National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001

March 5, 2002

Reply to Attn of: Q-1

Memorandum for the Record

Pursuant to the provisions of the Federal Advisory Committee Act (Public Law 92-463, October 6, 1972) and NASA Policy Directive 1150.21, entitled "Establishment, Operation and Duration of NASA Advisory Committees," the enclosed minutes of the Aerospace Safety Advisory Panel's open meeting conducted on March 1, 2002, at NASA Headquarters are submitted for the record.

David M. Lengyel
Executive Director
Aerospace Safety Advisory Panel

Richard D. Blomberg
Chair
Aerospace Safety Advisory Panel

4 Enclosures:
1. Meeting Minutes
2. Attendance Log
3. ASAP's Response to Dr. Greenfield
4. July 16, 2001, Tasking Letter from Mr. Gregory

Aerospace Safety Advisory Panel (ASAP)
Open-FACA Telecon Between the Acting Associate Administrator (AA) for Safety and Mission Assurance and the Aerospace Technology Team
March 1, 2002
NASA Headquarters
Room 5W63

Mr. Blomberg: Mr. Blomberg discussed the original Code Q/Office of Safety and Mission Assurance tasking (see Enclosure 4). He stated that the Panel discovered variability in the aviation safety programs across the Code R centers. A common thread in the mishaps last year appears to be that management personnel were looking outside of their basic areas of responsibility because of external distractions. They were distracted by budget exercises, strategic resources reviews, etc. and this caused them to lose focus on internal operations. This was coupled with a desire and eagerness to please their customer(s). The wind tunnel mishap at the Langley Research Center (LaRC) is a perfect example of well-meaning people doing inappropriate things. The lesson learned is that the distractions mentioned above tend to undermine day-to-day safety activities. There was no evidence, however, that management was ignoring safety and demanding employees to do too much with too little resources.

Mr. Schaufele: Agreed with Mr. Blomberg's comments and stated that many operations that were treated as routine and ordinary, when combined with a loss of vigilance, allowed mishaps to happen.

Mr. Blomberg: The Lear Model 24 mishap was an example of a lack of discipline from the bottom up as well as a lack of good management discipline to ensure that flight crews were not doing something unsafe. This problem would have likely been caught had it gone through the same review process as the Space Shuttle.

Mr. Francis: Did not agree with the assumption that the Lear mishap was only a bottom up failure. This was an organizational accident where a pilot was allowed to be placed in a situation that he should not have been in. In other words, this is a top down problem where the safety part of the program was not being managed.

Mr. Gutierrez: Stated that the Aviation Safety Officer (ASO) performance report should be written, in part, by the Center Director. NASA Headquarters needs to tell Center Directors that this is the way it should be done and that it took an accident at the Dryden Flight Research Center (DFRC) to prove it. The Johnson Space Center (JSC) has a related problem in that the previous Center Director (Mr. George Abbey) had an open door policy with the ASO but no input on his performance report. There was a tendency for the formal relationship to be personality driven versus organizationally driven.

CDR Kilrain: The ASO at JSC reports to the Flight Crew Operations Directorate (FCOD) and not to air operations, which works well. This puts them one level above the other Centers. His/her performance report is written by FCOD. At the HQ level, we need to work on a better reporting system for near misses and close calls. We tend to meet a lot of resistance from the NASA Centers. HQ cannot perform trend analysis without this data.

Mr. Francis: Commercial aviation went through this years ago and no one at the airlines wanted to go along. It required regulatory action on the part of the Federal Aviation Administration to make it happen. Mr. Francis agreed to work with CDR Kilrain on examining NASA's safety reporting systems vis-à-vis airline reporting systems.

Dr. Greenfield: We have different organization structures at different centers and there is a lack of pilots at the smaller Centers to be heads of aviation safety. Before Mr. Gregory left for the Office of Space Flight, he organized an Aviation Safety Board (ASB) because he was concerned with the same issues that the Panel was warning the agency about. I have since asked Dr. Horowitz, my acting deputy, to look into this matter. I think our air worthiness reviews are good but the current organization structure is not "optically" satisfying or effective. We also need to look at the role of the Office of Management Systems (Code J) in this. The agency ASO is in this organization and we question whether this is the best organization structure from a Headquarters (HQ) perspective. We have an Aviation Safety Assurance Officer in the Office of Safety and Mission Assurance/Code Q who is supposed to provide the HQ aviation safety leadership role.

Mr. Blomberg: The Center Directors can only obtain insight into various flight operations programs if the ASO reports to them. What bothers me is that a Center Director can go for perhaps twelve months or more without even seeing the ASO. The bottom line from our task is that it is a "good news/bad news" story. The Panel did not see any overt evidence of a wanton disregard for safety. There were, however, gross breakdowns in safety processes and the centers now realize that. Remedial actions have been put in place but they are not necessarily coordinated across centers. With regards to ASOs and Center Director relationships, I think it is a classic case of putting trust in a specific individual. There is currently no organization structure that will guarantee safety and that is a worry.

Dr. Greenfield: Dr. Greenfield thanked the Panel for their report and suggested that the ASAP examine NASA's full aviation safety organization structure as it relates to aircraft accident reporting.

Mr. Blomberg: Agreed to do this task and then adjourned the meeting.

The meeting was adjourned with actions to Messrs. Francis and Gutierrez to modify/add to the attached letter/report from the Panel to the AA for Safety and Mission Assurance.

Enclosure 2

Attendance Log

Mr. Richard Blomberg, ASAP (via Telecon)
Ms. Faith Chandler, Code QE
Mr. Robert Francis, ASAP
Dr. Michael Greenfield, ASAP
Mr. Sidney Gutierrez, ASAP (via Telecon
Mr. Jay Henn, Code RS
CDR Susan Kilrain, Code QS
Mr. David Lengyel, ASAP
Mr. Karl Loutinsky, Code RP
Mr. Roger Schaufele, ASAP (via Telecon)

National Aeronautics and
Space Administration

Headquarters
Washington, DC 20546-0001

March 8, 2002

Reply to Attn of: Q-1

Dr. Michael A. Greenfield
Acting Associate Administrator for
Safety and Mission Assurance
NASA Headquarters
National Aeronautics and Space Administration
Washington, DC 20546

Dear Dr. Greenfield:

On July 16, 2001, Mr. Gregory issued a letter to me as Chair of NASA's Aerospace Safety Advisory Panel (ASAP) noting that NASA's organizations responsible for research and development of aerospace technology had experienced an unusually high incidence of costly mishaps. The letter requested that ASAP gather information for a study of organizational and operational factors that might identify environments conducive to spawning future accidents. This letter presents the results of the resulting ASAP study.

Study Approach

The study task was undertaken by the existing ASAP Aerospace Technology Team led by Mr. Roger Schaufele. This group was already well familiar with NASA's aerospace technology activities. The Team gathered information related to five recent incidents during the course of their normal fact-finding visits to the Code R Centers. Additionally, reports issued by the formal Mishap Investigation Boards (MIB's) appointed to investigate these incidents were reviewed. It was reasoned that a focus on the root causes of these incidents coupled with discussions with personnel at the Dryden Flight Research Center (DFRC), Ames Research Center, Langley Research Center (LaRC), and Glenn Research Center would highlight any systemic problems. By following this approach, the Team drew attention to those organizational and operational factors that, if not corrected, might lead to future mishaps.

The balance of this letter first briefly describes and comments on each of the studied incidents and then presents a discussion of specific causal factors.

The Studied Mishaps

F-15 Inlet Model Failure in the LaRC 16 Foot Transonic Wind Tunnel - A full scale F-15 inlet model equipped with Shape Memory Alloy (SMA) actuators devices was being tested at transonic speeds. The primary purpose of the test was to show that the SMA actuators could change the inlet model cowl and lip angles at Mach numbers and dynamic pressures representative of full-scale conditions. During a scheduled change in inlet cowl angle, with the inlet model producing loads on the wind tunnel sting near the sting rolling moment limit, the inlet cowl rapidly moved past the desired setting. The resulting aerodynamic loads on the model caused the sting to fail and the inlet model to separate from the sting. The model was completely destroyed and the tunnel suffered major damage.

The primary purpose of this test--to demonstrate that SMA actuator devices have the ability to change the shape of a full-scale inlet duct for a supersonic aircraft at dynamic pressures and Mach numbers representative of full scale operating conditions—was reasonable. The mounting of the inlet model in the tunnel made use of existing hard points on the inlet structure, which over the range of test conditions resulted in rolling moments near the established rolling moment limit for the sting. An earlier test of this model over a range of tunnel and model operating parameters established a set of limits based on measured loads for which the rolling moments were within the limit for the sting. These parameter limits, which included a maximum test Mach number of 0.75, were still in place for this test. However, the test sponsor requested an increase in the test Mach number to 0.80, which was approved by the NASA Facility Safety Head, provided the loads were closely monitored. This action, taken without any study, analysis, or risk assessment, was clearly not consistent with sound operational safety procedures. The MIB did find that this action was one of three "Root Causes" of the mishap.

NASA 805 Learjet 24B Landing Mishap - NASA 805 sustained substantial damage in a landing mishap at the Southern California Air Logistics Base (formerly George Air Force Base (AFB)). The aircraft was executing a planned "touch and go" landing on a proficiency flight from Edwards AFB with a pilot, copilot, and observer on board. No one was injured, but the aircraft was damaged beyond repair.

As determined by the MIB for this mishap, the direct causes of this incident were over control of the aircraft by the copilot (pilot flying) leading to an aggravated roll oscillation, hard landing, loss of control, and subsequent impact, and the failure of the pilot in command (pilot not flying) to recognize the deteriorating situation in time to recover the aircraft. Significant contributing factors were the copilot's limited total piloting experience, particularly in high performance jet aircraft, and a pilot in command who was not current in the aircraft and who had relatively little time in type. There also was no apparent need for carrying a casual observer on board who may have served as a distraction.

We believe that this is a classic example of an "organizational" accident. While the direct and contributory causes are accurate, the fact that the crew was permitted to fly the aircraft given their lack of experience and currency is an institutional responsibility. We also are unclear as to what role overall agency policies and practices emanating from headquarters may have

played a role in establishing an environment conducive to this accident. We have therefore planned, in the near future, to examine the NASA Headquarters organizational structure to determine if aviation safety agency-wide can be more effective with the aviation safety responsibility falling under Safety and Mission Assurance (Code Q) rather than under Management Systems (Code J).

Additionally, it has been noted that there is not a useful means agency-wide to track aircraft close calls and incidents. Mishaps can be prevented by tracking such events. There is a NASA requirement to enter these events into the Lessons Learned Information System database. However, this is not being done. The ASAP will be looking further into this in the future.

NASA X-43 Hyper-X Vehicle Launch Failure near DFRC – The first NASA X-43 Hyper-X research vehicle Pegasus booster suffered an in-flight breakup after launch from the DFRC B-52. Shortly after booster ignition the booster right fin suffered a structural failure and broke off, followed almost immediately by structural failure of the left fin and rudder. With the booster out of control, the booster main wing broke off. The booster flight termination system was successfully initiated, but the X-43 vehicle was lost.

The MIB report on this mishap has not been issued as yet, but it has been established that the initial failures took place in the Pegasus booster used to accelerate the X-43A vehicle to the desired test conditions. It has also been determined that legacy software models were used to characterize the dynamics of the vehicle and that these models were inadequate to characterize a Pegasus/X-43 combination.

ER-2 Engine Intake Cover Ingestion – During preflight of an ER-2, the ground crew failed to remove the left intake cover. The engine ingested part of the cover as the pilot ran it up for takeoff. The resulting damage was extensive and forced replacement of the engine.

The removal of the cover was the responsibility of a contractor-supplied ground crewmember who was subsequently discovered to be experiencing personal problems.

ER-2 Upper Q-Bay Hatch Departure in Flight – The ground crew for the flight failed to properly secure the upper hatch. As a result, the hatch departed in flight and struck the right engine inlet lip causing damage. The aircraft landed safely, but the hatch, latch mechanism, and affected inlet lip had to be replaced.

It was discovered that the same ground technician responsible for failing to remove the inlet cover was also the one who improperly secured the Q-Bay hatch. He was subsequently dismissed.

Discussion and Conclusions

In order to respond most directly to Mr. Gregory's letter, this section will be structured around the eight causal factors listed in his letter requesting this study.

Executive and Management Involvement in Achieving Safe Operations – As with any management function, the extent of direct involvement of NASA senior managers in the safety process is variable. Some become directly involved on essentially a day-to-day basis. Others delegate the line safety authority to subordinates. In any event, however, the ultimate accountability remains with senior management. To insure that this is understood by all, the Aviation Safety Officer should have a direct report line to the center director. The test of the existence of this line lies in the performance review process for the aviation safety officer. If the center director participates directly in this review, then a true line exists. Anything less is an indication that the line between the center director and the aviation safety officer cannot be relied on to be effective. The ASAP has made this recommendation in its annual reports and to multiple centers. In general, it has meet with resistance from senior management and has not been implemented. Only after the Lear accident was it implemented at Dryden. We believe it should be implemented NASA wide.

It is also important to note that in spite of this organizational shortcoming, all evidence points to a sincere safety concern on the part of senior management. Our Team did feel, however, that the daunting management tasks facing NASA executives arising from arbitrary budget cuts and external (to their projects) technical directives were potentially distracting and could lead to inadvertent management lapses with respect to safety.

The Cultural Value of the Leaders and Workforce Towards Safe Operations – In spite of obvious performance and judgmental lapses, the ASAP Team is confident that NASA and contractor leaders and workforce understand the importance of safety and assign it appropriately high values. The various incidents reviewed apparently arose from unusual circumstances or competing needs and not from a disregard for the importance of safety.

Workforce and Operations Discipline – The absence of appropriate discipline and adherence to basic, sound principles of operations was a clear, common factor in the studied incidents. The ASAP Team believes that these slips were not the result of a cavalier attitude towards safety. Rather, they appear to be at least partially an outgrowth of a pervasive "can-do" culture within NASA. There is a reluctance to shed or delay tasks even when budgets have been cut below the levels necessary to maintain them safely. Also, the desire to please "customers," as in the wind tunnel incident, can apparently lead to poor engineering judgment that can be detrimental to safety.

Line Supervisory Involvement in Safety – As mentioned above, there is no evidence that line supervisors are disregarding safety. However, under the prevailing operating conditions, safety can be compromised due to competing needs. Most of the incidents studied involved the failure of the involved line supervisors to intervene in the accident/incident generation process. It is believed this was not the result of a lack of appreciation of the need for safety but, rather, distractions and/or operating environments that elevated other needs above considerations of safety.

Operations Tempo/Scheduling – Our Team did not believe that tempo was a major causal factor in the incidents although eagerness to complete planned tasks was clearly involved in

several of them. The scheduled activities were all reasonable if they had been properly planned and executed.

Aircrew/Operator Workloading, Training, and Currency – Although this factor was clearly causal in the Lear accident, our Team does not believe it is a major root cause issue. In that specific case, operational discipline broke down and permitted an unacceptable crew situation. If cutbacks continue, workload, training, and currency can become a major issue. Our Team is, however, convinced that NASA management and supervisors are aware of this potential risk and will be vigilant to detect it before it becomes a safety problem.

Facilities/Equipment Maintenance Status – Maintenance status was not determined to be a contributing factor to the incidents. On the contrary, the ASAP Team found that aerospace technology aircraft and ground facilities appeared well maintained.

Other Significant Aviation and Operations Program Elements – The discussions of our Team with managers and staff at the various aerospace technology centers uncovered a significant outward focus. Reporting and supervisory demands from NASA Headquarters as well as changes in program emphasis distract managers from their project activities. This, in turn, has the potential to undermine their safety efforts. Managerial introspection on potentially hazardous projects is necessary for safe operations. When managers must spend a large proportion of their time preparing alternative program plans and delivering status reports in Washington, they can lose touch with day-to-day safety activities. Also, when values such as customer satisfaction are made paramount goals by NASA management, efforts to achieve them can become pervasive and therefore be detrimental to safety. For example, in the case of the F-15 inlet test it was clear that there was insufficient understanding on the part of NASA's wind tunnel operations personnel with respect to potential consequences of last-minute, on the spot changes in the agreed-to test plan. Rather than demand a complete review and analysis of the factors involved in testing outside of the previously defined limits, the desire to please the test sponsor ("customer") resulted in acceding to an unwise test condition.

Summary

The ASAP Team believes that the various mishaps were largely the result of a loss of focus rather than misdirected intent. The involved managers, from the most senior levels down to the line, have undergone a period of introspection and have initiated reasonable corrective actions. However, the problem of distractions due to budget and priority shifts is likely to continue. Over time, these demands on managers to focus excessively on issues outside the day-to-day operation of their projects retain the potential to once again erode safety. Safe operations require the appropriate involvement of center directors, NASA and contractor program and project managers, and the entire workforce. When competing demands on their time force these individuals to be less than totally engaged in the safety process, risk will inevitably increase.

Although this completes the specific task requested by Mr. Gregory, the ASAP Aerospace Technology Team will continue to examine these issues as part of its normal activities in the future.

Sincerely,

Richard D. Blomberg

Richard D. Blomberg
Chair
Aerospace Safety Advisory Panel

Enclosure 4

National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001

Reply to Attn of: QS

JUL 16 2001

Mr. Richard Blomberg
President
Dunlap and Associates, Inc.
110 Lenox Avenue
Stamford, CT 06906-2300

Dear Mr. Blomberg:

NASA's organizations responsible for research and development of aerospace technology have had an unusually high incidence of costly mishaps. These mishaps have included both ground as well as flight events. Over the course of this year's ASAP normal fact-finding visits, I would like the Panel to gather information for a separate study of organizational and operational factors that might identify environments conducive to spawning future mishaps.

For this tasking, please focus your attention on the Enterprise Office of Aerospace Technology and the following Centers:

- Dryden Flight Research Center
- Ames Research Center
- Langley Research Center
- Glenn Research Center

I would like the Panel to give particular attention to several postulated or actual causal factors identified in recent ground and aircraft mishaps. These factors include, but are not be limited to:

- Executive and management involvement in achieving safe operations
- The cultural value of the leaders and workforce towards safe operations
- Workforce and operations discipline
- Line supervisory involvement in safety
- Operations tempo/scheduling
- Aircrew/Operator
  - workloading
  - training and currency
- Facilities/equipment maintenance status
- Other significant aviation and operations safety program elements

I would like the Aviation Safety Officer from my organization, Commander Susan Kilrain, to accompany your Aerospace Technology Team during these upcoming Center visits. She, in conjunction with Ms. Richardson, my Enterprise Point of Contact for Safety and Mission Assurance, will provide the Panel, via the Executive Director, a copy of any associated mishap investigation reports, along with any other pertinent information required to prepare for these site visits.

I plan to attend the Panel's plenary session at NASA Headquarters in the November 2001 timeframe. We will set aside some time for a discussion of the findings of the Panel regarding the above topics.

I would also appreciate it if the ASAP would provide me a report on this effort before the end of the calendar year. Thank you for your assistance.

Sincerely,

Frederick D. Gregory
Associate Administrator for
Safety and Mission Assurance

cc:
AI/Dr. Mulville
Q-1/Mr. Lengyel
QE/Dr. Rutledge
Ms. Richardson
QS/Mr. Lloyd
Commander Kilrain
R/Mr. Venneri