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1568

# Technical Memorandum

~~Ref. Sym. 5141 (581)~~

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## PRELIMINARY RESULTS OF TRANSONIC WIND TUNNEL TESTS OF TX-28 CONFIGURATIONS

R. F. Brodsky - 5141

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Name: W. Layne
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## ABSTRACT


Preliminary results from wind tunnel tests encompassing the range of Mach numbers from .6 to 1.2 indicate the following:

1. The TX-28 external store with 32-inch tip-to-tip fin span should prove to have satisfactory stability characteristics.

2. Supersonic tests will be necessary to determine if a three finned version of the TX-28 external store designed to be carried in the F-105 bomb bay will require a spoiler band.


Case No. 409.01 [redacted] September 23, 1955

INVENTORIED DATE 3-27-69

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# PRELIMINARY RESULTS OF TRANSONIC WIND TUNNEL TESTS OF TX-28 CONFIGURATIONS

## INTRODUCTION

During the period September 1 to September 4, 1955 transonic wind tunnel tests on various proposed TX-28 configurations were conducted in the 3 x 4' Transonic Wind Tunnel facility of the Cornell Aeronautical Laboratory. Sandia personnel at the test were: R. F. Brodsky, 5141, J. A. Stark, 1215, R. L. Black, 5142, J. F. Reed, 5142, T. A. Blanchard, 5142 and V. T. Strascina, 5142.

The purposes of the test were as follows:

1. To select fins of suitable plan form and span for the externally carried TX-28

2. To determine loads on the fins in their erected condition

3. To determine loads on the folding fin in various conditions of opening

4. To provide aerodynamic data to support TX-28 load studies being conducted by various aircraft manufacturers

5. To investigate stability characteristics of three finned bodies

It is the intent of this report to present the significant results of this test at the earliest possible date. Note that the data used herein is preliminary in nature. A later report will present complete results from both the Cornell test and the forthcoming supersonic tests to be conducted in the MIT Supersonic Wind Tunnel during the week of September 19.

## CONFIGURATIONS TESTED

A detailed plan of the test is described in Pre-Test Report No. 76, "Wind Tunnel Tests of the Sandia Class D Special Weapon Through the Transonic Range", Ref. Sym: 5142-(110). Basically, two configurations were tested. The first was the nominal TX-28 external store. Four sets of fins were tested on the basic body. Three of these fins had identical cross section characteristics but varied in tip-to-tip fin span. The spans tested were 1.35, 1.6, and 1.85 body diameters. The fourth fin had a 1.6 diameter tip-to-tip fin span, but a relatively longer chord than the three above fins. The fin of 1.6 diameter tip-to-tip span with the short chord is called the nominal fin.

The second configuration tested consisted of the basic body with three short span fins. This configuration is tailored to fit into the F-105 bomb bay. It was tested both with and without a spoiler band on the forebody.

Note that the afterbody of the wind tunnel model was altered slightly from the full scale configurations to ease wind tunnel mounting. Details of the alteration will be provided in a later report. The ratio of sting support diameter to model basic diameter was .5; a value which in past tests of a similar nature has yielded negligible sting interference effects.

The results of the tests indicated a non-linear lift and moment curve with angle of attack, particularly at Mach numbers below unity. For this reason, static stability results are presented for both the angle of attack range of $\pm 2^\circ$ and $\pm 5^\circ$.

## RESULTS

Figures 1 and 2 present the static stability margin and the static stability parameter respectively of the TX-28 external store with the four sets of fins mentioned above. A static stability margin in the neighborhood of 20 per cent of body length is normally considered satisfactory for external stores. Thus it may be seen that the nominal fins appear to be satisfactory. It does not appear that the long chord fins of the same span as the nominal fins yield sufficiently better stability characteristics to warrant their use on the full scale weapon. As indicated on Fig. 3, no discernible difference in drag characteristics could be found between these two types of fins. Although the short span fins would lead to a lower drag configuration, both Figs. 1 and 2 indicate that the static stability margin of a configuration utilizing short span fins would not be adequate.

Using the data of Fig. 2, pertaining to the nominal fins, calculations of store frequency were made for a selected free flight conditions and are listed in the table below:

| M | h(ft) | f(cycles/sec) |
|---|---|---|
| 1.0 | 45,000 | 1.02 |
| 1.12 | 40,000 | 1.21 |
| 1.22 | 35,000 | 1.45 |
| 1.29 | 30,000 | 1.72 |
| 1.0 | 30,000 | 1.43 |
| 0.8 | 30,000 | 0.93 |

It may be seen that under these conditions, the frequency is sufficiently high so that roll-pitch coupling difficulties should not be encountered so long as the fin alignment specifications presently established are met.

The stability characteristics of the three finned versions are shown on Figs. 4 and 5. Fin span from tip to longitudinal center line is 15.125 inches. It may be seen that the spoiler band is particularly effective at Mach numbers in excess of unity. Testing in the supersonic range will be necessary before a decision as to the necessity of employing a spoiler band on this internal version can be made.

Figure 6 compares the drag characteristics of the three finned versions with the nominal store. Note the surprisingly large increment of drag contributed by the spoiler band. This high drag should decelerate the banded configuration at a greater rate than the unbanded one, and thus may reduce the significance of the higher supersonic stability of the banded version.

## DISCUSSION

Past experience indicates that a general reduction in static stability should be expected as the Mach number increases from 1.2 to 2. Normally, however, in this Mach number range the reduction in stability is not great. It is therefore believed that the nominal fins will remain adequate throughout the entire expected range of operation of the TX-28 external store. Confirmation of this statement will be made at the supersonic wind tunnel tests.

It is interesting to note that earlier tests conducted in the Sandia blow down facility lead to conservative values of the static stability parameters by 50 to 100 per cent.

R. F. BRODSKY - 5141

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FIG. 1

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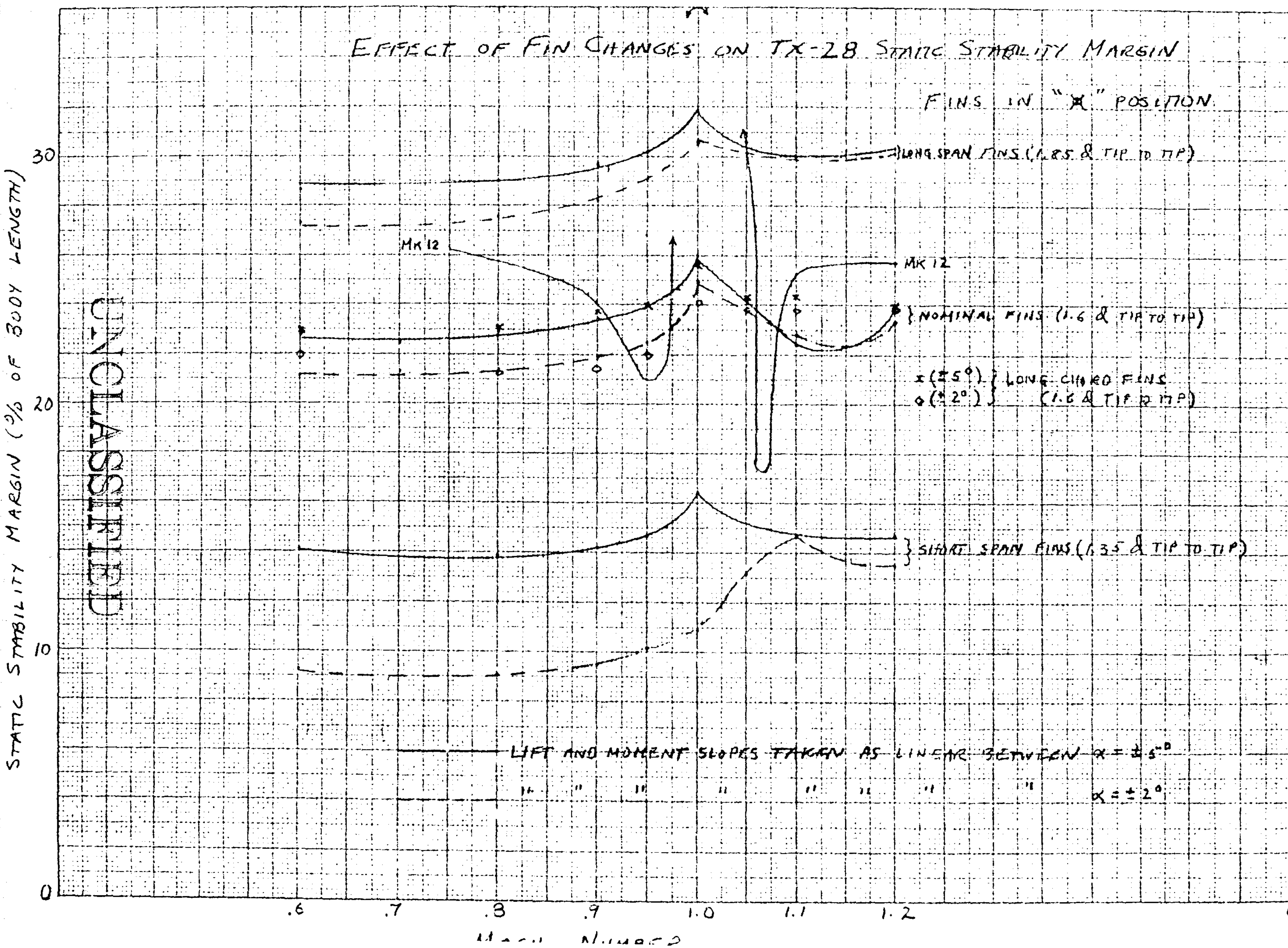
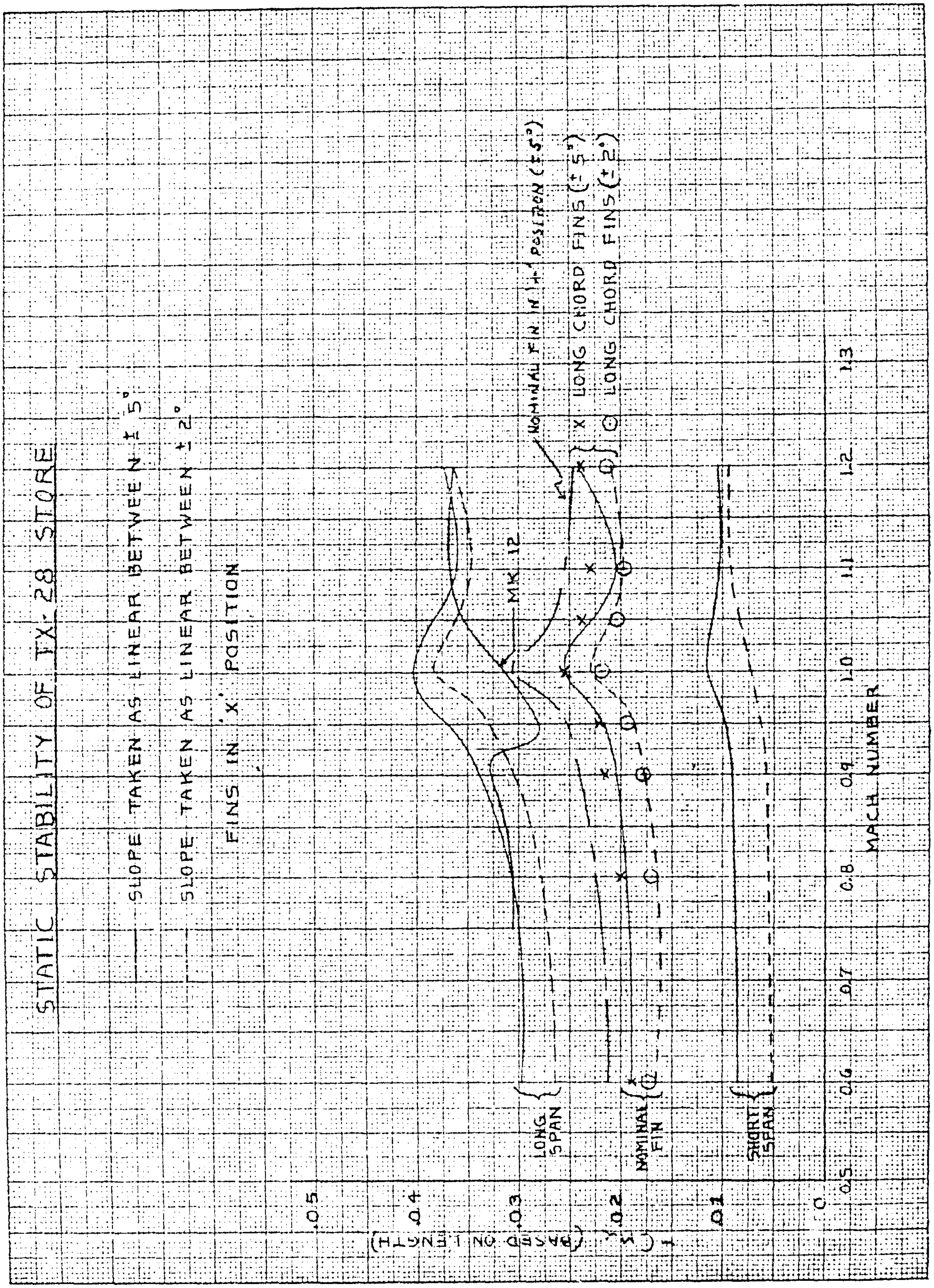

EFFECT OF FIN CHANGES ON TX-28 STATIC STABILITY MARGIN
FINS IN "X" POSITION
LONG SPAN FINS (1.85 & TIP TO TIP)
MK 12
MK 12
NOMINAL FINS (1.6 & TIP TO TIP)
x (±5°) } LONG CHORD FINS
◇ (±2°) } (1.6 & TIP TO TIP)
SHORT SPAN FINS (1.35 & TIP TO TIP)
LIFT AND MOMENT SLOPES TAKEN AS LINEAR BETWEEN α = ±5°
" " " " " " " " α = ±2°
STATIC STABILITY MARGIN (% OF BODY LENGTH)
30
20
10
0
.6
.7
.8
.9
1.0
1.1
1.2
MACH NUMBER

FIG 2


STATIC STABILITY OF TX-28 STORE
SLOPE TAKEN AS LINEAR BETWEEN N ± 5°
SLOPE TAKEN AS LINEAR BETWEEN ± 2°
FINS IN 'X' POSITION
MK 12
NOMINAL FIN IN '+' POSITION (±5°)
X LONG CHORD FINS (±5°)
⊙ LONG CHORD FINS (±2°)
LONG SPAN
NOMINAL FIN
SHORT SPAN
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
MACH NUMBER
0
.01
.02
.03
.04
.05
(BASED ON LENGTH)

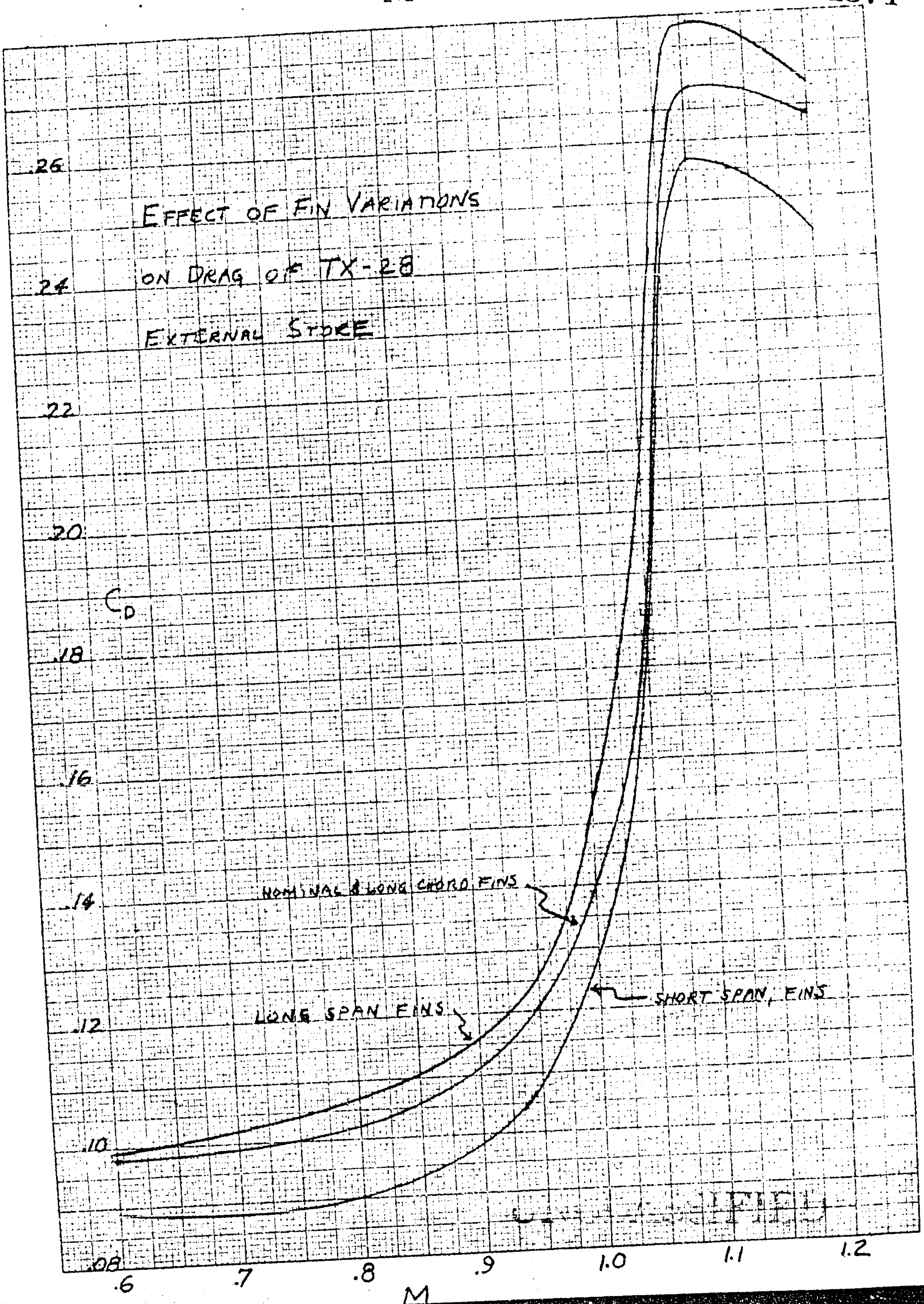





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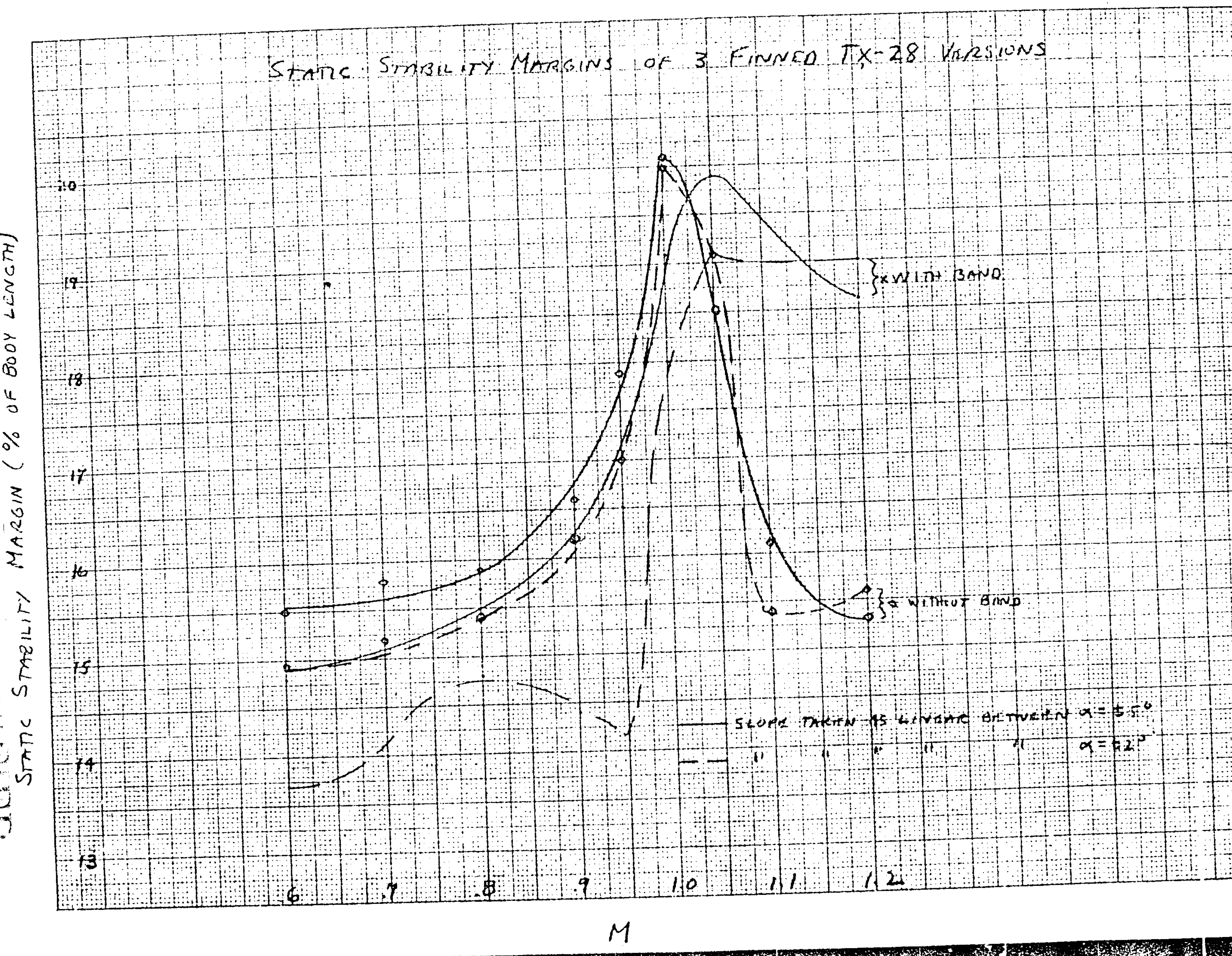
FIG 4



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# EFFECT OF SPOILER BAND ON 3-FINNED INTERNAL VERSION OF TX-28

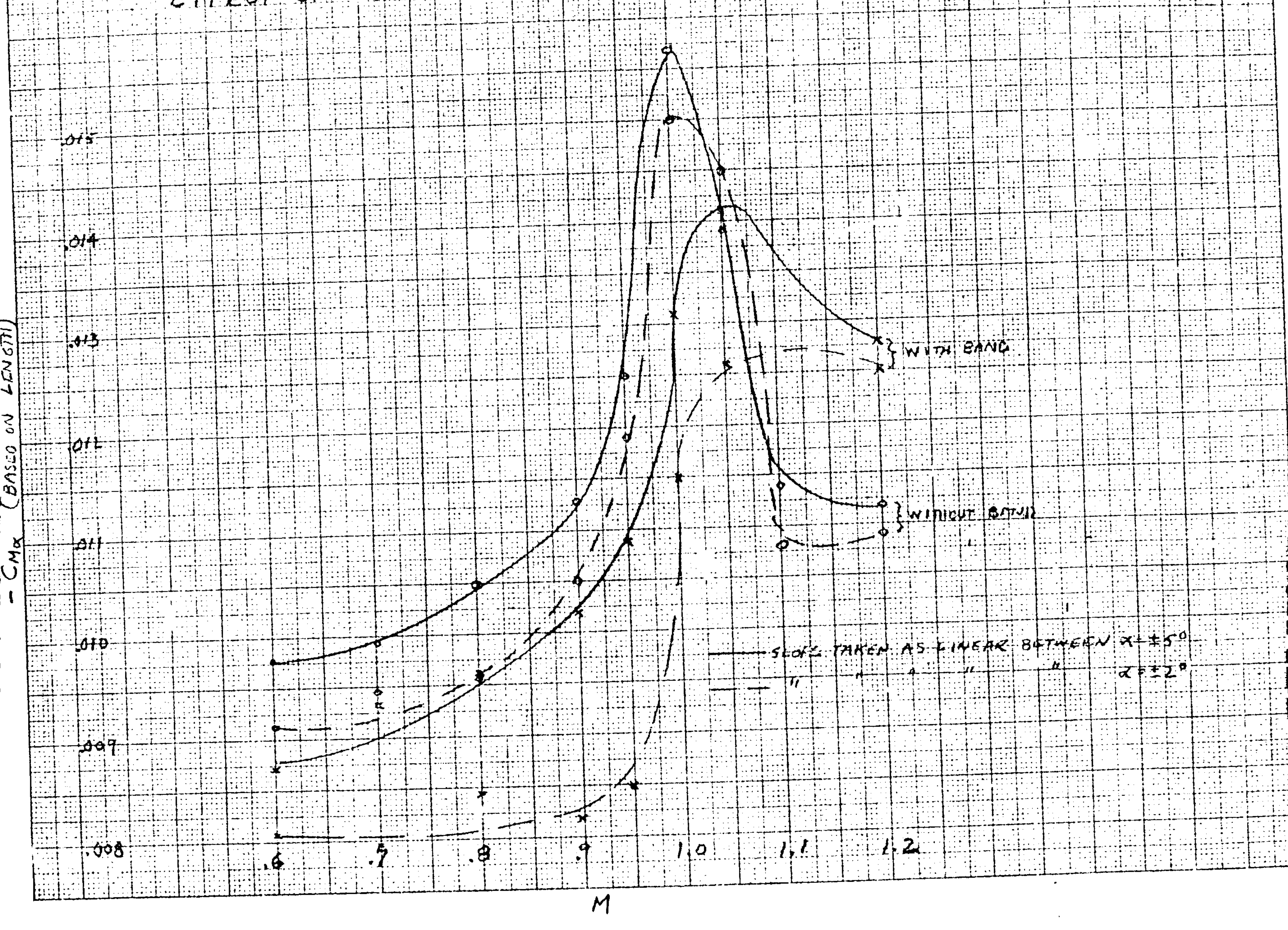


FIG 5 1576

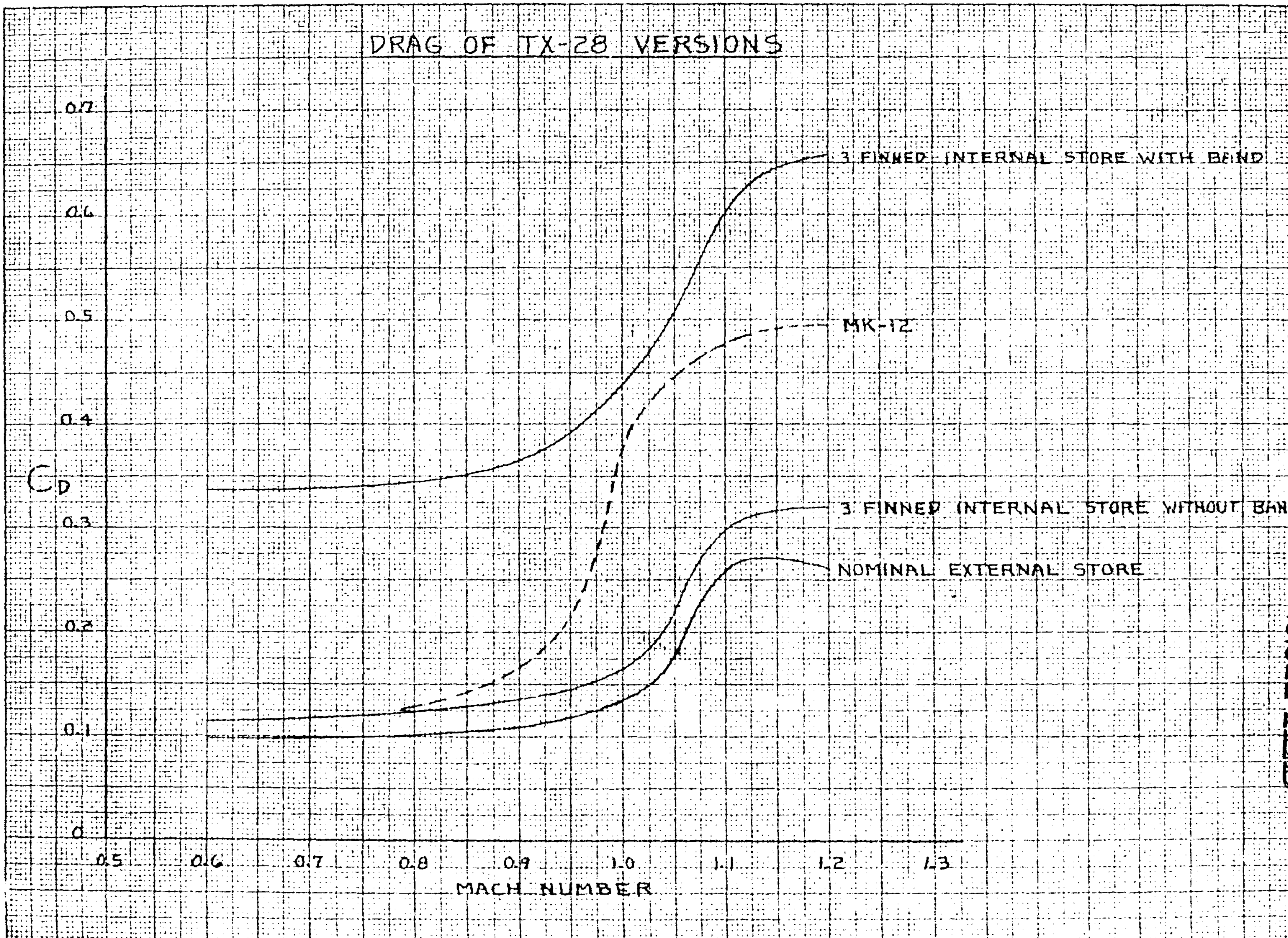


FIG 6

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