Interview: Andy Thomas

Space Station without the Mir would have been inconceivable

In 1995, the National Aeronautics and Space Administration embarked upon a challenging series of joint missions with the Russian Space Agency, which included link-ups between the Space Shuttle and the Mir space station. During that program, seven NASA astronauts lived aboard Mir, the last of whom was Andy Thomas, who returned to Earth on June 12, 1998.

The American stays on Mir became controversial when a fire started aboard the station in February 1997, and then a collision occurred with an unmanned Progress supply ship in June. There were calls in the U.S. Congress to end the joint program, because it was said to be too "dangerous" for American astronauts to be on the Russian station. The effort to end the program was unsuccessful, and the last two astronauts, including Thomas, completed their increments aboard Mir.

More recently, the Russians have indicated an unwillingness to deorbit the 13-year-old Mir station, which had been scheduled for this summer. They are trying to find private interests to finance Mir's continued operation for the next two years, while its successor, the International Space Station (ISS), is being assembled in orbit and readied for its first long-duration crews.

In an interview with 21st Century Science & Technology *Associate Editor Marsha Freeman on Dec. 10, 1998, Thomas described his way of coping with his stay on Mir, the lessons learned that should be applied to the ISS, and the future of the Mir. Thomas was born in Adelaide, South Australia in 1951. He obtained a doctorate in mechanical engineering from the University of Adelaide in 1978. He was a research scientist with the Lockheed Aeronautical Systems Co., and in 1989, he joined the research staff of NASA's Jet Propulsion Laboratory.*

Thomas was selected as a NASA astronaut in March 1982. He flew on a 10-day Space Shuttle mission in 1996, and on Jan. 22, 1998, launched aboard the Space Shuttle to Mir, where he served as Flight Engineer 2, and completed 141 days in space.

Q: I have interviewed some of the astronauts who have been on Mir. I did one with Dave Wolf [*EIR*, March 13, 1998], and one with Mike Foale [*EIR*, Oct. 16, 1998]. Those interviews focussed on some of the specific experiments and work that they did on Mir. But you are the "bridging" person, in between Mir and the International Space Station, the first two elements of which are now in orbit. So, I wanted to ask you some general questions, on the lessons learned from Mir for the ISS.

It seems to me that for long-duration missions to be successful, there has to be a good working relationship among the crew, and a minimum of hardware problems. You have previously mentioned some of the things that you thought were very helpful, or even necessary, to make it a successful long-duration flight. At your press conference after you returned to Earth, you mentioned that on the part of the visiting astronaut, it takes determination, and soul-searching. And, you've talked about the frame of mind that the crew member has to be in, in order to make it a successful, also pleasant, and happy, worthwhile experience.

What frame of mind do you think is necessary to adjust to, as you've said, the "unusual if not bizarre circumstances" of being on a space station?

Thomas: I think people need to be flexible, to have an adaptability to new situations. I think you need to be able to creatively find recreation for yourself, sort of within yourself, and not be too dependent on externals, particularly other people.

I think, for example, that if someone has a social life that's very outgoing, and they have a great dependence on social contacts with lots of different people, obviously they're going to have a difficult time in the confinement of a space lab. So, it depends on the kind of person, to a very large degree—what their personal characteristics are. I think the main one, though, is that you can think creatively, and find opportunities for recreation sort of within yourself.

Q: You've mentioned the importance of recreation. Would it be worthwhile for people who know they're planning to make a long-duration stay in space, to try to develop certain kinds of hobbies, or things that they work on, more or less by themselves, before they go? You've mentioned that you had tried sketching, and did a few different things.

Thomas: Yes. I hadn't actually done any of that before I went. I had planned to do it before I went; I had thought it through, but I hadn't done any on the ground. It wasn't until I got up there that I did that.

I think that hobbies are very important, and one of my recommendations when I came back from Mir, was that NASA provide certain standard forms of recreation—you

know, music, CDs, movies, computer aids, and so on. But I think it's important that the individual have something that is personally rewarding to him, if such a thing exists, and if it's transportable.

And I made a recommendation that that personal recreational vehicle, whatever it is—NASA needs to accommodate the needs of the astronaut in that regard, by providing that. In my case, it was providing pencil and paper. But it might be providing a musical instrument, or a particular collection of books, or something like that. And I think that that could go a long way to making a very big difference in the quality of the time that the person has in orbit.

Q: Relaxation, of course, can also be something that you do with one or more of the other crew members. Are there any things that could be taken along, or should be, where the crew can relax and do something together?

Thomas: We did that on Mir. We watched movies together, pretty much most evenings; we'd watch a video for a while together in the base block. And I think that's a good thing to do. Also, I think eating meals together is very important. So, your schedules have to be matched to accommodate that, so that people can all gather and share meals together, and have that sort of social interplay. That goes a long way to having sort of a balanced life up there.

The big challenge is to find a way of psychologically removing yourself from an environment, when you can't physically remove yourself from it. And that's why creative recreation is so important, because it lets you do that.

Q: One of the things you've said that I found surprising, is that you have to create a certain kind of psychological distance from the Earth—I suppose so you don't go to sleep every night being homesick. With the Russian system, voice communication with the ground was certainly much less frequent than during Space Shuttle missions. But you said that you get pulled back if you're going to spend a lot of your time talking with family or friends, and that you actually preferred e-mail.

Thomas: Yes. E-mail was very important. I've heard it said that people who go off to West Point, or a military academy, sort of go through the same thing. They like to get letters, rather than phone calls, because a phone call pulls you back to the environment that you have to pull yourself away from.

I've also heard it said that people who do some of these long Arctic and Antarctic expeditions in isolation, initially take lots and lots of pictures of their family and things like that, with them, and pin them all up, or hang them up in their tents. But after a while, they take them all down, because they're not actually helping them. And it sounds a little unkind to think that people might react that way to their loved ones, but it's not unkind. It's just trying to function as productively as you can in the environment you are in, and making the most of it, without sort of trying to live in two worlds at once.

Astronaut Andy Thomas

Q: And then, of course, there are things that should be done to make a crew member most productive. In your July 8 press conference, you said that "things have to be convenient and agreeable." It seemed to me that you were thinking more of the physical environment than the interpersonal one. You had mentioned "convenient," for example, in terms of not spending a lot of time looking for things that you have misplaced. Could you say what you mean by things having to be "convenient and agreeable"?

Thomas: There's a logistics issue that goes with being in zero gravity: that if things are all stowed away in inconvenient places, you can end up spending a huge amount of time looking for things. And it's amazing how easily you lose things. And so, you don't want to have a situation where you have to spend inordinate amounts of time looking for some stuff so that you can do a 15-minute experiment, or something like that.

And the way to overcome that, is that you need very well-organized storage of all the tools that you're going to use, and the equipment that you're going to use.

Q: Do the personal surroundings make a big difference?

Thomas: Yes, but after a while, you can tune out any surrounding. I think having a tidy environment, and a clean environment, is more uplifting to you than a depressing, messy environment. And I think that's important.

But from the environmental point of view, the most im-

portant thing is that when you serve on a flight like that, you do have some region in the spacecraft which you can basically call "home," and you think of it as your sort of place, and where you might have personal effects, your recreational aids, and it's a place where you go. It might be where you sleep. In my case, it was the place where I slept, and also the place where I worked.

But this gives you a sense of somewhere that you belong, and that you can go there when you need to be alone, or when you wish to be alone, and know that that area will be respected, and that if you want privacy there, you will have it when you need it. And that certainly happened on Mir. And it's also been the experience of my predecessors on Mir, too. I think that's very important, that you are able to do that. It makes a huge difference. So that if you leave something, personal effects, set up there, and you go away to do work in another module, you come back 10 hours later, you know that it's still there, and that sort of gives you the sense of coming home. That makes a big difference.

Q: Was there any difference in the way the Russian crew members that you were with looked at that? Did you find that there was any cultural difference in that respect?
Thomas: No. I think the need to have that sort of personal area, was common to us all. And we respected that area for everybody, each other's area, even though there might have been times, for example, when I would have needed to work in someone else's area, perhaps having to disturb their things. And I would go to that area, and I would ask them first, and make sure that they understood what I was doing, so as not to just take a liberty and assume that you can just barge in. Because it's a bit like someone's house, you know. You just don't barge in, you wait until you're invited in. And those sorts of boundaries, even though they're completely artificial in a spacecraft that's confined like that, they do nonetheless exist.

And once I got on board, and I'd set up my little work area, and my little habitation area in that way, it became a whole lot more comfortable for me. I had this place that I could identify with. It was like a small home for me, and I grew to kind of like the time there, and enjoyed it.

Q: One of the other things that you have mentioned that affects your work on a space station, is monotony. If you know you're going to be on a space station for three months, or for six months, and you're not on a minute-to-minute timeline like you are with the Space Shuttle, could there be a way of structuring it so that every day is not the same? For example, here on Earth, we have a staff meeting every Tuesday. I go food shopping on Sunday. Every day is not the same. You actually have to do different things on different days.
Thomas: Yes. And the work can be set up so that it's non-repetitive, so that you're not doing the same thing every day, day in, day out. And that's where the science program which you do, can be carefully planned, to provide that—but only to some extent, because you're in a confined situation. And that's where the creative recreation comes in. That's where the creative recreation is so important, because that's what lets you make the days different, and lets you get a personal reward from your activities. And that can break the monotony.

And, of course, in the case of being on the space station, you do have the extraordinary environment of being in zero gravity, being weightless, and having that view of Earth to captivate you, so you can always find that as something to distract you and let you get a little bit of escape from the day-to-day work activity.

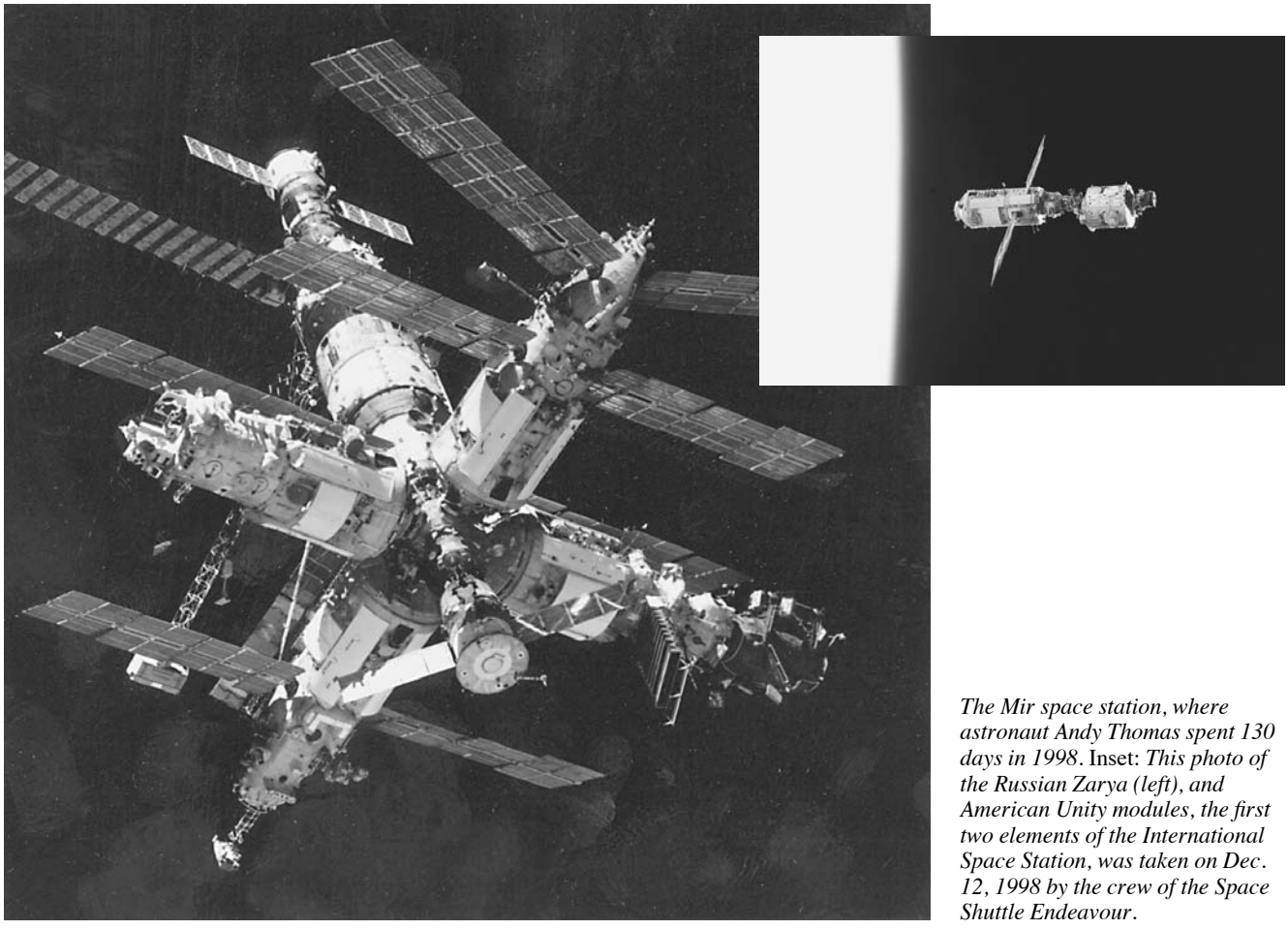
We actually had our time set up as sort of a work week, much like a five-day work week. The weekends we still had to work, we still had duties, of course, they don't go away, but it was a reduced level of duties. And so the weekends gave us a lot of time just to do things like take pictures, look out the window, or to do some recreation, to watch movies. In my case, do some drawings, or writing mail, or reading, and so on.

And, there was something kind of nice about having weekends up there. It broke that monotony of every day being like every other day. And it gave some sense of normalcy, of routine that you're accustomed to [on Earth]. And it lets you get psychologically recharged each weekend, too, much like it does here on the Earth.

Q: Will the science experiments on the International Space Station be more automated or need less astronaut and crew time than they did on Mir, which would give you more flexibility? Could you could say, for example, "Monday, Wednesday, and Friday I'm going to work in the greenhouse, and—"
Thomas: I think the experiments probably will be very comparable to the kinds of things flown on Mir. Perhaps in years to come, there will be more automation of experiments and ground control, but I think, initially, they'll be very similar to the Mir experience.

Q: You had an array of experiments to work on while you were on board Mir. Was there anything, just from your own background in research, that you enjoyed working on, or seeing the results from, more than something else? And would that be a consideration in deciding which mission specialists or payload specialists worked on different experiments?
Thomas: They were all very similar, in terms of what I had to do with them. So, I don't look upon them with a preference. I guess maybe I preferred the physical science experiments, rather than the biotechnology experiments—the medical experiments, I should say, not the biotechnology experiments. You know, doing the blood draws and things like that is not something I'm accustomed to, and they're not a lot of fun either, let's face it.

As you know, on the Space Shuttle, they do occasionally fly payload specialists, because there's some unique expertise that they feel is appropriate for an experiment. I think that



The Mir space station, where astronaut Andy Thomas spent 130 days in 1998. Inset: *This photo of the Russian Zarya (left), and American Unity modules, the first two elements of the International Space Station, was taken on Dec. 12, 1998 by the crew of the Space Shuttle Endeavour.*

may come to pass on the International Space Station, too, where there's an attempt to match professional capabilities with the science requirement, but not in the early days, because the early days are going to be so much more engineering-oriented than science-oriented.

Q: You are from Australia, which has a small space program. Just recently, Ukraine concluded an agreement with Russia to build one of the science laboratories for which the Russians haven't been able to get financing. Brazil has been brought in on a bilateral basis through the United States. Have you thought about the opportunity that the ISS might afford countries that have no space program to speak of themselves right now, but could start one with the ISS? There are many different levels on which a whole host of countries could participate.

Thomas: Yes, you're absolutely right. My country could build a small experiment and fly it, or a small sensor, or something to go on one of the modules, or some small piece of hardware, and participate in that way. At the other extreme, a country could train crew persons to fly, and fill up modules. And a country could do anything it wants in between those two extremes, because a full spectrum of activities exists. And, it's really up to the political and economic will of the country concerned to decide if it wants to do that, and at what level.

Q: I know that you were in Australia in the fall, making a tour, and discussing your flight. And I'm wondering if you were able to coax the government there into taking a more active role, or to think about participating in some way in the station?

Thomas: I've used the forums that I've had to give speeches to make that point on a number of occasions, that there are opportunities there, and they could be in any of those range of activities that I just mentioned. As yet, nothing has been forthcoming. But I think, ultimately, it will, because interest is slowly increasing. And it will reach a point where something will be done. It's just a matter of time.

Q: You were the last NASA astronaut to work on Mir. I'm sure that you are very well aware that over the last few weeks, there has been a lot of back-and-forth in Russia about the future of Mir, as we come closer to the point at which a decision must be made on deorbiting it this summer. There are a lot of political issues involved, but I wanted to ask you more

specifically about the practical aspects of keeping Mir in orbit. In terms of the condition Mir is in at this point, how much of the crew's time is taken up with things like maintenance, and would it make sense to keep it going?

Thomas: I think yes, if it were a possibility, it would be good to do that. I mean, that's fundamentally an economic decision, not a technical decision, because Mir technically is quite capable of continuing to fly. The Priroda module on Mir is only two years old. That's nothing in the scheme of things. And so, to lose that capability would be very unfortunate. And technically, there's no reason why it cannot continue to fly. I don't think it has reached the point where the level of crew time required for maintenance is excessive.

The problem is one of economics, and the fact that it's not possible for Russia to maintain active involvement in the ISS, which they want to do, as well as support Mir, which they'd also like to do, because it's a symbol of national prestige. And there has also been a lot of talk about taking one of the modules from Mir, and taking it over to the International Space Station, but that's not really feasible.

Technically it's feasible, but it's probably not economically justifiable. So, I think the writing is on the wall that the days are numbered for Mir, and it's just a question of when is the appropriate time to close it down. And I don't know whether we're there just yet. Certainly, when the International Space Station is up and flying and staffed [in two years], it would probably not be appropriate to keep Mir going at that point, just because of the economics of it.

Q: Another option that has been discussed is some kind of private consortium trying to keep Mir operational, assuming that the Russian Space Agency could not continue to put very much money into it. There have also been proposals to get enough money to put it in an orbit where it would be in cold storage, and maybe it can be brought back a couple of years from now, and something done with it.

Thomas: I'm not sure that's very feasible, though. You can't really mothball a system like that, and expect all the systems to survive. They really need to be operational to maintain themselves, to prevent leaks from forming, and prevent seals from drying up. It's a bit like taking a car and leaving it parked in your garage for two years. You know, the car's going to deteriorate—even though it's not being driven, it will deteriorate. And that will be the same with trying to park Mir somewhere, and shut it down.

Q: Sometimes people try to reduce it just to dollars. They say, "It takes about $250 million to keep the Mir going, so if somebody would come up with that amount of money, they could do it." But it seems to me to not be at all that simple. First of all, you'd have to be training crews for both spacecraft.

Thomas: Yes, you would, and you'd need to have Progress flights to resupply it. It would be an enormously difficult undertaking, and very hard to justify for a private consortium, from the point of view of return on investment, I would think.

Q: Are there any other lessons to be learned from your stay on Mir? Your increment was a lot less eventful than Jerry Linenger's, when they had a fire on board, or Mike Foale's, when the Progress collided with the Mir.

Thomas: But the reason why it was a lot less eventful, was because of the experience that was gained in the flights of my predecessors. We learned how to work with the Russians, we learned how to do a science program on a space station like that. We learned all about the human factors, and we learned how to get the Shuttle up and back. We learned about the [crew] support structures needed on the ground, the psychological support and technical support. And so, it was not coincidental that my increment went very smoothly. You know, it was a long process of evolution of learning how to do it, and doing it [based] on the experience of my predecessors, that made it successful.

And that's an exercise that's useful for the International Space Station, too, because we've learned a lot. And I do think it would have been inconceivable to try to do a collaborative space station with the Russians, without having done the Shuttle-Mir program. We could have done it, but it would have been enormously difficult.

Q: It is my understanding that when we had to deal with the crises on Mir, we really had to learn about their technology and systems.

Thomas: Yes. You learn about the systems involved, the technical systems. And, many of the technical systems on Mir are very similar to the ones that will be on the International Space Station.

Q: Are you training for a flight at this time?

Thomas: No. I'm not assigned to a flight, nor is Dave Wolf, or Shannon Lucid [who also lived on the Mir]. Mike Foale is assigned to a flight, but it's not a Space Station flight. He's assigned to one of the Hubble [Space Telescope servicing] missions coming up next year. So I, like my predecessors, have a technical assignment here to support the flight program, and I'm working with Mike Foale in what they call the "expedition office," which is to help address the issues of training what we call the "expedition crews." And we are helping solve problems pertaining to the training in Russia that they have to go through, and all of those sorts of things that come up.

Q: The expedition crews are the long-duration crews who will live on the Space Station?

Thomas: Yes. That's what they're going to call each mission on the Space Station; it's going to be called an expedition.

Q: Like to the Antarctic?

Thomas: Yes.

Q: Do you plan to be spending any time in Russia? You'll be working from here, but will it require you also to have an

interface with people there who are doing the same thing, getting the expedition people ready?

Thomas: Yes, that's one of the things I will do. In fact, Mike Foale is in Russia right now, with a group of astronauts, doing preliminary Soyuz training. And I will be going there, probably in February, for a similar kind of exercise. I probably won't be doing the training, since I've done it, but I'll be acting as a supervisor for a group of astronauts going there. And so, yes, I would expect to be in Russia on various occasions over the course of this program. In this line of work, it's inevitable.

Q: That's probably one of the most valuable learning experiences that came out of the long-duration flights on Mir, the training in Russia.

Thomas: Oh, absolutely. It got us way ahead on the issues of training, and understanding the Russian culture; training cosmonauts as well as understanding the Russian hardware. Way, way ahead.

Q: One point that I do not think has been well understood, is that the International Space Station really does not ever have to be considered as being completed, that there will always be the possibility of changing things, updating them.

Thomas: I'm sure that will happen, too.

Q: As things wear out or become obsolete, they can be replaced with something more advanced. Also, additional capabilities could be added to the station. Have you thought about it as something that would be evolving? People always say assembly completion is 2004. But it seems to me it can be a capability that can be used for many things.

Thomas: Yes, I'm sure it will be. Right now, for example, there's a lot of talk about how the U.S. habitation module should be designed. Should it be a standard cylindrical aluminum shell? There's a lot of interest and likelihood that it will be an inflatable structure, one that provides a lot of structural benefits and weight benefits, and is ideal for a space station. But, of course, it's also a technology that has application to a Mars habitat, or even a lunar habitat. So, you can learn a lot by flying that kind of habitation system on the Space Station, that would help you with other explorations.

Q: Are there other areas where people are consciously thinking about that? When the Space Station program started in the early 1980s, it was proposed as something more than a set of research laboratories. It was seen as a jumping-off point, to go back to the Moon, then to Mars, to be used as a test bed for technology to do what you're describing. Are there other technologies that are being considered for development in the future?

Thomas: I'm sure there are, but I would have to say I'm not really close enough to it to tell you about it. It wouldn't surprise me if we saw something done with tethers at some point in the future, way downstream, for example, because that provides a lot of benefits for overall space flight. So, that wouldn't surprise me.

There are probably lots of power-generation schemes that could be evaluated [on the Space Station]. Virtually any spacecraft system that you wanted to examine, you could examine up there, and use that as a forum for testing it out.

Q: The first assembly mission of the International Space Station was covered widely in the press and on television, reflecting the great public interest in space exploration. I think we should keep this activity in people's visual sighting, as well as in their thinking about it.

Thomas: Well, it's inevitable, of course, that interest waxes and wanes. But as this vehicle gets more developed and larger, and as crews spend more time on it, and people see it going overhead, I think there will be a collective enthusiasm for it that is sustained. It's starting already.

Q: Will it be visible before it's completed?

Thomas: Oh, yes. I would imagine that if conditions are right, you could see it now. It requires that it be early morning or early evening, so that it's still flying in the part of space where there's illumination from the Sun, but where it's dark down here on the ground. Then it will be lit up, and because it's dark down here, you'll be able to see it. I'm sure you'd be able to see it, if those conditions were right.

There are places on the Internet where you can find out information about its ground track and times of visibility. I know they have that for Mir. It's not that hard to determine ground track and times of visibility. You just need a clear sky, and it needs to be going over in the morning or in the early evening. I've seen Mir plenty of times.

And you can see the Shuttle, too, under the same circumstances. Winter is not often the best time, because there's so much cloud cover around. But yes, the Space Station will be visible. It will be a lot brighter when it's finished. It's going to be very bright, when it's large and it's got all its solar arrays.

I think the Space Station assembly flights are going to be very dramatic flights, with all the EVAs [extra-vehicular activities, or space walks]. So I think there's going to be a lot of good visuals that will come out of those.

Q: When you look back at the history of space policy, you find that there has always a been a natural progression proposed, of a permanent presence and capability in Earth orbit, and then trips to the Moon and Mars.

Thomas: We'll make it to Mars yet. I may live to see it, too. I may not fly up there, but I think I'll get to see it.

Q: Unless you're 77, and you are like John Glenn. Then you might go.

Thomas: Well, I'm not sure I'm going to be wanting to do that when I'm 77! We'll see.