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NATF(SI) 13800/16 (Rev. 9/67)

REPORT NO: NATF(SI)-R6
DATE: 17 APR 1968

NATF(SI) LETTER REPORT OF TEST RESULTS

| | | |
|--|-------------------------------------|-------------------------------|
| FROM Commanding Officer, U. S. Naval Air Test Facility (Ship Installations) U. S. Naval Air Station, Lakehurst, New Jersey 08733 | | |
| TO Commander, Naval Air Systems Command (AIR-5373), Washington, D. C. 20360 | | |
| AIRTASK A-05-537-007/204/1/S-416-00-05 | WORK UNIT 01 | EFFORT LEVEL NORMAL |
| SUBJECT 1-1/2-Inch-Diameter 6 x 25 FW LLRS Purchase Cable in the RALS Mark 7 Mod 1 Arresting Gear; evaluation of | | |
| TEST DATES 4 August - 5 December 1967 | LOCATION OF TEST NATF(SI) | |
| NATF(SI) PROJECT ENGINEERS Mr. A. Buray and Mr. H. Swiencinski | | |
| ENCLOSURES | PHOTOGRAPHS | TABLES |
| | DRAWINGS | CURVES |
| | 4 | |
| APPENDIX | | |

- Ref: (a) NAVAIR 51-5BAA-1, Handbook of operation, maintenance, and overhaul instructions with illustrated parts breakdown; aircraft recovery equipment Mark 7 Mod 1
- (b) Report NATF-EN-1094 of 27 Apr 1967, subj: Comparison of results obtained from tests of the RALS Mark 7 Mod 1 arresting-gear system reeved with 1-3/8 x 6 x 30 LLFS Type G and 1-3/8 x 6 x 25 FW LLRS purchase cables

INTRODUCTION

- The Mark 7 Mod 1, as normally utilized in the fleet, is reeved with 1-3/8-inch-diameter 6 x 25 FW LLRS (Filler Wire, Lang Lay Round Strand) purchase cables. In an effort to increase the service life, 1-1/2-inch-diameter 6 x 25 FW LLRS purchase cables were reeved into the engine. Recent tests at the Naval Air Engineering Center (NAEC) with the larger cable indicated a significant increase in fatigue life when compared to the standard 1-3/8-inch-diameter purchase cable; however, before an extensive fatigue test program could be undertaken, it was necessary to determine the effects, if any, the larger diameter cable would have on arresting-gear performance.
- A total of 80 arrestments of A-3, A-4, F-4, and F-8 aircraft were conducted at the centerline and the 20-foot-to-port OFF-CENTER engaging positions. Ten of the A-4 arrestments were made with the sheave dampers inoperative in order to investigate aircraft arresting-hook/pendant dynamics. (Similar data with 1-3/8-inch-diameter wire rope is not available in this configuration for comparative purposes.

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AIR-5373 Washington 20360

3. The configuration of the Mark 7 Mod 1 arresting gear on a 95-foot deck span with sheave dampers installed was in accordance with reference (a) except for the following:

a. 1-1/2-inch-diameter purchase cable, and

b. Modified deck- and anchor-cable fittings to connect the purchase cable to the 1-3/8-inch-diameter pendant, and to standard anchors.

TEST RESULTS AND DISCUSSION

4. Pertinent information from the aircraft arrestments conducted at the RALS is as follows:

| Number of Events | Aircraft | | OFF-CENTER | Engaging-Speed Range |
|------------------|----------|-------------------------|------------------------|----------------------|
| | Type | Weight Range (1,000 Lb) | Engaging Position (Ft) | (Kn) |
| 6 | F-8* | 21.3 - 21.8 | 0 | 100 - 128 |
| 15 | A-3* | 48.2 - 50.1 | 0 | 82 - 117 |
| 2 | " * | 48.7 - 49.2 | 20 P | 102 - 106 |
| 10 | A-4* | 12.4 - 14.3 | 0 | 81 - 123 |
| 22 | " * | 13.0 - 14.5 | 20 P | 98 - 110 |
| 7† | A-4 | 14.4 - 12.9 | 0 | 89 - 107 |
| 3† | " | 13.2 - 12.7 | 20 P | 88 - 105 |
| 10 | F-4* | 30.8 - 33.0 | 0 | 92 - 113 |
| 5‡ | " | 31.1 - 32.0 | 0 | 82 - 101 |

* Aircraft weight setting \pm 250 pounds

† Sheave dampers inoperative

‡ Single weight setting - 40,000 pounds

Every effort was taken to ensure that the aircraft engines were at MRT at pendant pickup.

5. The data presented in enclosures (1) through (4) also contain curves of normal engine data as reported in reference (b). These curves were drawn through the upper portion of the normal data. It is evident from these enclosures that the critical or limiting parameters (arresting-hook axial load, longitudinal deceleration, purchase-cable tension, and engine cylinder pressure) are comparable between the 1-3/8-inch and 1-1/2-inch cable values as long as the sheave dampers are operating. There is, therefore, no apparent reduction in engaging-speed limits of the A-3, A-4, F-4, and F-8 aircraft when using 1-1/2-inch-diameter purchase cables.

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6. Ten A-4 aircraft arrestments were conducted with the sheave dampers inoperative to investigate aircraft arresting-hook/pendant dynamics. Time histories of arresting-hook axial load and cable tension obtained with operating sheave dampers had a pronounced dip or decay at approximately 0.4 second after pendant pickup. It was theorized that inoperative sheave dampers would aggravate the dip, thereby causing the arresting hook to shed the pendant. The dip was aggravated by inoperative sheave dampers, however, there was no shedding of the pendant.

7. There are no apparent adverse effects on the fairlead or engine sheaves after 80 arrestments.

8. The single-weight-setting phase of the F-4 test program was performed as a support service for NAEC.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

9. The Mark 7 Mod 1 when reeved with 1-1/2-inch-diameter wire rope, does not reduce the ON-CENTER engaging-speed limits of the A-3, A-4, F-4, and F-8 aircraft for the weights tested as long as the sheave dampers are operating. (Paragraph 5)

10. Based on a very limited test program, no adverse effects were detected in either the fairlead or engine sheave systems. (Paragraph 7)

RECOMMENDATION

11. An extensive fatigue test program should be made on 1-1/2-inch-diameter cable.

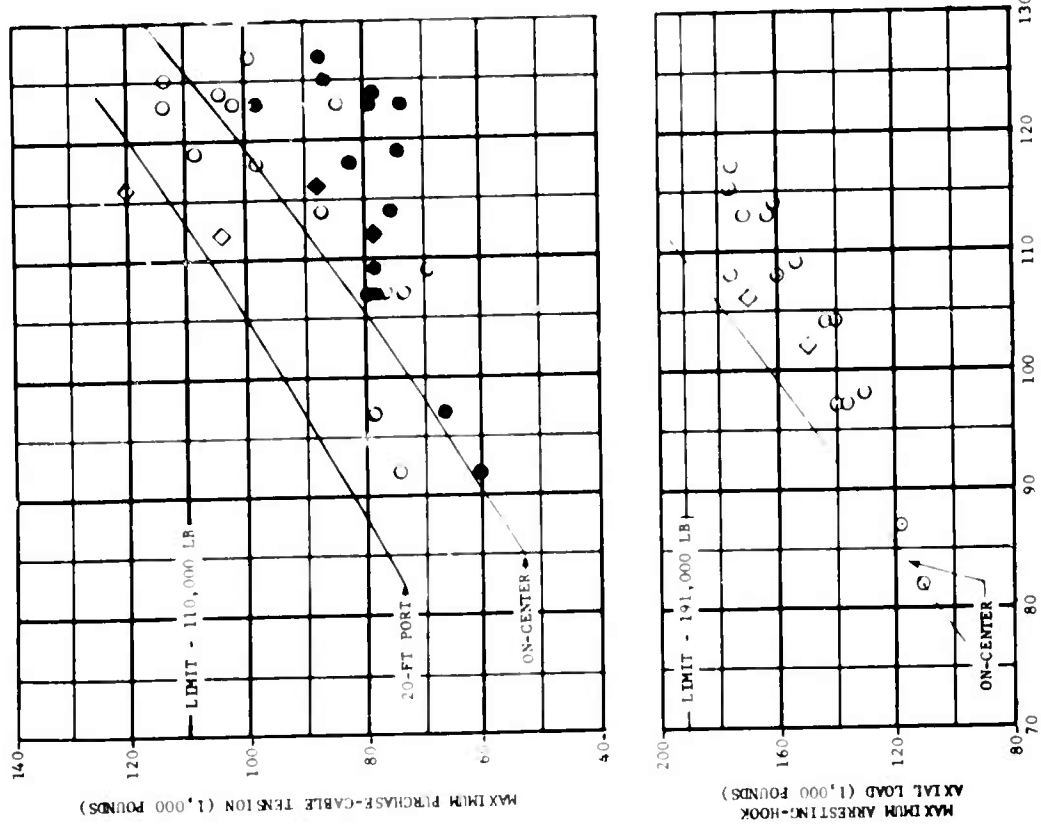
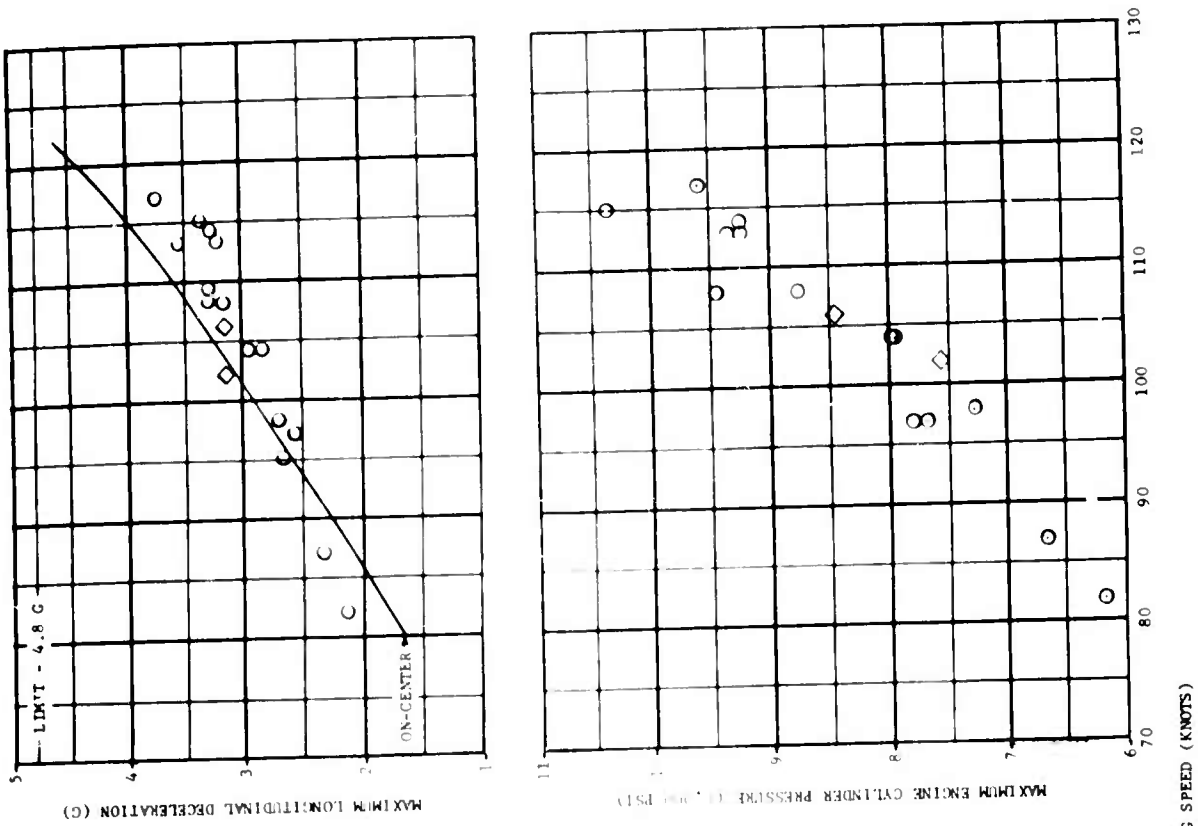
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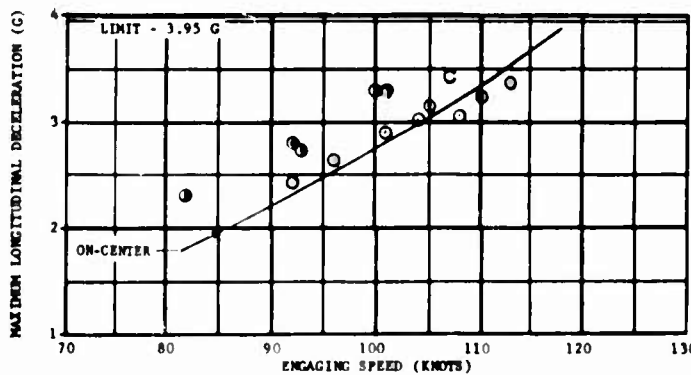
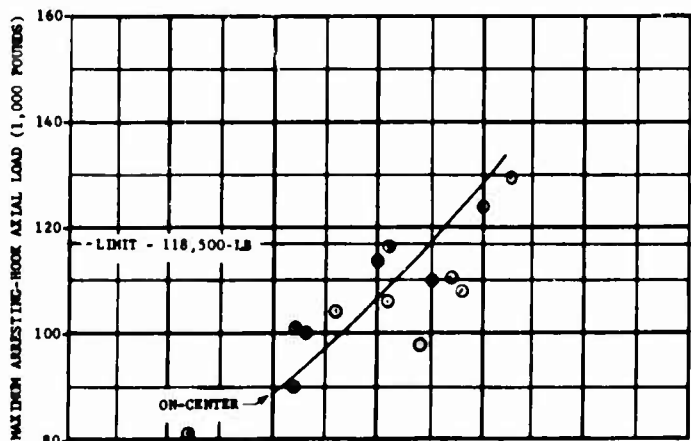
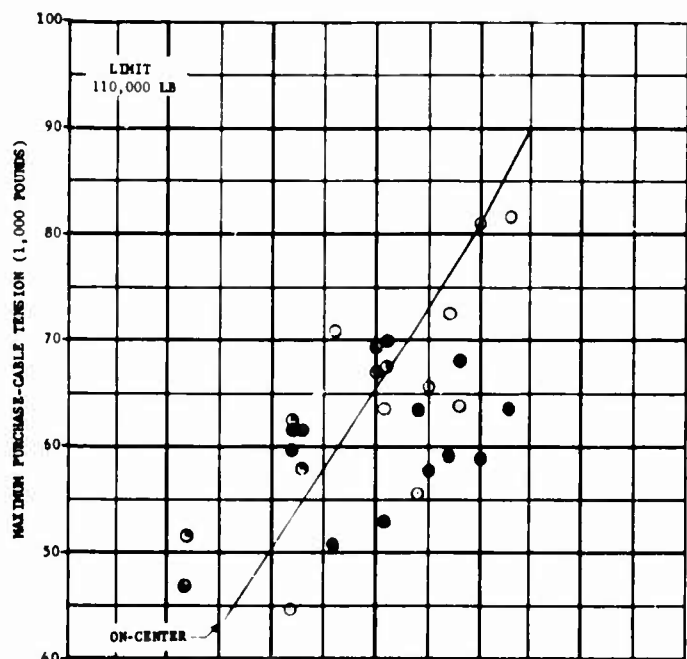
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KEY:
 ON-CENTER ○
 20-FT PORT ◊
 PURCHASE-CABLE TENSION PARAM- OTHER
 PORT STBD FTERS

NOTES
 ALL EVENTS CONDUCTED AT NORMAL WEIGHT SETTINGS.
 REFERENCE CURVES FROM REPORT NATF-EN-1094.

Figure 1 - Composite Graph of 48,200- to 50,100-Pound A-3 Aircraft Tests Showing Maximum Parameters versus Engaging Speed (Mark 7 Mod 1 Arresting-Gear System Reeved With 1-1/2 x 6 x 25 PW LLRS Purchase Cable and 1-3/8-Inch-Diameter Deck Pendant)



| KEY: | PURCHASE-CABLE TENSION | | OTHER PARAM-ETERS | AIRCRAFT WEIGHT RANGE (LB) | WEIGHT SETTING | NOTE: REFERENCE CURVES: REPORT NATF-EN-1094 |
|-----------|------------------------|------|-------------------|----------------------------|----------------|---|
| | NORM | STBD | | | | |
| ON-CENTER | ○ | ● | ○ | 30,800 - 33,000 | NORMAL | |
| ON-CENTER | ○ | ● | ● | 31,100 - 32,000 | 40,000-LB | |

Figure 2 - Composite Graph of 30,000- to 33,000-Pound F-4 Aircraft Tests Showing Maximum Parameters versus Engaging Speed (Mark 7 Mod 1 Arresting-Gear System Reeved With 1-1/2 x 6 x 25 FW LLRS Purchase Cable and 1-3/8-Inch-Diameter Deck Pendant)

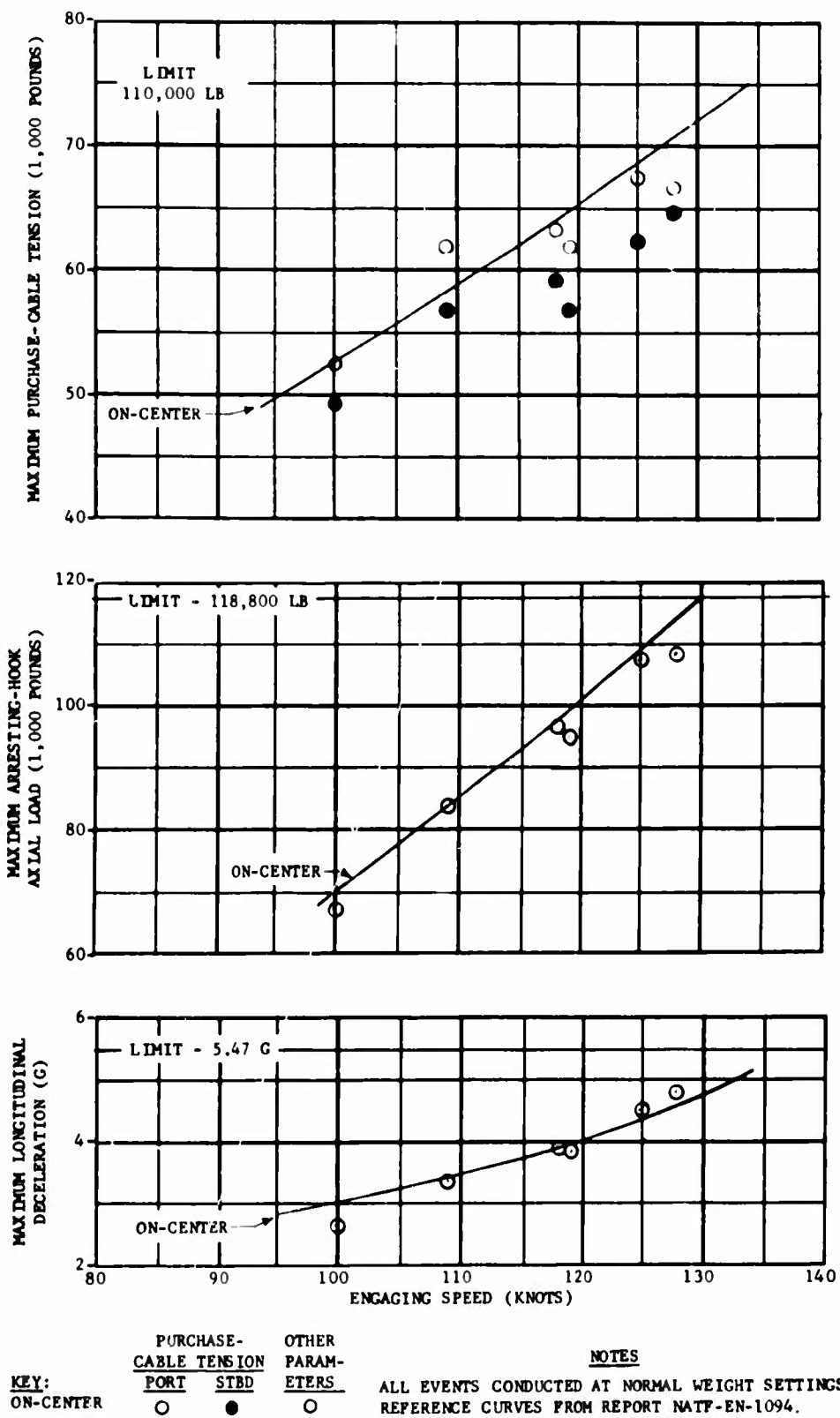
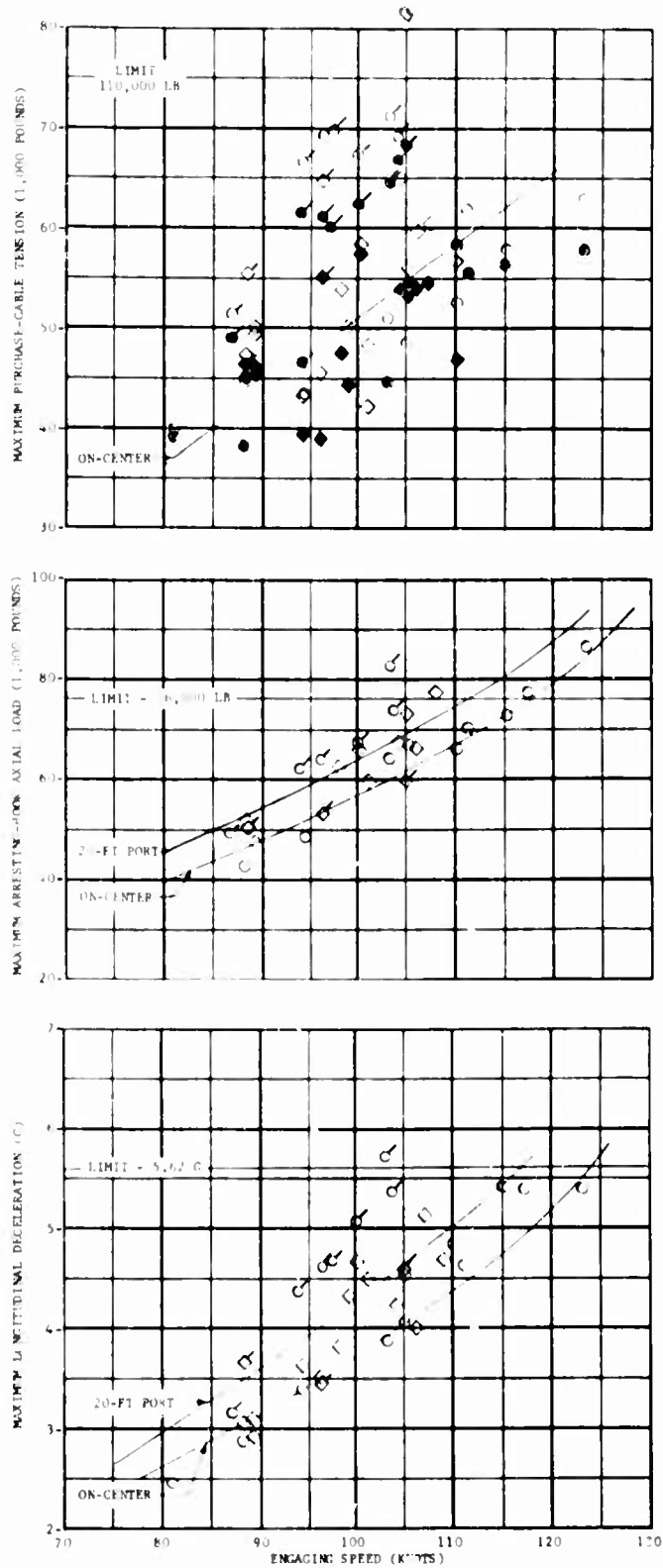


Figure 3 - Composite Graph of 20,000- to 22,000-Pound F-8 Aircraft Tests Showing Maximum Parameters versus Engaging Speed (Mark 7 Mod 1 Arresting-Gear System Reeved With 1-1/2 x 6 x 25 FW LLRS Purchase Cable and 1-3/8-Inch-Diameter Deck Pendant)



KEY:

| | PURCHASE-CABLE TENSION | | OTHER PARAMETERS |
|------------|------------------------|------|------------------|
| | PORT | STRD | OTHER |
| ON-CENTER | ● | ● | ○ |
| 20-FT PORT | ○ | ● | ○ |

NOTES

1. ALL EVENTS CONDUCTED AT NORMAL WEIGHT SETTINGS.
2. FLAG ON SYMBOL INDICATES SHEAVE DAMPERS INOPERATIVE.
3. REFERENCE CURVES FROM REPORT NATF-EA-1094.

Figure 4 - Composite Graph of 12,400- to 14,500-Pound A-4 Aircraft Tests Showing Maximum Parameters versus Engaging Speed (Mark 7 Mod 1 Arresting-Gear System Reeved With 1-1/2 x 6 x 25 Fw LLRS Purchase Cable and 1-1/8-Inch-Diameter Deck Pendant)