

Statement by Dr. William B. Roper, Jr.
Director, Strategic Capabilities Office

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Chairman Cochran, Vice Chairman Durbin, and distinguished Members of the Subcommittee, thank you for the opportunity to testify before you today. It is an honor to be here with Deputy Secretary Work and Dr. Steve Walker, both of whom share a common passion for modernizing our military in the face of changing technologies and changing modalities of war. To this end, the Department of Defense (DoD) must accomplish three things: combating non-state terrorism, modernizing the nuclear force, and overcoming advanced conventional threats, all in an era where technology exclusivity can no longer be our strategy's linchpin. Though daunting, there are many reasons for optimism. As the near-term element of the Department's Third Offset Strategy, the Strategic Capabilities Office, or SCO, has created new—and surprising—ways of using existing military and commercial systems to win tomorrow's war and buy time for future technologies to emerge. I am pleased to share with you that many of our current platforms have been up to the task. However, as we create new elements of surprise, there is one challenge we cannot take lightly: that technologies developed outside the government will strongly affect the next epoch of national security. To remain dominant, even relevant, we must leverage commercial technologies and adapt at their pace. Doing so will require embracing “good enough” solutions and avoiding cumbersome requirements that drive cost, schedule, and narrow the industry base. This is a core tenet of our innovation process in SCO that I look forward to sharing with you today.

CHANGING OUR MILITARY'S “PLAYBOOK”

Our national security challenges are global and increasingly interconnected. Violent extremism in the Middle East and Africa; North Korean provocations; Iranian missile ambitions; Chinese military advances; Russian aggression in Ukraine, Syria, and cyberspace; and a worldwide Internet of Things creating new military possibilities and vulnerabilities: needless to say, the demand for cutting-edge defense is growing. At the same time, game-changing technologies of the past—satellites, GPS, stealth, and net-enabled weapons to name a few—are no longer solely the purview of the United States; technology *exclusivity* is indeed ending. But this does not mean our military's decline is a fait accompli; how technologies are used on the battlefield is just as much a matter of strategy and concepts of operation (CONOP) as it is science and engineering.

The foundational strategy and CONOP of our current conventional force is achieving high precision so that a small number of weapons, vice the millions required in World War II, can win wars. This precision is achieved by centralizing and recycling many elements of the “kill chain”—the set of steps from finding to

destroying targets—to make the overall architecture affordable: satellite-based targeting and navigation are reused; planes, ships, and tanks are reloaded; and bases are resupplied. This keeps the cost of the weapons they enable affordable, but it assumes these centralized components will always be available. For decades, they have been. But now, satellites can be shot down; navigation, jammed; platforms, targeted; and bases, saturated by missile raids. Often called an anti-access, area-denial (A2AD) strategy, this countermove targets our centralized components because they represent single points of failure. Yet A2AD strategies carry their own fatal assumption: that tomorrow’s U.S. military will be as predictable as today’s.

The sports world is familiar with the curse of predictability. If our military were a football team, analysts would say we have run our current playbook for too long; rivals have watched our “game film” and exploited it. Whenever this happens in football, teams turn this into an opportunity by creating trick plays: running in pass formations, passing in run formations—reimagining their strengths rather than playing to their opponents’. Creating the analog of trick plays for our military is SCO’s primary mission: reimagining *its* strengths—ships, submarines, aircraft, armored vehicles—by using them in unforeseen, and hopefully uncontested, ways. Regaining surprise and transcending predictability is our counter-countermove to deter and defeat A2AD. However, striking the balance between deterrence and warfighting is one place the football analogy breaks down. There is no deterrence in football; teams show up to play regardless of skill differential. Because of this, surprising plays are concealed until game day, but our military’s surprises must fulfill two competing roles: war reserves to win conflicts and deterrence reserves to avoid them altogether. These latter “psychological salvos”—where capabilities are unveiled to change calculus and deter aggression—must be carefully and strategically analyzed to maintain a balanced stockpile for both peace and war. Aiding this is SCO’s secondary mission, and to that end, most of our capability details remain classified.

Though this innovation strategy often has cost and speed benefits, its core tenet, the need for change, is anchored in the DoD’s greatest advantage: our experienced operators, who can do the unparalleled with today’s systems and rapidly master new, unconventional tactics. As in football, it is people—not plays—that ultimately win the game.

SCO INNOVATION PROCESS

SCO's innovation process is, itself, innovative because it flows in reverse: from existing systems to new missions rather than existing missions to new systems. Living within the constraints of existing hardware and software focuses ideas, encourages joint cross-domain thinking, and partners SCO with system owners (usually the Services) and the system operators, the Combatant Commands, to prove out concepts before buying them in bulk. To date, SCO has produced 34 new warfighting concepts and transitioned 6 to the Services with none failing to transition thus far. We anticipate five more transitions in the near-term. Our portfolio is currently 35 percent Navy, 24 percent Air Force, 17 percent Army, and 24 percent other organizations.

SCO's unique innovation process enables us to move and grow quickly. Starting as a \$50M effort, SCO's PB17 request was \$902M, up from the \$519M appropriated the year before. This growth is due to our strategic partnerships with the Services, demand from the Combatant Commanders, and several key process characteristics:

- **Creative Imperative:** Because SCO has no top-line budget, we must create and secure funding for new concepts each budget cycle or else, slowly evaporate. This “survival-of-the-fittest” dynamic maintains the healthy sense of creative urgency we need to sustain idea quality each year.
- **Requirements Flexibility and “Good Enough” Solutions:** Because SCO innovates with existing systems, we cannot apply traditional, often overly constraining, requirements processes. In their place, we continually trade cost, schedule, and performance throughout each project's life to converge on high-payoff *but achievable* designs. Because speed of response is a key metric, good enough solutions that provide earlier, and often cheaper, options usually win over slower, costlier, but better performing counterparts.
- **“Fly-Before-You-Buy” Prototyping:** Because SCO repurposes systems for new missions, our concepts are high risk until demonstrated, even though the systems, themselves, may be mature. By funding two- to four-year prototyping efforts (i.e., “flying”) with the Services, we prepare for future transition (i.e., “buying”) without prematurely committing to new programs before cost and performance are fully understood. Prototyping is a natural bridge between new technology and new programs of record, especially in an era of rapid technology change.

- **Cross-Cutting Solutions:** Squeezing the full potential out of current systems forces us to look orthogonally across Service, Mission, Classification, and Title divides. Many of our projects integrate disparate capabilities into hybridized joint solutions.
- **Strategic Partnerships:** Our partnerships with the Services, Defense Agencies, Technology Developers, Combatant Commands, and the Intelligence Community are the true secret to our success; we are simply a hub that allows these important spokes to turn around a high-risk, high-payoff axle.
 - *Services and Agencies:* The systems we reinvent are owned by Services and Agencies; as such, we cannot explore new concepts without their unique engineering and programmatic expertise. SCO partnerships now span the Air Force, Army, Navy, Marine Corps, Missile Defense Agency, National Geospatial Agency, and the Office of the Under Secretary for Intelligence.
 - *Technology Developers:* Because SCO leverages, vice creates, new technologies to “up-gun” current systems, we have active technology transfers with the Office of Naval Research, Naval Research Laboratory, Air Force Research Laboratory, Army Research Laboratory, and the Defense Advanced Research Projects Agency.
 - *Combatant Commands:* The Commands are our customers; keeping close linkage with them is essential. As such, U.S. Pacific Command and U.S. European Command created local SCO teams to be our in-theater umbilicals, ensuring our ideas target their most difficult challenges. We also have active efforts with U.S. Strategic Command and U.S. Special Operations Command and are beginning work with U.S. Transportation Command and U.S. Central Command.
 - *Intelligence Community:* SCO is a voracious consumer of intelligence; it is vital to our understanding of adversaries and the challenges and opportunities they present. Because the information we covet must be synthesized across multiple topics and disciplines, we have forged close bonds with the Intelligence Community, turning their insights into new concepts.

When applied to the broad U.S. catalog of systems, this process evolves our immediate power projection playbook via three mechanisms: (i) enabling systems

to cross or blur domains, (ii) creating teams of manned and autonomous systems, and (iii) leveraging enabling commercial designs and technologies.

I. CROSSING AND BLURRING DOMAINS

Modifying systems for new missions in new domains—a practice likely to become easier as designs become open and payloads, modular—has the obvious advantage of creating fog of war, but it also provides an additional bonus—rapid force structure—whenever modifications can be retrofitted to current inventories en masse. Because inventory numbers are an important component of peacetime posture, achieving them rapidly makes this approach highly appealing. Some examples include:

- **Anti-Ship Standard Missile-6 (SM-6):** SM-6 was designed to defend ships from incoming threats. Partnering with the Navy, we added an anti-ship role into this now-fielded system, blurring the line between offense and defense.
- **Maritime Tomahawk:** Tomahawk is a go-to weapon for striking targets on land. We partnered with the Navy on advanced maritime targeting to hold ships at risk as well.
- **Cross-Domain Army Tactical Missile System (ATACMS):** ATACMS has been a cornerstone of the Army’s long-range fire capability since the 1980s. Partnering with the Army, SCO is incorporating an existing seeker that will enable our ground forces to target at sea.
- **Hypervelocity Guns:** The Army’s 155mm Paladin and Navy’s five-inch guns are relatively unchanged since their development in the 1990s. By leveraging projectiles from the electromagnetic railgun program, we are prototyping a system capable of both low-cost missile defense and long-range strike, blurring the line between artillery and active defense.

II. CREATING MANNED AND AUTONOMOUS TEAMS

Teams of systems can survive—and even thrive—in contested environments where individuals, alone, would fail. This is simply due to separating, and then specializing, responsibilities amongst multiple team members as opposed to relying solely on “solo act” systems. Some of our most unconventional—and usually classified teams—are “match.mil’ed” across Service and Agency lines. However, a few we can share publicly are:

- **Arsenal Plane:** Stealth fighters penetrate enemy airspace but at the expense of weapons capacity. Partnering with the Air Force, we are teaming them with standoff Arsenal Planes to extend mission impact without landing to resupply.
- **Sea Mob/Ghost Fleet:** Because of their high-value sensors, weapons, and most importantly people, naval ships must be heavily defended. Partnering with the Navy, SCO is converting existing vessels into autonomous, collaborative “ghost fleets” and “sea mobs” capable of dangerous missions without putting critical ships at risk.
- **Avatar:** Similar in concept to Ghost Fleet, SCO is partnering with the Air Force to team expendable drones with existing fighters, enabling pilots to “quarterback” them from safety.
- **Third Eye:** Kill chains are defeated by denying single links. Our Third Eye program is working with multiple Services to create resilient, smart “kill webs” where disparate sensors and shooters are increasingly interconnected.

III. LEVERAGING COMMERCIAL TECHNOLOGIES

The commercial revolution in “smart” technologies is rapidly changing most facets of the world. This revolution is taking ordinary things in our lives—refrigerators, thermostats, phones, to name a few—and infusing them with compact sensors and processors; wrapping them in high-speed networks and cloud-based services; and equipping them to learn at machine speed.

The net result is new, transformational applications, even though most of the underlying hardware—compressors, thermometers, and antennae—do not radically change. Its spillover into national security is accelerating. In a departure from the past decade, the Department must become a fast adopter of external technology to stay on the cutting edge. Though evolving commercial products may not meet all traditional DoD requirements, failure to move at their speed risks our entanglement in the global web of things, but not on our terms. We must envision and embrace “smart” military systems in order to thrive on this web; using commercial systems—especially data-driven technologies—and agile manufacturing to upgrade legacy assets is one way to begin. Some of our examples include:

- **Advanced Navigation:** Legacy air-to-ground weapons like the Small Diameter Bomb use GPS to navigate, making them effective for strikes against terrorists but less so in regions where GPS is denied. Partnering with

the Air Force, SCO is using commercial smartphone-class sensors so that these weapons remain mission effective without GPS.

- **Information Common Operating Picture (iCOP):** The information environment—changing sentiments, opinions, news, and misinformation—is increasingly important to peacetime and conflict. SCO is developing an information common operating picture, or iCOP, enabling the Department to understand and respond to changes in the information environment using advanced analytics, machine learning, and visualization.
- **Perdix:** Fighters are fast and maneuverable, making loitering over hostile territory a difficult task. By equipping them with 3D-printed swarming micro-drones, our fighters can now efficiently search hazardous areas without risk to pilots.

The rest and best of our project details must remain classified, but I hope these examples illustrate how widespread applications can be—no facet of future conflict should be as it seems.

CONCLUSION

In conclusion, both our challenges and opportunities are great: our challenges, because they require DoD-wide change; our opportunities, because they involve some of our greatest strengths—ingenuity, technology, and operational prowess. If we leverage these strengths in unison, a new U.S. power projection playbook—one that undercuts attempts to exploit our predictability—is imminently possible with today's systems. However, to sustain momentum on this playbook and buy time for new technologies to emerge, we need the stability of budgets without continuing resolutions or sequestration: they are syphons of creativity and energy we can ill afford.

Thank you, again, for the opportunity to testify today and for your continued support. I look forward to your questions.