Prepared Statement on "Mir Safety"Prepared Statement on "Mir Safety"
U.S. House of Representatives, Committee on Science
September 18, 1997
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Background:

It's an honor to be invited to testify today on an issue which has long concerned me, the proper assessment of the degree of safety of American astronauts aboard Mir. Thank you for this opportunity.

I am testifying here today purely as an individual, representing no corporation or agency or organization of any kind. But I'm not starting from scratch: I am a professional space engineer with a lifelong interest in the Russian space program, about which I have written and spoken for a quarter century. In my eight books, numerous encyclopedia entries, and over a thousand articles I have literally more than a million words in print about space exploration. They include a long list of successful assessments, prognostications, and "reality checks" of the Russian space program.

SUMMARY:

Context of the Recent Mir Mishaps: Recent problems aboard Mir, and the growing risk of being there, are predictable consequences of known, measurable. The decay of government support for space activities has forced what's left of their infrastructure to stretch scarce resources, use up reserves, drop levels of redundancy, push hardware well beyond planned lifetimes, and other practices which have had predictable impacts on flight success and safety. The crash last June of a Progress freighter into Mir was NOT "just one of those things" that could have happened at any time. Instead, it was a consequence of risks forced upon the Russians by the desperate need to replace formerly reliable guidance hardware no longer available due to the loss of the supplier. And the two men -- one Russian and one American -- who recently went outside the Mir to inspect for damage were further endangered by inadequate Russian space communications that forced them to prepare and perform the strenuous space walk in the middle of what was normally their sleep period, thus violating spaceflight standards to avoid carrying out hazardous operations while in esssence "jet lagged". Even top Russian space experts attribute recent mishaps on Mir to the overall decline of the Russian space industry. Some people claim that future Russian space safety can somehow be proven by past Soviet space glories, as if there was a purely numerical cause-and-effect. But the true causes of past space successes can easily be measured, and the recent decay of these very same factors does not augur well for future reliability.

Are Mishaps "Normal"? The mishaps now plaguing the Russian space program have been excused as only being typical of any bold space exploration, but this is not true. Russia's problems come not from trying NEW projects, but from simply struggling to stay afloat performing hitherto routine operations. They are not

the kinds of setbacks to be anticipated on a forward-moving space program, they are the problems to be expected in a space program in retreat.

Lessons From Mir Mishaps & Other Russian Experience: If the US were really interested in "learning lessons" from Russian space experience, somebody would find ways to effectively utilize the NASA astronauts who have already returned from Mir, and place them into rewarding positions of authority or influence, instead of seeing them one after another rush to quit the American space program. And somebody would be aggressively digging into other experiences aboard Russian space stations over the past two decades, interviewing cosmonauts and retired Russian space workers. But there appears to be no serious effort to do this, so the "We're learning important lessons" claim looks like only a rationalization to tolerate failure and danger.

Is Mir "Safe"? From a purely engineering standpoint, there is no justification to make such an assertion. This is because the familiar process of ground-up safety assessment, which has worked well in the past, has never been applied to this question. In order to prove objectively that something is safe, it is not enough to challenge others to "prove it's NOT safe" while then withholding information pertinent to the issue, and then to triumphantly conclude that the absence of proof of danger is equivalent to proof of the presence of safety. Instead, we are seeing claims of "safety" based on getting away -- so far -- with taking risks. But "dodging bullets" can lead to the delusion that one is bullet proof, even though it's more like "Russian roulette". In any case, ever-present risk on space endeavors must be balanced against expected gain. What benefit will accrue from exposure to these dangers? Simply glorifying such risk-taking as a measure of our courage becomes only an excuse for recklessness.

Can the Mir Crew Really Bail Out? It's been comforting to think that no matter what happens on Mir, the crew "can always escape" in the attached Soyuz landing capsule. But the most recent manned Soyuz landing suffered a major malfunction that could have seriously injured an American riding in it during an evacuation. Until the cause of this alarming incident is known, and until it has been verified that there is no commonality with the Soyuz currently docked to Mir, it is not warrented to claim that the Soyuz is "safe" for an American to land in during an emergency. And without a guaranteed safe escape vehicle, it is not provably "safe" for an American to be aboard Mir.

What Are the US Options? If it has not been objectively proved that leaving an American on Mir is safe, then it would be irresponsible to send him based only on wishes and guesses, however sincere and "gung-ho" they may be. Instead, work by a genuinely independent Mir safety review panel (perhaps from the NTSB, DOE, or DOD) is long overdue. Recent events on Mir have apparently caught existing review teams by surprise. Thus, putting such an ad hoc "Blue Ribbon Panel" together makes so much more sense BEFORE an accident rather than after one, and it's vital to do so. By early next year, their results could become available. As for leaving another American on Mir, the answer next year may turn out to be "Yes". But as for today, the rational answer must be "No".

## DISCUSSION

Context of the Recent Mir Mishaps:

The painful transition from Soviet society toward a more open, democratic, and free-market Russia has cost the Russian space industry dearly, both in absolute

terms of money and manpower, and in political terms of fragmenting the former industrial base into various independent countries. This in turn has forced what's left of their space industry to stretch scarce resources, use up reserves, drop levels of redundancy, push hardware well beyond planned lifetimes, and other practices which have had predictable impacts on flight success and safety.

Two recent examples will illustrate both this effect, and the apparent unwillingness of the US to recognize it.

When the Progress freighter smashed into the Mir station last June, precipitating the crisis from which they only now have begun to recover from, it was stated in the US that the accident "had nothing to do with the age of the Mir" and "could have happened on the first day of Mir's mission" (in 1986). This view totally overlooked the reason which made the docking test necessary in the first place: Russian space infrastructure collapse demanded that a replacement be found for guidance hardware no longer available from the Ukrainian factory which used to make it. The accident would have been inconceivable ten years ago because the robust Soviet space program devoted many times as much money and manpower to space as it does today. The accident -- and others like it, which haven't happened yet -- became much more likely under current conditions.

When the Mir crew went outside to inspect the Spektr module for punctures recently, they began the space walk already endangered by a scheduling constraint which forced them to prepare and perform the space walk during their normal sleep period -- in other words, they had to undertake a strenuous and dangerous activity while jet-lagged. This was because the Russians could not depend on the robust network of relay satellites which they had once deployed, but instead they had to wait for the time of day when the Mir was flying across the ground tracking sites inside Russia -- and this happened to begin not during the normal workday, but during the time they should have been sleeping. This violates scheduling standards for both programs, but was made necessary by inadequate communications capabilities. Fortunately, there were no serious consequences of this hazardous gamble, or of the bizarre command from Yeltsin that the crew be awakened in the middle of their abbreviated sleep period in order to take part in a live concert celebrating Moscow's 850th birthday.

Cosmonaut Vasiliy Tsibliyev, Mir commander during the serious recent troubles, had soon after landing said this: "All this happens because of the economic difficulties. Even when you ask them to send something of vital importance for the station, and we are not talking about coffee, tea, or let us say, milk, they cannot do this simply because they do not have it on Earth. Plants are standing idle, or suffering from not receiving sufficient supplies or are asking exorbitant prices. Therefore a lot of things are still missing on the station."

Viktor Blagov of Moscow Mission Control said recently, "All these malfunctions can be traced to the years when the industry has had absolutely no money, and we have had to find ways to survive using spare parts and old techniques." Earlier, he had reportedly explained Mir's computer breakdowns to a Reuters reporter as follows: "Due to financing problems, we have to use them till they die.... We are saving a lot of money on this scheme, but we really have to decide soon whether we need safety or money-saving."

In opposition, one often hears litanies of past Soviet space glories as somehow assuring current and future reliability. But that's as if those successes of the past didn't spring from an infrastructure, a budget, and political support that are now only distant memories. Claims that future Russian space safety can

somehow be proven by past Soviet space glories, as if there was a purely numerical cause-and-effect, miss the point entirely. The true causes of past space successes can easily be measured, and the recent decay of these very same factors does not augur well for future reliability -- as even Russian space officials, in moments of candor, admit.

No discussion of the current social context for Russian space activities would be complete without consideration of the growing evidence of large-scale corruption and graft within the Russian space industry. This is an issue which hundreds of American space workers in Russia have directly encountered, as massive amounts of Western money leaves the Russian space program as bankrupt as ever, while top officials build themselves half-million-dollar brick mansions on salaries of a thousand dollars a month at the same time that ordinary workers are underpaid, often months late.

## Are Mishaps "Normal"?

It has sometimes been claimed that the mishaps on Mir are "normal" for a space station, and that Americans had better get used to even worse mishaps aboard the future International Space Station. In this view, failures and breakdowns are an unavoidable part of space exploration and it's unfair to pick on recent Russian experience. Further, it is argued, it is unworthy of a great nation to shrink from danger in the pursuit of a good cause.

Yet there seems to be something qualitatively different about the mishaps now plaguing the Russian space program. True, a space program without mishaps and setbacks is probably one that's not sufficiently bold or ambitious -- and when our reach exceeds our grasp, such as on the Hubble Telescope, or the Tethered Satellite System, or even the better-cheaper-faster "Lewis" satellite, it's the price we pay for breaking new ground.

In contrast, Russia's problems come not from trying NEW projects (the last time they did, the Mars-96 probe last November, was a disaster), but from simply struggling to stay afloat performing hitherto routine operations, ones that used to be easy for them. Besides the Mir problems, another good example is the back-to-back Soyuz booster failure a year ago, followed by additional Soyuz booster breakdowns on launch pads last winter.

These mishaps are not the price of progress (there is none), nor are they simply "bad luck" (as sympathetic newspaper headlines label it). They are predictable consequences of measurable causes within the Russian space infrastructure, from its decaying hardware to its aging personnel to its fitful financing. They are not the kinds of setbacks to be anticipated on a forward-moving space program, they are the problems to be expected in a space program in retreat.

## Lessons From Mir Mishaps & Other Russian Experience:

"We've learned so much from these breakdowns" is a common chant. True or not, this sort of claim has been a self-serving exculpatory mantra for bunglers throughout the history of engineering. This time the truth of the claim can be subjected to rigorous verification. How much has been learned, and is exposing Americans to Mir the best way to go about learning from Russian space experience?

Some lessons, surely, have been learned for the ISS, although how much was due

to the American presence on Mir, and how much merely to normal reconsiderations over time, is hard to measure. The number of official "Design Changes" to ISS that were solely based on the Mir experience can be documented, and perhaps this committee should request a report on this.

Meanwhile, if the US were really interested in "learning lessons" from Russian space experience, there would also be at least two other activities that are still totally absent. First, somebody would find ways to effectively utilize the NASA astronauts who have already returned from Mir, supposedly with crucial insights, and place them into rewarding positions of authority or influence -- instead of seeing them one after another rush to quit the American space program. And somebody would be aggressively digging into other experiences aboard Russian space stations over the past two decades, interviewing cosmonauts and retired Russian space workers.

A great deal of information on Russian flight safety has long been available to independent investigators, but current US policy does not seem to know how to obtain it or utilize it. For example, in late 1994, I -- as an independent outsider -- tried to interest somebody in information that I had obtained about fire incidents aboard Soviet space stations, including Mir. My sources included both recent Moscow press accounts and private one-on-one interviews with Russians as well as other non-U.S. citizens who had been exposed to Soviet space activities.

There was no apparent interest in this information. It turned out that the Russians had recently delivered an official hazard assessment that included the assertion that there had never, ever been any fires aboard Russian manned space vehicles -- patently false when compared to available first-person accounts.

Even when news leaked out -- no thanks to Russian or American space officials -- about an October 1994 fire on Mir caused by an oxygen 'candle', the US side evidently believed that the Russians had told them all that was needed to be known about the subject and that further knowledge -- especially from private sources -- was not wanted. It was an oxygen candle, recall, that also caused the near-catastrophic fire in February 1997, that caught so many official experts by surprise.

Mission Creep on Mir:

One unadvertised lesson of the Mir visits has to do with a process that's been called "mission creep" (or maybe "commitment creep", an unexpected expansion of promises and duties) and what it does to expected costs. The US started out the Shuttle-Mir program as a paying customer, just like all previous non-Russian users of the space station. The US agreed to provide specified monetary payments and services, and in return the Russians agreed to provide specified facilities and support. This Shuttle-Mir program was to be practice for the next step, the genuine partnership -- as spelled out explicitly in inter-goverment agreements -- for the International Space Station.

But what happened was not predicted: caught up in enthusiasm, US officials began treating the Mir arrangement as a full "partnership" with the Russians, with many formerly unspecified obligations suddenly laid upon the US side and with many formal requirements removed from the Russian side. At US expense, radio relay equipment was set up and operated at NASA centers, to replace collapsed Russian space communications capabilities. At US expense, Russian crewmembers began flying on shuttle visits to Mir, with no normal quid-pro-quo from the

Russian side. At the expense of planned American scientific research, equipment was dumped off one shuttle flight after another in order to make room for last-minute Russian repair tools and emergency supplies. Finally the US even dumped one fully trained US crewmember because -- suddenly -- the US was no longer using the Mir for what it was paying for, but now had wound up committed to its upkeep. Thus the relationship turned out to be more costly and less valuable than originally planned.

## Is Mir "Safe"?

In any case, the calculation of a risk/return ratio needs to be made in a dispassionate and quantified manner. After two years of US visits, repeated flights add little marginal gain, especially as the original research programs continue to be cut. And there is no longer any dispute that the risk -- by any measure -- is rising. Somewhere there will be a crossover point where it's no longer justified to keep an American on the Mir.

So, what about all these claims that "Mir is safe"? From a purely engineering standpoint, nobody has any rational justification to make such an assertion. This is because the familiar process of ground-up safety assessment, which has worked well enough in the aerospace community in the past, has never been applied to this question. In documents released by NASA Headquarters, there are case-by-case reactions to safety issues that have already happened, but nowhere are there assessments of lurking future dangers and their statistical likelihood.

My own concerns for issues such as the over-age Mir Base Block's propulsion system (and its explosive potential), or general hull pressure integrity in the face of cumulative weakening from corrosion and metal fatigue (leading to sudden pressure loss), are not mentioned -- nor were any of the other problems which actually did occur in the following months (such as collision, or computer failure).

Some people seem to have gotten it backwards. In order to prove something is safe, it is not enough to challenge others to "prove it's NOT safe" while then -- as in this case -- withholding information pertinent to the issue, and then to triumphantly conclude that the absence of proof of danger is equivalent to proof of the presence of safety. Sherlock Holmes said it well: "Absence of evidence is not evidence of absence," at least of danger.

Instead of a proper, traditional safety review, we are seeing claims of "safety" based on getting away -- so far -- with taking risks (both known and unknown). But "dodging bullets" can lead to the delusion that one is bullet proof, even though it's more like "Russian roulette".
And as we found out, 24 successful shuttle launches with inadequate safety standards did not mean that the 25th had to work too. It was STS 51-L, the last flight of 'Challenger', and months later Richard Feynman summed it up that you might be able to fool yourself, but you couldn't fool Mother Nature. Many people perceive distressing parallels between the those pre-Challenger attitudes and today's.

## Can the Mir Crew Really Bail Out?

In all the assurances of safety, one common theme is that no matter what happens on Mir, the crew "can always escape" in the attached Soyuz landing capsule. But

even that comfort has been demolished by the little-known incident on August 14 when the last Soyuz returned to Earth with the two Russian cosmonauts, and during landing, suffered a major malfunction.

The soft landing rockets failed and the capsule impacted the ground very, very hard (the last known time this happened, in 1980, the crew took a momentary 30-G force). According to the Russian commander, it could have been a very bad day for anyone sitting in the right seat, which happened to take the brunt of the damage. But fortunately there was only freight strapped there, not an evacuated American astronaut.

This incident is doubly disturbing because the failed vehicle was not an over-aged Mir component, but a newly manufactured Soyuz. Until the cause of this alarming incident is known, and until it has been verified that there is no commonality with the Soyuz currently docked to Mir, it is not warrented to claim that the Soyuz is "safe" for an American to land in during an emergency. And without a guaranteed safe escape vehicle, it is not provably "safe" for an American to be aboard Mir.

What Are the US Options?

So what now? The first step is to avoid the "launch rush" to STS-86, now scheduled for September 25, one week from today. Launch schedules must support program objectives, not the other way around. If the mission of STS-86 needs to be re-assessed, then it can be put off. The Russians are planning their own supply ship launch early in October, it can carry any time critical supplies. Then STS-86 could go up almost as planned, to retrieve the American there now and leave the promised Russian supplies -- just leave the next-in-line American Mir visitor back on Earth for the time being. Or bring up another Russian repairman to leave aboard.

If it becomes clear that the safety of the American on Mir has not been proved to be safe, then it would be irresponsible to send him based only on wishes and guesses, however sincere and "gung-ho" they may be.

Instead, work by a genuinely independent Mir safety review panel is long overdue. It should not be difficult to use some existing NTSB, DOE, or DOD panel, with a track record better than those of previous teams that have tried -- and clearly failed -- to reliably foresee Mir reliability. Putting a "Blue Ribbon Panel" together for this subject makes so much more sense BEFORE an accident rather than after one.

Six months from now, the question of leaving Americans aboard Mir can be raised again. If the repairs to the Mir systems have proven their efficacy, and if redundancy has been restored to all life support systems, and if nothing else major has broken down, and if the Soyuz landing accident investigation results are credible and supportive, the time may well come to consider renewed long term American visits.

By then we'll also be able to add back the most promising scientific experiments, which have now been scrapped because of the greater need to help the Russians bail their leaky space boat. By then, also, we should have the results from the independent Mir safety review panel -- if they truly received adequate Russian engineering data to assess expected reliability of all Mir systems, even those which haven't failed yet.

Do we leave another American aboard Mir? The answer next year may turn out to be "Yes". But as for today, the answer must be "No".

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Profile, James E. Oberg

James Oberg, 52, is "by day" a senior space engineer in Houston, where he specializes in NASA Mission Control operations for orbital rendezvous as an employee of the "United Space Alliance" (formerly the Rockwell Space Operations Company), the leading NASA contractor for manned spaceflight operations. He has worked at the Johnson Space Center in Houston since 1975. In support of NASA's spaceflight operations he has written several books on Rendezvous Flight Procedures and on the history of orbital rendezvous. In honor of his pioneering work on developing and documenting these space shuttle rendezvous techniques, he was selected by the NASA-Area Association of Technical Societies as their 1984 "Technical Person of the Year".

However, when writing and speaking in public about non-duty related topics such as the Russian space program, his opinions and ideas are entirely his own and do not represent those of NASA, "United Space Alliance", or any other government, corporate, or private organization.

He is a widely-published author on the past, present, and future of space operations around the world (and off it), and has written eight books and a thousand magazine articles. Among these books are: Red Star in Orbit, universally considered the best inside portrait of the history of Soviet space activities through 1981; New Earths, the world's first non-fiction treatment of the futuristic topic of "terraforming" or "planetary engineering"; Pioneering Space (with his wife as co-author), a broad and insightful view of the human side of the spaceflight experience; and Uncovering Soviet Disasters, an analysis of secrecy and technological shortcomings in the former USSR which received wide praise around the world and even in post-glasnost Moscow.

Additionally, he is a leading world specialist on Russian aerospace topics. He is conversant in Russian & French, maintains strong personal ties with officials in the Russian and European space programs, and was recently named to the newly-formed "Russian Academy of Cosmonautics", the first foreign member. He travels to Russia regularly and has several times been to the once super-secret Baykonur Cosmodrome in Kazakstan. He provides expert assessment and forecasts of Russian space technology elements relevant to U.S. programs.

Mr. Oberg is a regular commentator on space topics for the national news media, and appears on "Nightline" and other news programs (he is an ABC-TV consultant and commentator on Russian space topics). In early 1991 he was featured on a PBS NOVA mini-series devoted to new revelations about the history of the Russian cosmonaut program. He was consultant and catalog contributor to auctions of Russian space memorabilia held by Sotheby's in NY.

A native of New York City and a Phi Beta Kappa graduate of Ohio Wesleyan University and Northwestern University, he lives on a 10 hectare ranch in rural Galveston County, Texas, with his wife Alcestis ("Cooky"), their two sons Greg (now at Texas A&M) and John, and a collection of cats, dogs, and horses.

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In accordance with the contents of Mr. Sensenbrenner's letter to me of Sep 11, I am providing you the following information.

I will be pleased to appear before your committee on September 18 and will travel to Washington DC at my own expense to do so.

I have prepared a brief opening statement which is attached, along with a profile.

Regarding revelations of federal government funding which directly supports the subject matter on which I am appearing, I have in the past two fiscal years been involved in only one relevant activity. Early in 1997 I was a consultant to Science Applications International in New york on a study for the safety office of NASA's Johnson Space Center, regarding documented flight safety related incidents for the Soyuz landing capsule. On March 19th I invoiced SAIC for $5100 per our agreed rate package and was paid soon thereafter. The information which I would provide to your committee would be information which I obtained entirely from my own sources, some of which was delivered to SAIC; I could not provide any information obtained from SAIC or NASA.

I am a full-time employee of the United Space Alliance (jointly owned by Boeing and Lockheed-Martin), the contractor which operates the Space Shuttle for NASA. However, my official tasks are in the area of orbital mechanics and flight operations, and explicitly exclude any privately-learned aspects of the Russian space program. So, since the Russian space program is not within the scope of my assigned duties, USA has acknowledged it has no responsibility for, or interest in, anything I say on this subject.

James E. Oberg