



February 2016

## VIRGIN GALACTIC

### HUMAN SPACEFLIGHT VEHICLES FACT SHEET

[Virgin Galactic](#), the world's first commercial spaceline, owns and operates a human spaceflight system consisting of two vehicles - the SpaceShipTwo spaceplane and its WhiteKnightTwo carrier aircraft:

#### SpaceShipTwo (SS2)

- Uses much of the same technology, construction and design of SpaceShipOne, but is twice the size in terms of wingspan and overall length and nearly six times the size in cabin volume. It has also been designed for commercial service rather than a proof-of-concept demonstration.
- Designed to carry two pilots and up to six passengers.
- Technical specifications:
  - Dimensions (rounded):
    - Wing / tail boom span: 42 feet.
    - Length: 60 feet.
    - Tail height: 15 feet (with feather down).
  - Cabin details: 6 passenger seats; 90-inch diameter x 12 feet long
    - Cabin diameter approximately the same size as a Falcon 900 jet.
    - Maximum possible fuselage volume used for passenger cabin.
    - Large windows positioned throughout the cabin to afford maximum viewing potential for passengers.
    - Reclining seats to maximize cabin space in microgravity and for comfort during re-entry.
    - Feathering wings for re-entry: same concept as SS1.
  - Construction: All structural components are 100 percent carbon composite.
  - Propulsion: Hybrid rocket motor uses a relatively benign fuel and oxidizer (the same means of propulsion as SS1) and is controllable – can be shut down at any time during boost phase of flight.
    - After release from carrier aircraft, the rocket motor is engaged for ascent to space; re-entry and landing are without propulsion.
  - Gear: Tricycle gear configuration; 2x wheeled main gear; 1x nose skid, with abrading shoe.
- Flight Profile:
  - Total independent flight time: Approximately 30 minutes.
  - Flight time including captive carry by WhiteKnightTwo: Between 1.5 and 2 hours.
  - G-Forces: Max  $G_x$  (front-to-back; reclined position on reentry): +6  $G_x$ ; Max  $G_z$  (head-to-toe; upright position on boost): +3.5  $G_z$ .
  - Planned apogee of spaceflight: to exceed NASA's definition of space.
  - Zero gravity phase – Several minutes of out-of-seat time.
  - Velocity: Supersonic within eight seconds of rocket ignition with a maximum velocity of more than Mach 3.5.

- Total Number of Flights: 54 (including 3 rocket-powered supersonic flights; all as of February 2016).
- SS2-001 (lost during test in October 2014) designed and built by Scaled Composites; SS2-002 and future SS2 vehicles are being manufactured by Virgin Galactic's [The Spaceship Company \(TSC\)](#).

### **WhiteKnightTwo (WK2, *VMS Eve*)**

- Carrier aircraft for SpaceShipTwo.
- Largest carbon composite carrier craft in service (all structural components are 100 percent carbon composite).
- Training vehicle for SS2 spaceflight:
  - Can perform winding turn manoeuvres in order to simulate SS2 Gz (head to toe) profile and is also capable of zero-G parabolas (neither yet implemented).
  - Both fuselages replicate that of SS2 potentially allowing for future passenger training;
  - Unique high-altitude lift aircraft potentially suitable for various payloads;
- Technical specifications:
  - Dimensions:
    - Wing span: 140 feet (only 16 feet less than Boeing 767-300);
    - Length: 78 feet;
    - Tail height: 26 feet;
  - Construction: Twin boom/fuselage construction;
  - Powerplant: Uses four highly efficient high-bypass turbofan jet engines.
  - Gear: Quadricycle gear configuration, retractable.
  - Range: Approximately 2600 nautical miles carrying SS2 (US coast-to-coast).
- Flight profile for nominal SS2 release:
  - Total flight time: Approximately two hours.
  - From takeoff to SS2 release: Approximately 60 minutes.
  - SS2 release: Approximately 50,000 feet.
- Total Number of Flights: 198 flights (as of February 14<sup>th</sup> 2016).
- Milestones:
  - First flight: December 21<sup>st</sup>, 2008.
  - Test flight program complete including high-altitude and long-duration tests.

### **ENVIRONMENTAL IMPACT**

- Air launch – avoids the need for large, ground-based rocket booster systems.
- Carbon composite construction a quarter the weight of steel for the equivalent strength – transforms the energy requirements for both WK2 and SS2.
- Hybrid rocket motor – relatively benign, non-toxic fuels with a short burn time due to air release.
- Unpowered descent and landing.
- Fully reusable, excluding the solid fuel housing.

### **LICENSING**

- U.S. regulatory framework was originally established by the 2004 Commercial Space Launch Amendments Act, which empowered the Office of Commercial Space Transportation within the Federal Aviation Administration to regulate and license commercial space launch vehicles and operators.

- That Act established the principle of Informed Consent for space flight participants, permitting a licensed operator to carry passengers on space flights, once the passengers are informed of and accept a comprehensive explanation of the potential risks involved.
- In November 2015, the U.S. Commercial Space Launch Competitiveness Act was signed into law. The new law extends until 2025 the space launch risk-sharing provision mentioned above. Overall, this new legislation modernizes commercial space regulations and provides an essential legal framework that will enable the commercial spaceflight industry to grow in the years ahead.

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