Preflight Interview: **Mary Ellen Weber**

The STS-101 Crew Interviews with Mary Ellen Weber, Mission Specialist No. 1.

Mary Ellen, why did you want to become an astronaut? What is there in your background that led you to want to do that?

I've been asked that question many times. I have to say that when I was small, when I was growing up, I never even considered being an astronaut. That was not something women did. It didn't even enter my mind as a possibility. It wasn't until I was in graduate school in chemistry and I was very much into science and research. I'd also gotten involved in a lot of aspects of aviation, and space just seemed like the perfect adventure and the perfect mix of all the things that I loved.

What got you into those previous areas of interest, into chemistry and aviation?

Well, in school, I liked problem solving. I liked trying to figure out how things worked, why things worked, trying to understand the details, the physics, behind things. I really enjoyed that in school, and so I went on to college and into graduate school just pursuing those same things. [I] just got involved in aviation. Actually, skydiving was the first [aspect] of aviation that I got involved with, and it was exhilarating. It was exciting. It was challenging-very challenging. It's a sport that you can do for many years and there's always room for improvement and always another challenge around the corner. That's what I liked about both fields, science and aviation.

Your NASA biography notes that you've made more than 3100 skydives since you were an undergraduate in school. Did you want to become a pilot first and fly planes or first want to jump out of them and then learn to fly?

I first wanted to jump out of them in college, and it wasn't until I was around aviation and I really got exposed to it and realized how exciting flying was. After graduate school, I got my license doing that.

I'm fascinated by the reference to your participation in the world's largest free-fall formation, almost 300 people at one time. How does a thing like that work?

Well, it's tough to get 300 people to do anything all at once. It's tough to get 300 people to go out to dinner at the same place, so it's quite an endeavor. Over the years, various people in the sport tried to break the world record, and they have to find a site with planes that are large enough, with facilities. It's a logistical nightmare, I think, for them, and usually they put together the event over two or three years before it comes together. And so, that particular one that I was on was actually in Russia several years ago. We did not get the official record at the time. In order to get a record everybody has to be in the formation in their predetermined slot, and we had some stragglers who didn't get into their slot before time ran out. But since then, there have been a couple of records that have been set where they managed to build the formations that they planned to build.

You said you became interested in this while in university, at the same time you first thought of becoming an astronaut. Can you take us through the steps in your career, from being a student, that led you to becoming the astronaut that you are today?

When I was a student and I was involved, obviously, in science and in research… I'm the kind of person that just likes to try new things and likes to experiment and likes to be bold. I like to try different things, and that's true in science, that's true in my hobbies- not just skydiving but other things that I like to try. And I think all of those experiences led me to try the biggest, the grandest adventure that I could imagine. And I applied to NASA and went through their selection process, which is a somewhat involved process, and I was very fortunate, very lucky, and I got selected in 1992.

You've been an astronaut, as you said, since that time. You've flown before. You've been training for STS-101 for some time now, and you recently got word that you and some of your crewmates were going to be flying a revised mission with some new crewmembers, and were going to have a relatively short time to prepare for it. Tell me your reaction to the news that, suddenly, you were going to be flying on assembly mission 2A.2a?

Well, it was the best of times, it was the worst of times, it was… It's very exciting to be going to the space station, [to] be involved in this incredible endeavor that we're trying to do, and that's build a space station. As part of that, you have to be flexible. You have to be able to adapt to new situations. And that's what we were all asked to do. The mission called for it. Mission needs changed, and we were disappointed [to actually not be flying with] those crewmembers that we trained with for over a year. Maybe we'll be fortunate enough to fly with them someday in the future, but that was certainly a very big disappointment to us. On the other hand, we have three new crewmembers who bring an immense amount of experience and skills to our crew, and that's certainly very exciting all in its own. It's been really enjoyable getting to know them. I think we'll be as close to them, by the time we launch, as we were to the crewmembers that are on the follow-on mission.

Help us understand what this mission is about. Why has NASA chosen to fly this mission at this time? What are the mission goals now?

Well, our primary goal is to go up and help some systems on the space station that are having some trouble. It's been up there for a while now, and, like anything, you need some maintenance and repair. So, one of our primary goals is to fix some of the glitches in the electrical system, for instance. Also, we're bringing up some other pieces of equipment that need to be brought to the space station, some things that are going to go on the outside of the station as well as go on the inside of the station. So, we're doing some maintenance and repair, and then the second half of it is bringing up equipment and supplies for the crews that are going to be up there for long periods of time.

Before we talk about the specifics, I'd like to get you to talk a bit more about something you made reference to earlier, and that is the fact that we're in an era now, on a space station, where things are going to break. Things can't be planned out meticulously very far in advance because we don't know what's going to happen. Is that something that NASA and its astronauts and everybody who's involved in this is going to have to get used to, this different sort of approach to preparing for spaceflight?

Absolutely. I will say that we do plan meticulously for a long time in the future, but at the same time we are prepared to adapt and overcome whatever changes happen to come down the pike. This is an unbelievable effort and an unbelievable endeavor that we, NASA, are trying to do with the other international partners. We are doing something that has never, ever been done before. There has never been an effort, a project, that has involved this many countries to do something to advance humankind. I mean, that's what this is all about. Technologically, it is more complicated than anything we've ever done before, and culturally, bringing together the world, having the world act as a single unit to do something to advance our whole society, is something that's never been done before. So, whenever you do anything that complicated, there [are] going to be challenges. There are going to be things that you can't anticipate, no matter how meticulously you plan. That's what we're faced with, and that's what we're dealing with, and that's what we're adapting to and solving. Pretty soon, we'll realize the dream, and we are going to have an orbiting laboratory in space.

The rendezvous with International Space Station on your mission is similar to what was conducted on STS-96, the last space station docking mission last year. If you could, talk us through, in general, what the steps are to rendezvous with the station and what your role is going to be when bringing these two massive objects together in space.

Well, when we launch, we go into an orbit that's slightly different than the actual space station's orbit. And we have to use Newton's laws of gravity and orbital mechanics and speed up and slow down appropriately so that our two orbits eventually are going to be the same orbit. And so we do a number of engine firings, thrust firings, to change our orbit in order to match the station's. I don't know if most people realize how complex an effort this is. I mean, we have two vehicles that are going over 17,000 miles an hour, both in slightly different paths, and we need to bring them together and dock them with a rate that's about a tenth of a foot per second! So, it's an incredibly complicated thing. We need to rely on navigational equipment to know exactly where the station is. To know exactly where we are, we're using lasers pointed at the station. We're using radar to try and judge the trajectory of the space station with reference to ours. That's what we're doing rendezvous day. My particular role is going to be dealing with the docking mechanism itself. It's my job to know all the nuts and bolts and ins and outs of the docking mechanism and to prepare for when these two vehicles do come together and make sure that we can get latched together and that we can make an appropriate seal, so that we can actually get inside the space station.

The day after Atlantis docks to the space station, timeline calls for you and your crewmates to complete a number of tasks. Some of them are on the outside of the International Space Station, and you're going to be the operator of the robot arm for the spacewalk that is planned. I'd like to get you to tell us about the jobs that are planned, the tasks that must be performed, during this spacewalk, and about the challenges for you and Jeff Williams and Jim Voss to coordinate and smoothly integrate the operation of the arm into what they're doing outside.

Well, for the spacewalk, we use a robotic arm because we have to be able to get the crewmembers from one side of the shuttle over to different areas on the space station stack itself. Without the use of gravity, you can't simply walk. You've got to have handholds. You've got to have paths so that you can translate across a great deal of equipment, sensitive equipment, etc., and it's difficult to do. However, we have this robotic arm out in the payload bay, and what it allows us to do is to pick up the different crewmembers [and] attach them to the end of the arm. In this case it'll be Jim Voss at the end of the arm, and I'll be able to use this big robot to move him to all the different places that he needs to get to. He'll be picking up equipment that we've brought up in our payload bay, and he'll be dropping it off at different points on the space station. There are definitely some challenges with the robotic arm operations that we'll be doing that's different than missions that we've done for years and years. The first thing is that this space station stack is just a couple of feet away from our windows that we use to look out into the payload bay. We have extremely limited views of the payload bay. So, we're having to do these robotic operations relying on cameras at the far end of the payload bay, at computer virtual reality displays that show where the arm should be with respect to different pieces of equipment. This whole idea that you can do these robotic operations without being able to directly view your work site and be able to view the different joints of the arm and to view the different pieces of equipment that we need to avoid, it is extremely challenging. As a crew, we've worked to come up with procedures and methods [as to] how we're going to use the different tools we have in order to accomplish this safely.

Is it like an out-of-body experience to be moving this arm but not see with your eyes what's going on directly?

I wouldn't quite call it an out-of-body experience. We live in an amazing time. Virtual reality, in which you can use computer-generated scenes and screens to mentally put yourself into those views, it's something. I mean, we're not just doing [it] at NASA. It's being done throughout our whole society. We're using these tools, and we're using this new capability to accomplish our job.

On the spacewalk in question then, tell us about the tasks that are planned, the places that you'll be moving Jim Voss back and forth to?

Well, at the top of the Node module, we have some equipment that we need to tie down and secure. So we'll be taking Jim up there to do that task. In the payload bay, what we're bringing up is a telescoping boom to attach to the station, which crews for many years to come will be able to use to move them to different places along the space station. We're bringing that boom up in several different pieces, and we're going to be assembling that and having to bring those pieces over to the station, where we're going to be installing it.

They're putting in handrails and other equipment; does that involve a lot of arm operation as well?

Yes. They're installing some handrails. There are a number of smaller pieces of equipment that we'll be dealing with on the space station, too, and that requires, us using the arm, to [move the crewmember] from one side of the space station to the other side, where they can install these handrails. To most people, it may not be obvious how important or how critical having these handrails in the right place can be. Again, when you're doing a spacewalk you don't have gravity. You don't have anything that allows you to step from one place to another. You're out in space, and you have nothing to push off against. You have nothing to grab a hold of on a smooth surface. You need to have handrails in order to even walk. We essentially walk with our hands when we're outside.

The day after all of this work on the outside of the station is the day that you all are planned to begin your work inside the International Space Station. Do you have any sense, at this point, of what you're going to feel when you float into that station for the first time?

It's going to be, obviously, exciting. We've all been looking forward to this mission and to these moments for a long time. It's also going to be intense. We have a job to do and there's a great deal of pressure on each and every crewmember on this mission, and on every shuttle mission, to do their job successfully and without mistakes. We train for a long period of time. We try to get as much information into our heads as we can so that we can do the job successfully. At the same time, you're rising to the occasion. Once you get there, it's time to do your job and you're pumped up. You're ready to go in there and to do it and to deliver the product to all the folks on the ground that have been working this mission for so long. So, just the gee-whiz aspect of it, it's going to be great! We're going into the space station. This is a whole new era of space exploration. This is a whole new space vehicle, and we're going to be [some] of the first few people inside of it. That's going to be exciting. The other feeling will just be, let's get to it. Let's do this job. Let's pull together. Let's do it right.

The work that you all are assigned to carry out inside the station has been divided into roughly three areas, the top priority being the repair of equipment that's inside Zarya, the first element of the station that's been on orbit since November of 1998. Tell us about the equipment that's being targeted for repair or replacement. What's involved for your crewmates, particularly, in the on-orbit fix of batteries?

Most of the equipment that we'll be repairing and replacing deals with the electrical system, and we'd have different current converters and things like that that are associated with it as well as the batteries themselves. What's involved is certainly getting to the work site. Again, every space vehicle is very compact. You have to put a lot of equipment in a very small volume. Getting to the equipment will be challenging, working our way around different things that might be in the way. Also, it's going to take a lot of coordination with the folks on the ground, both in Moscow and in Houston. You obviously don't want to be disconnecting and connecting live electrical parts, and so the commanding of the appropriate pieces of the electrical system - commanding them on and off at the right time - it's like any other electrician doing some major electrical repair work on a complex system.

After repair and replacement of batteries, there are a number of other tasks that involve extending the life of the Zarya module, as well as just the transfer of equipment onto the station that's going to be used by crews in the future, and you've got a big role to play in that as well. Tell us about those jobs that are going to occur, what some of this equipment is, and why the transfer of things from one spaceship to another is an intricate and complicated thing to accomplish.

Well, when the modules were launched up there, they just had the bare minimum of equipment, and very few living supplies and things like that. This is because it weighs so much. We only have so much power in order to lift these modules up there; therefore, we have flights like ours in which we're bringing up the bulk of the equipment and supplies that are going to be used by the crew. We're bringing up thousands of pounds of equipment. It all has to be transferred into the little nooks and crannies on the space station within just a few days. And it is quite a scheduling task and quite a logistical nightmare to think about moving one bag to its proper location and moving it at the time such that you're not interfering with other bags or other work that's taking place. So, this is something we've had a group of folks on the ground working on - how this transfer is going to take place in just the short period of time that we have - and I'll be heralding that effort once we're up there. We're bringing up things like exercise devices for the crew, things to help them repair the station in case there's a leak in the station, we're bringing up supplies for them - food, and clothing and, actually, water. Basically, right now what we have is pretty much an empty house, and it's sort of going to be "moving day" when we get up there. I'll be like the mover with the clipboard, making sure everything gets in the right place.

The last shuttle crew that visited the International Space Station encountered a slight degradation of air quality inside the station. First, can you tell us, at this point, what is believed to be the source of that, and second, what's being done on your mission to ensure that none of you would suffer any of the same symptoms that the STS-96 crewmembers did?

Well, it's hard to say for certain what the problem was. On the ground, when you breathe out carbon dioxide, it immediately, because we have gravity and we have different weights and things, mixes with all the other gases that are out there. So, we have a nice, even mixture of air that we breathe all the time. When you're in space, when there isn't gravity, there's nothing to cause that mixing to take place naturally. So if you breathe out carbon dioxide you can find yourself in a pocket of carbon dioxide. Now, we have fans and ventilation ducts and things like that up there, but what we found was that the configuration that we're in, with the shuttle docked to the station and the shuttle being the driving force for mixing all of this air at one end of it, [is] not the original design of the whole ventilation scheme inside the space station. Ultimately, the ventilation is going to be great with no problems, but in the meantime, for missions like ours where we're relying on the shuttle to do that mixing, they had some troubles. Now, we've had a lot of folks on the ground between that mission and this mission taking a look at the problem, trying to figure out a way to enhance this mixing. We're bringing up different air ducts. We're actually closing off some different ports, trying to force air further back into the shuttle. We're bringing up many different fans that we can stage throughout the space station, and we're pretty confident that we won't be having the same kind of symptoms that those folks had.

It's an awful lot of work to be done over the course of seven days that you're up there. As you undock and fly around the station and give it a good look before you head home, what will have to have been accomplished for STS-101 to be considered a success?

Well, all the things inside of our shuttle need to be put into the space station, and they need to be put in the right place. All the equipment that we're installing, both inside and out, needs to work. It needs to function. It needs to be connected properly, and those are really the two main things that are going to define mission success for our crew. It's not going to be easy. Every time you look at a problem you find out that there are thirty layers of details and constraints and nuances associated with solving that problem, and it's going to be a challenge for all of us not just on this mission in the space station and shuttle but for the folks on the ground planning and resolving the issues that come up.

At the end of last year [with] everyone compiling untold numbers of lists about things that happened in the 20th Century, human spaceflight was voted to be amongst the top five news stories of the 20th Century. Well, you're getting ready to be on one of the crews that's kicking off the 21st Century in space with a mission that's designed to help extend human presence in space. Why do you think doing that is important?

I think that our society is like any other living, breathing organization. If we're not growing, if we're not expanding, if we're not pushing out the boundaries around us, we're going to be a dying society. I mean, there is no better indication that we are thriving and that we're vital than the fact that we are exploring space, that we are conquering space. We are at the threshold of a whole new era! I mean, think about how lucky we are to have been born at the time we were born. Everybody alive today is going to be the subject of books and entertainment and movies, although they probably won't call them movies at that time. But we are going to be the focus for hundreds of years to come. We're going to have people, hundreds and thousands of years from now, looking back at us, imagining what life could have been like at the time when we were first exploring space. We are so fortunate. This mission is one small part of it, but it's absolutely critical. I feel so fortunate to be a part of it, and I want everybody to have this same sense of importance in history that's taking place here and to know that they're a part of it as well.

Greetings

Click on the image to hear Mary Ellen Weber's greeting. Mission Specialist, STS-101

Crew Interviews

Interviews Go