Aircraft Power is routed through the Power Distribution Unit (PDU) to the radar system. The various power supplies are controlled with individual push-ON/push-OFF switches, as shown below. In addition, most modules have a separate switch or CB on the front panel.

Figure 10: Power Distribution Unit

NOTE: Do not turn on the system until both engines are running and on speed, and the pilot indicates it is safe to do so. If the system is running before the second engine is started, the draw of power may cause numerous faults to be reported, necessitating an entire system reboot.

The system is powered up as follows:

1) All PDU CB's are set to ON (pushed), except CB's **JBOD** and **IMU**. RES is set to remote. SAU is set to remote
2) When the pilot is ready, the project power will be made available through a CB in the cockpit.
3) Operate the 60 Hz Inverter switch. Ensure associated monitor lights (3 Inverter On, 1 Inverter Fault) illuminate.
4) Wait 5 seconds for the system to stabilize.
5) Operate the 24 VDC, and 400Hz switches. Again, ***wait for the supplies to stabilize and monitor lights to illuminate (5-10 seconds)***
6) Turn on the IMU by pushing the IMU CB. Check for fan noise coming from the radome.

***CAUTION**: The 400 Hz system provides power to the IMU and CANNOT be cycled during flight. Any interruption of power to the IMU is reason to abort the flight.*

7) Power-up the radar modules as follows:

- TWTA ON/OFF switch on PDU - ON
- RES power switch - ON
- SEU power button - ON
- JBOD CB on PDU - ON
- RF Power Meter power - ON
- SAU power button - ON
- RCAS power button - ON
- MCC power button – ON

8) Confirm the following:
- 4 Links on the Ethernet HUB
- All JBOD lights are on (1 for each disk inserted!)

NOTE: Time taken for PLL LOCK ERROR lights to extinguish will depend on equipment temperature at start-up. The RO should become familiar with the rate at which the LED's flash, and then finally go out, as this is a clue to a potential PLL failure.

- Using Windows Explorer, verify at least 2 GB space on the D: drive

9) Measure PDU CT taps and record values on Flight Log
- (A: 2.0 ± 0.5, B/C: 28 ± 0.5)

10) RF Power Meter.
The RF Power Meter (RFPM) must be Zero'd and Calibrated as follows. Ensure RFPM has had adequate warm up time (approx 5 mins)

- Connect Power Sensor head to RFPM **POWER REF** connector
- Push **ZERO** button
  Wait for "ZEROING******" display to clear
- Push **SHIFT** then **ZERO** buttons, *NOT* simultaneously
  Meter should read "95.3%", if not, set 95.3%
- Push **ENTER** button

Wait for "CAL******" display to clear

- Move power sensor back to TWTA output sample port connection

11) Launch the MCC application from the 'MCC' icon on the desktop.
NOTE: Once the system starts the SEU and RCAS modules should power on, and have 2 green module status lights on the front panel. All of the JBOD disk lights will flash initially, and then remain on.

Aircraft 28 Volt DC Power is routed through the PWRDIST via three 70 Amp circuit breakers (CB). There is a master switch plus an individual breaker for most modules, as shown below. In addition, each module has a separate CB on the front panel.

4.4 STAR-4/5/6 Systems Power Up

Aircraft 28 Volt DC Power is routed through the PWRDIST via three 70 Amp circuit breakers (CB). There is a master switch plus an individual breaker for most modules, as shown below. In addition, each module has a separate CB on the front panel.

The **PWRDIST** contains the following CB's:

- ANT, NAV, RCVEX
- 115V AC (Inverter)
- Laptop
- JBOD
- AUX 1: (Spare 28V)
- AUX 2: (Radome Lights) **STAR-4 only**

The system is powered up as follows:

12) Ensure the PWRDIST MAIN DC PWR SWITCH is set to the Off (0) position.
13) Ensure all of the breakers on the NAV, ANT, WGASS, and RCVEX-RCAS modules are set to ON (pushed), **except the AUX 2 breaker (STAR-4 only).**
14) Ensure that all of the module breakers on the PWRDIST are pushed (on).
15) Turn on the MCC laptop, if not already on at paragraph 4.2, 4.
16) Turn the master power switch on the PWRDIST to 1 (vertical).
17) Wait 5 seconds for the system to power up and stabilize then push the AUX 2 breaker (STAR-4 only). The propose of this is to have the 400Hz invertors (IMU power source) stabilize before powering up the IMU
18) Launch the MCC application from the 'MCC' icon on the desktop.

Once the system starts all modules should power on, and have a green module status light on the front panel. All of the JBOD disk lights will flash initially, and then remain on.

NOTE: Do not turn on the system until both engines are running and on speed, and the pilot indicates it is safe to do so. If the system is running before the second engine is started, the draw of power may cause numerous faults to be reported, necessitating an entire system reboot.

The following discussion applies to the MCC applications found on all four systems:

4.5 Idle State

When the MCC starts, it begins in the IDLE state where it is waiting for all modules to start. Each module is represented by a widget with one of three colors:

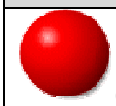
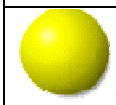
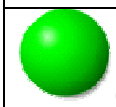
Condition	Description
 (Red)	The module is not responding (still booting, or disconnected), or there is an error condition that needs to be resolved. Check the Fault messages window for details.
 (Yellow)	The module has started normally with no error conditions, and is waiting for Time-synchronization from the NAV module.
 (Green)	The module is fully started and Time-synchronized.

Table 3: Widget Status

1) Wait for the module widgets to turn green, see Fig. 11. Unlike the other five widgets, the MDR widget will remain yellow until a new session is started. It is normal for some system faults to be reported during Start-up. This is due to timeouts waiting for status while the module is booting. Review the Fault list carefully. The system faults can be safely cleared at any time. Persistent faults cannot be cleared and the widget will remain red.

NOTE: If performing **tests** in a hanger or location with no GPS reception the widgets will likely remain yellow (unsynchronized). To avoid this problem, the "Set to computer time" option in the NAV diagnostic tool must be selected. This provides the system with the last know position. The widgets will then go green and the NAV diagnostic tool should be closed prior to starting a session.

2) Start a new session by clicking on '**New Session**' in the command bar. This will create a new session on the disk (under the Sessions directory) and connect the MDR to the JBOD. The MDR widget changes from Yellow to Green. At this point, the JBOD capacity is checked – the display should indicate 0% used, and 0/1093GB respectively. If required, (unless briefed otherwise to expect a partially full JBOD), the files must be deleted before data acquisition commences. The files can only be deleted in the Ready state, see paragraph 4.16, "JBOD (MDR) File Manager".

3) When the new session is started, the MCC will display the correct GPS time, day, week, satellites, PDOP, Lat and Long values from the GPS. Verify all values for reasonableness.

4) Note that the Init State MFD varies slightly depending upon the system:

Note that, to a very large extent, the MCC GUIs are the same from one system to the next. One major exception to this is illustrated at right. Due to the component differences, the Idle State MFD displayed on STAR-3 is different from those found on the other three systems (the PWRDIST block is "greyed out"). The PWRDIST model in Star3 is "dumb". There is no digital communication to and from the unit)

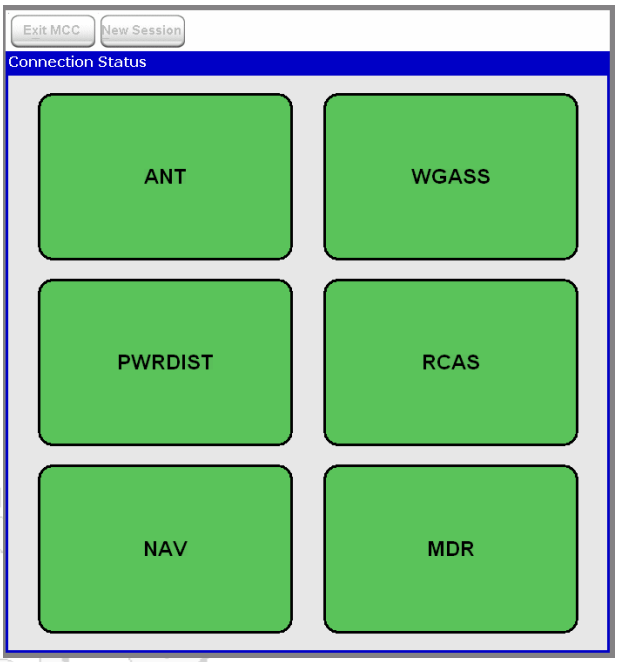


Figure 11: STAR-3/4/5/6 Idle State MFD

Idle State (cont.)

Upon launching the MCC Application, the MCC GUI will appear on the laptop screen. Initially, the individual widgets will be some combination of red, yellow, and perhaps green. At this point, the RO waits patiently for all of the widgets to go green, with the exception of the MDR widget. The MDR widget will not go green until a new session is started.

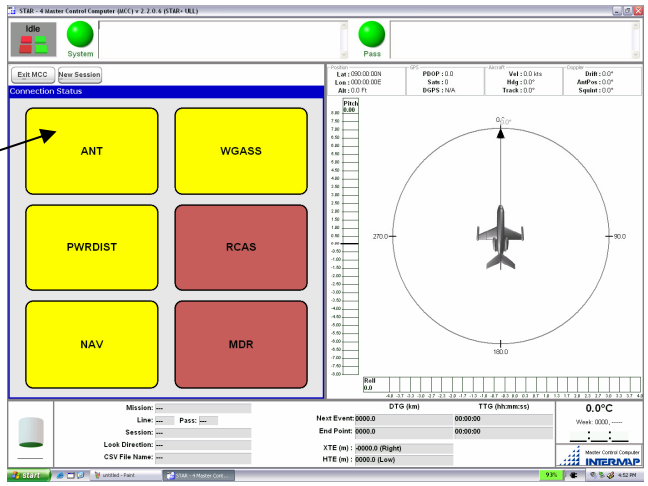


Figure 13: Idle State: Initial light-off indications.

With MDR widget yellow and all others green, the RO should clear all displayed System Faults. Any persistent faults that will not clear must be dealt with before proceeding. Clear indicated Faults by pushing the round System Fault Indicator.

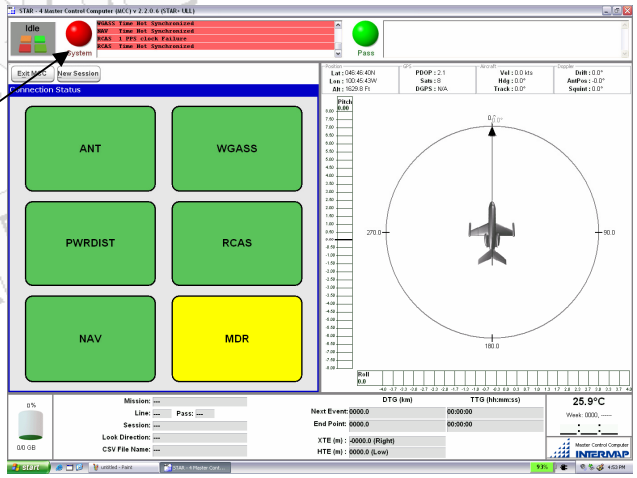


Figure 14: Idle State: Five green widgets/System Faults still indicated.

With no remaining faults, five green widgets, and one yellow widget, the RO can push the New Session button. He should watch to insure that the MDR widget shifts to green after several seconds, and the State indicator changes from Init to Busy.

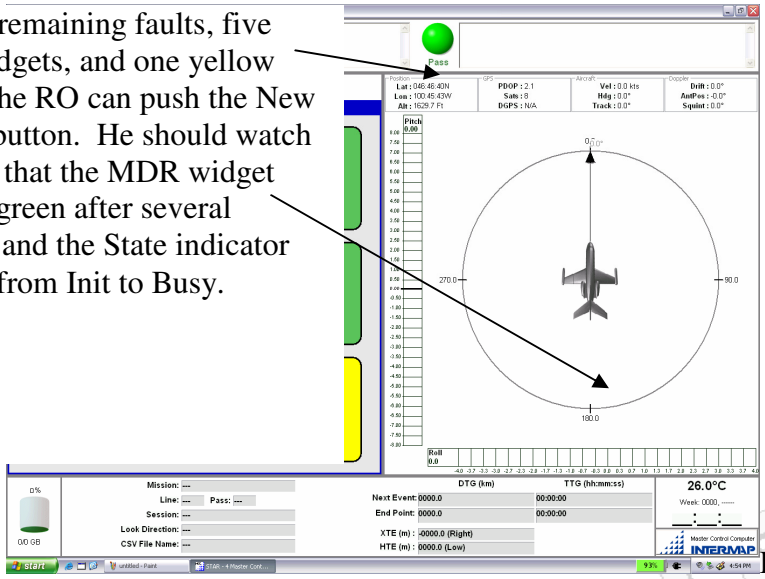


Figure 15: Idle State: Five green widgets

Idle State (cont.)

Upon pushing the New Session button, the MCC software creates a new session file. This is where the NAV data is located. Every new session requires that 10 minutes of NAV data and a 360° turn be completed before any raw radar data is collected. The RO is waiting for the state symbol to show Init. Note the Busy symbol, which appears during state changes and various other MCC actions.

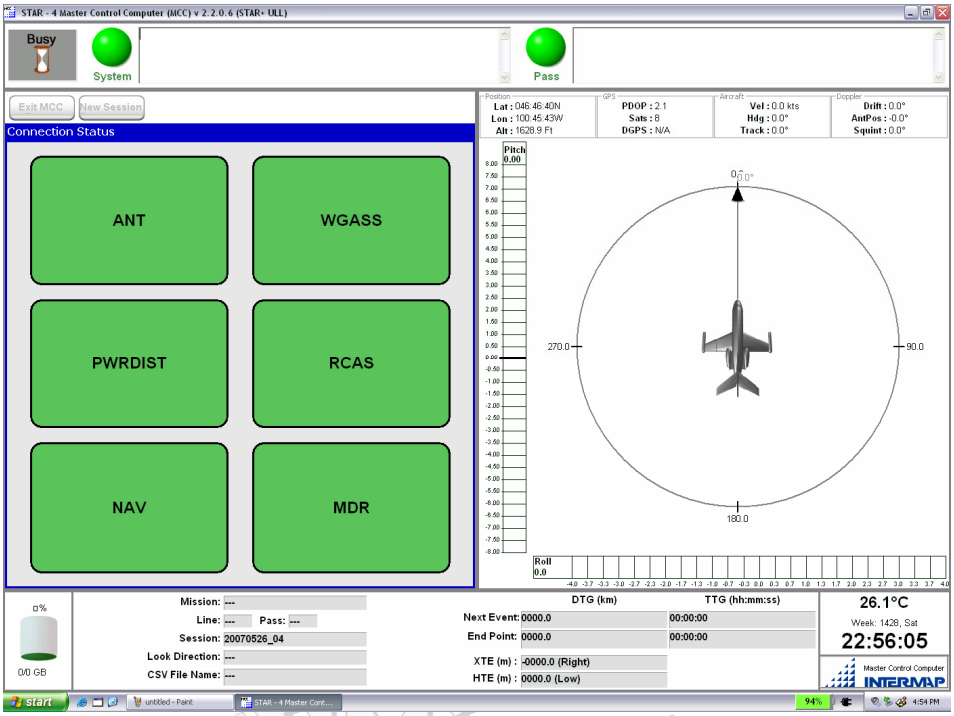


Figure 16: State Change: Idle to Init.

4.6 Init State

The initialization state requires several conditions to be met before continuing. A green 'LED' is illuminated when the following criteria are met:

1) The IMU must be aligned. This process is not automatic and will only begin when the 'Align' button in the MFD is selected. Alignment Quality counts down from 15 to 0.75, at which point the two additional conditions should have been met.
2) The Phase Lock Loop (PLL) detection in the RCAS must be consistently locked for 60 seconds. The RCAS module automatically monitors this condition.
3) The TWTA must be warmed up to a preset temperature. This is automatically started when power is applied, and takes a few minutes to complete.

NOTE: Once the alignment is started, the aircraft must remain stationary until the alignment sequence is completed. If the aircraft is moved, the alignment is restarted by pressing the 'Re-Align' button in the MFD.

Once aligned the MCC will display the correct Heading, Pitch, and Roll. During the alignment process, it is normal that they flicker slightly. Verify all indications for "reasonableness". Select 'Continue' in the MFD to move to the Ready state, if required.

Init State (cont.)

After the MDR widget goes green, and a new session is started, the MCC software shifts to Init. At this point, the RO can start the Alignment process. The PLL and/or the TWT Warm-up may already be complete (as indicated by green LEDs), or they may go green very soon after. The Alignment process however, will not commence until the RO pushes the Align button. Once pushed, the Align button will say ReAlign. The Alignment "sphere" will also change color once Alignment begins.

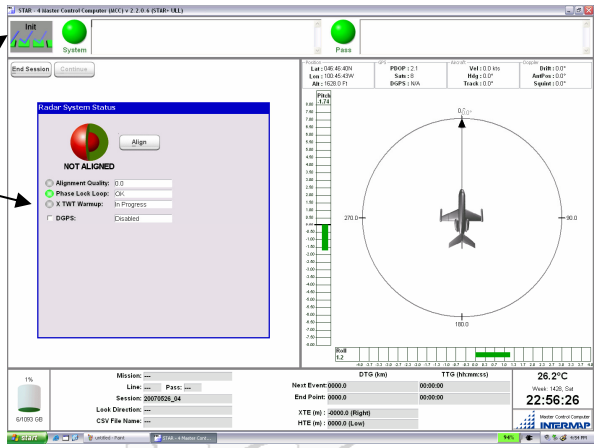


Figure 17: Init State: Align button not pushed.

Prior to pushing the Align button, the Alignment quality will display "0." After the button is pushed, there is a delay of a few seconds, and then the quality figure will read "15." The RO should watch the figure count down to the target quality of "0.75." This process will take several minutes. If any problem occurs during alignment, or if the aircraft is moved during the process, the RO can push the ReAlign button to restart the process.

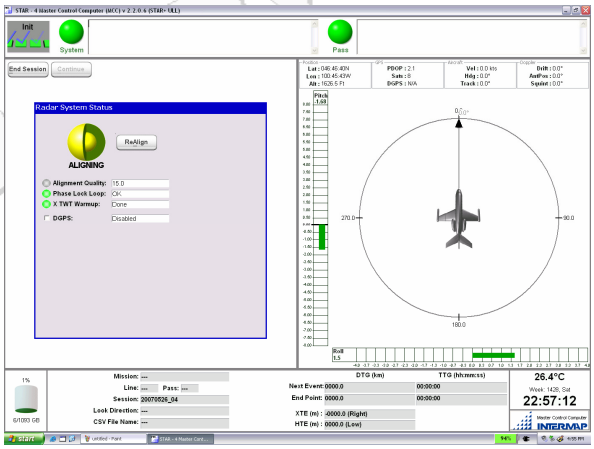


Figure 18: Init State: Alignment in progress.

After a few more seconds, the “0.75” will revert to “0,” the Alignment sphere will change to a darker shade of green, and the Alignment Quality LED will show green. The RO should be attentive to insure that this process runs smoothly. Once a successful alignment has been completed, the RO follows through with the Post-Alignment checks. He then pushes Continue to facilitate a change to the ready State.

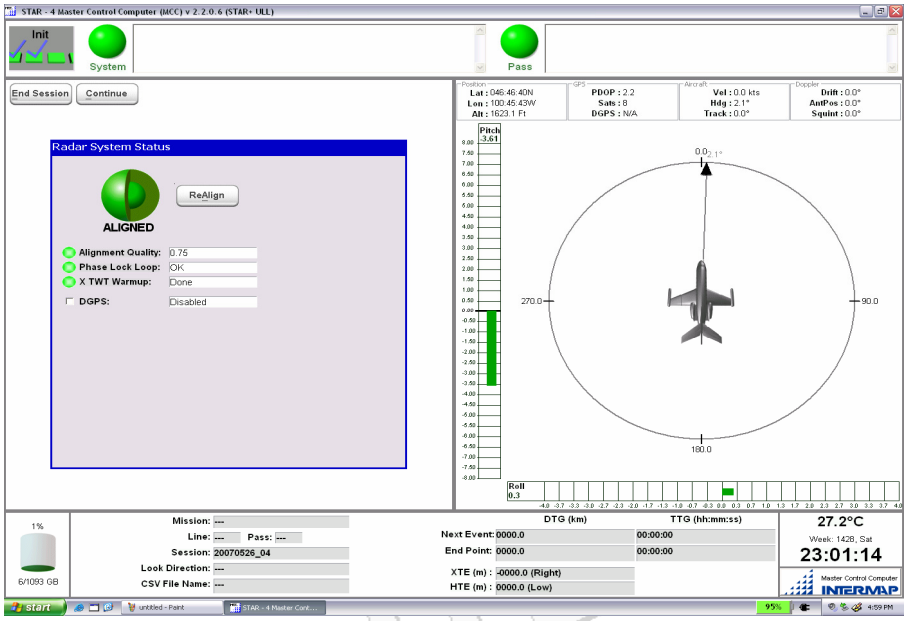


Figure 19: Init State: Alignment complete.

4.7 Ready State

Once at the Ready state, all of the .csv files that are present in the **Flightplan** folder are loaded and parsed. Invalid .csv files will be marked in RED, or not displayed. Any new CSV files must have been copied to the MCC laptop before starting the MCC application.

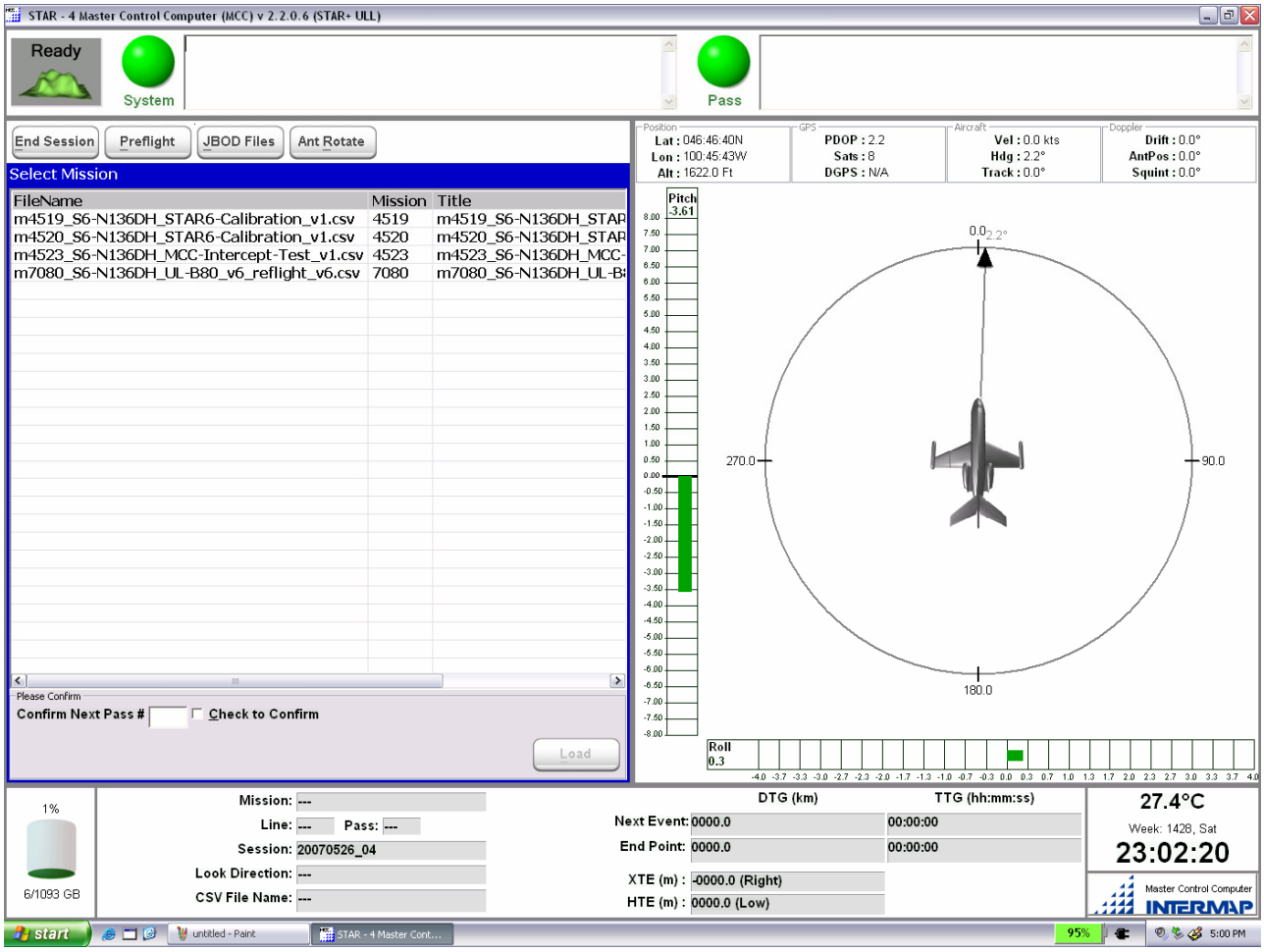


Figure 20: Ready State: Overview

From this state the following can be performed:

- **End Session**: If required, the current session can be ended.
- **Pre-flight**: Perform a pre-flight test (see 4.9 Pre-Flight)
- **JBOD Files**: If required JBOD files may be deleted through the built-in File Manager. If unable to delete the files, use the DOS-based MDRShell Program, see paragraph 4.16, "MDR Shell".

- **Ant Rotate**: This feature allows ROs on STAR-4 and STAR-5 to complete in-flight radome inspections.
- **Load**: Loads the selected mission.

4.8 Ready State (cont.)

The following steps must be performed.

1. Ensure that the mission file(s) for the flight has been loaded and accepted by the MCC. Verify that it is present in the MFD with the correct filename and version number.
2. Clear JBOD if necessary. The Pre-flight test results in data being written to the JBOD. Do not delete this data. By competing JBOD management before running the pre-flight, the RO avoids the risk of accidentally deleting the pre-flight data. See section 4.8 for JBOD management procedures.
3. A pre-flight test must be performed before takeoff. This is to test the system and identify any problems whilst still on the ground, and to avoid the fuel cost of take off / landing. Click on **Pre-flight** to start. See section 4.9 for Pre-Flight procedures.
4. Load a Mission. To load a mission it must first be selected in the MFD, and the starting pass number confirmed by checking off the check box. The MCC automatically increments and remembers the next pass number, but it should always be manually verified, and may be changed if required. Pass numbers should be cross checked with those indicated in the RO Log Book. Once the correct pass number has been determined and entered, click **Load** to load the mission.

4.8 JBOD Management

If required, JBOD files can be deleted using the MDR File Manager.

Figure 21shows that the JBOD set being used already has data on it. In this case, the amount of data (6 GB) is consistent with a complete pre-flight test. We have not completed a pre-flight yet, so this data probably resulted from a ground test run by Sensor Support staff. In any case, the RO must confirm that it's OK to delete this data. Having done so, he is free to complete a pre-flight of his own.

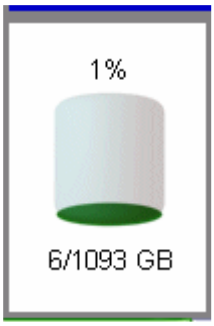


Figure 21: JBOD Status:

Currently contains 6 GB of data out of 1093 total capacity

(about 1% for an eight disk set).

NOTE: Proceed with caution, there is no UNDO command.

4.9 JBOD Management (cont.)

Click the JBOD Files button on the command bar to open the MDR File Manager. The MCC GUI will display the File Manager in the MFD as shown. No individual data files are displayed initially, even though the JBOD status indicator indicates 6 GB.

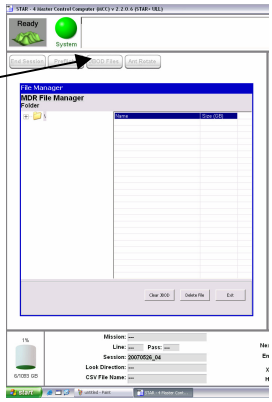


Figure 22: Ready State: MDR File Manager opened.

By clicking on the folder symbols in the left window of the MDR File Manager, individual data file are listed. Files can be deleted individually by highlighting them and then pushing the Delete File button, or all of the files can be deleted at once by clicking the Clear JBOD button. BE CAREFUL: There is NO Undo button. It is essential that the RO confirm that files can be deleted before doing so.

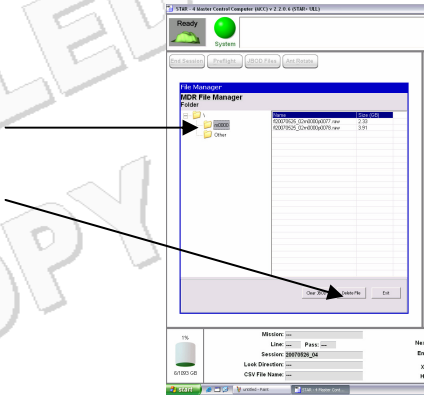


Figure 23: Ready State: JBOD files opened.

Having cleared the data using the MDR Manager, the RO should confirm that the JBOD usage now displays 0/1093 and 0%. The RO then pushes the Exit button to close the MDR Manager, and return to the normal Ready State MFD.

In the event that the MDR File Manager does not function as it should, the RO can use MDR shell to complete JBOD file management tasks. See section 4.16 for MDR Shell procedures.

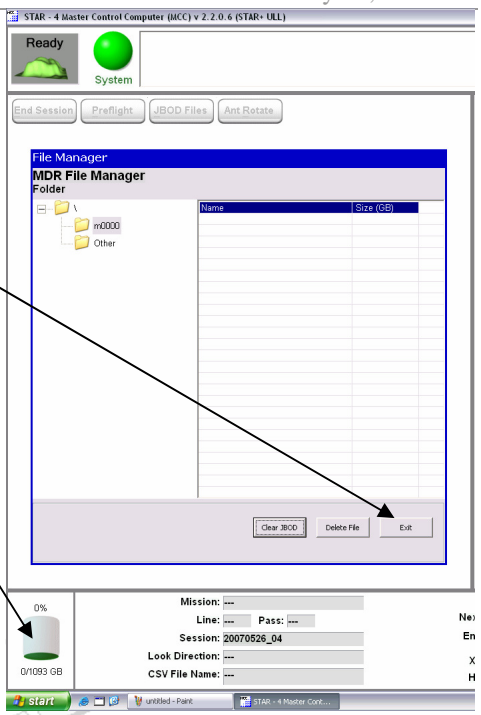


Figure 24: Ready State: JBOD cleared.

4.9 Pre-Flight

The Pre-Flight test is used to confirm system function on the ground.

1) **Before starting (on STAR-4 and STAR-5), load the 'Radar Camera' program on the desktop of the MCC laptop. STAR-3 and STAR-6 require visual inspections completed by opening radome inspection panels.**
2) Select 'Pre-flight' in the Command Bar
3) The pre-flight test begins with an antenna rotational test. **During the rotation use the radome camera laptop to inspect the radome internally for signs of moisture and foreign materials. Any moisture or debris must be removed before proceeding with the flight. It is imperative that this inspection is performed (STAR-4 and 5 only).** Confirm rotation of pedestal using the SAD on all systems.
4) Observe Pre-flight Progress as shown in Figure 17:

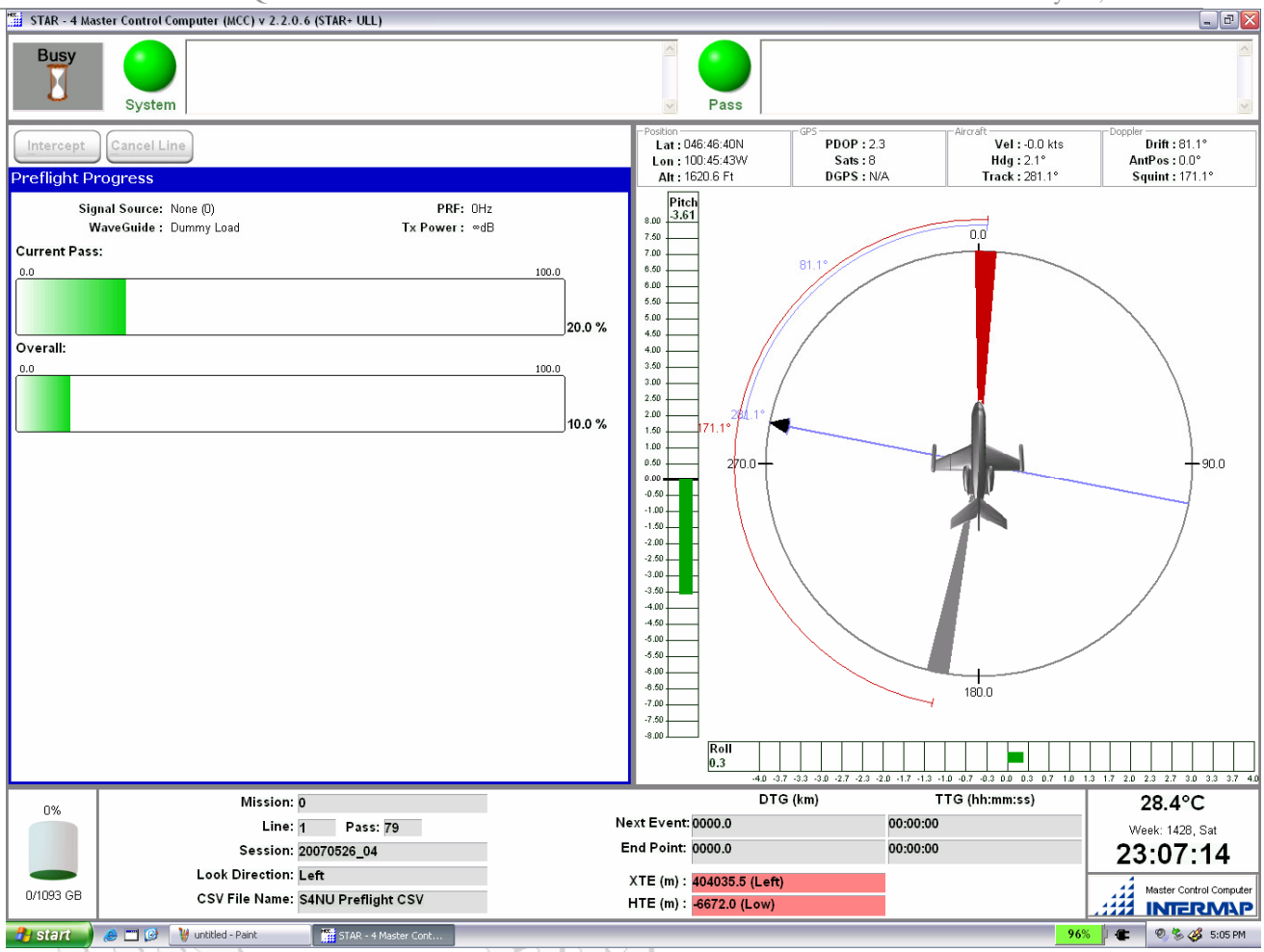


Figure 25: Pre-flight Progress

4.10 Pre-Flight (cont'd)

The signal source Start Map tests will begin after the antennas have rotated to each look direction. During the tests the following should be observed:

- JBOD Disk lights are flashing
- The signal sources are changing
- TX is on (TX Power ~ 0dB nominal)
- **The radome is clear of moisture and debris using the radome camera application on the MCC desktop for STAR-4 and STAR-5 (see section 5 of this document)**

During the pre-flight test, power is transmitted to the dummy load. The entire process is automated and requires no manual intervention. When the pre-flight test is complete ensure no failure modes are displayed.

The pre-flight test will take approximately 6-8GB of disk space. **At the end of the test the antenna will move to the 'stowed' position of +90 degrees for take off for STAR-4. It will be placed in the "home" position (0 degrees) on STAR-3, STAR-5 and STAR-6.**

NOTE: Multiple pre-flights can be performed without harm to the system.

4.10 Ready State following Pre-flight

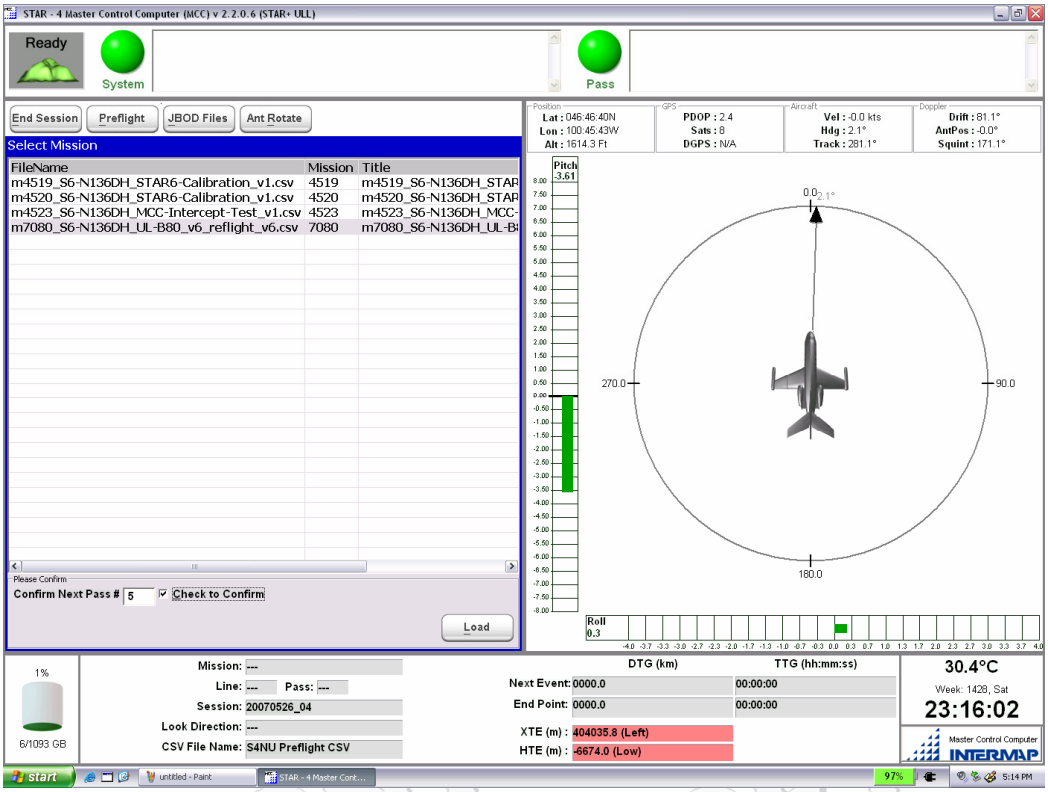


Figure 26: Ready State: Selecting and loading a mission.

4.11 Ready State following Pre-flight (cont.)

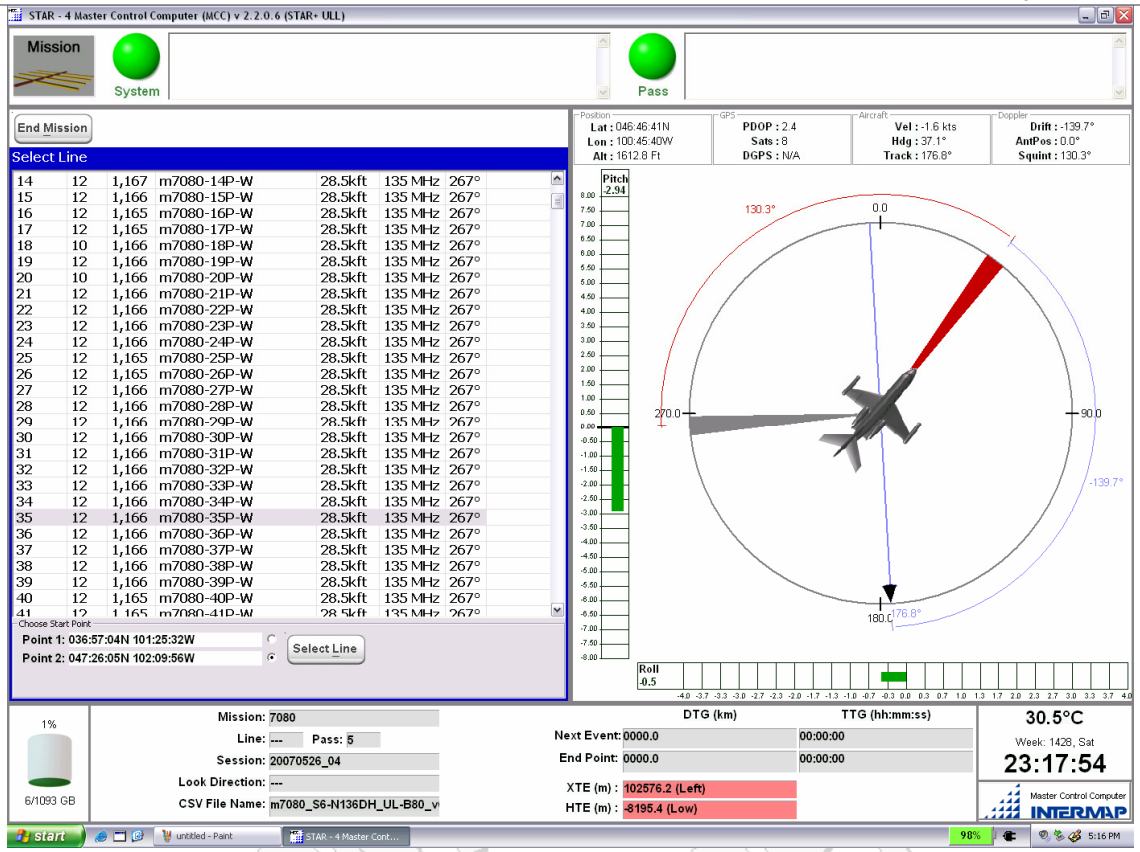
After a pre-flight test is performed and there are no faults, the system reverts to the 'Select Mission' window, which is displayed in the MFD. As multiple missions can be flown on one flight, verify that all briefed missions for this particular flight are available for selection. Select the correct mission .csv file, and log the file name on the Flight Log. Logged .csv file names should NOT be taken off of the Flight Report.

Once a .csv file is selected, the Confirm Next Pass window becomes populated. The RO needs to confirm the correctness of this number, by comparing it with the information recorded in the ROs Log Book. Once all is confirmed to be correct, the RO must check the Check to Confirm box. Failing to do so will prevent the Ro from being able to load the file.

Upon loading the .csv file, the RO will observe the MCC application to change from Ready State to Mission State.

4.12 Mission State

When the Select Line window opens, the RO should confirm that all planned lines are available. At this point, the RO will "pre-select" the line, but wait to actually "select" it.



14	12	1,167	m7080-14P-W	28.5kft	135 MHz	267°
15	12	1,166	m7080-15P-W	28.5kft	135 MHz	267°
16	12	1,165	m7080-16P-W	28.5kft	135 MHz	267°
17	12	1,165	m7080-17P-W	28.5kft	135 MHz	267°
18	10	1,166	m7080-18P-W	28.5kft	135 MHz	267°
19	12	1,166	m7080-19P-W	28.5kft	135 MHz	267°
20	10	1,166	m7080-20P-W	28.5kft	135 MHz	267°
21	12	1,166	m7080-21P-W	28.5kft	135 MHz	267°
22	12	1,166	m7080-22P-W	28.5kft	135 MHz	267°
23	12	1,166	m7080-23P-W	28.5kft	135 MHz	267°
24	12	1,166	m7080-24P-W	28.5kft	135 MHz	267°
25	12	1,165	m7080-25P-W	28.5kft	135 MHz	267°
26	12	1,165	m7080-26P-W	28.5kft	135 MHz	267°
27	12	1,166	m7080-27P-W	28.5kft	135 MHz	267°
28	12	1,166	m7080-28P-W	28.5kft	135 MHz	267°
29	12	1,166	m7080-29P-W	28.5kft	135 MHz	267°
30	12	1,166	m7080-30P-W	28.5kft	135 MHz	267°
31	12	1,166	m7080-31P-W	28.5kft	135 MHz	267°
32	12	1,166	m7080-32P-W	28.5kft	135 MHz	267°
33	12	1,166	m7080-33P-W	28.5kft	135 MHz	267°
34	12	1,166	m7080-34P-W	28.5kft	135 MHz	267°
35	12	1,166	m7080-35P-W	28.5kft	135 MHz	267°
36	12	1,166	m7080-36P-W	28.5kft	135 MHz	267°
37	12	1,166	m7080-37P-W	28.5kft	135 MHz	267°
38	12	1,166	m7080-38P-W	28.5kft	135 MHz	267°
39	12	1,166	m7080-39P-W	28.5kft	135 MHz	267°
40	12	1,165	m7080-40P-W	28.5kft	135 MHz	267°
41	12	1,165	m7080-41P-W	28.5kft	135 MHz	267°

Figure 27: Mission State: Line pre-selected.

NOTE: Before the first pass of any session a >360° orbit must be performed. Also, at least 10 minutes of NAV data is required.

The MFD will display a list of all of the lines available for a mission. When a line is highlighted it is displayed on the SAD, as well as the look direction and flight direction. See SAD in fig 27.

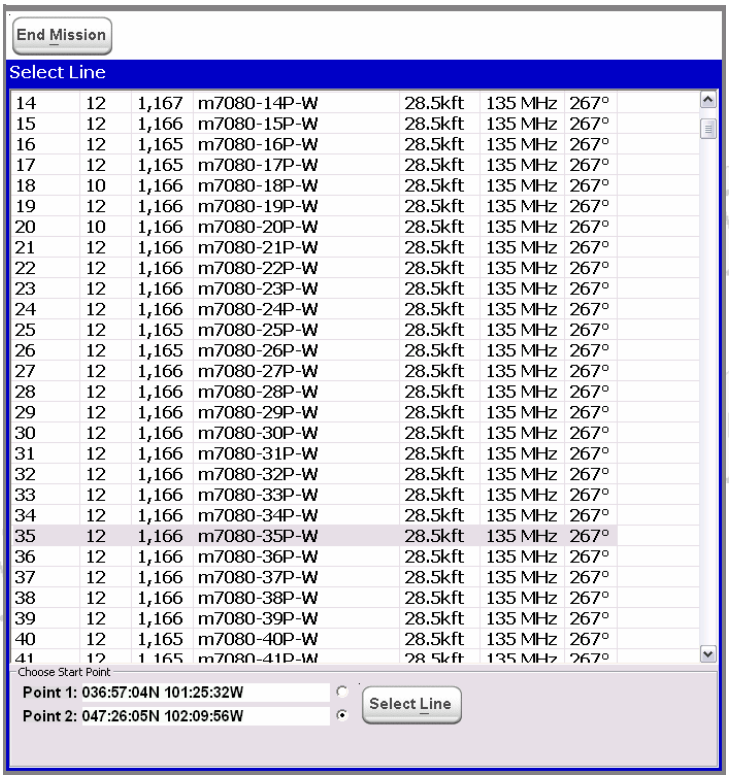


Figure 28: Pre-Selecting a Line

1) Highlight next line in MFD. The line can be composed of numerous segments, or just one segment.
2) Select starting point as required. As most lines can be flown in either direction, the starting point must be set correctly. Check Flight Report to insure that any given Line does not have a specified direction.
3) Line segments can be flown individually using a "Reflight .csv" file which is provided by the SysDAP program. Using this RF .csv, each segment is assigned a unique Line Number.
4) Before selecting the line, confirm the Line Orientation and number with the pilot.

5) When turning towards the line, click **Select Line** in the MFD.

4.13 Taxi & Take Off

Once a line is pre-selected, the RO will designate a start point, and thus a specific direction of travel. This is achieved by selecting Point 1 and Point 2. Line number and direction should always be confirmed with the pilot.

The system is now ready for take off. Inform the pilot of this fact!

During taxi, ensure that the MFD is live, and the various navigational parameters are changing. These include Heading, Latitude, Longitude, etc. The RO should confirm that these parameters are "active" by watching that they change during the taxi. Following that confirmation, the MCC should be stowed for take-off.

Following the takeoff, the RO will monitor the MCC for faults. He will insure that a 360 degree turn is completed prior to data collection. Upon turning toward the first pass – when the aircraft Heading is perpendicular to Track as indicated on the SAD – the RO should **Select** the line.

4.14 Intercept State

Once a line is selected the MCC will begin intercepting the Setup Point. The MCC will monitor the GPS position, and when the position is within specified Altitude and Cross Track Error (XTE) limits, it will shift to the Setup state.
The Time to Go (TTG) and Distance to Go (DTG) indications tell the RO how soon he should expect to arrive at the next event. These "events" include the Setup Point, the Start Map Point, and on Ultra Long Lines, all intermediate Tie Lines. There is also an End Map point. Tie Line events all fall within the Map portion of the line illustrated below:

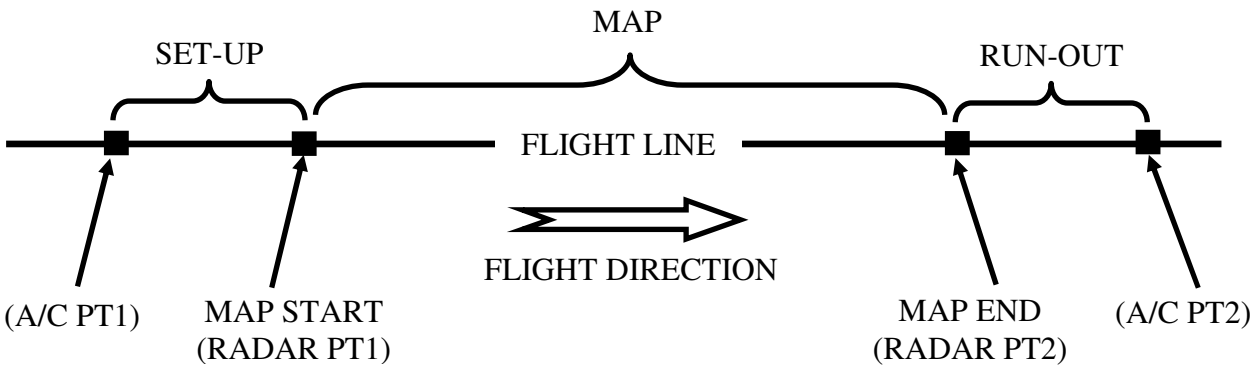


Figure 29: Flight Line Waypoints

During the Intercept State, the aircraft is turning on to the line, and moving toward the Setup Point.

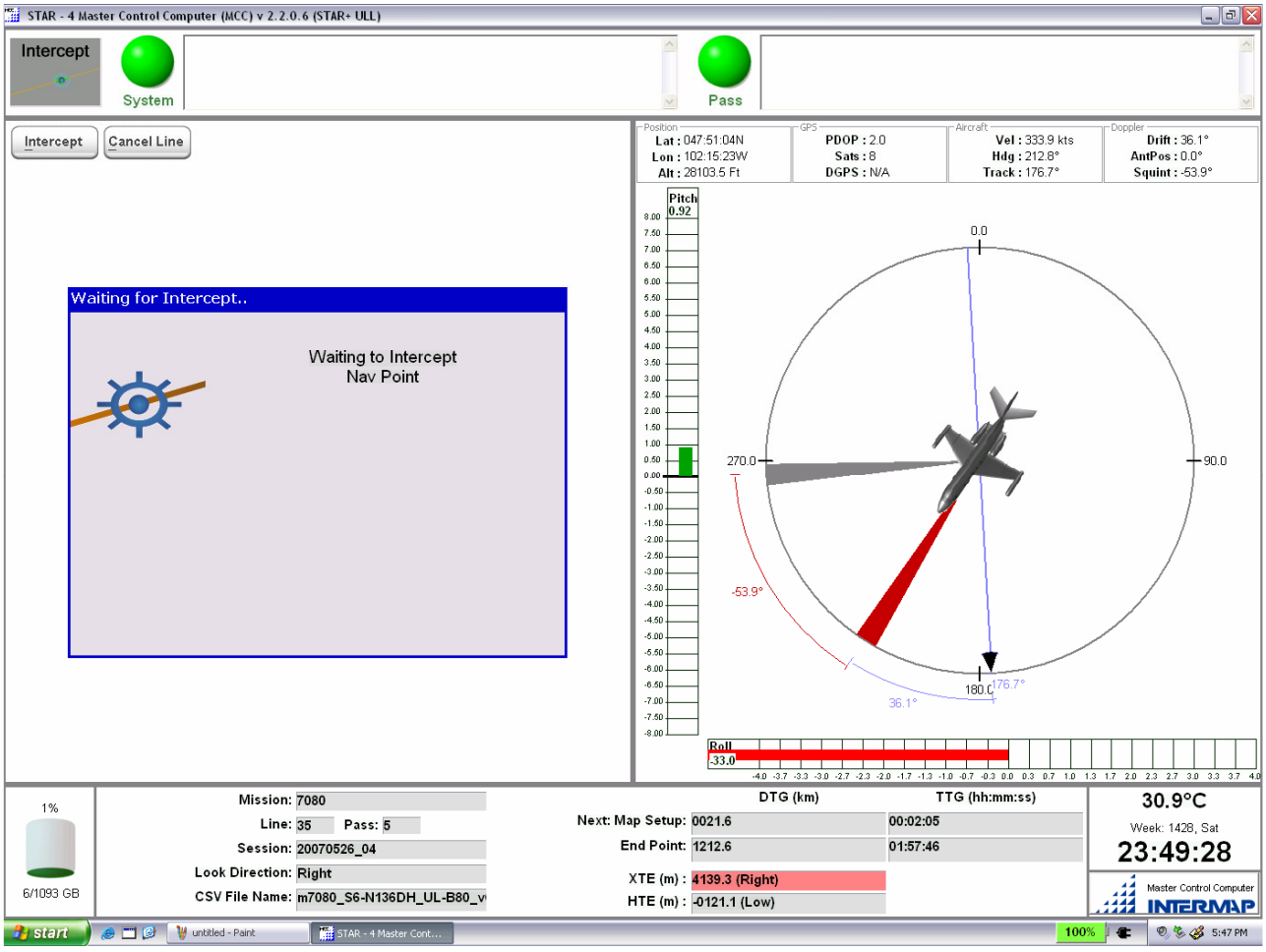


Figure 30: Intercept State

The RO should monitor the SAD, expecting that the aircraft symbol will rotate around until the aircraft's nose points down track. The RO should also expect the Roll indication to drop as the wings level, and the cross-track error should also be dropping quickly. If the first two conditions are met, but the third is not, the RO should suspect that the aircraft is NOT lining up on the same line that he has selected in the MCC.

Again, the RO is looking for three critical indications:

- Relatively low and steady drift angle.
- Relatively low and steady XTE
- Relatively low and steady roll.

Remember: It is only when these conditions are all met the **DTG** and **TTG** indications are trustworthy.