



X PRIZE Team Summary Sheet

ARMADILLO AEROSPACE



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TEAM OVERVIEW

ArmadilloAerospace™

Leading a small team of dedicated enthusiasts with eclectic backgrounds, John Carmack founded Armadillo Aerospace in 2000 and incorporated on January 1, 2001. Since that time, the Armadillo team has accomplished more than some groups have in decades; and each successful achievement leads them to one of their goals. Armadillo Aerospace has set its site on winning the X PRIZE. Armadillo Aerospace is located in Mesquite, Texas, USA.

TEAM LEADER BACKGROUND

John Carmack, co-founder and Chief Technical Engineer of id Software, became well-known for his creations of first-person “shooter” games *Wolfenstein 3D* (1992), *DOOM* (1993), and *Quake* (1996). A long-time rocketry enthusiast, John Carmack has been a regular contributor and supporter of amateur groups working toward sending civilians into space. Frustrated by the slow progress, Carmack decided to jump into the effort himself in his spare time. John Carmack has already established himself one of the most distinguished careers in the world of computer games. His work in the field of aerospace may win an equal amount of notoriety.



DATA AT-A-GLANCE

TEAM SPECIFICATIONS

- Name: Armadillo Aerospace
- Leader: John Carmack
- Place: Mesquite, Texas, USA
- Registered with X PRIZE: October 2002
- Web: www.armadilloaerospace.com

VEHICLE SPECIFICATIONS

- Name: Black Armadillo
- Length: 24 feet (730 cm) (est.)
- Diameter: 5.25 feet (160 cm)
- GTOW: 14,000 lb_m (6,350 kg)
- Dry Weight: 1,800 lb_m (815 kg)
- Crew Environment: Pressurized cabin
- Payload Capacity: 595 lb_m (270 kg)
- No. of Engines: 4
- Propulsion System: Pressure fed monopropellant
- Oxidizer: Hydrogen Peroxide
- Total Thrust: 30,000 lb_f (133,500 N)
- Reaction Control System: Cold gas expelled through engines

MISSION SPECIFICATIONS

- Ascent Method: Vertical ground takeoff with active attitude control.
- Max. Accel. Force on Ascent: 3 Gs
- Alt. at Engine Cut-off: 34.5 miles (55.5 km)
- Time at Engine Cut-off: 144 seconds
- Max. Speed: 2,270 miles per hour
- Max. Altitude: 67 miles (106.7 km)
- Time in Weightless Conditions: Not yet disclosed.
- Reentry Method: Ballistic Descent
- Accel. Forces on Descent: 5 Gs
- Landing Method: Parachute with crushable nose cone
- Total Duration: 15 minutes
- Landing Distance from Take-off Location: Not yet disclosed.
- Time Between Missions: Not yet disclosed.





VEHICLE/LAUNCH SYSTEM DESCRIPTION



As testing on vehicle systems progresses, the design of the Black Armadillo is gradually maturing. The current design is a single stage vehicle with non-traditional operating features.

PROPULSION SYSTEM

The Black Armadillo's propulsion system consists of four pressure fed, hydrogen peroxide, monopropellant system rocket engines fed from a single tank. The propellant tank has a capacity for 1,600 gallons (6,055 liters) of hydrogen peroxide. The exhaust of a hydrogen peroxide propulsion system is environment-friendly (superheated steam and gaseous oxygen).

MISSION DESCRIPTION

The flight profile of the Black Armadillo starts out in a familiar fashion, but shortly after reaching the peak altitude of 107 km (67 miles), it operates in a manner which can only be described as "ground breaking."

Orientation of passengers in the cabin has not been finalized.

VEHICLE ASCENT

Initial acceleration of the Black Armadillo is 2 Gs, dropping off as speeds increase, and then rising again towards the end of the engine burnout. There is a much longer than typical burn because the rocket engines are used to stabilize the vehicle during ascent. The engines will burn for approximately 145 seconds, at which time the vehicle will be traveling at a speed of almost 2,300 miles per hour and will be at an altitude of almost 35 miles.



WEIGHTLESSNESS

After burnout, the passengers begin to experience weightlessness. During the next 100 seconds, the vehicle coasts to the peak altitude of 67 miles (107 km).

A small amount of remaining pressurized gas remains in the propellant tank and will be expelled through the engines in a cold gas mode to perform minor vehicle orientation maneuvers while outside the atmosphere.

After reaching apogee, the passengers continue to experience micro-gravity conditions as the vehicle begins its ballistic descent back to Earth.

VEHICLE DESCENT AND LANDING

Once the density of the atmosphere starts to increase, the aerodynamic drag on the vehicle begins to increase and the passengers begin feeling G-forces again.

After it has descended to an altitude where the air density is great enough, a small drogue chute will be deployed from the base of the vehicle to insure proper reentry, which will briefly deliver an estimated five Gs of deceleration.

At approximately nine minutes into the flight and when the vehicle descends through an altitude of 1.9 miles (3 km), the main chute will be deployed. Sufficient time is given to deploy a backup chute if necessary.

Approximately six minutes later, the vehicle will make contact with the ground at approximately 25 feet per second. The crushable, aluminum nose cone neatly and systematically collapses into itself, decelerating the vehicle to a stop. The capsule then falls on its side to end the mission.





HARDWARE & TESTS

Armadillo has spent considerable time developing hydrogen peroxide monopropellant rocket engines at their own facility.

More recently, time and research has been spent on bipropellant engines (primarily with hydrogen peroxide and kerosene).

- Static engine tests of up to 800 lb_f thrust have already been successfully conducted. Heat sink and regeneratively cooled engines are being researched and tested.
- Development of a single-person hovering vehicle is in progress, using the small monopropellant engines developed in-house. Successful manned flights of the 525 lb_f vehicle were conducted in late 2002.
- A first generation “tube rocket” has been designed and flown from the Oklahoma Space Port facility.
- Drop tests of the full-scale cabin have been conducted to measure deceleration forces and performance of the crushable nose cone.
- A 5,000 lb_f engine will be tested soon, pending the delivery of sufficient propellant quantities.



PUBLICITY

PERSONAL APPEARANCES

John Carmack will be making the following appearances in early 2003:

- March – Icon Science Fiction Convention
- April – Space Access Society Convention

PRINT MEDIA

- January 2003 – Wired Magazine
- Coming Soon - Popular Science

TEAM BACKGROUND

TEAM MEMBERS

- Russ Blink
- Phil Eaton
- Joseph LaGrave
- Neil Milburn
- Matthew Ross
- Katherine Anna Kang, Business Manager

X PRIZE QUOTE

“The X PRIZE is stimulating the re-examination of a premise that has gone almost unchallenged for decades – that ‘rocket science’ can only be undertaken by governments and corporations with billions of dollars at their disposal. It doesn’t have to be that way, because we have advantages at our disposal today that no government on earth had at the beginning of the space age – the amazing advances in electronics, computerized manufacturing processes, in-place space assets like GPS and satellite data systems, and, of course, several decades of hindsight. I expect people to remain skeptical, but an existence proof will change the conversation completely.” – John Carmack

PHILOSOPHY

“The appalling inefficiency in the aerospace industry is also a bit of a driving factor. Due to an accident of history tying them to ICBMs, the evolution of space vehicles has wound up tending towards a local optimum that is in a completely different area than better global solutions, and it doesn’t seem likely to break out of the current context. The aerospace industry needs a fresh reboot. There is an order of magnitude improvement available in low hanging fruit.” – John Carmack



MISSION AND GOALS

“The traditional arguments for going to space, like space solar power, asteroid defense, and colonization of the solar system, just don’t sound all that compelling for near term development, and we don’t believe they are going to get us from here to there. It can be a lot simpler. Wouldn’t it be cool to just go? Do we need a better reason? There are enough people that want to go and are willing to pay a good amount of money to justify the endeavor on those grounds alone.” – John Carmack



X PRIZE FOUNDATION

Below is contact information for the X PRIZE Foundation.

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