What is the Value of Space Exploration? - A Prairie Perspective

North Dakota

November 1 & 2, 1995

What Is The Value of Space Exploration? - A Prairie Perspective

A Symposium

Sponsored by the

Mission From Planet Earth Study Office, Office of Space Science
NASA Headquarters
and the
University of North Dakota

November 1-2, 1995
North Dakota

Department of Space Studies

UND AEROSPACE
UNIVERSITY OF NORTH DAKOTA

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Preface

Within the span of a single generation the purpose, form, and mission of the United States civil space program has changed radically. Demonstrating technological superiority through a lunar landing has given way to an, as yet, unclear agenda.

Although hazy, the rough features of a 21st century program are discernable: it must be cost effective; economically, as well as, politically driven; and, international. Less clear are the missions. Will they include human habitation of cislunar space and the solar system? Earth observations? Planetary discovery? A Mars settlement? Perhaps, some of each? And if so, in what balance?

Changing, too, is the democratic base upon which public support from which any space activity must be derived. In the 1950s, 1960s, 1970s, and 1980s space decisionmakers generally came from a rather homogenous group: well-educated engineers, scientists, and policymakers with similar social, cultural, and economic backgrounds. The general citizenry, although more diverse, were united by the exigencies of the Cold War and readily accepted the decisionmakers' judgment with few, if any, questions.

However, the results of the 1990 national census show that this will change by the time the next census is taken at the turn of the millennium. At that time, the census results project, groups of people who have historically held positions of political and economic power will be in the mathematical minority of the population. At the same time, it is expected that groups of people who have historically been minor participants in national political and economic decisions, will become the mathematical majority.

These demographics, along with the end of the nearly half-century long Cold War, require that many aspects of life in the United States be examined with an eye toward an ambiguous future. Space activities are no exception.

This is why NASA's Mission From Planet Earth Study Office, the UND Department of Space Studies, and UND Aerospace sponsored the symposium, *What is the Value of Space Exploration? —A Prairie Perspective.* It was designed to reach a segment of the population traditionally at the periphery of space decisionmaking: citizens of the United States "heartland."

Symposium sponsors were not disappointed. For two evenings in November of 1995 — one during a major blizzard — citizen farmers, students, ranchers, businessowners, teachers, military personnel, and others, presented themselves at six locations across North Dakota. They expressed their opinions, shared their concerns, and raised critical questions.

They listened to a panel of North Dakotans that included an editorial writer from a local newspaper, a physician, a farmer, a priest and

Preface

sociologist, a teacher, and a former astronaut. Symposium attendees were then invited to take the floor. One of the first participants was a farmer who enthusiastically "thank[ed] all the space explorers." He detailed the many technological innovations used on his farm that have a NASA heritage. In one, extemporaneous communication, he conveyed a personal experience that wove together the space program's cutting-edge achievements and down-to-Earth benefits into a tapestry of interconnected capabilities.

Other participants represented a spectrum of views. They raised many expected, unexpected, and difficult questions. Among the comments that might have been reasonably anticipated were those of a teacher from Hazen seeking to reconcile the space program with social and fiscal imperatives; a Grand Forks Air Force officer wanting to know if space was taught in the schools; and, a number of people who discussed the future of international cooperation in space activities.

The comments that could be fairly considered unexpected included those of a philosopher from Minot who considered how going into space might change the human conception of God; the organic farmer from Jamestown who questioned the environmental impact of space activities; a tavern owner in Mott seeking specific information about attracting high technology companies to rural North Dakota; and, a farmer's wife inquiring how cultural diversity will be addressed in future space exploration.

Equally difficult, but perhaps more familar, subjects were raised by a science teacher analyzing detailed trade-offs among specific planetary and human missions; a nuclear engineer questioning whether the general population understood space technology any more now than it understood nuclear energy in the early days of nuclear science; a student attempting to identify what the NASA administrator's priorities ought to be; and, a business person's concern about a legal regime for space and property rights. One participant— a Fort Berthold Reservation school girl— combined elements of the expected, unexpected and difficult when she asked how could she become an astronaut.

In short, *What is the Value of Space Exploration? — A Prairie Perspective* demonstrated that there are people – citizens – in the heartland ready, willing, and able to join in defining the future in space. Symposium participants repeatedly expressed appreciation for the fact the *they were asked* to give their insights about the evolution of the nation's civil space program. It was also their expressed hope that they would continue to be asked. Judging from the symposium results, it would also be wise.

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What Is The Value of Space Exploration? - A Prairie Perspective
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Wednesday, November 1

Rodney (Lanny) Faleide — ***The Economic Value of Space Exploration***
Farmer and founder and President of Agri ImaGIS, Maddock, ND

Dr. Linda Gourneau — ***The Cultural Value of Space Exploration***
Acting Clinical Director, Minne-Tohe Health Clinic, New Town, ND

Rick Hieb — ***The Scientific and Technical Value of Space Exploration***
Former NASA Astronaut, Mission Specialist and Payload Commander, Greenbelt, MD

Joanne Irene Gabrynowicz, J. D., Moderator — ***Opinions and Questions from the Audience***
Professor and Director of Graduate Studies, Space Studies Department,
University of North Dakota, Grand Forks, ND

Thursday, November 2

Tim Fought — ***The Political Value of Space Exploration***
Opinion Team Leader, Editorial Staff, The Grand Forks Herald, Grand Forks, ND

Vivian Meiers — ***The Educational Value of Space Exploration***
Teacher, Northridge Elementary School, Bismarck, ND

Father William C. Sherman — ***The Social Value of Space Exploration***
Sociologist and Pastor, St. Michael's Catholic Church, Grand Forks, ND

Joanne Irene Gabrynowicz, J. D., Moderator — ***Opinions and Questions from the Audience***
Professor and Director of Graduate Studies, Space Studies Department,
University of North Dakota, Grand Forks, ND

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North Dakota Satellite Downlink Locations

Grand Forks

Clifford Hall, University of North Dakota
Moderator: Joanne Irene Gabrynowicz
Site Coordinator: Donna Matthews

Hazen

Hazen High School
Moderator: Lauren Donovan
Site Coordinators: Gloria Hovde and Chad Oster

Jamestown

James River Area Vocational Center
Moderator: Dave McDowell
Site Coordinator: Irene Miller

Minot

Erik Ramstad Junior High School
Moderators: Barb Solberg and Bob Rau
Site Coordinators: Don Daugherty and James Bailey, Jr.

Mott

Mott Public School
Moderator: George Jones
Site Coordinator: Larry Ritzo

New Town

New Town High School
Moderators: Karen Gillis and Delores Wilkinson
Site Coordinator: Esther Beltran

A Welcome From The Director

All of us at the University of North Dakota Space Studies Department are excited about tonight's program, ***What Is The Value of Space Exploration? - A Prairie Perspective***. We want to get your opinion of the value and potential of NASA's work in space.

North Dakota is the first state in the nation to hold a statewide, interactive community conversation about space. It will focus on the value of space exploration and it's future relationship with rural areas. Each of the six North Dakota communities which have gathered tonight were chosen to represent the diverse sizes, interests, and industries found throughout our state.

After listening to this evening's speakers—all North Dakotans—you will also have the opportunity to voice your concerns, thoughts, and ideas about how NASA might plan for the future of space exploration. NASA will receive, in published form, the combined opinions expressed during this two-evening symposium. You will be heard and we look forward to hearing from you.

Thank you and welcome,

Joanne Irene Gabrynowicz
Symposium Director

Joanne Irene Gabrynowicz

Gabrynowicz

Joanne Irene Gabrynowicz is currently a Professor in the Department of Space Studies at the University of North Dakota, teaching graduate classes in *Space Treaties and Legislation, Space Policy and International Implications, Remote Sensing Law & Policy,* and *The Philosophy of Human Space Activities.* The University has offered the world's first Master of Science in Space Studies degree since 1987. In 1996, the department had more than 200 graduates and began offering its degree via the Internet. Students in the program include civilians and officers of the Air Combat, Air Mobility, and Space Commands, at Grand Forks Air Force Base and Minot Air Force Base.

Raised in New York City, Ms. Gabrynowicz received her Juris Doctor degree from the Benjamin N. Cardozo School of Law of Yeshiva University and her B.A. in history and literature from Hunter College of the City University of New York.

She writes and speaks regularly on space and remote sensing law and has a number of published papers on the subject. Ms. Gabrynowicz is a member of the International Institute of Space Law and has presented her work to that organization as well as the Federal Bar Association, the Association of American Law Schools, the Space Studies Institute, and the Lunar and Planetary Institute, among others. In 1985, Prof. Gabrynowicz testified before the National Commission on Space concerning space law. She was a member of the Congress of the United States Office of Technology Assessment Earth Observations Advisory Panel; the International Academy of Astronautics Subcommittee on Return to the Moon of the Committee on International Space Plans and Policies; and, the M.I.T. Dewey Library Macro-Engineering Collection Advisory Committee. She is currently a member of a National Research Council advisory group studying transborder scientific data policy. Ms. Gabrynowicz was also an advisor for "The New American Revolution" and "Space Worker" PBS television shows. She was awarded a 1994-1995 NASA/American Society of Engineering Education Summer Faculty Fellowship from Goddard Space Flight Center and a 1996 research fellowship from the United States Geological Survey EROS Data Center.

Wednesday, November 1, 1995
Economic, Cultural, and Scientific & Technical Value of Space Exploration

Joanne I. Gabrynowicz, J.D., Moderator
Professor and Director of Graduate Studies
Space Studies Department
University of North Dakota

Rodney (Lanny) Faleide
AGRIMA**GIS**

Dr. Linda Gourneau
Acting Clinical Director
Minni-Tohe Health Clinic

Rick Hieb
AlliedSignal Technical Service Corp.

Joanne Gabrynowicz

"Hello, good evening and welcome to a *Prairie Perspective on the Value of Space Exploration.* Tonight we are here to discuss the possibilities of space. Joining me tonight in Clifford Hall Auditorium are North Dakotans who have chosen to share their views with us. Our speakers are Lanny Faleide, a farmer from Maddock and president of AGRIMA**GIS**; Dr. Linda Gourneau, a physician from New Town; and Rick Hieb, former astronaut and native of Jamestown. Six North Dakota towns are linked together tonight by satellite---space technology---to discuss the topic of space. We are broadcasting via an AT&T Telstar-401 satellite which is located at 97 degrees in west geosynchronous orbit. Grand Forks, Hazen, Jamestown, Minot, Mott, and New Town are participating in this community conversation. Graduate students from the Space Studies Department are in each of these towns with the local community to discuss and participate in tonight's event. Each town has a local moderator who has agreed to participate by acting as my counterpart.

"NASA is funding this symposium as a continuation of one held in Washington, D.C. in 1994. The question, 'What is the value of space exploration?' is now being asked in the heartland. We have invited you here tonight to talk to us, and with us, about space because NASA wants your opinion. What should the United States be doing in the future with the space program?

"Tonight's topics are the economic, cultural, and scientific value of space exploration. After the speakers' presentations, we will open the floor here in Grand Forks and at the other locations for the town hall meeting part of our program. The participants at the distant sites will be able to see us. We're not going to be able to see you, unfortunately. However, we will hear you and we will receive your questions live. So with that, I am going to turn to tonight's first speaker Lanny Faleide. Welcome.

Lanny Faleide

"Thank you. My topic tonight is the economic value of space exploration. I never thought I would be sitting here tonight doing this after 20 years of agriculture (ag) experience. Space has always been interesting to me. Ever since I saw the first moon walk I have always wanted to be an astronaut like Rick, but I guess I never will be. The next closest thing is to be able to see things from space. We developed a new company called AGRIMA**GIS,** to bring satellite technology into agriculture in a form that is usable by the average farmer. In the last few years, computer power has become so extreme that we now have power on our desktop which five or ten years ago was only available in mainframe computers. We now have so much power that we can access things that most scientists could access a few years ago. This allows space information to reach the consumer public. Right now we are able to take

imagery from space and zoom down to a tenth of an acre level and actually see things in the fields that normally would have required aerial photos. Eventually we can see it on a week-to-week basis.

"I am going to show a few slides to give you a better idea. This slide shows a field [in] Rendel, Minnesota. We are actually monitoring sugar beet acreage. The yellow fields are sugar beets and the red ones are corn or wheat. We access imagery from SPOT Image corporation, which uses a French-owned satellite. This is an area of Fargo. You can see the interstate and the West Fargo fairgrounds. If we start zooming in a little farther, we can actually start seeing the patterns in the field and we can use that in the precision ag techniques. This is an area where we've been working with the sugar beet companies for the last six months analyzing fields. This is a change detection between July 12, 1995 and August 17. All the sugar beet fields are showing up gold and the wheat fields, red. We're able to analyze the patterns within a field and be able to take them and put them into a variable-rate application spreader and analyze the vegetation and change the fertilizer on the go. That technology is all being driven by a satellite system called GPS [Global Positioning System.] We can actually locate ourselves anywhere in the world within a centimeter if we have the proper receivers. Right now in agriculture, we can locate ourselves economically at about a foot level. [Using a] grid of the field, the satellite imagery [is used] to find the vegatative patterns in it. Then the fertilizer or chemical is applied to where it is needed.

"The whole ag industry is moving along in leaps and bounds right now. We are able to see down to a tenth of an acre level on the color imagery. And on the black and white imagery, we can see down to one-fortieth of an acre. We can see you as a white speck if you have a white combine sitting out in a field. But the new technology is allowing us to go even further on down the line in the next five years. The black and white imagery that we receive right now is tied into the mapping system and allows us to use maps that we have had for a long time.

"In agriculture, in the past, we believed in moving horizontally to expand. We want more acres to become more economically viable in agriculture and survive. With this space technology, we're able to go down to the micro level and expand vertically instead of horizontally. We've always known variability within the field. Every farmer knows his fields very well. But there have not been any tools to economically put different compounds on the land to increase yield or save expenses. The technology from space systems allows us to do that. The future of the farm [is] at the micro level instead of the macro level. Within the space industry we're able to revolutionize agriculture in a form that we never knew would happen. The future is endless. Even though I've never been up in space like Rick, I'm able to see my farm [from space] and say 'Wow, this is my little spot that I knew existed!' We can get perspective from being in space. It's just amazing to me."

Joanne Gabrynowicz

"Lanny's actually talking about two kinds of space technology and combining them: a remote sensing satellite and the global positioning satellites. In fact, the farmer is using two kinds of space technology. Thank you.

"Our next speaker is Dr. Linda Gourneau. Dr. Gourneau."

Dr. Linda Gourneau

"Thank you, Joanne. Hello out there in New Town! It's an honor to be asked to be a part of this panel. [Recently,] I had a chance to go down to Houston with Dr. Jensen [a member of the Space Studies faculty]. I never really gave much thought to space exploration

or what they were doing down there before. But when I went down there I learned so much, especially with the weightlessness training. I think a lot of people are like me and don't really think about what space exploration or what space programs are doing. Once you find out, it's very interesting. And you don't realize how much it's affecting our culture here in America today. Especially with agriculture: what we just saw here and the weather images that are coming right into our television sets at home; these are all just amazing.

"We had the NASA Administrator, Daniel Goldin, come [to North Dakota] and he did a presentation along with a couple other people. One of the things he said was, 'Space is the final frontier.' This is some place that we are going, to the 'final frontier.' We have to be like our forefathers of the United States. I wanted so much to say, 'Yes, let's do that.' But then a part of me kind of hurt. I have two ways to look at this. Culturally, I'm proud to be an American and to be a part of that forward movement. I also have some feelings of loss---that my ancestors lost a lot---with that frontier movement. However, looking back, I know there's culture all over the world. And with the satellite images that we have now, we are able to go to everyone's back door. That's sharing culture, I guess.

"I did want to share some things about the culture we lost with the new frontier. [In] that frontier, they moved fast and a lot of people were hurt. There was a loss, but things have to happen that way. It's like in science. I remember being in a chemistry class and the professor was telling us that all matter wants to exist in its natural form, which is to be out in the open and to be free. That's why ice melts: to go to its most natural state, to water. That's why wood disintegrates. That's why everything that we try to form into a shape gradually goes to its natural order. He gave us a good example of that---perfume. If you take a bottle of perfume, put it in the middle of the room and open it, eventually everyone will smell that perfume. That's just those molecules trying to get out and be in their natural state. I think, in a way, that's what happens with us here in the world. We are growing, and we need to move out. We are moving out. We are kind of gradually moving across the world, all around the world transversely. Then we'll [move] vertically. I know there are space stations. I don't know how far ahead it is that people can live up there.

"One of the things I am concerned about is the rapidity and the lack of other cultures contributing to this movement. That is something that really needs to be added when we're moving into space. Everybody belongs to this world; we are all a part of this world. When you look back, my ancestors knew everybody was related. I was taught, yes, I am related to my relatives, sisters, uncles, aunts, and cousins. But I am [also] related to the animals, and to the plants, and to the air, and the clouds, and to the water. Everything. We are all a part of this life. And we are also related to all mankind and womankind. I can understand that we are related. Sometimes people don't see that. But I think once you get up in space and you look back down to the Earth, you realize you belong. That's home. And all the people there are family. So we are all in this together and I think it's important that we all have a voice, as to what is going on with space exploration.

"My culture, in a way it's still here, but we've lost so much of it. The good parts of the culture, I am hoping that some of them will come back. At the same time, I know that it's impossible to come back. I'd hate for us to make movements and lose things that are so important. We have future generations. Not only our children, but our children's children, and their children that have to live on this Earth. We need to think about that type of thing. That's something my ancestors

taught. You need to think about the future and what life is going to be for them because we are here for a short time. In my life span I have seen so much happen and I am not that old. I want to make sure that my children and your children are going to have something when they are adults; when it's their turn to be the leaders or the lawmakers, or whatever, of the world. It's so important to me. So once again, I would like to stress that culture is important to space exploration because space exploration is going to affect all of our cultures. Thanks."

Joanne Gabrynowicz

"Thank you Linda. Our next guest is also a North Dakotan, Richard "Rick" Hieb. Rick is a former astronaut with NASA. Rick, it's your turn."

Rick Hieb

"Thanks very much, Joanne and everyone, for having me back to North Dakota. Tonight I am going to talk mostly about the third of my space shuttle flights. In a lot of ways, it was certainly the least glamorous space shuttle mission I was part of because this was a spacelab mission. In fact, the mission that is up right now, the *United States Microgravity Laboratory II*, is a spacelab mission much like the one that I flew on.

"On [my] mission we had about eighty experiments. They ranged all the way from pretty straightforward life sciences, where we're the ones who are the subjects, to microgravity experiments with exotic chemicals and compounds, metallic compounds. The reason I want to talk about spacelab tonight [is] I can pretty well guarantee that ten or fifteen years from now, the things that will affect your life in ways you don't even know about will be discovered [on missions like these.] If it comes from the [human] space program most of those discoveries will be made in laboratories like this one. What you probably don't know, for example, is if you have a stove or a refrigerator that was bought in the last ten years you have insulation in those appliances that was developed because of research done for space vehicles. Your appliances are more efficient than they would have been otherwise. Stuff like that shows up everyday in everything you do.

"[The astronauts] are the subjects [of experiments] because we want to see what happens to human bodies in space. How do they change? Why do they change? We lose bone mass and that is very similar to the disease, osteoporosis. There are probably some connections between the two. We really don't understand yet whether or not we lose bone mass [in space] for the same reasons that people with osteoporosis do. We are working with some simple animals and creatures and trying to understand how they respond when there is no gravity. If we can understand what makes them change, then maybe we can understand what happens to people. All of these animals depend on gravity to work properly. So if we can find out what the threshold is, how much gravity they need, that will tell us something about when we start building stations in space. How much gravity are people going to need? Is the space station going to have to spin for people to live in space? We kind of think over the long-haul that is going to be necessary. But we don't know. Do you have to be in space a year before you need that, or two years, or three, or ten? In order to answer that we don't want to put people up there and find out the hard way that it doesn't work.

"I have talked a little about life sciences experiments that have happened in space. Let me talk about material [science]. Materials experiments are also going to show up in your life in a number of ways. For example, one of the eighty experiments we flew had a furnace in which we had a bunch of different samples that could be injected into the furnace [and] held in place with magnetic fields. Then another electric or

magnetic field was applied to melt the samples and then they were allowed to cool down. The problem is, on Earth you have to have a very strong magnetic field to hold the sample against gravity. The sample then curves out of shape when it gets molten, because of gravity and where the electric coils are, one part gets hotter than the other. That causes flows. The hot part wants to go to the top and the cold stuff wants to go to the bottom. We have done those experiments on Earth but they are less successful. In space you can do the same experiment with no gravity to cause flows. The whole point of the experiment was to allow these samples to cool down with no disturbances. They were hoping they would get some very unique crystal structures. In fact, one material wasn't even a crystal structure but metal that formed a glass structure. 'Well what's the 'big deal' about that?,' as my son would say. The big deal about that is, this particular metal [with] this special structure would be more slippery than Teflon, and yet a metal. I think that anybody in here can draw some rapid conclusions. If you can do that commercially you are going to see it on the ball bearings of your car, in the sleeves of cylinders, [and] your gas economy is going to go up in your car. If produced commercially, every motor in the world, within a decade, would have to take this stuff into account. This is basic physics going on. How does it work, how can we take advantage of these physical properties?

"Another experiment along those lines was a multi-phase experiment having gas and liquid, all at the same time, in the chamber. Once again, the problem on Earth with gravity is that the heavier stuff sinks to the bottom, the light stuff goes to the top. You just can't keep it suspended long enough to determine the physical effects. What would be the result of that? We have no idea, it's an area of physics that we don't understand. And yet, everywhere in chemical factories, all over the world, people work with materials that are at the gas phase or are at the liquid phase and they don't understand the transition between the two. Believe it or not, you would think that all the years we have studied physics we would understand that.

"So that's just a little bit of the physics part, science part, life sciences part, that's going on in space. Which of these experiments going on in space will change your life? I have no idea.

"One other thing before I stop, I want to talk about medicines. We are growing [crystals] in space. From those crystals, they can develop medicines. Medicines are in the USDA drug approval cycle that will be on the market in the next five years which are a direct spin-off of space flight. Which ones may save your life or your children's lives? I don't know but that is what is going on up there."

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Questions & Answers

Q: Don Naismith, Grand Forks.

"You people have given us several suggestions of where we might go. I have no doubt that we will get there. I think the world, however, seems poorly prepared to do this. My training was in nuclear engineering in the 50s and 60s. I can well remember the time we were going to have free energy and lots of other things that were going to occur. Those things have not happened. The things that you have suggested may be wilder than those things were, but I still don't doubt that they will happen. Our world population wasn't ready for nuclear energy at the time it occurred. I am wondering if any of you can tell me what we can do right now. I am older than you, Linda, and I have less time. I would like to do something to accomplish some of these things in my children's or my grandchildren's lifetimes. Any comment would be appreciated. Thank you."

A: Lanny Faleide.

"Well, we always think that space technology is 'gee whiz' technology. How are we going to use it? We are here today seeing it in the [Red River] Valley. For instance, last year we had one fertilizer spreader being driven by the GPS navigation system. This year we have seventeen. The growth from one to seventeen is just astounding. That technology is used today. We have to take a look at our everyday life and see that it is actually here. Everything we touch, every electronic device we touch, has got some space technology in it."

A: Linda Gourneau.

"Yes, I feel the same way. Another thing is this [symposium] program here [in North Dakota] is a step towards doing something like that. We are reaching out to the rural communities and actually sharing some of these technologies that are here today. This is a step in that direction."

A: Joanne Gabrynowicz.

"We are at an interesting point in the evolution of space technology right now. A lot of it, as Lanny has said, is becoming smaller, is becoming more accessible to parts of society, including the private sector, that maybe could not have dealt with it before. We are seeing a lot of space technology: communications, remote sensing, and environmental monitoring spreading into a lot of different portions of society, making it even more available."

Q: Scott Kraus, Jamestown.

"Hi, I have a question for Rick Hieb. I am curious if satellite constellations become a reality, what will that mean for technology development worldwide?"

A: Rick Hieb.

"Well, number one, we can take the 'if' part out. Satellite constellations will become a reality. They will become a reality by the end of this decade. *Iridium* is probably the most well-known example, sixty-six satellites. The project is rolling along, they have had some technical difficulties, but they will get there. Maybe it will be a year or two later. That is going to mean no matter where you are on planet Earth, if you have an *Iridium* telephone you can pick up the telephone and [call]. These constellations are exactly what the space program is about that's commercial. They aren't doing that on government grants. There's not a cent of government money, that I know of, going into the *Iridium* constellation or any of the others. That's businesses saying, 'We can make money doing this, so let's go do it.' That is what the space program is about, the government spending money on high-risk research so industry can come back later and say, 'There is something here!' We spend money on research, ultimately to be productive."

A: Joanne Gabrynowicz.

"An inter-esting part of this is what Linda talked about: how we are all related and connected. These satellite constellations are a high-tech reminder that this is probably truer than we have been aware of for a long time."

Q: Solomon Maendel, Grand Forks.

"I just want to thank all of the [space] explorers for everything they have done for our farming. Instead of running 108 motors, the computer that feeds my chickens runs 10 motors, ten minutes at a time. I still feed the same 60,000 chickens without causing a brown-out in Grand Forks. We run center pivot irrigation, and they tell me that my irrigator is a direct descendant from NASA.

"The second irrigator we put up, we told the state where we wanted to put it and that we wanted to level out this little hill. The state said, 'You have a problem. That is an Indian mound.' We said, 'What can we do?' The state said, 'This one is being disturbed by foxes because it is so shallow they are digging

up the bones. We will send two archeologists out [to] do a dig and remove the bones. Then you can level the site.' You know what we discovered about the natives? They dehydrated their food---the grape seeds and the juneberry seeds. The medicine man was buried in a sitting position with a 2000 year old spear in his hand. They know that the flint came from Europe. He also had a buffalo head in his lap for food for the happy hunting grounds. He knew already that his soul was going somewhere else. The education that we got from just that day, showing us that people have been here before we were and what they were preparing for already. They knew that there was life somewhere else more powerful than here on Earth. They were getting ready for it. These natives would travel to Manitoba, Montana, Idaho, South Dakota. Up on the iron range they would use rocks to heat their food, and then the copper would melt out and it would form the copper. They had beads around their necks and hands for arthritis, so they knew [some of] what we know today.

"I just want to say for me it was a real shocker what they knew already then and the technology we see now. The radar gun on our tractor, the computers, the computers in our homes, where I'll be able to use [remote sensing] images to tell me exactly how much water I put on what soil type. The energy saving that we have seen already, the water savings that we've seen with irrigation. We have cut our water use in half. With this imaging I can see how we can cut it another 70 to 80 percent in the next four or five years. The technology is here already.

"An engineer came to visit his brother-in-law in Nebraska in the summer and the brother-in-law said, 'Let's go out to the corn fields and check the irrigators.' They went out and the mechanical water meter was broken down. The engineer said that that was nothing. 'At NASA we check the flow,' he said, 'I'll send you one of them.' It's just a magnet that makes it run and there are no moving parts. Today all our water meters are a direct descendent from NASA. And the potential is so great it is just incredible. I just want to thank all of you."

Q: Kurt Kreim, Hazen.

"I really appreciate the chance here to find out about the new things that are coming from the space program. However, I have a great concern. The concern is that the funds for [space] will rapidly diminish as competition for funds increases. How are you going to prepare for that? How are you going to get your fair share, you might say, and convince the general public that we should be spending money on space when they see funds for hospitals, Medicare, those types of things that are being cut back, slashed? How do you prepare to, or how are you preparing to, convince us, the general public, that the funds we are spending in the space program are funds well spent not only for the future, but for the present?"

A: Joanne Gabrynowicz.

"That's an excellent question. As we speak, the space program is in a critical time. Because of the budget pressures the entire country is feeling, the space program is being reconsidered. There are some very strong dynamics going on right now. For the next three or four years it will continue. But to put it in perspective, we need to keep in mind how much we do spend on the space program. If you take everything that the federal government has to spend money for---roads, schools, education, national defense, everything---the space program is less than one percent of that entire total. Even at the height of *Apollo,* the total expense of the civil space program was less than four percent of the total budget. We need to keep that in mind.

"We are at a transition from a time when space was undertaken by the United States and other countries for

Cold War political reasons. Now we are beginning to grasp the economic and social reasons for going into space. We had a most eloquent statement here about the social value [of] going into space from [Mr. Maendel who] discuss[ed] in one moment everything from agriculture to soil science to archeology [as part of space]."

Q: George Jones, Mott.

"Something that I have never been too familiar with is this imaging and stuff. We were talking when a farmer happened to walk up and tell us what he has in his John Deere tractor. He went on to explain it pretty much the way Lanny did. This has all come together pretty good for me. I didn't realize we were that sophisticated.

"As far as questions are concerned, David Krane, who was here and had to go, left us with a couple of comments and questions that he asked me [to raise]. He is [coming] from another perspective; an economic development aspect which is affecting, of course, all of the small communities in North Dakota. Most of us are familiar with the Buffalo Commons [theory]. We are reminded in the Bismarck paper that the gentleman from Chicago asked, 'Why do we need North Dakota?' [Mr. Krane's] question was, 'Can NASA or UND Space Studies help beat back the Buffalo Commons theory?' His comment is, in southwest North Dakota there is an emerging economic development strategy to identify relocatable companies, buy them [and] move their operations to small towns in North Dakota. In this area, our preference would be a small, high-tech, space-related, type company or a manufacturing company. Can UND Space Studies or NASA help identify companies for sale that can be relocated? Provide technical expertise to assist relocating? Help evaluate a relocation candidate's products or services? As an alternative, can you suggest ideas for start-ups derived from some spin-offs in the aerospace industry?"

A: Rick Hieb.

"Your specific question about NASA helping you identify businesses would probably be best directed to your state congressional delegation at the state or national level. NASA probably can't do that for you because, from an economic point of view, there is no way that you could argue that's part of NASA's charter. But it seems to be clearly part of what your state delegation, your congressional bodies should be doing. It's becoming more and more sensible to move those high-tech businesses to areas like North Dakota. I can tell you from my very limited perspective, companies will be interested in the people up here because of the work ethic you have. People are going to be interested in hiring people that live up in these areas."

A: Joanne Gabrynowicz.

"As for the Space Studies Department, contact us so we can discuss this further."

A: Lanny Faleide.

"I've always lived in Maddock, North Dakota, a small town of six hundred people. When I located the company there, people asked me, 'Why do you want to be here in Maddock?' And I said, 'Why not?' I said, 'We're connected everywhere.' I could hook onto the Internet and be anywhere in the world. [Regarding the Buffalo Commons idea,] there was an interesting article in the *New York Times*. One of the towns that was identified [in the article] was Hamburg, North Dakota, which is about eight miles south of me. There are about twenty-five or so people in that town. There has been twenty-five people in that town for thirty years; as long as I can remember. The article was using that to show how North Dakota is gradually dying and leaving the state. They didn't look eight miles north and see that here I am, using satellite

imagery in precision agriculture. The main thing to think of in the state is that we can bring technology into the state. Some people tell me that I am foolishly fighting and that I am very optimistic. But you have to be. You have to get something rolling, you have to just go for it. We have that spirit up here. We need to really push it further."

A: Joanne Gabrynowicz.

"Probably the most dramatic thing that space technology is doing right now is enabling people to engage in commercial activities, that at least for the last two hundred years, has been aggregated in urban areas. You can operate a business out of your home no matter where it is now. There are modems, faxes, communications, pagers, whatever you need. That is very quickly becoming the norm. In fact, statistics show that there are more at-home businesses now in the United States than at any other time. It is due, in large part, to the technology and space-based assets that makes these activities possible."

Q: Amanda, New Town.

"I'm 16 years old and I want to be an astronaut when I grow up. What does it feel like when you're going into outer space and when you're on a spaceship?"

A: Rick Hieb.

"Well first of all, I should tell you just a little bit [about] what it feels like before you launch into space. You feel scared if you have any sense at all. When you're riding on a spaceship, you have to understand that it's a very high-tech thing. There's risk involved always. It's still very much the state-of-the-art and so there's always risk. If you don't understand that, then you're foolish.

"Having said that, once you get underway the first couple of minutes with the solid rocket boosters burning, it's a pretty rough ride. You're getting pressed in your seat and shook up. You really get a pretty good shake. After the [solid rocket boosters] finish their job they fall off, go back into the ocean, [and] they're picked up and reused. The main engines on the space shuttle are on the backend and are fueled by oxygen and hydrogen in the big tank [which is] still attached. These main engines burn for another six-and-a-half minutes and they're a very, very smooth ride. You're still getting pushed into your seat, but it's a very smooth ride. You're not getting shook around. Then when you get the main engine cutoff, suddenly you're floating. You're still strapped into your seat so you really don't appreciate the fact yet that you are in zero gravity. Strangely enough, it's not even as much of a rush as you get in your stomach when you go over a bump in the road; when the kids all [say] ' Yeah, do that again Dad!' It's not even quite that much until you release yourself from your seat belt, and then you're floating. Every time for me, it's like, 'Yeah, it really works!"

Q: Milo Buchholz, Jamestown.

"Hello, I'm an organic farmer from southern North Dakota and I guess my biggest thing is the weather. I work closely with Mother Nature, being an organic farmer, so the chemical farmer and I wouldn't see eye to eye. There's parts of the world that are being burned up. China and Australia have not had rain in four years, they've got cracks in the ground that you can break a leg in."

A: Joanne Gabrynowicz.

"You've hit on the fact that the environment and the Earth's weather system is very important and that we know very little about it. A very complex and important part of the space program is observing the Earth's atmosphere, learning about it, and how human activity on the planetary surface may or may not be affecting these weather patterns. There is an international mission called *Mission to Planet Earth* where we are observing the Earth's environment in order to try to

answer some of the questions you are asking."

A: Rick Hieb.

"The biggest business of space flight is to look back at the Earth right now, non-commercial. The biggest commercial business is communications. But what NASA and the federal government is sponsoring is the capability to look at the Earth and see what's going on. Even in our missions, with my eyes, I can look and see the rain forest in South America as it is being burned. The smoke from those fires literally comes all the way up into continental U.S. You can see it with your eyes. In fact, on some days in Houston I think you can smell it. One thing I should say, though, about the Earth's atmosphere is that I think the Earth is a lot tougher than anybody really gives it credit for. What we do on Earth will affect mostly us. The bad things that we do to the environment will hurt us, but the Earth will outlast us. When we do things to the Earth without thinking about the possible ramifications down the road, we're the ones who will suffer from that."

A: Lanny Faleide.

"One thing that space technology allows us to do is, instead of blanketing the field with a hundred pounds of nitrogen, whether that spot needs [it or not], we can vary the rate. So, if a spot requires only fifty pounds, we only apply fifty. There will be less runoff. The technology can allow us to handle our planet with much more environmentally friendly practices than we were ever capable of doing."

Q: Robert Tarquinio, Grand Forks.

"Has NASA considered any goals for the future for human space flight beyond our solar system to the nearest stars?"

A: Rick Hieb.

"To my knowledge there is no specific program beyond the solar system. I know that certainly people within the space program would love to see a way to get there. If you had the absolute best technology we have today, launched something towards the nearest star, before the thing even ever cleared the solar system we will have better technology. Whatever would pass that poor thing would leave it in its dust. The day is going to come, but we think it is not yet today."

Q: James Bailey, Minot.

"We really appreciate the effort you and others made to get this program brought to North Dakota. The folks in Minot are really interested. They are eager to get their questions to you. First of all, with respect to a potential cultural problem, I would like the panelists to address the international space station, particularly potential cultural and linguistic incompatibilities. How we can improve our international relations? What are we doing to fulfill greater international cooperation?"

A: Joanne Gabrynowicz.

"Because the space program was a creature of the Cold War, there has been an overwhelming focus on the competitive and adversarial aspects of the space program. The fact that cooperation has been an integral part of civil space since the beginning is overlooked sometimes. We need to keep in mind that cooperation is not something entirely new. You are talking about bringing cooperation to yet another level. The international space station currently involves the United States, Japan, Canada, Russia, and the European Space Agency, which is a collection of thirteen countries. That is pretty heavy international cooperation.

"Another field where we are seeing a lot of international cooperation is in Earth observations. There is an organization called the Committee for Earth Observing Satellites. It is a global organization of space agencies responsible for operating Earth observation satellites or significant

ground-based activities involved in Earth observations. They work very hard to coordinate the satellites that nations already have in order to better cover the Earth on an operational basis and to reduce costs. There is an enormous amount of activity going on internationally. Rick said earlier that if we can work it out in the space station, we can work it out on Earth. The diplomatic and political problems those programs raise are learning-grounds for how we work together in other areas."

A: Lanny Faleide.

"All I can say is, the imagery that I access is from a French satellite and I don't speak a word of French."

A: Rick Hieb.

"Well, along those lines in my last spacelab mission we had a Japanese national as one of our crew, the first Japanese woman to ever fly in space. We had experiments from seventeen different countries. I trained in Japan, France, Italy, Netherlands, Canada, and Germany. The amazing thing I found was that there are vast cultural differences between us and the Japanese. Make no mistake about it. If you have been there you know what I'm talking about. In Japan, when you talk to the Japanese and you are discussing an issue, they will be nodding their head. What they mean is, 'Yes, I hear you,' not necessarily, 'Yes, I agree with you.' As Americans, when we see nodding heads we think it means, 'I agree.' We found we had a common interest, a common goal to successfully pull off experiments in space, we found a way to communicate. That's what's going on with space stations. Virtually every day there are between one hundred and two hundred Americans in Russia and vice-versa. It's a huge international undertaking. I believe that down the road, one of the greatest accomplishments of the space age will be international communication that really got its start in space."

Q: Gary Schuborg, Minot.

"I was wondering with all the different countries and the different companies getting involved in satellite systems and stuff like that, do you ever think there will be zoning in space?"

A: Rick Hieb.

"Good question. Geosynchronous orbits which are 23,000 miles out are very special orbits because at that distance from Earth the amount of time it takes to get around the Earth is exactly the same it takes for the Earth to make one turn. This means that from the point of view of a person here on Earth, that satellite is 'nailed' to the sky. If you want to see Telstar-401, it is always at 97 degrees west. It doesn't go anywhere else because it's in geosynchronous satellite. The problem is, there are only so many slots for those satellites, and they are already spoken for in many cases and heavily competed for.

"I could list all the people who want to put up constellations. They would have to get an approval from the Federal Communication Commission in order to use frequency band-width to send messages up and down to the spacecraft. All over the world they would have to get the same permission to use that radio frequency over other countries, so it's a major headache. But definitely, zoning is required and someday there will be regulations."

A: Joanne Gabrynowicz.

"You raise an interesting question because there is a legal regime for space. There are a number of treaties in place since the 1960s. The United States has been a leader, along with the former Soviet Union, in establishing them. The fundamental premise of the treaties is that space is the province of all humankind. Nations on Earth cannot use sovereignty to claim space. Space has a legal regime in which sovereignty is not the organizing principle; it is very different from what we do on Earth. That doesn't mean there can't be private

property, we just haven't figured out how to do that yet. We're working on it. That doesn't mean there isn't room for the kind of regulations that Rick is talking about. What it does mean, is, it's going to have to be done on a transnational or supranational basis and that requires a lot of cooperation. It's very complicated and very political right now, but if we are going to live by the law that we helped create, we have to learn how to solve these problems."

Q: Lisa Faleide, Grand Forks.

"How do you think we might encourage not only cultural diversity, but discussion of cultural questions as part of future space exploration and the space program in general? What is the value of including such questions as diversity?"

A: Dr. Linda Gourneau.

"I don't profess to be a scholar in cultures. I only know my own. As I mentioned earlier, we may not have had some of the damage we did if some of [our] philosophies had been followed. I think those [philosophies] are so important to be considered. Some of them should be considered, they should be added.

"I have heard somewhere that for every action there is a reaction. That's going to happen with whatever is being done with space. It is so important to consider all the cultures of the world, because we are all in this together. I think everyone should be allowed to have a voice to contribute to what's happening to them, because it's their future and their children's future. I feel that this symposium is an effort to do that. We are letting people be aware of what's going on and encouraging them to contact their leaders and to become involved, to have a voice in this, and to ask questions."

A: Joanne Gabrynowicz.

"In the very long term, it is inevitable that human beings are going to live in other parts of the solar system. And in an even longer term, beyond the solar system. We need to have a memory of who we are and where we came from. Before we go dispersing among the stars, it would be a very valuable thing to remember we are humans and we have human attributes, qualities, faults, and problems that go with us wherever we go.

"One of the most exciting applications of remote sensing I've heard of recently was in the field of archeology. There had been a theory about the cave paintings of prehistoric people [who] probably existed in a particular area of southern France. The archeologists hypothesized that, if the people went along a migration route they probably would have done so because a particular plant would have been plentiful. The archeologists hypothesized further that if you could look down from above the Earth, the archeological remains, the root systems of this particular kind of plant could be seen, even if they couldn't be seen from ground level. So they used *Landsat* imagery. As luck would have it, they found the remains of the certain kind of plant they were looking for. That's where they decided to dig. And sure enough, what they found was absolutely astonishing. They found not only a cave with paintings of the caliber of previous finds, but this particular cave had not been entered into since its original inhabitants left. The first scientists on the scene had presence of mind not to go in when they realized what they had found. They walked out. Now they're very systematically going back and getting information. They found that the floor of the cave still has the footprints of the prehistoric people who lived there. It's just like it was the day they left. There are bowls with the paint and the painting utensils. Now we are going to learn about these people in a deeper way than their art can tell us. How they lived day to day, probably what they were like physically, because we have the

shape and size of their feet. How they made the paints and the pigments. How they made the bowls and the utensils for painting. And in the very furthest back part of this cave, they found a little pocket of air that's never been disturbed, it's prehistoric air. Who knows what they're going to find from that? And all this information came from a single satellite image. That's the kind of thing that enriches our human experience. That's the other side of knowing why we have to know who we are before we go out in space, because we're still learning about who we were."

Q: Paul Lunstrom, Hazen.

"Are there any plans to send man into space farther than the Moon?"

A: Rick Hieb.

"There are visionary people in the space program who are thinking very seriously about it. There's no question from the perspective of the space enthusiasts, we are going back to the Moon, and we're going on to Mars. Mars is going to be a place where people live and work just like you live and work in North Dakota. Even today with no modification, the nicest day on Mars is roughly akin to about the nastiest day at the Earth's poles. That's not that far away from being a place you can live. We have people that winter over in Antarctica every year, so it's not that extreme. It's worse than a North Dakota winter. Not much, but it's worse. The point is it's not that extreme. There are people who want to be back to the Moon. Very serious people want to be back to the Moon by the year 2001, and be on to Mars by 2005-2010. Do I believe those dates? I don't, not without some breakthrough technology. But I think that in the lifetime of at least the kids, our children, we will have people on Mars for the first time. I wish I could be one of them. I hope it's one of my kids that has the chance to go there."

A: Joanne Gabrynowicz.

"It is the official United States' policy to have human beings populate the Solar System. In the late 1980s that was passed as part of a NASA authorization bill, so it is officially national policy that we will do that."

Q: Tim Bratton, Jamestown.

"I am very glad that Rick made the remarks that he did because in light of all the criticism in North Dakota by the *New York Times*, it's obviously going to be Alaskans and North Dakotans that are going to colonize Mars and that justifies our existence. The thing that I am concerned about is, I feel to some extent that planetary research programs have been sacrificed to keep the space station afloat. It strikes me that the planetary probes were very cost effective. Yet recently we have seen things like the comet rendezvous and asteroid fly-by [CRAF] program killed. *Cassini* has been kept alive only because NASA is cannibalizing leftover parts from the *Mariner* and *Voyager* to keep the cost down to keep it going. There hasn't been any talk about the Pluto fly-by, and it bothers me that the money is being sucked up by the space station for a number of reasons. Presumably if you build a space station you'd have to shoot up specialized equipment to perform the experiments anyway, so why not just do it on the shuttle? The Russians have far more time in space than we do, literally astronauts up there for months, maybe even years. So presumably they have an awful lot of medical data on weightlessness in space and the related problems that we can draw upon. My question is, why not instead go directly to the Moon and establish an international colony there? You could use the Moon's raw materials and relatively low gravity to build the next flight to Mars. What's the logic of committing everyone to the space station?"

A: Rick Hieb.

"It hurts me to see us not do the unmanned probes to the far reaches of the solar system as well. Certainly I agree that the space station has an enormous amount of politics involved; but then again, that would be shocking if that weren't the case because if you are going to spend 10 billion, 20 billion, however many billion dollars, it is going to be very politically important and very politically sensitive. I want to also [say] the space shuttle does not solve all of the things we would like to do in space. Space shuttles, at their best, are good for a couple of weeks in space. In order to really learn what happens to people you need to spend a long time in space. The Russians have spent a long time in space. One of the problems is they have the long duration [but] we've got the equipment to find out what really happens to the people in space. Medical technology is one of the areas where the Russian space program is far behind the U.S. program. Now with the cooperative programs we are learning from their flights but their program is drawing to a close. The *Mir* won't last forever, so for long-term studies we need something in low Earth orbit that we can spend some time on. That is a reason for the space station. I can tell you based on my observation of the political system, canceling the space station would not guarantee funding for the planetary probes. That money would not be dedicated. Congress would not say, 'We are going to take out this two billion dollars a year and spend it on the space program.' They would take the two billion away and would probably not put anything in its place. I am not sure that by getting rid of the space station we'd get to do the planetary stuff. But I share your concerns, and it's one of those places where we all have to be a part of the political process."

A: Joanne Gabrynowicz.

"The reality is everything done in space has been a result of politics. *Apollo* was politics. The entire program was politically driven and to say that it wasn't simply fails to recognize the fact that it was paid for by tax dollars. That is the nature of it. If you are going to pay for something by tax dollars it has to go through a political process. That doesn't mean it is the best process, but it is unrealistic to say that we ought to do space without politics. The space station is playing an important political role now. One of the reasons why Congress has given its support in the last couple of years is because they are very concerned about being able to access and influence the former Soviet military. Unlike the United States, the Soviet Union only had one space program and it was military. Now we are looking at a country that is in a very unstable condition, dangerously chaotic. There are still large weapons arsenals over there. A lot of the people who are in control of them are the same people with authority over the space program. The hard truth is, the space station and the civil space program are among the few, and perhaps the best, ways that we can gain access to those people in a very dangerous time. Now that doesn't make the astronomers happy, I'm sure. That doesn't make the planetary scientists happy. But that's life right now."

Q: Cassie, Minot.

"How long would it take to build a space station? How big would it be? Where will they build it? How long would it take to build one?"

A: Rick Hieb.

"Well, let's see how big would it be? Really big. Something like four hundred tons of hardware up in space. How long would it take? Years, at least five or six years to put it all up there in place. Where would they build it? The individual pieces would be built on the ground, launched on all manner of spacecraft and assembled in space. It'll be in an orbit that goes over North Dakota regularly, which not all space flights do."

Q: Kira King, Grand Forks AFB.

"I want to be an astronaut when I get older and I am going to go to space camp. I wanted to know how I could prepare for that more?"

A: Rick Hieb.

"In order to be an astronaut in the foreseeable future you've got to be involved in science or technology. Really, the most important thing is to choose some areas of study that you like and that you enjoy. Because I guarantee, that if you wanted to be an astronaut and you studied math or physics just for that reason, you would hate it. You would grow up to be a very unhappy person. The most important thing is to study something that you care about, you can be good at, and enjoy being good at. What's most important in life as an adult is to be working in an area that's challenging and exciting for you. That's how you can prepare yourself to be an astronaut. Then there are a lot of little steps along the way but we can talk some more about it later. The most important thing is to do what you want to do and what's fun for you. That way you can be very good at it."

Joanne Gabrynowicz.

"I think that we will use that as your wrap-up statement. We are rapidly coming to a close. Linda, do you have any final comments that you'd like to share?"

Dr. Linda Gourneau.

"Yes, I'd like to consider [that] a lot of my relatives, culturally Native American, [have] legends about star stories or stories about space. There are also tribes down in the southwest who have these cave drawings. They were aware of all the interplanetary happenings in space a long time ago. There's even stories about different worlds, not 'worlds', but this world going through different stages. Something interesting I just wanted to say."

Lanny Faleide.

"I think space is so exciting we have to grab onto it and go for our dreams. Like I said before, I was never going to be able to be an astronaut like Rick, but I can see a lot of things that he did in a little different perspective. I feel like I am up there right now. So go with your dreams and let's move this technology to the next level."

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Thursday, November 2, 1995
Political, Educational, and Social Value of Space Exploration

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St. Michael's Catholic Church

Joanne Gabrynowicz

"Hello. The first speaker is Tim Fought."

Tim Fought

"The question at hand is, 'What is the political value of space exploration?' I think the evidence at hand suggests that there isn't much political value to space exploration. Take a second or two to consider just how gloomy the situation is. Consider for a moment the politics of the day in Washington. You don't hear about space even though space is in for some tough times with the budget. Space is not an issue, space does not come up when Newt Gingrich and Bob Dole meet the President, and that's worrisome. It suggests that there isn't a coalition to support space. I think that's been the case for quite a while [since] the great let-down that occurred after the *Apollo* missions. The only bright spot that I have seen in recent years is with the question of a political platform. One that I found fascinating a few years back was enunciated by Jerry Brown, the former governor of California. It was something along the lines of protect the Earth, serve the people, and explore the Universe. Of course, Jerry Brown is widely regarded as a flake and was pretty much dismissed from American politics. I must confess that I admired the platform as a statement of first principles. But it is not a political platform in the sense one could run for the Senate or a national office on those grounds. So I think that tonight we need to say that there isn't much political value, but that's not to suggest that there couldn't be.

"I would like to take a couple of minutes to think about the circumstances under which there could be political value to space exploration. A couple of premises to my observations, which I don't think will be controversial in these environments: one, space exploration is a noble thing. I've been fascinated by space as many baby boomers have; ever since the day the *Cincinnati Time Star* landed on my front porch and I realized that there were people orbiting the Earth. One of my first reporting jobs was wangling a way to cover Neil Armstrong's homecoming in Wapakoneta, Ohio, which gave me an incredible thrill. I thought that was really great! A lot of people of my generation feel the same way, and a lot of younger people feel the same way. We have had three and four generations now of *Star Trek.* It is amazing to me that sort of enthusiasm hasn't translated into a political coalition, but it hasn't. Nevertheless, space is a noble thing.

"The second premise might be slightly more controversial. Nation-states have proved to be the best guarantors of political liberty and the best engines of economic prosperity. I think I would add that it takes a nation-state to amass the resources to explore space. The third premise is that it would take a profound shift in circumstances, in political circumstances, and perhaps in social and economic circumstances, for space to assume great political value in this country.

"So, let's think for just a minute or so just what sort of circumstances we might find ourselves in which space would be something that would inspire voters to move politicians to promote space exploration. One thing that might happen is that there might be a resurgence of economic nationalism in the United States. Free trade economics has dominated the thinking of the policymakers that have won in recent years, but there is nonetheless a strong strain of economic nationalism in the U.S. It has expression in Ross Perot and the opposition to NAFTA. This could result in a renewed interest in space exploration if the notion of an American economic fortress were also linked to a superior technology and a superior economic performance via space. Another set of circumstances might be a resurgence of redistributive economics. I think that the links might be more tenuous there. But a country that decides the disparity of wealth was so great as to be intolerable, might also be amenable to including space as a way to redistribute the opportunities that are available. We could see a government of cultural renewal. Something that might be an amalgam of the thinking of William Bennett and Louis Farrakan. Not a pleasant thought to my mind, but that might also be something that engenders support for something such as space exploration.

"Let's conflate two possibilities that space might be seen as an engine of economic renewal, and neo-new deal. Space might be considered as a grand public work that would employ people, engineers, for instance. That I think is a promising prospect in an economy that is in difficult straits despite its current growth. And finally, grimly, there might be a resurgence of political interest in space due to military threats. We can't imagine all the things that might happen in the future, but many of the threats to national security might be based in space.

"In some ways the alienation of space from the politics of the day isn't all bad. It might be that we are in a period of consolidation in which the exploitation of space fills in the territory that exploration has opened. We heard a lot last evening, and we will hear more tonight [about] some of the ways in which human beings have exploited space. Fascinating things, wonderful things, imaginative things. Things I think are a credit to the human race. More of that may be necessary before we are ready to do the sort of 'on to Mars stuff' that I would like to see. If that's the case, maybe things are about where they ought to be. I don't think in the long run we are going to be satisfied with these circumstances. The problem before us is how to link our politics with this wonderful vision of further space exploration."

Joanne Gabrynowicz

"Our next speaker is Vivian Meiers."

Vivian Meiers

"Thank you. And thank you on behalf of the teachers of North Dakota who are now teaching the students that will soon graduate in the 21st Century, for this opportunity to speak about the educational value of space exploration. I was a student-teacher during the time of the golden age of *Apollo*. At that time, student-teachers, teachers, and students alike were very excited about space exploration. We call it now 'teaching in real-time.' It isn't hard to motivate students when you have real-time learning going on around you. Those kids were inspired by each other and by what was going on around them. There was a particular exceptional student that I remember quite well. He didn't miss a newspaper clipping, nor did he miss a magazine article. He brought them all to class and he absorbed every word. And he made sure everyone else did as well. We all learned from him, and I learned a lot about learning from him. Space

exploration was real at that time and it was exciting.

"Now I teach the class of 2002. Compared to the 60s and 70s, the students of the 90s are more informed, but not necessarily better informed. My teaching tools are more sophisticated, but not necessarily easy to integrate. With the influx of all the information we have and all the technologies we have to use, we are faced now with more decisions on what to teach. What we choose to teach, to save, to learn, to create, or to reject will define the education of the future, the education of our nation. So it is not an easy decision, and we as teachers cannot do it in isolation. Now, more than ever before, we need institutions such as NASA to help us do the research, give us updated information, and help us decide educational goals for the future of our kids. If you step back and take a look at the larger picture of learning, space education is a perfect avenue for the students of the 90s for they have before them a world of unknowns. There are unpredictable hazards and occupations yet to be discovered. These kids have to be equipped with higher level learning skills, more so than ever before. Space exploration is a unique opportunity for this avenue of learning. Think for a minute about students trying to project into the future, trying to visualize what it would be like to live in space, to create a space camp, or to solve problems of garbage in space. These are the kinds of questions we go through when we go through units of space exploration. Kids are turned on about these ideas and are futuristic in their thinking.

"To create higher level thinking skills we teachers need tools. We need topics that are interesting to students. Space exploration is one of those. Space exploration and education integrates perfectly well with all the other disciplines. Health education, math education, social studies and cultural education. They all integrate very well with space exploration, if it's done well. It's a natural attention getter, and the materials are rich and high-tech. That's what students deserve and want today. They want their curiosities to be aroused in school. They are not satisfied with just textbook learning. They jump out of their seats for experiences that will give them ideas and they plunge into hands-on experiences. They relish virtual reality and the latest state-of-the-art technology. NASA resources have been, to me, invaluable. When I can tap into the Internet and the World Wide Web and at the click of the mouse access the latest updated information on space technology, or for that matter any kind of scientific research on NASA's web page, it is an invaluable tool for me. The challenge for teachers in the 60s was, and still is, today a race. But it is a race to create the desire to learn. To instill the dreams to surpass, and to light the fires to shine. We need to provide the hope to flourish and it's a race to develop stellar productivity in our students of today. Space education, space exploration---it's a keeper. For us, for teachers, for educators of all levels of learning, a well-conducted space education unit will turn kids on and excite them with their activities in school."

Joanne Gabrynowicz

"Our next speaker is the Rev. William C. Sherman. Father Sherman is going to speak to us on the sociological value of space exploration."

Father William C. Sherman

"Well, I come in a sense, in two disguises. One as a sociologist and one, as you mentioned, as a clergyman. My remarks will kind of reflect both of those things. But just two weeks ago, I was in the little villages near Odessa, in the Ukraine. I spent a few days there doing some research. We were looking at houses in villages from which the ancestors of many of the people who are listening tonight came from. A technical assistant and I were in this country [which in the past had been] conquered

by God knows whom. Russians, Communists, Polish, and so on. What we expected to find was a great sense of optimism, a real jubilation that for the first time, [they had] their own lives, their own opportunities. Sixty million people, a marvelous country, a wonderful people! But what we actually found, was just the opposite. A sense of the gray, a sense of foreboding, a sense of pessimism. A lack of hope, there was evidence of that, too. Industry was slow, and a great deal of alcoholism and even mentions of suicide. [It was] just the opposite of what we expected. That set me [about] the question of optimism in a nation, in a people. The question of hope. I think you and I have to agree that one of the motivating powers of the United States has been that it is a new country, a world of challenge, a world of opportunity.

"The Puritans came over for a new world, a new opportunity. Then the colonists came over to this country filled with challenges and filled with natural resources. There was a sense of optimism about the whole thing. Then subsequent migrations through the generations, always coming to find something new and wonderful. Then I think we have to admit that as the frontier moved west and our ancestors joined it, there was again that sort of thrill of expectation. There is no question about it. If Americans were forward-looking and optimistic it was colored by all those generations of expectation. And here you and I are as North Dakotans, and that frontier was only 100 years ago. We can go into small towns and talk to some of the old-timers who still remember the sound of the hammer and the saw as the village was being built. Your ancestors and mine, from Norway, Germany, Poland and so on, came out here filled with hope and excitement. The frontier disappeared and still there was an excitement of now being part of the democratic enterprise, the new machinery, and the prospering farms. What's a little threatening now, however, is that affluence is old hand, technology has been around for a while, and we all have education, the things that thrilled our ancestors. Some of the politicians talk of America as in a kind of 'funk.' As if there is a sort of boredom, a sense of loss of hope. We wonder when we see alcoholism and drugs and escapism among our youth. That led me to think that what we got here in space is really a new frontier. Like the old frontier, not everyone was part of it, but everyone was captured by that sort of 'virus.' And here you and I are, sort of a collective enterprise, space, adventure, challenge, and hope. Maybe it's not the only thing, [but it is] but one of those ingredients we need to keep America optimistic. That vital environment. That is why I feel that every penny we spend, even though not politically satisfactory, but every penny we spend, on everything like aerospace, like these seminars, like this [college] is most valued. It gets that something much more vital than just a matter of technology.

"Now the second thing I'd like to talk about, in a sense maybe it's unrelated, is the question of the notion of God. If we go back through the religious experience of people through the centuries---Christian, Jewish, Middle-Eastern, or whatever it is---there is always the notion of God colored by their physical environment.

"Warrior people see God as being vengeful and a person of conflict. Pastoral people have no problem with the Good Shepherd. One of the things scholars have pointed out is that human beings have a problem of keeping together the transcendence of God and the imminence of God. That's their technical terms. The imminence of God is the sort of feeling that each one of us has that God is close to many of us. That God is gentle. God is comforting. God is present with me in every moment. The transcendence of God is that God is vast, powerful, the thing of the universe, immense, far beyond us. You have to keep both these things

together. If you have too much of that imminence business, God is too personal, too pedestrian, too easy to discard. He needs the transcendence. I don't have to tell you that we people here in North Dakota don't have a problem of the imminence of God. [And] the transcendence of God is also what we know about. We live out here in these prairies where life is not gentle. It's harsh and cruel. The days may be comfortable but all of a sudden we get a night like tonight. We get blizzards and we get hail that can rip us apart and kill us!

"So we have the best of both worlds, the transcendent and the majesty of God and the gentleness of God. Maybe that is what space can do. As a reminder to us who sort of fall into easy habits that God is beyond us, that God is the God of the Universe, we see the pictures of the Earth floating around a little part of the vast Universe. Maybe that's why the Good Lord has---looking at it from the perspective that faith---brought aerospace into our world, to remind us of that other dimension of God. God isn't something to be discarded, to be set aside, to be ignored, the power and the majesty of it all. Some of you remember that in the Holy Scripture it says something like this, 'The fear of God, the awesomeness of God, the awe before the presence of God is the beginning of wisdom.' Well, I think that space does that. So even theologically, believe me we need it. Thank you."

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Questions & Answers

Q: Henry Borysewicz, Grand Forks.

"Everyone on the panel is speaking about how space exploration has inspired them. Ms. Meiers has told us how space exploration is inspiring her students. Since the end of the *Apollo* project, the United States has been retreating from its all-out space exploration. I was wondering if you see that as a broken promise to your students who maybe have been studying very hard in order to get a job within the space program. Will they grow up to find there are no jobs available or no space program to get a job in?"

A: Vivian Meiers.

"I think education now is trying to address that in more of a general way. If they do have aspirations of being an astronaut we don't take that dream away, especially at a very young age. If we want to develop and nurture that idea, that is probably the best avenue. As I get older I find that it is good to prepare them for avenues in space exploration or related ones. For instance, the spin-offs from all of the NASA research that improves our society in so many other ways. I'm not sure if you meant [would] the student be disappointed [if] they would not actually be in space or an astronaut. But I do think it is important for levels of higher education to make sure students are aware of the diverse occupations that can come from space."

Q: Don Daugherty, Minot.

"What is it you think that keeps people wanting to go into space even though the Cold War is over? Do you still see that spark that the young people in the 60s and 70s had that so invigorated them to want to grow up and become astronauts and work in the space program? Do you see that still there, even though the political climate has changed recently?"

A: Father Sherman.

"I must admit that I don't, certainly not to any large degree. And I think that what Tim is picking up on politically is probably a symptom of the general public. I think enthusiasm for such programs is really necessary. We do a lot of things in our country for morale building. God knows we've got sports programs that are endless and not very productive. We don't ship them overseas. Look at the amount of effort we put into advertising or just plain

entertainment. That's morale building, I suppose. But, maybe public policy should shift to the point where people would get the urge to look outward, that we need to recapture something in the old American spirit. But honestly, I am a bit pessimistic right now. It's the matter of dollars and cents, and I don't think we are going to do much changing. We need things like space, believe me, to keep the collective national spirit moving ahead."

Q: Claud Heidt, Minot.

"I was wondering if man's concept of God will change when we get into outer space? When we aren't down here on Mother Earth anymore and we look to the Universe, is our idea of God going to be any different, our spiritual concept any different?"

A: Father Sherman.

"Well I think that it does lift our eyes above the horizons. Back in World War II there was a poem that went something like, 'I flew higher and higher and I touched the face of God.' There is something to that. There is something to the fact that we get a sense of, not only the Divine, but also the unity of human beings. You can't look at those pictures of the Earth and see the human race as a set of fragmented individuals. The whole business of ethnic and national conflict becomes petty when we see the one world in which we reside. Space tells us something about men and women, as well as the Divine. The utter immensity of it all. When I was in the Ukraine everybody had a television. They didn't always have running water. Some were still burning cow chips for fuel. But they had television, seeing all these wonderful things of space. It registers. It tells us something about God, about being human, about human relationships, about international politics."

Q: John Graham, Grand Forks.

"Should there be a teacher in space, especially after the *Challenger* problem with Christa onboard?"

A: Vivian Meiers.

"You know it's one of those questions I have thought about a lot because it was such a profound experience. Yes, it created a huge impact on education and people in education. As far as a teacher in space, yes I do [think there should be one]. I think that if there is someone that wants to, is willing to, is prepared to, as much as anyone else, to go through all the preparation that it would take [then the teacher should be given the opportunity to go].

"The impact [of the *Challenger*] doesn't lessen. [My students] work with computers and they can access the *Challenger* explosion on one of the CD-ROMs called *Time Almanac*. Two students were just about to do this [when] one of them said, 'Do you want to press it or should I?' They were sincere, they weren't being silly, they were thinking. They did press the key and they did watch it. These sixth graders were kindergartners [at the time of *Challenger*] so one student said to the other, 'I don't remember that day, I was probably just jumping around on the couch or something.' It will always have an impact on the way we feel about human beings. But teachers, educators, astronauts, anyone that wants to learn and explore should be able to."

Q: Louis Quinn, Grand Forks AFB.

"My specific question is directed to Ms. Meiers and Father Sherman. I personally believe we cannot afford not to go to space. We as a society, as a nation, and as a species, we have to go to space. However, the question is how can we reconcile the fact that as a nation we are suffering economically and the fact that we have to be socially responsible with the fact that we have to go to space? The second part of my question is, in schools I see a lot [about] the topic of the responsible citizen. Do

we teach kids that being a responsible citizen is going to space?"

A: Father Sherman.

"I don't know how you do it politically. I am convinced that as a sociologist, the morale of a people is absolutely essential, fundamental. A sports team does not win unless it believes it's going to win, that it's the best. Aerospace programs, such as we see in this institution, would not produce good products unless the students were convinced they were elite. Our nation cannot afford to do otherwise. We must not downsize our effort in space. We must have the challenge."

A: Vivian Meiers.

"I think convincing political leaders is not an easy task. But most of us have heard the quote 'if you think education is expensive try ignorance.' We, I think, do a very poor job in educating politicians about education, and they need to be educated. I think people are passive. They are just sitting around letting someone else do the work of educating politicians and lobbyists with special interests that are very powerful. We have lobbyists and we have people drumming for us in the legislature, but we need more. We need more people to bring the information to our political leaders."

Q: Jason Scherman, Jamestown.

"My question is kind of a political question in reference to the previous one. I am concerned the new budget plan that just passed the House and the Senate will cut too much from NASA. How much will it actually cut?"

A: Joanne Gabrynowicz.

"You're right. I couldn't give you a number right now because literally, it's changing from day to day. The NASA authorization bill is being consolidated into what is now called the 'omnibus science bill.' Right now,
projections are that NASA will probably have at least a multi-billion dollar decrease over the next five years. It's a moving target."

Q: Unidentified Speaker, Grand Forks.

"What do you think the political ramifications of the new international space station are going to be with the Russians joining the Japanese, the Americans, and the Canadians? Do you think a new kind of political entity will be coming out of all that?"

A: Tim Fought.

"I must confess, I really don't know. I'm hopeful about those things, I'm hopeful about those sort of joint efforts. I think there is some evidence, as we saw last night, that the joint *Soyuz-Apollo* mission was sort of a precursor of the eventual end of the Cold War. So I'd hope that those sorts of things are a model for more cooperative efforts internationally. I must say when you look at the other things that go on in the world, there isn't a lot more hopeful evidence."

Q: Bob, Minot.

"If it is considered that there is not much political value to space, why is it that the popular press only reports astronauts drinking Tang, those kinds of things? Why is it that the press does not report more scientific findings in detail? Wouldn't this create the greater political interest in society at large?

"My question to Joanne is what are the commercial values of space exploration and why don't we develop that in a more active way? Father Sherman indicates that we are frontier people, a pioneering people using those techniques, using those inherent values we have. Could the people of North Dakota properly develop the findings of space through the frontier and pioneering attitude they have? How can they develop that through a contract attitude with NASA?"

A: Tim Fought.

"I think the press does a reasonable job of [reporting] scientific and technological developments associated with space. Even today, we talk via satellite and CNN brings us the world over satellite, and the World Wide Web links us with every other point in the world—all by computer. Culturally, we have begun to take all of these miracles for granted. We don't stand back in awe and say anything anymore. We kind of get mad when our Web link breaks down. So I think that the problem is not in how the information is conveyed—the problem is in how the information is received."

A: Joanne Gabrynowicz.

"Right now many people believe we are about to experience a new burst of commercial space activity. We do have commercial space, it's called telecommunications satellites. It's a multi-billion dollar industry around the world. Communications via satellite has been a very successful commercial activity for over thirty years now. The technology for other space applications is now less expensive and smaller. If you think about the size of a satellite, you typically think of a massive piece of hardware that costs in the range of a hundred and fifty million dollars. This has been beyond the reach of the private sector. However, now that technology is shrinking, you are going to see a burst of commercial activity in space. Like Tim said, it is going to be quickly absorbed and considered normal. Then people aren't going to think about it as 'space' anymore. They don't think about telecommunications satellites as 'space.' They think about telecommunications or telephones. The space part is almost invisible to them."

Q: Kristen Rall, Grand Forks.

"I have been reading letters to the editor in the *Grand Forks Herald* from our Senator, Kent Conrad. I am very interested in his position of fighting a 'Star Wars' mission even though it would mean jobs and economic growth for North Dakota. How do you feel about that and why do you think he would take such a stance?"

A: Tim Fought.

"First off, I think that the senator who has been most vocal about that has been Byron Dorgan. I think he truly believes that a 'Star Wars' system would be a boondoggle. And I think so, whether he is right or wrong. It's very rare these days for a politician to say that the jobs can go hang if you are wasting money. I think that reflects Dorgan's probably longtime political attitude. I'm not sure exactly where Conrad stands on that, but I suspect he is much more favorable towards a 'Star Wars' program."

Q: Dave McDowell, Jamestown.

"I guess what I have is a philosophical question. We are assuming that we can eventually get to Mars and that we can eventually colonize Mars. As technology advances it would seem like the colonies on Mars could become independent. Pretty soon you would have babies born on Mars. I am wondering, if after a time, people on Mars would lose their allegiance to people on Earth. And if so, would there have to be interplanetary laws passed? Who would pass these laws? What would be the social and human ramifications to all of this? We couldn't do anything about it if they decided to revolt, so what are the ramifications with this?"

A: Joanne Gabrynowicz.

"One of the most important things you can do to look towards the future in space, is to look back into history and see what we have done in similar situations. It is inevitable, in my opinion, that when human beings settle Mars, in the long term, there will come a time that they will look at Earth as the place they used to come from. They will look at Mars as their home. Just the same way people who lived in what

became the United States eventually came to think of England as the place they used to come from after two or three generations of never setting foot there. Their identity is going to be from the place that they know. That is inevitable. The time frame, I don't know. The laws will be different, just the same way the founding generation in the United States had to create laws that were American instead of ones that were British. This sounds funny, but the Martians are going to have to do the same. There will be a time when there will be a connection to Earth people the same way the original settlers felt connected to England. But as the economic ties lessen, as institutions are established on Mars, and as economic independence becomes more feasible, people will write their laws based on their experiences of where they are. It's not just the history of the United States. You can look at Australia and what happened to the people who were sent there. Eventually the place that the people came from recedes in their communal mind and the place where they are becomes more important."

A: Father Sherman.

"I can imagine Vivian and the kids see it. I am an old timer, you know, but I can imagine it would be exciting for the kids to project or suggest what that world would be like."

Q: Matthew Axvig, Grand Forks.

"My question is if you were the administrator of NASA, what would your priorities be for the future of NASA?"

A: Father Sherman.

"If I were the administrator, I think I would agree with the senator and knock out stuff like 'Star Wars.' In light of that boondoggle, that would be my position. I would then get those in congress to work on the issue. I would personally stress information and I would dramatize it. But I think it has to be put into a perspective that says, the American will to move ahead is at stake here. This isn't just a matter of highways and make work-projects. This is a matter of winners, win and losers, lose. That's fundamental. We have to dramatize the issues."

A: Tim Fought.

"I haven't the faintest, except I think it has to be a pretty scary time. I would say the strategy has to be survival. I think the tactics should be to get rid of many missions that involve exploitation, consolidation, and filling in what was left behind. I would try to find a single mission that could have a fairly broad constituency economically and that could be as inspiring as possible. I would suggest that would be the space station rather than the shuttle. It might well be on to Mars instead of either of those."

A: Vivian Meiers.

"As far as getting information out, I think they do a good job. Maybe even a great job. But one of the things that I would change would be to get them to advertise themselves more. I don't know that we use the media enough."

Q: Alex Willman, Grand Forks.

"I have a question for the entire panel. I would like to ask them their opinion on the potential for access to space for ordinary citizens. If your opinion is negative why would an ordinary citizen seek value in space if there is no chance of them being personally involved? Or the converse?"

A: Tim Fought.

"I don't know what the cost curve looks like, but it seems to me it would be an awfully long time before very many people would be able to fly. It just seems that the cost would be so great that it's hard to imagine in my lifetime people of my generation will get to fly in great numbers. I think you have to look elsewhere to find the value of space

exploration. You are not going to get it from the kick of flying."

A: Father Sherman.

"I don't think the fact that the ordinary citizen is not an aviator necessarily negates the business of space exploration. Look at the millions who watch a football game. We are involved in it, it's 'my team.' They are my heroes. Maybe we could capture the imagination of the nation with spectacular things. Maybe that's what Tim was talking about. Fix on something that has all kinds of ramifications and we'll go along, and we'll support our team, our men, our women."

A: Joanne Gabrynowicz.

"There are people who think if there is some way to actually get the common person into space, there would be a great deal of support. There are developed ideas about space tourism. I believe Hilton Hotels has said if they had the capability of getting there, they would put a hotel in low Earth orbit. It would be a great place to go for a week! There are people who take this very seriously. The actual capability for people to visit space might be very expensive. But an around-the-world-cruise is something people will pay for once in a lifetime, too. It would get people more interested, but I agree with Father [Sherman]. There's so much else we get from space that it ought not be contingent upon whether or not specific individuals can go."

Q: Mark, Grand Forks.

"Tim, do you think that the news media has a responsibility to sell space to the masses?"

A: Tim Fought.

"No more responsibility than it has to promote other viewpoints. The news media is not homogenous. No doubt there are newspapers whose editorial boards are spending the right amount of time on space and those who think going on to Mars is foolish and ought to be put off for a couple generations. I'm not sure that I would say they have a responsibility. There are all kinds of views about space. It's not valid to think of the news media as having a responsibility. I think a lot more newspapers and journalists ought to be eager about space, and there ought to be more information about space. But I am not sure I would assign the press a responsibility.

"Decisions are almost always *ad hoc*. It depends on what the vote is about. It depends how it affects your perceptions of your readership and your constituency. It depends on how spectacular your story is about space, how inherently interesting. Just having the two stories in front of you there is no way to answer that question. There are judgments you make on how interested you think your readers will be based on your understanding of your readership. Sometimes it's a pretty rational decision and sometimes you make it in your gut. If I am making decisions at the *Herald* about two wire stories, I am going to be much more inclined to run a space story. Other people with the same set of circumstances might make a different decision. Like everything else in the press it's a human enterprise. You are never sure what you are going to get, and you never know until you have the stuff right in front of you."

Q: Chad Chidgy, Grand Forks.

"Don't we risk a real danger of having a backlash if we encourage the next generation coming up to get their hopes up for space, both for the job market and in technological expectations, only to have them be let down if we can't meet the expectations? From a sociological standpoint, and also from the standpoint of an educator, don't we risk the real danger of having a backlash and a lot of disappointment down the road?"

A: Father Sherman.

"I think we do. But through the years I have been involved with the University, I've seen that a lot of professions that graduates enter seem to by cyclical. Even medicine and engineering have had their various ups and downs, so I wouldn't really want the students here to be pessimistic about the future. Because we might have present-day difficulties, like Tim was saying, who can predict the future? What combination of factors such as economic, political, and military, are going to come together five, ten years from now? I would say, 'Stick with it.' The other disciplines have their swings and shifts, but the jobs appeared. I wouldn't be that pessimistic."

A: Vivian Meiers.

"What they are telling us in education now is that most of the population will have about seven different jobs before they are done with deciding upon a career and then eventually retiring. Most of the professions that are in existence today probably won't even look the same in ten years. So these space exploration careers probably won't either."

A: Joanne Gabrynowicz.

"When I went to law school from 1977 to 1980 there was one paragraph in one book that mentioned the space treaties. That was it. And here I am, 15 years later, a full professor teaching space law full-time. Granted, there aren't enough space lawyers in practice to make it look like a burgeoning field. But the fact is, what I do now didn't exist when I was preparing to do what I do now. It's a typical example of what Vivian is saying. A lot of the jobs we are preparing people for in space are just being created or don't even exist. Look at GPS, the Global Positioning System. Until a few years ago hardly anybody heard of that. Now there are entire industries established to use it. Avis is putting GPS into their cars. In Fargo there is a company creating grid maps for GPS devices. That's an entire industry that didn't exist a few years ago."

Q: Renee, Minot.

"I guess a lot of the communications companies now are hiring experts in the space field. What exactly do they need from these people?"

A: Tim Fought.

"Not much differently these days. I suppose that we're talking about the technical end of it. We heard about the *Iridium* system and I suspect if you wanted to work on that, one of the best things you could do is be an engineer."

Q: Steve Williams, Grand Forks.

"They have been doing education lessons led by astronauts from space ever since the beginning of the shuttle missions. My question for Ms. Meiers is, do you utilize that in the classroom? Have you heard of those kind of interactive lessons being used in the classroom?"

A: Vivian Meiers.

"A couple of years ago, [former Astronaut and native North Dakotan] Jim Buchli spoke at one of our science conferences. He alerted us to the fact that we could have lessons and interactive lessons from space with astronauts. I went up right afterwards and said, 'How can I do that?' Well, it's just been the last year or two I've been fortunate to work in a school that is equipped with enough technology to be able to even think of doing something like that. So as technology gets more sophisticated and we, as teachers and professionals, get more sophisticated at using them, we can start to visualize what they're trying to do. I would love to be one of the first ones to do it in my school district. I'm sure I wouldn't be the first in the state. But I plan to do it. I would love to."

Q: John Brauner, Jamestown.

"My question is not really a question rather a comment. It seems in U.S. society there's increasing polarization. The rich are getting richer and [the poor, poorer.] It seems that there are areas that have a very strong educational system, yet other parts of our society are not getting educated enough. Those who have the technology are realizing that it is very exciting and fun. But what fraction of the people needing education are really able to take part in that technology? This glitzy fun is seeming to come sometimes even in the absence of some basic understanding. So I think we have to be cautious of what we are doing in really providing education, we are not providing entertainment. Comments please."

A: Joanne Gabrynowicz.

"That's an excellent point. I think you just put your finger on probably one of the most profound challenges the civil space program is facing, and that's demographic shifts in the United States. If you think about the roots of the space program, who has participated in it and who has supported it, that is changing. The 1990 census told us that for the first time we can expect by the next census the mathematical majority of people in the United States will not be white people. We see a coming to prominence of many different groups of people who did not come up through the engineering schools and the scientific backgrounds that are a foundation of the space community. One of the most profound issues that the space program faces is: in a democracy where the people determine where the nation goes, is the space program going to be relevant to these groups of people who are becoming so large? One of the reasons NASA is interested in having a symposium like the one we are having is because it is necessary to get the opinions of different people who traditionally have not been the aerospace engineering stereotype which has been so much of the space program for the last 30 years. I don't have an answer, but I think that is a terrific comment."

Q: James Bailey, Minot.

"What are the kinds of jobs your graduates from the UND program obtain? And secondly, what kind of coordination was required in order for this project to come together? What are the chances of us doing this again?"

A: Joanne Gabrynowicz.

"We have been very pleased to find that most of our graduates are getting space-related jobs. We teach both civilian graduate students here on campus and Air Force personnel, mostly officers but some enlisted, at Minot and Grand Forks Air Force Bases. On the Air Force side, prior to the missile officers becoming part of Space Command, many of our graduates told us they got postings in Space Command because of their degree. They were told that the degree is what made the difference for them. Space Command is considered a very desirable career path in the Air Force. We have gotten some very positive feedback there. Now we can say all of our missile officers are in Space Command, but we didn't have a whole lot to do with that.

"On the civilian side, we have had students gain employment across the board. We have had graduates employed at NASA, the General Accounting Office, Boeing, McDonnell Douglas, the House of Representatives, and private companies doing policy consulting. We are very pleased with the track record. What we hear from our students and their employers is they value an interdisciplinary education.

"As far as an opportunity to do this program again, I hope somebody does. This program is a follow-on to a symposium held in 1994 in Washington. I suggested it be done again but be taken outside of Washington and to the heartland. NASA thought that was a

great idea. Now we have taken it even further and we have proven that this can be done on a state-wide basis via satellite. We are not just talking about space, we are engaging in space right now. We have brought the town-hall meeting experience to another whole level. I hope that maybe another state wants to do the same, adding their own unique dimension to it. I would work with another state who wants to do it. I certainly look forward to any opportunities we may have here to do it again as long as we can continue to get the support we've gotten from the outlying towns. We have a lot of people who came out around the state to participate, and I consider this a huge success. I hope we can get to do it again."

A: Father Sherman.

"You mean my voice is going up and hitting one of those things and bouncing down? That's amazing! When I first started teaching we almost had to stand on the top of a box and yell. That's how much times have changed."

A: Tim Fought.

"Well, I guess that I would say that I don't want to be as gloomy as I sounded in the beginning. I think that the mere existence of the [college] that we sit in today is a testament to the aspiring vision in space. As long as that vision is out there and alive and kept alive, a lot of good things can happen. I think that we should all leave tonight feeling pretty good about what is going on and feeling that there is a little bit of hope for things in the future."

A: Vivian Meiers.

"Modern technology is going to be able to spread the word a lot faster than what we anticipate. In the future people will see the relevance of this kind of education and the way we are disseminating it tonight. Students today, more than ever, need heroes. They really don't need any more famous people with faces that they recognize. They need heroes who do things good for society. Hopefully, as a population and as a society, we can create more of those heroes."

A: Father Sherman.

"Well, I still think that aerospace is one of the few vehicles by which the nation can be galvanized and acquire a new sense of challenge, of frontier, of opportunity. I really don't see where else we can find it. We have to do the routine housekeeping problems, taking care of our folks at home in various social difficulties. But that space banner waving, that flag flying, that will help make us one people. That is why I think it is so valuable."

Joanne Gabrynowicz

"I would like to take a minute before the satellite forces us to say good-bye and recognize some people around the state of North Dakota who have helped bring this event into being. In Hazen, I would like to thank Laura Donovan. In Jamestown, Dave McDowell. In Minot, Barb Solberg and Bob Rau. In Mott, George Jones. In New Town, I'd like to thank Karen Gillis and Delores Wilkinson. Thanks also to our site coordinators, our graduate students, who have worked so hard and volunteered to go out to the towns. They face a blizzard coming home.

"My experience with this has been an affirmation of why I have become a space professional. My gut, my instinct, my intuition tells me that the value of space and space exploration is its ability to bring us together. There is nothing more dramatic than the last two nights to prove it. Here we are, spread around an entire state, and it is space technology that has brought us together over time and distance. We are spread over two time zones and an entire state, yet it is one experience. I want to thank you all, and I hope we get to do it again. Thank you."

Faleide

Gourneau

Hieb

Fought

Meiers

Sherman

PANEL

Rodney (Lanny) Faleide is a farmer and founder and president of Agri ImaGIS, an agricultural satellite imaging company. He is a distributor for SPOT Image Corporation and is currently analyzing satellite imagery for the sugar beet industry in the Red River Valley and southern Minnesota. Faleide has been involved in the agricultural industry for 20 years.

Dr. Linda Gourneau serves as the Clinical Director of the Minne-Tohe Health Clinic, New Town, at the Three Affiliated Tribes of Fort Berthold Reservation, North Dakota, where she was raised. Gourneau works with area tribes and health providers to establish new clinical opportunities at Native American health facilities. She also assists Native American medical students in developing and implementing research projects which are relevant to Native American healthcare. Gourneau is a 1989 graduate of the University of North Dakota School of Medicine in Grand Forks.

Rick Hieb is a former NASA Astronaut. He is a veteran of three space shuttle flights and has been involved in other numerous NASA projects, logging more than 750 hours in space. Hieb was selected by NASA in 1985 and became an astronaut in 1986. He graduated from Jamestown High School in 1973, received his Bachelors from Northwest Nazarene College in 1977, and a Masters from the University of Colorado in 1979.

Tim Fought is an editor and reporter for the Grand Forks Herald. His responsibilities include writing editorials and directing a project in public journalism known as "A Community Conversation." Fought has worked for the Herald for 15 years in positions ranging from statehouse reporter to managing editor. He's also had responsibility for introducing new technology at the Herald. Fought previously worked for the Associated Press and the Columbus (Ohio) Dispatch. He is a graduate of Ohio State University.

Vivian Meiers has been teaching elementary education for 21 years in North Dakota. For the past 17 years she has taught in Bismarck, the last three of which she also served as the assistant principal at Northridge Elementary. Meiers received her elementary education degree from the University of Minnesota, Morris, in 1971, and her Masters from the University of North Dakota in 1986.

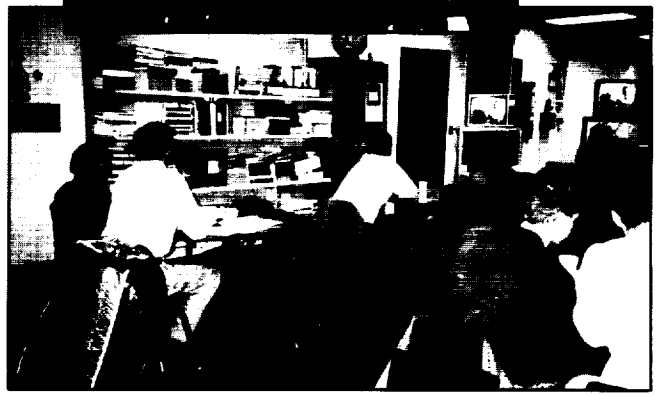
Reverend William C. Sherman is the pastor of St. Michael's Catholic Church in Grand Forks. He has been with the St. Michael's congregation for 19 years. Sherman is also an Associate Professor of Sociology at North Dakota State University in Fargo. Sherman is an author of several books and numerous articles on North Dakota's present day populations. His publications include: *African-Americans in North Dakota*, *Scattered Steeples*, and *Plain Folk*.

Site Photographs

First Evening Panel

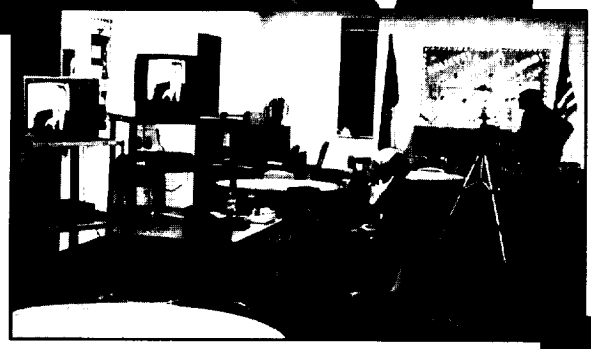
Second Evening Panel

Above: New Town

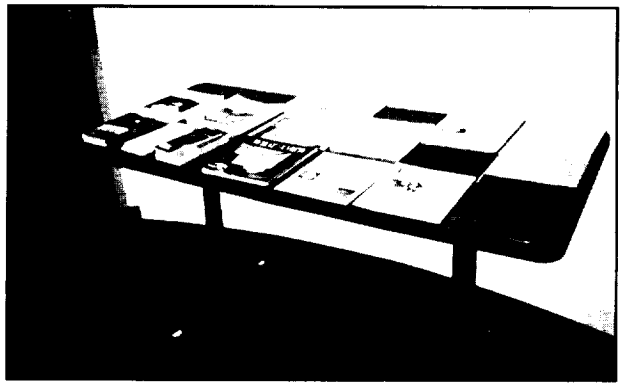


Above: Jamestown

Site Photographs



Above: Jamestown



Information Table

Top: Auditorium Set, Above: Press Conference

Above: Minot