

UNCLASSIFIED

AD NUMBER

ADA800140

CLASSIFICATION CHANGES

TO: unclassified

FROM: confidential

LIMITATION CHANGES

TO:
Approved for public release; distribution is unlimited.

FROM:
Distribution authorized to DoD only;
Administrative/Operational Use; 10 APR 1950.
Other requests shall be referred to Air
Materiel Command, Wright-Patterson AFB, OH
45433. Pre-dates formal DoD distribution
statements. Treat as DoD only.

AUTHORITY

AFSC ltr dtd 2 Jun 1970; AFSC ltr dtd 2 Jun
1970

THIS PAGE IS UNCLASSIFIED

CLASSIFICATION CHANGED

ATI

FROM **CONFIDENTIAL** TO **UNCLASSIFIED**

78222

ON 29 November 1954 By authority of § List No. 58

This action was rendered by Arthur L Creech OSA
Name in full Date

Reproduced

FROM

LOW CONTRAST COPY.

ORIGINAL DOCUMENTS
MAY BE OBTAINED ON
LOAN

FROM

C A D O

78 222

Stability and Control Flight Tests of XB-46 (Bomber) Airplane, USAF No. 45-59582 (FTD Project No. 49B173) - and Appendixes I and II (Memorandum Report).

(None)

Ritchey, Wallace M.; Dennen, Richard L.
Air Materiel Command, Flight Test Div., Dayton, O.
(Same)

MCRFT-2282

April '50 Conf'd'l U. S. English 59 photos, graphs (Same)

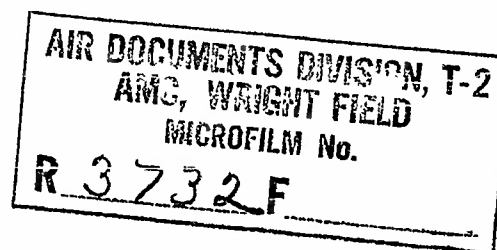
Stability and control flight tests of the XB-46 high-speed, high-altitude, medium bomber powered by four J-35 turbojet engines were performed. The test flights were flown at a take-off gross weight of 86,000 lb including a crew of four, full fuel tanks, 44 gal of oil, and 1610 lb of lead-shot as ballast to locate the CG at 25, 19, and 26.6% MAC, respectively. Longitudinal stability and control characteristics of the airplane were satisfactory for the configurations and CG positions tested. Laterally, however, the feeler ailerons were unsatisfactory under flight conditions in which the spoiler ailerons were locked. It is therefore recommended that the lateral control system be redesigned to allow full use of the spoilers throughout the speed range of the airplane.

LIMITED. Route requests through AMC, Attn: MCRFTR for approval.

B -46 - Flight tests

Aerodynamics (2)
Performance (2)

B-46



CONFIDENTIAL

TITLE SHEET

CONFIDENTIAL

HEADQUARTERS
AIR MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, DAYTON, OHIO

MEMORANDUM REPORT ON

MCRFTR/WMR/elm
Date 10 April 1950

SUBJECT: Stability and Control Flight Tests of
XB-46 Airplane, USAF No. 45-59582
(FTD Project No. 49E173)

OFFICE MCRFTR-152 Contract or Order No. _____
SERIAL No. MCRFT-2282 Expenditure Order No. _____

A. PURPOSE:

1. The purpose of these tests was to obtain pilots' comments and factual data on stability and control characteristics of the XB-46 airplane, USAF No. 45-59582.

B. FACTUAL DATA:

2. Introduction.

Stability and control flight tests were conducted at Wright-Patterson Air Force Base, Dayton, Ohio, by authority of the Chief, Flight Test Division, and consisted of 23 flights, totalling 41:20 hours, between 9 August 1948 and 26 July 1949.

3. Description of the Airplane.

a. The XB-46, USAF No. 45-59582, was built by the Consolidated-Vultee Aircraft Corporation, and was designed as a high speed, high altitude medium bomber, built without external armament or radar protuberances of any kind, and powered by four J-35 engines. The dimensions of the airplane were: length, 105.5 feet; span, 113 feet; and height to top of rudder, 28 feet. The airplane was tested in the following configurations: Power Approach (PA), Cruise (C), Glide (G), Landing (L) and Power (P), as defined in USAF Specification No. 1815-B (Flying Qualities of Piloted Airplanes). The fuel system was modified in such a manner that it was possible to counteract the tendency of the center of gravity to move aft from its mid or aft position as fuel was consumed. A connecting line was placed in the fuel system so that the most aft tank could feed No. 2 engine (regularly fed by the most forward tank) in addition to its regular engine, No. 1, and a counter would record the additional fuel being used from the most aft tank.

CONFIDENTIAL

CONFIDENTIAL

Memorandum Report No. MCRFT-2282
10 April 1950

CONFIDENTIAL

b. Special instrumentation was installed in both the pilot's panel and the photo-observer panel as shown in Figures 6 and 7, Appendix II. The open photo-observer panel, which could be read in flight by the observer, was located in the nose section and the camera, which recorded the photo-panel readings, could be controlled by the pilot, copilot, or observer. Strain gages were installed on the pilot's pedals and a force wheel was installed in order to measure the control forces applied by the pilot. A boom, one chord in length, was installed on each wing tip, one for a swiveling pitot head and the other for a yaw vane.

4. Description of the Tests.

a. The instrumented airplane was weighed on platform scales at Wright-Patterson Air Force Base. The test flights were flown at a take-off gross weight of 86,000 pounds, including a crew of four, full fuel tanks, 44 gallons of oil, and 1610 pounds of lead shot. The lead shot was originally loaded into the bomb bay in such a manner as to locate the center of gravity at 25% MAC with the landing gear in its retracted position. Later, to locate the center of gravity at 19%, the ballast was divided, and 1210 pounds were placed in the nose and 400 pounds in the forward end of the bomb bay. Lastly, all of the ballast was to be placed in a ballast box in the tail to obtain a CG position of 31%; thus, it was planned to fly at all three CG positions at the same take-off gross weight. Lowering the landing gear moved the CG aft about one and one-half percent.

b. Flight tests were conducted as outlined in AAF Technical Report No. 5242 ("Stability and Control Flight Test Methods," by Perkins and Walkowicz). Complete longitudinal tests were run at the mid-CG positions of 25% MAC (gear up) and 26.6% MAC (gear down). At the forward CG position of 19% MAC, data on static and maneuvering longitudinal stability were obtained only in the power configuration. The project was cancelled because maintenance difficulties, aggravated by lack of spare parts, required a prohibitive number of man-hours to keep the aircraft in flying condition.

5. Discussion of Results.

The stability and control flight tests were incomplete. Quantitative results are given for longitudinal stability as the result of flights made with the CG in its mid-position and one flight with the CG in its forward position. No flights were made to measure lateral and directional stability.

a. Mechanical Characteristics of Control Systems.

In all cases, except for up elevator, the static control friction forces (which include the dead weight of the control surfaces) exceeded those limits prescribed in USAF Specification No. 1815-B; although, in flight, these friction forces were not objectionable to the pilots. The friction was measured in a closed hangar at a temperature of about 70°F. The friction forces, obtained as required in the above specification, are as follows:

CONFIDENTIAL

Memorandum Report No. MCRFT-2282
10 April 1950

<u>Control</u>	<u>Position</u>	<u>Movement</u>	<u>Static Friction - Pounds</u>
Elevator	Neutral	Up	2.5
	Neutral	Down	19.4
Aileron (Spoilers Locked)	Neutral	Left	7.6
	Neutral	Right	7.6
Aileron (Spoilers Unlocked)	Neutral	Left	7.6
	Almost Full Left	Left	33.
	Neutral	Right	7.6
	Almost Full Right	Right	39.4
Rudder	Neutral	Left	30.
	Almost Full Left	Left	52.
	Neutral	Right	25.6
	Almost Full Right	Right	48.

b. Dynamic Longitudinal Stability.

During the flight testing the pilots observed that there was a noticeable amount of flexure in the fuselage resulting from buffeting in rough air or from a deliberate oscillation of the controls. This flexure was of a much greater magnitude than either of the pilots had previously experienced in any other airplane, and although it did not seem to affect the dynamic longitudinal stability adversely, this flexure was great enough to cause a difference of opinion between the pilots as to its significance. The airplane was longitudinally dynamically stable in all configurations and speeds tested. The short period oscillation of normal acceleration, following an abrupt deflection and release of the elevator control, was completely damped in one cycle, as shown in Figures 1 and 2, Appendix I.

c. Static Longitudinal Stability.

Static longitudinal stability results are incomplete because only in the power configuration was the airplane tested at two CG positions. At 10,000 feet and in configuration (P), the airplane possessed satisfactory static stick-fixed and stick-free longitudinal stability. The stick-fixed and stick-free neutral points were determined in Figure 13 from the slopes of the curves in Figures 11 and 12, Appendix I. The CG position for neutral stability is shown in Figure 14, Appendix I, for various values of C_L . The elevator control throughout the range of speeds tested was very satisfactory, both in feel and in effectiveness.

d. Elevator Control in Take-Off and Landing.

Take-offs were made with 30° flaps and residual heat doors closed and landings were made from a very flat approach at idle power and with

Memorandum Report No. MCRFT-2282
10 April 1950

full flaps. The elevator control was adequate for both take-offs and landings with the CG at 20.6 and 26.6% MAC. The rudder control in these tests was also adequate, the greatest force required in landing being 100 pounds whereas the limit prescribed in USAF Specification No. 1815-B is 180 pounds. Time histories of a take-off and landing are shown in Figures 21 and 22, Appendix I. Both tests were made with the CG at 26.6% MAC. Figure 21 illustrates that the nose wheel was lifted at about 68 knots.

e. Longitudinal Control: Maneuvering.

Wind-up turns were conducted in configuration (P) at 10,000 feet with the CG position at 19% and 25% MAC, and at 30,000 feet with the CG position at 25% MAC. Results of these tests, as shown in Figures 23 and 24, Appendix I, indicate the elevator control force gradient at the forward CG position was five pounds above the top limit of 60 pounds prescribed in USAF Specification No. 1815-B. The position of the maneuver points for each altitude is shown in Figure 24, Appendix I, as the CG position at which the elevator wheel force gradient becomes zero. The elevator control in maneuvering flight was excellent. Normal accelerations of 2.2G were obtained with less than half the available up elevator travel of 25°, as shown in Figure 25, Appendix I. The elevator angle required in maneuvering flight increases sharply above a lift coefficient of 0.9.

f. Longitudinal Trim Changes.

Tests were conducted at 10,000 feet, with the CG position at 25% MAC, to determine the elevator force required to maintain a given trim speed after changing power, flap, or gear setting. As shown in the table below, the trim changes in Item 3 required a pull force, as specified in USAF Specification No. 1815-B, and the other forces were low enough to comply with the specification.

Longitudinal Trim Changes 10,000 Feet

	<u>Trim Speed</u> (Knots) (Elev. Force Zero)	<u>Flaps</u>	<u>Gear</u>	<u>RPM</u>	<u>Variable</u>	<u>Elev. Force Required</u> <u>to Maintain Trim</u> <u>Speed - Pounds</u>
1.	156	Up	Up	6400	Gear down	10.8 push
2.	156	Up	Down	6400	Flaps down	15.1 push
3.	125	Down	Down	7200	Power off (3700)	2.7 pull
4.	125	Down	Down	Off (3500)	Full power (7700)	14.5 push
5.	125	Down	Down	7700	Gear up	9.4 pull
6.	125	Down	Up	7700	Flaps up	0.9 push
7.	125	Take off (30°)	Up	7700	Flaps up	1.5 push

CONFIDENTIAL

Memorandum Report No. MCRFT-2282
10 April 1950

	Trim Speed (Knots) (Elev. Force Zero)	Flaps	Gear	RPM	Variable	Elev. Force Required to Maintain Trim Speed - Pounds
8.	106	Down	Down	Level flt (7200)	Full power (7700)	4.3 push
9.	106	Take off (30°)	Down	7700	Gear up	8.9 pull
10.	358	Up	Up	7700	Power off (5500)	3.5 pull

g. Trimming Devices.

Each elevator had an electrically-actuated trim tab. The airplane was easy to trim and the tab was irreversible. Figure 26, Appendix I, shows the tab angle required to trim the airplane at various speeds in the configurations (P), (G), and (L). It was found, however, that with the CG in the forward position of 20.6% MAC, the elevator trim was not powerful enough to trim the airplane in configuration PA at an indicated air speed of 106 knots at 10,000 feet. The airplane could be trimmed to about 110 knots in that configuration and it is believed that the airplane could have been trimmed at 106 knots at 23% MAC, which was the maximum forward CG position suggested by the manufacturer. The rudder and aileron trim tabs were irreversible and gave sufficient control to trim the airplane wings level in all configurations and speeds tested, with the exception that with the wing flaps full down, the airplane became left wing heavy and full right aileron trim was insufficient to trim out this condition.

h. High Speed Requirements.

(1) This airplane was flown at a maximum Mach number of about 0.76 in a dive at 10,000 feet and there was no buffeting or shaking of the controls or of the airplane, no control force reversal, nor any erratic behavior which might have been attributed to compressibility effects and which would have placed a limit on the maximum speed of the aircraft.

(2) At 30,000 feet it was possible to descend at 2000 feet per minute, in a clean configuration, at an indicated speed of 208 knots, which would fulfill the requirement of Specification 1815-B.

i. Straight-ahead stalls were made at 10,000 feet with the CG in mid-position. Approach to the stall was indicated by tail buffeting, which gave ample warning in all cases except for the (PA) configurations, when the warning was only 1.5 knots above the stall. Stalling characteristics were normal with no noticeable tendency to roll. Stalling speeds for four configurations are shown below. Time histories for these stalls are given in Figures 27 through 30, Appendix I. On entering the stall, the wings were held level, and no rolling tendency following loss of lift after the stall, was observed.

Memorandum Report No. MCRFT-2282
10 April 1950

<u>Trim Speed (Knots)</u>	<u>Config.</u>	<u>Gross Weight</u>	<u>CG Position</u>	<u>RPM</u>	<u>V_c Knots</u>	<u>Stall Warning (Knots)</u>
222	CR	75,100	25%	6400	115	5
160	G	74,700	25%	3600	114	7
106	PA	71,900	26.6%	7200	88	1.5
120	L	71,400	26.6%	3600	89	4

Accelerated stalls were made at the completion of the "windup turns." Figure 31, Appendix I, shows the time history of a stall out of a turn at 10,000 feet in configuration (P). The warning for these stalls was given by a buffeting of the tail surfaces. The stalls themselves exhibited no drastic pitching or rolling tendencies.

j. Lateral and Directional Stability and Control.

(1) No quantitative data were obtained from lateral or directional stability and control flight tests, but, qualitatively, the lateral control was unsatisfactory. Lateral control, below 240 knots indicated air speed, was obtained by spoilers and small "feeler" ailerons and above that speed, because of their bouncing tendency, the spoilers were locked into the wing and only the ailerons were used. The effectiveness was very good when the spoilers were used; however, with them locked, the lateral control effectiveness was very low, although adequate for safe flight. Lateral control forces were excessive at all speeds because the major part of the aileron forces was produced by the "feeler" ailerons. The spoilers did not come into effect until the ailerons were displaced appreciably, thus causing a dead spot in the control effectiveness which was particularly noticeable in landing.

(2) Directional control was excellent at all speeds and very little rudder was required even with asymmetric power.

k. Left Wing Heaviness.

Left wing heaviness in flight was encountered with the wing flaps full down. This condition is believed to have been caused by the right flap traveling down slightly farther than the left and the inability of the small "feeler" ailerons to trim out the resulting left wing heavy condition.

l. Elevator Spring Tab.

Forward or aft movement of the control column was transmitted directly to elevator spring tabs and indirectly through springs to the elevators. These spring tabs proved to be very effective. Figures 32 through 38, Appendix I, show the variation of spring tab angle with elevator wheel force. The data for these curves were recorded on the flights to determine the static and maneuvering longitudinal stability, and the equivalent air speed is marked for each point. The air loads on the tabs result in an increased slope with an increase in speed. There was an appreciable amount of friction in the operation of the spring tabs which could account for the difference in maximum tab deflection illustrated in Figures 32, 36, and 38, Appendix I.

Memorandum Report No. MCRFT-2282
10 April 1950

C. CONCLUSIONS:

6. Longitudinal stability and control characteristics of the XB-46 airplane were satisfactory for the configurations and CG positions tested. Laterally, however, the feeler ailerons were unsatisfactory under flight conditions in which the spoiler ailerons were locked.

D. RECOMMENDATIONS:

7. Prior to further development of this airplane or if this airplane is to be maintained in flying condition for an extended period, it is recommended that:

a. The lateral control system be redesigned to allow full use of the spoilers throughout the speed range of the airplane.

b. Cause of the left wing heaviness with full flaps be determined and corrected.

CONFIDENTIAL

Memorandum Report No. MCRFT-2282
10 April 1950

Wallace M Ritchey

Prepared by: WALLACE M. RITCHIEY
Engineer, Aerodynamics Branch
Flight Research Section
Test Engineering Subdivision

Richard L. Denmen

And: RICHARD L. DENMEN, 1st Lt, USAF
Engineer, Aerodynamics Branch
Flight Research Section
Test Engineering Subdivision

for Paul M. Butan, Major, USAF

Flown by: PAUL M. BUTAN, Major, USAF
Chief, Instrumentation Section
Test Engineering Subdivision

Charles J. Clemence, Jr.

And: CHARLES J. CLEMENCE, JR., Capt, USAF
Pilot, Bomber Operations Section
Operations Subdivision

Leo C. Moon

Concurred in: LEO C. MOON, Lt Colonel, USAF
Chief, Test Engineering Subdivision

Franklin K. Paul

Approved by: FRANKLIN K. PAUL, Colonel, USAF
Chief, Flight Test Division

2 Incls
Appendix I
Appendix II

CONFIDENTIAL

CONFIDENTIAL

Memorandum Report No. MCRFT-2282
10 April 1950

Distribution:

- 1 Directorate, Research and Development, MCR
- 2 Director of Research and Development, Hq USAF, Washington 25, D. C.
- 3 CG, Air University, ATTN: Dept of AF Library, Maxwell AFB, Alabama
- 4 CG, Strategic Air Command, Offutt AFB, Nebraska
- 5 CG, Air Defense Command, Mitchel AFB, New York
- 6 CG, Tactical Air Command, Langley AFB, Virginia
- 7 Commander, Military Air Transport Service, Andrews AFB, Washington 25, D. C.
- 8 Air Proving Ground Liaison Officer, MCIATG
- 9-12 Bureau of Aeronautics General Representative, BAGR (4 copies)
- 13-14 Aircraft Laboratory, Engineering Division, MCREXA (2 copies)
- 15 Aerodynamics Branch, Aircraft Laboratory, Engineering Division, MCREXA-3
- 16-17 Aircraft Projects Section, Engineering Division, MCREQA (2 copies)
- 18 Flight Data Branch, Aircraft Projects Section, Engineering Division, MCREQA-9
- 19 Bomber Operations Section, Flight Test Division, MCRFOB
- 20-21 Performance Engineering Section, Flight Test Division, MCRFTP (2 copies)
- 22 Instrumentation Section, Flight Test Division, MCRFTI
- 23-26 Flight Research Section, Flight Test Division, MCRFTR (4 copies)
- 27 Aircraft and Missiles Section, Procurement Division, MCPPXA
- 28 Technical Analysis Division, Intelligence Dept., MCIA
- 29 Performance and Characteristics Branch, Intelligence Dept., MCIAXA-1
- 30 AMC Experimental Test Pilot School, MCRFXS
- 31 Technical Engineering Section, Edwards AFB, Muroc, California
- 32-35 NACA Liaison Office, TSXNA (4 copies)

CONFIDENTIAL

Memorandum Report No. MCRFT-2282
10 April 1950

APPENDIX I

Operational Limitations		Page 2
Figures 1-2	Dynamic Longitudinal Stability	Pages 3-4
Figures 3-20	Static Longitudinal Stability	Pages 5-22
Figure 21	Time History of Take-Off	Page 23
Figure 22	Time History of Landing	Page 24
Figures 23-24	Stick Forces in Maneuvering Flight	Pages 25-26
Figure 25	Longitudinal Control: Maneuvering	Page 27
Figure 26	Elevator Trim Tab Effectiveness	Page 28
Figures 27-30	Time Histories of Stalls	Pages 29-32
Figure 31	Stall Out of a Turn	Page 33
Figures 32-38	Elevator Spring Tab Characteristics	Pages 34-40
Figure 39	Air-speed Calibration	Page 41

APPENDIX I

Memorandum Report No. MCRFT-2282
10 April 1950

Operational Limitations

Design Gross Weight 91,000 pounds

Maximum Speed-Extending Landing Gear - 213 knots

Maximum Speed-Extending Full Flaps - 182 knots

Maximum Speed - Operation of Spoilers - 240 knots

Load Factors

Limit Maneuver Load Factors 3.00 positive

1.50 negative

(The limit maneuver load factors were limited to three-quarters of the above values because the aircraft structure had not been statically tested.)

The maximum travel of the control surfaces are listed below (degrees):

Aileron - L: + 17, -16

R: + 16, -17

Aileron Trim Tabs - L: + 11, -9.5

R: + 10.5, -9.5

Spoilers - +45, -3

Elevator - +24.6, -9

Elevator Trim Tab - L: +10, -10

R: +10, -11

Elevator Spring Tabs - +3.5, -12

Rudder - ±13

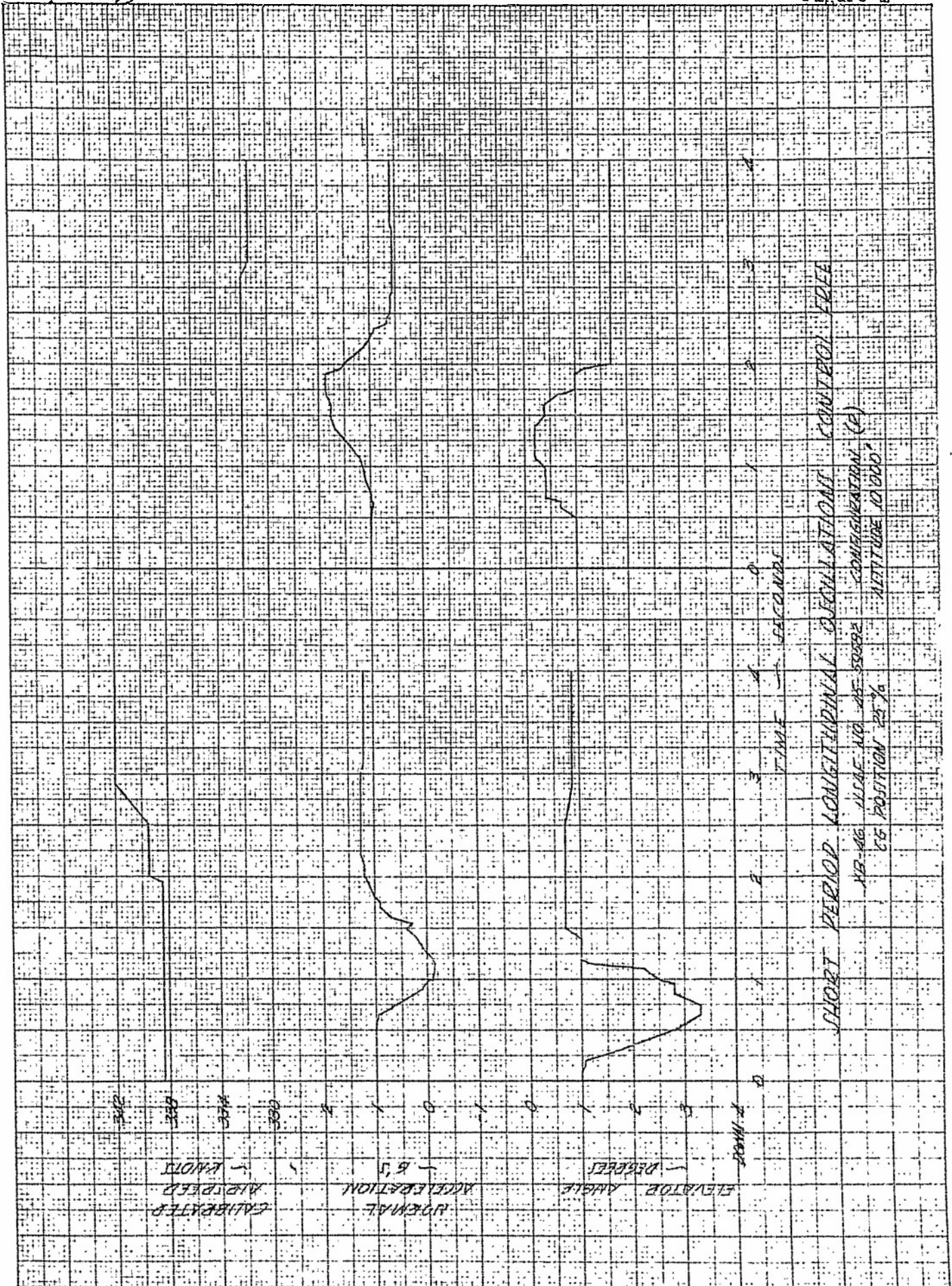
Rudder Trim Tab - ±7

Rudder Spring Tab - ±8

APPENDIX I

Memorandum Report No. MCRFT-2282
10 April 1950

Figure 1



MADE IN U.S.A.
KODAK SAFETY FILM
KODAK SAFETY FILM
KODAK SAFETY FILM

REPRODUCED FROM THE REPORT OF THE
RESEARCH AND DEVELOPMENT DIVISION,
NAVY AIR FORCE RESEARCH AND DEVELOPMENT
DIVISION, WASHINGTON, D. C., APRIL 1950



SHORT PERIOD LONGITUDINAL OSCILLATIONS CONTROL FREE

XB-46 WING NO. 25-59582 CONVERSION (P)
CG POSITION 25% ALTITUDE 3000'

STICK FIXED STATIC LONGITUDINAL STABILITY

NA-46 WING NO. 45-59382

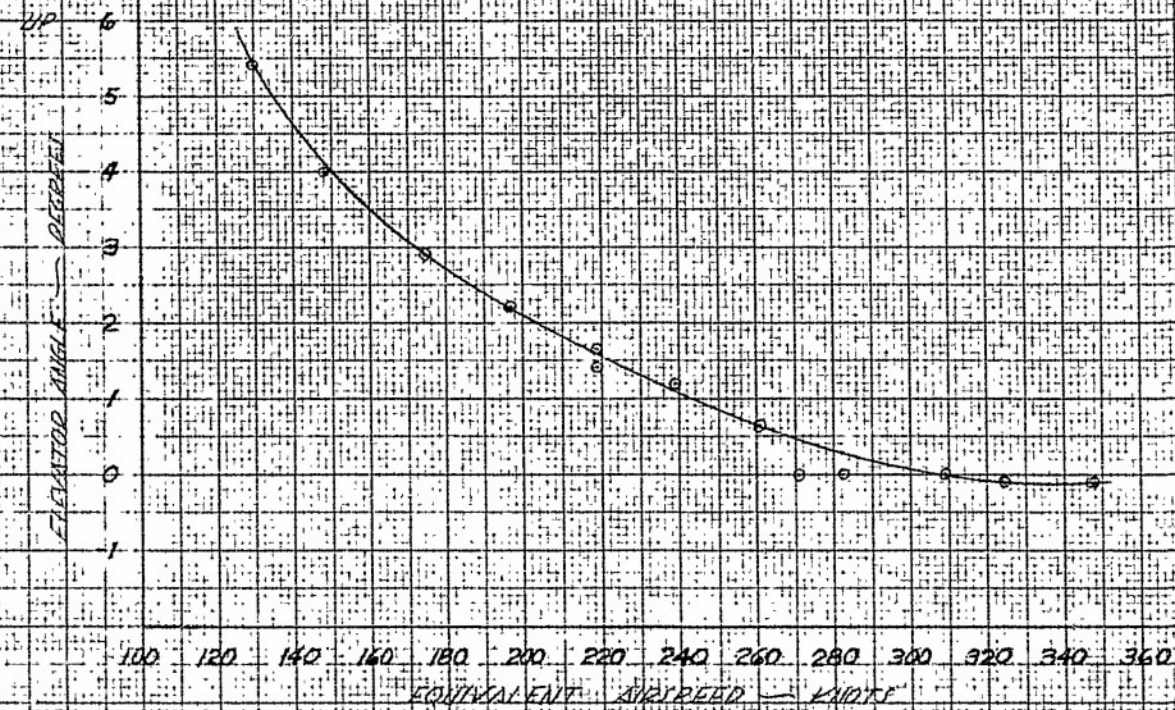
CONFIGURATION (C.P.)

TRIM 16 270 KNOTS

10 000 FT

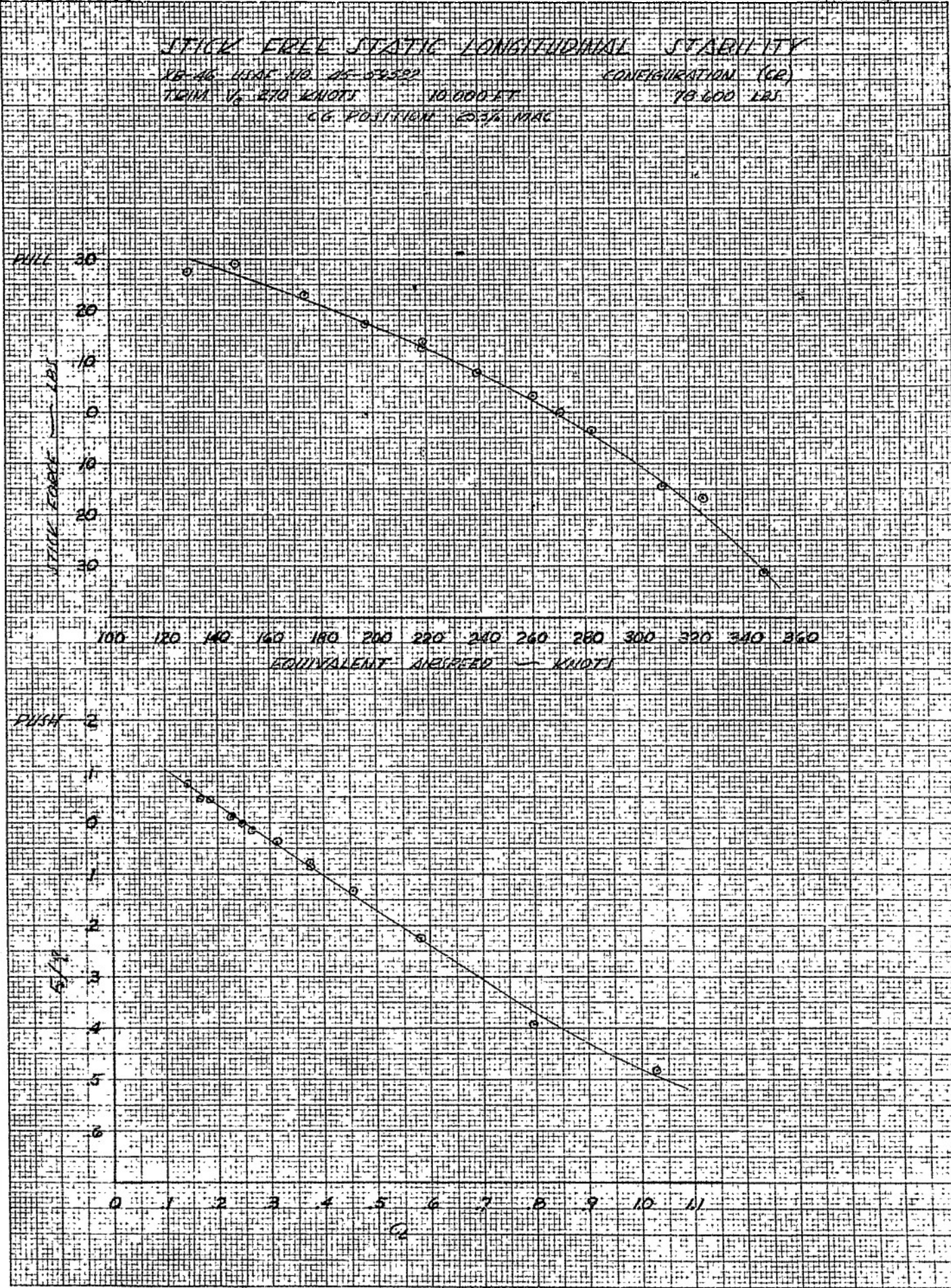
75 000 LBS

CG POSITION 25.3% MAC

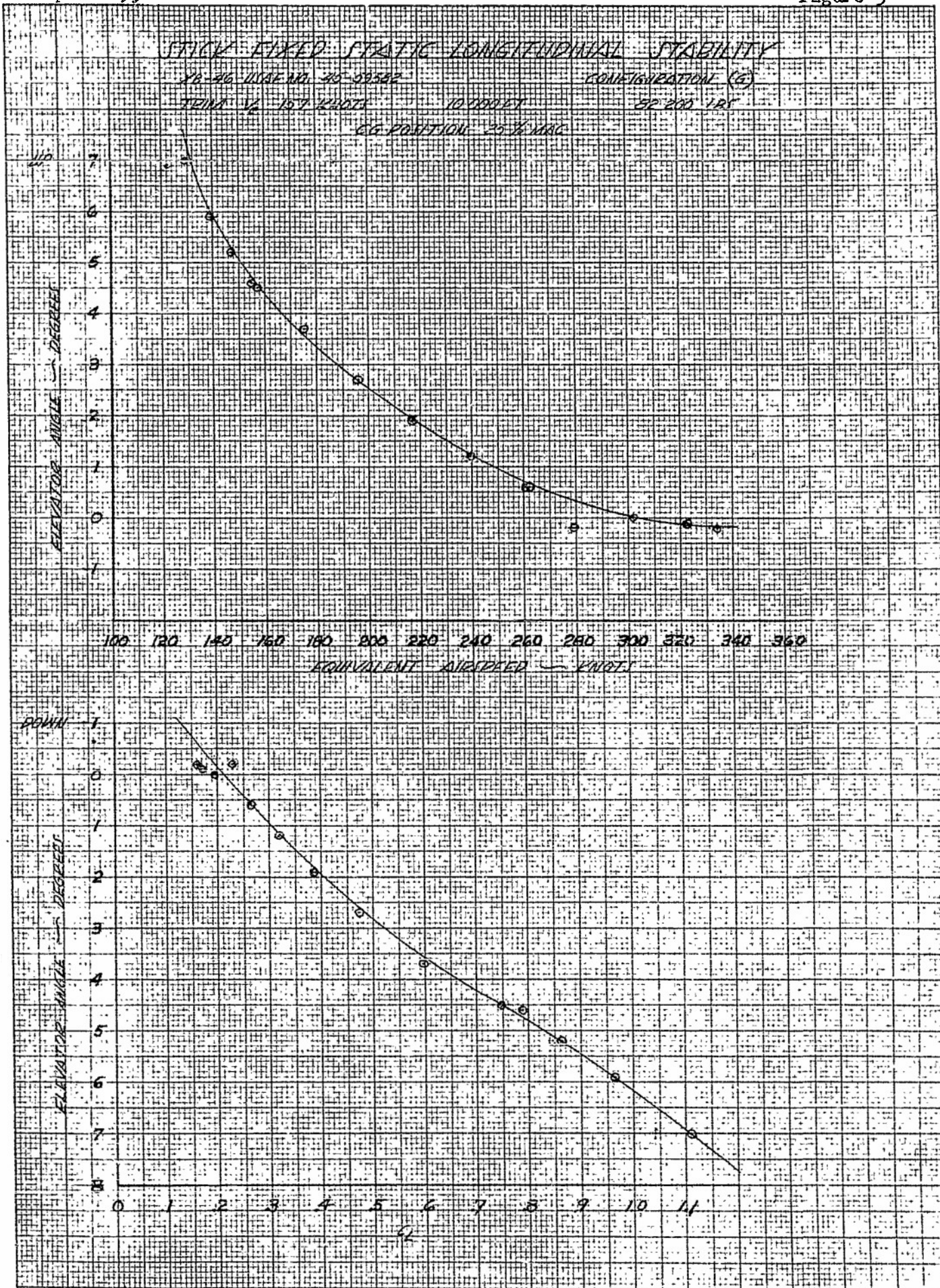


APR 1950
NATIONAL BUREAU OF AERONAUTICS
RESEARCH REPORT NO. 46

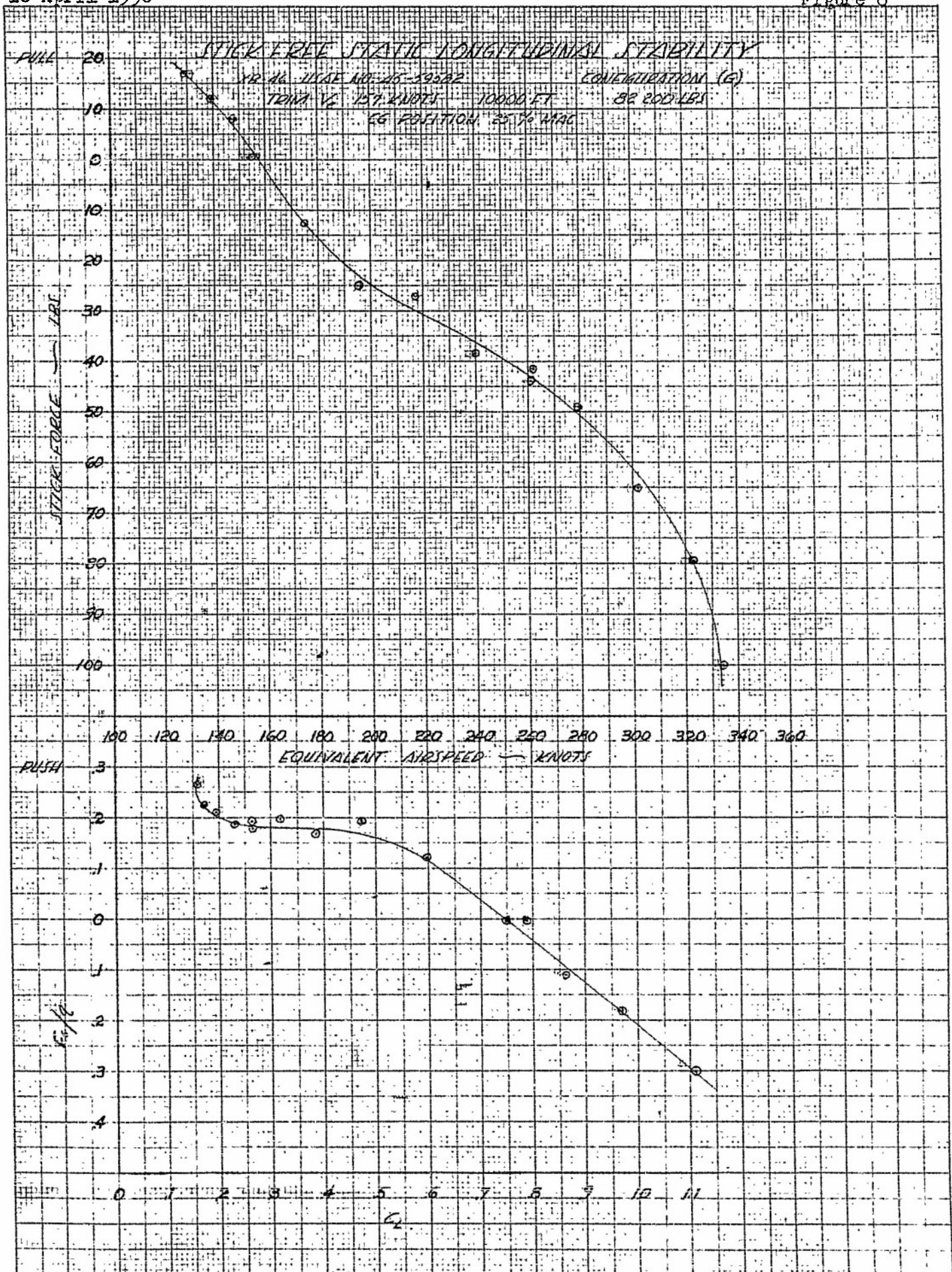
STICK FREE STATIC LONGITUDINAL STABILITY
 XB-46 WING NO. 25-52322 CONFIGURATION (GR)
 TRIM: V_0 210 KNOTS 10,000 FT. 70.600 LB.
 CG POSITION: 23% MAC



MADE IN U.S.A.
 20000-04-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000



MADE IN U.S.A.
GENERAL ELECTRIC CO. N. Y. NO. 324-100



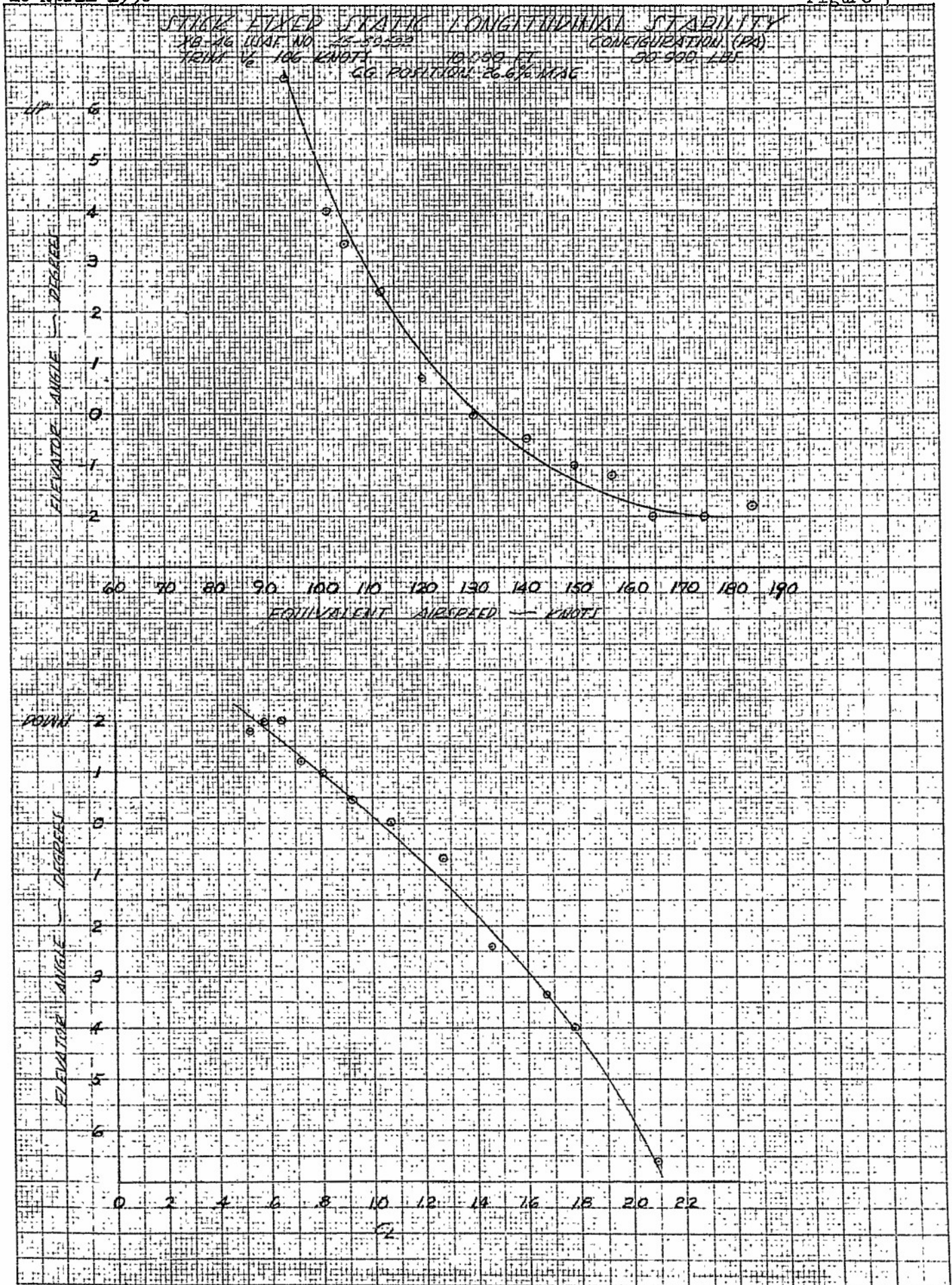
MADE IN U.S.A.
 Reproductions of this report are prohibited
 without the express consent of the RAND
 Corporation

APPENDIX I

CONFIDENTIAL

Memorandum Report No. MCRFT-2282
 10 April 1950

Figure 7

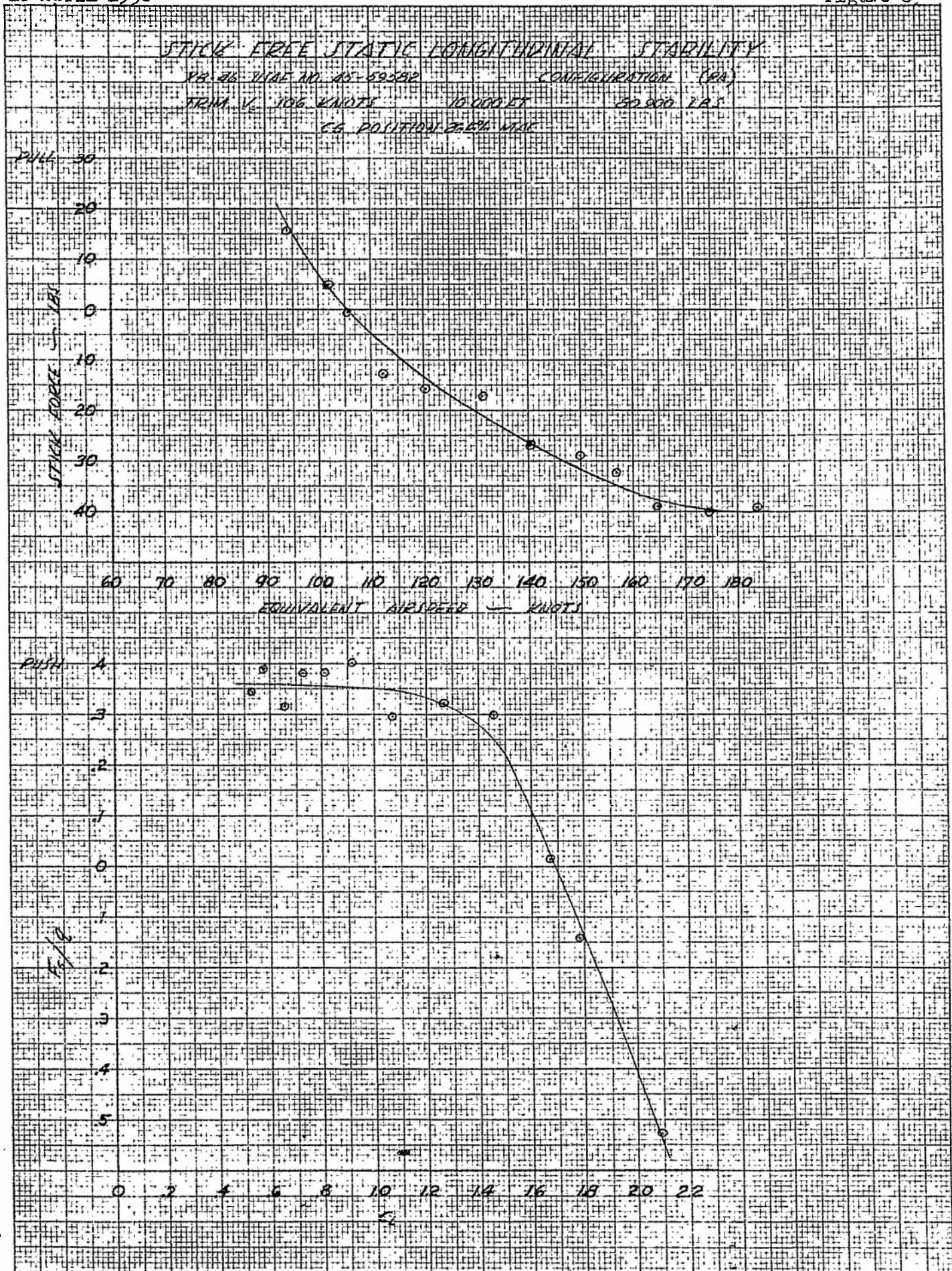


MADE IN U.S.A.
 7 1/2" diameter x 2 mm thick - standard cam - from part 2
 KENNEDY & ECKER CO., N. Y. NO. 2257-140

007-10000

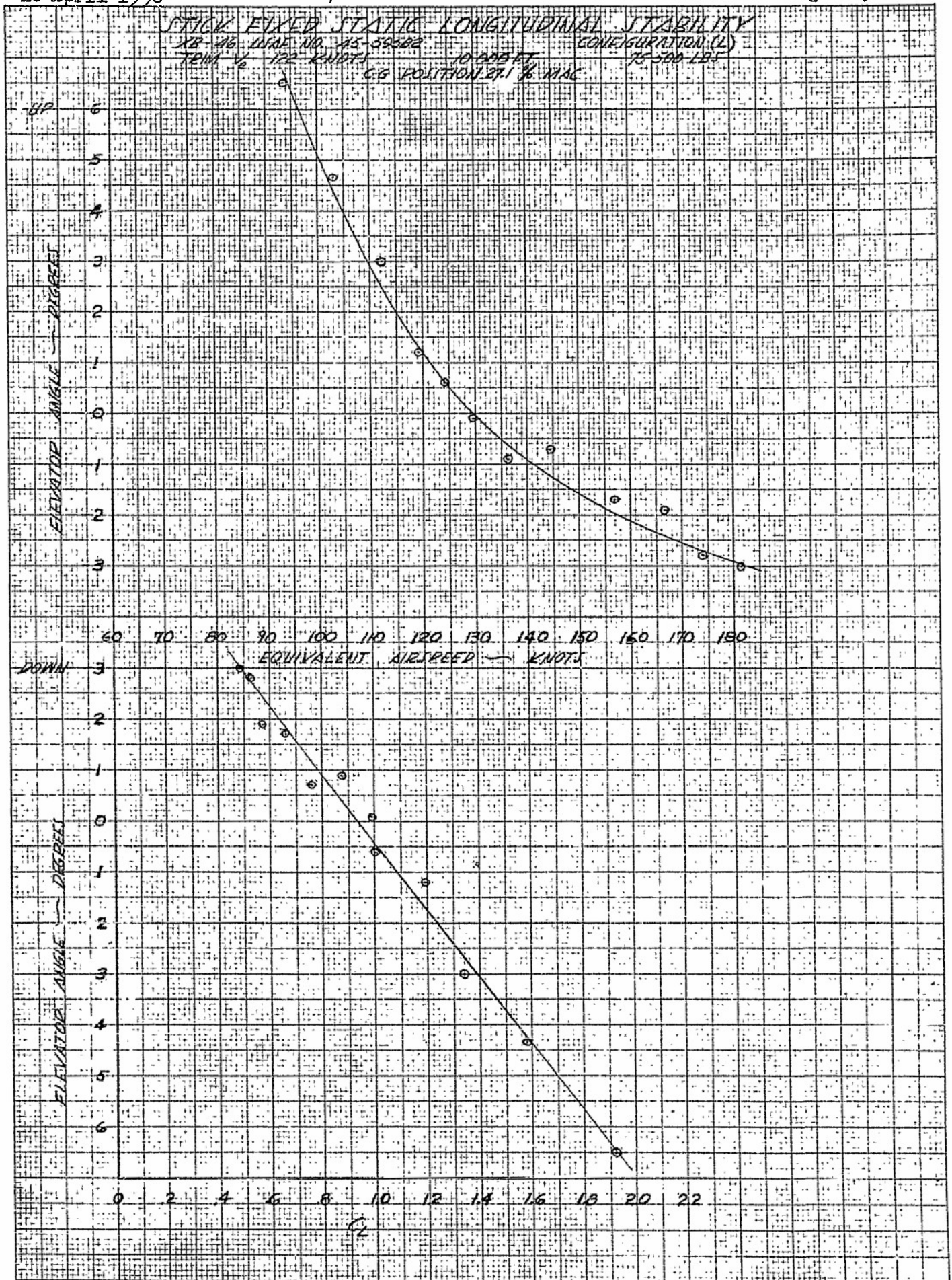
Memorandum Report No. MCRFT-2282
 10 April 1950

Figure 8

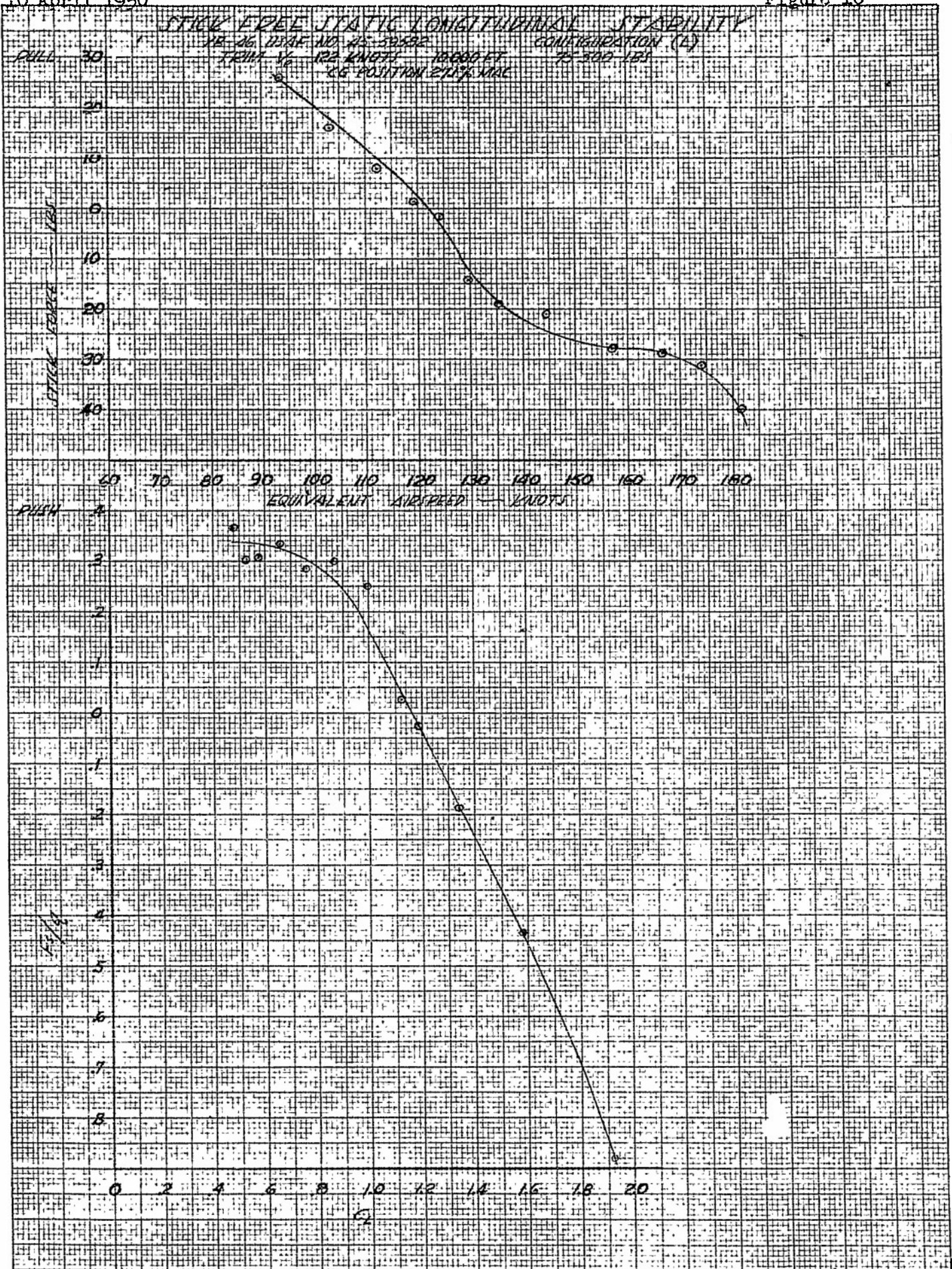


APPROVED: 2 min. June 20, 1950
 GENERAL & ENGINE CO. N. Y. N. Y. TO REGISTER

APPENDIX I



NVOE IN U.S.A.
 7101 Jackson St. 2 min. from intersection of 4th and 15th Sts. N
 KENNERLY & REISER CO. N. Y. N. O. 3201-120

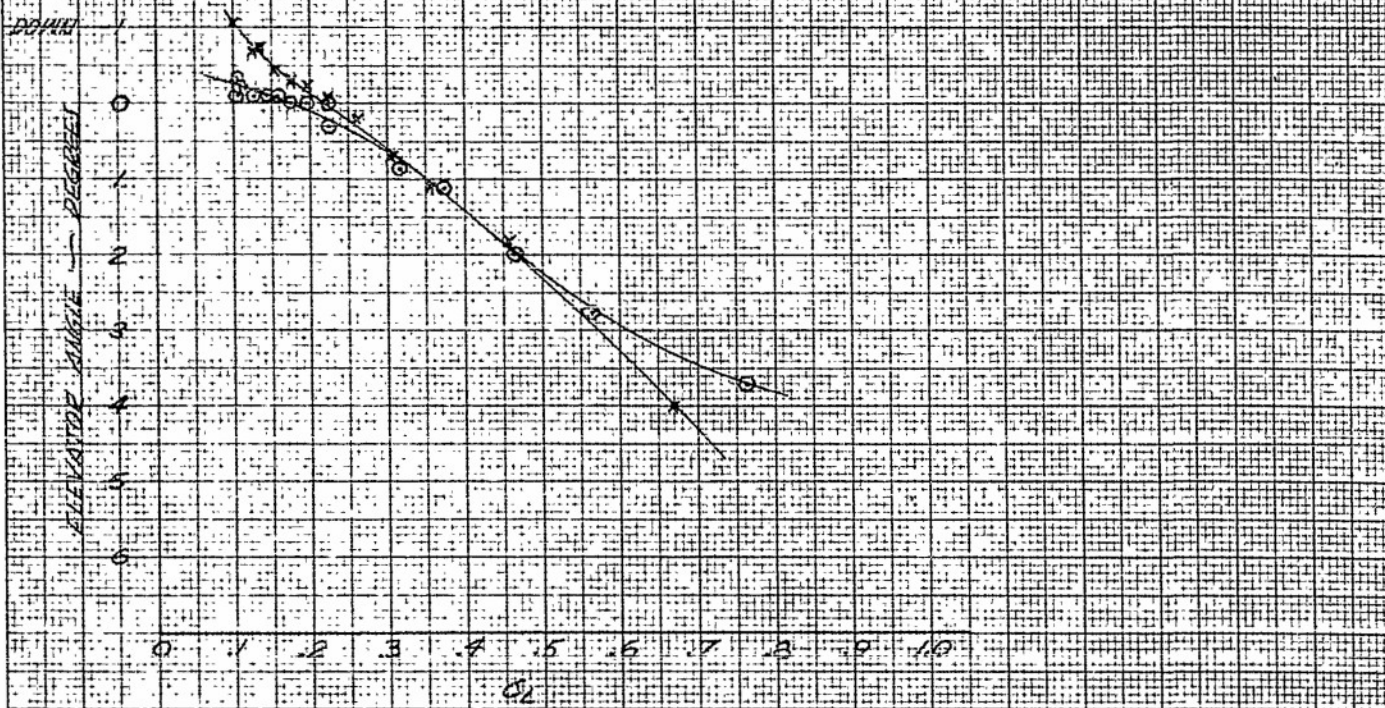
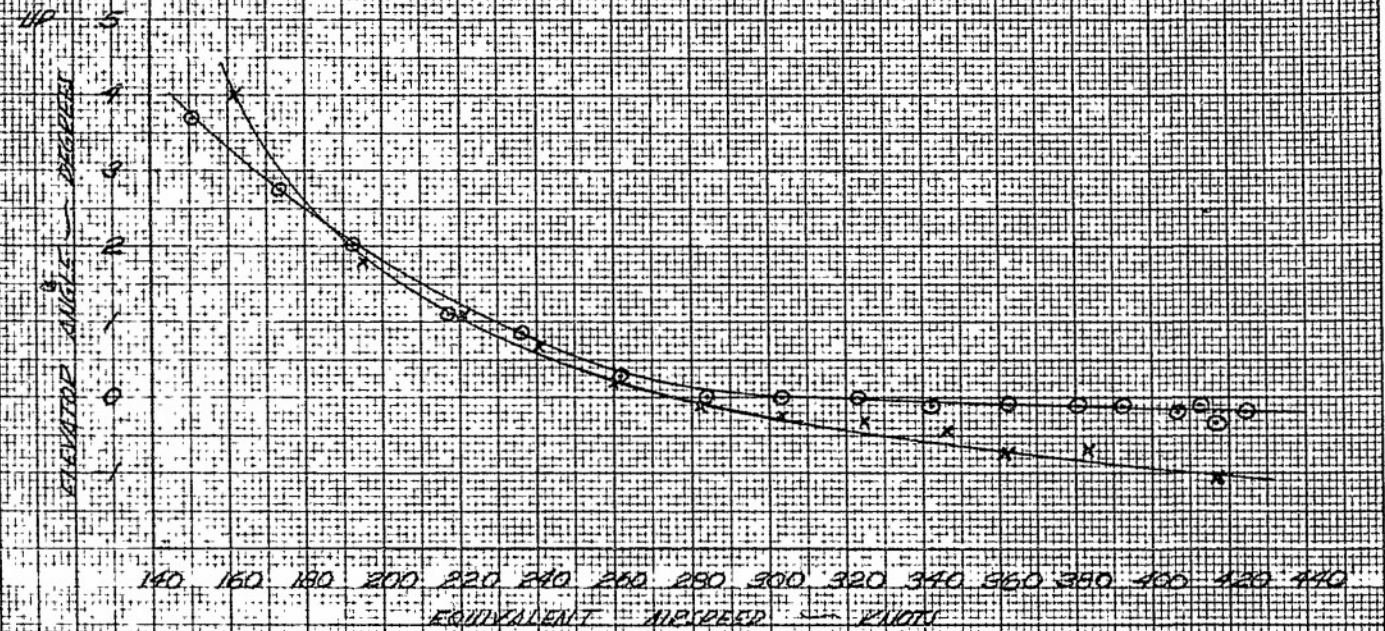


MADE IN U.S.A.
 Manufactured under license of the
 KENNEL & ESSER CO., N. Y. NO. 3931-146

STICK FIXED STATIC LONGITUDINAL STABILITY

1B-40 WING NO. 45-39524 (CONFIGURATION 1)
TRIM 1/6 375 KNOTS 10,000 FEET

	CG POSITION	GROSS WT
x	19% MAC	50,500 LBS
o	23% MAC	31,200 LBS

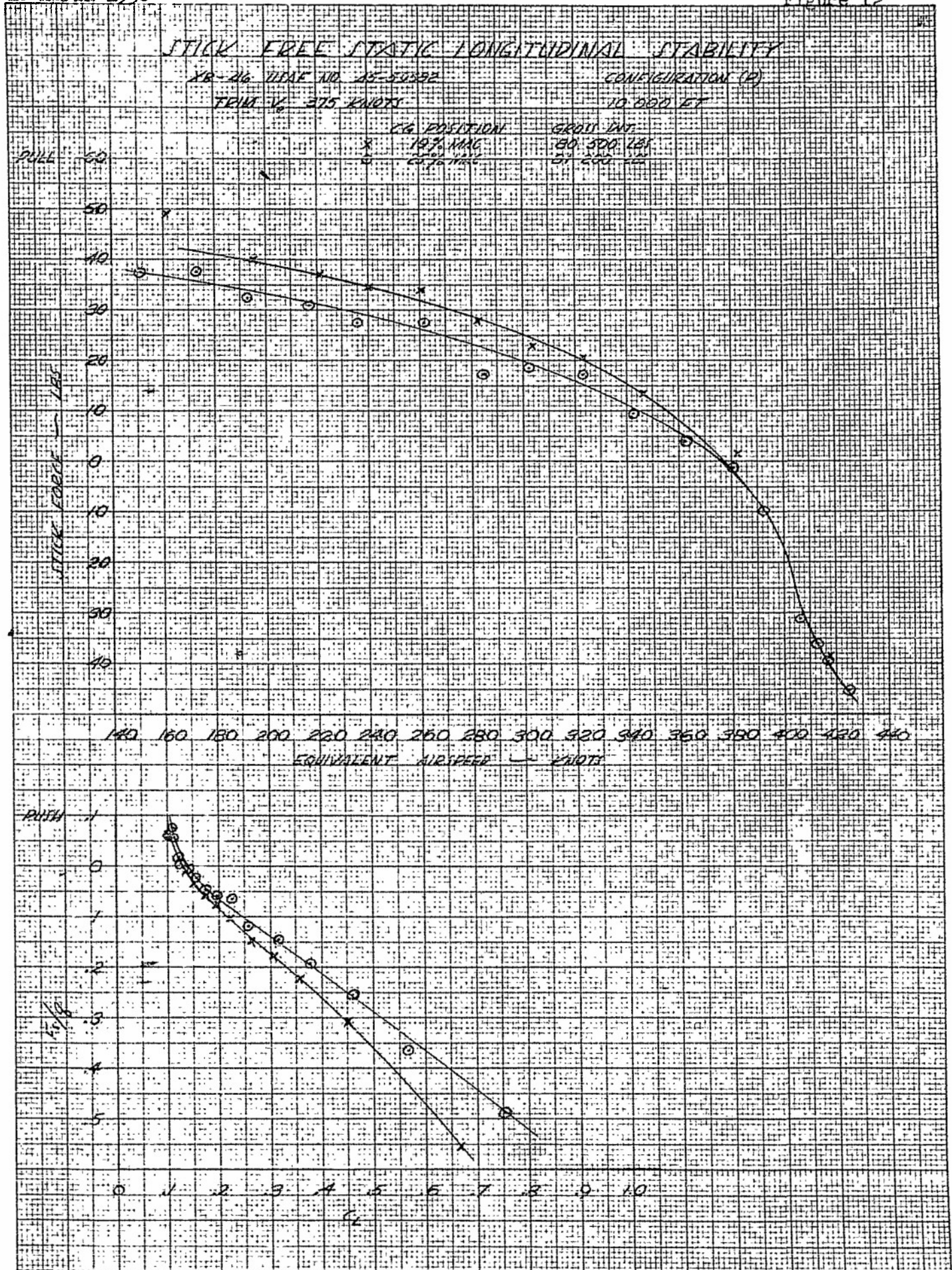


APPENDIX I

REPRODUCED FROM THE REPORT OF THE
 NATIONAL BUREAU OF STANDARDS
 NATIONAL BUREAU OF STANDARDS
 NBS MONOGRAPH NO. 10, 1949

10 April 1950

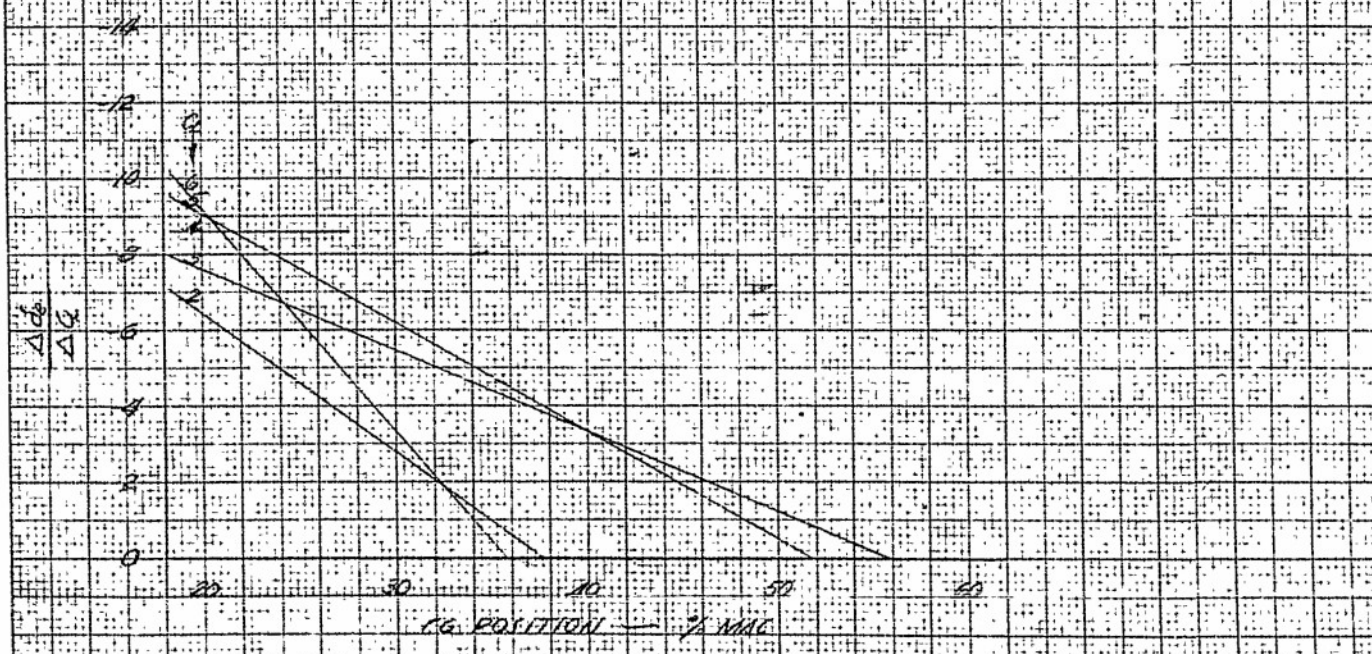
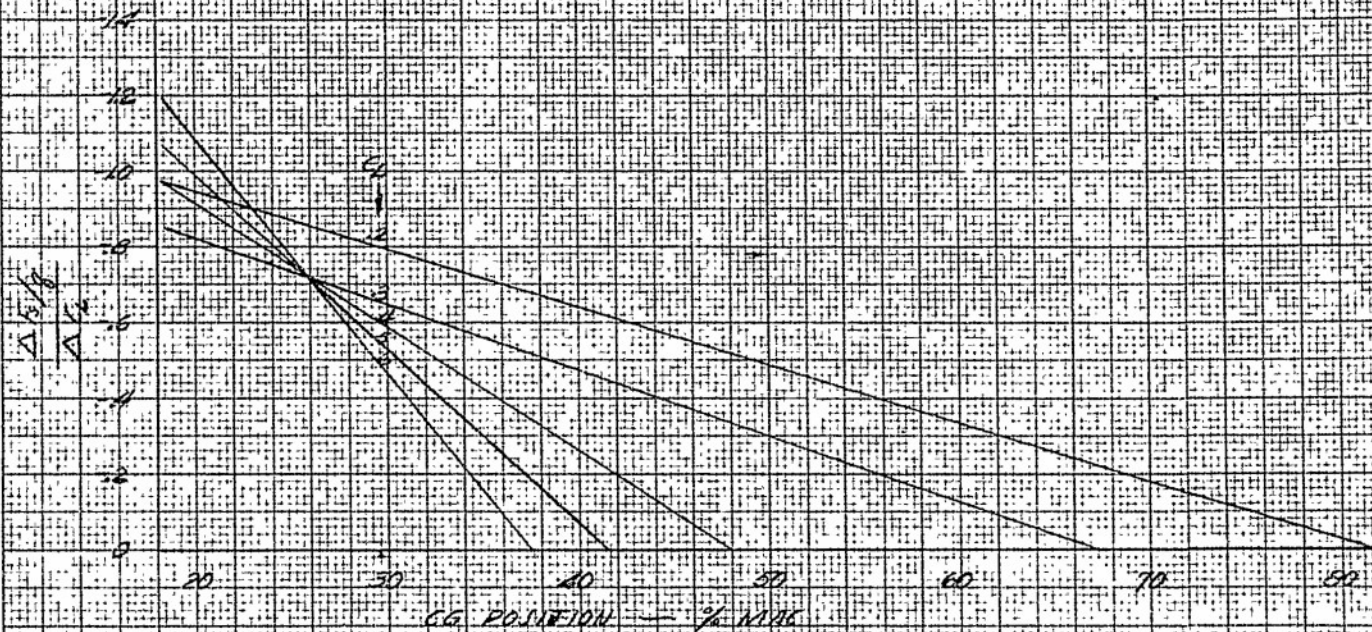
Figure 12



WAVE I. D. U. S. V.
 211 Broadway 2nd Floor New York 7, N. Y.
 KEENE & ESSER CO. N. Y. NO. 2231-146

APPENDIX I

STATIC LONGITUDINAL STABILITY
 XB-46 MODEL NO. 46-59582 CONFIGURATION (B)
 TRIM V_0 375 KNOTS 10,000 FEET

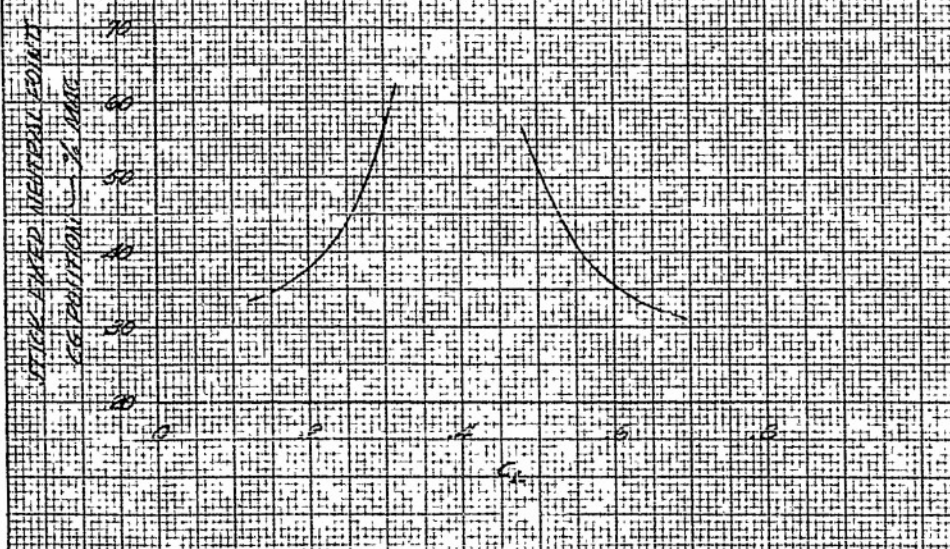
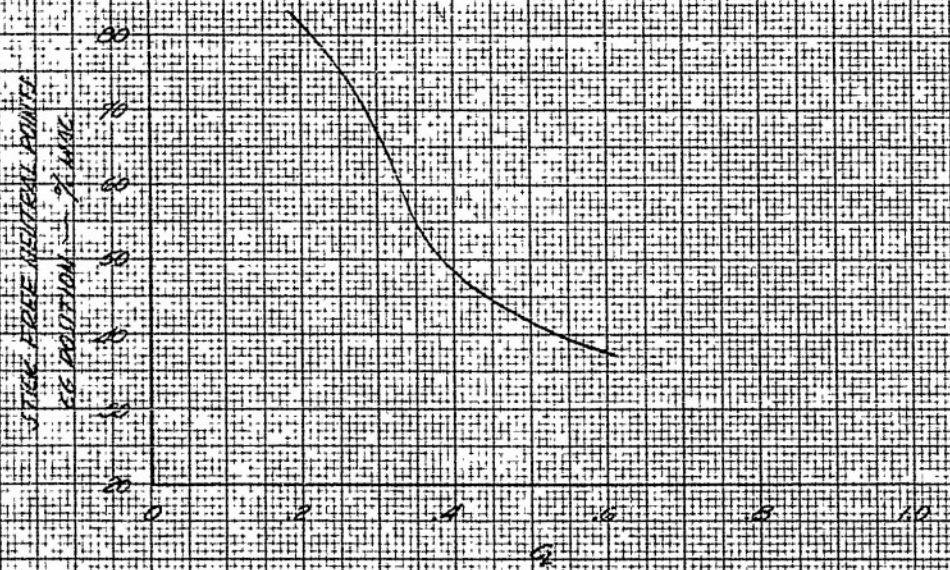


APPENDIX I

REPRODUCED FROM THE NATIONAL ARCHIVES
 NATIONAL ARCHIVES COLLEGE PARK, MARYLAND
 REFERENCE ID: A66502

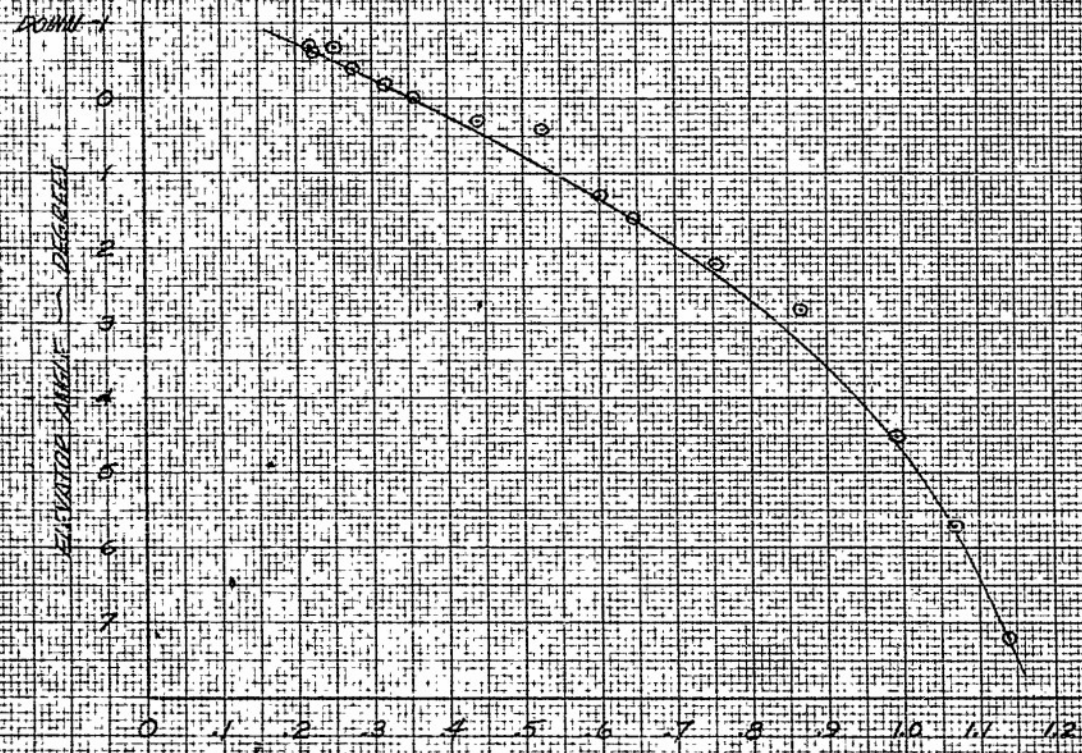
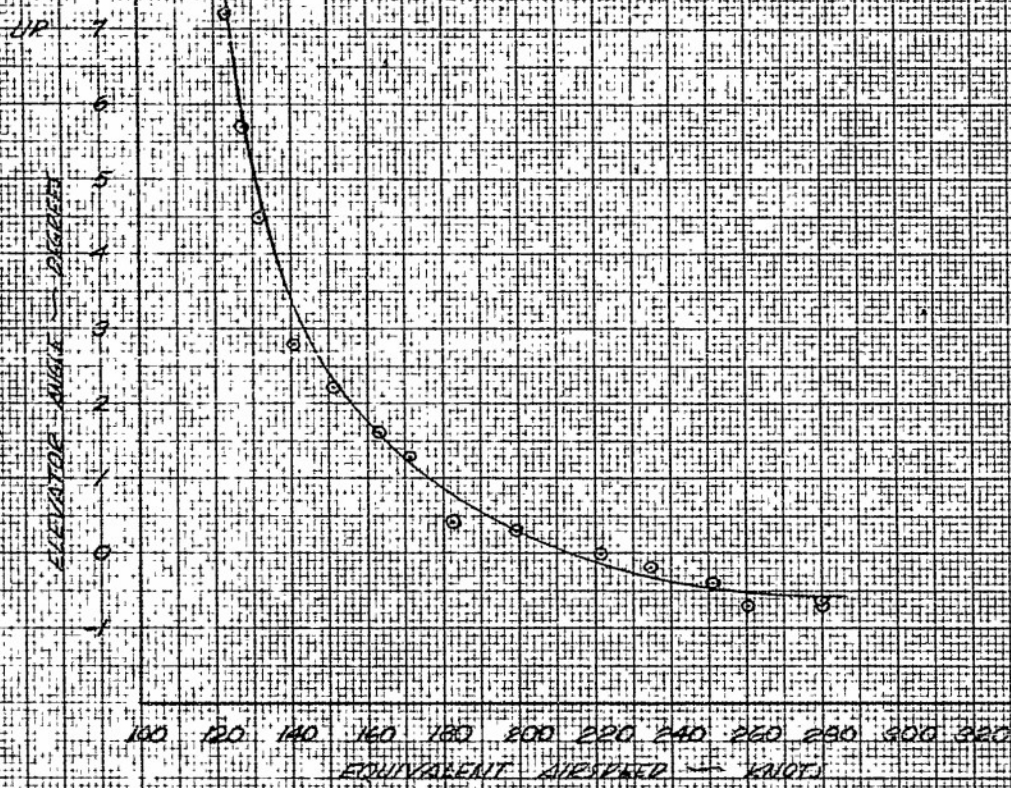
STATIC LONGITUDINAL STABILITY

XB-46 USAF NO. 43-59582 CONVERSION (P)
TRIM V_0 325 KNOTS 10 GROSS



INDE IN U.S.A.
KIMMELMAN & MURPHY ENGINEERING COMPANY
KENNETH P. EPPER CO., N. Y. NO. 328-146

STICK EYED STATIC LONGITUDINAL STABILITY
XB-46 (NAF NO. 45-59622) CONFIGURATION (62)
TRIM V_0 203 KNOTS 30,000 FT. 76,600 LBS
CG POSITION 25.2% MAC



APPENDIX I

MADE IN U.S.A.
KENDALL & BAKER CO. INC. 2, AVIATION
VICTORVILLE, CALIF. NO. 2882-1000

10 April 1953

Figure 16

STICK FREE STATIC LONGITUDINAL STABILITY

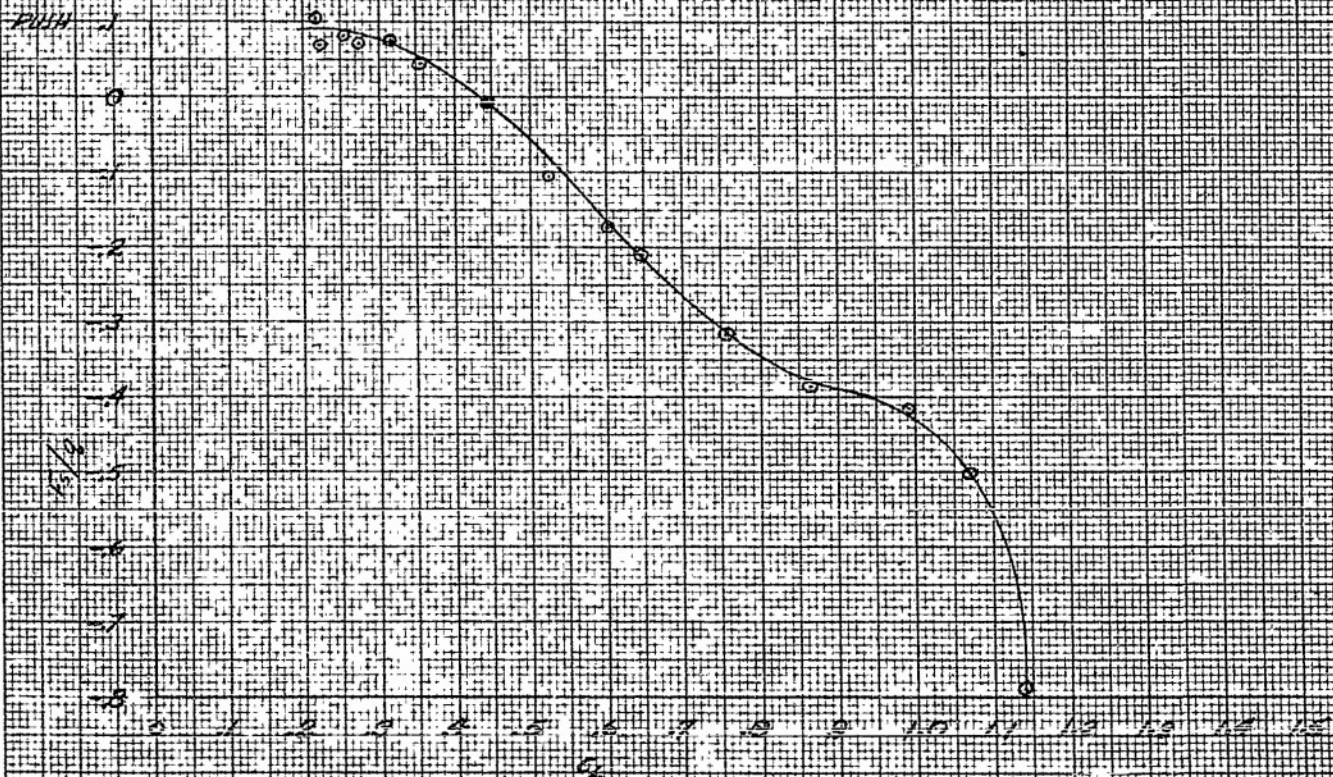
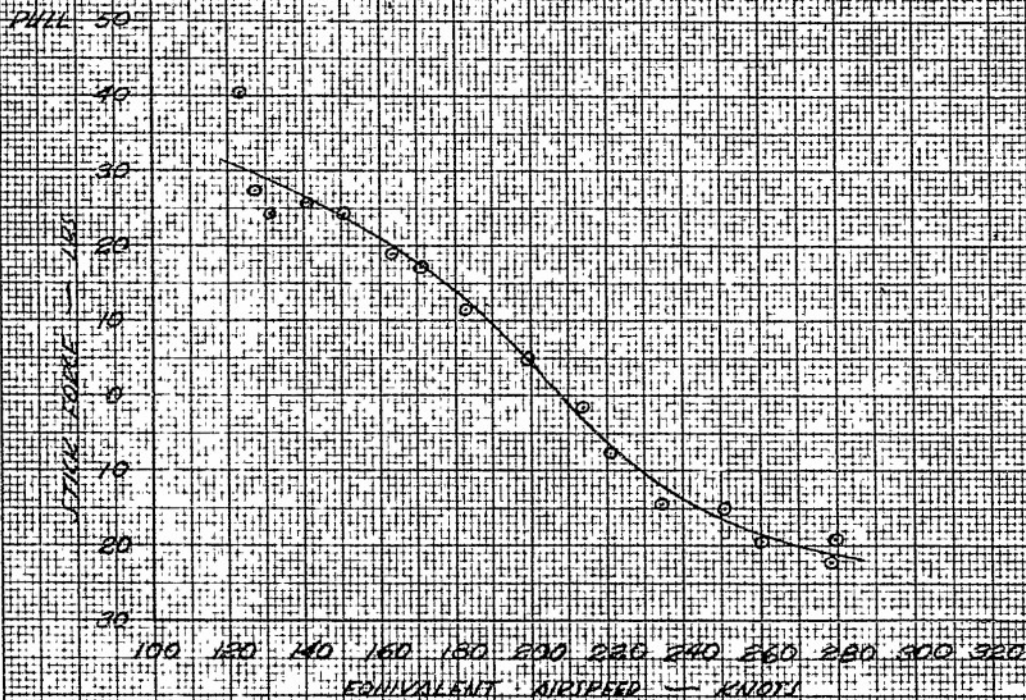
XB-26 WING NO. 25-59532

CONFIGURATION (CP)

TRIM V_0 200 KNOTS 30,000 FT

76,600 LBS

CG POSITION 25% MAC



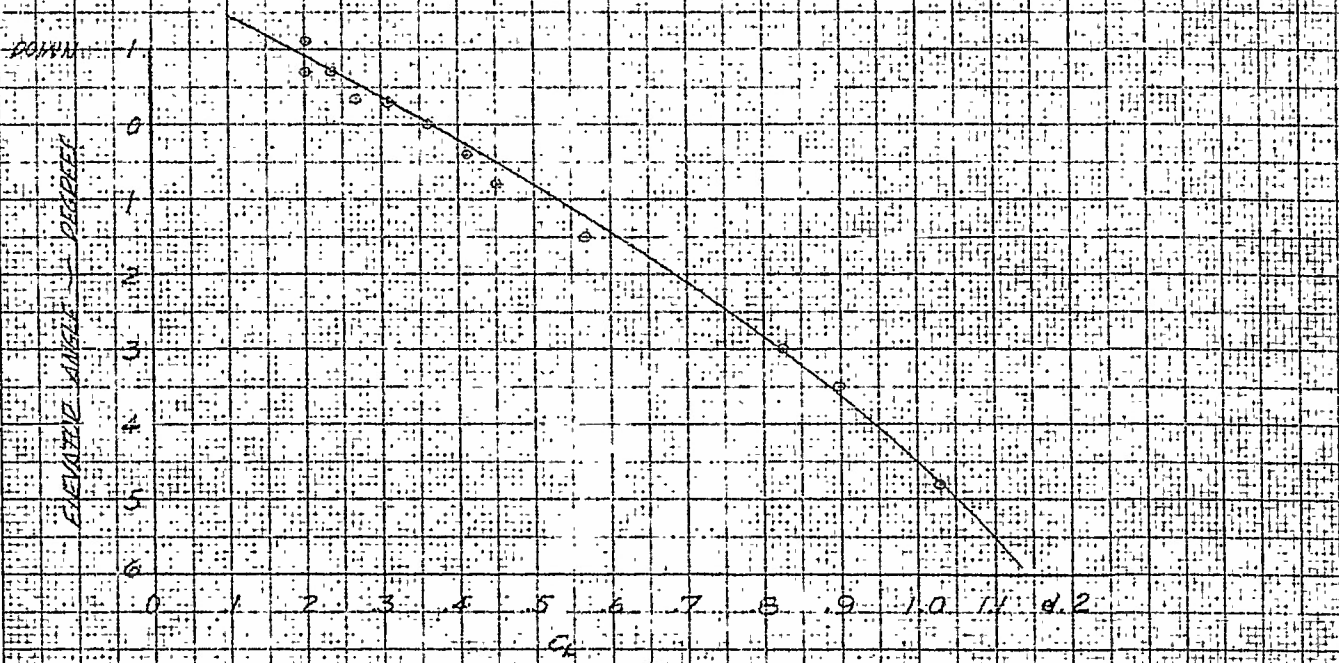
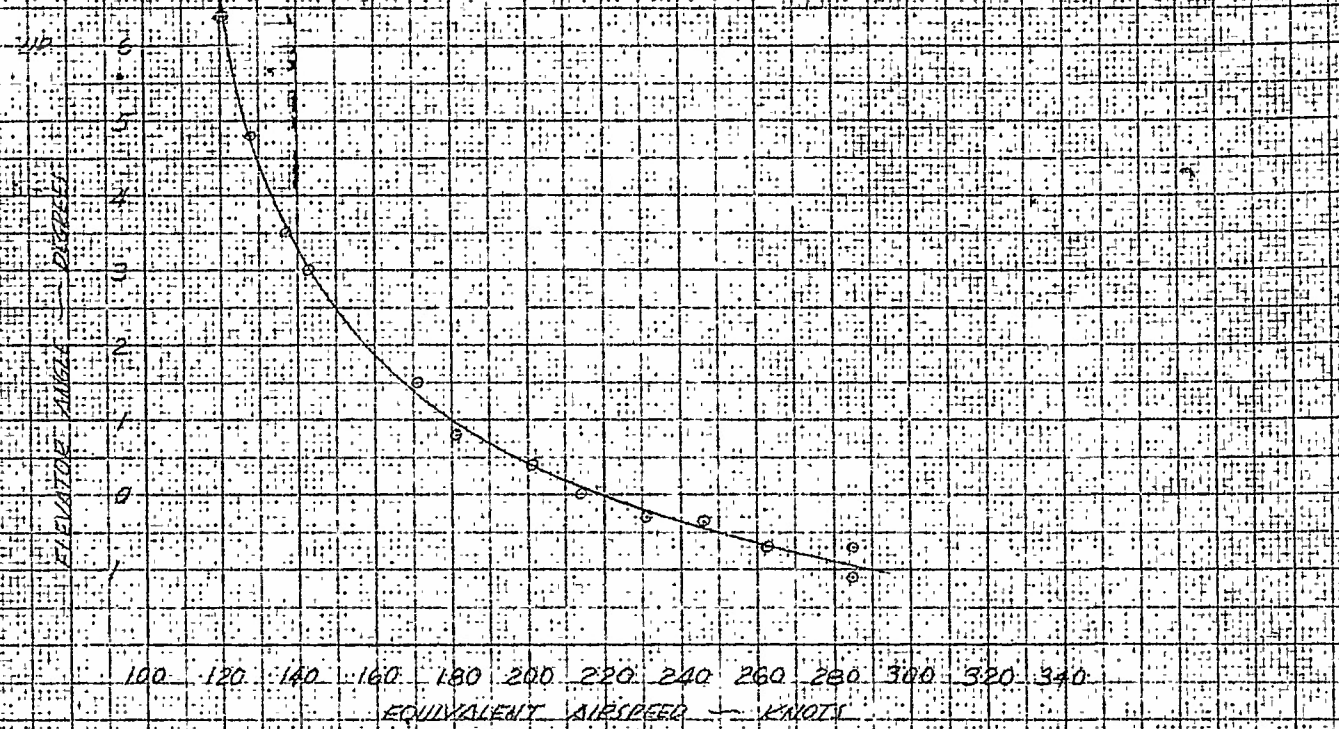
APPENDIX I

NOTED IN U.S. AIR FORCE
MILITARY 2 mm jets received on June 1951
KRIEGER & CASER CO. N. Y. N.Y. NO. 280-1182

Memorandum Report No. MCRFT-2232
10 April 1950

Figure 17

TWINE ELKED STATIC LONGITUDINAL STABILITY
XB-46 WAF NO. 45-33582
CONFIGURATION (B)
WING 6 135 KNOTS 30,000 FT. 73,500 LBS
CG POSITION 28% MAC

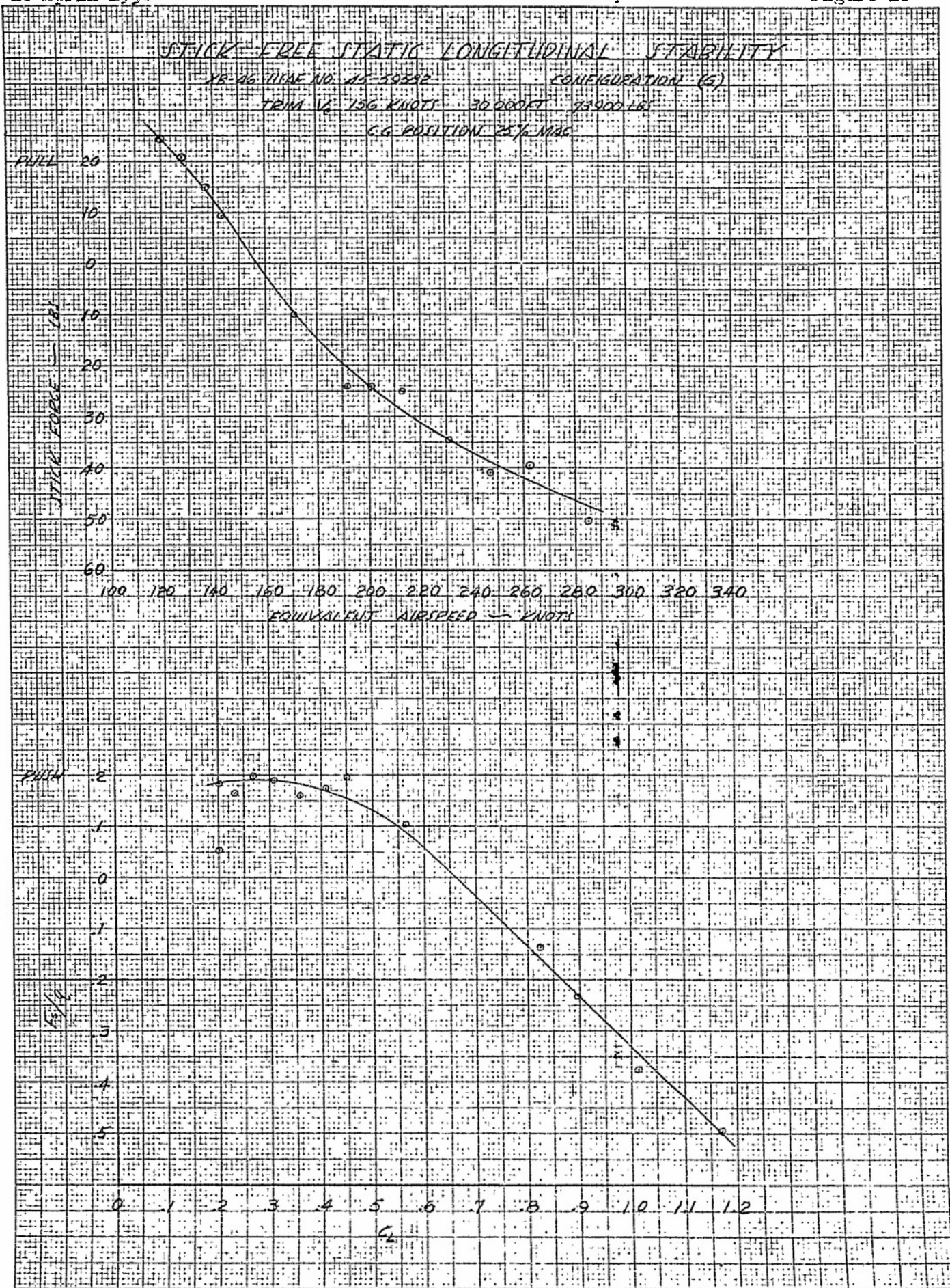


No. 329-14 Millimeter 2 mm pins secured, cu pins used.

KENNELT & FOSBER CO.

APPENDIX I

19
CONFIDENTIAL



400 353-14 Millimeter 2 mm lines spaced, cu lines jused.
 MADE IN U.S.A.

KENNEL & ESSER CO.

APPENDIX I

STICK-FIXED STATIC LONGITUDINAL STABILITY

XB-46 WAF NO. 45-59382

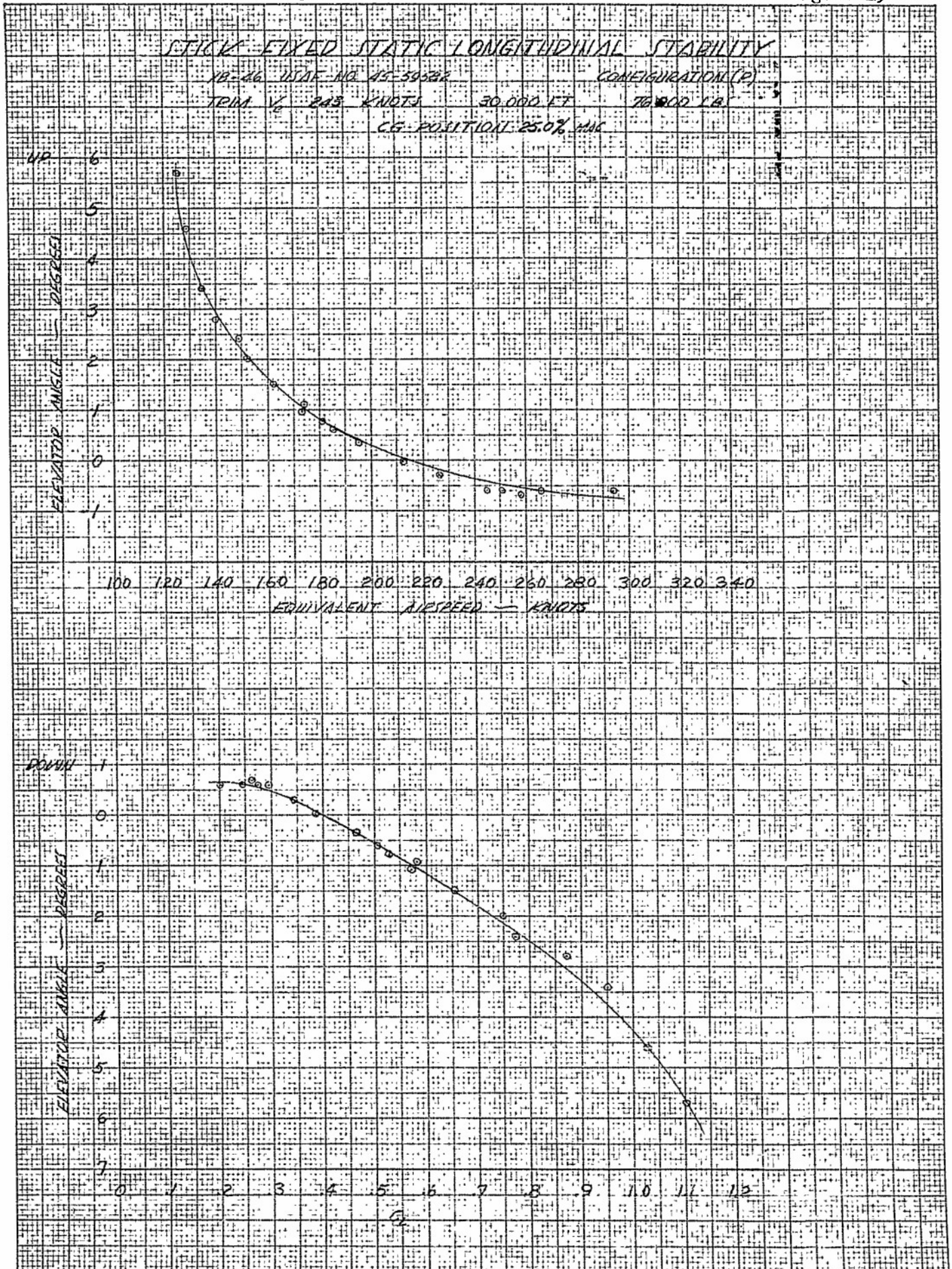
CONFIGURATION (P)

TRIM $\frac{1}{2}$ 243 KNOTS

30,000 FT

70,000 YR

CG POSITION: 25.0% MAC



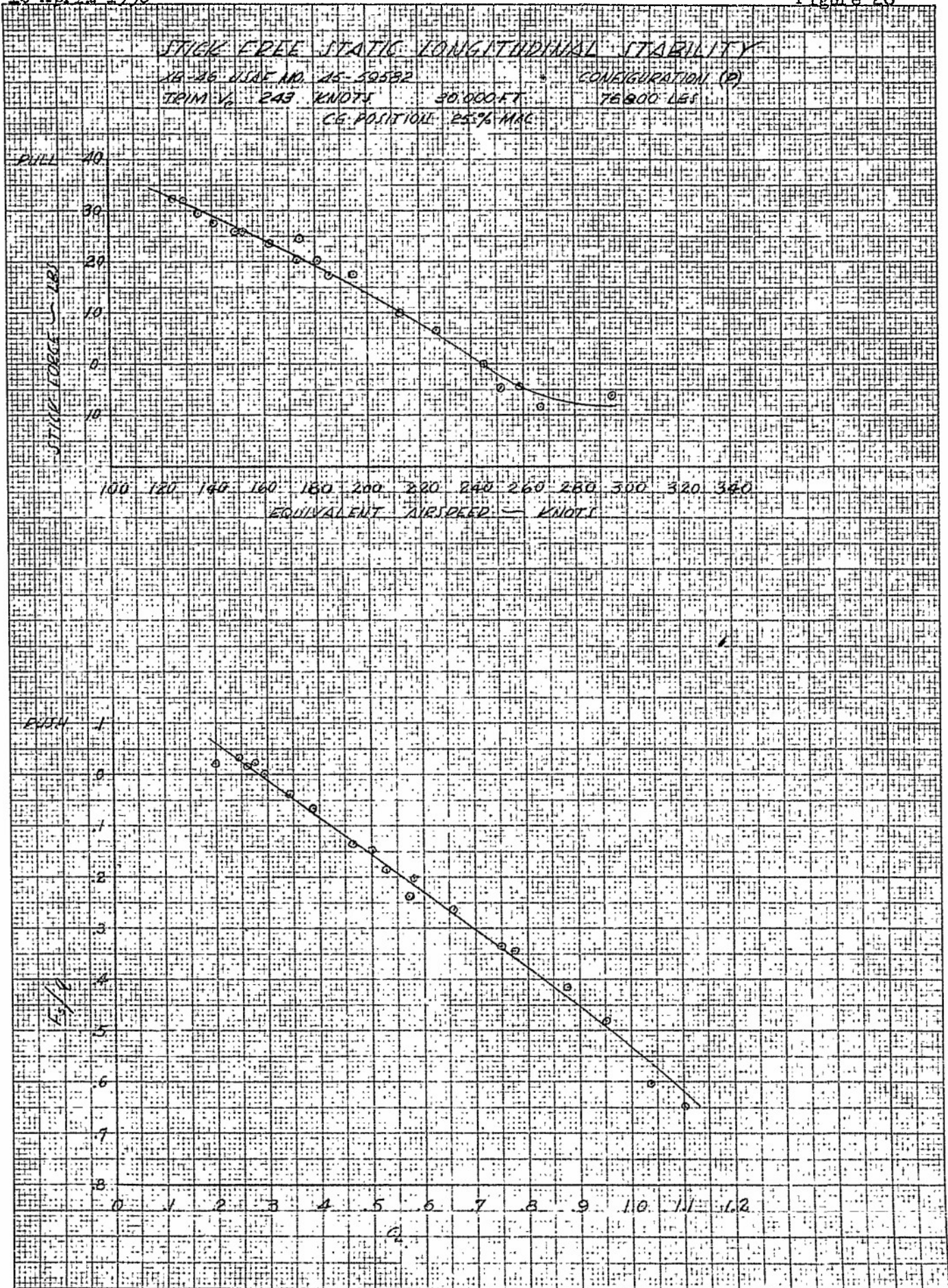
No. 328-14 - Millimeter 2 mm lines spaced 2 mm; cut lines per inch

KENTZEL & ESSER CO.

APPENDIX I

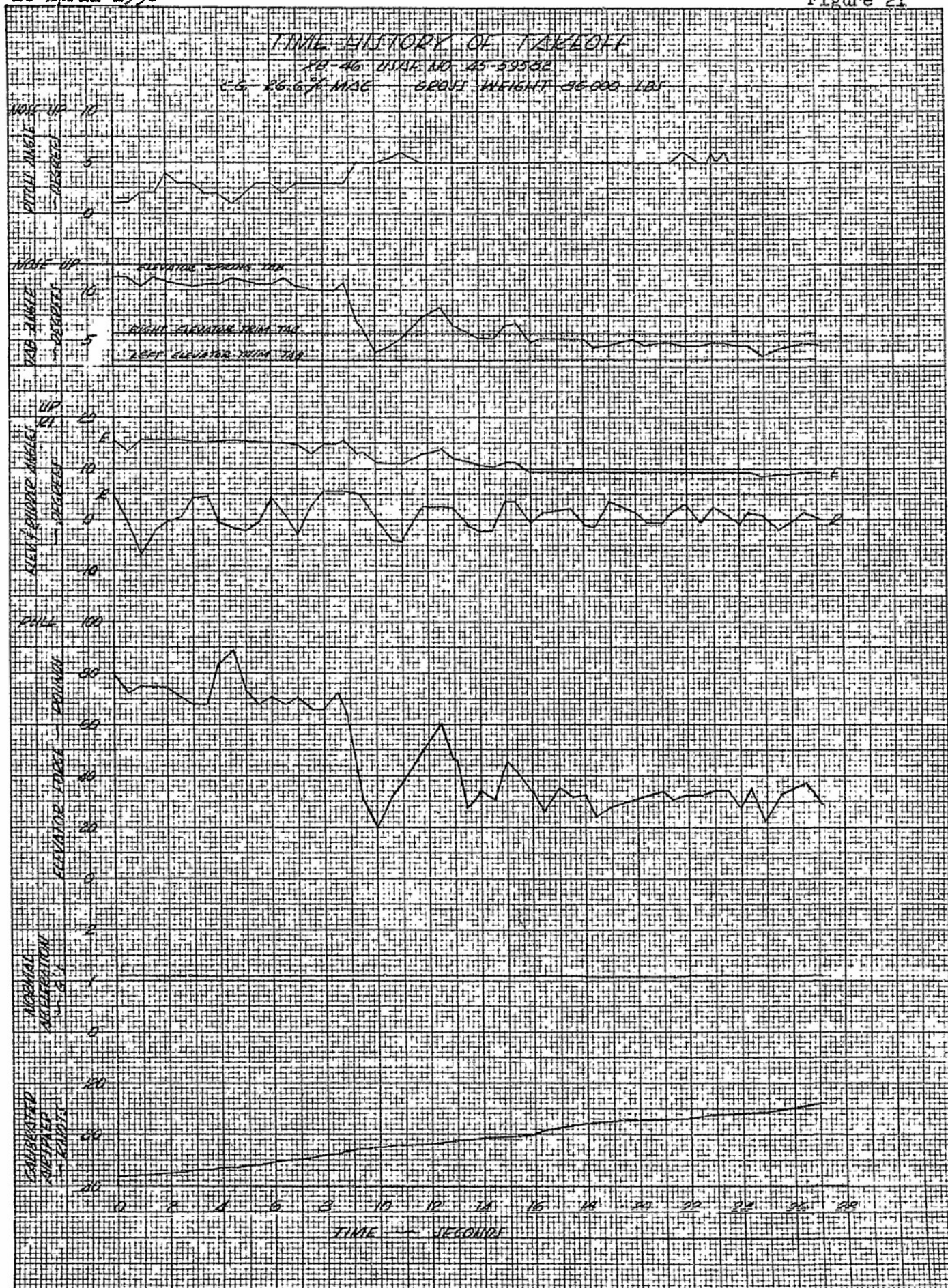
10 April 1950

Figure 20

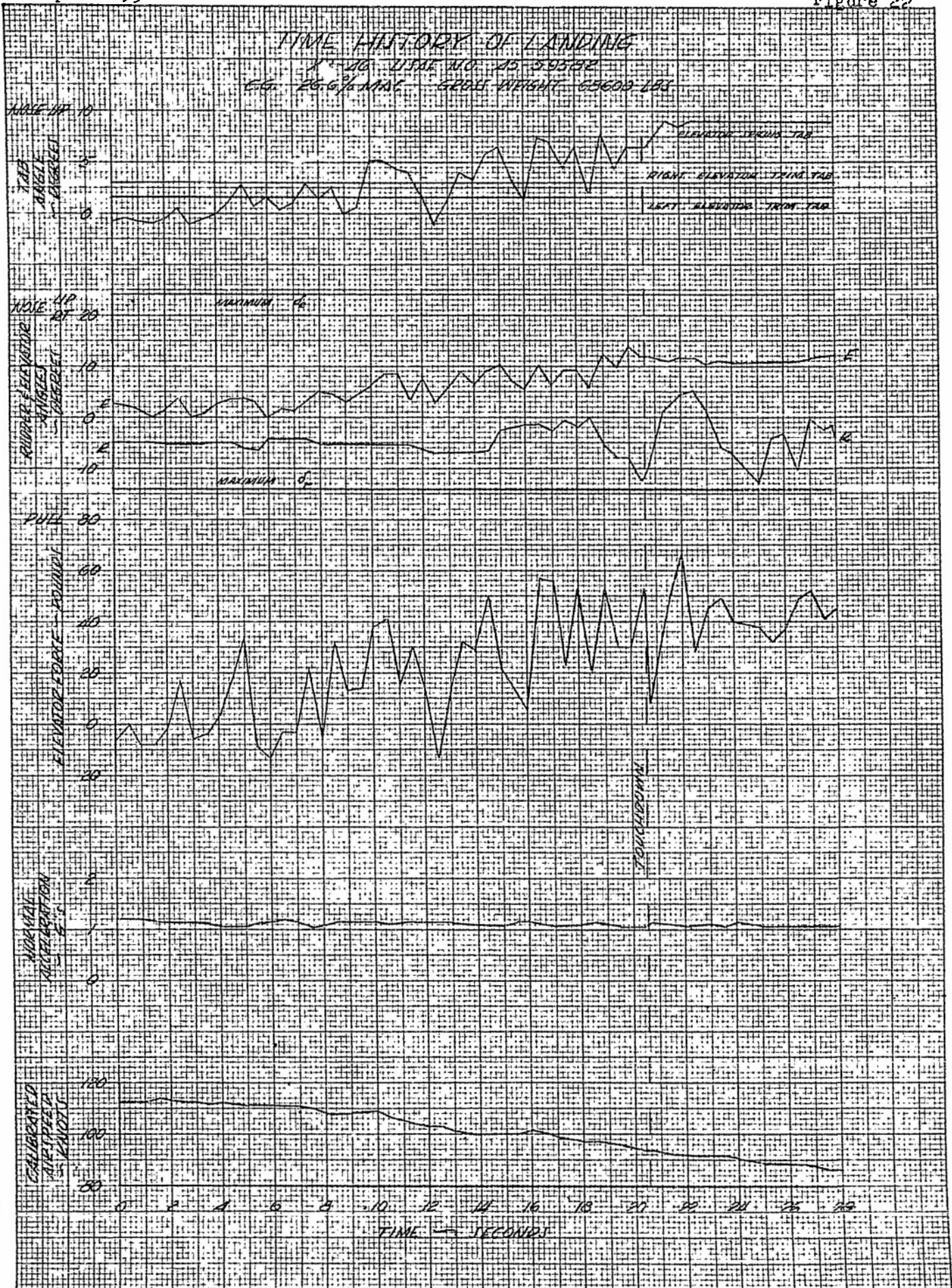


No. 328-141 - Millimeter 2 mm plus accuracy, cm plus fraction.
 MADE IN U.S.A.

KENNEL & ESSER CO.



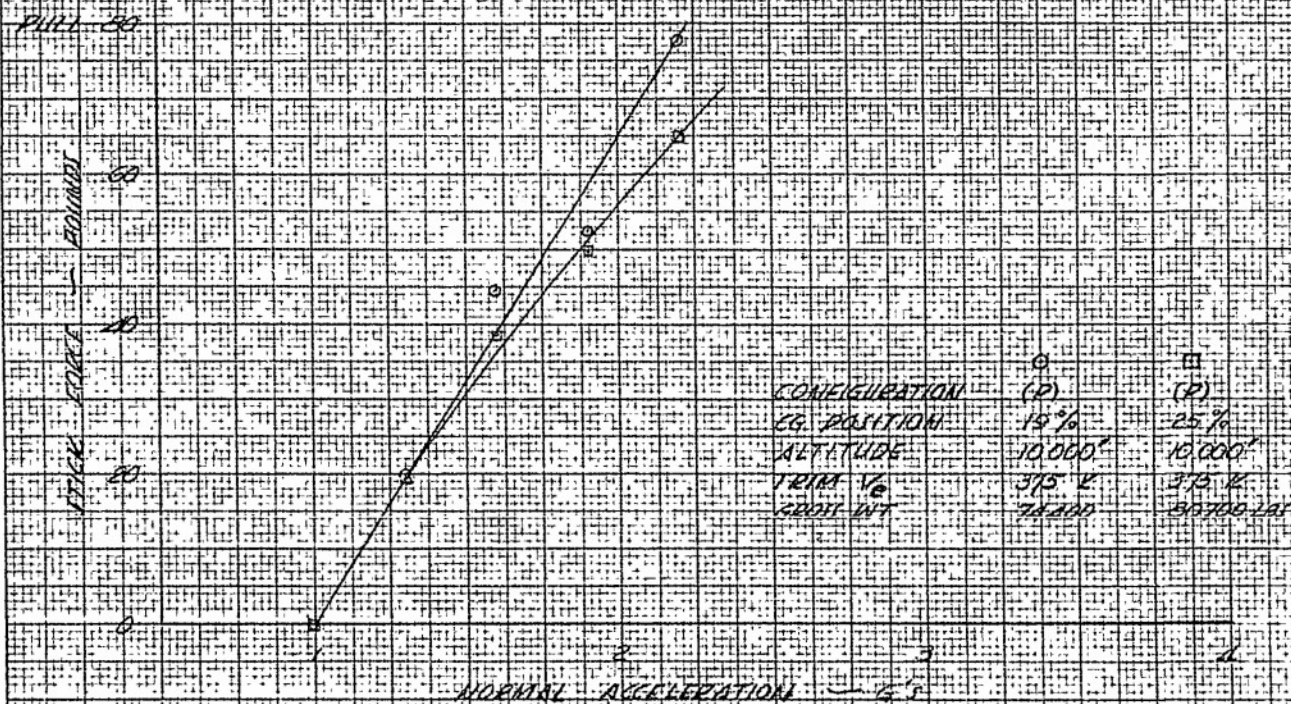
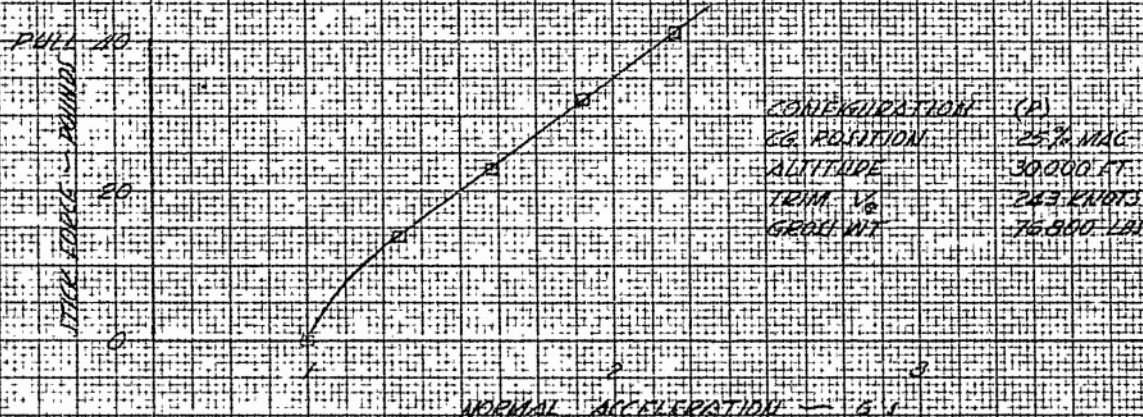
MADE IN U.S.A.
 MILLIGROVE 2 mm. Inset recording cam. Inset Perla.
 KRIEGER & ERBER CO., N. Y. NO. 3201-10C



MILLIGRAMS 2 mm. These recordings are final prints.
 KENNER & EBER CO. N. Y. N. O. 2282-40

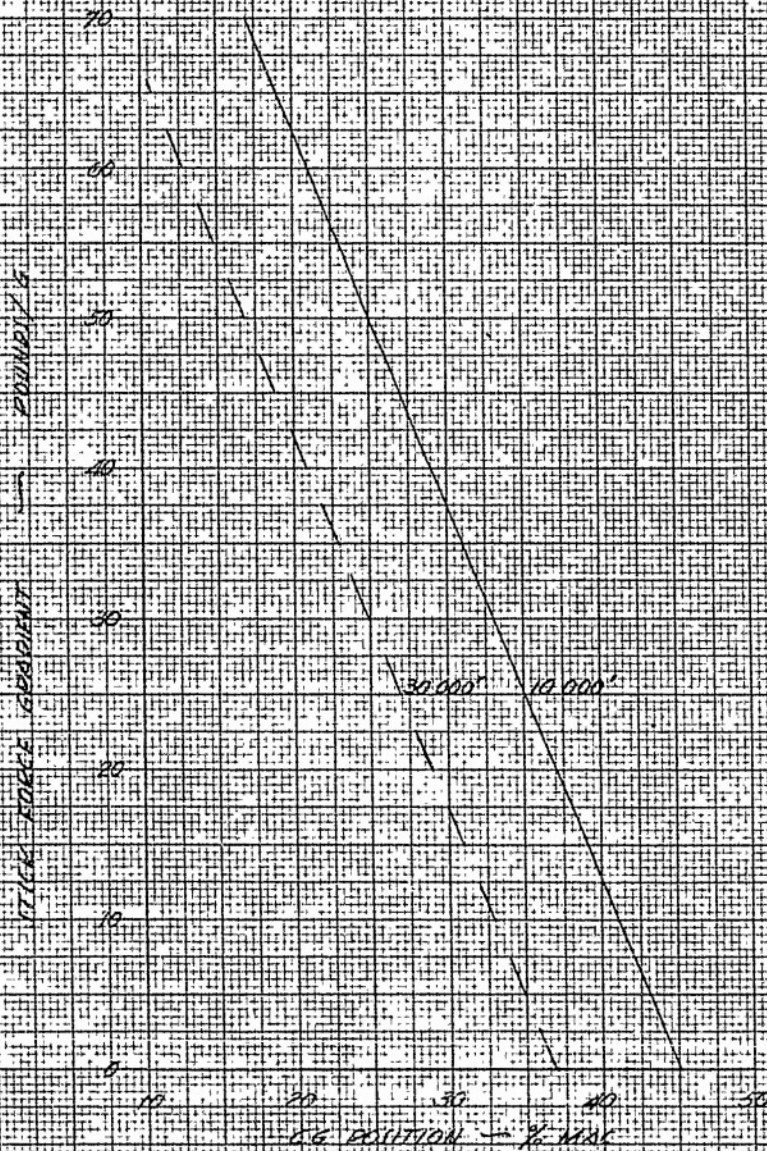
MADE IN U. S. A.

STICK FORCES IN MANEUVERING FLIGHT
XB-26 WTAE NO. 15-59532 TAKEOFF WT. 36,000 LBS



MADE IN U. S. A.
 MILLIMETER 2 mm. lines spaced 1/16" and 1/32" lines spaced 1/32".
 KENNER & ESSER CO., N. Y. N. Y. NO. 2201-11C

STICK FORCE IN MANEUVERING FLIGHT
XB-46 WING NO. 45-59582 TAKEOFF GW. 66,000 LB.



MADE IN U.S.A.
KINEMATIC & ENGINE CO., N. Y. NO. 2281-116

LONGITUDINAL CONTROL - MANEUVERING

NO. 40 LHMK NO. 45-29588

CONFIGURATION (P)

TAKEOFF G.W. 38,000 LBS

UP
DOWN
ELEVATOR ANGLE

ALTITUDE 30,000 FT.
CG POSITION 25% MAC
TRIM V_0 243 KNOTS
GROSS WT. 16,800 LBS

0 2 4 6 8 10 12

UP
DOWN
ELEVATOR ANGLE

ALTITUDE 10,000
CG POSITION 25% MAC
TRIM V_0 375 KNOTS
GROSS WT. 30,100 LBS

0 2 4 6 8 10 12

UP
DOWN
ELEVATOR ANGLE

ALTITUDE 10,000
CG POSITION 15% MAC
TRIM V_0 375 KNOTS
GROSS WT. 24,000 LBS

0 2 4 6 8 10 12

NET COEFFICIENT C_N

NORMAL ACCELERATION
1.0 G
1.3 G
1.6 G
1.9 G
2.2 G

MADE IN U. S. A.
 MILLIGRAMS & INCHES
 KENNETH & ESSLER CO., N. Y. 10014

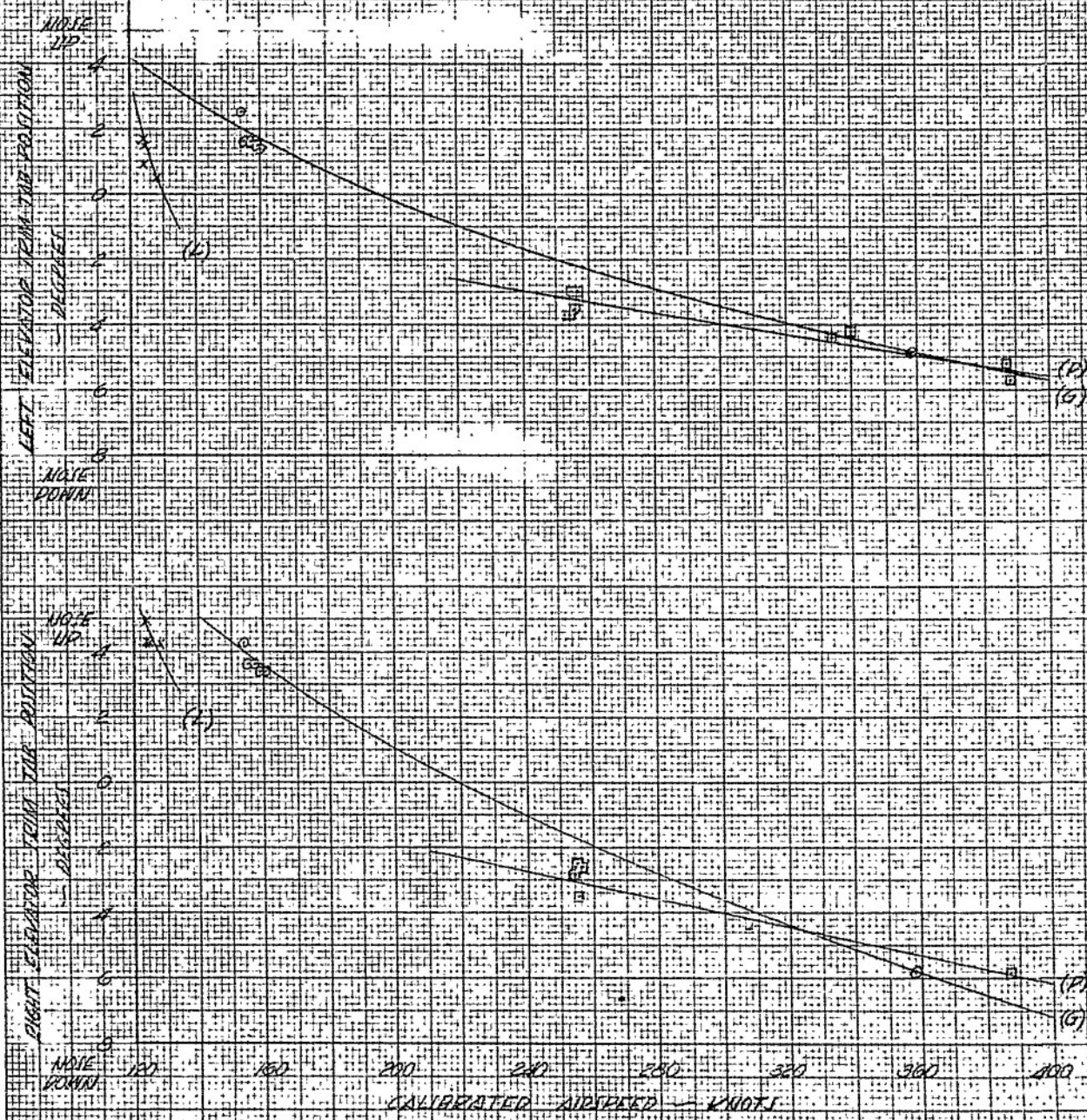
APPENDIX I

ELEVATOR TRIM TAB EFFECTIVENESS

NA-46 WAF NO. 26-59582

TAKEOFF GROSS WEIGHT: 56000 LBS. ALTITUDE: 10000 FT.

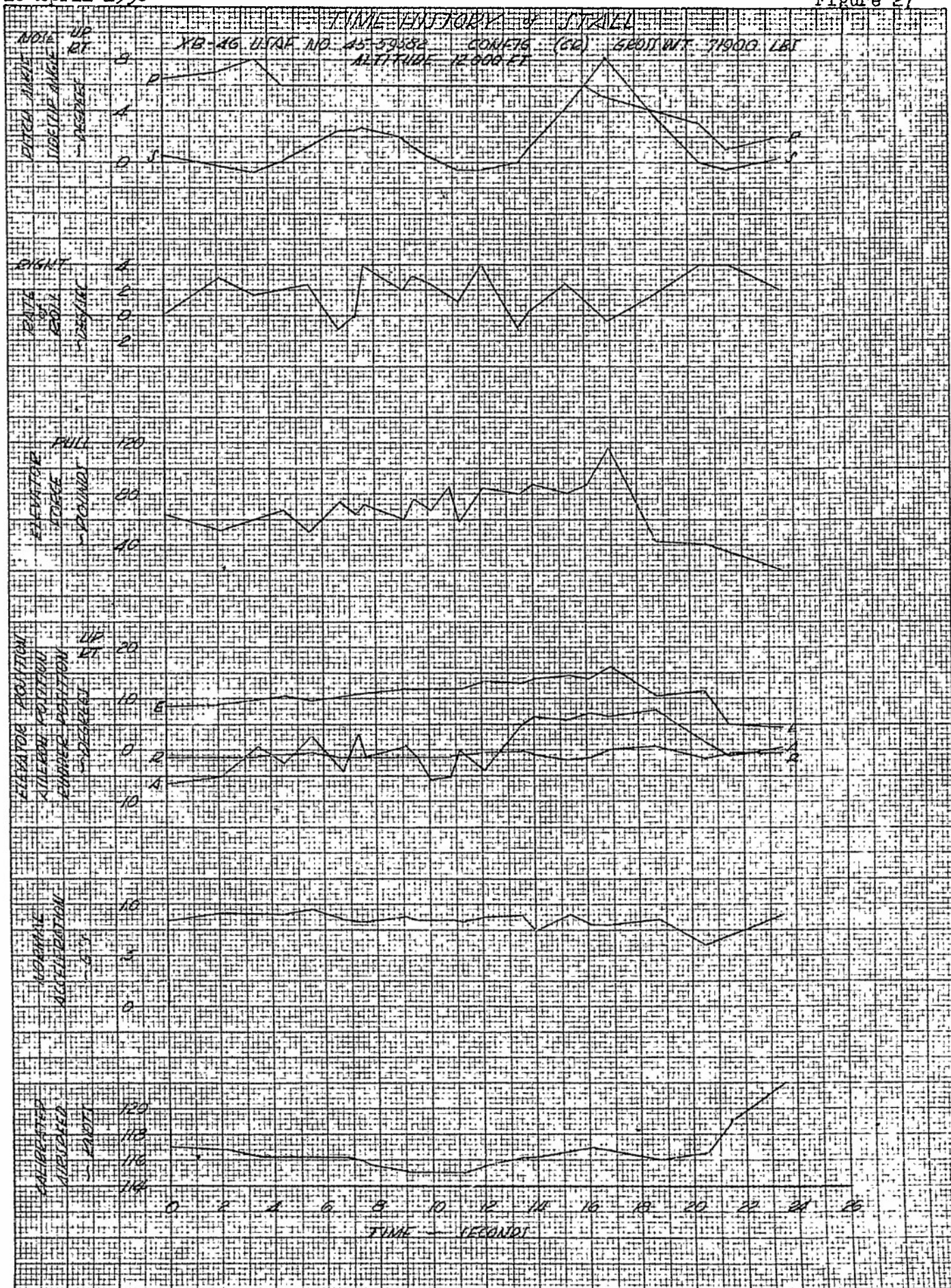
- O CONFIGURATION (G) CG 25 3/4 MAC
- CONFIGURATION (F) CG 23 3/4 MAC
- X CONFIGURATION (E) CG 22 3/4 MAC



MADE IN U.S.A.
KRELLER & ESSER CO., N.Y. NO. 2282-26

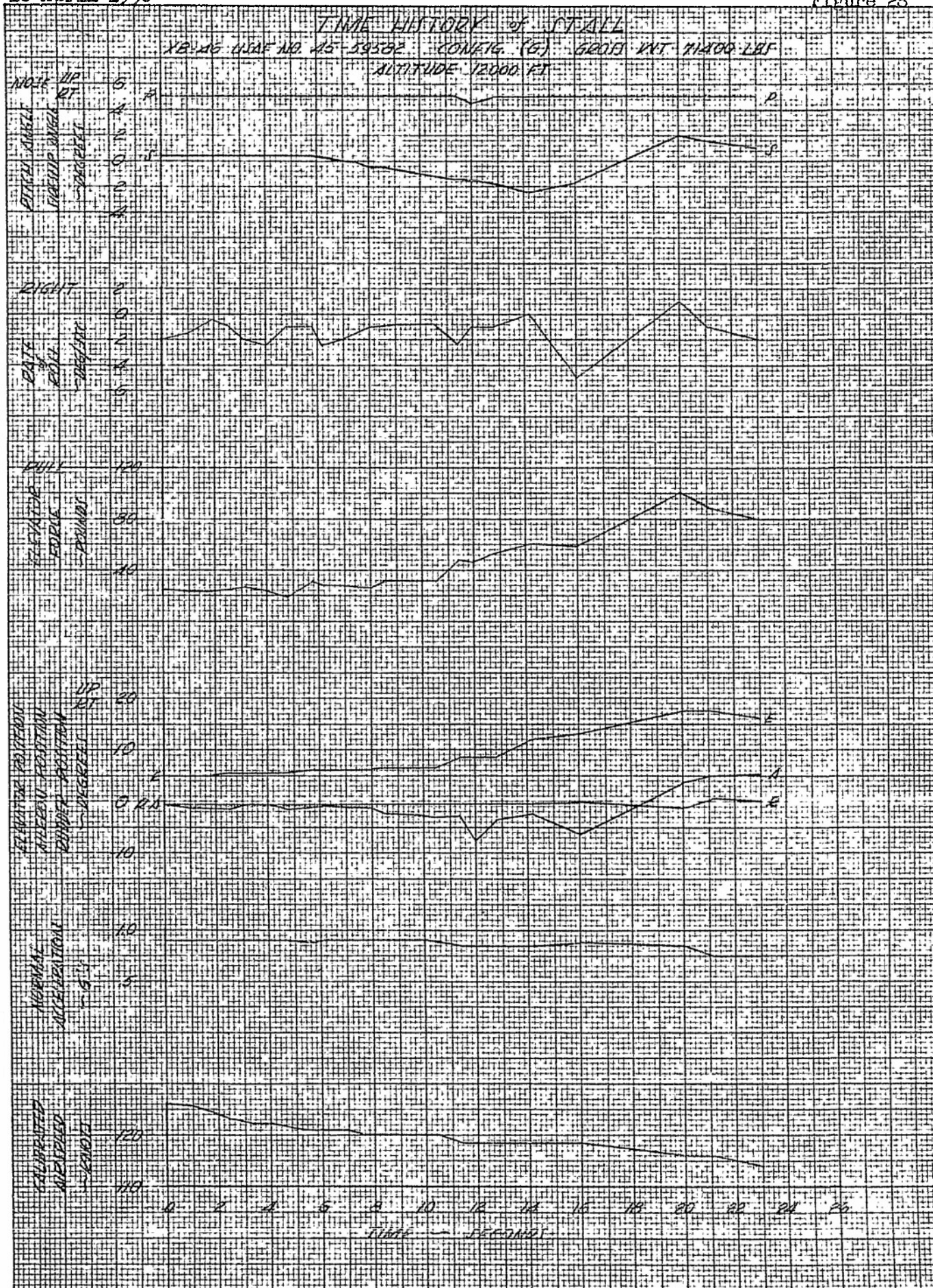
10 April 1950

Figure 27



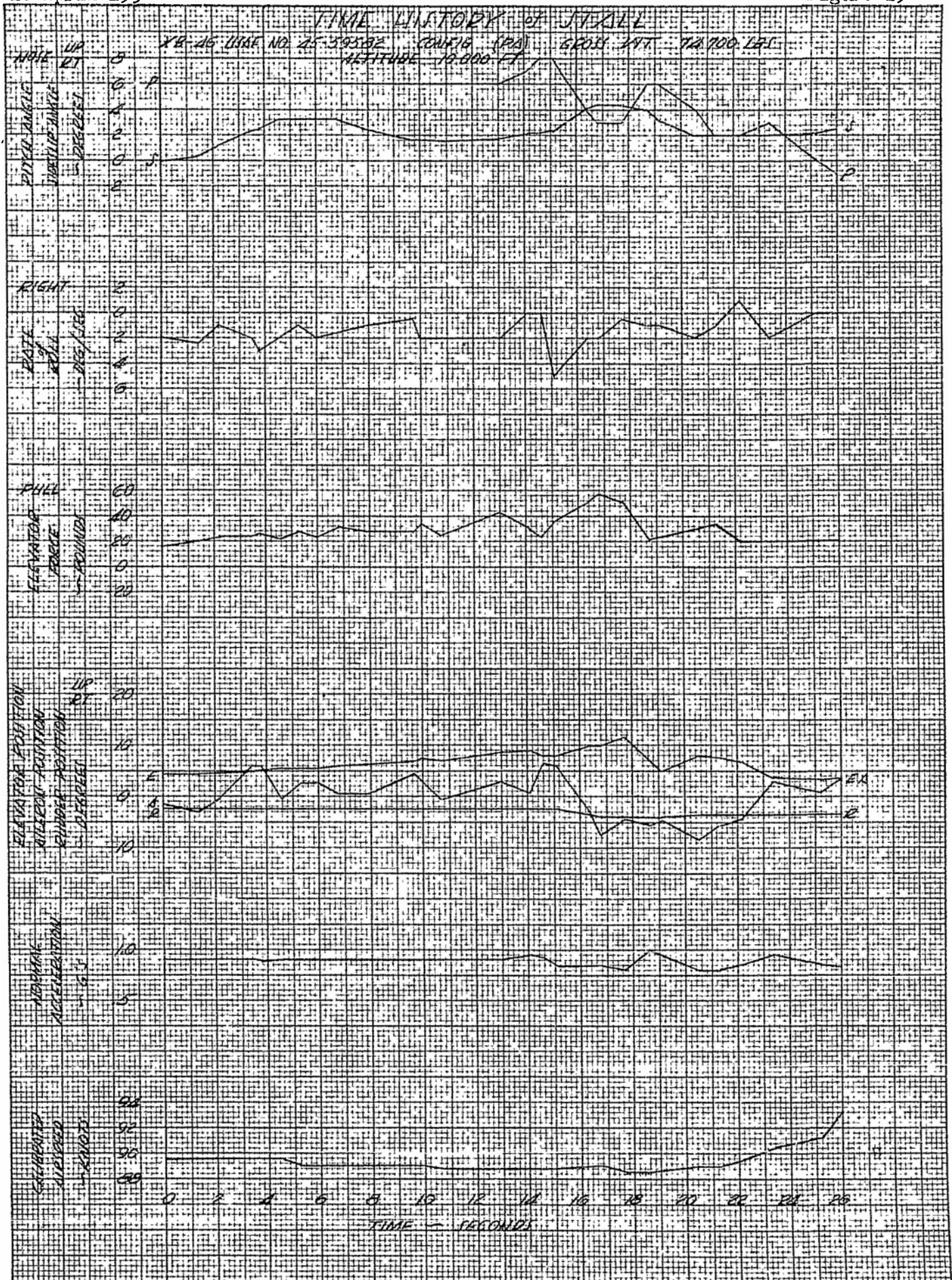
MADE IN U.S.A. BY KODAK SAFETY FILM DIVISION, EASTMAN KODAK CO., N. Y. N. Y. NO. 234-100

APPENDIX I



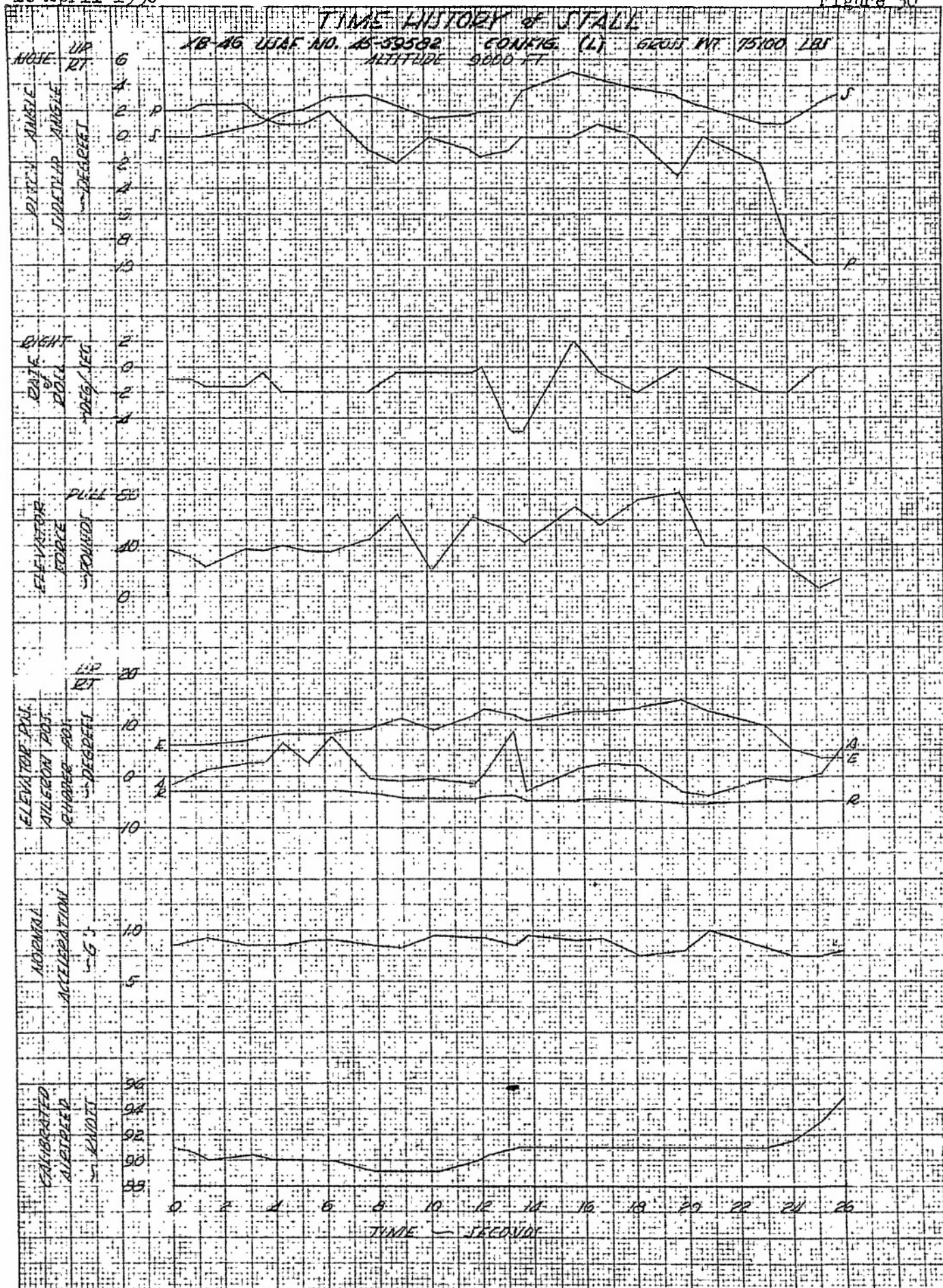
MADE IN U.S.A.
 KENNETH & KERR CO., N. Y. NO. 282-110

APPENDIX I



MADE IN U. S. A.
 MILLIGRAM 3 mm. Japex mounting, car. Japex parts
 KENNEL & ESSER CO., N. Y. NO. 2821-11C

APPENDIX I



REPRODUCED FROM REPORT CRFT-2282
BY THE NATIONAL BUREAU OF STANDARDS
ON APRIL 10, 1950

APPENDIX I

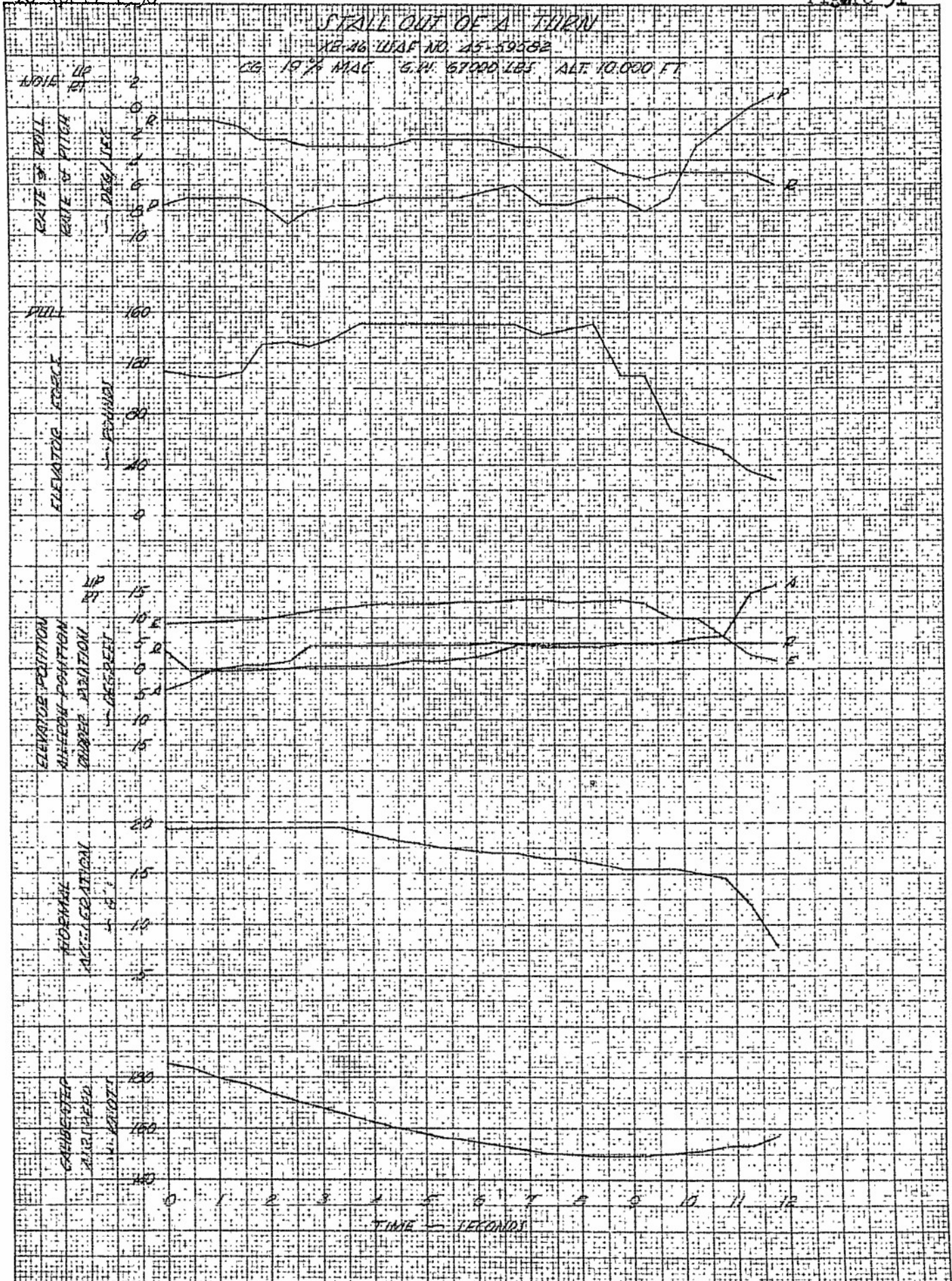
10 April 1950

Figure 31

STALL OUT OF A TURN

XE-46 W3AF NO. 25-59582

CG 19% MAC G.W. 67000 LBS ALT 10,000 FT



NOTED IN REPORT NO. 2282-1000

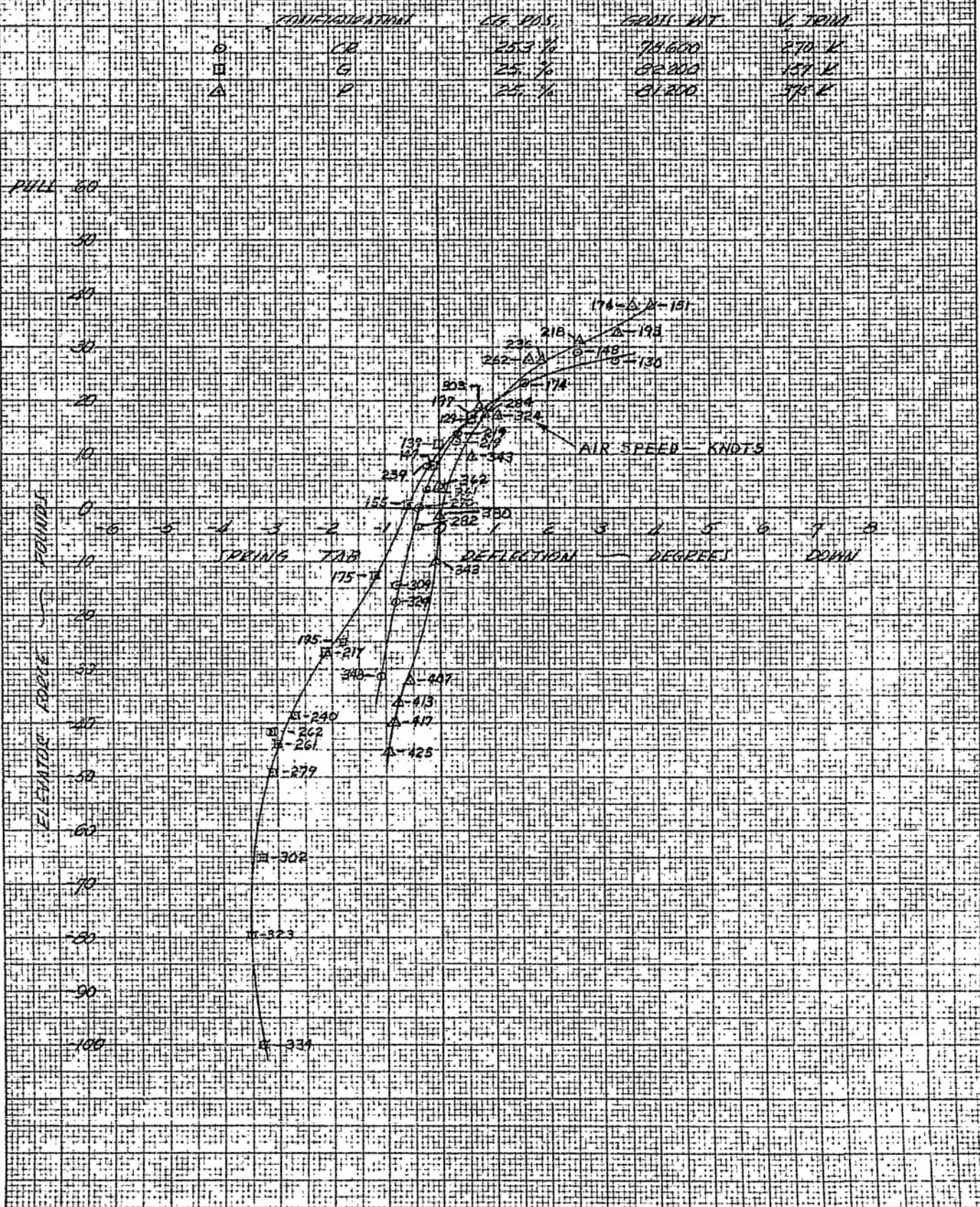
APPENDIX I

ELEVATOR SPRING TAB CHARACTERISTICS

13-AG-1106 NO. 15-21882

NORMAL ACCELERATION 1 G

10 FOOT



MADE IN U.S.A.
 MILLIGAN & COMPANY, INC.
 KENNER & ESSER CO., N.Y. NO. 2281-18C

APPENDIX I

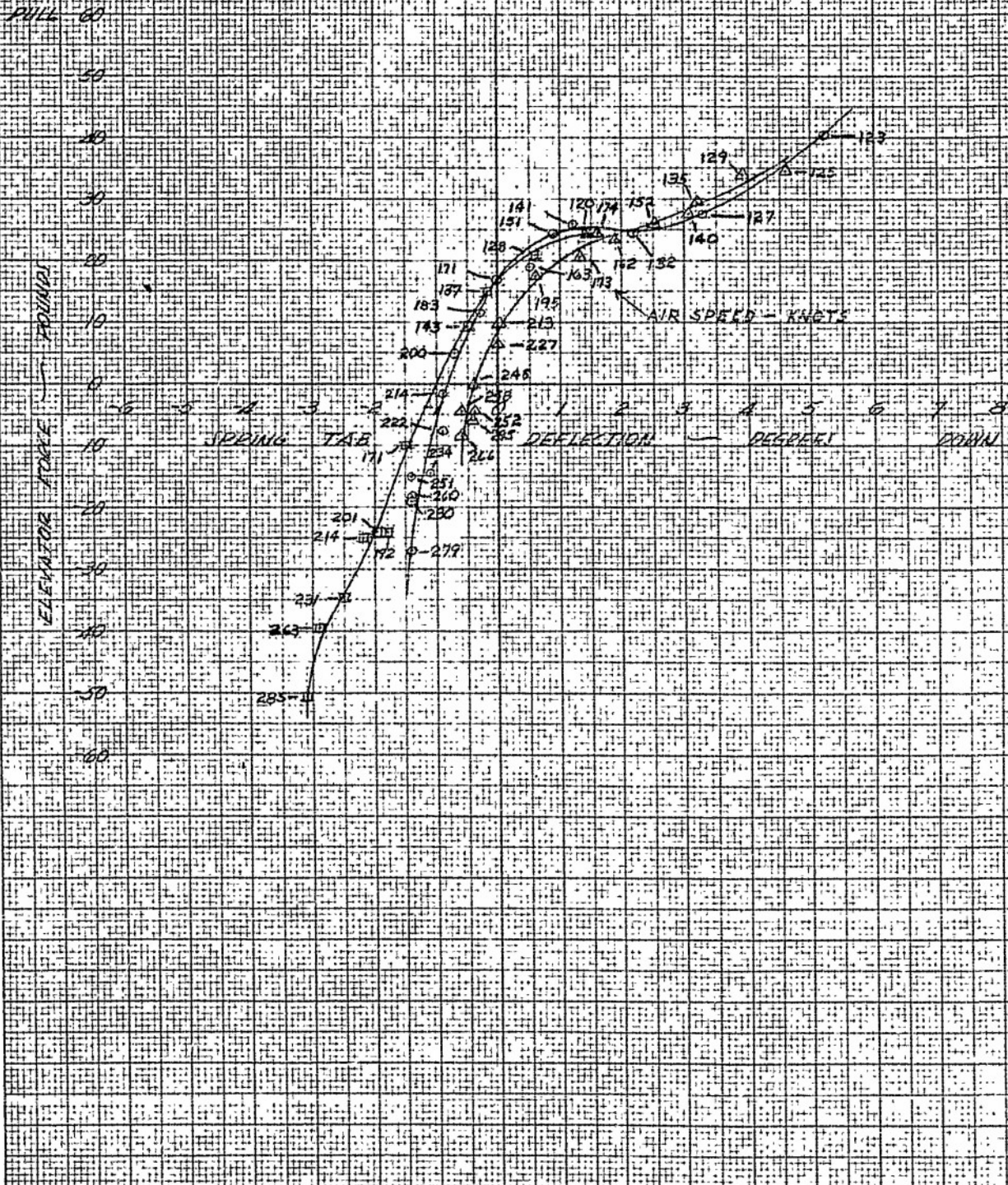
ELEVATOR SPRING TAB CHARACTERISTICS

XD-46 WACAF NO. 25-53542

NOMINAL ACCELERATION 1 G

30,000 FT

	CONFIGURATION	% FULLSPAN	GROSS WT	A TONNA
○	SR	25.4 %	176.600	203.4
□	G	25.4 %	179.900	196.8
△	P	25.4 %	176.300	213.2



MADE IN U.S.A.
 MILLIMETERS & INCHES SCALING ON THIS PORTAL
 KNAUER & ERBER CO., N. Y. NO. 2281-15C

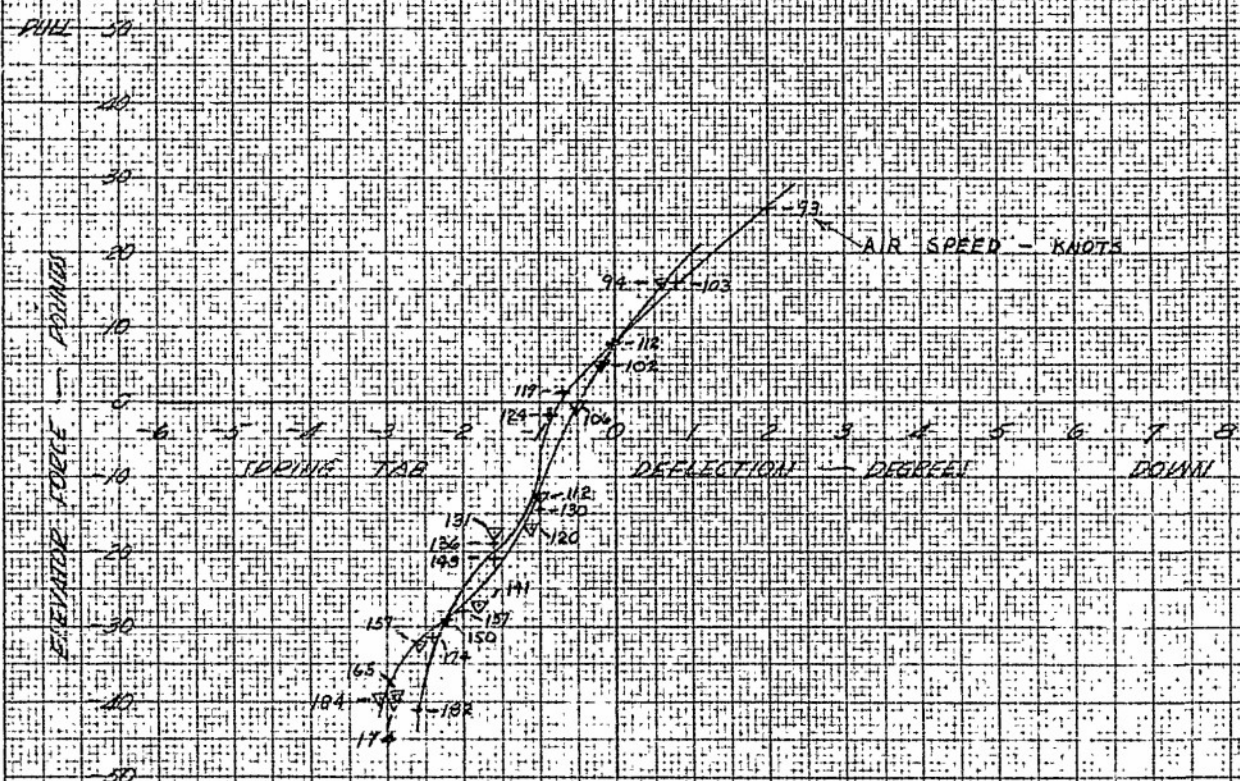
ELEVATOR SPRING TAB CHARACTERISTICS

NR-46 DRAWING NO. 45-50582

NORMAL ACCELERATION 1G

10,000 FEET

CONFIGURATION	CG POSITION	TAROST WTT	W. TOLLA
PA	25.6%	20.900	100-K
L	27.1%	15.300	122-K



MADE IN U.S.A.
 Minimum of 2 mil. (two thousandths) for lines parallel to MINIMUM & CENTER CO. U. S. A. NO. 2231-100

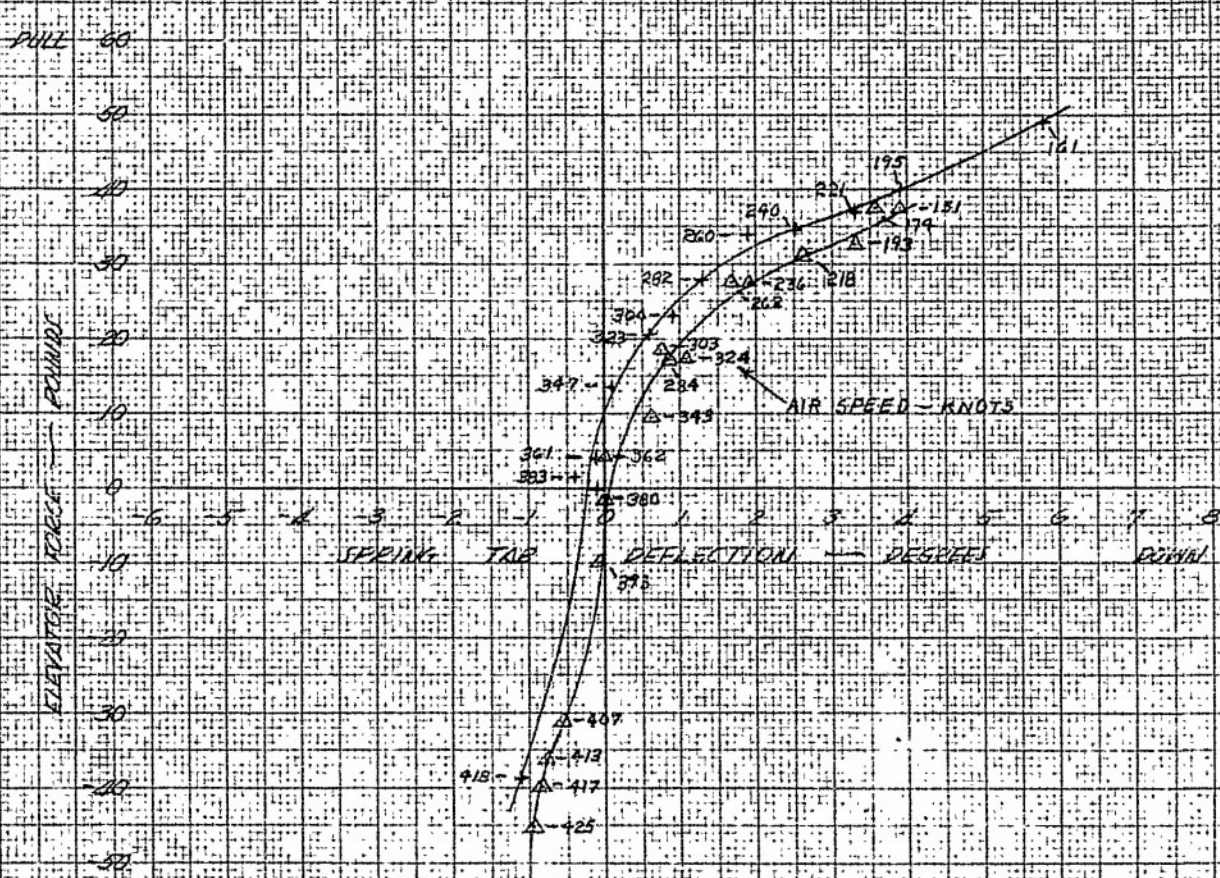
ELEVATOR SPRING TAB CHARACTERISTICS

XF-46 WING NO. 44-39592

NORMAL ACCELERATION 1.0

10,000 FT

CONFIGURATION	CG POSITION	GROSS WT	V ₆ TRIM
△ P	25%	31,200	375 K
△ E	19.7%	29,300	375 K



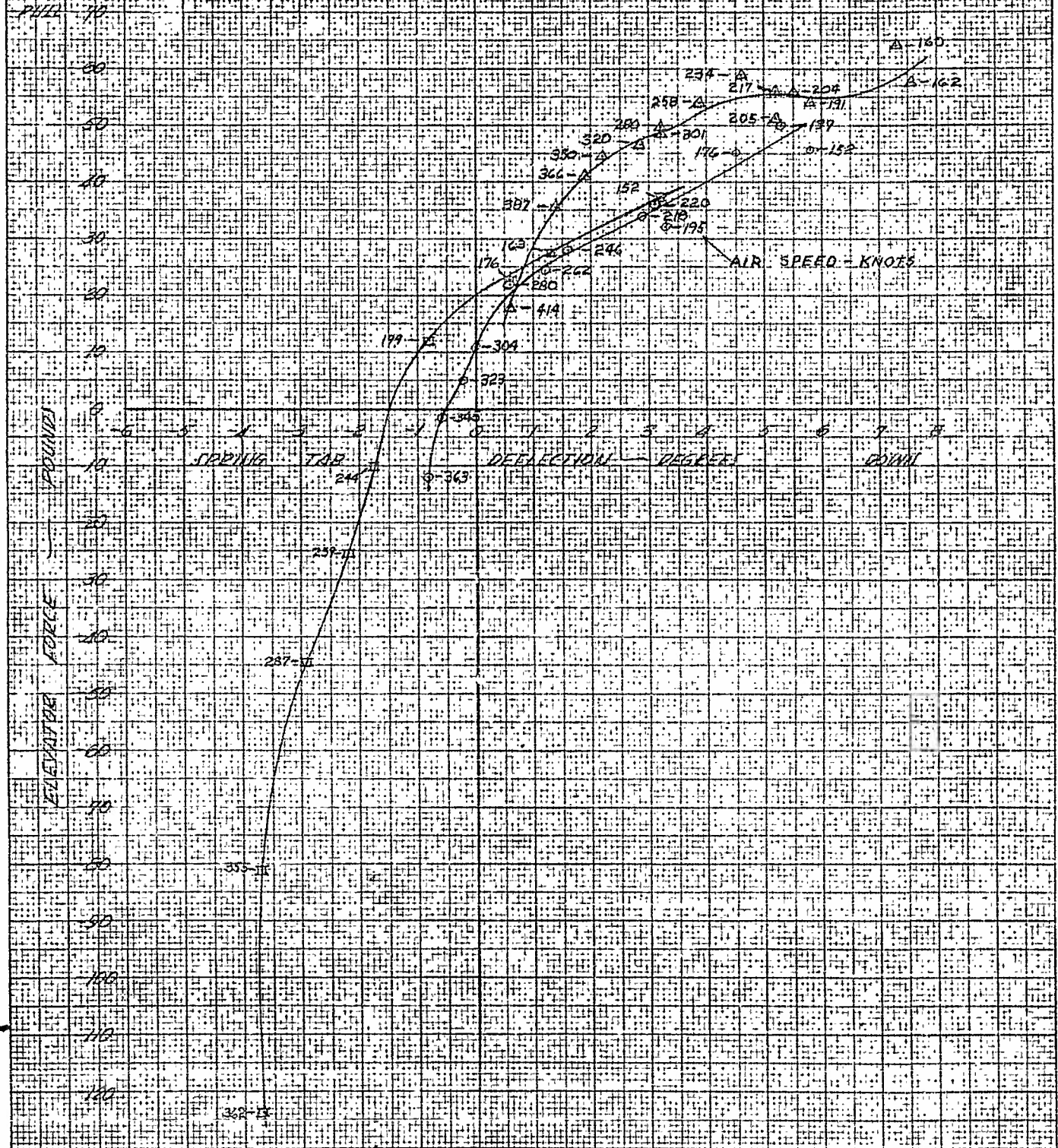
MADE IN U.S.A.
 MILLIMETER & INCH TYPING
 KENNETH G. REZER CO., N. Y. NO. 208-1-10

ELEVATOR SPRING TAB CHARACTERISTICS

XB-46 WING NO. 46-40592

NORMAL ACCELERATION 10G 10000FT

CONFIGURATION	CG POSITION	GROSS WT	V ₀ TEST
○	CR	25,376	212 K
□	G	25,760	194 K
△	F	25,760	375 K

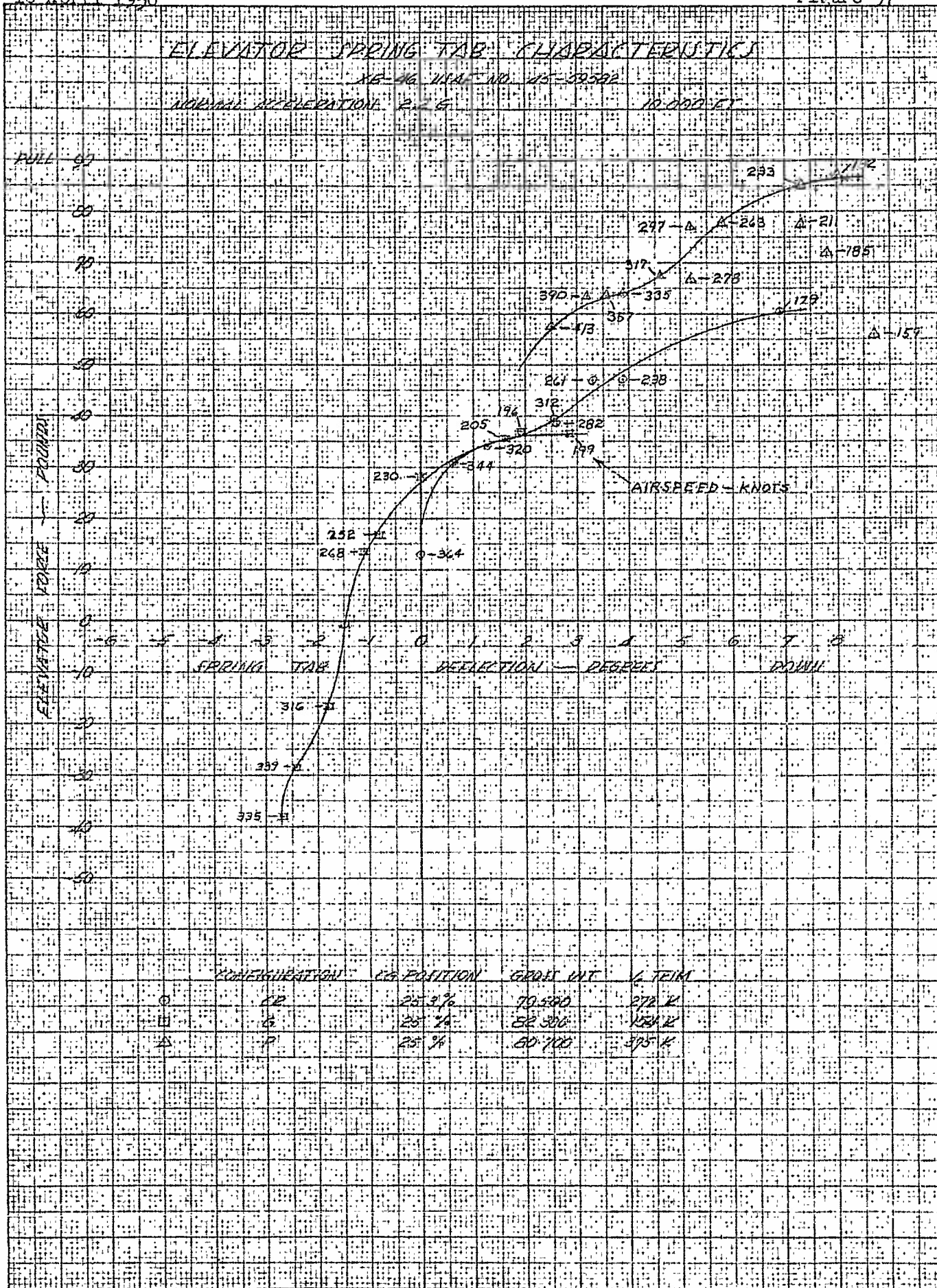


MADE IN U.S.A.
 MILLIKEN & CO. INC. ENGINEERING DIV. JET PROP. DEPT.
 KANSAS CITY, MO. 64110

ELEVATOR SPRING TAB CHARACTERISTICS

XC-46 USAF NO. 45-59592

NORMAL ACCELERATION: 2 G 10,000 FT



HYDRE 111 0 2 1 V
 MILLIMETER 2 mm 1/16 inch accuracy, cut light pencil
 KENNER & ECKER CO., N. Y. NO. 281-18C

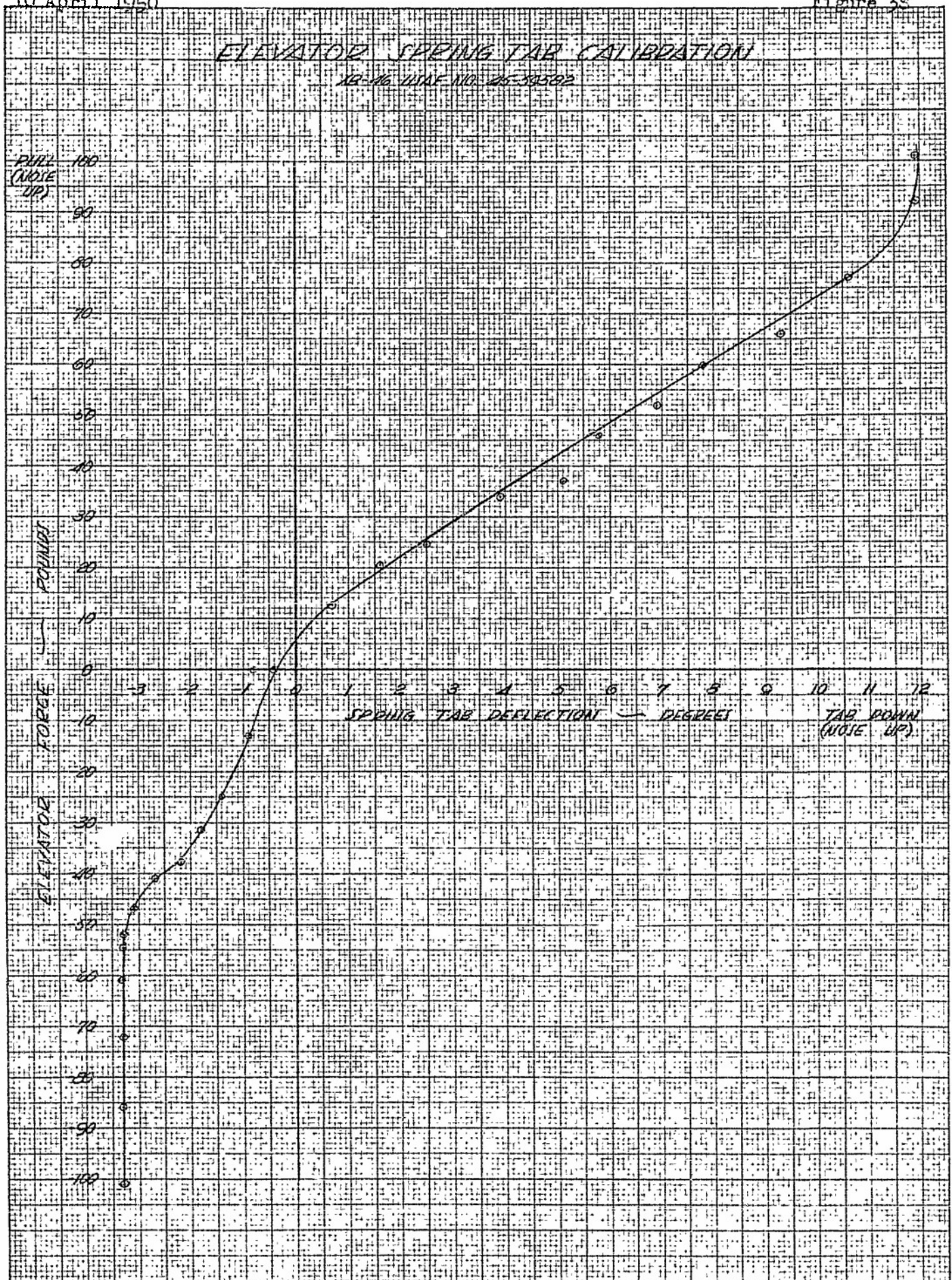
CONFIGURATION	CG POSITION	GROSS WT	CG TRIM
○	CR	25.2%	79.500
□	G	25.2%	82.300
△	P	25.2%	80.700

APPENDIX I

CONFIDENTIAL

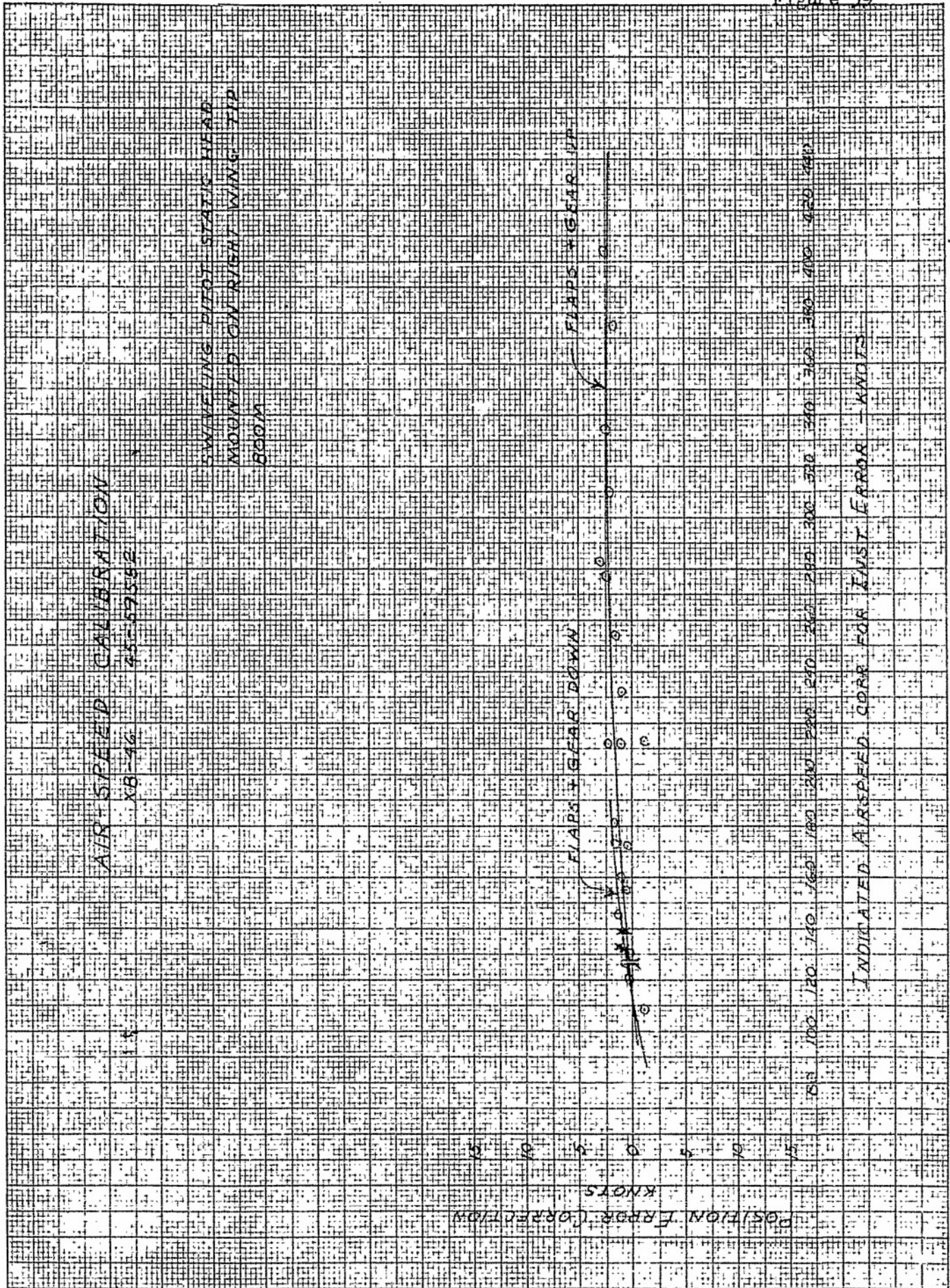
ELEVATOR SPRING TAB CALIBRATION

NR-16 LINE NR. 45-33592



MADE IN U. S. A.
Reproduced & may have been received for your personal
KONIKOFF & EBER CO., N. Y. N. O. 224-110

Figure 39



MADE IN U.S.A.
 THE KODAK COMPANY
 351-1-1950

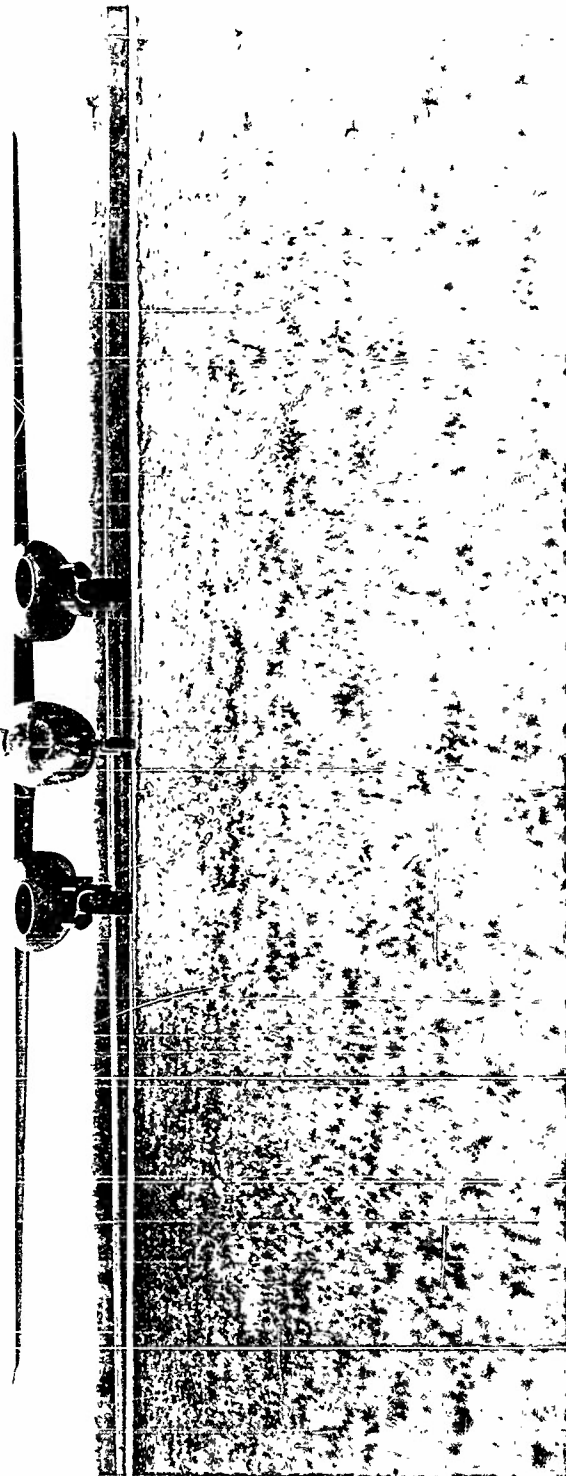
Memorandum Report No. MCRPT-2282
10 April 1950

APPENDIX II

Photographs of XB-46 Airplane, USAF No. 45-59582

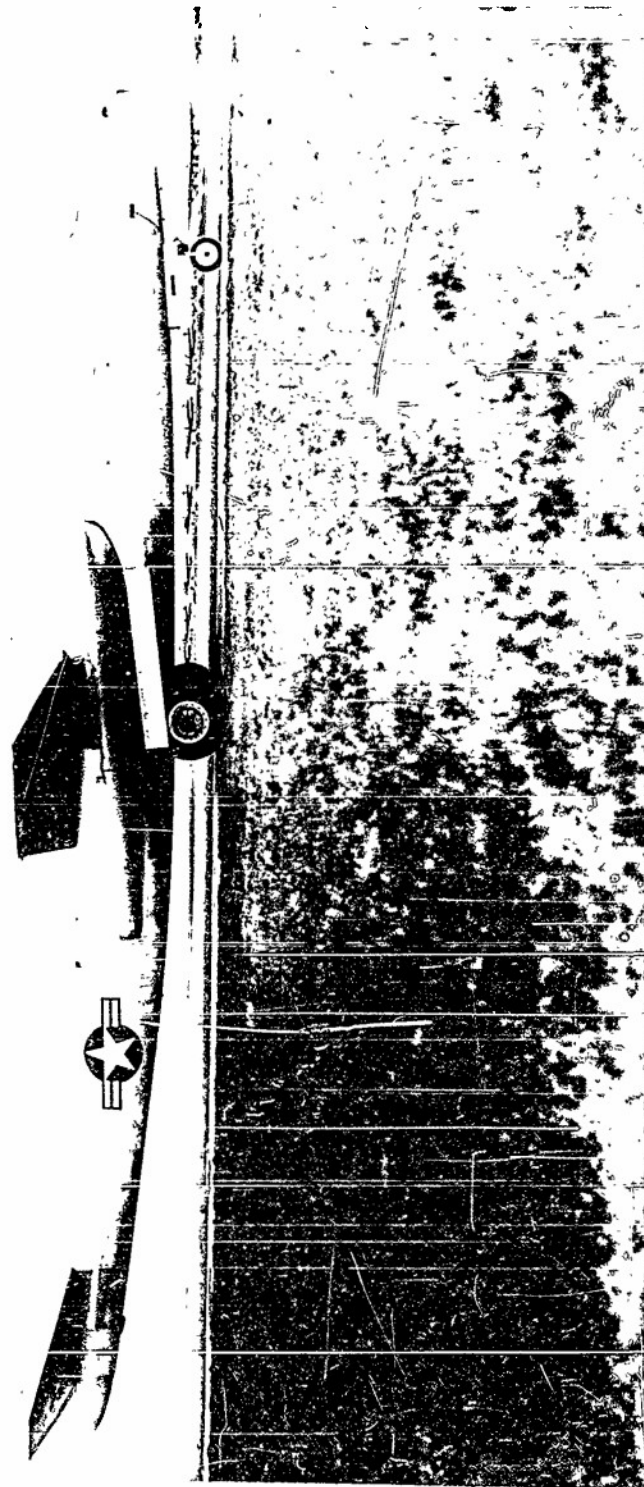
Figure 1	Front View	Page 2
Figure 2	Right Side View	Page 3
Figure 3	Right Front View	Page 4
Figure 4	Pilot's Cockpit	Page 5
Figure 5	Pilot's Panel	Page 6
Figure 6	Photopanel	Page 7
Figure 7	Yaw Vane, Left Wing Tip	Page 8
Figure 8	Swiveling Pitot Head, Right Wing Tip	Page 9

APPENDIX II

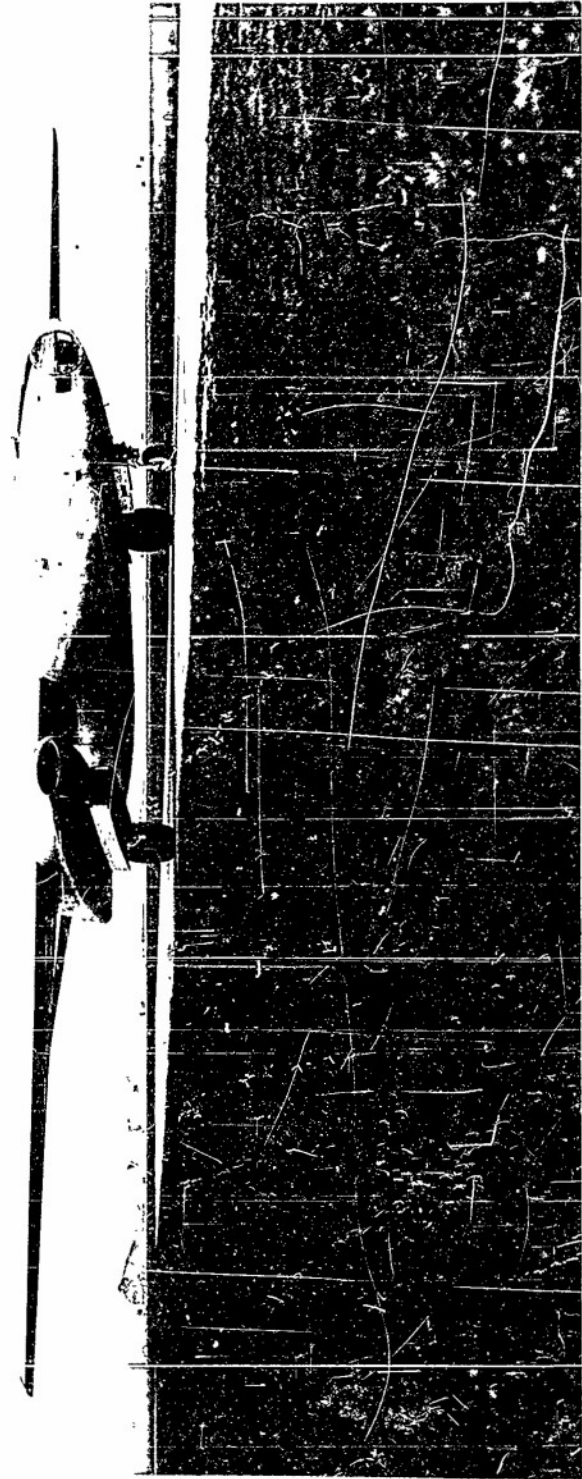


North View
- 1 - 132

50 - 4 - 162



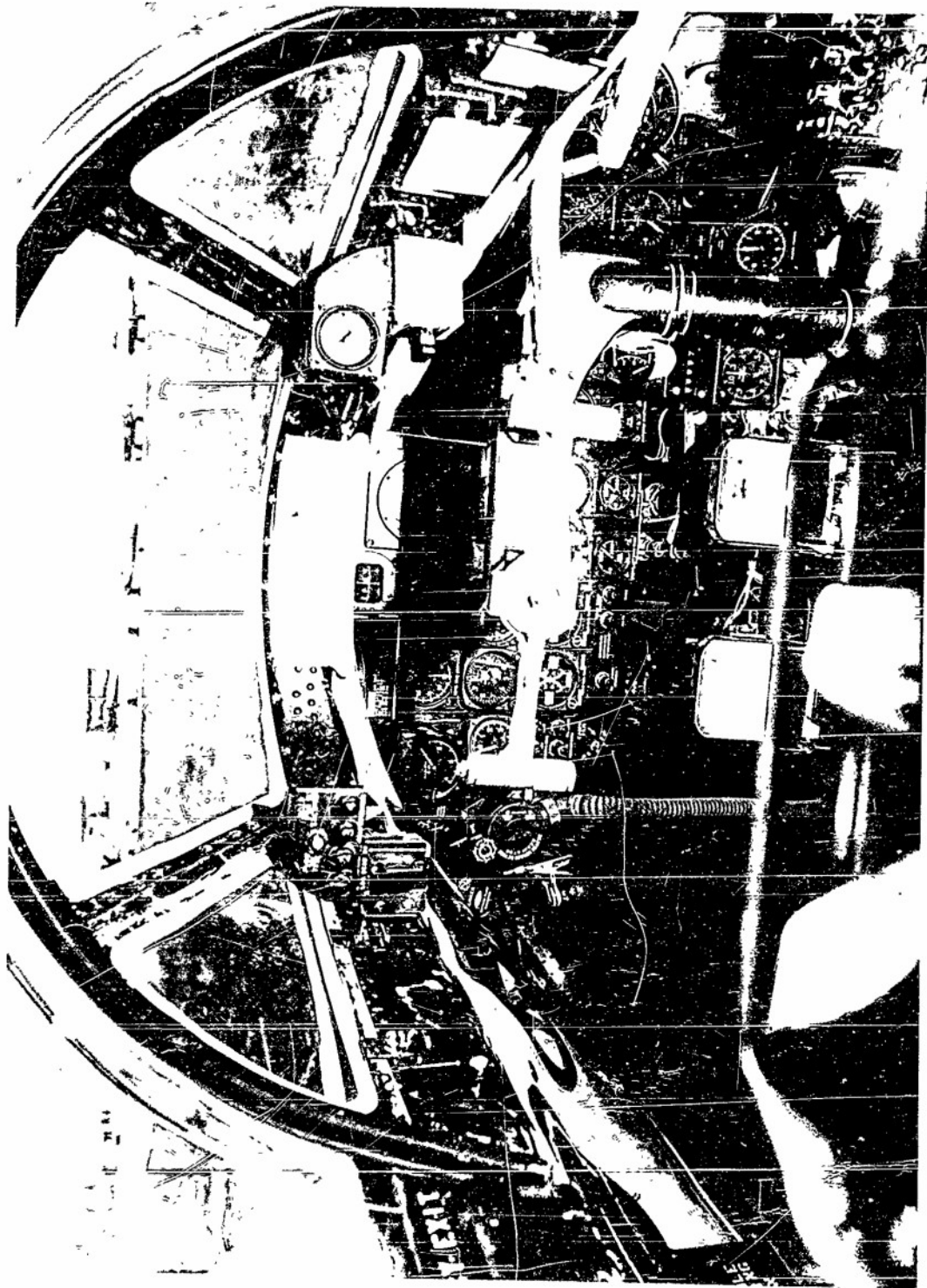
50 - 4 - 163



Small aircraft photo
taken in 1932

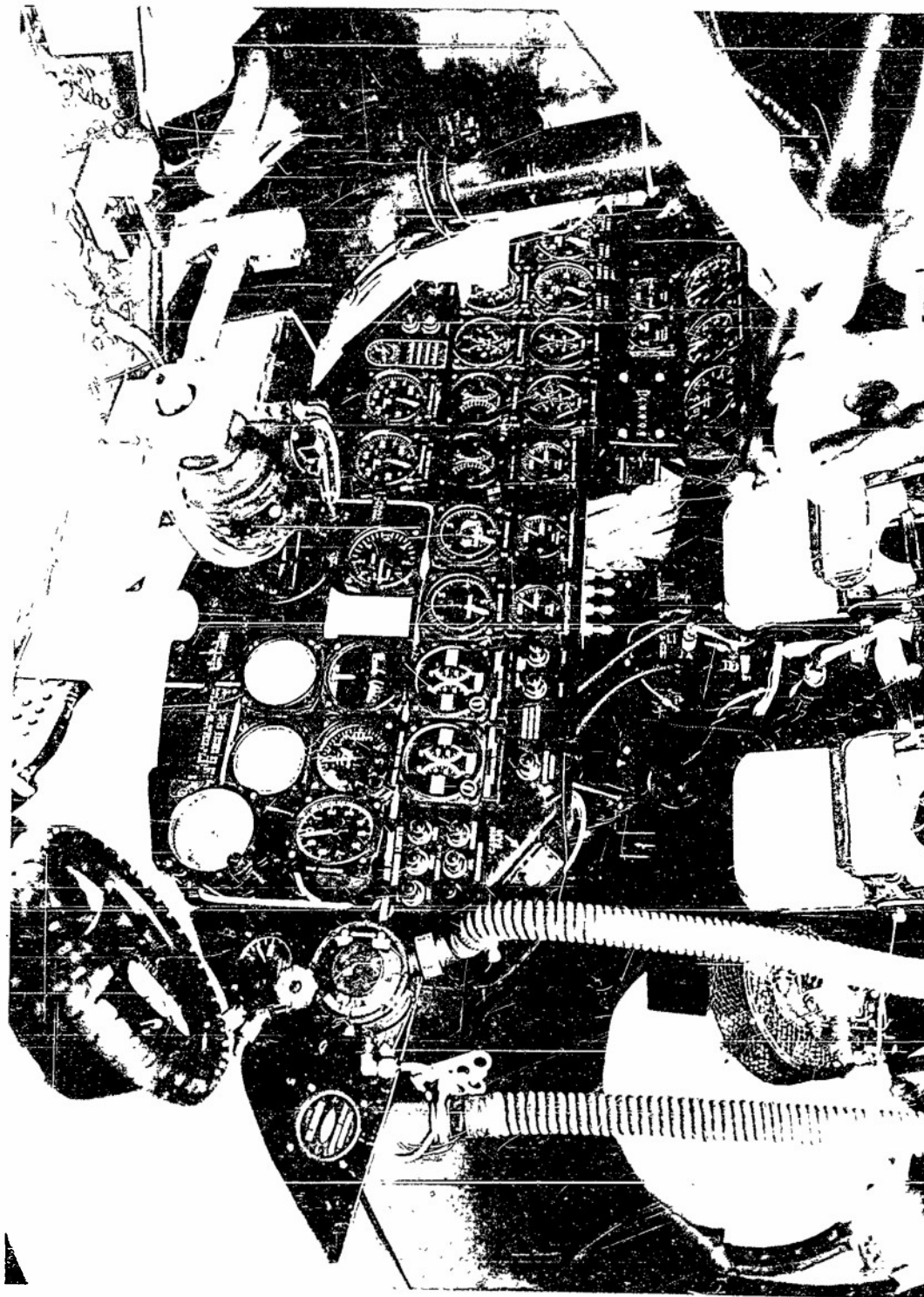
50 - 1 - 164

1932 E. 11



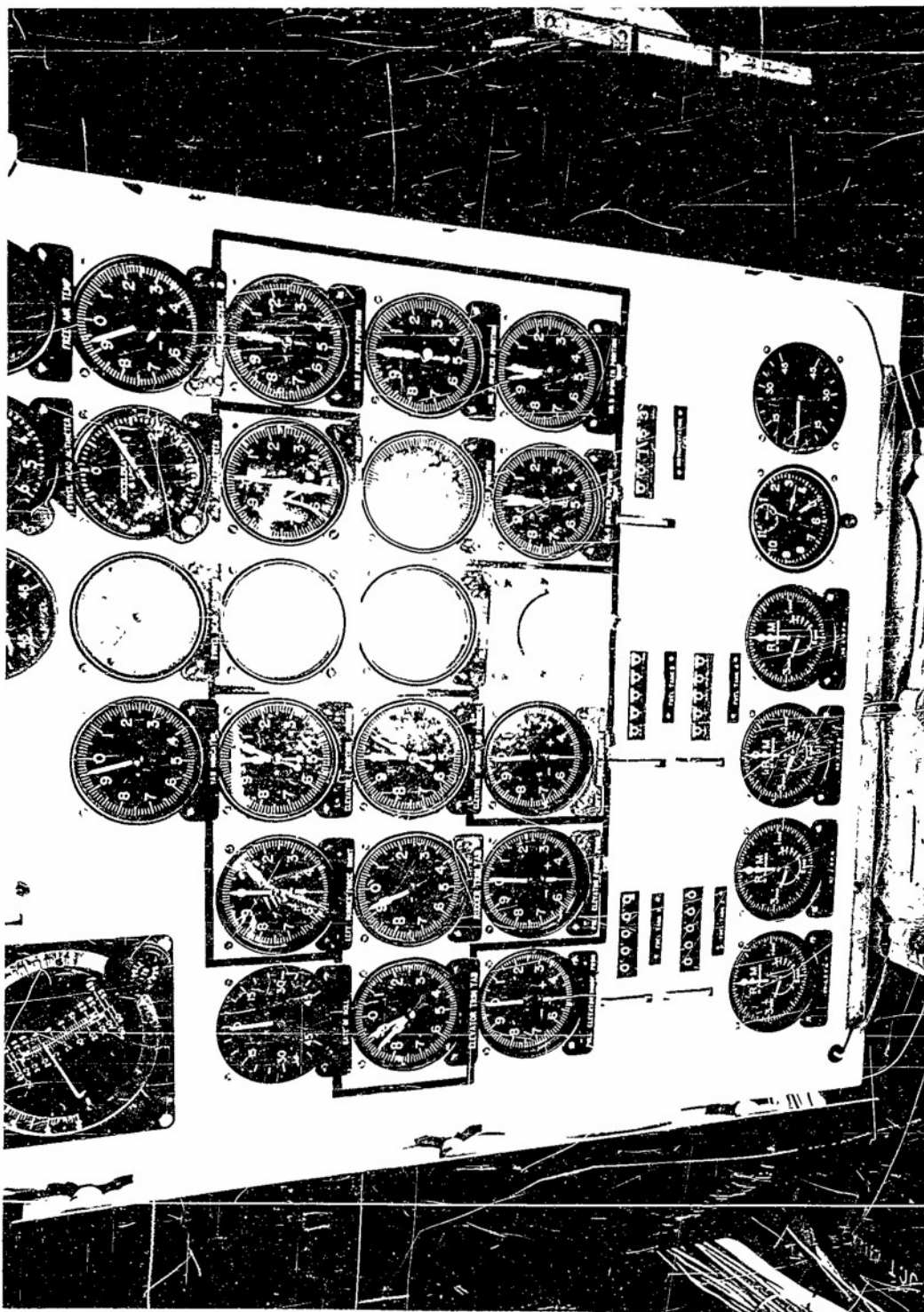
20564 91-107
41-1000 51401

50 - 4 - 165



50 - 1 - 166

CONFIDENTIAL



CONFIDENTIAL

90 - 4 - 167

CONFIDENTIAL

CONFIDENTIAL



50 - 4 - 108

CONFIDENTIAL



100 - 4 - 169

CLASSIFICATION CHANGED

ATI

FROM **CONFIDENTIAL** TO **UNCLASSIFIED**

78222

ON 29 November 1954 By authority of List No. 58

This action was rendered by Arthur E. Creech OSA
Name in full Date