Strategic Triage vs. Strategic Overstretch

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Photo: FRED TANNEAU/AFP/Getty Images
Choosing Strategic “Triage” over “Overstretch”

• Define mix of strategies in terms of credible plans, programs, budgets (PPB) and risks based on “triage” that balances goals with resources and capabilities.

• Rebuild PPB and Future Years Defense Program (FYDP), focusing on strategies with clearly defined force plans and budgets.

• Focus on key missions and major commands, not budgets of military services.

• Treat in terms of Joint All Domain Operations (JADO).

• Look beyond warfighting to all aspects of strategic competition from “white area” to nuclear war.
Introduction

The Emeritus Chair in Strategy at CSIS is issuing a briefing on the challenges the U.S. faces in developing a global strategy that it can sustain with the resources it can actually make available in the years to come – and one that can adapt to the possible emergence of China as a true peer competitor, the sustained challenges from Russia, the threats from powers like Iran and North Korea, and the need to meet global commitments and sustain its strategic partnerships.

This requires changes to both U.S. strategy and to strategic “triage” to avoid “overstretching” its capabilities and resources as it attempts to address a myriad of global concerns, including uncertain domestic spending priorities, competition with China, a hostile Russia, lesser threats like Iran and North Korea, terrorism and extremism, new threats, the global instability of “fragile states,” and emerging and disruptive technologies (EDTs).

This briefing highlights the weaknesses in the current U.S. efforts and the need to define a mix of strategies, including credible plans, programs, and budgets (PPB) and the Future Years Defense Program (FYDP) that can realistically balance its goals with its resources and capabilities. Recent U.S. efforts to define a strategy have failed to go beyond broad goals and statements of good intentions by failing to create real plans and programs, by budgeting based on military services, and by budgeting on an annual budget basis without a real-world Future Years Defense Program and budget. During the time of this writing, the Biden administration has yet to release the FY 2023 defense budget request. This briefing will be updated to reflect any changes to U.S. strategy as reflected in the FY 2023 defense budget.

A realistic strategy must instead focus on key missions as well as on real-world plans, programs, and budgets. It must focus on the major combatant commands and functional commands rather than the shopping lists of the individual military service; fully reflect the need to conduct joint all domain operations (JADO); deal with emerging and disruptive technologies (EDTs); and address the whole range of strategic competition with China, Russia, and other major threats from civil “white area” operations to gray area warfare, theater level conflicts, and nuclear war.

The U.S. also has a defense budget and a defense-oriented planning, programming, and budgeting process rather than a true national security strategy and integrated national security budget. It decouples far too many aspects of the civil aspects of U.S. foreign policy and national security strategy from the military efforts of the Department of Defense. It ignores both the warnings of Clausewitz regarding “ideal war,” and the fact that its primary challenge is now a China that focuses on the integration of civil and military operations advocated by Sun Tzu.

More broadly, the U.S. also needs to exercise “strategic triage” to address the need to balance national security spending and domestic spending and to create real-world strategic partnerships with allied and partner states, rather than burdensharing bullying and arms sales. The present U.S. approach to strategic partnerships undervalues its allies and the need to develop common and interoperable forces – mistakes as serious as the lack of an effective focus on strategy priorities and on a meaningful, mission-oriented planning, programming, budgeting system.
Key Areas of Potential Overstretch

- Deal with conflicting and uncertain federal spending priorities.
- Shift from nuclear balance defined by arms control to full range of emerging “existential” threats to U.S., allies, and partners.
- React to emergence of China as potential peer superpower by 2030.
- Treat Russia as largely hostile under Putin.
- Deal with lesser threats like Iran and North Korea on a global basis.
- Shift from focus on “terrorism” to the challenge of “fragile states.”
- Rethink strategic partnerships. Focus on effectiveness, not burdensharing.
- Adjust to an ongoing revolution in military affairs driven by emerging and destabilizing technologies
Conflicting and Uncertain Federal Spending Priorities

Defense and National Security Do Not Drive the Fiscal Side of “Overstretch”
Pre-Covid (“Normal”?) Rises in the Impact of Federal Spending Were Driven by Civil Mandatory Spending Programs

<table>
<thead>
<tr>
<th>Year</th>
<th>Social Security</th>
<th>Major Health Care Programs</th>
<th>Other</th>
<th>Defense</th>
<th>Nondefense</th>
<th>Net Interest</th>
<th>Total Outlays</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>2.8</td>
<td>0.8</td>
<td>2.2</td>
<td></td>
<td></td>
<td>1.4</td>
<td>18.7</td>
</tr>
<tr>
<td>1995</td>
<td>4.4</td>
<td>3.2</td>
<td>2.1</td>
<td>3.6</td>
<td>3.6</td>
<td>3.1</td>
<td>20.0</td>
</tr>
<tr>
<td>2020</td>
<td>4.9</td>
<td>5.4</td>
<td>2.6</td>
<td>3.2</td>
<td>3.2</td>
<td>1.7</td>
<td>21.0</td>
</tr>
<tr>
<td>2030</td>
<td>6.0</td>
<td>7.0</td>
<td>2.2</td>
<td>2.8</td>
<td>2.8</td>
<td>2.6</td>
<td>23.4</td>
</tr>
</tbody>
</table>

Projected Long-Term Rises in the Impact of Federal Spending Were Driven by Civil Mandatory Programs

Federal spending grows from an average of 21.3 percent of GDP over the 2010–2019 period to an average of 29.7 percent over the 2042–2051 period in CBO’s projections.

The Uncertain Impact of Domestic Covid Spending on the Budget

Net Increase in the Deficit From Major Pandemic-Related Legislation (Enacted and Considered)

The effects on the deficit were much larger in 2020 and 2021 than they will be from 2022 to 2030, CBO estimates.

Civilian Discretionary Spending Is Now Overtaking Defense Spending

Don’t Hype the Challenge:

Historically, the Current “Burden” of Defense Is Now Close to a Post-War Low and There Is Ample Precedent for Far Higher Spending Efforts
Declining Strain on U.S. Economy – DoD Estimate of Defense Spending as a Percent of GDP: Korean War to 2024

Source: National Defense Budget Estimates for FY 2019 (Table 6-13); historical and projected GDP from both the FY 2019 and FY 2020 Budget of the United States Government.
CBO Estimate of Long-Term Cost of FY2022 U.S. DoD Defense Budget

… as is common when a new administration submits its first budget request, DoD did not release a 2022 FYDP. Therefore, the report draws from the fiscal year 2022 budget request submitted by the Biden Administration, other documents and statements published by the Administration, and the 2021 FYDP (the most recent five-year plan released by DoD).

The Administration’s 2022 budget request calls for $715 billion in funding for DoD. In real terms—that is, with adjustments to remove the effects of inflation—the funding request is 1.5 percent less than the total amount provided for 2021 and 1.0 percent less than the amount that would have been requested for 2022 under the Trump Administration’s final (2021) FYDP.

As for Current Operational Costs, They Were Minimal Even Before the Collapse of Afghanistan

<table>
<thead>
<tr>
<th>Operation/Activity</th>
<th>FY 2021 Enacted</th>
<th>FY 2022 Request</th>
<th>Delta FY 2021 to FY 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation FREEDOM’S SENTINEL (OFS) Direct War Costs</td>
<td>12.9</td>
<td>8.9</td>
<td>-4.0</td>
</tr>
<tr>
<td>Operation INHERENT RESOLVE (OIR) Direct War Costs</td>
<td>7.0</td>
<td>5.4</td>
<td>-1.6</td>
</tr>
<tr>
<td>Enduring Theater Requirements and Related Missions</td>
<td>29.5</td>
<td>24.1</td>
<td>-5.4</td>
</tr>
<tr>
<td>European Deterrence Initiative (EDI) and the Ukraine Security Assistance Initiative (USAII)</td>
<td>4.5</td>
<td>3.7</td>
<td>-0.8</td>
</tr>
<tr>
<td>OCO for Base Requirements(^1)</td>
<td>16.5</td>
<td>-</td>
<td>-16.5</td>
</tr>
<tr>
<td>Subtotal</td>
<td>70.4</td>
<td>42.1</td>
<td>-28.3</td>
</tr>
<tr>
<td>Prior-Year Rescissions</td>
<td>-1.9</td>
<td>-</td>
<td>+1.9</td>
</tr>
<tr>
<td>Grand Total</td>
<td>68.5</td>
<td>42.1</td>
<td>-26.4</td>
</tr>
</tbody>
</table>

\(^1\) The FY 2021 “OCO for Base Requirements” reflects the Department of Defense’s base budget requirements requested in the FY 2021 OCO budget in order to comply with the base defense caps in current law.

\(^2\) The FY 2022 Request amounts are accounted for in the base budget.

Source: OSD Comptroller, Defense Budget Overview, May 2021, p. 3-7,
But Do Create a Real National Security Budget and PPB System

Competition with China and Russia is as much civil as military. U.S. civil effort must be as adequate as the military one.
Defense, However, Is Only Part of the U.S. National Security Budget: An Estimate of the Pre-Covid Total Is Shown Below

Begin by Creating Real-World Strategies

The U.S. (Like Most Countries) Does Not Explain or Justify its Strategy in Its Defense Budgets and Force Plans

Need to Rebuild the PPB system and the FYDP, focusing on strategic priorities with clearly defined force plans and budgets.
Open-Source U.S. Strategy Documents Have Virtually No Substantive Content, No Plans, No Budgets, and No Programs

• National Security Strategy and National Defense Strategy documents are little more than broad statements of problems and objectives.

• Actual budget submissions are shopping lists for military services.

• No real posture statements or FYDPs.

• No ways to cost Major Commands or see strategic objectives by regional or functional commands.

• No net assessments to justify strategy or spending.

• No official effort to provide an integrated National Defense Strategy including the State Department and full intelligence community.

• No effort to address strategic partnerships in any detail.

• No serious official comparative analyses of Russian, Chinese, Iranian, or North Korean military spending and efforts.
U.S. Strategy Is Shaped by U.S. Major Command; Spending by Military Service: The “Shopping List” Wins
Planning, Programming, and Budgeting for Efficient JADO Strategy Should Be Shaped by Major Combatant Commands

In Practice, It Is Dominated by which Military Service “Wins” in the Spending Contest.

(Discretionary and Mandatory Dollars in Millions)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Current Dollars</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army</td>
<td>166,190</td>
<td>155,393</td>
<td>150,093</td>
<td>148,240</td>
<td>154,865</td>
<td>166,352</td>
<td>178,797</td>
<td>190,324</td>
<td>183,295</td>
</tr>
<tr>
<td>Air Force</td>
<td>147,718</td>
<td>147,169</td>
<td>150,341</td>
<td>156,315</td>
<td>168,162</td>
<td>187,110</td>
<td>198,044</td>
<td>200,729</td>
<td>207,573</td>
</tr>
<tr>
<td>Defense-Wide</td>
<td>103,824</td>
<td>100,394</td>
<td>103,241</td>
<td>104,291</td>
<td>110,518</td>
<td>118,423</td>
<td>119,589</td>
<td>119,194</td>
<td>130,511</td>
</tr>
<tr>
<td><strong>Total Current Dollars</strong></td>
<td>577,885</td>
<td>562,501</td>
<td>555,369</td>
<td>568,894</td>
<td>600,607</td>
<td>653,975</td>
<td>690,414</td>
<td>712,454</td>
<td>729,444</td>
</tr>
<tr>
<td><strong>FY 2022 Constant Dollars</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army</td>
<td>191,397</td>
<td>177,129</td>
<td>169,578</td>
<td>164,540</td>
<td>169,017</td>
<td>178,541</td>
<td>186,189</td>
<td>194,441</td>
<td>183,295</td>
</tr>
<tr>
<td>Navy</td>
<td>183,066</td>
<td>160,407</td>
<td>182,199</td>
<td>177,074</td>
<td>160,640</td>
<td>192,378</td>
<td>201,464</td>
<td>206,679</td>
<td>208,066</td>
</tr>
<tr>
<td>Air Force</td>
<td>167,284</td>
<td>160,023</td>
<td>169,137</td>
<td>172,673</td>
<td>181,341</td>
<td>197,124</td>
<td>205,305</td>
<td>205,158</td>
<td>207,573</td>
</tr>
<tr>
<td>Defense-Wide</td>
<td>121,455</td>
<td>116,044</td>
<td>117,207</td>
<td>115,892</td>
<td>120,190</td>
<td>125,197</td>
<td>124,564</td>
<td>121,966</td>
<td>130,511</td>
</tr>
<tr>
<td><strong>Total Constant Dollars</strong></td>
<td>663,202</td>
<td>639,603</td>
<td>638,120</td>
<td>630,182</td>
<td>650,188</td>
<td>692,240</td>
<td>717,521</td>
<td>728,243</td>
<td>729,444</td>
</tr>
<tr>
<td><strong>Percent Real Growth (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army</td>
<td>-14.0</td>
<td>-7.5</td>
<td>-4.3</td>
<td>-3.0</td>
<td>2.1</td>
<td>5.1</td>
<td>5.5</td>
<td>4.4</td>
<td>-5.7</td>
</tr>
<tr>
<td>Navy</td>
<td>-1.3</td>
<td>-1.5</td>
<td>1.0</td>
<td>-2.8</td>
<td>2.0</td>
<td>6.5</td>
<td>4.7</td>
<td>2.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Air Force</td>
<td>-4.5</td>
<td>-0.8</td>
<td>1.9</td>
<td>2.1</td>
<td>5.0</td>
<td>8.7</td>
<td>4.2</td>
<td>-0.1</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Total Real Growth</strong></td>
<td>-6.1</td>
<td>-3.6</td>
<td>-0.2</td>
<td>-1.2</td>
<td>3.2</td>
<td>6.5</td>
<td>3.7</td>
<td>1.5</td>
<td>0.2</td>
</tr>
</tbody>
</table>

NOTE: War and supplemental funding is included.

“Wins” in Acquisition Are Defined by Military Service

Costs for acquisition in the 2022 budget request are $1.4 billion higher than the amount planned for 2022 in the 2021 FYDP, an increase of less than 1 percent.

Changes were larger within each of the components of acquisition, however:

Costs for procurement decreased by $5.6 billion (or 4 percent), and costs for RDT&E increased by $7.0 billion (or 7 percent).

Some of the decrease in procurement costs resulted from developmental delays... For other programs, DoD may have slowed purchases while it awaits the outcome of its national security review.


Data source: Congressional Budget Office. See www.cbo.gov/publication/57541#data.
The Sheer Scale of Needed Change is Indicated by the Shift from a Nuclear Balance Defined by Arms Control to an Unstable Range of Emerging Existential Strategic Threats
Remembering the Past History of U.S.-Soviet/Russian Competition

**Current “Classic” Nuclear Forces – FAS Estimate: 2021**

<table>
<thead>
<tr>
<th>Country</th>
<th>Deployed Strategic</th>
<th>Deployed Nonstrategic</th>
<th>Reserve/Nondeployed</th>
<th>Military Stockpile</th>
<th>Total Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>1,600</td>
<td>0</td>
<td>2,887</td>
<td>4,487</td>
<td>6,237</td>
</tr>
<tr>
<td>United States</td>
<td>1,700</td>
<td>100</td>
<td>2,000</td>
<td>3,800</td>
<td>5,500</td>
</tr>
<tr>
<td>France</td>
<td>280</td>
<td>n.a.</td>
<td>10</td>
<td>290</td>
<td>290</td>
</tr>
<tr>
<td>China</td>
<td>0</td>
<td>?</td>
<td>350</td>
<td>350</td>
<td>359</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>120</td>
<td>n.a.</td>
<td>105</td>
<td>215</td>
<td>230</td>
</tr>
<tr>
<td>Israel</td>
<td>0</td>
<td>n.a.</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Pakistan</td>
<td>0</td>
<td>n.a.</td>
<td>165</td>
<td>165</td>
<td>165</td>
</tr>
<tr>
<td>India</td>
<td>0</td>
<td>n.a.</td>
<td>160</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td>North Korea</td>
<td>0</td>
<td>n.a.</td>
<td>45</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>-3,700</td>
<td>-100</td>
<td>-5,820</td>
<td>-9,600</td>
<td>-13,100</td>
</tr>
</tbody>
</table>

May not include weapons in new missile silos found in fall of 2021. “Deployed strategic warheads” are those deployed on intercontinental missiles and at heavy bomber bases. “Deployed nonstrategic warheads” are those deployed on bases with operational short-range delivery systems. “Reserve/Nondeployed” warheads are those not deployed on launchers and in storage (weapons at bomber bases are considered deployed). The “military stockpile” includes active and inactive warheads that are in the custody of the military and earmarked for use by commissioned deliver vehicles. The “total inventory” includes warheads in the military stockpile as well as retired, but still intact, warheads in the queue for dismantlement.

The Range of Demonstrative to “Existential” Threats: 2022-2030

• From “MAD” to Mutually Assured Nothing:
  • End of MTCRs, Open Skies, full nuclear inspection, uncertain limits on strategic nuclear offensive forces…
  • And, emergence of major Chinese strategic and dual threat.
• Nuclear (CBW?) proliferation: Iran and North Korea.
• New delivery systems include dual capable, hypersonic, “smart evasion.”
• Precision conventional strike and targeting capabilities at all ranges: air, land, and sea.
• Cyber, interconnect, space, other technologies.
• Intimidation, threat to strategic partners.
• Concentration of critical civil and military infrastructure nodes – often with long-lead replacement, no option.
The Other Aspects of the Superpower Challenge go far beyond the Ukraine and Taiwan, and they are as much “White Area” civil and “Gray Area” military as classic Deterrence and Warfighting.
The U.S. Does Spend an Immense Amount on Defense – More than the Next 11 Countries Combined

Many other nations grossly understate their real spending.

As for the U.S., this SIPRI estimate includes discretionary and mandatory outlays by the Department of Defense, Department of Energy, Department of State, and the National Intelligence Program.

In contrast, the typical US official budget estimate of defense discretionary spending ($714 billion in 2020) excludes outlays by the Department of State and all mandatory spending.

CRS Estimate of Comparative Global Military Spending

Russia Remains a Key Threat but China Is Emerging as the Peer and Perhaps Larger Superpower –

Where “White Area” Competition is Critical
Regional Comparison of Official 2021 Defense Budgets

<table>
<thead>
<tr>
<th>Country</th>
<th>Defense Budget (In Billions, USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRC (Official Defense Budget)</td>
<td>$209</td>
</tr>
<tr>
<td>India</td>
<td>$64.8</td>
</tr>
<tr>
<td>Japan</td>
<td>$55</td>
</tr>
<tr>
<td>Russia (National Defense Budget)</td>
<td>$66.8</td>
</tr>
<tr>
<td>South Korea</td>
<td>$48</td>
</tr>
<tr>
<td>Taiwan</td>
<td>$15.4</td>
</tr>
</tbody>
</table>

China vs. IISS vs. SIPRI Estimates of Military Spending

CRS: Comparative National Expenditure on Global Research and Development: 2000-2019

In SUS Billions of PPP Dollars


Notes: PPP = Purchasing Power Parity. PPP is used to determine the relative value of different currencies and to adjust data from different countries to a common currency allowing direct comparisons among them.

Source: Adapted from John F. Sargent Jr., Global Research and Development Expenditures: Fact Sheet, Congressional Research Service, CRS R44283, Updated September 27, 2021.
High-tech exports are important because they show the distribution of global supply chains for the production of high-tech goods. In 1997, the United States was the leader in both absolute and relative terms, with over 30 percent of its exports being high-technology products.

China was mainly exporting lower value-added goods, with only 13 percent of high-tech goods in its export mix. The figure for Russia was even lower, at 9.3 percent. By 2005, the indicators for the United States and China reached comparative values: 32.7 percent for the United States and 30.8 percent for China.

This parity reflected China’s accession to the WTO and accelerating offshoring of high-tech production to China. Over the same period, although Russia doubled the dollar value of its high-tech exports from 1.89 billion current dollars in 1997 to 3.82 billion current dollars in 2005, the relative share of high-tech products in its exports decreased from 9.3 percent in 1997 to 8.4 percent in 2005, mainly because of the increase in other commodities, such as chemicals.

By 2012, the high-tech goods share of U.S. exports declined to 17.7 percent because of continuing offshoring, while the share of high-tech exports of total Chinese exports decreased to 26.2 percent. In absolute terms, however, U.S. high-tech exports decreased from 190 billion current dollars in 2005 to 148 billion in 2012, while Chinese exports increased from 215 billion current dollars in 2005 to 506 billion in 2012.

The relative decline in the case of China is explained by the fact that other manufactured exports grew at a higher rate. Russia’s high-tech exports also increased in absolute terms, from 3.8 billion current dollars in 2005 to 7 billion in 2012, while the relative share of high-tech goods in overall manufactured exports remained at 8 percent.

In 2016, China’s high-tech exports slightly decreased in absolute and relative terms, to 496 billion current dollars (25.2 percent of its total manufactured exports), while U.S. high-tech exports slightly increased, from 148 billion current dollars and 17.7 percent of total manufactured exports in 2012 to 153 billion current dollars and 20 percent of total manufactured exports in 2016.
China’s Growing Global “White Area” Influence

These challenges are global and involve more limited threats, all our strategic partners, and other key states – which have their own changing internal challenges and forces.
Comparative Spending of China and Regional Powers

Competition with China and Russia – and to some extent Other States – Will Be Driven by Military Dynamics and the Operational and Technological Drivers of an Ongoing “Revolution in Warfare”
New Military Dynamics – I

• Declining focus on existing conventional major weapons system platforms.
• Shifts in JADO warfare, C4I, IS&R, and battle management.
• New capabilities for life cycle development, sustainment, and combat intensity.
• Drones, ballistic missles, cruse missiles, and long-range attack systems.
• New forms of countervalue and counterforce targeting and strikes.
• Missile defense, layered air/missile defense/passive and civil defense.
• Proliferating other “smart” weapons to other countries, non-state actors, and extremists.
New Military Dynamics – II

- New focus on space, cyber, information warfare for both military and internal security operations.
- New forms of paramilitary and internal security forces and operations.
- New types of “spoiler,” gray area, hybrid, and irregular forces.
- New types of security assistance, outside military support, volunteers, mercenaries.
- Shifts in popular warfare to increase effectiveness of human shields, use of population for defense and offense.
- Random character of the impact of emerging and disruptive technologies (EDTs).
1. **Seed Areas of Emerging Opportunity**

**Biotechnology**

Biotechnology is an emerging engineering discipline that uses living systems to produce a wide range of technologies and capabilities. From fighting global pandemics and avoiding surprises to reducing logistics and sustainment costs and increasing energy efficiency, biotechnology can help change the way the Department conducts missions, performs in contested logistics environments, and adapts to major global changes.

**Quantum Science**

Quantum Science is the study of physical properties at small, even atomic, scales. Defense applications include atomic clocks, quantum sensors, quantum computing, and quantum networks. Quantum science promises to enable leap-ahead capabilities. Quantum computing can provide unprecedented computational speeds and help solve the Department’s hardest analytical problems. Quantum sensors promise the ability to provide unprecedented accuracy in position, navigation, and timing. From more accurate information to faster decision making, to significantly stronger encryption capabilities, quantum science has the promise to deliver cutting-edge technology.

**Future Generation Wireless Technology (FutureG)**

FutureG is a suite of emerging wireless network technologies enabled by DoD and commercial industry cooperation to enable military operations and ensure a free and open internet. As Fifth Generation (5G) wireless technology is adopted and provides building blocks for capability, the DoD will also look to FutureG for leap-ahead technologies to lead in creating future standards. The Department will invest in FutureG technology development to lay the groundwork for continued United States leadership in information technology, which is vital for maintaining our economic and national security.

**Advanced Materials**

Advanced materials explore innovative new materials and novel manufacturing techniques that can dramatically improve many of the Department’s capabilities. Materials that have higher strength, lighter weight, higher efficiency, and can handle more extreme temperatures will have the potential to better protect our service members and enhance their ability to accomplish their missions.

2. **Effective Adoption Areas – where there is existing vibrant commercial sector activity**

**Trusted AI and Autonomy**

Artificial Intelligence (AI) is the software engineering discipline of expanding capabilities of software applications to perform tasks that currently require human intelligence. Machine learning is an engineering subfield of AI that trains software models using example data, simulations, or real-world experiences rather than by direct programming or coding. Autonomy is the engineering discipline that expands robots’ abilities to perform tasks while limiting the need for human interaction. AI holds tremendous promise to improve the ability and function of nearly all systems and operations. Trusted AI with trusted autonomous systems is imperative to dominate future conflicts. As AI, machine learning, and autonomous operations continue to mature, the DoD will focus on evidence-based AI-assurance and enabling operational effectiveness.

**Integrated Network Systems-of-Systems**

Integrated Network Systems-of-Systems technology encompasses the capability to communicate, provide real-time dissemination of information across the Department, and effective command and control in a contested electromagnetic environment. Integrated Network Systems-of-Systems capability must enable engagements by any sensor and shooter, with the ability to integrate disparate systems. An interoperable network that leverages emerging capabilities across the electromagnetic spectrum such as 5G, software defined networking and radios, and modern information exchange techniques will allow the Department to better integrate many diverse mission systems and provide fully networked command, control, and communication that is capable, resilient, and secure.
U.S. Under Secretary of Defense for Research and Engineering: Critical Technology Priorities – II

Microelectronics
Microelectronics are circuits and components that serve as the “brain” to human-made electronic functional systems. Virtually every military and commercial system relies on microelectronics. Diminishing microelectronics manufacturing in the United States and supply chain concerns have highlighted national economic and security risks. Working closely with industry, academia, and across the Government, the Department is addressing the need for secure microelectronics sources and will leverage state-of-the-art commercial development and production for defense microelectronic solutions.

Space Technology
Space technologies include space flight, space communication and other technologies needed to maintain space operations. With rising threats and increasing dependence on space-based systems, the Department’s space strategy must shift away from exquisite satellites to a more robust and proliferated architecture. Novel space technologies are necessary to enable resilient cross-domain operations. The space strategy must incorporate technologies that enhance the Department’s adaptive and reconfigurable capabilities in space situational awareness, space control, communication path diversity, on-orbit processing, and autonomy.

Renewable Energy Generation and Storage
Renewable energy generation and storage includes solar wind, bio-based and geothermal technologies, advanced energy storage, electronic engines, and power grid integration. Renewable energy generation and storage promises to decrease warfighter vulnerability and deliver new operational capabilities for the Department. From more efficient batteries to diversifying energy sources and reduced fuel transportation risks, renewable energy generation and storage will add resilience and flexibility in a contested logistics environment.

Advanced Computing and Software
Advanced computing and software technologies include supercomputing, cloud computing, data storage, computing architectures, and data processing. Software is ubiquitous throughout the Department, but the speed at which software develops outpaces the Department’s ability to stay up to date. The Department must rapidly modernize its legacy software systems with resilient, affordable, and assured new software that has been designed, developed, and tested using processes that establish confidence in its performance. The Department must migrate to a Development-Security-Operations (DevSecOps) approach in its software development and evolve to a model of continuous development, continuous test, and continuous delivery. The Department must leverage modular open system architecture approaches to isolate hardware from software and enable rapid upgrades to secure processors.

Human-Machine Interfaces
Human-Machine Interface refers to technologies related to human-machine teaming and augmented and virtual reality. Rapid advancements in this technology will have a multitude of benefits for our service members. Highly immersive realistic training environments provide real-time feedback to enhance warfighter performance. Intuitive interactive human-machine interfaces enable rapid mission planning and mission command by providing a common operational picture to geographically distributed operations.

3. Defense-Specific Areas

Directed Energy
Directed Energy Weapons utilize lasers, high power microwaves, and high energy particle beams to produce precision disruption, damage, or destruction of military targets at range. Directed energy systems will allow the Department to counter a wide variety of current and emerging threats with rapid responses and engagement at the speed of light. High-power lasers and high-power microwave technologies both offer new ways to counter diverse sets of threats.

Hypersonics
Hypersonic systems fly within the atmosphere for significant portions of their flight at or above 5 times the speed of sound, or approximately 3,700 miles per hour. Hypersonics dramatically shorten the timeline to strike a target and increase unpredictability. While strategic competitors are pursuing and rapidly fielding advanced hypersonic missiles, the DoD will develop leap-ahead and cost-effective technologies for our air, land, and sea operational forces.

Integrated Sensing and Cyber
To provide advantage for the joint force in highly contested environments, the Department must develop wideband sensors to operate at the intersection of cyber space, electronic warfare, radar, and communications. Sensors must be able to counter advanced threats and can no longer be stove-piped and single function.

The Complex Mix of Emerging and Disruptive Military (EDT) Technologies – I

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<td>Autonomous Behavior</td>
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<td>Human-Autonomous Machine Teaming</td>
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<td>Sensor Integration &amp; Networks</td>
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<td>Secure &amp; Resilient Communications</td>
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The Complex Mix of Emerging and Disruptive Military (EDT) Technologies – II

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<td>Active &amp; Passive EM, Acoustic and Optical Countermeasures</td>
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<td>Active &amp; Passive EM, Acoustic and Optical Countermeasures</td>
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<td>Weapons – Techniques and Systems</td>
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<td>Fast and Agile Platforms</td>
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<td>Hypersonic Platforms</td>
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The Complex Mix of Emerging and Disruptive Military (EDT) Technologies – III

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<th>Bioinformatics</th>
<th>Big data &amp; Long Data Processing and Analysis</th>
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<td>Non-EM Sensors</td>
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<td>Synthetic Biology</td>
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<td>Medical Solutions for Health Optimisation</td>
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<td>Human Augmentation</td>
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<td>Alternative and Renewable Energy Sources</td>
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<td>Hypersonic Platforms</td>
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White House List of Key Areas of Competition in Critical and Emerging Technologies – I

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<th>Advanced Computing</th>
<th>Advanced and Networked Sensing and Signature Management</th>
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<tr>
<td>Supercomputing</td>
<td>Payloads, sensors, and instruments</td>
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<td>Edge computing</td>
<td>Sensor processing and data fusion</td>
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<td>Cloud computing</td>
<td>Adaptive optics</td>
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<td>Data storage</td>
<td>Remote sensing of the Earth</td>
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<td>Computing architectures</td>
<td>Signature management</td>
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<td>Data processing and analysis techniques</td>
<td>Nuclear materials detection and characterization</td>
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<td>Chemical weapons detection and characterization</td>
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<td>Biological weapons detection and characterization</td>
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<td>Emerging pathogens detection and characterization</td>
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<td>Transportation-sector sensing</td>
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<td>Security-sector sensing</td>
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<td>Health-sector sensing</td>
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<tr>
<th>Advanced Engineering Materials</th>
<th>Advanced Nuclear Energy Technologies</th>
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<td>Materials by design and material genomics</td>
<td>Nuclear energy systems</td>
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<td>Materials with new properties</td>
<td>Fusion energy</td>
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<td>Materials with substantial improvements to existing properties</td>
<td>Space nuclear power and propulsion systems</td>
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<td>Material property characterization and lifecycle assessment</td>
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<tr>
<th>Advanced Gas Turbine Engine Technologies</th>
<th>Artificial Intelligence (AI)</th>
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<tbody>
<tr>
<td>Aerospace, maritime, and industrial development and production technologies</td>
<td>Machine learning</td>
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<tr>
<td>Full-authority digital engine control, hot-section manufacturing, and associated technologies</td>
<td>Deep learning</td>
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<td>Reinforcement learning</td>
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<td>Sensory perception and recognition</td>
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<td>Next-generation AI</td>
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<td>Planning, reasoning, and decision making</td>
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<td>Safe and/or secure AI</td>
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White House List of Key Areas of Competition in Critical and Emerging Technologies – II

Autonomous Systems and Robotics
- Surfaces
- Air
- Maritime
- Space

Biotechnologies
- Nucleic acid and protein synthesis
- Genome and protein engineering including design tools
- Multi-omics and other biometrology, bioinformatics, predictive modeling, and analytical tools for functional phenotypes
- Engineering of multicellular systems
- Engineering of viral and viral delivery systems
- Biomanufacturing and bioprocessing technologies

Communication and Networking Technologies
- Radio-frequency (RF) and mixed-signal circuits, antennas, filters, and components
- Spectrum management technologies
- Next-generation wireless networks, including 5G and 6G
- Optical links and fiber technologies
- Terrestrial/undersea cables
- Satellite-based communications
- Hardware, firmware, and software
- Communications and network security
- Mesh networks/infrastructure independent communication technologies

Directed Energy
- Lasers
- High-power microwaves
- Particle beams

Financial Technologies
- Distributed ledger technologies
- Digital assets
- Digital payment technologies
- Digital identity infrastructure

Human-Machine Interfaces
- Augmented reality
- Virtual reality
- Brain-computer interfaces
- Human-machine teaming

Hypersonics
- Propulsion
- Aerodynamics and control
- Materials
- Detection, tracking, and characterization
- Defense

Quantum Information Technologies
- Quantum computing
- Materials, isotopes, and fabrication techniques for quantum devices
- Post-quantum cryptography
- Quantum sensing
- Quantum networking

White House List of Key Areas of Competition in Critical and Emerging Technologies – III

**Renewable Energy Generation and Storage**
- Renewable generation
- Renewable and sustainable fuels
- Energy storage
- Electric and hybrid engines
- Batteries
- Grid integration technologies
- Energy-efficiency technologies

**Space Technologies and Systems**
- On-orbit servicing, assembly, and manufacturing
- Commoditized satellite buses
- Low-cost launch vehicles
- Sensors for local and wide-field imaging
- Space propulsion
- Resilient positioning, navigation, and timing (PNT)
- Cryogenic fluid management
- Entry, descent, and landing

**Semiconductors and Microelectronics**
- Design and electronic design automation tools
- Manufacturing process technologies and manufacturing equipment
- Beyond complementary metal-oxide-semiconductor (CMOS) technology
- Heterogeneous integration and advanced packaging
- Specialized/tailored hardware components for artificial intelligence, natural and hostile radiation environments, RF and optical components, high-power devices, and other critical applications
- Novel materials for advanced microelectronics
- Wide-bandgap and ultra-wide-bandgap technologies for power management, distribution, and transmission

Global Political and Economic Challenges will also Force Continuing Change in U.S. Strategy

Need to end the current overemphasison Terrorism and Extremism and focus on Global Instability and “Fragile” (Failed) States
Putting Terrorism in Perspective

• Terrorism is a real, but comparatively limited threat, although worst case attacks can still occur.

• The overall patterns of global violence are driven largely by failed governments in failed states, often provoking violent and extremist reactions.

• Levels of corruption are surprisingly good indicators of major protests, violent political action, and propensity for terrorism and extremist violence – although also for legitimate popular action.

• The failures to develop, govern effectively and fairly, and deal with civil challenges are far more intense and present broad problems compared to terrorism and extremism.
Intensity of Terrorism in 2020

Deaths from Terrorism in 2019

Excerpted from Institute for Economics and Peace, *Global Terrorism Index 2020*, START, November 2020, 

Deaths from terrorism by country, 2019

Ten countries accounted for 80 per cent of deaths from terrorism.
Trend in Deaths from Terrorism in 2018-2019

Broad Patterns of Global Violence in 2021
(Battles, Violence against Civilians, Explosions/Remote Violence, Riots)

Adapted from ACLED, https://acleddata.com/dashboard/#/dashboard.
Major Acts of Violence in 2021 Go Far Beyond Terrorism
(Battles, Violence against Civilians, Explosions/Remote Violence)

TIME PERIOD:
07/01/2021-07/01/2022
EVENTS: 83,843
FATALITIES: 152,742

Adapted from ACLED, https://acleddata.com/dashboard/#/dashboard.
Riots and Protests Show Massive Global Unrest
(Riots and Protests)

Adapted from ACLED, https://acleddata.com/dashboard/#/dashboard.
The Structural Forces Driving Global Political Violence and Instability
Military Threats and Violence Are Often
the Symptom and Not the Cause

• Population pressure is a key factor, reshaping every aspect of global behavior.
• So is urbanization which is changing the politics, stability, economy and social structure of at least one third of the world’s states.
• Governance is a critical issue. Most of the world’s countries have high levels of corruption and limited effectiveness.
• At least one third of the world has no reason to trust the competence of its current government, and even basic legal security in peacetime is often a critical issue.
• The U.S. may be able to help a government “win” battles against insurgents, but these victories are pyrrhic if the government’s security forces cannot hold and provide local security and the government cannot build an economy and political structure that wins popular acceptance.
• Outside military forces are not nation builders, and the U.S. cannot help a government with a failed civil structure and cannot use aid to effectively help itself.
Population Dynamics Alone Mean Another Half Century of Instability in Much of the World
Global Population Growth Is a Key Dynamic: 1050-2050

In Billions

Growth Poses a Potential Malthusian Threat

Sources: Estimated/United Nations

Adapted from The Overpopulation Project, https://overpopulation-project.com. Data source is UN.
Population Dynamics Have Key Global Impacts: One of Many Estimates

Adapted from The Overpopulation Project, https://overpopulation-project.com. Data source is UN 2017.
A Novelist’s (Dan Brown’s *Dante’s Inferno*) Worst Case
But, Such Pressures Are Radically Different by Region,
And Major Increases in Population are Driven by a Limited Number of Poorer and Fragile States in Africa and Asia
Urbanization and Economic Change Have Similar Impacts on Stability
Urbanization Affects a Wide Range of Nations with Very Mixed Effects

- Forces majority of population to live in a modern market economy.
- Creates major new dependence on trade, communication, infrastructure, service industries.
- Makes youth and other employment a critical internal security issue.
- Forces major changes in the location and isolation of tribal, regional, ethnic, and sectarian groups.
- Requires far more effective governance and internal security/rule of law.
- Changes entire media structure and role of internet in reporting on government and politics.
- Radically alters dependence of government services like health and education.
- Extends impact of corruption on population, resentment and anger over weak and corrupt governance.
- Greatly increases ideological outreach capability of protestors, insurgents, radicals, and terrorists.
- Changes military threat from neighbors and outside powers; forces competition and modernization.
- In many cases, governance fails to adapt, becomes dominated by small elites that now have the power to rule in authoritarian ways.
- In all cases, puts governments under major new strains that constantly evolve.
How Urbanization Is Changing the World

Number of people living in urban and rural areas, World, 1960 to 2020

Source: World Bank based on data from the UN Population Division
Note: Urban populations are defined based on the definition of urban areas by national statistical offices.

Share of people living in urban areas, 2020

Source: UN Population Division (via World Bank)
Note: Urban populations are defined based on the definition of urban areas by national statistical offices.

For a detailed analysis of these trends, see Hannah Ritchie and Max Roser, *Urbanization*, Our World in Data, November 2019, [https://ourworldindata.org/urbanization](https://ourworldindata.org/urbanization).
UN Estimate of Key Trends in Urbanization – I

• Today, 55% of the world’s population lives in urban areas, a proportion that is expected to increase to 68% by 2050. Projections show that urbanization, the gradual shift in residence of the human population from rural to urban areas, combined with the overall growth of the world’s population could add another 2.5 billion people to urban areas by 2050, with close to 90% of this increase taking place in Asia and Africa, according to a new United Nations data set.

• The 2018 Revision of World Urbanization Prospects produced by the Population Division of the UN Department of Economic and Social Affairs (UN DESA) notes that future increases in the size of the world’s urban population are expected to be highly concentrated in just a few countries. Together, India, China and Nigeria will account for 35% of the projected growth of the world’s urban population between 2018 and 2050. By 2050, it is projected that India will have added 416 million urban dwellers, China 255 million and Nigeria 189 million.

• The urban population of the world has grown rapidly from 751 million in 1950 to 4.2 billion in 2018. Asia, despite its relatively lower level of urbanization, is home to 54% of the world’s urban population, followed by Europe and Africa with 13% each.

• Today, the most urbanized regions include Northern America (with 82% of its population living in urban areas in 2018), Latin America and the Caribbean (81%), Europe (74%) and Oceania (68%). The level of urbanization in Asia is now approximating 50%. In contrast, Africa remains mostly rural, with 43% of its population living in urban areas.

• By 2030, the world is projected to have 43 megacities with more than 10 million inhabitants, most of them in developing regions. However, some of the fastest-growing urban agglomerations are cities with fewer than 1 million inhabitants, many of them located in Asia and Africa. While one in eight people live in 33 megacities worldwide, close to half of the world’s urban dwellers reside in much smaller settlements with fewer than 500,000 inhabitants.
UN Estimate of Key Trends in Urbanization – II

• As the world continues to urbanize, sustainable development depends increasingly on the successful management of urban growth, especially in low-income and lower-middle-income countries where the pace of urbanization is projected to be the fastest. Many countries will face challenges in meeting the needs of their growing urban populations, including for housing, transportation, energy systems and other infrastructure, as well as for employment and basic services such as education and health care. Integrated policies to improve the lives of both urban and rural dwellers are needed, while strengthening the linkages between urban and rural areas, building on their existing economic, social and environmental ties.

• To ensure that the benefits of urbanization are fully shared and inclusive, policies to manage urban growth need to ensure access to infrastructure and social services for all, focusing on the needs of the urban poor and other vulnerable groups for housing, education, health care, decent work and a safe environment.

The Greatest Threat in Failed States is Failed Governance
Key Afghan and Iraqi Lessons for U.S. and “Strategic” Partners: The Four Real-World Threats in Irregular and Insurgent Warfare

1. The Enemy(ies), which are usually well established and have made major gains before U.S. military intervention begins.

2. The Government or Strategic Partner (whose gross failures allowed a major threat to evolve).

3. The United States (whose ignorance of the country, division of its civil-military effort, effort to impose its own approach to warfighting, and lack of strategic triage can be critical).

4. Foreign and neighboring states which almost inevitably create additional threats and problems. (Pakistan, Iran?)
The Quality of the State is the Driving Factor

Fragile States Index for 2021

World Bank Estimate of Government Effectiveness in 2020

World Bank Estimate of Control of Corruption in 2020

Transparency International’s Global Corruption Rating for 2020

World Bank Estimate of Rule of Law in 2020

One Key Response is for the U.S. to Redefine its Strategic Partnerships and Make Better Use of the Combined Resources
At Least Three Areas of Continuing Global Engagement

- Iran and North Korea may be the focus of today;
- But, cannot deter and contain in Europe, Asia, or MENA unless engage forward indefinitely into the future.
- Power projection is no substitute for substantial forward presence.
- Must correct burdensharing bullying, failed trade policies.
- Work far more closely with allies to create effective forces and foreign aid efforts – treat as real partners.
- JADO, and coping with EDT, must occur at partner level.
- White area partnerships needed as well as Gray Area to Theater/Strategic.
- Redefine “extended deterrence” – layered defense, conventional precision strike, (restore nuclear?).
Strategic Overstretch Can Be Cut Radically By the Right Kind of Reliance on Partner Forces or Lead to Defeat


$US Billions

US Troops

Note: Numbers have been rounded. Cumulative obligations reported by DOD for the Cost of War through June 30, 2021, differ markedly from cumulative appropriations through September 30, 2021, as presented elsewhere in this Status of Funds section, because the former figures do not include obligations in the obligations section, while the latter figures do.


Projected for 2018 based on public statements of NATO Secretary General Jens Stoltenberg. According to USFGR, the publicly releasable U.S. troop level, as of March 1, 2018, remains 14,000.

On January 15, 2021, the number of U.S. troops in Afghanistan was 2,600; the number dropped to 650 by late June/early July as U.S. forces withdrew, peaked at 5,754 in late August as the U.S. deployed forces to assist the Noncombatant Evacuation Operation, and went to zero on August 30, 2021.
But the Right Kind of Partnership Is Critical

• Strategic partners provide critical military assets and economic strength in all of the major areas where U.S. commands need support.

• The defense spending levels by partners are already at the point where getting more money as burdensharing is not the key objective; it is creating more effective partnerships.

• This means treating partners as real partners in terms of interoperability, common planning, and dealing with their deterrent and defense needs.

• Aiding other states in dealing with terrorism, extremism, and security threats must be done on triage basis.

• What is their real strategic importance to the U.S., can they provide effective civil governance and support?

• Must not waste resources trying to help states that cannot credibly help themselves.
Strategic Partners, Threats, and Other States: Comparative 2020 Defense Budgets Affecting NATO
(In $US Billions)

Note: * indicates no data available.
NATO Europe includes the defense expenditures of all participating countries of NATO.
Partners Total include NATO Europe and Canada.
The SIPRI Military Expenditure Database for 2020 estimates the defense budget as $61.7 for Russia (in $US billions).

Source: IISS, Military Balance, 2021; and NATO, Defence Expenditure of NATO Countries.
Strategic Partners, Threats, and Other States: Comparative 2020 Defense Budgets Affecting INDO PACOM
(In US$ Billions)

Partners Total: $168.46

Threats Total: $236.2

Others Total: $80.58

Note: * indicates no data available.

The SIPRI Military Expenditure Database for 2020 estimates the defense budgets as $252.3 for China and $61.7 for Russia (in US$ billions).

Strategic Partners, Threats, and Other States: Comparative 2020 Defense Budgets Affecting CENTCOM
(In $US Billions)

Note: * indicates no data available.
GCC Total includes the budgets of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE.
Partners Total include Morocco, Egypt, Israel, Jordan, and the GCC Total.
The SIPRI Military Expenditure Database for 2020 estimates the defense budget as $61.7 for Russia (in $US billions).

To Conclude: Repeating Possible Solutions to Key Areas of Potential Overstretch

- Deal with conflicting and uncertain federal spending priorities.
- Shift from nuclear balance defined by arms control to full range of emerging “existential” threats to U.S., allies, and partners.
- React to emergence of China as potential peer superpower by 2030.
- Treat Russia as largely hostile under Putin.
- Deal with lesser threats like Iran and North Korea on a global basis.
- Shift from focus on “terrorism” to the challenge of “fragile states.”
- Rethink strategic partnerships. Focus on effectiveness, not burden sharing.
- Adjust to an ongoing revolution in military affairs driven by emerging and destabilizing technologies.
But, Strategic Triage Challenges Political Reality

Engaging effectively now will be far cheaper in terms of any longer-term outcome, but may be politically and institutionally impossible for the United States.