

Future data services are promising some exciting new capabilities for rotorcraft.

Rob Coppinger considers what next-generation satellite communications will bring to helicopter operations.



Star quality

Data and voice services from helicopters are currently limited to dial-up internet speeds, but with new satellite constellations and next-generation antennas and avionics, the next few years could see broadband reach rotorcraft.

With omni-directional antennas and new powerful satellites, combined with more capable, less power-hungry communications units, future data services will deliver HD images for medical crews and real-time engine performance data for fleet managers.

Canada's SkyTrac is a satellite-based aircraft flight tracking and communications provider that uses the Iridium satellite constellation. 'The Iridium Next constellation, which is due to start launching in 2015, will allow data transfers of 1.5Mbps, up to 8Mbps, and users will be able to send images and surf the web,' explained Kim Bagnall, international sales account manager at the company.

Today, the Iridium constellation has 66 satellites orbiting around 780km away. This is considered low Earth orbit (LEO), which is defined as between 80 and 2,000km from sea level. Iridium Next will be fully deployed by 2018.

Photo synthesis

For medical crews, a data link of up to 8Mbps would allow HD images of an onboard patient. 'They want

a photo to see the patient, as a picture is a thousand words,' said Rod Danielson, chief technology officer at Outerlink, a US-based mobile communications company that provides satellite voice, data and tracking for aircraft. 'There is interest in moving patient data to and from the hospitals – it doesn't require a lot of bandwidth, but with satellites it's more than you think.'

'We are waiting on Globalstar, and they should be able to provide a higher bandwidth. Outerlink wants to use these, but there is a bit of a waiting game.'

Globalstar's constellation is also in LEO, this time at the higher altitude of 1,400km. Its first-generation satellites, launched between 1999 and 2001, are experiencing problems that are affecting two-way voice and data services. This means at certain times, at any given location, it might take longer to establish calls, and the duration could be limited.

The company has been launching its second-generation satellites since 2010, and the final spacecraft will be put into orbit next year.

Another satellite provider, LightSquared, launched its SkyTerra-1 satellite into geostationary orbit (GEO) in 2010, serving the North American market. The company also has the MSAT-1 and MSAT-2 satellites, which provide services to the same region. Outerlink uses these GEO satellites as well as Iridium's LEO satellites.

However, current antenna technology makes GEO satellite use more challenging. Danielson noted: 'One of the problems with GEOs [geostationary satellites] is you tend to want to use a directional antenna, and that is nearly impossible with a helicopter, so you have to use omni-directional antenna.'

A drawback with such antennas, however, is lower bandwidth. Danielson is expecting omni-directional antennas that can provide higher bandwidth to become available in the 2013/2014 timeframe.

While fleet tracking, data and voice service providers await more capable satellite constellations and antennas, the general public is being offered ever faster, greater broadband mobile phone networks, such as 4G.

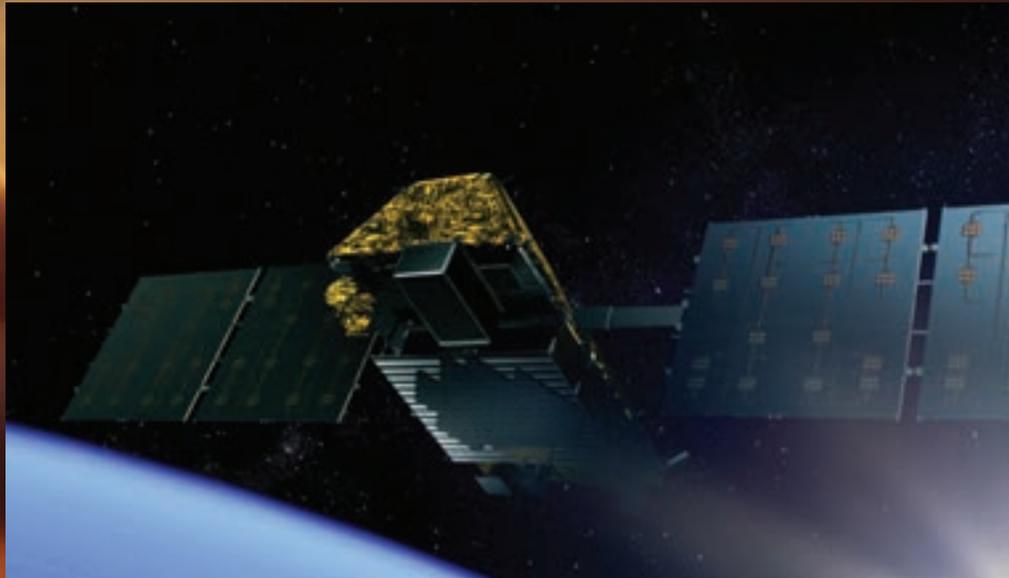
Regulatory restrictions

According to Ofcom, the UK's telecommunications regulator, 4G will provide up to 6Mbps. However, in the US, fleet tracking and voice/data providers cannot use mobile networks, whether they are 4G or not, because the country's telecoms regulator, the Federal Communications Commission (FCC), has banned the practice.

Only once on the ground can a helicopter's communication system link to a local mobile phone mast. 'We would love to be able to do that

(Photo: Sikorsky)

(Right) The Iridium Next constellation, which is due to start launching in 2015, will allow data transfers of up to 8Mbps. (Image: Iridium)



[mobile phone networks], but there is an FCC requirement that if your transmitter is not attached to the ground, you're not supposed to use it,' explained Danielson. 'The FAA doesn't ban all cell phone use, but the FCC does.'

Until the higher bandwidth satellites are fully operational and mobile phone technologies allowed, the telecommunications network common across the tracking, voice and data companies is Iridium's existing narrowband service.

According to Paul Duran, VP of marketing and sales at Blue Sky Network, the Iridium bandwidth 'is definitely less than dial-up data rates'. Dial-up services would provide up to 56kbps, and David Thomas, senior account manager for another provider, Latitude Technologies, told *RotorHub* that Iridium's bandwidth was 'like the old modem 2,400-baud rate'.

Steve Durante, CEO of Outerlink, also sees a problem with relying on one satellite operator. 'If you're relying on one satellite constellation, that's a risk a lot of people don't think of,' he said.

To make its service as reliable as possible, Iridium cross-links its satellites, allowing them to speak to each other and downlink to a ground station at any time. It also has an advantage with helicopters that will be flying at different latitudes. Satellites in certain orbits will not be able to transmit to or receive signals from latitudes beyond what is visible to the

spacecraft's antenna. With a total of 66 satellites, Iridium can cover all latitudes. 'Other satellites have problems with certain latitudes, but with [Iridium's] there aren't,' noted Duran.

Latency lengths

Even with very reliable satellites, latency can be an issue, according to Danielson. He said: '[LightSquared's] MSAT has very low latency, but it is [a service] limited to North America. Some customers on the data side, they use MSATs and get a 2-3-second latency from transmit to display, versus Iridium, where it can be up to 45 seconds – however it can be faster on Iridium.'

Outerlink has a proprietary system it uses with the MSATs to overcome this latency for clients wanting near-real-time updates, especially those operating in the Gulf of Mexico. This proprietary system allows users to see where their helicopters are every 10-15 seconds and get messages 'to and from the asset as quick as possible'. Improvements in latency and availability are why Danielson said his company wants 'to go down the path of a hybrid solution'.

The desire for short, regular messages that can confirm location or provide other data means that SMS is becoming popular, according to Duran.

While users transmitting SMS at a high frequency might test a satellite service – especially

'The desire for short messages that can confirm location means that SMS is becoming popular.'

where latency is an issue – it is a different sort of data demand that represents a bigger challenge. 'There certainly is a greater requirement for adding more data and bringing it off the ship to the ground in flight,' added Durante. 'There is a bigger market for growth at that end.'

That market includes specialist helicopter users. They can be fire-fighting platforms transmitting remaining water payload levels or hospitals requesting patient data from air ambulance crews. Durante explained that medical staff 'want to see the blood oxygen data, the different pieces of data that come off of medical equipment'. However, specialist users are not where the main data demands are from – those are always going to be aircraft performance.

The fleet managers want to know how their aircraft are performing and where they are, and, according to Durante, operators are looking for life-cycle enhancements. ➔



For medical crews, a data link of up to 8Mbps will allow transmission of high-definition pictures of an onboard patient. (Photo: Eurocopter)

Data request

SkyTrac has found its clients are asking for more data, such as engine parameters and exceedance notifications, utilising it for maintenance, flight operations quality assurance and safety management system programmes. 'Our equipment has the ability to take this type of data from the aircraft and forward it to the ground in real time, or download it at the end of the flight,' said Bagnall.

Those exceedance notifications will be for a range of aircraft performance parameters, and this is another driver for SMS use. 'They want different types of exceedance data to trigger messages from the aircraft,' explained Durante, adding that he is also seeing demands from customers for weather data with real-time updates.

Meanwhile, Duran is certain that 'with SATCOM [satellite communications] data links, fleets will become more efficient in the future. Users can monitor their fleet for savings in money, time and cost.'

For these kinds of data services, products can also interface with other onboard equipment, such as moving maps and flight data management systems, according to Bagnall. For the pilot, SMS need never be read. While displays are available for the cockpit, text-to-voice services are also

'For now, neither the helicopters nor onboard SATCOM units are the bottleneck.'

provided, where the pilot can hear messages in their headset. Voice SATCOM can also be tied into the cabin's intercom systems with the narrowband Iridium service.

SkyTrac offers a cockpit display panel and keyboard that can be used to provide two-way voice and messaging services. The unit is wired through the aircraft audio panel, and the crew can talk through their headsets. Another option is push to talk. 'The system is attractive to a lot of people because there is a delay with a half-duplex [voice communication] system – it allows pilots to deal with the conversation when they can,' explained Danielson.

Wireless technologies can also be linked to the SATCOM service. 'You can allow the user to connect Bluetooth from the cockpit and tie them into the Iridium infrastructure,' added Duran.

Outerlink, Blue Sky Network, SkyTrac and Latitude all see SATCOM units staying the same in size, weight (generally under 1kg) and maximum power consumption because of FAA certification requirements. It is easier for service providers to obtain approval for the same box, even as electronics become more capable and take up less room inside. Reduced space requirements mean that some boxes have become lighter.

Speeding up

In Durante's experience, long-term SATCOM technology developments have seen power requirements 'coming down and bandwidth capability going up'. That growth is all about meeting customers' needs. 'Looking forward, the requirements look more like broadband in the cockpit, such as real-time weather,' he continued. 'That is what we're hearing for our customers who are moving a lot of people in the gulf.'

The new satellite constellations also present a fresh challenge to SATCOM unit design, and Outerlink aims to have a satellite-agnostic product. 'SATCOM boxes can now switch from one to the other [constellation],' added Durante. 'We've combined our product suite into one unit, and we've built a multi-modal, tri- and quad-modal system, so it not only operates on an Iridium, but any number of the new "geos" on orbit or terrestrial systems, for when the vehicle is on the ground.'

As electronics have become more capable and smaller, the multi-modal systems have become small enough to fit into the certified box. Despite helicopters being tough environments for SATCOM units due to vibration and noise, all of the service providers say their units have no problems. They are installed in aircraft for many years – more than a decade in some cases – and only connection checks are required.

For now, neither the helicopters nor onboard SATCOM units are the bottleneck. 'The [customer] requirements exist today for greater bandwidth, but the [satellite] services really have to be turned on,' noted Durante, referring to the ageing and new constellations that are seeing spacecraft launched, but are still some way from being completed, such as Globalstar, LightSquared and Iridium Next. 'They could be turned on tomorrow, but the MSS [mobile satellite services] industry is a little upside down at the moment.'

For SkyTrac, exploration is one growth area for helicopter SATCOM. 'As the exploration market grows – offshore drilling, northern mining etc – helicopter services become more in demand, and with that an effective communications system is required,' concluded Bagnall. **RH**