

## Disruptive innovation

### Case study: Unmanned Aerial Vehicles (UAVs)

Warfare is *enormously* expensive. U.S. military superiority results from a number of factors, but one of them surely is having the most sophisticated weaponry — and a lot more of it than anyone else. But the latest, greatest fighter jets, ships and submarines don't come cheap. Between fiscal year 2000 and 2011, the U.S. Department of Defense's (DoD's) base budget increased by 91 percent.

In recent years, however, at least one disruptive technology has gotten considerable traction in warfare. Once a feature of science fiction, the unmanned aerial

vehicle (UAV) has become “the poster child for transformation” of the military<sup>1</sup> — and what may turn out to be one of the most important new military weapons of our time.

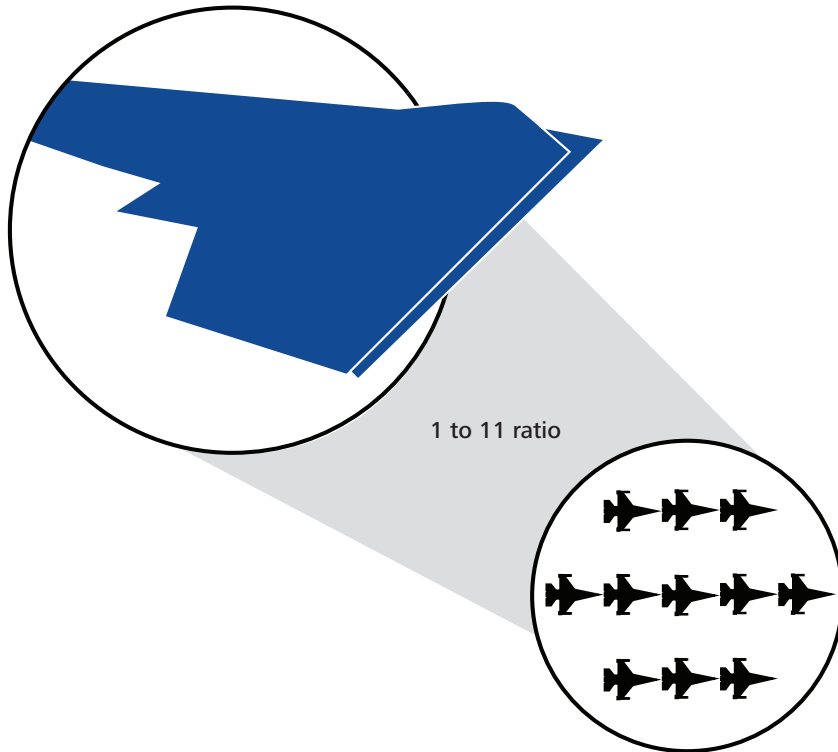
Today, the U.S. military, intelligence and border security sectors employ UAVs for an astoundingly diverse range of activities, including real-time surveillance, critical combat search-and-rescue missions and assistance in the apprehension of terror suspects. Moreover, UAVs are now being used to execute operations typically reserved for manned attack aircraft, such as missile strikes on high-value targets.<sup>2</sup>

In all, it's estimated the United States has more than 7,000 UAVs in operation.<sup>3</sup> Others are racing to catch up — more than 50 countries have built or bought unmanned aerial vehicles, according to defense experts.<sup>4</sup> Recent estimates indicate that the UAV industry, supporting a broad and evolving range of military, intelligence and commercial sector activities, will become a US\$50 to US\$94 billion annual business within the next 10 years.<sup>5</sup>

Thanks to their persistence, cost, and flexibility, UAVs are clearly *disrupting* existing defense and intelligence operations.<sup>6</sup> The Pentagon's recommendation to curtail the development of the manned F-22 and F-35 aircraft while increasing its procurement of UAVs is just one sign of this development.<sup>7</sup> Additionally, in the future, the Navy plans to dramatically expand the number of remotely piloted vehicles to perform underwater missions such as finding mines, detecting enemy ships and providing port and harbor security—missions now routinely conducted by more expensive manned vehicles.



**Figure 1: Number of UAVs that can be purchased for one manned aircraft**



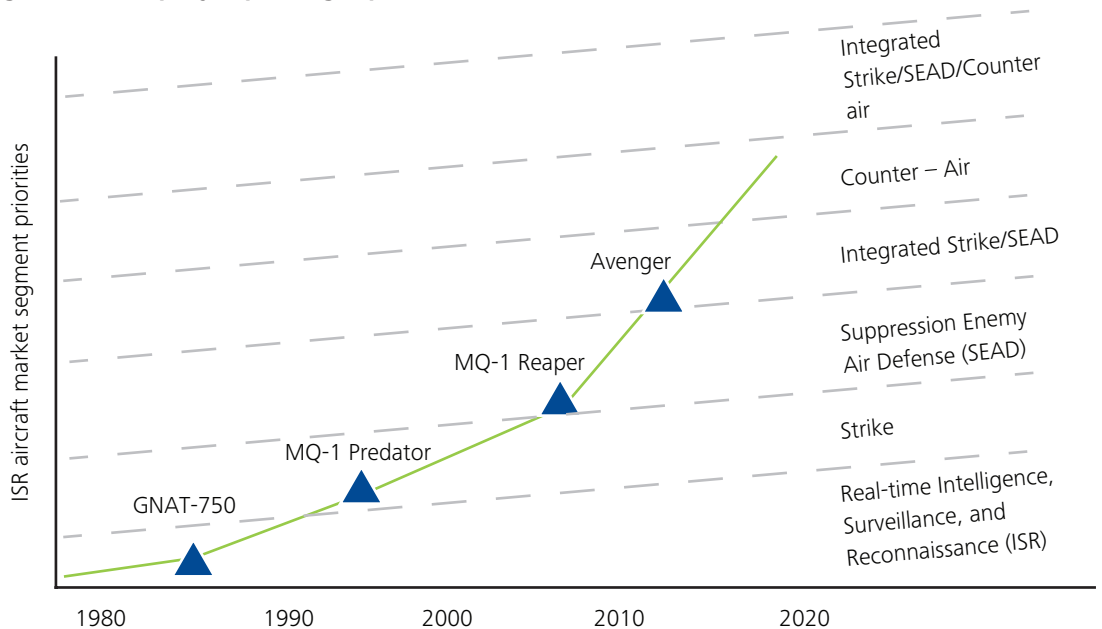
**Breaking the trade-off**

One of the best-known UAVs is General Atomics Aeronautical System’s (GA-ASI’s) Predator drone. As with other disruptive innovations, the Predator has consistently broken existing cost and performance trade-offs in the defense and intelligence arenas. At roughly US\$4.5 million, the Predator costs just a fraction of the tab for manned aircrafts and satellites; it even undercuts other UAVs in cost-competitiveness.<sup>8, 9</sup>

As for performance, Predators and other UAVs actually provide several key performance capabilities that exceed those of manned aircraft: persistence (the ability to provide persistent coverage over an area for an extended period of time); flight longevity (days compared to hours for manned aircraft); undetected penetration; the ability to operate in dangerous environments; and the ability to conduct remote operations with fewer direct combat personnel.<sup>10</sup> And of course, they do not require a pilot to go into harm’s way.

Pentagon officials say the remotely piloted planes, which can beam back live video, have done more than any other weapons system to track down insurgents and save American lives in Iraq and Afghanistan.<sup>11</sup> “[The] remotely piloted aircraft was one of the most important developments since 9/11,” says Air Force Chief Scientist Dr. Mark Maybury.<sup>12</sup>

**Figure 2: The rapidly expanding capabilities of UAVs**



Source: DGovLab and Innosight LLC

How did this come about?

The viability of the UAV as a modern surveillance and reconnaissance platform first was realized during the 1980s, when Israel demonstrated the advanced capabilities of its low-cost Scout UAV over Lebanon's Bekaa Valley. The Scout was capable of real-time surveillance and was difficult to detect and destroy, as it was made of lightweight fiberglass with a low radar signature.



## A sampling of the diverse uses of UAVs

### A sampling of the diverse uses of UAVs

#### Military and Intelligence

- Reconnaissance
- Surveillance
- Strike
- Close combat support
- Deception operations

#### Security

- Policing
- Border Patrol
- Perimeter security – (close quarters, inside buildings, over hills)
- Port monitoring / security

#### Environmental, emergency response and infrastructure

- Surveillance (intelligence, oil rigs and pipelines)
- Storm and weather monitoring
- Search and rescue
- Emergency management (wild-fire monitoring, suppression, and fire-crew information tool)
- Damage assessment (natural disasters, battle environments)
- Monitoring real estate

---

## In 2011, the U.S. Air Force will train more “joystick pilots” than new fighter and bomber pilots.<sup>13</sup>

The big break for UAVs, however, came in the mid-1990s, when the Advanced Concept Technology Demonstration program (ACTD), a small procurement shop at the Pentagon responsible for funding and testing innovative technologies, decided to invest in them. The Predator effort began with a 30-month ACTD contract awarded in January 1994.

The Predator's mission is to provide long range (500 nautical miles), long endurance (up to 40 hours) and near real-time imagery for reconnaissance, surveillance and target acquisition. These capabilities were demonstrated in Bosnia. The performance data gathered there “convinced the military users that the Predator was worth acquiring.”<sup>14</sup>

#### Pace of disruption

Once integrated into defense and intelligence operations, the UAV adapted quickly to evolving performance needs. Recalls General Atomics CEO Tom Cassidy Jr.: “The airplanes, the way we designed them, was for a lot of growth, to be capable of carrying weapons and to control them through satellites. We figured that was kind of the way of the future...”<sup>15</sup> From miniaturization to real-time digital imagery, the Predator and other UAVs such as the Global Hawk, Reaper, Sky Warrior and Avenger have continuously advanced to meet the dynamic challenges of post-9/11 military warfare.

The terrorist attacks of September 11, 2001 created new demand for weapons systems that could conduct reliable, real-time surveillance and reconnaissance as well as satisfy combat needs. In response to these changing needs, General Atomics equipped Predator drones with Hellfire missiles. The Air Force put the weaponized Predator into immediate use in Operation Enduring Freedom, hitting approximately 115 targets in Afghanistan during its first year of combat operations. According to one report, “Iraqi soldiers actually surrendered to a Pioneer, knowing that after it spied them, gunfire was imminent.”<sup>16</sup>

The UAV experience demonstrates that revolutionary technologies can disrupt even the most seemingly hidebound operations. UAV proponents in and outside of government began by identifying a need for low-cost, basic unmanned aircraft. Once the initial technology was proven, the UAV manufacturers continually and relentlessly improved the capabilities. As a result, UAVs have transformed the way the U.S. government

conducts intelligence and military operations. Even the successful operation to uncover and kill Osama Bin Laden relied on intelligence gathered by a stealth UAV.<sup>17</sup>

The flexibility, versatility, and low costs of UAVs have resulted in their extension into an amazingly diverse set of tasks (see accompanying box).

## Five Lessons Learned from UAV Adoption

The convergence of multiple internal and external factors helped UAVs emerge as a disruptive innovation in the defense space.

### #1. Organizational autonomy

UAVs were introduced as an alternative technology to manned aircraft by General Atomics Aeronautical Systems Inc., a company outside the ranks of traditional military aircraft contractors. The company invested tens of millions of dollars of its own money into UAV technology in the belief that UAVs would prove transformational. “Everyone talks about how the world has changed,” explained CEO Tom Cassidy in justifying the investment. “We’re building the technology for where it’s going.”<sup>18</sup>

### #2. Start off worse but rapidly evolve the technology

Although the initial UAVs lacked dual surveillance and combat capabilities, they were significantly less expensive than traditional aircraft — and safer for personnel, obviously.<sup>19</sup> UAV capabilities rapidly evolved to satisfy the changing needs of post-9/11 warfare<sup>20</sup>

### #3. Highly adaptable platform

The rapid evolution of UAVs was made possible by highly nimble platforms that proved extremely conducive to customization and improvement, which includes everything from video cameras to missiles.



### #4. May require significant trial and error

Prior to the Predator UAV, the U.S. Department of Defense (DoD) experienced repeated failure launching a UAV program. Between 1975 and 1996, the DoD spent about US\$4 billion on nine UAV programs that were all canceled without producing significant real-world benefits to national military or intelligence activities.<sup>21</sup> Importantly, however, the DoD, the intelligence community and defense manufacturers didn’t give up.<sup>22</sup>

### #5. Proof of concept

UAVs gained momentum once they were proven in combat. A pivotal point in their acceptance was the effectiveness of the Predator during the beginning of the Iraq and Afghanistan wars.

## Endnotes

1. Anne Marie Squeo, "Small Maker of Unmanned Jets Fights Big; Goliath Competitors Scramble to Move in on General Atomic's Specialty." *Wall Street Journal*, January 29, 2003, p. B8.
2. "Regarding Unmanned Combat Air Vehicle (UCAV) and Unmanned Aerial Vehicle (UAV)," *Testimony of Lieutenant General Walter E. Buchanan III Commander United States Central Command Air Forces Commander Ninth Air Force Before the House Armed Services Committee United States House of Representatives Subcommittee on Tactical Air and Land Forces*, Mar. 17, 2004. <[http://www.globalsecurity.org/military/library/congress/2004\\_hr/04-03-17buchanan.htm](http://www.globalsecurity.org/military/library/congress/2004_hr/04-03-17buchanan.htm)>.
3. Scott Shane, "Coming Soon: The Drones Arms Race," *The New York Times*, October 8, 2011. <<http://www.nytimes.com/2011/10/09/sunday-review/coming-soon-the-drone-arms-race.html>>
4. Ibid.
5. "The Pilotless Plane That Only Looks Like Child's Play." *New York Times*, April 15, 2007. <http://www.nytimes.com/2007/04/15/business/yourmoney/15atomics.html> and Shane, "The Drones Arms Race," *The New York Times*, October 8, 2011.
6. Email exchange with Brigadier General Peter Gersten, December 6, 2011.
7. Michael Auslin, "The Case for Reviewing the F-22 Fighter." *The Wall Street Journal*, February 24, 2011. <[http://online.wsj.com/article/SB10001424052748704476604576158121568592568.html?mod=googlenews\\_wsj](http://online.wsj.com/article/SB10001424052748704476604576158121568592568.html?mod=googlenews_wsj)>
8. Christopher Drew, "Drones Are Weapon of Choice in Fighting Queda." *The Wall Street Journal*, March 16, 2009. <[http://www.nytimes.com/2009/03/17/business/17uav.html?\\_r=2](http://www.nytimes.com/2009/03/17/business/17uav.html?_r=2)>
9. Otto Kreisher, "Northrop sees risking demand for Global Hawks," *Government Executive.com*, December 8, 2009. <<http://www.govexec.com/dailyfed/1210/120810nj4.htm>>
10. Today at least UAVs typically don't result in overall manpower savings primarily due to the backend requirement to do something with all of the data being produced from the surveillance. In time, advances in big data analytics will likely reduce the backend manpower needed to support the massive amount of data generated by the UAVs.
11. "Drones Are Weapons of Choice in Fighting Queda." *The New York Times*, March 16, 2009. <<http://www.nytimes.com/2009/03/17/business/17uav.html>>
12. Carla Voorhees, "Rise of the Drones – UAVs After 9/11," *Armed with Science*, <http://science.dodlive.mil/2011/10/03/rise-of-the-drones-uavs-after-911/>.
13. "Attack of the Drones." *Newsweek*, September 2009. <<http://www.newsweek.com/2009/09/18/attack-of-the-drones.print.html>>
14. "Unmanned Aerial Vehicles DOD's Demonstration Approach Has Improved Project Outcomes". *United States General Accounting Office Report to the Secretary of Defense*, August 19, 1999. <<http://www.gao.gov/archive/1999/ns99033.pdf>>
15. "Piloting an Unmanned Revolution," *C4ISRJournal.com - Military Intelligence, Surveillance, Reconnaissance*. 1 Sept. 2008. <<http://www.c4isrjournal.com/story.php?F=3644685>>.
16. Elizabeth Bone, "Unmanned Aerial Vehicles: Background and Issues for Congress." *Report for Congress - Order Code RL3187*. Web. <<http://www.fas.org/irp/crs/RL31872.pdf>>
17. "RQ-170 Stealth Drone Used in Bin Laden Raid." *DefenseTech*, May 18, 2011. <http://defensetech.org/2011/05/18/rq-170-sentinel-stealth-drone-used-in-bin-laden-raid/#ixzz1Nlvr1x2L>
18. Charles Duhigg, "The Pilotless Plane That Only Looks Like Child's Play," *New York Times*, April 15, 2007. <<http://www.nytimes.com/2007/04/15/business/yourmoney/15atomics.html>>
19. An important caveat here is that there are certainly costs associated with the operation that should not be overlooked. The cockpit (Ground Station), the uplink (PPSL), Ground data terminal (GDT), the satellite array, the long haul command/control link, server uplink facility, the launch facility and all equipment and manpower add to the US\$4.5 million direct cost of a Predator UAV. This said, manned aircraft also carry with them substantial backend operation costs.
20. There is no question, however, that some UAVs are becoming more complex, and more expensive as military and intelligence agencies continues to add on new requirements. Consider the X47B that when completed will have mid-air refueling capabilities and be able to land on carriers.
21. "Unmanned Aerial Vehicles DOD's Demonstration Approach Has Improved Project Outcomes," *United States General Accounting Office Report to the Secretary of Defense*, August 19, 1999. <<http://www.gao.gov/archive/1999/ns99033.pdf>>
22. Neal and Linden Blue, who bought General Atomics Aeronautical System Inc in 1986, believed that despite previous failures by other contractors it was possible to build an inexpensive, technologically reliable and ultra-light unmanned airplane that could stay aloft for days. They cited the technological advances in micro-processing and global positioning systems as a key enabler for modern UAVs. They poured tens of millions of dollars into the project, eventually establishing a separate company. See "The Pilotless Plane That Only Looks Like Child's Play," *New York Times*, April 15, 2007. <<http://www.nytimes.com/2007/04/15/business/yourmoney/15atomics.html>>

**For more information, please contact:**

**William Eggers**

Global Research Director  
Public Sector  
Deloitte Services LP  
Washington, DC  
+1 571 882 6585  
[weggers@deloitte.com](mailto:weggers@deloitte.com)

**Laura Baker**

Senior Consultant  
Deloitte Consulting LLP  
+1 571 882 6031  
[labaker@deloitte.com](mailto:labaker@deloitte.com)

**Ruben Gonzalez**

Consultant  
Deloitte Consulting LLP  
+1 571 814 7422  
[rugonzalez@deloitte.com](mailto:rugonzalez@deloitte.com)

**Audrey Vaughn**

Senior Consultant  
Deloitte Consulting LLP  
+1 571 814 6899  
[avaughn@deloitte.com](mailto:avaughn@deloitte.com)

**About Deloitte**

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee, and its network of member firms, each of which is a legally separate and independent entity. Please see [www.deloitte.com/about](http://www.deloitte.com/about) for a detailed description of the legal structure of Deloitte Touche Tohmatsu Limited and its member firms. Please see [www.deloitte.com/us/about](http://www.deloitte.com/us/about) for a detailed description of the legal structure of Deloitte LLP and its subsidiaries. Certain services may not be available to attest clients under the rules and regulations of public accounting.

**Disclaimer**

This publication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms or their related entities (collectively, the "Deloitte Network") is, by means of this publication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. No entity in the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relied on this publication.