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Transforming Government:

Dan Goldin and the Remaking of NASA

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Professor of Political Science and Public Administration
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Syracuse University

The PricewaterhouseCoopers Endowment for
The Business of Government

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Foreword

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On behalf of The PricewaterhouseCoopers Endowment for The Business of Government, we are pleased to present this report by Professor W. Henry Lambright, "Transforming Government: Dan Goldin and the Remaking of NASA."

This is another in our series of reports providing case studies of outstanding government leaders and the lessons learned from their transformation initiatives. Previous reports have examined the transformation of the Federal Emergency Management Agency by James Lee Witt ("Transforming Government: The Renewal and Revitalization of the Federal Emergency Management Agency" by Daniels and Clark-Daniels), the Veterans Health Administration by Ken Kizer ("Transforming Government: The Revitalization of the Veterans Health Administration" by Gary Young), and the Department of Defense Procurement System by William Perry, Paul Kaminski, Colleen Preston, and Steve Kelman ("Transforming Government: Creating a New Defense Procurement System" by Kimberly Harokopus).

Dan Goldin now has the longest tenure as administrator in the history of the National Aeronautics and Space Administration. He has had the unique experience of being appointed by President George H. W. Bush in 1992 and continuing to serve under President George W. Bush in 2001. As a consequence of his long tenure, Administrator Goldin has overseen many successes, as well as some failures. One of the lessons learned from his experience is the importance of turning a "crisis" into an opportunity. Professor Lambright describes how Goldin "changed course" on several important NASA projects, including the Mars program, and documents how Goldin has constantly led change throughout his tenure.

We trust that this report will be valuable to new political appointees, as well as other government executives, as they undertake the challenge of transforming or revitalizing the organizations they lead. There is much to learn from the experience of proven managers — people such as James Lee Witt, Ken Kizer, and Dan Goldin — who fundamentally transformed their organizations and delivered improved results to the American people.

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Executive Summary

The National Aeronautics and Space Administration (NASA) was born of the Cold War and survived for most of its organizational life linked to competition with the Soviet Union. When the U.S.S.R. dissolved in 1991 and the Cold War ended, NASA was bereft of its central rationale. At the same time, it was constrained in seeking new missions by an agreement between the President and Congress to cap federal expenditures and ridiculed by politicians and the media for launching the *Hubble Space Telescope* with a defective lens. Conflict between the White House and NASA over priorities forced President Bush in 1992 to ask then NASA administrator, Richard Truly, to resign. With its principal program, the Space Station, under sharp attack from congressional and other critics, NASA was an agency in disarray, its very survival threatened.

It fell to Daniel S. Goldin, an aerospace executive from California, appointed NASA administrator in April 1992, to steer the agency through the turbulent 1990s into the 21st century. Strong-willed, confrontational, and decisive, Goldin wasted little time in forcing NASA to face budget reality. He shook up the agency by asking it to seek a new vision and strategy, while also restructuring offices, replacing officials, and making preemptive cuts in the budget. When the Bush administration ended, many officials in NASA hoped Goldin would go.

However, President Clinton retained Goldin through two terms, giving the controversial administrator that rare commodity in Washington — time. Breaking the record of continuous service for a NASA administrator, Goldin persevered in what became an ongoing campaign to transform NASA and align it with a new environment. He was able to initiate a number of reforms and then see how they were implemented, for better or worse.

In the Clinton years, Goldin directed the redesign of the Space Station and helped bring in Russia as a partner. He made use of the microelectronics revolution to institute a "faster, better, cheaper" (usually smaller) approach to unmanned spaceflight. He reoriented and accelerated the Mars exploration program, and renewed NASA's technical credibility through a dramatic *Hubble* repair mission in space.

Beset constantly with budget woes, Goldin nevertheless helped build support for NASA and the Space Station in the White House and Congress and brought it a measure of financial stability. He made NASA a model of the Clinton-Gore reinvention efforts, downsizing NASA, dispensing with non-central functions, privatizing aspects of the Space Shuttle, and ordering programs killed if they had excessive cost overruns. He also reoriented NASA's environmental mission while defending it to hostile critics. Even as he won plaudits externally from the President and Congress, Goldin was criticized internally for his abrasive methods of accomplishing reform.

In 1997, the relatively inexpensive *Pathfinder* mission to Mars seemed to vindicate Goldin, especially his faster, better, cheaper strategy. Here was an example of a small spacecraft that cost less than

the $1 billion planetary efforts that had been NASA's norm prior to Goldin. Moreover, its performance was extraordinary. A robotic device was released from *Pathfinder*, crawling across the Martian surface. *Pathfinder* was hailed as a great success, exemplifying how far NASA had come from its low state in 1992. NASA was able to launch spacecraft more frequently, save money, and get good performance.

However, two years later, the Mars program suffered a significant setback when both the *Mars Climate Orbiter* and *Mars Polar Lander* failed. Investigations indicted "faster, better, cheaper," showing that NASA had pushed too far and arguing that faster and cheaper are not always better. At the same time, a critical $1 billion-plus public-private program to develop the X-33, a successor to the aging Space Shuttle, ran into technical barriers. The Space Station program was also falling well behind schedule, rising in cost as Russia failed to deliver hardware promised. It seemed that NASA might be going in the wrong direction once again.

However, Goldin was willing to adapt to the new reality. One year later, in 2000, the Mars program was on its way back, at a slower and more expensive pace. Also, the Space Station reached a historic milestone when it became possible to have it permanently occupied by a crew. In effect, space was now a habitat for humanity. Further, Goldin got White House and congressional support for a new Reusable Launch Vehicle program that would supplant the X-33 effort.

As the above account suggests, Goldin's tenure at NASA's helm has been a roller coaster ride. Most of the time, however, Goldin has managed to guide his agency around the most perilous curves and rescue it from its deepest descents. The following study describes and analyzes Goldin as an administrative change agent. His legacies and strategies are assessed. There are many lessons to be learned from the Goldin years at NASA. Most are positive, but there are also cautionary lessons, owing in part to Goldin's administrative style. To be a political executive is never easy. To be one charged with the radical change of an established agency in complex times is downright daunting. Goldin took charge and stayed in charge at NASA for a record-setting time. He saw his reforms adopted and implemented. He experienced success and failure. As George W. Bush, son of the President who originally appointed Goldin, takes command of the White House, NASA is leaner, bruised, but stronger for his efforts.

The following lessons can be learned from this account:

1. Who is appointed the agency executive matters.
2. The leader must make the most of a mandate for change.
3. It is important for the leader to adopt a general strategy on what needs to be done at the outset of his or her tenure.
4. The leader must implement a change process quickly, instilling a sense of urgency and getting as much organizational support as possible.
5. The leader should use crises as opportunities for action.
6. It is important to build on success, to establish momentum for change.
7. The leader should be aware of the limits of change. He or she needs to communicate clearly and get adequate feedback on problems being caused by those limits. If the problems lead to serious organizational setbacks, he or she should assess what went wrong, admit mistakes, make needed modifications in strategy, and move forward.
8. The leader must anticipate long-term future needs of the organization.

Part One — Lessons Learned from the National Aeronautics and Space Administration (NASA)*

Lesson 1: Who Is Appointed the Agency Executive Matters

The 1990s were a time of turbulence for NASA. The Cold War ended in 1991 with the dissolution of the Soviet Union, taking from NASA its primary referent since *Sputnik*. NASA had to have a new rationale. At the same time, there was a huge budget deficit and agreement between the President and Congress to bring that deficit down. President Clinton and Congress later reinforced this imperative with the aim of balancing the budget. NASA was caught in the middle of changing times and had to adapt. Whoever came in to lead NASA in this decade would have to have change as his top priority and the temperament of a change agent. Such an individual would ideally have certain personal characteristics — a sense of vision; the intellect and managerial experience to run a huge technical organization; political skills; a high tolerance for controversy, since change implies conflict; and a willingness to persevere, given the opportunity, since the task would take many years.

The choice of Dan Goldin was fortuitous given the need. He was a good match for the organization and times. He replaced a man who was forced to leave because he was not viewed as the right person for the challenges facing the agency. There were certainly some rough spots where Goldin was concerned. He was not always sensitive to others' feelings insofar as his administrative style was concerned. He lacked Washington experience and had to learn quickly. On the whole, however, his original appointment and retention by Clinton were good for NASA and the country.

Lesson 2: Make the Most of a Mandate for Change

It helps an administrator if he or she has a clear mandate for change. It is the equivalent of the honeymoon that a President gets following election — a time of grace, when more discretion is granted a

* *This report is based on research performed under a grant from The PricewaterhouseCoopers Endowment for The Business of Government. The author gratefully acknowledges this support. He also wishes to thank NASA for support in research on Administrator Goldin's reforms, which was helpful in getting the author started in this work. The views expressed in this report are those of the author alone.*

leader than usual, and some political constraints are temporarily lifted.

Goldin had a mandate, throughout his tour with Bush and Clinton, to align NASA with administration priorities. How he did that was very much left to him as long as he showed results. This alignment was in large part a painful budget process — a downsizing. A "good face" was put on this process under Clinton — called "reinvention." However, it was still painful to the agency.

Beyond this budgetary alignment, there was a policy alignment of historic significance. Whoever was administrator would have to deal with the foreign policy need of the United States to forge a new relationship with the Russians and the world. Goldin, through the Space Station, made NASA a positive instrument of this policy need, elevating NASA to a component of presidential foreign policy and making it more relevant to the times. Goldin had the budgetary mandate handed to him when he arrived. The policy mandate evolved over the 1990s and beyond. Goldin helped forge the policy mandate to which he then responded.

Lesson 3: Adopt a General Strategy of What Needs to Be Done

It is important for an administrator to have a plan of action, however general and vague, when he or she takes command of an agency. If the President chooses a good match, he assures that the individual is knowledgeable about the agency and can hit the ground running. This general strategy, or "mental model," provides the administrator with at least an initial agenda and sense of priorities.[1]

Given the budget constraint Goldin faced when he first was appointed, he was forced to deal with the question, "What do I do to bring NASA's expectations into line with likely funding?" His answer was not to eliminate programs. Rather, he intended to promote technological and managerial reforms that would allow the agency to carry out all its existing programs and even provide funds to make new starts. This basic orientation guided Goldin throughout his tenure. All the major space programs he inherited were still there in 2001. However, they were all vastly different. While critics would say he was unnecessarily ruthless in carrying out his reforms, the fact is that NASA still had high expectations, but operated from a much leaner organization.

In having a mental model, he also had priorities. He saw the agency's top priority as human space exploration, and gave emphasis to pushing the frontier of research and development and abandoning more routine functions. He gave unqualified priority to the Space Station as the linchpin upon which NASA's future depended. And he kept his long-term sights on a manned Mars mission as the next great goal of NASA, the United States, and planet Earth. He knew he would not be around when such a mission became national policy, but he wanted to move NASA in the direction of that mission.

In developing a plan, a leader brings his own background and perspectives. However, he should seek a range of advice from outside and inside the organization, and listen to that advice. There are strategic and tactical dimensions to any plan of action, and some executives are more skilled in one aspect or the other.

The leader needs a general strategy at the outset. He must be willing to adapt that approach as time goes on, depending on events. Goldin generally held to his strategy, but his tactics were critical in the short term, requiring a number of side trips and delays on his way to NASA's future.

Lesson 4: Implement a Change Process Quickly, Instilling Urgency and Gaining as Much Organizational Support as Possible

Translating the leader's general strategy or mental model into agency action requires enlisting the organization. There are two methods for doing so. One is the slower, participatory approach, in which the leader, organization, and its external constituencies come together into a consensus. What results is a policy compromise, but it tends to be more acceptable to those who must carry it out or live with it indefinitely. The other approach is a top-down technique, in which change is forced on the agency and participation yields to the administrator's

[1] *Peter M. Senge,* The Fifth Discipline: The Art and Practice of the Learning Organization *(New York: Doubleday, 1994), 8-9.*

agenda and timing. Both the bottom-up and top-down approaches require an internal coalition of officials to carry out change. In the bottom-up approach, this cadre would be largely drawn from inside the organization. The top-down approach implies a cadre of the administrator's choosing, often drawn from outside the organization.

Goldin brought no one with him when he took NASA's reins. He initially sought change through the bottom-up strategy. He wanted the organization to reach a consensus and then interact with the public in creating an even larger consensus for change. Unfortunately, this participative strategy was coupled with financial costs. He ordered "red and blue" teams to counter one another in downsizing various programs even as they sought a vision statement and engaged in strategic planning. Cutback planning was a threat to many inside officials. Because it was late in the George H. W. Bush term, many thought they could wait out Goldin through "passive resistance."

Goldin countered with a top-down strategy that reorganized offices and replaced personnel. He made preemptive cuts, heading off budget reductions from his political masters. He felt an urgency to act on the budget, whereas many NASA officials believed growth was still possible. When he made his moves, he did not have a coalition of mid-level leaders ready to help him. Moreover, external political factors constrained him in making changes in the Space Station, NASA's lead program.

The basic lesson is that the ideal change strategy (bottom-up and consensual) takes time, and the leader may not have the time if there is an urgency to act. However, it is incumbent on the leader to communicate that urgency to his organization so that his top-down moves do not appear arbitrary and unnecessarily authoritarian.

Lesson 5: Turn Crisis into Opportunity

A leader can be aided by a threat from the organization's environment in conveying the requisite urgency for change to the organization. The key is the clarity and immediacy of the threat. Goldin felt the threat in the last year of the Bush administration, but his organization did not share his perception. In the first year of the Clinton administration, when the Space Station was in jeopardy first from the White House and then from Congress, NASA knew it was in deep trouble. At this point, the threat became a crisis to the viability of the agency.

A crisis situation creates an organizational need for leadership and willingness of the organization to go along, at least for a while. Goldin proved an effective crisis manager. He seized command of Space Station decision making from those formally in charge and created what was, in effect, a parallel unit under his direction, which redesigned the Space Station. Then he gained White House support by linking the Russians with the Space Station. A "summit" between the President and Congress stabilized the budget for the "new" Space Station, which now bore the stamp of Goldin.

In addition, Goldin seized another moment in 1993 — the failure of the $1 billion *Mars Observer* — to push through his "faster, better, cheaper" approach to planetary exploration. The Mars program was to be the flagship, de facto, for demonstrating technological and managerial reforms. It would allow NASA to do more while saving money.

Goldin additionally used the *Hubble Telescope* crisis, which also came to a head in 1993, to advantage. *Hubble* had to be fixed or NASA would have no credibility insofar as Space Station construction was concerned. Again, Goldin took command of *Hubble* repair decision making. He gave it organizational and budgetary priority. When *Hubble* was repaired and shown to work in early 1994, Goldin and NASA gained enormously in credibility from the success.

The lesson is that a crisis can help the leader in forwarding major change. Crisis allows the leader to pull power up to himself. Because he spans the boundary across organizational programs and negotiates the space between organization and environment, he is in a strategic position to seize the initiative. He can use a crisis to go beyond incremental to radical change. A leader who successfully leads his organization through a crisis can secure his position, neutralize rivals, and enlarge the change coalition within the organization through his appointees and insiders, who become believers.

Lesson 6: Build on Success

Successful response to crisis can create momentum for further change. Subsequent threats and opportunities in the environment provide occasions for action. For Goldin, "faster, better, cheaper" became his mantra, which he communicated inside and outside the organization — constantly.

He used budget constraint to trigger more change — structural change (focusing on research and development, privatizing Shuttle "operations," decentralizing authority from headquarters to field centers, downsizing personnel especially in headquarters, etc.). However, he held to his initial overall strategy. That is, he would protect existing programs and cut costs through managerial and technological efficiencies, as well as personnel reductions. Also, he would find the money to start new programs with an aim to NASA's future. NASA's future required "faster, better, cheaper" access to space. Hence, he initiated the X-33 program in 1996 as a potential replacement for Space Shuttle.

NASA also required a new mission beyond the Space Station. In the mid-1990s, opportunities opened with the discovery of planets orbiting distant stars. This exciting knowledge helped galvanize the Origins program to explore the cosmos and search for evidence of potential life. The disputed discovery of possible fossilized life in a Mars meteorite also helped boost interest in the Mars planetary exploration program. Goldin made a Mars soil sample return mission a relatively near-term goal. The remarkable success of *Pathfinder* in 1997 seemed to legitimate the acceleration of Mars exploration and Goldin's faster, better, cheaper strategy in general.

Lesson 7: Be Aware of the Limits of Change and Modify Strategies When Flaws Are Detected — Preferably Before They Lead to Organizational Setbacks

A leader has to know the limits of change. A change process pushed too far can lead to failure. A great success (e.g., *Pathfinder*) can give rise to over-optimism as to what can be accomplished. The 1999 Mars failures showed the limits of faster, better, cheaper. If not the limits of the management approach, they certainly showed limits in either how that approach was communicated or heard. A lesson to be drawn is that there are limits to change where technical, financial, and human resources are involved. A leader needs to detect those limits sooner than later. How can a leader get early feedback on a program pushing those limits? He needs good information, and that information must flow upward from those closest to the work.

A hard-driving administrator with a confrontational style can shut off the flow of communication, especially if he gets a reputation for killing the messenger of bad news. Mid-level officials will contribute to the communication blockage due to their own desire to show a "can do" attitude to the boss. Finally, even those at the project level will share the blame for technological over-optimism. Because they succeeded once, they believe they can succeed again, even faster, better, cheaper than before.

A leader and those below have to guard against hubris born of success. Communication, communication, and more communication in an organization is the answer to heading off disaster. The communication has to flow freely and candidly from the bottom to the top and vice versa. A leader has to work overtime to assure he gets such communication and feedback. This is especially the case where the change process is so strongly pushed from the top. If a leader is perceived as closed-minded by his officials and staff, he will be a barrier to his own reforms.

Moreover, if an administrator stays in office long enough, he will see not only success, but also failure in some of his policies, at least if he is innovating and taking risks. The aim is to minimize the failures through realism based on adequate communication within the agency and between the agency and contractors. It is also to learn from mistakes and make timely corrections in hardware, management, and, if need be, the administrator's personal style in dealing with the agency.

Lesson 8: Anticipate Future Needs

An administrator needs to anticipate the future in a range of ways. There are agencies with programs having long lead times, but perhaps none with lead

times as long as NASA's. Missions have to be planned a decade or more in advance. Many long-term missions — such as human spaceflight to Mars — will require the creation and development of technological capabilities that do not now exist. The Origins program will need a telescope with strengths well beyond those of *Hubble*. Access to space necessitates a successor to Shuttle. Rockets have to be eventually replaced with a far better technology. In virtually every program of NASA, there are limits to success based on knowledge and human resources, as well as money.

A leader of an organization who thinks beyond a decade's length will emphasize basic research and the education of the next generation of professionals. The lesson is that not only must a leader fight today's battles, he must also look far ahead to coming challenges. It is not enough to provide visionary rhetoric about the future. To turn dreams into reality requires new ideas, understanding, and, above all, a share of the coming generation's best and brightest. Goldin, like most of NASA's leaders, is a child of the first Space Age, whose locus was in the Cold War. The Space Age of the 21st century will need a new generation of leaders, and they must be prepared today.

Leaders of organizations must "think in time."[2] They are individuals who step into an ongoing river of action. They may divert the flow this way or that, but must realize they have but a brief moment to make a difference, for the river moves on. Thinking in time implies a capacity for the longer view, understanding where the river began and envisioning where it may (and should) be headed. By seeing the present with past and future perspectives, a leader is more likely to make positive changes in an agency's course that last.

[2] *Richard E. Neustadt and Ernest R. May,* Thinking in Time: The Uses of History for Decision Makers *(New York: The Free Press, 1986).*

Part Two — The NASA Case Study

Introduction

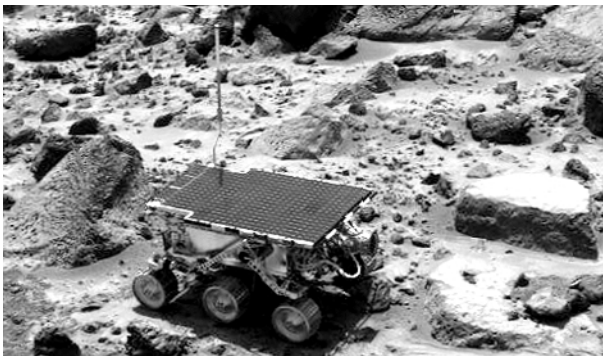
Daniel Goldin, administrator of NASA, stood nervously outside the House legislative chamber June 23, 1993, as lawmakers voted on the future of the Space Station, NASA's lead program. As Goldin saw it, if the Space Station went down, so would NASA as a significant agency and his career at NASA as well. As the vote began, Goldin could see the count recorded on a board outside the chamber. The vote was nip and tuck, with one side and then the other pulling ahead. At 214-214, voting stopped. John Lewis, an African-American congressman from Atlanta who had marched with Martin Luther King, rushed down the hall to enter the chamber and break the deadlock. "Say something to him," whispered Goldin's legislative aide, Jeff Lawrence. "Remind him you are from an ethnic neighborhood in New York City. Maybe you can connect with him. You've got to make your case in 10 seconds." All Goldin could blurt out as Lewis rushed past him was, "Please vote for the Space Station."

Lewis did vote positively, and the Space Station survived, 215-214. "It's a win," a relieved Goldin told the media. But to Lawrence, he confided, "It's exciting to win by one vote, but I never want to do it again."[3] The Space Station vote was the most dramatic of many tests faced by Goldin over what has been the longest continuing tenure in the history of any NASA administrator. The Space Station endured and Goldin survived, and over the years he remade NASA.

Daniel S. Goldin was appointed NASA administrator by President George H. W. Bush in 1992 and served through both Clinton terms. Without question, he has been the most change-oriented administrator since James Webb refashioned a small and weak NASA into a super-organization capable of taking America to the moon in the 1960s. Whereas Webb led an agency that was young and flexible, Goldin dealt with one that was middle-aged and in many ways calcified. It was his task to reinvent NASA in the post-Cold War era and take it into the 21st century. A self-proclaimed "agent of change," Goldin has made a substantial difference. The most influential NASA administrator since Webb, he was also the most controversial leader that NASA has had.

When Goldin became administrator, many observers saw NASA as a bloated bureaucracy pursuing missions that took too long, cost too much, and used technology that was old by the time it was put into space. Goldin instituted a "faster, better, cheaper" approach that increased the number of launches, reduced costs, and put a premium on employing innovative, usually smaller, technology. The technical and public relations returns from space and earth science missions increased substantially. The high point for faster, better, cheaper

[3] *Interview with Jeff Lawrence, February 18, 1999, Washington, D.C.*



Sojourner, *the Mars rover, near the Rock Garden on Mars.*

reforms came in 1997 when *Pathfinder* reached Mars and its tiny *Sojourner* robot separated to inch along the surface. The mission cost a fraction of the expense of previous Mars probes.

Also, Goldin rescued the *Hubble Telescope*, turning despair into triumph, and brought the Space Station back from the brink of political demise. By enlisting the Russians as a partner in a redesigned International Space Station, he elevated the program to the level of presidential foreign policy interest, and gave it new excitement with Congress and the media. He made dramatic moves to privatize the Space Shuttle, and launched the X-33 program to develop the Shuttle's successor.

Further, he cast NASA as a model for the Clinton-Gore reinventing-government campaign, creating a long-term vision and strategic plan for the agency. In doing so, he streamlined NASA's civil service workforce by approximately one-third, with the headquarters' civil service and contractor workforce reduced by more than half — without forced layoffs. Finally, he gave a new priority to Mars and launched the Origins program, by which he aimed to create an appealing rationale for space exploration. Its purpose was to understand the universe's past and future, and detect evidence of life beyond Earth.

For his work, Goldin received strong plaudits from the White House and Congress, Democrats and Republicans alike. Vice President Gore called him "the most impressive NASA administrator I have ever worked with." *Aviation Week and Space Technology* said he "delivered on his promise to reshape NASA into a model government agency." The *New York Times* praised Goldin and credited NASA's revitalization "to the influence of Dan Goldin."[4] Long-time NASA space policy analyst John Logsdon lauded Goldin for seeking "great accomplishments" in space and moving the agency in the right direction for the 21st century.[5]

Yet, Goldin has many critics, and his record is not perfect. He has been called inconsistent and impetuous, "Captain Crazy," "paradoxical," and a man with a "dark side."[6] Charming one moment, he can attack another, especially subordinates. His impatient, demanding, intimidating management style engendered a "Goldin-watch" website within NASA where he was criticized incessantly. His reputation for "slaying the messenger" has hurt free communication within the agency and may have contributed to mission failures.[7] There has also been concern that his personnel cutbacks have created potential safety risks for the Space Shuttle. His program to develop a Shuttle successor has proved a bitter disappointment. Faster, better, cheaper turned out to be not necessarily better after *Pathfinder* when *Mars Climate Orbiter* and *Mars Polar Lander* both failed in 1999. Critics of Goldin also say he too easily accepted lower budgets for NASA, whereas other agency heads fought harder for increases. While admitting Goldin helped save the Space Station by linking its fate to the Russians, critics call it a Faustian bargain that caused delays and huge overruns in funding for the International Space Station (ISS).

Thus, Goldin has his supporters and detractors. But historians are more likely to see positive than negative in his overall record. He has been responsible for significant needed change at NASA, and clearly turned around an agency headed downward in reputation and performance. Most of his decisions have been correct, and he has accepted responsibility for errors. While his personality is volatile, the passion in that personality has effectively helped move NASA forward from the Cold War to a new century.

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[4] *Biography of Hon. Daniel Saul Goldin, NASA Administrator, NASA, http://www.nasa.gov/bios/dan_goldin.html.*

[5] *John M. Logsdon, "Has Goldin Failed?"* Space News *(April 17, 2000), 21.*

[6] *Joseph Anselmo, "NASA's Paradoxical Daniel S. Goldin,"* Aviation Week and Space Technology *(December 29, 1997), 95; also, David Leonard, "The Goldin Years at NASA,"* space.com *(Nov. 24, 1999).*

[7] *"NASA Strikes Out,"* Space Times *(May-June 2000), 3-4.*

Approach

In understanding Goldin's leadership and change strategies at NASA, it is useful to consider, analytically, the process of policy innovation. One model may be called the evolutionary process.[8] In this model, change is straightforward and incremental. Once a performance gap is recognized, there is a search for options in how to address the problem. The leader selects an option, which is given legitimacy through formal policy-adoption procedures. This policy is then implemented. At an appropriate point, evaluation occurs and modifications are made as required. In time, the change is incorporated into the routines of the agency. There is consolidation and stability while the organization digests the innovation prior to initiation of another policy-change process.

This incremental, evolutionary model of policy change may apply to a number of situations, but not all. There is another model that may be called the radical or discontinuous-change process. The signature of this model is accelerated change.[9] It involves not just one policy innovation, but a sequence of innovations that produce a total effect registering a break with the past. The stages of policy innovation move quickly, sometimes erratically. Implementation of one change is barely underway before another is promulgated, overlapping the previous action. In the radical-change model, there is little time for consolidation. Stability for the organization is rare. The leader is much more assertive than in evolutionary change, forcing the process forward. The leader is entrepreneurial in style, championing change almost as an end rather than the means.

The radical-change model describes NASA under Goldin. While Goldin espouses theories of "total quality management," with its notion of "continuous improvement," and speaks of "non-linear thinking" and even "management by chaos," he also understands the value of stability for implementing innovation. However, in the real world of public management, a leader must deal with not only the administration, but also the politics of change. Much of what Goldin has done has entailed coping with internal resistance and especially reacting to pressures from outside the agency. NASA's politically turbulent environment created conditions under which NASA needed a leader with the temperament of a radical-change administrator. Goldin surely had that kind of temperament. And while he coped with short-term pressures and spoke of participation, he always held to a strategy geared to his strong-willed view of NASA's future. He was himself a prodigious force for change, constantly seeking to maintain initiative and control of his organization.

The Setting: NASA, an Agency in Trouble

In 1992, when Goldin came to NASA, the space agency was in deep trouble. To some extent, the trouble went back to 1986, when *Challenger* exploded shortly after launch. However, the Reagan administration provided funds to replace the lost Shuttle and gave support to NASA to help it recover. NASA's budget was going up when George H. W. Bush became President in 1989, and he continued to back NASA. In fact, he proclaimed, on the anniversary of the Apollo moon landing, a new mission: back to the moon and on to Mars. This mission, known as the Space Exploration Initiative,

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[8] *This approach is essentially the same as the policymaking model described by Charles O. Jones,* An Introduction to the Study of Public Policy *(Monterey, Calif.: Brooks/Cole, 1984).*

[9] *The concept of managing discontinuous change is not well developed in the literature. It is clearly related to managing or leading in a turbulent political environment. Dwight Waldo sought to deal with some of these issues in a 1960s context of turbulence. See Waldo, ed.* Public Administration in a Time of Turbulence*, (Scranton, PA: Chandler, 1971). For a general discussion of organizational change and management, see Hal G. Rainey,* Understanding and Managing Public Organizations*, 2nd ed. (San Francisco: Jossey-Bass, 1997), Ch. 13. There has been a large body of literature on the "reinventing government" drive of the Clinton-Gore administration, see Donald Kettl,* Reinventing Government: A Fifth-Year Report Card*, (Washington, D.C.: Brookings, 1998), and Patricia Ingraham, et al., eds.* Transforming Government: Lessons from the Reinvention Laboratory*, (San Francisco: Jossey-Bass, Inc., 1998). This literature does not yet capture the dynamism — and chaos — of leadership of reinvention in a turbulent political setting. In the business administration field, the literature is perhaps larger in relation to management of change, and it too seeks to address certain issues of management where discontinuous change is required. See Jerome Want,* Managing Radical Change*, (N.Y.: Wiley, 1995), and John P. Kotter,* Leading Change *(Boston: Harvard Business School, 1996). Much needed in the literature is analysis of specific leaders coping with change and seeking to master it in the public sector. There is some writing concerned with "public entrepreneurs." One book especially relevant in this context is James Doig and Erwin Hargrove, eds.,* Leadership and Innovation: A Biographical Perspective on Entrepreneurs in Government *(Baltimore: Johns Hopkins, 1990).*

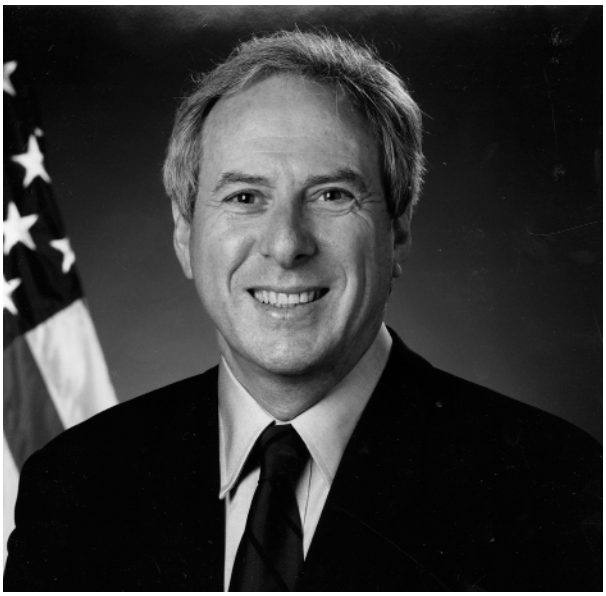
had no timetable and seemed hopelessly too expensive when NASA estimated the cost at one-half trillion dollars over 30 years.[10] The economy, meanwhile, was suffering and the budget deficit growing. NASA's lead program, the Space Station, begun in 1984, was years behind schedule, billions beyond the projected cost, with no hardware ready.

Worse, the *Hubble Telescope*, launched in 1990 amidst enormous media hype, turned out to have blurred vision. NASA had been roundly criticized after *Challenger*, but the reaction to *Hubble* was in some ways worse, as the space agency now became the subject of ridicule. With numerous other problems involving Shuttle glitches and space science launches, with many programs competing for funds without a sense of priority, NASA seemed adrift. *Time* magazine described NASA as "under siege, its reputation tarnished, its programs in disarray, its future clouded."[11]

A 1991 blue-ribbon presidential commission, headed by former Lockheed Martin Chief Executive Officer Norman Augustine, recounted NASA's many ills and recommended an infusion of new money that would have raised NASA's budget of $14 billion in 1991 to $30 billion in 2000.[12] However, a budget agreement by the President and Congress to rein in expenditures made that kind of increase impossible. Moreover, there was growing concern that NASA Administrator Richard Truly, an admiral and ex-astronaut, was not the man to turn NASA around. He was in constant combat with the National Space Council, a White House coordinating committee headed by Vice President Dan Quayle, and seemed unable to prevent congressional micromanagement and internecine strife among NASA's programs and field centers. The Office of Administrator was weakening as a force for central control. In 1991, Quayle and Presidential Chief of Staff John Sununu decided Truly had to go. This view was endorsed by three former NASA administrators. In early 1992, President Bush reluctantly agreed and forced Truly to resign.[13]

[10] *Robert Zubrin,* The Case for Mars *(New York: Touch Tone, 1996), 47.*
[11] Time *(August 6, 1990). Cited by John Logsdon, "Creating a Goldin Report Card,"* Space News *(March 10-16, 1997), 13.*
[12] *Advisory Committee on the Future of the U.S. Space Program,* Report *(Washington, D.C.: USGPO, 1990).*
[13] *Bryan Burrough,* Dragonfly: NASA and the Crisis Aboard MIR *(New York: Harper Collins, 1998), 239-243.*

Enter Dan Goldin: A Mandate for Change



On April 1, 1992, Daniel Goldin became NASA administrator. He was an "outsider" in terms of the Washington civil space establishment.

Fifty-one, Goldin was vice president and general manager of TRW's Space and Technology Group. Born in New York City, he had received a B.S. in mechanical engineering from City College of New York in 1962. Fascinated with space from boyhood, he had been captivated by *Sputnik* and was anxious to help America win the "space race." He wanted to be an astronaut, but his poor eyesight precluded that option. Instead, he went to work for NASA's Lewis Research Center immediately after college. He intended to help NASA with its next big program beyond Apollo, which he expected would be Mars.

After a few years at Lewis, he felt constrained and sensed the country losing interest in the space program. He put his Mars dream on hold and left NASA in 1967 to join TRW. There, he worked mainly on classified defense programs, rising through the ranks of the giant aerospace company. In the mid-1980s, he became heavily engaged in the nation's top-priority Strategic Defense Initiative, or SDI ("Star Wars"). The National Space Council, which presided over military as well as civil space, took note of Goldin's dynamic and innovative policies at TRW. In the "black" world of military space,

Goldin was a rising star with a reputation as a hard-driving innovator. He, in particular, was winning attention by using very advanced microelectronic technology to launch smaller spacecraft.

National Space Council staff saw Goldin as what NASA needed. He was known to be abrasive, but the Council believed NASA required a "shaking up." The biggest issue was whether Goldin could move from the relatively cozy classified-weapons world to the goldfish bowl environment of NASA. He was inexperienced in the political world of Washington.[14]

Why did Goldin take the job? There was no guarantee he would survive beyond January 1993, even if Bush won a second term — a victory hardly guaranteed. He had a wife and two grown daughters, a huge salary in industry, and a lot of good reasons to stay in California. But Goldin was ready for a move, flattered by a presidential offer, anxious for public service. He had participated on national aerospace committees and spoken out on the need for greater innovativeness in U.S. technology policy. Perhaps most importantly, he had maintained, from a distance, his love affair with space, especially exploration. He still wanted America to go to Mars — his concept of the country's next great frontier. In agreeing to lead NASA, he felt he was coming home.[15]

In conversations with the White House, he was assured that he — not the National Space Council — would be in charge of NASA. The President wanted Goldin to align NASA's program with budget reality. That reality, he was told by White House staff and senior lawmakers in Congress, was grim. NASA could not expect much more than steady-state funding in the 1990s. Goldin thought about what he would do and how. In spite of the financially pressed environment, he decided that he would maintain all major programs and centers and even try to initiate new starts. His reforms would be technical and managerial. In his senatorial confirmation hearings, he stressed his intent to exercise firm control of NASA and to be in command of civil space policy. "I detect a backbone in the nominee," then Senator Al Gore, chair of the subcommittee conducting the hearings, declared.[16]

Goldin came in with a mandate for change from the White House and Congress. The fact that he was a NASA outsider was regarded as a plus by many observers. The fact that he was a virtual unknown to most of the Washington community and media meant that they did not know what to expect from Goldin.

A Fast Start

Joining NASA April 1, Goldin immediately established himself as a man in a hurry. In his first month, Goldin traveled to all the NASA centers around the country and met with upper managers and employees. He talked with White House officials and legislators, read numerous reports on NASA and its problems, and engaged in wide-ranging conversations with Carl Sagan and other space luminaries. Everywhere, he searched for ideas while pondering the tight budget he faced.[17] His most important formal appointment, not made until November, was General John Dailey as acting deputy director. Recently retired from his post as second in command of the Marines, General Dailey provided a steady internal hand, while Goldin focused largely on the outside role and occasional major decisions affecting internal activities.

In addition, Goldin relied closely on the advice of George Abbey, a NASA veteran on leave to the National Space Council. He also worked closely with the Space Council's staff director, Mark Albrecht. Goldin's proximity to the National Space Council enhanced the impression NASA officials had of him as the Space Council's man, rather than their man. Goldin saw himself chiefly as the President's man,[18] although Bush was seemingly uninvolved with space policy including his Space Exploration Initiative.

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[14] *The sense of need for change in NASA was pervasive in the media. "Fresh Air for the Space Agency,"* New York Times *(March 13, 1993); "Confirm Bush's Choice for NASA," (Commentary)* Space News *(March 16-22, 1992).*

[15] *Interviews with Daniel Goldin, December 16, 1999; October 21, 1999; November 12, 1998, Washington, D.C. "Bush Nominates TRW Executive Goldin to Succeed NASA's Truly,"* Aerospace Daily *(March 12, 1992).*

[16] *Nomination of Daniel S. Goldin to be Administrator of the National Aeronautics and Space Administration, U.S. Senate, Committee on Commerce, Science and Transportation, 102 Congress, 2d Session, (March 27, 1992) (Washington, D.C., USGPO, 1992), 7, 12.*

[17] *Goldin interviews.*

[18] *Goldin interviews.*

Believing change required a vision, Goldin set about defining what that vision would be. He also spoke about empowerment with the notion being the vision would come from a wide-ranging participative process. The problem was that long-term vision making could not be disassociated from immediate budget cutting. In May, he established at headquarters a set of teams charged to produce a new direction for NASA. The teams were organized so that each program area would be reviewed by two teams ("red" and "blue"), with one serving as a critic of the other. He directed the teams to streamline NASA programs by as much as 30 percent. The results were to be integrated into the next budget submission in the fall.[19]

Goldin accepted budget constraint as inevitable for NASA in the 1990s, and his strategy was to have NASA control program cuts rather than have Congress and the White House impose priorities on the agency. It was a preemptive-cut strategy, but he found many NASA program officials unwilling to join him in this course of action.

To help the internal teams set priorities, he brought in various external management experts, even the elderly W. Edward Deming, founding father of Total Quality Management. Goldin spoke of "cultural change" and "if you can't measure it, you can't manage it." He also wanted to involve the public in NASA planning through town meetings after NASA had finished its own planning.

Goldin heralded the coming of a "new NASA," but officials in NASA saw an inconsistency. He replaced the existing NASA logo with the insignia used during the Apollo era. If Goldin wanted NASA to look ahead rather than back, why return to the Apollo logo? The answer, he said, was that he wanted to remind NASA of what it could be again.[20] Also, what was perceived as another inconsistency was that while Goldin stressed participation and empowerment in his rhetoric, he was perfectly willing to make decisions by himself when he thought them necessary. The red-blue process was not producing the revolutionary change he believed was required. He understood the desire of senior officials to wait him out, figuring he would be gone with the upcoming election. But Goldin did not wait.

In September, six months after his arrival, Goldin announced a significant reorganization that sent a shockwave throughout NASA. While the decision could be rationalized in strictly organizational terms, the widespread perception in NASA was that Goldin was making a statement about power — his power vis-à-vis that of other senior officials.

The NASA unit most affected was the Office of Space Science and Applications (OSSA). OSSA was second only to the manned space program in NASA in budget and prominence. Len Fisk, leader of OSSA, was an astute bureaucrat who fought hard for his projects. Influential inside NASA, he had a considerable outside constituency in the scientific community.

Goldin spoke of a "vicious cycle" afflicting OSSA and other NASA entities. He said NASA loaded a large number of experiments onto a few big, expensive machines launched into space. The scale of the enterprise made it take a long time to get the spacecraft developed and operating. Because it took so long to get these spacecraft built, they incorporated obsolete technology by the time they reached orbit. With so much incorporated into these expensive machines, NASA could not afford to lose any of them. The agency had become risk-averse, he said, and emphasized extra-reliable (i.e., less innovative) technology. If anything ever did go wrong, NASA took a huge political hit because so much money and time appeared to have been wasted.

Goldin's solution was faster, better, cheaper technology, taking advantage of the many technical advances outside civil aerospace to produce smaller spacecraft that could be built more quickly, launched more frequently, and cost less. The faster, better, cheaper policy was not new to the world — the National Space Council and SDI had used the concept and Goldin had implemented it at TRW. However, it was new to NASA. Such a policy could

[19] *NASA Administrator Daniel S. Goldin, "The New NASA — Faster, Better, Cheaper, Without Compromising Safety," document summarizing NASA Senior Management Team Meeting (May 18, 1992), NASA History Office Files, Wash. DC.; James Asker, "Goldin Orders Sweeping Review of NASA Programs, Eyes 30% Cut,"* Aviation Week and Space Technology *(June 1, 1992), 29-30.*

[20] *Eliot Marshall, "Making Less Do More at NASA,"* Science, *Vol. 258, No. 5079 (Oct. 2, 1992), 20-23.*

allow NASA to take greater risks and fail occasionally. Also, there was a certain public relations value in showing Congress and the American people that NASA was active, an energetic organization launching spacecraft often, rather than at long intervals.

Also, in reorganizing OSSA, Goldin wanted more visibility for the earth observation and life science elements of the enterprise. The former was politically salient given its environmental mission and was particularly of interest to then Senator Gore, whose support NASA needed. The life science element was increasingly vital to the Space Station and its mission. Moreover, the budget crunch made OSSA competitive with Space Station for funds, given its future funding trajectory. Finally, while at TRW, Goldin had crossed swords with OSSA over its designs for large-scale Earth-observing space satellites. Goldin argued that smaller was better. OSSA management had strongly disagreed and told TRW to keep Goldin quiet or risk losing NASA work.[21]

As administrator, Goldin was now in a position to get his way. He split OSSA into three offices.[22] This decision meant that astronomy, Earth observations, and life sciences would each have its own director, but each would preside over a relatively smaller and weaker operation. Fisk was summarily reassigned to a new role as chief scientist, with no program and budget authority. Fisk, whose treatment seemed unnecessarily harsh to many observers, soon left the agency, while Goldin personally reduced the Earth-observation budget by $750 million beyond cuts already absorbed.[23]

As Goldin moved other executives around, in the manner of Fisk, NASA veterans worried about being "Fisked." To those who criticized him for forceful moves that contradicted his talk about participative management, Goldin responded defiantly that some decisions were not subject to debate.[24]

[21] *Theresa Foley, "Mr. Goldin Goes to Washington,"* Air and Space *(April/May 1995), 36-43.*

[22] *Ibid. Initially, he split OSSA into two offices, but it was clear that a third office would emerge. Shortly after the first two came into being, the third did also.*

[23] *Kathy Sawyer, "The Man on the Moon,"* Washington Post *(July 20, 1994). W. Henry Lambright, "Downsizing Big Science: Strategic Choices,"* Public Administration Review *(May/June 1999).*

[24] *Eliot Marshall, "Space Scientists Get the Jitters,"* Science*, Vol. 258, No. 5086 (Nov. 20, 1992), 1296-98; Foley.*

Goldin wanted to also make changes in the Space Station's design and management. But here he was told to hold back by Space Station proponents in the White House and Congress. They told him support in Congress was so tenuous that any change could cost votes on the Hill. What an executive might do in the private sector, or even in the defense world, was limited in the more visible and politicized arena of NASA, at least where the Space Station was at issue.[25]

The Clinton Transition: Turning Crisis into Opportunity

In January 1993, Bill Clinton became President. He disbanded the National Space Council, but the Vice President remained the principal White House official overseeing space. Al Gore, a space enthusiast, was a potential friend of NASA — and Goldin. Exactly where Clinton stood on space was uncertain, but it was clearly not a priority for him. To his surprise, Goldin was retained, in part perhaps because Clinton could not get others to take the job. Whatever the reason, he let Goldin continue, and Goldin was determined to finish the task of change he had started under George H. W. Bush.

There were three crises that occurred over the ensuing year to which Goldin responded decisively and effectively. The way he handled these situations allowed Goldin to strengthen his hand at NASA as a change agent. The first crisis concerned the Space Station. In February, Leon Panetta, director of the Office of Management and Budget, summoned Goldin to the White House, where he told him that the administration intended to cut NASA's budget and perhaps terminate the Space Station. Goldin argued that without the Space Station, the Shuttle had little purpose. With both Station and Shuttle down, there was no manned space program. NASA would lose its core mission and could be broken up, with its parts distributed to other agencies. He pled for time to see if he could bring Space Station costs down to a point acceptable to the Clinton administration.[26]

On March 9, the President formally directed Goldin to find alternative ways the Station's projected bill over the next five years could be cut

[25] *Marshall, "Making Less Do More at NASA."*

[26] *Goldin interviews.*

from the planned $14.4 billion to an administration goal of $9 billion. Goldin established an independent review group, headed by MIT President Charles Vest, to review NASA's recommendations.[27] In early June, NASA provided three approaches for redesign at varying costs, none of which met the President's $9 billion target. After listening to a variety of views, the President chose a hybrid of two of the options, which incorporated much of the work already done on Station design, estimated to cost $10.5 billion over the next five years.[28] While Goldin did not get the precise design option he might have preferred, he did get redesign — which he could not obtain under Bush. Moreover, he also was able to commence a major management overhaul he believed essential. These management changes involved personnel reductions, reorganization, and replacement of officials in charge with managers of Goldin's choosing.

The Space Station crisis was not over, however. It now moved to Congress, where the battle was again one of life and death. With Goldin making pleas until the last second, and the White House adding its weight, the Station survived the House vote of June 23 by only one vote.[29] Then, it was back to the executive branch and on to a foreign policy front for Goldin.

The United States and Russia had been talking about joint ventures in space since the Cold War ended in the early 1990s. Under Bush, Goldin had gone to Russia to discuss technical options. In the Clinton administration, Russia proposed, in a way more serious than previously, a partnership involving the Space Station. Goldin and Clinton saw the Space Station as a symbol of the new relationship with Russia. But Clinton wanted Russia to agree not to sell certain missile technology to India in order to stem possible proliferation. The two policy interests collided, and while the Space Station debate took place within Congress, the Clinton administration sought a compromise with the Russians. Goldin was a strong proponent of a Space Station

Backdropped against white clouds, the International Space Station moves away from the Space Shuttle Discovery.

partnership. He saw Russia as having technology and experience from which NASA could learn. He even could envision saving money on the Station given Russian cooperation.

On November 29, the Space Station crisis reached a climax with a "summit" meeting at the White House involving the President, various other top executive branch officials including Goldin, and congressional leaders. They agreed that the redesigned Space Station be rechristened the International Space Station, with Russia a new partner — the primary partner — in a venture already featuring Europe, Canada, and Japan. Russia would cancel the impending missile technology transfer with India and would get $100 million a year for four years from NASA for ISS work to compensate for the abrogated missile arrangement. The President and Congress agreed to stable support for the Station over the ensuing five years, provided NASA held ISS costs to $2.1 billion a year.[30]

The second crisis with which Goldin had to deal was the *Hubble Telescope*. The Space Station's

[27] *"Space Station Redesign Advisory Members Named,"* NASA News *(Washington, D.C.: NASA, April 1, 1993).*

[28] *Andrew Lawler, "Gore, Panetta Dispute Shaped Space Station Fate,"* Space News *(July 26-August 1, 1993); Andrew Lawler, "Clinton Picked Station Matching His Vision, Priorities,"* Space News *(Aug. 2-8, 1993); William J. Broad, "US To Cut Costs, Seeks Russian Role in Space Station,"* New York Times *(April 7, 1993).*

[29] *Lawrence interview.*

[30] *William Broad, "Impasse is Broken on Space Station,"* New York Times, *Dec. 1, 1993.*

Goldin and the Space Station

1992	Goldin appointed; he inherits a Space Station program that is behind schedule and over cost. Goldin moves to redesign the Space Station but is directed to cease doing so by Space Station supporters in the Bush White House and Congress.
1993	Goldin is warned by OMB that the Space Station may be terminated due to budget problems. He is ordered by President Clinton to redesign the Space Station to save money. Goldin lobbies the House of Representatives, which comes within one vote of terminating the Station. Goldin helps bring the Russians into the program and agrees to cap yearly spending at $2.1 billion as part of a presidential-congressional "summit" decision to maintain and stabilize the program.
1995-1997	As part of the "new" International Space Station program, U.S. astronauts train aboard Russian Mir. A series of accidents in 1997 cause great concern about the safety of Mir and put the U.S.-Russia relationship in jeopardy. Goldin defends the Russian partner. Following his assessment of the risks, Goldin sends an astronaut to Mir in spite of public opposition from the NASA Inspector General and House Science Committee Chairman James Sensenbrenner. The overall Space Station program moves ahead.
1998	Continuing Russian financial problems cause delays in the Space Station's development. Although Goldin develops a contingency plan in case Russia does not deliver needed equipment, he continues to support Russian involvement. The President agrees to further subsidize Russian participation. The $2.1 billion annual cap for the Space Station is breached. At the end of the year, the U.S. and Russia launch the first two components of the Space Station, and assembly in space begins.
2000	Following another year of delays and controversy, a U.S.-Russian team is launched to the Space Station to occupy a newly assembled module for living quarters. "Permanent" human habitation of the Space Station begins. Goldin reorganizes NASA to prepare for the utilization phase of the Space Station, upgrading attention to life sciences and human impacts of long-duration spaceflight.

prospects could not be totally separated from *Hubble* repair. Goldin regarded *Hubble* repair as make or break for NASA, since if NASA could not repair *Hubble*, how could it build the football-field sized ISS?[31] His strategy was to lift *Hubble* repair from its existing and somewhat conflicted bureaucratic setting and devote to it special managerial priority and resources. He appointed an overall director for this specific mission and made it clear that this director could get to Goldin to overcome any administrative roadblocks. He ordered unprecedented astronaut training for what would be extraordinary work in space. At the turn of the year, the mission was carried out superlatively, with high public attention, and in January 1994, an ebullient Goldin announced *Hubble* repair was a complete success.[32] That summer, with NASA's credibility strengthened by *Hubble*, and a year of Goldin lobbying behind, the vote on ISS came up. The House margin of victory expanded from the one vote of 1993 to 123 votes in 1994.

While ISS and *Hubble* were the most visible crises Goldin faced in the early Clinton administration, there was a third that also marked his unusual capacity to turn adversity to advantage. In August 1993, just three days short of its orbital rendezvous

[31] *Joseph Tatarewicz, "The Hubble Space Telescope Servicing Mission," in Pam Mack, ed.* From Engineering Science to Big Science *(Wash., DC: NASA, 1998), 365-396.*

[32] *Ibid.*

with Mars, the *Mars Observer*, a $1 billion spacecraft, lost contact with Earth. This had been the first Mars probe since *Viking* in 1976, and *Observer's* demise caused great chagrin in NASA, but not for Goldin. While the Space Exploration Initiative of Bush was a casualty of first congressional and then Clinton budget cuts, Goldin still fervently wanted to go to Mars. He would keep a focus on Mars through unmanned probes that were faster, better, cheaper than anything planned before. He directed NASA to develop a new Mars effort, with more launches, reoriented to demonstrate his faster, better, cheaper approach.[33]

Becoming a Model for Federal Reinvention

Early on, the Clinton administration proclaimed the need to "reinvent government." Goldin pointed out that he had already been reinventing NASA, starting under Bush, and would continue doing so.

NASA's Budget in the Goldin Years

Fiscal Year	Total Appropriations (in Billions of Dollars)
1992	14.317
1993	14.310
1994	14.570
1995	13.854
1996	13.886
1997	13.711
1998	13.649
1999	13.655
2000	13.602
2001	14.254

Source: The Budget for Fiscal Year 2001, Historical Tables (http://w3.access.gpo.gov/usbudget/fy2001/pdf/hist.pdf) pp. 88-90

Goldin's reforms included new procurement rules that threatened cancellation of projects if contractors experienced overruns beyond a certain point. Those reforms were increasingly appreciated by Clinton and Gore. They asked Goldin to do more, and he enthusiastically took up the cause. Goldin declared that he emphasized not the 95 percent of NASA work that was excellent, but the 5 percent that needed improvement. Officials who did not share his enthusiasm for change did not survive. While Goldin continued under Clinton, many others at NASA did not. Before too long, more than half the senior managers — program and center directors — were Goldin's appointees.

In November 1994, the Republicans, for the first time in decades, gained control of Congress. Led by Newt Gingrich, they declared they had a "contract with America" and vowed action. Chastened by this surprising political defeat, Clinton, in January 1995, went beyond "reinvention" to proclaim "the end of Big Government." He promised tax relief, a future balanced budget, and cuts in federal spending. His strategy was one of preemption, a means of holding policy initiative rather than letting Gingrich decide what was cut and by how much. This was the same strategy Goldin had been exercising in his domain. However, as used by the President in relation to agencies, preemption took Goldin by surprise.

With no prior consultation with Goldin, Clinton asked NASA to find $5 billion in additional savings in its spending plan for the next five years. Since the ISS summit had "fenced off" funding for the Space Station, such a cut meant all other NASA programs were in jeopardy. Goldin had hoped his earlier moves had bought him breathing space. For two weeks, he was utterly depressed.

Then, he bounced back, determined once again to be proactive, and declared he would use the cuts as an opportunity to complete the revolution he had begun.[34] From February to May, NASA conducted a strategic planning exercise aimed at determining how NASA could maintain all its programs on far less funds than it had expected. The faster, better, cheaper strategy was not enough. There had to be a restructuring of the agency.

[33] *Foley, 40.*

[34] *David Morrison, "Low-Rent Space,"* National Journal *(April 29, 1995), 1028-1072.*

Space Shuttle Endeavour *landing at Edwards.*

The restructuring strategy had at least four major dimensions: "back to basics," privatizing, decentralizing, and downsizing. While these aspects related to one another, there were differences. "Back to basics" meant focusing on the primary business of NASA, which was research and development (R&D), not operations. The latter was the job of the private sector or other non-R&D agencies. This view led to consideration of what functions NASA could let go and to whom. In February, Goldin commissioned a study that recommended "privatizing" the Shuttle, by which was meant turning over much of the routine work NASA civil servants did to a private contractor.[35] Such action was projected to save program money through efficiencies business could introduce. In November, NASA announced it would negotiate a sole-source contract with United Space Alliance, a partnership of the Lockheed Martin and Rockwell corporations specifically formed for Shuttle "operations."[36]

Restructuring also meant decentralizing. In February 1996, for example, Shuttle management was shifted from headquarters to Johnson Space Center in Texas. The decision prompted the resignation of the highly regarded Shuttle chief, Bryan O'Connor, who was at headquarters. O'Connor, a former astronaut, charged that NASA was returning to the organizational design that contributed to the *Challenger* disaster.[37]

Goldin countered that having too many civil servants sign off on flight readiness "represents a threat" to safety, rather than a guarantee of it, because the layering of bureaucrats obfuscated responsibility. Goldin insisted safety was his number one priority. Nevertheless, this element of the restructuring strategy received White House review, which ultimately supported Goldin's move to decentralize.[38]

All these changes eventually led to personnel downsizing, especially at headquarters. Goldin's view was that headquarters was overloaded with unnecessary personnel, since headquarters should be focused on policy-related functions of agency-wide relevance and not perform work others in NASA or outside could handle. In April, Goldin announced a major cut in headquarters personnel, a cut so severe and rapid as to constitute a shift in downsizing strategy. Rather than downsize through attrition, this new tact appeared to involve actual layoffs.[39]

Senator Barbara Mikulski of Maryland, the most influential democrat on NASA's Appropriations Committee, "went ballistic." With many NASA employees in her constituency, she placed language in NASA's legislation preventing the announced cutbacks and called Goldin before her committee to explain what he had in mind. Goldin claimed errors in communication and said he would proceed slowly and humanely.[40] No reductions-in-force (layoffs) did take place, and reassignments and attrition became the means to accomplish the downsizing end, which was eventually accomplished.

Nevertheless, the incident reinforced the view in and outside NASA that Goldin might well be correct in his strategies, but the way he went about achieving them — the tactical details — were unnecessarily harsh and insensitive. He wanted to reinvent NASA so it would be stronger, but his methods contributed to morale problems.

[35] Report of the Space Shuttle Management Independent Review Team *(Washington, D.C.: NASA, 1995).*

[36] *Sean Holton, "Shuttle Deal Has Panel Asking NASA for Answers,"* Orlando Sentinel *(Dec. 1, 1995).*

[37] *"Shuttle Chief Resigns in Management Dispute,"* Space News *(Feb. 5-11, 1996).*

[38] *"Safety Panel to Conduct Space Shuttle Program Review," NASA News Release (May 31, 1996).*

[39] *Seth Borenstein, "NASA Headquarters Job Cuts Slice Deeper,"* Orlando Sentinel *(April 18, 1996).*

[40] *Kathy Sawyer, "Goldin Takes the Heat,"* Washington Post *(May 3, 1996).*

Making New Starts

In spite of the criticism, Goldin persevered and had more admirers than detractors among his political masters. Remarkably, these included elected officials as diverse as Clinton and Gingrich. These adversaries both saw Goldin as an able man driving for positive change in an environment marked by financial constraint, partisan wrangling, and even government shutdown.

For Goldin, most of his change strategies had been in management, "how" to carry out existing programs: faster, better, cheaper; restructuring; ISS redesign and Russian partnership. However, he was after even greater changes in "what" NASA would do. He wanted new programs, new starts, or radical redirections of key efforts that would take NASA into the 21st century. There were three dramatic decisions in 1996 that stood out as most central to this strategy.

Goldin was sincere in wanting his agency "to dream again," and his speeches reveal a man of vision capable of looking far ahead. While some of his subordinates were intimidated by his style, others were inspired by his encouragement that they think imaginatively and "big." He engaged in yearly strategic planning with his officials not only to satisfy administration reinvention requirements, but also to get them to envision the future and how they could get there.

As before, events affected the timing of many executive actions. In the mid-1990s, there were striking new discoveries of planets circling stars beyond the sun. Might "other Earths" be out there — with life? NASA's Office of Space Science had in Goldin an administrator who shared its curiosities about the cosmos. In early 1996, Goldin announced a new program called Origins that would seek knowledge about the beginnings and destiny of the universe — and also look for life. This program envisioned a new emphasis on biological research and what was called "astrobiology." There would eventually be an astrobiology institute established at NASA, with a director who was an eminent scientist.[41]

In a related move, in 1996, Goldin used an apparent meteorite discovery to stimulate a second reorientation in the Mars exploration program — which he had first redirected in 1993. Reputable scientists associated with NASA claimed that a meteorite from Mars, found in Antarctica, contained evidence of ancient life. This claim was disputed by other scientists. However, the meteorite statements excited the White House, elements in Congress, the media, and Goldin.[42] He redirected the Mars program from more general science goals toward a search for life (present or past) on Mars.

In effect, Goldin reinvented the Mars program again and made it complementary to Origins (though organizationally separate). NASA would now launch a series of orbiting spacecraft and landers that would go to Mars every two years, culminating in the return of a soil sample to Earth in 2008. This program would also push the faster, better, cheaper philosophy further than ever before to accomplish as much as possible.

Another new start Goldin promoted in 1996 involved launch technology. Human exploration was stymied by launch costs. The Shuttle had not lived up to its promise of frequent, inexpensive, and reliable launches. Goldin badgered aerospace chief executives and his own manned space officials about the need for a breakthrough in launch technology. The Shuttle was aging. Something had to be done.

In 1996, Goldin went to California with Vice President Gore to announce that NASA and Lockheed Martin were forming a partnership in a new program called X-33. The X-33 would be an experimental vehicle, projected to cost $1.4 billion, developed primarily with NASA funds, but also some industry money. Its aim was to demonstrate new technology essential to a Shuttle successor. Once X-33 proved out that technology, Lockheed Martin would develop the operating vehicle, VentureStar, for which it presumably would largely pay.[43]

[41] *Interviews with Gerald Soffen, May 12, 1999 and February 18, 1999, Washington, D.C.*

[42] *Michael D. Lemonick,* Other Worlds*:* The Search for Life in the Universe *(New York: Simon and Schuster, 1998), 136; "Goldin Chooses Logic Over Emotion,"* Space Views *(August 8, 1996), http://seds.lpl.arizona.edu/spaceviews/hotnews/goldin.960808.html.*

[43] *Charles Petit, "Lockheed to Build Next-Generation Spaceship,"* San Francisco Chronicle *(July 3, 1996).*

There were many space analysts who believed the single biggest problem NASA faced in the immediate future was to make human access to space faster, better, cheaper — and safer. Goldin intended, through the X-33/VentureStar program, to deal with this central challenge in a way that innovated technically and managerially. The X-33 involved high risks, as it pushed both frontiers — but that was what Goldin said NASA was all about.

Legitimating Faster, Better, Cheaper

In 1997, President Clinton began his second term, retaining Goldin, who was now a valued member of his administration. The NASA administrator had been in office long enough that he could see the results of some of his early initiatives. Most significantly, there was *Pathfinder*. On July 4, the *Pathfinder* spacecraft landed on Mars. This was a $171 million successor to the $1 billion *Mars Observer*. Almost universally, *Pathfinder* was heralded as legitimating faster, better, cheaper.

People everywhere could experience the Red Planet on television. They also had access to a *Pathfinder* website on their home computers as the *Sojourner* roving vehicle was released and crawled along the Mars surface. Skeptics now grudgingly admitted that faster, better, cheaper could work. Goldin received considerable praise. *Pathfinder* marked the high point of Goldin's personal reputation as a NASA change agent. Many supporters who had heard him criticized over the years felt he had been vindicated.[44]

Not only did *Pathfinder* legitimate faster, better, cheaper and help Goldin, but it also gave NASA and its contractors confidence to push ahead with the Mars sample return program, of which *Pathfinder* was an integral part.

Coping with the Russians

While *Pathfinder* indicated the Mars program was going well, the situation with the International Space Station was not so positive. By 1997, it was abundantly clear that Russia was going downhill economically and also not proving particularly reliable as a partner in ISS.

[44] *Sharon Begley, "Greetings From Mars,"* Newsweek *(July 14, 1997), 27.*

Goldin and Mars

1992 Goldin appointed Administrator; he inherits Bush's Space Exploration Initiative (humans to the moon and Mars) and unmanned Mars program.

1993 The Space Exploration Initiative is terminated by Congress and Clinton. The *Mars Observer*, a $1 billion spacecraft, is lost. Goldin uses this loss to capture momentum for reorienting the Mars program toward "faster, better, cheaper" philosophy.

1996 A Mars meteorite is claimed by some scientists to contain ancient bacterial life. Goldin uses the meteorite publicity and excitement to accelerate the Mars program with the aim of finding evidence of life, present or past. The Clinton administration issues a policy statement supporting Goldin by committing to a "robotic presence" on Mars by 2000, and endorsing the faster, better, cheaper philosophy. However, the statement says nothing about human exploration, for which Goldin is a strong advocate.

1997 The *Mars Global Surveyor* orbits Mars; *Pathfinder* lands and releases *Sojourner*, a rover that moves on the surface. This mission cost less than half that of the *Mars Observer*. Goldin's faster, better, cheaper approach is hailed as successful.

1999 The *Mars Climate Orbiter* and *Mars Polar Lander* fail. NASA is brought under intense scrutiny. Investigations by expert panels suggest faster, better, cheaper was pushed too hard, too soon by Goldin and there are limits to this strategy.

2000 Goldin accepts responsibility for setbacks and appoints a new Mars program director. The new director and his associates slow down the Mars program and allow costs to grow. However, the basic goals for the program remain the same and the faster, better, cheaper approach is retained in what employees perceive as a less doctrinaire form.

Between 1995 and 1997, U.S. astronauts — as part of the U.S./Russian arrangement — had traveled to and stayed aboard the Russian space station, Mir, as a way of learning from Russian experience. In 1997, however, Mir suffered a sequence of mishaps, including a fire, collision, computer outages, power failure, and a leak from the *Soyuz* escape capsule docked for Mir. NASA's inspector general and Rep. James Sensenbrenner (R-Wis.), chairman of the House Science Committee, warned Goldin about risking U.S. astronauts on future Mir missions. Goldin had good relations with many in Congress, but Sensenbrenner was a critic who repeatedly scored the decision to partner with Russia.[45]

Goldin asked for an independent review of the risks. With positive recommendations from two sets of experts, he decided to let astronaut David Wolf go to Mir in September. All went well.[46] While safety was paramount in the decision, preservation of the ISS partnership was also important. This was a way to show confidence in the Russians and Mir.

The Mir phase soon ended, giving way in 1998 to even greater worries about Russia and its ability to deliver on its promises. NASA was depending on Russia for certain components that put Russia on what NASA called a "critical path" for development. As delays occurred, Goldin admitted that the decision to allow the United States (and ISS) to be so dependent on Russia was a mistake. While continuing to stand by the Russians publicly (although imploring and badgering them privately), he allowed that Russia would have to be subsidized and the $2.1 billion annual cap on the U.S. Space Station budget imposed at the 1993 summit exceeded. Following the much-heralded Shuttle launch of Senator John Glenn in November 1998, President Clinton acknowledged that the administration would cover additional Station expenses arising from Russia's problems.[47]

At the end of 1998, the U.S. and Russia launched the first two components of ISS and they were linked in space.[48] Another key component to be supplied by Russia continued to be delayed, setting back the overall program. Goldin, pressed hard by Congress, had NASA develop a contingency plan involving new hardware to protect ISS from abrogation of its agreement by Russia. Goldin continued to support his Russian partner, but he was not going to bet the future of ISS on the troubled nation.

Suffering Major Setbacks

In 1999, Goldin saw more problems with ISS delays. Also, the X-33 ran into technological barriers that put it at acute risk as key to post-Shuttle access to space. Shuttle problems also brought about an internal evaluation that indicated personnel cutbacks and reduced government supervision might be raising safety issues. The number of Shuttle flights would have to increase to get ISS assembled, enlarging risks.[49] With White House approval, Goldin reversed course on downsizing and decided to hire employees in key areas. This decision to rethink personnel policy also related to serious setbacks in the Mars program.

First, the *Mars Climate Orbiter* (MCO) in September failed to find the proper trajectory around Mars. Second, the *Mars Polar Lander* (MPL) in December apparently crashed. Third, two microprobes carried on MPL that were to radio data after penetrating several feet into Martian soil did not function. This triple failure, so visible and so unexpected, appalled NASA and its constituents. It was the most serious setback for Goldin of his tenure. He had dealt with troubled programs before, but those were generally inherited from a previous regime. The Mars program bore his personal stamp and embodied not only his greatest hopes for NASA's future, but symbolized the faster, better, cheaper approach. These failures put his overall change strategy in question and tarnished his reputation.[50]

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[45] *Larry Wheeler, "Goldin's Decision Destined for History,"* Florida Today *(Sept. 25, 1997); Paul Recer, "NASA Chief Bore Weighty Burden,"* Buffalo News *(Sept. 26, 1997).*

[46] *Burrough,* Dragonfly*; Kathy Sawyer, "NASA Decides to Send Another Astronaut to MIR,"* Washington Post *(Sept. 26, 1997).*

[47] *Chuck McCutcheon, "Lost in Space: NASA's Quest for a New Direction,"* CQ Quarterly *(June 6, 1998), 1494-1502; "The Way It Is, Walter,"* Aviation Week and Space Technology *(Nov. 2, 1998), 23; Joseph Anselmo, "Clinton Raises Hopes for NASA Bailout,"* Aviation Week and Space Technology *(Nov. 9, 1998), 40-41.*

[48] *"Dawn of a New Era for Space,"* Syracuse Post-Standard *(Nov. 21, 1998); Craig Covault, "US, Russia Modules Link to Begin Station,"* Aviation Week and Space Technology *(Dec. 14, 1998), 22-25.*

[49] *Independent Assessment Team,* Report to Associate Administrator, Office of Space Flight, Space Shuttle*, (Wash. DC: NASA, March 7, 2000); Craig Covault, "Shuttle Quality Control Now a Major Concern,"* Aviation Week and Space Technology*, (Dec. 20/27, 1999), 10.*

[50] *Leonard David, "NASA's Mars Losses Spark Anger and Opportunity,"* space.com *(Dec. 20, 1999), wysiwyg://17http://www.space.com/…arsystem/NASA-Marsloss-991220.html.*

X-33, Reusable Launch Vehicle in simulated flight.

To find out what went wrong, he appointed a number of investigating panels. The most prominent was the Mars Program Independent Assessment Team headed by retired Lockheed Martin executive and former NASA executive Tom Young. The panels determined that the MCO accident was due to human error, confusion in English/metric units that caused navigation software mistakes. The likely cause of the MPL failure was a premature shutdown of landing engines, leading to a crash. No "most probable cause" could be identified for the microprobe failure, but it was concluded that due to inadequate testing the microprobes were not ready for flight in any event.

Beyond the technical issues were the management problems, which were specifically addressed by the Young Panel. Reporting in March 2000, it said that the two spacecraft were underfunded by about 30 percent and suffered from understaffing, inadequate margins, and unapplied institutional expertise. Communication among the principal organizational units was "highly ineffective." The contractor, Lockheed Martin, did not tell NASA's Jet Propulsion Laboratory (JPL), which was managing Lockheed Martin's work, about the risks it saw, and JPL did not adequately inform headquarters about cost problems, or perform its own risk assessments as it should have.[51]

Did the Mars failure mean that Goldin's faster, better, cheaper strategy had not worked? There was much soul-searching on that issue. Goldin went out to JPL and addressed the employees in the wake of the Young report. Afterward, he told the media:

> I asked these people to do incredibly tough things, to push the limits. We were successful and I asked them to push harder and we hit a boundary. And I told them that they should not apologize. They did terrific things and I pushed too hard. And that's why I feel responsible.[52]

NASA made a number of immediate changes in the Mars program, including a delay in follow-up missions pending corrections. NASA also announced a new headquarters post of Mars program director to serve as a single point of contact and deal with communication and other administrative problems.[53]

Congressional hearings followed, along with innumerable editorials and other media comment. It became clear that faster and cheaper were not necessarily always better. While no one stated it was possible or desirable to go back to "the old days" of billion-dollar unmanned Mars spacecraft, there seemed to be agreement that there would have to be adjustments upward in cost. The faster, better, cheaper policy was retained as a general guide. The problem was stated to be one of implementation. But implementation meant dealing with NASA staff stretched too thinly, often young and under-mentored — a function of personnel cutbacks and retirements of senior technical people. It also extended to issues of unrealistic expectations by NASA and its contractors. In addition, fear and distrust were rife within the implementation system. Goldin had indeed pushed too hard. Contractors and center officials worried that if they raised issues of cost to headquarters, they would have their programs killed or risk their own careers.

Goldin deliberately began softening his words, attempting to create a new image and work environment, showing a "kinder, gentler face."[54] He did

[51] *Leonard David, "Mismanagement Blamed for NASA/JPL Mars Failures,"* space.com *March 28, 2000;* Mars Program Independent Assessment Team Summary Report *(March 14, 2000), NASA History Office files, Washington, DC. Michael A. Dornhiem, "NASA Says MPL was Too Cheap, Too Fast,"* Aviation Week and Space Technology *(April 3, 2000), 40.*

[52] *Andrew Bridges, "Goldin Accepts Blame for Lost Mars Missions,"* space.com *(March 29, 2000).*

[53] *Michael Dornheim.*

[54] *Andrew Lawler, "'Faster, Cheaper, Better' on Trial,"* Science *(April 7, 2000), 32.*

not look for scapegoats and accepted responsibility. He seemed painfully aware that he was part of the problem. At the same time, he declared he still believed in the central thrust of his management reforms and would continue on his course.

A Final Push for Change

The year 2000 moved forward with Goldin knowing that his record-setting tour at NASA was likely to end with a new President. How was he to use the time remaining? While chastened by the Mars failures, he signaled no letup in his efforts to make NASA stronger for his having been its leader. His strategies included: (1) reorienting programs that had not gone as he had hoped or that required adaptation because of their inherent technical evolution; and (2) launching a new initiative that would make it possible for the space enterprise to have a long-term future.

The reorienting strategy was seen in the Mars and X-33 programs. In November, NASA unveiled a new 15-year blueprint for Mars exploration. It allowed more science, but at a slower and more cautious pace. It sought to identify "the most compelling places from above, before moving to the surface," and thus delayed the sample return — the prime goal sought from the previous program. Moreover, the cost would be approximately one-third greater during the ensuing five years than previously projected. The revamped Mars program was not as fast, not as cheap, but hopefully would be better.[55]

A second reorientation, even more drastic than that of Mars exploration, although not as visible to the general public, concerned the research and development program for a Shuttle successor. Goldin in 2000 all but admitted that the X-33 effort was failing. This government-industry partnership was at a virtual standstill due to a costly test stand failure and other technology problems. The government had already sunk $900 million into the X-33. Goldin decided he had to look for alternatives.

Hence, in 2000, he proposed a $4.5 billion five-year Space Launch Initiative. Conceivably, X-33 could compete for funds under that program, but the Space Launch Initiative was seen as a new activity, one that would attract different innovative concepts that would help take NASA to the Shuttle successor it eventually required. Goldin commented on the irony he faced, saying he had come to NASA to lead the agency to Mars, but "we've had a little diversion because we can't build launch vehicles."[56]

The Mars and launch vehicle changes were due to failures in implementation. The third major reorientation in 2000 was because of belated success. In November, a huge milestone in ISS progress was reached — a U.S./Russian team was launched to ISS, heralding a new era of "permanent" human habitation of space. Still years from being complete in assembly, ISS was judged ready enough for a living quarters, and the expectation was that the first crew would be replaced by succeeding crews for the next 15 to 20 years, and probably beyond. It was a huge moment for Goldin, who had lived and suffered with the Space Station and its "perils of Pauline" virtually from the day he had arrived.[57]

That moment underlined for Goldin the importance of reorienting NASA for the permanent human habitation phase. Using ISS had to get the same priority as building it did now. Goldin consequently shifted personnel and reorganized for the ISS-utilization era. He established a Biological and Physical Research Enterprise on a par with the other major NASA programs. He declared that "it was time for the research for the station to be at the same level as the head of the space flight program."[58]

Also, Goldin announced the launch of a new initiative. He said that NASA was going to establish a stronger relationship with universities. NASA already had relationships with universities, but they were fragmented, limited in scale, and not linked

[55] *Andrew Lawler, "A More Cautious NASA Sets Plans for Mars,"* Science *(Nov. 3, 2000), 915-916; "NASA's Reworked Mars Exploration Plan,"* Aviation Week and Space Technology*, (Oct. 30, 2000), 24.*

[56] *Leonard David, "NASA Chief Predicts Scientific Tsunami,"* space.com*, (Oct. 11, 2000); Brian Berger, "Activists Say Lockheed Should Not Compete for X-33 Funds,"* Space News *(Oct. 16, 2000), 21.*

[57] *Craig Covault, "ISS Finally Manned as Challenges Abound,"* Aviation Week and Space Technology*, (Nov. 6, 2000), 30-31; Remarks after launch of Expedition 1 crew to the ISS, (Oct. 31, 2000), http://www.nasa.gov/bios/goldin_speeches.html.*

[58] *Brian Berger, "Funding Still Unclear For New BRP Mission,"* Space News *(Oct. 16, 2000), 4.*

in any strategic way to what NASA needed long term. The generation of space scientists and engineers that had come to NASA in the 1960s was aging, and many senior people had already left. Fifty-seven percent of all present NASA employees were eligible to retire in the next five years. NASA needed to nurture a new generation that would breathe life into the space program in the 21st century.

NASA had had a substantial university program in the Apollo era and then let that program atrophy. The agency had become inbred, with much of its research focused in its centers. The kind of work NASA was going to do in the future, particularly that associated with long-duration human missions to Mars and the search for life in the universe, needed scientific and technical breakthroughs most likely to come from fundamental research performed in universities. Also, NASA desperately needed young people to select space as a focus for their careers.

This university initiative would mean a build-up of the percentage of NASA's research and development funds that went to universities in the future. It would involve establishing space research institutes in universities, graduate student fellowships, and more internships at NASA centers. Fields emphasized would include nanotechnology and physiological research on humans exposed to deep space. In addressing a meeting of university administrators in October, Goldin declared, "I'm here to talk about where we go in a decade, and that's where we have to be coupled with universities."[59]

Finally, in early January 2001, NASA released a new report that was, in effect, a final word on the Mars failures. Entitled, "Enhancing Mission Success — A Framework for the Future," the report stressed that faster, better, cheaper principles were still valid if properly applied. However, these were not always applied correctly. Admitting mistakes in communication, and that the Mars missions were "overconstrained," the document argued that the concepts of faster, better, cheaper had to "be better articulated" and incorporated into NASA procedures so as to have them applied in a more uniform way across the agency. It provided definitions and implementation guidance regarding the management approach, noting the need for flexibility in specific cases. The document spoke of "open communication" and "trust." It provided prescriptions for improving the agency atmosphere and mechanisms within which faster, better, cheaper could be carried out with or without Goldin at the NASA helm.[60]

Conclusion

Goldin's record as a change agent at NASA is mixed, but decidedly positive. His greatest achievement was saving the Space Station. While others were involved, he was central. Although ISS is controversial, it lies at the heart of NASA in the early 21st century. Without it, there would be little to NASA's core mission. ISS keeps manned spaceflight alive and gives NASA a chance someday to build on this program with a humans-to-Mars mission — Goldin's dream. Goldin lobbied Congress unceasingly for the Station. Also, bringing the Russians aboard was essential to saving the project, although the Russian connection has surely had its costs. Whether it is viable over the long haul depends on circumstances beyond the power of any NASA administrator to control. However, had Goldin not done what he did in 1993 and subsequently maintained the Russian-U.S. alliance, the ISS might well not have made it to the next century.

Goldin's second great legacy was his revamping of the unmanned space science program. He directed *Hubble* repair and turned the *Mars Observer* failure into a trigger for infusing faster, better, cheaper into all science efforts, especially Mars exploration. Pictures from *Hubble* helped spawn Origins, an awe-inspiring program dealing with some of the most profound questions of science. *Pathfinder* showed faster, better, cheaper could work — and gave the nation and world an emotional lift that is one of the intangible rewards of space. He maintained the Earth observations effort, also using faster, better, cheaper techniques, and thus put it into a position to serve planet Earth in the future.

[59] *Ron Southwick, "NASA Outlines Plans For Closer Collaboration with Colleges on Research Projects,"* Chronicle of Higher Education *(Nov. 10, 2000), A29.*

[60] *"Enhancing Mission Success — A Framework for the Future, A report by the NASA Chief Engineer and the NASA Integrated Action Team," Dec. 21, 2000 (Washington, D.C.: NASA, 2000).*

Third, Goldin streamlined NASA, an agency that was considered bloated and bureaucratic when he took it over. This streamlining was done in a way that linked NASA to Clinton administration reinvention goals, thus turning necessity into a political and public relations gain.

Fourth, he restored the authority of the office he held. The Office of NASA Administrator that Goldin assumed in 1992 was under fire from all sides and perceived as losing control of NASA to subunits, the National Space Council, parochial elements in Congress, and various external interest groups. The centrifugal forces were overwhelming the Office of Administrator as a point of coherent control. Goldin reasserted command and placed the office at the forefront of agency leadership. In this respect, Goldin's forceful personality was a critical asset. His dynamism and visibility empowered the office, and Goldin used the authority he gathered to give NASA a measure of control over its destiny.

Goldin was able to accomplish these positive legacies in part because of certain personal characteristics — he worked intensely, was quite intelligent, learned quickly about Washington politics, and was utterly relentless in pursuit of his aims. He has lasted a long time in office, outlasting many of his adversaries. He also employed certain strategies for change that made a difference.

First, he came in with a vantage point of what he had to do — align the agency with a static budgetary environment and do so in a way that enhanced existing programs and gave him room for new initiatives. However vaguely expressed, Goldin did see space exploration (manned and unmanned) as NASA's principal purpose, with Mars as a destiny and force for coherence over the long run. In the short run, he had to maintain NASA through management and technological innovations usually expressed as faster, better, cheaper. However, the short run took place within a vision of NASA's future and its priorities that Goldin held throughout his years in office. Goldin had a "mental model" of NASA and its role and what he had to do.[61]

Second, he moved quickly, taking advantage of the "honeymoon" provided by the mandate for change he received from his political masters. He acquired information about NASA and its political setting from various sources he trusted. Following an attempt at participative management, during which he detected resistance, he acted forcefully to reorganize programs and replace specific managers with individuals who supported his vision of a "new NASA."

Third, he used adversity, specific events, and crisis as opportunities for change. Adversity began with the initial budget for which he prepared. He exercised preemptive cuts in order to make sure he — not the White House and Congress (or subunits of NASA) — determined NASA priorities. His fast start under former President George H. W. Bush was followed by successive tests at the outset of the Clinton era — Space Station, *Hubble* repair, *Mars Observer*. He passed all these tests, thereby securing his position with the White House and Congress, and building a constituency of support while neutralizing potential rivals. Additional tests followed, such as more budget cuts, and again he responded with change-oriented policies, such as "privatizing" the Shuttle. There were also events, such as the discovery of new planets and possible discovery of one-time life on a Mars meteorite, that he used to launch or reorient programs. Goldin revealed a politician's sense of timing in identifying and using these triggers for decision.

Fourth, he excelled externally in "selling" space to a host of political and other constituencies. He used his technical understanding, visionary capacities, and rhetorical skills to look ahead 25 years or more to the space frontier. At his best, Goldin had a capacity to inspire, conveying his own genuine enthusiasm about space exploration. Origins and the Mars program personified his vision and allowed Goldin to build external constituencies for the agency at a time of budget constraint and a troubled Space Station.

Fifth, Goldin sought out weaknesses in NASA — "the last 5 percent." He was always looking for improvement and used independent panels to assess NASA problems and solutions. This strategy eventually extended to himself, when, in the wake of the Mars failures of 1999, he realized his own

[61] *Peter Senge,* The Fifth Discipline: The Art and Practice of the Learning Organization *(New York: Doubleday, 1990), 8-9.*

administrative style had contributed to the "communication problems" found as contributing to the setbacks. It was ironic that Goldin the change agent was winding up his tour at NASA trying to change himself.

All these strategies had administrative transformation as their goal. Goldin engineered not one or two policy changes, but a torrent of changes. This was not evolutionary change, but radical or discontinuous change; it was cultural change. He had to think in these terms, for he presided over a NASA that was caught on a cusp of history.

The Cold War was over and Goldin wanted to steer an agency whose mental model was geared to the past (Apollo, in particular) to the 21st century and his vision. Had he been less able and willing to move decisively, NASA might have collapsed. The general view among close observers in Washington is that while Goldin made NASA leaner, he also made it stronger. Moreover, he has achieved at least partial success in his larger transformational goals.

On the negative side of Goldin's ledger would be failure to solve NASA's access to space problem. Goldin put his eggs into the X-33, and it has so far cost NASA close to $1 billion and much valuable time. Also, he pushed too hard, too fast on the Mars program, as he admitted. He showed that faster and cheaper is not always better and that a leader's reach can exceed his grasp. He was not always clear on what he meant by faster, better, cheaper, and those down the line trying to implement drew their own conclusions, with varying results. His confrontational administrative style blocked his getting unpleasant information an administrator needs to make good decisions. He was more adept with external constituencies than his internal NASA constituency. One has to wonder whether a bit more attention to the "care and feeding of the organization" in winning its support would not have served Goldin's objectives.[62] There are limits to change imposed from the top, and Goldin found those limits.

Nevertheless, Goldin's achievements outweigh flaws in his record. There are cautions to be drawn from the Goldin years at NASA, but there are far more positive lessons for leadership in turbulent times. In the history of NASA, Goldin will likely stand out as a man who preserved the agency by forcing it to change.

[62] *James Webb was quite conscious about this need to think about the organization as a constituency to be won, much as any external constituency. Webb was an excellent manager in part because he was such an able politician. Goldin had political skills, as noted, but he apparently did not direct them internally, a circumstance that is one of many paradoxes about his leadership style. For Webb, see W. Henry Lambright,* Powering Apollo: James E. Webb of NASA*, (Baltimore: Johns Hopkins, 1995).*

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A long-standing NASA-watcher, he has worked for NASA as a special assistant in its Office of University Affairs and has been a member of its History Advisory Committee. Dr. Lambright has performed research for NASA, the Department of Energy, the Department of Defense, and the State Department. Recently, he chaired a symposium on "NASA in the 21st Century." A book will be published from this symposium.

Dr. Lambright is the author or editor of six additional books, including *Powering Apollo: James E. Webb of NASA*; *Technology and U.S. Competitiveness: An Institutional Focus*; and *Presidential Management of Science and Technology: The Johnson Presidency*. In addition, he has written more than 250 articles, papers, and reports.

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