

SMALL SATELLITE MISSIONS SYMPOSIUM (B4)

Joint Session: Small Spacecraft Launch, Injection, and Orbit Transfer Systems (5.-D2.7)

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UKLAUNCH: TAKING SMALL SATELLITES TO ORBIT ON THE CREST OF THE SPACE
TOURISM WAVE**Abstract**

Virgin Galactic is developing Spaceship 2 and the Whiteknight 2 carrier aircraft, capable of lifting 6 passengers plus crew on a suborbital trajectory to greater than 100km altitude, using an air drop approach and a simple 'green' (non-hydrazine) propulsion system. The unique Whiteknight 2 carrier aircraft has been proposed as an airborne platform for deploying a small satellite launch vehicle. Its lift capacity of 17tons, ability to carry a large (in excess of 2m diameter) vehicle, and service ceiling of 50000ft remove a number of constraints that previous air dropped small satellite launchers have faced. Initial trade-studies carried out by SSTL and Virgin Galactic have indicated that an attractive launch service would be hugely attractive to the growing small satellite market around the 100kg mass point where real services can be delivered (e.g. RapidEye, DMC), if the following parameters could be satisfied:

- Low absolute price of \$2M per vehicle, with a target price point of \$5000/kg,
- Large volume available, e.g. for accommodating satellites carrying booms or deployed solar arrays,
- Benign (e.g. low vibration loading) launch environment,
- Wide range of accessible orbits in particular the high inclination sun-synchronous orbit at 400-800km altitude
- Good responsiveness, or ability to launch on demand ideally within weeks, or preferably, days of signing a contract),
- No need to find co-passengers or fill the launcher to obtain the indicated price point Freedom from political constraints, dictating whom can buy launch services,
- A practical, high margin, reliable design aimed at cost first, and absolute performance second.

Although new satellite launch concepts, and air launch designs have received considerable attention in IAF congresses, this is the first time a responsive small launcher has been addressed from a cost driven, customer focused perspective by the UK space community. Virgin Galactic is a service company, and does not directly build or operate launch vehicles. SSTL concentrates on small satellite engineering and services, typically purchasing launch services for its customers at the best possible price on the open market. The synergy of these two cost focused organisations, both based in the UK with its long aerospace

heritage and significant technical capability in all the required subsystems for a small launcher, promises an attractive commercially focused design tailored to the precise needs of the very small satellite market. This paper will address:

- The market through 2020 for various sizes of small satellites <50kg up to 200kg,
- Launcher options trade space (ground v. air, number of stages, propulsion, launch sites and options),
- Interfacing a small
 - launcher to White Knight 2,Launcher concept design - making use of UK heritage where possible. Propulsion, guidance, structures and flight termination systems are key elements,
- CONOPS and launch site options, logistics,
- Benefits of manufacturing, production and launch from the UK,
- Operating cost estimate and development plan,