To the Moon and Beyond
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Hello. I am so glad to see all of you here today. I knew I had some pretty stiff competition when I discovered that this talk would be at the same time as a Starfleet meeting. Moving on, my name is Mary-Frances Bartels and I have been a NASA Solar System Ambassador since 2002. The Ambassador program consists of volunteers who bring the excitement of solar system exploration to the public. For the past 3 ½ years I have written a monthly column called "Planetary Wonderings" for the education community, focusing especially on homeschoolers. Prior to that I used amateur radio to host on-air meetings for astronomy enthusiasts. I do not consider myself an expert or professional, just a space enthusiast like you. I live just east of Centerburg, about an hour NE of Columbus, where I raise ducks, geese, goats, rabbits, and my three teenage boys. Today we will briefly look at the history of lunar exploration, but mostly we'll learn about what NASA is doing now to return to the moon as well as what is planned for the future. Also, for anyone who is interested, I have put this talk and links to the videos on my website at www.KeepLookingUp.net.

Most people here probably already know that this year is the 40th anniversary of the moon landing. Can anyone here tell me what mission that was? (Apollo 11, July 20) Can anyone tell me what mission this year is the 50th anniversary of? I'll give you a hint: it had to do with lunar exploration. . . . Luna 1 (Mechta/Dream) was a Soviet mission launched on Jan. 2, 1959. It was the first spacecraft to reach the vicinity of the moon.

Before manned missions can be sent somewhere there must be unmanned ones to study, or reconnoiter, the destination of interest. Prior to the Apollo landing in 1969 there were a number of unmanned missions to the moon. The Surveyor and Lunar Orbiter missions helped determine landing sites for Apollo. They also gave us our first glimpses of the moon's far side, lunar gravitational field fluctuations, and lunar soil characteristics.

Now we move on to the Apollo program. The Apollo program used Saturn V rockets as launch vehicles. The Lunar Modules, or Lems as they came to be known, launched with the command modules. The Lem-command module assembly flew to the moon and the Lem landed on the moon with two astronauts on board while one astronaut remained in the command module orbiting the moon. Would anyone like to share their memories of the moon landing? . . . Since I was only seven years old when we landed on the moon I do not remember much from then. However, my parents were big fans of the space program. My mom even told me how she watched John Glenn's flight the month before I was born. I know that I would not be the space fan I am today had my parents not cared as much about the space program as they, and indeed the whole nation, did. They let me watch all the launches and splash-downs. The night Neil Armstrong and Buzz Aldrin walked on the moon they got me out of bed so I could see it. I remember breathlessly watching the console TV in our living room in Audubon, NJ. It and all the space shots were big deals. Between 1969 and 1972 the Apollo (#11-17) program put twelve men on the moon. The six missions that landed on the Moon returned a wealth of scientific data and almost 400 kilograms of lunar samples. Studies included soil mechanics, meteoroids, seismic, heat flow, lunar ranging, magnetic fields, and solar wind experiments.

To this day the US is the only nation that has sent men to the moon.

Before moving on I just wanted to note that several well-known astronauts came from Ohio. I've already mentioned Armstrong and Glenn. Others with which you may be familiar are Lovell and Resnik. I wanted to give a short plug for the Neil Armstrong Air and Space Museum in Wapakoneta. It's fairly small, but I believe they do a good job with the space they have. There are a number of artifacts from both the Americans and Soviets from the beginning of the space race through Starfleet. If you are into geocaching, there's even an easy find on the premises. Another location of interest is John and Annie Glenn Historic Site and Exploration Center in New Concord.

Since Indiana is just next door I did not want to neglect to mention that that state lays claim to about the same number, possibly more, astronauts than Ohio. Some famous ones include Grissom and Chaffee of Apollo 1 and Borman of Apollo 8. Since Armstrong attended Perdue, both Indiana and Ohio claim him.

I also wanted to pass around a picture that was taken about 11 years ago. It is of my family with Buzz Aldrin when he briefly visited Denver where we lived at the time.

It's now been 40 years since the moon landing and 37 years since we last went in person. Have we forgotten about the moon? It sure seems like it. However, we haven't exactly left the moon alone. In the '90's two missions laid the groundwork for today's unmanned missions that are, in turn, to lay the groundwork for returning men to the lunar surface. The most significant discovery made by the Clementine mission was evidence of a large deposit of ice in a permanently shadowed crater on the moon's South Pole. That was in 1994. Just four years later Lunar Prospector, loaded with scientific instruments, was sent to the moon. After 1 ½ years of studying gamma rays, magnetic fields, and the lunar surface it was intentionally sent into the moon in hopes of dislodging enough material to determine if the ice discovered by Clementine was made of water. Results of that experiment were inconclusive.

Let's now jump to the present to what I call a 2-in-1 mission due to launch in a couple months. The Lunar Reconnaissance Orbiter and Lunar Crater Observation and Sensing Satellite (or LCROSS) are soon to be sent to the moon from the same launch vehicle. Rather than me talking about these missions myself, let's let some of the people directly involved in those missions tell you themselves **(videos)**.

One of the neat things about LCROSS I wanted to emphasize is that the ejecta plume may be visible in amateur telescopes. A group was set up at Google for those planning on viewing the event. It is called LCROSS_Observation. The latest and greatest on LRO and LCROSS is available not only at NASA websites but also social networking sites such as Facebook and Twitter. I'm not sure about MySpace.

The next step after LRO and LCROSS will be the Constellation Program. This program will be similar to the old Apollo program, but with new twists. There will be rockets, lunar modules, and command modules. The rockets will be Ares rockets. The lunar modules will launch before the crew on an Ares V rocket and be placed in low Earth orbit awaiting rendezvous with the astronauts. Altair, the name of the new Lems, will be capable of landing four astronauts on the moon, providing life support and a base for weeklong initial surface exploration missions, and returning the crew to the Orion spacecraft that will bring them home to Earth.

The Orion crew vehicle will be five meters in diameter, having a volume 2 ½ times that of the Apollo command module. It will first be used to ferry crew and supplies to the International Space Station as a replacement for the Space Shuttle. It, along with an emergency abort system, will be launched atop an Ares I rocket. It is designed to stay docked with the ISS or in orbit around the moon unmanned for up to six months at a time. It will be able to carry four astronauts to the moon or up to six to the Space Station. Right now it is planned that Orion will begin shuttling crew to the ISS in 2014 and a moon landing by 2019. **(video)**

Let's move on to the 2020's and beyond. There are plans for building a moon habitat. The whys and wherefores of building a moon base are extensive enough to warrant another talk. However, I will try to give a nutshell view of a few of the problems and reasons here. Some of the problems that will have to be addressed are that of the health hazards of moon dust and cosmic radiation, hazards of micrometeorite impacts, living in low G for long periods of time, and cost of transporting supplies. First off, the form of the first habitat is still very much up in the air. It is believed that the first ones could be inflatable, built on earth, and transported to the moon. Another idea is to build a more durable structure in low Earth orbit and ship it to the moon when complete. The Ares V rocket could be used to transport the pieces for the structure into space. Later, it is hoped that man will be better able to "live off the land" and use lunar materials for construction. One of these ideas involves living underground in lava tubes. Another idea already under investigation is using lunar materials to make concrete. The lunar soil might also be used to extract oxygen or fuel. An intriguing idea I found on Universe Today when researching for this talk is the use of a roving lunar base, what I call a kind of a lunar Winnebago. **(video)**

The video talked about reusing materials as many times as possible. Last year NASA also challenged school children to design and build a lunar plant growth chamber. I also mentioned that it would be important to be able to live off the land when we got to the moon. Using the idea of a plant growth chamber, with this milk bottle I hope to demonstrate three concepts pertaining to living on the moon. Firstly, I reused a resource just like will have to be done on the moon. Secondly, I started my garden in here, tomatoes to be specific, to demonstrate that we will have to grow our own food on the moon. Thirdly, if we're able to live off the land it will save on money and resources as, in today's dollars, it will cost more than $100,000 just to get one gallon of water to the moon. You can see it would be a great benefit to find water already there.

Whatever we learn in establishing a moon base, or more likely multiple moon bases, can be used to establish a Mars base. Right now it is planned that the Mars spacecraft will be assembled in low Earth orbit and the Orion module would be used to rendezvous with this vehicle prior to launch, which would be from orbit instead of the ground. The only timetable I have seen for men landing on Mars, and that was from Wikipedia, is somewhere around 2030 or 2040.

In summary --- Lunar exploration helped get NASA started about 50 years ago with the Surveyor and Lunar Orbiter missions. Apollo is probably NASA's best known and favorite lunar program. Lesser known missions like Clementine and Lunar Prospector followed Apollo. And today we have two missions about to go to the moon; that of Lunar Reconnaissance Orbiter and LCROSS. What we learn from those missions, combined with the development of the Constellation Program will help put man back on the moon, but this time to stay longer than just a few days. Lunar bases are being planned, and experience gained from their development will help us reach for Mars. Who knows where we will go from there?

Again, I want to remind you that this talk, along with links to the videos, and sources I used are on my website at www.KeepLookingUp.net . Information on how to subscribe to "Planetary Wonderings" is also there. Thanks again for coming to hear me. Are there any questions?

Sources:

http://en.wikipedia.org/wiki/List_of_Constellation_missions
http://www.universetoday.com/2008/02/09/building-a-base-on-the-moon-part-2-habitat-concepts/
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http://www2.indystar.com/library/factfiles/history/space_program/hoosier_astronauts.html

Videos (YouTube videos are often on the site in multiple locations):

- LCROSS Overview http://ails.arc.nasa.gov/public/lcross/08lcross_lrg.wmv
- LRO/LCROSS Launch and deployment http://www.youtube.com/watch?v=WZCMjj7kTyI
- Lunar Reconnaissance Orbiter (Real World) http://www.youtube.com/watch?v=UDrJFRr-KHo
- Constellation Program http://www.youtube.com/watch?v=zi0YuWmTNxI
- Lunar Habitat (Our World) http://www.youtube.com/watch?v=RTHKoeO5jWc