Overview

- Background/Purpose
- Scope/Method of Test
- Results
- Questions
Background/Purpose

- In 1981, T-45 Training System selected to replace T-2C and TA-4J as Navy undergraduate jet trainer.

- Undergraduate jet trainer mission includes carrier qualification (CQ).

- Sea Trials testing performed to assess suitability for carrier operation in support of jet trainer mission.

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Aircraft Type: Two-seat, single engine jet trainer for the US Navy and Marine Corps

Prime Contractor: McDonnel Douglas Aerospace

Fuel capacity: 3,000 lb

Features: Nose wheel steering
Gas Turbine Starter (GTS)
On-Board Oxygen Generating System (OBOGS)
Repeatable Release Holdback Bar (RRHB)

Airplane Basic Weight: 10,300 lb
Max Arrested Landing Gross Weight: 13,400 lb
Max Catapult launch Gross Weight: 14,000 lb

Minimum WOD for recovery: -5 kt

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Scope of Test

Catapult Launch Tests

- Minimum End airspeed
- Longitudinal trim requirements
- Mis-trim characteristics
- Crosswinds
Scope of Test

Approach and Landing Tests

- Nominal and off-nominal approaches
- Waveoff and bolter performance
- Crosswinds
- Degraded mode (ARI/YDC off)
Scope of Test

Aircraft/Ship Compatibility

Taxi characteristics  Tie down provisions
Engine startup/shutdown  Catapault hookups
Post-arrestment cleanup  Towing operations
Elevator operations  Maintainability
EMC  CV jacking
Post-start/pre-shutdown checks

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Method of Test

Minimum end airspeed

- Defined by 20 ft sink off bow
- Evaluated at two gross weights
- Launch technique and longitudinal trim established to maintain wings level and rotate to 15° AOA (0.9 Cl max)
Method of Test

Longitudinal trim requirements

- Initial trim settings based on simulation and shorebased launches. Less nose up trim required during shipboard catapult launch.
- Optimum trim setting to obtain: pitch rate < 12 deg/sec and AOA <15° with acceptable flying qualities.
Method of Test

Crosswinds

- Tests performed to establish operational envelope to 15 kt
- Bow and waist catapults
- Clearance with ship structure critical during waist catapult operations.
Method of Test

Nominal and off-nominal approaches

- Approaches with intentional deviations in glideslope, line-up and AOA.
- WOD range from 5 to 40 kt
- Approaches with ARI/YDC off.
Method of Test

Waveoff and Bolter performance

- Waveoff performance evaluated for nominal and off-nominal glide slope and thrust conditions
- Bolter performance evaluated by moving aircraft touchdown point forward to 350 ft remaining.

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Method of Test

- Crosswinds

Aircraft handling qualities evaluated to 8 kt port and starboard crosswind.

- Degraded mode (ARI/YDC off)

Evaluate lineup control
Results

Minimum End Airspeed

Initial Sea Trials (IST)
- "Stick free" technique
- Longitudinal and lateral stick motion

Follow-On Sea Trials (FOST)
- "Guarded stick" technique
- Longitudinal trim rotate to 15° AOA (0.9 Cl max) with pitch rates 7-9 °/s
## Results

- **Minimum End Airspeed**

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<th>Gross weight (klb)</th>
<th>Airspeed (keas)</th>
<th>SOB (ft)</th>
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<td>20</td>
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<tr>
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</table>

- **Performance satisfactory**
Results

Longitudinal Trim

- Inconsistent stick motion
- Slight forward to full aft
- Pitch rates 11.5 to 17 °/s
- AOA to 18.5°
Results

Longitudinal Trim

FOST

- Acceptable pitch rate and flyaway AOA with 3.5° NU trim for CG range and excess end airspeed
- Longitudinal trim satisfactory
- Trim rate excessive (6 °/s)
- Stick interference in aft cockpit during wipeout
Results
Crosswind Launch

FOST

- Bow and waist catapult launches with port and starboard crosswind to 15 kt satisfactory
Results
Approach and Landing Tests

- AOA control - satisfactory
- Approach airspeed - 121 kcas at maximum landing weight
- Waveoff performance - satisfactory
- Bolter performance - satisfactory evaluated to 350 ft remaining
- Crosswinds up to 8 kt - satisfactory
Results
Arresting Hook Slap

IST Configuration

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Results
Arresting Hook Slap

- Add bumper to FR 34 and FR 37.
- Beefed up tailcone structure
  - Added steel frames
  - Added skin doublers at new bumpers
  - Reinforced aircraft attachment structure

FOST Configuration

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Method of Test

Mis-trim characteristics

- Evaluate mis-trim effects on
  - pitch rate
  - AOA
  - sink off bow
- ± 1/2° to ± 2° mis-trim
- 10 to 40 kt excess
- Evaluate on bow and waist catapults
Results
Arresting Hook Slap

Follow-On Test Configuration

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Results

Nose wheel steering (NWS)

IST

- NWS disengagements during flight deck taxi
- Slow NWS turn rate during flight deck taxi
- Imprecise NWS due to rudder pedal buffeting

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Conclusions

T-45A airplane in compliance with the Test and Evaluation Master Plan (TEMP).

T-45A airplane satisfactory for CQ phase of undergraduate jet trainer mission.
Results

Standard Attitude Heading Reference System (SAHRS)

FOST

- SAHRS failures during flight deck taxi
- Inaccurate heading information following shipboard alignment
Results
Nose wheel steering (NWS)

FOST

- NWS disengagements during flight deck taxi-corrected
- Slow NWS turn rate downgraded to Part II
- NWS disengagements due to EMI