

June 2014

AEROSPACE

A M E R I C A



A wildfire's newest enemies

**Commercial
airtankers
take shape
with no time
to waste**

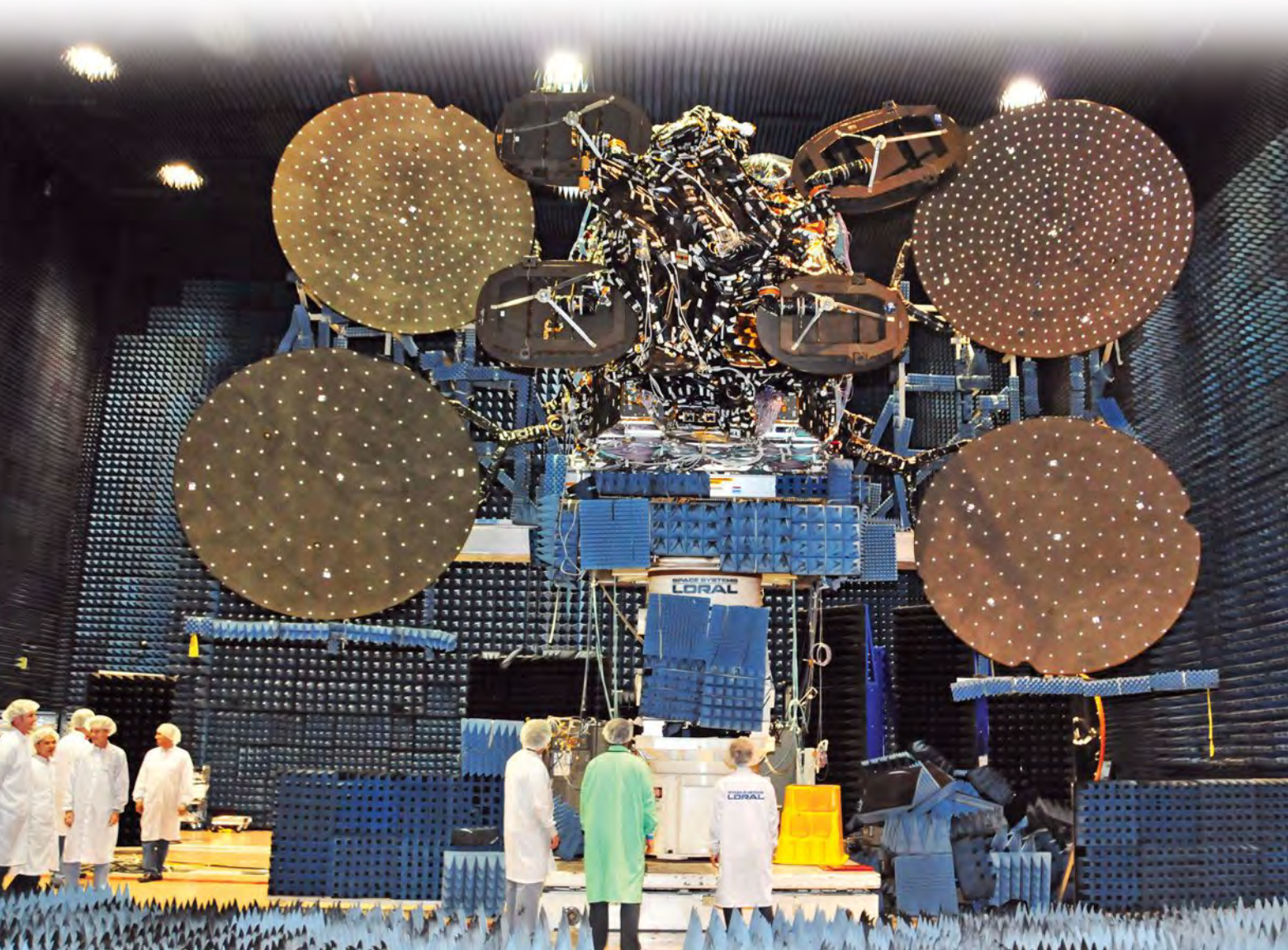
page 28

Air Force chief Welsh's budget survival plan 22

WiFi on airliners 34

3D printing heads for space 38

WiFi



Testing the antennas on the ViaSat-1 satellite at Space Systems/Loral in Palo Alto, Calif. The satellite is beginning to provide WiFi for JetBlue passengers.

goes airborne

Time spent aboard airliners could be getting a whole lot better for those who can't live without broadband Internet. Natalia Mironova explains the satellite technology and aircraft upgrades that will revolutionize connectivity for air travelers, provided a sound business plan can be found.

Jim Cramer, the spirited host of CNBC's "Mad Money," told his viewers he wants to watch Netflix while he is traveling by air, and he ventured an upbeat market prediction: The business of in-flight WiFi is "growing like a weed," and is "expected to expand fifteen-fold over the next decade, from a \$350-million business to a \$5-billion business," Cramer told viewers.

While Cramer may be excited about the state of in-flight WiFi as an investor, as a customer he must be feeling quite the opposite. The current state of Internet connectivity offered to passengers on most commercial flights is expensive and slow. "They are good enough to say 'I am connected' but not good enough to satisfy the modern mobile device or modern traveler's needs," says ViaSat's Don Buchman, the vice president in charge of the California company's new in-flight WiFi service, called Exede.

Most airliners connect passengers to the Internet via antennas on the bellies of their planes and cellular towers on the ground. Because a limited amount of spectrum is allocated for those towers, the bandwidth must be shared by potentially hundreds of passengers on any planes within range of the towers. If a flyer wants to use Netflix he'll need to hope that nobody else in the air was planning to catch up on "The House of Cards."

But what if the airliner — or a cruise ship for that matter — had an antenna

pointing upward toward a 7,000-kilogram geosynchronous satellite designed to do the job of many cell towers? Next-generation satellites launched recently or in development for Inmarsat, Iridium and Intelsat, among others, are designed for exactly that kind of broadband connectivity. They provide two-way communications over dozens of spot beams that dice up and reuse the radio spectrum allocated to the satellite. Interference is avoided through physical separation of the beams. A good example is ViaSat's 6,740-kilogram ViaSat-1 spacecraft positioned over North America and now starting to provide Internet to passengers on JetBlue planes. ViaSat says the satellite's 130-gigabit-per-second total capacity instantly eclipsed "all other satellites over North America combined." ViaSat is not alone in sensing a lucrative new market. Inmarsat of London has begun launching high-capacity satellites and Intelsat of Luxembourg plans to start doing so next year.

It will be up to the airlines and cruise ship companies to develop business models that will deliver the coveted high-speed connectivity to their customers in an effective and cost-efficient manner.



Intelsat

Intelsat's teleport at Fuchsstadt, Germany. The company sees sharply rising demand for broadband connectivity.

by Natalia Mironova

Battle over broadband tech

Space Systems/Loral says it will try to overturn a federal court's award of \$283 million in damages to its onetime customer, ViaSat. The companies have been locked in a patent infringement dispute over broadband technology aboard the ViaSat-1 satellite, which was built by SSL and is beginning to provide WiFi to JetBlue passengers. ViaSat accused SSL of infringing patents describing how

to operate multibeam satellites, avoid interference and organize ground gateways. SSL will work to "overturn the verdict in post-trial motions and if necessary, through the appeal process," President John Celli said through a spokeswoman. ViaSat wants an injunction that would prevent SSL from making or selling satellites with the technology. Expect more legal action in August. *Ben Iannotta*

The satellite operators are confident this will happen, because consumers are expecting the same kind of WiFi experience at sea or in the air as they have on terra firma: "You don't even realize you're connected to the Internet, it's kind of like breathing air," as ViaSat's Buchman puts it. And who wants to hold their breath on a cross-country flight?

If a revolution is underway, it's one that will require installation of new equipment on large numbers of airliners. Honeywell Aerospace, for example, is partnering with Inmarsat to develop, produce and distribute the radomes, antennas and terminals that will connect jets to Inmarsat's new Ka-band Global Xpress, or GX, constellation, which will consist of three new geosynchronous satellites, the first of which was launched in December with two additional launches planned by the end of the year.

Surge in demand

To gauge the market, Honeywell surveyed consumers in 2013. The survey concluded that "almost 90 percent of fliers would give up an amenity on their flight — preferred seats, extra legroom and more — to be guaranteed a faster and more consistent wireless

connection." Air travelers also said they expect the same quality of the wireless connection they experience at home or in the office.

Intelsat, for one, sees the same trend: "The amount of bandwidth needed in terms of connectivity is going through the roof, and that has been the real focus of Intelsat's business: How [to] service that demand in the most appropriate way by providing the bandwidth at the right price and in the right locations," says James Collett, director of mobility services at the Luxembourg-based Intelsat.

Cruise lines operating out of range of cell towers are also struggling to keep their passengers connected. Eric Merz is the director of guest mobility services for Carnival Cruises, the world's largest cruise ship company (based on the number of passengers carried), and he says connectivity on a cruise ship is even more critical than it is on an aircraft: "For the most part you are typically on a plane for a few hours; that isn't that earth-shattering to be disconnected for that period of time. But you tell people they are going to be disconnected for a week, for some people that's a deal breaker for a vacation," he says.

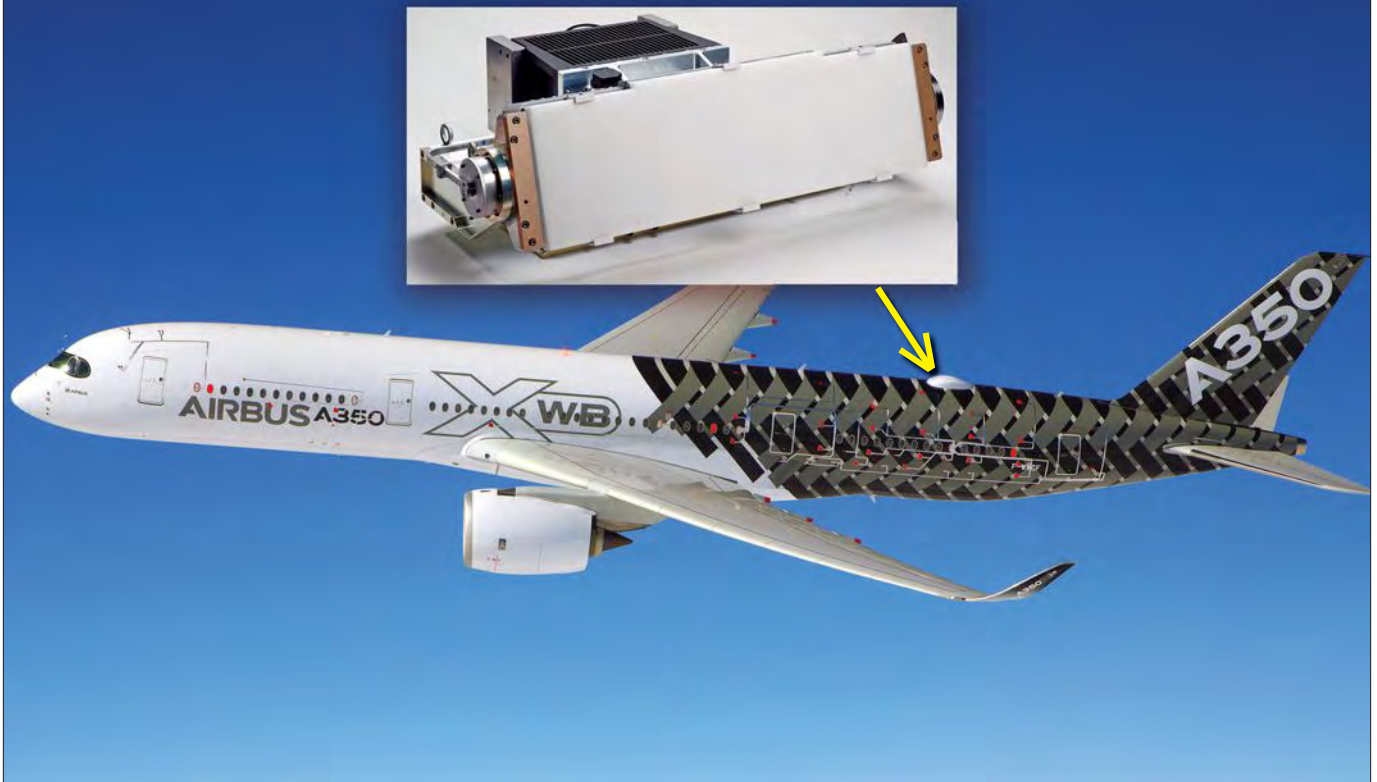
According to Merz, Carnival currently offers its passengers and crew some options to connect, but they come at a price — 75 cents per minute, and the connection speed is not ideal. Carnival has resorted to tricks like cacheing the most popular sites, like CNN or ESPN, for instance, on the ship using an appliance called a "riverbed" to optimize traffic and limit the need to connect to the original IP address.

Intelsat calls its high-capacity satellite design Intelsat EpicNG. Two EpicNGs are scheduled for launch in 2015, one built by Boeing and the other by Airbus Defense and Space, formerly Astrium. Boeing also is manufacturing an EpicNG for launch in 2016, and is on contract to manufacture three

Partnership: Working with ViaSat, JetBlue plans to finish equipping its Airbus fleet with satellite Internet by the end of the year.



JetBlue



The GX antenna, built by Honeywell for Inmarsat's Global Xpress satellite constellation, is located inside the radome atop this Airbus A350 aircraft.

more. The satellites employ frequency reuse by using the same frequency in different spot beams serving different locations. The more frequency reuse supported, the greater the total bandwidth that can be delivered through a given allocation of spectrum.

Intelsat works with cruise ships and airlines, and for both markets the strategy is to place the satellites over the most trafficked routes — the North Atlantic corridor for aircraft and the Caribbean for cruise ships. “The more you can concentrate your coverage, the more you can increase the bandwidth to the mobile users in that region,” says Collett. With its fleet of over 50 satellites, Intelsat can do just that. “We’ve got a very sizeable fleet, which provides a great deal of global reach, which is fundamental to a cruise ship moving around the world or to an aircraft,” he says.

The EpicNG satellites will provide C and Ka-band capacity, but also the tried-and-true Ku frequency band, which has been the standard for satellite transmissions for the last two decades. Collett says this continuity allows customers to upgrade to a higher class of service while avoiding the costly

hardware upgrade. Users can tailor their networks with the frequency and application combination that best fits their needs.

Who pays

The cost of the hardware required for satellite connectivity could be a hurdle, experts say. Outfitting each aircraft with the required antenna will set the airline back several hundred thousand dollars and take the plane out of circulation for several days, perhaps a week. The cost is relative, says ViaSat's Buchman: “I would say it's not that expensive. It's probably at least 10 times cheaper than doing in-flight entertainment systems with seat-back TV devices that you have on international routes. It's really not that expensive if you look at it in the context of what you're getting [compared to] what the other available technologies and offerings are for airlines.” And the size, weight and power required for the antennas is coming down, according to Wayne Plucker, aerospace and defense industry research manager at the consulting firm Frost & Sullivan:

(Continued on page 43)

WiFi goes airborne

(Continued from page 37)

The expense is “only marginally higher than the air-to-ground solution,” he says.

Still, there is an ongoing discussion about who will end up paying for the new technology. “The passengers will [be willing to] pay, but only so much,” says ViaSat’s Buchman. Some airlines may choose to invest in high-speed broadband and offer it to the passengers as an amenity, like soft drinks or peanuts. “We think that model has pretty good, strong legs to it, because that’s how the airline builds its brand; the airlines have gone from competing on price to competing on value, which is the value of their amenities,” he explains.

Intelsat’s Collett says each airline will have to figure out a business plan based on its marketing strategy and its place in the market: A regional carrier is more likely to opt for a cheaper (and slower) Internet solution and charge the passengers for it, whereas an international carrier operating trans-oceanic flights might choose to offer the high-speed broadband for free. There may also be some interest from third-party content providers like Google or Yahoo to capitalize on the “captive audience” an aircraft full of Internet users will provide.

While the specifics of how to make connectivity fit into the airlines’ business models are still being discussed, “what’s clear is connectivity is now very much in the mix of the criteria that passengers are applying when they are deciding who their carrier is. And therefore it certainly has the focus of the airlines right now,” says Collett.

Changing the landscape

JetBlue is betting on its investment in satellite connectivity to give it an edge. The company partnered with ViaSat in a deal that will have its Airbus fleet outfitted with Ka-band aeronautical terminals — which include a modem, an antenna and radome for high-speed satellite Internet — by the end of this year. The airline’s Embraer 190s will follow closely behind. Currently the Fly-Fy Internet connectivity, as the company is branding it, is offered for free under the Simply Surf plan that allows basic web browsing and limited media use. For streaming movies or other applications requiring higher bandwidth, there is Fly-Fy premium, which costs \$9 per hour.

“Customers love it and offer compli-



Intelsat’s Epic 29e satellite, scheduled for launch in 2015, will allow customers to shift to higher-grade service without costly hardware changes, the company says.

ments highlighting its speed, convenience, and reliability. It was important for us to ensure we offered enough bandwidth so that every customer on a flight could connect simultaneously without feeling an impact to service,” says Jamie Perry, JetBlue’s director of product development, in an e-mail. Being able to offer high-speed connectivity to every passenger on the plane at the same time is one of ViaSat’s major selling points: “We’re changing the landscape from ‘it’s a precious commodity,’” says ViaSat’s Buchman, “to ‘anyone who wants to use it should be able to use it.’” ViaSat’s service is also available on some United Airlines flights, and the company is gearing up to launch a Europe-Middle East service with El Al airlines next year, working with the France-based Eutelsat.

Some industry experts argue that while the airlines will have to choose which technology is worth the investment, whether or not to provide connectivity on their planes is not really much of a debate. Advocates predict in-flight WiFi will one day be standard, like an in-flight snack. “The expectation is certainly already there. And I think the challenge for the satellite industry is to deliver that capability in a simple and cost-effective manner that allows all the airlines to adopt it,” says Collett. Frost and Sullivan’s Plucker says it’s all a numbers game: “The longer the airlines are in profitable mode, which they finally are again, the more likely they are to make this investment. If they catch another downturn — don’t hold your breath. ▲