



AD-A284 184

Overview

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

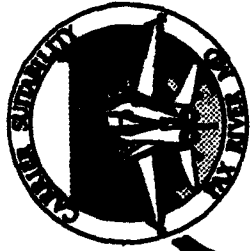
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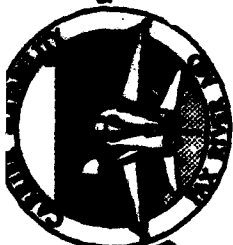
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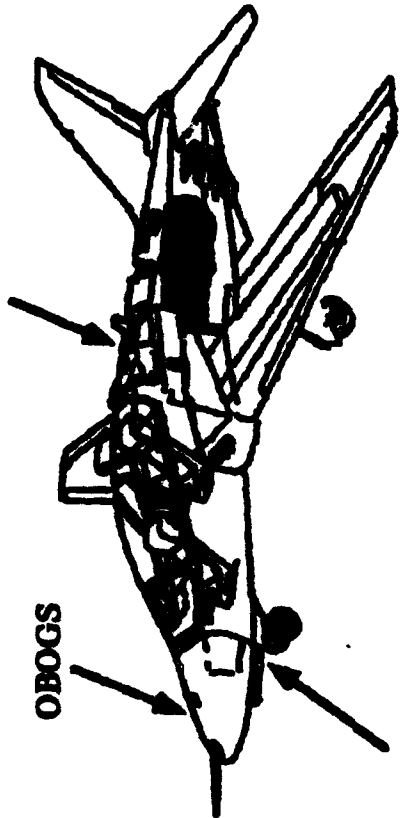
Background/Purpose

- 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.





T-45A "Goshawk"



Nose tow launch
NWS
RRHB

Accession For	<input checked="" type="checkbox"/> NTIS <input type="checkbox"/> CRA&I <input type="checkbox"/> DTIC <input type="checkbox"/> TAB <input type="checkbox"/> Unannounced <input type="checkbox"/> Justification
By Distribution /	<i>Dr. [Signature]</i>
Availability Codes	
Dist	A-1
Avail and/or Special	

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

Prime Contractor: McDonnell Douglas Aerospace

Airplane Basic Weight: 10,300 lb

Max Arrested Landing Gross Weight: 13,400 lb

Max Catapult launch Gross Weight: 14,000 lb

Fuel capacity: 3,000 lb

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

Minimum WOD for recovery: -5 kt





Scope of Test

Catapult Launch Tests

- Minimum End airspeed
- Longitudinal trim requirements
- Mis-trim characteristics
- Crosswinds



Scope of Test

Approach and Landing Tests

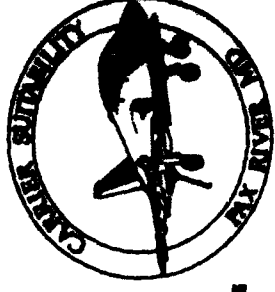
- Nominal and off-nominal approaches
- Waveoff and bolter performance
- Crosswinds
- Degraded mode (ARI/YDC off)

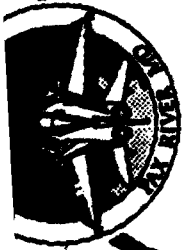


Scope of Test

Aircraft/Ship Compatibility

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





Method of Test

Minimum end airspeed

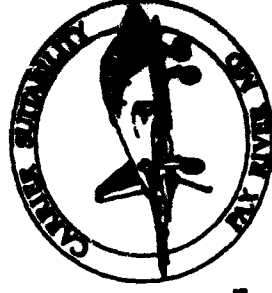
- Defined by 20 ft sink off bow
- Evaluated at two gross weights
- Launch technique and longitudinal trim established to maintain wings level and rotate to 15° AOA (0.9 Cl max)

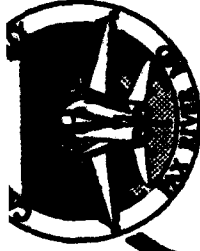


Method of Test

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 $< 15^\circ$
with acceptable flying qualities

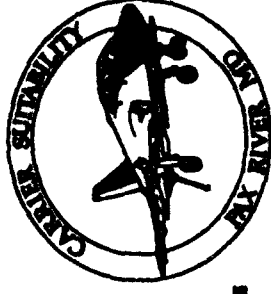


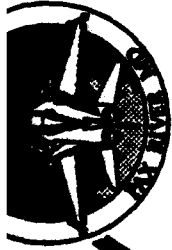


Method of Test

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.

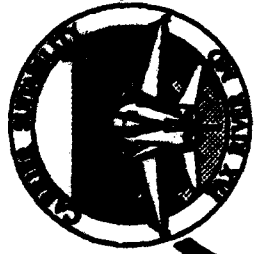




Method of Test

- ### 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.





Method of Test

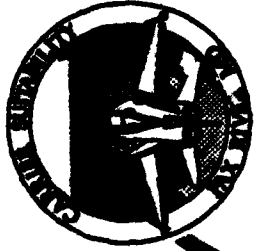
- **Crosswinds**

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

- **Degraded mode (ARI/YDC off)**

Evaluate lineup control





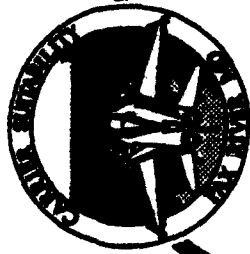
Results

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

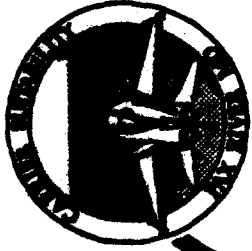




Results

- Minimum End Airspeed
- Gross weight (klb) Airspeed (keas) SOB (ft)
- 13.5 101 20
- 12.5 96 14
- Performance satisfactory



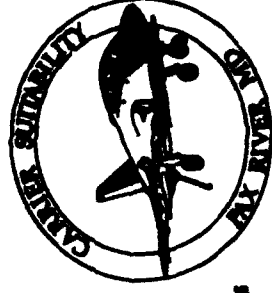


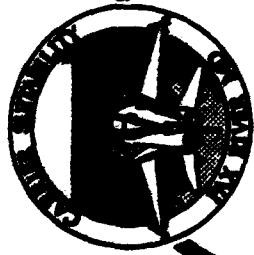
Results

Longitudinal Trim

IST

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





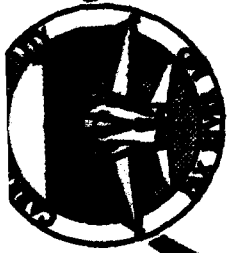
Results

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

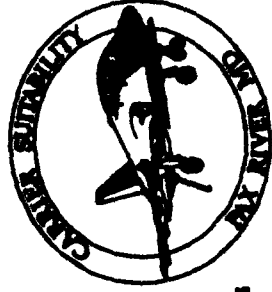




Results Crosswind Launch

FOST

- Bow and waist catapult launches with port and starboard crosswind to 15 kt satisfactory



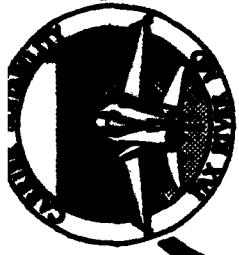


Results

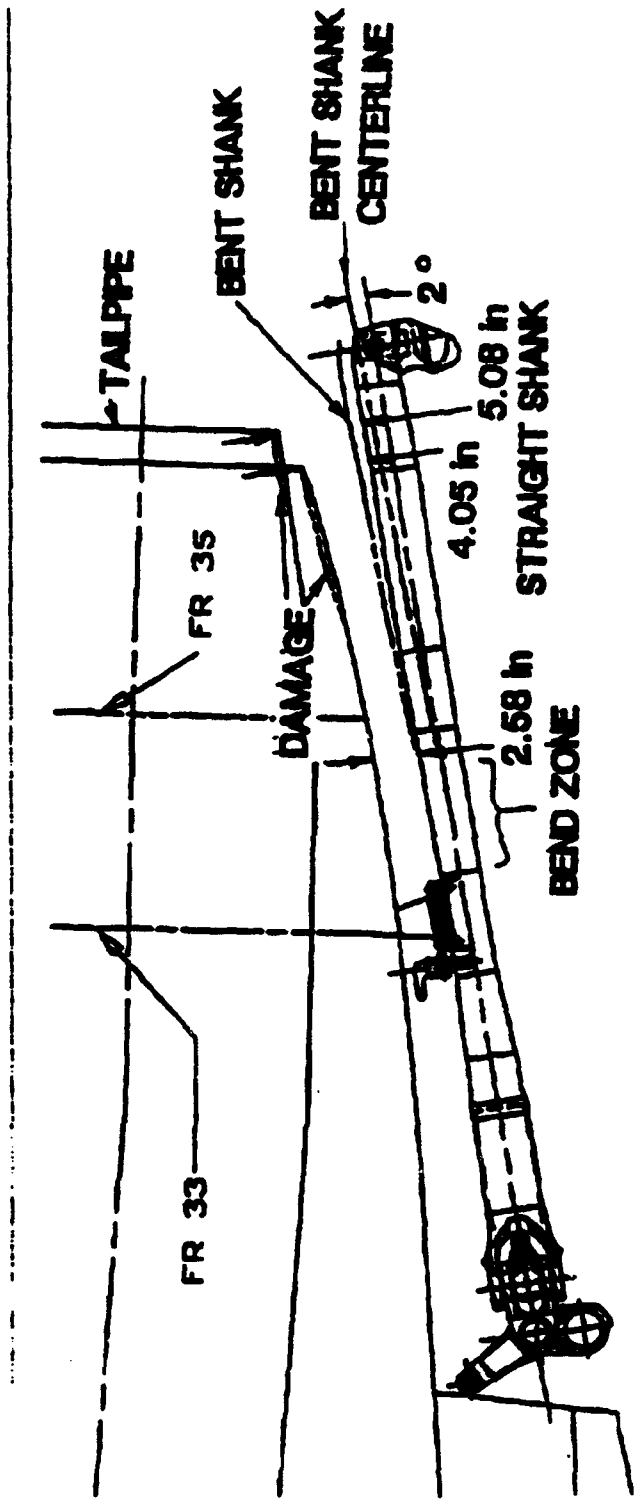
Approach and Landing Tests

- 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



GEOMETRY WITH BUMPER CONTACTING FUSELAGE AND NO LOADS

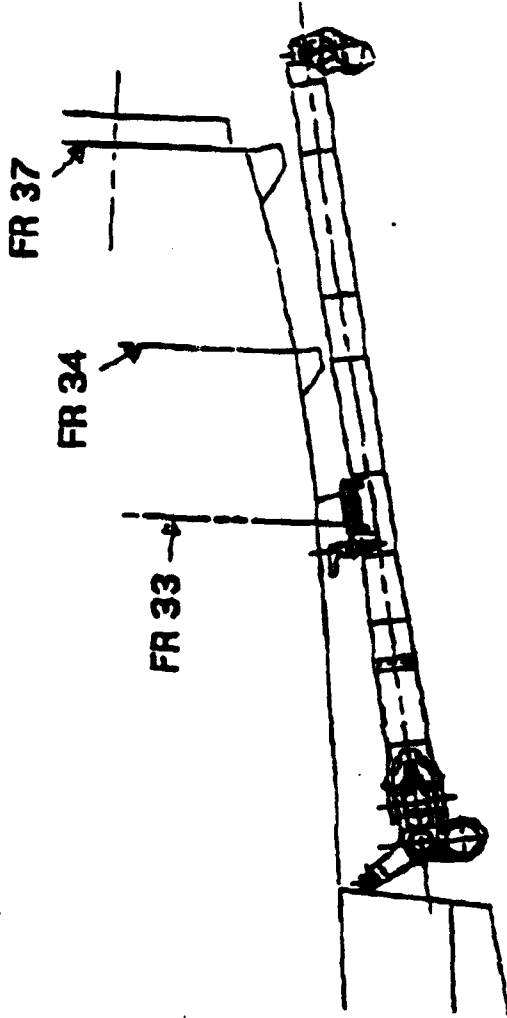
IST Configuration



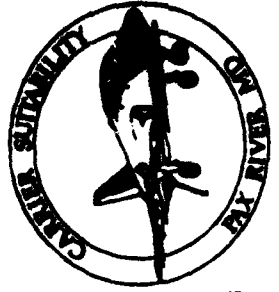
Results

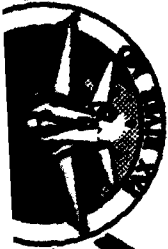
Arresting Hook Slap

- ADD BUMPER TO FR 34 AND FR 37.
- BEEFED UP TAILCOMB STRUCTURE
 - ADDED STEEL FRAMES
 - ADDED SKIN DOUBLERS AT NEW BUMPERS
 - REINFORCED AIRCRAFT ATTACHMENT STRUCTURE



FOST Configuration





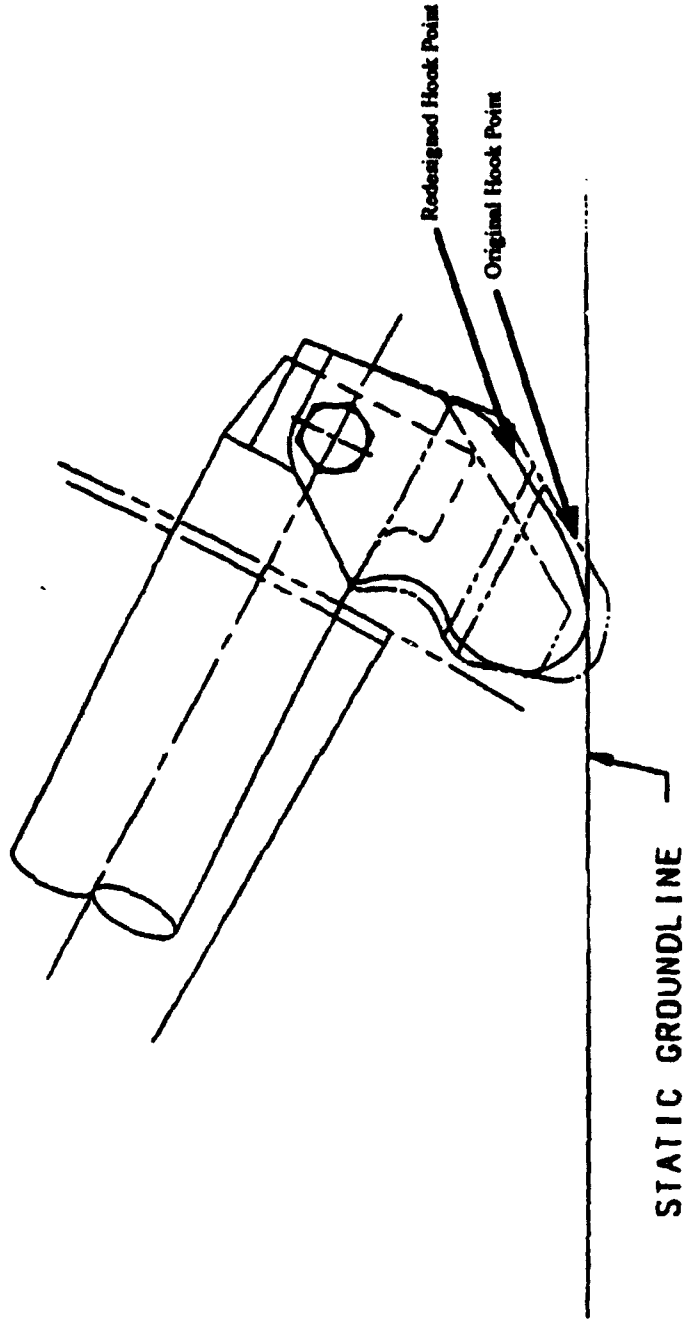
Method of Test

Mis-trim characteristics

- Evaluate mis-trim effects on
 - pitch rate
 - AOA
 - sink off bow
- $\pm 1/2^\circ$ to $\pm 2^\circ$ mis-trim
- 10 to 40 kt excess
- Evaluate on bow and waist catapults

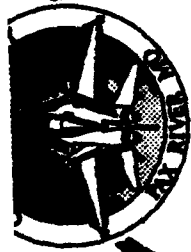


Results Arresting Hook Slap



Follow-On Test Configuration





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

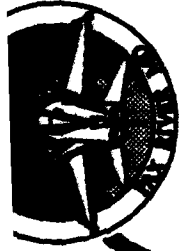




Conclusions

- 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.





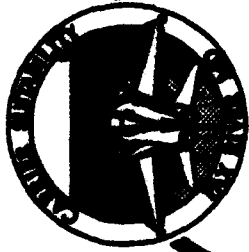
Results

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

