

Aircore Tracking Software Manual

Draft Copy - Needs much work!!!

This is in process. Download to Word and insert ScreenCaptures for Final Procedure

Todo: make procedures for misc step, radio box, iMet setup, 900 mhz setup, Iridium setup, Garmin Astro setup, cutter setup, Linx transmitter setup. Iridium and 900 Mhz software functionality.

The Aircore Tracking Software is used for Aircore payload tracking, 900 Mhz two-way communications for cutdown and backup tracking, Iridium backup communications to the FAA website, GPS and iMet interface and location data processing for display in Global Mapper, and for flight data logging.

1. Main Window

a. Pull-down Menus:

- i. **File > Close:** will close the program. It should be stopped first if it was started otherwise if might generate an error.
- ii. **External Programs:** programs must be started in the order listed before pressing the **Start** button on the main window.
 1. **Virtual Serial Port Emulator:** start the VSPE program with the correct settings provided the file is in the correct folder on the computer. If it does not work properly, the VSPE program can be started manually.
 2. **SkySonde Server** starts the program. The AirCore Tracking Radio Box must be connected.
 3. **SkySonde Client** pull-down selection is not currently working. SkySonde Client must be started manually.
 4. **Global Mapper 12** starts the Global Mapper program that displays the location of the AirCore and the Chase Vehicle simultaneously.
- iii. **Help:** incomplete ** Make a help directory and place misc procedures in it for program load.
 1. **Help**
 2. **About**
 3. **Tracking Radio Setup Procedure - OLD**
 4. **Config.txt** - opens the config.txt file for modification. If this file is modified the tracking program will need to be closed and reopened before the changes will take place. This file can also be modified and saved in the **Configuration** tab.
 - 5.
 6. **** More choices as necessary
 7. IC-R5 ICOM Radio Instruction Manual

8. [AirCore Solenoid Valve Module Schematic](#)
9. [Cutter Relay Module Schematic](#)

b. **Start** button starts the program once all the prerequisites are met. When pressed, it takes about 15 seconds for the program to start. This button will disappear and a Stop Button will appear. When the Start button is pressed the program will also create or append three log file in the root directory of the tracking program. These log files are generated for a month long period.

i. Log Files:

1. **Log_Aircore_900MhzRadioComms_YYYY_MM.txt** - this file logs all messages received via the 900 Mhz radio.
2. **Log_Aircore_PRAVEmsg_YYYY_MM.txt** - this file logs all \$PRAVE NMEA messages that are formatted and sent to Global Mapper for display. These messages include AirCore, Chase Vehicle, 900Mhz, and Iridium.
3. **Log_Aircore_Events_YYYY_MM.txt** - this file logs info such as some error conditions, Iridium transmissions, com port errors, and some GPS problems.

ii. The prerequisites are:

1. SkySonde Server is running.
2. SkySonde Client is running.
3. Virtual Serial Port Emulator (VSPE) is correctly setup for Com4<>Com5 and Com14<>Com15.
4. The AirCore Tracking Radio box USB cable is connected and all the Com Ports are set correctly.

iii. When the program is started it also reads the config.txt file that is located in the programs root directory. The file contains info about which AirCore is being tracked, usually Aircore-1, Backup Iridium designation, etc... This file can be modified and saved before program start if changes need to be made. Usually the only time that anything would need to be changed is if more than one AirCore were to be tracked at a time from multiple tracking vehicles.

c. **Data Text Boxes:**

- i. **- Descending - Box** (not visible when the payload is ascending or when the program is not running): is located under the program title at the top of the main window. Displays “- Descending -” when the payload is descending. This sometimes incorrectly displays when the iMet is first turned on or is still sitting on the ground. It can be reset by going to the **Configuration** tab and pressing the **Reset Descending** button.
- ii. **Payload Box** (no info visible when the program is not running): displays the payload’s altitude above sea level and Course/Speed in black letters when the payload is ascending and in green letters when the payload is descending.
- iii. **Payload Height Above Chase Vehicle Box** (no info visible when the program is not running): displays the payload’s height above the chase vehicle in black letters when the payload is ascending and in green letters when the payload is descending.
- iv. **Payload Distance from Chase Vehicle Box** (no info visible when the program is not running): displays the payload’s horizontal distance from the chase vehicle in black letters when the payload is ascending and in green letters when the payload is

descending.

- v. **- Status Message Area -** : display info about Iridium backup messages being transmitted from the chase vehicle such as the percentage of successful transmissions, number of messages sent, number of messages attempted, and how many bytes have been sent. This box only displays messages when the **Iridium On** checkbox is checked under the **Backup Tracking** tab to use the backup Iridium transmitter in the tracking radio box.
 - vi. **Asc/Des Status X 1000 Ft** column: displays a yellow box every 5000 ft up to 110,000 ft as the payload is ascending. Once the payload starts descending, a green box will appear from 110,000 ft down to the current altitude until the payload is on the ground. If this is prematurely displayed, it can be reset by using the **Reset Descending** button.
- d. **Payload Info Group Box** contains data about the iMet radiosonde being tracked via the 402-405 Mhz radio signal. Displays iMet GPS data for Altitude (Alt), Course / Speed (Crs/Spd), Number of Satellites (Sats), estimated Ascent/Descent Rate (A/D Rate), Maximum Altitude the iMet reached (Max Alt), Latitude and Longitude, and calculate Vertical Angle and Bearing True and Relative from the chase vehicle to the AirCore payload. Bearing True displays the in relation to true north and will always display as long as there is a valid iMet signal and chase vehicle GPS signal. Bearing Relative displays the bearing to the payload in relation to the direction the chase vehicle is travelling. Again, it needs a valid iMet signal and a valid chase vehicle GPS signal in addition to the chase vehicle needs to be moving. It is calculated from the heading of the vehicle which is most accurate only when the vehicle is moving. A green “heartbeat” box with the word “iMet” will blink at the update rate of the received iMet signals. If this box fails to blink then the tracking box is not receiving a signal from the iMet. This does not necessarily mean there is a problem with the iMet or tracking equipment. It could just mean there is not Line-of-Sight between the iMet and the chase vehicle.
- e. **Chase Vehicle Info Group Box** contains data from the chase vehicle’s GPS. It displays Altitude, Speed, Heading, Number of satellites, Latitude and Longitude. A gray “heartbeat” box with “Car” will blink at the update rate of the GPS. If this box fails to blink then the chase vehicle GPS is not functioning properly.

2. Tabs

- a. **NMEA Data**: displays the NMEA messages received from the iMet and the Chase Vehicle GPS. These messages are reformatted into the \$PRAVE format so that Global Mapper can display them simultaneously.
 - i. **Payload NMEA Messages** box: displays the \$PRAVE formatted NMEA messages from the iMet on the payload. If the chase vehicle loses the signal from the iMet, this box’s background color will change starting at 10, 30, 60, and 120 seconds ending in red for the signal being lost for more than 120 seconds. Once the signal is received again, the box background color will reset to white. This feature will not work if the chase vehicle’s GPS is not working. There is also a timer that will appear above this box showing “Time Since Last” signal received from the iMet. This timer box will also disappear once a signal is received from the iMet again.

- ii. **Tracking Vehicle NMEA Messages** box: displays the \$PRAVE formatted NMEA messages from the chase vehicle's GPS. This box will not change colors if the signal is lost.
 - iii. **Misc Messages** box: displays various messages to alert if there is a problem. Not all messages are critical. If Iridium backup tracking is active, it will display a message every time the Iridium sends a message.
- b. **Iridium Info**: displays various info about the backup Iridium and also contains embedded FAA webpages.
 - i. **Dropdown box 1**: selects which AirCore to display FAA website info in the webpage below it.
 - ii. **Dropdown box 2**: selects which AirCore to display FAA website info in the webpage below it.
 - iii. **Webpage 1**: displays the FAA (findU.com) webpage info for the selected AirCore. An internet connection is needed for this to work. This page will automatically update every 30 seconds.
 - iv. **Webpage 2**: displays the FAA (findU.com) webpage info for the selected AirCore. An internet connection is needed for this to work. This page will automatically update every 30 seconds.
 - v. **Backup Iridium Response Messages** box: displays response messages that are received by the backup Iridium transmitter from the satellite GSS. It displays the transmit status along with information about the messages sent. Only functions if the backup Iridium transmitter in the AirCore Tracking Radio Box is active.
 - vi. **Iridium Payload Last Point** groupbox: is used to inject the last point from the payload's Iridium transmitter into Global Mapper that was sent as an email attachment to its yahoo.com email inbox. The message attachment must be downloaded and saved in the appropriate directory so it can be loaded. Click the **Help** button to see how to use the below features:
 - 1. **Help**: opens a text file in Notepad that explains how the last point feature works.
 - 2. **Send Iridium Point to Mapper**
 - 3. **BCD** and **Text** checkboxes
 - 4. **LAT, LON, ALT, CRS/SPD** boxes
- c. **900 Mhz** tab – displays information about the 900 Mhz two-way communications with the payload. Most of the information displayed in this section is also logged in the **Log_Aircore_900MhzRadioComms_YYYY_MM.txt** log file located in the same directory as the tracking program. All buttons in this section are grayed out prior to the **Start** button being pressed. Depending on which radio button is selected some features will be grayed out since they will not function for the selection. Example: the * **Cutdown Payload** * button will be grayed out if the Broadcast radio button is selected. This is to keep from sending the cutdown command to more than one AirCore.
 - i. **Upper Data Window**: displays messages sent to the payload and received from the payload via the 900 Mhz transmitter.

- ii. **Lower Data Window:** displays GPS NMEA messages received from the payload via 900 Mhz that are reformatted into the "\$PRAVE" format for display on Global Mapper in the chase vehicle. If the **Iridium On** checkbox is checked and the **Send Cell / Iridium** checkbox in this section is also checked then these messages will also be transmitted out of the backup Iridium transmitter on the chase vehicle in the event that the Iridium transmitter on the payload has failed. This capability is the third way to transmit payload location data to the FAA website. This data is only collected and transmitted after the **Poll 900 Mhz GPS** button is pressed or the **Auto Xmit 900 Mhz GPS** button is pressed and the AirCore is sending location data on a regular interval.
- iii. **Radio Buttons:**
 - 1. **AirCore 01** - when checked all commands sent from the program will be directed exclusively to AirCore 01 via unique addressing.
 - 2. **AirCore 02** - when checked all commands sent from the program will be directed exclusively to AirCore 02 via unique addressing.
 - 3. **Broadcast** - when checked allowable commands will be sent to both AirCore 01 and 02. Cutting down of the payload is not allowed in **Broadcast** mode.
 - 4. **Chat** - when checked all commands to AirCores are disabled and a chat out text box and **Send - Chat** button appear between the data windows. The 900 Mhz transceivers on the AirCores are used as repeaters so that ground stations send messages back and forth if cell phone comms are lost. This feature works in the lab but has not been tested in real world. It is crude but might allow communications between ground stations in remote areas. When a chat message is sent, in theory it will appear in the upper data window of all ground stations if they receive the message. They will then need to select the **Chat** radio button in their software to respond.
- iv. **Poll 900 Mhz GPS** button: sends a command to the payload and polls it for its most recent GPS location from its onboard GPS receiver. If the **Broadcast** radio button is selected the command will poll all available AirCores. This data is then processed and sent to Global Mapper. It is also sent to the backup Iridium transmitter if that feature has been activated as discussed above. This button also instructs the payload to cease any automatic transmission started with the **Auto Xmit 900 Mhz GPS** button per below.
- v. **Auto Xmit 900 Mhz GPS** button: sends a command to the payload to instruct it to send its location at a predetermined interval in the payloads 900 Mhz Arduino program. The payload will continue to transmit its location until the **Poll 900 Mhz GPS** button is pressed. If the **Broadcast** radio button is selected the command will be sent all available AirCores.
- vi. **Send Cell / Iridium** checkbox: transmits the 900 Mhz GPS data out thru the backup Iridium transmitter on the chase vehicle in the event that there is a problem with the iMet.
- vii. **Time Sync** button: sends the tracking computer's current date/time to the 900 Mhz transceiver on the payload so it is recorded on its internal microSD card along with its Arduino time. Since the Arduino processor on the 900 Mhz payload does not have real time, these time syncs are used to matchup the recorded times in seconds on the data card with the real time on the tracking computer.

- viii. **Disable Descent Cutter** button: turns the descent cut capability off in the payload's 900 Mhz transceiver provided this is being used on the AirCore flight. If the descent cut capability is thru a different unit on the flight string sending this command will have no affect the the cutter. The descent cutter is used on the payload to cut the balloon shards loose from the parachute after balloon burst keep them from becoming tangled in the parachute.
 - ix. **Enable Pressure Cutter** button: turns the pressure cut capability on in the payload's 900 Mhz transceiver provided this is being used on the AirCore flight.
 - x. **Cutdown Payload** button: sends a series of cut down commands to the 900 Mhz transceiver on the payload. This causes the balloon to be severed from the rest of the flight string. This feature is necessary to satisfy the FAA requirement for a commanded cut-down feature and can be used if it is desired that the balloon not go to burst. Choosing this command will give the operator two warning boxes to cancel this operation before the actual cut down command is sent to the payload. Once activated, the program sends out multiple one-letter codes over about an 8 second period that tell the cutter on the balloon to activate. When the processor on the payload receives the first of the one-letter commands it ignores all following commands and activates the cutter for 10 seconds. It then sends a series of responses to the chase vehicle. The cutter on the payload might not always cut the flight string on the first try so it is a good idea to immediately verify that the payload is descending about 20 seconds after the command is sent. If it is not, then send the cut down command again.
 - xi. **T M** button: puts the 900 Mhz transceiver on the payload into Test Mode. This is used mostly in the lab and should not be used in the field. Once the transceiver on the payload is in test mode it must be powered down and back up to clear it. If the payload is in flight it is impossible to clear test mode. Choosing this command will give the operator two warning boxes to cancel this operation before the actual Test Mode command is sent to the payload.
 - xii. Most of the commands listed above will receive an acknowledgement from the AirCore they are sent to. Bear in mind that just because the ground station does not receive an acknowledgement does not mean that the AirCore did not receive the command. The antenna on the payload is a small omni-directional antenna and the range is only about 20 miles.
- d. **Backup Tracking** tab:
- i. **Backup Tracking** groupbox:
 - 1. **Iridium On** checkbox: enables both iMet and 900 Mhz location data received from the payload to be sent out thru the ground station's backup Iridium transmitter.
 - 2. **Create iMet Files** checkbox: enables creation of "..._AC11.sbd" files in the C:\Aircore01 directory so they can be automatically emailed out to Philip Gladstone for backup tracking on the FAA findu.com website. A reliable internet connection is required for this to work. This feature is a backup to the ground stations backup Iridium transmitter which is generally more reliable.
 - ii. **CV GPS Test** groupbox: not used.

- iii. **iMet GPS Test** groupbox: not used.
- e. **Configuration** tab: displays the configuration file data. This generally should not need to be used. It displays the config.txt file data from the config file located in the root directory that the tracking program is located in. The most useful feature is the “Reset Descending” button.
- i. **Config File Values** groupbox: these settings need to be correct depending on which Aircore is being flown and also how the peripheral equipment is attached to the tracking laptop. The config file can be modified either with notepad.exe or with this program and saved. Once modified, the tracking program should be restarted.
 - ii. **Load Config File** button: loads and displays the config file.
 - iii. **Name**: is the name that is formatted into the “\$PRAVE” NMEA message that is sent to Global Mapper. It is generally “Aircore-1” or “Aircore-2” depending on which payload Iridium transmitter is being flown.
 - iv. **Chase Vehicle Name**: is the name that is formatted into the “\$PRAVE” NMEA messages that are sent to Global Mapper. It is generally “Chase Vehicle-1” or “Chase Vehicle-2”.
 - v. **Aircore Msg Name**: is the three-number designation assigned to the message that is sent out by the backup Iridium transmitter on the chase vehicle. It is generally “051” or “061” and helps identify the message on the FAA website.
 - vi. **Message Version**: is the version of the backup Iridium message. This should be left at “01”.
 - vii. **GPS Default Port**: is the comm port that the chase vehicle GPS is connected to. It is usually comm port 1.
 - viii. **VSPE Port**: is the serial port that the Virtual Serial Port Emulator Program is sending GPS data on. It should be left at comm port 5.
 - ix. **Cell Modem Msg Loc**: is the directory location on the hard drive where iMet data messages are stored in case an auto emailer program is being used for backup track reporting to the FAA. It is usually “C:\Aircore01\”.
 - x. **Email File Version**: is the trailing part of the cell modem message file. It should be left as “_AC11.sbd” or “_AC21.sbd”. The cell modem message name consists of the date/time the message was generated with “_AC11.sbd” attached to the end.
 - xi. **Iridium Port**: is the comm port that the back Iridium transmitter is connected to. It will vary with different laptops.
 - xii. **Iridium Xmit Rate (Sec)**: is the interval in seconds between backup Iridium transmissions. 30 seconds to 45 seconds is a recommended interval. More often might slow the system down and some of the transmissions might not get through. Less often might not be very useful since the FAA needs to see updates

at least every minute and there is a lag between when the transmission are sent and when the FAA sees them.

- xiii. **MAC High**: used for the 900 Mhz communications. Set to 0013a200 for both AirCore01 and 02.
- xiv. **MAC Low**: used for the 900 Mhz communications. Set to 4047076d for AirCore01 or 404f09f4 for AirCore02.
- xv. **Save Config File** button: saves the config file as config.txt. It also saves the old config.txt file under a different name.
- xvi. **Reset Descending** button: resets the green Descending status on the top of the window when the payload starts descending. It also resets the Asc/Des Status column. This is useful sometimes when warming up equipment at the beginning of a flight when the iMet GPS is not stable and might report a much lower elevation than where it is actually located. If the iMet altitude is 200 meters lower than the chase vehicle altitude than the “Descending” designation will be set in the program. This button will clear that condition.
- xvii. **Check for Com Ports** button: checks the computer for active comm ports and displays them in the Misc. Messages window under the NMEA Data tab. This is useful if you are not sure which port an item is connected to.
- xviii. **Chase Vehicle GPS** groupbox: selects whether to use the tracking radio box’s internal GPS (default) or to use an external Garmin GPS connected to com 1. Selection must be made before pressing the **Start** button.
 - 1. **External Com1**: sets the chase vehicle GPS selection to Com1 with a baud rate of 4800. An external configured Garmin GPS must be connected to Com 1.
 - 2. **Internal Com20**: this is the default and sets the chase vehicles GPS to the internal SANA V UBLOX FV-U8 on Com20 at a baud rate of 57600. This is a USB GPS located in the tracking box. It eliminates the extra cable and external power needed for an external GPS.
- xix. **Special Settings: (Lab Use Only)** groupbox:

- 3. Setting up Virtual Serial Port Emulator (VSPE)
- 4. Setting up SkySonde Server
- 5. Setting up SkySonde Client
- 6. Setting up Global Mapper
 - a. Setting up maps
 - b. Starting the GPS section
 - c. displaying info
 - d. changing map settings
 - e. loading maps
 - f. turning data on and off
- 7. asdf
- 8. asdf
- 9.