HB
540

House Committee on State Affairs

RECAP OF
HB 540

Space and Science Week

Received February 12, 1990
by Rep. C. Davis

Heard March 1, 1990

Passed Out of Committee March 1, 1990
4 Do Pass

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HB 540: Space and Science Week

HOUSE COMMITTEE REPORT

(7)
Date Referred: February 12, 1990 FURTHER REFERRALS:

Date of Committee Action: ________

The STATE AFFAIRS Committee considered: HB 540

HOUSE BILL NO. 540 SPACE AND SCIENCE WEEK

"An Act establishing Space and Science Week."

RECOMMENDATIONS:
[ ] be replaced with ______________ [ ] the same title [ ] a new title
[ ] have attached amendment(s)
[X] do pass
[ ] do not pass
[ ] no recommendation
[ ] individual recommendations
[ ] additional referral to the ______________ Committee

ADOPTS: ______________ letter of intent

ATTACHES NEW FISCAL NOTE(s): (Dept)
[ ] fiscal impact ________
[X] zero fiscal note Rev
[ ] zero with analysis ________

APPROVES PREVIOUS: (Date/Dept)
[ ] fiscal note(s) ________
[ ] zero fiscal note(s) ________
[ ] zero fn/analysis ________

SIGNING DO PASS:

Bruce Hanley
[illegible]
David Donley
O. J. Brooks (signature)

SIGNING: (Check approp. column)

	Do Not Pass	No Rec	Amend

O. J. Brooks (signature)
Chairman's Signature

Item 2

STATE OF ALASKA
1990 LEGISLATIVE SESSION

BILL VERSION: HB 540
PUBLISH DATE:

FISCAL NOTE

REQUEST:
Revision Date:
Title: An Act establishing Space and Science Week
Sponsor: C. Davis
Requestor: House State Affairs

Agency Affected: Department of Revenue
BRU: Alaska Science & Technology
Components:

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96
PERSONAL SERVICES	0	0	0	0	0	0
TRAVEL	0	0	0	0	0	0
CONTRACTUAL	0	0	0	0	0	0
SUPPLIES	0	0	0	0	0	0
EQUIPMENT	0	0	0	0	0	0
LANDS & STRUCTURES	0	0	0	0	0	0
GRANTS, CLAIMS	0	0	0	0	0	0
MISCELLANEOUS	0	0	0	0	0	0
TOTAL OPERATING	0	0	0	0	0	0
CAPITAL	0	0	0	0	0	0
REVENUE	0	0	0	0	0	0

FUNDING: (Thousands of Dollars)

GENERAL FUND	0	0	0	0	0	0
FEDERAL FUNDS	0	0	0	0	0	0
OTHER	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0

POSITIONS:

FULL-TIME	0	0	0	0	0	0
PART-TIME	0	0	0	0	0	0
TEMPORARY	0	0	0	0	0	0

ANALYSIS: Attach a separate page for analysis.

Prepared By: John Sibert
Phone: 272-4333
Division: Alaska Science & Technology Foundation
Date: February 23, 1990

ACKNOWLEDGED
~~Approved~~ by Commissioner: Hugh Malone
Date: 2/23/90
Agency: Department of Revenue

Distribution (by preparer):
- Legislative Finance
- Legislative Sponsor
- Requestor
- Office of Management and Budget
- Impacted Agency(ies)

Item 3

ALASKA STATE LEGISLATURE

ELECTIVE DISTRICT I
HYDER
KETCHIKAN
KUPREANOF
MEYERS CHUCK
PETERSBURG
SAXMAN
WRANGELL

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JUNEAU, AK 99811
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Representative Cheri L. Davis

February 22, 1990

Mrs. Jean Ellis
CB/ Astronaut Appearances Office
NASA - JSC
Houston, TX 77058

Dear Mrs. Ellis:

I recently met Col. Jim Adamson in Wrangell, Alaska, where he was the guest of the community during their annual "Tent City Days" Festival. I saw his slide presentation showing our earth's geography, from the point of view of the shuttle.

In a conversation with Col. Adamson later, he indicated that you work with school districts, and others, to have astronauts make appearances in schools. I was so impressed by Col. Adamson's presentation and with my conversations with him that I initiated a bill in the Alaska House of Representatives asking that our State set aside one week as Space and Science Week. My objective is to focus some attention on the sciences, in particular geography, as they relate to space travel.

I would like to know the name of someone I could communicate with in your organization to see if we could arrange visits in Alaska with a number of school districts next year. Whether or not my bill passes, I intend to follow up on this. I have already talked with a couple of teachers, one from my town of Ketchikan and the other a Juneau Middle School geography teacher, both of whom were very excited about the possibilities of this.

Thank you for your help.

Sincerely,

Cheri L. Davis

Cheri L. Davis
Alaska House of Representatives

POSITION PAPER FOR HOUSE BILL 540

I am very concerned about our national problem with the lack of knowledge about the sciences. In particular I am concerned that most of our population has little, if any, knowledge of geography. This is evidenced by the need for the recent passing of Rep. Ulmer's HJR64, which asks that Alaska be placed closer to where it geographically is.

A recent presentation by Col. Jim Adamson, one of the shuttle astronauts, gave me the idea to focus attention on the subject by using astronauts in the schools to spark students interest in geography and other sciences. Col. Adamson presented slides that he had taken from the shuttle showing such prominent features as volcanos, mountain ranges, lakes, etc., and finishing with shots of Southeast Alaska. I know students would be interested in meeting and talking to Col. Adamson or his fellow astronauts.

My intent with this bill is to focus some attention on the subject and, at the same time, I will be working with school districts and N.A.S.A. to see if we can develop a program for several Alaska schools.

Robert L. Gibson

Introduced by
Dave Haugen
Lynden, Inc.

Commander Robert L. Gibson, USN, is a NASA astronaut. He was born October 30, 1946 in Cooperstown, New York, but considers Lakewood, California his home.

He holds a bachelor of science degree in Aeronautical Engineering from California Polytechnic State University, graduating in 1969.

Gibson entered active duty with the Navy in 1969. He is a graduate of the Naval Fighter Weapons School, "Topgun." His flight experience includes over 4,000 hours in different types of civil military aircraft. He holds commercial pilot, multi-engine, and instrument ratings. Gibson has also completed over 300 carrier landings.

He was selected by NASA in January 1978, becoming an astronaut in August 1979. He flew a Challenger mission in February 1984, logging 191 hours in space. His second flight was aboard the Columbia, in January 1986 and included a night landing at Edwards Air Force Base.

A little more than a year ago, he was spacecraft commander aboard the Atlantis, a mission that carried a Department of Defense payload. All total, Gibson has completed 442 hours in space. His current assigned duties are within the Astronaut Office in support of upcoming Shuttle flights.

He is married to Dr. M. Rhea Seddon and they have two children.

what is something that we can pick out so that when we're in orbit we see something that's unusual, we shoot a photo of it and let them tell us what it all means later on.

Before I get into all of that, let me spend just a couple seconds talking about the fun part of it. Mr. Chase earlier today mentioned the fact that this is an anniversary for the roller coaster. Let me say that this trip has completely spoiled me. The trip into orbit has completely spoiled me for any roller coaster. Because this ride is by far about 3 or 4 or 10 times anything that I've ever seen on a roller coaster before.

The moment that's pictured here -- and these are a bunch of slides from the three space flights that I've been on -- is kind of a significant moment. This is where you realize that they're serious about launching you into space. And if you had any second thoughts about it, this is not the right time to say hold on a second. Right about here happens about 4 seconds later. There's not a whole lot of difference in time between those two pictures, and this is where the co-pilot looks over and says, "Whats all that noise I hear behind us." And that's about 7,000,000 lbs. of thrust that's boosting us up into orbit. The noise aspect of it is something that I have never really quite gotten use to. I think everyone of your sensors is maxed out at this point in the lift-off.

At this point here, which is about that same point, we're well over 200 miles an hour when we get that high off the launch pad. The acceleration is something that I never really appreciated from watching it from the outside, because the vehicle is so big. It looks like such a stately majestic lift-off and it looks so slow, but in fact, you are really being slapped back in the seat. We fly straight up hill for two minutes, and this point right here is where the solid rocket boosters have about burned out. You can see that by the smoke diminishing way down, and we're about to jettison the booster rockets. Notice that we've gone from liftoff to this point in 2 minutes and 5 seconds. And this point is 30 miles up and 30 miles down range, and we're going about 4500 mph. So its a pretty good acceleration in that 2 minutes. Its better than any Covette I've ever been in.

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ROBERT L. (HOOT) GIBSON
COMMANDER USN, ASTRONAUT
Speech to "MEET ALASKA" '90 Conference
Anchorage, Alaska
January 20, 1990

Let me say thank you to the Alliance for inviting me to come up here to speak to you today. This is a place I've passed about 70 times now, but I've never stopped by to say hello.

I'd like to talk today a little bit about how we study the earth; how we explore the earth from the vantage of manned space flight. And I know that the observation from space and use of sensing, remote sensing, from orbit is something that you're all very familiar with. I know that you use it to study the growth and the movement of the ice flows. I know that you use it to keep an eye on the weather, and you use it for some clues in studying geology. And, of course, those types of systems that you use are multi-spectral sensors, visible light, infra red and things of that nature.

I'm going to show you a little bit about what we do from the space shuttle using the human eye and using the sensors that we have onboard, and how it augments and assists with what we do in the way of space flight.

In the case of earth observation from space and our use of crews onboard, it's of course, sort of a piggyback mission, if you will, in that the major payload, of course, defines the mission. But once we have loaded aboard the major payload, we go from there and we structure a number of secondary payloads in, we wind up with an awful lot of time that we spend in orbit that we could devote to studying the earth and looking for different things that are of interest to a bunch of different people. And along those lines we study geology, we study oceanography, meteorology, astronomy and we study uses and utilization of earth resources. What we try to do is pick a number of particular target areas, as you will, that these people, these scientists that are involved with these things, would like to look at, and then along the way they teach us what's interesting, what's unusual, and what is something that we can pick out so that when we're in orbit we see something that's unusual, we shoot a photo of it and let them tell us what it all means later on.

Before I get into all of that, let me spend just a couple seconds talking about the fun part of it. Mr. Chase earlier today mentioned the fact that this is an anniversary for the roller coaster. Let me say that this trip has completely spoiled me. The trip into orbit has completely spoiled me for any roller coaster. Because this ride is by far about 3 or 4 or 10 times anything that I've ever seen on a roller coaster before.

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We continue up hill for another 6.5 minutes and that's where we get rid of the tank. Than engines are shut down on the orbiter at that point. We jettison the external tank, and then any maneuvering that we do on orbit, we use what we call OMS thrusters (Orbital Maneuvering System) and these are the engines that you see burning here. There's one of them burning in this picture. So we use that for all of our orbital maneuvering.

Just real quickly. The kinds of things that we do when we're up on orbit, and these are the major payloads and the major reasons for being there: one of them is deploying communication satellites, and this is a picture of a satellite that we deployed on my second flight, coming out of the cargo bay. We carry these as a contractor, if you will. We carry the satellite for a paying customer, drop it off on orbit, and then it uses its own booster motor to take it up to a geosyncronous orbit from there.

Some of the really fun things that you can do though happened on my first flight, which was where we sent two of our guys outside to do a space walk. And this is a picture of Bruce McCanlus running a test on the end of the robot arm. This is an arm built in Canada, the Canadian Remote Manipulator System. And we put Bruce in this foot platform, maneuvered him all over the cargo bay to test different work stations. But by the far the most fun that they got to do was go flying. They put on the Buck Rogers jet back-pack, if you will, the man maneuvering unit, and used it to fly away from the orbiter without being tethered to the shuttle. And as you can see, they used it to fly pretty far away from us. Bruce and Bob both flew out to about 300 feet away, the length of a football field, and equally as important to them, to fly back to the orbiter from that point. And, of course, while he was out there, he took some pictures looking back at us. And this is a few of what we looked out in Challenger about 200 miles up over the earth. I think you can probably picture - we have a pretty nice view looking out the windows of the orbiter, but the view that they have looking out below their feet and seeing the earth 200 miles below must have been pretty good.

We spend 8 days up on that first flight, and this is a picture of us as we were coming back down. We landed at, this was the first landing at Cape Canavaral in Florida on my first flight, and this is a picture of what we looked like as we went by Galveston Island. This is a picture taken from Galveston as we came across the Gulf down there in the Lower 48, and coming back into land. What this looks like from inside the cabin is pretty impressive. This is a view taken kind of early in the re-entry, and we're looking out my forward window over on the left side. This was a night time re-entry and so it should be dark as night outside, but you can see we're seeing kind of a pinkish glow, and the farther down we get the brighter this gets.

This is a little bit later and we're starting to see some flow interaction. As the flow is coming up, this is out the pilot's side of the orbiter, out the pilot's right hand window. We're seeing some flow interaction as the flow comes up over the nose and hits the flow that's coming over the right side. And you can see we're getting some pretty hot spots out the window. A little bit farther down its even brighter outside. This last picture shows its just as bright as day outside the window. You fly surrounded by this kind of fire and flame for about fifteen minutes during the course of re-entry, and it looks like you're flying inside of a blow torch. In actuality, its a lot hotter than any blow torch. The temperatures of that plasma, outside the window, are just a little bit hotter than the surface temperature of the sun. Its about 7,000 degrees _____ out the window and the surface of the sun is about 6,000. So its a little bit warm outside. Fortunately, it stays nice and cool inside. And we arrive back down in the atmosphere gliding, of course, as you'll recall we're a 100-ton glider at that point, which isn't a real great glider. So we hold the landing gear right up until the last second, cause it glides worse than pit special does when you shut the engine off, but it glides pretty poorly with the gear up, it really glides terribly with the gear down, so we hold the gear until the very last second. Drop the gear, and if the gear doesn't come down - people have asked me a lot of times, what are you going to do? I said we're going land anyway. And of course that's true. That's kind of what our system is right now. Where's it going to go from here.

I found this picture kind of interesting because this was something that was drawn or depicted maybe about 40 years ago by Willy Lay and Co., and its kind of interesting because it shows a big manned rocket that flies into space, it joins up with a big space station up there, and low and behold 40 years later that's exactly what we're talking about. We can accomplish a lot of things with the space shuttle, and this flight that just landed last night, you probably heard, achieved 11 days in orbit, which is a new record for us. We're working on a capability that the Congress has asked us to develop called extended duration orbiter, where we try to keep the orbiter up (I emphasize try) on the order of 16 to maybe even 28 days. It's going to be a real process of evolution to get it to be up that long 'cause it was designed as a delivery truck. So the real capability to get some continuity, to really be able to learn and evolve in our earth observation and in other things, is going to come to us from our space station, which we're working on now. And I'm not going to go into all of these functions, but there are a number of things that we'll do with the space station, and one of the things that we'll accomplish of course, is a lot more continuity and lot of more things that we can do with our earth observation. Its going to be a multi-national facility. We have the Europeans involved, the Japanese are getting involved, so its going to be a facility that a lot of people are going to be utilizing. And one of the things that we will be using it for, of course, will be earth observation.

Looking a little farther down the road, we may even replace our space shuttle at some point with this vehicle, which is the space plane, National Aero Space Plane, that we hope to be able to take off from a runway and launch into orbit and fly up to the space station with that, and then return and land on a runway again. This is something that we're hoping to fly before the end of this decade, and we're expecting a production decision on the first three, the X-3 National Aerospace plane in about 1993.

Well what are some of the things that we wind up doing - getting back to the real heart of this - the earth observation. The one big advantage that we have in the manned space program is that we have the human eye. The human eye can see a lot of things that we can't catch on film. The resolution in some of these very good overhead systems that we have up there, is not quite as good as we what we can capture on plain old film. And the areas in the field geology, and here's a couple of examples here of some of our geologic observations, they'll have us look for interesting things, they also have us look at areas that change real fast. This is one of those - up in the upper Andes, where they have earthquake activity, where they have wintertime activity, mudslides and things like that, some volcanic activity. They have us keep a close eye on this area because it does change its topography fairly frequently. So this is one area that we have consistently watched quite a bit.

To get an idea of the kind of scale that we can catch, this is a picture taken from outside - this is down on the Lower 48 again (I just learned that expression this weekend) - but we're looking at perhaps the kind of viewpoint that we have from orbit with cameras and film. And this is a picture we've taken, and down on the bottom corner here we're looking at San Diego, CA, and that's the arbor, Pt. Wilma, right there, so we're looking at San Diego, CA down in the bottom of the picture. And to summarize, we're looking across half the United States at one time. Because in looking at this picture, Phoenix, AZ is right here. The Great Salt Lake is this little blue spot right up here. This line of mountains right here is the Rocky Mountains, so Denver is right about there, and Colorado Springs is down right about here, and there's a little dark spot that you can just barely make out right up here and that's the black hills of South Dakota. So right on the edge of the picture is Kansas City. So we're seeing halfway across the United States with one shot. And this is one of the things that we can accomplish. We've got decent resolution down at this altitude and we can take in a fairly large area, when you look at what we're seeing here.

This was kind of a dramatic photograph, and while I'm telling you how we can accomplish such wonderful things in our earth observation, this was a photograph that we took on my second mission in 1986, and this was the first ever photograph from space of the Niger River Delta. It took us 25 years to get a photograph from space of the Niger River Delta. Why is that? That's because those pesky clouds keep getting in our way. The meteorologists, of course, don't like us to say things like that, because the only thing worth studying from orbit is clouds and meteorology to them, but nevertheless, over all those years, clouds and weather conditions have prevented us from ever getting a photo of the Niger River Delta. And if you look at the Niger River on maps, you'll see a whole bunch of white areas that say relief lines are not available in this area. So this is one of the things that we use our photography from space to accomplish.

Speaking of those clouds - one of the other things that we do of course, we photograph any of the major storms, this one being a major summer storm, obviously a hurricane. This is Hurricane Delaphena which we shot off the coast of Australia on my second flight. It turns out that photography is really about the only good way you can study the eyewall of a hurricane and study the eyewall characteristics. The DMSP satellites, the GO satellites, really won't get you the granulary, they can't get the detail, whereas when we pass over these things 200 miles up, we can shoot right down into the eye and get the vertical structure of the eyewall. And in that way, we can help them, the meteorologists, calibrate what they're seeing on the DMSP satellites, and calibrate what they're getting out of their other data, the GO satellite, and try to understand what they are seeing. And this is probably where one of our major contributions is in the way of manned space flight, is helping to look at the overhead sensors that we have up all the time and get a better idea of what a multi-spectral sensor is telling us.

During my last flight which was aboard Atlantis, I was on a 57 degree orbit, so that's when I passed by here about 70 times, and we had a chance to study, which we don't study very often because we aren't usually that far north. We had a chance to study the major winter storms, and you're very familiar with those. I guess I lucked out by not being here last year, cause I missed one of those apparently, but this is a shot that we took off the Aleutians in December of 88 of a rather larger winter storm brewing.

Its been in the area of oceanography, however, that we have really come up with the most surprises from manned space, and we have been able to see things in the ocean that none of the sensors had ever predicted or had ever had an inkling of. And of the biggest features that we use on the ocean to be able to see things that are going on is the sun glint, where the sun is reflecting off the surface of the ocean. It lets us see a lot things. It lets us see texture, it lets us see underwater features, and lets us see things that, like I say, none of the other sensors had expected. When you look at this picture, down in this area here. We're seeing some large linear features. Well surfs up, because those are waves in the water, and if you can see a wave from orbit, that's got to be a pretty big wave, and these are pretty big waves. These waves are 50 to 100 feet high. Well these aren't waves that you'd see on the surface of the ocean though. These are underwater waves. These are what are known as internal waves. We can't feel them if we're out on a ship going along through the ocean, but they tell me that other things can feel them. They tell me that drilling platforms out there in the water can feel these underwater waves. These particular ones were named V-Brand waves for Vance Brand, who was my commander on my first shuttle flight, because he's the first one to capture these things, and this was in the Endomen Sea as I recall, and we went on to catch some other pictures, and here's some more photos showing just a whole slew of internal waves out there again in the Endomen Sea. And you can see they are pretty prevalent. All over the place here, up in that area. So all of a sudden we're seeing all kinds of features in the ocean that oceanographers never suspected were there, and they're just too big to see. You get down to close to them and you can't see them happening. You have to back off far enough to where you can really see them going on.

Here's kind of an interesting picture. I guess you all know about tides up in this area, but this is a tidal feature. This is the Straits of Gibralter. And again we're using the sun glint to let us see some things going on. We look at a bunch of waves up in this area and you can just make out a circular feature up here. This is the flow of the tide into the Mediterranean. And again we're able to pick it out by using the sun glint reflecting off the surface to see it happen.

The real · dramatic thing - and this is kind of a boring looking photo - but this is a really dramatic photo to oceanographers, because all of a sudden, when we started bringing back this data from flights, we were seeing these circular features out in the ocean. We seeing things called spiral eddys, and the oceanographers had never seen these before on any of the satellite data. They're too big to show up in photography from airplanes like that. There are on the order of about 20 miles across, so there are features that just didn't show up from down here on the surface, and yet when you take the total amount of energy that we are suddenly finding in these spiral eddys, Its caused the oceanographers to have to completely revise their theories of what the total energy level is that's in the oceans. Because the spiral eddys and the amount of energy that's wrapped up in those about quadrupled the amount of total energy that they calculate that the ocean possesses. So this was a rather dramatic find. And once we started looking for these things - as you can see in this picture - we see them everywhere. Sometimes they're caused by flow and of course that's something that we're used to in aeronautical engineering or mechanical engineering with fluids, we'll see eddys form around corners. And that's what we're seeing here. We're seeing a large eddy formed out here off the Straits of Warmuse, I guess this group is pretty familiar with some of that area, but this is a large circular eddy being formed out here. But there is another interesting thing showing up in this picture - and that's a ship wake. We can see a ship sitting right here. You can just make a little V-shape Kelvin wake of a little ship sitting right down there. This isn't a real dramatic picture of a ship wake because they show up quite well from orbit.

There are a lot of people find it kind of interesting how well we can spot ships from orbit, and when you find them, you'll generally see a wake out behind the ship that's about 150, 180 miles long. Now it isn't a white water foamy type wake that we see out behind them. Its the Kelvin wake, the 15 degree wake that extends out behind them, and it disappears if you're on the ship and you really can't see it very far behind you. We can see them from orbit out a 150-180 miles. Well the Navy finds it real interesting that he's just told us everywhere he's been for the last 10 hours. If you take the normal speed of advance of a ship out on the ocean, we know everywhere he's been for quite awhile. They find that kind of interesting.

Here's the, I think this is the last oceanography picture, but this is kind of an interesting photo. This again shows a couple of these significant features. Here's an eddy, a not very well-defined eddy up here, but here's a horizontal shear in the ocean. We can see this wake from a ship coming from the bottom of the picture and then its being cut by this horizontal shear in the ocean. Well there's a lot of people find that's kind of interesting. Submarines find any kind of shears in the ocean very interesting, because they can use them to hide in. They can hide in spiral eddys, they can hide on the other side of a shear, any kind of a discontinuity in the ocean is very interesting to the Navy. There's a couple of other interesting things here: there's another ship wake sitting out here. This is in the Mediterranean as I recall. There's another ship wake down here, a pretty long wake. These two people seem to be following about the same sort of general path, but this guys wake doesn't seem to show up very well. It certainly doesn't show up as well as this guy's wake. And there is a good reason for that. This bad boy here has been dumping his bilge. That shows up real clearly when we look at the sun glint and when we look at pictures from orbit. And this one, he's not doing a lot of dumping, just enough to alter his wake. When they really dump, you can really spot it from orbit. I know none of the American ships are doing that, but we need to keep an eye on all those other guys.

One of the other things that we have watched from orbit and I guess its probably of interest to you up in this area, is getting some small scale pictures of the aurora, and this is a picture of the Northern Lights taken from orbit. Its kind of interesting cause we looked down on the Northern Lights. We look down on meteorites and we look down on the Northern Lights, and I had a chance to see those on my third flight for the first time, and its really fascinating and interesting to get to watch that. And as you recall, its just a portion of a circle. This was a picture taken from way up high. And that's what the aurora looks from a satellite that's out a couple thousand miles.

I mentioned the other big area that we can study, is we can study earth resources, land use practices, and that sort of thing. And this is a picture that kind of illustrates how well we can watch what's going on in the rivers, what's coming down the rivers. This, of course, being the Mississippi River Delta. We can take these images and our scientists and people back in Houston, can take these images and digitize them and really measure what the area of the delta is and estimate how much water is coming down, how much silt is coming down the delta. We also can use information like this to forecast what we see going on and what the prospects look like in a number of the developing countries where we can't get in and get ground truth data. This is a picture taken of Mt. Kilimenjaro, looking straight down on it. And its just to illustrate the cutting down of the forest that we see going on. And of course this is happening, as I'm sure you're aware, on a very large scale down in Brazil and in a couple of other areas across the world. But you can see down here how the forests are being trimmed back along the slopes of Mt. Kilimenjaro, and its these hard wood plantations of trees that are being harvested and turned into charcoal that we see an awful lot of in Africa. Of course the very large scale resettlement projects that we're continuing monitoring in Brazil, when we can get through.

There are sometimes such large clouds of smoke over the Amazon Basin, that we're not able to get any photographs of it because of how much of the land is being cut and burned in that area.

Another area that we're keeping an eye on is Madagascar and in that area there is an awful lot of the slash and burn economy going on. And we don't even have to look at the area where its all being done. We can look at the harbors and river mouths. And this is a picture of the Betsy Bocca River in Madagascar, and of course we talked about the Red Dog mine earlier. This isn't the same phenomena. The red coloring that we see coming down the water is the silt from mountainous areas that have been cleared of trees and the rainfalls come down and it washes away all the topsoil. The topsoil is coming down in such droves, that its filling in the harbor in the Betsy Bocca River. They've had to try and dredge out some areas for ships to get through. There are going to be some major changes in Madagascar based on the slash and burn economy that's going on in that area. So we're keeping an eye on that.

This was kind of an interesting photo. One of the other places that we were studying water usage - this is a picture that we took on my third flight over the Soviet Union. This is the Aerol Sea, and that's an area where the water is being pumped off at a tremendous rate for irrigation, so we have watched the size of this lake decreasing. And this is the shoreline, and this peninsula used to be an island, is about to be turned into a large peninsula by the amount of water that's being dredged off. This isn't a very good picture of the Aerol Sea, but I threw it in because down in the bottom of the picture is where the Soviets launch their space shuttles from.

The Soviet space launch center, the _________, is near the town of Ti_____ and that's right down here. There's a little industrial area that I can just barely make out. This was in December of '88, so the sun was kind of low this far north, but this industrial area that's right down here is where the Soviets have their launch pads and launch all their manned space flights from.

A couple more pictures referring to water use. And again, one of the things we have watched over the last 6-8 years has been the very critical process going on in Africa in the _________, with the drought that was occurring there. This was taken from my first flight in February, 1984, and it's Lake Chad, which is in Chad, and you can see in this picture the lake used to be pretty big and the extent of the lake where it used to be is referenced by that outer dark line. The present boundaries of the lake in 1984 is the lighter blue color and you can see its about 1/5 of its former size. This was about the height of the drought and this was about the lowest that the lake got. Two years later, after they had a little bit of a recovery, we took this picture from Columbia on my second mission, and to reference the two, the lake portion with these little islands is what's seen on this picture. We've zoomed in on the lake a little bit and you can see out in these areas. The lake has really expanded quite a bit. It doesn't really show off that its expanded a lot, but its filled out a lot of the water out among those sand dunes and out in the areas out there where the lake has filled in and really increased the amount of water that's there. They went on to recover quite a bit more since '86 when this was taken. But, again, its one of the areas we have been keeping an eye on.

And I've got just a couple of pretty pictures. One of the other things that we can accomplish very nicely from orbit is taking pretty photos. And this is one taken up in the right part of the world, this is up 57 degrees north off the east coast of the U.S., this is what Greenland looks like from orbit. I had never been that far north before and it was kind of reassuring to see that it really looks like what it is drawn like on the maps. Its all white and looks just like its supposed to.

Here's the last picture I was going to show. This is the really significant part of the world. This is right at the very center of the universe. You'll probably recognize again, those pesky clouds are kind of getting in our way, but this is one the pictures I took as I went by 70 times a little bit over a year ago, and what we're seeing: here's Cook Inlet, here's the Kenai Peninsula, this would be Kodiak Island, Anchorage is sitting somewhere about right in here. I was hoping to get a better look at it when I flew in yesterday, but you had clouds in the way for me, so this is even a better picture than I could have arrived with yesterday.

Let me say in summary, that there are a number of things that we can do in studying the earth from orbit. I wish that I could say that everyday we discover oil from orbit and obviously we can't do that. I don't think we even get very close to it. The type of scales that we deal with in the world of geology and so on is going to kind of limit what we can accomplish. We serve probably as more of a calibration, like I mentioned, for the other satellites that we have up for the remote sensing things that, again, don't use film and don't use direct view, but are digital images, and therefore give us some of the limitations.

Space station will really enhance our capabilities.