

U.S. GOVERNMENT
ACCOUNTABILITY
OFFICE



TRENDS

AFFECTING GOVERNMENT
AND SOCIETY

Accessible Version

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Foreword

The continuation of the COVID-19 pandemic into 2022 has created new and unexpected challenges across domestic and global issue areas. The pandemic brought about such challenges and changes to nearly every sector in the United States, from health care to education to defense, to name a few.

As the nation contends with the ongoing and complex effects resulting from the pandemic, the need for innovation and foresight to solve current and future problems has grown stronger. In addition, global conflict, emerging national security threats, and financial sector stresses are key areas of concern and drivers of future uncertainty.

In 2018, GAO established the Center for Strategic Foresight to identify major emerging issues, challenges, and opportunities that help GAO fulfill its mission to support the U.S. Congress and the public in making the federal government more efficient, effective, and responsive.

For more than 100 years, GAO has helped to ensure the accountability and effectiveness of the federal government. GAO regularly engages in strategic foresight, in both accomplishing its mission to provide the Congress, executive agencies, and the American public with timely, fact-based, non-partisan information and managing our internal operations.

Through environmental scanning and analysis, GAO has identified 12 key trends the agency anticipates will affect the domestic and global context for years to come. To identify these 12 trends that reflect the breadth and scope of GAO's work across the federal government, GAO's subject matter experts conducted research across a range of domains. These observations point to the uncertainties and implications of various trends over the near term (five years) and longer term (10-15 years). The trends are not designed to predict the future; rather they help GAO and our stakeholders understand possible implications.

By exploring these trends, key uncertainties, and their possible implications, GAO can better be prepared to respond to the national issues of greatest concern to the Congress and the American people in the years ahead.

With these 12 trends, GAO's Center for Strategic Foresight aims to ensure that GAO is prepared to assist the Congress as it addresses evolving challenges and seeks innovative solutions. GAO will continue producing work that elaborates on the trends through the span of our 2022-2027 Strategic Plan. The Center for Strategic Foresight will maintain focus on its ongoing environmental scanning systems and trend analysis capabilities, to ensure that GAO remains agile and responsive in its mission to serve Congress and the American people.

Abbreviations

AI	artificial intelligence
ACS	American Community Survey
CBO	Congressional Budget Office
CDC	Centers for Disease Control and Prevention
CFPB	Consumer Financial Protection Bureau
COVID-19	Coronavirus Disease 2019
CRISPR	clustered regularly interspaced short palindromic repeats
DHS	Department of Homeland Security
DOD	Department of Defense
FBI	Federal Bureau of Investigation
FTA	free trade agreement
GAO	U.S. Government Accountability Office
GDP	gross domestic product
NASA	National Aeronautics and Space Administration
PPE	personal protective equipment
R&D	research and development
STEM	science, technology, engineering, and math



National Security: Global and Domestic Threats

Current Trend

Threats to national security continue to evolve—including threats from Russia, China, North Korea, and Iran, as well as from other global and domestic threats. The war in Ukraine underscores the potential for threats that challenge the international order and jeopardize global security.

The White House’s March 2021 Interim National Security Strategic Guidance highlighted China’s and Russia’s challenge to the traditional international order and the **re-emergence of long-term, strategic competition among nations** as principal security trends.

Global adversaries, including regional and non-state actors, seek to act in the “gray zone,” below the threshold of armed conflict. They continue to grow cyber capabilities, weaponize emerging technologies like AI and synthetic biology, and develop electromagnetic spectrum capabilities.



On the domestic front, the DHS Secretary said in 2021 that racial, ethnic, and ideologically motivated domestic violent extremism poses the most lethal and persistent terrorism-related threat to the homeland and must be treated as a national priority. The FBI has noted that terrorist threats have expanded from predominantly externally directed plots to attacks

carried out both by homegrown violent extremists inspired by foreign terror organizations, and by what the FBI identifies as self-radicalized domestic terrorists. According to the Extremist Crime Database, **81 violent extremist attacks led to 240 deaths in the U.S. from 2010 through 2020.**

In addition, conspiracy theories and misinformation are increasingly tied to violent extremism, and both at home and abroad, **social media remains a powerful tool** for disseminating misinformation and organizing attacks.

Key Facts

- China and Russia, our primary potential adversaries, are developing advanced weapons, destabilizing regions, and using new political and military methods to advance their interests.
- The rise in violent extremism, both foreign-influenced and domestic-focused, has been accelerated by widespread misinformation on social media.
- In March 2021, the FBI reported having about 2,000 active domestic terrorism investigations, an increase of at least 600 in the first two months of 2021 alone.

THE U.S. IS NOT SUFFICIENTLY PREPARED

for threats from events such as pandemics and climate change, or threats from technologies, including AI-based capabilities, drones, and cyberattacks on critical infrastructure.



Foreign governments use cyber capabilities to

AGGRAVATE
SOCIAL AND
RACIAL TENSIONS
IN THE U.S.

UNDERMINE
TRUST IN
AUTHORITIES

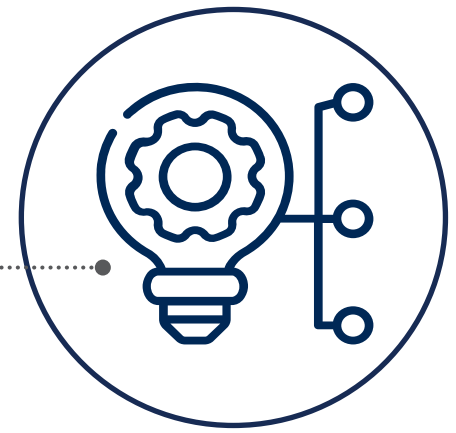
TARGET
ASSETS AND
INFRASTRUCTURE

Drivers of Uncertainty

- Extremists' use of social media presents complex challenges, such as those related to freedom of speech and cooperation between governments and social media companies.
- Significant questions remain about how best to deter foreign adversaries from using gray-zone approaches, such as cyber and electromagnetic spectrum capabilities, to target U.S. assets and infrastructure.

It is unclear what **coordinated national strategy**

or combination of strategies the federal government will apply to counter the full range of national security threats, whether foreign or domestic.



Gathering and sharing actionable threat and intelligence information depends on the **effective collaboration** of numerous intergovernmental or international partners and private sector entities.



Implications

The U.S. must adjust to the uncertainties of gray-zone conflict, determining when deterrence must give way to more active military response.

Policies must also consider national security threats with no adversary behind them, such as climate change, natural disasters, or demographic shifts.

Policy approaches for countering violent extremism will need to consider

- helping people distinguish between misinformation and facts;
- supporting disengagement from terrorist movements; and
- clarifying the difference between free speech and unlawful violence.



Many government entities work to counter violent extremism and threats from foreign adversaries. Military, diplomatic, intelligence, and law enforcement officials will need to work together effectively to respond to such threats.



Preparing for near-peer conflict in areas like **cyberspace, the information environment, and space** will need to be balanced with constrained funding resources.



Adversaries like China have a system that facilitates civil-military integration; the U.S. tends to separate the two and needs to focus efforts to counter a range of complex and evolving threats at home and abroad.

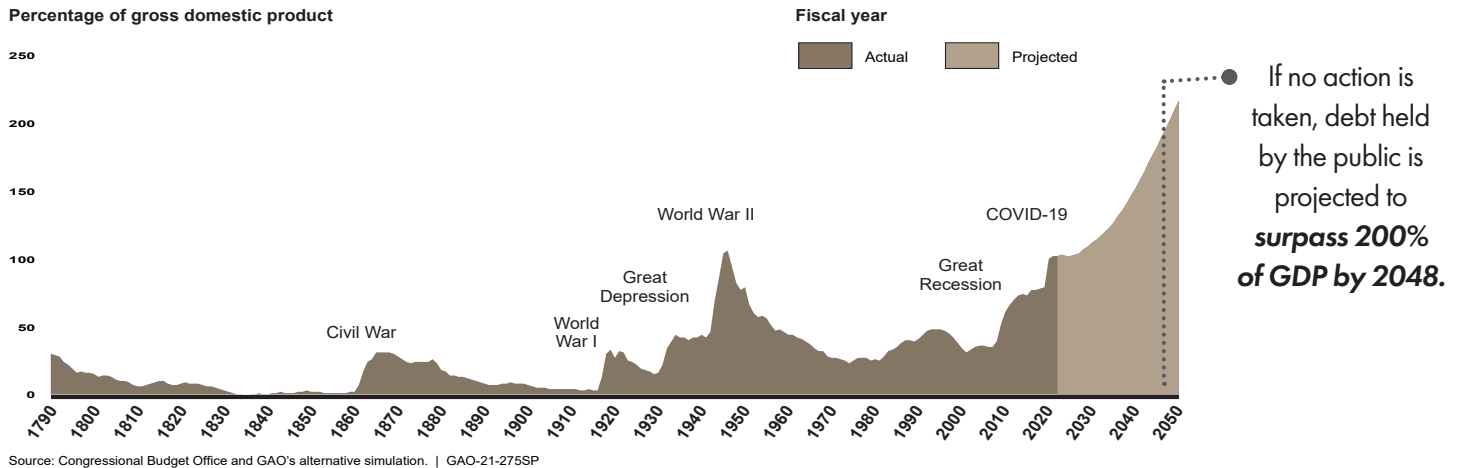


Government partnerships with the private sector will be essential to addressing social media's role in violent extremism and to assuring cybersecurity and protection of critical infrastructure like pipelines, communication networks, and transportation.



Fiscal Sustainability and Debt

Current Trend



The Congress and the administration responded in an unprecedented manner to address the COVID-19 pandemic and its effects on the economy. Congress appropriated and agencies provided federal assistance to support individuals and many public and private entities, including local public health systems and private sector businesses.

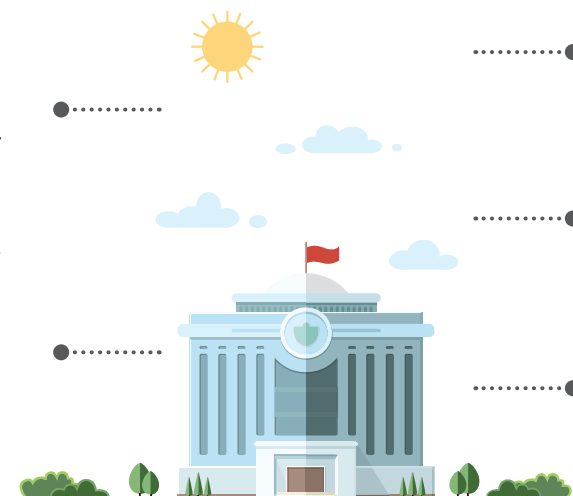
After the pandemic recedes and the economy substantially recovers, Congress and the administration should quickly pivot to developing an approach to place the government on a sustainable long-term fiscal path.

In the long term, spending on federal health care programs and Social Security drive most of the increase in federal non-interest spending as a share of GDP, which will further increase the gap between projected spending and revenues. GAO suggested the Congress consider establishing a long-term fiscal plan for returning to a sustainable path that includes fiscal rules and targets and alternative approaches to the debt limit.

Key Facts

As of November 2021, the Congress had provided about **\$4.6 trillion** to fund pandemic-related response and recovery efforts.

Federal health care programs and Social Security are projected to drive increases in federal non-interest spending.



- GAO projected in March 2021 that net interest spending will exceed Medicare spending in 2040 and Social Security spending in 2044.
- CBO forecasts that many key trust funds supporting health care and Social Security programs will be **depleted in 15 years or less**.
- Growing debt and projected rising interest rates are expected to lead to higher net interest costs in the long term.

Drivers of Uncertainty

The federal government faces numerous **fiscal exposures not fully accounted for** in fiscal projections, such as public health emergencies, global military conflicts, natural disasters, and unexpected economic conditions.

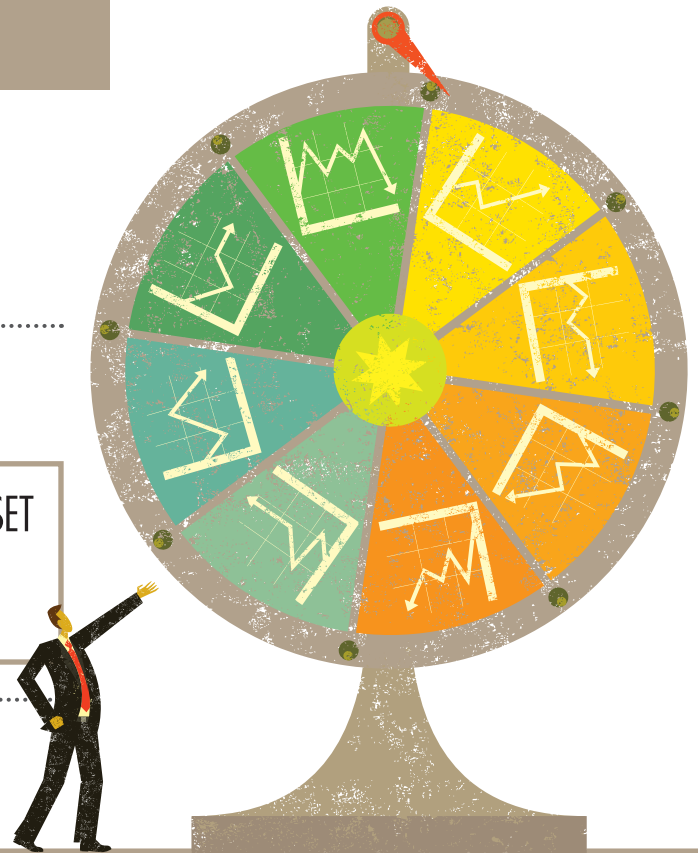
The fiscal conditions of state and local governments after the pandemic will largely depend on the extent of

ECONOMIC
GROWTH

INCREASES IN
HEALTH CARE
COSTS

PENSION ASSET
RATES OF
RETURN

Questions over whether the debt limit will be raised or suspended leads to increased borrowing costs and disrupts the market for Treasury securities.



Implications



An unsustainable fiscal path strains the federal budget and contributes to growing debt.

CBO reported high & rising federal debt

- increases the likelihood of a fiscal crisis and
- could lead to a large drop in the dollar's value or a loss of confidence in the government's ability or commitment to repay its debt in full.

Rising debt could also cause policymakers to feel constrained in their capacity to support the economy during downturns or unexpected events.

POST-PANDEMIC

After the pandemic recedes and the economy substantially recovers, policymakers should swiftly focus on strategies to change the long-term fiscal path.

THE SOONER ACTIONS ARE TAKEN, THE LESS DRASTIC THE CHANGES WILL NEED TO BE

Policymakers will need to consider the entire range of federal activities, as well as both revenue (including tax expenditures) and spending (entitlement programs, other mandatory spending, and discretionary spending).

Congressional efforts to improve the long-term fiscal path could benefit from well-designed fiscal rules, such as a debt-to-GDP target. The Congress should consider **alternative approaches to the debt limit** as part of any long-term fiscal plan.



Preparing for Catastrophic Biological Incidents

Current Trend

The COVID-19 pandemic underscores the importance of building resilient systems that can detect and withstand catastrophic biological incidents. These incidents can significantly affect public health. For example, they can increase rates of disease and death, disrupt health care delivery, and worsen longer-term public health concerns such as drug misuse and mental health.



Fragmentation within and across federal and nonfederal governments and the private sector makes it harder to build integrated capabilities and to coordinate with international partners. Moreover, the vast range of threats—intentional, accidental, and naturally occurring—makes it difficult to effectively prepare.

In addition, **mistrust** of government and science can frustrate response and recovery efforts.

In September 2020, Pew Research Center reported that **only 20% of Americans trust government.**

GLOBALIZATION

CLIMATE CHANGE

URBANIZATION

increase the probability, intensity, and frequency of catastrophic biological incidents.



Individual and collective stressors weaken systems needed to prepare for, detect, respond to, and recover from these incidents. For example, there have been a variety of funding challenges, including declining funding for public health, uneven investments in health care, reactionary and disease-specific funding, and limited funding to prepare for high-consequence, lower-probability events.

Key Facts



BIODEFENSE STRATEGY

The 2018 National Biodefense Strategy provides goals and objectives to build national capabilities, but has **not reached its full implementation potential.**



MEDICAL CARE DELAY, AVOIDANCE

Approximately 40% of Americans delayed or avoided medical care because of COVID-19,¹ including people with underlying medical conditions.



CLIMATE CHANGE, PROXIMITY

Climate change and the close proximity and ease of movement for people and animals **provide new opportunities for diseases to emerge and rapidly spread.**



BIOENGINEERING TECHNOLOGIES

Improvements in bioengineering technologies pose additional threats, such as the **potential development of bioweapons.**



DECREASED FUNDING

From 2002 to 2021, federal funding designed to help nonfederal public health departments prepare for biological incidents **decreased by nearly 50%.²**

Drivers of Uncertainty

Preparedness funding—for robust public health systems, strategic and integrated investment approaches, and lower-probability events—faces sustainability challenges as crises recede and priorities shift.



The National Biodefense Strategy may not fully drive change across fragmented agency missions to prepare for unpredictable threats that could occur simultaneously.



Integrating data to create reliable information for timely national situational awareness, detection, response, and recovery is a significant challenge.



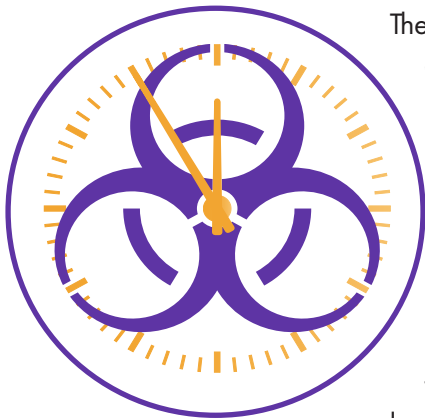
Federal efforts to build a more resilient medical supply chain may not be sufficient to allow for rapid access to supplies during future catastrophic incidents.



Progress to enhance trust in government and science and overcome disparities in health care may be uneven and challenging.



Implications



The COVID-19 pandemic demonstrates the devastating effects of biological incidents, yet **future incidents could be even more catastrophic and disruptive**. Failure to effectively prepare for the future, including responding to concurrent threats, leaves the nation vulnerable to cataclysmic outcomes.

Inherent fragmentation and uncertainty will continue to make it difficult to build and maintain effective capabilities for catastrophic biological incidents.

Federal and nonfederal entities can improve efforts to detect, respond to, and recover from biological incidents by collaboratively defining capabilities, roles, responsibilities,

authorities, and resources. They can also

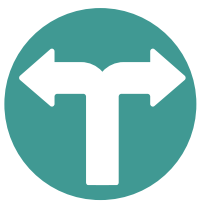
- establish system-wide targets to measure progress, and
- institute mechanisms to ensure accountability and equitable outcomes.

Awareness of interdependencies—including appropriate integration across systems and the cascading effects of biological incidents on other public health crises—will help in designing more robust and effective capabilities.

Focus on **activities that help mitigate other public health effects**, such as mental health support and drug misuse prevention, will be an essential aspect of preparedness.

Similarly, **attention to public messaging modes, methods, transparency, and accessibility** may help to

- confront misinformation and
- address mistrust in government and science.



Racial and Ethnic Disparities

Current Trend

Equality of access to and provision of services, procedural fairness and equal treatment of all individuals have been a persistent challenge across different aspects of American society. The focus of the trends presented below is on racial and ethnic disparities, including areas such as:



The effects of **these disparities are intertwined and far-reaching**. For example, the legacy of past federal housing policies such as “red-lining” has contributed to racial and ethnic segregation. That segregation, in turn, has contributed to racial and ethnic disparities in wealth and public education.

Also, the recent high-profile killings of Black Americans during encounters with law enforcement have led to **heightened public scrutiny of racial and ethnic disparities in policing**.

At the same time, COVID-19 and the resulting economic disruption have disproportionately affected these communities’ physical, social, economic, and mental well-being. In addition, concerns exist about voting access and the potential effects of certain voting requirements on racial or ethnic minority voters.

As racial and ethnic disparities persist, the population of the United States is projected to become increasingly diverse. According to the U.S. Census Bureau, 56 percent of the population is projected to be a race other than White by 2060.³ The U.S. Census Bureau also reports that people who are two or more races are projected to be the fastest-growing racial or ethnic group over the next several decades, followed by Asians, then Hispanics.⁴

Key Facts



According to a Federal Reserve Bulletin, in 2019, the median net worth of Black families and Hispanic families was about \$24,000 and about \$36,000 respectively, while it was about \$188,000 for White families.



According to the CDC, as of April 2021, the rate of COVID-19 hospitalizations for American Indian/Alaska Natives, Hispanics, and Blacks was 3.5, 3, and 2.8 times higher (respectively) than for Whites, when adjusting for age.



In 2018, Black-owned businesses made up approximately 2 percent of all employer firms in the U.S. while Blacks represented an estimated 13.4 percent of the U.S. population, according to the U.S. Census Bureau’s 2019 Annual Business Survey.



As of the end of 2018, the Black imprisonment rate was nearly twice the rate of imprisonment among Hispanics, and more than five times the rate among Whites.⁶



Sixteen percent of Black mortgage applicants were denied conventional home-purchase loans in 2019, compared to 6.1 percent of White applicants, according to CFPB.



According to one study⁷ of the 2018 election, in precincts with 10 percent or less non-White voters, the average wait time was 5.1 minutes, whereas in precincts with 90 percent or more non-White voters, the average wait time was 32.4 minutes.



For 2019, 18 percent of Black fourth graders and 23 percent of Hispanic fourth graders scored at or above proficient on a national education assessment, compared to 45 percent of White fourth graders.⁵

According to U.S. Census Bureau data, Black, Asian, and Hispanic citizens were registered to vote and voted in the 2020 election at lower rates than White citizens.

Drivers of Uncertainty

- Disparities in wealth and income, which are intertwined with disparities in education or home ownership, could widen or narrow depending on policy responses, the economy, and other factors.
- Whether new policies will be enacted to address racial and ethnic disparities in housing affordability or homeownership remains an important question.
- The extent to which COVID-19 will exacerbate racial and ethnic disparities in education and health, and how long these effects will last, is unknown.
- It is difficult to predict whether and how the criminal justice system, to include law enforcement, will be reformed.
- While some federal election requirements change over time, the effects of these changes on voters may not be known until subsequent elections.

Implications



HELPING ALL AMERICAN CITIZENS THRIVE

Efforts to address racial and ethnic disparities across society, such as in education, housing, criminal justice and healthcare, are likely to continue to be an area of public policy debate. For example, improving paths to obtaining and sustaining homeownership for communities of color may help these borrowers build wealth and could improve education and health outcomes. Likewise, efforts to address racial and ethnic disparities in educational experiences may help reduce gaps in achievement, which limit upward economic mobility and perpetuate inequality.

- By some estimates,⁸ racial and ethnic disparities in the U.S. health care system amount to approximately

\$93 BILLION
in excess medical care costs due to poorer health for racial and ethnic minorities

\$42 BILLION
in lost productivity per year

INCALCULABLE
societal effects due to premature deaths and reduced quality of life

In addition, **addressing inequities in the criminal justice system** remains a continuing subject of debate.

Finally, as the Congress and the states continue to **consider changes to election requirements**, it will be important to understand their effects on all voters.

Addressing racial and ethnic disparities will be a persistent challenge facing the country and its policymakers.



Science, Technology, and the Innovation Economy

Current Trend

The U.S. was a global leader in innovation for much of the 20th century. Many new categories of products and services came from the U.S. technology sector. Further, public and private investment in R&D played a crucial role in generating millions of jobs for American workers.

In the 21st century, however, the U.S. **increasingly faces expanding and changing competition** in an innovation-based global economy. For example, the United States has lost significant capability to manufacture advanced technologies that result from innovations such as AI, biotechnology, and semiconductors. The nation also relies heavily on imports for many of the raw materials to manufacture these technologies.



The U.S. still offers one of the world’s best environments for launching innovative products and companies. However, as the pace of innovation continues to accelerate globally, there is a **critical need to modernize aspects of the U.S. intellectual property and technology transfer systems**. Additionally, American inventors and entrepreneurs do not currently represent the diversity of the country, and many parts of U.S. society are at risk of being left out of the innovation economy.

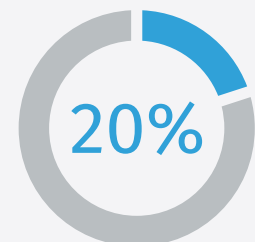
Key Facts



- In the U.S., the percentage of public investment in R&D is declining and private investment is growing—but the **overall U.S. share of global R&D spending is declining**.
- The U.S. framework for translating federally funded R&D into commercial technologies has not been updated since it was created in the 1980s.
- U.S. firms and federal agencies are looking for workers with strong technical skills, amid concerns that the **nation faces a shortage of skilled technical workers**.
- The loss of domestic manufacturing capacity has created **gaps in the U.S. innovation system** in sectors where technological advances are tied to the manufacturing process.

TECH FIRM SHARE OF MARKET VALUE

In March 2021, the 5 largest technology firms were valued at \$7 trillion, representing more than 20 percent of the market value of the 500 largest U.S. publicly traded companies, according to GAO analysis of S&P data.



Drivers of Uncertainty

- **Competing funding priorities** could limit the U.S. government's ability to expand support for science-based innovation, R&D, workforce training, and STEM education.
- The dominance of the largest technology firms can make the U.S. market a challenging environment for innovative and diverse smaller competitors.
- A global shift toward localizing supply chains, along with continued geopolitical conflicts, may further hamper U.S. access to critical materials needed for manufacturing advanced technologies.

Increasing competition from China in standards setting raises questions about **who will control global technology standards.**



Significant uncertainties in the types of software and biotechnology innovations eligible for patent protection in the U.S. create risks for investors.

Implications

DEVELOPING POLICIES TO ENCOURAGE INNOVATION

The United States stands to benefit from policies that encourage innovation. A national innovation and industrial strategy might be an important step in coordinating federal efforts.

In addition to policies that directly address the development of new technologies, policies concerning intellectual property, education and training, and supply chains, among others, play a significant role in innovation.

For example, the United States may want to clarify which forms of biotechnology innovations are patentable and provide leadership in developing new technology standards.

● Policymakers may also need to

RETHINK
COMPETITION
POLICY

IMPROVE
INCENTIVES FOR
SMALL BUSINESSES
TO INNOVATE

REVERSE THE
DECLINE IN PUBLIC
R&D INVESTMENT

Further, enhancing public-private partnerships, such as those between industry and federal labs, may help industry better access publicly funded innovations.

Investments in innovation infrastructure, such as regional technology-based economic development efforts, may also boost the productivity of the U.S. economy.

To maintain global leadership and competitiveness, the U.S. must invest in and grow a strong, talented, and diverse STEM workforce, and seek ways to ensure that the benefits of U.S. innovation flow more broadly to the American people.



Security Implications for an Increasingly Digital World

Current Trend

People are spending more time working online.

This trend has only accelerated since the COVID-19 pandemic made online interaction a safer alternative to in-person contact.



As society shifts more personal and professional activities online, **criminals are also shifting their activities online** and becoming more sophisticated in exploiting vulnerable populations. Law enforcement efforts to address related technical and legal challenges, such as accessing criminal activity on encrypted technologies and tracking illicit financial transactions that use cryptocurrency, come at a significant cost in terms of time and money. Federal entities, such as DHS's Cybersecurity and Infrastructure Security Agency, work to educate consumers on cybersafety and protect them from security breaches online.

Furthermore, **people increasingly rely on digital tools for news and information.** At the same time, artificial intelligence systems and other technologies have made it easier to disseminate false content. Consequently, the role that social media companies play in monitoring the information on their platforms has come under increased scrutiny.

Key Facts

As law enforcement intensifies its use of digital tools, criminals also increasingly use technologies to disguise their activities.

Americans have increased their reliance on social media and technology firms, such as Facebook, Twitter, and Google, as their news sources.

Extremist groups have increasingly used social media to promote their ideologies.

Deepfakes and other synthetic media can be used for exploitation and disinformation.

Nation-states have used the internet to undermine democracy, operating social media pages designed to influence U.S. audiences and buying political advertisements on social media.



Drivers of Uncertainty

- It is unclear how law enforcement, legislatures, and the courts will **balance preserving civil liberties** against using monitoring technology to identify and counter illicit activities.
- The extent to which **increased reliance on internet-connected technologies** (i.e., Internet of Things) will result in serious security and privacy implications is uncertain.
- Technologies to disguise illicit activities will evolve at an unpredictable pace and potentially inhibit law enforcement efforts to effectively identify and counter them.
- The future role of social media entities in filtering information for accuracy and in controlling the content presented to each social media user is uncertain.
- It is uncertain how fast AI technologies will advance and become widely used for illicit purposes.



Implications

BALANCING SECURITY AND SAFETY

Governments and society will continue to confront questions of how best to balance security and safety with personal freedoms. Defining and agreeing on appropriate regulatory responses will be a challenge when facing rapidly changing technologies. Failure to develop and employ effective monitoring technologies to improve public safety in a balanced way could result in increased violations of privacy and civil liberties. As society adopts new digital technologies, law enforcement's ability to identify and counter illicit activity online will depend on its ability to understand and employ these new technologies.



PREPARING FOR AND MITIGATING SECURITY ISSUES

The use of algorithms and other technologies to create and distribute news and information may pose threats to governments and democracy, as individuals may be making decisions based on manipulated, inaccurate, or incomplete information. Similarly, individuals may encounter information and news that attempts to exploit biases, perpetuate ideological echo chambers, and limit alternative views. Consequently, individuals could take actions that undermine the security of individuals and property. Federal agencies may have to undertake new or additional efforts to inform themselves about, prepare for, and mitigate security issues.

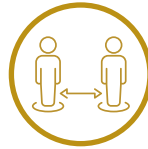


Changes to How and Where We Work

Current Trend



The effects of the COVID-19 pandemic and rapid advances in technology herald profound changes for the workforce.



The pandemic brought widespread physical distancing and accelerated shifts to remote work, which will likely influence the way people perform their jobs going forward.



The sharp increase in remote work during the pandemic, from 20 percent to 70 percent,⁹ also triggered changes in urban centers in the concentration of jobs and populations, office vacancies, and mass transit demand.



Extensive use of videoconferencing for meetings is also likely to replace some business travel.



In addition, advances in technology, AI, and robotics continued through the pandemic and may further accelerate changes in the nature of work. The push toward automation as a result of the pandemic stems, in part, from the **need to reduce workplace crowding, cope with surges in consumer demand, and offer contactless services.**

Such technologies are expected to alter the types of available jobs, their locations, and the specific skills they require. As more workers face job losses in declining occupations, many will need training and education for entirely new occupational categories requiring different skills.

Key Facts



- Some industries **rapidly reduced their workforces** during the pandemic or adopted technology that altered the nature of the work.
- COVID-19 resulted in novel challenges to workers' well-being and **increased concerns about protection for essential workers**, e.g., food supply chain workers and health care providers.
- Technology and the advance of automation continue to **disrupt existing jobs and require new skills of workers** in sectors such as food service and transportation.
- More than half the low-wage workers currently in declining occupations will need to **shift to occupations in higher wage brackets** that require different skills.
- Data indicate that automation and the **effects of the pandemic disproportionately affect certain groups**, including women, Black, Hispanic, low-income, and less educated workers.

Drivers of Uncertainty

ADOPTION OF ADVANCED TECHNOLOGY

The federal government tracks adoption of advanced technology—such as artificial intelligence, autonomous transport, and 3D printing—but the extent of workforce changes is unknown.

DURATION OF PANDEMIC-RELATED JOB DISLOCATION

The duration of pandemic-related job dislocation remains uncertain and may depend on how well worker training, transportation, dependent care, and other supports can be adapted.

AVAILABILITY OF KEY TOOLS

Movement to remote work will be affected by availability of key tools, including secure networks and internet bandwidth.

REQUIREMENTS FOR CYBERSECURITY

Remote work and remote access technologies may require additional cybersecurity measures given greater exposure to external threats compared to more tightly controlled access at a worksite.

EVOLUTION OF EMPLOYER/WORKER RELATIONSHIPS

The prevalence and permanence of task-based work (commonly known as contract or gig work) will vary as the relationship between employers and workers evolves.

By 2025, automation could displace 85 million jobs while creating 97 million new ones requiring different skills.¹⁰

Implications

- The COVID-19 pandemic highlighted the vulnerability of certain groups of workers and accelerated technological changes in the nature of work that were already underway.
- Workers of different races, genders, income levels, and education experienced job losses differently due to pandemic business closures.
- Women left the workforce at disproportionately high rates given added education and childcare responsibilities when schools and day cares closed.
- While technology can boost productivity and lead to economic growth, workers in industries undergoing automation may be displaced if they cannot acquire in-demand skills.
- Policymakers, businesses, and educators must collaborate to ensure supports for workers and training for the jobs of the future.



The rise in remote work provides flexibilities for employees, including opportunities to relocate to smaller cities and rural areas, which could see revitalization.



Conversely, it means less demand for office space, retail establishments, and residences in urban centers.



Shifting commuting patterns also impact public transit.



Moreover, decreases in business travel affect employment in a range of industries, including airlines, hotels, food service, and taxis.



Finally, the changing geography of workplaces may have lasting tax implications for cities, employers, and workers.



Future of Global Supply Chains

Current Trend

The value of global international trade is estimated to have fallen by about 8% in 2020 due primarily to COVID-19.¹¹



The number and complexity of global supply chains has grown around the world, but **recent events have raised questions about the economic and national security risks** these supply chains may pose. Firms develop global supply chains by breaking up their products into key components, and then making decisions about what to produce where based on factors like

- labor costs,
- infrastructures, and
- host government investment policies, such as taxation.

Global supply chains have become a central aspect of the international trading system, illustrating the **shift in trade from traditional commodities and finished goods to intermediate goods and services.**

However, recent events such as the COVID-19 pandemic have raised questions about the risks—including potential shortages of key items—these supply chains pose for particular sectors, the overall economy, and in some cases, national security.

These risks are particularly concerning for supply chains concentrated in a certain region or reliant on a single supplier. In addition to these concerns, factors like rising wages in China and advances in manufacturing technologies that have lowered the cost of producing items at home, such as automation and 3-D printing, have slowed the pace of growth of global supply chains in recent years.

Key Facts



Numerous factors influence the formation and configuration of global supply chains, including FTAs, export controls, and labor and manufacturing costs.



Shortages in PPE during the COVID-19 pandemic prompted some countries to restrict export of these goods or promote domestic production.



The U.S.-China trade war has caused companies to adjust supply chains, moving manufacturing out of China to avoid existing and possible future tariffs.



While global trade can boost overall employment, certain geographical regions suffer job losses associated with global supply chains, such as when manufacturing locations change.



Foreign adversaries attempt to exploit global supply chains to obtain technologies critical to national defense.

DISRUPTION AND DISTORTION

Approximately 75% of supply chain executives representing 628 companies reported supply chain disruptions in 2020 due to COVID-19.¹²

The share of global trade affected by distortionary measures—including tariffs—was at 40% in late 2019 and rising.¹³



Drivers of Uncertainty

The U.S. and other countries may adopt measures to incentivize or force companies or certain industries to

SHORTEN THEIR
GLOBAL SUPPLY
CHAINS

INCREASE
DOMESTIC
PRODUCTION

It is unclear how willing companies will be to embrace technologies, like 3D printing, to **localize production and add flexibility and resiliency** to supply chains.



Reliance on a small number of companies or one geographical region for critical components, such as microchips, could cause **severe disruptions when demand outpaces supply**.

Microchip shortages forced General Motors and Ford to slash automobile production in three states in early 2021.

The **uncertainty caused by U.S.-Chinese trade relations** may raise products' costs by forcing firms to maintain higher inventories or seek alternative sourcing to avoid tariffs.

Disruptions from the pandemic and other factors may have unpredictable effects on global supply chains in terms of supply, demand, and workforce availability for surface transportation, port operations, manufacturing, and distribution.

Implications



The U.S. and other countries will need to balance fostering economic growth through increased global trade with important economic and national security considerations. Increasing global risks, including health issues such as COVID-19, international terrorism, foreign acquisition of U.S. businesses, and increased natural disasters due to climate change, will likely increase **the need for resilience, reliability, and security** of global supply chains. For example, shortages caused by COVID-19 are expected to prompt numerous supply chain reconfigurations as companies seek to diversify their suppliers by setting up subsidiaries in multiple countries or closer to their home markets.

Companies will also look to future U.S. policy decisions to determine how to configure their supply chains, potentially affecting job growth and the accessibility, quality, and price of goods in the U.S.

Growing global supply chains can

BROADEN
ECONOMIC
GROWTH

LOWER
PRICES

STRENGTHEN
RELATIONSHIPS
AMONG NATIONS

However, in times of crisis, they could also create shortages or hamper national security if access to key components or services is restricted. Therefore, the U.S. and other countries may look to partner with companies to identify and mitigate these risks.



Online Learning and Technology in Education

Current Trend

Advancing technology has reshaped education, creating online learning opportunities for students at all levels. In 2020, the COVID-19 pandemic accelerated this evolution, making online classes the norm for many students as K-12 and college buildings closed nationwide. Technology offers the **potential to create personalized learning experiences** using adaptive content and assessments, while online classes provide flexibility for students in remote locations or with work or family responsibilities.

At the same time, education technologies have not lived up to their promise. Many students lack reliable access to the internet to participate online, especially low-income students and students of color. Further, **online classes are not well suited for all disciplines or for students who require a more structured and supportive environment** with in-person interactions to thrive, such as some students with disabilities. Some research indicates that course completion rates and grades for online classes are lower

than those for in-person classes, particularly for students who are less prepared academically. The increased role of technology also raises safety and privacy concerns, as online classrooms have been hacked by outsiders and data breaches have disclosed students' personal information.

In late spring 2020, nearly 93 percent of U.S. households with school-age children reported that their children were in some form of distance learning due to COVID-19.¹⁴



Key Facts

Almost one-third (15-16 million) of public K-12 students—primarily Black, Hispanic, Native American, and rural—**lack adequate internet access or devices¹⁵** needed for online learning.

Strategies to keep students engaged and motivated to learn remotely was the most common need identified by K-12 teachers in a spring 2020 RAND Corporation survey.

Thousands of K-12 students were affected by **99 reported data breaches** from July 2016 to May 2020.



COVID-19 led colleges to move classes online; in fall 2020, **first-time enrollment at community colleges fell 19%,¹⁶** with larger decreases among students of color.

Research on the effectiveness of online vs. in-person college classes is mixed—with some studies finding similar student outcomes, and others reporting worse outcomes online.

Drivers of Uncertainty

- It is difficult to predict the effects of online learning on post-pandemic K-12 education or how it will further transform higher education.
- Questions remain regarding how many of the students who left K-12 schools or did not enroll in college during the pandemic will return to school.
- The quality and effectiveness of online models—from videotaped lectures to artificial intelligence systems that customize student assignments—vary significantly and are not well understood.

The extent of **pandemic-related learning loss**, especially for students with already-unmet academic needs—often students of color and low-income students—is not yet fully known.



More research is needed on how to structure and conduct online classes to facilitate engagement and success for students with diverse needs.

Implications

ADDRESSING CHALLENGES TO LEVERAGE TECHNOLOGY

Technology will remain part of the educational landscape, but schools and colleges will not be able to fully leverage the potential benefits without addressing key challenges. These include online engagement and student success, and the digital divide that prevents some students from participating in remote learning.

The sudden move to online classes during the pandemic has been detrimental for many students, raising concerns about:

LONG-TERM
LEARNING LOSS

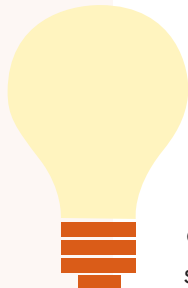
DISENGAGED
K-12 STUDENTS

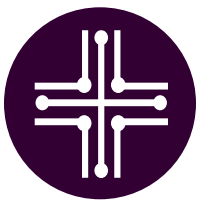
LOWER COLLEGE
ENROLLMENT
especially among low-income students and students of color

If these students do not reengage with learning, it could adversely affect the skill levels of the nation's workforce and exacerbate disparities in access to educational and employment opportunities.

Building on what educators have learned about effective digital practices will be critical to creating learning options that meet the needs of a diverse student population; to offering lifelong learning opportunities for workers; and to ensuring a skilled workforce.

Further, developing a variety of reliable and effective online options and addressing safety and privacy concerns will also help education systems and schools prepare for and respond to disruptions caused by future emergencies.





Evolving Health Technologies

Current Trend



New technologies have the **potential to improve health care delivery, speed recovery, and increase rates of survival** for life-threatening diagnoses. The COVID-19 pandemic, which increased the use of telemedicine and autonomous robots in hospitals, has accelerated technological innovations. Other innovations merge biology and technology to restore and enhance human abilities. Examples include: advanced prosthetics that may allow users to feel their prosthetic devices; genetically engineered therapeutics; 3D printed organs to potentially reduce the incidence of transplant rejection; advances in regenerative

medicine based on stem cell technology; smartphone applications that may identify mental health crises and provide treatment support; virtual reality that may be used to treat pain; and tiny devices about the size of nerve fibers that may augment the body's ability to heal.

The use of AI and robotics continues to grow. For example, AI has been used to augment drug and vaccine development, which has positively affected the development of treatments for COVID-19. Robotic capabilities offer precision, flexibility, and control for doctors performing complex procedures, while robotic devices that mimic biological systems may help researchers advance their understanding of the human body.

POTENTIAL BENEFITS AND COSTS OF AI

- AI can decrease the time and cost required to bring more effective drugs to market.
- AI could reduce provider burnout and free them to spend time on more complex tasks.
- AI could increase resource use efficiency, potentially resulting in cost savings or health gains.
- Patient data will become more accessible as AI technology becomes more widespread, raising privacy concerns.

Key Facts



- **U.S. health care spending continues to grow faster than the economy**, with GAO projections showing federal spending growing to 8 percent of GDP by 2050.
- Health advances, including new procedures and treatments, generally increase total spending. This differs from other sectors, like manufacturing, where innovation can decrease costs.
- Effects of COVID-19—including increases in mental health conditions and the ongoing need

for vaccines and therapeutics—will likely result in health care spending growth.

- Genome editing techniques, such as CRISPR, are **starting to yield new treatments for health conditions**, including sickle cell disease.
- Stem cells, which have been used to treat some types of cancer, are showing promise for other diseases, including multiple sclerosis.

Drivers of Uncertainty



Broad adoption of AI-enabled health technologies could be limited by questions about safety, data quality, and the scalability across locations, settings, and populations.



Funding is a key factor in determining how quickly technology is launched, as demonstrated by the government funding that accelerated COVID-19 vaccine development.



Long-term effects of medical advances, including gene therapies and vaccines developed using novel platforms, require study to address unanswered questions around bioethics, equity, and related issues.



New technologies change rapidly and may not always fit into regulatory processes or standards, which evolve slowly and may present barriers to innovation.

Some population groups may have limited or uneven access to advances in health care, due to

GEOGRAPHIC
LOCATION

SOCIO-
ECONOMIC
STATUS

INSURANCE
COVERAGE



Biotechnology, including advances in regenerative medicine and vaccines, could be one of the most transformational technologies of the 21st century.

Implications



Evolving health technologies are poised to change health care delivery and outcomes. Ideally, technological developments would make it easier for health care providers to offer high-quality care to more people and reduce costs. **Agility will be an important factor for success amid unexpected challenges.** Increased funding helped spur vaccine development, highlighting the importance of funding for innovation.

A 2020 survey of health care consumers indicates they increased their adoption of certain health technologies, including wearable fitness trackers and telehealth services.

The U.S. ranks fourth in the World Index of Healthcare Innovation, behind Switzerland, Germany, and the Netherlands.¹⁷ But a 2020 report showed that the U.S. health care industry lags behind other domestic industries and other countries' health care systems in technology adoption.¹⁸ To help ensure that U.S. patients are getting high-quality health care, policymakers need to consider social, ethical, financial, and other factors affecting innovation.



Sustainable Development

Current Trend



The world is facing **complex and interdependent challenges in all three dimensions of sustainable development**—economic, social, and environmental—that

threaten the well-being of the Earth and its people, both now and into the future. These challenges include pandemics, climate change, new pollutants, poverty, ocean health, energy sources and infrastructure, and forced migration. Sustainable development reconciles these three dimensions by proposing a concept of development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

Successful sustainable development requires an **integrated systems approach and a broad, long-term perspective** that considers the interdependent nature of these challenges. Governments are key in setting the direction, making policy, and providing coordination for sustainable development. However, governments may not be positioned to meet these challenges using existing practices, regulatory frameworks, and infrastructures.

To address the most pressing challenges, it is important for governments, institutions, intergovernmental organizations, the private sector, academia, and nongovernmental organizations to collaborate with each other.

Collaboration requires a significant investment of time and resources but brings together complementary resources and shared risk.

Key Facts

1

Sustainable development is a multi-dimensional way of thinking about the interdependencies among global social, environmental, and economic systems.

2

There is a need to modernize institutions in order to meet the challenges of present and future environmental trends.

3

Some environmental challenges may disproportionately affect vulnerable populations. For example, low-income communities may face greater risk from hazards, as they have less ability to relocate or invest in mitigation measures.

4

Long-term environmental and development challenges could benefit from near-term actions and strategic planning, such as investing in disaster resilience measures to mitigate the impact of future disasters.

5

Climate change has led to record low levels of Arctic ice—increasing economic opportunities as well as defense and safety risks.

Drivers of Uncertainty

More frequent and severe disruptions to energy infrastructure can significantly affect other critical sectors such as health, transportation, and telecommunications.

- It is uncertain how and when technologies and policies—such as those affecting energy and natural resource management—will evolve, or how they will affect sustainable development.
- Anxiety over misinformation has increased and trust in institutions has declined, which can affect citizens' confidence in climate and other science information they receive.
- There are questions about how the federal government will address its vast and growing environmental liabilities to reduce costs, protect health, and sustain the environment.
- The integrated nature of sustainable development will pose challenges to institutions that often were not designed to work across boundaries.
- Resources available for sustainable development may be limited by competing economic, social, and other spending priorities and governments' constrained budgets.

Implications

Sustainable development requires thinking in a new way about the links across sometimes competing social, environmental, and economic priorities. A **whole-of-society approach** identifies, supports, and coordinates contributions from a diverse set of stakeholders, establishes mechanisms for multi-stakeholder engagement, and supports multi-stakeholder partnerships.

This prospective approach is reflected in, for example, the United Nations Sustainable Development Goals, which aim to promote shared prosperity, environmental sustainability, and progress on sustainable development that leaves no one behind. Achieving any particular target under these goals will **require a combination of factors**, including legal and regulatory components; multiple institutions at various levels; and potentially broader societal changes, which themselves can be spurred by changes in institutions.

Governments can help facilitate this through **information sharing, ongoing multi-stakeholder engagement, and initiatives that promote collective contributions**

toward sustainable development. For example, federal regulations or conditions on federal financial assistance can help promote long-term, forward-looking investments in development.

Currently, the COVID-19 pandemic—an unprecedented social, economic, and health crisis—offers an opportunity to develop recovery plans that cut across institutional boundaries to build a more sustainable future.





Evolving Space Environment

Current Trend

People are increasingly using space for **national security, commercial, and human exploration** purposes.

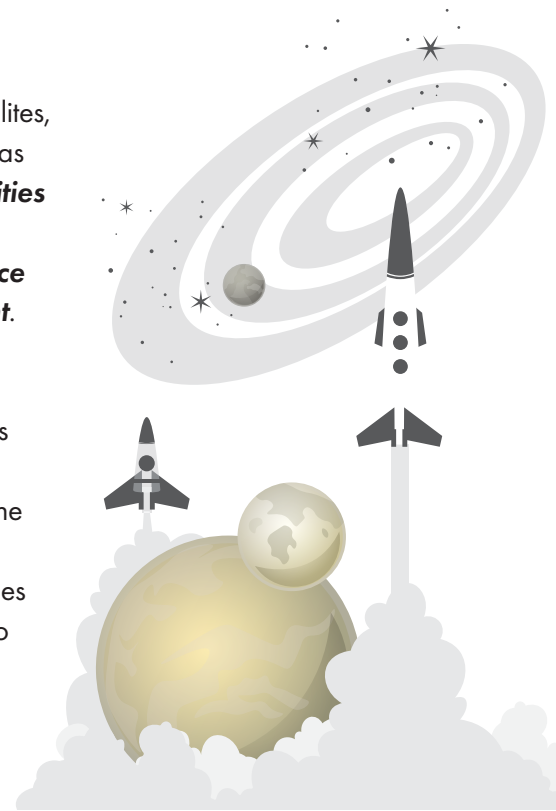
From a national security perspective, **space is increasingly an arena for military operations** as other countries over the past 20 years have advanced their own military space capabilities.

Commercial opportunities have also proliferated. The **number of active satellites in orbit has more than tripled** over the past 5 years,¹⁹ and some experts predict a substantial increase over the next decade. Additionally, the Federal Aviation Administration is overseeing a growing number of commercial space launches.

Private companies are also pursuing a range of activities, from space tourism to resource mining. And, the rapidly increasing number of space objects—including active

and inoperative satellites, and space debris—has exposed **vulnerabilities in the current U.S. architecture of space traffic management.**

Further, budgets and schedules for NASA’s portfolio of projects are increasing, and the agency is partnering with private companies and other countries to extend human space exploration beyond low Earth orbit.

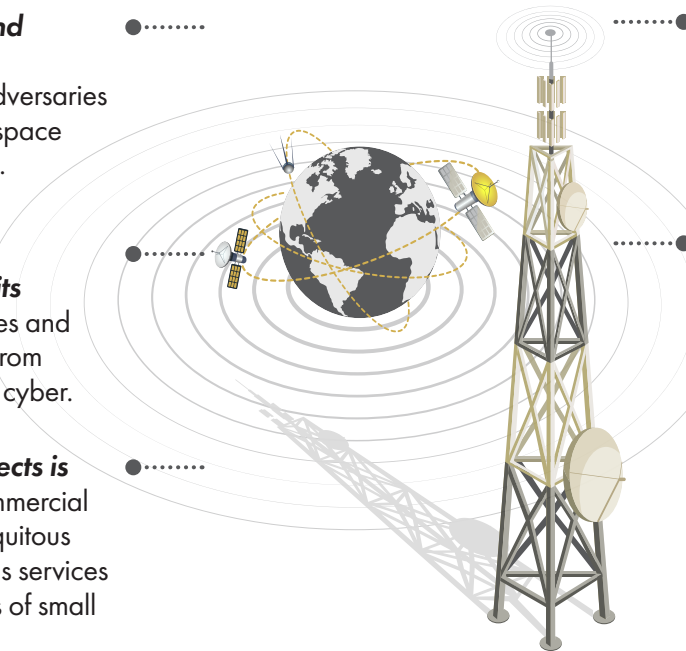


Key Facts

Threats to commercial and military use of space are emerging, including U.S. adversaries developing ways to target space assets and communications.

DOD has faced **mounting challenges in protecting its weapon systems**—satellites and ground systems included—from numerous threats, including cyber.

The **number of space objects is rapidly increasing** as commercial entities seek to provide ubiquitous broadband communications services through large constellations of small satellites.



• NASA is partnering with private companies to develop systems for a return to the moon no earlier than 2025 with **plans to develop a long-term lunar presence.**

• **New commercial ventures are on the horizon**, including human space tourism and non-traditional space activities, such as resource mining and satellite servicing.

According to BryceTech, the **global space economy** was estimated at more than \$350 billion in 2019.

Drivers of Uncertainty



ACTIONS AND RESPONSE

“Dual-use” capabilities—e.g., when adversaries can use satellite repair systems to disable other satellites—create uncertainties regarding actions in space and how to respond.



GAPS IN OVERSIGHT

Current law may create gaps in oversight authority for non-traditional space activities, such as space-tourism passenger safety.



COMMITMENT TO FUNDING

Long-term budget commitment to develop sustainable deep space exploration, including investment in new propulsion capabilities (such as nuclear) is unclear.

AMBITIOUS EXPECTATIONS

NASA’s 2025 lunar landing goal is years earlier than originally planned, and it is uncertain if required work can be completed in this timeframe.



Implications



Increased use of space has wide-ranging benefits but may outpace U.S. policies and approaches. From a national security perspective, the U.S. needs to keep pace with and accurately assess adversaries’ space capabilities and intentions to avoid investing in the wrong capabilities or conflict in space.

Conflicts in, or over, space operations could then result in **broader diplomatic and national security implications**.

Commercial use of space may enable increased global broadband availability. At the same time, the U.S.

approach to tracking increasing numbers of satellites and other space objects **cannot yet address current and future risks**, such as catastrophic collisions.

For example, according to NASA, the U.S. government is tracking over 23,000 space objects orbiting the Earth.

Further, in the absence of regulations for space tourism passenger safety or clear regulations around non-traditional activities, businesses face uncertainty about future projects and investments. This has implications for the U.S. space economy and international competitiveness.

There are also **potential environmental effects**, such as

INCREASED SPACE & RE-ENTRY DEBRIS	LIGHT POLLUTION <i>that affects astronomical research</i>	INCREASED SPECTRUM INTERFERENCE
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Endnotes

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Strategic Planning and External Liaison

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U.S. Government Accountability Office
441 G Street NW
Washington, D.C. 20548