
“And Now for Something Completely Different”: Creating Twenty-first Century Space Access

by Roger D. Launius

Like the great Monty Python line — “and now for something completely different” — early in the administration of President Barack Obama in 2009 space policy turned in a direction just as strikingly different as what had taken place in the transition from the Apollo to the Space Shuttle program in the early 1970s. The president convened a blue-ribbon panel chaired by Norm Augustine, the former CEO of Lockheed Martin and a longstanding space guru, that recommended in the fall of that year the harnessing of private sector, especially entrepreneurial,

firms in supporting Earth orbital operations instead of relying on the Constellation program, itself a plan hatched in 2004 to replace the Space Shuttle that was nearing the end of its service life and would be retired in 2011.

Augustine’s report concluded: “Under current conditions, the gap in U.S. ability to launch astronauts into space will stretch to at least seven years. The Committee did not identify any credible approach employing new capabilities that could shorten the gap to less than six years.” This would be true even with increased funding for

NASA’s program.

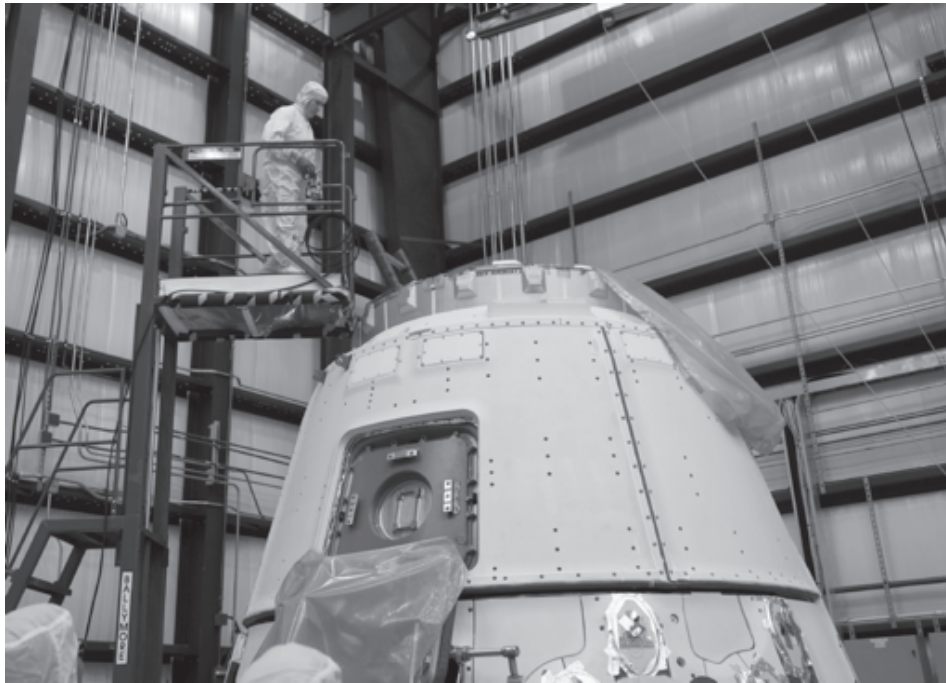
The panel also noted that a \$3 billion a year increase for fiscal years 2010-2014 could return the Constellation program to health. But there was also another option. “As we move from the complex, reusable Shuttle back to a simpler, smaller capsule, it is appropriate to consider turning this transport service over to the commercial sector,” the panel concluded. “This approach is not without technical and programmatic risks, but it creates the possibility of lower operating costs for the system and potentially accelerates the avail-



Blue Origin Orbital Crew Spacecraft in flight (Source: Blue Origin)



Technicians position microphones around the Orion MPCV and LAS test articles in preparation for the second round of testing in the acoustic chamber at Lockheed Martin's facilities near Denver on August 17, 2011. The vehicle was bombarded by acoustic levels of 150 decibels to simulate conditions during launch and abort if necessary. (Source: Lockheed Martin)



The SpaceX Dragon capsule undergoes a crew equipment interface test. (Source: SpaceX)

ability of U.S. access to low-Earth orbit by about a year, to 2016. If this option is chosen, the Committee suggests establishing a new competition for this service, in which both large and small companies could participate.”

The response to this report from the U.S. space community was immediate. Some administration officials urged that the president cancel Constellation. Edward Crawley, a Massachusetts Institute of Technology professor and a member of the Augustine panel, remarked that Ares I was suffering from technical issues that could only be overcome with more money and time. “It was a wise choice at the time,” said Crawley, when asked about originating the program in 2005. “But times have changed...the budgetary environment is much more tight, and the understanding of the cost and schedule to develop the Ares I has matured.” Others were supportive of continuing Constellation.

Based on these responses, President Obama proposed on February 1, 2010, with more details added in a presidential speech on April 15, a new path for

future U.S. human spaceflight efforts. Central to this would be the termination of the Constellation program as a single entity, continuation of certain technology developments such as the Orion space capsule, the continuation of operations on the International Space Station until at least 2020, and the fostering of private sector solutions to support operations in low-Earth orbit.

Since this declaration numerous high profile spaceflight advocates have weighed in on both sides. In April 2010 Apollo astronauts Neil Armstrong (Apollo 11), Gene Cernan (Apollo 17), and Jim Lovell (Apollos 8 and 13) famously sent the U.S. president a letter warning that the proposed change to human spaceflight “destines our nation to become one of second- or even third-rate stature.” Proponents of the new strategy, among them Apollo 11 astronaut Buzz Aldrin, countered that the president’s approach will return NASA to its roots as a research-and-development organization while private firms operate space systems. Turning low-

Earth orbit over to commercial entities could then empower NASA to focus on deep space exploration, perhaps eventually sending humans to Mars or elsewhere.

The debate has largely been over maintaining a traditional approach to human spaceflight with NASA dominating the effort, owning the vehicles, and operating them through contractors. That was the method whereby America went to the Moon; it has proven successful over fifty years of human space exploration. Then there are those from the “new space” world that emphasize allowing private sector firms to seize the initiative and pursue entrepreneurial approaches to human spaceflight.

Advocates of the more traditional approach believe that the other side will sacrifice safety; advocates of the entrepreneurial approach criticize the forces of tradition by pointing out their large, over-budget, under-achieving space efforts. It remained unclear how much (if any) of this new initiative will be approved by Congress. In 2012 there still was no resolution.

While these concerns are ever-present in the current debate over the future of human transportation into space in the United States, the place of commercial activities in this arena seems assured. There does not look to be any consensus in favor of undertaking a traditional approach to space access, one that NASA dominates both from a market standpoint and an ownership imperative. As space policy analyst Stewart Money commented in the *Space Review* in 2011: “While the market for publically-funded commercial crew transport to ISS is clearly limited, it is becoming increasingly certain. NASA Administrator Charles Bolden’s emphatic declaration in support of commercial crew may well signify a bellwether date in space history.... The most significant implication may

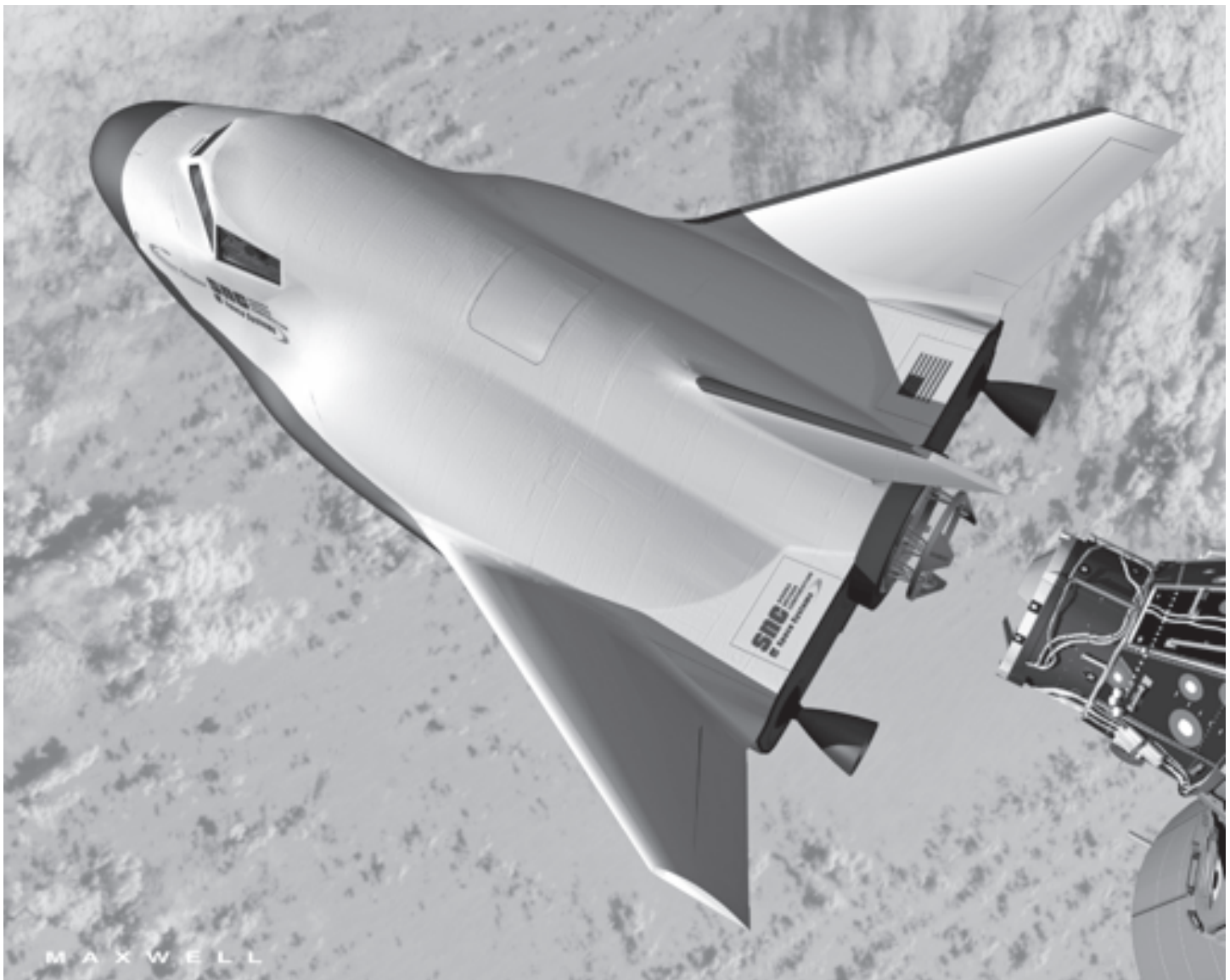
be that other opportunities for leveraging the spacecraft initially offered for ISS cargo and crew duties can begin to emerge in earnest....The fact that several of the proposed crew transport craft are promoted as being able to launch on more than one rocket indicates an encouraging shift in the way some aerospace companies are approaching the marketplace. It is something more akin to an aircraft manufacturer's role, an analogy Boeing was happy to make in the same announcement...Taken together, these developments, along with

others, offer the tantalizing possibility of being the opening act in a new era of both public and private spaceflight to low Earth orbit.

In this situation, furthermore, issues of reusability have largely been forgotten, despite this critical necessity in developing a cost effective replacement for the Space Shuttle.”

During 2010 and 2011 NASA pursued efforts to replace the vehicle providing access to low-Earth orbit previously offered by the Space Shuttle through a multiphase space technology

development program known as Commercial Crew Development (CCDev). Intended to stimulate development of privately operated crew vehicles to low-Earth orbit, its first phase offered a token sum of \$50 million during 2010 to stimulate five American companies to undertake research and development of new human spaceflight concepts and technologies. In its second phase, with contracts of \$269 million awarded to four firms in April 2011, the objective was to move toward the establishment of one or more orbital spaceflight capa-



The Dream Chaser® Space System is a crew and cargo transportation system designed to service low Earth orbit, including the International Space Station. (Source: Sierra Nevada Corporation)



45th Space Wing launch of a United Launch Alliance-built Atlas V carrying an X-37B Orbital Test Vehicle on April 22, 2010 (Source: ULA/Pat Corkery)

bilities on which NASA could purchase cargo and eventually crew space.

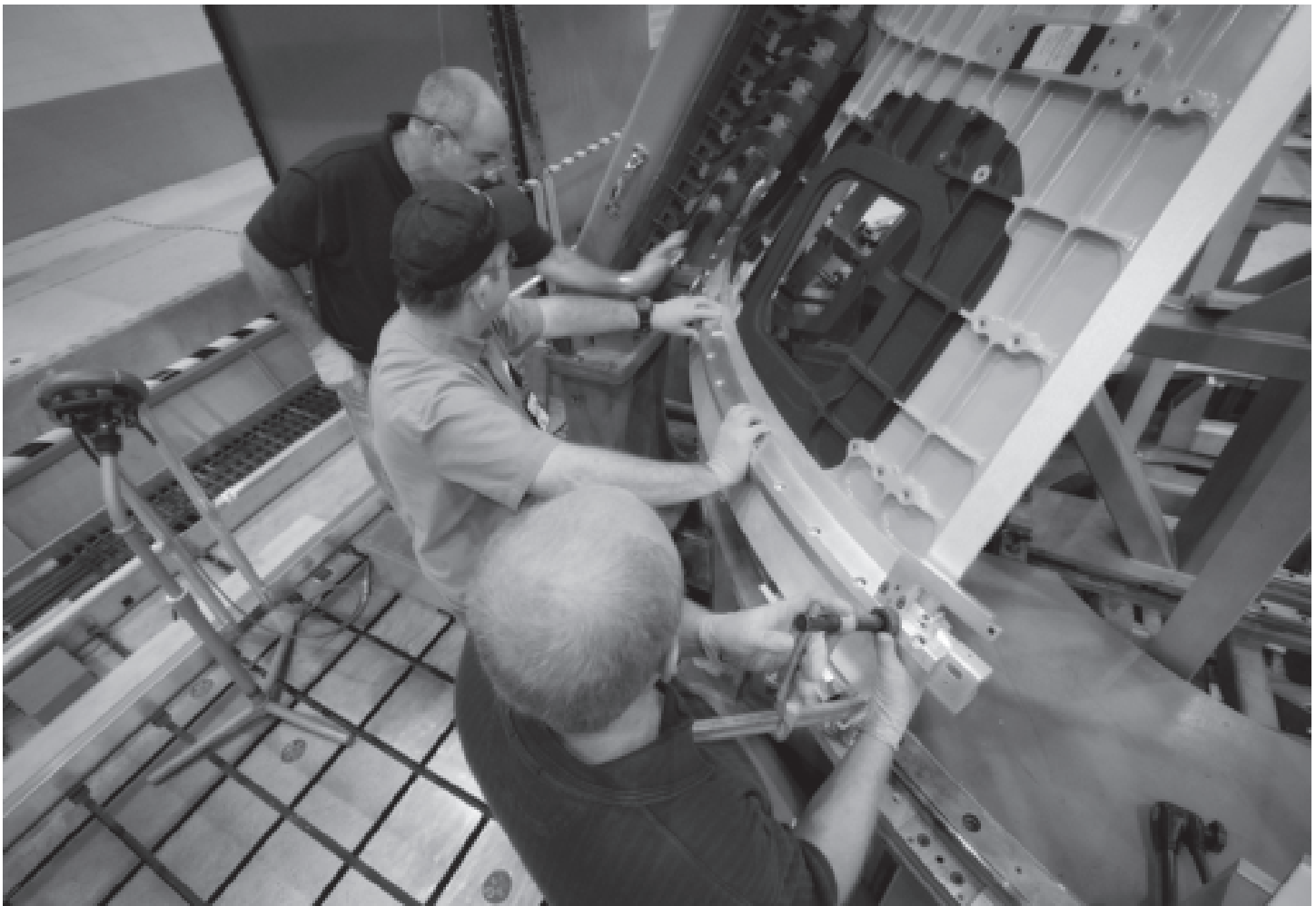
The awardees were all American firms and their approaches ranged from lifting body to capsule spacecraft. Those companies — Blue Origin, Sierra Nevada Corporation, Space Exploration Technologies (SpaceX), and Boeing — are envisioned as a vanguard that will be able to usher in a new era of innovative human spaceflight opportunities. As announced by Ed Mango, NASA's Commercial Crew Program manager: "The next American-flagged vehicle to carry our astronauts into space is going to be a U.S. commer-

cial provider. The partnerships NASA is forming with industry will support the development of multiple American systems capable of providing future access to low-Earth orbit."

This ferment of ideas and broad set of actions stimulated through the CCDev program suggest that the issue of human space activities remains an unsettled issue. The longstanding set of issues and trade-offs necessary to fly into space safely, perform useful missions on-orbit, and return to the ground in not only a safe but an elegant manner remain very much on the table as 2012 begins. While they may have benefited

from changes in technology and greater knowledge of the processes involved in development and using these capabilities, discovering optimal solutions, as well as the most elegant of them, requires diligence and creativity.

The spacecraft nearest to being ready for operational use might well be the SpaceX Dragon capsule launched atop the Falcon 9 rocket. With its successful suborbital test flight on December 8, 2010, the SpaceX entry into this competition appeared destined for an early operational capability. This is a use-once/throw away space access combination similar to what has been used



Construction on the first space-bound Orion Multi-Purpose Crew Module began with the first weld at the Michoud Assembly Facility on September 9, 2011. This is the capsule that will be used during Orion's first test flight in space. After welding is completed at Michoud, the Orion spacecraft orbital test article will be shipped to NASA's Kennedy Space Center (KSC), where the heat shield will be installed. At KSC, it will undergo final assembly and checkout operations for eventual flight. (Source: NASA)



The SpaceX Falcon 9 carrying a Dragon capsule lifts off the launch pad at Launch Complex 40 at Cape Canaveral Wednesday, December 8, 2010, to begin what would be a successful test flight for its program designed to deliver cargo to the International Space Station. (Source: NASA/Alan Ault)

for decades, but it is intended to be less expensive than comparable systems already available. Even so, test flights for the Falcon 9/Dragon capsule have been repeatedly postponed, and no launch is scheduled until later in 2012.

The second awardee, garnering the largest award of \$92.3 million, was Boeing. Its CST-100 crew capsule has been pursued as a support vehicle for the International Space Station. Very close in design to the Orion spacecraft of the Constellation program, but without the deep space capability, it was intended to house crews as large as seven and could be attached to ISS for more than half a year before requiring swap-out. In every case, Boeing has emphasized the long history it has in developing and operating the technologies going into the CST-100. Boeing officials have projected flight for this vehicle in 2015.

Another recipient of the CCDev award, but receiving only \$22 million, was Blue Origin, a start-up entrepreneurial firm that proposed developing a biconic orbital capsule launched atop an Atlas V. Information about this project is limited, Blue Origin is reticent to speak in public about its activities. As Dan Rasky of NASA Ames remarked in mid-2011: "I joke with people that if you want to see what a billionaire's clubhouse looks like, go visit Blue Origin."

Finally, the CCDev program awarded an \$80 million contract to the Sierra Nevada Corp. to build a commercial Space Transportation System based on NASA HL-20 and launched on an Atlas V. This Dream Chaser lifting body spacecraft would utilize Virgin Galactic's carrier aircraft as a platform for atmospheric drop tests as early as 2012. As a lifting body, this vehicle is intended to land on a runway and be reusable. Its carbon composite airframe looks large, but weighing only 27,100 lbs, it is actually quite light because of

the composite structure. For all of the spaceplane's sleekness, as one commentator noted, it could handle only 1500K cargo and only 2 crew. This is a good looking vehicle, but it is not a mini Shuttle. It is a minuscule Shuttle."

Some successes have been registered since this point, most especially the Falcon 9/Dragon capsule flight in late 2010. But this approach has a bit of risk. If it pays off, it may set the stage for an entirely new trajectory in human space operations. If it fails, it will require a retrenchment of American human operations in space and a reinvestment of public dollars. Nothing about this is settled, including the policy implications. John M. Logsdon recently commented that in forty years of watching space policy he has not seen such an unsettled situation. This may be an understatement.

Perhaps the private sector efforts of SpaceX, Orbital Sciences, and others will come to the rescue of human spaceflight in the United States. The successes thus far in this direction are positive signs, but I urge caution in trumpeting this as THE answer to the nation's human space access dilemma. Although the trajectory is positive, the CCDev firms still have a long road to hoe before achieving an operational system. Likewise, the U.S. Air Force's recent success with a modified X-37B reusable orbital vehicle suggests that innovation for non-crewed military purposes may also be applicable to NASA's human spaceflight program.

Interestingly, beyond technology R&D at NASA — which of course may be critical to the next human spaceflight system — the space agency may well have to look beyond its personnel and its various centers for the next human space access system. This is not unprecedented, but it is troubling after more than forty years of being able to harness on its own capabilities to resolve these technological challenges.

The space agency relied on modified ballistic missiles developed by the military to launch its Mercury and Gemini spacecraft into orbit, but since Apollo it has owned and operated its own systems.

President Obama's decision to rely on private sector efforts to develop next generation human space access capabilities was a bold, controversial initiative. However it turns out, it represents a path that harkens back to an earlier model in which NASA had more equal partnerships with other organizations to accomplish its space exploration mandate. I am heartened by recent developments in this arena. Of course, if this fails, it is quite possible in the next few years that America may find itself without a human spaceflight capability indefinitely.

At this point in the history of human spaceflight, more than fifty years after Allan Shepard made his first suborbital flight and John F. Kennedy challenged Americans to reach the Moon by the end of the 1960s, it is appropriate to consider the possible futures for American astronauts in space. I am reminded of a statement that has been used repeatedly to suggest American ingenuity: "If we can send a man to the Moon..." But I would then end the phrase with this question, "...how come we can't send a man to the Moon?" Are we seeing U.S. leadership decline in this most exclusive of all endeavors undertaken by great nations of the world?

A lesson in humility might spur a

national commitment to redouble our efforts. The late social commentator and comedian Sam Kinison once said to other nations seeking to undertake space spectacles: "You really want to impress us! Bring back our Flag!" If Americans are sufficiently impressed that another nation can do things in space that we cannot, we may come to view this as a crisis, and as is always the case in a perceived crisis, the U.S. will make the investment necessary to overcome it. Maybe China, India, or any number of other nations seeking to advance their national prestige will bring back our flag from the Moon, metaphorically at least, and prompt us to redouble our efforts.

With sufficient diligence and resources, of course, virtually anything humans can imagine in spaceflight may be achieved. We should be concerned, however, that neither sufficient diligence nor resources will be available for this great initiative. In the process of failure, we may also lose our longstanding intrinsic ability for access to space with our seasoned, capable, and resolute astronaut corps. These outcomes are most unsettled presently; how long can we accept this unsettled situation?

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