

Development of new space vehicles for future space tourism essay sample

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1. Introduction

Space Tourism is the current phenomenon of traveling to space for personal delight. To date, it is affordable only to affluent individuals. But surprisingly, even at \$20 million a ticket, agencies are already fully booked until 2009. The price is claimed to be worth it, because of the experience – the unique thrill, the intense and mind-boggling awe of looking at Earth from space, and most especially, the weightlessness. Because of the possible immense market, the space tourism industry is now being aimed by numerous spaceports in different countries, like the United States, Japan, and the United Kingdom.

2. New Space Vehicles

For anyone to be able to avail space tourism, and other purposes in space, there is a need for reusable launch vehicles. Just as commercial land, water, and air transport vehicles are reusable, commercial space transport vehicles must also be reusable. Because of this, there are now researches intended for building low-cost reusable launch vehicles. Some of the recent projects of several companies are discussed below.

1. Virgin Galactic

Virgin Galactic is a company established and owned by Richard Branson's Virgin Group. It is known worldwide as the world's first commercial space line. Aiming to be number one in all respects, its goal is to build a vehicle which would give everyone an equal chance to become part of the first ever sub-orbital space tourism that is comfortable, enjoyable, non-exhaustive, time-worthy, and affordable. ("Intro")

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Virgin Galactic will privately built, own and operate spaceships modeled to SpaceShipOne. It was the first privately funded craft to reach space – with an altitude greater than 100km – in June 2004, winning the Ansari X Prize on October 4th of the same year. It was designed and built by aviation prodigy Burt Rutan and his company, Scaled Composites. SpaceShipOne is now at the Smithsonian Museum in Washington DC. (“ Intro”)

SpaceShipOne is air launched, that is, it needs a mother ship to carry it at a certain height before being launched to space. One such mother ship is White Knight, a specially designed jet carrier aircraft. Besides being a mother ship, White Knight is also expected to be used as an integral part of the preparation training at the spaceport. (“ Intro”)

The first spaceship Virgin Galactic will launch for space tourism is SpaceShipTwo, the first space craft in history to be designed for the safety, comfort and enjoyment of six astronaut passengers and two pilots, though maximum load is 20. Its hybrid rocket motor combines the reliability of a solid rocket but avoiding its lack of control, with the “ controllability” of a liquid rocket motor but avoiding the associated inherent instability. (“ Intro”)

The actual flight starts when passengers board a spacecraft (like SpaceShipTwo), which is attached to a mother ship (like White Knight). The mother ship takes off at almost 2500mph, over 3 times the speed of sound. Once at 50, 000 feet, the space craft will be air launched from the mother ship, beginning a climb to over 360, 000 feet – Space boundary is 330, 000 feet. Afterwards, the spaceship folds its wings in preparation for re-entry into the earth’s atmosphere. After reaching its maximum altitude, the ship is then

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drawn by the Earth's gravitational pull. At approximately 60, 000 feet, the spaceship's wings are re-spread, allowing for a glide landing back at the spaceport for 30 minutes. The whole spaceflight will take approximately 2 ½ hours. Operations will initially be at the Mojave Spaceport, and tickets are starting at \$200, 000, around 100 times less expensive than what is being paid by current space "tourists". ("Intro")

The spacecrafts mentioned are designed for the safety of the passengers and the crews, for cost-effectiveness, and for environment-responsiveness. Virgin Galactic ensures that every passenger is fully equipped for his first space flight. There will be pre-medical checks, but the required medical assessment will be simple and unrestrictive so that majority of the space tourists will not be prevented by health and fitness considerations. The whole space experience will also be fully documented. ("Intro")

The spacecrafts are currently being designed at Rutan's base in Mojave, California. Testing of WhiteKnightTwo and SpaceShipTwo prototypes has started; their test flights will begin later this year. Commercial flights are expected to commence early in 2009. ("Intro")

1. Kankoh-Maru

Kankoh-Maru is a single-stage to orbit, reusable, space tour vehicle of the Japanese Rocket Society, manufactured by Kawasaki Heavy Industries, Ltd. It is cone-shaped, weighs 550 tons and can carry 50 passengers. (Isozaki) In Japanese, "Kankoh" means tourism, and "Maru" means circle, symbol of Japan. ("Vehicle Designs")

Kankoh-Maru is a fully reusable launch vehicle (RLV), that is, it can operate routinely like an aeroplane in order to reduce operating costs sufficiently to match the demand for travel to orbit. The lower cost of launching reusable rockets enable economies of scale to be obtained. This leads to a dramatic reduction in cost per passenger, making space travel affordable to middle-income people. Another extended use of Kankoh-Maru is being a dedicated reusable cargo vehicle, thereby achieving economies in development. However, this low cost renders expendable launch vehicle makers less business. (Collins, “ The JRS”)

Space Tourism was selected as an academic research program of JRS in 1993. JRS is the oldest established academic astronautical society in Japan, and one of the oldest rocket societies in the world. It celebrated in 2006 its 50th year of formally studying the establishment of a space tourism business, and publishing unique series of papers and reports. (Collins, “ The Japanese”) Then a Transportation Research Committee was established to design a vehicle suitable. Kankoh-Maru became the reference model design, which finished Phase 3 – Setting Safety Standards – in 1999. (Isozaki)

Space Future is a website “ for everyone who’d like to travel to space.” It highlights the highly desirable affordable space tourism, and publishes a collection of works being done to make space travel popular. The people behind Space Future also discuss the issues, the problems, and ideas to address them. (“ About Space Future”)

1. Ascender

Ascender is a sub-orbital manned space plane built by the Bristol Spaceplanes Limited. Its concept was proposed in 1990's by David Ashford, who believes that space tourism would become the largest business in space. It was manufactured to act as a technology demonstrator for the orbital Spacecab and Spacebus programs. As proposed by its designer, Ascender became an X-Prize contender. It weighs only 4500 kg (9920 lb), and can carry two passengers and two crews. (" X-Prize")

It takes off from a conventional runway using two turbofan engines. Upon reaching 30, 000 ft., it starts a steep climb, igniting its liquid oxygen-liquid hydrogen rocket engine. Ascender reaches a peak altitude of 100 km. before starting its ballistic steep dive back to Earth. Upon reaching the atmosphere, it resumes level flight and flies back to the runway. (Oakley, " The Ascender")

Using wings during the first part of the travel is a good idea (Oakley, " The Ascender"), because it creates an impression to the passengers that it is just a normal plane flight. The impression is a great assurance that everything will be just fine. (Oakley, " The Ascender")

One disadvantage of the Ascender is its expensive use of fuel. After take off, it uses up some energy to reach 30, 000 ft. without focus onto getting into space. Plus, its wings cause drag during ascent. This drag, as well as the gravity, must be overcome to climb vertically; hence, it has to generate more thrust. To do this, it has to burn more fuel (over 3. 2 gal of fuel per second). At landing, it will have used up all of its rocket fuel. (Oakley, " The Ascender")

Ascender appeared at Tomorrow's World Live Show, an exhibition (attended by 70, 000) held in West London on July 1999. It also stood out at the Farnborough Air Show, the world's premiere aerospace trade fair, on July 2004. (" News & Events")

1. Michelle-B

Michelle-B is an X-Prize suborbital rocket-shaped ballistic spacecraft concept of Kent Ewing of TGV Rockets in Bethesda, Maryland. MICHELLE stands for Modular Incremental Compact High Energy Low-cost Launch Example. (" Michelle-B")

The vehicle uses rocket power to takeoff vertically and the same rocket power to land vertically. After reaching the maximum altitude of 104 km, the vehicle would make a ballistic arc, reducing speed and moderating re-entry temperatures. At an altitude of 3 km, landing rocket power is applied by the pilot, the spacecraft hovering to a touchdown at the same location it was launched. (" Michelle-B")

It lifts off under power of six pressure-fed lox/kerosene engines. Kerosene has a high efficiency (energy to fuel ratio); six engines using this fuel can accelerate the vehicle to a maximum of 2, 460 miles/hour. Kerosene is also far cheaper than the concentrated hydrogen peroxide used by most rockets. Moreover, during the ascent, the pilot can vary the engine power level to manage dynamic pressure loads. This is another way to save fuel; smaller amount of power is used for lighter loads. Thus, Michelle-B can reliably and cost-effectively carry up to 1000 kg of passengers. (" Michelle-B")

Besides the mentioned cost-effective features, Michelle-B has full avionics suite, with INS, Radar, GPS, and a self contained precision approach system; hence, it is self-sustaining and needs no external tracking, range safety or ground based telemetry systems. (“ Michelle-B”)

Unlike other vehicles with multiple engines, each engine on the Michelle-B has a separate fuel/oxidizer tank and pressurization system. Any panel may fail to deploy on the drag devices; the remaining ones leave tolerable margins for descent. Up to 2 engines may fail on descent, and the vehicle can still safely hover. (Oakley, “ The MICHELLE-B”)

Michelle-B also has an aero-brake that is sized to lower its terminal velocity (less than 50 m/s for a 7000 kg vehicle) during descent, an excellent way to reduce speed. As safety measures, the vehicle has ejectable seats or capsules to protect the passengers and the crews. (Oakley, “ The MICHELLE-B”)

1. Black Armadillo

Black Armadillo is an X-Prize suborbital ballistic spacecraft designed by John Carmack, and manufactured by Armadillo Aerospace of Texas, USA. It is a single stage rocket shaped vehicle that weighs 8, 000 kg (17, 600 lbs.), and carry three people to 100 kilometers (62. 5 miles). With four engines and no fins (to save mass and drag), the control system depends heavily on the programming of the system. (“ Black Armadillo”, Astronautix)

Black Armadillo is a completely recoverable and reusable rocket. The launch can be repeated with the same ship within 2 weeks. Majority of its

components can be reused. No more than 10% of the vehicle's non-propellant mass needs replacing after the flight. Also, the use of commercial off-the-shelf parts dramatically lowers development costs. (Oakley, "The Black Armadillo")

Black Armadillo uses four pressure-fed, hydrogen peroxide rocket engines to take off vertically. After reaching apogee (peak), the vehicle begins its ballistic descent. Afterwards, a small drogue chute is deployed to insure proper reentry and to deliver deceleration. Upon reaching an altitude of 1.9 miles (3 km), the main chute is deployed. A backup chute is available if necessary. The touchdown to ground is cushioned by the vehicle's crushable (and replaceable) aluminum nose cone landing system. It neatly and systematically collapses into itself; then the capsule falls on its side, signaling the end of the flight. ("Black Armadillo", Astronautix)

Black Armadillo uses a monopropellant engine. It simplifies the design of the engine plumbing because it only requires one propellant tank and one set of feed plumbing. Hence, in theory, Black Armadillo is the easiest to operate among its competitors. (Oakley, "The Black Armadillo")

The flight computer operates at 180 Hz, and adjusts each of the four engines every frame. The valves that open and close every 0.8 seconds constantly make tiny adjustments, which ensure the stability of the vehicle and overall safety of the flight. (Oakley, "The Black Armadillo") Another benefit is that the exhaust of a hydrogen peroxide propulsion system is environment-friendly. It emits only superheated steam and gaseous oxygen. ("Black Armadillo", Gunter's)

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3. Summary

The new technologies of space vehicles increase the development of the space tourism. People are trying to invent low cost space vehicles for the future space tourism. In this paper, there are different types of new space vehicles discussed in detail that are benefit for the development of future space tourism. The first one is Virgin Galactic. It's the passenger-carrying space liner company. Their plans are taking shape to offer suborbital space flights. It also offers point-to-point rocket travel around the globe, as well as to space hotels, and trips to the moon. All the designs are direct by aerospace designer, Burt Rutan. Rutan and his team built and flew the piloted SpaceShipOne on a trio of suborbital treks in 2004, and they are the winning of the \$10 million Ansari X Prize. Now they are hard at it fulfilling the Virgin Galactic order for commuter-class space liners. The White Knight is also equipped to flight-qualify all the SpaceShipOne systems, except rocket propulsion. The next space vehicle is Kankoh-Maru.

This space vehicle is developed by Japan. It's a passenger-carrying reusable rocket designed to carry 50 passengers to 200 km Earth orbit. It is part of a study program by the Japanese Rocket Society(JRS). The JRS started a Space Tourism Study Program in 1993 to go around the orbit for \$10, 000 per passenger. Kankoh-Maru project has developed the space tourism today. The other space vehicle is Ascender. It is a sub-orbital space plane from Bristol Spaceplanes.

It's carrying two crew and two passengers intended to provide the concept for the development of the Spacebus; moreover, is capable of reaching

space. They are also being an entrant for the X-Prize, Ascender is intended to return commercial revenues through its passenger carrying capability. The next one is Michelle-B. Michelle stands for Modular Incremental Compact High Energy Low cost Launch Experiment. It is a manned reusable sub-orbital proposed by TGV Rockets. It designed to allow a variety of payloads such as scientific instrumentation to be substituted. The last one is Black Armadillo. It is a research and development team by computer games entrepreneur John Carmack. Armadillo Aerospace is now competing for the X-Prize with its simplest possible design. Black Armadillo is powered by four hydrogen peroxide engines feeding from a 1000 gallon composite fuel tank. So it's very powerful.

4. References:

“ About Space Future.” *Space Future* . Space Future. 3 May 2007.

.

“ Black Armadillo.” *Astronautix* . 2007. Astronautix. 3 May 2007.

.

“ Black Armadillo.” *Gunter's Space Page* . 1996. Gunter's Space Page. 3 May 2007.

.

Collins, Patrick et al. “ The Japanese Rocket Society's Space Tourism Research.” *Space Future* . 20 March 1997. National Space Development Agency, Tokyo. 3 May 2007.

<https://assignbuster.com/development-of-new-space-vehicles-for-future-space-tourism-essay-sample/>

.

Collins, Patrick et al. " The JRS Space Tourism Study Program Phase 2." *Space Future* . July 1997. National Space Development Agency, Tokyo. 3 May 2007 . .

" Intro." *Virgin Galactic* . 2006. Virgin Galactic. 24 April 2007.

.

Isozaki, Kohki et al. " Status Report on Space Tour Vehicle ' Kankoh-Maru' of Japanese Rocket Society." *Space Future* . 1998. Kawasaki Heavy Industries Limited. 3 May 2007.

.

" Michelle-B." *Astronautix* . 2007. Astronautix. 3 May 2007.

.

" News & Events." *Bristol Spaceplanes* . 19 July 2004. Bristol Spaceplanes Limited. 4 May 2007.

.

Oakley, Mark. " The Ascender." *Rocket Man Blog* . 12 October 2003. 4 May 2007.

Oakley, Mark. "The Black Armadillo." *Rocket Man Blog* . 26 September 2003. 3 May 2007.

.

Oakley, Mark. "The MICHELLE-B." *Rocket Man Blog* . 03 November 2003. 3 May 2007.

.

"Vehicle Designs." *Space Future* . Space Future. 3 May 2007. .

"X-Prize." *Astronautix* . 2007. Astronautix. 4 May 2007.

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