21st Century UAV perspective by an industry leader

UAV (Drones) Inquiry Unit
Visit Source: http://news.northropgrumman.com/news/presentations/speednews-8th-annual-aerospace-defense-industry-suppliers-conference-extending-the-value-of-unmanned-aerial-systems-into-civil-air-space

SpeedNews 8th Annual Aerospace & Defense Industry Suppliers Conference — Extending the Value of Unmanned Aerial Systems into Civil Air Space

Bruce Gerding Addresses Aerospace & Defense Industry Suppliers Conference
May 04, 2010

On Tuesday, May 4, Bruce Gerding, Sector Vice President, Strategy Development & Planning, Northrop Grumman Aerospace Systems, addressed the SpeedNews 8th Annual Aerospace & Defense Industry Suppliers Conference in Century City, Calif. Below are his delivered remarks.

Extending the Value of Unmanned Aerial Systems Into Civil Airspace

Good morning. I'd like to begin by thanking Jeff Roncka and Joanna Speed for all their terrific work in setting up this conference. They've provided a great forum for us to share our thoughts on some of the pressing issues of our industry.

And before I begin my talk on extending the value of unmanned aerial systems into civil airspace, I'd like to acknowledge our warfighters still engaged in conflict overseas. They continue to make great sacrifices for our safety and security, and I know everyone in this room is committed to their well-being and success.

Those brave men and women in the combat zone are the beneficiaries of a revolution in military technology. Unmanned aerial systems — UAS — have changed the way we fight. But today, we examine their evolution into the civil and commercial domains. This subject is of vital importance to the future of the aviation industry — a revolutionary change with the potential for significant market expansion and revenue growth across the industry. But these are very early days, and I'd like to begin my remarks with a story that frames the challenges ahead.

On Jan. 15, 2009, at approximately 3:25 p.m., US Airways Flight 1549 took off from New York's LaGuardia airport en route to Charlotte, N.C. The plane was an Airbus A320, a modern digital "fly-by-wire" aircraft where the computer interprets the pilot commands via the side-stick. The captain was Chesley Sullenberger, known as Sully, a veteran former fighter pilot who was also a noted safety expert.

Within minutes of taking off, as the aircraft climbed to an altitude of about 3,200 feet, something went horribly wrong. Everyone on board heard loud bangs come from the engines. Suddenly, those engines were spitting flaming exhaust. The cabin was filling with smoke and violently shaking. Then, both engines turned silent.

This modern aircraft flown by an experienced pilot in perfect weather conditions had collided with a flock of birds. And the birds had won. The aircraft was now effectively a glider.

"We're gonna be in the Hudson," reported Sullenberger. And as the plane passed just 900 feet above the George Washington Bridge and descended toward the dark, cold water, the captain spoke a final time into his radio. "Brace for impact," he told the passengers and crew.

And the impact came. But not the tragedy that some were expecting. Capt. Sullenberger made a perfect landing on the water. The plane did not sink. Rescue crews arrived within minutes. The flight crew took command and was integral to the rescue efforts. The end result? All 150 passengers and the entire crew were saved.

Many of you have, of course, heard this story before. It has become the stuff of legend. It also points to one of the greatest
obstacles facing the maturation of the UAS civil and commercial markets: The public still wants a pilot in the cockpit.

It's understandable. Pilots are possessed by situational awareness and flying skills that are difficult to transfer to a machine. You could argue that the Airbus' fly-by-wire technology allowed Capt. Sullenberger to concentrate fully on landing that plane. But does technology trump the human element? As advanced as our unmanned aerial systems have become, it would be impossible to argue that a UAS could have accomplished what Capt. Sullenberger did. That's why there is a strong institutional and cultural bias against taking chances with UAS in national airspace over populated areas.

But today's barriers will be surmounted. I believe we are moving toward a time when UAS will indeed become common in our skies, as indispensible to the conduct of commerce and some civil operations as manned aircraft are today. This is not a question of "if" but "when." For now, we must look to the military UAS market as a model for what may come. After all, just as
with development of manned aircraft, the military market ultimately drives the civil one.

The explosive growth of unmanned systems on the battlefields of Iraq and Afghanistan is indisputable. In 2000, the Defense Department's (DoD) UAV (unmanned aerial vehicle) inventory was fewer than 50 UAS. By the end of 2009, that number had skyrocketed past 6,800.

This is part of a larger trend. The latest Quadrennial Defense Review, the roadmap for budgeting used by the administration and Congress, emphasizes increased funding and development of present and future UAS. The Pentagon has an insatiable appetite for intelligence, surveillance and reconnaissance — ISR — and UAS are recognized as an ideal technology to deliver this. And it goes beyond ISR to long-range strike capability. There's speculation that the next-generation bomber may have unmanned capability. Meanwhile, the U.S. Navy is currently developing an Unmanned Combat Aerial System, UCAS, to demonstrate the feasibility of unmanned combat aircraft operating from one of the most complex environments known: the aircraft carrier flight deck.

It's not just the troops in the field but the American public who are following this unfolding story. Predators, Reapers, Hunters, Global Hawks and the like have become brand names. The media has promoted UAS as game-changing technology in the nature of warfare. With all the chatter going on about UAS as a thoroughly modern technology, I'd like to take the moment to put this all into perspective.

The fact is UAS have been around for a long time. The Radioplane Company, founded in 1935 by actor Reginald Denny, sold thousands of remote-controlled targets to the U.S. government during the Second World War. The Hollywood connection didn't end with Denny. A worker on the Radioplane assembly line in Van Nuys went by the name of Norma Jean Dougherty. After the war, she traded in her name and coveralls and pursued a career on the other side of the Santa Monica Mountains, taking the name Marilyn Monroe.

Radioplane and a San Diego-based company called Ryan Aeronautical both specialized in developing and manufacturing targets for the U.S. military. Ryan had great success converting Firebee targets into the first unmanned reconnaissance aircraft. Known as Lightning Bugs, they flew over 3,500 combat missions in Southeast Asia between 1962-1973.

Both Ryan and Radioplane became part of Northrop Grumman, who has delivered over 100,000 UAS to the U.S. government over the past 70 years. Other companies — Boeing, Lockheed Martin, Raytheon, General Atomic, Israeli Aerospace Industries, to name just a few — have developed their own UAS capabilities as well, with successes spread across the armed services.

So UAS technology is not new. But it has seen exponential improvement over the last decade. Advances in computing power, composite manufacturing and software design go to the increasing capabilities of UAS. All those advances will drive the civil/commercial UAS market. And today, the market is poised for significant growth as technology matures and the possible missions multiply.

So let's take a look at the size of the total UAS market today. And again, let's keep in mind that the civil/commercial market is dependent on advances in the far larger military UAS market. And to be clear, by "civil" we are talking about the market for non-military government customers such as the Border Patrol or NASA. The commercial UAS market describes that of the private sector.

The U.S. Department of Defense is the largest UAS customer. According to Frost & Sullivan, the U.S. UAS military market in 2008 was roughly $3.2 billion. The firm further predicts the total value of the American UAS market — military and civil — to be about $27 billion between the years 2009 through 2013. Now that market includes not just platforms but also payloads, procurement, R&D, services, etc. So in comparison, of that $27 billion, the total value of the civil UAS market is estimated to be $131 million. The commercial UAS market is even smaller — estimated at some$49 million.

For some further perspective, the Teal Group estimates UAS worldwide total production value from 2010-2019 to be $45 billion. Of that, $3.7 billion total will be spent on civil UAS over the decade. Which means roughly the global amount spent on civil UAS over the next decade will be equivalent to what was spent by the Pentagon on military UAS just last year.

So the potential civil UAS market will be, according to these projections, an order of magnitude smaller than the military UAS market despite steady growth over the next decade. But it's important to remember that such projections can't take into account transformative events and technological breakthroughs that change the game. Projections for the military UAS market growth prior to 9/11 were much more conservative. The rapid growth fueled by the conflicts in Iraq and Afghanistan was unforeseen, as were the technological advances that continue to unfold.

Now let's look at some of the UAS market dynamics. Here, too, the UAS military market will impact the future civil/commercial market. Currently, there are many players as far as platforms, payloads and R&D (research and development). The market is international with major foreign firms like BAE Systems, EADS, IAI and Finmeccanica all fighting for market share. Both big and small companies are in the mix. Once small firms like General Atomics and AeroVironment have staked out very competitive positions. The larger American contractors like Northrop Grumman, Boeing and Lockheed Martin have all made significant investments in UAS technology and compete for large programs. This incredibly competitive environment is fueling innovation and rapidly improving technology, resulting in multiple platforms and systems for an expanding number of missions.

Now I'd like to take a moment to look at the potential roles of UAS in the civil/commercial market.
Government, non-DoD agencies are already using UAS and will be the largest potential customers in the near term. Agencies within the Department of Homeland Security such as the Customs and Border Patrol, as well as the Coast Guard, perform law-enforcement functions where UAS can make an immediate impact. NASA is using UAS for scientific research missions, and I'll talk to these developments more in a moment. Emergency response is another area where UAS have great potential for government customers.

The energy industry will find UAS perfect for the dull but necessary work of monitoring oil and gas pipelines as well as power lines. We could see such missions first playing out in Iraq, where sabotage on existing energy assets demands a higher level of surveillance. Once that value is proven in the war zone, it would be a natural transition to the United States. Power lines and pipelines in less populated areas would the best place to start.

The agricultural industry could benefit from UAS taking on crop dusting, crop monitoring and livestock tracking. Again, the great advantage here is that most agricultural areas are not densely populated. That means UAS can prove their worth with a smaller chance that any potential accident would lead to fatalities.

On the battlefield, UAS have shown great potential as communication hubs. One could imagine the communications and broadcasting industries ultimately using UAS in place of satellites for communications relay.

The insurance industry could turn out to be a key customer. The data provided by UAS payloads could be used to create risk models for crop failures and potential real estate losses due to climate change.

And finally, the ultimate customer could be the aviation industry itself. Are we moving toward the day, albeit decades away, where air passengers and cargo will travel by UAS? I think we are. One could certainly imagine this market beginning with long-haul cargo flights over the oceans with the flights originating and ending in less populated areas. For instance, a UAS cargo flight from Japan to Alaska would be the sort of route where confidence could be built up and the commercial viability of UAS proven.

So yes, though the civil/commercial UAS market is in its infancy, there are many significant industries that will benefit as the market matures. I'd like to now look at some of the challenges ahead. These are regulatory, technical, political and societal issues that could curb growth unless addressed.

Let's take the regulatory challenges first. There is a growing demand to operate UAS in the National Airspace System, or NAS. But the Federal Aviation Administration tightly regulates that access. That's to be expected. The FAA has a laser-like focus on safety. Their greatest fear is that a UAS operating in NAS will collide with a manned passenger plane or crash due to technical failure in a populated area. The widespread use of UAS for commercial and civil uses will only materialize here in the United States when the FAA feels a high level of confidence that UAS can be operated with the same degree of safety as manned aircraft.

Right now the FAA has no UAS airworthiness standards, nor are there UAS procedural and regulatory standards. Federal aviation regulations are oriented toward manned aircraft operations. And the FAA doesn't have the resources or the intimate knowledge to address requirements for the civil and commercial UAS market.

So how does it work today? Currently, UAS flying in the NAS have to obtain a Certificate of Authorization (COA) from the FAA. This is a time-consuming and expensive process.

Let me just take the case of the Global Hawk UAS, which is operated by the Air Force. Now some of these are based at Beale Air Force Base in California and must traverse NAS to carry out missions overseas. Here's the basic process: The Air Force self-certifies the Global Hawk to operate in NAS via a restrictive COA. Each operational location must be investigated and negotiated. It can also not be used for "non-public" ownership, so this process doesn't help corporations wishing to operate their own UAS. And despite Global Hawk's excellent record and ability to fly at 60,000 feet above commercial traffic, there are further restrictions. The Global Hawk has to get to that altitude so special regulations might include a chase pilot, no flights over populated areas, no flights in commonly used airways, temporary flight restrictions, etc.

Now of course, most UAS don't fly as high as Global Hawk, so you would have any number of other restrictions with UAS hoping to operate at lower altitudes in more commonly used airspace.
I'm not here to point a finger at the FAA. The technology and the demand have grown faster than the agency's ability to regulate. That's where our industry must come in as a proactive partner. We must accept major responsibility for making this market mature. And we can do that by making sure the technical standards of civil/commercial UAS are equal to that of manned aircraft operating in the NAS. Right now, they aren't because the safety requirements of UAS operating in military airspace are so different.

First, let's go to situational awareness. All UAS operators lack the situational awareness of the aircraft's surroundings that an onboard pilot enjoys. A UAS operator only has a soda straw sensor view. Federal Aviation Regulation 91.113 outlines the "Right of Way" requirement that drives detect, sense and avoid. There is great work being done to develop a system that uses a combination of radar, electro-optical and software to allow UAS to sense and avoid other aircraft and take evasive action, if necessary. The fact is we could make the NAS even safer by making sure manned aircraft, which rely on the pilot's eyes and the Traffic Alert and Collision Avoidance System, have a comparable system to UAS.

Recently, the news media reported that hackers had compromised the data links of UAS operating in Iraq and viewed video from the sensor payloads. Corrective measures have since been taken and we've learned a lot from operating UAS in the war zones. We're going to be able to take that experience into the civil/commercial world to make sure the data link between operator and UAS will not be breached. And we can go farther, making sure latency standards and spectrum usage for command and control systems will meet the standards expected by the FAA.

UAS airframes and avionics must be designed for use in NAS. Industry must also manufacture UAS with redundancy of systems such as flight control and dual generators found on manned civil aircraft. And UAS software must be of the highest integrity and fully compliant with prescribed standards from the Radio Technical Commission for Aeronautics (RTCA). Finally as a civil/commercial market develops, we must leverage the momentum for interoperability that is being established in the military UAS market.

Here's the ultimate goal: A "file to fly" world where the use of UAS is as straightforward as that of manned aircraft. That means flights in the vicinity of other aircraft. That means no chase pilot necessary. That means flights over populated areas. That means international recognition of both the military self-certification and the FAA Type Certification.

We know what we need to do. The hurdles are not insurmountable. Thanks to the explosive growth and innovation in the military market, technical progress is proceeding at a rapid pace.

We can get there. But not with one company working alone. Competition fuels technical innovation, but cooperation and a multilateral approach are essential to win hearts and minds and make the civil/commercial UAS market a reality.

On the engineering and manufacturing front, our industry has to pursue technology solutions that drive future standards. And one set of standards won't do — they must be matched to the capabilities and missions of the many types of UAS that will potentially operate in the NAS: medium altitude, high altitude, vertical takeoff, etc.

These standards have to be developed in close conjunction with the FAA and other federal agencies so that we are on the same page from the outset. Right now, RTCA Special Committee 203 is working on proposed recommendations for detect, sense and avoid as well as secure communications between ground station and UAS. They'll deliver these to the FAA in 2013. To ensure the FAA will buy into these recommendations, we need to educate and collaborate with the agency on a daily basis.

Extending UAS into civil and commercial applications is not just about technology or regulations. We also need the insurance industry to step up to the plate. Currently, the military self-certifies its aircraft and assumes liability. We'll need a robust underwriting market for the civil/commercial UAS world. We saw how the light aircraft industry faced great difficulty because of liabilities in the '80s and '90s. And government had to step in and support commercial aviation in the aftermath of 9/11 as insurers cancelled coverage. Underwriters have to be partners with industry and truly understand the technology and operational issues so that they can price risk accordingly.

Finally, all of us in the UAS business must employ a public relations campaign to change people's perceptions. It is a campaign where we must engage in Washington with the help of the House's Unmanned Aerial Vehicle Caucus. It is a campaign we must work with various trade organizations such as the Airline Pilots Association and the National Business Aviation Association. And it is a campaign we must engage with the American public.

But people's perceptions can change. Forty years ago, elevator operators were the norm. Now, they are a novelty and people think nothing of pressing the buttons themselves. The move to "fly-by-wire" was resisted by some pilots as "taking the touch" out of flying. But as we saw with the case of Sully Sullenberger, a level of autonomy can free the pilot to focus in an emergency. As UAS move toward more autonomy, this can be a selling point. We see autonomy in the commercial world with the new Mercedes E-Class, which can basically parallel park itself. That's not hurting sales. And I think the reason is the public is more technologically savvy in this age of iPads and the Internet. They have seen how quickly technology evolves and impacts their lives.

Finally, perhaps no part of the population is more important to our cause than the warfighters returning home. They've seen firsthand how UAS saved lives by doing the dirty, dull, dangerous work of war. This is a generation that grew up with UAS as essential to their mission. As they integrate back into the civilian workforce, they are our best ambassadors. And we can work with them to carry the message into new markets.

I'd like to conclude my remarks by noting three recent success stories that give us a glimpse of the future for UAS. On Jan. 12, 2010, a 7.0 earthquake hit Haiti. The quake was centered near the capital of Port-au-Prince, a city of more than 2 million people. The impact was devastating, causing significant loss of life and property while leaving more than a million people homeless. But Haiti's plight would have been much worse if not for the heroic international relief efforts that commenced just hours after the earthquake hit.

We at Northrop Grumman were proud that a Global Hawk operated by our Air Force customer was one of the first military assets to arrive over Haiti.

On Jan. 13, just hours after the quake, a Block 10 Global Hawk en route to Afghanistan was diverted toward Haitian airspace. By the next day, the Global Hawk was flying its first mission over Haiti, spending 14 hours over the country before landing at Patuxent River Naval Air Station in Maryland.

Collaborating with both the U.S. Air Force and Navy, the Global Hawk team executed over 130 hours of flight time in support of the Haitian mission.

Global Hawk's integrated sensor suite provided well over 3,600 high-fidelity images of key facilities such as airfields, ports, bridges, roads, water and power facilities. These images helped relief workers locate undamaged structures for aid centers, identify roads to support food distribution and uncover clusters of survivors awaiting help.

Last month, NASA completed the first science flight of a Global Hawk over the Pacific Ocean. This was the first of five scheduled flights using the UAS to help study atmospheric science over the Pacific and Arctic oceans. The Global Hawk is perfect for this sort of mission because it can fly autonomously for as long as 30 hours, covering some 11,000 nautical miles, and thus deliver measurements over longer time periods and greater distances than any manned aircraft. The aircraft's sensors were calibrated with the Aura satellite, part of NASA's Earth Observing Satellite System, and [this] points the way for integrating UAS with existing satellite assets to leverage the advantages of each platform.

Finally, last month we saw a Northrop Grumman-built MQ-8B Fire Scout successfully supported a drug interdiction mission in the eastern Pacific Ocean. The vertical take-off and landing unmanned aerial vehicle was stationed on the USS McInerney. The Fire Scout was on a routine mission to test its settings when it acquired a suspected narcotics "go-fast" vessel on its radar. It was given permission to pursue and was able to feed real-time video back to the McInerney. The vessel then moved in along with its Coast Guard Law Enforcement Detachment. The suspected traffickers were apprehended along with 60 kilos of cocaine.

From humanitarian relief to science missions to law enforcement, UAS are already successfully performing civil missions beyond our NAS. One day, their operation within our national airspace will be routine. Technology, like time, moves relentlessly forward. But when will that day be? I'll take my cue from an industry pioneer far wiser than me. At a celebration in his honor on the 34th anniversary of the first flight, Orville Wright was asked, "To what point do you think airplanes will be developed?" Orville replied, "There is no way of telling. Things are moving too fast. No one can predict where it will end."

And that respectfully includes me.

Remarks of Bruce Gerding, Sector Vice President, Strategy Development & Panning, Northrop Gruman Aerospace Systems, at the Aerospace & Defense Industry Suppliers Conference, May 04, 2010.
http://news.northropgrumman.com/news/presentations/speednews-8th-annual-aerospace-defense-industry-suppliers-conference-extending-the-value-of-unmanned-aerial-systems-into-civil-air-space
Accessed: 23, July, 2017