



The commercial applications and considerations of flying small drones

by Bill Carey

Before the June release of the FAA's Part 107 regulation for small unmanned aircraft systems (sUAS), the commercial drone industry in the U.S. emerged through exemptions to existing aviation rules. Analyzing the types of operations allowed by those exemptions, which in late May numbered several thousand, offers insight into where the growth may be.

In the FAA Modernization and Reform Act of 2012, Congress inserted a number of provisions designed to speed the introduction of unmanned aircraft into the National Airspace System. Section 333 of the act, titled "Special Rules for Certain Unmanned Aircraft Systems," became the predominant route that aspiring

commercial drone operators followed to gain entry. It gave the secretary of transportation authority to determine "if certain unmanned aircraft systems may operate safely" in the airspace before the FAA promulgated standards for certifying and operating drones weighing less than 55 pounds through the long-awaited sUAS regulation.

The FAA started accepting petitions to fly drones commercially under Section 333 in May 2014. It granted the first exemptions, each with 35 conditions attached, to six aerial photography and video production companies backed by the Motion Picture Association of America that September. As more petitions arrived, the agency relaxed the way it

administered them. In March last year, the FAA announced that operators who obtained exemptions would automatically receive a "blanket" certificate of authorization (COA) to fly their machines at or below 200 feet anywhere in the country, except in restricted airspace or in major cities. (A COA is required of operators in addition to the exemption.) A month later it announced a "summary grant" process—a more expeditious method of approving batches of exemptions in cases that were similar to previous approvals. This past March, it doubled the blanket operating altitude for Section 333 exemption holders to 400 feet.

As of late May, the FAA

said it had granted 5,238 petitions from operators seeking to fly small drones for business purposes. Another 1,517 petitions were denied or closed because they lacked adequate information.

The bow wave of applications from aspiring drone entrepreneurs hinted at the exponential growth predicted by the trade group Association for Unmanned Vehicle Systems International (AUVSI), which this year renamed its annual conference "Xponential" to reflect its optimism. AUVSI recently published an analysis of the first 3,000 companies to receive exemptions, indicating which applications and markets they were targeting. The findings cannot be considered



conclusive, as the industry is still forming and some of the more hyped applications—such as Amazon’s “Prime Air” project to deliver small packages by drone—were impeded by the FAA’s prohibition of beyond visual line-of-sight operations and flights over people.

In an economic impact study it released in March 2013, AUVSI predicted that “precision agriculture” uses involving remote-sensing and precision spraying of crops by drone would command 80 percent of the commercial market once the FAA produced a regulation, a share that was still not apparent. In its aerospace forecast this year, the FAA predicted that the top five sUAS markets will be industrial inspection (42 percent), real estate and aerial photography (22 percent), agriculture (19 percent), insurance (15 percent) and government (2 percent).

Section 333 exemptions often applied to multiple applications for which an operator intended to use drones, meaning there were more overall applications than exemptions. Many companies received multiple exemptions and operated more than one drone type. According to AUVSI’s analysis of the first recipients, 2,557 exemptions made reference to general aerial photography, 1,969 to real estate and 1,496 to construction. There were 38 application categories mentioned in the petitions; in order, the top 10 were aerial photography, real estate, aerial inspection, aerial survey, construction, infrastructure inspection, agriculture, filmmaking, advertising and environmental uses such as forestry, geological mapping and land management.

More than two-thirds of exemption holders—2,121—were companies employing fewer than 10 people; another 541 were individuals. California

led all states with 360 exemption holders, followed by Florida (328) and Texas (268). Rotary-wing drones were specified six-fold over fixed-wing models in the petitions, and Shenzhen, China-based DJI claimed six of the top 10 models. Most popular among exemption holders was DJI’s Inspire 1, a quadcopter with articulated rotor arms that lift in flight to provide its rotating camera with an unobstructed, 360-degree view. It retails for around \$3,000.

A moneymaking proposition?

Among the top ways to make money with a drone are to sell aerial footage to luxury prop-

Pictorvision, one of the first companies to receive a Section 333 exemption in September 2014, poured cold water on the notion that drones present a sure-fire business case. “There is barely a commercial market yet,” instructed Tom Hallman. “I can tell you as a guy with boots on the ground, very few people are making any meaningful profit in this game.”

Speaking then as vice president of business development for Approved Technologies, a start-up company devoted to advancing drone-related technologies and services, Hallman said the FAA’s slow-going rulemaking process, “competing agendas” of major industry

test on airspace rules. Section 333 exemptions have required that an operator have a sport pilot certificate at a minimum. The FAA promised to deliver the final regulation by late this spring.

“It’s really hard as a company to jump into this game. You don’t know if you’re too early or too late until we see Part 107,” Hallman said. “Do I get a pilot certificate or do I wait? What’s going to be the timing of Part 107? How long until that actually goes into effect? In spite of the existing rules, there’s a huge problem. As a guy trying to make a living, I’m competing against guys who choose not to follow the rules...who honestly just don’t care.”

Hallman suggested that the FAA, deprived of resources and pressured by Congress and industry, opened the floodgates to some operators who may be incompetent by granting so many commercial exemptions. “When we got the first [exemption] it was a really big deal,” he related. “The fact that they’ve cranked out 5,000 of these things since then tells me the vetting process is probably pretty lenient. I can tell you from experience that there are some folks in our area who have had multiple problems with the FAA but still got their exemption. After cease-and-desist letters, they were still able to get an exemption, so what is the vetting process?”

Buyer Beware

The Part 107 sUAS rule will provide a long overdue regulatory framework for the industry and, according to the FAA, will be the primary method of authorizing commercial drone operations. But the regulation is just a start, a minimum standard to which drone operators must adhere to gain entry to the airspace system. To be successful as trusted,



The DJI Inspire 1 quadcopter was the most popular drone among the first operators to seek Section 333 commercial exemptions from the FAA.

erties such as golf resorts, offer aerial photography of weddings and “inspect stuff,” advises drone hobbyist and marketing consultant Alan Perlman, who produces the website *UAV Coach*.

But not unlike the rush to do business on the Internet, the stampede of petitions to operate small drones left unanswered the question of whether they can be deployed profitably in the current environment, at least by sophisticated operators.

At the Xponential conference in New Orleans in May, the former president of

players and a lack of commercial-grade equipment are creating drag on the growth of the commercial market.

Foremost among the challenges operators face is continued uncertainty over provisions of Part 107, which the FAA released in draft form in February last year. At the time, Administrator Michael Huerta said the regulation probably would not require that small drone operators have a pilot certificate; instead it would establish an “unmanned aircraft operator’s permit,” issued on the basis of passing a knowledge



accredited operators, they will need to implement proven safety management processes, said Art Dawley, CEO of aviation risk management and safety auditing firm Wyvern. That could prove challenging for an industry that is immature and largely undisciplined when it comes to benchmark safety practices.

"This is the challenge," said Dawley, whose company exhibited at the Xponential conference. "We're not working with aviation providers, number one," he explained. "We found that in the acceptance, even the recognition, of these types of process, most operators have no clue. Safety management is not even part of what they do. These are people who have never had to document and implement organizational policies, risk management processes—all these kinds of things."

Best Practices

Wyvern, of Yardley, Pa., has advised business aviation clients on safety best practices for more than two decades. It also now assesses vendor compliance with quality- and safety-management practices for consumers of unmanned aircraft services.

The safety-auditing firm participates as a third party in the UAS Insurance Association, an industry group focused on insurance, risk management and safety aspects of commercial drone operations. Formed late last year, the group's founding members are aviation insurance providers Allianz Aviation, AIG Aviation, Global Aerospace and Transport Risk Management. Thus far, it is mainly aircraft insurers that offer drone coverage as a modification to their policies; for other types of insurance aircraft are an exclusion, said Tom Karol, National Association of Mutual Insurance Companies general counsel, who was interviewed recently by the

Center for the Study of the Drone at Bard College. One impediment insurers face in setting premiums is a lack of data on the frequency and severity of accidents involving small UAS, he said.

At Xponential, Wyvern announced the launch of a safety assessment program for drone operators called Exact, short for "Excellence through Assessment, Consistency and Training." It provides a certification process for operators benchmarked from the International Civil Aviation Organization (ICAO) Document 10019 Manual on Remotely Piloted Aircraft Systems. The goal of the program is to help drone users "make informed decisions" about the vendors they use, and measure vendors' "commitment to mitigate risk" in their operations.

"Our aim is to ensure that you have an organizational management structure in place, quality management, internal evaluation-type processes, a safety management plan, a documented emergency response plan," said Dawley. "Then, on the technical side, that you conform to recognized benchmarks from everything from command and control to security- and intelligence-type processes."

Wyvern developed the Exact program after hearing from its fixed-wing aviation clients, including "big corporate groups" such as General Electric, Boeing Flight Services and Disney, he said. Asked if these companies planned to employ unmanned aircraft, Dawley replied: "They already were; they already are." Clients "want to know when they're going out and sourcing these vendors. Do they meet a certain benchmark?"

RTI Forensics, a forensic investigation and engineering firm based in Stevensville, Md., was the first company Wyvern

awarded Exact certification. RTI uses small drones to collect aerial data for accident investigations, infrastructure inspection, failure analysis and other requirements of law firms, insurance adjusters, surveyors, manufacturers and government agencies. The firm received a Section 333 exemption from the FAA in June last year allowing it to perform "aerial data collection" using DJI multi-rotor drones; this was later amended to add "closed-set" filming, allowing flights near on-scene investigators.

Early Applications

Jeremy Reynolds, RTI's COO, said the firm started by using radio-controlled airplanes and helicopters in the regulatory void of the 1990s and early 2000s. In 2007 the FAA issued a policy notice that forbade flying unmanned aircraft "for business purposes," causing RTI to ground its model-aircraft fleet. "We followed what the FAA put out there" and had "a lot of disappointed clients," he recalled.

The now-ubiquitous quadcopter and other multi-rotor drones provided better platforms for aerial data collection at a lower price for clients, Reynolds said. "The UAS is really a support tool for preserving the evidence at the scene," he explained. "It's more of a value-added service that we can provide to our clients. Does it make us money? No, not the UAS alone. But what it allows us to do is provide our clients with a better solution than what was out there."

Wyvern's Exact certification assures potential clients that RTI operates to certain standards, and Reynolds expects the approval will also help his firm do business in other countries because it is built on ICAO best practices. "One problem that we are finding is providing our services globally," he said. Different countries "have different

requirements and restrictions and hoops to jump through. I'm looking more internationally and trying to figure out how we can create an international standard that will allow us to fly more freely in other countries."

In a paper that it posted to its website in May, NBAA provided a checklist designed to assist corporate flight departments that are considering using an sUAS service provider. Recommended questions include whether the provider has received one or more Section 333 exemptions and COAs from the FAA; employs an operator with a current pilot certificate; has a written flight operations manual, maintenance manual and safety plan; and will provide aviation liability insurance coverage of at least \$2 million "for each occurrence."

The paper, "Integrated Operational Management and Oversight of sUAS," also makes the case that corporate flight departments are a natural fit to operate drones for their respective companies.

"With the recent advancement and accessibility of sUAS as tools to support business pursuits and services, desire for use by engineers, technicians, marketing personnel and other company employees continues to increase. However, such individuals may not have received the appropriate aviation training, certification or practical experience development to operate these machines safely and effectively," the association stated.

"Involving flight departments in proposed operations improves the potential for successful task completion and continued operational safety," NBAA asserted. "As aviation professionals, these flight departments are well versed in best practices and potential implications of operating aircraft in specific environments and conditions." □



Research organization Battelle reports growing sales of its point-and-shoot DroneDefender system to U.S. government agencies.

Taking stock of the drone universe

by Bill Carey

The number of exemptions the FAA has granted for small drone operations offers an early indicator of the commercial market in the U.S.; the number of people who have registered to fly their machines for fun suggests the size of the drone universe. As of early May, the FAA reported that 443,000 hobbyists had registered their drone—or drones—weighing from 0.55 pound (250 grams) to 55 pounds with the agency's Small Unmanned Aircraft System Registration Service.

Given the speedy gestation of the so-called national drone registry, which was conceived and born between October and December last year, the number of registrants who paid the \$5 fee and the universe they represent seems impressive. But in its latest annual aerospace forecast, the FAA projects sales of 2.5 million hobbyist and commercial drones this year, growing to 7 million sales (4.3 million hobbyist, 2.7 million commercial) by 2020. The forecast includes very small units that fall below the 250-gram weight triggering registration.

Although couched as “highly uncertain,” the numbers may cheer retail outlets such as Wal-Mart, Best Buy, Apple and Amazon that sell drones. But they are concerning for flight crews that could find themselves sharing the airspace with hobbyists who flout voluntary guidelines to stay below 400 feet, outside five miles of an airport and “well clear” of manned aircraft.

In the last two years, incident report releases by the FAA and headline-grabbing flybys at major airports have pointed to a growing problem from rogue drones. The Center for the Study of the Drone at Bard College analyzed records of 921 incidents involving drones and manned aircraft dating from Dec. 17, 2013, to September 12 last year. It organized the reports into two categories: “sightings,” or incidents in which a pilot or a controller spotted a drone flying within or near the flight paths of manned aircraft; and “close encounters,” in which a manned aircraft came close enough to a drone that it met the FAA's definition of a “near midair collision.” By those criteria, 35.5 percent of incidents were close encounters; 64.5 percent were sightings.

“We found that 90 percent of all incidents occurred above 400 feet, the maximum altitude at which drones are allowed to fly. A majority of the total incidents occurred within five miles of an airport,” the center stated. “Our findings indicate that incidents largely occur in areas where manned air traffic density is high and where drone use is prohibited... The locations with the highest number of incidents were large metropolitan areas.”

Drone Defenses

Significant resources are being applied to the problem. The national drone registry is one response; by requiring hobbyists to mark



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their aircraft with a unique registration number, the system provides a means of tracing back a rogue drone to its owner and thereby subjecting that person to civil or criminal penalties.

The FAA's "Center of Excellence for UAS Research," a coalition of universities and companies led by Mississippi State University, is developing computer simulations of drone strikes on aircraft engines and airframes. Led by retired U.S. Air Force Maj. Gen. James Poss, the center reported working on 146 drone-related research projects overall, worth \$148 million. Project focus areas were: air traffic integration, airworthiness, control and communication, detect and avoid, low-altitude operations safety, human factors and training.

Current Solutions

The UAS traffic management (UTM) effort spearheaded by NASA Ames Research Center in Mountain View, Calif. with substantial industry involvement aims to create a low-altitude air traffic management system for drones. In April, researchers demonstrated the simultaneous operation of multiple drones at six FAA-sponsored UAS test ranges, accomplishing the first multi-state test of the UTM platform and the first coordinated test involving all six FAA ranges. Through successive software builds and demonstrations, the program's goal is to create a prototype UTM system for transfer to the FAA by 2019.

Other solutions are available now. In March, digital mapping services provider AirMap, of Santa Monica, Calif., and the American Association of Airport Executives (AAAE) rolled out the Digital Notice and Awareness System (D-NAS), a notification system that enables unmanned aircraft operators to inform nearby airports of the location of their flights. Through interfaces that include flying apps from drone manufacturers DJI, Yuneec and 3D Robotics, operators can send encrypted digital flight notices to an AirMap dashboard at the airport's operations center. The dashboard provides managers with a map view of flights in proximity to the airport and the option to contact the drone operator directly.

Ben Marcus, co-founder of light jet brokerage JetAviva, and Pepperdine University professor Gregory McNeal founded AirMap in January last year. With the AAAE, it announced that 50 airports had joined the D-NAS pilot program.

Another recent start-up company—DroneShield, of Herndon, Va.—offers a detection and alerting system that uses a network of acoustic sensors that can sense small drones that evade radar or have no radio frequency link to disrupt. DroneShield markets the system for use by airports, commercial venues, prisons and operators of critical infrastructure. Authorities tested

Shown is a monitor scene from the CACI 'SkyTracker' system to detect drones, evaluated earlier this year at Atlantic City International Airport.





FEDERAL 'MULTI-STAKEHOLDER' EFFORT ON UAS YIELDS CAREFUL DOCUMENT

The operators of unmanned aircraft systems (UAS) should notify people before using their drones, avoid using them to collect information when people have a "reasonable expectation of privacy," limit the use and sharing of data that reveals identity and secure any such information. These are guidelines agreed by a group of privacy and consumer organizations, trade associations, news groups and companies convened by the National Telecommunications and Information Administration (NTIA), a branch of the U.S. Department of Commerce.

The NTIA's "multi-stakeholder process" on UAS privacy, transparency and accountability was initiated in February last year by a presidential memorandum and involved a series of meetings. The effort concluded on May 18 with the release of a carefully worded eight-page document that sets forth voluntary "best practices" for commercial and recreational drone users.

UAS best practices are not meant to establish a legal standard "or serve as a template" for future statutory or regulatory requirements, the document states. "These guidelines provide the flexibility to evolve as the industry grows while ensuring a baseline understanding of ethical practices," the NTIA explains in a blog post.

Central to the guidelines is the treatment of "covered data," which the stakeholders' group defined as information collected by a drone that identifies a particular person. Best practices relate to the means by which covered data is collected, stored, used and secured.

The recommendations do not apply to news reporting organizations, which are "strongly protected" by U.S. law, including the First Amendment. "Newsgatherers and news reporting organizations may use UAS in the same manner as any other comparable technology to capture, store, retain and use data or images in public spaces," the document states.

Best practices for recreational drone users are listed separately in an appendix titled "Guidelines for Neighborly Drone Use."

Among parties listed as supporting the best practices document were Amazon, Intel, X (formerly Google X) and PrecisionHawk representing industry; the Small UAV Coalition, the Association for Unmanned Vehicle Systems International, the Academy of Model Aeronautics and CTIA-The Wireless Association among trade groups; and the News Media Coalition, Newspaper Association of America, National Association of Broadcasters and Radio Television Digital News Association among news organizations.

Not all interested parties concurred. "During the May 18 multi-stakeholder meeting on UAS, we urged important changes to the best practices document to bring it in line with core privacy principles," states a joint letter from Access Now, the American Civil Liberties Union and the Electronic Frontier Foundation. "However, those changes, which would have provided greater protections for privacy, were not reflected in the final document. Absent those changes, the undersigned believe that the document cannot represent 'best practices' for the use of UAS."

—B.C.

it at the last two Boston Marathons.

Under its "Pathfinder" initiative on unmanned aircraft systems, the FAA recently signed cooperative research and development agreements to test prototype drone-detection systems from Gryphon Sensors, Liteye Systems and Sensofusion at selected airports. These added to an agreement the agency reached last year with CACI International to test the latter's "SkyTracker," a passive detection system that senses the radio frequency link between a drone and its operator within a defined electronic perimeter. Testers evaluated SkyTracker from January 25 to February 2 at Atlantic City International Airport, the first such detection research at a commercial airport, the FAA said.

In May, the FAA tested an "FBI drone detection system" at John F. Kennedy International Airport in New York. Other agencies participating in the test were the Department of Homeland Security, the Department of Justice, the Queens District Attorney's Office and the Port Authority of New York and New Jersey.

There is also the option of disrupting rogue drones in flight. With support from multiple federal agencies, Mitre is conducting a counter-drone technology challenge this year to identify technological solutions to "detect and safely interdict" small unmanned aircraft weighing less than five pounds that present a potential safety or security threat in urban areas. The sought-after solutions would down small drones that fly too close to airports or other sensitive locations, and must be "domestically viable," according to Mitre.

Aerospace and defense companies large and small have developed drone countermeasures using radar or other sensors in combination with jamming or laser technology to detect and disable drones, among them Raytheon, Boeing and Lockheed Martin in the U.S., Thales in France, MBDA and Rheinmetall Defence in Germany and Blighter Surveillance Systems, Chess Dynamics and Enterprise Control Systems in the UK.

Last year, nonprofit research and development organization Battelle introduced "Drone-Defender," a directed-energy, point-and-shoot technology resembling a rifle. The system uses radio control frequency to disrupt drones in flight at a range of 400 meters, causing them to slowly descend and land or return to their origin. "The technology is restricted to use by federal authorities under a strict permitting process, but sales are taking off with nearly 100 units sold" to the U.S. departments of defense and homeland security, Battelle said in April. □



MATT THURBER

A small drone gives the hobbyist a chance to take in beautiful vistas, such as the Mormon Rocks in San Bernardino County, Calif.

Drone flying: a hobbyist's perspective

by Matt Thurber

Owning a hobby drone in Los Angeles is a little frustrating. As much fun as these devices are to fly, especially with their high-resolution video and still cameras that keep getting better and better, there are many areas where some authority wants to keep me grounded.

I do live in a fairly congested area, and there is little opportunity to fly my Yuneec Q500 Typhoon in my neighborhood. I could probably get away with flying it in a local park early in the morning, but local rules are strict about not flying any radio-controlled models in parks. The gorgeous California coastline beckons as a perfect place to photograph stunning vistas, but again, local authorities have ruled that out, and we're not supposed to fly our drones over

beaches. (Not surprisingly, there are plenty of drone videos of California beaches on YouTube, so it appears that people are flying drones there despite the rules.)

The FAA's B4UFly smartphone app is an attempt to help drone fliers figure out safe areas to fly, but the app has some serious flaws that make it all but useless.

When I fire up B4UFly on my iPhone, according to its depiction, I have to drive about 25 miles to get away from all the restricted flying zones. This is because there are a significant number of privately owned heliports in the Los Angeles area, from pads atop hotels to obscure heliports that apparently exist but are never used. The B4UFly app draws a five-mile circle around

everything that the FAA qualifies as an "airport," including all those heliports.

However, the app incorrectly states that "permission" is required to fly within these five-mile circles, when in fact a drone operator merely needs to notify the airport operator of the planned flight; permission is not part of the process. The other flaw of B4UFly is that it contains little useful information to find out how to contact the airport operator to make the required notification, although it does include the airport identifier, which can be Googled to find out the operator information. In any case, my Yuneec contains geo-fencing software that doesn't allow it to operate near airports.

The hassles of flying my

drone in the nearby area mean that I usually drive out to the desert for flying fun. After a day of snowboarding in the San Gabriel Mountains, for example, I stopped at Mormon Rocks on the way home for some drone photography of the setting sun reflecting off the bulbous rocky formations.

To make my drone more useful, I'm tempted to follow in the footsteps of my friend Bob Howie, a professional pilot who went to the trouble of getting an FAA 333 exemption and started his own commercial drone company (Lone Star Drones in Texas). Howie films construction sites, disaster aftermaths and commercial property and has enough business to keep a few pilots busy. "Honestly, it is some of the most exciting flying stuff I've ever done in some respects," he said. "I like the results and I like how people are happy with the work." □