

JACK D. GORDON INSTITUTE
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LATIN AMERICAN AND
CARIBBEAN CENTER

SECURING THE HIGH GROUND

A HUMAN ASPECTS APPROACH TO SPACE SECURITY

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OCTOBER 2026

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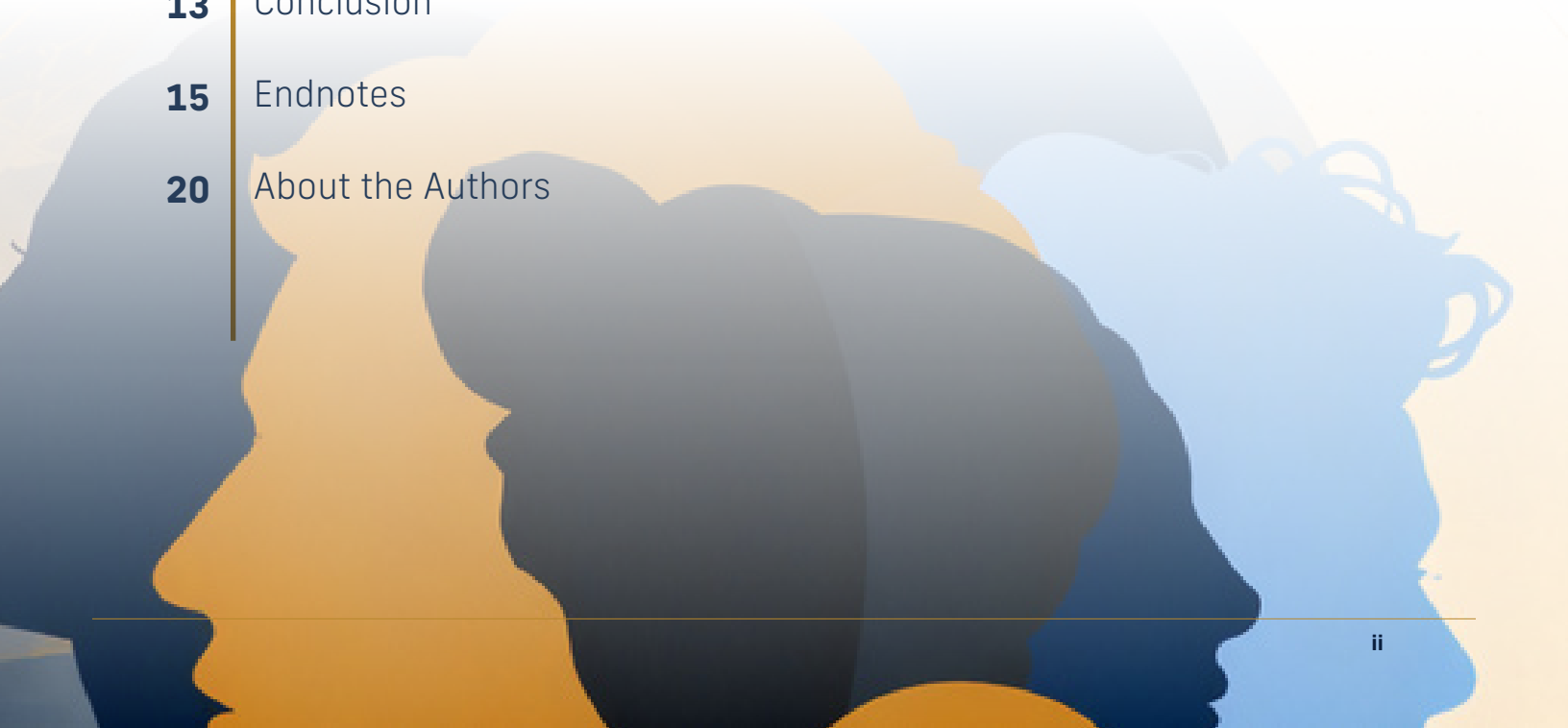
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EXECUTIVE SUMMARY

The article applies a Human Aspects of Security (HAS) approach to demonstrate that space security is not only a technological challenge but also a human one. Effectively maintaining space security depends on institutional readiness and sound human judgment. This requires contextual intelligence, which involves interpreting the broader strategic and operational environment, including the intentions of foreign actors. To illustrate, a case study focusing on the Western Hemisphere is presented, demonstrating how extra-regional influence and geopolitical shifts make space security in the region increasingly vulnerable. This dynamic is illustrated by China's lease of Argentine land for its *Espacio Lejano* ground station, alongside suspected Chinese intelligence gathering at sites in Cuba. Further, space issues are complex in ways different from other domains, which make human "sense-making" imperative.

First, grey-zone operations like nonkinetic cyber interference obscure the difference between state cooperation and conflict. When coupled with the dual-use nature of space technology, it becomes challenging to ascribe intent behind some actions in space. Differentiating mechanical failures from hostile actions requires contextual intelligence and human sense-making that automated tools cannot replicate. A purely technical and data-centric approach to space policy overlooks a nation's geopolitical intent. Accordingly, space strategy ought to consider decision-making under ambiguity as its core competency.

Second, the absence of internal oversight systems prevents regional space actors from seamlessly integrating governance mechanisms to coordinate their scientific, military, and geopolitical goals. This fragmentation is evident despite demonstrated technical capacity and strategic will in some Latin American nations, including Argentina, Brazil, Chile, and Mexico. For instance, China operates a tracking facility in Argentina with minimal regulatory control. The U.S. military's decision to halt sharing Defense Meteorological Satellite Program (DMSP) weather data with civilian entities provides another example. These instances show that institutional readiness depends on human relationships and coordination.

Third, the long-term investment in human talent and institutions allows for real strategic gains in space. One example is India's initiative to build an autonomous space program. Ultimately, states should prioritize building legal coordination frameworks and broader recruitment and retention strategies to improve their preparedness for any future crises.

SECURING THE HIGH GROUND: A HUMAN ASPECTS APPROACH TO SPACE SECURITY

Political scientist and author of multiple books on war, John Stoessinger, analyzed the Vietnam War as a tragedy in five acts, referencing the five U.S. presidents who oversaw U.S. efforts in the war. He attributed the failure of one of those presidents, John F. Kennedy, to not understanding what he was actually up against, specifically the human values of the enemy. Former Harvard Kennedy School Dean Joseph Nye, Jr. called that requisite understanding "contextual intelligence" and considered it a central variable in the design and execution of successful strategy. Regarding Kennedy, Stoessinger said:

> Kennedy and his military advisors never took seriously the statement made by many Vietcong soldiers that it was the duty of their generation to die for their country … Thus President Kennedy – essentially a man of reason with a profoundly skeptical bent – became the victim of that particularly American form of hubris that blithely assumed that technology … could overcome any adversary.[1]

Beyond the geopolitical motivations usually considered for triggering war (e.g., resources, alliances, and geography), Stoessinger's books repeatedly addressed the idea that "people matter" in decision-making. We share that view, but with an even broader aperture.

Florida International University's Jack D. Gordon Institute for Public Policy recently launched a Human Aspects of Security Forum,[2] expanding on a prior emphasis on Women, Peace and Security (WPS) to

address the need for a multidisciplinary, cross-cultural, whole-of-society approach to developing and executing successful security-related strategies in an ever more volatile, uncertain, complex, and ambiguous global environment. In the same way that the WPS framework considers the differences between men, women, boys, and girls when generating analyses of strategic environments, so should the ideology, values, creeds, and resources of individuals be accounted for. Without these human factors, decision-makers misread the strategic environment. Contextual intelligence starts here.

Space is a complex security domain most often associated with technology because of its unpopulated, inhospitable environment. Nevertheless, space security, humans, and human security are inextricably intertwined. As Air Force General Dan Caine, Chairman of the Joint Chiefs of Staff, was quoted as saying in 2025, "It really is true that humans are more important than hardware."[3] The complexity of the space domain and the traditionally narrow approach to addressing issues within the area have created serious and increasing risks.

In response to these growing issues, we advocate for a human aspects approach to space security aimed at maintaining the space domain as a sustainable, stable, and safe environment while maximizing the achievement of national security goals. In doing so, we demonstrate why consideration of the human aspects of security must be a core component of any space strategy.

Our analysis focuses on cognition and decision-making, human–machine interaction, and workforce and system design. The article is written for policymakers, military planners, and the civil and commercial managers whose decisions shape the domain. Space security is an interagency and multinational enterprise, and the U.S. Space Force serves here as the main institutional example because it is the newest actor and its workforce choices are the best documented. The case studies come from different settings to demonstrate how human judgment and social context shape the outcome. While the focus here is on space security, the intent is also to trigger discussions about human aspects of security in other fields.

It is necessary to first define what we mean by space security and human security. Space security refers to the maintenance of space as a sustainable environment, free from intentional interference with space assets vital for national security, communication, and economic activities.[4] Those conditions depend on decisions made by governments and military services, civil space agencies, commercial operators, and the multilateral agencies that establish the norms. This article examines the human judgment at each of those levels. Space war, especially a kinetic space war, serves no one well due to the massive, long-term debris fields that would be created and threaten everyone's assets. The importance of space to national security objectives is broadly referenced in the 2020 U.S. Defense Space Strategy,[5] 2025 U.S. Space Force Doctrine and Canada's 2014 Space Policy Framework,[6] the European Union's 2023 Space Strategy for Security and Defence,[7] and NATO's 2019 Space Policy.[8] Therefore, "getting it right" is imperative.

Human security is often defined as people-centered and focused on protecting individuals from chronic, widespread threats such as hunger, disease, and environmental threats – all "soft" security issues, as opposed to state-centered "hard" security issues like geopolitics and conflicts. But here, we expand that meaning to include, as Caine implied, the human aspects that influence decisions regarding space security. The 2016 U.S. Joint Concept for Human Aspects of Military Operations defines human aspects as "the interactions among humans and between humans and the environment that influence decisions."[9] Human aspects in this sense do not refer to the individual. The same concept lists the social, cultural, physical, informational, and psychological elements that shape decisions,[10] and that is the wider sense in which we use the term here. We chose space as an environment for consideration specifically because it is a particularly intricate one.

A COMPLEX SPACE DOMAIN

Space strategists have long looked to classical thinkers, from Sun Tzu to Alfred Thayer Mahan and Julian Corbett, for principles drawn from land and sea that might apply in orbit. British analyst Bleddyn Bowen coined the expression "cosmic coastline" to compare Earth's orbit to a "coastline" or "littoral zone" closely linked to Earth-bound affairs, with orbital assets serving as high-value, vulnerable, and

easily contested assets, much like ships and other assets in a coastal region.[11] While the analogies are useful for conceptualization and visualization, the absence of geographic boundaries in space and the unique ways in which physics operate there –unlike anything pertaining to land, air, and sea – place real limitations on transferring strategic principles and operational considerations from the terrestrial domain to space.

Space, like cyber, is neither geographically nor operationally confined to "somewhere"; it is everywhere, operating within unique and often poorly understood parameters that can be unfamiliar even within technical communities. This lack of understanding has more than once led to statements by politicians and military officers regarding space-related capabilities that later had to be walked back or clarified as to "what they really meant." President Ronald Reagan's idealized 1983 "Star Wars" speech, ostensibly promising a technological umbrella to make nuclear weapons "impotent and obsolete" and thereby "protect our people,"[12] was almost immediately "explained" as meaning "protect missile silos," based on the realities of physics and cost.[13] National Oceanic and Atmospheric Administration (NOAA) former administrator Jane Lubchenco recalled that, while discussing weather-satellite funding on Capitol Hill, a member of Congress told her, "Doctor, I don't need your weather satellites, I have the Weather Channel."[14]

Air Force General John Hyten, a career space officer until his retirement in 2021, commanded both U.S. Strategic Command and Air Force Space Command during his career. He spoke of his frustration regarding the lack of awareness, even within the military, of the importance of space, relaying a conversation he had with a flight-rank officer: "We were talking about the threat that space was now coming under … and he pointed out to me it's not really that big a deal because if space goes away, we can just fly UAVs (unmanned aerial vehicles) and we'll be fine."[15]

Space scientists from the Union of Concerned Scientists published a reference manual in 2005 – still timely as physical principles remain constant –*The Physics of Space Security: A Reference Manual*[16] to enable nontechnical individuals and decision-makers working on space issues to better understand the parameters of space, but developing a broad working knowledge of those parameters remains a challenge. The Secure World Foundation has announced a Space Boot Camp for early-career nuclear policy professionals, given the space-nuclear nexus.[17]



Figure 1. U.S. service members at Diego Garcia observe an antenna tracking NASA's Artemis II SLS rocket over the Indian Ocean on April 2, 2026. Artemis II is NASA's first crewed Artemis mission, sending four astronauts on an approximately 10-day journey around the Moon. (U.S. Navy photo by Mass Communication Specialist 1st Class Samantha Jetzer).

Beyond the complexity of the space environment is the ambiguous nature of most space assets. Much space technology is dual-use, meaning it can be used for either civilian or military purposes. The same remote sensing satellite, for example, might be used for civilian purposes such as gathering data relevant to crop rotation or water availability, or for information relevant to troop movements or even targeting. Communications satellites might be used to broadcast the Olympics worldwide or by the military for command and control. Additionally, if a space asset is deemed to have military purposes, it is often not clear whether it is intended for offensive or defensive purposes. There is a short technical distance between missile defense technology and offensive anti-satellite technology, as demonstrated by missile defense technology being used by the United States in 2008's Operation Burnt Frost to shoot down one of its own malfunctioning satellites.[18]

Grey zones are "spaces in which the rules of governance and conduct are not clear or are contested."[19] In space, this ambiguity makes intent harder to assess and escalation more difficult to control. Grey zone activity further blurs conventional lines between war and peace in space. Activities such as non-kinetic interference with space systems through, for example, cyber operations fall into such grey zone activity and tie the space and cyber domains together. Cyber operations belong in the grey zone because they stay below the threshold of armed attack, are hard to attribute, and give the actor behind them room to deny it. Hostile grey zone activities often require a response, but calibrating that response and considering unintended consequences can complicate response calculations. Further, the grey zone is often influenced by the beliefs and values of stakeholders, which again complicates decision-making.

Finally, the "tyranny of distance and speed" adds further complexity to space activities. If a satellite stops working or goes rogue, especially in the middle of a crisis, and the cause is not clear, what is reasonable to assume? The cause might be technical. Satellites can also fail due to being hit by space debris or damaged by geomagnetic or solar storm activity. Or the cause could be intentional interference by a malevolent actor. The problem is that satellites are far away and traveling at speeds ranging from 8 kilometers (km) per second in low Earth orbit to 3 km per second in geosynchronous orbit, making incident analysis difficult at best.

In sum, the complexities of the space environment make it "anomalous" in comparison to land, sea, and air. Space has more in common with cyber, and indeed there is a strong link between the two domains. For many years, the complexity and uniqueness of the space domain resulted in space being treated as neither fish nor fowl in the military/security community, as a political tool in geopolitics, and as a domain having a hard time gaining traction in the commercial world. Much of that has changed, and consequently, so too must the human aspects of how it is approached in all three sectors.

BEYOND HARDWARE: WORKFORCE AND INSTITUTIONAL READINESS

A human aspects approach to space security requires the full participation of men and women to bring more information and perspectives into policy and technical decisions and to consider the effects of decisions beyond narrow conceptualizations of conflict and harm. These considerations can be broadly categorized as workforce issues, situational awareness, and effects. For the workforce dimension, that means opening recruitment as widely as possible to access the most qualified candidates.

In 2019, Air Force Lt. Gen. (ret.) Mary O'Brien developed, as part of an effort to bring down barriers to women's advancement in the Air Force, a "business model" that succinctly explained the value of the whole-of-society approach. Known as the five-R model, it focuses on recruiting, retention, readiness, resources, and risk.[20] In simple terms, it pointed out that obtaining the most qualified person requires a wide *recruitment* aperture; retaining good people, in turn, *requires steady attention to retention*. Otherwise, the organization must constantly hire replacements and retrain them, which costs *resources* and lessens *readiness*, which increases *risk to the force and risk to the mission*. By tying all five criteria to quantifiable warfighting metrics, O'Brien presented the framework as a case for policy change.[21]

The establishment of U.S. Space Force as a separate military entity presented an opportunity to do things differently in terms of workforce policies, within the bounds of Department of the Air Force regulations. According to interviews with individuals involved,[22] the interviewees did not expect Space Force to happen as quickly as it did. Rather, it was thought Congress would dictate a planning phase before the standup, but that didn't happen. Consequently, the early days were somewhat chaotic but exciting. Initially, about 30 people were brought in to build the framework for Space Force, about half from the Air Force and half from other services who knew, perhaps not surprisingly, little or nothing about space. But they were eager and professional, and many were sent to special introductory courses on space to at least quickly familiarize them with the basic terminology and concepts. Space Force also had to manage the additional challenge of standing up during the COVID-19 pandemic.

Initial discussions among the standup group specifically recognized that they had an opportunity to chart a new approach. Taking a whole-of-society approach to building its workforce, the standup team prioritized qualifications and performance when reviewing candidates, with consideration given to diverse backgrounds and military service when candidates were equally qualified.[23]

The U.S. Space Force is a military service responsible for organizing, training, and equipping forces that support U.S. Space Command and the joint force. Space Force personnel are known as Guardians. In 2021, the *Guardian Ideal*[24] was published, intended to provide the vision and values of Space Force. Although it does not use O'Brien's five-R framework, the *Guardian Ideal* similarly treats talent management and readiness as operational concerns. In practice, that meant weighing work and family issues such as joint spouse assignments, working spouses, and a child in a senior year of high school, and making both maternity and paternity leave available.[25] Space being a highly technical, STEM-heavy field, recruiting and retaining good people is key to keeping Space Force mission-ready.

Unlike other U.S. military services, Space Force has met its recruitment goals every year since its inception. Its goals, however, have been significantly smaller than those of the other services. In 2026, Space Force targeted 730 recruits, down from 800 in 2025, compared to the Air Force's goal of 33,000.[26] Those numbers are expected to grow significantly, potentially doubling the number of Guardians. The critical question is whether Space Force can sustain retention rates that keep readiness high and mission risk low.

THE SPACE-SECURITY CONNECTION: THE HUMAN ELEMENT

Space security policy is often framed in terms of technology, strategy, and geopolitics. These are necessary but not sufficient – strategic impact through technical capacities can be achieved only when people and groups make sound decisions, organizations support those choices, and political leaders understand how technical capacities are employed under operational constraints. This view is consistent with the 2016 U.S. Joint Concept for Human Aspects of Military Operations, which emphasizes the importance of a human-centered approach by asserting that the success of military operations cannot be measured in terms of physical damage but in terms of behavioral changes in key actors.[27]

Operations in space push the human dimension to its limits. Decision timelines are short, action attribution is often ambiguous, and some consequences are irreversible. Further, orbital debris lasts for decades, and spaceflight damages the human body. Both raise ethical questions that remain unsettled, and we still put far more analytic effort into the hardware than into the people making the calls and operating the systems. Even so, the 2025 United States Space Force Doctrine states that achieving space dominance depends on the readiness of its operators. In the foreword to Space Force Doctrine Document 1, former Chief of Space Operations General B. Chance Saltzman writes that "our success or failure hinges entirely upon the performance of Guardians." The same document defines mission command as a leadership philosophy "centered on the art of command, the science of control, and the discipline of decision making."[28]



Figure 2. U.S. military personnel and NASA staff monitor operations from a control facility, highlighting the coordination between the U.S. military and NASA in support of space missions. (U.S. Navy photo by Mass Communication Specialist First Class Samantha Jetzer).

Space security, therefore, runs on human decisions made well beyond any operational center. Governments develop the legal structures that guide these activities, and diplomats negotiate behavior patterns in multilateral settings. Businesses, meanwhile, make daily decisions that affect space, often without regard for security considerations. With the United States and China planning lunar expeditions, questions such as operational safety zones and radio-frequency coordination become more important. Government and industry both carry that responsibility, and it shows up most clearly once a mission is underway.

Canadian researcher Jessica West has conducted research that revealed the breadth of considerations needed regarding enhanced attention to the human aspects of space activities, the challenges, and the importance of the specific task:

> Discussions unearthed myriad ways in which space is implicated in the unequal distribution of benefits and harms. People view outer space as a valuable resource that permits essential services such as Internet access, supports civilian infrastructure, spurs new knowledge, and even satisfies more niche needs such as combating gender-based violence with space data and communication. Among the countless uses and users of space, we must ask which are deemed critical and prioritized. A secure use of space by some can be harmful to others. Participants pointed to the mining of resources and appropriation of land to power space programs, the ability to use satellite imagery and geo-location to inflict violence, the growing privatization of data, and environmental impacts on the atmosphere and night sky.[29]

Concerns raised in her 2023 research and further addressed in a follow-up in 2024 focused on "how the multiple overlapping determinants of advantage and disadvantage shape the human experiences, benefits, and vulnerabilities that are associated with outer space; in effect, factors that allow the secure uses of space for some result in insecurity for others."[30]

Artemis II showed how human decisions connect governance and operations. On April 1, 2026, Artemis II took Reid Wiseman, Victor Glover, Christina Koch, and Jeremy Hansen farther from Earth than any humans had traveled before. The previous record had stood since Apollo 13 in 1970.[31] The mission tested both untried technology and, equally importantly, the limits of human performance.

Artemis II is also a story of governance. The success of the mission relied on international agreements made possible through politics and diplomacy, and not just engineering. For example, Canada's participation was because of its partnership with NASA on the Gateway program.

The Artemis Accords provide broader principles for civil space activity and collaborations. Signatories agree to deconflict their activities, to notify others of safety zones, and to limit debris. These are the conditions that keep the domain stable and safe as traffic to the Moon grows. Who should be part of this effort, on what basis, and for what purpose are all executive questions whose answers depend on context. This is the contextual intelligence that Nye identifies as essential to effective strategy and governance.[32] Other countries have similarly demonstrated that technology is a necessary but not wholly sufficient aspect of space development and security.

India stands out as a prime example of what people can achieve through decades of investment in the space sector. On November 21, 1963, Indian scientists launched the country's first sounding rocket from the Thumba Equatorial Rocket Launching Station in Kerala, near the geomagnetic equator. The nearby St. Mary Magdalene Church served as an office and laboratory and was used for rocket assembly.[33] Among the young engineers assembled there was A.P.J. Abdul Kalam, who would go on to become the architect of India's missile program and eventually the country's president.[34] The United States sanctioned the Indian Space Research Organisation (ISRO) in 1992 over a Russian cryogenic engine deal, and India built its own engines instead.[35] In 2019, India's Mission Shakti anti-satellite test brought the country into the military side of space security.[36]

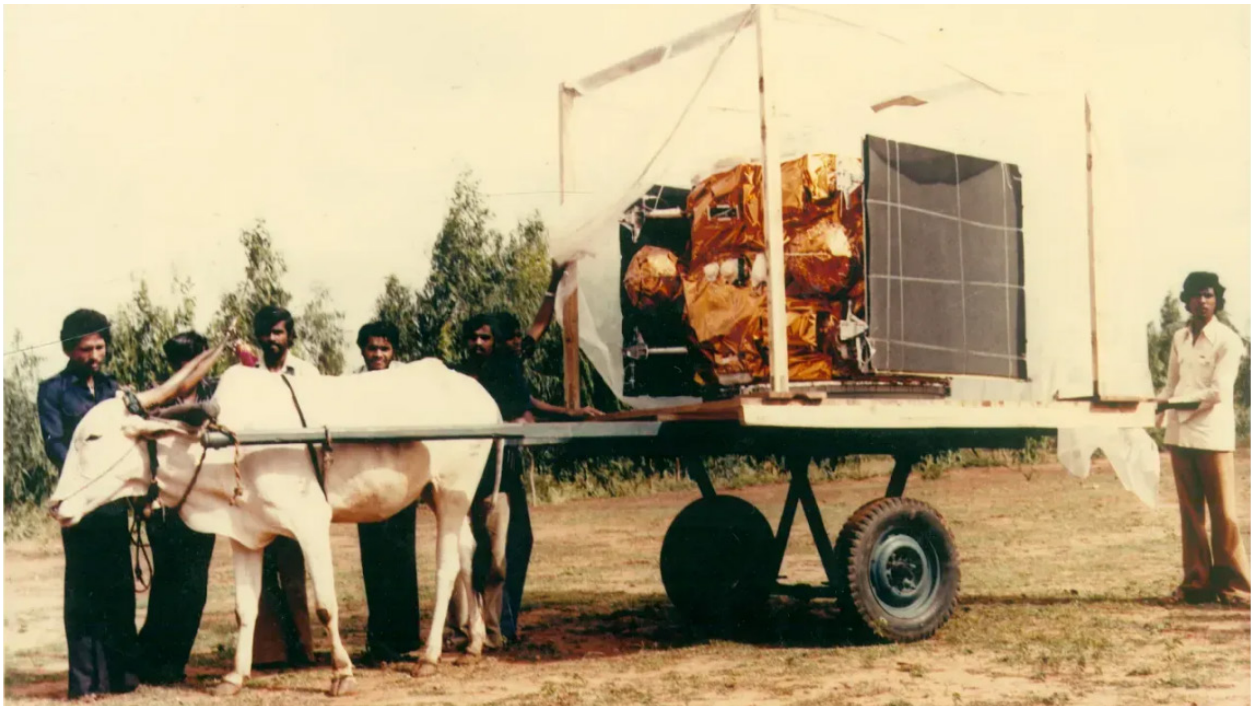


Figure 3. A 1981 photograph of Indian Space Research Organisation (ISRO) personnel moving a satellite by bullock cart. India's space program worked with modest resources in its early years. (Photo credit: ISRO Photo Archives, 1981)

Six decades later, continued time and effort radically transformed India's space sector. In June 2025, Group Captain Shubhanshu Shukla became the first Indian astronaut to reach the International Space Station.[37] He piloted Axiom Mission 4 alongside astronauts from the United States, Poland, and Hungary. His mission reflects India's broader effort to build a pipeline of space professionals. That journey from the cattle shed in Thumba to the International Space Station was made possible by decades of sustained investment in society and its institutions, investment that has created advantages that extend beyond India's technical space program.

AN INTEGRATED APPROACH: COGNITION, HUMAN–MACHINE INTERACTION, AND SYSTEM DESIGN

When assessing the impact of human factors on space security, three dimensions merit consideration, each spanning a range from cognitive to mechanical. These include (1) cognition in decision-making, (2) human–machine interaction, and (3) assumptions made about the makeup of the workforce. Space security successes and failures can occur at any of these junctions.

First, cognitive overload is a real operational limitation when working in the space domain. Operators manage several systems simultaneously, deal with limited information, and make decisions under compressed decision cycles. Research on groupthink and high-reliability organizations shows that shared assumptions can suppress dissent and independent judgment. When team members share similar training and assumptions, they are more likely to reinforce one another's rationale and become overconfident. Thus, expanding the pool of talent available for recruiting operators and analysts can broaden the perspectives brought to operational decisions.[38]

Second, human–machine interaction becomes more consequential as artificial intelligence and automation assume a larger role in space operations. Grey zones, however, have a distinct character that makes the role of the human operator more important than ever. Determining whether an anomaly reflects technical failure or intentional action still requires human reasoning. That skill requires real investment, and it becomes more operationally important as command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) space domain systems integrate automation.[39]

Third, assumptions about workforce composition can create operational vulnerabilities and negatively impact system design and operational planning. For example, NASA changed the crew assignment for a planned all-women spacewalk in 2019 after Anne McClain found that a medium-size hard upper torso fit her best and only one could be made ready for the scheduled spacewalk. The first all-women spacewalk took place nearly seven months later.[40] This case belongs here because the same design assumption shows up in military space systems. Operator consoles and protective gear are built around an idea of who will use them, and when that idea leaves out qualified people, readiness suffers. When human performance matters this much, a missing suit size carries a real cost and is an oversight that can be corrected with the right space security strategy.

Figure 4 shows the technical and organizational elements of the HAS framework as applied to space, and how they bear on decision-making under uncertainty.

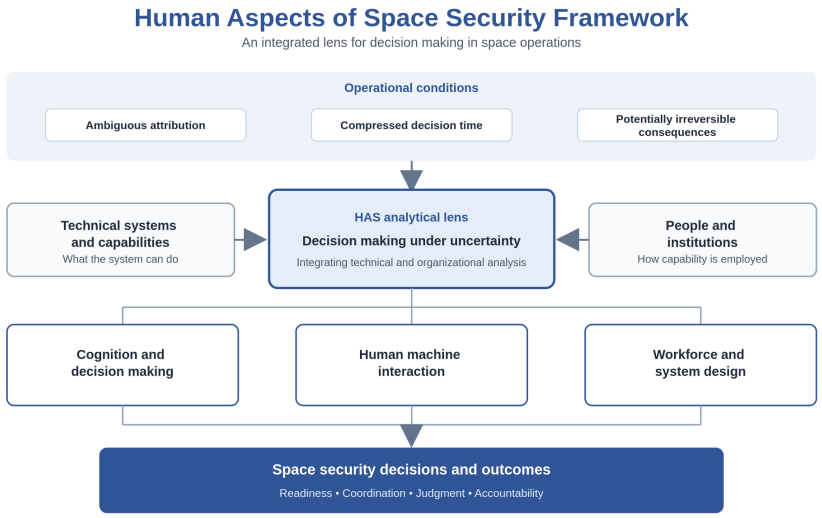


Figure 4. The Human Aspects of Space Security framework, which integrates technical capabilities, people, and institutions in the analysis of decision-making under uncertainty. Authors' illustration.

THE NEED FOR HUMAN COLLABORATION AND DATA SHARING: THE DMSP EXAMPLE

Since its inception more than five decades ago, the Defense Meteorological Satellite Program (DMSP) has collected worldwide meteorological and space environmental information to support the U.S. military. A portion of the collected weather data has also been used for civilian forecasting through NOAA, such as hurricane forecasting, in which DMSP contributes about half of the available microwave scan data. In 2025, the proposed end to this data sharing showed how quickly decisions affecting the human infrastructure behind the data could disrupt life-saving weather forecasting.[41]

In June 2025, the Pentagon announced that the U.S. Navy's Fleet Numerical Meteorology and Oceanography Center would no longer provide DMSP data to other partners without offering any public rationale. The timing of this decision raised immediate concern with the scientific community because it was announced during the Atlantic hurricane season. A University of Miami researcher described such an abrupt cutoff of data during the season as pure "insanity." Senators John Hickenlooper (D-Colo.) and Lisa Murkowski (R-Alas.) appealed to Defense Secretary Pete Hegseth and interim NOAA Administrator Laura Grimm, warning that cutting off key microwave imagery would put coastal communities at risk.[42]



Figure 5. An artist's rendering of a Defense Meteorological Satellite Program satellite in orbit. Image from Air & Space Forces Magazine.[43]

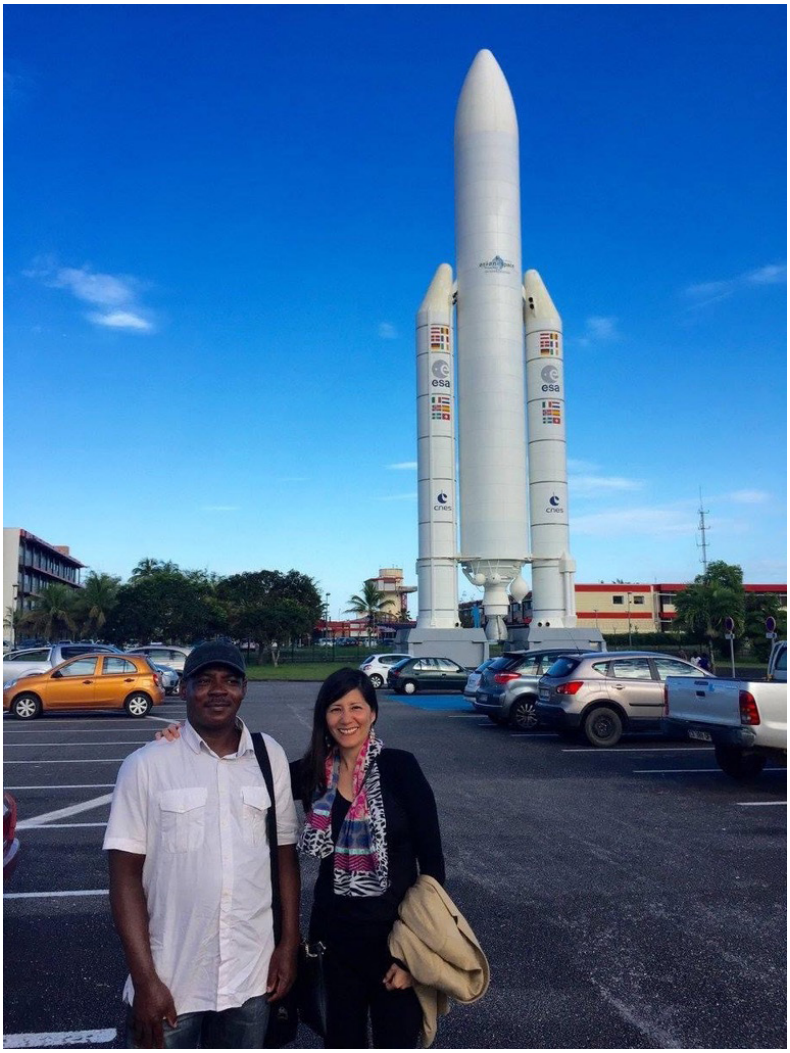
The Pentagon changed its stance in late July 2025, following advocacy by meteorologists, NOAA and NASA officials, and some members of Congress. The Fleet Numerical Meteorology and Oceanography Center renewed its commitment to maintaining information sharing through the end of the program in September 2026. The lesson lies in how the decision was made. Available reporting did not indicate that civilian partners who depend on the data had been consulted, and it took weeks of advocacy to reverse it. While technological developments can facilitate coordination and collaboration, they do not automatically build the interpersonal and institutional relationships necessary for successful cooperation and alignment. The DMSP case illustrates how the absence of those relationships carries real consequences, both domestically and internationally.[44] The same institutional problem appears across the Western Hemisphere, where space capabilities have often developed faster than the institutions that govern them.

ANALYTIC CASE STUDY: HUMAN ASPECTS OF SPACE SECURITY IN THE WESTERN HEMISPHERE

Latin America's growing space potential provides an opportunity to strengthen regional and domestic regulation along with coordination among civilian, private, military, and government counterparts. There has been visible progress in a relatively short period: countries across Latin America and the Caribbean have signed the Artemis Accords, Ecuador acceded to the Registration Convention in 2025, and Brazil adopted its national space law in 2024.

Nevertheless, as legal scholar Andrés Terán indicates, the domestic institutions needed to implement these commitments remain insufficient or missing.[45] As such, there are gaps in synchronization, liability, and day-to-day operational authority.[46] Laura Delgado-López, a senior fellow at FIU's Jack D. Gordon Institute and a former NASA policy adviser, examined Argentina, Brazil, Chile, and Mexico and reached a similar conclusion. These countries have the will and technological capacity, but appear to lack established mechanisms for coordinating within their scientific communities, government agencies, military institutions, and regional partners. These challenges are not unique to Latin America, as the DMSP case demonstrated that even within the U.S. government, institutional coordination cannot be taken for granted.

The 2017 shutdown of the Guiana Space Centre in Kourou, French Guiana, illustrates how social contexts and political circumstances can interrupt access to orbit even when space systems work properly. Located five degrees north of the equator, Kourou offers launch advantages unavailable from continental European sites. In March 2017, a local strike over issues related to safety and education resulted in the closure of the spaceport for five weeks. The strike was part of a general protest across French Guiana over crime, the cost of living, and poor public services, and the spaceport was the most visible place to apply pressure.[47]



One of the postponed launches was an Ariane 5 carrying Brazil's Geostationary Defense and Strategic Communications Satellite and South Korea's Koreasat 7. The rocket and satellites had already been assembled, but the strike prevented the launch. Operations resumed after the French government agreed to provide €1.1 billion (US$1.18 billion) in immediate assistance and to consider an additional €2.1 billion (US$2.25 billion).[48] This episode shows that access to orbit depends as much on social conditions and context as on technology.

Figure 6. The co-author, Duilia Turner, with a guide at the Guiana Space Centre in Kourou, French Guiana, 2015. The full-scale Ariane 5 model stands at the entrance of the launch complex. (Photo courtesy of the author.)

Extra-regional involvement in Latin America's space sector also deserves careful consideration. Unintentionally, Argentina relinquished some of its territorial oversight when it agreed to host China's Espacio Lejano ground station. Argentina leased the land in 2012, and by 2017, the site was operating under the China Satellite Launch and Tracking Control General in affiliation with the People's Liberation Army (PLA). The station's 35-meter antenna uses S-, X-, and Ka-bands, which can support both civilian and military functions. The agreement required Argentina not to "interfere or interrupt" activities at the station.[49] Although foreign-operated space infrastructure is not uncommon, the terms of this agreement left Argentina with limited oversight of activities conducted on its territory.[50] In April 2026, SOUTHCOM's Donovan described the Western Hemisphere as hosting the largest collection of Chinese-built space infrastructure outside mainland China. He warned that reliance on Russian GLONASS sites could expose regional partners to data disruption and cyberattacks.[51] For countries in the region, social context comes down to whether host nations have the capacity to oversee infrastructure on their territory and manage the risks of relying on foreign systems.

Concerns about possible extra-regional malign influence also extend into the Caribbean. Signals intelligence sites in Cuba have regional space security implications despite the island's lack of satellites or a national space program. Commercial imagery analyzed by the Center for Strategic and International Studies indicates that China most likely operates or can access four such sites, positioned to monitor radio traffic and potentially intercept data from U.S. satellites passing over Florida.[52] This access developed amid Cuba's worst economic crisis since the fall of the Soviet Union, during which Chinese firms supplied the backbone of its telecommunications infrastructure. What the sites collect has not been established, and, again, the activity occurs without a national space governance framework.

Space capabilities strengthen security only when people and institutions work together. For Latin America, this means building the domestic authority and regional ties needed to govern and advance space operations. In terms of security and defense, it also means understanding the intentions of all actors operating in the region. For the United States, it means helping partners build that capacity and not simply providing technology, as well as identifying possible threats to its own space security.

APPLYING THE HAS FRAMEWORK: THE VALUE OF HUMAN SENSE-MAKING

Technical capability is the segment of space security easiest to measure, but technology alone does not determine space operational outcomes. In all the cases studied here, the common denominator is that individuals and organizations influenced the development, management, interpretation, and implementation of technical architectures. The HAS approach is intended to analyze these interactions.

Operational decisions in space take place in an increasingly complex environment. In this sector, the natural tendency has been to accumulate information and to display more of it in an attempt to build a cohesive operational picture. For instance, an operations center today might have dashboards in which information from various sensors is layered one over the other. Nevertheless, the accumulated data still has to be analyzed by professionals to determine what the display means, whether the trend it shows will hold, and what should be done in response. These inquiry phases are commonly described as descriptive, predictive, and prescriptive analytics.[53] Moving from one phase to the next depends on human sense-making. Without it, a dashboard alone cannot reliably support sound decision-making.

The Pentagon's Joint All-Domain Command and Control (JADC2) strategy describes "make sense" as analyzing information to understand and predict the operational environment, where "data transforms into information and information transforms into knowledge." It also establishes a Human Enterprise line of effort that joins human performance and professional development with artificial intelligence and machine learning.[54]

Stoessinger's account of President Kennedy describes the same problem in an earlier setting. The information was available. Vietcong soldiers stated openly that it was the duty of their generation to

die for their country. Military strategists did not consider what that level of commitment, which came from their history and culture, meant for the war. The failure was in reading the context, not in anyone's performance. Asking those types of questions is what Nye calls contextual intelligence, the ability to interpret not only what data shows but what it means within a broader strategic and human environment. It is the same question facing an operator who must determine whether an anomaly on a display reflects a technical failure or a deliberate act.

Considered this way, the cases discussed here illustrate the role of human sense-making in space, one of the most technologically sophisticated security and defense domains.

Table 1. Where human sense-making mattered.

Case	The Human Sense-Making Factor
India's space program, 1963 to 2025	Decades of investment in people and institutions made later technical gains possible.
Espacio Lejano ground station, 2012	The station's technical specifications were known. Its long-term effect on Argentine management of its territory was less clear.
Guiana Space Centre, 2017	The rocket was ready, but local social conditions kept it on the ground for five weeks.
NASA spacewalk, 2019	Planning did not account for the full range of spacesuit sizes the workforce needed. NASA had to change the crew, and the first all-women spacewalk took place months later.
Cuba signals intelligence sites, 2024	China's presence in the region could not be assessed through technical capability alone. Intent, local conditions, and oversight also matter.
DMSP data sharing, 2025	The decision to stop sharing the data beyond the U.S. military did not account for the needs of civilian forecasters worldwide who relied on it for lifesaving weather predictions.
Artemis II, 2026	International agreements settled the mission partnership and profile years ahead of launch. The Artemis Accords provide broader principles for civil space activity.

In each of these cases the outcome turned on human judgment instead of the hardware. The implications below are derived from this pattern.

IMPLICATIONS FOR SPACE SECURITY STRATEGY

The cases above point to several key implications for how human factors influence outcomes in the space domain. Each identifies a specific requirement for the development and implementation of space security strategy.

1) Decision-Making Under Ambiguity Is a Trainable Competency

As discussed earlier, ambiguity is built into space operations. Decision windows are short, cause and effect are hard to distinguish, and some effects cannot be undone, from orbital debris to an outcome in a complex sequence of events that nobody can attribute to a single actor. Funding comes first for technical procurement, but it is training that makes the hardware usable. The 2016 Joint Concept for Human Aspects of Military Operations supports this argument because it measures operational effectiveness in human behavior rather than physical effects alone. Decision-making under ambiguity needs to be treated as a core competency in space security strategy.

2) Space Security Requires Domestic and International Coordination

Fragile institutional systems create challenges not only at the national but also at the international level. The Defense Meteorological Satellite Program (DMSP) and Kourou cases illustrate this predicament. The same need for coordination applies across different areas, including criminal

law, which most individuals consider Earth-bound but which also has applications in space. For instance, federal criminal jurisdiction over crimes committed aboard U.S.-registered space vehicles stems from a 1981 amendment to the federal statute defining the special maritime and territorial jurisdiction of the United States.[55] The 1998 Intergovernmental Agreement generally assigns criminal jurisdiction according to the nationality of the alleged offender, and it becomes even more complex when the possible misconduct affects a crew member from another nation. Creating and sustaining international legal frameworks and coordination mechanisms before crises arise is essential.

3) Human Sense-Making Enables Effective Decision-Making

A system can process data and still miss what it means. Human sense-making is the process of interpreting available information in context so that it can guide judgment and action.[56] Automation technology has achieved major improvements in space awareness. In the context of the grey zones, for instance, the problem is not the amount of data but, rather, how to determine whether a possible abnormality is due to a collision, geomagnetic interference, software error, hostile activity, or even an unidentified anomalous phenomenon (UAP).[57] For instance, the Pentagon's May 2026 release of unresolved UAP files illustrates this.[58] Automated tools can help detect inconsistencies; nonetheless, humans still need to critically analyze machine-generated data. The gap between data gathering and source attribution is precisely where human sensemaking matters most.

4) Broad Recruitment Supports Readiness

Research on groupthink and high-reliability organizations has often found that shared assumptions can suppress dissent and reinforce overconfidence. Therefore, recruiting broadly becomes an operational matter. Interviews with the original planning team confirm that the Space Force intentionally adopted a broad recruitment aperture from the beginning. Recruitment and retention should be measured against mission requirements, adequately funded, and given the same attention as the platforms themselves. Inherently, this will support readiness.

5) Contextual Intelligence Takes Time

Strategic gains from investment in space technology depend on long-term development supported by highly trained personnel and capable institutions. India's 60-year investment in space shows how people and institutions adapted to changes in strategy, politics, and economics. The technical gains followed. Nye's discussion of contextual intelligence helps explain why this matters: Sound strategy depends on understanding the setting, and that understanding develops over time through education, experience, language, and human relationships.

CONCLUSION

The decisions that matter most in securing space are often made before a satellite is launched, and they lie in the hands of the decision-makers involved. Artemis II could get as close to the Moon as it did because of collaboration among international partners, the technical sector, and operators who established the necessary framework for the mission. India's 60-year journey from the launch of a sounding rocket in a Kerala fishing village to Group Captain Shukla's participation in the International Space Station mission was the result of methodical development of people and institutions that reached far beyond propulsion and avionics. The proposed interruption of DMSP data-sharing in 2025 demonstrated that even a functioning technical framework agreement cannot sustain itself without the human relationships and institutional commitment behind it.



Figure 7. Members of the Artemis II crew prepare to board the USS John P. Murtha following their April 10, 2026 splashdown in the Pacific Ocean. The U.S. Navy supported the recovery of the crew and Orion spacecraft after the first crewed lunar mission in more than 50 years. (U.S. Navy photo by Mass Communication Specialist David Rowe).

SOUTHCOM Commander Donovan clearly framed the defense implications related to the space domain: "Military strategy has long recognized the importance of controlling the high ground. In the twenty-first century, that high ground is space."[59] Securing that high ground therefore takes more than hardware. It takes people who can judge what they are seeing, institutions able to act on that judgment, and partners who trust one another.

A human aspects approach to understanding human roles in no way eliminates the need for technology; instead, it helps make sense of where technology fits into its proper place for those who build it, use it, control it, and rely on it. In the space domain, ambiguous attribution, distance, speed, and compressed decision timelines all increase the importance of human judgment. The contribution of the HAS approach is that it brings this framework to a domain that has been treated primarily as a hardware-focused challenge. The principle that humans are more important than hardware matters, and acting on it is where the advantage lies. This means changing workforce policy, procurement, training, and doctrine.

The application of the HAS approach is not limited to space. The same analysis that identifies human perspectives, opportunities, and constraints in the space domain also applies to cyberspace, AI-enabled practices, autonomous systems, and beyond. From its inception, this framework also addresses a gap in the current literature and academic discourse on critical strategic concepts like strategic competition, transnational crime, and the changing nature of war, extending its reach beyond a single domain. In applying these perspectives, the advantage will belong to those who invest in their people as purposefully as they invest in their systems. That choice can be made now, while it is still possible to mitigate challenges and threats.

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OCTOBER 2026