Two years ago SES entered the nascent market of inflight connectivity (IFC) and actively drove its operations to become the leader it is today. Behind every plane that is, or will be, connected by SES there is a differentiated network that was developed using five principles: collaborative processes, tailored coverage, customised service, diverse fleet options, and open architecture. These elements are the basis to the success of SES, and of its customers, as this approach has enabled efficiencies and offerings that were previously unattainable.

SES's ability to create value by leveraging its unique combination of satellites as well as its scalable and flexible infrastructure is the reason the leading IFC operators have entrusted their businesses to SES. SES has global capacity deals with the leading IFC service providers, Global Eagle Entertainment (GEE), Gogo, Panasonic and Thales, who are supporting in some way at least 90% of all connected airplanes in service today. In 2016 alone SES experienced a 95% growth rate. Capacity on the SES fleet is set to grow even further in the coming years as the company focuses on supporting the inflight connectivity requirements of airline passengers around the globe, and IFC providers and airlines stretch the bounds of what’s possible.

SES built its approach off a unique foundation made of a multi-band, multi-orbit network, unmatched in the industry. SES already operates over 60 satellites in orbit, and has 15 new satellites under procurement, 11 of which are High Throughput Satellites (HTS) with 20 times the bandwidth of conventional satellites. HTS technology is vital for the IFC market to continue thriving, and SES is offering the global coverage in orbit that is needed. Today SES’s growing fleet covers nearly all of the 50,000 air travel routes criss-crossing the Earth with ubiquitous bandwidth. With its MEO and GEO fleet, SES is uniquely positioned to serve the Aero market with the most efficient and reliable solutions. And by doing so, it is accelerating the delivery of a new era of unlimited inflight connectivity.
THE SES METHOD

Two years ago the demand for IFC was emerging as a powerful driving force, but airlines were not able to provide the connectivity that their customers were looking for. At that point IFC was still being provided via L-band and Air-to-Ground (ATG), which meant only essential connectivity for applications such as cockpit operations, and very limited service across the oceans. SES stepped up, making its global fleet of GEO satellites available as a first step, and at the same time offering a future-proof value proposition by committing to technological innovations that would shape the future of IFC.

This offered SES an entry point into the domain of IFC, but its success was decided thanks to its customer-centric method both in its current operations and when planning for the technological innovations that would shape the future. The SES method to building smart IFC systems consists of five principles that cover the entire lifespan of a satellite, from design to delivery.

COLLABORATIVE PROCESSES

SES customers are integrally involved in the design of SES satellites, which provide advanced technologies capable of addressing future demands. By working closely with customers, SES ensures that every aspect of their requirements can be taken into account from the drawing board.

In the case of SES-17, SES worked closely with Thales to develop its new Ka-band HTS satellite, with the high throughput payload specifically designed for aero mobility throughout the Americas. SES-17 is set to launch and begin delivering Thales’ FlytLIVE inflight connectivity and streaming services to airline customers in 2020. Yet collaboration in all SES projects continues past the design phase. In this case, SES worked with Thales to create a solution to serve FlytLive until the launch of SES-17 in 2020. By leveraging two existing SES satellites (AMC-15, AMC-16), together with a pair of HTS satellites and next-gen modem technology from Hughes Network Systems, SES is enabling Thales to start IFC service over North America in 2017.
**TAILORED COVERAGE**

SES aero customers have left their mark on the design of SES coverage around the globe. IFC service providers and airlines have had a tremendous influence on the shape of SES satellite beams and its coverage of key travel routes. In its work with Panasonic Avionics, SES fleet management teams took informed input from them early in the development stages of new HTS satellite designs. A series of collaborative meetings with Panasonic Avionics shaped pivotal satellite footprints serving major travel routes over North America, the Atlantic Ocean region, Europe, and beyond, ensuring that SES capacity would serve Panasonic Avionics well into the future.

**CUSTOMISED SERVICE**

The specialised service packages SES creates for its customers do not end with the construction of a satellite. Customers need flexibility in order to meet the needs of a dynamic market such as inflight connectivity. SES understands this, and connects the challenges and opportunities customers are navigating to deliver the capacity they need. When Gogo launched its new 2Ku inflight connectivity service aboard flights across North America and the Atlantic Ocean, it called on the tailored capacity SES offered across multiple satellites covering key regions. This successful delivery led to further collaboration, with Gogo contracting significant capacity from two SES HTS satellites set to launch in 2017 (SES-14, SES-15) targeted for the global IFC market.

**DIVERSE FLEET OPTIONS**

In the fast-moving market of IFC, when capacity is needed on a time-frame, out-of-the-box solutions must be found. With a large fleet in orbit, SES has the resources to deliver new types of solutions, such as contracting capacity from a satellite in an inclined-orbit. Satellites in inclined orbits are not aligned perfectly with the equatorial plane, and are often thought to be past their prime. Yet they can also present attractive opportunities for customers such as Global Eagle Entertainment (GEE). By using an SES satellite that is completely functional and reliable, but in an inclined orbit, GEE quickly increased inflight capacity for airlines serving North America, the Gulf of Mexico and the Caribbean. This innovative solution and business model was conceived thanks to the close collaboration between the two companies. The breakthrough is enabling GEE to scale throughput at very competitive pricing over one of the leading IFC markets in the world.

**OPEN ARCHITECTURE**

The SES network is based on the principle of technological inclusiveness. SES’s open architecture allows for, and drives, collaboration and innovation at every level of IFC delivery – from advancements in ground infrastructure, to satellite design, to next generation aircraft antenna and modem development. SES customers can integrate their chosen systems into its network seamlessly, allowing for complete technological flexibility. By working closely with IFC technology providers SES is able to constantly push for a better connected passenger experience. This includes a new antenna roadmap on the cusp of enabling fibre-like bandwidth from MEO satellites to deliver next-generation IFC.
IFC IN PRACTICE

The SES method is not only responding to the demands of the IFC market of today, but helping to shape the connectivity expectations of tomorrow.

CONSUMERS

A record 3.6 billion airline passengers boarded over 40 million commercial flights worldwide in 2016 and 65% of today’s air travellers prefer to access inflight entertainment services on their own device. Airline passengers increasingly expect to connect inflight to high-speed Wi-Fi, stream video entertainment, text, and catch-up on email and social media. The availability and quality of inflight Wi-Fi has become a deciding factor for passengers booking flights.

Today airlines are offering a seamless mix of satellite-delivered Wi-Fi offerings and cached content, including bite-sized news and sports updates periodically refreshed via satellite. Inflight entertainment (IFE) is so popular that seven of ten passengers would like to order their meals through the IFE system. Nearly half are willing to pay for Wi-Fi-based entertainment and connectivity services, and 72% prefer watching movies and TV over sleeping on long-haul flights.

The future is already here as SES collaborates closely with providers across the aviation value chain to translate technology into the ultimate experience for passengers, and a reliable profit centre for airlines. SES’s global reach ensures that live TV broadcasts to passengers are never interrupted, and that internet speeds continue to increase. The passenger of tomorrow will have all the capabilities they have at home, including the ability to stream on demand HD video directly to their own device, and use virtual reality.

The capabilities will not be the only aspect of IFC that will improve. Inflight Wi-Fi pricing models currently vary as much as the airlines themselves (i.e. free Wi-Fi, pay-per-use, package services), but satellite-driven efficiencies and opportunities will ultimately enable the airlines to turn IFC into a soaring profit centre. The future of inflight connectivity will be fuelled by flexible platforms that deliver high-speed connectivity to every passenger, bundling the cost into the price of their airfare and even further down the line, their normal cell-phone package. Inflight connectivity has already flown past the nice-to-have phase, it’s a must-have for the airlines that want to thrive in the fiercely competitive connected skies.

3 Air Transport Action Group, Aviation Benefits Beyond Borders, 2014
4 SITA 2016 Passenger IT Survey
5 Gogo 2016 Global Airline Passenger Study
6 IATA 2015 Global Airline Passenger Survey
7 IATA 2015 Global Passenger Survey
Airlines

As much as IFC is changing the experience for passengers, it is also enabling airlines to optimise their processes.

More bandwidth to the plane is enabling airlines to more effectively manage, transmit and store each passenger’s inflight preferences and selections, ultimately providing a far more personalised travel experience.

Flight crews today can easily access electronic passenger profiles on their connected tablets to provide up-to-the-minute connecting flight information, real-time credit card processing, and even inflight meal choices and suggestions. Logistical procedures also improve with IFC, as airplane cabin maintenance issues, such as a broken cargo bin latch or seatback TV screen, can be reported during the flight in order to secure a timely maintenance fix before the next scheduled departure.

The connected pipes the airlines have installed aboard their aircraft represent real opportunities for new revenue streams as well as operational analysis. For example, a single flight by a new Boeing 787 generates more than 500 gigabytes of information from thousands of sensors across the plane. That’s more than 30 terabytes of data in the span of a mere month of flights. Satellite connectivity enables airlines to track sensor data to monitor vital operations, from fuel consumption to engine performance, with an eye toward improving safety and cutting costs.

Additionally, Electronic Flight Bags (EFBs) have replaced stacks of flightpath reports stuffed in the pilot’s briefcase, with tablets offering access to real-time weather, turbulence and operations updates. When pilots and flight and ground crews have real-time operational data at their fingertips, they can make better, more informed decisions that have a significant impact on the bottom line. EFBs can save millions by enabling airlines to avoid costly delays caused by turbulence alone. It’s estimated that connected aircraft could save the aviation industry more than USD 1 billion annually.

8 Data Science Central, Bernard Marr, 2015
9 The Future of Aeronautical Connectivity Report, Valour Consultancy, 2014
THE FUTURE OF IFC

SES has achieved success in two years thanks to the power of its GEO constellation and its unique method to leverage all its assets, but this is only the beginning. As SES grows its HTS fleet with the launch of hybrid GEO Ku-band and Ka-band HTS, its constellation will become even more differentiated. This will allow SES to provide services into the future that are even more scalable and flexible, driving the development of the IFC market. The designs of SES’s soon to launch hybrid HTS GEO satellites feature wide beams for live inflight television broadcasts, spot beams for high-powered connectivity, and on-board digital processing technology that allows SES to quickly move capacity where it is needed most as air traffic patterns change daily or due to weather. That unique level of in-orbit flexibility and global coverage are true differentiators for SES, as airlines and service providers look to diversify their platforms to stay ahead of evolving aviation demands.

HTS satellites require a complementary ground segment, and half the investment SES has made into its GEO HTS hybrid capabilities in space actually happens on the ground. In preparation for the first HTS satellite launch in 2017, multiple gateways and antennas are coming online. These are augmenting a diverse base of ground terminals as well as an extensive network of teleports and hub assets around the world that SES already has. All of which are interconnected by MPLS and fibre. New super nodes and teleports are the brains behind the intelligent and automated routing of data and HTS capacity, which enables connected aircraft worldwide. This powers the distinctive customised solutions SES provides that the meet exact specifications of each different situation and customer.

In MEO SES’s high throughput, low latency capacity could soon play a pivotal role in revolutionizing inflight connectivity, much like it has already transformed connectivity at sea aboard some of the largest cruise ships in the world. SES already serves more than a million Royal Caribbean cruise line passengers each year with fibre-like latency. To bring this capability to the IFC market, antenna design has become the key. MEO satellites are not in a stationary orbit, and instead rely on antennas to handover the connection between the satellites as they speed around the Earth faster than it rotates. Therefore SES is working with service and technology providers to co-develop a dual-constellation antenna system that will ultimately bring game-changing GEO-MEO coverage to aero. The high-throughput MEO capacity delivers up to 16Gbps of throughput per beam at a low latency of less than 150 milliseconds.

MEO bandwidth will complement and augment SES’s high-powered GEO fleet, including the innovative SES-17 Ka-band HTS satellite designed specifically to serve the ever-changing inflight connectivity market. Thales will launch its FlytLIVE IFC service across the Americas region aboard the new-age spacecraft, opting to have SES fully manage its IFC network to optimize bandwidth efficiencies along travel routes throughout the travel day. Set for launch in 2020, SES-17 will be interoperable with MEO satellites, which have steerable beams capable of delivering ultra-high-speed connectivity exactly when and where it is needed on specific routes and planes.

SES-15, the first of series of three GEO hybrid satellites, is set to launch first and will begin the SES transformation of commercial and business aviation fuelled by its powerful GEO-MEO HTS combination. This differentiated network will continue to grow and enable passengers to enjoy improved access to a new level of inflight connectivity services, such as streaming and cloud storage.
UBIQUITOUS COVERAGE — THE SES STANDARD

SES has more than 60 satellites in orbit and is committed to blanketing the globe in ubiquitous high-powered, scalable coverage. It is a band-agnostic strategy aimed at providing a terrestrial-like service capable of facilitating connectivity anywhere.

In the near future, service providers and airlines can focus on inflight services without a thought or concern about Ku, Ka or HTS. The passenger is easily connected to the same types of secure entertainment and communications services they use on the ground. The cockpit is linked to the latest flightpath weather reports, airport updates, and airline communiques. The airline can create its own differentiated brand of inflight connectivity to serve its passengers, crew and operations teams across the globe.

SES is enabling a global wave of connected aircraft, expected to grow from the 5,300 flying in 2015 to more than 23,000 by 2025.

Demand for more inflight connectivity per plane is soaring. To meet these needs SES is intensely involved in the development of the new technologies that will support them. In orbit this means a new breed of electric, software-defined satellites that can be built in far less time and deliver far more programmable flexibility in space to meet even the unforeseen inflight connectivity demands for decades to come. On the ground it translates to SES working with developers to create aero terminal systems that leverage the multi-layered SES fleet and allow airlines to move beyond discussions of which frequency band is right for them.

SES is enabling a global wave of connected aircraft, expected to grow from the 5,300 flying in 2015 to more than 23,000 by 2025. Airlines in Latin America, Europe, the Middle East and North America are connecting aircraft at staggering rates. While 80% of the world’s connected aircraft are flying over North America today, the largest growth is expected to come from Latin America over the next eight to ten years. Latin America had just 44 connected airplanes in 2015, and more than 1500 are projected to be operational across the region by 2025.

SES’s flexible, adaptable satellite systems built on collaborative work and innovative platforms are accelerating the future of inflight connectivity across the globe.