Preflight Interview: **Janet Kavandi**

Before we get into the specifics of this particular flight, tell me a little bit about yourself. Why did you want to become an astronaut?

Space has been a subject that's intrigued me since I was a child. I've always been interested in space and astronomy. In school whenever I had a choice of subjects to write about I'd always pick something to do with space or astronomy, black holes or quasars or something like that. Then all the space launches I watched as a child, especially the moon landing, fascinated me. So growing up it was something that I thought would be fascinating to be able to do. Of course at that time, being a young girl, there were no girls in space yet. But as we got into the space shuttle program and they started taking women and scientists instead of all test pilots, that's when I decided to try my hand at it and send in my application.

Tell me about your career that got you to this point. Give me a little bit of your history.

I have a Ph.D. in analytical chemistry. I went to the University of Missouri in Rolla. I also went to the University of Washington in Seattle and that's where I got my doctorate. I worked at the Boeing Aerospace Company in Seattle for almost eleven years and worked on power systems and electrochemical power systems, mainly batteries, for spacecraft and missile applications. I also did some research on aerodynamic properties using a chemical porphyrin paint that we painted onto aerodynamic models, and we used that to help NASA provide continuous pressure maps of aerodynamic models and wind tunnels. That's what I used for my doctoral dissertation. Then during that time frame I applied to NASA for the astronaut program, was selected in 1994, and showed up in 1995.

Summarize for me. If you would, what you will be doing during the flight. What are your primary responsibilities?

This time I will be MS2, Mission Specialist number 2, which is new to me and which relates to a flight engineer on a commercial aircraft. I've accepted this new role, and I've learned the shuttle systems very well. Mainly the job involves backing up the Pilot and the Commander in their roles during the ascent and entry phases. In addition to that, I'm the lead extravehicular activity person. Should we have to go out on an EVA, I'd be the lead EVA crewmember. This could be to fix anything that might happen to the shuttle or to the payload. In addition, I'm one of the Mission Specialists responsible for the payload itself. I will be with Gerhard on the on-orbit checkout portion of the flight right after we get up into orbit. At that time, we need to power up the payload and extend this long mast that we have that will come out of the payload bay. That all has to be done expediently so that we don't lose any data takes for this mission.

Why is this flight important? What more is there really to learn about the surface of the Earth?

It's hard to imagine that we have better three-dimensional maps of other planets like Mars and Venus than we do of the Earth, but we do. So this mission is to accomplish a three-dimensional topographical map of about eighty percent of the landmass on the Earth which we do not have today. We have small sections of the planet that have been mapped with aircraft, but we do not have a three-dimensional map of the surface of the Earth. So that's our prime objective on this mission.

The Shuttle Imaging Radar-C, or SIR-C, and the X-band Synthetic Aperture Radar, or X-SAR, flew on the shuttle in April and October of 1994. Can you tell me what innovations for SRTM separate it from those Space Radar Lab missions?

On SRTM we have the capability to add the three-dimensional aspect of the mapping of the Earth. The way we do that is we have a long 200-foot boom that will extend out from the payload bay from a canister. On the end of this boom we have a second set of radars, a SIR-C, SIR, C-band and an X-band radar, and we can do simultaneous radar measurements with both booms and thereby get the three-dimensional aspects of the Earth surface.

What kind of resolution do you expect, and how does this compare to other forms of spaceborne imaging?

We hope that if everything aligns right we should get at least 30 meters horizontally and at least 16 meters vertically. This is far better than anything they have been able to do in the past.

The flight has a special piece of hardware with the mast. Can you explain the process of the mast deploy? Tell me what happens and how long it takes.

The mast is the boom that I was referring to earlier, and it's very similar to the mast or the booms that would be used on space station where we deploy these out. It's a very ingenious way of folding up 200 feet of material into a six-foot canister and then deploying it with a couple of motors that we have. Should these motors all function properly, it would take about seventeen minutes to unfold the mast and lock each individual bay in place as it comes out until it fully extends the 200 feet or 60 meters out.

What happens if the mast does not fully deploy? Could you do an EVA to fix the problem?

Depending on the failure, we have a fairly high confidence that we could fix that. We have had the capability of using space station power tools to interface with the motors on the canister, and we can disengage the motors from the outside then put these power tools on and extend the mast manually with the power tool. We could also do it manually if we had to by cranking it out by hand. That would take some thousands of turns, so we don't want to do that if we don't have to. Hopefully, the power tools will work fine and the batteries will hold up. We can deploy the whole mast if we had to with those power tools.

Does the mast need to be fully deployed for acceptable science to be gathered? Can you get any sort of information at all if it only partially deploys?

Actually I think it has to be fully deployed - the resolution depends on its being fully deployed. I think it's something like one or three millimeters accuracy within the length of the boom to make sure that all the data is accurate.

What is the fly cast maneuver, and why are you using it?

The fly cast maneuver is needed to keep us at a constant altitude above the Earth's surface. We have to do this twice daily, otherwise, we will start drifting back into the atmosphere slowly, and we will be at different altitudes when we are taking data. Then the data won't be as accurate. We need to maintain about 126 miles as best we can. This fly cast technique was developed so that we don't damage the mast while we're pulsing the jets on the shuttle. It is so long that when you apply a pulse it will cause this mast to sway back and forth and it will ring out eventually. Some smart people in Mission Control Center have developed a technique so that when you apply the first pulse the mast will swing back and then the second pulse will hold it there during the burn. When you turn the jets off, the mast will want to swing back to its original position and then you pulse it one more time to stop it there. That way you avoid the ring out.

Tell me about the process of mast retraction. Is it just simply the reverse of the deploy?

Essentially it is. You just put it in reverse for the most part and we'll retract it back in. Then the latches will have to latch at the end there to safe it for landing.

What can be done if there's any trouble with the retraction? What if it gets stuck?

Again we could go out [on an] EVA potentially depending on the failure and disengage the motors and retract it back in with the power tool. If that should fail, and we don't have any other option, or we run out of time and consumables at the end of the flight, we do have the option of jettisoning the whole canister with the mast in it. Thereafter we close the doors.

Do you have specific mapping targets on the Earth's surface such as the SRL missions did?

Basically we're just going to try to cover all landmass. We're not going to select specific ones, although, for instance, we will target several islands out in the ocean. But the objective is to cover all the landmass that we can see on this mission.

You mentioned going over the oceans. Is the radar on for the entire flight?

It is not on over ocean passes where there is no landmass. However, if we're coming up on Hawaii, for instance, we can turn on the radar, image the islands, and then turn it back off.

Why is the data being recorded instead of downlinked live?

We just have far too much data to downlink it live. So we will take passes where we can downlink portions of the data, not all the data at once. They will take portions of the data in playback mode from the recorders and look at that to make sure everything's being recorded properly.

What type of tapes are you using to collect the data?

They're a larger 19-millimeter format. They look similar to a VHS tape only a little bit larger.

How long will it take to process this huge amount of data?

I believe it's going to take at least a year of processing time to process the whole thing.

Are the X-band data and the C-band data processed in a similar manner?

I believe they are. The X-band will be processed by the Germans as the DLR is the one that's taking the data for the X-band. The United States is using the C-band data, and it will be processed here, but I believe the processing is similar.

The two ASTRO astronomical observation flights used the Star Tracker, and SRTM uses it in a new way. Tell me about the Star Tracker and how you are using it.

We also have the Star Tracker on the shuttle. The Star Tracker's function is to identify individual stars in space and thereby orient the reference of the shuttle, or the payload in this case, to the stars, thereby producing their inertial reference for the position of the payload. We also, of course, have to know the position of the outboard antenna. We're using GPS receivers to help us identify the location of that in addition to some optical alignment systems that we'll be able to use to make sure everything is properly aligned with each other. With a combination of all those things, we'll have an exact knowledge of where we are and how we're oriented with respect to the Earth's surface.

What will we learn about the Earth from the data acquired on this mission? For example, what kinds of applications are there for this technology?

There are a wide variety of applications. Everything from urban planning, ecological evaluations, earthquake studies, measurements and fault line shifts. Something that my husband has particular interest in since he's a commercial airline pilot is the application to ground proximity warning systems. We'll have a much better database to give to airlines to put in their airplanes for conditions where they can't see the ground because of the weather. We can use this better terrain map to avoid running into mountains and bad things like that.

If a volcano erupts or there's some other sort of natural disaster while you are up there, will you be able to pay any sort of special attention to it?

Of course, we're moving so fast across the surface of the Earth, if we know in advance that we're coming up on a site like that we can take photographs of those types of things. And, of course, we'll be doing radar images of that area as we pass over. So in that respect, we can pay some special attention to it, but you don't have a lot of time to spend on one particular area because you can't slow down once you're going up there. You just always pass over the Earth about 5 miles a second so you don't have a lot of time to take a look.

Once the payload is functioning properly, the crew kind of slips into a regular routine. Do you think the work could ever get boring or tiring up there?

I don't think it would ever get boring. I think we'll have to be careful later on in the flight after we've been doing it for several days not to become overconfident that we've got this routine down and that we wouldn't have to be so careful. I think we'll have to always monitor the data takes very carefully throughout the flight to make sure the hardware's recording when it's supposed to and to compensate for anything that goes wrong in a timely manner so that we don't lose any important data.

You mentioned earlier the role of the Germans in this flight. This mission does include international partners. What are they contributing?

The German Space Agency is contributing the X-band radar system, so we'll have X-band on both the inboard and the outboard portions of the radar.

Describe for me if you would the nature of the relationship between NASA and the international partners. What's it been like working with them on this flight?

I always enjoy working with international partners, and it's been very good on this flight. We've worked with them in simulations, and we've worked with them at JPL before we started training at JSC. I think they're very good people to work with; it is a very good relationship.

What is the National Imagery and Mapping Agency, and how are they involved in this flight? Describe for me the relationship between NASA and NIMA.

NIMA is the government agency that does the mapping for our country. They have a huge database of all types of images of the Earth, and this will greatly increase their database for all the Earth within the areas that we are covering. This will give them their first three-dimensional coverage of the whole Earth. They use this information for our country as far as defense goes, and also they are then able to disseminate this information to the airlines and the other people that need this information as well.

Does NIMA get digital topographic data from their own satellites? Why do they need this flight if they do?

I'm not aware of all the information NIMA gets from their satellites. I think if they had already been able to get this, they would not need this mission. I'm assuming that this is the only way they are able to get this information and that's where we fit in.

Tell me about EarthKam. What is it and is it comparable in any way to the flight's primary payload?

EarthKam is something that we've set up as an educational program with middle schools throughout the country. We are able to place a 35-millimeter camera in the overhead window of the shuttle, and we let students throughout the country select sites that they want to photograph and study. Then those sites are programmed into a computer, and the camera automatically takes pictures at the appropriate time of these particular areas. Then the students can access the data almost real time, in a very timely manner, while we're still up in space. They can get their images back and then talk about what they see and do comparisons of earlier images of the same area.

How would you characterize the long-term importance to science of the work that you and your crewmates will be doing on STS-99?

I am very happy that we're able to contribute this amount of information to the world. In fact, we'll provide the best surface map that we've had to date of this Earth. We should be able to help people throughout the world in planning agriculture, preventing airline crashes, and providing better planning for urban development. I think it's a great mission.

Greetings

Click on the image to hear Janet Kavandi's greeting.
Mission Specialist, STS-99

Crew Interviews

Interviews Go