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NASA Headquarters
Office of the Administrator
Mr. Sean O'Keefe

Subject: Space Shuttle Safety Question

Sir,

At the AIAA Space 2000 conference, I asked NASA Administrator Dan Goldin, "If Space Shuttle safety is NASA's number one priority, why isn't a crew escape module(s) NASA's number one Shuttle upgrade?" His reply that it was too large of a weight penalty, was not correct. He had been misinformed by Shuttle management. It is not a weight or technical problem. It was a NASA political decision not to replace the weight of the piloting functions with the weight of an crew escape module.

At the May 2002 Senate, Technology, and Space Subcommittee, You testified that for Shuttle, "there is no higher requirement than safety." With the shuttle fleet again being grounded, my question to you is, "If Space Shuttle safety is NASA's number one priority, why isn't a crew escape module(s) NASA's number one Shuttle upgrade?"

I strongly recommend that you ask the new NASA Chief Engineer, Mr. Theron M. Bradley and Gen. Michael C. Kostelnik to investigate and advise you on this critical issue!

Don A. Nelson

Don A. Nelson
Retired NASA engineer

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PAGE.001

Space Shuttle Safety Moratorium

Questions and Answers from the Aerospace Community

Don A. Nelson is a retired NASA engineer that has been advocating that the Space Shuttle is unsafe for manned flights. He believes that crew escape modules are a mandatory upgrade for the flight system. Past NASA studies have indicated that these modules are too heavy and costly to fly on shuttle vehicles. Mr. Nelson disagrees with that conclusion. The following questions and answers are explanation's for the necessity of a safety moratorium.

Q. Why did you ask for a moratorium that limits the crew to four? If the system is unsafe, why not shut it down?

A. Complete shutdown of the system is certainly an option that should be considered. However, the space shuttle is still an experimental launch vehicle. Ever flight provides knowledge to the reusable flight vehicle data base. Unfortunately, NASA management has let conjecture cloud their judgment and the vehicle is being flown as if it were certified by the FAA. Unfortunately, the upgrade program to improve flight safety is in shambles. What this moratorium would do is kick-start the upgrade process. It would get it focused on the most critical issue and that's providing an effective crew escape system. To do anything less condemns some future crew to the same fate as that of the Challenger's crew!

Q. Why limit the crew to four.

A. The primary reason is that it will save at least three lives and reduce the time to evacuate the cabin in event of an emergency. With a crew of four, the pilots would be required to support the payload activities. This means that fewer pilots fly more missions. Flying more in order to remain proficient at piloting and have the time to train for payload support. It forces the shuttle and station project offices to consider automation and turn more in-flight control activities over to the ground controllers. Also with less people to train the operations cost goes down. Money and resources would be saved which could be applied to the upgrade program.

Q. Wouldn't the crew limit have an adverse effect on the space station?

A. No, just the opposite. The objective of the space station is to be a research facility, not a space hotel. There are already too many people on the station. The more people you have, the more cost you have, the more problems you have. Like the space shuttle, the station has too many hands-on operations. Automation is not a dirty word. The station should be operated as a manned tended facility. The only need for human long term occupancy is when they are a subject of the research.

Q. Why do you disagree with NASA's conclusion that crew escape modules cannot be incorporated on the Shuttle?

A. At the AIAA Space 2000 conference, I asked then NASA Administrator Dan Goldin, "~~If Space Shuttle safety is NASA's number one priority, why isn't a crew escape module(s) NASA's number one Shuttle upgrade?~~" His reply was that it would cause an "unacceptable weight penalty of 7500 pounds." Another part of the problem is that the weight increase for putting a crew escape module or individual modules in the Orbiter flight deck moves the vehicle center of gravity (c.g.) to an unstable aerodynamic position. Putting ballast in the aft to move the c.g. back only increases the weight problem. Therefore, the only solution is that weight must be removed from the flight deck area to install the crew modules. The only significant weight in this area that is not absolutely required for flight operations is the piloting function. If the piloting function is removed approximately 4000 pounds of weight margin is then available for the escape modules.

Q. Wouldn't removing the pilots from the Shuttle operations be another safety issue?

A. Actually it would be a safety improvement. Human error is a major concern, especially during the launch phase. The level of reliability and redundancy of automated flight systems has increased significantly since the initial Shuttle design. A sobering example of this is the recent airliners collision over Switzerland. The automated system made the correct decision which was tragically over-ridden by a ground controller's fatal error. Even NASA's own design specifications for new launch systems eliminates the requirement for piloting. This is more of an emotional issue than a technical issue. The moratorium is an attempt to get past the emotions and political aspects and back to engineering.

Q. This has got to be a big ticket item. Do you have some idea what it might cost?

A. It is a big ticket item. A preliminary study estimated the cost to be \$5.4 billion. However this was a total Shuttle upgrade package. It included the cost of airframe, avionics, and ground facilities upgrades. The total upgrade would replace the \$20 billion plus Space Launch Initiative program. Just adopting an avionics/crew modules only upgrade for automated operations was estimated to be \$1.5 billion. NASA management has already wasted more funding than this on their futile Space Launch Initiatives program.

Q. With NASA's current budget problems, isn't this an impossible goal for the near term?

A. In round numbers each Shuttle flight now costs half a billion dollars. By automating, over \$200 million per launch can be saved by the reduction in flight and ground operations. Also the flight rate can be significantly increased by automated post and preflight operations. Flying only a minimum of four flights per year saves \$800 million per year. The real question is, can NASA and the government afford not to make this upgrade to the flight system?

Q. Isn't it more important that NASA put its funding on the critical system problems, like the hydrogen bed liner?

A. Upgrading of the Shuttle must be a package deal. From 1994 to the year 2000 NASA has spent \$4.9 billion on a hodge-podge of Shuttle upgrades. After all these upgrades the catastrophic expected failure is a dismal 1 in 500 flights. By their most optimistic estimate the failure will still be 1 in 1000 after spending billions more on proposed hodge-podge upgrades. Launch vehicle systems reliability is not at a development level for airline type operations. If NASA proceeds with their piecemeal upgrade philosophy, we can be assured there will be another Challenger type disaster!

Q. You have been proposing a crew escape module(s) and automated shuttle flight system for some time. Why do you think it hasn't been adopted?

A. There are two reasons. Credibility is one reason. It is hard for anyone to believe that if anything could be done to improve flight safety, NASA wouldn't do it. But I don't think many people are aware that NASA has

changed. For example, Shuttle engineering management has been generally replaced by former flight controllers and astronauts. While these managers were highly qualified in their previous assignment, they generally lack the engineering background to evaluate and manage an advanced integrated development project. Again, the dismal upgrade efforts, are evidence of a lack of management skills.

Q. And the other reason?

A. NASA management has failed to provide a feasible and realistic strategic plan that gives a long range overview of how the development of the space transportation system will proceed. The mismanaged X-33/VentureStar program was dead before it started and even now management is wavering on the direction of the once again revised Space Launch Initiative. Without an achievable vision of the future, the 17,000 or so Shuttle people are very protective of their jobs. So when Shuttle changes are proposed that would reduce manpower requirement... out come the "marching armies" of Shuttle supporters with their prediction of safety problems if their jobs are eliminated. Automating the Shuttle operation eliminates those jobs.

Q. And the solution is?

A. Automate the Shuttle operations and turn the flight operations over to a contractor operator. Then proceed with the next step in the development of space transportation... the development of a space based upper stage. A space based upper stage would be a very exciting project. It's the logical step for the development for a space based lunar/Mars transfer vehicle. That's where the people supporting the Shuttle operation should be working. Their future is in the payload bay of the automated Shuttle. Their future should be in space research.

Q. Before, your moratorium letter, have you ever approached the NASA Aerospace Safety Advisory Panel about the crew module?

A. Yes, I tried to get two different panels to request an *independent* study on the feasibility of a crew escape module and automated space shuttle flight system. Neither panel replied to my request. However, the 2000 Annual Report states that a crew escape system will provide the largest potential improvement in crew safety and the time is past due for implementation. The 2001 Annual Report made no reference to the need for a crew module.

Q. Are you optimistic about getting the safety panel to support the moratorium?

A. No I'm not... It's been my observation that the panel has been very timid and ineffective. For example, after months of my prodding one panel that the X-33 had serious safety problems, NASA assigned one safety monitor. That's like the FAA certifying that the Boeing 777 was safe for flight on the word of one inspector. The panel lacks the ability to conduct independent investigations and replies on what NASA tells them. Even NASA's safety offices are uncoordinated and ineffective.

Q. If this is the case, why bother with the moratorium?

A. I'm attempting to get support from the aerospace community and the government. I've sent requests to aerospace organizations, congressional committees, and the President, asking that they make a public statement on the moratorium. I plan to post their replies on my webpage.

Q. Why are you going to all this effort?

A. Because I believe that in the not too distant future there will be another Shuttle disaster. I want to be able to tell myself I did all I could to save that crew...

Additional information can be found at

<http://www.nasaproblems.com>

RECEIVED SEP 06 2002

August 25, 2002

173

Office of Science and Technology Policy
Executive Office of the President

Director, John H. Marburger III, Ph.D.

Subject: Executive Order for a Moratorium on Space Shuttle Flight

Dr. Marburger:

It is requested that this moratorium on space shuttle flight be reviewed by your office. Please forward the enclosed letter to the President and the recommendations of your office to the President as soon as possible.

Supporting documents to assist your analyses are enclosed in this communication.

A handwritten signature in black ink that reads "Don A. Nelson". The signature is written in a cursive style with a long, sweeping underline.

Don A. Nelson
Retired NASA Aerospace Engineer

August 25, 2002

Office of the President of the United States

Mr. George W. Bush

Subject: Executive Order for a Moratorium on Space Shuttle Flight

Mr. President,

I am a recently retired NASA aerospace engineer and it is my duty to inform you that our space shuttle astronauts are in eminent danger. Your intervention is required to prevent another catastrophic space shuttle accident. NASA management and the Aerospace Safety Advisory Panel have failed to respond to the growing warning signs of another shuttle accident. Since 1999 the launch system has experienced the following potential disastrous occurrences:

July 1999 - Space Shuttle Columbia delayed by hydrogen leak.

December 1999 - Space Shuttle Discovery was grounded with damaged wiring, contaminated engine, dented fuel line, and paper work errors.

January 2000 - Space Shuttle Endeavor is delayed because of wiring and computer failures.

March 2000 - Space Shuttle Atlantis main engine must be replaced because of paperwork errors.

August 2000 - Inspection of Space Shuttle Columbia reveals 3,500 defects in wiring. Wiring defects plague entire fleet.

October 2000 - The 100th flight of the space shuttle was delayed because of a misplaced safety pin and concerns with the external tank.

April 2001 - NASA failed to keep adequate watch on safety operations of a major contractor.

July 2002 - The inspector general reports that space shuttle safety program not properly managed.

April 2002 - Hydrogen leak forces scrub of the Atlantis flight.

August 2002 - Shuttle launch system grounded after fuel line cracks are discovered in all the fleet!

Mr. President, as you are painfully aware NASA management has been lacking for a number of years. Unfortunately, your new NASA Administrator has failed to recognize the eminent space shuttle danger and has accepted the consul of the pre-existing NASA shuttle management. These managers still pursue a management philosophy that has stagnated the safety upgrades

efforts and perpetuates the staggering launch costs.

The space shuttle or any space transportation vehicle without crew escape modules will never be safe to transport humans. To incorporate crew escape modules in the space shuttle requires that the piloting function be removed from the vehicle. Unfortunately, the background of the shuttle management is that of former flight controllers and astronauts. They have been trained to never trust automated flight control systems. Therefore, they are adamantly opposed to automation of the space shuttle. Efforts by NASA engineers and contractors to automate the shuttles are met with stern rebukes and reprimands in some cases.

~~Mr. President, to prevent another shuttle disaster it is requested that an~~ Executive Order be issued that places a moratorium on space shuttle operations. This moratorium must limit shuttle missions to flight crews that do not exceed four members. The moratorium must remain in effect until crew escape modules can be incorporated.

This moratorium will serve as a catalyst to kick-start the resisting NASA management into action. The lives of our astronauts and the future of our space program must not be ignored. The warning from the Thiokol engineer was ignored and the Challenger exploded. The terrorist training warning from FBI agents was ignored and we had the 9-11 disaster. When the next shuttle explodes...and Murphy's Law says it will, we can exclaim with pride a loud "YES!" as the crew escape module carries our astronauts to safety... or if this moratorium is ignored...we can watch in horror and shame as the astronauts face certain death.

A handwritten signature in black ink that reads "Don A. Nelson". The signature is written in a cursive, flowing style with a long horizontal flourish at the end.

Don A. Nelson
Retired NASA Aerospace Engineer

Fax to: Dr. Charles F. Kennel, Chair NASA Advisory Council

Subject: NASA Operations Directives for the 21st Century

Dr. Kennel,

The proposed "NASA Directives" that have been sent to you by the NAC Secretariat are the first step in correcting NASA's many management problems. These directives will be opposed by many, who view them as a threat to the agency. However, the real threat is by not taking the corrective actions that NASA management has ignored. A grave example is the following ignored memo:

September 28, 2000

*Fred Gregory
NASA Headquarters
Office of Safety & Mission Assurance*

Fred,

This reply is the information you requested on my challenge to the Administrator at the ALAA Space 2000 conference. His answer to my question, "Why isn't a crew escape module(s) NASA's number one Shuttle upgrade?", indicates that he has been misinformed. A large payload penalty is not the reason for not installing a crew escape module(s). Even if it was a payload penalty, installing an escape system would still be a mandatory requirement.

The critical issue in installing a crew escape system is that the weight of the system moves the center of gravity of the vehicle (c.g.) to a position where the vehicle becomes aerodynamically unstable. Every 100 pounds added to the flight deck moves the c.g. forward 0.4 inches. This situation can only be solved by removing any flight deck component that is not a mandatory flight requirement. The only significant weight components that are not mandatory are those supporting the piloting function. Automated flight control systems and backup ground monitoring have made the requirement for on-board piloting obsolete. Removing the obsolete non-mandatory piloting components (commander and pilot weight, their seats, forward flight deck display and control systems, escape pole, forward windows, etc.) will provide enough c.g. margin to install four one-person escape modules on the flight deck. When required, additional astronauts can be carried in an escape module placed in the payload bay. This additional weight would be charged to the payload margin. Automated launch vehicle flight systems are not new technology. Automated ascent flight is a standard procedure for all expendable launch vehicles. The Russian Buran

Shuttle test flight was flown without a crew. The X-33 project should provide a state of the art automated flight control and vehicle health monitoring system configuration. The X-38 is being designed for automated flight. The X-40 recently demonstrated a GPS guidance landing to within inches of the runway center line. Automated flight control systems are proven technology.

Shuttle management has steadfastly opposed automating Shuttle flight operations. They have even prevented the testing of the Shuttle auto-land capability. Now they are preventing a crew escape system from being installed by enforcing their opposition to automated flight operations. The \$2.1 billion provided by Congress for Shuttle Safety upgrades is more than sufficient to automate the launch, entry, and landing phases of flight and provide the mandatory crew escape module(s).

Automate Shuttle flight operations will dramatically reduce the manpower and funding required to support missions. Just deleting the training aircraft and piloting training simulators will be an enormous savings. The reduced operation cost has the potential of making the Shuttle a commercial competitor to the Ariane 5. However, Shuttle automation can be viewed as a threat to the "marching army" of work forces now required to operate the Space Shuttle system. As I told the Administrator at the conference, "The reason NASA's is not installing a crew escape module is political." It is certainty not technical. The fate of some future Shuttle crew is now in his hands!

*Don A. Nelson
Retired NASA Aerospace Engineer*

*Many of my colleagues believe it will take another Shuttle disaster to turn NASA around. Others believe the "NASA Directives" that the NAC is being asked to approve will be the mechanism to avoid another tragic event. **The fate of the NASA program and that of some future Shuttle crew is now in the hands of the NAC.***

Don A. Nelson

NO REPLY 11/11

February 11, 2002

To: Richard D. Blomberg

Chairman, NASA Aerospace Safety Advisory Panel

Subject: Space Shuttle Crew Escape Module(s) Study

I am a retired NASA aerospace engineer, who was a member of the flight design and mission control team for the Challenger 51L mission. I will never forget the forty-five minute wait after the Challenger exploded... the time we had to standby to allow the debris to impact before a search and rescue effort could be started. We all knew this would be a hopeless effort, because the crew didn't have an escape system.

~~We had convince ourselves that the Shuttle was so safe that the crew didn't need an escape system.~~ We were wrong. However, today that position is still the policy of the Shuttle management... and they are still wrong! Today, we have the technology to incorporate a crew escape module(s), in the Shuttle. However, in my professional opinion the only reason there is not a crew escape system is internal NASA politics... it's certainly not technical!

My efforts to have an "independent" comprehensive study conduct on the escape system have been met with strong opposition because the concept requires deleting the piloting function. Piloting is not a required operation to safely operate the Shuttle... but it is a very emotional issue.

Emotions must not be allowed to put our astronauts and our national space program in harms way. With the appointment of Mr. Sean O'Keefe as the new NASA administrator comes the opportunity to correct this dire situation. Therefore, I am requesting the Aerospace Safety Advisory Panel to request the NASA Administrator to conduct an "independent" study on the feasibility of a crew escape module(s) for an automated space shuttle flight system.

Every year we wait ... another group of astronauts are exposed to a deadly fate that they shouldn't have to face... Please help prevent another space tragedy!

For supporting information see: <http://www.nasaproblems.com>

Don A. Nelson
Retired NASA Aerospace Engineer

REPLY!!!

July 31, 2002

To: Ms. Shirley C. McCarty
Chair, NASA Aerospace Safety Advisory Panel

Subject: Space Shuttle Safety Moratorium

Today, once again the Shuttle launch system has been grounded. In the last three years a host of potential catastrophic failures (wiring, hydrogen leaks, paperwork snafus, etc.) have been discovered. Unfortunately, NASA's effort to upgrade the shuttle launch system has been ineffective and misguided. Unfortunately, the safety findings and recommendations of the panel have, in effect been ignored.

It is time for the panel to take decisive action. It is time for the panel to insist for a moratorium that limits the flight crew to four. This moratorium must be binding until a crew escape module can be incorporated.

I ask each member of the panel to give a public reply as to their position on this flight safety moratorium.

Don A. Nelson

Don A. Nelson
Retired NASA Aerospace Engineer

PS: Addition information can be obtained at the following webpage: <http://www.nasaproblems.com>

21 No REPLY 6/16

Associate Administrator of Space Flight

Comments:

The current Space Shuttle is safe for human operations.

Reply: False, the launch system is currently grounded! The space shuttle is still an experimental launch system, operating with a fatal flaw...operating without crew escape modules. It is the only launch system that does... even the Russian Buran space shuttle had a crew escape system.

These studies have always shown that modifying the orbiters to include a crew escape module would provide an increase in the probability of crew survival in the event of a catastrophic event.

Reply: True, the probability of a crew member failure to survive would be 1 in 30,000.

Such a design would decrease available crew volume and adversely impact on orbit operational capabilities.

Reply: False, removing the piloting systems provides adequate space on the flight deck for the escape modules. Removing the piloting systems provides the weight margin for the crew escape modules. Removing the piloting systems requires a change in NASA's antiquated flight operations philosophies and this is the real issue. Will it require another shuttle disaster to get NASA's flight operations into the 21st century?

The crew's ability to evacuate the vehicle while on the launch pad would be degraded due to the entire crew having to be accommodated on the flight deck.

Reply: False, The entire crew of four can be accommodated on the flight deck and the crew escape modules provide the greatest opportunity of survival. With the crew escape module the crew can be evacuated by crew modules ejection in milliseconds instead of the 15 minutes required to get the tower walkway platform back in position.

The activation system has to provide sufficient time to escape a catastrophic event, but cannot produce "false positive" indications that would destroy the vehicle unnecessarily.

Reply: False positives indications are and will, always be a concern. However, state of the art automated flight control systems have significantly reduced the possibility of such an occurrence. The over-riding concern is that a ground flight controller or pilot astronaut will take too long to identify the problem or mis-identify it. Again, will it require another shuttle disaster to get NASA's flight operations into the 21st century?

Don A. Nelson

