

Rocket and space exploration technologies assignment



**ASSIGN
BUSTER**

? Running head: SpaceX SpaceX Abstract SpaceX is a well known private launch service provider in the commercial space transportation industry. Awarded with a NASA Launch Services contract, SpaceX is taking the industry by storm with low cost and ambitious operations. This paper will describe their background, operations, successes, shortcomings, safety aspects and their role in commercial space transportation. SpaceX Space Exploration Technologies Corporation (SpaceX) is a launch vehicle service provider in the commercial space travel industry.

Their main focus is to increase the capability and reliability of commercial launch vehicles while reducing the cost of accessing space (Space Exploration Technologies Corporation, 2008). The Federal Aviation Administration (FAA) defines the term commercial space transportation as “the launch of an object into space or the reentry of an object from space by a private, nongovernment entity” (Chapter IX, 2005). SpaceX has introduced three launch vehicles; Falcon 1, Falcon 9, and Falcon 9 Heavy. They also developed a spacecraft called the Dragon.

Elon Musk, founder of SpaceX, says he’s going to cut the cost of space missions by at least one third the price of any competitors using these vehicles (Space Exploration Technologies Corporation, 2008). SpaceX is the third company founded by entrepreneur Elon Musk who serves as CEO. Musk started SpaceX in El Segundo, CA in 2002. Before SpaceX, Musk co-founded the world’s largest electronic payment system known as Pay Pal. After selling Pay Pal to EBay for \$1.5 billion, he set his eyes on space in hopes of taking over NASA’s space missions (Space Exploration Technologies Corporation, 2008).

<https://assignbuster.com/rocket-and-space-exploration-technologies-assignment/>

NASA will be shutting down their space shuttle operations in 2010 because of funding issues. SpaceX is one of the two winners of the Commercial Orbital Transportation Services (COTS) contracts that NASA awarded in August 2006. The other contract winner is Rocketplane Kistler. The purpose of the COTS contract is to create a competitive market for supply flights to the international space station (ISS). The COTS contract will award both companies a total of \$500 billion to help fund operations (NASA Invests in Private Sector Space Flight with SpaceX, Rocketplane-Kistler, 2006).

A year before the NASA contract, SpaceX received a \$100 million contract by the U. S. Air Force to provide low cost orbital launch vehicles and responsive launch services. This will be performed on a recurring basis using a mature vehicle design and a commercially derived booster to meet mission/payload requirements. SpaceX will use their Falcon 1 to fulfill their Air Force contract (Space Exploration Technologies Corporation, 2008). The Falcon 1 is a two stage, liquid oxygen and rocket grade kerosene (RP-1) powered launch vehicle.

With a flight costing under \$10 million, this launch vehicle is the lowest costing per flight rocket in the world. It is currently being tested at the Reagon Test Site of Omelek Island in the Marshall Islands. The Falcon 1 is designed from the ground up by SpaceX for cost efficient and reliable transport of satellites to low Earth orbit. The dimensions of this launch vehicle are 90 feet long and 5.5 feet wide. It has a mass of 46,760 kg and a thrust of 556 kN on liftoff. The vehicle will be held down after engine start to verify that all systems are fully functional before liftoff.

Once released, it will reach a height of about 300, 000 feet and then stage separation will occur after stage one engine burnout. This is when the bottom portion of the rocket detaches from the rocket and returns back to earth by parachute. The first stage is reusable and is powered by a single SpaceX Merlin engine. The Merlin was developed by SpaceX and has a thrust of 125, 000 pounds at sea level. After stage separation, the second stage ignition will begin at about 325, 000 feet. Stage two is powered by the SpaceX Kestrel engine which will burn out at 1, 330, 000 feet.

During stage two the fairings will separate and the falcon will be ready for payload deployment after engine burnout. The elapse time between liftoff and payload deployment is 580 seconds (Space Exploration Technologies Corporation, 2008). The falcon 1 has been tested in four flights to date. The first three flights were failures in which each one experienced a different problem. The first test flight was launched on March 24, 2006 and ended after about a minute of flight due to a fuel leak which caused a fire.

The cause of the leak was claimed by corrosion from aluminum bolts. All hardware was later replaced by stainless steel hardware to prevent this from happening again. The second flight was launched on March 21, 2007. It lost control in the second stage and failed to reach orbit (American Institute of Aeronautics and Astronautics, 2007). After making minor adjustments, the third flight was launched on August 3, 2008. This flight carried satellites for both NASA and the Air Force. This flight failed to reach orbit due to stage separation malfunction.

This problem was corrected by increasing the time between the first stage engine shutdown and stage separation. The fourth flight was a total success. The vehicle was carrying a payload mass simulator of 165 kg. Originally flight four was scheduled to carry a Malaysian satellite but was later pushed to Flight five. Flight five is in production and will be complete in January 2009. SpaceX is currently building a Falcon 1 every four months and hopes to double this rate (Space Exploration Technologies Corporation, 2008).

Similar to the Falcon 1, the Falcon 9 is a two stage, liquid oxygen and rocket grade kerosene (RP-1) powered launch vehicle (Space Exploration Technologies Corporation, 2008). The primary launch site of the Falcon 9 will be at Space Launch Complex 40 (SLC-40) at Cape Canaveral Air Force Station. SLC-40 is a world class heavy lift launch facility that's capable of supporting the Falcon 9 and future Falcon 9 Heavy (SpaceX Breaks Ground at Cape Canaveral's Space Launch Complex 40, 2007). The Falcon 9 is twice the size of the Falcon 1.

It has nine first stage Merlin engines and one second stage Merlin engine. The Falcon 9 is the vehicle SpaceX will use to fulfill their COTS contract. The Falcon 9 is capable of supporting the Dragon spacecraft which the Falcon 1 is not. The first Falcon 9/Dragon COTS Demo flight is scheduled for early 2009 (Space Exploration Technologies Corporation, 2008). The Dragon spacecraft is a reusable capsule capable of transporting cargo, crew, or a mixture of both. It can support up to seven passengers in crew configuration.

The spacecraft was designed with simplicity and human factors in mind. It has a pressurized cargo/crew capacity of more than 2500 kg. The Dragon will

start with cargo only missions and eventually begin transporting crew to the ISS. The spacecraft is equipped with parachutes for a safe ocean recovery. Safety is the most important aspect of design of the Dragon (Space Exploration Technologies Corporation, 2008). SpaceX must complete a three phase review by NASA's Safety Review Panel in order to send their Dragon spacecraft to the ISS.

This review will examine many different hazards and pay extra attention to the danger of a collision (Space Exploration Technologies Corporation. 2008). The FAA also plays an important role in commercial transportation. Steven Millard, an aerospace engineer, of the FAA stated that “ the FAA has been given the authority by Congress to license commercial launch or reentry activity to ensure protection of public property, the national security interests of the United States and to promote U. S. Commercial Space Transportation.

To meet this responsibility the FAA performs a safety evaluation of an application to launch a vehicle from any launch site in the world by a United States citizen or corporation”. As a result of a launch of a Falcon 1, the FAA performed a safety analysis using special risk analysis tools to determine the risk to the uninvolved public (American Institute of Aeronautics and Astronautics, 2008, pg. 1). The success of the Falcon flight four has made a huge advancement in the commercial space transportation industry. No other company in the world will send rockets to orbit for the price that SpaceX has proved they can and will.

With such a strong production rate and a commitment to reliability, SpaceX is going to change the commercial space transportation industry with their launch vehicles. References Space Exploration Technologies Corporation. (2008). Retrieved Sept 2, 2008, from <http://www.spacex.com> American Institute of Aeronautics and Astronautics. (2007). The DARPA/USAF Falcon Program Update and the SpaceX Maiden Launch, Mishap Investigation and Return to Flight. GPO, AAIA 2007-9912 American Institute of Aeronautics and Astronautics. (2008).

Risk Considerations for the Launch of the SpaceX Falcon 1 Rocket. GPO, AAIA 2008-7121 Chapter IX. (2005). Retrieved Sept 25, 2008, from http://www.faa.gov/data_statistics/aviation/aerospace_forecasts/2004-2015 SpaceX Breaks Ground at Cape Canaveral's Space Launch Complex 40. (2007). Retrieved Sept 15, 2008, from http://www.spaceflorida.gov/news/11-01-07_SpaceX.php NASA Invests in Private Sector Space Flight with SpaceX, Rocketplane-Kistler. (2006). Retrieved Sept 5, 2008, from http://www.nasa.gov/mission_pages/exploration/news/COTS_selection.html