MCC File System

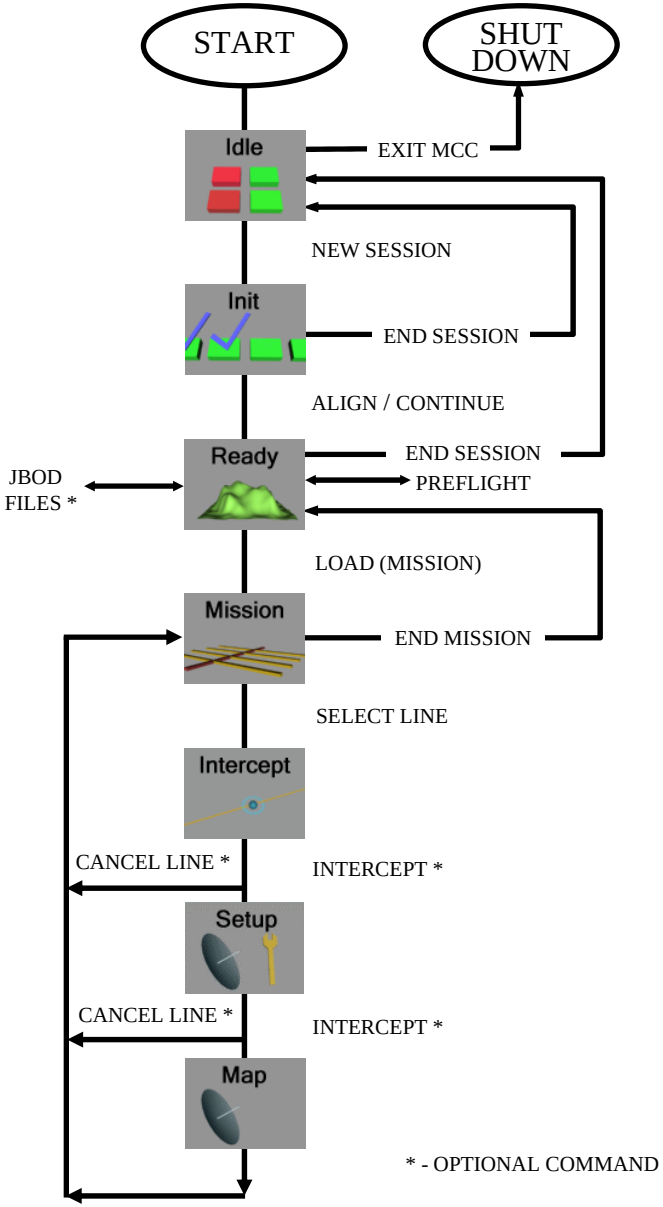
- The MCC reads the CSV file from the ‘Flightplan’ folder, and records data into the ‘Sessions’ folder.
- The location of these folders is configurable by Engineering, and may change depending on the make and model of the laptop.
- These folders are normally located on the D:\ drive of the laptop under the ‘MCC’ folder

MCC Functions

The MCC performs the following functions:

- Configures the Radar
- Controls Data Acquisition
- Records Auxiliary and Navigation Data
- Manages recording of RAW data on the JBOD through the Mass Data Recorder (MDR) - the MDR is an internal component of the RCAS.
- Displays Radar Status to the Radar Operator.
- Provides Operator Interface to select Missions and Lines.
- Facilitates Fault Recovery

MCC Radar States

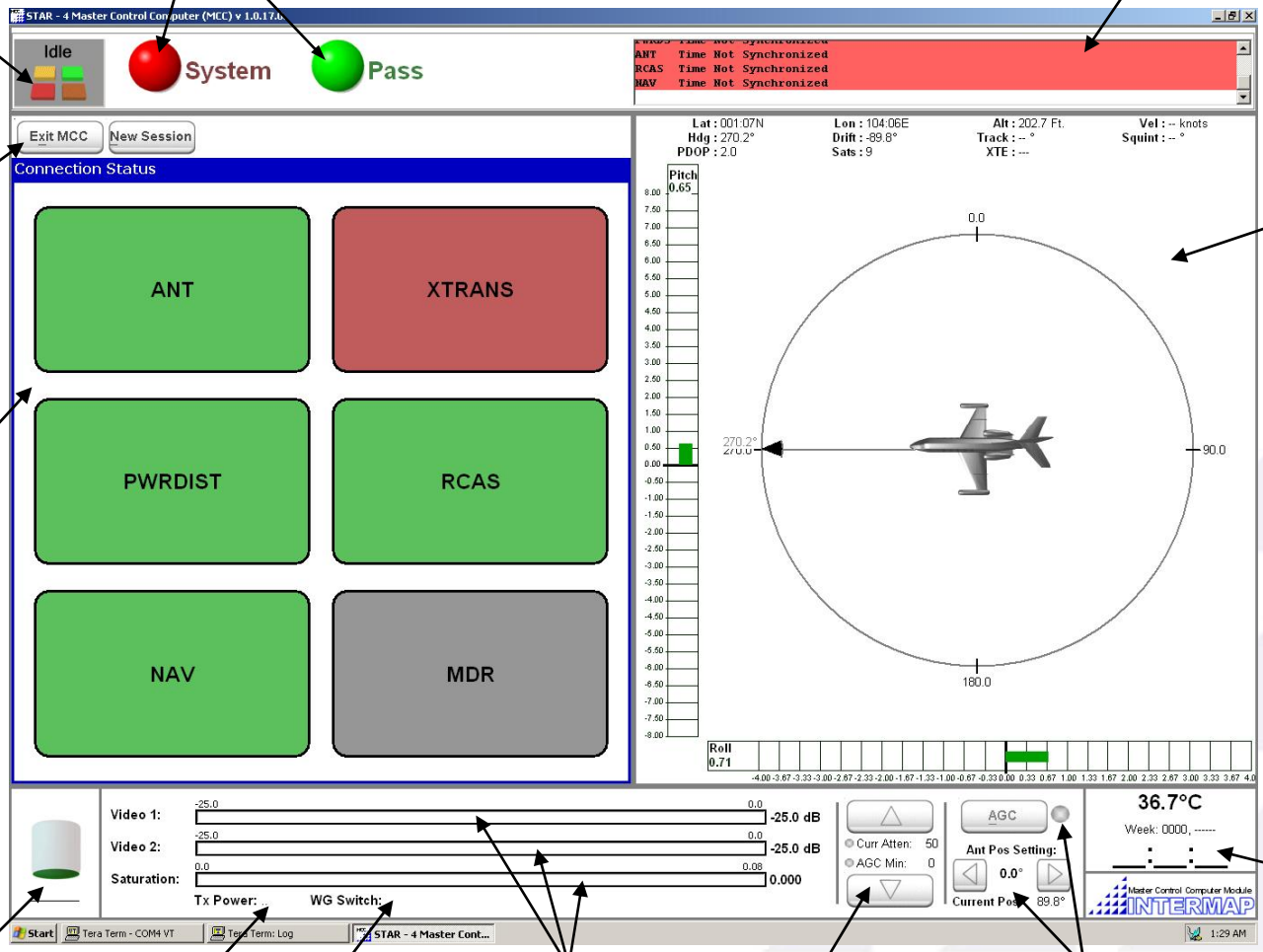


System Start-up

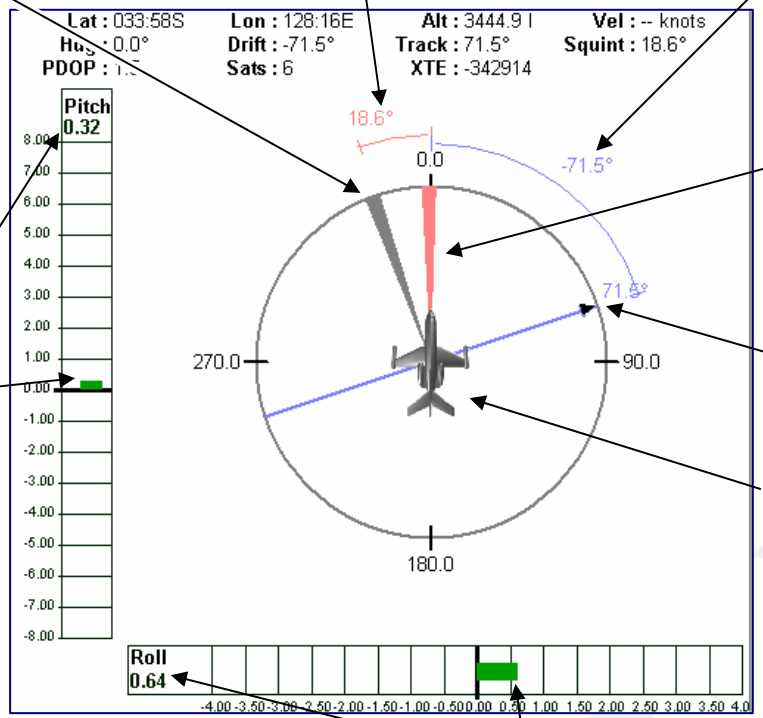
Before attempting a Radar Acquisition flight, the RO must power up and test the system on the ground.

- The RO will verify that all equipment is off, and in a proper state before applying power to the system.
- When ready, the pilot will indicate that project power is available.
- The RO will then use the RO Check-List to ensure the correct power-up sequence is used.
- Switch the WGASS Antenna/Dummy Load switch ‘Antenna’.
- Main DC power switch on the PWRDIST module to On (1)
- Check to ensure all modules are powered (Status light on all modules). If not, check individual breakers on each of the modules.
- Start the MCC software on the laptop, using the designated icon.

MCC Start-up Screen



MCC ~ Situational Awareness Display



Squint Angle of 18.6°
(Red arc showing difference between actual antenna look and desired look)

Drift angle of -71.5°
(Blue arc showing difference between A/C Heading and line track)

Desired "look" direction (90º left look from line track)

Current Ant Position
(0.0° – at Home Position)

Line Track at 71.5°

Current Aircraft Pitch & Direction, (showing 0.32º Nose Up)

A/C Heading at 0.0°

Current Aircraft Roll & Direction, (showing 0.64º Right Wing Down)

INTERMAP

MCC Status Widgets

The module is fully started and Time-synchronized.

The module has started normally with no error conditions, and is waiting for Time-synchronization from the NAV module.

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.

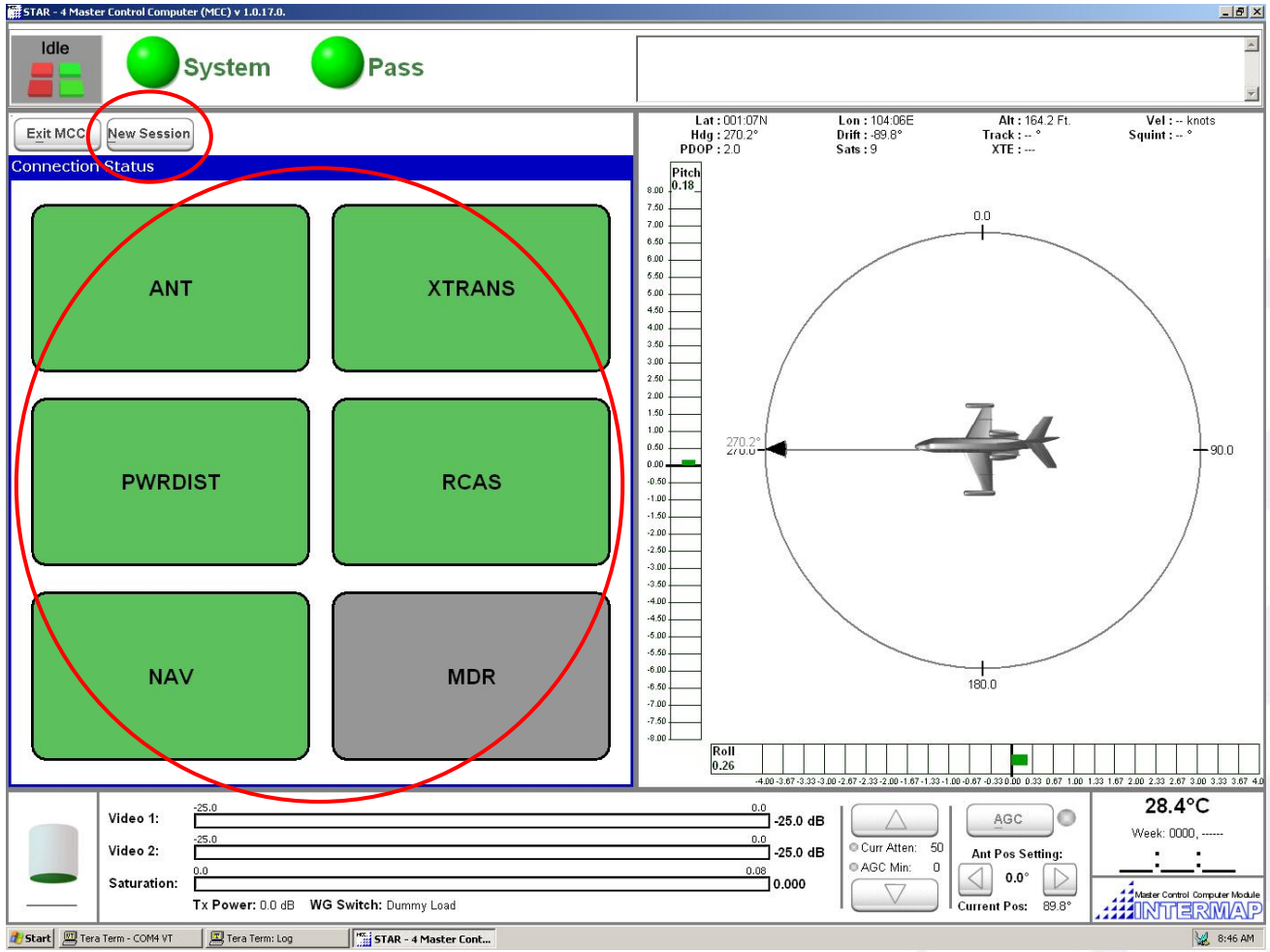
This status widget applies only to the MDR. It indicates that the MDR is ready for the 'New Session' to be started (during the initial start-up sequence) and will change to green when all MDR/JBOD connection parameters are satisfied.

INTERMAP

Operation ~ Idle State

All units should report Status Green except the MDR

- Select 'New Session'
- MDR widget changes to green
- State changes to **Init**
- 'Exit MCC' available



Operation ~ Init State

- New Session has been started
- Review IMU alignment.

When not aligned, select the 'Align' button.

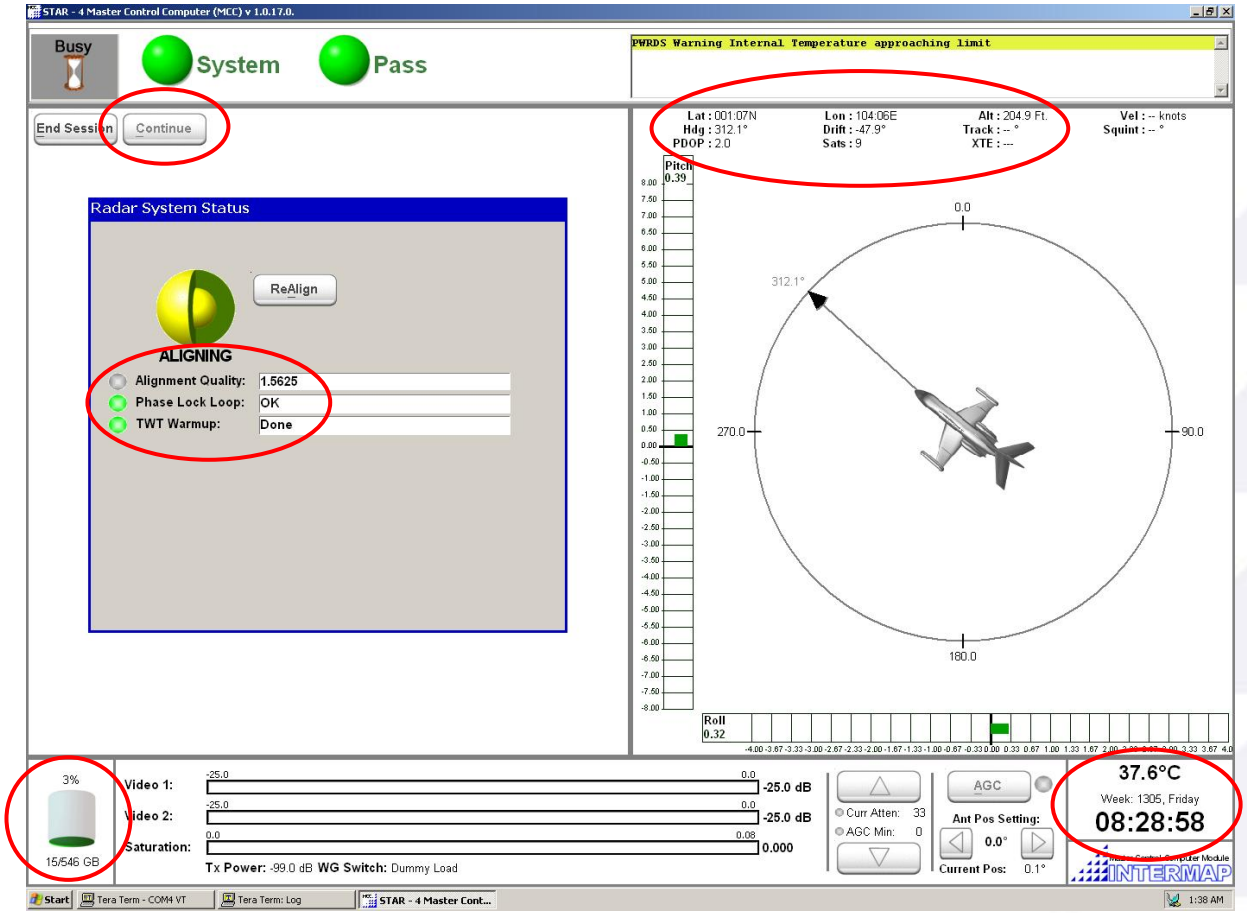
- If required, select the ReAlign button.

Select 'Continue' when three green lights indicate:

- IMU Aligned
- PLL Locked
- TWT (TX) Warmed up

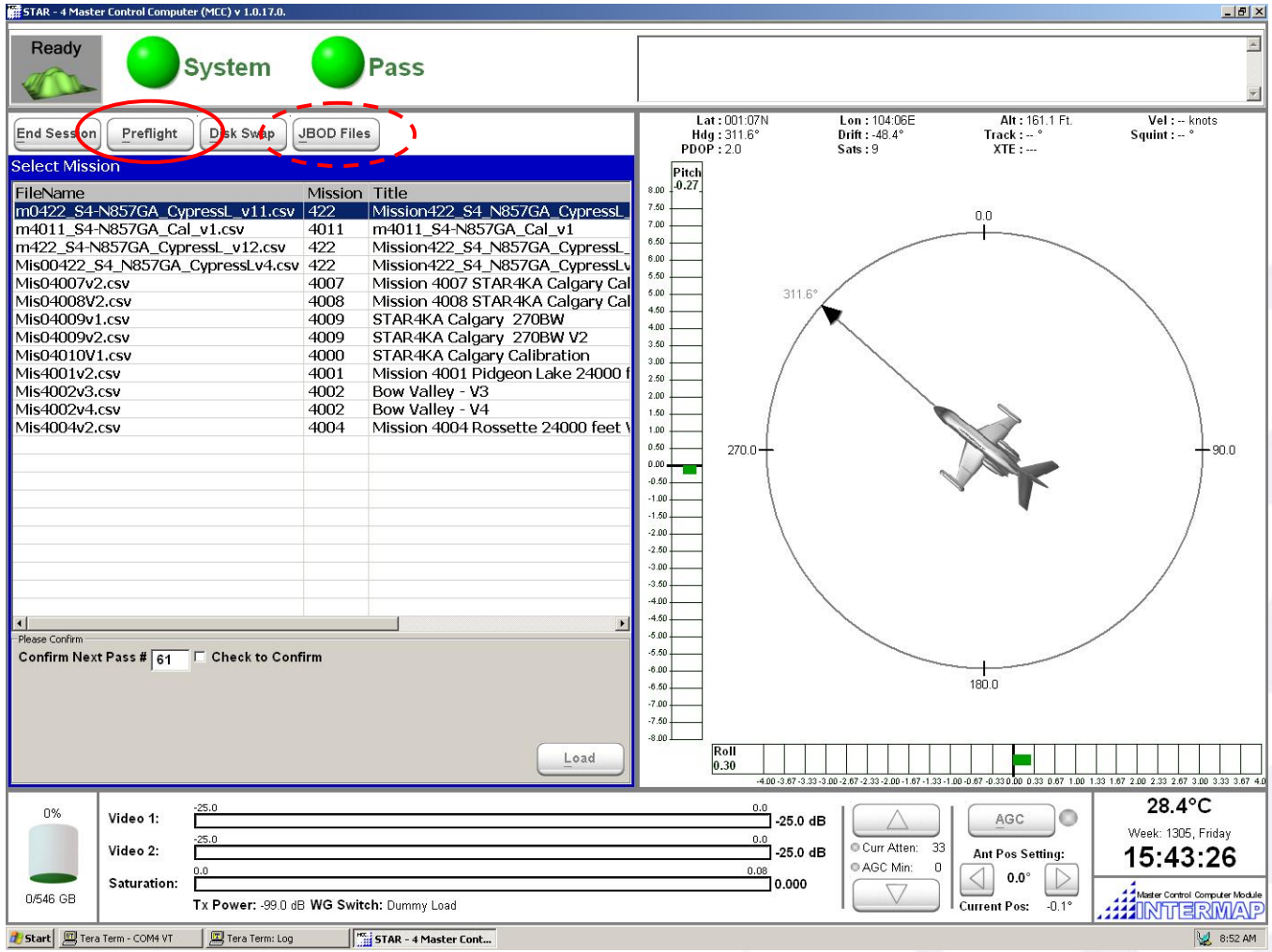
NOTE: Aircraft must remain stationary during alignment.

- Hard drive space is checked
- Verify JBOD space
- Validate GPS information, including Lat / Lon / Alt & Time
- Verify Hdg is correct



Operation ~ Ready State 1

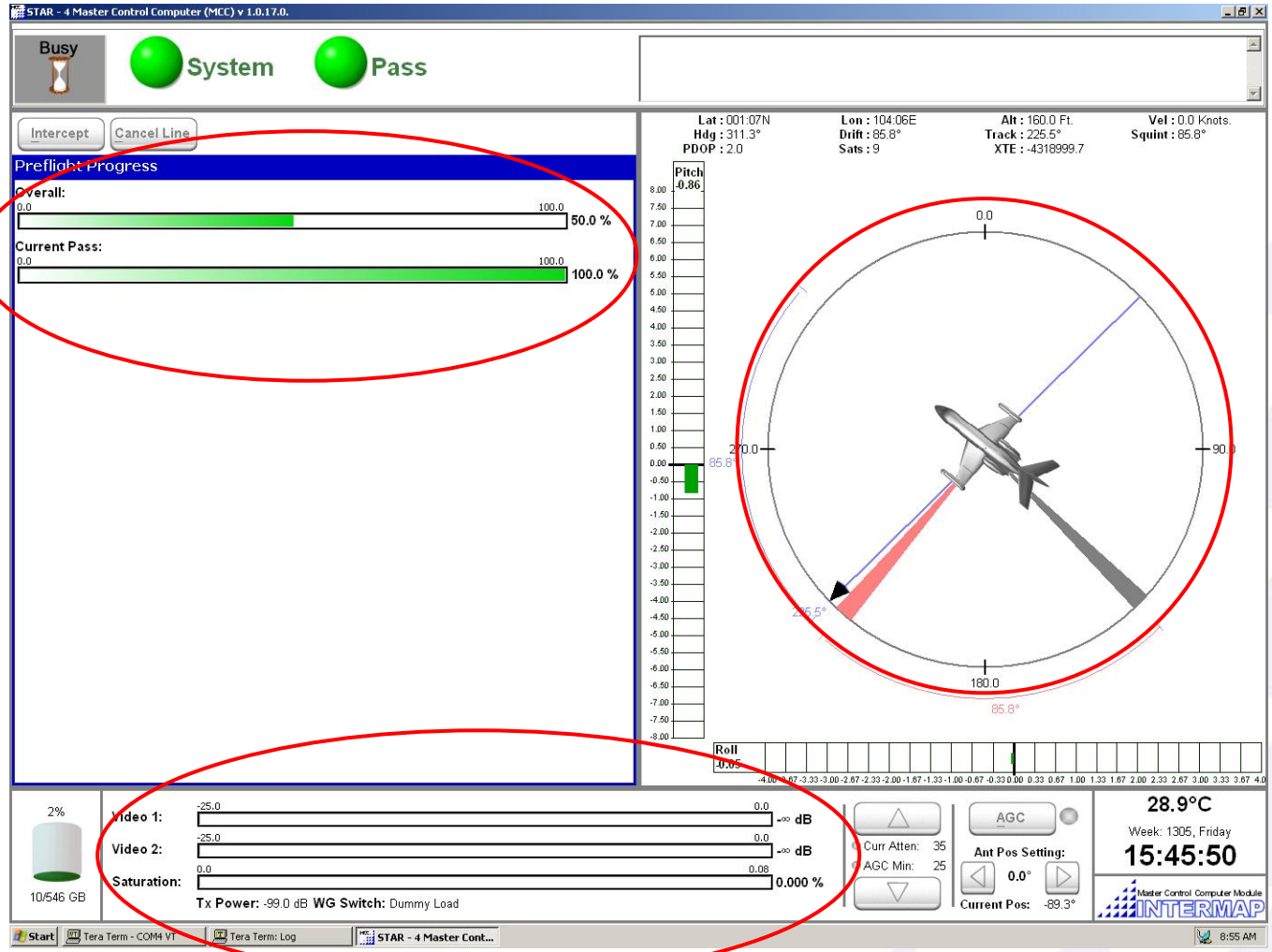
- If required, the JBOD files can be deleted at this point.
- <u>'Disk Swap' is not to be used</u>
  Ensure radome camera is operational before starting Preflight test
- Select the 'Preflight' button



Operation ~ Preflight Test

Ensure the following occurs:

- two passes
- correct signal-source test results
- smooth pedestal movement during WMM
- no moisture or debris in radome
- TX power and video levels are present
- JBOD lights are flashing
- WG Switch indicates 'Dummy Load'



Radome Inspection - Internal

STANDING MOISTURE

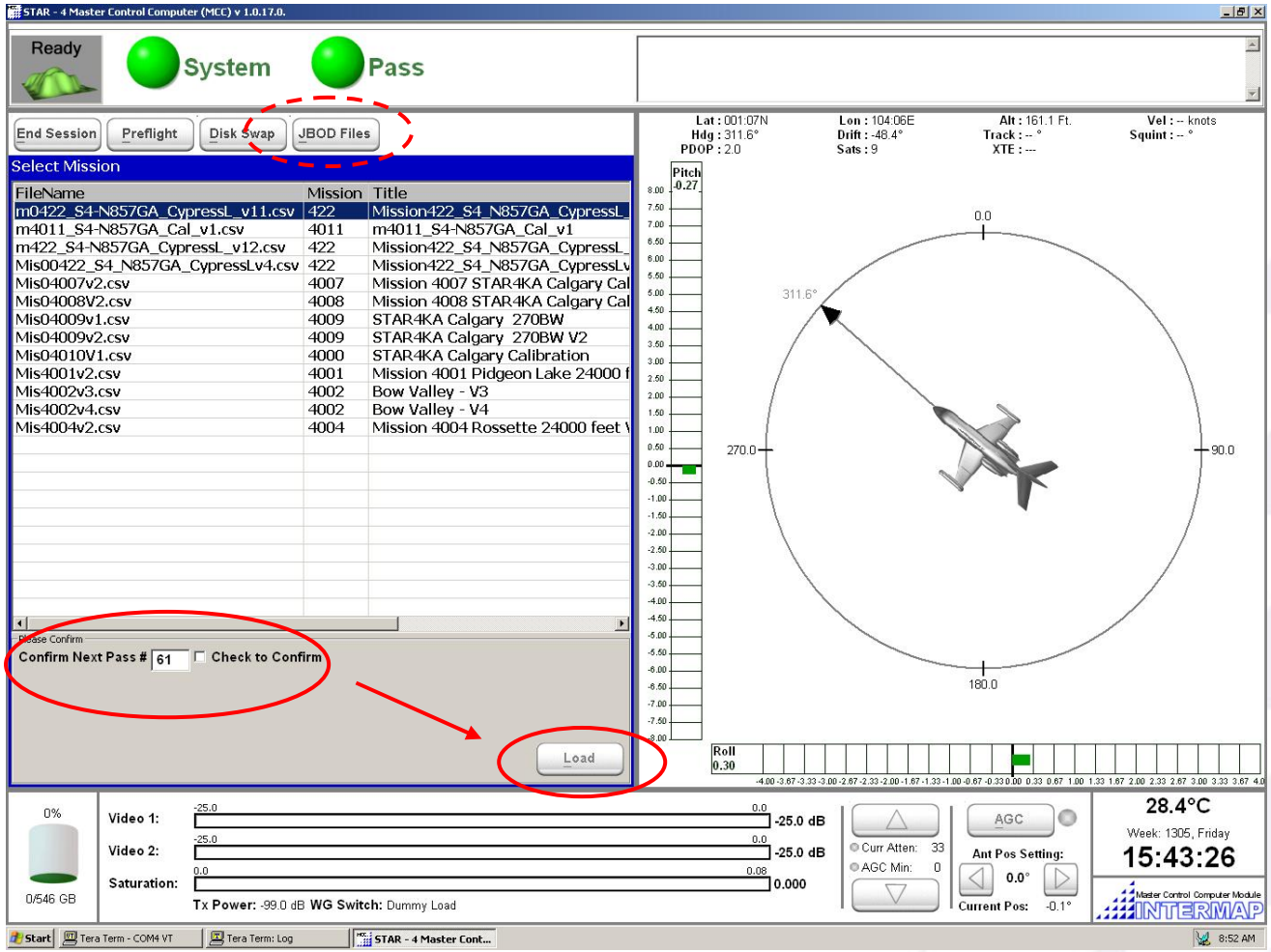
DEBRIS (VELCRO)
4” x 1.5”

RADOME INTERNAL INSPECTION
USING THE RADOME CAMERA

INTERMAP

Operation ~ Ready State 2

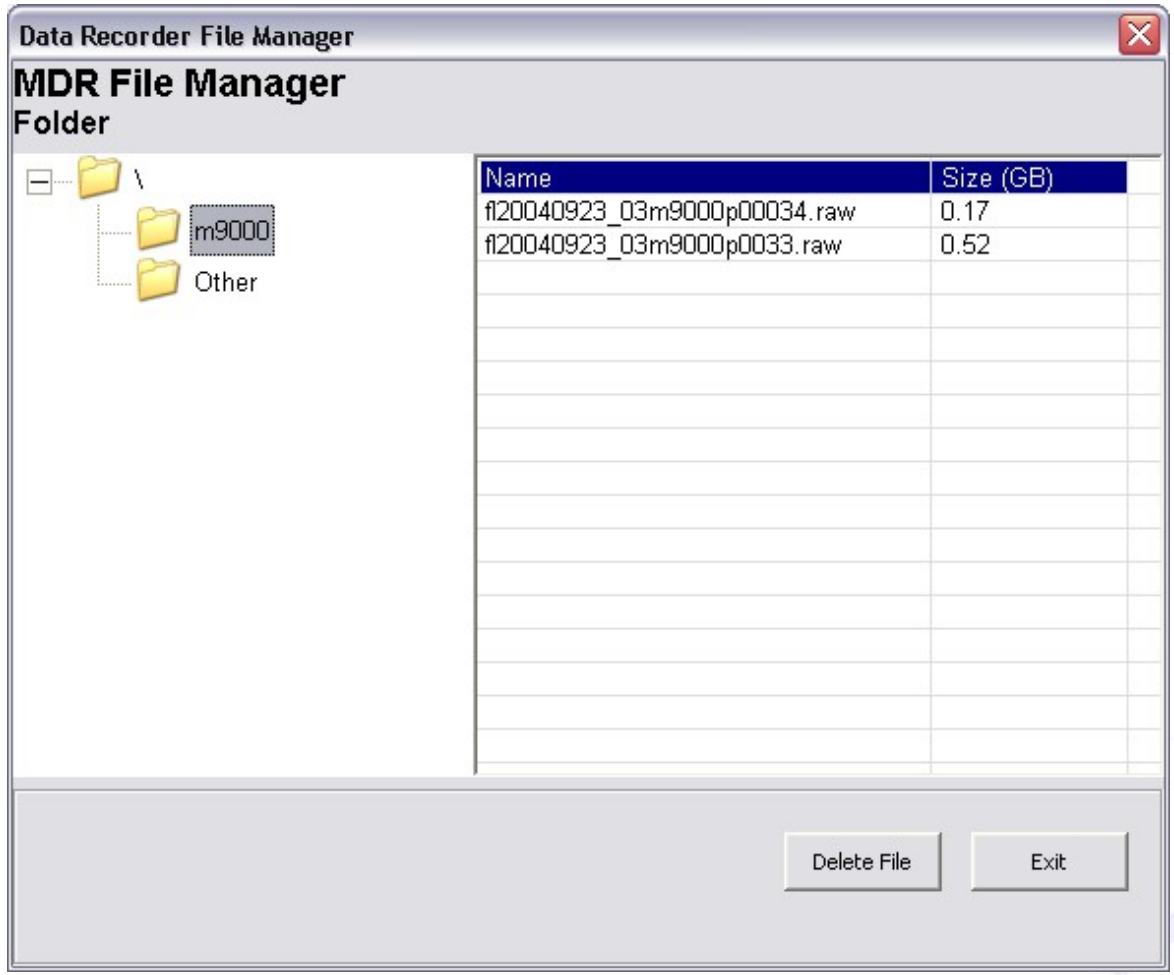
- Pre-select the correct mission as indicated by the flight-plan and as discussed at the preflight briefing. (Note that it is possible for lines from multiple missions to be flown in one flight) Confirm next pass # is correct and "Check to Confirm"
- If required, the JBOD files can be deleted at this point.
- Select 'Load', changes to Mission State



JBOD File Management

•Permits files to be deleted from the JBOD. (Not used under normal circumstances)
•If a pass will **definitely** be rejected by the DP and space is short, this method may be used to free up space for a re-try of the pass.
NOTE: There is no "Undo" feature

If there is any doubt, a disk swap procedure must be carried out.



INTERMAP

JBOD Maintenance ~ MDR Shell

- When the MCC is not able to connect to, or communicate with the MDR, it may be necessary to perform JBOD disk maintenance functions through the MDR shell program, a text-based utility that enables basic disk operations to be performed on the JBOD.
- Control of the MDR/JBOD should be done through the MCC laptop PC. The MDRSHELL should only be used as a last resort, and cannot be run simultaneously with the MCC application due to conflicts. MDRShell is to be used for trouble shooting and maintenance only.
- To access MDRShell, shut down the MCC application, and open a DOS (Command) prompt. NOTE: The radar does not need to be shut-down.
- Change directory to **C:\mcc\utils\mdr\520**
- Type the command: **mdrshell 192.168.0.3**
- Press Enter to connect to the default disk group.

CAUTION: THERE IS NO 'UNDO' COMMAND

- Type appropriate command, e.g. **clear** <Enter> if all files are to be deleted
- When asked "**Do you really want to continue?** type **y** <Enter>
- Type **exit** <Enter> When asked "**Do you really want to exit**? type **y** <Enter>
- Restart the MCC.
- Confirm JBOD space is now 546 GB.
- Continue with the mission

INTERMAP

MDR Shell Commands

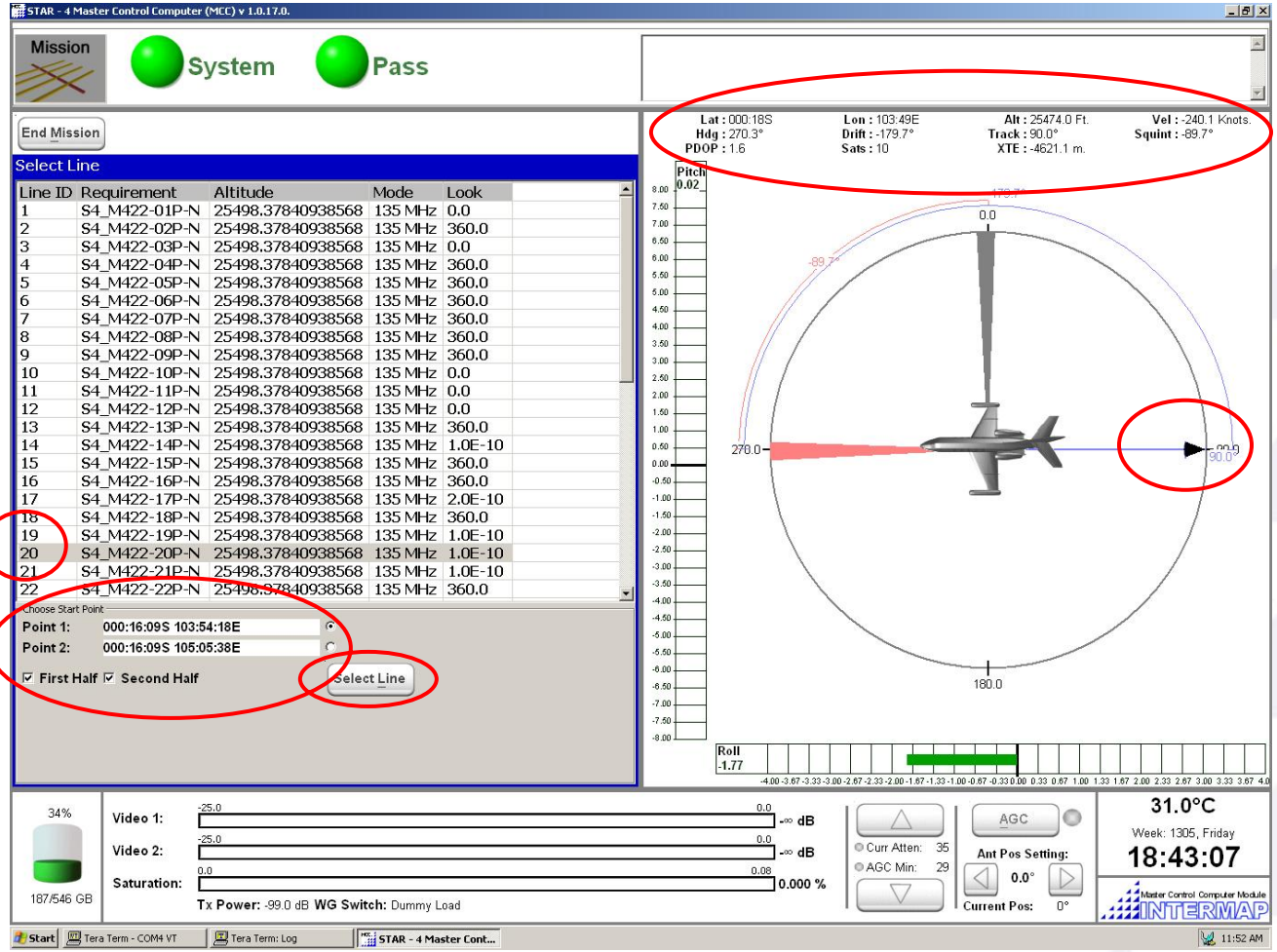
Command	Arguments	Description
Show		Displays a list of all the available commands
Clear		Deletes all recordings from the disk set. Use with Caution.
Delete	Recording name or number	Deletes the specified recording from the disk
Rename	New name	Renames the current recording to the specified name

- When use of the MDR Shell is complete, type EXIT
- Restart the MCC application using the Desktop icon
- Continue with the mission

Operation ~ Mission State

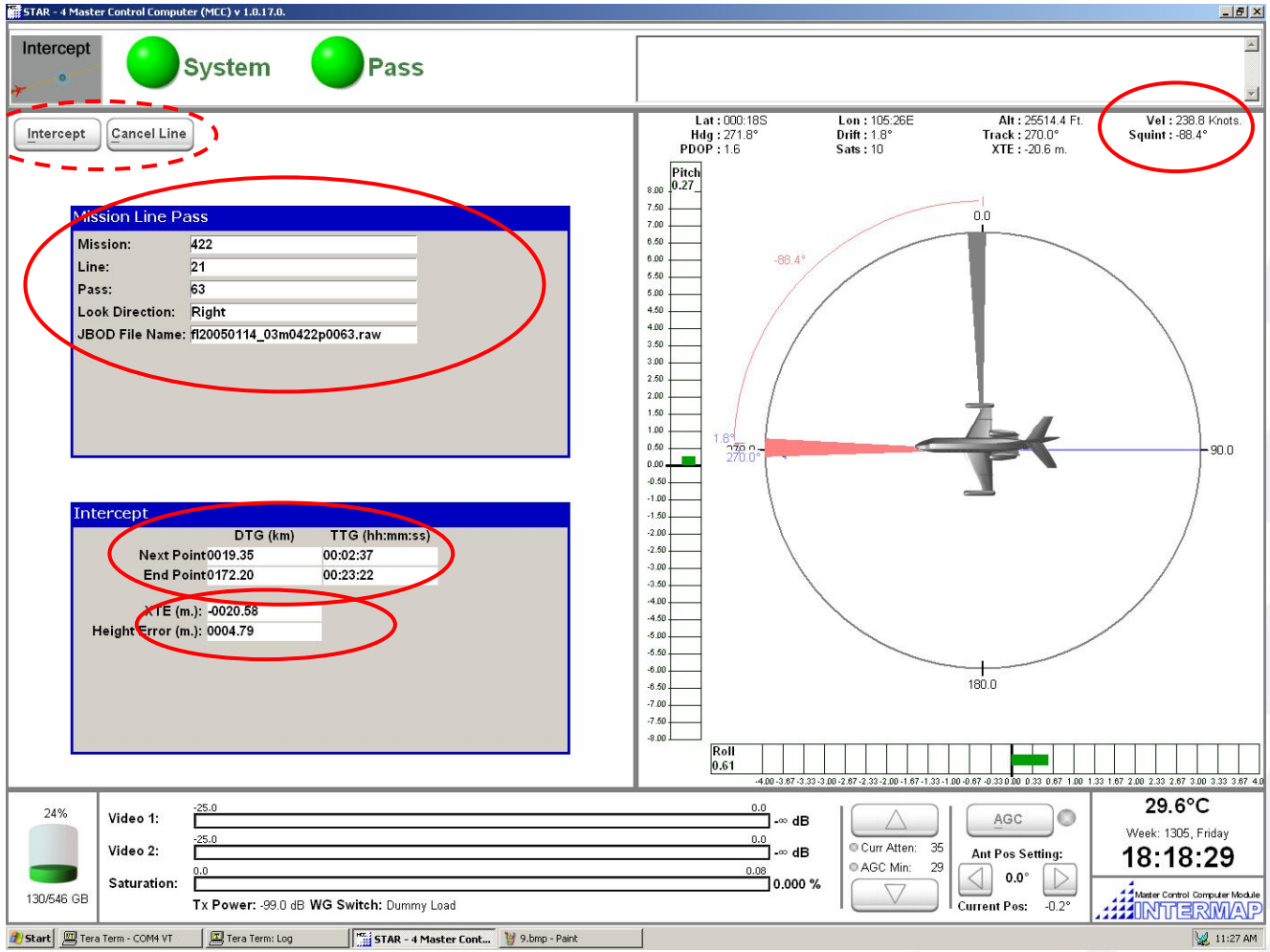
- Pre-Select the correct line as indicated by the flight-plan, and as discussed at the preflight meeting.
- Select Point 1 or Point 2 for Start Map point
- First Half/ Second Half are selected by default
- Confirm correct line orientation
- During Taxi, ensure Lat / Lon / Hdg & Vel are “live”

- When airborne, and at correct point, (when turning onto line), select ‘Select Line’.



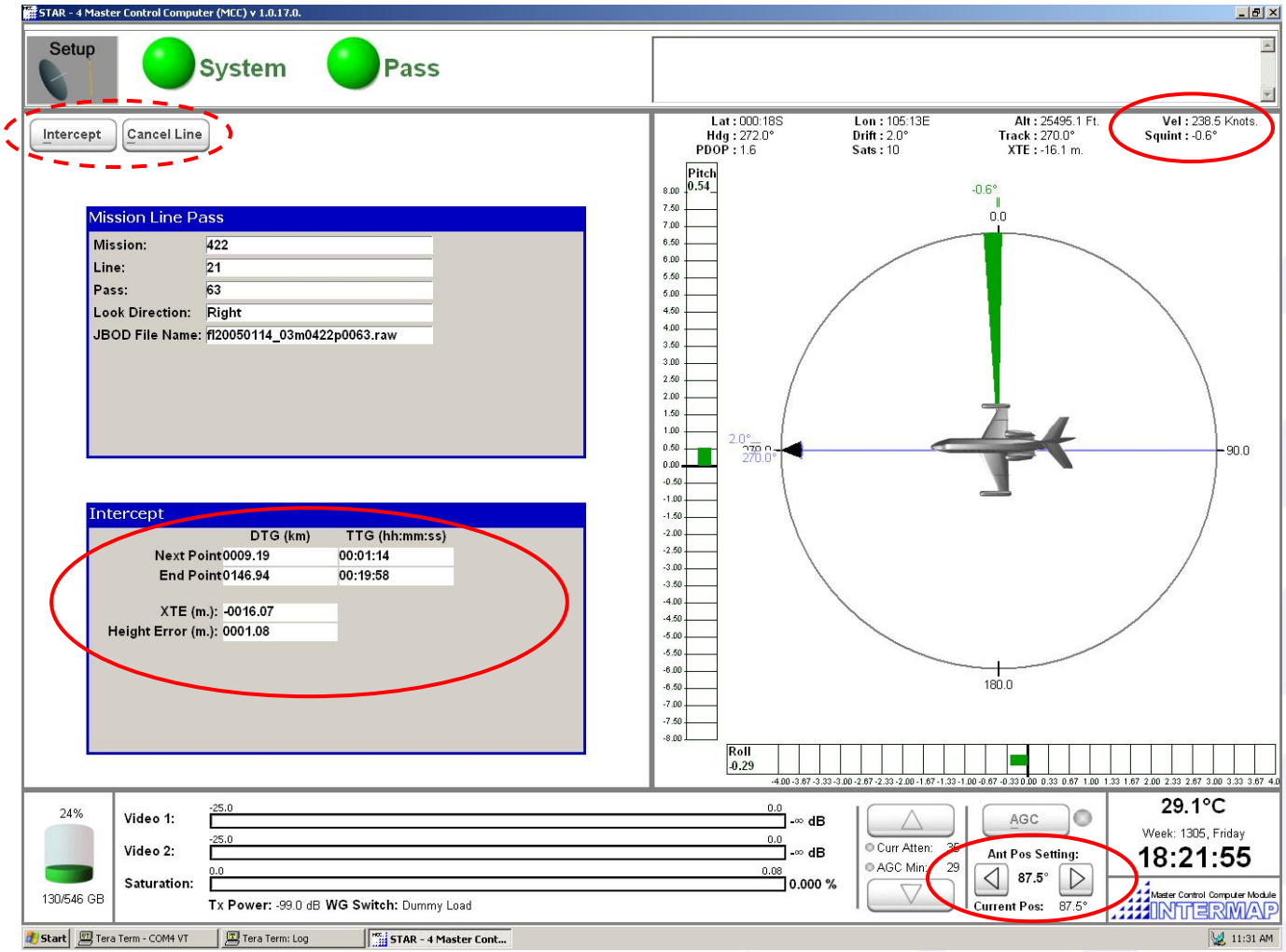
Operation ~ Intercept State

- Confirm 'Mission Line Pass' window displays correct info
- Validate DTG and TTG values
- Confirm XTE/HTE, Vel and Squint are within spec
- If required, line may be cancelled
- If Setup point is missed, line may be intercepted manually



Operation ~ Setup State

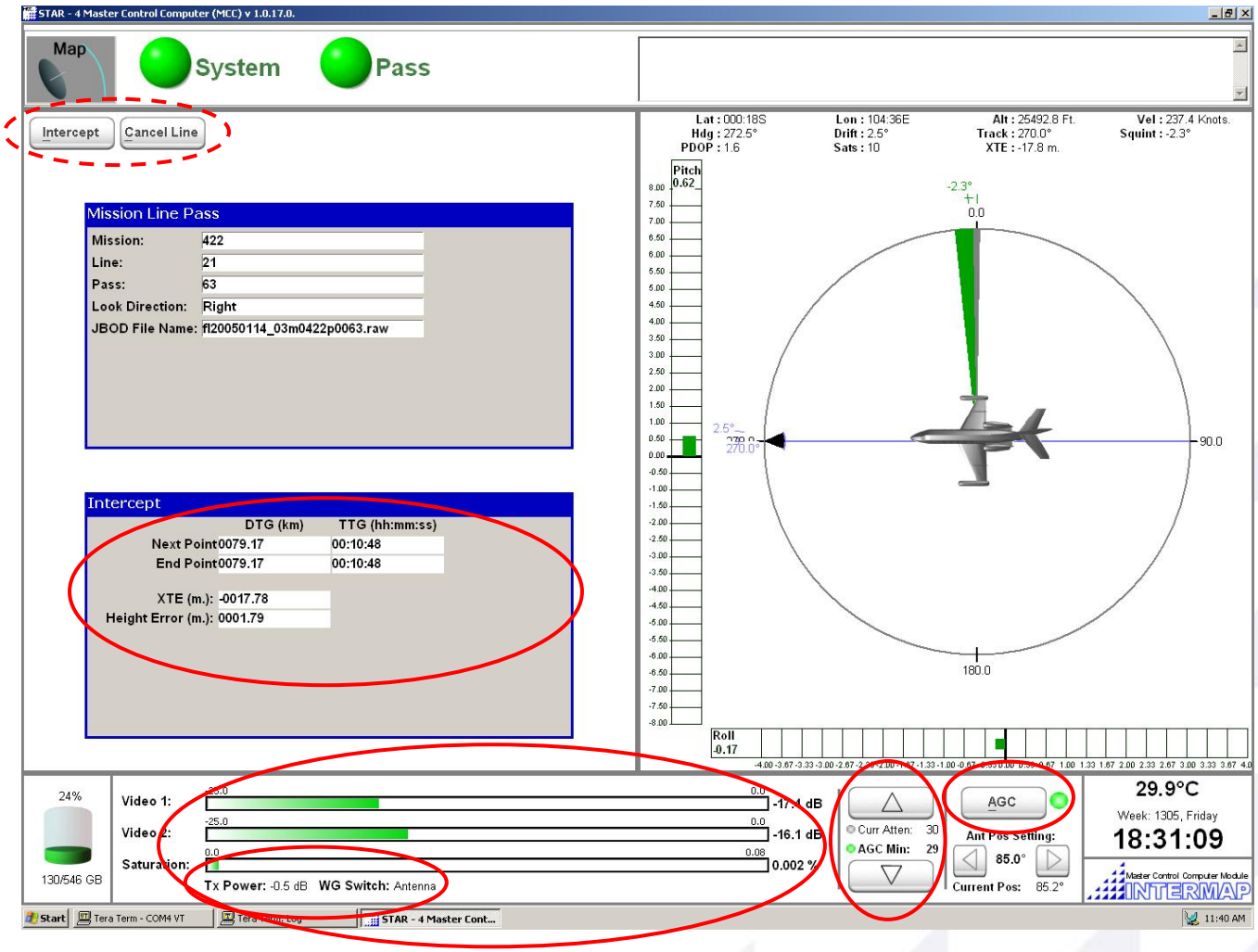
- When WMM is complete, assess antenna point / squint and adjust as required (±80°-±100°, 2½° incrs.)
- Confirm XTE / HTE still OK
- PRF is adjusted based on Groundspeed & Pulses Per Meter requirement
- If required, line may be cancelled
- If Map start point is missed, it may be intercepted manually



Operation ~ Map State

Ensure the following occurs:

- Signal source tests are carried out at SOL
- WG Switch is set to Antenna by the WGASS
- TX is On, RMS video is present, and data is being recorded on the JBOD
- AGC is On, unless briefed otherwise
- If End Map point is missed, it may be intercepted manually
- If required, line may be cancelled
- Signal source tests are carried out at EOL
- Reverts to Mission state at EOL



Repeating Steps for a Pass

- Mission State - Select Line
- Intercept State - confirm line selection and direction on SAD, and if necessary through communication with pilot.
- Monitor XTE, HTE, Attitude until Setup point is reached & confirm intercept of Setup point
- Monitor for faults through Setup State
- Adjust the antenna position, if necessary
- Continue to monitor Attitude, XTE, until Map Start is reached
- Monitor for faults during intercept of Map Start point
- Map State - Monitor system through to end of pass, and make Flight Log entries per ROCL. At EOL, ensure switches back to Mission State
- Wait until aircraft is lined up for next pass and return to top …

Signal Levels

- Automatic Gain Control (AGC) - On
  - Automatically adjusts attenuation to prevent saturation.
  - As long as image saturation allows, decreases saturation to improve signal level
  - ***The RO controls the lowest attenuation level that AGC allows. You may decide to increase or decrease this minimum value to better manage signal level.***

- Manual Gain Control, AGC Off
  - RO performs the task of minimizing saturation while maximizing signal level, with manual adjustments of the attenuation.

Signal Levels (cont'd)

- AGC is defaulted to On. AGC is turned off only when instructed to do so.
- Notify the FM when you suspect the AGC is not working correctly.
- Be aware of the type of terrain you're flying over:
  - Water and wet snow will drastically lower the return signal. **Do not** lower the AGC minimum threshold, because the first instance of solid ground will be saturated
  - Urban areas will produce large differences in signal level during the pass
  - Mountain ranges may produce great increases in signal level during the pass

Signal Source Tests

Signal Source	Attenuation	RMS Video level (+/- 1dB)
Cal Tone	35	-6
Noise Test	8	-15/16
Noise Test w/o LNA	8	-15/16
Syntar	24	-9
Replica	38	-14
Antenna Reflection	24	-20

- Signal Source tests are carried out at SOL and EOL.
- EOL tests are in the reverse order of the SOL tests.

Failure Reporting

- System light goes red – an error condition has occurred within the system, even if the fault condition was only temporary
- System light stays red until ‘accepted’ by the RO, (clicks on it).
- All errors are accompanied by a message which includes the source module, e.g. :

  ‘WGASS Error receiving Status from Module’
- Warnings are displayed in yellow and provide for situations where an action could prevent the error from recurring e.g.:

  ‘PWRDS Warning Internal Temperature approaching limit’.
- All errors should be annotated on the Flight Log
- A Problem Service Report (PSR) must be raised to inform Sensor Support group of the unserviceability

INTERMAP

Fault Indication

There are three kinds of error condition:

1. Module Status Error – Environmental, or internal components not functioning correctly, the '**Module Status'** LED on the module front panel is Red. MCC **System** status light is On (Red).

2. System Error - Failure to complete a state change (TX did not turn on, Antenna did not move, unable to configure the radar) – MCC **System** status is Red, message in the system status window includes 'Pass Failed'. Next point on the line will not be intercepted.

3. Pass Error – The system is operating correctly but one or more of the parameters have been exceeded (motion, XTE, Squint, Height Error, Pitch, Roll). Condition may result in rejection of acquired data, but pass should be continued to the end of line.

Fault Recovery ~ 1

Module Status Errors

1. Environmental Errors are preceded by a warning. If a module overheat warning is displayed, ask the pilot to lower the cabin temperature. The error/warning will not re-appear when cleared from the system.
2. Failure of internal components like temperature sensors should be noted on the Flight Log, and a PSR must be completed. The flight may have to be aborted, depending on the severity of the failure.

System Error - Failure to complete a state change

1. Bring the system back to a known state - Modules only report errors for as long as the error condition exists.
2. Under normal conditions, errors like this indicate a hard failure of a system component, requiring repair.

INTERMAP

Fault Recovery ~ 2

Startup Problems: That may occur during initialization.

Problem 1: The modules widgets are all yellow, and do not change to green
Cause: The modules have not been time-synchronized by the NAV module. The NAV module will only synchronize the other modules when it has a valid GPS position / time.
Solution: Make sure that the aircraft has a clear unobstructed view of the sky, or a GPS repeater is installed and working. Check the antenna cable and GPS antenna.

Problem 2: There is a system fault "XXXX Error receiving status from module", and 1 or more widgets are red.
Cause: The MCC has not received status from 1 or more modules.
Solution: Some modules may require up to 1 minute to fully start up. As such this fault condition may be present until then. If the fault persists confirm that the LED on the front of the module is lit, if it is not check the power connections / breakers. Otherwise check the network connection of the modules.

INTERMAP

Fault Recovery ~ 3

Problem 3: 1 or more module is red, while the rest are green, or there is an un-clearable System fault.

Cause: This indicates that one or more modules has a fault that needs to be resolved.

Solution: The solution is dependant on the fault condition. Write the error message down for future reference. Depending on the exact message, the problem may be easily solved. Check the list of System Faults. Is the error repeatable? Shut down the module, check all connections and cables, and power the module back up again. Ensure adequate time is allowed for it to start up.

Fault Recovery ~ Pass Faults

Pass Fault	Description
"PDOP exceeded Tolerance"	The GPS Position Dilution Of Precision (PDOP) has exceeded tolerance. This is probably due to poor GPS reception (geometry of satellites). Perhaps blocked by buildings while on the ground or a poor GPS "window".
"Pitch Exceeded Tolerance"	The Pitch of the aircraft has exceeded tolerance
"Roll Exceeded Tolerance"	The Roll of the aircraft has exceeded tolerance
"Height Error Exceeded Tolerance"	The "Height Error" tolerance has been exceeded. This is probably caused by excessive turbulence or by flying at the wrong height.
"Cross Track Error Exceeded Tolerance"	The Cross Track Error (XTE) has exceeded tolerance. This is most likely due to turbulence, or the selection / navigation of the wrong line.
"RMS Video 1 Error Exceeded Tolerance"	This is caused when the RMS video level of Antenna 1 is too high for a brief period. The current attenuation setting maybe incorrect.
"RMS Video 2 Error Exceeded Tolerance"	This is caused when the RMS video level of Antenna 2 is too high for a brief period. The current attenuation setting maybe incorrect.
"Squint Exceeded Tolerance"	Occurs when the squint angle exceeds the tolerance for an instant. This may be caused by crosswinds (changing of aircraft heading). The problem may be corrected by better positioning of the antenna in the Setup state on subsequent lines.

Fault Recovery ~ MDR 1

MDR Data Fault

Covers the following error messages:
Anything with MDR!

In event of an MDR Fault, the following steps should be taken to recover:

1. Exit the MCC Application.
2. Pull the **JBOD** breaker (turn off JBOD).
3. Pull the **RCVEX** Breaker (turn off RCAS).
4. Wait 10 seconds.
5. Verify that all disks are inserted correctly (use anti-static strap).
6. Verify the JBOD Fibre Optic cable is connected to the RCAS.
7. Push **JBOD** breaker.
8. Push **RCVEX** breaker.
9. Restart MCC.
10. Wait for RCAS widget to go green, and continue.

Fault Recovery ~ MDR 2

NOTES:

When the MCC is restarted, it is the start of a new session. A >360 degree orbit and 10 minutes of NAV data is required before starting the next pass.

Depending on the error, the JBOD may be full, and require the last pass to be deleted to continue. This will cause the loss of the last pass. If available, the JBOD disk set may be swapped instead.

An Error message of 'MDR: No Disks or bad DiskGroup Inserted' indicates that either 1 or more disks are missing, are out of order, or are not configured properly. Check disk connections, and set correct order.

Fault Recovery ~ NAV

IMU / GPS / NAV Data Errors:

Covers the following error messages:

- GPS/IMU Data Error
- NAV: Timeout reading raw data …
- NAV: unable to connect raw data…

1. Exit the MCC Application.
2. Press the **Reset** button on the front of the NAV module. (Do not pull the circuit breaker!). Be careful when resetting the NAV module. Press the Reset button once only. To ensure that the module has had enough time to reset, wait at least 10 seconds between attempts.
3. Restart MCC.
4. Wait for all modules to synchronize Green again. (They may all flash RED momentarily after the NAV is green)

NOTE: When the MCC is restarted, it is the start of a new session. A >360 degree orbit and 10 minutes of NAV data is required before starting the next pass.

Fault Recovery ~ Last Ditch

Last Ditch Effort

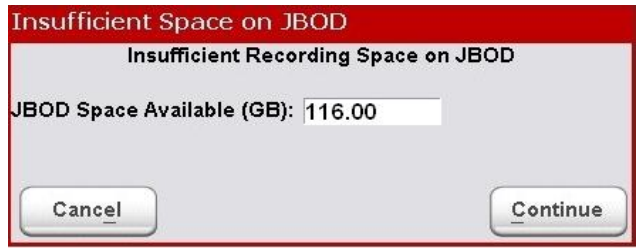
1. Exit the MCC application.
2. Pull the **JBOD** breaker (turn off JBOD).
3. Pull the **RCVEX** Breaker (turn off RCAS).
4. Pull the **ANT** Breaker (turn off ANT).
5. Switch the **WGASS-XTRANS 28V Power** switch to **Off** (on front of module).
6. Press the **Reset** button on the front of the NAV module. (Do not pull the circuit breaker!). Be careful when resetting the NAV module. Press the Reset button once only. To ensure that the module has had enough time to reset, wait at least 10 seconds between attempts.
7. Press the **Reset** button on the front of the PWRDIST module. (Do not switch off Master Power Switch!). Be careful when resetting the PWRDIST module. Press the Reset button once only. To ensure that the module has had enough time to reset, wait at least 10 seconds between attempts.
8. Wait 10 seconds.
9. Restart MCC application.
10. Push **JBOD** breaker.
11. Push **RCVEX** breaker.
12. Push ANT breaker.
13. Turn WGASS-XTRANS switch back to **On**.
14. Wait for RCAS widget to go Green, and continue.

NOTE: When the MCC is restarted, it is the start of a new session. A >360 degree orbit and 10 minutes of NAV data is required before starting the next pass.

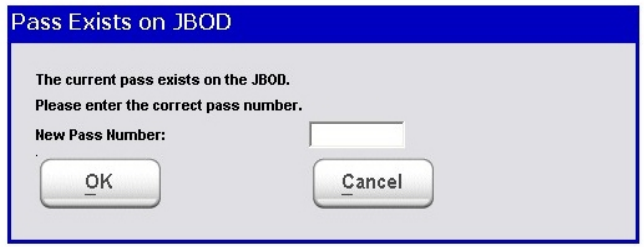
INTERMAP

Warning Message Windows

HD space trigger value is 2000MB (2GB)



JBOD Space trigger value is 120 GB



Under *normal* operating conditions, none of these messages will be displayed!

INTERMAP

Session Management

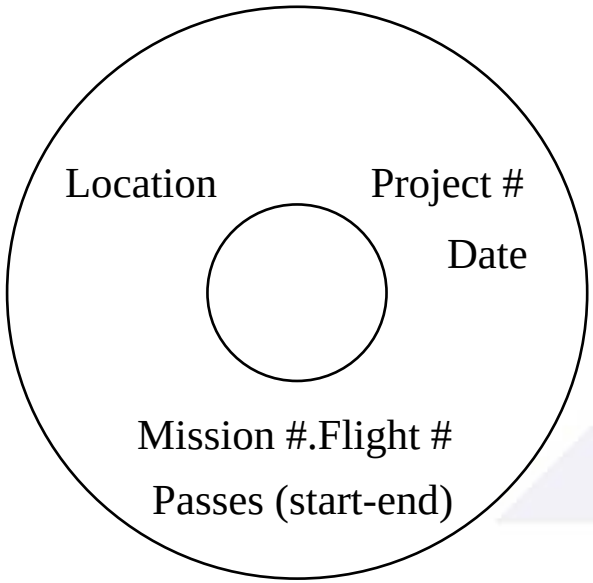
- A Session is a continuous recording of navigation data.
- Navigation data (GPS and IMU) is received from the NAV Module and recorded in the session folder.
- If either the data stream is interrupted, or the RCVEX-RCAS or NAV modules need to be reset, then the current session must be ended, and a new session started, i.e. ‘End Mission’ – ‘End Session’ – ‘New Session’.

NOTE: When a new session is started, a >360º orbit must be completed and 10 minutes of NAV data collected before the next pass is started.

INTERMAP

Offload Session Data

- The Session data recorded on the MCC is offloaded for ground processing of the flight, including any pictures that were taken. This may be started while still in the air.
- The Data is transferred to a DVD-R N.B. DVD **minus** R
- As a precaution, 5 days-worth of sessions are backed up on the MCC.
- After the Session disk has been created, it is labelled as follows:



INTERMAP

Disk Swap

- JBOD Disks can be swapped during flight, but require the RCAS module to be reset, and thus the start of a new session.

  - Select ‘End Mission’, ‘End Session’, ‘Exit MCC’
  - On PWRDIST module, pull ‘JBOD’ and ‘RCVEX’ CB’s
  - Change JBOD disks (use wrist-strap)
  - Set ‘RCVEX’ and ‘JBOD’ CB’s.
  - Restart MCC program using desk top icon.
  - Continue with normal system start-up.

NOTE: After a disk swap or any in-flight shut downs (starting of new sessions), a new >360º orbit must be completed, and 10 minutes of NAV data collected before the next pass is started.

INTERMAP

Additional Considerations

- **Engineering Change Notice** (ECN)
  - Issued to inform field personnel of a change to operating procedures in advance of a formal change to the process and/or procedures documents.
  - The change may be temporary, in which case, it will be cancelled when no longer applicable.
  - RO changes are *sometimes* in the form of hand-written amendments, which is an interim measure until formal updates can be issued.
  - Current ECN's - discussion

Summary

The Radar Operator must:

- comply with standard practices and processes
- pay attention to detail
- be self-motivated
- care about product quality and data production rates

Additional Resources

- Various www sites, a great deal of information on SAR/INSAR
  - Keywords, ‘TWT’, ‘Imaging Radar’, ‘Synthetic Aperture Radar’, ‘Radar Interferometer’ ‘GIS’ ‘Mapping’
- FAA AC 43-13A, Standard Aircraft Practices
- Radar Handbook, Second Edition, Merrill Skolnik
- www.twtas.com (a Boeing site, good details on TWT)
- www.spatialnews.geocomm.com (Mapping/GIS News & Info)
- www.intermap.ca Check out the papers in our Library section

Thank You for Your Attention!