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REPORT ON ACCIDENT TO  
AVRO ARROW 1 - 25201  
PART 2

June 11, 1958

71/ENG PUB/10



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REPORT ON ACCIDENT

TO

AVRO ARROW 1 (25201)

PART 2

Classification cancelled/changed to.....

by authority of.....(date).....

on Signature.....Rank.....

11 June 1958

at

MALTON

Report No. 71/ENG PUB/10

Compiled By

*P.C. Ingley*

Approved By

*A. Higgins*  
*C. Ambow*

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NOTE

This Report is in two parts. Part 1 contains details of the accident and the investigation into the cause. Part 2 contains details of damage to the aircraft resulting from the accident, and details of the necessary repairs.



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## 1. INTRODUCTION

Part 1 of this report details the cause of malfunction of the L.H. landing gear which caused the accident to aircraft 25201, on landing at the completion of flight 11.

When the left-hand wheel struck soft ground, it is assumed that the following sequence of events took place and caused extensive damage to the aircraft:

- (a) The left-hand main landing gear collapsed and was torn from its bearing housings in the wing. (See Figure 17 - Part I of Report).
- (b) The nose landing gear twisted out of its attachments below the flight observer's bulkhead, and collapsed, causing damage to the nose wheel bay.
- (c) The right-hand main landing gear broke away at the top of its wheel bogey.
- (d) Due to its forward momentum, the aircraft pivoted about the right-hand landing gear stub causing it to drop upon the left-hand air intake ramp and the rear fuselage. The left wing tilted downward, so that the wing tip and aileron struck the ground.

The position of contact with the ground is shown in Figures 23 and 24.



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## 2. SALVAGE METHOD

In order to conduct salvage operations, the aircraft had to be lifted so that a low float could be positioned under the fuselage.

The hoisting sling (part no. 7-2700-6) is designed to attach to four pickup points in the airframe. The two forward points are tapped receptacles, located on top of each air intake duct (26.25 inches each side of aircraft  $\bar{c}$ ) and at station 256.125 just aft of the intake opening. The sling is designed to screw into these receptacles. The two aft pickup points are the cross-shafts in the upper part of each of the main landing gear legs. Two metal straps from the sling are inserted through two emergency holes in the top of the wing, and are looped around each landing gear cross. (station 589.97).

However, since the left-hand landing gear had been sheared off, the approved sling could not be used. Consequently it was decided to use three cranes to hoist the aircraft. Two holes were cut in the wing skin. One crane was attached to the right-hand landing gear cross-shaft to lift the right-hand wing. A second crane, using emergency tackle and air bags, was required to lift the left-hand wing. The third crane was attached to the two forward pickup points.

The aircraft was lifted and transported to the hangar where the instrument pack, batteries and liquid oxygen were removed. The residual fuel was made inactive with dry ice before the damage survey was started.



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### 3. SURVEY OF DAMAGE

3.1 The initial survey revealed the following damage: (see Figure 25).

- (a) Left-hand main landing gear torn out of its housing.
- (b) Right-hand main landing gear broken at top of wheel bogey.
- (c) Nose landing gear torn out of attachment fittings.
- (d) Rear fuselage buckled and torn, mostly on left-hand side.
- (e) Left-hand air intake ramp buckled at bottom edge.
- (f) Left-hand air intake scoop buckled inside.
- (g) V-struts broken at station 742.0.
- (h) Vertical strut buckled at station 717.36.
- (k) Left-hand main landing gear door buckled.
- (l) Left-hand outer wing leading edge dented.
- (m) Engine bay bottom formers and skin buckled from station 697.0 to station 742.0.
- (n) Inner wing skins over main landing gear pivot housings damaged due to salvage operation.
- (p) ~~Left-hand~~ aileron damaged due to wing striking the ground.

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#### 4. OUTLINE OF REPAIRS

##### 4.1 Examination of Service Equipment

The electrical harness from the left-hand gear was reinstalled, and circuit checks conducted to investigate possible cause of the accident. (Ref. Part 1, para. 3.3)

Damaged areas of the aircraft were then dismantled to assess further damage.

Flying control, radio and hydraulic equipment was removed for structural and functional examination in accordance with "B" aircraft crash procedure.



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#### 4.2 Replacement of Major Parts

The survey indicated that replacement of the following major parts was necessary:

- (a) Left-hand and right-hand main landing gears.
- (b) Left-hand and right-hand main landing gear doors.
- (c) Nose landing gear.
- (d) Nose wheel door.
- (e) Left-hand and right-hand rear engine access doors.
- (f) "Heavy former" at station 697.0.
- (g) "Heavy former" at station 742.0.
- (h) V-strut assembly at station 742.0.
- (j) Front inboard lower boom cap at inner/outer wing joint.
- (k) Bushing for left-hand landing gear front pivot bearing housing.





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#### 4.3 Damage and Repair to the L.H. and R.H. Inner Wings

Damage to the L.H. inner wing did not warrant removal of the outer wings. Radiographs were taken of the main leg pivot fitting, the surrounding structure at the front spar, the drag strut fitting and aft pivot fitting at main spar. (Ref. Appendix 1, Metallurgical Report No. M 5158).

The accident caused elongation of the sleeve insert which carries the main leg pivot forward fitting. The sleeve was removed using heat lamps and dry ice. Examination showed that the bore of the pivot fitting had elongated with the sleeve. The fitting was rebored in situ using a special boring bar. (Ref. Figures 3,4,5 and 6). A modified sleeve was made to fit the rebore, and the internal bore of the sleeve was honed out to suit the pivot shaft.

Radiography and measurement checks indicated that no damage had occurred to the right wing. Figure 26 shows the examination conducted on main landing gear leg attachments.

The R.H. refuelling door surrounding frame structure was replaced.



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#### 4.4 Damage and Repair at Nose Area

Major damage to the nose area was at the attachment of the nose leg pivot mountings to the flight observers bulkhead. In addition, the nose wheel bay skirt and nose wheel door were also damaged. (Ref. Figures 7, 8, 9 and 10).

Repair of the major damage to the nose area was effected by installing a new flight observer's bulkhead and cross beam assembly, below the cockpit floor. A utility jig was fabricated to position the nose leg pivot fittings. Structural repairs were made to nose wheel bay skirt, and nose wheel door.

#### 4.5 Damage and Repair to L.H. Air Intake Ramp

The left-hand air intake ramp was buckled and cracked at the outboard web, and buckled at the inboard web. (Ref. Figures 11 and 12).

Damage to the intake ramp perforated bleed skin was determined by radiography and was repaired in situ by means of a machined patch.

Additional repairs in the ramp lower area were as follows:

- (a) De-icer boot replaced.
- (b) Bottom skin complete with attachment angle beams for the bleed skin and inner skin replaced.
- (c) Ejector scoop front guide vane replaced.

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#### 4.6 Damage and Repair to Rear Fuselage and Engine Bay

Damage was mainly confined to the left-hand side of the rear fuselage and engine bay. (see Figures 13 to 19 inclusive). The L.H. and R.H. rear engine doors suffered damage (Ref. Figure 13) and were replaced.

Figure 14 shows damage to L.H. engine access door and engine bay, just forward of the door. The L.H. engine access door was repaired and L.H. engine bay skin replaced.

Figures 15 and 16 show damage to L.H. engine bay lower surface.

Figures 17, 18 and 19 show damage at forward positions of L.H. engine bay.

Figures 20, 21 and 22 show damage to R.H. engine bay. The skin in these areas was replaced.

The fuselage and engine bay were repaired by replacing formers 697.0 and 742.0 right across the fuselage.

##### 4.6.1 The lower portions of formers at following locations were replaced:

Former Sta. 702.30	(L.H.)
Former Sta. 722.38	(L.H.)
Former Sta. 727.40	(L.H.)
Former Sta. 732.42	(L.H.)
Former Sta. 737.44	(L.H.)





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- 4.6.2 The lower portions of formers at following locations were repaired by splicing in new portions:

Former Sta. 687.65 (L.H.)

Former Sta. 712.34 (R.H.)

Former Sta. 717.36 (L.H.)

The former at station 697.0 was replaced and a new portion of centre skin was spliced in to facilitate this replacement.

Repairs were also made to the L.H. engine shroud stiffeners in the station 742.0 area.

- 4.6.3 Rear Fuselage The centre portion of the former at station 753.0 was repaired by installing a reinforcing doubler, after a distortion was pressed out.



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4.7 Damage and Repair to L.H. Outer Wing

Part of the outer wing leading edge and lower surface were damaged by contact with the L.H. landing gear wheels. (see Figures 1 and 2)

Repairs to this area were as follows:

- (a) Nose ribs 6,7,9, 10 and 11 were replaced.
- (b) New portions of stringers 2 and 3 were spliced in.
- (c) Nose skin between ribs 6 and 14 was replaced.
- (d) New portion of nose skin spliced in between ribs 3 and 6.
- (e) Navigation light fairing and cover replaced.

4.8 Damage and Repair to L.H. and R.H. Main Wheel Bay Roof

Skin repairs were incorporated in each wheel bay roof where holes were cut in each inner wing top skin to facilitate salvage operations (ref. para. 2).

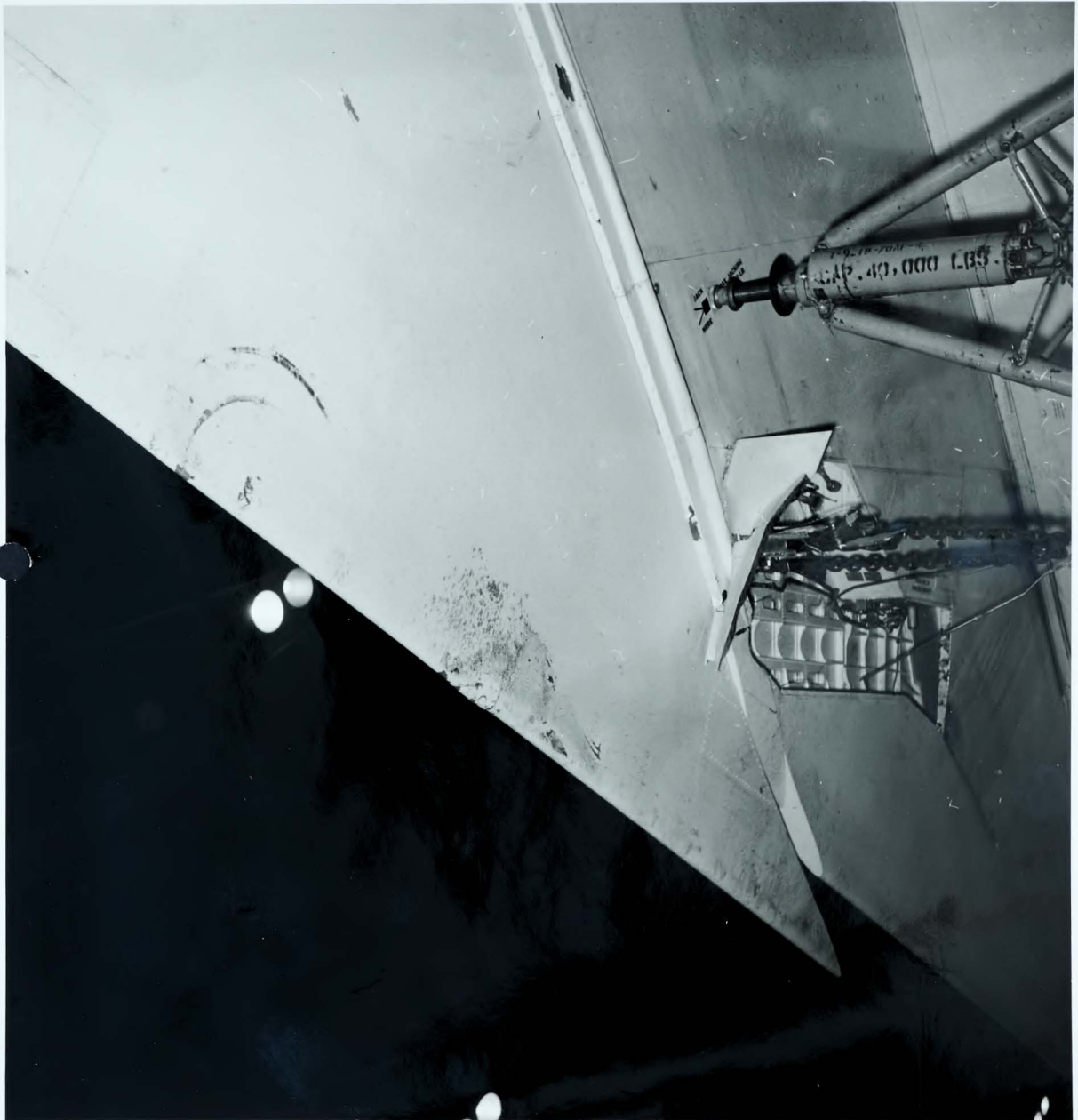
4.9 Damage and Repair to L.H. Aileron

The L.H. aileron outboard end was damaged when it struck the ground, and was repaired by splicing in a new skin portion.

4.10 Damage and Repair to Engine Air Intake Duct

- 4.10.1 The left-hand engine air intake bottom skin was buckled between Sta. 244.0 and Sta. 255.0. The damaged skin portion was cut out and replaced.

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FIG. 1



















































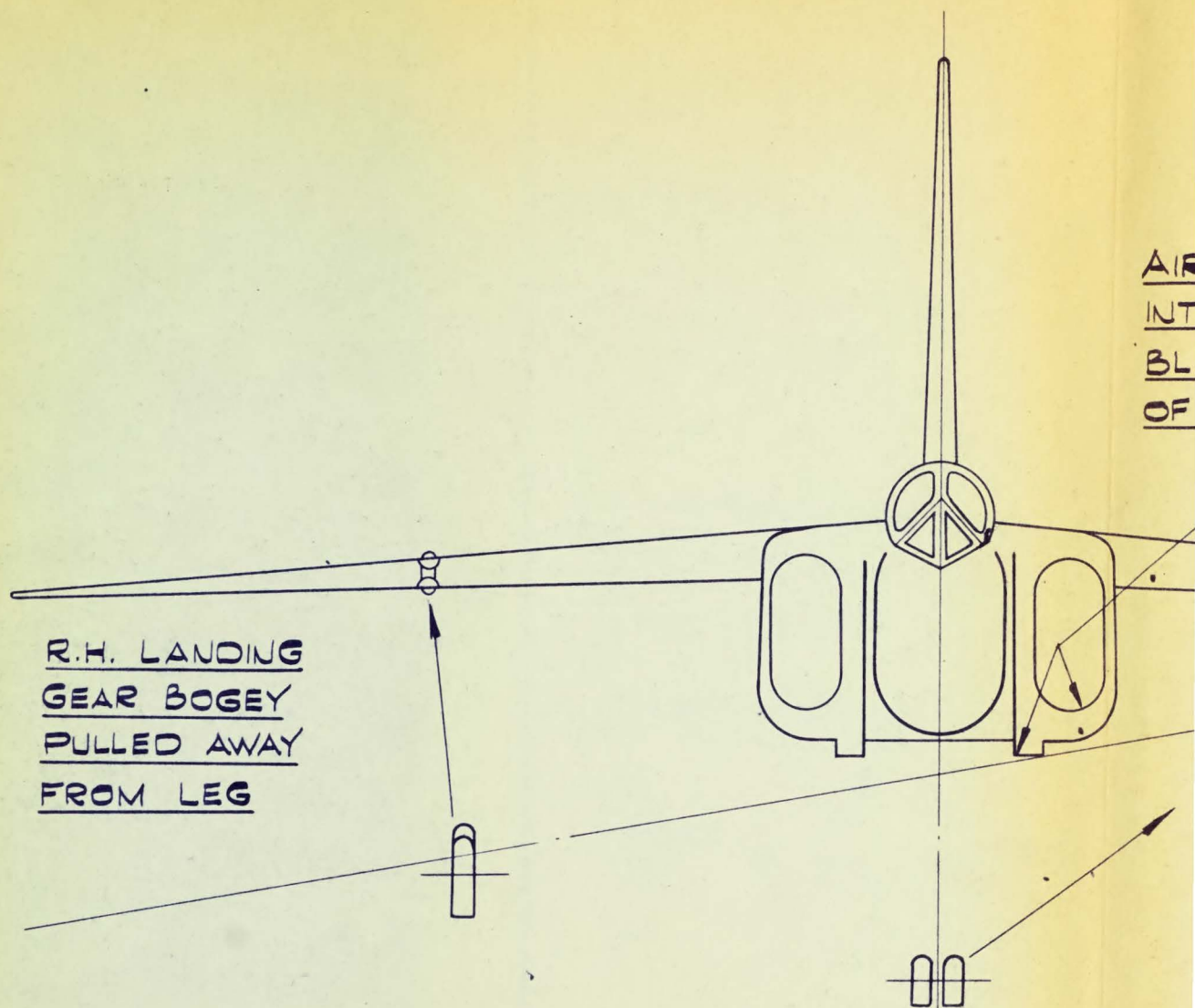






ARROW 1 25201 LAND

AIRCRAFT POSITION



R.H. LANDING  
GEAR BOGEY  
PULLED AWAY  
FROM LEG

NOSE LA  
PULLED  
ATTACHM  
ON NAVIC  
BULKHEAD  
NOSE WH



# 5201 LANDING ACCIDENT

## POSITION - FRONT VIEW

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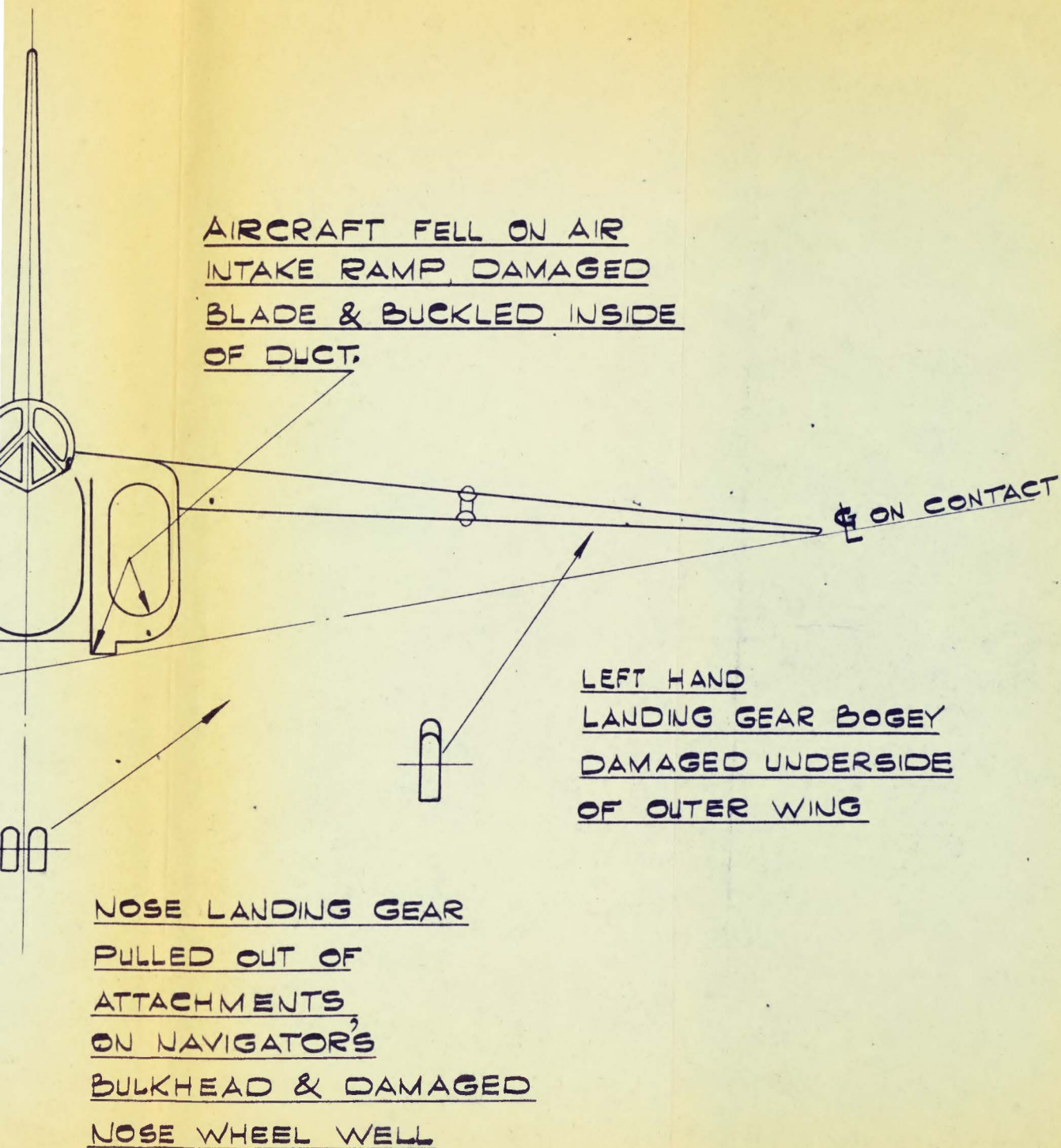
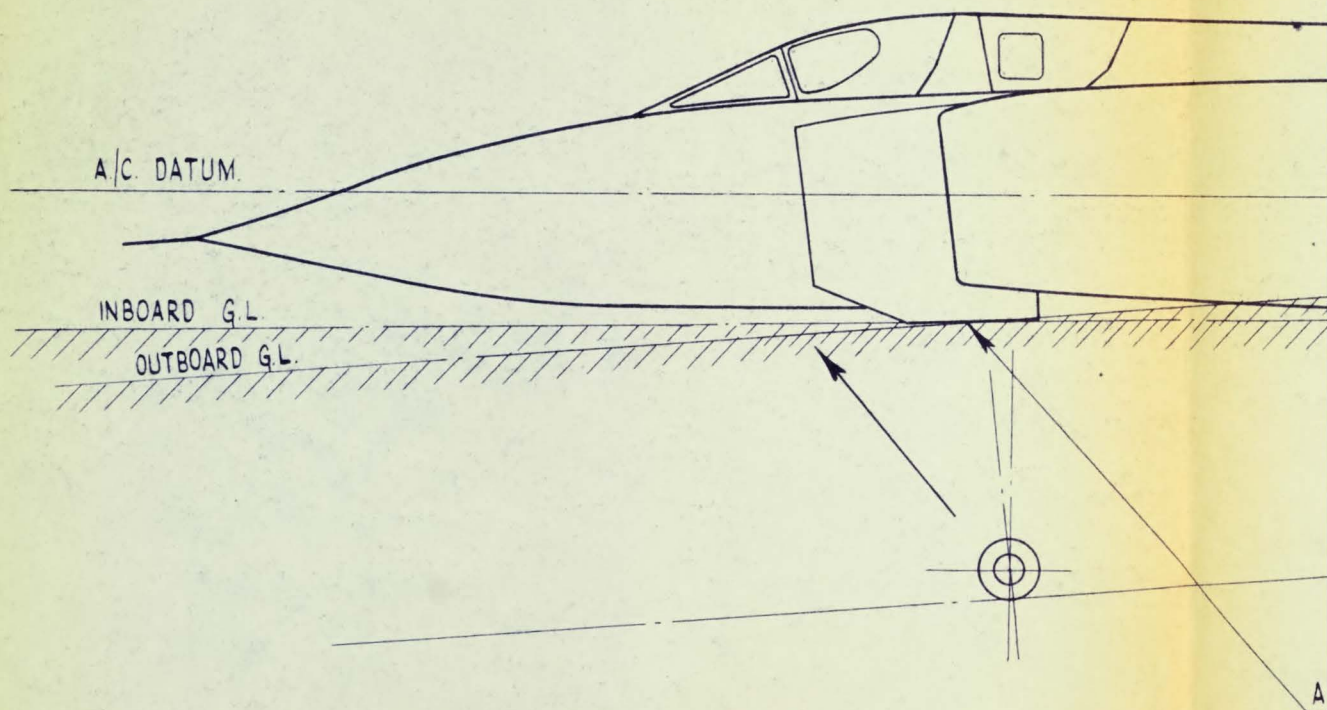


FIGURE 23

A

OUTER  
BY MA





ARROW 1 - 25201 LANDING ACCIDENT.

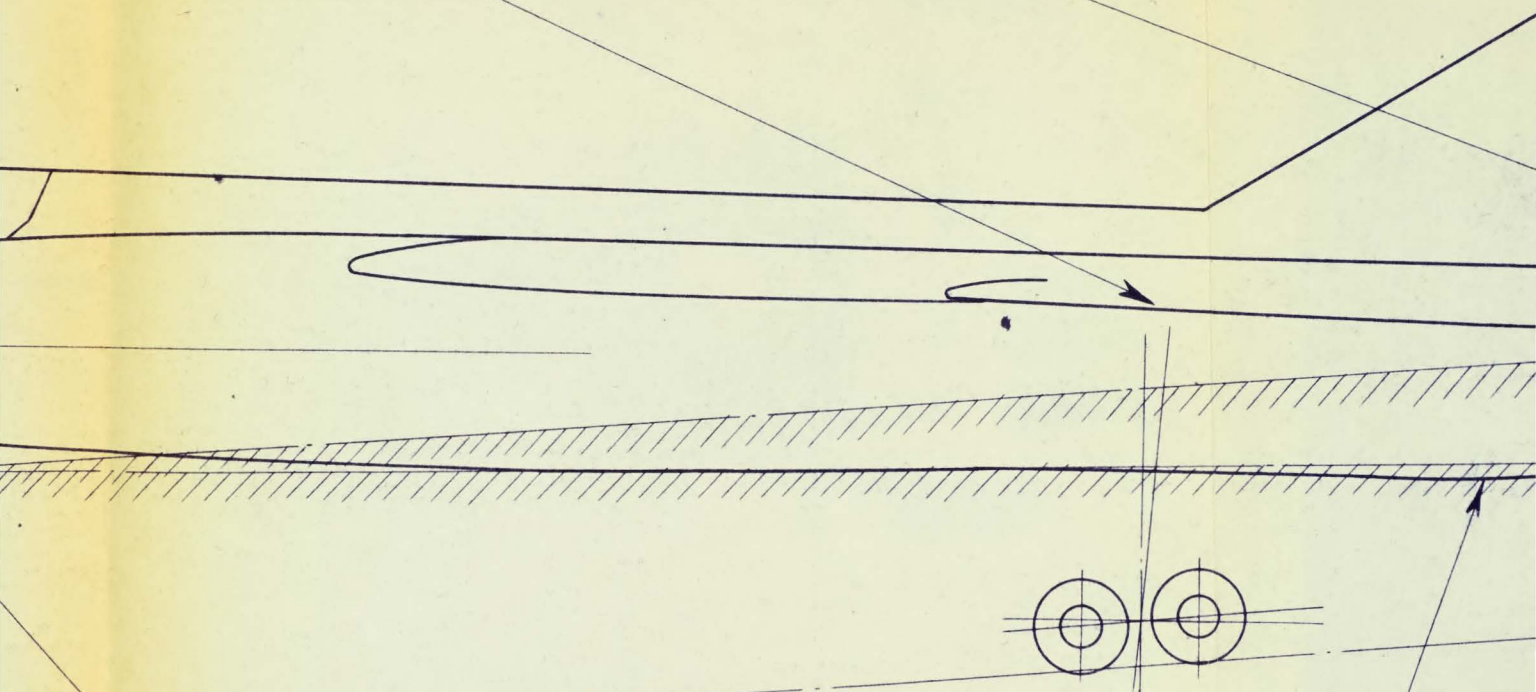
AIRCRAFT POSITION - SIDE VIEW.

OUTER WING DAMAGED  
BY MAIN LANDING GEAR.

SLIGHT DAMAGE TO  
AILERON & WING TIP.

AIR INTAKE RAMP.

ENGINE BAY FORMERS  
LOWER SURFACE BUCKLED.



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W.

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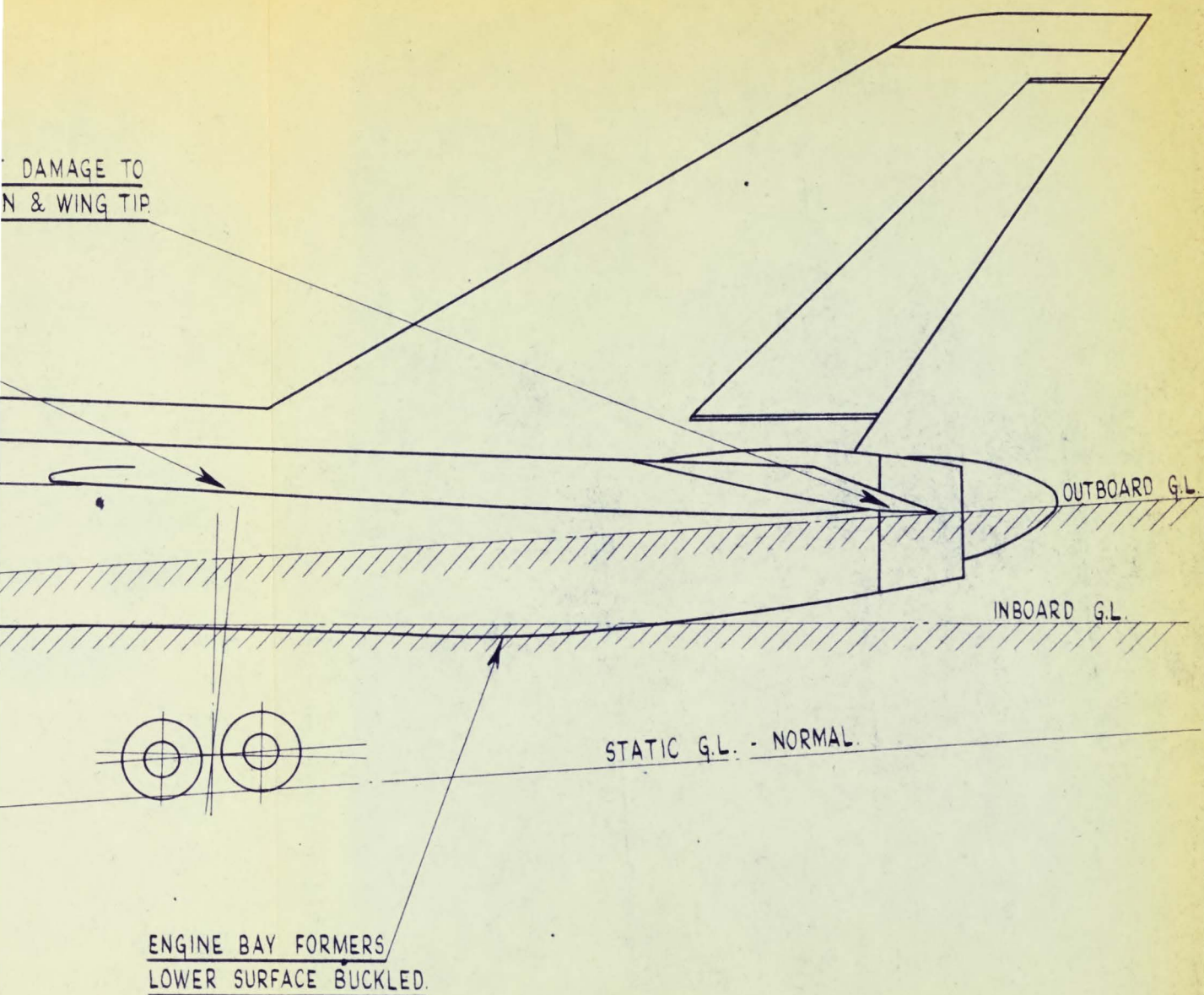
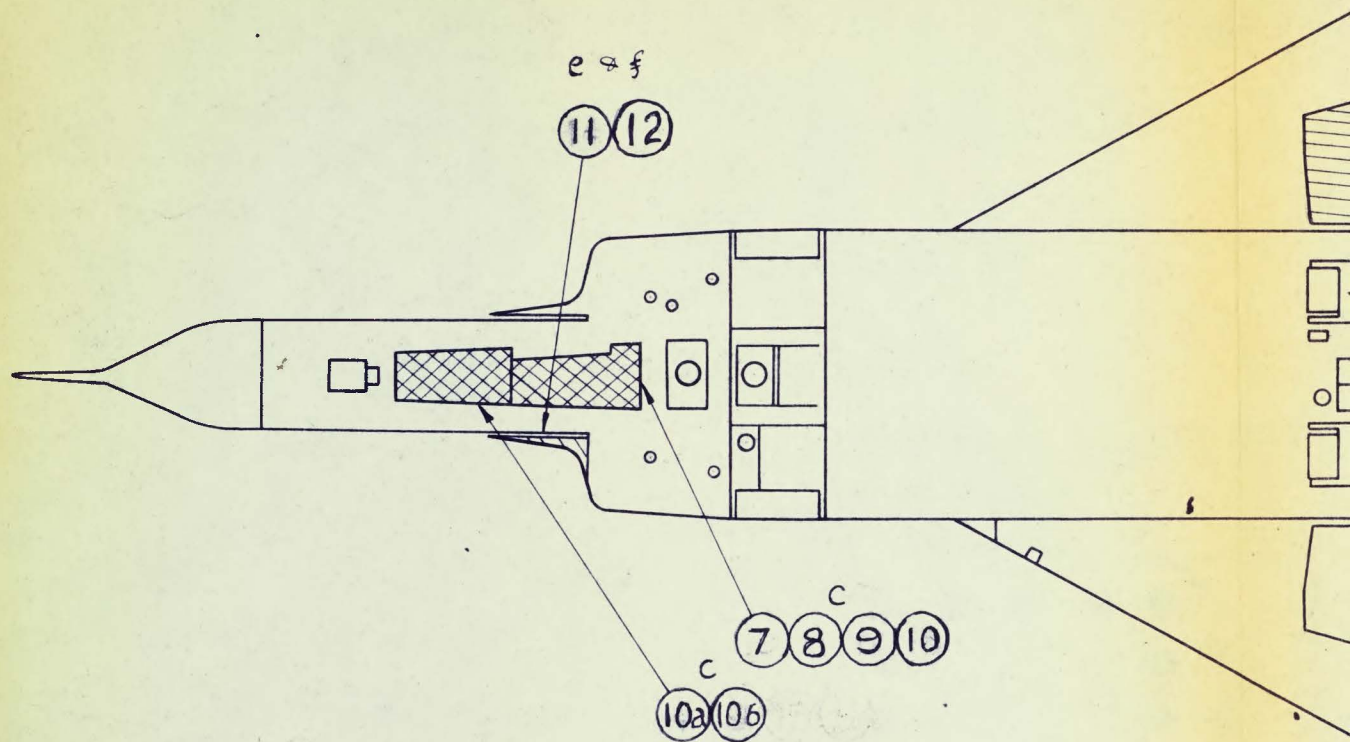




FIGURE 24





LEGEND

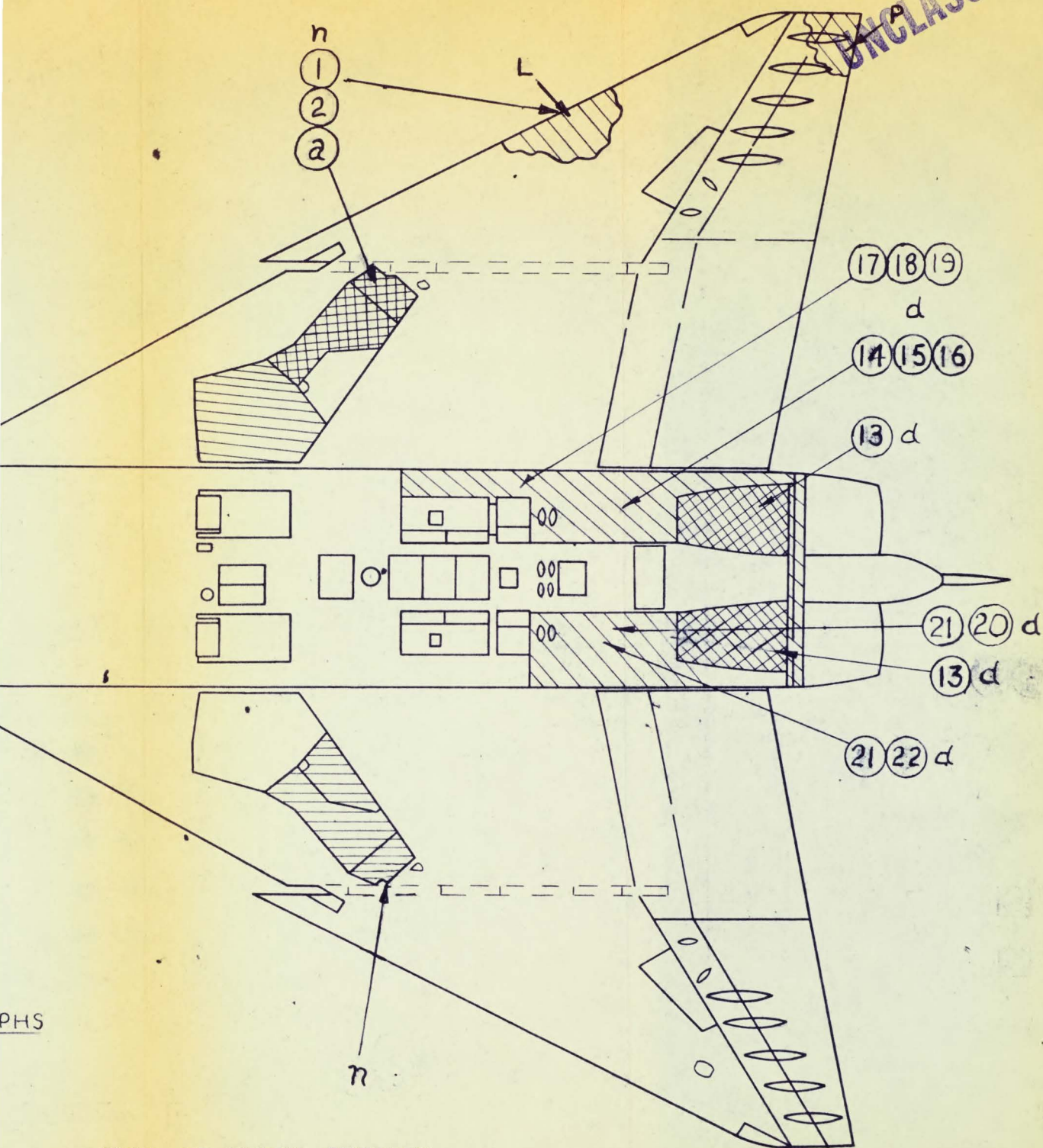
REPAIR BY REPLACEMENT 

COMPONENT REPAIR 

NUMBER INDEX TO PHOTOGRAPHS

LETTER INDEX TO REPORT

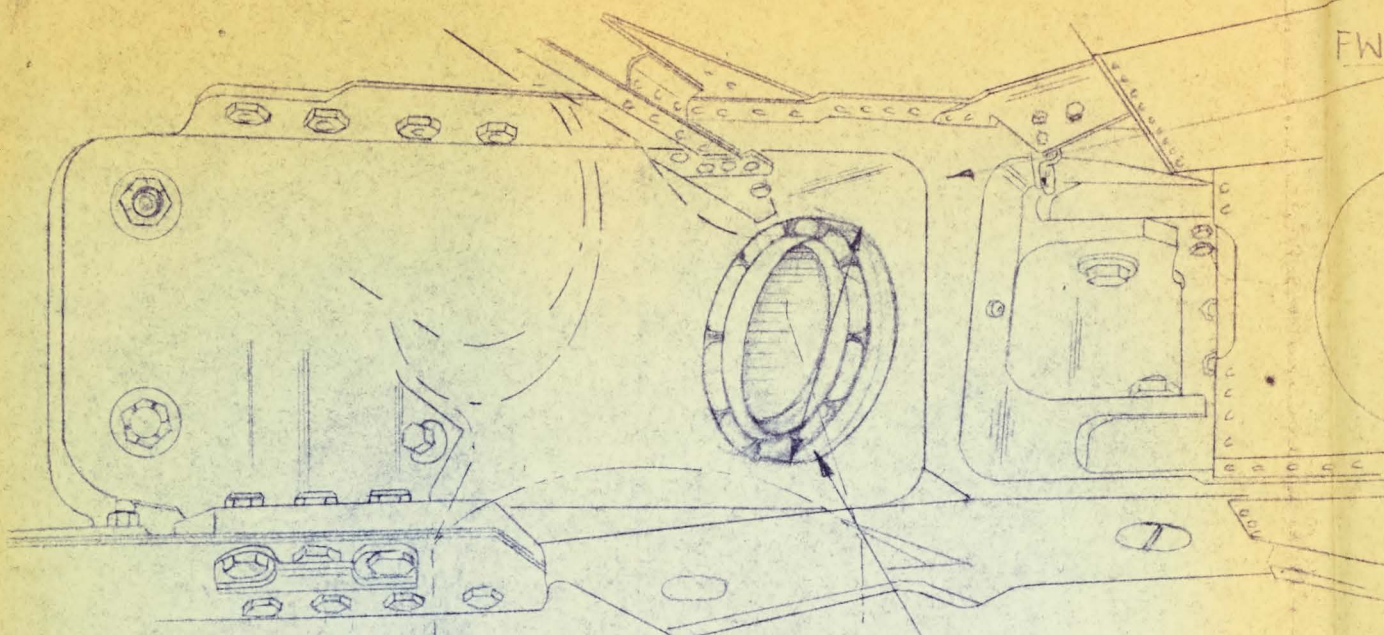
VIEW OF



VIEW OF UNDER SURFACE.

FIGURE 25



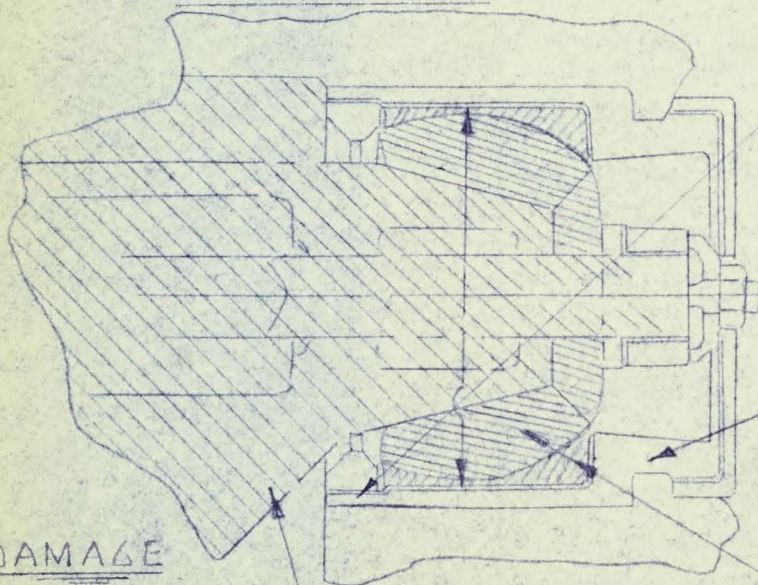


DAMAGE

APPROX. .030 OVALITY  
DIAM. SLEEVE AND PIVOT FTG.  
L.H. SIDE ONLY

DAMAGE

RETAINING RING  
ON SLEEVE DAM  
L.H. SIDE ONLY



DAMAGE

L.H. SIDE SHAFT PULLED OUT

REPAIR L.H. SIDE  
L.H. SLEEVE REMOVED  
PIVOT FITTING REBOR  
NEW D/S SLEEVE FIT

DAMAGE

BEARING BROKEN  
L.H. & R.H. SIDES



FWD. PIVOT FITTING  
AT FRONT SPAR

L.H. AND R.H. SIDES RADIOGRAPHED  
FOR STRUCTURAL CHECK  
WHERE ACCESSIBLE

AREAS X-RAYED

E  
NING RING THREADS  
SLEEVE DAMAGED  
SIDE ONLY

DRAG STRUT FITTING  
MAIN SPAR

AFT. MAIN LEG PIVOT  
MAIN SPAR

L.H. SIDE ONLY  
E REMOVED  
ING REBORED  
SLEEVE FITTED

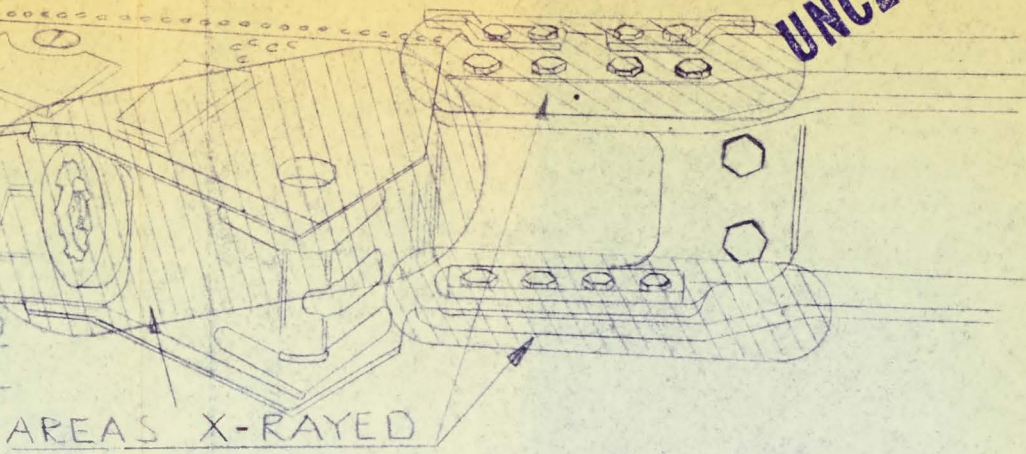
BROKEN  
H. SIDES

BOTH OF THESE FITTINGS REMOVED FROM L.H. AND  
X-RAY AND CRACK DETECTION CARRIED OUT  
AND STRUCTURE

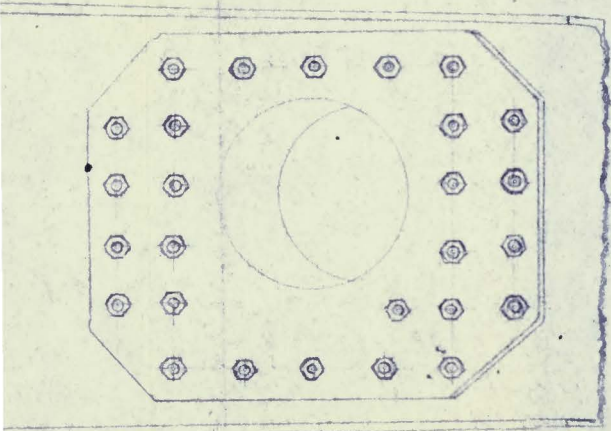


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AFT. MAIN LEG PIVOT FITTING  
MAIN SPAR



MOVED FROM L.H. AND R.H. SIDES  
ON CARRIED OUT ON FITTINGS

FIGURE 26





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S.R.A. 13

TECHNICAL DEPARTMENT

SHEET NO

1 OF 3

AIRCRAFT:

ARROW MK 1  
A/C 25201

REPAIR TO A/C ENGINEERING A.L. Carter  
DISPOSITIONS

PREPARED BY

DATE

July 21, 1958

CHECKED BY

DATE

Stress

ENGINEERING DISPOSITIONS REQUIRED BY INSPECTION

REPORT REF: S.I.R. #393 ISSUES 1 & 2

Numbers on Left refer to tabulation as per S.I.R.

(19) Right Wing Landing Gear Pivot Fitting 7-1062-1568 (at main spar)

Front face of housing is dented two places approx. .500 each, at rim of 4.33 Dia. causing the material to close the .120/.125 wide slot.

Answer

This is acceptable providing the item is crack free and the slot is cleared to drawing dimensions, to accept circlip.

(20) Left Wing Landing Gear Pivot Fitting 7-1062-1567 (at main spar)

Front face of housing is dented over approx. .500 at rim of 4.33 Dia. causing the material to close the .120/.125 wide slot.

Answer

This is acceptable providing the item is crack free and the slot is cleared to drawing dimensions, to accept circlip.

(35) L.H. Outer Wing L/E

Request engineering disposition for rib 6 L/E, slightly buckled at nose area.

Answer

It was later discovered that nose portion of rib has cracked and rib has therefore been replaced.

(36) L.H. Outer Wing L/E

Request engineering disposition for rib 7 L/E, slightly buckled at stringer 1 bottom.

Answer

Rib replaced.

(37) L.H. Outer Wing L/E

Request engineering disposition for rib 9 L/EDGE Buckled at aft end.

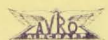
Answer

Rib replaced.



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REPORT NO. S.R.A. 13


 AVRO AIRCRAFT LIMITED  
MALTON, ONTARIO

## TECHNICAL DEPARTMENT

SHEET NO.

2 OF 3

AIRCRAFT:

 ARROW MK 1  
A/C 25201

 REPAIR TO A/C ENGINEERING  
DISPOSITIONS

PREPARED BY

DATE

A.L. Carter

July 21, 1958

CHECKED BY

DATE

Stress

### (40) L.H. Outer Wing L/E

Request engineering disposition for stringer 3 bottom. Bent at rib 6-7 area and fractured at rib 10-11 area L/EDGE.

#### Answer

Carry out repair scheme 7-4765-7.

### (41) L.H. Outer Wing L/E

Request engineering disposition for stringer 2 bottom bent at rib 10-11 area L/EDGE

#### Answer

Repair scheme 7-4765-7 also covers this damage.

### (44) L.H. Outer Wing L/E

Request engineering disposition for abrasions to U/SIDE skin of L/EDGE at rib 23-24 forward area.

#### Answer

Clean off external finish, polish out abrasions as far as possible. Report by memo to repair group, copy to Mr. Mackenzie, Stress, maximum depth of metal removed. Restore flat surface by filling with Epon 828 to process 61. Renew external finish in accordance with CS-D-2.

### (46) L.H. Outer Wing L/E

Request engineering disposition for scores in bottom skin of outer wing and underside of L/EDGE in rib 4-6 area - also score at rib A to rib 1.

#### Answer

Bottom L/EDGE skin replaced. Repair scheme 7-4765-15 provisions for splice between ribs 3 & 4 for replacement of skin from this area to rib 6. Remaining scores to be polished out, crack tested and filled with Epon 828 to process 61. Report depth of score after polishing to repair group and stress as indicated by answer to (44). Renew external finish.

### (47) L.H. Outer Wing L/E

Request engineering disposition for abrasions to bottom skin of outer wing at extreme outer edge and along front spar area to rib 24.

#### Answer

As for (44)

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MALTON ONTARIO

REPORT NO. S.R.A. 13

SHEET NO. 3 OF 3

TECHNICAL DEPARTMENT

AIRCRAFT:

ARROW MK. 1  
A/C 25201

REPAIR TO A/C ENGINEERING  
DISPOSITIONS

PREPARED BY

A.L. Carter

DATE

July 21, 195

CHECKED BY

DATE

(48) L.H. Outer Wing L/E

Request engineering disposition for scores in bottom skin of outer wing at front spar and stringer 1 area and inboard of rib 13.

Answer

Bottom L/E skin replaced in this area.

(49) L.H. Outer Wing

Request engineering disposition for scores in bottom skin of outer wing at stringer 3-4 area between ribs 15 and 16.

Answer

As for (44).

(53) Area of L/H Speed Brake Stn. 485.0 to 534.0

Request engineering disposition for score marks throughout speed brake skin.

Answer

As for (44).

ISSUE 2 OF S.I.R. # 393

(30) Engine Bay Structure

Request engineering disposition for buckle in R.H. engine bay inside skin at sta. 742.50 (looking fwd. area about 8 o'clock) a step exists of about .75 between marry-up positions.

Answer

Buckle in lower shroud skin due to rivets being omitted during production for attachment of shroud skin to stiffeners. Rivets to be inserted at missed pitches in accordance with drawing 7-1058-5311/2. Step in shroud to be re-checked by A. Carter after removal of distortion in diaphragm at 'A' brace in rear fuselage.

(32) Engine Bay Structure

Request engineering disposition where L.H. engine bay shroud is buckled between sta. 717 and 742 inboard side.

Answer

Carry out repair scheme 7-4758-55.



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MALTON, ONTARIO

## TECHNICAL DEPARTMENT

AIRCRAFT  ARROW MK. 1 A/C 25201	COMPLETE A/C	REPORT NO. <u>S.R.A. 15</u>  SHEET NO. <u>1 of 2</u>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">PREPARED BY</td> <td style="width: 50%;">DATE</td> </tr> <tr> <td>A.L. Carter</td> <td>July 29, 1958</td> </tr> <tr> <td>CHECKED BY</td> <td>DATE</td> </tr> </table>	PREPARED BY	DATE	A.L. Carter	July 29, 1958	CHECKED BY	DATE
PREPARED BY	DATE								
A.L. Carter	July 29, 1958								
CHECKED BY	DATE								

### REPAIR SCHEMES FOR A/C 25201

The following repair schemes cover S.I.R. 393 up to issue 18 for damage due to landing accident on June 11, 1958. This completes repair scheme coverage for this aircraft as required by assignment X73-4116.

<u>REPAIR SCHEME NO.</u>	<u>TITLE</u>	<u>S.I.R. 393 (Ref.)</u>
--------------------------	--------------	--------------------------

#### FRONT FUSELAGE

7-4752-8	Repair splice lower longeron-nose wheel bay	
7-4752-10	Repair to navigators bulkhead L.H.	)
7-4752-15	Repairs to L.H. skirt nose wheel bay	)
7-4752-24	Repair to navigators bulkhead R.H.	) Issue 2
7-4752-27	Repair to aft diaphragm sta. 214-43	) Items
7-4752-29	Clip for above	) 63 to 98
7-4752-43	Assy. of stiffening angle fwd. face Navs. B'HD.	)
7-4752-51	Repair to shear plate L.H. lower longeron	)
7-4752-53	Replacement of cross beam	)
7-4752-54	Replacement of shear panel	)
7-4752-55	Repair to angle lower longeron R.H.	)
7-4752-58	Repair to fitting lower longeron R.H.	)
7-4752-59	Repair to fitting lower longeron L.H.	)
7-4752-61	Repair to lower longeron sta. 214-43 R.H.	)
7-4752-64	Installation of canted fmr. sta. 214-43	)

#### ENGINE BAY

7-4758-40	G.A. Repairs to engine bay formers	
7-4758-40 (sht.2)	Splice for fmr. sta. 687-65	) Issue 1 Items
7-4758-40 (sht.3)	Alternative fasteners fmr. sta. 742-0	) 1 - 18
7-4758-51	Repair for fmrs. sta. 712-34 & 717-36	)
7-4758-55	Repair to shroud top hat sections	)
7-4758-57	Repairs to intercostals sta. 692 to 697	) Issue 2 Items
7-4758-60	Skin splice for centre skin	) 28 - 42
7-4758-69	Repair to engine access door	) Issue 13 Items
7-4758-72	Repair to intercostals between sta. 737 & 742	) 1 - 3

#### AIR INTAKES

7-4755-48	Repair to duct skin sta. 244-0 to 255-0	
7-4755-54	Repair to outboard skin L.H. ramp	) 22 - 24
7-4755-55	Repair plate for above	)
7-4755-57	Repair to inboard skin L.H. ramp	)

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TECHNICAL DEPARTMENT

REPORT NO. S.R.A. 15

SHEET NO. 2

UNCLASSIFIED

AIRCRAFT.

ARROW MK. 1  
A/C 25201

COMPLETE A/C

PREPARED BY

DATE

A.L. Carter

July 29, 1958

CHECKED BY

DATE

INNER WING

7-4762-36	Repair to top skin L.H. & R.H. wheel bay	) Issue 1
7-4762-54	Repair to fuel door R.H. L/G bay	) Items
7-4762-55	Repair to L/G pivot door	) 54 - 70
7-4762-58	Repairs to element V4 & A2	) Issue 2 Items
7-4762-68	Replacement of anchor nuts ribs 8-9 main spar	) 4 - 17
7-4762-69	Repair to element J	) Issue 10
7-4762-73	Repair to L/G front pivot fitting L.H.	) Item 2

OUTER WING L/E

7-4765-7	Repair to ribs & stringers leading edge L.H.)	
7-4765-15 (sht.1)	Skin splice between ribs 3 & 4	) Issue 1 Items
7-4765-15 (sht.2)	Repairs to stringers for skin splice	) 33 - 50
7-4765-30	Repair splice for electrical conduct	)
7-4765-33	Repair to L/E rib 6	)
7-4765-36	Alternative fasteners L/E skin	)

AILERON

7-4774-8	Skin splice adjacent to rib 7A	) Issue 7 Items
		) 1 - 2

REAR FUSELAGE

7-4759-89	Reinforcing for fmr. 753 after dressing of buckle)	
7-4759-53	Repairs to tailcone	)

NOTE: The following repair schemes are due to servicing reasons and are not connected with landing accident.

REAR FUSELAGE STINGER

7-4759-77	Splice lower longeron - stinger
7-4759-83	Skin repair at R.H. lower latch
7-4759-84	G.A. Repairs to stinger

ENGINE

7-4795-5	Replacement of stiffeners - power plant can.
7-4795-6	Repair to edge member - power plant can.

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RCAF APPROVAL T16-3/48

REPORT NO. M 5158

DATE June 25, 1958

A. V. ROE CANADA LIMITED

MALTON - ONTARIO

AIRCRAFT ENGINEERING

## METALLURGICAL DEPARTMENT REPORT

TITLE: Examination of Undercarriage Pivot Attachment Fitting -  
Left Hand - Part No. 7-1062-411 - Arrow Aircraft #25201

1

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AVRO AIRCRAFT LIMITED

ENGINEERING DIVISION

METALLURGICAL DEPARTMENT

REPORT

RCAF APPROVAL T-039-7755

**UNCLASSIFIED**

REPORT NO. M 5158

SHEET NO. 1 OF 4 SHEETS

DATE June 25, 1958

## 1. INTRODUCTION

Subsequent to the malfunctioning of the undercarriage of Arrow Mk. 1 aircraft #25201 on 11th June and damage sustained thereby, it was required that the left hand undercarriage pivot attachment fitting be non-destructively examined to determine the presence of internal discontinuities, if any, which may have resulted from the heavy landing.

Areas of the pivot fitting were selected by representatives of the Stress Office for examination, which was carried out initially using radiography and finally by means of ultrasonics.

External damage was checked by the Inspection Dept. using penetrant die and visual methods.

## 2. CONCLUSIONS

- 2.1 No internal discontinuities were revealed by either of the two non-destructive methods used for this examination.
- 2.2 There was no evidence of shear in any of the bolts which could be covered by radiography.

## 3. DESCRIPTION OF SPECIMEN

The undercarriage pivot attachment fitting in 7079T65 Aluminum alloy part no. 7-1062-411 was as assembled in the left hand wing structure, the landing gear and pivot pin having been removed. The steel insert was in the fitting when radiography was commenced but was subsequently removed, the marry-up strap at rib 10 was also in position. The bore of the pivot pin steel insert showed 0.003" ovality, after removal of the insert, the bore ovality of the housing was found to be 0.030".

## 4. METHOD OF EXAMINATION

### 4.1 Radiographic

The 160 KV portable Fedrex X-ray unit was used for this examination with Ilford type F film. The complete record of the radiographic technique which was employed is on file in the Radiological Lab. and is not reproduced in this report. The ident of this radiographic technique is PF 10 series 1-51 and 57 to 59. Film coverage is listed in Table I.

### 4.2 Ultrasonics

Ultrasonic inspection was carried out on the lower segment of the pivot pin housing to resolve indications found in that area by the radiographic examination. For this a Kelvin-Hughes Mark 4 two-probe unit was used and its effectiveness was demonstrated on the job.



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#### 4.3 Partial Disassembly

- 4.3.1 To clarify radiological indications in the lower flange of the fitting, the marry-up strap at rib 10 containing a visible crack was removed.
- 4.3.2 Because of difficulty in interpreting a radiological indication in the lower segment of the pivot pin housing and to permit greater penetration, the steel insert was withdrawn, when it was found that the ovality of the light alloy housing was 0.030".

#### 5. RESULT OF EXAMINATION

##### 5.1 Upper and Lower Flanges

Films on this area showed no positive indications of internal damage after removal of the marry-up strap which showed a visible crack at the end.

##### 5.2 Rib 10 - Pivot Fitting Pin Joint

Films of this region showed no indications of internal damage.

##### 5.3 Pivot Pin Insert Housing

Films covering the upper segment were found to be clear. Films covering the lower segment comprise a series of multiple exposures taken in an attempt to define an indication found in this region.

Initially exposures were made with the steel insert in position. The indication persisted in these shots and was still present in shots taken after removal of the insert.

Shots 40 to 48 taken at angular differences of plus or minus 1° up to 3° each side showed that the indication was obtained only with the X-Ray beam normal to the pad on the fitting which lies below the insert bore.

To check whether the indication was characteristic or not of material which had not been in service an unused fitting and a 1.25" thick block both in 7079-T65 were examined radiographically using the same techniques to those used on the aircraft.

A pattern of flow lines was apparent in the check shots and in the 25201 fitting but the initial indication could not be accounted for.





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### 5.3 (Cont'd.)

It is possible for Radiography to reveal stress patterns where plastic deformation has occurred and it could well be that the indication is due to this.

Because of the flat pad immediately beneath the indication it was possible to use "Two Probe" ultrasonics to generate a cross beam to intersect the suspected area.

A strong back reflection echo was obtainable and scanning of the area did not give any loss of this echo or any indication of a discontinuity in excess of Avrocan M-2-2, Grade B. For this reason the indication obtained radiographically cannot be ascribed to any discontinuity.

### 5.4 Inboard "Flower Pot"

This is not part of the undercarriage attachment fitting but is adjacent to the fitting and was examined radiographically at the same time as the fitting. All steel parts were removed from this area and the shots revealed no defects.

### 5.5 Bolts

No shearing or deformation of any bolts in the radiographed areas was detected.

July 28, 1958



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METALLURGICAL DEPARTMENT  
REPORT

TITLE:

EXAMINATION OF UNDERCARRIAGE ATTACHMENT FITTING  
- LEFT HAND - PART NO. 7-1062-411 ARROW AIRCRAFT  
NO. 25201

DISTRIBUTION:

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INVESTIGATION  
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DATE July 28, 1958

1. ADDENDUM

- 1.1 Subsequent to the boring out operation on the Pivot Attachment Fitting on Aircraft No. 25201 to receive an oversize steel insert, it was required that the fitting be radiographed to determine if the fitting had been subjected to damage and if the radiographic indication noted in paragraph 4.3.2 of Report No. M 5158 was still present.
- 1.2 The right hand undercarriage Attachment Fitting part No. 7-1062-412 on Aircraft 25201 was to be examined by radiography.

2. RESULT OF EXAMINATION

- 2.1 The films of the lower segment of the bore revealed no damage and it was noted that the indication mentioned in paragraph 4.3.2 of Report No. M 5158 had been removed.
- 2.2 The films of the areas radiographed, duplication of the exposures of the left hand except for the marry up strap which was not radiographed, showed no indication of any internal damage, neither was there any indication of shearing or deformation of any bolts in these areas.





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RCAF APPROVAL T-039-7/55

TABLE I

Areas Covered by Radiographic Examination and Film Idents.

<u>Area</u>	<u>Film Idents.</u>
Upper and Lower Flanges	4, 10, 15, 16, 17, 18, 19, 20, 21, 22, 23
Rib 10-Pivot Fitting Pin Joint	31, 32, 33, 34, 38, 39
Pivot pin insert housing	
- Upper Segment	11, 12
- Lower Segment	5, 6, 24, 25, 26, 27, 28, 29, 30, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51
"Flower Pot"	57, 58, 59
General Shots	1, 2, 3, 7, 8, 9, 13, 14, 35, 36, 37



