



# X PRIZE TEAM SUMMARY SHEET ADVENT LAUNCH SERVICES



All the information given in this document has been cleared for official release by the X PRIZE Foundation and the Advent Launch Services (ALS) team. Quotes provided by ALS are shown in italics. For more information or if you have questions about ALS, please visit their web site at [www.ghg.net/jimakkerman](http://www.ghg.net/jimakkerman).

## TEAM OVERVIEW



Advent Launch Services (ALS) is an employee-owned corporation established to provide reliable earth-to-orbit payload deliveries at a small fraction of today's costs and to establish a fully-commercial space program. ALS is a group of NASA retirees having extensive experience with space vehicle development. The Advent concept has been developed using a cost/performance modeling technique which allows the vehicle to be optimized for cost. The proposed Advent fleet consists of a group of vehicles with the same design differing only in size. All the development is performed on the first vehicle, which is the smallest, and is used as the initial orbiter. Successive vehicles are each about 2 and 1/2 times larger than the previous vehicle, and can be used as boosters or orbiters.

## TEAM LEADER BACKGROUND

James W. (Jim) Akkerman is the president and the person primarily responsible for the Advent concept. Jim's career at NASA began in June of 1962 in the Propulsion and Power Division at the NASA Johnson Manned Spacecraft Center and ended in January of 1999 working in the manufacturing area. He has been responsible for engineering work in propulsion, orbit maneuvering systems, reaction control systems, space station concept definition, solar power satellites, high altitude airplane engines, electric flight control systems, propulsive landing deceleration systems and many non-aerospace items such as the left ventricle assist blood pump.



## DATA AT-A-GLANCE

### TEAM SPECIFICATIONS

- Name: Advent Launch Services
- Leader: Jim Akkerman

- Place: Houston, Texas, USA
- Registered with X PRIZE: 17 October 1996
- Web: [www.ghg.net/jimakkerman](http://www.ghg.net/jimakkerman)

### VEHICLE SPECIFICATIONS

- Name: Advent
- Length: 35 feet
- Diameter: 4.75 feet (12 ft wingspan)
- GTOW: 12,600 lb<sub>m</sub>
- Dry Weight: 4,100 lb<sub>m</sub>
- Crew Capsule: 8 feet long, 4.5 feet in diameter
- Crew Environment: Cabin pressurized to 1 atm with no pressure suits
- Payload Capacity: 600 lb<sub>m</sub>
- No. of Engines: 1
- Propulsion System: Pressure fed
- Fuel: Liquid Methane
- Oxidizer: Liquid Oxygen
- Total Thrust: 18,900 lb<sub>f</sub>
- Reaction Control System: Cold gas methane

### MISSION SPECIFICATIONS

- Alt. at Ignition: From within the ocean
- Orientation at Ignition: Vertical
- Max. Accel. Force on Ascent: 4.6 g
- Alt. at Engine Cut-off: 145,000 feet
- Time at Engine Cut-off: 97 seconds
- Max. Speed: 3,600 feet/second
- Max. Altitude: 105 kilometers
- Time in Weightless Conditions: 220 seconds
- Reentry Method: Aerodynamic controlled glide
- Accel. Forces on Descent: 5.2 g
- Landing Method: Winged rocket designed to glide down to ocean surface for a safe, controlled, horizontal landing
- Total Duration: 13 minutes
- Landing Distance from Take-off Location: 0 kilometers
- Time Between Missions: approx. 4 hours





## VEHICLE/LAUNCH SYSTEM DESCRIPTION



The Advent spacecraft is launched vertically from water and landed horizontally like a sea plane. It is a winged rocket that is designed to glide down to the ocean surface for a safe, controlled landing.

(Early designs of the Advent system included capacity for six passengers, but the design has since

reduced the size and capacity to the basic X PRIZE requirements.)

The Advent vehicle is mechanically much simpler than an airliner because it has fewer components, a shorter run time and very robust mechanical parts.

The Advent vehicle requires only seven signals to totally control the propulsion system: two for fill of the propellant tanks, two for pressurization of the propellants; two for vent of the pressurization, and one for the on/off of the engine. Pitch and roll will be the only flight control functions and a signal to abort the passenger may be added. The mission will be further controlled by data and switches added into the passenger module for trajectory control and landing.

## PROPULSION SYSTEM

The rocket uses pressure-fed liquid natural gas (methane) and oxygen to develop almost 19,000 lb<sub>f</sub> of sea level thrust.

The reaction control system uses cold gaseous methane.



## MISSION DESCRIPTION

Passengers and crew of an Advent launch will board a barge and be taken out to sea where the Advent launch vehicle will be launched. The passengers and crew enter the passenger module which will later be

placed atop the propulsion system. When the propulsion system is positioned for launch, fueled, and ready for flight, the manned module is attached. The countdown for launch can then begin.

## VEHICLE ASCENT

After notification from air traffic control that a launch corridor has been cleared, the engine on the Advent vehicle is started. The vehicle immediately begins to rise out of the water. The engine exhaust forms a large bubble in the water below. The engine reaches maximum thrust within a couple of seconds, about the same time the vehicle clears the water. The large bubble will float to the water surface and generate a sizable wave emanating in all directions.

The engine will run for about 97 seconds and the vehicle and passengers will experience an acceleration force of approximately 4.6 g. Approximately 97 seconds into the flight, when the vehicle is at an altitude of approximately 145,000 feet and traveling approximately 3,600 feet per second (2,500 miles per hour), the engine will stop firing. The vehicle will then coast up to space and the crew and passengers will begin to experience microgravity conditions.

## WEIGHTLESSNESS

The time at weightless conditions will last approximately three and a half minutes. One minute and forty-five seconds after engine shut down, the vehicle will reach the maximum altitude of 105 kilometers and will slow down to zero velocity for an instant.

The Advent X PRIZE launch is planned to be from the Gulf of Mexico. The view will be dramatic. At the top of the trajectory passengers will be able to see all the way to Colorado to the North and all the way to Brazil to the South. Florida will be clearly visible as will the mountains on the West side of Mexico.

Then the vehicle begins its return to Earth.

## VEHICLE DESCENT AND LANDING

The first part of the descent will be just like the ascent, a zero-gravity free fall





for about two minutes. Then the vehicle will begin to encounter the upper atmosphere and begin the deceleration from nearly 3000 miles per hour. Within a minute the deceleration will increase to a little over 5 g lasting for approximately 10 seconds. The vehicle makes the transition from vertical fall to horizontal glide traveling about 700 miles per hour. It then begins a slow 180 degree turn as the pilot glides the rocket back to the launch site.

The landing will simply occur when the glide intercepts the water. Depending on the height of the waves, an additional turn may be required to have a smooth landing. A tow boat will return the vehicle back to the launch site. The vehicle recovery team will help crew and passengers disembark and will then re-fuel the vehicle for its next flight much like typical airline operations.

## HARDWARE & TESTS

ALS has created two scale models of the Advent vehicle to illustrate the concept. One is for the X PRIZE system and the other for illustrating the all-up orbital delivery system.

An engineering prototype model has been used for aerodynamics testing as well as a radio controlled flight test model.

The propulsion system for the X PRIZE vehicle has passed the cryogenic nitrogen tests and is ready for static firing. The test facility is being upgraded and certified to handle liquid methane and liquid oxygen.



After propulsion system testing has been completed, work will begin on the passenger module and the wings.

Flight test plans of the full scale, operational hardware include extensive unmanned testing until it can be shown that the system is fully operational and safe.

## PUBLICITY

### PERSONAL APPEARANCES

- Three presentations for the Rotary Club of Houston.

### TELEVISION

- 1999 - Evening news interview, Channel 13
- March 2002 - Project progress and test site visit by Channel 13 news

### PRINT MEDIA

- February 1997 - "Barnstorming in Space", Houston Chronicle, Sunday, page A-1.

## TEAM BACKGROUND

*"Our team includes a lot of people... approximately 100 that have contributed to the effort, most without pay. Records have been kept of each contribution and its estimated value. All these people own the Advent corporation in proportion to their contribution. The contributions of time and effort have been sufficient. Tri-Gas company and RC Technical Welding and Fabrication are companies that have contributed considerably. The welding and fabrication has been paid for, but they have furnished a place to work on the system and the crane that is necessary for handling it. The rice farmer has been a tremendous help by providing a test site for the propulsion system. Friends and family continue to provide valuable comments and advice. The chief astronaut at JSC has been a big help too, especially with the cabin and seating concepts. Our team is a very 'loosely knit' group, but it has been working well as a team."*

– Jim Akkerman



### TEAM MEMBERS

- Glen Smith, Systems Engineering manager
- Charlie Stamps, Procurement
- Dave Dannemiller, Mission Design



- Cynthia Price, Public Relations
- Bill Shaver, Tax
- Frank Elam, Legal
- Bob Williams, Test
- Neil Akkerman, Ocean operations
- Lynn Revak, Vehicle assembly
- Raul Cordona, Engine production
- Phoenix Metallurgical, Titanium fabrication

## X PRIZE QUOTE

*“To the start up company, the X PRIZE provides encouragement with publicity, financial opportunity and the romance of competition. People are talking about the ten million dollar race into space. It’s in the news, on TV, in the newspapers, in magazines and all over the Internet. Potential investors see it. The man in the street sees it. Soon everyone is going to realize that the vast demand for low cost, high speed intercontinental transportation can be served with rockets spawned by the X PRIZE and that industry will develop quickly.” Ultimately the vast resources of space will become available ... low-cost energy supply ... tourism ... inexpensive data systems plus a very unique manufacturing environment. We live in an exciting time.”*  
 – Jim Akkerman



## PHILOSOPHY

*“The focus of the Advent team is to produce the desired effect at minimum cost ... including the cost of failures. With that kind of focus the "effect" can be enjoyed by the most people. The Advent design philosophy is "Keep it Simple". Simplicity is a key factor in reducing cost as well as enhancing reliability.”* – Jim Akkerman

## MISSION AND GOALS

*“Advent’s early goal with the X PRIZE was to have a ‘directed’ effort toward a specific goal ... winning the \$10 million. The suborbital system is somewhat*

*simpler than the orbital system we plan to ultimately have and makes a good ‘practice’ run at our ultimate goal ... inexpensive orbit deliveries.”*  
 – Jim Akkerman

## X PRIZE FOUNDATION

Below is contact information for the X PRIZE Foundation.

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