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Harvard Business Review

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Unmanned aircraft systems are set to transform a host of American industries in the next decade—if users, manufacturers, and regulators can overcome some significant hurdles.

INTRODUCTION: A GROWING BUSINESS

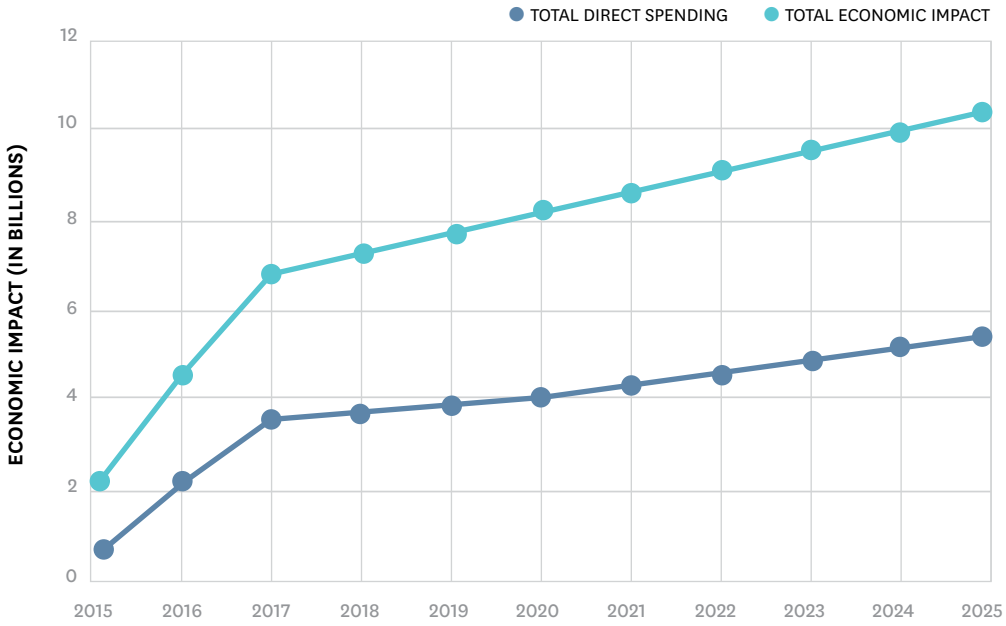
American business and government are taking to the air: Unmanned aircraft systems (UASs), or "drones," are at last moving out of the military and homeland security sectors and spreading into a host of commercial, law enforcement, and public safety applications. UASs aren't airplanes and they aren't model aircraft: They are small, unmanned vehicles and their supporting equipment, flown either remotely via ground control or robotically by an onboard computer with communication links to ground operators. With their capability to observe, photograph, and record data and to deliver small payloads, often to remote or less accessible locations, they hold the potential to cut costs, reduce risk, and increase productivity across a broad swath of industries, from oil and gas to real estate and entertainment.

The economic impact of integrating UASs into U.S. airspace could be significant. According to a 2013 report for the Association for Unmanned Vehicle Systems International (AUVSI) by Bijan Vasigh, aviation consultant and professor of economics and finance at Embry-Riddle Aeronautical University, and Darryl Jenkins, an airline analyst and former director of the Aviation Institute at George Washington University, the addition to the economy could total more than $13.6 billion in the first three years and more than $82.1 billion between 2015 and 2025 while generating 103,776 new jobs.[1] figure 1 Technology analysts at Teal Group predict that spending on unmanned vehicles will nearly double over the next decade, from $6.4 billion annually to $11.5 billion, with the U.S. accounting for 65 percent of total investment worldwide.[2]

More than 20 million remotely piloted aircraft systems have been sold and 1.2 million are in commercial use globally.[3] UASs were used to provide security during the 2014 World Cup soccer tournament in Brazil. From 1995 to 2012, Japan increased the number of acres sprayed by unmanned vehicles from 250,000 to 204 million, notes Don Bonte, former director of the Center for Unmanned Systems and Human Capital Development at Indiana State University.

FIGURE 1

UNMANNED AIRCRAFT SYSTEMS: TOTAL PROJECTED SPENDING AND ECONOMIC IMPACT IN THE U.S., 2015-25



SOURCE "THE ECONOMIC IMPACT OF UNMANNED AIRCRAFT SYSTEMS INTEGRATION IN THE UNITED STATES," AUVSI, 2013

America, however, is a latecomer to UAS development. The lag is due in large part to the Federal Aviation Administration, which has been slow to develop rules and regulations for UAS operators in the airspace below the pathways commercial planes travel. But this is changing. As of August 21, 2015, the FAA had granted 1,277 authorizations for various commercial and government entities to operate UASs in U.S. airspace under Section 333 of the FAA Modernization and Reform Act of 2012, and authorization will no longer be needed for many UAS activities once the FAA releases final rules for routine commercial use of the vehicles, expected some time next year. The FAA made public its proposed requirements in February. Highlights include:

- Flights are limited to daylight hours.
- Flights are limited to 500 feet altitude, no faster than 100 miles per hour, and with minimum weather visibility of 3 miles from the control station.
- The UAS must remain visible to the operator at all times.
- Small UASs must not fly over people not directly involved in the flight.
- Operators must stay out of airport flight paths and restricted airspace areas.
- Operators must perform a preflight inspection, including checking the communications link between the control station and the UAS.

Once the proposed rules are finalized, operators will have a road map for developing vehicles that can be used for aerial imaging and mapping, disaster detection and management, natural resource exploration, weather monitoring, package delivery, and many other tasks. Organizations that want to operate UASs beyond the operator's line of sight—which encompasses some of the most promising and economically valuable potential uses of the technology, such as to examine bridges, roads, and other infrastructure for needed repairs—will be able to do so by applying for FAA authorization, Jenkins notes. The same goes for autonomous or robotic UASs that don't need someone to operate them in flight—for instance, vehicles that could make deliveries over much wider areas.

Nevertheless, Jim Williams, recently retired manager of the FAA office in charge of UAS integration, has said that he expects package delivery by the vehicles to be "fairly routine" within the next five years, although for "built-up major metropolitan" areas it may take longer.[4]

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One reason take-up of unmanned systems could be rapid is that the technology is already far advanced, thanks to use of UASs by the military and by industry in other countries. Dave Kroetsch, president and CEO of Aeryon Labs Inc., a Canadian UAS manufacturer and developer, says his company's UASs can now read a license plate 1,000 feet away; fly up to 50 minutes without refueling, versus 11-12 minutes seven years ago; range up to 10 kilometers from base versus some 100 feet; and be equipped with thermal night-vision cameras. UAS systems used to examine, say, a fire-damaged house, a highway accident site, or an agricultural field threatened by weed infestation now have software that enables them to take multiple pictures that the operator can then use to create a three-dimensional image of the location.[5]

Unmanned aircraft technology is increasingly durable and decreasingly demanding of maintenance. It is off-the-shelf and thus can be produced quickly. The vehicles themselves are relatively uncomplicated, although training is needed to operate them. UASs are generally cheaper to employ than the manned vehicles currently used in agriculture, law enforcement, and transport, in part because they are lighter and require less fuel—and carry no human cargo. Some models run on solar batteries. UAS expertise is spreading as universities create courses geared to developing, operating, and maintaining unmanned systems. The University of North Dakota, for example, had 120 students in a master's degree program in unmanned aircraft in 2012, up from five in 2009.[6]

All of these factors—technological maturity, ease of use, a growing trained workforce—point to a rapid rise in spending on UASs. The AUVSI projects that total direct spending will increase from $1.2 billion this year to $5.1 billion in 2025, while the overall economic benefit from integration of UASs into the U.S. national airspace system will generate more than $82.1 billion by 2025.[7]

INDUSTRY BY INDUSTRY

Data collection and analysis are among the primary impact areas for UASs; they can quickly reach locations that are less accessible to human beings and share information in near-real time, such as aerial photos and data for precision mapping. As a result, much of the direct economic activity they generate will fall into the category of risk management and mitigation: helping law enforcement map crime scenes, assisting in the creation of risk assessment surveys of various kinds, and enabling more rapid response to disasters. Telecommunications companies can use them to inspect telephone lines and cellphone towers, and energy companies can survey power lines.

Three industries—law enforcement and public safety, agriculture, and insurance—are expected to be early and especially rapid adopters.

LAW ENFORCEMENT AND PUBLIC SAFETY

Only about 2 percent of the 18,000 law enforcement agencies in the U.S. used unmanned vehicles in 2013,[8] but use could grow to 25 percent within the next five years, Kroetsch predicts, given the range of potential uses both for law enforcement and public safety. These include crowd monitoring and control; search and rescue; delivery of medicine and medical devices to remote locations; fire and disaster detection and management; and forensic reconstruction of crime or accident scenes. Making them especially valuable in this space is the rising frequency of natural and human-generated disasters and the increasingly data-driven nature of police work.

AGRICULTURE

Agriculture may see the widest use and deepest economic impact of any sector from unmanned systems, many experts say, directly helping farmers produce more crops per acre of farmland—at a time, says Bonte, when the amount of farmland in the U.S. is shrinking. The FAA has granted authorization to fly UASs to about 300 farmers, and others are doing so without approval.[9]

UASs can help farmers track the quantity and activity of cattle; monitor crop health, maturity, and irrigation; and detect the spread of weeds or blights—faster and more efficiently than by manned aircraft and, given their ability to create 3-D terrain maps, with more accurate and fine-grained information. "Crop dusting by UASs has a huge potential for agriculture," as well, says Vasigh, citing their widespread use in Japan, although most still do not accommodate a large enough payload to rival manned aircraft.

INSURANCE

The increasing number of disasters, combined with an aging workforce in the insurance industry, is expected to create a gap in addressing claims that UASs could help to alleviate. As of August 21, 2015, six major insurance organizations or subsidiaries have been approved by the FAA to operate UASs: AIG PC Global Services, State Farm Mutual Automobile Insurance Company, United Services Automobile Association, Liberty Mutual Insurance Company, American Family Mutual Insurance Company, and Erie Insurance Group.[10]

With unmanned systems, claims adjusters and risk engineers "can easily navigate drones through properties and capture high-resolution photos and videos of roofs and other property structures to help in developing high-quality loss appraisal and risk assessment reports quickly—all without disturbing the scene," says Agil Francis, a principal at Cognizant Business Consulting specializing in insurance. Given these capabilities, unmanned systems "can save significant time, while improving the productivity and efficiency of claims adjusters and risk engineers."

UASs can also improve underwriting, enabling carriers to more accurately assess candidates for insurance—for instance, by determining the probability of damage to buildings, helping insurers to determine where they should assign high deductibles, and advising the insured on loss prevention measures. UASs can make the claims adjustment process less expensive and time-consuming by cutting down on the need for multiple site visits by different specialists.

HURDLES AND HAZARDS

How quickly the U.S. economy can realize the advantages that UASs offer will depend on how well operators, manufacturers, and regulators negotiate a number of real and potential obstacles.

To generate the most benefit from UASs, users need to treat them not as add-ons to their existing information-gathering and delivery systems, but as integral to their operating model.

In law enforcement and public safety, budget limitations and procedural hurdles could hold back incorporation of unmanned systems, even after the new FAA rules are published, Kroetsch points out. Jenkins expects usage—especially of UASs that operate beyond the line of sight or autonomously—will take off more quickly in agriculture, since regulators tend to be more comfortable with unmanned vehicles flying in less populated areas.

Regulators, meanwhile, will be challenged to keep up with the rapid development of UAS technology. To do so, says Jenkins, they need to adopt a "constructive, not confrontational" stance: flexible enough to work with operators and manufacturers on new rules that expand the use of UASs as the technology advances rather than simply handing them down. Whether such an approach can take hold is likely to be tested, first, by proposals for UASs that operate robotically or beyond the operator's line of sight.

Manufacturers and operators must adapt as well. To generate the most benefit from UASs, users need to treat them not as add-ons to their existing information-gathering and delivery systems, but as integral to their operating model. Francis stresses: "The insurer needs to structure itself so that information from unmanned units flows back through to its claims and underwriting systems—no more upload, download—so that it makes the process easier and people can see substantive results coming out of it."

Making this more challenging is the flood of data UASs can generate. While the systems themselves are becoming easier to use—"if you can use Google Maps, you can use one of ours," Kroetsch says—the need will grow for people with the skills to analyze and draw actionable conclusions from the information transmitted. Bonte says: "Whether in agriculture or any other business, the analytic side of this is going to be huge."

In a Reuters/Ipsos poll last year, 73 percent of respondents said they want more regulation of drones and 71 percent said unmanned systems should not be allowed to operate over someone's property. figure 2 The same day the FAA released its proposed UAS regulations, a presidential directive ordered federal agencies to publicly disclose where they fly unmanned vehicles in the U.S. and what they do with the data.

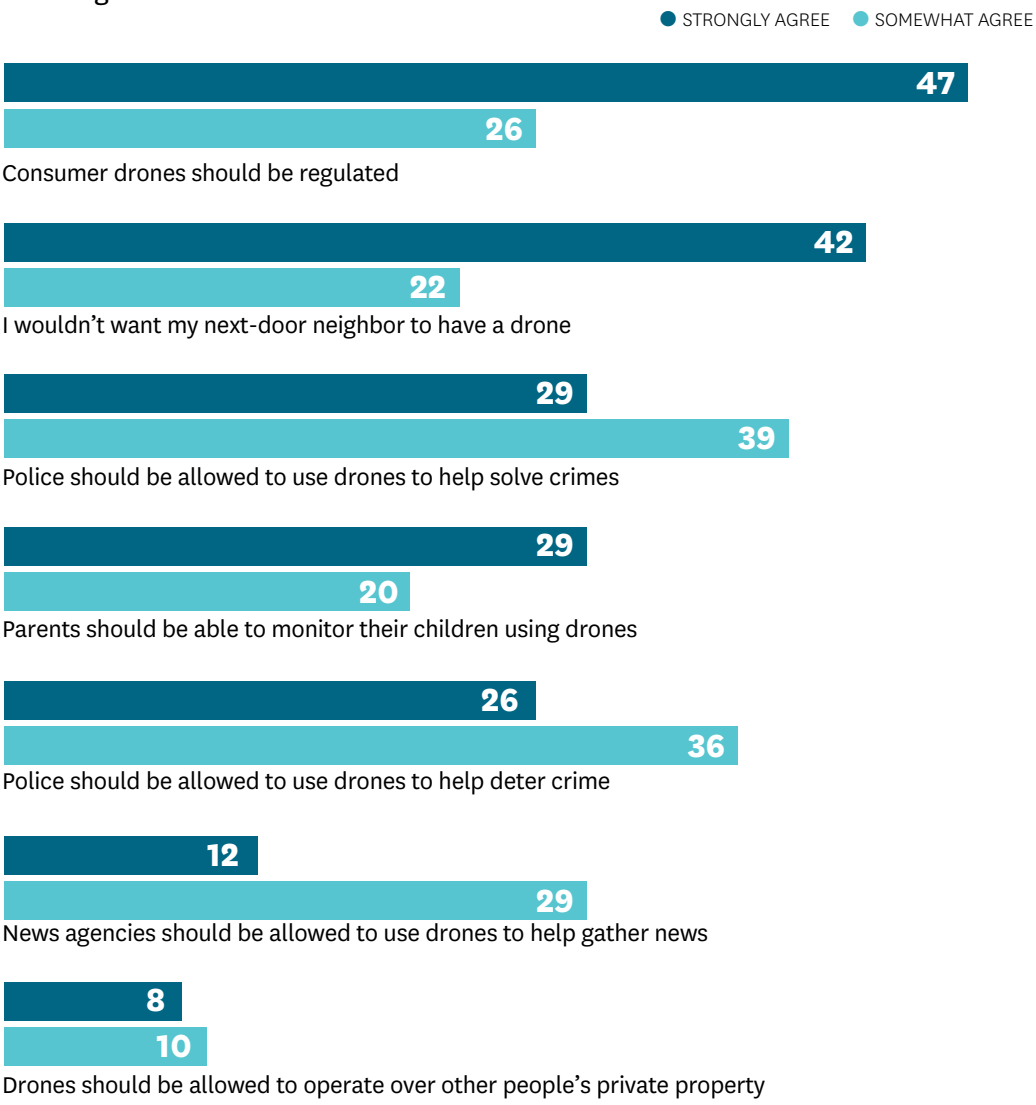
"This is the major, million-dollar question: How do we integrate drones in our commercial system while preventing potential accidents and preventing some other things that naturally could happen—privacy violations such as paparazzi covertly taking pictures of celebrities?" says Vasigh.

These issues would only become more urgent should a major accident occur—for example, a UAS unit crashing into the windshield of a car on a highway, or being sucked into the engine of an airliner. In June, a DC-10 tanker carrying fire retardant to firefighters in California's San Bernardino Mountains had to turn back when a "hobby drone" was spotted near its drop site, and further

FIGURE 2

HOW DRONES SHOULD BE USED AND REGULATED

Percentage of respondents answering "strongly agree" or "somewhat agree" to the following statements.



SOURCE IPSOS POLL CONDUCTED FOR REUTERS, DRONES 01.29.15. IPSOS, 2015

air drops had to be shut down for two hours.[11] The Department of Homeland Security has logged over 500 incidents in the past three years in which rogue drones hovered over "sensitive sites and critical installations," including military bases and nuclear plants.[12]

"Every time someone does something dumb with a drone, it pushes back the date of wide acceptance," says Bonte. Regulators and law enforcement are also concerned about incidents in which UASs were used to smuggle illegal drugs.

… UASs' economic presence is likely to grow rapidly, as technology continues to improve, as they generate jobs, and as the benefits and conveniences they offer become evident.

After the crash of a small recreational quadcopter on the White House grounds in January, President Obama, a proponent of integrating UASs into the national airspace, called for tougher regulations.[13] Seventeen states have passed laws governing how recreational users and law enforcement use UASs, while some small towns have banned the vehicles,[14] creating a fragmented assortment of legal regimes. Nevada has one of the most stringent, prohibiting the weaponization of civilian UASs and enabling homeowners to sue owners of the vehicles who fly them over personal property.[15] Faster completion of the FAA's regulations on unmanned vehicles could help forestall or discourage further balkanization.

Other concerns focus on the security and safety of UASs themselves. GPS "spoofing" technologies could enable hackers to wrest control of unmanned vehicles and steer them off course. "Hacking into data captured by drones for claims and underwriting processes, which are mostly property images and videos, is not a major concern today," says Francis. "However, as information from drones becomes a key data source for risk evaluation, pricing, and damage assessment, insurance carriers should ensure that the data transfer between drones and core insurance applications is secure and adheres to corporate IT security standards and procedures." Manufacturers, too, will feel pressure to make their products "100 percent safe" from remote tampering, says Vasigh.

CONCLUSION: WHY THE PUBLIC WILL EMBRACE UASs

Despite these concerns, UASs' economic presence is likely to grow rapidly, as technology continues to improve, as they generate jobs, and as the benefits and conveniences they offer become evident. The proliferation of "consumer" or recreational drones, which had their origin in the combination of a microcontroller chip with familiar model airplane technology, is already making the public more familiar and comfortable with unmanned vehicles.[16]

Once regulators create a consistent set of rules for unmanned systems, the public is likely to see economic and other benefits quickly: higher-quality food, lower food prices, better safety on the job, more efficient air flight, better and faster response to disasters, and a faster claims adjustment process for insurance policyholders. As the UAS subsector grows, it will generate new jobs not only in aerospace but in local economies that benefit from its presence.

Perhaps the greatest benefit, however, will be one of the least overt: a decline in risk across a variety of industries and many walks of life, from oil and gas to real estate and construction to public safety. The nature of work itself will be reshaped, since many of the tasks that UASs would assume fall into the category of "dirty, dull, and dangerous." If power line and cellphone tower inspections; accessing of dangerous settings such as wildfires, earthquake sites, and plane crashes; and delivery of goods to remote locations can be done remotely in the future, many fewer workers—and their employers—will find themselves in harm's way.

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