ANSARI X PRIZE Team Summary Sheet

CANADIAN GOLDEN PALACE.Com DAVINCI PROJECT TEAM

"For once you have tasted flight you will walk the earth with your eyes turned skywards, for there you have been and there you will long to return." - Leonardo da Vinci (1452–1519)

All the information given in this document has been cleared for official release by the X PRIZE Foundation and The da Vinci Project (DVP). Quotes provided by DVP are shown in italics. For more information about DVP or if you have questions about DVP, please visit their web site at www.davinciproject.com/.

TEAM OVERVIEW

The Canadian-based Golden Palace.Com da Vinci Project is perhaps one of the most unconventional teams in the ANSARI X PRIZE competition. Its *Wild Fire MKVI* rocket will be launched not from ground level, but from 24 kilometers (80,000 feet) up, having been carried to that height by a reusable helium balloon. Da Vinci is also staffed completely by volunteer labor – 500 workers have contributed over 150,000 man-hours so far. Team leader Brian Feeney says it's the largest volunteer technology project in Canadian history, according to the *Toronto Star*. The da Vinci Project has also received significant donations of technical software and support from corporate sponsors such as Sun Microsystems and ANSYS.

GOLDEN PALACE .COM SPACE PROGRAM Powered By The da Vinci™ Project

TEAM LEADER/PILOT BACKGROUND

Brian Feeney has a strong background in large project management and 3-D computer aided design. He possesses specific design and analytical skills in liquid rocket propulsion engines and systems, aero structure layouts and design, reaction control systems, and flight profile and trajectory analysis. His own business background is in closed loop life support systems specializing in the development of advanced life support solutions for aerospace, military and commercial applications. Brian is on the Advisory Board of CSEDI, Canadian Space Exploration and Development Institute. Brian plans to pilot the first flight of the *Wild Fire MKVI* rocket.

DATA AT-A-GLANCE

TEAM SPECIFICATIONS

- Name: The Golden Palace.Com Space Program Powered By The da Vinci Project
- Leader: Brian Feeney
- Place: Toronto, Ontario, Canada
- Registered with X PRIZE: 2 June 2000
- Web: www.davinciproject.com

VEHICLE SPECIFICATIONS

- Name: *Wild Fire MKVI*
- Dimensions: 8 m (26 ft) long, 2 m (78 in) in diameter
- Gross Take-Off Weight: 3,860 kg (8,500 lbm)
- Dry Weight: 1,660 kg (3,650 lbm)
- Crew Capsule: 2 m (78 in) diameter sphere
- Crew Environment: Pressurized to 1 atm with pressure suits
- Payload Capacity: 410 kg (900 lbm)
- Propulsion System: Single, pressure-fed, hybrid engine
- Propellants: Nitrous Oxide and proprietary solid fuel
- Total Thrust: 80,000 N (18,000 lbf)
- Reaction Control System: Cold gas nitrogen integrated with GPS and INS for flight guidance
- Miscellaneous: Two drogue shoots and two mains on the capsule deploy and it repeats again separately for the propulsion section during descent.

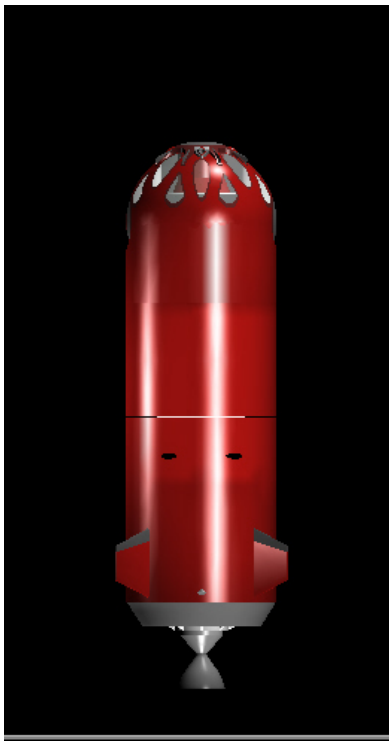
MISSION SPECIFICATIONS

- Ascent Method to Ignition Alt.: Reusable helium balloon

- Ascent Duration: 90 to 120 minutes
- Alt. at Ignition: 21 - 24 km (70,000 - 80,000 ft)
- Orientation at Ignition: 75 degrees up, changing to 90 deg after 8 seconds
- Max. Accel. Force on Ascent: 3.5 g
- Alt. at Engine Cut-off: 62.8 km (206,000 ft)
- Time at Engine Cut-off: 90 seconds
- Max. Speed: 1,190 m/s (2,670 mph)
- Max. Altitude: 115 km (377,000 ft)
- Time in Weightless Conditions: 3.5 minutes
- Reentry Method: Capsule and propulsion section reenter separately using their own shielding with passive stability.
- Accel. Forces on Descent: 20 sec > 3 g; max 6.75 g
- Landing Method: Aeroconical parachutes are deployed before landing on airbags. Mercury style shielding, they deploy and soften the blow.
- Total Duration: 90 to 110 minutes
- Landing Distance from Take-off Location: 50 - 100 km (31 - 62 mi), depending on winds
- Time Between Missions: Days

VEHICLE/LAUNCH SYSTEM DESCRIPTION

The DVP vehicle is called *Wild Fire MKVI* and is designed to carry three people to an altitude of 100 kilometers (62 miles) and return them safely to the Earth. The entire launch system is comprised of two parts: the rocket and an unmanned reusable helium balloon which lifts the rocket to altitude before the rocket engines are fired. Guidance is accomplished using an integrated GPS / INS system into the RCS (Reaction Control System). The vehicle is a cylindrical rocket with a blunt nose cone, and uses inflatable base cushions for both the capsule and propulsion sections that land separately (used to cushion the landing). *Wild Fire MKVI* is approximately 8 meters (26 feet) long and 2 meters (78 inches) in diameter. Its gross initial take off weight is approximately 3,860 kilograms (8,500 pounds), including a 410 kilogram (900 pound) payload (passenger) capacity. The rocket is suspended beneath the helium balloon and carried to an altitude of 24 kilometers (80,000 feet) before its engines are fired.



PROPULSION SYSTEM

The propulsion system of *Wild Fire MKVI*, under development since 1996, is based on the principles of reliability, reusability, and safety. A single engine is used on the *Wild Fire MKVI* burning nitrous oxide and a proprietary solid fuel mixture in a pressure fed system to generate 80,000 newtons (18,000 pounds) of thrust. The rocket engines, the entire propulsion subsystem, and the flight guidance system were developed by the DVP propulsion in house team in Canada. Ground firing and flight testing have occurred already.

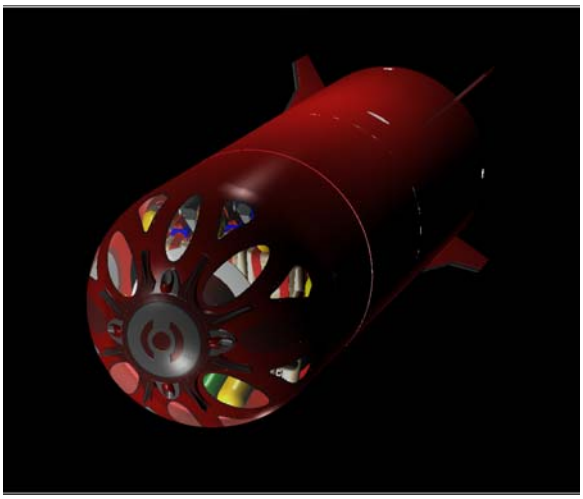
MISSION DESCRIPTION

VEHICLE ASCENT

The rocket will be tethered to the world's largest fully reusable helium balloon and floated to an altitude of 24 kilometers (80,000 feet). The ascent sequence starts with ground launch of the helium balloon with the DVP rocket tethered 250 meters (820 feet) below the base of the balloon at an 75-degree up angle. After approximately one and a half hours, the rocket will arrive at a launch altitude of 24,380 meters (80,000 feet). Following a series of launch procedures, a 120 second computer controlled automatic countdown sequence is initiated and the engines are ignited. Immediately on engine start the rocket releases from the balloon tether and for the next 8 seconds the vehicle flies at a 75 degree angle trajectory. The RCS changes the trajectory of the rocket to 90 degrees (straight up) for the remainder of flight. Main engine cut off occurs at 63 kilometers (39 miles); 3.5 G's have been reached, total time since firing engines is 90 seconds. The speed is about Mach 3.5 or about 1.19 kilometers per second (2,670 miles per hour). The rocket continues up to apogee. At 85 kilometers (53

miles) altitude the capsule separates from the propulsion section – about 100 seconds - 110 kilometers (68 miles) – and then begins free fall for 105 seconds - total zero G time about 3 minutes 30 seconds. Drogue chutes deploy at 12,190 meters (40,000 feet) on both the capsule and propulsion section, separately. The main chute on both deploys separately at 3,050 meters (10,000 feet). Landing occurs at 5 meters per second (16 feet per second). During the ascent (and descent) stages, live camera feed from the balloon and rocket occur throughout the flight.

WEIGHTLESSNESS



After 100 seconds and at 62.8 kilometers (206,000 feet), the main engines are cut off. The crew has experienced acceleration forces up to three and half times the force of gravity (3.5 g). The speed of the vehicle at this point is about Mach 3.5, or approximately 1,190 meters per second (2,670 miles per hour). The rocket coasts for about 105 seconds to an altitude of 110 kilometers (68 miles) and then begins free fall for another 105 seconds. The total time the crew experiences micro-gravity conditions is approximately 3 minutes and 30 seconds.

VEHICLE DESCENT AND LANDING

Fifteen seconds after apogee is reached, at 85 kilometers (278,900 feet), the capsule separates from the propulsion section. Both the capsule and propulsion section have passive static stability during reentry. Drogue parachutes are deployed at 12 kilometers (40,000 feet) on both pieces of hardware, followed by main parachute deployments at 3 kilometers (10,000 feet). Both the capsule and propulsion section deploy their reentry shields separately, prior to ground landing, and act as air cushions (in a similar fashion to mercury capsules of the early 1960s).

HARDWARE & TESTS

DVP has a full-scale engineering prototype of *Wild Fire MKVI* which has appeared at a wide variety of aerospace industry and general public occasions.

The da Vinci full scale propulsion system has been built and is in the process of undergoing significant testing. Full-scale hardware is presently nearing completion. Throughout 2000-2004, DVP has been busy developing and testing the propulsion systems, engine, flight guidance, and flight analysis software.

BEHIND THE SCENES

"When the [ANSARI] X PRIZE was announced in 1996, I was actually living in Hong Kong," recounts team leader Brian Feeney. "The same week it was announced, it got caught by *Business Week, Newsweek* and the *International Weekly Press*. I picked it up, I saw that and that was the catalyst. I said, 'I'm going to do that.' … A "10 Million Dollar Race to Space is On," or whatever the headline was, and I took it seriously from that moment on. I took my battleship and turned left."

TEAM IDEOLOGY

ANSARI X PRIZE QUOTE

"The [ANSARI] X PRIZE is captivating the minds of the best and the brightest to prove that one can do what many think to be impossible. Its success will break down the barriers inspiring growth and achievement in space flight. The entire planet's population will no longer see itself as bound to just one planet. The [ANSARI] X PRIZE's vision will bridge the chasm once again just as the Orteig Prize did to bridge the mind barrier of crossing the Atlantic by air." – Brian Feeney

PHILOSOPHY

"DVP symbolizes the capability of the common person and visibly demonstrates what can be achieved privately without the necessity of governments' involvement. It will be an affirmation that anything is

possible with vision, determination and ingenuity. DVP hopes to be an inspiration to people and to show that there is no greater power than the will of the individual, that there is freedom in exploration and joy in discovery. The important discoveries for a society seldom come at the points where the path is smooth and straight. It is the curves in that path to adventure that make the trip interesting and worthwhile." – Brian Feeney

MISSION AND GOALS

"History is filled with the exploits of ordinary individuals doing extraordinary things and whose accomplishments propel human progress. Today, we of the da Vinci Project strive to do the same. We seek to win the [ANSARI] X PRIZE, safely launching the first privately funded manned rocket into space and back. We are pulling together the best and brightest in Canada and from around the world in a collaborative effort to realize this dream. We are people driven by the simple desire to participate and contribute to the true renaissance of Man in space." – Brian Feeney

THE CREW

Other members of the DVP team members include:

- Brian Feeney, Team Leader (Pilot Wild Fire MKVI)
- Marc De Jordy, Operations Director
- Mike Viechweg, Program Management
- Dr. Vladimir Kudriatsev, Head of R&D and Eng. Computational Fluid Dynamics (CFD)
- Prof. Alexie Borovkoff, FEA, Univ. of St. Petersburg, Russia
- James Porcher, Team Leader Ground Ops & Logistics
- Arny Sokloff, Team Leader, Avionics
- Dave Loewen, Aerospace Engineer
- Bill Lishman, Designer
- Lorne Brandt, Education Programs
- Stephen Hewitt, Media Relation, National Public Relations
- Shannon Davidson, Communication and Public Relations
- Rob Richardson, Computer Systems and Information Technologies

TEAM CONTACT INFO

Below is contact information for the da Vinci Project.

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