STATEMENT OF

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BEFORE THE

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Mr. Chairman and members of this committee, thank you for giving me the opportunity to testify today on the subject of the culture of safety that has allowed Naval Reactors to be successful for the last 55 years.

But first, let me say that that I wish the circumstances that brought me here were different. Obviously, the underlying reason I'm here involves your oversight of NASA in the aftermath of the space shuttle *Columbia* tragedy. I want to begin, then, by extending my sympathy to all the families, colleagues, and friends of the *Columbia* crew. I must also tell you that although there has been and continues to be much public discussion of the tragedy—why it happened, what changes NASA should pursue, and others—I do not know first-hand the details surrounding the accident, nor am I an expert on spacecraft or the NASA organization. I therefore am not qualified to make judgments about the causes of the tragedy or to suggest changes that NASA may implement to prevent our Nation from suffering another terrible loss. However, having studied the final report of the *Columbia* Accident Investigation Board, I believe you may draw some useful conclusions from my testimony.

My area of expertise is the Naval Reactors Program (NR), so it's better for me to talk about that. Admiral Hyman G. Rickover set up NR in 1948 to develop nuclear propulsion for naval warships. Nuclear propulsion is vital to the Navy today for the reasons Admiral Rickover envisioned 55 years ago: it gives our warships high speed, virtually unlimited endurance, worldwide mobility, and unmatched operational flexibility. When applied to our submarines, nuclear propulsion also enables the persistent stealth that allows these warships to operate undetected for long periods in hostile waters, exercising their full range of capabilities.

In 1982, after almost 34 years as the Director of Naval Reactors, Admiral Rickover retired. Recognizing the importance of preserving the authority and responsibilities Admiral Rickover had established, President Reagan signed Executive Order 12344. The provisions of the executive order were later set forth in Public Laws 98-525 [1984] and 106-65 [1999]. The executive order and laws require that the Director, Naval Reactors, hold positions of decision-making authority within both the Navy and the Department of Energy (DOE). Because continuity and stature are

vital, the director has the rank of four-star admiral within the Navy and Deputy Administrator within the Department of Energy's National Nuclear Security Administration and a tenure of 8 years.

Through the Executive Order and these laws, the director has responsibility for all aspects of naval nuclear propulsion, specifically:

- Direct supervision of our single-purpose DOE laboratories, the Expended Core Facility, and our training reactors.

- Research, development, design, acquisition, procurement, specification, construction, inspection, installation, certification, testing, overhaul, refueling, operating practices and procedures, maintenance, supply support, and ultimate disposition of naval nuclear propulsion plants and components, plus any related special maintenance and service facilities.

- Training (including that which is conducted at the DOE training reactors), assistance and concurrence in the selection, training, qualification, and assignment of personnel reporting to the director and of personnel who supervise, operate, or maintain naval nuclear propulsion plants.

- Administration of the Naval Nuclear Propulsion Program, including oversight of Program support in areas such as security, nuclear safeguards and transportation, public information, procurement, logistics, and fiscal management.

- And finally, perhaps most relevant to this committee, I am responsible for the safety of the reactors and associated naval nuclear propulsion plants, and control of radiation and radioactivity associated with naval nuclear propulsion activities, including prescribing and enforcing standards and regulations for these areas as they affect the environment and the safety and health of workers, operators, and the general public.

For more than 7 years, I have been the director, the third successor to Admiral Rickover. I am responsible for the safe operation of 103 nuclear reactors—the same number as there are commercial nuclear power reactors in the U.S. Roughly 40 percent of the Navy's major combatants are nuclear powered, including 10 of its 12 aircraft carriers plus 54 attack submarines, 16 ballistic missile submarines, and 2 former ballistic missile submarines being converted to SSGNs (guided missile submarines). Also included in these 103 reactors are 4 training reactors and the NR-1, a deep submersible research submarine. The contribution these ships and their crews make to the national defense and, more recently, to the Global War on Terrorism is remarkable. And the Program's safety record speaks for itself: these warships have steamed over 128 million miles since 1953 and are welcomed in over 150 ports of call in over 50 countries around the world.

Safety is the responsibility of everyone at every level in the organization. Safety is embedded across all organizations in the Program, from equipment suppliers, contractors, laboratories, shipyards, training facilities, and the Fleet to our Headquarters. Put another way, safety is ***mainstreamed***. It is

not a responsibility unique to a segregated safety department that then attempts to impose its oversight on the rest of the organization.

To clarify what I mean by mainstreaming, let me tell you a story from my days as Chief of Naval Personnel. I was speaking to a large gathering of Army, Navy, Air Force, and Marine Corps military and civilian personnel at the Defense Equal Opportunity Management Institute. I startled the group by beginning with the phrase, "I'm here to tell you about plans to put you out of your jobs in a few years!" I explained that a worthwhile goal would be to have an organization that didn't need specialists to monitor, enforce, and remind line management to do what's right. ***That's*** mainstreaming.

Our record of safety is the result of our making safety part of everything we do, day to day, not a magic formula. To achieve this organizational culture of safety in the mainstream, Admiral Rickover established certain ***core values*** in Naval Reactors that remain very visible today. I will discuss four of them: ***People***, ***Formality and Discipline***, ***Technical Excellence and Competence***, and ***Responsibility***.

PEOPLE

Admiral Rickover has been rightly credited with being an outstanding engineer and a gifted manager of technical matters. His other genius lay in finding and developing the right people to do extremely demanding jobs.

At NR, we still, and we always will, select the best people we can find, with the highest integrity and the willingness to accept complete responsibility over every aspect of nuclear-power operations. Admiral Rickover personally selected every member of his Headquarters staff and every naval officer accepted into the Program. This practice is still in place today, and I conduct these interviews and make the final decision myself.

It doesn't end there. After we hire the best men and women, the training they need to be successful begins immediately. All members of my technical staff undergo an indoctrination course that occupies their first several months at Headquarters. Next, they spend 2 weeks at one of our training reactors, learning about the operation of the reactor and the training our Fleet sailors are undergoing. This is experience with an actual, operating reactor plant, not a simulation or a PowerPoint presentation—and it is an important experience. It gives them an understanding that the work they do affects the lives of the sailors directly, while they perform the Navy's vital national defense role. This helps reinforce the tenet that the components and systems we provide must perform when needed.

Shortly after they return from the training reactor, they spend 6 months at one of our DOE laboratories for an intensive, graduate-level course in nuclear engineering. Once that course is complete, they spend 3 weeks at a nuclear-capable shipyard, observing production work and work controls. Finally, they return to Headquarters and are assigned to work in one of our various technical jobs. During the next six months, they attend a series of seminars, covering broad technical and regulatory matters, led by the most experienced members of my staff.

At Headquarters, there is a continued emphasis on professional development as we typically provide training courses that are open to the entire staff each month on various topics, technical and non-technical. In particular, we have many training sessions on lessons we've learned—trying to learn from mistakes that we, or others, have made in order to prevent similar mistakes from recurring.

Throughout their careers, the members of my staff are continually exposed to the end product, spending time on the waterfront, at the shipyards, in the laboratories, at the vendor sites, or interacting directly with the Fleet. My staff audits nuclear shipyards, vendors, training facilities, laboratories, and the ships to validate that our expectations are met. In addition, we receive constant feedback from the Fleet by several means. When a nuclear-powered ship returns from deployment, my staff and I are briefed on the missions the ship performed and any significant issues concerning the propulsion plant. Additionally, I have a small cadre of Fleet-experienced, nuclear-trained officers at Headquarters who, like me, bring operational expertise and perspective to the table.

My Headquarters staff is very small, comprised of about 380 people, including administrative and support personnel. We are also an extremely "flat" organization. About 50 individuals report directly to me, including my Headquarters section heads, plus field representatives at shipyards, major Program vendors, and the laboratories. Included in this is a small section of people responsible for Reactor Plant Safety Analysis. In an organization where safety is truly mainstreamed, one might ask why we have a section for Reactor Plant Safety Analysis. Here's why: they provide most of the liaison with other safety organizations (such as the NRC) to help ensure we are using best practices and to champion the use of those practices within my staff. They also maintain the documentation of procedures and upkeep of the modeling codes used in our safety analysis. Last, they provide one last layer that our mainstreamed safety practices are in fact working the way they should—an independent verification that we are not "normalizing" threats to safety. Thus, they are full-time safety experts who provide our corporate memory of what were past problems, what we have to do to maintain a consistent safety approach across all projects, and what we need to follow in civilian reactor safety practices.

Nearly all my Headquarters staff came to Naval Reactors right out of college. A great many of them spend their entire careers in the Program. For example, my section heads, the senior managers who report directly to me, have an average of more than 25 years of Program experience. It is therefore not uncommon that a junior engineer working on the design of a component in a new reactor plant system will be responsible several years later for that same system during its service life.

Even though the focus of my testimony is on my Headquarters staff, I should also point out the importance of the Navy crews who operate our nuclear-powered warships. Again, I personally select the best people I can find and then train them constantly, giving them increasing challenges and responsibilities throughout their careers. My Headquarters staff and I oversee this training directly.

FORMALITY AND DISCIPLINE

Engineering for the long haul demands that decisions be made in a ***formal and disciplined*** manner. By "the long haul," I mean the cradle-to-grave life of a project, and even an individual reactor plant. Before a new class of ships (which may be in service for more than 50 years) is even put into service, we typically have already determined how we will perform maintenance—and refueling, if needed—and have considered eventual decommissioning and disposal of that ship. In the long life of a project, all requests and recommendations are received as formal correspondence. Resolution of issues is documented, as well. Whether we are approving a minor change to one of our technical manuals or resolving a major Fleet issue, the resolution will be clearly documented in formal correspondence.

That correspondence must have the documented concurrence of all parties within the Headquarters that have a stake in the matter. There are formal systems in place to track open commitments and agreements or dissents with proposed actions. I receive a copy of every recommended action prior to issue, a practice initiated by Admiral Rickover in July 1949; in fact, these recommendations are frequently discussed in detail and, when necessary, "cleared" with me prior to issue.

The 50 individuals who report directly to me inform me regularly and routinely of issues in their area of responsibility. In addition, commanding officers of nuclear-powered warships are required to report to me routinely on matters pertaining to the propulsion plant.

This organizational "flatness" streamlines the flow of information in both directions—allowing me to ensure that the guidance I provide reaches everyone, while ensuring that my senior leaders and I receive timely information vital to making the right decisions.

In our ships and at our training reactors, we require formality and discipline. Detailed written procedures are in place for all aspects of operation. These procedures are based on over 50 years of ship operational experience, and they are followed to the letter, with what we call ***verbatim***—but not blind—***compliance***. Independent auditing, coupled with critical self-assessments at all levels and activities, is virtually continuous to ensure that crews are trained and procedures are followed properly. We insist on forceful backup, from young sailor to commanding officer. We also insist that the only way to operate our nuclear power plants—the only way to ensure safe operation, generation after generation—is to embrace a system that ingrains in each operator a total commitment to safety: a pervasive, enduring commitment to a culture of safety and environmental stewardship.

TECHNICAL EXCELLENCE AND COMPETENCE

Technical excellence and competence are required in our work. Nearly all of my managers are technical people with either an engineering or science background. My job requires me to be qualified by reason of technical background and experience in naval nuclear propulsion. I am a qualified, nuclear-trained naval officer, having previously served in many operational billets, including commanding officer of a submarine and of a submarine tender that maintains nuclear ships. It is crucial that the people making decisions understand the technology they are managing and the consequences of their decisions. It is also important that much of the technical expertise reside within the Government organization that oversees the contractor work. This

enables the Government to be a highly informed and demanding customer of contractor technology and services.

An important part of our technical effort is working on small problems to prevent bigger problems from occurring. The way we do this is to ask the hard questions on every issue: *What are the facts? How do you know? Who is responsible? Who else knows about the issue and what are they doing about it? What other ships and places could be affected? What is the plan? When will it be done? Is this within our design, test, and operational experience? What are the expected outcomes? What is the worst that could happen? What are the dissenting opinions?* When dealing with an issue that seems minor, these and other questions like them not only lead us to solving the current problem before it gets worse, but also help us prevent future problems.

As we look at the many potential solutions to a given problem, we determine the range of technically acceptable answers first. Then we find out how to fit one of those solutions into our other constraints, specifically cost and schedule, ***without imposing any undue risk***. If we need more time or more money, we ask for it. Although we pride ourselves as stewards of the Government's resources, we do not let funding or schedule concerns outweigh sound technical judgment.

Occasionally, the decisionmaking process brings out dissenting opinions. When this occurs, my staff presents the facts from both sides of the issue to me directly. Before a final decision is made, every opinion is aired. There is never any fear of reprisal for not agreeing with the proposed recommendation; rather, we solicit and welcome the ***minority opinion*** and treat it with the same weight as the consensus view. If I determine there is enough information to make a decision, I decide. If more data are needed, we get more.

Because things do happen—especially at sea—we rely on a multilayered defense against off-normal events. Our reactor designs and operating procedures are simple and conservative, and we build in redundancy to compensate for the risks involved and the operational environment. (For example, the pressurized water reactors are self-regulating: the reactor is designed to protect itself during normal operations or casualty situations.) The systems and components are rugged—they must be to withstand battle shock and still perform. In certain key systems, there are redundant components so that if one is unable to function, the other can take over.

RESPONSIBILITY

Admiral Rickover realized the importance of having total responsibility. He once said:

> Responsibility is a unique concept: it can only reside and inhere in a single individual. You may share it with others, but your portion is not diminished. You may delegate it, but it is still with you. You may disclaim it, but you cannot divest yourself of it. Even if you do not recognize it or admit its presence, you cannot escape it. If responsibility is rightfully yours, no evasion, or ignorance, or passing the blame can shift the burden to someone else. Unless you can point your finger at the person who is responsible when something goes wrong, then you have never had anyone really responsible.

His concept of total responsibility and ownership permeates NR at every level. He also realized that while the Navy designed and operated the ships, the Atomic Energy Commission (the forerunner of the Department of Energy) was responsible for the nuclear research and development—he would need to have authority within both activities. Hence, he forged a joint Navy/Atomic Energy Commission program having the requisite authority within each activity to carry out the cradle-to-grave responsibility for all aspects of naval nuclear propulsion, including safety.

CONCLUSION

In the aftermath of the Three Mile Island accident in 1979, Admiral Rickover was asked to testify before Congress in a context similar to my appearance before you today. In this testimony, he said,

Over the years, many people have asked me how I run the Naval Reactors Program, so that they might find some benefit for their own work. I am always chagrined at the tendency of people to expect that I have a simple, easy gimmick that makes my program function. Any successful program functions as an integrated whole of many factors. Trying to select one aspect as the key one will not work. Each element depends on all the others.

I wholeheartedly agree. As I said earlier, there is no magic formula. Safety must be in the mainstream.

Mr. Chairman, with your permission, I will submit a copy of Admiral Rickover's 1979 testimony for the record. This testimony is relevant because it describes many of the same key attributes and core values I have discussed today—demonstrating that in fact, these key elements of Naval Reactors are timeless and enduring. That testimony also details the continual training program for the nuclear-trained Fleet operators I mentioned earlier. I have updated the statistics on the first 4 pages to make them current and placed them in parentheses beside the 1979 data. Also, with your permission, I will submit a copy of the Program's annual environmental, occupational radiation exposure, and occupational safety and health reports.

Our basic organization, responsibilities, and, most important, our core values have remained largely unchanged since Admiral Rickover founded NR. These core values that I've discussed today are the foundation that have allowed our nuclear-powered ships to safely steam more than 128 million miles, equivalent to over 5,000 trips around the Earth…without a reactor accident… indeed, with no measurable negative impact on the environment or human health.

Thank you for allowing me to testify before you today.