X PRIZE Team Summary Sheet
FTS

All the information given in this document has been cleared for official release by the X PRIZE Foundation and the Fundamental Technology Systems team. Quotes provided by FTS are shown in italics. For more information about FTS or if you have questions about FTS, please visit their web site at www.funtechsystems.com.

TEAM OVERVIEW

Fundamental Technology Systems, Inc. (FTS), the developer of the Aurora Spaceplane, is an engineering product development company with expertise in development and testing of air vehicles, dynamic vehicle force and moment measurement systems, navigation systems, real-time absolute performance determination systems, and high fidelity simulation. Aurora Spaceplane represents an opportunity for FTS to demonstrate the first step of affordable space flight.

TEAM LEADER BACKGROUND

Jim Toole, President of Fundamental Technology Systems, has 28 years experience in aerospace systems development with Hughes Aircraft and Lockheed Martin.

Ray Nielsen, VP of Engineering for Fundamental Technology Systems, has 28 years experience in high performance air vehicle and space launch system development and test with Lockheed Martin.

DATA AT-A-GLANCE

TEAM SPECIFICATIONS

- Name: Fundamental Technology Systems (FTS)
- Leader: Ray Nielsen & Jim Toole
- Place: Orlando, Florida, USA
- Registered with X PRIZE: 21 November 2000
- Web: www.funtechsystems.com

VEHICLE SPECIFICATIONS

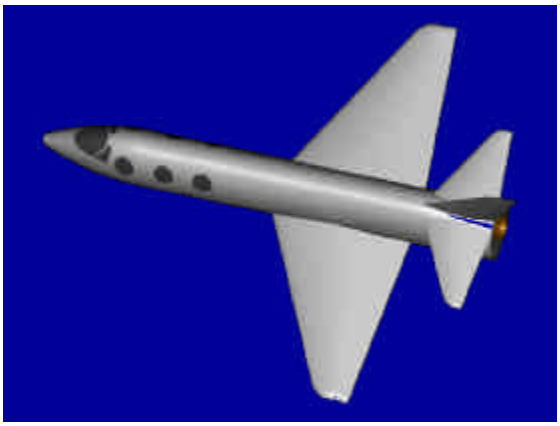
- Name: Aurora
- Length: 36.0 feet
- Span: 30.0 feet
- GTOW: 10,600 lb_m
- Dry Weight: 3000 lb_m
- Crew Environment: Pressurized cabin
- Payload Capacity: 8 feet long
- No.of Engines: One
- Propulsion System: Variable liquid w/thrust vectoring
- Fuel: Kerosene
- Oxidizer: Hydrogen Peroxide
- Total Thrust: 10,000 lb_f (vacuum)
- Reaction Control System: Cold gas

MISSION SPECIFICATIONS

- Ascent Method: Horizontal take-off from runway under rocket engine thrust
- Alt. at Ignition: Earth surface, 100% power at 80,000 feet
- Orientation at throttle-up: +75 degrees
- Max. Accel. Force on Ascent: 3 G
- Alt. at Engine Cut-off: >200,000 feet
- Time at Engine Cut-off: T+220 sec
- Max. Speed: 5,000 feet/second
- Max. Altitude: Over 350,000 feet
- Time in Weightless Conditions: ~4 minutes
- Reentry Method: Unpowered glide
- Accel. Forces on Descent: -4 G
- Landing Method: Conventional runway
- Total Duration: ~30 minutes
- Landing Distance from Take-off Location: none
- Time Between Missions: 7 days

VEHICLE/LAUNCH SYSTEM DESCRIPTION

The Aurora rocket plane is fitted with a single kerosene and hydrogen peroxide rocket engine. A high L/D planform provides aerodynamic lift for ascent and descent. The pilot, co-pilot, and mission specialist are seated in-line in a pressurized cabin that is temperature controlled. No special flight suits are required.



Avionics include an inertial navigation and guidance system, VHF com, A/C transponder, UHF data link, flight displays, and vehicle instrumentation. The forward portion of the fuselage can be pyrotechnically separated from the wing and engine assembly in an in-flight emergency. A ballistic parachute recovery system is deployed from the nose to provide a soft landing of the entire cabin assembly on inflated airbags. A crash locator beacon is activated automatically. Flight controls are redundant actuator assisted with mechanical backup.

PROPULSION SYSTEM

Aurora's variable thrust main engine uses gimballed thrust vectoring during ascent for pitch and yaw rate stabilization. The vehicle carries just enough fuel to ascend above 62 nautical miles and is statically stable through its flight envelope with a large wing area for low take-off and landing speeds. A cold gas reaction control system provides reentry attitude control.

MISSION DESCRIPTION

Aurora 1 is intended to provide the fun ride of a lifetime. In our view the ride must be fun, interesting, and reasonably comfortable. The passenger sits in a comfortable seat, in a pressurized cabin, feels a significant acceleration rush, sees a view of the world few have seen, experience weightlessness, and then another acceleration rush ending in a glider ride back to the airport.

VEHICLE ASCENT

After final vehicle preflight checkout and range status checks, the crew enters the forward main hatch and straps in. Aurora is towed out to the engine start area at the take-off end of the runway. The ignition system ground safety pin is removed. The navigation system is initialized and communication with ground controllers verified. Upon ground controller clearance the main engine is pressurized and ignited for final status checks.

The brakes are released at half throttle starting the take-off roll. At 110 knots Aurora is rotated for liftoff, landing gear retracted, and the pilot pulls up to the initial climb attitude. The climb attitude is continually increased to maintain subsonic flight until above 60,000 feet. At 80,000 feet and with a flight path angle nearly 75 degrees above the horizon the engine is commanded to 100% power. The pilot rolls Aurora inverted for a good view of the earth.

WEIGHTLESSNESS

The main engine cuts off above 220,000 feet and 5000 feet per second. Aurora coasts in a ballistic trajectory above 350,000 feet. In preparation for reentry the pilot uses the RCS to orient Aurora into the initial deceleration attitude.

VEHICLE DESCENT AND LANDING

As Aurora decelerates the flight path angle is decreased until a turn back towards the departure field can be initiated. The best glide profile is commanded until the downwind initial point for landing is achieved. Aurora has a high L/D and the normal landing pattern is flown at 100 knots. On short final the airspeed is reduced to 80 knots for touchdown and roll out. Conventional hydraulic wheel brakes are used to slow the vehicle down. Upon stopping on the runway a tug is sent to tow the Aurora back to the hangar. The crew opens the main forward hatch and egresses for debriefing and celebrations.

HARDWARE & TESTS

The primary efforts to date have been the rocket motor and avionics system development. We have a 50 lb_f testbed rocket engine test program underway

and a follow-on 1000 lb_f scale engine in development. The purpose of the scale testing is to validate performance models, verify starting sequencer software, validate throttling approach, and catalyst bed research. The 1000 lb_f engine will be installed in a FTS research rocket plane (RRP) designed to emulate the Aurora flight phases. The 18 foot long RRP also takes off and lands on a runway, is fully autonomous using Aurora avionics, and is capable of Aurora velocities.

The Aurora guidance computer has been built and flown in the company testbed aircraft. Aurora uses a FTS developed GPS-aided inertial guidance package to drive vehicle flight controls and generate crew displays.

PUBLICITY

PERSONAL APPEARANCES

- None

TELEVISION AND RADIO

- None

PRINT MEDIA

- *Florida Team Vies For Orbit - $10M XPRIZE Contest Seeks Space Tourism Vehicles* - Florida Today, February 23, 2002

TEAM BACKGROUND

TEAM MEMBERS

- James Toole
- Ray Nielsen
- Rob Nix
- Steve Phillips
- James Brown
- Rob DeBardeleben
- Sean Toole- Webpage

X PRIZE QUOTE

"The X PRIZE people figured out that we were taking our sweet time to get started, so they became the catalyst to get us all moving. Now the general public will be able to experience space travel."
– Ray Nielsen

"The X PRIZE is the catalyst that can lead to personal space flight for all who dream of it."
– Jim Toole

PHILOSOPHY

"Strap yourself in, hit the igniter, and hold on!"
– Ray Nielsen

MISSION AND GOALS

"In our view the ride must be fun, interesting, and reasonably comfortable. A spaceplane like Aurora satisfies that requirement. You sit in a comfortable seat, in a pressurized cabin, view your own flight instruments, feel a significant acceleration rush, and then see a view of the world few have seen. You experience weightlessness and then another acceleration rush ending in a glider ride back to the airport." – Ray Nielsen

X PRIZE FOUNDATION

Below is contact information for the X PRIZE Foundation.

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