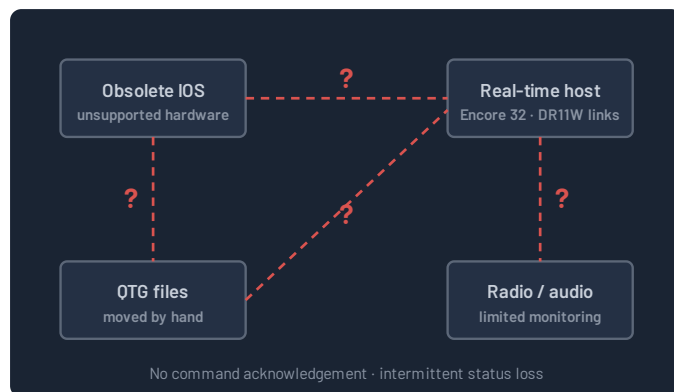


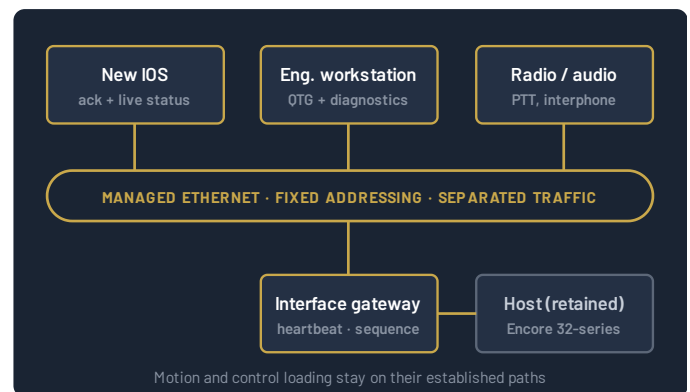
## SYSTEMS INTEGRATION · BOEING 737 CLASSIC FFS

# New IOS, same core: modernizing a legacy B737-400 simulator

Controlled retrofit of instructor station, host communications, flight deck radio integration and QTG execution, while retaining the aircraft simulation core.



**BEFORE** Fragmented tools and opaque links: a command could appear issued with no confirmation the host had applied it.



**AFTER** Contained modification at defined interfaces, with visible link health and traceable test evidence.

| PLATFORM                            | SCOPE                                      | RETAINED                                    | OUTCOME                             |
|-------------------------------------|--------------------------------------------|---------------------------------------------|-------------------------------------|
| B737-400 FFS, Encore 32-series host | DR11W host links, IOS, network, radio, QTG | Aircraft model, cockpit, motion, CL, visual | Supportable, traceable, recoverable |

## 01 The challenge

The simulator ran on a legacy Encore 32-series host, linked to its subsystems over DR11W parallel links. It kept a serviceable aircraft model and cockpit, but an obsolete IOS, poorly documented interfaces and manual QTG file handling made fault isolation slow. Status dropped intermittently, communication faults were hard to see, and test runs could not be reproduced reliably.

## 02 What we did

We surveyed and protected the installed baseline, then contained the change at defined interfaces: a controlled gateway, a managed Ethernet network, a modern IOS and a traceable QTG workflow, including flight deck radio and interphone integration. Work ran in six staged checkpoints with a defined rollback window.

## 03 The result

A more supportable operating environment, clearer diagnostics and a repeatable process for running and reviewing QTGs, handed over with the configuration, recovery procedures and validation records needed for operator acceptance.

## Engineering boundaries

### Encore 32-series host RETAINED

Aircraft and systems calculations kept; DR11W interfaces and execution load verified.

### Motion and control loading RETAINED

Control paths and safety interlocks untouched; indirect timing effects assessed.

### Visual and cockpit I/O RETAINED

Changed only where a documented defect or integration need justified it.

### IOS and engineering tools REPLACED

Obsolete hardware replaced; controlled commands, feedback and diagnostics added.

### Radio and audio RENEWED

Aircraft logic preserved; integration and monitoring functions renewed.

### B737-400 configuration CONTROLLED

Engine, FMS/autoflight, nav and radio fit held distinct from -300 and -500 data.

### DESIGN DECISION

#### Contain the change at defined interfaces

Keeping the aircraft model and subsystem paths focused replacement on the IOS boundary, communications and tools, and made each change easier to verify.

### INTERFACE INTEGRITY

- DR11W parallel links characterized: handshake, byte order, timeouts, recovery
- Every parameter specified: units, scaling, rate, range, failure
- Command IDs and acknowledgements separate receipt from application
- Heartbeats and age-of-data checks stop stale values

## Integration in six controlled stages

- 1 Protect the baseline**  
Recovery assets, existing defects, rollback triggers
- 2 Prove the interface**  
Bench-test mapping and timing before enabling control
- 3 Integrate the network**  
Switches, gateway, addressing, traffic separation
- 4 Commission the IOS**  
Positioning, W&B, weather, failures, freeze, reset
- 5 Restore QTG execution**  
Triggering, acquisition, comparison on a diagnostic set
- 6 Validate and hand over**  
Close discrepancies, regression, release package

### COMMISSIONING DISCREPANCY · RESOLVED

#### Displaced transient in an early QTG run

Traced to misaligned host sample timing and workstation receipt time in the new acquisition path. Timestamp mapping corrected, affected tests repeated, related channels checked. Aircraft model, reference data and tolerances unchanged.

### FAULT INJECTION AND RECOVERY

- Disconnected cables, gateway and IOS restarts, switch power loss
- Delayed or missing data, unavailable storage, interrupted tests
- No replay of queued control actions after recovery
- Interrupted runs flagged invalid, never accepted as evidence

## Flight deck communications verified

### Crew & instructor audio

Correct routing, intelligible speech, no cross-talk

### Radio selection & PTT

Transmit follows the selected radio; receive independent

### Failures & recovery

Reset and reconnect never leave a stuck transmit

### Sound interaction

Comms audio does not mask cockpit warnings

## A repeatable QTG workflow

| STEP                       | REQUIRED CONTROL                                                                                               |
|----------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Prepare</b>             | Correct aircraft and software configuration; mass, CG, atmosphere, runway and system state set per test.       |
| <b>Check readiness</b>     | Host and interface health, calibration and sampling confirmed; execution blocked if prerequisites are missing. |
| <b>Execute</b>             | Approved procedure with traceable inputs, event markers and recorded manual actions.                           |
| <b>Acquire</b>             | Specified parameters at required rates with known time alignment; gaps, stale samples and saturation flagged.  |
| <b>Evaluate</b>            | Results compared with aircraft reference data and tolerances, reviewing traces, not only a pass flag.          |
| <b>Close &amp; archive</b> | Reviews, discrepancies and reruns recorded; failed or invalid runs kept beside accepted evidence.              |

Regression covered the applicable B737 Classic MQTG areas: takeoff, climb and engine response, longitudinal and lateral handling, trim and control loading, approach and landing, autoflight modes and response timing.

## Result and value delivered

|                                                                                                        |                                                                                       |                                                                                           |                                                                            |                                                                                              |
|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| <b>VISIBLE FAULTS</b><br>Link health, command acknowledgement and time-correlated logs speed isolation | <b>SUPPORTABLE IOS</b><br>Current workstation hardware and documented host interfaces | <b>REPEATABLE QTGS</b><br>Controlled setup, valid capture and reviewed, traceable results | <b>PROVEN RECOVERY</b><br>Verified images and rehearsed restore procedures | <b>RETAINED KNOWLEDGE</b><br>A controlled configuration and handover package for future work |
|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|

## Handover package

|                                              |                                 |                                         |                                            |
|----------------------------------------------|---------------------------------|-----------------------------------------|--------------------------------------------|
| As-installed architecture & network drawings | Interface & audio routing specs | Hardware & software inventories         |                                            |
| Recovery images                              | Switch & gateway configurations | Startup, shutdown & recovery procedures | Change-impact matrix                       |
| QTG evidence                                 | Discrepancy records             | Engineering acceptance package          | Hands-on restore & test training for staff |

|                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LESSONS FOR SIMULATOR OPERATORS</b> <ul style="list-style-type: none"> <li>● <b>Protect before you touch:</b> a rehearsed restore is the real safety net.</li> <li>● <b>Acknowledge, don't assume:</b> receipt of a command is not its application.</li> <li>● <b>Evidence carries context:</b> versions, conditions and raw data belong with every run.</li> </ul> | <b>QUALIFICATION NOTE</b><br>Engineering acceptance and regulatory authorization remain distinct. Release for credited training stayed within the operator and applicable authority process (FAA modification provisions; EASA per the applicable qualification basis). |
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**A legacy simulator can stay in service:  
modernize the interfaces, keep the core.**

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Customer identity, simulator serial numbers, network addresses, software versions, MQTG data and configuration details are omitted and remain in the controlled engineering record.