Testimony before the House of Representatives
Committee on Science and Technology

NASA at 50 – Past Accomplishments and Future
Opportunities and Challenges

30 July 2008

John Glenn
U.S. Senator (Ret.)

Mr. Chairman and members of the committee, thank you for inviting me to testify today.

Just 50 years ago, we were learning -- for the first time in all human history – how to travel above the earth's atmosphere at amazing speeds and remain there for increasing amounts of time. It has been a wondrous half-century.

We will always remind ourselves that progress was not without losses of some wonderful and dedicated friends along the way.

In the beginning:

My interest in NASA goes back to the 1950's when the first seven astronauts were starting what I viewed as a completely new service, akin in nature to the existing military services. The impetus for the manned space program back in those days was the cold war, but I felt that this was not just a short-term interest to be laid down when we prevailed in that confrontation with the Soviets. There would be new exploration, whether just out of the atmosphere, as we were contemplating in those days of Project Mercury, or deeper into space as a permanent and growing part of our national future. After all, people had looked up for thousands upon thousands of years and wondered what was up there and what we could do, what we could learn if we were there. Now, for the first time in all human history, we could go.

What was contemplated was exploration, to go where people had not gone before, and to exercise our innate and questing human spirit in ways never before possible.

Macro-Micro:

We could term that "macro" exploration to deeper space, but to me it's more than matched in importance by the opportunity, also for the first time in human history, to do onboard "micro" exploration, in a zero G environment. For the very first time we would be able to do unique experiments with medicines, pharmaceuticals, material, processes, physics and other research where astronauts could be working surrogates for the interest of the scientific community.

That dual view had the general interest, cooperation, and support of the successor administrations, our people, the Congress and scientific community, particularly in the area of micro-exploration.

From the earliest days of the space program, I believed that we served our nation best by maximizing the research return – macro and micro – at each new deeper venture into space. We would create maximum long-term public support as people realized and appreciated the personal value of this research to them and their families.

That concept was generally accepted through the years. In fact, we had experiments on board even from the beginning flights in the space program. Even on our first orbital flight of Friendship 7 whose main purpose was to just prove we could do it successfully, I had special film for certain solar pictures as well as a spectrometer and other experiments.

Gemini taught us how to rendezvous.

And of course nothing can surpass Neil Armstrong's first step ever on someplace other than earth. And the lunar samples they brought back.

Skylab used leftover Apollo equipment and had varied research studies on a longer term, but was not a vehicle that could remain in orbit permanently. By this time, the Shuttle with its fourteen-day limitation was used for expanded micro research. The Shuttle had much more space and capacity for research. NASA encouraged colleges, universities and private interest with "zero G" projects or experiments to submit their proposals for consideration along with NASA's own in-house developed research. A process of evaluation and review was set up to consider the hundreds of proposals. Although some Shuttle flights had dual purposes, all manifests were filled to the maximum with research projects. For example, on the STS-95 Discovery flight in 1998, we had 83 different research projects, and Columbia, before its ill-fated disaster, had 90 research projects on board. Scientific, academic and corporate communities had responded very well to the challenge of doing experiments in micro-gravity. Space Station was conceived as a semi-permanent long-term research vehicle that could accommodate a normal crew of six. To date, crew size has been limited to two or three as construction has been delayed. The Shuttle would revert to its name and become principally the builder-transport vehicle.

And in a move that I supported, we asked fifteen other nations to become our international partners on what now became the International Space Station. Some would have their own research modules. In other words, this was envisioned as a cooperative – rather than a competitive – space program.

Doing the macro-micro research – along with involvement with international partners – seemed to get the maximum return for every dollar spent on the space program and I still back that concept.

Robotics:

Meanwhile, as we proceeded with short-range exploration and research on board, we would also have a robust robotic program to learn all we could about potential deeper space human destinations.

The concept of the ISS and its completely unique mission was well debated many times in the 1990's in Committees and on the House and Senate floors. I strongly supported this concept of the ISS and the NASA program and floor managed the Senate "pro" debate for several years. There was a long list of ISS potential benefits of space research. The Senate voted in favor of that, as did the House. The people of this country accepted that direction for the space program, and looked forward to benefiting from the research results.

Research Planning:

NASA established an Office of Biological and Physical Research (OBPR) that oversaw five areas of inquiry to receive special research priority on the ISS: Biotechnology, Combustion, Fluid Physics, Fundamental Physics, and Materials Science.

Delays:

Tragedies and engineering difficulties have delayed station completion. It has been partially manned all through this period, usually with a two person crew, but will eventually have a crew of 6. It is due to be completed within the next couple of years.

MARS (SEI):

The first President Bush (41st President) announced an intent to establish a Mars mission (Space Exploration Initiative – SEI), but it was very controversial and never was seriously considered or funded.

MARS (VSE):

In January of 2004, the current President George W. Bush (43rd President) announced what was called his Vision for Space Exploration (VSE). This came as a surprise and shock to most if not all members of Congress since they had voted the NASA appropriations for a different purpose, to the space community and our international partners, who had not been part of the decision making process. This time the President just directed NASA "to do it" – period.

The timing of the President's announcement I'll leave to your speculation. The new program, however, was to be a complete change of direction for NASA. It called for returning to the moon, for extensive exploration, and then on to Mars at a later date. Those two objectives were to be the driving force of the program. Everything else was to be secondary or eliminated.

Recalling that decision in Cleveland in 2007, the President said, "And therefore, we set a new mission, which is to go the moon and set up a launching there for which to further explore space."

If carried out, this proposal to launch from the moon to Mars would be by far the most complicated and expensive compared to other Mars mission alternatives.

Presidential advice can come from many quarters, but it would be interesting to know just who advised the President on some of the VSE proposals.

Money:

Even with that, I was much in favor of this new program because I felt it added a new dimension, added new excitement for our young people and would engender new support from the American people. However, I presumed, as did most others, the "vision" was in addition to other scheduled NASA program, not in place of. I naturally assumed there had to be a request for more money within the budgeting process to accomplish these new objectives.

My assumptions were incorrect. With no legislative change, the President's VSE had just unilaterally put into place an enormous "unfunded mandate."

Then Administrator Sean O'Keefe came to one of the National Advisory Council (NAC) meetings – of which I was a member – and informed us that the VSE would come out of NASA's existing budget. Therefore, all research on the ISS that did not apply directly to going to the moon or Mars would be peremptorily cut. To say that I was amazed at this development is an understatement.

I was certainly in favor of the Moon/Mars VSE, but if the only way that could be done was by cutting out all research on the ISS – the reason it had been built – then that broke faith with what our people had accepted as the purpose of the program, what Congress had debated and approved, and what our allies had been promised from this great nation.

There had been little or no consultation with Congress before this change of direction or with the fifteen other nations involved. Just directing NASA from the White

House into new priorities to the Moon and Mars completely altered the nature of the NASA job. It gave NASA an enormous task with no additional funding.

The changes announced by Administrator O'Keefe basically eliminated most research projects with colleges, universities and corporations unless those projects were specifically and directly connected with the Moon/Mars objectives. He said there would not only be no increase in funding, but there would even be a research cut of 1.2 billion over a five-year period.

New Administration:

The current NASA Administrator, Dr. Mike Griffin, is a broad based scientist who headed up the space department at Johns Hopkins prior to becoming Administrator, and had been in the hierarchy of NASA many years ago, during the earlier Mars proposal. He is a loyal person trying to do the best job possible under the circumstances with the directions he's been given from above. He's taken hard criticism for the research cuts, both ISS and others, but the changed NASA mission he's been given and the lack of funding he is faced with comes from higher Administration decisions to not adequately fund the new NASA direction, and I presume is being enforced by whoever is in charge of the NASA account at OMB.

If we are to have new and expensive national objectives, then we must be willing to pay for them. With no change in budgeting policy, Dr. Griffin has been handed a near "mission impossible."

As someone said a long time ago,

"Great plans without resources remain dreams."

My former astronaut colleague, the late Gus Grissom, put it in even more understandable terms when a cut was being proposed in Project Mercury:

"No bucks, no Buck Rogers."

End of Shuttle:

Shuttle launches are expensive, running some four hundred million dollars plus per event.

The ISS is scheduled to be completed during 2009. To save money, Shuttle use will be terminated in 2010, leaving us with at least a five year period in which the U.S. will not have a human space launch capability – until our newly designed Orion spacecraft has been tested and brought into operation. That assumes it will be operational on schedule.

During that five-year hiatus, we will be in the position of buying launch services from the Russians. A 750 million dollar contract has already been signed to provide a specific number of Russian launches to ferry U.S. personnel and equipment to/from our ISS. We will not have a heavy-lift capability, up or down, as the Shuttle has. Our astronauts and equipment will have to be launched from and return to Russia to maintain ISS access. This assumes that recent reentry problems of the Soyuz are corrected. If there would be further Soyuz difficulties, we will be left with no way to get to or from the ISS.

Correcting the Problem:

Additional funding of 2.8 to 3.0 billion dollars per year could keep the Shuttle in operation until our new Constellation program equipment is ready, and at least partially restore the ISS research program.

Workforce:

Another major benefit of that process would be the preservation of the world's most experienced engineering and launch teams who could not be maintained with a five-year stand-down while we develop the Constellation concept. Personnel qualifications, training, and experience must be of great concern.

Investments:

With completion of the ISS, we will have invested just over 100 billion dollars – 100 billion – and our colleague nations will have spent 12-15 billion to build and equip this most unique laboratory ever conceived. We should be doing everything we can to maximize its scientific utilization and extends its life, instead of just the opposite.

For the richest nation on earth with a budget of 3 trillion dollars, to make a 100 plus billion dollar investment and then not utilize it may be viewed as penny-wise, but is pound-foolish.

Unintended results:

There are other unintended results from the Shuttle termination decision.

Dr. Samuel Ting is a professor at MIT and Nobel Laureate recipient for his work in particle physics. When the underground Super-conducting Super-collider was cancelled in 1993, he proposed an alternative concept that the Department of Energy supported and which NASA put on its flight manifest. It is the product of some 450 scientists in 50 institutions in 16 countries that would study cosmic rays, matter and anti-matter, with equipment weighing some 15,000 pounds and which would need on-board

launch space of approximately one-third of the Shuttle cargo bay. It would then be mounted on trusses on the ISS for its operation.

1.5 billion dollars has been spent on the project to date, mostly from European and Asian researchers. A proof of concept prototype was successfully flown in 1998. NASA and DOE preparation teams have spent several tens of millions of dollars. With the cutback in shuttle launches, the program has been put on what amounts to a permanent hold.

Reliability:

Changing direction in mid-stream has in effect pulled the rug out from under our own scientific community that worked very closely with NASA through the years. It has also pulled the rug out from under the colleges, universities, and businesses that took NASA seriously and cooperated with them. Perhaps even more dangerous, it's pulled the rug out from under our international partners, some of whom according to published reports are now looking at new space efforts by other nations for their cooperative plans in the future.

At a reception in Washington a short time ago, I met a foreign official high up in his country's space program – one of our ISS members – who told me they had trusted that the US was serious about the Space Station and that they could not believe what the US has done to them.

Globalization:

Another aspect to this that is very troubling for the long term. We're into a period of globalization that will be extremely competitive. Our continued superiority in science

and research is not one that is guaranteed. Tom Friedman's book, "The World is Flat," outlines some of the difficulties and prospects.

A more recent book by Fareed Zakaria discusses how other nations are closing the scientific gap with the U.S.

U.S. Historical Strength:

If I were asked a question about what made this country great and gave us a position of international leadership in a comparatively short period of time, my answer would have to be two things.

Education:

One, we emphasized education, particularly in the hard sciences; math, science, technology, with K-12 education that became the norm for most of our people. Out of that came the best educated general citizenry in the world. Though not the major subject of this discussion, our K-12 education "system" is actually just over 14,700 school boards across the country, basically operating independently and too often more interested in saving money than in seeing that their children have a world competitive education.

Research:

The second element is basic research and this does apply to this discussion. Throughout our history, we put more effort into basic research, learned the new things first, and with that educated citizenry in a free democracy, new businesses were created, standard of living went up, and we were able to develop an economy that rapidly became the envy of the world.

Results:

A good example is the research impact of NASA's predecessor agency, the National Advisory Committee for Aeronautics (NACA). In the early days of aviation, NACA did the best aviation research in the world in structures, materials, aerodynamics, power plants, controls, etc. Utilizing that research, whole industries, were formed in a short period of time. We became the world's leader with Boeing, Lockheed, Northrop, Grumman, North American, Martin-Marietta, and others leading the way. They pioneered for the world the aviation travel and uses we depend on today. That would never have occurred without the kind of research that NACA did.

Today we find ourselves in the position of still being ahead in space research, but with the trends wrong. Our research seems to be leveling off – certainly government research has been reduced – at the same time other nations are increasing their research, so the trends for the long-term are not good.

Those same basics apply for the future. World leadership for the future will still go to nations that lead in education, research and innovation.

Government Leadership:

For many years, some government agencies – NASA and DARPA for example – have been fountains of new and innovative "free thinking" type research. The Defense Advanced Research Projects Administration (DARPA) was the predecessor and inspiration for the Internet as we know it today. But DARPA, as I understand it, has now been restricted to only project oriented research. I presume that means fewer innovation initiatives by some of the brightest minds in the world.

NASA has a network of some of the finest laboratories in the world with some of the best engineers and scientists anywhere who have worked for years getting ready for ISS research. Now research is cut in the most unusual and unique laboratory ever conceived. Granted, if we were doing the ISS over again, it would undoubtedly be done differently, but that's hindsight. We have it and its required an enormous investment. We should make the most of it.

Apollo:

With the VSE announcement in January of 2004, perhaps the President recalled the clearly enunciated Apollo goal that was successful, but that included an equally clarion call for enabling funds. In those days, the people and the Congress responded favorably. After January 2004, to the best of my knowledge, the President has never made another speech about the VSE.

Additional:

Addition of 3 billion dollars to the yearly NASA budget is small when compared to other budget figures; to a 3 trillion dollar national budget, to an announced 490 billion dollar deficit, to a monthly 10 billion Iraq bill, and to other comparisons. But with this 3 billion investment, there is the potential of enormous return.

Additionally, we preserve our ability to travel in space and to our ISS.

We maintain a continuing engineering and launch workforce.

We restore the confidence of our international partners.

We make possible projects such as Dr. Ting's Alpha Magnetic Spectrometer.

Our space program will remain as a symbol of a great nation, willing to propose great projects and carry them out for benefit of all, a true world leader defining what the future will be.

At one time NASA's mantra was:

to improve life here

to extend life to there

to find life beyond

We can follow that prioritization and still do the VSE if we just have the will, but –

"A great plan without resources remains a dream."