

**WHITEPAPER**

# SELECTING SATCOM TRACKING SOLUTIONS FOR AIRCRAFT FLEETS

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## 1.0 TRACKING CONSIDERATIONS

Managing a fleet of aircraft requires a lot of data. Essential real-time data needed during fleet operations includes answers to the following questions:

- Where is each aircraft, at any moment in time?
- When will each aircraft accomplish its tasking?
- How is the aircraft doing while in operation?

For mission efficiency and aircraft safety, tracking is the starting point for everything else. Knowing the location of an aircraft from the time it powers up until it powers down becomes the basis for everything that will be done with and on behalf of that aircraft. This includes risk mitigation, weather assessment, crew duty hours, fuel management, and task assignments.

Every fleet operator, regardless of fleet size, can benefit from a dedicated tracking solution. For continuity of service, satellite-based (Satcom) solutions are ideal for aircraft fleets because the service can work from the tarmac to any altitude. When equipped with a satellite radio terminal, the location of the aircraft can be transmitted to and confidentially viewed by the fleet operation center.

There are many Satcom tracking products on the market. One of the first decisions a fleet manager will need to make is whether to choose an installed (certified) system or a portable (non-certified) device. This whitepaper will provide an overview of both options to enable the right decision.

### AS9100 Standards-Backed Quality

From program design, data validation and calibration through product manufacturing and installation, SKYTRAC's quality systems meet aerospace AS9100 standards. Our data management programs are further informed by standards set by the FAA, ICAO, EASA, ANAC, Transport Canada & CASA.

### Stability, Security & Global Reliability

At all stages in the communications and data storage chain, SKYTRAC solutions are backed by robust satellite and IT infrastructure. SKYTRAC products communicate encrypted data over Iridium's Low Earth Orbit (LEO) satellite network - the only commercial satellite network with pole-to-pole coverage and 99.9% availability. Data is stored in a secure cloud with all the firewalls, security infrastructure and redundancy you would encounter when accessing a private bank account. We operate two geographically remote data centers (separated by 4100 km/2547 miles), each with multiple Internet providers, environmental controls, and backup power sources.

### Expert, Dedicated Client Support

As a single source solution, SKYTRAC offers end-to-end customer support from a single point-of-contact. We assist at all stages of hardware integration, STC certification, and program design, setup and execution.

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## 2.0 SATELLITES: A BRIEF PRIMER

Let's start with a satellite primer. Where satellites are put into orbit determines what can be done with them.

Some satellites fly in a geosynchronous orbit (GEO) about 22,000 miles above the equator, which gives them a constant view of one part of the Earth. Currently, these are the satellites which provide high-speed (and expensive) internet for airliners and business jets. The service is limited to these kinds of aircraft because they are large enough to support the large antennas and powerful radios needed to talk to the satellites. Other types of satellites are in orbits that are much closer to Earth, flying in a range of about 350-1000 miles overhead. One of these low-earth orbit (LEO) systems is called Iridium®, with a constellation of 66 satellites circling the entire globe.

Because Iridium satellites are relatively close to the Earth's surface, the antennas and radios needed to work with its satellites are much smaller, lighter and need much less power. Satellite communications (telephones) and connectivity (data, messaging) work very well with trucks, ships, and airplanes because the antennas mounted on top have a good view of the satellites as they fly across the sky. Crucially, the radio frequency bands used for satellite communications depend on that two-way visibility; the radio link can be blocked by buildings and trees. Appreciating this key fact about satellite antennas is important when selecting a Satcom-based tracking system.

This white paper will focus on Iridium Satcom solutions. Because Iridium satellites are in constant motion, the signal availability to an antenna will vary over the course of about 10-15 minutes, as the satellites rise above the horizon, pass across the sky, and

then descend down below. Because of the arrangement of satellites in the constellation, there are typically 2-3 satellites "visible" to an antenna at any given time. This may sound familiar because this is the same way that GPS satellites work.

At any particular time, the flight path of an aircraft and the antenna view of the sky may result in just one Iridium satellite being visible. A top-mounted external antenna will have a substantially better view of that satellite than an antenna located inside an aircraft.

### Aviation VAM & VAR to Iridium

SKYTRAC is a Value Added Manufacturer and Value Added Reseller to Iridium. This means SKYTRAC is one of a select handful of organizations that have beta development capabilities to develop new products and services using Iridium's satellite network. See what we're up to at [skytrac.ca](http://skytrac.ca).

### Latest News

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## 3.0 MISSION BENEFITS

Satcom-based tracking is the entry into a game-changing method of dramatically enhancing fleet operations through customized direct monitoring of aircraft power (on/off), phase of flight, position, and other valuable data.

There are alternative ways to keep track of aircraft using apps like FlightAware or Radarbox24 or through routine radio calls from the pilot. The first way offers good fidelity about the aircraft location and flight path as long as the aircraft is being observed within ADS-B or radar surveillance. The second way via voice advisories can be haphazard, increases pilot workload, and often can't work if the aircraft is beyond VHF radio range.

The type of business or mission that a fleet serves will determine the net value of each of the following points, to the extent in some cases where the lack of Satcom tracking may compromise safety, regulatory, or contractual compliance.

### Situational Awareness

- Active, direct tracking of an aircraft substantially reduces and can eliminate searching for an aircraft that crashes or lands off-airport.
- Ground-side software can alarm based on urgent alerts from the aircraft, such as a master caution alarm, manually selected emergency

switch, float activation, or rapid descent.

- Ground-side software knows the reporting rate of each aircraft. An alarm can be raised when a threshold of missed reports occurs.
- Mission success depends on proper execution of an intended flight. An example is when an air ambulance Operations Center observes that an aircraft is not on the right course to an accident location; an immediate communication with the flight crew to review the concern can minimize possible delays.

### Fleet Management

- For many mission types, aircraft assignments may need to be changed mid-flight, which can be efficiently done by knowing the location and status of each aircraft.
- Especially with larger fleets and complex mission cycles, crew duty management has safety and regulatory implications. Various tracking software options provide insight about progress and potential delays due to weather and risks of crew timeouts.

### Business or Mission Requirements

- Tracking is often a regulatory mandate, such as for helicopter air ambulance in the US, and contractual mandates for fire-fighting in many countries.
- Most oil companies require helicopter transport fleets to have Satcom tracking as a component of their comprehensive safety management systems.

### SKYTRAC Products & Services

Stay objective, stay connected, and get efficient with SKYTRAC's portfolio of products and solutions.

#### Data Acquisition

Capture and transmit 4D aircraft data in real time with our combined Data Acquisition Unit (DAU) and onboard server. Camera, WiFi and data concentrator accessories available.

#### Flight Following

Track high-accuracy flight paths, weather conditions, system health status and worldwide fleet activity with SKYTRAC automated flight following.

#### Flight Data Monitoring

Combine rich FDM reports with onboard data analysis, real-time alerts, and program management and implementation services.

#### Voice, Text & Push-to-Talk

Communicate live from air to ground via satellite voice and text. Iridium Push-to-Talk group talk packages available.

#### Medical Data Transfer

Send critical patient data such as patient care reports with no connectivity interruptions with Iridium.

#### EFB Solutions

Automate flight and crew reports, journey & eTech logs, prepopulated with objective flight data from your aircraft.

#### GADSS Compliance

Gain fully autonomous and GADSS-compliant Global Distress Tracking. Go beyond GPS awareness to understand what went wrong and why.

[View our Capabilities](#)





## 4.0 SELECTION CONSIDERATIONS

Iridium satellites are close enough to Earth that very lightweight Satcom radios can be used. For aviation fleets, there are systems which are certified to be installed and there are self-contained portable devices that are not certified but can be carried onboard an aircraft.

SKYTRAC has both portable and installed Iridium systems. The ISAT-200A, the Iridium Certus-enabled ISAT-200A (08) and SDL-350, are all certified installed Satcom systems. The SKYTRAC Portable device is an uncertified device one can simply bring onboard any aircraft to enable fleet tracking functionality.

**Figure 1.** SKYTRAC Portable Satcom aircraft tracking solution (left), ISAT-200A installed Satcom aircraft tracking solution, Iridium Certus-enabled ISAT-200A (08) and SDL-350.





## Installed Satcom Systems

### Benefits of Installed Iridium Systems:

- High fidelity tracking due to externally mounted antenna
- Ability to connect to aircraft GPS receiver for position data
- Begins operating from power-up to power-down with no crew intervention
- Connects to aircraft systems for automated aircraft status monitoring and alerting
- Enhanced value with voice telephone service and push-to-talk (PTT) comms
- Text-messaging support via Bluetooth or WiFi
- Enables data off-loading in real-time to support FDM and HUMS
- Requires installation and wiring of the radio unit and antenna, plus optional cockpit interface unit for telephone and PTT

The Iridium service that supports tracking is called SBD®, which is similar to text messaging on a cell phone. SBD is a robust protocol that works very well, and with a properly located antenna atop the helicopter, it can provide continual tracking through every phase of flight: engine start, hover-taxi, departure, steep banking turns, terrain-following, auto-rotations, and landing. With the ability to connect to the aircraft GPS receiver, additional features are available including the ability to send GPS flight plans and waypoint changes to be displayed on the dispatcher's tracking map.

In addition to assured tracking with virtually no missed position reports, installed systems offer substantial capabilities to support the effectiveness, efficiency, and safety of fleet operations.

Any or all of these can be implemented by an operator depending on mission need and equipment capability:

- **Text Messaging:** Two-way messaging provides easy communication in much the same way as sending and receiving text messages on a phone. This capability is supported through the cockpit interface unit or through an EFB/tablet application.
- **Push-to-Talk (PTT):** The newest Iridium service, this operates exactly like a VHF radio or a walkie-talkie where a group of Iridium-equipped aircraft, ground vehicles, and Operations Center can talk to everyone in the group at the push of a button. This service is fully encrypted and 100% secure and the fleet operator manages the group membership. PTT members can be any distance apart, unlike VHF radio that requires fairly

close proximity, especially at low altitudes. For many operators, VHF can't be used to discuss patient or other security-sensitive information.

- **Telephone:** For air ambulance operators, an Iridium telephone is essential for enabling a flight clinician to discuss patient care with a doctor, with complete HIPAA compliance, and regardless of where the doctor might be.
- **Flight Data Monitoring:** Though FDM itself is not an Iridium service, the SBD messaging service enables real-time, in-flight alerts to be transmitted to provide notifications about possible aircraft operations and HUMS issues that a Director of Maintenance or Flight Operations would want to know about before the next flight.





## Portable Satcom Systems

### Benefits of Portable Iridium Systems:

- Lowest cost Iridium solution
- Easy to implement for tracking
- Considered a carry-on device (uncertified)
- Ability to move between aircraft
- Text-messaging support via Bluetooth or WiFi

Portable systems typically use built-in antennas for Iridium, and some have connectors to use external ones. With the antennas placed inside the aircraft, tracking reliability is compromised. An Iridium antenna that doesn't have a clear view of the sky simply cannot provide the same assurance and fidelity of tracking as an installed system using an external antenna mounted on top of the aircraft. The poor connectivity

of inside antennas is a result of the aircraft structure, other avionics, and, often unrealized, heated windshields. The same signal issues apply to internal GPS antennas. Depending on the mission requirements and operational expectations, dropped position reports or long breaks in position reporting can be disruptive and create false concerns about aircraft status.

Without the ability to interconnect with aircraft systems, crucial automated situational awareness capabilities are not available. While some portable systems have internal sensors that make simple measurements about aircraft movement (rapid descent, excessive pitch/bank angles), other important aircraft systems cannot be monitored, such as master caution, over-torque, float deployment, winch operations, etc.

The flexibility to move portable systems between aircraft is convenient and may be considered cost effective. But this apparent advantage relies on several key steps for proper operation which

can reduce or impact organizational efficiencies:

- Reliance on the crew to power the device on, prior to departure, and to power it down, after flight.
- Adequate and safe placement in the aircraft
- Power supply connection and proper securing of cables (high risk in helos)
- Assignment of the device to the current aircraft tail number

### Speak with a SKYTRAC Expert

Our sales and support teams are available throughout the business week. Get in touch at [skytrac.ca](http://skytrac.ca) or dial 1.844.643.6033 toll free within North America to get immediate support.

[Contact Sales](#)





## 5.0 CHOOSING: INSTALLED VS. PORTABLE

The decision about selecting an installed Iridium system or a portable one is guided by an operator's mission and business requirements.

For fleets that operate within a small area around a single base, needing only general position awareness about each aircraft, portable solutions would be suitable. For fleets flying complex missions, extended range and duration operations, and mandate-driven obligations, installed solutions are ideal.

### Installed Satcom Systems

Many fleets perform missions and conduct business which have various safety and communications equipment requirements that must be in place in order for flights to be conducted. Even if the requirement is purely position tracking, installed systems are the only way to fully satisfy the demanded level of performance. Typically, aircraft are

actively monitored by flight dispatchers such that, if the status of an aircraft becomes a concern, assistance will be rendered without delay and often before communication with the air crew takes place. To support this, a tracking system must turn on automatically when the aircraft is powered-up. It should provide an indication of status (parked, taxi, departure, cruise, approach, on-ground), and most critically, it must have high fidelity and reliability to minimize false alarm notifications to flight dispatchers.

In many cases where fleets must meet other safety and communications requirements, installed systems provide an extensive array of in-built features to support those.

#### Tailor Made Form, Fit, and Function

SKYTRAC has deep experience designing products and services for the industries we serve. Whether provided out-of-the-box or customized for an operator's unique requirements – our flight following and analytics software are developed for ease-of use and tailored to work seamlessly within your existing operating environment.

**The SKYTRAC Advantage**

## Installed System Use Case

Bigdeal Air Transport has a contract with Castaway Oil & Gas to fly personnel and supplies to oil rigs in the Gulf of Mexico, the North Sea, and Nigeria. Some of these rigs are considered deep-water because they are up to 250 miles off-shore. Castaway's contract has stipulations for Bigdeal about safety performance, including:

- Full-time active tracking of flights, with an alert threshold not to exceed five minutes from last position report received when the dispatcher will begin lost comms procedures, such as contacting the aircraft by voice using Satcom telephone or PTT.
- Alert notifications for high risk phases (descent below an altitude on approach, winch operations) and emergency actions (autorotation, float deployment).
- Ability to communicate with the aircraft using Satcom-based text, telephone, or PTT.
- Full-time monitoring of flight performance using FDM to detect unusual flight action (rapid descent, high bank rate, etc.) and aircraft systems (over-torque, low fuel, etc.).

## Portable Iridium Systems

For fleets that operate within a small area around a single base, needing only general position awareness about each aircraft, portable solutions are useful.

### Portable System Use Case

ACME Flight School has a fleet of 12 single-engine and light twin airplanes and two piston helicopters offering basic flight training from student to instrument-rated commercial multi-engine ratings. 80% of operations take place within about a 100-mile region around ACME's airport, with only cross-country flights going further. Tracking would be helpful for the scheduler, for example, when dealing with a pilot who is late returning to the airport when someone else is waiting for the aircraft. With active tracking, the scheduler can understand if the airplane is 5 or 50 minutes away. Tracking is also helpful for an instructor to keep tabs on solo student cross-country flights. The flight school does not need tracking for any regulatory requirement and there is no intention to use tracking as a safety service where pilots would expect assistance from someone monitoring the flights. Further, because tracking is not required for flight operations, an aircraft can still be used if the tracking device was inoperable, not turned on, or unavailable. Portable tracking systems are a convenient tool for this type of operator.



# 6.0 COMPARISON TABLE

## How do you know which option is best for your operations?

When comparing an installed system to a portable system, the most important aspect is your operations. How do you intend to leverage the data from your solution, and how do you seek to implement it? The following table breaks down the considerations between the two systems.

**Table 1.** Comparison table evaluating the differences between installed and portable devices.

	Installed Systems (Certified)	Portable Devices (Non-certified)
<b>Ability to See the Iridium Satellite Network</b>	Externally mounted certified antenna assures highest reliability of tracking and voice communications with uncompromised view of Iridium satellites	Antennas inside aircraft cause intermittent service and tracking failures due to compromised view of Iridium satellites
<b>Access to all Iridium Satcom Services</b>	High-fidelity Tracking, 2-way Texting Plus: Telephone and Fleet-wide Push-to-Talk	Basic Tracking and 2-way Texting
<b>Complete Awareness about Aircraft Operation</b>	Integration with weight-on-wheels, weight-on-skids, flaps, collective, etc., enables distinct information about aircraft movement and flight phase: taxiing, take-off, landed, parked	Limited to imprecise internal sensing
<b>Assured Operability of Tracking System</b>	Hard-wired Integration with aircraft power enables assured tracking and operation from aircraft power-up until aircraft shutdown	Relies on crew to situate and manually power-up. Loss of operation if battery runs out; power cable and jack may be used for continued operation. Potential safety issue with loose equipment placed atop the instrument panel and wire/cable interference with flight controls
<b>Automated Reporting Rate Changes</b>	Emergency condition detection (such as float deployment, rapid descent, etc.) will transmit alerts and increase the reporting rate accordingly	No wired interconnection for other emergency condition monitoring. Automatic alerting limited to internal sensing of aircraft movement upsets.
<b>In-Flight Monitoring of Aircraft Systems</b>	Full-time automated monitoring of critical systems, such as HUMS, Master Caution, Float Deployment, Autorotation, with alerts sent to the fleet operator	Not applicable.
<b>Flight Data Monitoring (FDM)</b>	Ability to connect to aircraft data streams (engines, FADEC, GPS, RADALT, etc.) for complete capture of flight data to support FDM/FOQA/MOQA/SMS. Fully compliant to FAA AC-135-14B	Fundamentally not capable, though some FDM-type data (speed, track, altitude, bank angles, etc.) may be derived from internal sensors. Insufficient to satisfy FAA AC-135-14B
<b>Flight Deck and Cabin Crew Access</b>	Multiple dialers can be installed to support cockpit and mission crew members for communications	Portable unit may not be accessible to both the flight crew pilots and the cabin crew





## 7.0 KEY CONSIDERATIONS

What questions should you ask when outfitting your fleet?

The ultimate decision rests with the operator's requirements. Ask yourself:

- Have you reviewed your mission in detail and identified where this technology could enhance safety/efficiency/crew workload/risk mitigation?
- What regulatory, contractual, and mission requirements are driving the need for tracking?
- Have you considered all of the touchpoints the right solution will need to integrate with?
  - Operations/Dispatch
  - FOQA and Safety Management System programs
  - Flight Personnel, including Pilots, Crew Chiefs, Clinicians, Rescuers, etc.
  - Agencies outside of your Operation
    - Hospitals
    - First-Respondents
    - Oil-rig Operators
    - Partner Companies (such as fellow firefighting contractors)

**It boils down to this:** To support an entire fleet during flight operations using Satcom-based technologies, an installed Iridium system provides the best long-term solution to meet current and anticipated requirements with a robust set of capabilities to leverage the most value out of the investment.

SKYTRAC works with new and current customers every day to optimize the technology for their unique missions and operations. There are many choices to consider and the best way to start is with a conversation with SKYTRAC.

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- FAA 14 CFR §135.607 [Flight Data Monitoring System](#)
- FAA Advisory Circular AC135-14B [Helicopter Air Ambulance Operations](#)
- AAMS.org [Helicopter Flight Data Monitoring Toolkit](#)

### 2. Offshore Oil and Gas Industry

- HeliOffshore.org [Safety Through Collaboration](#)

### 3. Fire Fighting Industry

- USDA Forestry Service [Automated Flight Following](#)

### 4. United Nations Tracking Mandate

- United Nations [Contracted Air Operators Tracking Requirements](#)



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