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Space Transportation: A Rhetoric of Routine, Risk, Research, and Renewal

Valerie Neal

Space History Division

Smithsonian National Air and Space Museum

Washington, DC

The United States National Space Transportation System, commonly called the Space Shuttle, is widely recognized as an achievement in engineering and technology, but it can and should be recognized also as a rhetorical endeavor. After the glory days of human spaceflight in the 1960s, the National Aeronautics and Space Administration (NASA) faced a daunting challenge: to ensure the continuation of that enterprise despite declining public and political interest, reduced funding, and having already reached the pinnacle of success. How did the agency and its proponents make the case for a new space transportation system and ultimately a space station? They turned to rhetoric.

In the classical sense of the term, rhetoric is the art of persuasion, a mode of communication that appeals to the reason, emotions, and values of an intended audience. It is a form of civic and civil discourse. In the pejorative sense of the word, rhetoric is exaggeration or nonsense, used to manipulate a target audience. Both styles of rhetoric punctuate the history of the Space Shuttle transportation system from the 1970s until its demise in 2012, but the main current was a legitimate effort to influence public opinion. As NASA sought to sustain human spaceflight, it crafted an evolving rhetoric to engage political and public support and to indoctrinate its own workforce. Over four decades, emphasis shifted from routine to risk, research, and then renewal as NASA kept refreshing its argument in response to skeptics, critics, and changing circumstances. A subtext to the technological and operational history of the shuttle era is the ongoing effort to communicate a compelling sense of purpose for a governmental program of human spaceflight. Such a rhetorical effort continues among the new providers of commercial space transportation services—SpaceX, Orbital Sciences, Virgin Galactic, and others.

The situation was different in the urgency of the 1960s, when public opinion coalesced on the purpose of a novel and costly spaceflight effort. The president himself articulated the rhetoric for the Space Race, and this imprimatur energized the endeavor. John F. Kennedy eloquently appropriated America’s frontier heritage and its foundation in freedom to frame the challenge of moving into space. Situating spaceflight in the pioneering tradition and the expansion of freedom made it a patriotic imperative that was hard to resist.[[1]](#endnote-1) The White House, NASA, the news and popular media in the 1960s readily promoted spaceflight in the familiar language of adventure, exploration, and competition – all resonating with American identity and values. In speeches about the space effort, as in the inaugural address, Kennedy and his aides attended to rhetoric, artfully using the power of language and cadence to persuade and inspire. They believed in the power of words and metaphors to set goals, sway opinion, win votes, and move the nation.[[2]](#endnote-2) By linking the future to the ideals and values of the past, he challenged the nation to enter the space age as leaders.

With such presidential leadership, NASA hardly needed to rally the public but for a time could ride on the crest of popular and political support. Its public relations efforts aimed less at persuasion than at providing information to the voracious media so the public could understand what this novel mission involved. The agency rapidly developed the launch vehicles and capsules for transporting men into space and perfected the procedures to launch and return them safely. NASA ensured that the astronauts, as the principal icons of the Space Race and the space frontier, appeared to the public as unblemished heroes, exuding courage and competence. These confident “all-American boys” embodied national pride and the will to succeed.[[3]](#endnote-3)

Spaceflight after the lunar landings was a tougher sell. NASA found little support for its ambitious program leading to a space station and a human mission to Mars, so it settled for an Earth-orbiting spacecraft to maintain a U.S. presence in space until more promising times. Thus was born the Space Transportation System or Space Shuttle. President Richard M. Nixon’s 1972 announcement of the decision to proceed with the shuttle revealed a much different rhetorical approach for a basically utilitarian vision of spaceflight. There was no spirit of adventure or pioneering, and no basis in any widely held cultural tradition.[[4]](#endnote-4)

Although easy access to space in a new vehicle had merit, the announced purpose of such access – “practical utilization of space” – was probably less inspiring to the public than “pioneering.” The announcement expressed the virtues of the revolutionary new space transportation system in engineering terms: capability, reliability, operating costs, applications. Allusions to spacecraft as tools and the shuttle as a workhorse sounded more agrarian than high tech. The goals of “routinizing” access to space to establish “a real working presence” there aimed to reap benefits on Earth and to keep NASA and the aerospace industry productively engaged. Except for the hyperbolic claim that the shuttle would “take the astronomical costs out of space exploration,” this announcement offered a mundane vision of spaceflight in contrast to the adventure of going to the Moon. Only at the end did a brief flourish buoy the spirit but it was unrelated to the imagery in the rest of the message: “we must sail, and not drift, nor lie at anchor.” The bland workaday rhetoric that launched the shuttle era suggested that a persuasive case had not yet gelled to *inspire* continued space travel.

Over the next four years, NASA rallied to that effort and rolled out a more coherent rhetoric when the first shuttle orbiter, *Enterprise*, rolled out of the assembly plant in 1976. A more appealing gloss brightened the practical purposes of spaceflight. The versatile, reusable space shuttle would usher in “a new era in space transportation,” according to the main theme of NASA’s press release. [[5]](#endnote-5) This “new era” set space transportation into a long tradition of innovations in travel by ship, rail, and automobile, as well as the arc of progressive advances in technology and society. The cultural resonance of “a new age” or “new era” echoed a key concept of national identity—America as a new world.

Speakers at the roll-out ceremony accented the new era theme, and news reporters took their cue from NASA’s rhetoric in their accounts of the shuttle’s debut. The dawning era of space transportation generated a buzz of anticipation pegged to two keywords: routine and reusable. NASA claimed, and the media repeated, that the reusable space shuttle would make spaceflight routine. NASA worked hard to make those concepts appealing by stressing the practical benefits of more frequent and economical access to space. At first, there was little or no mention of astronauts, who had been front and center as the icon for spaceflight in the 1960s. Now the vehicle itself had the starring role, and its delta-winged shape became the icon for this new era.

By the time *Columbia* roared off the launch pad in 1981, NASA had tailored the new era rhetoric into a more familiar notion of routine. “Going to work in space” soon became the theme of a series of posters and published material to explain the uses of the new vehicle. In a nation of commuters, “going to work” had a more contemporary ring than workhorse and readily conveyed a sense of routine transportation. Spaceflight would no longer be a pioneering adventure; it would become commonplace and practical, in Earth orbit, not outward-bound, as people and cargo regularly went back and forth. Again, the news media eagerly appropriated this rhetoric as they reported the early missions.[[6]](#endnote-6)

NASA further elaborated the concept of routine access to space with purposes that would appeal to special interests and make sense to the public at large. Commercial enterprise could use the shuttle to launch satellites or develop manufacturing capabilities there. Knowledge would increase as shuttle crews placed observatories in orbit and conducted laboratory science in space. National security would be enhanced by regular testing and delivery of Department of Defense payloads. NASA anticipated that all these activities on the shuttle would lead to practical benefits on Earth.

Although the shuttle actually resembled a familiar transport vehicle for passengers and freight—an airliner meant to operate on scheduled departures and returns—it was often called “America’s space truck” by NASA and the media, and the Smithsonian National Air and Space Museum featured an exhibit by that title.[[7]](#endnote-7) The shuttle functioned as a freight hauler on a highway in space and as a service vehicle on orbital repair missions. The rhetoric of these roles, more suggestive of the blue collar labor of cargo delivery and repair services than the professions of science and engineering, might either broaden or diminish the public appeal of human spaceflight. On one hand, the rhetoric of routine spaceflight hinted at middle class values and the dignity of ordinary work, as if spaceflight might no longer be an elite privilege. At a time when pickup truck sales were booming and big rigs crowded the interstate highways, people could readily understand the utility of a space truck. On the other hand, this image made spaceflight seem less adventurous and challenging, perhaps too prosaic to notice.

As the shuttle began flying in the early 1980s, adding new capabilities with each successive mission, enough technical problems occurred to hint that “routine” operations might take a while to achieve. Nevertheless, crews delivered communications satellites and operated science and engineering experiments, and individual astronauts soon had second and third flights on the new vehicle. Shuttle crews good-naturedly accepted their roles on the space truck and adopted the motto “We Deliver,” giving themselves such monikers as “Ace Moving Company” and “Ace Satellite Repair.” Editorial cartoonists treated the routine work of shuttle missions with good humor.

With a record of twenty-three missions in the first five years of operation (1981-1985), the Space Shuttle did establish the semblance of routine spaceflight, and 1986 was to have been the busiest year yet with more than ten missions planned. Yet, technical glitches and failures had caused an inordinate number of launch scrubs and delays, casting doubt on just how routine and reliable the system actually was. And the ever changeable launch schedule also made routine flight seem ephemeral.

The rhetoric of routine spaceflight died abruptly in January 1986 with the *Challenger* launch tragedy on the 25th Space Shuttle mission. NASA and the public had grown complacent in thinking that the space transportation system had become routine and safe enough for limited passenger service. Several non-astronaut guests had flown with shuttle crews—a commercial customer to operate his company’s experiment, several foreign representatives to observe the deployment of their nations’ satellites, scientists from other nations, a U.S. Senator and Congressman—and finally a teacher was to fly. The loss of *Challenger*, the teacher, and the entire astronaut crew soured the terms “routine” spaceflight and “space truck.” Critics had already dismissed freight hauling as an improper and costly task for human spaceflight; rockets could launch satellites very well without risking human life, and there was no compelling reason to squander human capabilities on relatively mundane work.[[8]](#endnote-8) NASA and the astronauts, as well as the public, became more sensitive to risks involved in a transportation technology that really was still experimental.

Several investigative journalists and shuttle program insiders immediately brought risk to the fore in reconsidering this transportation system, and the *Report of the Presidential Commission on the Space Shuttle Challenger Accident* left no doubt that “routine” spaceflight was a misnomer. Too many flaws in communications and decision-making, too many unresolved technical issues, and too much pressure to maintain a flight rate without enough resources elevated the risk for each shuttle mission.[[9]](#endnote-9)

The most damning finding to come from assessment of the accident was the “normalization of deviance”—the tolerance for anomalies in the vehicle’s condition or performance that should have been recognized as critical risk factors. The shuttle was “an accident rooted in history” and “an accident waiting to happen” because clues were not recognized for the danger they represented, and too many problems received waivers rather than solutions. Seemingly small flaws were in fact unacknowledged indicators of serious problems. NASA had treated the space transportation system as an operational one when it actually was still experimental. Years later, the *Challenger* accident remains a textbook example of risk misread. Engineers and historians alike have accepted that the shuttle remained an experimental vehicle to the end, and at least twice the public realized that spaceflight is an inherently dangerous, high-risk endeavor.[[10]](#endnote-10)

A viable transportation system cannot operate by treating problems as acceptable risks, a habit that NASA had developed to meet expectations of routine flight. The investigative board issued nine sets of recommendations, all aimed to reduce risk and improve safety. Return to flight depended on actions to reduce the risk of the same or a similar accident occurring again. Some of the necessary changes made during this period of recovery became evident to the public, such as appointment of NASA-only crews and daylight-only launches and landings until confidence in the system was restored. Other changes occurred behind the scenes with staffing of a high-level safety office, thorough reviews and improvements in procedures, and resolution of resolvable hazards.[[11]](#endnote-11) President Ronald Reagan also made some changes, directing that there be no further commercial satellite deployments or military missions on the shuttle – another departure from the goal of routine spaceflight.

Sobered by tragedy and stung by the revelation of its internal flaws, NASA quit using the rhetoric of routine spaceflight and did not mount a thematic rhetorical campaign for the resumption of shuttle missions in 1988. The agency announced the STS-26 mission simply as the “return to flight”; the shuttle went back to work with a communications satellite and several experiments on board. It was a rather ordinary mission to verify the success of the safety changes, about which the agency offered ample information. The solid rocket booster joint seal, the failure point on the fatal *Challenger* mission, had been redesigned to be leak proof. A crew emergency escape system was installed to allow the crew to abandon ship under certain conditions. Improved brakes, main engines, and the reentry thermal protection system also were noted. Toward the end of the mission, the crew donned tropical shirts, a gift from the orbiter processing team that prepared *Discovery* so well for its return to flight. This lighthearted photo probably was more reassuring than anything but the launch itself that the shuttle had flown safely again and space transportation could resume.

NASA scheduled the backlog of pending satellite deployments and Department of Defense missions, and then turned its sights to the 1990s, a decade of research missions and preparations for a space station. As a multipurpose vehicle, the shuttle had always carried small experiments and occasionally had flown massive ones in the payload bay, including a laboratory module and exposed platforms loaded with instruments. The shuttle’s utility for research conducted by a crew of scientists was the intellectual complement to the muscular satellite delivery missions. Various disciplines, especially the biomedical and materials sciences, stood to benefit from a microgravity research lab.

As NASA gave up the going-to-work-in-a-space-truck-rhetoric, it recast the shuttle rhetorically as a facility for knowledge and discovery and sought to demystify scientific research. Admittedly, some claims were exaggerated; the odds of finding a cure for cancer or AIDS in space or of manufacturing high-tech materials there were improbable. However, the opportunity to do hands-on experiments that were not possible on the ground was real, and it added a new dimension to human spaceflight and space transportation. The switch in emphasis from space *truck* to space *lab* also had a broader purpose: to cultivate support for a space station.[[12]](#endnote-12)

Spacelab developed in tandem with the Space Shuttle during the 1970s as a way to make space readily accessible to researchers. First flown in 1983, mounted in the payload bay with a connecting passageway to the crew cabin, it turned the shuttle into a temporary space station. By then, NASA Administrator James Beggs had launched a concerted effort to win approval to establish a space station as “a permanent presence in space.” Like the earlier rhetorical appeal of pioneering the space frontier, a “permanent presence” resonated with national traditions and values. Space transportation made possible the settlement phase that normally follows the opening of new territory and opened the opportunity for people to live and work in orbit almost a naturally as on the ground. President Ronald Reagan was persuaded and authorized an orbital station as NASA’s next major initiative in 1984.[[13]](#endnote-13)

Persuading the scientific community and members of Congress proved more difficult. Scientists interested in the opportunity to do laboratory research in microgravity were wary of a complex project that would take years to develop and probably impose burdensome hardware requirements on them. Astronomers, astrophysicists, and planetary scientists had little interest in using a space station and feared that funding for their projects would be diluted by a huge space station project. Congress was skeptical of a complex project that would inevitably increase in scope and cost and fall behind schedule, causing budgetary headaches. In the face of such reluctance and resistance, NASA thought it was important to use the shuttle as a temporary space station until a “permanent presence” was established. It became primarily a research center and secondarily a transport vehicle.[[14]](#endnote-14)

To that end, NASA promoted research as another kind of useful work to be done in space. The twenty or so Spacelab missions in the 1990s offered opportunities to practice and refine investigations destined for the eventual space station. These missions also were occasions for outreach to the scientific community and the public about the benefits of doing research in a microgravity laboratory. The resultant rhetorical strategy was embodied in a variety of publications and narratives that explained the purpose of experiments and the anticipated value of research results.[[15]](#endnote-15)

As the International Space Station developed since assembly in orbit began in 1999 through its fully operational status today, NASA has focused on research as the primary purpose of human spaceflight.[[16]](#endnote-16) Research is another mode of exploration, following paths of curiosity and discovery to the destination of knowledge. It taps some of the same interests as the exploratory missions of robotic planetary probes and orbiters.

Meanwhile, during much of the thirty year period of Space Shuttle operations, the planetary space exploration program flourished, achieving its own level of “routine access to space” while also suffering the vagaries of risk. At least 20 U.S. missions launched to Mars in an increasingly focused plan to “follow the water” to study the planet’s geologic history and look for evidence of life, and a comparable number of other exploration craft went toward the sun or outward toward Pluto. As robotic explorers, especially the Martian rovers, become more capable, the public, and even the machines’ operators, tend to endow them with human-like attributes, rhetorically personifying them as surrogates for a human presence. As differences begin to blur in the way people think about humans and robots in space exploration, they begin to share a common rhetoric of exploration.

Since the beginning of the end of the Space Shuttle program after the *Columbia* tragedy in 2003, NASA has tried several versions of a new rhetoric of renewal in defining its role in space transportation. The agency is seeking to return to its heritage of technological innovation and meeting the most difficult challenges. The first foray was the Constellation program to develop new spacecraft for venturing to the Moon, Mars, and beyond in response to President George W. Bush’s 2004 *Vision for Space Exploration*. In redirecting NASA to prepare to extend human presence into the solar system, the president anchored his rhetoric in America’s tradition of exploration and discovery, citing Lewis and Clark, the missions to the Moon, and ongoing journeys into new territory via robotic planetary explorers and great telescopes. He called for a new crew exploration vehicle, its purpose clear in its name, not for routine, utilitarian flight but for a renewed focus on outward-bound discovery.[[17]](#endnote-17)

NASA, too, adopted this rhetoric in its literature, speeches, and website, leaving behind the notion of routine transportation service between Earth and near orbit and embracing the adventurous spirit of discovery “like the explorers of the past and the pioneers of flight.” It was a transformative moment for the agency to realign its mission and organization for space exploration as the priority. It would separate crew and cargo vehicles rather than develop another multipurpose mega-vehicle. Research on the International Space Station would be refocused to support space exploration goals, and robotic exploration projects would be linked to plans for human exploration. NASA developed guiding principles for exploration, developed an exploration roadmap, used inspirational quotations about exploring, organized an office for the Exploration Systems Enterprise to lead the development of spacecraft and technologies for exploration, and commissioned artful illustrations of explorers on the Moon, Mars, Jupiter’s moon Calisto, and elsewhere. After a presidential commission endorsed the goals of the vision for exploration, NASA gave its program an evocative name, Constellation.[[18]](#endnote-18)

The new space transportation system would include two launch vehicles (Ares I for crew and Ares V for cargo), the crew exploration vehicle Orion, and a lunar landing vehicle Altair. Constellation would build on the legacies of the past and innovate as needed. NASA proudly announced that “The Next Giant Leap has begun!”[[19]](#endnote-19)

To NASA’s dismay, the rhetoric of renewal did not suffice to alter reality enough to complete the Constellation program, despite five years of work and promotion of the exploration agenda. A critical study by a review commission determined that the Constellation program could not be executed as funded and recommended a more modest approach involving little or no exploration unless sufficient resources were committed. President Barack Obama stepped in, declaring the Constellation program “over budget, behind schedule, and lacking in innovation,” too mired in the legacies of the past. In 2010 he canceled the program, then endorsed salvaging part of it (the Orion crew vehicle), and sent NASA back to the drawing board.[[20]](#endnote-20)

President Obama redirected the agency to prepare for a scaled-back new era in space transportation by relinquishing operations in low Earth orbit to commercial service and concentrating on new technologies for a less aggressive plan of solar system exploration. He specifically cancelled any near-term return to the Moon, but called for a set of destination options, including travel to an asteroid.

The new NASA Administrator, four-time shuttle astronaut Charlie Bolden, had to announce the end of Constellation, introduce the new directive to a workforce stunned by this setback, and rally the troops so recently steeped in the rhetoric of renewal. He (and his speechwriters) deployed a new rhetoric of innovation and change, coining new terms for NASA’s role as an “engine of innovation” and “catalyst” for “transformative technologies” and a more “sustainable” approach to spaceflight. He sought to persuade the agency and its contractors that what felt like loss was “bold” and “ambitious,” that it would be “trailblazing,” would “spur” invention and creativity, would inspire and “ignite the passion” of youth, and would be good for NASA and the nation. It was an energetic rhetoric meant to counter demoralization; the powerful imagery resonated with the inventive industrial tradition of the United States, charging the agency to move ahead and re-invent space transportation for the twenty-first century. From this first statement in 2010 to his latest speeches, Administrator Bolden has stayed on message, using this same rhetoric to convince all constituencies that innovation is NASA’s core mission and cutting-edge technologies are in the pipeline.[[21]](#endnote-21)

Despite all that, the current scheme for U.S. space transportation is touted as “America’s Next Giant Leap.”[[22]](#endnote-22) NASA has pegged its future vision to the 45th anniversary of the Apollo 11 mission this year, the pinnacle of achievement in space. Past and future are united in a graphic with Neil Armstrong’s phrase and boot print, now dusted with orange soil as it straddles lunar gray and the tint of Mars. This combination of words and image is powerful visual rhetoric for those who remember the shared sense of amazement, national pride, and human achievement in 1969. This rhetoric of renewal inherently looks backward to recapture a past capability or glory. Will it resonate with the much younger millennial generation whom NASA is so eager to inspire, who have only a vague awareness of spaceflight five decades ago?

Everything new in NASA’s space transportation plans for humans is on a horizon still years away and dependent on new vehicles not yet ready for flight. The Space Launch System (SLS) launch vehicle and Orion crew spacecraft are being developed and tested to take humans farther into the solar system, to an asteroid, the Moon, and Mars, in the 2020 to 2040 time frame. It is a long time to sustain interest and support, and NASA may need to refresh its rhetoric to avoid going stale. The space agency has mapped out a “Journey to Mars” but independent studies already find it unachievable with projected funding.[[23]](#endnote-23) It remains to be seen whether the planned Journey to Mars can be sustained through the political and social vagaries of the coming years and what new rhetorics NASA may adopt to keep long-distance space transportation viable.

On the other hand, the commercial space transportation industry is active, growing, and moving out. SpaceX and Orbital Sciences already are providing cargo service to the International Space Station, as have the Russian, European, and Japanese space agencies. SpaceX expects to be transporting humans soon, ferrying crews to and from the space station as the shuttle did, but separating cargo and crew transport missions. Other firms are working to the same goal, and yet others, such as Virgin Galactic, are poised to offer suborbital spaceflight and launch a space tourism industry.

Space transportation businesses also use rhetoric to woo customers, distinguish themselves from competitors, and draw public attention. SpaceX alludes to its spacecraft as “next generation” and gives them names sure to appeal to a generation steeped in fantasy games and literature: Dragon (Dungeons and Dragons?), Draco (Latin for dragon, a constellation and also a main character in the *Harry Potter* tales), and Falcon (an allusion to the Millennium Falcon from *Star Wars* or the Marvel Comics superhero?). SpaceX founder and CEO Elon Musk is motivated by the possibility of making the human species interplanetary, in his view the ultimate purpose of space transportation. Like NASA in developing the Space Shuttle, SpaceX posits a reusable, reliable rocket to revolutionize spaceflight by making it economical. Musk sees that as the key to achieving the company’s true mission: sending people to live on other planets. This space transport firm is but one of Musk’s several ventures focused on sustainability and smart use of energy. Providing launch services for satellites is currently its core business, but human spaceflight looms next.[[24]](#endnote-24)

By comparison, Orbital Sciences Corporation, also in the commercial launch business, has a less existential mission and rhetoric: “Innovation you can count on.” Its focus is launching small and medium payloads, including the Cygnus cargo vehicle to the International Space Station. Human spaceflight is not yet on its agenda, but low-cost, reliable service to Earth orbit is. Orbital’s fleet of launchers bear mythological names—Minotaur, Pegasus, and Antares—reminiscent of the NASA spacecraft naming tradition, and Orbital has personalized the Cygnus craft by naming them in memory of former astronauts who also were former employees.[[25]](#endnote-25)

Virgin Galactic, soon to provide suborbital trips for space tourists, has the most colorful verbal and visual rhetoric in the space transportation community. Co-founded and owned by Sir Richard Branson of Virgin Atlantic Airline and many other Virgin-branded companies, this firm is selling a VIP experience, in fact a package of exotic experiences culminating in a brief spaceflight of about five minutes in weightlessness. Marketing promises those who book a flight the fulfillment of their dream: “You're on a high; this is really happening, you're loving it and you're coping well.” For $250,000, one can join an exclusive club of space travelers with the added perks of staying at Branson’s private Caribbean island or his game preserve in South Africa, touring the Virgin Galactic manufacturing site and spaceport, and training in zero-gravity in simulators. Although the promotional pitch could appeal to anyone, in reality this is a luxury offered at a price well beyond most who dream of spaceflight.[[26]](#endnote-26)

Other space transportation vehicles under development include Sierra Nevada Corporation’s Dream Chaser, perhaps the most evocatively named crew transport craft. Resembling a mini-shuttle, it is a reusable lifting body design that will launch atop an Atlas V rocket and transport up to seven people to the International Space Station and back. XCOR Aerospace is developing a small reusable suborbital spaceplane named Lynx for excursions by one passenger plus pilot. It has an integral rocket engine and needs no other launch vehicle to head to space. Ticket prices for a Lynx flight are $95,000 or $100,000 depending on model.[[27]](#endnote-27)

Boeing, long involved in the Space Shuttle, program and an airline industry leader, is developing a reusable crew space transport vehicle called CST-100 capable of launching on the Atlas V or other rockets and landing on the ground. This capsule-style craft, similar to the NASA-Lockheed Martin Orion spacecraft, can be configured to ferry up to seven people or a mix of crew and cargo to and from the International Space Station. Boeing’s slogan for the CST-100 is “Safe, Affordable, Soon,” a salient message as the company competes with SpaceX and Sierra Nevada to become NASA’s crew taxi for low Earth orbit. At present, SpaceX is flying the cargo version of its Dragon capsule, but the Boeing capsule and Dream Chaser, like the Orion, are in early test phase. Boeing’s marketing materials accent the futuristic interior design for passenger comfort and pilots’ efficiency; WiFi, a tablet based cockpit, and other amenities recall the *Star Trek Enterprise* more than the utilitarian interior of typical spacecraft.[[28]](#endnote-28)

Meanwhile, NASA is working with Lockheed Martin to develop the capsule-style Orion spacecraft for the longer human missions into the solar system. It is to be America’s exploration vehicle for the journey to Mars, after initial forays to an asteroid, perhaps, or the Moon. It, too, is called “next generation” and the herald for a new era in space transportation and deep space exploration. Still in testing, the Orion has already been called revolutionary, innovative, and the safest, most advanced spacecraft ever built – a vehicle designed to serve for decades to come. The same was said of the Space Shuttle not so long ago. NASA’s claim that “this new spacecraft will take us farther than we’ve gone before” subtly, and perhaps intentionally, echoes the *Star Trek* motto “To boldly go where no man has gone before.”[[29]](#endnote-29)

Of course, the use of rhetoric by a tax-supported government agency to convince its constituencies has a broader target audience than rhetoric used in the competitive corporate marketplace to win customers. Rhetoric can appeal to reason, emotions, and values and can motivate people to action, but it can influence decisions only insofar as it resonates with human will, which is subject to such realities as limited resources and competing priorities. NASA’s space transportation rhetoric is inherently positive and hopeful, but reality has no such predisposition. Despite NASA’s confident rhetoric today, the future of human spaceflight and deep space transportation looks quite uncertain.

Meanwhile, the up-and-comers in the commercial space transportation industry are promoting their own innovations to achieve reliable, economical space transportation. They seem to be on the verge of human spaceflight in the near future. When that happens, the rhetoric of space transportation may shift again and come full circle back to the routine of going to work, or even to play, in space.

1. John F. Kennedy, address on “Urgent National Needs” to a joint session of Congress, 25 May 1961, in *Public Papers of the Presidents of the United States, John F. Kennedy, 1961* (Washington, DC: Government Printing Office, 1961); address at Rice University in Houston, Texas on “The Nation’s Space Effort,” September 12, 1962, in *Public Papers of the Presidents of the United States, John F. Kennedy, 1962* (Washington, DC: Government Printing Office, 1962); remarks at Dedication of Aerospace Medical Health Center in San Antonio, Texas, November 21, 1963, in *Public Papers of the Presidents of the United States, John F. Kennedy, 1963* (Washington, DC: Government Printing Office, 1963). [↑](#endnote-ref-1)
2. Theodore C. Sorensen, *“Let the Word To Forth”: The Speeches, Statements, and Writings of John F. Kennedy, 1947-1963* (New York: Dell, 1988); Ted Sorensen, *Counselor: A Life at the Edge of History* (New York: Harper, 2008); Thurston Clarke, *Ask Not: The Inauguration of John F. Kennedy and the Speech that Changed America* (New York: Henry Holt and Company, 2004); and Richard J. Tofel, *Sounding the Trumpet:* *The Making of John F. Kennedy’s Inaugural Address* (Chicago: Ivan R. Dee, 2005) describe the meticulous attention of Kennedy and his aides to rhetorical nuances. [↑](#endnote-ref-2)
3. David Meerman Scott and Richard Jurek, *Marketing the Moon: The Selling of the Apollo Lunar Program* (Cambridge, MA: MIT Press, 2014); .Linda T. Krug, *Presidential Perspectives on Space Exploration* (New York: Praeger, 1991); Robert Sherrod, “The Selling of the Astronauts,” *Columbia Journalism Review*, May/June 1973: 16-25. [↑](#endnote-ref-3)
4. Richard M. Nixon, “Statement by President Nixon, 5 January 1972,” *Public Papers of the Presidents of the United States, Richard M. Nixon,* 1972 (Washington, DC: Government Printing Office, 1972) and NASA Historical Reference Collection and Key Documents in the History of Space Policy, <http://history.nasa.gov/stsnixon.htm>. [↑](#endnote-ref-4)
5. NASA News Release No: 76-149, “Shuttle Roll-Out Set for Sept. 17” and companion Press Kit: “Space Shuttle Roll-Out,” both undated. NASA Historical Reference Collection File 007952 [↑](#endnote-ref-5)
6. John Noble Wilford of the New York Times presented the shuttle-era spaceflight rationale and followed the missions closely. Among his early articles were John Noble Wilford, “Another Small Step for Man: Shuttling into Space,” *The New York Times*, August 7, 1977, Sunday Magazine: 7, 28, 54 ff; John Noble Wilford, “Commuting Age Dawns in Space,” *The New York Times*, December 30, 1979; and John Noble Wilford, “Space and the American Vision,” *The New York Times*, April 5, 1981, Sunday Magazine: 14 ff, 118 ff.

   [↑](#endnote-ref-6)
7. <http://www.si.edu/Exhibitions/Details/America's-Space-Truck-The-Space-Shuttle-3550>; accessed July 20, 2014. [↑](#endnote-ref-7)
8. “Too Fine a Machine,” *The New York Times,* March 31, 1982: A30, one of several similar critiques in this newspaper. [↑](#endnote-ref-8)
9. *The Presidential Commission on the Space Shuttle Challenger Accident, Report to the President* (Washington, DC: June 6, 1986). [↑](#endnote-ref-9)
10. *Presidential Commission on the Space Shuttle Challenger Accident Report*; Diane Vaughan, *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA* (Chicago: University of Chicago Press, 1996); James R. Chiles, *Inviting Disaster: Lessons from the Edge of Technology* (New York: Harper Collins, 2001). [↑](#endnote-ref-10)
11. National Aeronautics and Space Administration, *Report to the President: Actions to Implement the Recommendations of The Presidential Commission on the Space Shuttle Challenger Accident* (Washington, DC: July 14, 1986). [↑](#endnote-ref-11)
12. Space Science Board, *Scientific Uses of the Space Shuttle* (Washington, DC: National Academy of Sciences, 1974) surveyed the various disciplines and research questions for which the shuttle might be an effective asset. Walter Froehlich *Spacelab: An International Short-Stay Orbiting Laboratory* NASA EP-165 (Washington, DC: NASA, 1983); David Shapland and Michael Rycroft., *Spacelab: Research in Orbit*: (Cambridge: Cambridge University Press, 1984). [↑](#endnote-ref-12)
13. Hans Mark, *The Space Station: A Personal Journey* (Durham: Duke University Press, 1987). [↑](#endnote-ref-13)
14. Hans Mark, *The Space Station,* especially Chapters XI-XVII. [↑](#endnote-ref-14)
15. Examples include themed magazine-style publications for each of the Spacelab missions from Spacelab 1 (STS-9, 1983) to Neurolab (STS-90, 1998) that explained the experiments and research rationale. [↑](#endnote-ref-15)
16. NASA websites abound with frequent updates on investigations in progress. For example, <http://www.nasa.gov/mission_pages/station/research/experiments_category.html>; accessed July 20, 2014. [↑](#endnote-ref-16)
17. President Bush Announces New Vision for Space Exploration Program: Remarks by the President on U.S. Space Policy; Fact Sheet: A Renewed Spirit of Discovery, and document, *A Renewed Spirit of Discovery: The President’s Vision for U.S. Space Exploration*, all issued January 14, 2004 and available in the NASA History Office key documents in the history of space collection at <http://history.nasa.gov/sep.htm>; all accessed September 1, 2014. [↑](#endnote-ref-17)
18. NASA, *The Vision for Space Exploration*, NP2004-01-334-HQ(Washington, DC: NASA Headquarters, February 2014); *A Journey to Inspire, Innovate, and Discover: Report of the President’s Commission on Implementation of United States Space Exploration Policy* (Washington, DC: June 2014), both available in the NASA History Office key documents in the history of space collection at <http://history.nasa.gov/sep.htm>; accessed September 1, 2014.

    [↑](#endnote-ref-18)
19. The Constellation program brochure and related Constellation documents are available at <http://www.nasa.gov/mission_pages/constellation/main/index2.html>; also there are NASA press releases, “Ares: NASA’s New Rockets Get Names” (June 30, 2006) and “NASA Names New Crew Exploration Vehicle Orion” (August 22, 2006) at <http://www.nasa.gov/mission_pages/constellation/orion/orion_announcement.html>; all accessed September 1, 2014. [↑](#endnote-ref-19)
20. *Summary report of the Review of U.S. Human Space Flight Plans Committee* and final report, *Seeking a Human Spaceflight Program Worthy of a Great Nation* (Washington, DC: September and [October 2009);.](http://history.nasa.gov/AugustineCommfinal.pdf)both available in the NASA History Office key documents in the history of space collection at <http://www.hq.nasa.gov/office/pao/History/spdocs.html>. Also, Office of Management and Budget, “Terminations, Reductions, and Savings, Budget of the U. S. Government, Fiscal Year 2011”, available at <http://www.whitehouse.gov/sites/default/files/omb/budget/fy2011/assets/trs.pdf>; accessed September 1, 2014.

    [↑](#endnote-ref-20)
21. **Statement by NASA Administrator on the Fiscal Year 2011 NASA Budget** (February 1, 2010); Statement of Charles F. Bolden, Jr. NASA Administrator before the Subcommittee on Commerce, Justice, Science and Related Agencies Committee on Appropriations U.S. House of Representatives (April 8, 2014); both archived at <http://www.nasa.gov/news/speeches/admin/index.html>; accessed September 1, 2014.

    [↑](#endnote-ref-21)
22. America’s Next Giant Leap, issued July 14, 2014 at <http://www.nasa.gov/nextgiantleap/> and <http://www.nasa.gov/sites/default/files/files/NextGiantLeap.pdf> accessed July 20, 2014. [↑](#endnote-ref-22)
23. NASA’s Journey to Mars at <http://www.nasa.gov/content/nasas-human-journey-to-mars/> accessed July 20, 2014; National Research Council, *Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration* (Washington, DC: National Academies Press, 2014) at <http://sites.nationalacademies.org/DEPS/ASEB/DEPS_069080.htm>; accessed July 20, 2014. [↑](#endnote-ref-23)
24. <http://www.spacex.com/about>; <http://www.spacex.com/news/2014/05/30/dragon-v2-spacexs-next-generation-manned-spacecraft>; Elon Musk, “Risky Business,” *IEEE Spectrum*, <http://spectrum.ieee.org/aerospace/space-flight/risky-business>, posted May 30, 2009; <http://www.ted.com/talks/elon_musk_the_mind_behind_tesla_spacex_solarcity> ; all accessed September 5, 2014. [↑](#endnote-ref-24)
25. <https://www.orbital.com/> and Robert Z. Pearlman, “Orbital Sciences Names Next Private Space Station Freighter for NASA Astronaut,” <http://www.space.com/23887-private-space-cargo-ship-astronaut-name.html?cmpid=514648> December 9, 2013; both sites accessed September 5, 2014. [↑](#endnote-ref-25)
26. <http://www.virgingalactic.com/> accessed September 5, 2014. [↑](#endnote-ref-26)
27. <http://www.sncspace.com/ss_space_exploration.php> and <http://xcor.com/lynx/>; accessed September 5, 2014. [↑](#endnote-ref-27)
28. <http://www.boeing.com/boeing/defense-space/space/ccts/index.page> and <http://www.businessinsider.com/boeing-space-capsule-renderings-2014-5>; both accessed September 5, 2014. [↑](#endnote-ref-28)
29. The Orion home page <http://www.nasa.gov/exploration/systems/mpcv/index.html>; accessed September 5, 2014. [↑](#endnote-ref-29)