

FALCON 360 AIRCRAFT TRACKING SYSTEM

User Guide & Technical Manual

 iOS Version



Version 1.0.04 © 2015



Q QUICK REFERENCE

Function	Action Required
Trigger an ALERT	Press and Hold Alert button for 3 seconds (button starts flashing)
Cancel an ALERT	Press and Hold Alert button for 3 seconds (button stops flashing)
Start Quiet Mode	Press and Hold Power button for 3 seconds (all lights will go out)
Cancel Quiet Mode	Press any of the 5 buttons briefly

Q REFERENCE – COMMON DISPLAYS



Startup Diagnostics (all flashing)



All signals blocked, or modem starting



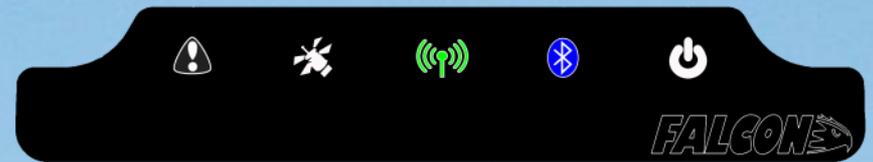
GPS acquired, Inmarsat still acquiring



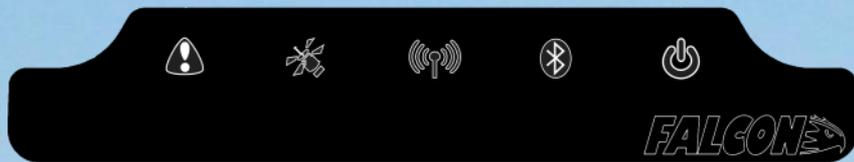
GPS acquired, Inmarsat authorizing



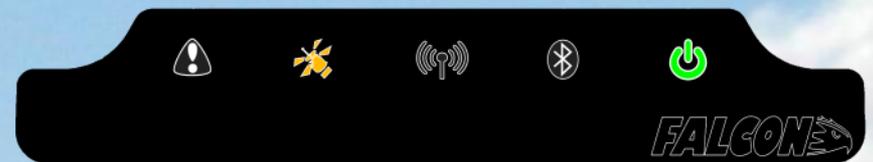
Normal Operation



Normal Operation with Bluetooth



Quiet Mode – after 1 min Normal Operation



Shutdown (waiting for last transmission)

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SYSTEM OVERVIEW

Thank you for purchasing the Falcon 360 – we have designed this system to provide efficient and cost-effective tracking for your aircraft, as well as provide you with a tool for reliable communication and data gathering during flight operations.

The Falcon is essentially a system that gathers information from the aircraft, requiring very little or no interaction from the flight crew, and transmitting that information to ground operations for display on a tracking system. In normal installation and operation it will automatically track the aircraft whenever the Avionics bus is powered.

This User Guide covers version 1 and version 1.5 of the Falcon system, the major difference between the two versions being the adoption of Bluetooth Low Energy in version 1.5.

1 SYSTEM COMPONENTS

The Falcon 360 system consists of the tracking module which is mounted in a suitable position on the glareshield, and a power cable which is connected to an auxiliary power supply in the aircraft. Please refer to the Installation section for more information on installation options for the system. The components are illustrated below:



1

BUTTONS AND INDICATORS (all versions)



1. ALERT Button
2. Antenna Indicator
3. Light Meter
4. Signal Indicator
5. Bluetooth Button
6. Power Indicator

1 PLUGS AND CONNECTORS (version 1)



1. Power Connector
2. Factory Plug
3. Mini-USB Port
4. Antenna Connector



1 PLUGS AND CONNECTORS (version 1.5)



1. Power Connector
2. USB Port
3. Factory Plug
4. CPU LED
5. Antenna Connector
6. Reset Pin



INSTALLATION

The Falcon is a portable unit, and is designed to be used without any modification to your aircraft. The system requires only a power supply, preferably from the aircraft's Avionics Bus, in order to operate. The unit does not have a Power switch, and the Power indication button is not designed to switch the unit on or off – the Falcon will start operation only when external power is supplied.

The Falcon should be positioned in the aircraft to ensure an optimal satellite signal as well as easy operation by the flight crew. The best way to establish the ideal position for the Falcon is to follow these steps:

1. Connect the Antenna to the unit
2. Connect the Falcon to the power source and switch on external power
3. Use the Signal indication to find a location where the indication is solid green
4. Fix the Antenna in place at this position using the Velcro supplied
5. Fix the Falcon unit in your preferred location in the cockpit using the Velcro supplied
6. Tidy the cables to ensure there is no snagging of controls or interference to the crew

Use the information on the following pages to assist you in positioning the Falcon in your aircraft.

2 ANTENNA LOCATION

The communication with the Inmarsat and GPS satellite constellations may be hampered by metallic obstructions, so position the antenna in the best position to avoid shadowing from the roof of the aircraft, or the central divider (if present). The Falcon antenna is best located on the co-pilot's half of the glareshield, positioned as far forward as possible. Below are some typical locations to illustrate good positions for the antenna:



2 FALCON UNIT LOCATION

In an ideal installation, the Falcon will usually achieve a satellite lock in about 30 seconds after the diagnostics have completed. It will update the satellite signal strength indication every 5 seconds whilst there is no full satellite lock - if you don't get a satellite lock in your initial position, move the antenna every 10s or so, and observe the **Signal Indicator** to find the best position.

Once you have positioned the antenna, put the Falcon in a suitable location in the cockpit, considering the following:

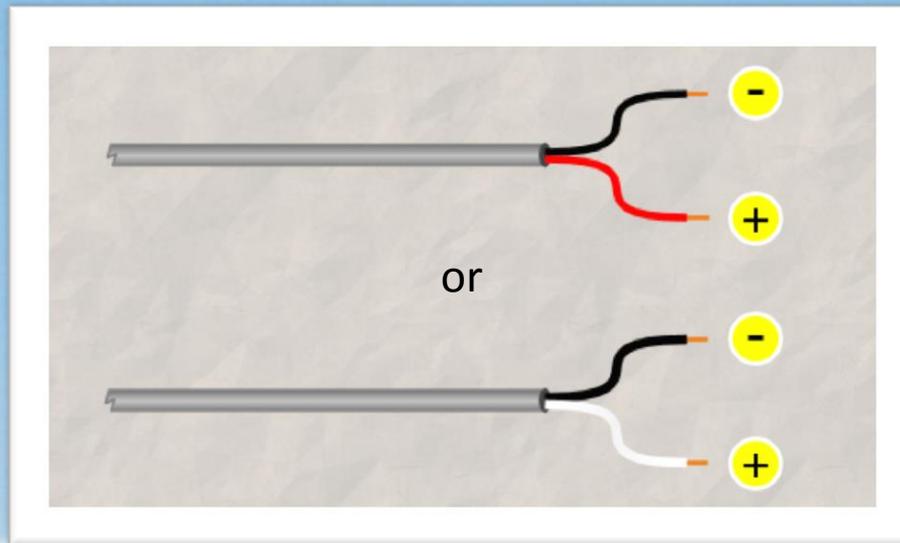
1. Ease-of-reach: the crew should be able to easily press the Alert button
2. Visibility: the Falcon will notify the crew of incoming messages via the front display
3. Connectivity: the Bluetooth connection has a range of around 5m
4. Safety: the Falcon and cables should not interfere with any aircraft controls or the crew's actions

Once the ideal position is located, use the Velcro supplied to ensure the that unit is secure and cannot move during operation.

2 POWER CONNECTION

The Power Cable provided has a self-locking connection to the Falcon unit to ensure that it cannot become accidentally unplugged whilst in operation. The other side of the cable is terminated with an Auxiliary power plug – this should be inserted into the Auxiliary Power socket in the aircraft.

If the aircraft does not have an Auxiliary Power socket, or you would prefer to have the cable connected directly to the aircraft power, the following wiring diagram should be used by your Aircraft Maintenance Organization to get approval for this modification to your aircraft. Please refer to the color key for the cable provided with your equipment.



3 STARTUP DIAGNOSTICS

During startup, the Falcon will run a number of self-diagnostic tests, which will determine whether the unit is in good working order. If any of these diagnostic tests fail, one or more of the indicators will flash amber – please consult the following table to determine what has failed, and what steps to take to rectify.

Flashing Icon	Issue and Resolution
	Modem Failure – unit needs factory inspection
	Antenna Failure – unit needs factory inspection
	Internal storage issue – the unit will continue to function, but no recording will take place.
	Bluetooth failure – no pairing via Bluetooth is possible, but other functions will continue to work
	Internal battery failure – the unit will function whilst powered by the aircraft, but will immediately shutdown when the aircraft is powered down. This may result in some corruption of data, and any queued messages will not be transmitted.

For all diagnostic issues, please contact Apex Flight Operations technical support to determine the best course of action to resolving the problem.

3 BUTTONS AND INDICATORS

The unit features 5 indicators on the front display; the characteristics and function of each is described in the reference table below:

Icon	Type	Description
	Button/Indicator	Triggers or Cancels the Alert Status
	Indicator	Shows the Antenna Status (flashes during receive or transmit)
	Indicator	Satellite signal strength
	Button/Indicator	Bluetooth pairing initiation and status
	Button/Indicator	Power indicator and Quiet Mode button

These indicators are also illuminated during the startup diagnostic process – refer to the section on Diagnostics for more information on the various indications and their meanings.



The Falcon 360 features an Alert mode function, which gives the aircrew a quick and reliable means of notifying ground operations of an emergency situation on board the aircraft. This Alert function can be triggered both from the Falcon itself, as well as via IndigoTrack Crew. To trigger the Alert on the Falcon, press and hold the Alert button for at least 3 seconds – note that this can also be triggered via IndigoTrack Crew, please refer to the IndigoTrack Crew User section.

When triggered, the Alert indicator on the Falcon will flash red, and if the unit has been configured with a normal reporting interval greater than 30 seconds, this will also change so that the Falcon reports positions every 30 seconds.

Color	Meaning
Off	Normal tracking operation
Flashing Red	Alert Mode

To cancel an Alert, hold the Alert indicator again for at least 3 seconds.

3 ANTENNA INDICATOR



This indicator shows the antenna status – it shows the following conditions:

Color	Meaning
White	Normal tracking operation
Flashing White	External antenna is connected – transmit or receive in progress
Flashing Red	Antenna failure
Flashing Amber	Unit is in house-keeping mode during shutdown, and there are still messages awaiting transmission

When in normal operation, the indicator will also flash 3 times each time the unit transmits or receives a message via the satellite.

SATELLITE SIGNAL INDICATOR



This indicator shows the satellite signal strength, GPS acquisition state, and Inmarsat communication lock – the various states are indicated as follows:

Color	Meaning
Green	Good satellite visibility, GPS acquisition, Inmarsat lock
Green/Blue Flashing	Good satellite visibility, GPS acquisition, no Inmarsat lock
Amber	Non-optimal satellite strength – delays in transmission, GPS acquisition, Inmarsat lock
Amber/Blue Flashing	Non-optimal satellite strength, GPS acquisition, no Inmarsat lock
Red	Low signal strength – receive only, GPS acquisition, Inmarsat lock
Red/Blue Flashing	Low signal strength, GPS acquisition, no Inmarsat lock
Red Flashing	Zero signal strength, no GPS acquisition, no Inmarsat lock

The satellite signal indication is refreshed every 2 seconds when not locked with the Inmarsat satellite, and every 10 seconds once locked – this indication can be used to determine the best position for the unit in the aircraft.



This button is used to reinitiate the pairing process with a Bluetooth 4.0 LE device (such as an iPad, Tablet or laptop), as well as to show the connectivity status once paired. The following are used to display the various states:

Color	Meaning
Off	No Bluetooth connection
Blue Flashing	Bluetooth pairing in process
Blue	Bluetooth device paired
White/Blue Flashing	Message received but not yet acknowledged by Bluetooth device
White Flashing	Message received but Bluetooth device not paired

The button is pressed and held for 3 seconds to initiate the Bluetooth pairing process, and pressed and held again for 2 seconds to cancel any pairing in progress and/or close the current Bluetooth connection.

3 POWER BUTTON/INDICATOR



This indicator shows the power status – it shows the following conditions:

Color	Meaning
White	External power is connected and available
Green	Internal battery in use – good condition
Amber	Internal battery in use – less than 50% available
Red	Internal battery in use – less than 15% battery available
Flashing Red	Internal battery in use – too low for transmission

The button can be used to put the Falcon into Quiet Mode – press and hold for 3 sec to enter this mode, and press any button to exit. In Quiet Mode, all indicator lights are extinguished, with the exception of the Alert and Bluetooth message waiting indications.

Quiet Mode will also automatically start after two minutes after the last button press

3 BLUETOOTH COMPATIBILITY

The Falcon 360 version 1 offers Bluetooth Classic connectivity, whilst version 1.5 has Bluetooth LE connectivity. Please consult the following table to determine the compatibility of your Falcon unit with other Bluetooth devices:

Falcon Version	Other Device Type	Other Device Bluetooth Capability
1.0	Microsoft Windows	 Bluetooth™ or  Bluetooth® <small>SMART READY</small>
1.5	iPad (Air, Mini, 3 rd & 4 th gen) iPhone (6 Plus, 6, 5s, 5c, 5 & 4s)	 Bluetooth® <small>SMART READY</small>

FALCON CREW

The Falcon system pairs via Bluetooth[†] to a compatible tablet, laptop or Smart Device with the Falcon Crew application installed. Please consult the following table on how to install the relevant application for your device:

Device Operating System		Installation Location	Falcon Version
iOS 7 or later		Apple App Store Search for "Falcon Crew"	1.5
Windows 7 or later		Apex Website at www.apexflightops.com/downloads.aspx	1.0

† see section on Bluetooth Compatibility



4 FALCON CREW – iOS VERSION

Once you have downloaded and installed the Falcon Crew app from the Apple iTunes App Store, all you need to do is start the application. It will immediately scan for Falcon units in the vicinity – make sure your Falcon is powered on and operational before starting the app to ensure the quickest connection.

Once located, the app will initiate a synchronization of information, as shown in the screenshot. As the data is synchronized, the app will enable the buttons for use.



As soon as the initial synchronization is completed, the signal strength indication will show the quality of the signal as follows:





4 FALCON CREW – FUNCTION LAYOUT

After the initial synchronization, the main screen of the Falcon Crew app will have the following icons and indications available.

Clicking on any of the main icons when active will take you to another screen with that functionality.



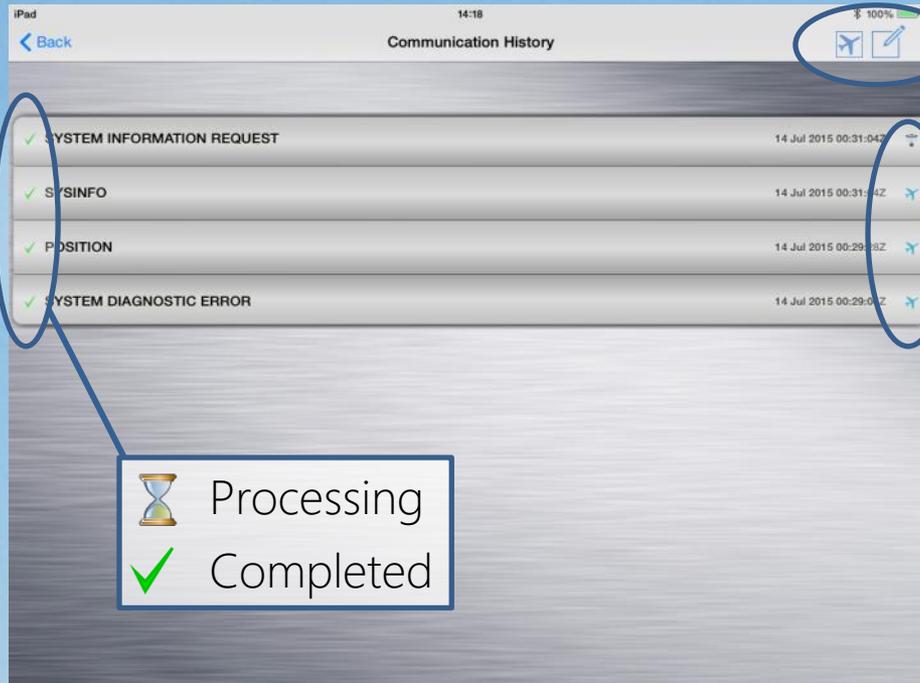
	Help		System Information
	Data Tx		
	Alert		Messages
	GPS		Flight Folio
	ECTM		Downloads
	Bluetooth		Config



4 FALCON CREW – MESSAGES

The Messages window will display all messages in the Falcon's Sent, Receiving and Outgoing queues. You can hide the system messages by toggling the aircraft icon in the top right.

To compose a new message, click on the Compose icon, and to read any text messages received from ground operations, click on the row in the list to review.



- System messages are displayed
- System messages are hidden
- Compose new message

- Message triggered by Falcon
- Message sent by crew
- Message received from ground



4 FALCON CREW – NEW MESSAGE

Composing a new message is as simple as typing into the message field and clicking on one of the Send options. You can choose to attach the current GPS position data to the message, or just sending the text.

You can also choose to have the message forwarded to a list of email addresses by entering them in the Forward to email field displayed.



To send to multiple email addresses, use the semi-colon (;) to separate each address.

Press "Send With Position" to bundle the current GPS data, or press "Send" to send only the text.

All messages will be timestamped with the current date and time.



Clicking on the GPS icon on the main screen will load the GPS Information screen displayed below.

On this page will be listed all the current GPS information, including date, time, latitude, longitude, ground speed, altitude AMSL, ground track, the number of GPS satellites used in

fixing the position, the dilution of precision value, and the fix type.

GPS Information	
GPS Date	14 Jul 2015
GPS Time	04:17:06
Latitude	S 33° 45' 59.148
Longitude	E 151° 16' 29.442
Speed	0 kts
Altitude	0 ft
Ground Track	0° True North
Number of Satellites	5
DOP	3.6
Position Fix	3D
Inmarsat Connection	Active
Signal Strength	126%

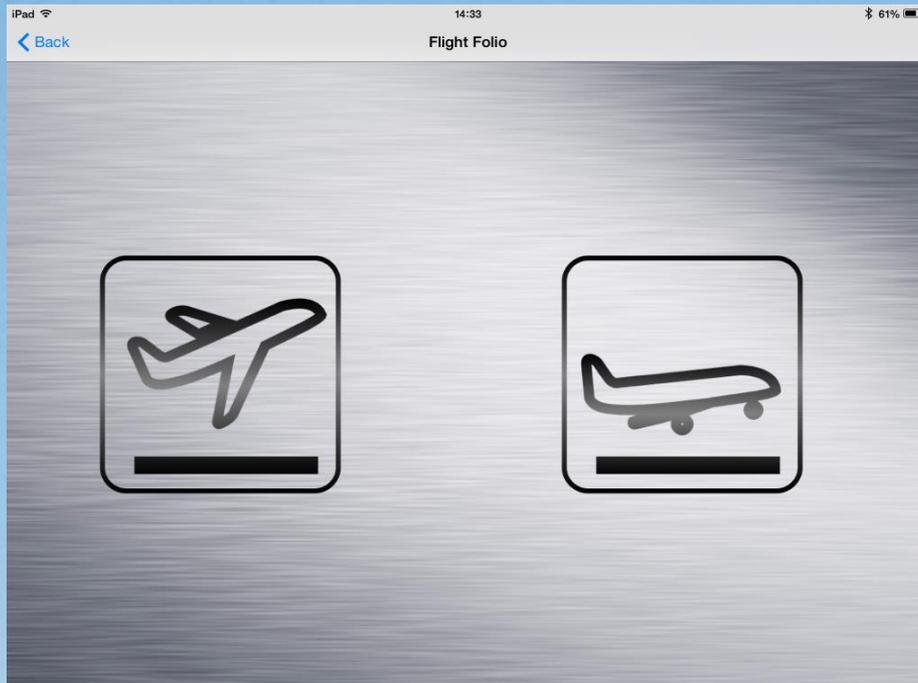
Also listed on this page is the status of the Inmarsat communication channel, including connection status, and signal strength value.

Click on the “Markers” button to access the customised marker points functionality.



4 FALCON CREW – FLIGHT FOLIO

The Flight Folio navigation screen provides options of entering Departure or Arrival information – click on the appropriate icon to open a window containing all the fields required for transmission.





4 FALCON CREW – DEPARTURE INFO

The Departure Information window allows you to enter any or all of the available fields relating to the taxi, takeoff and departure of the aircraft. You can either type the values directly into the fields, or use the convenient slider options to quickly configure the values.

To empty the fields and reset them to default values, click on the “Clear” button.



Once you have completed the form, click on the “Send” button to transmit the data through to IndigoTrack and the ground operations team.





4 FALCON CREW – ARRIVAL INFO

Similarly, the Arrival Information window allows you to enter any or all of the available fields relating to the landing and arrival of the aircraft. You can either type the values directly into the fields, or use the convenient slider options to quickly configure the values.

To empty the fields and reset them to default values, click on the “Clear” button.

The screenshot shows the 'Arrival Information' form on an iPad. The form has a 'Back' button on the left and 'Clear Send' buttons on the right. The fields are as follows:

Field	Value
Date	14 Jul 2015
Landed	16:16
Block End	16:20
Ending Fuel	967 liters
Fuel Burn	1055 liters
Total Flight	01:08
Total Block	01:21
Flight Report	Ops normal
Defects Report	None

Once you have completed the form, click on the “Send” button to transmit the data through to IndigoTrack and the ground operations team.



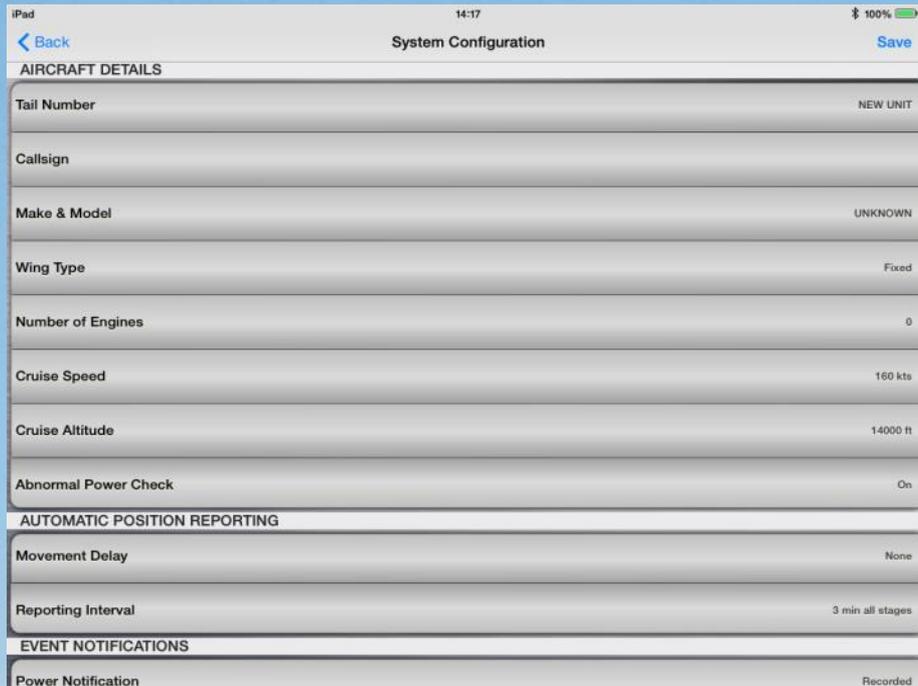


4 FALCON CREW – CONFIGURATION

The Falcon can be configured either from the ground, or optionally, by the aircrew. Clicking on the icon will display a screen listing all the configured values of the Falcon. The options are grouped into Aircraft Details, Position Reporting and Event Notifications.

If permission has been provided for the configuration to be altered by the crew, clicking on each item will pop up a screen with the options available.

To change the permission for values to be altered, the Falcon will need to be reconfigured via satellite using IndigoTrack with the option “Allow Configuration by Aircrew” enabled.





4 FALCON CREW – CONFIGURATION

AIRCRAFT DETAILS

The details of the aircraft that the Falcon is tracking should be entered to allow full functionality from the system. Complete the fields using the following guidance:



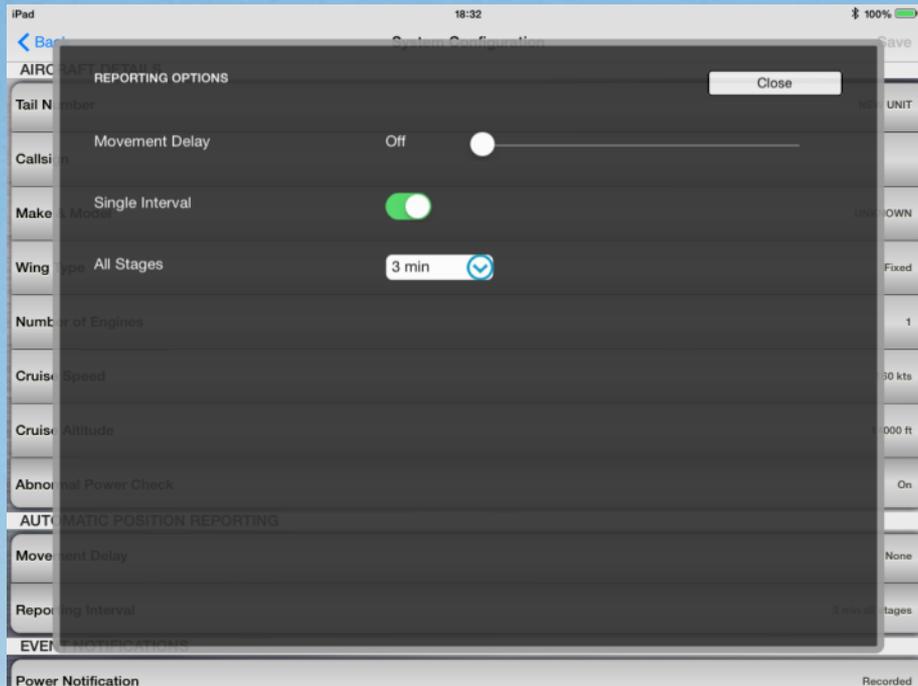
Field	Functionality Affected
Wing Type	Will alter the takeoff/landing logic accordingly
Cruise	When the aircraft's speed and altitude exceed these values, it will be considered to be in cruise conditions
Abnormal Power	If the Falcon loses power whilst in flight, this option will force it into a silent Emergency mode reporting every 30 seconds until power is restored or the aircraft lands.



4 FALCON CREW – CONFIGURATION

POSITION REPORTING OPTIONS

The Falcon has an extremely flexible reporting range. Firstly, you can set a movement delay which will stop the unit reporting (after an initial position report) until a specific distance has been exceeded. Slide the bar to set your selected movement delay as required.



The automatic reporting of the Falcon can also be configured using Single Interval reports, on a range of 10s to 30 min between reports.

Changing to Multiple Intervals will allow you to customize different reporting times when the aircraft is Stationary on the ground, Taxiing, in Ascent/Descent, or in Cruise* mode.

** Cruise is determined by the settings configured for the aircraft*

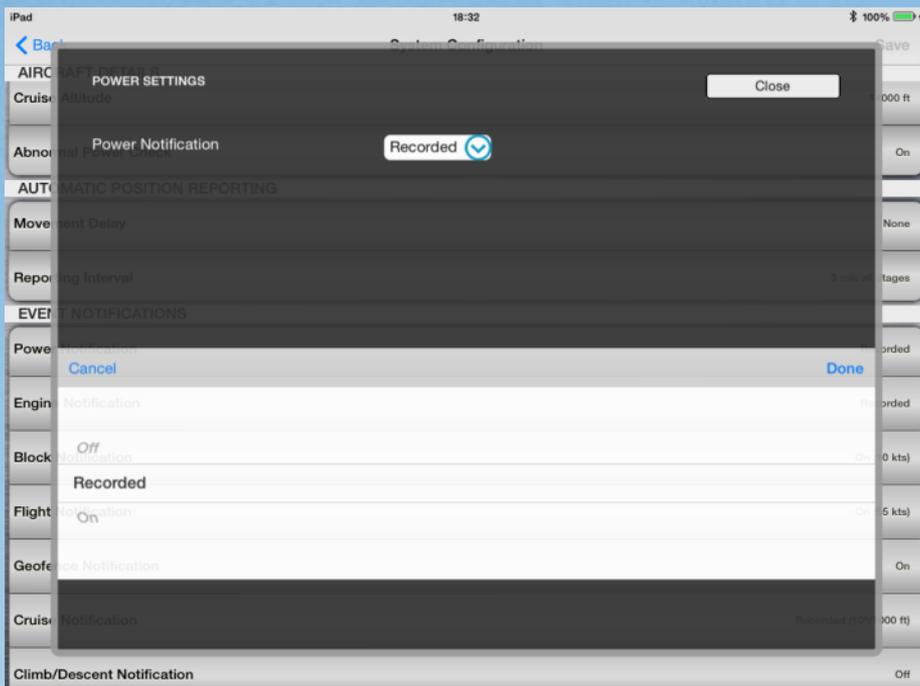


4 FALCON CREW – CONFIGURATION

POWER SETTINGS

The Falcon can report when external power is switch on or off – this is typically used when connected to the Avionics bus of the aircraft to report on Avionics On/Off events.

Options available are: Off, Recorded or On, as explained in the table below:



Value	Functionality
Off	No action at all – event is ignored.
Recorded	The Falcon will record the event in the internal log.
On	The Falcon will record the event in the internal log, and transmit the event via the satellite to IndigoTrack.

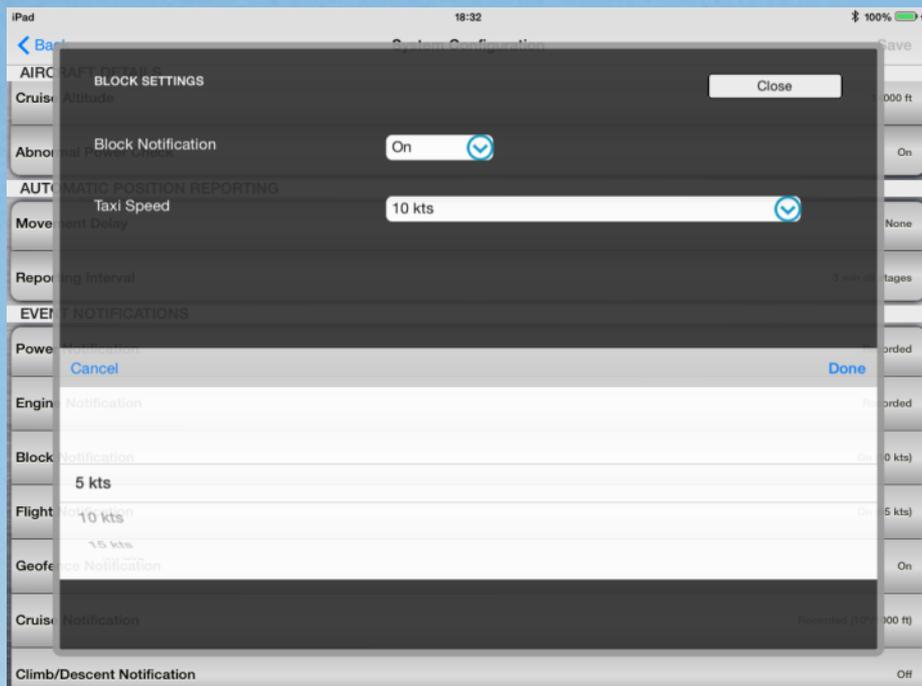
Note that this option should not be used when the Falcon is powered independently from the aircraft, e.g. when using a portable battery pack.



4 FALCON CREW – CONFIGURATION

BLOCK (TAXI) SETTINGS

When switched on the taxi time for the aircraft is reported according to the notification level set on this window. For fixed-wing aircraft you can also set the trigger speed of the taxi start and stop – when above the selected speed the aircraft will be considered taxiing, and below will be considered stationary.



Value	Functionality
Off	No action at all – event is ignored.
Recorded	The Falcon will record the event in the internal log.
On	The Falcon will record the event in the internal log, and transmit the event via the satellite to IndigoTrack.

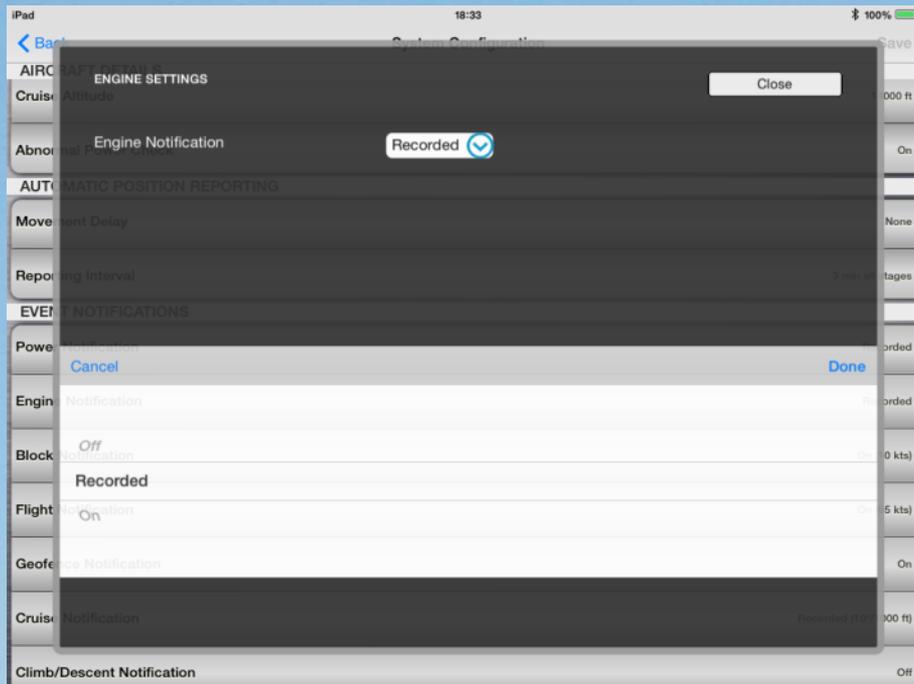


4 FALCON CREW – CONFIGURATION

ENGINE INDICATION SETTINGS

The Falcon can estimate when engines are started and stopped by analyzing the incoming voltage from the aircraft power bus.

Options available are: Off, Recorded or On, as explained in the table below:



Value	Functionality
Off	No action at all – event is ignored.
Recorded	The Falcon will record the event in the internal log.
On	The Falcon will record the event in the internal log, and transmit the event via the satellite to IndigoTrack.

Note that this option should not be used when the Falcon is powered independently from the aircraft, e.g. when using a portable battery pack.



4 FALCON CREW – CONFIGURATION

FLIGHT SETTINGS

Aircraft takeoff and landing notifications are generated based on GPS speed for fixed-wing aircraft, and altitude/speed for rotorwing. You can select what action is taken when these events are triggered, as well as the GPS speeds which must be exceeded.



Value	Functionality
Off	No action at all – event is ignored.
Recorded	The Falcon will record the event in the internal log.
On	The Falcon will record the event in the internal log, and transmit the event via the satellite to IndigoTrack.



4 FALCON CREW – CONFIGURATION

CRUISE SETTINGS

When the aircraft is in Cruise conditions (see Aircraft Configuration above), the Falcon can detect and report on specific events. Again, you can choose the action to be taken when an event is triggered, and set the value for Course and Altitude Change that must be exceeded for the event to be triggered.



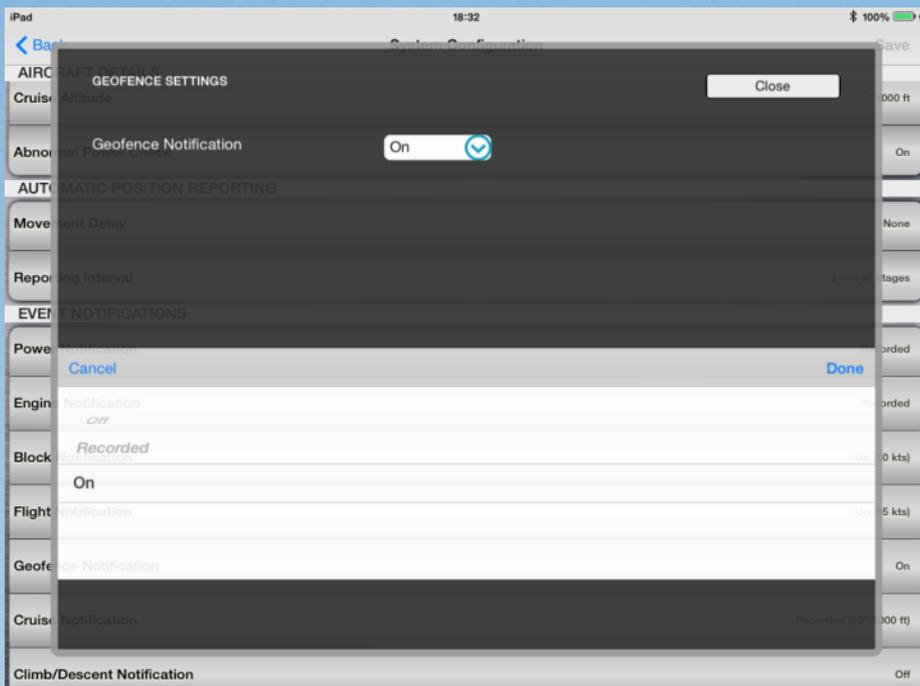
Value	Functionality
Off	No action at all – event is ignored.
Recorded	The Falcon will record the event in the internal log.
On	The Falcon will record the event in the internal log, and transmit the event via the satellite to IndigoTrack.



4 FALCON CREW – CONFIGURATION

GEOFENCE SETTINGS

Geofences (airspace definitions) can be defined in IndigoTrack and uploaded to the unit, which will then be monitored by the system in real-time using the aircraft's current position and trigger a warning event if the geofence rule is broken.



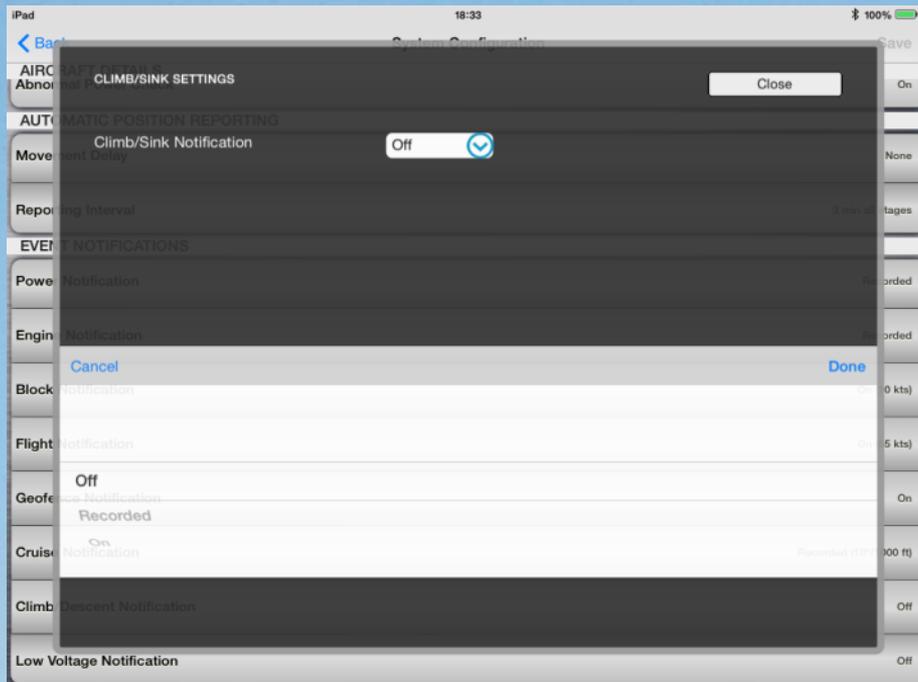
Value	Functionality
Off	No action at all – event is ignored.
Recorded	The Falcon will record the event in the internal log.
On	The Falcon will record the event in the internal log, and transmit the event via the satellite to IndigoTrack.



4 FALCON CREW – CONFIGURATION

CLIMB/SINK INDICATION SETTINGS

The Falcon can monitor the Climb and Sink rates of the aircraft, and will trigger an event notification if they exceed predefined limits. You can select what action to take in the event of these events being triggered. The trigger point values can only be set in IndigoTrack and updated via the satellite.



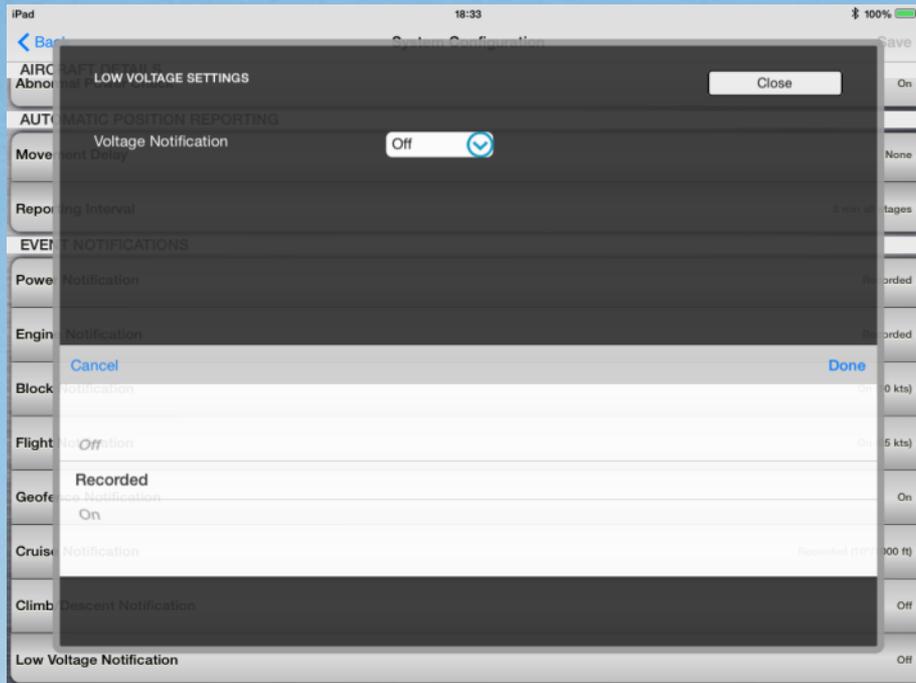
Value	Functionality
Off	No action at all – event is ignored.
Recorded	The Falcon will record the event in the internal log.
On	The Falcon will record the event in the internal log, and transmit the event via the satellite to IndigoTrack.



4 FALCON CREW – CONFIGURATION

LOW VOLTAGE INDICATION SETTINGS

On initial start-up, the Falcon will compare the incoming power to a predefined minimum, and if the incoming power is lower than this, it will trigger a Low Voltage event notification. You can select what action to take in the event of these events being triggered, but the minimum voltage can only be set from IndigoTrack.



Value	Functionality
Off	No action at all – event is ignored.
Recorded	The Falcon will record the event in the internal log.
On	The Falcon will record the event in the internal log, and transmit the event via the satellite to IndigoTrack.

Note that this option should not be used when the Falcon is powered independently from the aircraft, e.g. when using a portable battery pack.



4 FALCON CREW – SYSTEM INFO

Clicking on the System Information icon on the main screen will display a window containing details of the hardware and performance of the Falcon unit.

Important information that might be required by our support team when assisting you can be found here, in particular the Firmware Version, Library Version and Modem Version details.

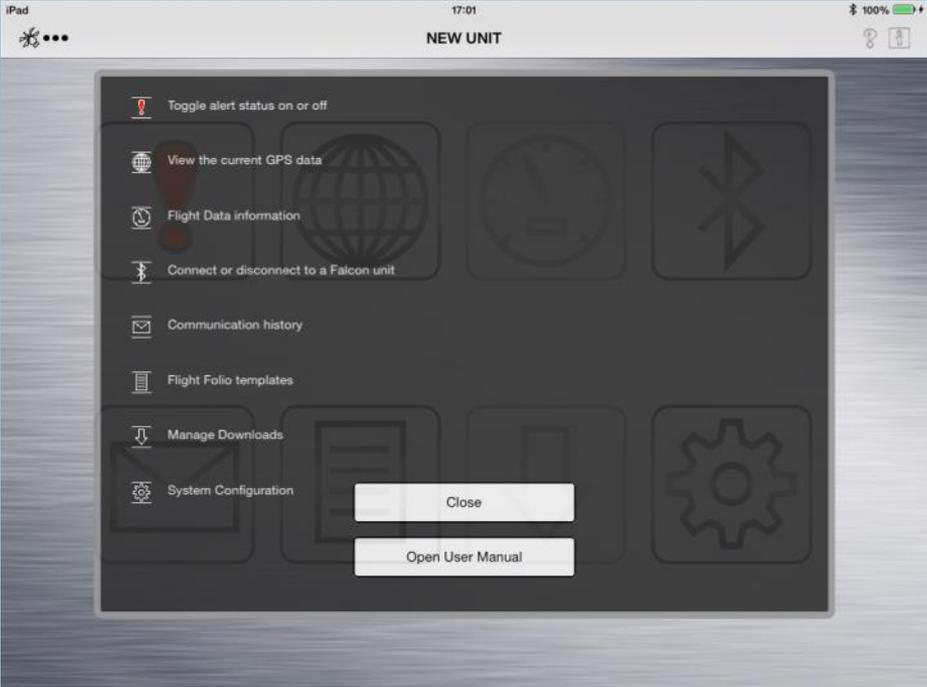


Additionally, the Aircraft Voltage (external power supply) and Internal Voltage values as well as the Unit Temperature can be used to troubleshoot any issues with the performance of the equipment.



4 FALCON CREW – HELP

The Help icon on the main screen will display some basic information about the meaning of each icon, and also provide a link to download and open this manual.





To disconnect the Bluetooth connection with the Falcon, you can click on the Bluetooth icon on the front screen.

It is, however, not necessary to disconnect the Bluetooth connection as the Falcon will automatically close the Bluetooth after a period of no communication with the app, and automatically reinstate the connection when available again.

For feedback and support on the iOS Falcon Crew app, please either review the app in the App Store, or contact support@apexflightops.com with any requests, suggestions or feedback.

5 WARRANTY INFORMATION

The Falcon has a one-year warranty against defects in manufacture from the date of activation of the unit on our website. If you have any issue with your Falcon, please contact our technical team at support@apexflightops.com to obtain a Returned Materials Approval (RMA) number – all warranty returns require this in order to be processed.

Full warranty details are enclosed in the Terms and Conditions documentation in each Falcon kit, as well as from our website at www.apexflightops.com

5 SYSTEM INFORMATION

Satellite Service: Falcon utilizes the IDP data service for Inmarsat – this is a guaranteed delivery service, and ensures that there are no missing positions or “gaps” in the aircrafts reporting history.

Power Supply: The Falcon is powered via an external power input requiring 11-33Vdc, and also has an internal battery for emergency operations and safe shutdown procedures. It meets RTCA/DO-160G certification requirements, and each unit can optionally use an external battery pack to provide operation independent of the aircraft power supply.

Reporting Interval and Latency: The Falcon can report the position of the aircraft at any interval between 10s and 30 min; all units have a factory setting of a 3-min reporting interval. The average latency of the Falcon service (time taken from the position/event being triggered to being available on the IndigoTrack servers) is 5 seconds elapsed time.

5 TECHNICAL SPECIFICATIONS

Mechanical	
Dimensions	19cm x 12.5cm x 4.5cm 7.5" x 5" x 1.75"
Weight	750g
Antenna Connection	SMA – only for use with approved Falcon antenna and cable
User Interface	5 touch button/indicators, Bluetooth LE
Operating Temp	-10°C to 55°C
Accelerometer	3-axis

Communication	
Satellite Network	Inmarsat F-4
Service	Two-way, Global, ISatData Pro
Frequency Range	Rx: 1525.0 to 1559.0 MHz Tx: 1626.5 to 1660.5 MHz
EIRP	7.0 dBW
Bluetooth	4.0 (Low Energy)

Performance	
Max Speed	900 kts ground speed
Max Ceiling	65,000ft AMSL
Min Reporting Interval	10 s
Max Reporting Interval	30 min
Typical Latency	< 10s
Elevation Angle	+20° to +90°
Service Range	Between 80°N and 80°S

Electrical	
Input Voltage	11 to 33V _{dc}
Max Input Current	2.5A

GPS/GLONASS	
Acquisition Time	<30s cold worldwide
GPS Channels	16
Accuracy	2.5m (Horizontal CEP)



Please contact our support staff at the details below if you experience any issue with the use or performance of your Falcon equipment.

TECHNICAL SUPPORT

support@apexflightops.com

ACCOUNTS DEPT

accounts@apexflightops.com

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Website: www.apexflightops.com

Knowledgebase: www.apexflightops.com/help