ASTR 308 "Into the Final Frontier"

Pioneers and Cold War Rocketry

1. Space Pioneers

(a) Provide a brief biography of Konstantine Tsiokovsky, including (i) when he lived and died, (ii) what a few of his major accomplishments were, (iii) what his most important legacy is. Much of the information you can glean is available on wikipedia.org (via the links on the class web page)

Konstantine Tsiokovsky (September 17, 1857 - September 19, 1935) was a Russian rocket science theorist. He is considered the father of rocketry and spaceflight. He calculated the minimal speed for orbit around the Earth. He also calculated that a multi-stage rocket with liquid hydrogen and oxygen fuel could reach this orbit. His most famous paper is *The Exploration of Cosmic Space by Means of Reaction Devices*. He published over 88 papers on spaceflight and influenced rocket scientists such as von Braun and Korolyov. He developed a 26-point agenda outlining humanity's manifest destiny toward becoming a space faring civilization; more than half of these points have been accomplished!

(b) Provide a similar biography of Robert Goddard.

Robert Goddard (October 5, 1882 - August 10, 1945) was an American rocket science theorist *and* engineer. Goddard wrote one of the classic texts of modern rocket science, *A Method of Reaching Extreme Altitudes*. He created and built the world's first liquid-fuel rocket. He developed methods to control rocket flight, such as gimbaled gyroscopes, 3-axis (pitch-yaw-roll) control, and "thrust vectoring" (changing the direction of a rocket without using control surfaces like flaps). He also proved that rockets could work in a vacuum.

(c) Provides a similar biography of Herman Oberth.

Hermann Oberth (June 25, 1894 - December 28, 1989) was a German rocket science physicist and engineer. Like Tsiokovsky, he is considered a father of modern rocketry. He wrote a book, *Ways to Spaceflight*, spread the idea of rocketry and spaceflight by consulting for the first movie involving outer space, and mentored von Braun. He witnessed the Apollo program and the Shuttle program!

(d) Provide a similar biography of Werner von Braun.

Werner von Braun (March 23, 1912 - June 16, 1977) was a German rocket scientist and engineer. He is probably the most famous rocket scientist in both Germany and the US. He designed the V2 rocket for the Germans during WWII, and he and his staff subsequently surrendered to the US through Project Paperclip. Von Braun led the team that developed the rocket that launched the US's first satellite (Explorer I) and he was the chief architect of the Saturn V manned moon rocket.

(e) Provide a similar biography of Sergie Korolev.

Sergie Korolev (January 12, 1907 - January 14, 1966) was a Russian rocket and aerospace engineer. Korolev was THE key person behind the Russian space program. He designed rockets and was important in developing the Russian ICBM (the R-7 rocket). He conceived and implemented the Sputnik (1st man made orbiting satellite) and the manned Vostok missions and, more importantly, laid the plans for Russian to compete in the Space Race to the Moon.

2. Rockets.

(a) Who is recognized as launching the first liquid fueled rocket (kind of like the Wright brothers first flight)? When did he do this? What country did he do it in?

Robert Goddard developed and built the first liquid-fuel rocket. The first launch was March 16, 1926 in the US (on his Aunt's farm!).

(b) During WWII the first "real" rocket was successfully launched. What was the name of this rocket? What date was the first successfully launch? What country sponsored the building of this rocket, and for what purpose? Who was the rocket scientist who is responsible for this feat?
The first "real" rocket was the German V2 rocket, developed by Werner von Braun, sponsored by the German Army of the Third Reich, and first launched October 3, 1942. The V2 was the world's first long-range ballistic missile intended to hit London from Germany by achieving sub-orbital flight.

(c) What was the first rocket called that launched the first earth orbiting satellite? What was this rocket actually designed to do? What was the name of the satellite that was successfully launched? What was the date of this feat? What country did this happen in? Who was the rocket scientist who was responsible for this feat?
The Soviet R-7 booster launched Sputnik, the first man-made satellite to orbit Earth, on October 4, 1957. Sputnik was designed by Sergei Korolev. The R-7 booster had successfully proven itself one month earlier to be the world's first intercontinental ballistic missile (ICBM); it was designed to deliver nuclear warheads as far as 7000 km away.

(d) What was the second Earth orbiting satellite called? What was the date of this feat? What country did this happen in? Who was the rocket scientist who was responsible for this feat? What was discovered by this satellite?
Explorer I was the second Earth-orbiting satellite. It was launched by the US on January 31, 1958. Werner von Braun developed the rocket (Redstone booster) that launched the satellite, which itself was developed by James van Allen. Explorer I's cosmic ray equipment detected far fewer cosmic rays than expected, which van Allen suggested was due to the detector's being saturated by passing through a region of particles trapped by Earth's magnetic field.

3. Early Cold War
(a) What was Operation Paperclip? When was this operation undertaken? Why was this operation undertaken?
Operation Paperclip was a program to recruit German rocket scientists and engineers to the US after WWII (after 1945). At the time the cold war was just beginning, so the US wanted to deny the Soviets the German scientific knowledge and expertise.

(b) Who was President of the United States when Sputnik was launched? Who was Premiere of the Soviet Union when Sputnik was launched?
When Sputnik was launched, Eisenhower was the US President and Khrushchev was the Premiere of the Soviet Union.

(c) What was NATO and when and why was it formed? What was the Warsaw Pact and when and why was it formed?
The North Atlantic Treaty Organization was a military alliance created in 1949 between governments for mutual defense (in particular, defense of Western Europe against the communist block countries of Eastern Europe). NATO originally comprised 12 nations: the US, United Kingdom, Canada, Belgium, Denmark, France, Iceland, Italy, Luxembourg, Netherlands, Norway, and Portugal.
The Treaty of Friendship, Cooperation, and Mutual Assistance, more commonly known as the Warsaw Pact, was a treaty of mutual non-intervention and defense among the eight communist states in Eastern Europe: the Soviet Union, Albania, Bulgaria, Czechoslovak Republic, East Germany, Hungary, Poland, and Romania. The Warsaw Pact was created in 1955 response to West Germany's integration into NATO in 1954.

(d) What are the circumstances that resulted in the formation of NASA? What year was NASA formed and from what institution did it morph from? What was the initial purpose (mandate) for which NASA was formed?
After the successful launch and orbit of the Soviet satellite, Sputnik, the US scrambled to catch up in space technology and exploration. In 1915, the National Advisory Committee for Aeronautics was created as a US agency that would handle all civilian (non-military) activity in aeronautics. In 1958 Eisenhower turned the NACA into NASA, expanding it, but also exploiting its already existing large-scale development and management structure. NASA's purpose was to study flight in and out of the Earth's atmosphere, but it's first goal, mandated by the President, was to get an American into space first.

4. Mercury Program and Man in Space
(a) Name the Original Seven Astronauts (the "Mercury Seven")
(1) Malcolm Scott Carpenter, (2) Leroy Gordon "Gordo" Cooper Jr., (3) John Herschel Glenn Jr., (4) Virgil Ivan "Gus" Grissom, (5) Walter Marty "Wally" Schirra Jr., (6) Alan Bartlett Shepard Jr., and (7) Donald Kent "Deke" Slayton

(b) Who was the first man in space? What was the date and what country was he from? Briefly describe the specifics of his flight (Duration? Orbits?)
Yuri Gagarin was the first man in space, and he was from Russia. His flight was on April 12, 1961. He was in space for a total of 108 minutes and completed one orbit around the Earth.

(c) Who was the second man in space? What was the date and what country was he from? Briefly describe the specifics of his flight (Duration? Orbits?)
Alan Bartlett Shepard, Jr. was the second man in space, and he was from the United States. His flight was on May 5, 1961. He was in space for just less than 16 minutes on a ballistic flight path up and then down again, meaning he did **not** orbit the Earth (kind of a big Horseshoe flight path).

(d) Who was the second Russian to go into space? Briefly describe his flight (Duration; Orbit?)
Gherman S. Titov was the second Russian in space. His flight was on August 6, 1961. He was in space for 25.3 hours and orbited the Earth 17 times! This presented a huge challenge and embarrassment to the US.

(e) In the chronology of the above space flights… when is it that President Kennedy boldly gave NASA the directive to put a man on the moon by the end of the 1960s decade? How much total time in space had American astronauts accumulated by the time of this directive?
Kennedy gave his famous speech only 20 days after Shepard's flight, with an American having been in space for a total of just less than 16 minutes.