C-105 P/MODELS/48

STRUCTURAL INVESTIGATION OF A 1:5.25 SCALE PLASTIC MODEL OF THE FORWARD FUSELAGE STRUCTURE ON THE C-105 AIRCRAFT

A.P. Sentance September 1955

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: C-105 REPORT NO P/MODELS/48

FILE NO: P/Models/48 NO OF SHEETS: 22

TITLE:

CONFIDENTIAL

STRUCTURAL INVESTIGATION OF A 1:5.25 SCALE PLASTIC MODEL OF THE FORWARD FUSELAGE STRUCTURE ON THE C-105 AIRCRAFT

PREPARED BY A.P. Sentance DATE June 1955

CHECKED BY DATE

SUPERVISED BY W. Czerwinski DATE July 1955

APPROVED BY DATE

ISSUE No	REVISION No	REVISED BY	APPROVED BY	DATE	REMARKS

FORM 1316A

AIRCRAFT		PREPARED BY	DATE
C-105 PLASTIC MODELS	FORWARD FUSELAGE STATIONS 255 to 485	A.F. Sentance	July 1955
		CHECKED BY	DATE

SUMMARY

A structurally similar plastic model of the forward fuselage between stations 255 and 485 was constructed and tested under various load conditions. The model was supported in such a way as to simulate a built-in condition of the fuselage at frame 485, with the fuel tank and ducts attached to frame 485 in the appropriate manner. Deflected shapes of the fuselage side walls and at the fuel tank centre line were measured as well as the strain distribution along the lengths of the fuselage corner longerons.

From the results of the tests can be seen the manner in which the ducts and fuel tank form an integral part of the structure forward of frame 485, and the manner in which they give up their loads to the fuselage in the vicinity of frame 485. The effect of a forced deflection of the centre of frame 485 under wing bending load was investigated and the diffusion of the this load into the forward fuselage structure is shown. The data collected under these tests has been of use in setting up the mathematical analysis of this rather complicated structure. The results will be used as a comparison with the forthcoming solution of the mathematical analysis to help substantiate the assumptions and simplifications made to the structure in that analysis.

INTRODUCTION

Following on from report P/Models/46, dealing with a 3% t/c ratio fin, this constitutes the second of a series of tests on plastic models of components of the C-105 aircraft and has as its basic purpose the determination of the deflected shape of the forward fuselage structure and the strain distribution along the fuselage longerons.

The type of structure envisaged in the first instance for the frame 485 region called for continuous fuselage top and side skins and longerons, but a discontinuous lower skin, with no means for carrying across frame 485 any bending moment in the duct skins or the fuselage fuel tank. See illustration of Figure 1. This presented the problem of determining just how the fuel tank and ducts acted as a part of the fuselage structure and in what manner loads in these components were transferred to the fuselage proper when the ducts and tank became ineffective. For use in the torsional stiffness calculations, the possibility of determining experimentally the effective material in torsion of the forward fuselage was of interest.

Introduction (Continued)

It was decided therefore to apply to the model structure load simulating the bending moment and shear force distribution over the length of the structure, also a distributed load simulating fuel inertia loads in the tank region and pure torque loads applied from the nose fuselage and at the front spar pick-up points. A forced deflection was applied at the centre line of frame 485 as would be caused by wing bending deflection. The complete collection of test results and data are available in another volume of this report, herein being presented the most pertinent points.

APPARATUS

The structure was once more investigated through the facilities of the Structural Test Department and photographs of figures 2 to 4 show the test set-up used. Facilities did not allow constant temperature and humidity control throughout the tests although variation was kept to a minimum as much as possible.

The Model

As illustrated the model consisted of a 1.0 to 5.25 scale replica of the structure included within the stations mentioned. Skin and web thicknesses were in the ratio of 1.0 to 2.5 of the full scale thicknesses, which is based on structural similarity for an equal strain condition between model and full scale. Complete derivation of the model-full scale parameters is given in report P/Models/52 .

Material used in the construction was again cellulose nitrate, "Xylonite", all cementing being done with an acetone and ketone mixture.

To create the "built-in" condition at frame 485, this frame was made considerably stiffer than actually and clamped to the support plate by means of steel plates which allowed distortion of the frame within its own plane but very limited movement normal to its plane. This movement was measured and the appropriate correction made to deflection measurements.

The model was tested in two conditions:-

(a) With end load connection in the lower or armament bay skin. (Torsion tests were done in this condition only.)

(b) Without end load connection in lower skin. This was accomplished by cutting the skin connection at frame 485 and providing a stiffener at the skin termination to gather up the skin shears. This arrangement would not be satisfactory for asymmetrical loading but since all cases investigated in this state were symmetrical, it was deemed reasonable.

AVRO AIRCRAFT LIMITED
TECHNICAL DEPARTMENT (Aircraft)

REPORT NO	P/Models/48
SHEET NO	3
PREPARED BY	A.P. Sentance
DATE	July 1955
CHECKED BY	
DATE	

AIRCRAFT: C-105 PLASTIC MODELS

FORWARD FUSELAGE STATIONS 255 to 485

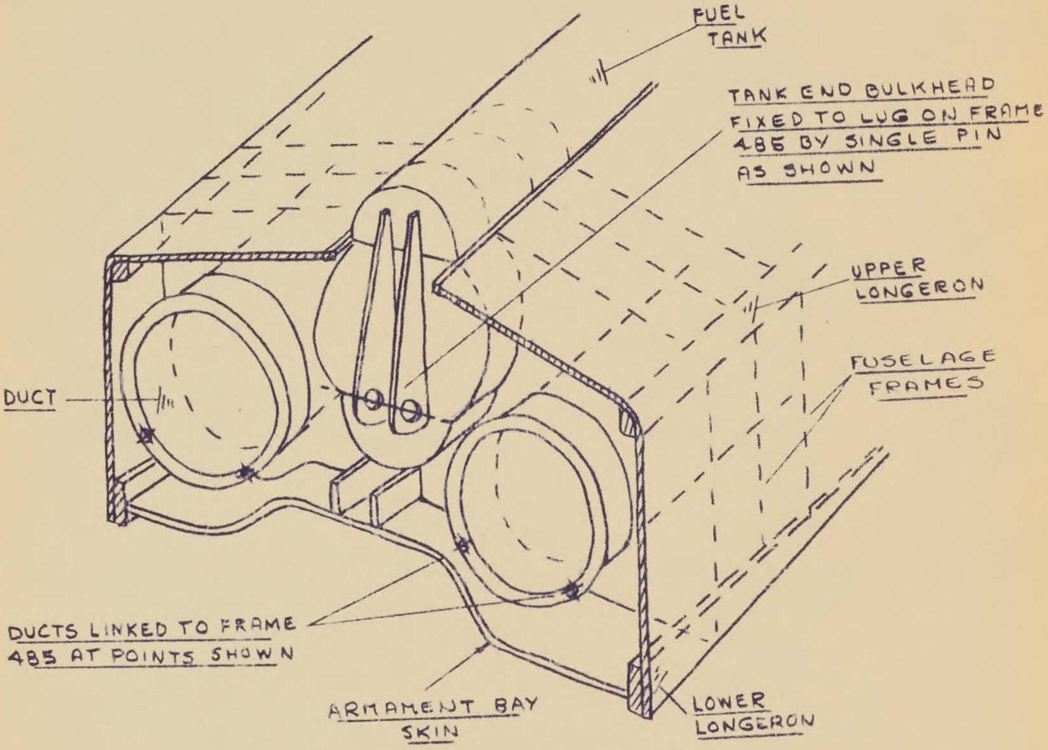


FIG 1. DETAIL OF CONNECTION TO FRAME 485 LOOKING FWD.

- SKINS AND LONGERONS SHOWN SHADED WERE FIXED TO FRAME 485 TO SIMULATE CONTINUITY OVER THE FRAME.
- TESTING WAS DONE BOTH WITH AND WITHOUT THE ARMAMENT BAY SKIN HAVING END LOAD CONNECTION TO FRAME 485.
- DUCT LINKS CAPABLE OF TRANSFERRING VERTICAL SHEAR ONLY TO FRAME 485.
- TANK LUG PIN CAPABLE OF TRANSFERRING SHEAR AND END LOAD ONLY TO FRAME 485.

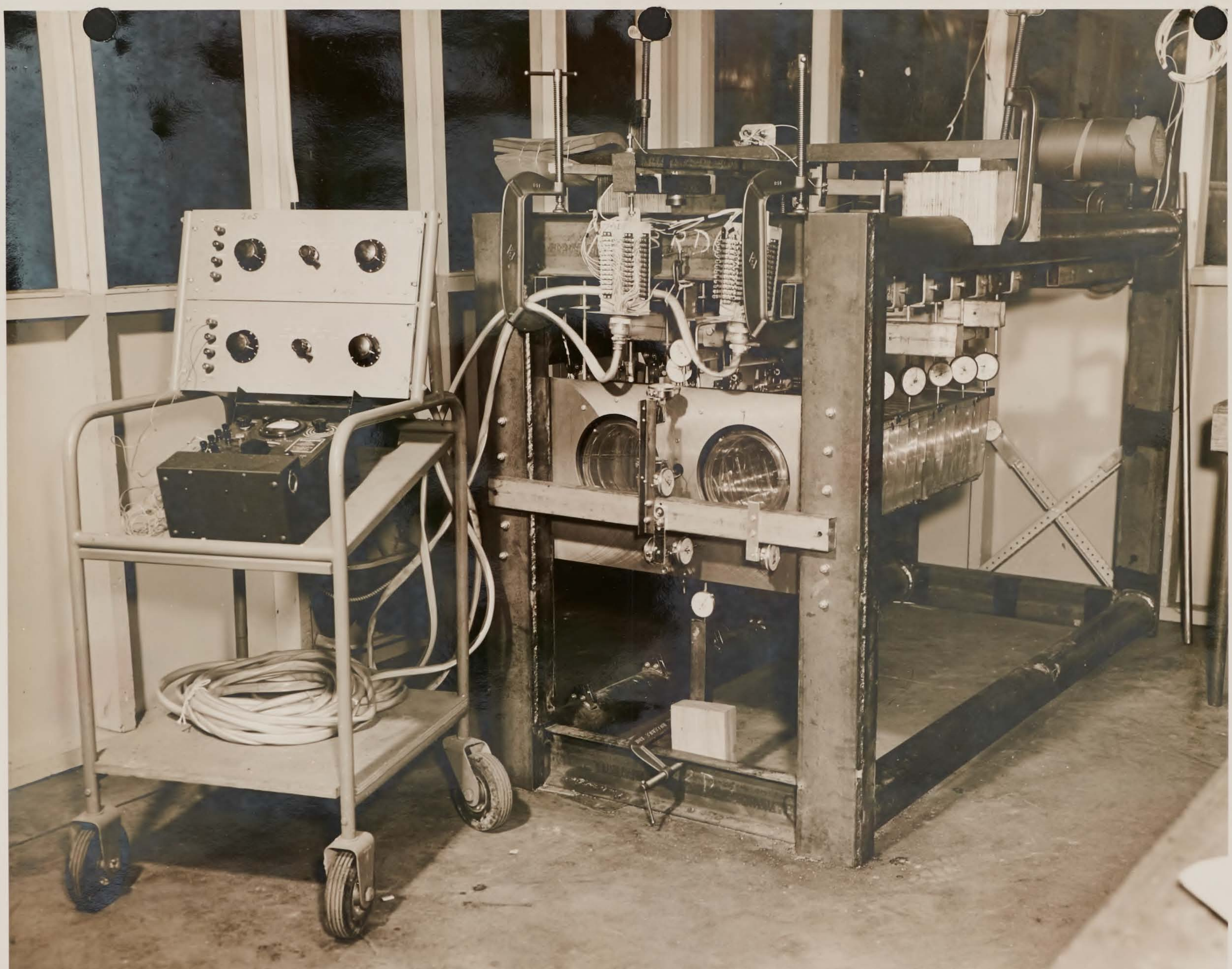


FIG 2

AVRO AIRCRAFT LIMITED

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: C-105 PLASTIC MODELS	FORWARD FUSELAGE STATIONS 255 to 435	REPORT NO: P/Models/43	SHEET NO: 4
		PREPARED BY: A.P. Sentance	DATE: July 1955
		CHECKED BY:	DATE:

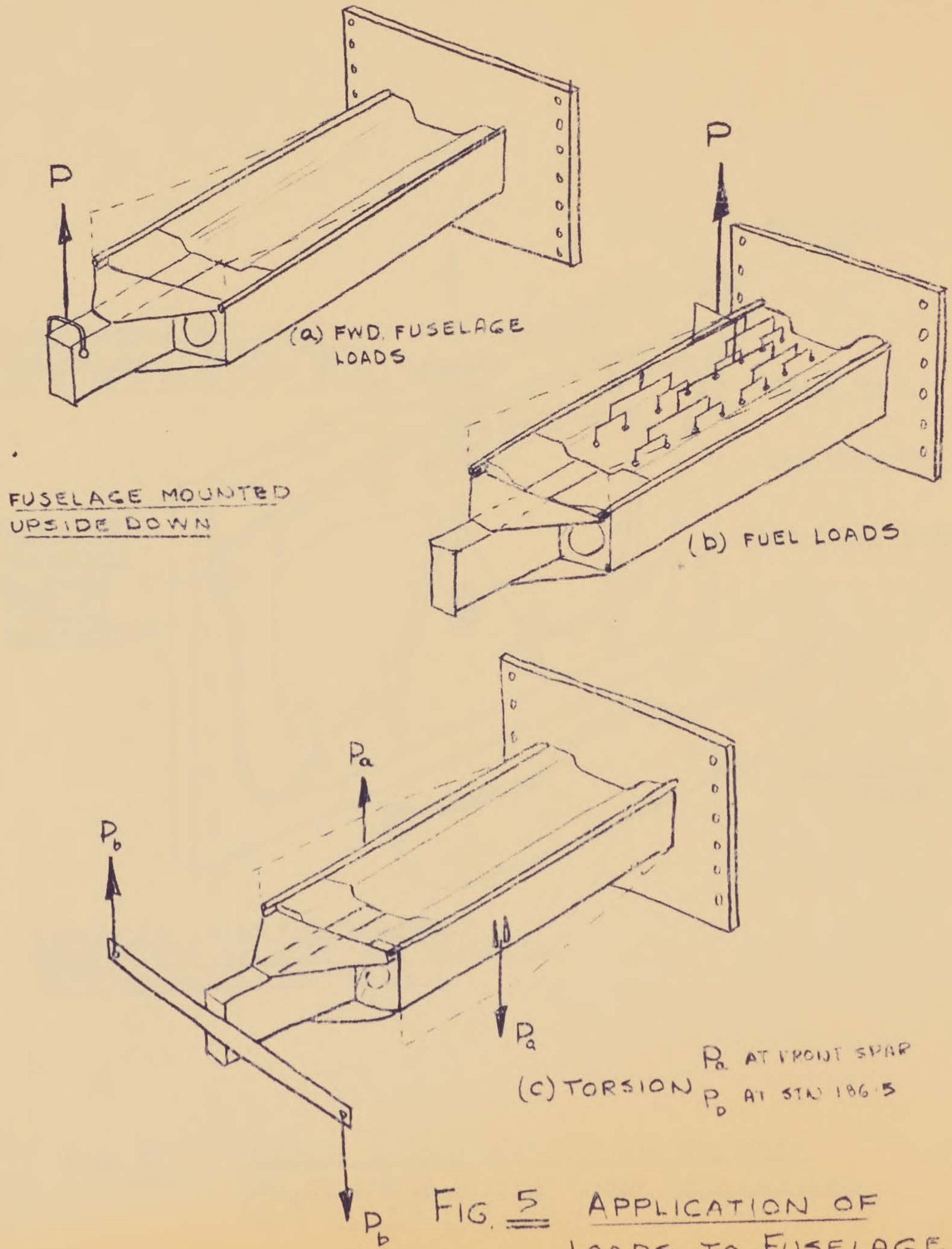


FIG. 5 APPLICATION OF LOADS TO FUSELAGE MODEL

AVRO AIRCRAFT LIMITED

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT		REPORT NO. P/Models/43	
C-105 PLASTIC MODELS	FORWARD FUSELAGE STATIONS 255 to 485	SHEET NO. 5	
		PREPARED BY	DATE
		A. P. Sentance	July 1955
		CHECKED BY	DATE

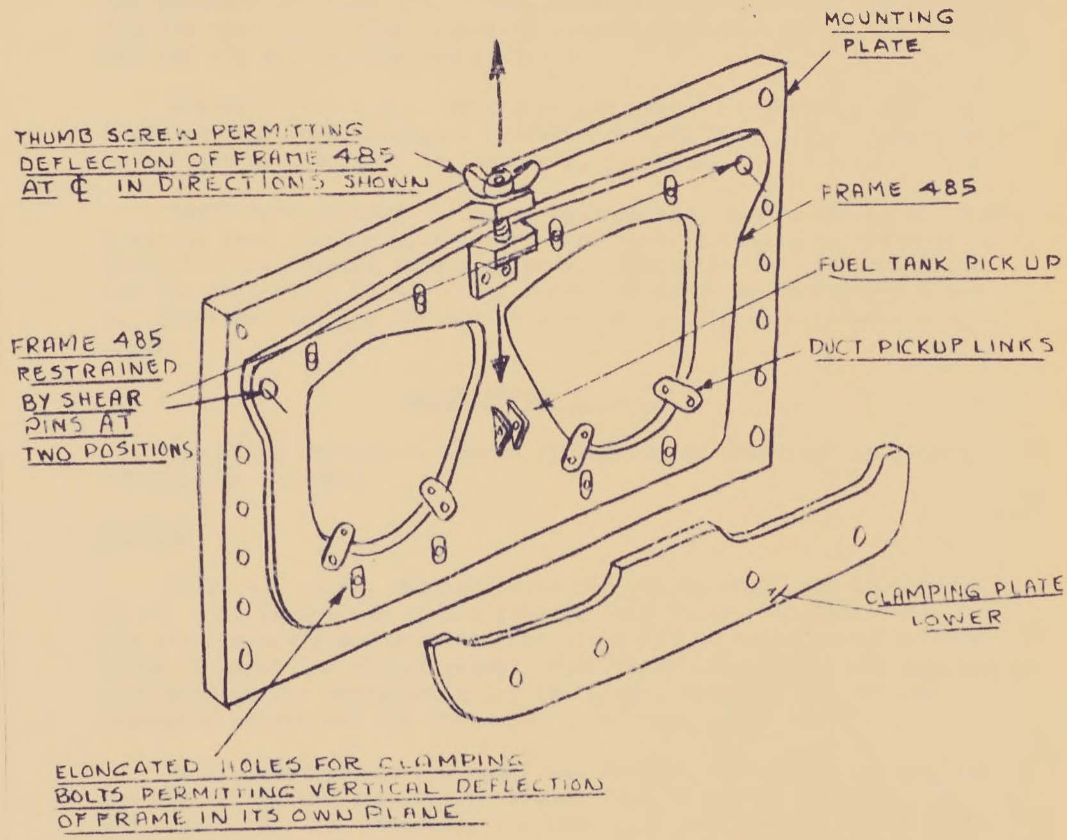


FIG 6 SKETCH SHOWING MOUNTING DETAILS AND METHOD OF APPLYING DEFLECTION TO ℄ OF FRAME 485

Apparatus (Continued)

Instrumentation

Ames or Federal dial gauges were located along the fuselage length at the sidewalls and along the centre line as shown in accompnaying photographs. Additional gauges are shown behind the mounting plate which measured the movement of the plate itself and the movement of frame 485. These measurements were used for correcting the main deflection gauges to account for rotation of the specimen and rig at the mounting position.

One-half inch N.R.C. strain gauges were distributed along the longerons and read through a Baldwin-Southark SR-4 unit. Locations of all gauges are shown in figures 2, 3, and 4.

Loads were applied through a beam balance device acting through a wiffle tree for the distributed fuel tank loads and at a single point for the forward fuselage loads. The manner of applying loads and the deflection to centre of frame 485 is shown in Figures 5 and 6. The model was mounted upside down to facilitate application of loads.

DESCRIPTION OF TESTS

The fixed deflection method of loading as described in report P/Models/46 was used.

General

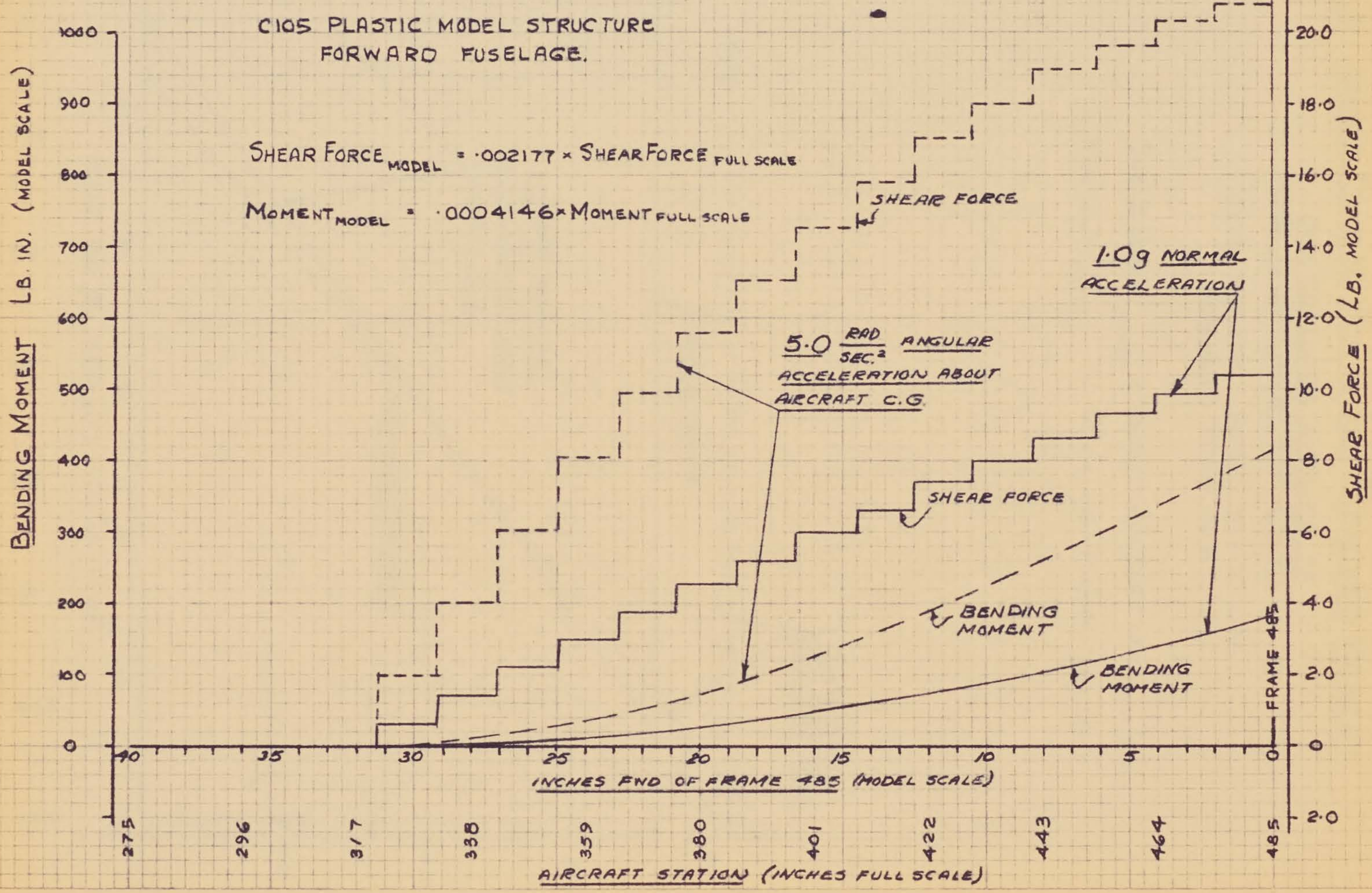
Under all tests, readings were made, at several load increments, of all dial gauges and strain gauges, unit values for deflection and strains being derived from the slope of the reading versus load curve for each individual gauge. Some minor adjustments and repairs were made to the specimen during the tests, however, all results presented herein are for the model in correct condition.

It was possible as the model was designed to remove and replace the pin making the attachment between the aft end of the fuel tank and frame 485. For interest, the test runs were repeated both with and without this pin in place.

Fuel Tank Loads

The distribution of fuel weight was taken from report P/Wts/X7/1600/5 and reduced to model scale. The total load was distributed to fixed loading points in such a way as to closely simulate the actual distribution. A plot of shear force and bending moment as applied to the model structure is given on Sheet 7.

FIG. 7 UNIT SHEAR FORCE AND BENDING MOMENT
DUE TO LOADS APPLIED TO FUEL TANK STRUCTURE



AIRCRAFT C-105 COMPONENT FORWARD FUSELAGE SHEET No. 8 REPORT No. P/Models/48
A.U.W. PLASTIC MODELS DATE July 1955 PREP. BY A.P. Sentance

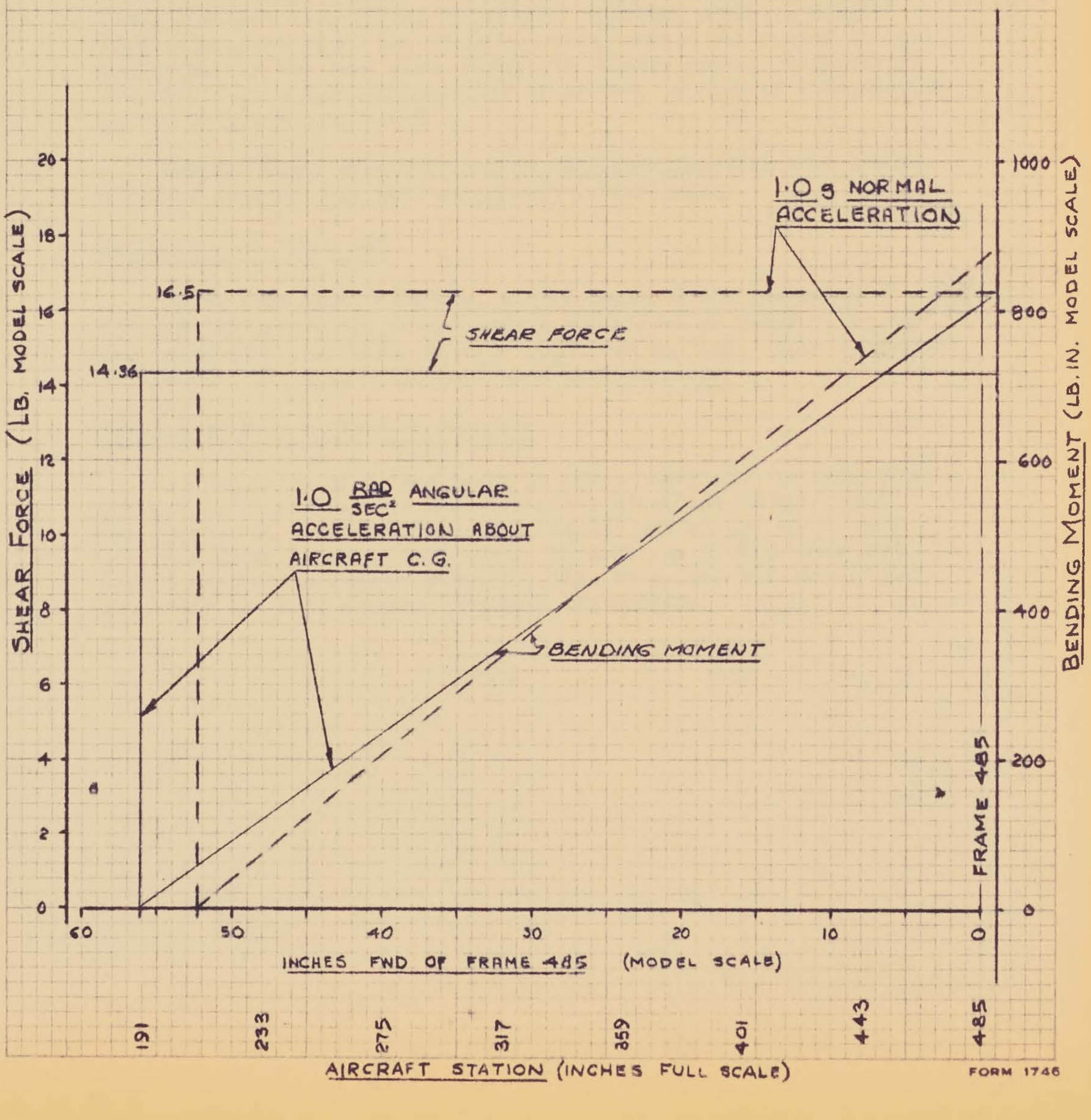
FIG. 8 UNIT SHEAR FORCE AND BENDING MOMENT

DUE TO LOADS APPLIED TO NOSE FUSELAGE STRUCTURE

C105 PLASTIC MODEL STRUCTURE
FORWARD FUSELAGE.

$$\text{SHEAR FORCE}_{\text{MODEL}} = .002177 \times \text{SHEAR FORCE}_{\text{FULL SCALE}}.$$

$$\text{MOMENT}_{\text{MODEL}} = .0004146 \times \text{MOMENT}_{\text{FULL SCALE}}.$$



FORM 1746

Fuel Tank Loads (Continued)

Several test runs were done to determine good average values of results and tests were repeated with the modified condition of the armament bay skin.

Nose Fuselage Loads

The weight distribution of the forward fuselage less armament pack and fuselage fuel was taken from weights report 7-0450-0001, Issue 4 attached to I.D.M. 8543/11/J. At model scale, a single load point forward of the structure being tested was chosen to give approximately the same shear force and bending moment distribution over the test section as actually developed. A plot of this distribution is given on Sheet 8 .

Several tests were run in this configuration with both conditions of armament bay skin attachment investigated.

Deflection at Frame 485

Under this test procedure, and by means of the mechanism illustrated previously, a deflection equivalent at model scale to the calculated deflection at this point was applied. Both conditions of armament bay skin attachment were investigated.

Torsion Applied to Forward Fuselage

A unit value of torque based on preliminary runs to determine a reasonable value within the strength limitations of the model was applied at stations 186.3 (full scale) and at the front spar pick-ups under separate test runs. Repetitions of the tests were made to determine average results. This procedure was carried out only with the full armament bay skin connection.

RESULTS AND DISCUSSION

Calculated Values

At the time of performing these tests, preparation of the theoretical analysis was underway. Results obtained herein were used to some extent in this preparation as a guide to the performance of the structure. At the time of writing, the solution of the analysis was not yet complete so no calculated values are available for comparison.

Experimental Results

For all cases and conditions, plots of deflection and strain distribution as recorded are presented. These plots are best average values taken from several test runs and are for conditions stated on the graphs. Individual results for each test run and curves for each test performed are filed in another volume of this report.

Fuel Tank Loads

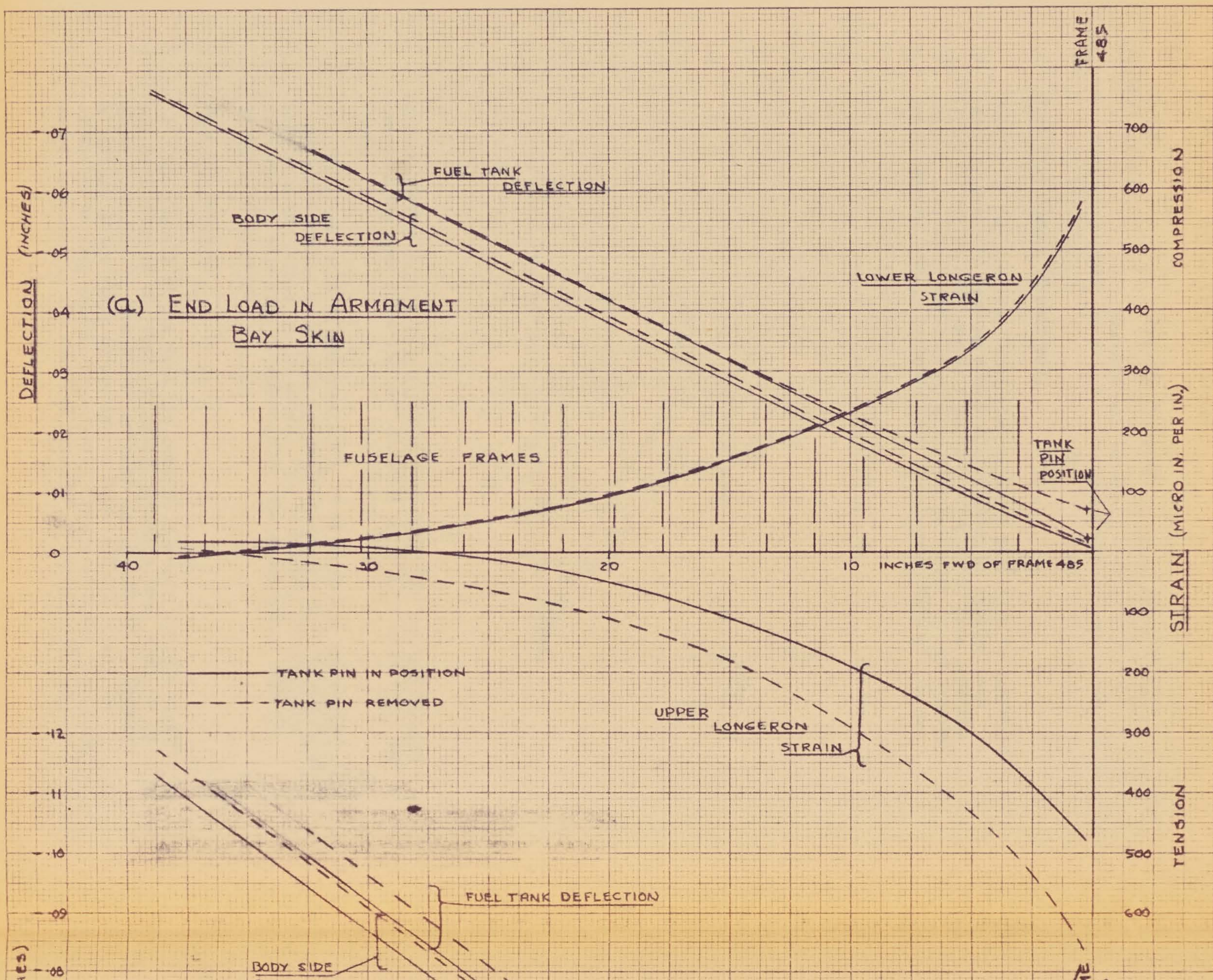
Results are given in Figure 9 for the model equivalent of 5.0 'g' normal inertia acting on the fuselage fuel. Deflections and strain distributions are shown for:-

(a) Armament bay skin attached to frame 485 and carrying end load.
(b) No end load connection in armament bay skin.

The most pronounced difference, of course, is the increased deflection and strain in the lower longeron for the (b) condition, these being in the order of 45 percent greater. The upper longeron strains maintain approximately the same values for both conditions.

The rapid increase in the gradient of the strain curves within three frame pitches of frame 485 is very pronounced and is an indication of the region in which the fuel tank and duct loads are rapidly transferring to the fuselage side walls, as the tank and ducts become ineffective in bending due to the manner in which they are fixed at frame 485.

Of very great interest here is the shape of the elastic curve for the fuselage side walls. It is noted that the deflection line has a constant slope over the entire length to within two or three frame lengths from frame 485. This, of course, is not the bending deflection curve expected and it was thought for a while that the accuracy of measurement was not sufficient to detect the proper curvature. However, repeated tests under fuel load cases showed the same phenomenon. An explanation can be put forth by considering the shear deflection of the side walls. Over the forward


(a) End Load in Armament Bay Skin
FUEL TANK DEFLECTION
BODY SIDE DEFLECTION
LOWER LONGERON STRAIN
UPPER LONGERON STRAIN
TANK PIN POSITION
FUSELAGE FRAMES
FRAME 485
INCHES FWD OF FRAME 485
40
30
20
10
DEFLECTION (INCHES)
.07
.06
.05
.04
.03
.02
.01
0
.12
.11
.10
.09
.08
STRAIN (MICRO IN. PER IN.)
COMPRESSION
TENSION
700
600
500
400
300
200
100
TANK PIN IN POSITION
TANK PIN REMOVED
FUEL TANK DEFLECTION
BODY SIDE

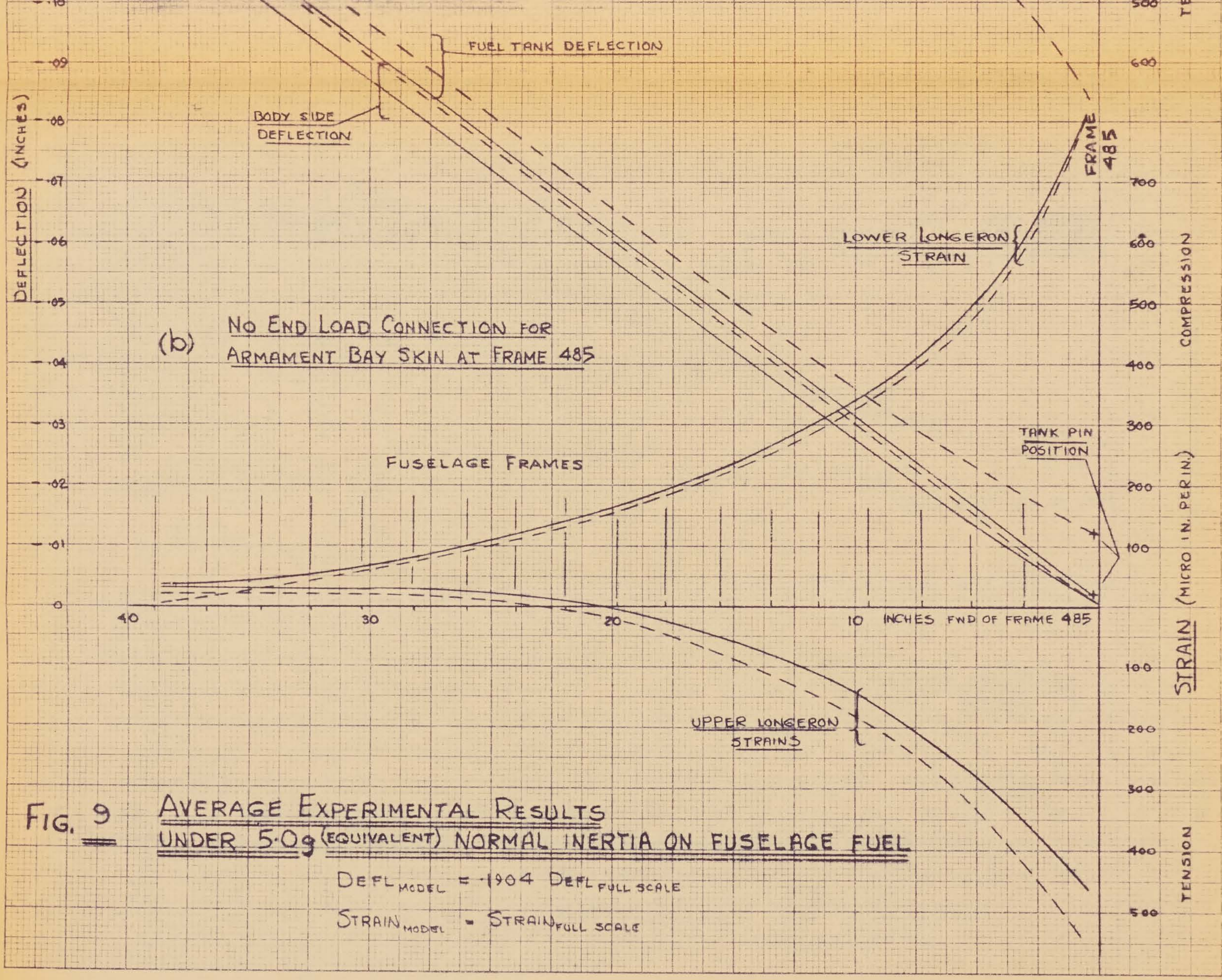


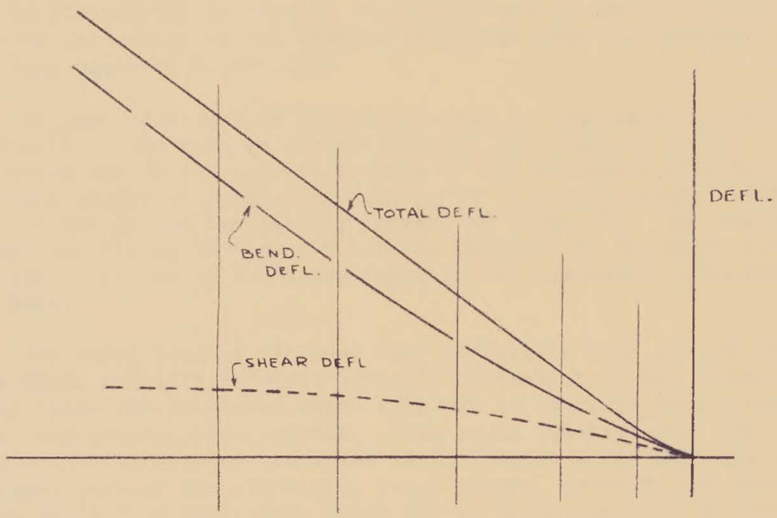
FIG. 9 AVERAGE EXPERIMENTAL RESULTS UNDER 5·0g (EQUIVALENT) NORMAL INERTIA ON FUSELAGE FUEL

$DEFL_{MODEL} = \cdot 1904 \, DEFL_{FULL\ SCALE}$

$STRAIN_{MODEL} = STRAIN_{FULL\ SCALE}$

Fuel Tank Loads (Continued)

portion of the specimen (that portion where the slope is constant) under a shear and bending moment distribution as applied (see Figure 7) the elastic curves from each effect will have opposite shapes, i.e. shear deflection curve will be convex up and bending curve concave. It is probable that the superposition of the two



will therefore result in a straight line until the bending becomes overpowering near frame 485 and produces the slight curve into the frame.

This fact will be substantiated, it is hoped, in the analytical solution but an attempt was made to measure the shear deformation at a few points on the model. Due to extreme difficulties in measuring this type of deformation, the experimental work is of doubtful accuracy.

Tank Pin Removed

The removal of the tank pin results in a considerable vertical deflection of the tank pin or lug position under load, as is shown in Figure 9. The effect of removing the pin is to destroy a portion of the shear connection to frame 485 and reduce the effective bending section immediately forward of frame 485 by the amount provided by the end load capacity of the pin and lugs.

Fuel Pin Removed (Continued)

Since the pin is relatively near to the neutral axis of the section, the effect on the shear stiffness will be greater than that of the bending. This seems to be substantiated in the fact that the straight portion of the fuselage elastic curve persists to a slightly closer point to frame 485, i.e. the bending curvature does not become overpowering so soon. The total deflection at the forward end is greater due to pin removal in the (b) condition because the pin forms a greater percentage of the section stiffness with the armament bay end load connection destroyed.

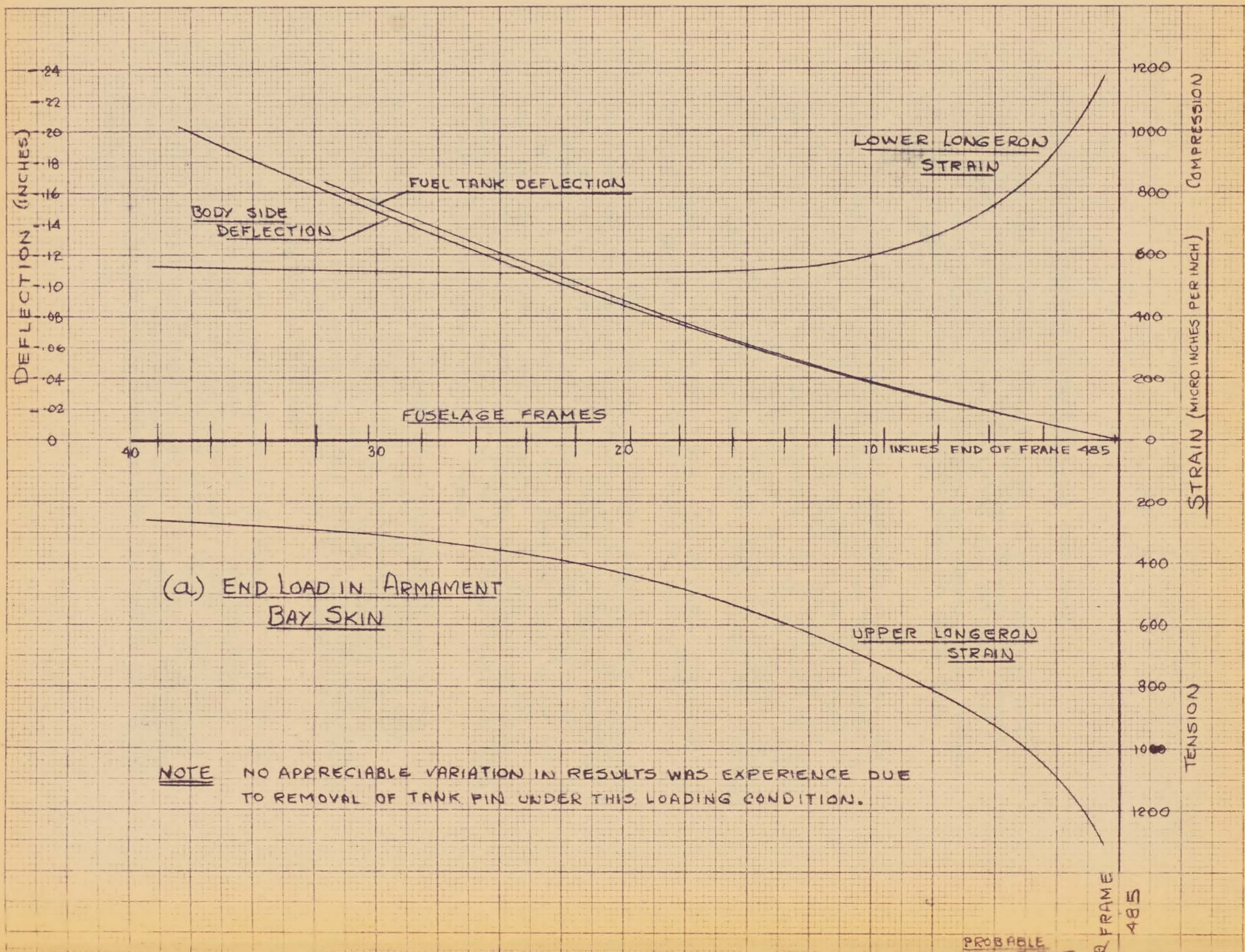
Without considerable analytical work on this section, it is difficult to pin down an explanation for the longeron strain variation due to pin removal because of the secondary effects of movement of the pin position, causing an increased lateral distortion of the frames immediately forward of frame 485. The experimental results as in Figure 9 show an increase in the upper longeron tensile strain while the lower longeron strains remain effectively the same.

The comparison of the fuel tank deflection line and the body side shows a fairly constant lateral deformation of the frames until frame 485 is neared where with pin in position this becomes less, and greater with pin out. This would indicate that the torsional stiffness of the ducts in the region where they are an integral part of the structure, i.e. forward, resists this lateral frame deflection while near frame 485 at which position no torsional restraint of the ducts exists this resistance drops off (in the pin out condition). The pin itself, of course, when in, provides a torsional restraint to the frames due to its ability to take vertical load.

This effect prompted the construction of a simple slice of the typical fuselage structure which could be investigated to study in more detail the effect of the ducts on the lateral frame deformation. This work is presented and discussed in Report P/Models/53 .

Normal Inertia Loads on Forward Fuselage

Results are given in Figure 10, for the model equivalent of 2.0 'g' normal inertia acting on the forward fuselage structural weight only. As before, deflections and strain distributions are shown for the (a) and (b) conditions (See Sheet 10).



(a) END LOAD IN ARMAMENT BAY SKIN

NOTE NO APPRECIABLE VARIATION IN RESULTS WAS EXPERIENCE DUE TO REMOVAL OF TANK PIN UNDER THIS LOADING CONDITION.

Normal Inertia Loads on Forward Fuselage (continued)

These show a fairly constant strain in the longerons until the vicinity of frame 485 is reached where the strains increase quite rapidly as the effectiveness of the tank and ducts falls off. The lower longerons were designed as constant stress members and this is substantiated in the region where the whole cross section is effective.

The effect of destroying the end load connection in the armament bay skin is to increase the total deflection, the majority of this effect coming in an increased curvature of the deflection line as frame 485 is approached and the end load in the armament bay skin is diffused into the lower longerons. It is indicated by the longeron strain curve and the deflection curve that this diffusion starts about 9 frame positions forward of frame 485 at which point the lower longeron strains increase more rapidly in the (b) condition.

As previously, the upper longeron strains remain effectively the same as regards value and distribution for both conditions.

In this case where the bending moment is about three times more powerful, as compared with vertical shear force, than in the fuel load case, an elastic curve of gradually increasing curvature as expected results. The application of the point load to the forward end of the structure being such that the shear enters the representative structure approximately at the fuel tank sides or more correctly along the air-conditioning compartment side walls, results in the greater deflection of the fuel tank forward end with lateral deflection of the fuselage frames.

As indicated on the graphs, no measureable difference was experienced for pin in and pin out conditions in this test case. This is understandable with no direct load being applied to the fuel tank and with the tank pin position being near the bending section neutral axis and having little effect on the bending stiffness. Due to the manner of applying load, the shear deflection effect is negligible in this case.

It is felt that lower longeron strain values at frame 485 as recorded and averaged for tests in the (b) condition should be higher, 1300 to 1400 micro inches per inch instead of 1150 as plotted. This would agree with the general higher strain values recorded at positions forward of 485 for this case. These tests were among the last conducted and definite indications in results show that the strain gauges concerned were starting to give faulty readings.

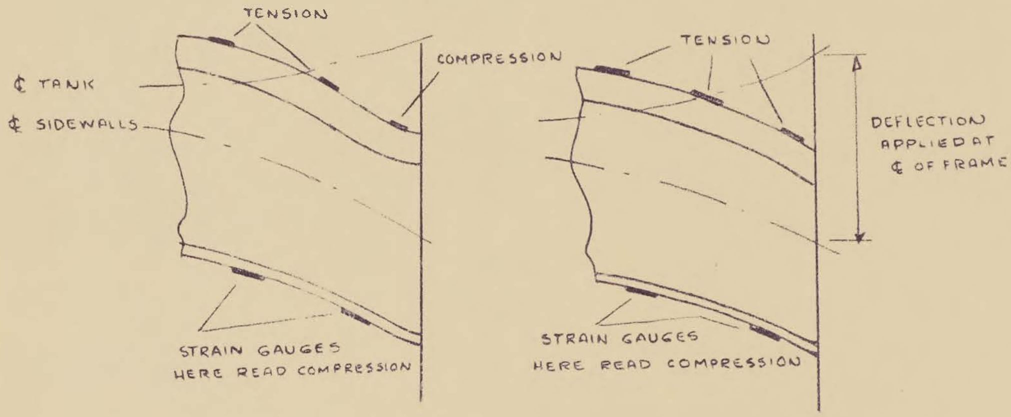
Deflection at Centre Line of Frame 485

Fuselage deflection and longeron strain distribution for this case are shown in Figure 11 for the (a) and (b) conditions.

The fuel tank being pinned to frame 485 at the frame centre line results in the applied deflection at the wing spar modified by the deflection of the centre member of frame 485 being applied to the aft end of the tank. The applied deflection was .095 inches at model scale and the pin position on the graphs show a deflection of .072 and .076 for (a) and (b) conditions respectively, indicating a compression deflection in the frame central member of the difference. In condition (a), the deflection curves indicate equal stiffness of tank and fuselage as their elastic curves are almost equal but in opposite directions. With the srmament bay skin detached the curves show less stiffness in the fuselage, hence a greater curvature near frame 485 resulting in a definite rotation of the forward fuselage structure, the fuselage movement in (a) having been approximately parallel.

Both deflection and strain curves indicate that the effect of the forced deflection of frame 485 carries forward in the fuselage structure for ten or so frame pitches before it dies out to almost negligible value, the severest effect being experienced, however, over the first five fuselage frames forward of station 485.

It is indicated in the (a) condition that the lower longeron strain developes a violent reversal in the proximity of frame 485. This is explained by the fact that the depth of the longeron is considerable and with the armament bay skin fully connected to frame 485 the lower longerons were fully built in to the frame, whereas the much smaller upper longerons acted as effectively pinned at 485 or, with their much reduced stiffness in a vertical plane the effect of being built in was so local to frame 485 that it waa not picked up with the strain gauge positioning used. An exaggerated sketch below shows the probable effect.



(a) LONGERON BUILT IN TO FRAME (b) LONGERON FIXITY DESTROYED

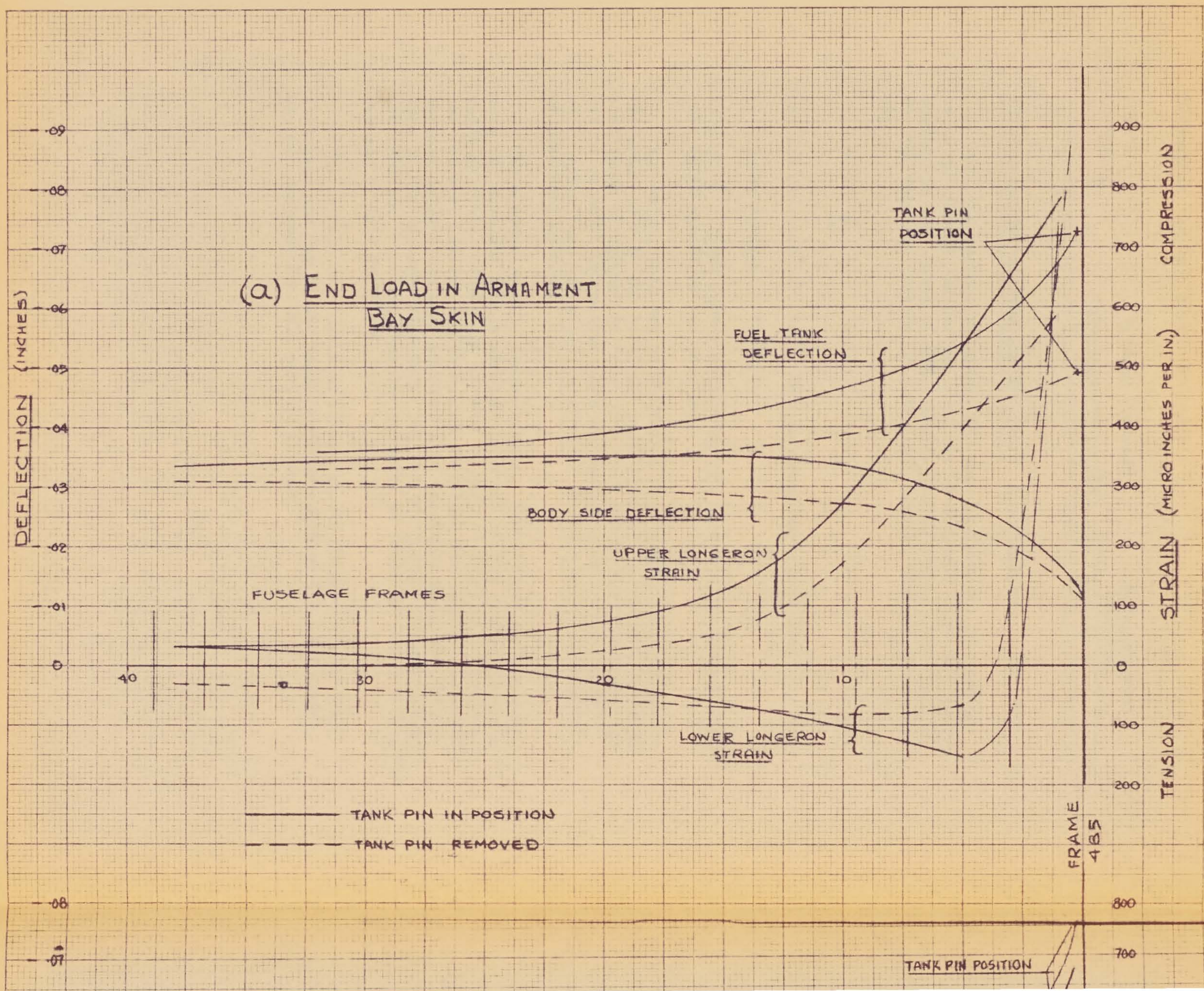
When the armament bay skin was disconnected from frame 485 for the (b) condition, the built in effect of lower longeron was reduced or destroyed and the high tension strain recorded.

Fuel Tank Pin Removed

The effect of removing the tank pin was mainly to reduce the deflection of the tank and hence that of the fuselage and to reduce the longeron strains. Tank deflection persisted, however, due to secondary longerons and intercostals at the tank top and bottom which still maintained their connection to frame 485. The tank deflection in the (b) condition pin-out is far less due to the absence of the intercostal and skin connections at the bottom of the tank.

Torsion Applied to Fuselage Structure

Figure 12 shows results for a unit torque applied at (a) the front spar pick-ups, and (b) an arbitrary point forward of the representative structure.


(a) END LOAD IN ARMAMENT BAY SKIN
DEFLECTION (INCHES)
.09
.08
.07
.06
.05
.04
.03
.02
.01
0
STRAIN (MICRO INCHES PER IN.)
COMPRESSION
TENSION
900
800
700
600
500
400
300
200
100
0
100
200
40
30
20
10
TANK PIN POSITION
FUEL TANK DEFLECTION
BODY SIDE DEFLECTION
UPPER LONGERON STRAIN
LOWER LONGERON STRAIN
FUSELAGE FRAMES
FRAME 485
TANK PIN IN POSITION
TANK PIN REMOVED

Torsion Applied to Fuselage Structure (continued)

From the deflection curves for both conditions, an average twist of .000208 radians per inch can be deduced. From the torque applied in both cases of 891.2 lb.in. (model scale) a value of GJ for the fuselage section of 4.28×10^6 results from the relationship

$$\theta = \frac{T}{GJ}$$

For $G = .13 \times 10^6$ lb./in.^{2} (Ref. National Research Council).

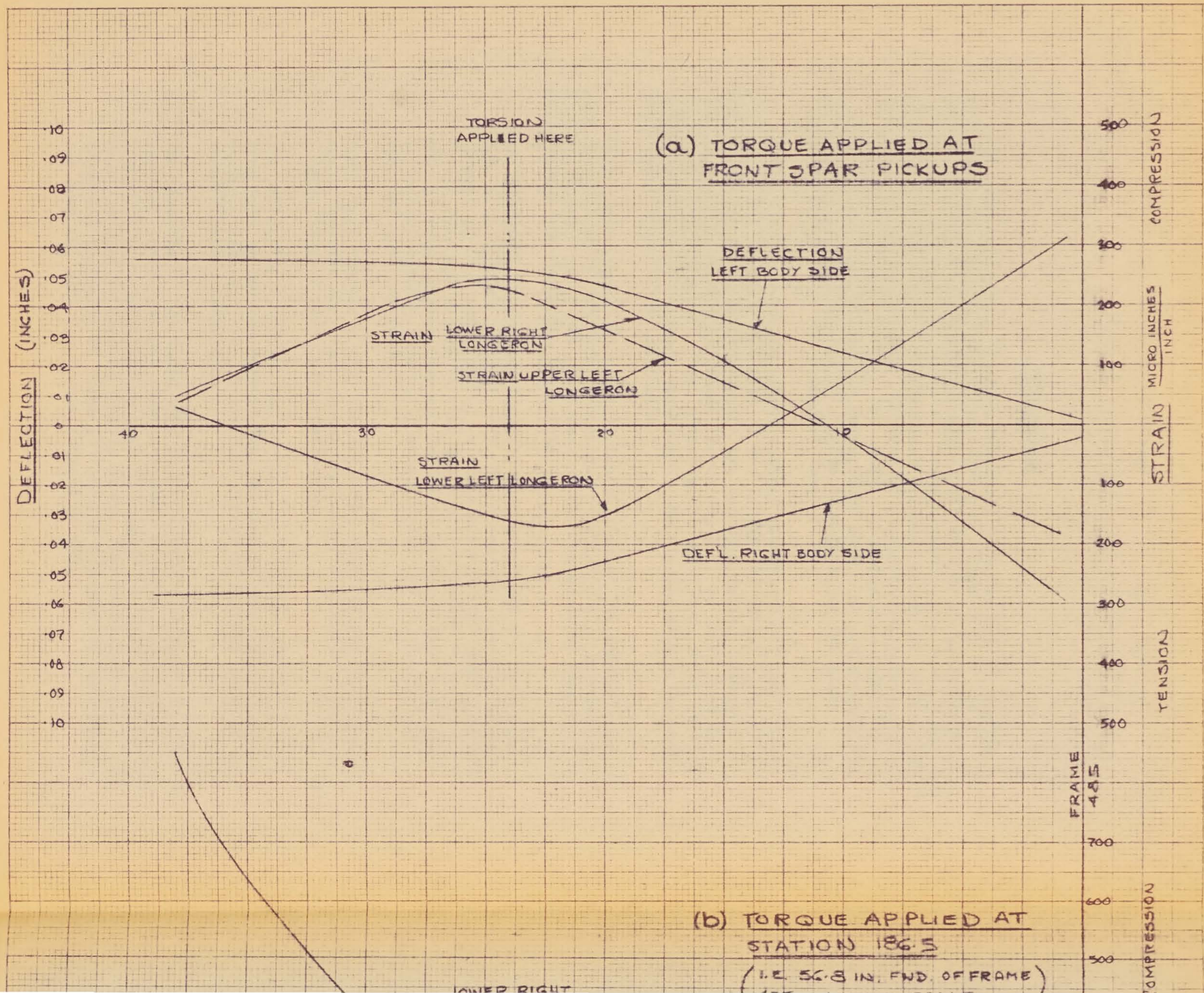
J for section = 33 in.^{4}

from which a first approximation for the torsional stiffness of the full scale structure was obtained.

As stated, this was an incidental test conducted to determine the order only of the torsional stiffness, as it was felt that the conditions of support at frame 485 could not be fully defined. The method of mounting neither allowed freedom to warp at frame 485 as in actuality, nor could it possibly be fully built in because of practical reasons.

The plotted results indicate this. The deflection line for case (a) develops into a straight line aft of the load application point as would result from freedom to warp at frame 485, however, the longeron strains indicate that curvature must exist. Case (b) wherein deflections were measured more carefully shows the curvature of the fuselage side walls and the appropriate longeron strain distribution resulting from the clamping of frame 485 which restricts warping at this position.

The extreme high peaks of strain at the forward end of the structure are due to the means used for applying the load which was not designed for this particular case.


K+E 10 X 10 TO THE ½ INCH KEUFFEL & ESSER CO. 359-11L
(a) TORQUE APPLIED AT FRONT SPAR PICKUPS
TORSION APPLIED HERE
DEFLECTION LEFT BODY SIDE
STRAIN LOWER RIGHT LONGERON
STRAIN UPPER LEFT LONGERON
STRAIN LOWER LEFT LONGERON
DEF'L. RIGHT BODY SIDE
DEFLECTION (INCHES)
STRAIN MICRO INCHES / INCH
COMPRESSION
TENSION
FRAME 485
40
30
20
10
(b) TORQUE APPLIED AT STATION 186.5
(I.E. 56.8 IN. FWD. OF FRAME)

CONCLUSIONS

The model structure has been subjected to a variety of loading conditions as described herein and sufficient repetition of tests carried out to give fair average values of performance under those loads. The testing procedure as followed, wherein some testing was done previous to finalizing the theoretical analysis, gives much aid in the development of that analysis. Results of a qualitative nature only are necessary for this work as the analyst is interested primarily in checking or establishing his assumptions as to the performance of the structure under load and in a guide to separating the major elastic phenomena from the secondary ones.

As previously, without proper control of atmospheric conditions, with which the elastic constants of the plastic materials vary, absolutely correct quantitative results are not obtainable. However, sufficiently accurate corrections can be made, it is felt, from an approximate knowledge of actual atmospheric conditions, which existed during each test, to compare numerically the results with calculated values when these become available.

Since this report is primarily descriptive of the observations made during test of the model structure, no attempt will be made to draw conclusions as to the efficiency of the design other than to re-emphasize the following few points:-

1. The structure as tested definitely indicates that the fuel tank and ducts form an integral part of the bending structure in the forward portion and in doing so cause concentrated shear transfer to the fuselage sidewalls over the last few frames forward of 485, at which region they are forced to give up these loads due to lack of bending continuity across frame 485 on the part of the fuel tank and ducts.

2. Under fuel inertia loads, the deflected shape of the structure would indicate the great amount that shear deflection plays as a proportion of the elastic deflection.

3. The deflection forced at the centre line of frame 485 under wing bending induces differential bending between the tank and fuselage side walls which persists for about ten bay lengths forward before dying out.

4. The presence of the ducts adds to the lateral stiffness of the fuselage frames through virtue of their torsional stiffness. This effect is investigated more thoroughly in report P/Models/53. This, of course, ties in with 1. above. The ducts have no torsional restraint at frame 485 and the majority of load comes off over the last few frames forward of 485.

CONCLUSIONS (Continued)

5. The effect of the fuselage tank pin and its removal are as might be expected. Under fuel tank loads, the pin forms an important vertical shear connection to frame 485 which when removed throws additional loads onto the fuselage side walls through the fuselage frames. Under forward fuselage loads, primarily bending moment, the effect of removing the pin is negligible because of its proximity to the neutral axis of the bending section whereby it adds nothing to the bending resistance of the section.

6. The destruction of end load continuity in the armament bay skin has the obvious effect of reducing the bending stiffness of the section as frame 485 is approached.

REFERENCES

Fuel Weight Distribution from	P/Wts/X7/1600/5
C-105 Fuselage Weight Distribution	Report 7-0450-0001/4 Memo 8543/11/J
Inter-Departmental Memorandum	4746/31/J
Requisition for Test	R.T. No. 08-329 Addendums 1 & 2
Advance Test Results	A.T.R. No. 2398/1 A.T.R. No. 2398/3
Structural Investigation of a 3% t/c Ratio Multi-Spar Plastic Model Fin	P/Models/46 or 60