Inflight connectivity

A guide to conducting business at altitude

gogo® BUSINESS AVIATION

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Why we connect

Rooted in a market need

As air travel has been normalized over the decades, the purpose of flying has evolved. Today, unlike earlier passengers who were amazed to be among the clouds, thousands of people fly cross-country each day with no more than a passing glance out their window. Many of these travelers are doing business on private aircraft, and their work responsibilities don't let up because they're 35,000 feet in the air.

Gogo Business Aviation and other connectivity pioneers exist because of a powerful market need: instant digital connection as a conduit for data and ideas. This is a new paradigm for business leaders in many sectors, but the adjustment doesn't have to be difficult. Choose the right technology and partners, and it can drive important business outcomes.

In the pages that follow, you'll learn about technologies and market forces that have shaped aviation connectivity. You'll be able to speak more fluently about the benefits this connectivity affords, and you might even have a better idea of your priorities and preferences when it comes to making procurement decisions.

This is a fascinating field, and the future, we're happy to say, promises even better connected skies.

"A lot has changed since I started flying in the 1980s. Today, people expect to be connected even at 35,000 feet going 500 mph. Anymore, connectivity is almost as important as a pilot and propulsion, it's must-have technology."

TODD DUNCAN, CHAIRMAN, DUNCAN AVIATION

THE VALUE PROP OF CONNECTIVITY

You know it already: Today's business travelers must connect in the air because their jobs won't wait. Gazing out at the horizon isn't a luxury most of us have while flying; instead, we need to stay focused on the tasks at hand. Connectivity enables us to complete those tasks.

There are plenty of ways to provide this connectivity, and we'll go into more detail in subsequent chapters. But from a practical standpoint, connectivity technology must meet a few basic requirements. It must:

- Provide good download speeds.
- Accommodate the same apps and tools you use in the office.
- Be durable and dependable wherever your flight path takes you – and on whatever type of aircraft you're using.
- Help you improve your bottom line.

For the last 25 years, advancements in systems and usage models have met these needs with increasing effectiveness.

A YEAR IN GOGO BUSINESS CONNECTIVITY

730,000
unique devices connected

7.2
device connections per flight

618M
miles flown while connected

2/3
of passengers said they were more productive in flight than at the office

CONNECTIVITY: A TECHNOLOGICAL HISTORY

Inflight connectivity first took root in commercial air travel and evolved to fit the needs of business travelers. In the 1980s, passengers were thrilled to listen to real-time cockpit radio transmissions, garbled as they were; early moving maps on television screens gave people a sense of place in the vastness of the sky.

These inflight communications technically were the result of connectivity; they relied on data pushed from the ground to the aircraft – but they weren't interactive, and they didn't give passengers any real-time functionality.

By the time Gogo was created in 1991 – originally called AirCell – the future of connectivity was becoming visible. The far-fetched goal of equalizing business productivity in the air with what travelers experienced on the ground didn't seem so far-fetched after all.

A HISTORY OF CONNECTION

1973
Twelve military officers at the Pentagon discuss the Defense Navigation Satellite System (DNSS), the synthesis from which GPS is born.

1989
Apple, Zenith Data Systems, Compaq, and IBM release their versions of the laptop.

1997
FCC authorizes Aircell's first-generation analog cellular network for aviation.

2001
Apple releases the iPod, a portable media player for music, eventually supporting photos, video, and more.

2005
Aircell Axxess, aviation's first all-digital multichannel communications system, is introduced.

2006
Aircell is granted exclusive air-to-ground broadband frequency license in a historic FCC auction.

WE'VE COME A LONG WAY

Today, connectivity is meeting our evolving business needs:

MOVE AT THE SPEED OF BUSINESS

The markets won't wait for your flight to land. Neither will your competitors.

KEEP UP WITH YOUR TEAM (AND KEEP THEM UP TO DATE)

If you're a leader, your team relies on you to remain productive and address issues as they arise.

TAP INTO THE LATEST INTELLIGENCE

If you own and pilot your own aircraft, a connected cockpit increases efficiency and safety.

INCREASE THE VALUE OF YOUR ASSETS

Connectivity technology increases the resale value of aircraft. If you're a charter, it makes you a more desirable choice.

CONNECT WITH FAMILY AND UNWIND

We all know that connectivity isn't just for business. Sometimes you need to hear from your kiddos or your partner – or keep up with your friends via social media.

2007
The iPhone revolutionizes smartphone capabilities and is named the invention of the year.

2008
Gogo launches the first air-to-ground connectivity network.

2010
Apple announces a 2010 release date for the iPad.

2013
Gogo Text & Talk service enables the use of personal smartphones in flight.

2015
Gogo Vision introduces a new era of inflight entertainment.

2016
Gogo and Weather Services International join forces to crowdsource turbulence data for better awareness and smoother flights.

2017 and beyond...
Gogo announces high-performance services: Gogo Biz 4G, Next Gen, and Gogo 2Ku.

02

Inflight connectivity: the basics

A feat of engineering

For business travelers, inflight connectivity used to be a bonus. Now it's obligatory.

On average, we carry around two or three connected devices at any given time, and we check them reflexively. Colleagues and business partners expect us to be accessible no matter where work takes us – often instantly. Sometimes, even a 30-second hiccup in service is enough to create anxiety.

The fact that technology has met these business needs is remarkable. Behind the scenes, inflight connectivity requires impressive feats of engineering and planning – things that go unnoticed by most business travelers simply because they work so well.

This isn't your average cell service, after all. When the devices you're connecting are moving near the speed of sound at an altitude of 35,000 feet, they require a whole new connectivity paradigm.

MOVING TARGETS

One of the most basic differences between ground connectivity and inflight connectivity is motion. Airplanes don't stand still. Instead, they dart through airspace at hundreds of miles per hour, requiring the data link to adjust quickly in real time. At home, your coax cable doesn't have to go anywhere; even if you're texting in the car, the speeds and distances involved are modest compared to those in the sky.

But in the air, a signal has to connect with an aircraft thousands of times an hour and navigate rapid shifts in orientation, speed, and direction – all while ensuring an "always-on" experience for pilots and passengers.

Distance and latency are two of the factors that impact these connections the most. The vast distances involved in air travel can weaken connections and demand switching between many ground stations or satellites; latency, often caused by making such a switch, can cause service gaps.

Fortunately, today's inflight systems are extraordinarily efficient and make all of this nearly invisible to end users.

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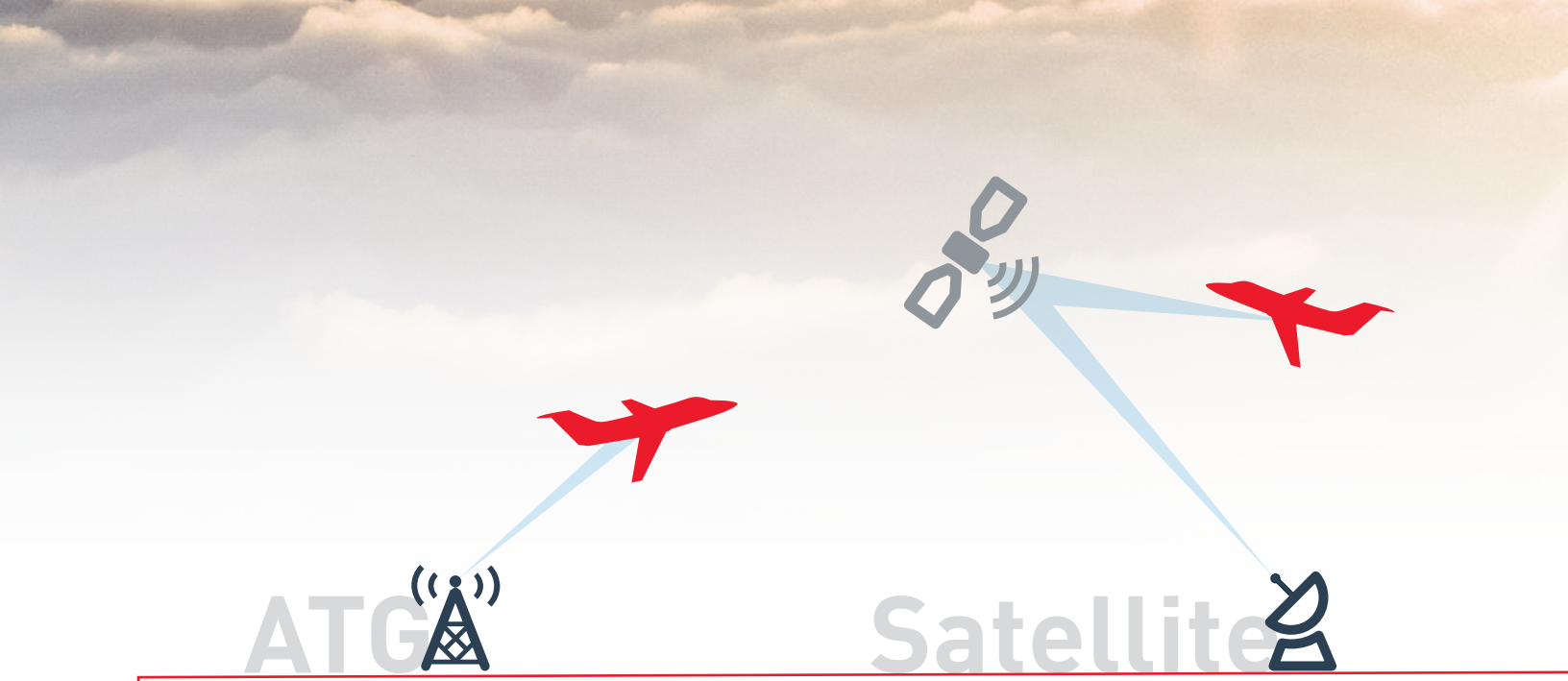


AIR-TO-GROUND VERSUS SATELLITE

How have Gogo and other companies succeeded at connecting business travelers in the air? They've used available resources exceptionally well. Two of the most important of these resources are air-to-ground (ATG) and satellite technologies.

ATG isn't much different than your cellular connection. An aircraft communicates with a ground station, ideally within a target range and line-of-sight bearing. With ATG, the ground station antennas serve aircraft that pass through their airspace, similar to the way your cell phone connects while you're in a moving car.

Satellites are different, and there are additional steps involved in getting, say, an email to outer space and back:

- Your airborne transmitter translates your conventional binary data into radio waves for transmission to the satellite.
- The satellite receives and routes the radio transmission, along with countless packets of data from other sources, back to ground stations. Communication satellites often have geosynchronous orbits (they stay above the same patch of ground), but aircraft can still transfer between several satellites as they move along their flight path.
- A receiving ground station converts the radio waves back into usable binary data, and transmits that to your aircraft.

Importantly, once a satellite is in orbit, it's untouchable. This is one of the limiting factors of satellite communication: You can't just reach up there and upgrade the hardware. So ground- or air-based communication devices have to be configured to optimize available satellite resources until something else makes its way into orbit.

SPEED VERSUS CAPACITY: A METAPHOR

Speed is an intuitive measure of a connection's quality – but it's not the whole story. The better measure is capacity. Consider this in plumbing terms: A small pipe and a big one can have the same throughput speed, but the larger pipe is going to transmit more material (or data). "Bandwidth" describes capacity, and a larger bandwidth means you can send more information at a given transfer speed.

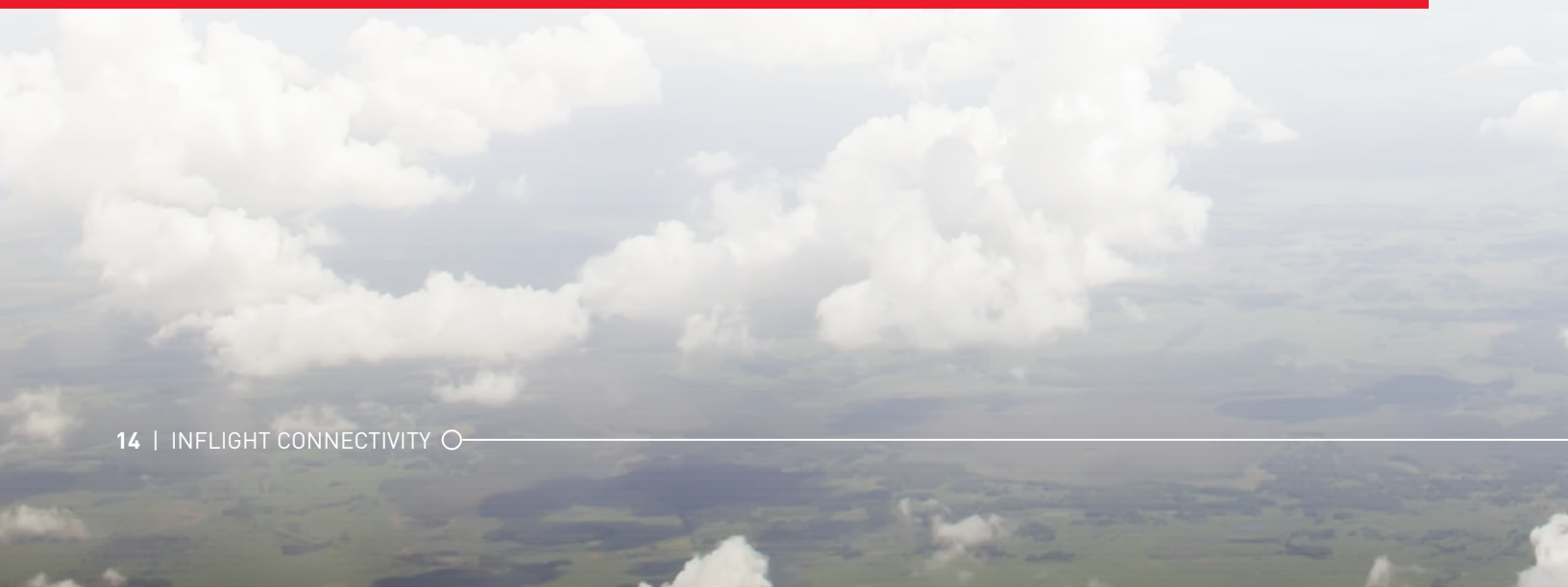
Except there are two pipes

There are actually two "pipes" at work on your aircraft – one for the incoming data stream and one for the exiting stream. Inflight connectivity systems keep these data streams separate to ensure that both can function regardless of the other's load. Outbound streams are usually smaller, since people are impacted more by how fast they receive data than by how fast it gets sent away.

A NOTE ON EFFICIENCY AND OPTIMIZATION

One of the easiest ways to compromise your connection is to leave a bunch of your devices on while you're working on something else. Even though those devices might not appear active to you, they're still sending and receiving information without your input. And that uses up both your inbound and outbound data capacity. Protect those pipes.

More information about efficiency and optimizing your system appears in chapter 3.



NOT ALL STREAMING IS EQUAL

The files we stream vary widely in size. One way to express this is by the minimum connection speed required to stream each type.

For example, according to the FCC, the connection speed needed for a phone call over VoIP is less than 0.5 Mbps; an HD video requires 4.0 Mbps.

Users can unknowingly exceed their data limits by treating each file type as if it uses the same system resources. By remembering what kind of data you're asking your system to handle – and the scale of its consumption – you can avoid such surprises.

SPEED REQUIREMENTS FOR COMMON TASKS

THE HARDWARE

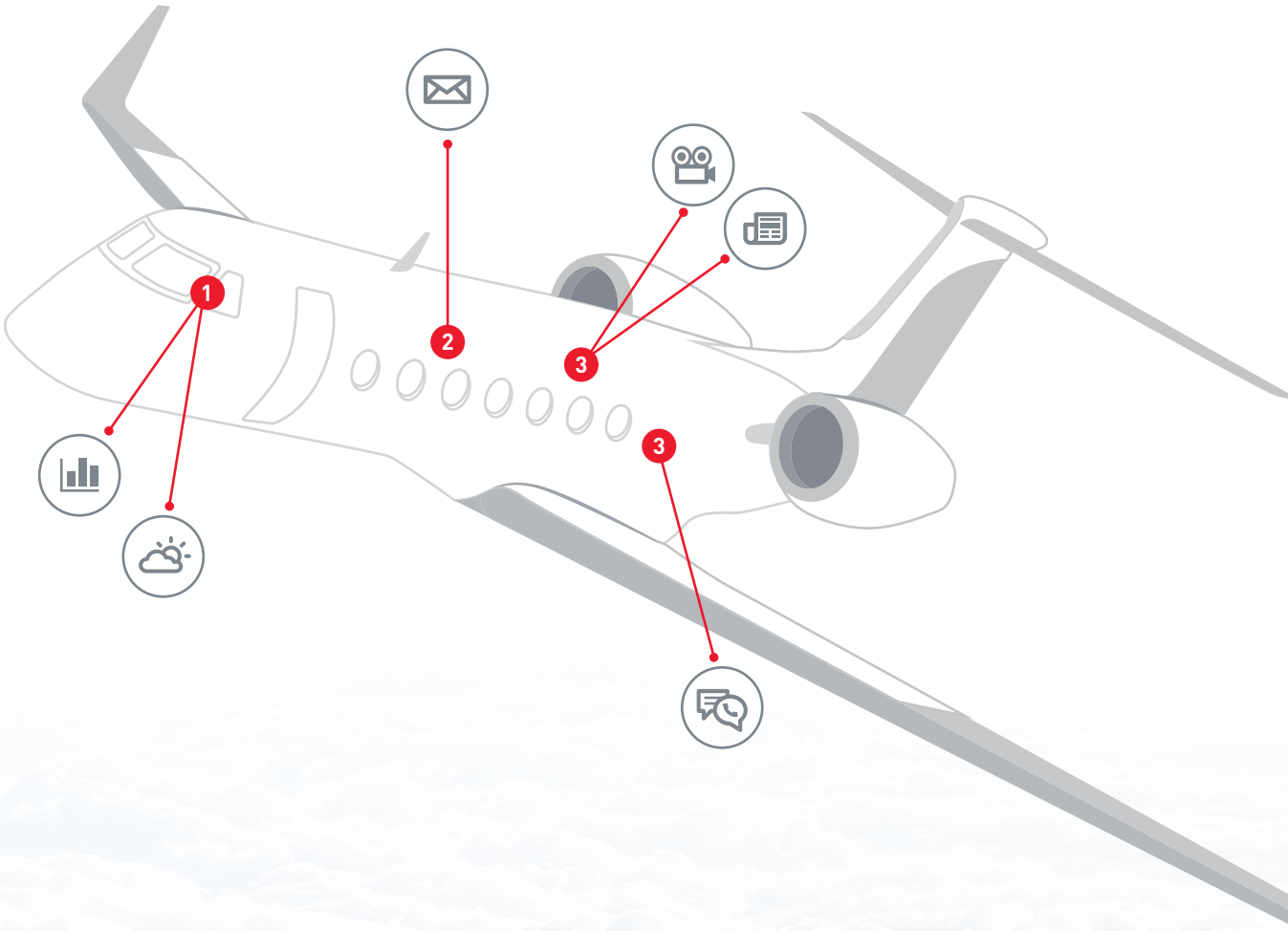
Fortunately, the hardware involved in inflight connectivity is minimal – you might even say elegantly so. Aside from the obligatory box (which resembles the modem/router boxes you have at home), most connectivity solutions will include aerodynamic antennas that attach to the fuselage.

Here's a sample setup – this is the Gogo AVANCE L5, an ATG system that accommodates multi-network management, streaming of video and audio, email, text and talk, and high-speed Internet. Gogo AVANCE represents a shift in how new functionality is delivered. It's a core platform that allows for easy upgrades to service plans, features, and capabilities as time goes on.

- **Gogo AVANCE L5**
- **Type:** Air-to-ground for domestic networks
- **Dimensions:** 13 x 6 x 8 inches
- **LRU weight:** 18 lbs.
- **Antennas:** 2

THE CONNECTED ECOSYSTEM

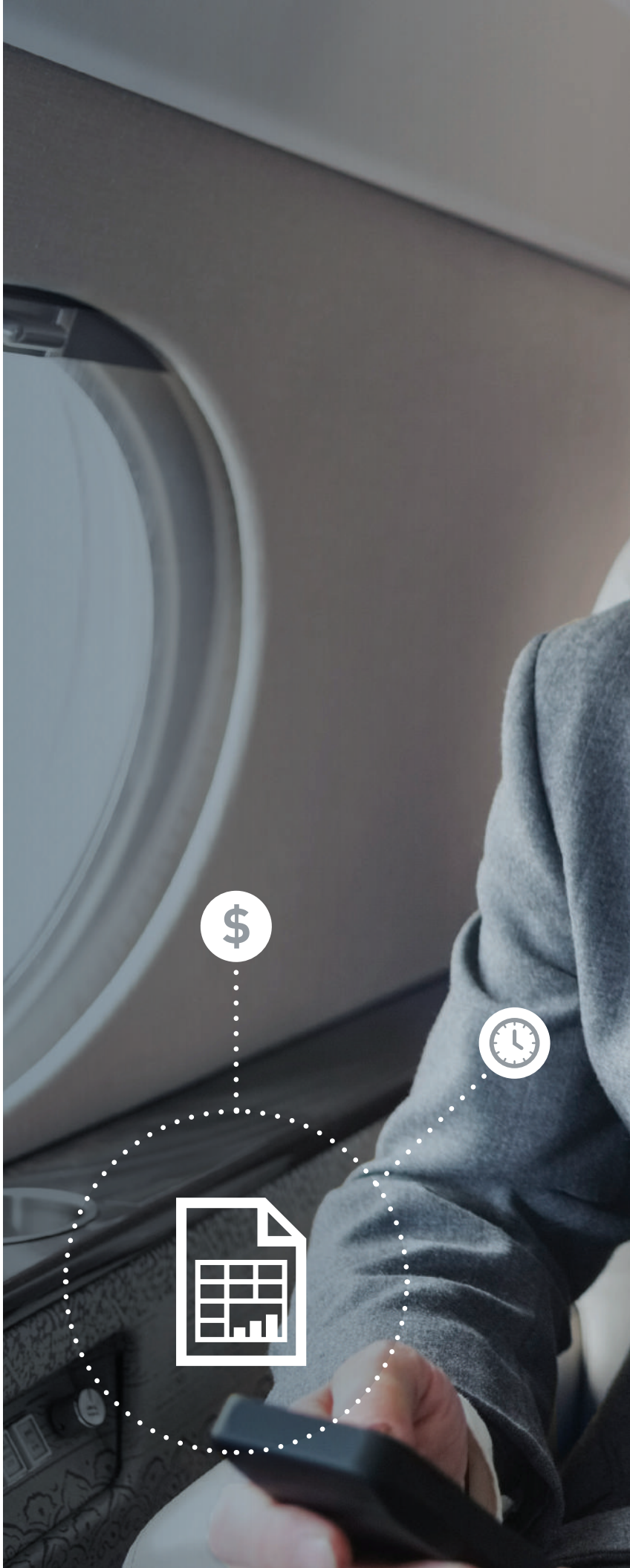
Regardless of your plane's purpose and specifications, today's connectivity products are durable and serve the whole plane. By allocating available resources well, 1) pilots can get up-to-date intelligence pushed to the cockpit via their favorite flight apps; 2) you get your email and attachments at your workstation; 3) and your other passengers or family get the connectivity they need.



For more information, visit **business.gogoair.com/solutions**

03

Connectivity in practice



When the stakes are sky-high

As consumers of inflight connectivity, business travelers are primarily concerned with one thing: productivity. Million-dollar contracts are routinely sent, received, and signed at 35,000 feet – often, business simply won't adjust to your flight plan.

As a result, the connection you have while you're in flight had better perform regardless of where you fly. No executive or manager wants to experience four hours of dead air, only to find that a competitor made a move while they were airborne.

Here's how to optimize your system and control your life in the air.

BECOMING A GOOD USER

A few key ideas can help users get the most from their connection. For example, as we discussed in an earlier section, understanding bandwidth is a little trickier – and more consequential – than it might seem.

HOW TO MAXIMIZE BANDWIDTH

- Limit the number of devices that are active at any given time. Remember that even "inactive" devices consume small amounts of bandwidth. Power them down when you can, and disable automatic updates while you're in the air.
- Suspend cloud services (iCloud, Google Drive, etc.). Sync them once you've landed.
- Be aware of what data types you're consuming. For example, watching a video will consume exponentially larger volumes of bandwidth than downloading an Excel sheet. And content within apps – like that autoplaying Facebook video – can stealthily rob you of bandwidth.

BEARING THE LOAD

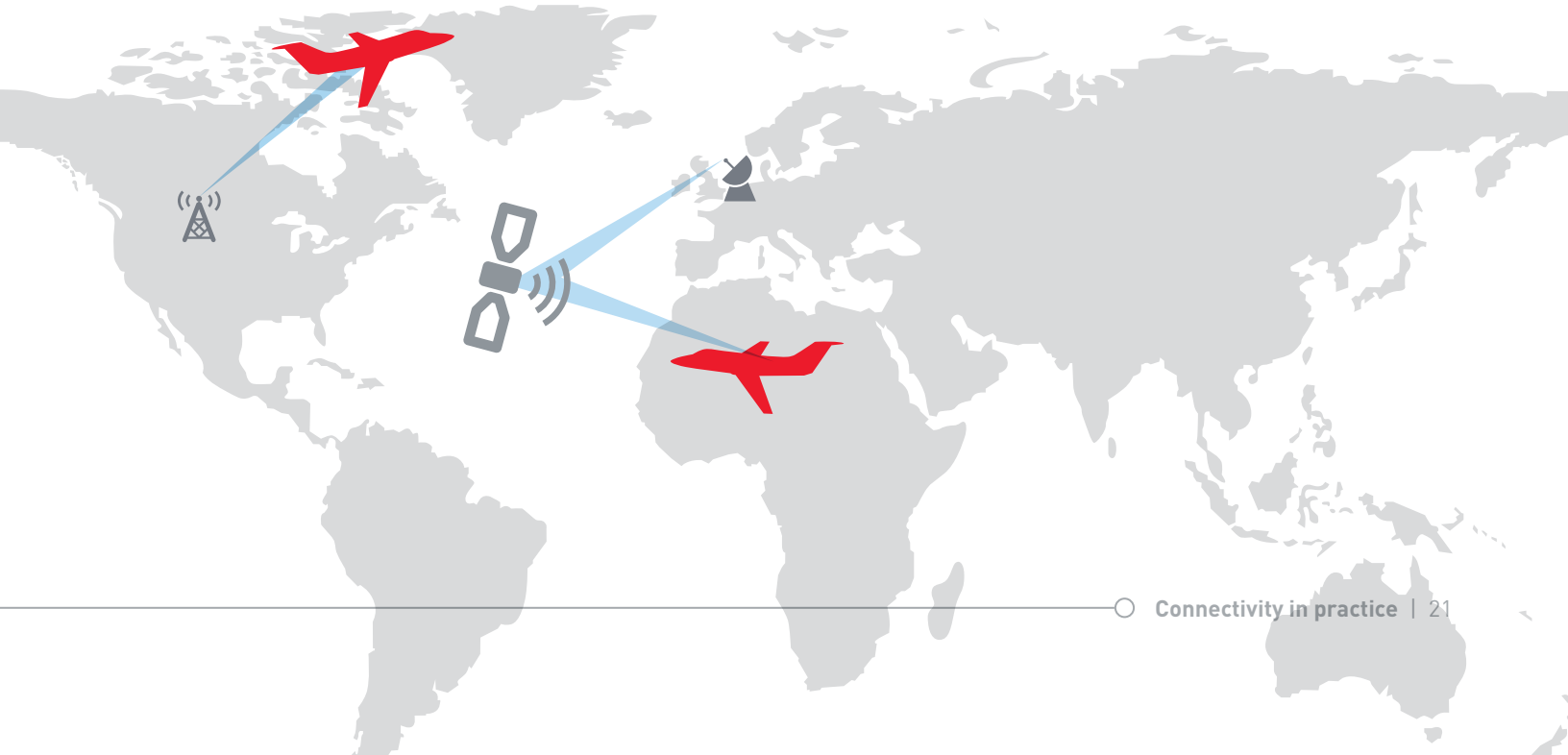
The connection quality you experience is only partly dependent on your usage habits. The other factor, of course, is infrastructure.

With air-to-ground (ATG) connections, latency increases with the distance between your plane and its nearest ground station, as well as the frequent changeovers made from one ground station to the next as your plane moves along its path. For satellite users, latency is influenced by the distance data has to travel to outer space and back, and the need to convert the data from binary digits to radio waves along the way.

Which connection type applies where?
If you're flying over the continental United States – Gogo's network also includes large portions of Canada and Alaska – you're probably using ATG. If you're crossing the Mexican border or flying over oceans and beyond, you're probably looking to the stars.

What does this mean for consumers?
It means that the purchase decision isn't just about bandwidth or promises of speed – it has to also be about the nuts and bolts of network infrastructure.

Gogo has worked behind the scenes for years to secure the most robust ATG and satellite network configurations available in the industry. This is a laborious process fraught with regulatory complexity, and it doesn't necessarily make it into the sales brochure. But it affects the outcomes buyers experience in the long run.



SOLVING VIDEO

The most affordable and dependable way to enjoy video in flight is to download what you want to watch while you're on the ground and store it on a server on the plane. Gogo Vision, Gogo's inflight entertainment and information solution, automatically connects the cockpit and cabin with ground facilities within a hangar or at a fixed-base operator (FBO), downloading the newest content. Once you're in flight, watching the latest Hollywood release doesn't require an ATG connection.

This is both practical and financially smart. Even when streaming video midair is technically feasible, the cost can sneak up on you because video files are so huge.

To learn more, visit business.gogoair.com/products-services/gogo-vision.

LONG-TERM INVESTMENTS

Adding a connectivity solution to your aircraft is an important decision with long-term impact. Here's how Gogo is planning for the future:

4G We're currently introducing Gogo AVANCE on Gogo Biz 4G, as well as other solutions for all aircraft sizes and mission profiles (light-jet users, take note). These platforms are designed to be easy upgrades for existing customers, and a future-proof platform for new ones.

An upgrade to Gogo AVANCE puts you on a path of natural progression to even better technology – the platform can grow as new technology becomes available.

No customer who upgrades will be left in the lurch when future products come out. In the case of Gogo AVANCE, for example, you'll simply make an expansion, not a full replacement.

We have two decades of experience with network management and support services to draw from, and we're constantly looking ahead. While technologies can evolve by leaps and bounds, our newest solutions are all supported by our proven network and support services, which are continually optimized. Customers routinely tell us how important stable infrastructure and personal, honest-to-goodness support are to them.

CONCLUSION: BE A SMART CONSUMER

We've described some of the nuances of inflight connectivity, but we're pretty sure what you care about most is your ability to live your life and conduct business – uninterrupted and undeterred even when you're flying. Today's systems are advancing rapidly, but your most basic need for connection remains constant.

So when it comes time to buy, think about the whole picture. All of these elements impact connectivity in practice:

- **Building good habits:** As the user, you have control – what can you do to tailor and optimize your experience?
- **Support:** Is help readily available? Is there a real person waiting to give you a hand when you need it?
- **Upgrades:** Are you positioned to leverage future upgrades without a complete re-install? Are you buying in to a one-trick pony or a proven provider that can handle growth and change?

04

Connectivity in business

Who needs connectivity?

The users of inflight connectivity are as diverse as the industries they represent. What matters to a pilot or an owner/operator might not matter to a charter president, a software engineer who takes hops on the company fleet, or the granddaughter of the company owner.

Here, we'll provide some context about who uses these solutions – and along the way, you'll see the value of the solutions we provide. The customer types and experiences referenced here are not exhaustive, but they give a cross-section of the needs and concerns that can drive adoption of inflight connectivity.

AVIONICS AND FLIGHT DEPARTMENTS

For large businesses and enterprises, an avionics or flight department serves as the hub of flight operations. Not only are these departments responsible for keeping the aircraft in safe, working condition, but they are also responsible for providing the services that passengers desire – "keeping the back of the plane satisfied." This includes making sure Wi-Fi is installed and operational for the duration of a given flight.

Interestingly, these departments' priorities have evolved. According to Brian Wilson, director of key accounts at Gogo Business Aviation, a decade ago business leaders were often interested in taking a break while in flight – recharging in preparation for what was to come – and they found inflight connectivity to be either superfluous or icing on the cake.

But today, there are no such breaks. Business leaders are fiercely committed to staying connected at every step of their journey. Avionics and flight departments are the ones in charge of making that happen. And when businesses ground airplanes just because the connectivity isn't working, the stakes couldn't be higher.

CHARTERS

In the past, charter companies could tout inflight connectivity as a luxury. Today, it's almost as necessary as a pilot and propulsion.

Increasingly, charters are faltering in the marketplace unless they can provide fleet-wide inflight connectivity for anyone who might engage their services. Even casual business travelers presume connectivity, so charters that don't provide it across their fleet are undesirable. "They have inflight Wi-Fi – check them out" has become "They don't have connectivity – steer clear."

Today, the evolution of charter connectivity has entered what you might call its second generation: Now that most charters have connected their fleets, the top players are upgrading to create another layer of differentiation. The technological leapfrogging will continue.

"Our company provides great aircraft, professional pilots, and all around great service. These are the main things that keep our business viable. But, Wi-Fi is something that customers want and another reason why they choose TMC."

SCOTT WISE, CEO, TRAVEL MANAGEMENT COMPANY (TMC) JETS

PILOTS

To a typical pilot, whether they own the plane or not, money management is always a priority. These are the users who understand the value of connectivity but must fit it within a more constrained budget environment if they want to stay in the air.

Pilots also bring different needs, including real-time cockpit intelligence. To them, connectivity isn't necessarily about pleasure or even conducting business – it's about safety. And when up-to-the-minute weather intelligence can be the difference between flying and being grounded, pilots rely on constant uptime and dependable networks.

Fortunately, there is a menu of aviation apps supported by Gogo, and these can provide indispensable intelligence for navigation, logging, briefings, and flight-plan filing. Providers include Garmin, ForeFlight, FlightAware, Honeywell, and other industry leaders that improve the flight experience with every software update.

MANAGEMENT COMPANIES AND DEALERS

Management companies and dealers are partners to both the connectivity provider, like Gogo, and the end user. They sell, install, and maintain connectivity services on customers' aircraft – and they're expected to be frontline experts.

These men and women need to keep up with the latest developments in connectivity technology and services. They are also at the mercy of the economy, since they rely on customers being willing to spend capital and providers being able to meet customers' demands. Because of this, they provide an important reminder to any connectivity stakeholder: These technologies and services exist not for the gadgetry and frills, but because they make business sense.

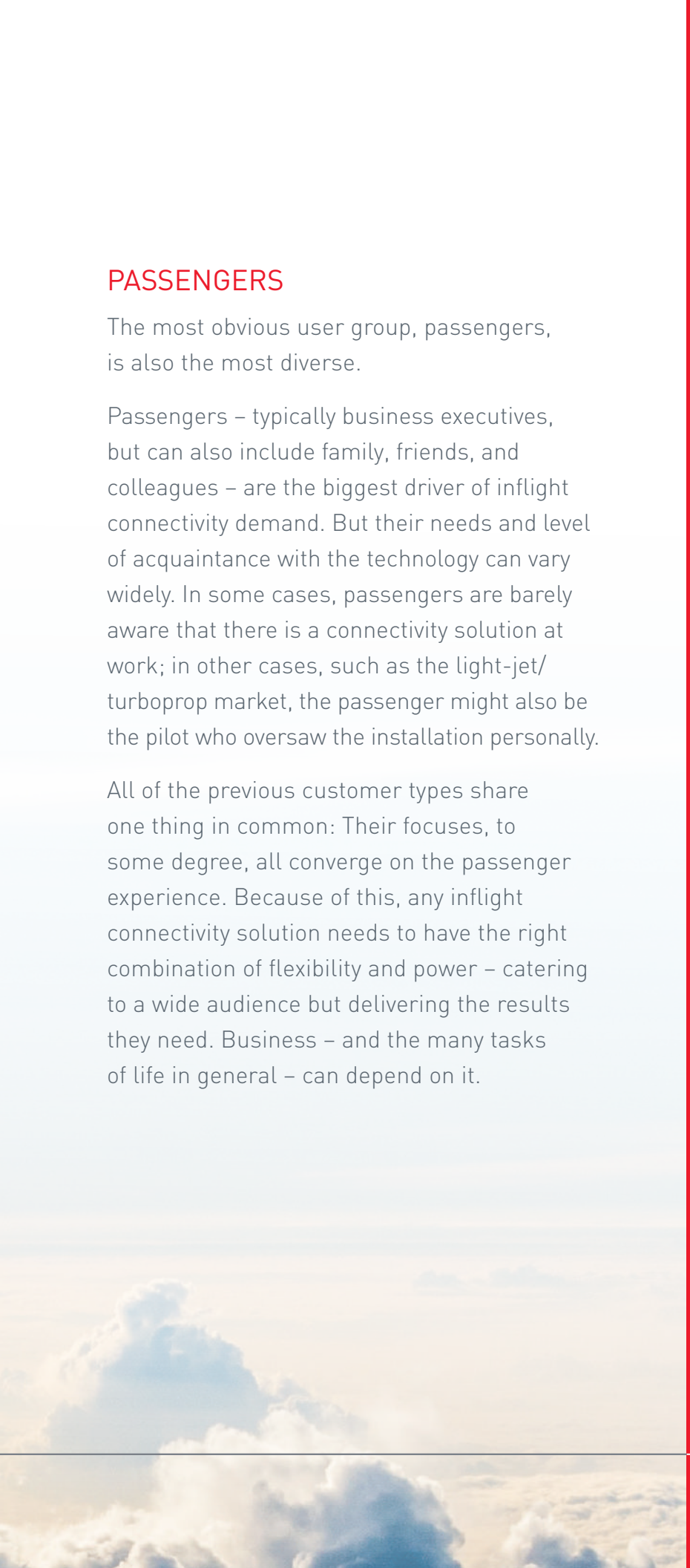
Any inflight connectivity solution needs to have the right combination of flexibility and power – catering to a wide audience but delivering the results they need. Business – and the many tasks of life in general – can depend on it.

PASSENGERS

The most obvious user group, passengers, is also the most diverse.

Passengers – typically business executives, but can also include family, friends, and colleagues – are the biggest driver of inflight connectivity demand. But their needs and level of acquaintance with the technology can vary widely. In some cases, passengers are barely aware that there is a connectivity solution at work; in other cases, such as the light-jet/turboprop market, the passenger might also be the pilot who oversaw the installation personally.

All of the previous customer types share one thing in common: Their focuses, to some degree, all converge on the passenger experience. Because of this, any inflight connectivity solution needs to have the right combination of flexibility and power – catering to a wide audience but delivering the results they need. Business – and the many tasks of life in general – can depend on it.



WHO NEEDS CONNECTIVITY? EVERYONE.

Connectivity technology has become ubiquitous – first on the ground, and now in the air – because the need to stay connected applies to every area of our lives. It's a business need, but it's also a personal need; any executive will tell you that the line between business and life is easily blurred.

So whether we've described your circumstances or not, consider the myriad ways inflight connectivity can impact – and enrich – your sense of connection to what matters to you. You might discover more than you expected.

05

Differences between plane types

Know your plane, know your solution

Gogo can equip almost any business aircraft – from a Cessna to a Boeing 757 – with connectivity, but not all solutions fit all planes. Flying, after all, is a complicated contest of physics, where adding equipment and antennas forces us to address aerodynamics and gravity. Equipment and installation costs, and the expense of monthly plans, are also concerns.

That's why we market diverse solutions. We also provide the advice and background buyers need to help them make the best decisions.

Here's an overview of plane types and the different systems that can provide needed connectivity. We'll use Gogo equipment as examples, but these principles apply to many different connectivity options and services.

THE BIG FOUR

Four factors commonly affect connectivity choices across plane types:

1. Physical/structural considerations
2. Device count
3. Service costs
4. Mission type

Keep these in mind when you're considering connectivity options, and you'll be more likely to find the right combination of functionality and cost effectiveness.

01

PHYSICAL/STRUCTURAL CONSIDERATIONS

Particularly among smaller aircraft, internal fuselage space can be at a premium, which means the connectivity solutions for these planes are likely to resemble the cable equipment you might have at home: a smallish box coupled to one or two externally mounted antennas. This equipment provides more than enough functionality for many cases, particularly for light to midsize jets.

Interestingly, larger aircraft are also physically impacted by connectivity equipment, even though their mass makes them more resistant to changes in weight and balance. Some high-end satellite equipment can weigh in at 300 lbs. – equivalent to two passengers – so planning is crucial for any aircraft.

02

DEVICE COUNT

Service plans commonly scale up in proportion to the number of allowed device connections. That's because, unsurprisingly, increasing the number of devices raises the cost of administering them. With this in mind, it makes little sense to buy a plan that allows for 24 connections if your aircraft only has five passenger seats.

Rightsizing your device count is also a way to self-throttle your data usage and avoid unforeseen costs.

For example, Gogo's ATG 1000 and ATG 2000 systems allow for up to five devices to connect simultaneously – more than enough for many aircraft and use cases. But this is not always the case for midsize and heavy aircraft, which typically have more passengers (and that's more devices) onboard. Gogo offers other solutions that accommodate more connected devices to ensure adequate service for those larger aircraft.

"Even for lighter aircraft, inflight connectivity provides a value you may not realize. Consider the cost of your time along with having access to external data to support your flight and flight operations. The value of staying connected to your teams, your family, your business may become obvious. With inflight Wi-Fi, you can stay accountable and responsible, even when you fly."

TRACY FORREST, CITATION JET 3+ PILOT/OWNER AND CITATION JET PILOTS (CJP) ASSOCIATION BOARD MEMBER

03
SERVICE COSTS

More connections and functionality equate to higher costs. For example, provisioning multinetwork management, as the Gogo AVANCE L5 does, is desirable to some customers but unnecessary for others. Internet that's equivalent to what you get at a coffee shop? That could be either obligatory or non-critical, depending on your situation.

We've found that most customers keep the same general use habits in the air that they have on the ground. Crave constant connection and frequent email refreshes? No problem. Need to send enormous attachments and stream video? There's a solution for that, too. In any situation, it's helpful to realistically assess your passenger and pilot needs.

04
MISSION TYPE

Does your plane fly outside North America, or are its routes domestic? How long does it fly, and how far? What types of passengers are on the flights (corporate executives, family members, engineers and technical staff)? How much do these factors vary flight to flight?

Your mission type tells you and your connectivity provider how a plane is used and what its typical needs are. Fortunately, this usually isn't difficult to assess. Given the availability of current infrastructure domestically (ATG) and globally (satellite), once you've defined your mission type you typically can determine your inflight network needs.

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STARTING SMALL

The owners and pilots of lighter aircraft often come up against predictable cost constraints, and it's worthwhile to explore how their cases can be unique.

Customers who fly lighter aircraft often have tighter budgets – they're especially concerned with affordability of the initial equipment and installation investment, as well as the long-term sustainability of monthly charges. Naturally, upfront costs and service plans are intertwined, and sometimes, enthusiasm over meeting the upfront costs can be tempered when the reality of monthly plans sets in.

That's part of why Gogo has developed tailored air-to-ground (ATG) systems. The ATG 1000, for instance, gives customers inflight Wi-Fi for the most common business tasks and smartphone use, as well as a simplified, flat hourly service rate.

LARGER AIRCRAFT. LONGER MISSIONS.

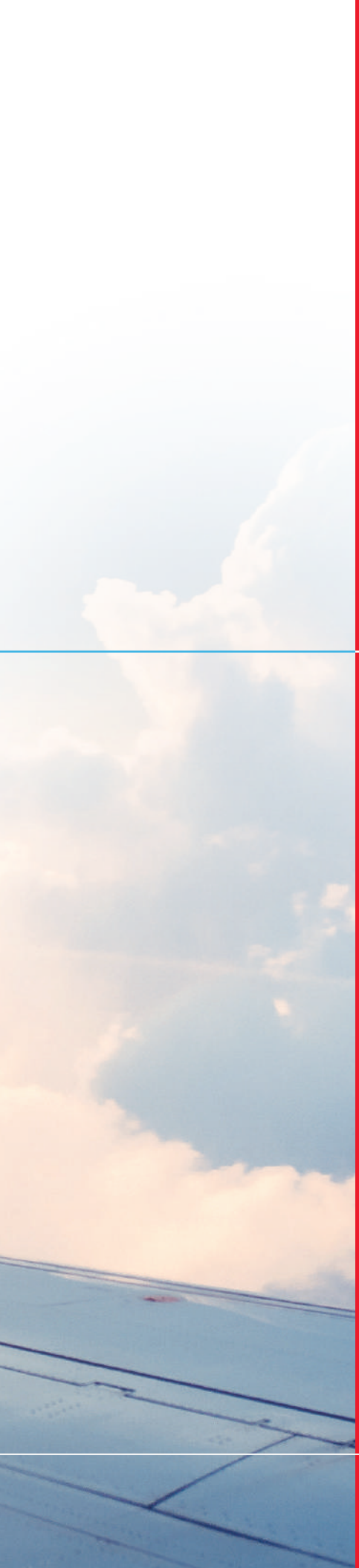
For the mid-heavy market, the equation changes a bit. It's mostly a difference of scale: Whereas an ATG 1000 customer flying a Learjet might never even reach the five-device limit, larger aircraft are going to require more connections and more powerful equipment.

International flight plans are no barrier to connectivity, but they require different equipment to leverage satellite connections. Many of the conversations with Gogo's mid-heavy jet customers involve satellite connections and a related suite of hardware and software.

WHAT ABOUT THE FAA?

Anyone in business aviation will know that it's a complicated regulatory environment, and manufacturing and installing connectivity equipment are not exceptions.

Matching your equipment to your plane type and service needs is the key to success. To do this, study up using resources like this one, and then enlist a partner you can trust. Not just someone who'll sell you a service, but someone with a proven track record who can ensure the service you choose won't cause compliance problems.



GET A DEPENDABLE PARTNER

Inflight connectivity solutions are only as complex as the use cases they serve. With the right partner – someone with industry know-how, the perspective to see changes coming, and a willingness to listen to your needs – connectivity can be demystified.

At that point, life won't have to stop between takeoff and landing – regardless of the plane you fly.

"Connectivity from the sky is not just about technology. You also need reliability, coast-to-coast coverage, and service and responsiveness from your provider. It's not just a question of functionality, but also dependability, support, and relationships."

TODD DUNCAN, CHAIRMAN, DUNCAN AVIATION

06

Understanding and controlling cost

Creating a sustainable plan

The primary considerations for inflight connectivity aren't just technical – any procurement must also be financially sustainable. Fortunately, there are several connectivity options to meet virtually any budget. And while there are many options available, the choice doesn't have to be daunting.

The following practices and guidelines will help you navigate the inflight connectivity acquisition process and fly away with a solution that is both useful and financially sensible. The following pages might even shed light on whether your current solution is the best available to you.

IT'S ABOUT BALANCE

Inflight connectivity customers have a menu of choices based on plane type, mission, domestic/international flight profiles, and budget. Any purchase decision involves judgment calls – balancing affordability and functionality, thinking ahead to future business needs, and signing on to a sustainable monthly plan.

There are two main cost-generating categories with inflight connectivity:

1. Hardware and installation
2. Ongoing monthly service plans

Each has been the savior – or downfall – of customers in this industry, so let's demystify them.

1. HARDWARE AND INITIAL SETUP

The range of hardware choices highlights the scalability of inflight connectivity solutions. On any plane, customers have choices when it comes to hardware and the scope of an install.

Among the systems that are fit for a given plane's weight, space, and technical profile, the most affordable are also typically the most limited. Similarly, basic setups often entail fewer installation hours, cutting labor costs substantially. When evaluating your choices for inflight connectivity, it helps to consider installation costs and consult an experienced installation facility.

1/3 of equipment costs could be attributed to labor

2. ONGOING MONTHLY PLANS

Much like a cell phone service plan, service plans for inflight connectivity are flexible according to customers' usage and need for month-to-month predictability. Each has its advantages, but companies eventually find that they're best suited to one or another.

PAY AS YOU GO

On the more affordable end of the spectrum are pay-as-you-go plans, which entail no fixed costs and appeal to customers who like to "pay for what they actually use." However, these plans can be less predictable than others, and their per-MB rates often are higher than the intermediate plans described at right.

UNLIMITED

These plans appeal to customers who either consume masses of data each month or have the financial resources to pay higher monthly fees to ensure that their passenger and crew requirements are met. Note that some satellite services, by their technical nature, can't support unlimited data – so check with your connectivity partner.

INTERMEDIATE PLANS

These plans are desirable to many customers because they can be tailored: A user can opt for a base data allowance that matches their typical needs – say 2,500 MB – and then pay overage charges beyond it. These overage charges are cheaper than a pay-as-you-go rate, and they typically decrease as the size of the base allowance increases.

Alongside these data plans are voice rates, infotainment options, and other cost categories, depending on your system capabilities.

UNDERSTAND. ESTIMATE. MONITOR.

Connectivity companies will provide a dashboard or other reporting tools for you to manage and monitor your data use – and just like your cell phone bill, they can provide alerts at certain usage thresholds. People usually have roughly the same device behavior in the air as they do on the ground, assuming they have connectivity equipment to support it. As you use the system during flight, you'll learn what your typical needs are and can adjust accordingly.

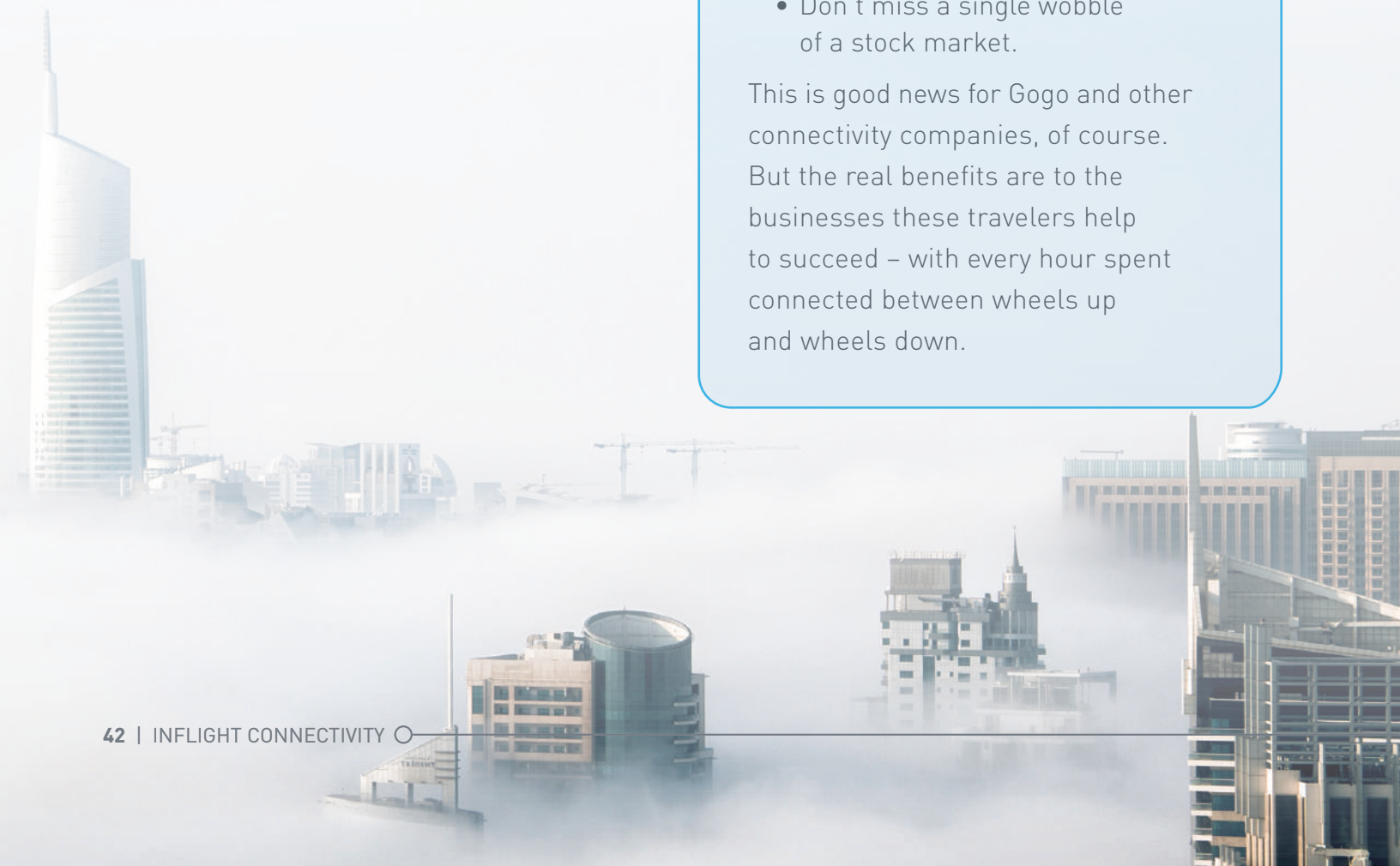
NO CHAMPAGNE, PLEASE

Inflight connectivity has become so prized in the business market that travelers' tastes are changing,

Not long ago, business travelers, particularly executives, placed a premium on relaxing and enjoying the finest flight experience possible. Today, however, their priorities are much more tactical:

- Stay plugged into the business.
- Stay engaged with staff on the ground.
- Don't miss a single wobble of a stock market.

This is good news for Gogo and other connectivity companies, of course. But the real benefits are to the businesses these travelers help to succeed – with every hour spent connected between wheels up and wheels down.



TO REPEAT OURSELVES

If you've read our earlier discussions of bandwidth and speed, you'll know what's coming:

To keep the price right, it's important not just to pick the right system, but to also learn how to use it well.

In other words, turn off idle devices, since they suck away bandwidth (and incur more usage costs, depending on your plan) even when you think they're inactive. And avoid downloading or streaming gobs of data in flight if you're equipped with something like Gogo Vision inflight entertainment. This service allows you to download large TV/movie/news/weather files while you're in the hangar and stream them from your airborne server later, without incurring streaming charges.

Every connectivity plan will present opportunities for optimization and smart usage, so it's best to get trained on them.

07

The future of connectivity

The future of connectivity

BUSINESS NEEDS CONTINUE TO PROPEL INNOVATION

As recently as a couple years ago, inflight connectivity was considered an extra – something nice, but not required. Today, nobody in the marketplace argues such a thing. Connectivity has become so obligatory that organizations that hesitated as few as three years ago are suffering in the marketplace.

Inflight connectivity continues to evolve, expanding the realm of what's possible and expected in the air. We'll soon see inflight connectivity match the speed and ease we experience from our ground-based connections. We'll also see new platforms that will improve access, dependability, and usability.

Here's a breakdown of some of the changes coming soon to hardware, software, and networks – as well as a few things that won't be changing at all.

FLYING WITH (OR WITHOUT) A LICENSE

The 2.4 GHz radio frequency has been ubiquitous for years – if you have a baby monitor or radio-controlled plane, they probably have "2.4 GHz" stickers on them. But this label isn't a measure of a device's power. It's a simple radio frequency closely related to the frequency of your microwave oven.

2.4 GHz is popular because it's unlicensed – anyone can operate their devices on it. Years ago, it was designated an industrial, scientific, and medical radio band because regulatory bodies wanted to spur innovation and the development of new technologies. And it worked.

Gogo leverages both licensed and unlicensed frequencies, including 2.4 GHz, to provide a wide serviceable spectrum. Our existing technologies and developments on the way position us to deliver improved functionality and redundancy across this spectrum.

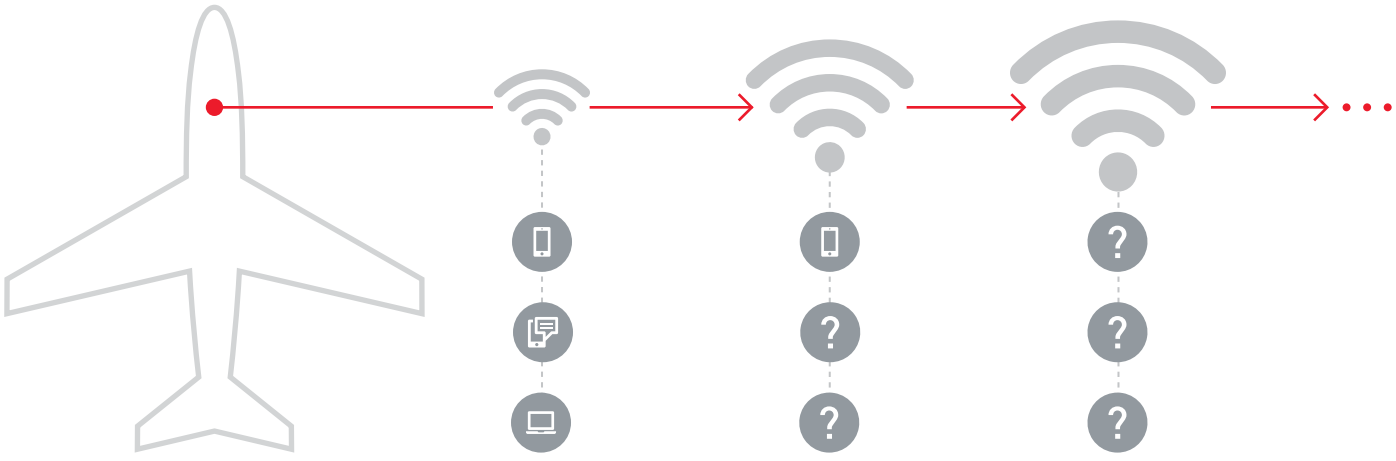
STEP ONTO THE PLATFORM

In any rapidly changing market, adaptability and scalability are crucial. Inflight connectivity is no different, and in the coming years, providers will have to refine their technology without it being too disruptive to consumers.

To address this need, Gogo recently created Gogo AVANCE, a versatile software platform where upgrades can be "bolted on" as they're developed. It's a little like your computer's operating system: When you need to make a change, you can install an update – or even a new application – without buying an entirely new operating system. Our friends in the defense sector do the same thing – when aerospace engineers developed the fifth-generation fighter jets now entering service, they designed them to accept software upgrades that haven't yet been imagined.

This new connectivity model reassures consumers because it means their equipment won't become obsolete any time soon (they won't have to replace any equipment at all). It's sensible for Gogo because it gives us a "home base" for our solutions – a familiar technical ecosystem to grow and develop.

DESIGNED FOR TOMORROW'S INVENTIONS



A MATTER OF DEGREE

For consumers, the most apparent changes coming to inflight connectivity will be in the scale of performance, not necessarily the types of equipment.

For example, Gogo AVANCE's capability on the company's 4G network improves bandwidth and throughput threefold. This impacts everyone involved with a flight – not just the passengers in the back and the pilot in the front, but also the mechanics and administrators on the ground. As the Internet of Things (IoT) has made its way to aviation, the amount of available intelligence has exploded. Today, for example, jet engines have thousands of embedded sensors that monitor performance while they're running. The intelligence they can provide in real time to the cockpit and the ground is astonishing.

With the increased speed, diminished latency, and near-100-percent uptime of today's connectivity solutions, aircraft are becoming some of the most important business enablers – by a degree unforeseen even five years ago.

"Passion is what drives each of our team members to deliver the best service to our customers. It is important, especially in aviation, to stay ahead of the available technology curve. Today, now more than ever, our customers want the same available communication capabilities in the air as they have in their home. Being connected in the air is becoming the norm."

STEPHEN MAIDEN, PRESIDENT, CONSTANT AVIATION

40,000

flights originate and terminate daily, in the U.S. alone, **generating 15 petabytes of data.**

IoT

sensors have already propagated in aviation. **(An A380 wing has 10,000 sensors, and jet engines have thousands.)**

+94M

inflight Internet sessions are enabled by Gogo, **on 3,000 equipped commercial aircraft and 7,000 business jets.**

~100%

uptime, increased speed, and diminished latency are **transforming aircraft to some of the most important business enablers.**

THINGS THAT WON'T CHANGE

THE EFFECTIVENESS OF YOUR SYSTEM IS ONLY PARTLY DEPENDENT ON TECHNOLOGY.

Customer support, trustworthy provider relationships, industry experts at your disposal, and dependable network infrastructure are at least as consequential as whiz-bang equipment and lofty promises.

YOU DESERVE A GOOD FIT.

Inflight connectivity is a sea of choices – equipment types, service plans, budgets, etc. – so continue to be assertive in finding a setup that works for you.

SCALABILITY IS KING.

Given the rate of change in inflight technology, any sustainable solution will be scalable and adaptable. Seek platforms that can accept "bolt-on" upgrades and grow over time – without a complete (costly) replacement.

INFLIGHT CONNECTIVITY ENRICHES YOUR LIFE.

The business functions are only part of it. Your connectivity solution should help you connect with what matters – your work, loved ones, and cherished pursuits.

CONNECTED WHEREVER YOU ARE

The most fundamental purpose of connectivity solutions is keeping you engaged with what really matters – all the time. The systems and mission profiles will vary, and the pressing business and personal needs to keep in touch will only continue to increase.

Gogo's approach, now and in the future, is to blend dependable infrastructure, leading-edge technologies, and partnerships built on trust. Our products will continue to evolve, of course, but our central commitment will not.

Happy connecting.

Fly smarter

Visit business.gogoair.com/solutions

gogo® BUSINESS AVIATION