Bomber pilots during the WWII and was repurposed in 1946 to test rocket engines utilising captured German rocket scientists, in particular Dr Johannes Schmitt.

## Moog Westcott Timeline



Their Westcott site possess three Hotfire test facilities where all their rocket engines are tested. Evidently when they first started test firing rocket engines, the local sheep used to scarpers to the other end of their field in panic, now however they don't even bother looking up to see what's going on. The Noise can be pretty loud.

During his talk Adam showed us a number of small positioning liquid fuel thrusters that use two propellants which when combined within the ignition chamber react to provide thrust. Control of the mix rate is provided by specially designed valves positioned near the top end of the exit nozzle. Some of the temperatures reached can be as high as 2500 degrees centigrade, and with some of their LEROS engines, the burn can last for as long as 7 hours continuously. The exhaust nozzles are specially coated to stop the metal they are made of from oxidising and flaking away during a burn. Another interesting fact is that the nozzles are carefully designed to shape the thrust to limit the force produced being wasted when shooting out the back of the nozzle.

Here are some photos of the rocket motors that Adam brought along to show us at the talk –





Shown on the previous page, bottom left is the smallest of the three motors which produces 1 Newton thrust. The rocket engine on the right produces 5 Newton's thrust and the larger engine shown on the left produces up to 500 Newton's thrust.

Westcott have played a key role in providing rocket engines for several US interplanetary missions, where the main propulsion was provided by a LEROS Apogee Engine. Here are a few details -

#### LEROS 1

Is out of production now but has flown on 27 missions, including 26 on Lockheed Martin spacecraft.  
467N thrust, 313 seconds Isp

#### LEROS 1b

Is available for specialist missions like JUNO which require good Isp and high thrust. So far 17 LEROS 1b's have been sold to LM and a total of 18 units have flown.  
635N thrust, 317 seconds Isp

#### LEROS 1c

Is the current evolution of the LEROS 1 and LEROS 1b MON/Hydrazine engines developed since the late 1980's at Westcott, UK  
458N thrust, 324 seconds Isp

#### LEROS 2b

Is the only MMH/NTO engine of the LEROS range and has so far flown on 1 mission. It is due to go to the moon in 2018/2019 as a contender for the Google X-Prize  
407N thrust, 318 seconds Isp

All in all it's great to see that GB is leading the world in the development of some of the most incredible and innovative technologies and in all places rural Buckinghamshire. There is a lot going on at the Westcott Venture Park where rockets are concerned, Moog are not the only rocket engine development company located there but also the Falcon Project which carries out major development on solid fuel rocket engines and are developing the hybrid rocket engine that will be, in part, powering the Bloodhound Project's 1000mph car. Also present at Westcott is Reaction Engines who are developing the SABRE (Synergetic Air Breathing Rocket Engine) which is intended for use on horizontal take off and land space planes such as SKYLON, which will be capable of Hypersonic speeds and may eventually shorten the journey from the UK to Australia to around 3 hours – Wow!

*Marius Stuart – The Adstock Science Club*