

NASA RANGE SAFETY PROGRAM 2005 ANNUAL REPORT

Winning the Ansari X-Prize

On 4 October 2004, SpaceShipOne claimed the ten million dollar Ansari X-Prize, formerly the X-Prize, when it reached 100 kilometers, about 62.5 miles above the earth, for the second time in a two-week period. At the same time, SpaceShipOne erased the 41-year-old record for winged aircraft held by the X-15.

The Ansari X-Prize was created in 1996 by the X-PRIZE foundation. Criteria for winning the prize included the following:

- A team would have to privately build, launch, and finance a vehicle capable of carrying three passengers (or one passenger and ballast to equal the weight of three) to 100 kilometers and safety return to earth.
- The same vehicle would have to repeat the flight twice within two weeks.
- No more than 10 percent of the vehicle's non-propellant mass could be replaced between the first and second flights as a demonstration of economic reusability.

SpaceShipOne

SpaceShipOne —constructed of composite materials—was funded by Paul G. Allen, designed by Burt Rutan, and built by Rutan's company, Scaled Composites. It cost approximately thirty million dollars to produce. On its first flight conducted on September 27, SpaceShipOne reached a maximum altitude of 337,500 feet with a motor burn lasting 77 seconds. The second flight attained a maximum altitude of 377,591 feet with a motor burn lasting 84 seconds, setting the new record.

Like the X-15 of the 1960s, SpaceShipOne uses an air-launch system. At a pre-designated altitude of just under 50,000 feet, SpaceShipOne launches from its carrier vehicle (White Knight) and proceeds on its suborbital path. The cocking tail section allows deceleration to happen at a higher altitude, reducing stress and heat on the vehicle.

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Photo Credit: Scaled Composites—taken from Dryden Flight Research Center Express

SpaceShipOne is a lifting body propelled via rocket after launch and uses a non-powered re-entry. The fuel combines nitrous oxide as an oxidizer and hydroxy-terminated polybutadiene (rubber). The propulsion system is called a hybrid rocket system because of this fuel combination. At approximately 150,000 feet, the motors stop burning and the craft coasts until it reaches apogee. At that point, the back of the craft's wings fold upward to increase drag and slow the airplane as it falls through the second half of its parabolic flight.

During the flight, personnel from Dryden Flight Research Center and the US Air Force provided assistance to the mission. Dryden's Western Aeronautical Test Range provided radar-based, time-space positioning information to the Air Force which was contracted to provide tracking services for SpaceShipOne's flight.

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The X-15

The X-15—the most remarkable of the rocket research aircraft and predecessor to SpaceShipOne—was a joint program operated by NASA, the Air Force, the Navy, and North American. With a technical approach somewhat similar to that of SpaceShipOne, the X-15 used an air launch system with a modified Boeing B-52 Stratofortress as its launch vehicle. Composed of an internal structure of titanium and a skin surface of a chrome-nickel alloy known as Inconel X, the X-15 was fueled by liquid oxygen and a non-cryogenic fuel (anhydrous ammonia).



X-15—from NASA files “X-15: Hypersonic Research at the Edge of Space”

Three X-15s were built. Among them, they completed 199 flights from 1959 to 1968. The X-15 program saw the same vehicle launch twice during a two-week period on 38 separate occasions during its testing period. On 10 occasions, the program sent the same vehicle up twice in under a week. From April 30, 1962 until August 22, 1963, the X-15 set three consecutive altitude records. The last—354,200 feet set on August 22, 1963—remained unbroken until the flight of SpaceShipOne.

The X-15 provided an enormous wealth of data on hypersonic air flow; aerodynamic heating; control, and stability at hypersonic speeds; reaction controls for flight above the atmosphere; piloting techniques for reentry; human factors; and flight instrumentation. This data contributed to the development of the Mercury, Gemini, and Apollo piloted space flight programs as well as the Space Shuttle program.