

# EXECUTIVE COUNCIL

## PUBLIC

<b>Title:</b>	<b>FIGAS – Funding for Replacement Aircraft (VP-FBM)</b>
<b>Paper Number:</b>	08/19
<b>Date:</b>	30 <sup>th</sup> January 2019
<b>Responsible Director:</b>	Director of Development & Commercial Services
<b>Report Author:</b>	General Manager, Aviation Services
<b>Portfolio Holder:</b>	Honourable MLA Elsby
<b>Reason for paper:</b>	This paper is submitted to Executive Council:  For information and approval
<b>Publication:</b>	Not Recommended:  <i>Under Executive Council Standing Order 23(2), Executive Council must have regard to the categories of exempt information in Schedule 3 to the Committees (Public Access) Ordinance when determining if information should be withheld</i>  <i>The categories which are potentially relevant to this paper are:</i>  Paragraph 10 - Information about relevant contracts and negotiations
<b>Previous papers:</b>	Review of Aviation Services 224/15 FIGAS – Pilot training capacity 12/18 Additional Funding for Aircraft Engines 09/18 FIGAS – Funding for Additional Airframe 55/18
<b>List of Documents:</b>	Damage Assessment Report VP-FBM Repair estimate <b>REDACTED</b>

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### 1. Recommendations

Honourable Members are recommended to approve:

- (a) To utilise funding from the Insurance Fund to purchase a new aircraft to replace VP-FBM;
- (b) Having approved the above recommendation refer the matter to the Standing Finance Committee for Financial Approval;
- (c) Approve sale/disposal of the components of VP-FBM that cannot be utilised by FIGAS;

## 2. Replacement Capital Programme Budgetary Implications

**REDACTED**

NB. Price has been provided in Pounds Sterling as requested by FIGAS and is fixed subject to the order being placed before 31<sup>st</sup> March 2019.

## 3. Executive Summary

- 3.1 FIGAS currently operates with five aircraft (four passenger and one dedicated to fisheries protection duties) A new aircraft was ordered as part of the 2018/2019 budget process which is due to arrive in July 2019 bringing the fleet to a total of six:

Registration	Total Hours	Total Landings	Age (years)
VP-FBD	17,001	42,948	34
VP-FBM (Damaged beyond economic repair)	16,499	41,109	30
VP-FBN	14,505	13,738	29
VP-FBO	11,468	5,904	29
VP-FBR	13,934	23,474	27

- 3.2 However, on 11<sup>th</sup> June 2018 Islander aircraft, registration VP-FBM incurred substantial structural damage whilst landing at Beaver Island. The aircraft was dismantled by a small team from FIGAS and returned to Stanley Airport via sea and road transport. A preliminary report was made by Britten-Norman Ltd based on information and photographs supplied by FIGAS. It was clear that a more in-depth report was necessary to determine the extent of damage and develop a cost of repair. Britten-Norman Ltd sent a senior design engineer out to the Islands in September 2018 for a week to conduct a systematic and extensive assessment of the damage. The design engineers report has been received along with approximate costings. It is estimated that to repair VP-FBM to full airworthiness will cost in the region of **REDACTED**. The largest and most expensive component the aircraft requires is a new wing; the lead-in time for a replacement wing cannot be confirmed as it will need to be built out of sequence on the production line. Britten-Norman Ltd has advised that it could be in excess of 12 months.

- 3.3 VP-FBM had an estimated hull value (based on readily available market information) of approximately **REDACTED** prior to the incident on Beaver Island. The aircraft is 30 years old. FIGAS management recommend replacing the aircraft with a new Islander rather than invest upwards of **REDACTED** an old aircraft. This recommendation is predicated mainly on alacrity of response to a growing market. Obviously repairing the aircraft will save **REDACTED** compared against replacing with a new aircraft **REDACTED** but this choice could leave us without an aircraft for a numbers of years adding to our vulnerabilities especially in light of the second international flight.

- 3.4 Britten Norman Ltd has confirmed an aircraft price of **REDACTED** (2018 price) provided we enter into a purchase contract before 31<sup>st</sup> March 2019. The price has been provided in pounds sterling rather than dollars which removes currency exchange fluctuations. Britten-Norman cannot confirm the price post 31<sup>st</sup> March

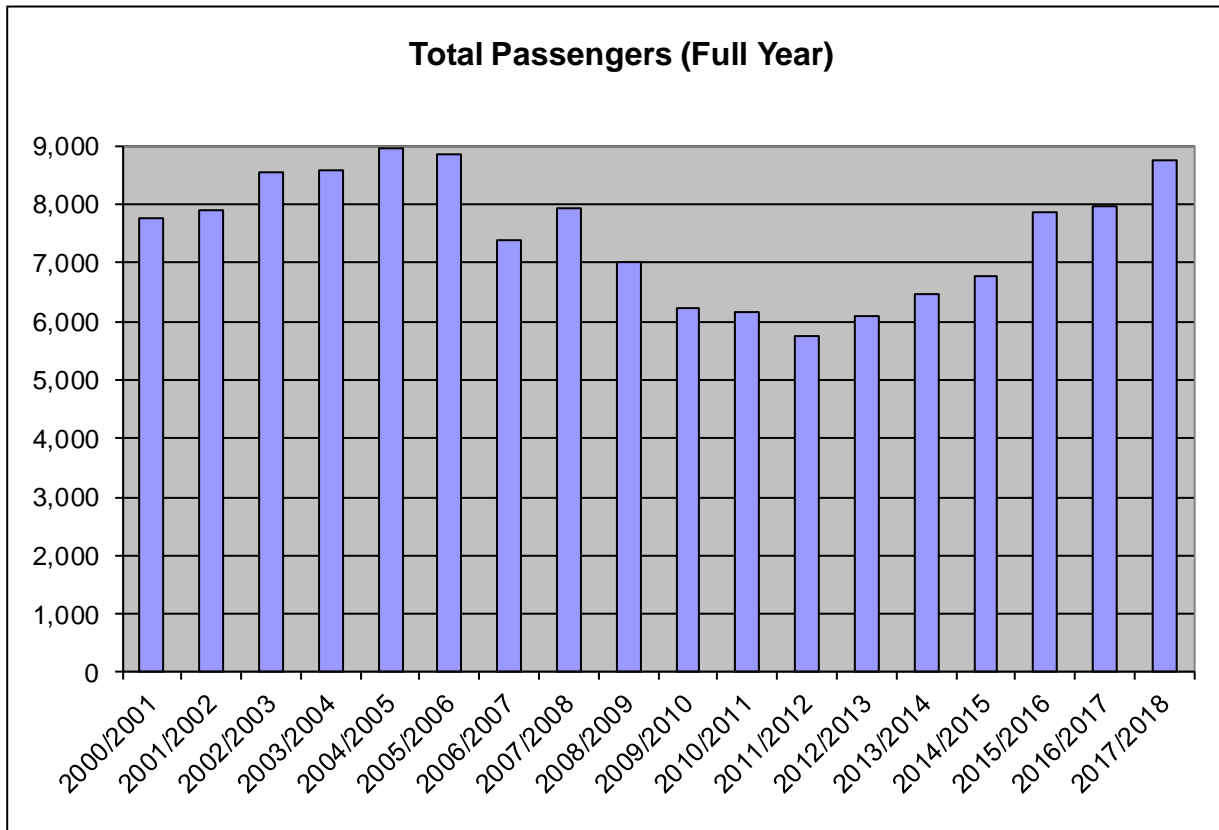
2019 as their vendors haven't provided any information on price fluctuations but have said an increase of 5% may be close. **REDACTED**

- 3.5 FIGAS would need to undertake a minimum three visits to the factory to carry out a visual examination at each critical stage of manufacturing. If funding is granted in Q1 2019 the aircraft should arrive in the Islands during Q2 2020. Shipping the aircraft is very expensive as the aircraft would need to be dismantled and re-assembled using the Britten-Norman team. A much cheaper alternative the aircraft can be flown as a ferry flight (c. 100 hours). Total cost of certification and ferry flight is estimated at **REDACTED**
- 3.6 Britten-Norman has advised that delivery may be possible in the second quarter of 2020 but this would be confirmed when the purchase contract is signed.

#### **4. Background (and Links to Islands Plan)**

- 4.1 The Falkland Islands Government Air Service (FIGAS) provides both commercial and critical community links between Stanley and the outlying islands and therefore it is prudent to ensure that all operational and strategic risks are effectively managed.
- 4.2 During the past six years, passenger numbers have been steadily increasing from around 5,800 in 2011/12 to 8,800 in 2017/2018. This increasing trend is forecasted to continue and with the prospect of a second weekly flight from South America the expectation is for a significant increase in passenger demand.
- 4.3 It is anticipated that the second flight will see visitor numbers increasing by a minimum of 25% in the first year. This significant increase in visitors will impact on the services provided by FIGAS and inability to service tourist destinations will adversely affect tourist businesses across the Falkland Islands.

Total passenger numbers are highlighted below:



LATAM connections are also growing in popularity with 6% growth per annum of passenger numbers within the weekly flight for the past ten years. This additional aircraft will provide resilience and greater flexibility.

Replacing VP-FBM with a new build aircraft will return the FIGAS fleet to its pre-2006 number of six aircraft, including the new aircraft currently in production VP-FMC. A new aircraft will increase overall business resilience such as aiding the provision of dedicated day-trip services for cruise ship passengers to destinations in highest demand such as Sand Point Airstrip (Douglas Station area) and Bleaker Island. **REDACTED**

It is worth remembering that there are a number of elements that impact on the ability to effectively maintain service operations; the availability of airframes; a robust maintenance schedule, the availability of trained engineers and technical staff to complete essential maintenance and suitably qualified pilots competent to take on the rigours of operating in a remote and varied landscape.

#### **REDACTED**

FIGAS continue to investigate viable alternatives to the Britten-Norman aircraft largely due to their limited production capacity (alternative aircraft has been discussed at length listing pros and cons in previous papers). Britten-Norman has recently increased production of the Islander aircraft to three aircraft per year. At present the only viable option for FIGAS is to continue using the Islander aircraft until such time a more economical, modern alternative is available.

There is an emerging alternative airframe making a move into the nine-seat market which FIGAS is watching with interest. The Italian Tecnam P2012 Traveller has

shown real potential as a direct replacement for the ubiquitous Islander aircraft. Tecnam's launch customer, Cape Air, expect to receive their first tranche of P2012 Travellers early in 2019. As launch customer, Cape Air has placed a firm order for 100 aircraft and is expecting 8 to 10 deliveries in 2019. Recent information shows that Tecnam are getting ready for a rapid production ramp-up with plans to build around 15 Travellers in 2019. Tecnam have approximately 30 additional orders from around the world. Additionally, production is set for 25 aircraft in 2020 rising to 35 the following year.

**Islands Plan 2018 – 2022, Transport and communication:** *'We will ensure modern and robust internal and external transport and communications – During this assembly we will: Invest in the Falkland Islands Government Air Service to improve the level of service provided.'* This investment in an additional airframe meets those objectives.

## **5. Options and Reasons for Recommending Relevant Option**

- 5.1 a) Do nothing - Failure to procure a replacement aircraft for VP-FBM will result in FIGAS continuing to operate with four passenger aircraft (VP-FBO is the fisheries dedicated aircraft and is too heavy to be factored into regular passenger transport duties but is currently operating with the reduced passenger payload). The new build aircraft VP-FMC arrives in July/August 2019. Replacement of VP-FBM will arrive Q2 2020. A reduced fleet is vulnerable to a lack of resilience due to unpredicted and unscheduled incidents, airframe repairs etc. Significant repairs to an aircraft can create a similar situation to that experienced summer season 2017/18. An additional aircraft will prevent long flying days, stress on the team, customer complaints and assist operational readiness for increased passenger traffic delivered by the second international flight.
- b) Repair VP-FBM – Although cheaper than buying a new aircraft, repairing an old aircraft is not recommended. FIGAS have experience of operating a heavily repaired aircraft (VP-FBD) which suffers from a significant weight penalty from the repaired wing. Available payload is paramount so any weight lost to repair is keenly felt. Additionally, market values of old/repaired Islander aircraft are low and it is unlikely that any investment would be recovered should a future fleet replacement program be initiated. Newer aircraft have a greater intrinsic sale value. An increased intrinsic value was one of the reasons we embarked on a fleet modification program. It is also worth bearing in mind that when FIGAS was reformed after the 1982 conflict a five year aircraft replacement fund was agreed (subsequently rescinded in the late 1980's) in recognition of our operating conditions. Moreover, FIG has an established 10 year replacement plan for plant and vehicles but FIGAS are operating equipment with two to three times older.
- c) Place a formal order with Britten-Norman before 31st March 2019 for one additional aircraft at the price of **REDACTED** (a decision must be made before 31<sup>st</sup> March 2019 to secure the aircraft at the 2018 price) plus the cost of inspection/transportation as set out below in 6.1. Option recommended is to improve the level of service provided by FIGAS as set out in the Islands Plan.

## **6. Resource Implications**

The proposed funding request covers the cost of purchasing a new aircraft, undertaking due diligence during its manufacture and transportation by way of a ferry flight. Existing staff would be available for due diligence during manufacture.

## **6.1 Financial Implications**

**REDACTED**

Quotations for new aircraft have been made in pounds sterling at FIGAS' request to remove the risk of price fluctuation if the exchange rate changes between financial approval and date of order before 31<sup>st</sup> March 2019.

The Financial Secretary has confirmed that FIG has an insurance fund which can be used to replace damaged and destroyed assets.

## **6.2 Human Resource Implications**

None anticipated.

## **7. Legal Implications**

- 7.1 There are no specific legal issues resulting from this report. The formal Order and Terms of Purchase will be reviewed by AG's office before signing.

## **8. Environmental & Sustainability Implications**

- 8.1 There are no environmental and sustainability implications

## **9. Significant Risks**

- 9.1 Failure to procure the additional aircraft could result in FIGAS continuing to operate with four passenger aircraft (VP-FBO held in reserve) with a lack of resilience due to unpredicted and unscheduled incidents, airframe repairs etc. Significant repairs to the aircraft can create a similar situation to that experienced summer season 2017/18. A replacement aircraft will prevent long flying days, stress on the team, customer complaints and provide greater resilience. During 2017/18 season no scenic flights were operated and although no passengers were turned away, there were a significant number of complaints due to delayed flights and inconvenience. Some customers had to wait all day for a flight and their time at destination was shorter than planned. This had a knock-on effect for the hospitality industry.
- 9.2 Failure to make a decision to purchase the aircraft before 31<sup>st</sup> March 2019 will result in a price increase.

## **10. Consultation**

- 10.1 The Director of Development & Commercial Services has consulted with stakeholders. The Transport Advisory Committee was advised of this paper during the December 2018; no objections were made.

## **11. Communication**

- 11.1 There are no additional communication requirements created as a result of this report.

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Report No. **DOR-BN2-0840**Issue No. **A**Title. **Damage Assessment on Constructor No 2200 (Ref Reg VP-FBM)**

COMPILED	CHECKED	DESIGN RELEASED	DATE ISSUED
NAME:  C.Grant	SIGNATURE:  (signature on file)  NAME: <b>D. Shaw</b>	SIGNATURE:  (signature on file)  NAME: <b>D. Shaw</b>	11 <sup>th</sup> November 2018

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## ABBREVIATIONS

ABBREVIATION	MEANING OF ABBREVIATION
BNA	Britten-Norman Aircraft
DOR	Design Office Report

## REFERENCES

DOCUMENT TITLE	DOCUMENT NUMBER	ISSUE	DATE
1. Preliminary Damage Assessment on Constructor No 2200 (Ref Reg VP-FBM)	DOR-BN2-831	1	06/07/18

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## 1. INTRODUCTION

### 1.1. PURPOSE

This document defines the major area of repair believed to be necessary to return the aircraft to service.

This document is based upon the initial damage assessment conducted from photographs sent by FIGAS to BNA and captured in DOR-BN2-831 "Preliminary Damage Assessment on Construction No. 2200 (Ref. Reg: VP-FBM) a BN2B-26 Aircraft After A Heavy Landing".

In addition, it includes information gained from the visit conducted by BNA Service Engineer, Chris Grant, in mid-September 2018.

### 1.2. Visit Scope

Christopher Grant left work on the 19<sup>th</sup> of September from the Southampton Design Office. The business trip involved a flight from Brize Norton to the Falkland Islands. The Quality Manager from FIGAS escorted Chris throughout his time in the Falkland Islands. Chris worked for the 4 days including the weekend reviewing the data on the occurrence. This review also included a review of the aircraft which was now in a hangar, split into major components. On the 6<sup>th</sup> day the Quality Manager took Chris the airport in the Falkland Islands, where he then flew from the Falkland Islands back to the UK. A more detailed account of the visit is included in Appendix 1.

### 1.3. Review Incident

From a conversation with the FIGAS technicians, they believe the aircraft had an unstable landing in which the port undercarriage hit the ground first. The initial contact destabilized the aircraft that forced the right undercarriage to clip the ground. The aircraft bounced back up again, and came down again to then hit a larger area of ground that caused the damage on the aircraft.

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## 2. Discussion and Conclusion

The survey on site in the Falkland Islands, added to the initial assessment made in DOR-BN2-831, which enabled to assumptions made in that report, to be reviewed and confirmed.

### 2.1. Overview of Damage

In summary the damage recorded to the aircraft is listed below:

- Figures 1 & 2 shows the engine close to where the aircraft stopped after the incident.
- Figure 3 shows the side of the fuselage under strain.
- Figure 4 & 5 shows the recovery of the fuselage and the wing.
- Figure 6 to 8 shows the broken engine mounts.
- Figure 9 to 12 shows the starboard damaged flap
- Figure 13 to 18 shows the starboard damaged engine cowlings
- Figure 19 to 21 shows the damaged leg fairing.
- Figure 22 shows the damaged engine frame.
- Figure 23 shows the undercarriage leg tubes.
- Figure 24 to 69 records the damage to the wing.

For the pictures and a description of the pictures please see Appendix 2.

### 2.2. Overview of Work Required

Due to the location of the incident the aircraft has already been extensively stripped to enable the aircraft to be placed in the hanger. The wing would have to be repaired. The wing will have to be installed on the fuselage. All the services disturbed in the removal of the wing would have to be reinstated. The fin and stabiliser will have to be installed. All the flying controls will have to be installed and rigged. All the engines would be subject to them being overhauled or replaced due to the loads that have been put into the engine casings. This means all the associated work required for the install and rigging of the engine would also be required. The props would also be overhauled. The undercarriage would have to be installed. All the flight systems will have to be connected and tested.

More detailed information is contained in Appendix 3

 The logo features a stylized aircraft silhouette with the letters 'B' and 'N' on either side, and the word 'AIRCRAFT' below.	<b>DESIGN OFFICE REPORT</b>	Document No.: DOR-BN2-0840 Issue A
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### 2.3. Conclusion

The damage to the landing gear and associated engine frame on the port and starboard side requires repair by replacement. In addition a significant number of primary structural components would have to be replaced.

To remove the damage on the wing, the rear bay of the wing would need to be repaired with most of the ribs replaced, from where the outboard section of the starboard flap starts to the outboard section of the port flap ends. In the primary structure many, if not all of the ribs in between the spars, would have to be replaced from the starboard outboard flap to the inboard section of the starboard flap. When the wing is apart some of the leading edge ribs would also need to be reformed or replaced.

However, on close inspection, it was revealed that a significant amount of wing twisting would need to be rectified. Due to the significant damage, the wing will need to be placed in a production jig to ensure correct alignment.

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### 3. APPENDIX 1 – DETAILS OF THE BUSINESS TRIP

Christopher Grant – Diary

On 19th September I concluded an EASA audit, and left Southampton just before five and drove up to Brize Norton. I dropped my car at Charles Taxis at 1940. They took me to the guard house where I was there for 1950. I checked in after waiting for fifteen minutes or so I had to wait for the transfer bus. I waited until 2100 hrs for the bus to transfer me to the terminal. At the terminal I checked my bag in. I then had to wait until 2145 to then go through security, which was the usual experience. Once through security I then had to wait until 00 15 until we could board the aircraft.

The aircraft took off at 0110 (UK Time). After the 6 hour flight I stopped at Cape Verde, 0730 (UK Time). We returned to the aircraft for 0920 (UK Time). Prior to take off they sprayed the cabin to kill all the bugs. I landed on the 20<sup>th</sup> Sept (Day 1) in the Falkland Islands at 2015 UK time 1615 Falkland Islands time. Kurt Whitney, FIGAS, met me and took me from Mount Pleasant Airfield (MPA) or Mount Pleasant Complex (MPC) to Stanley. I got into the house for 1800 Falkland Islands time.

Day 2 (Fri 21<sup>st</sup> September) I was introduced to Morgan Goss the FIGAS General Manager. I was also introduced to the engineers and the company premises. Throughout the day I was given various accounts of what happened, how the aircraft was recovered and how they think the aircraft sustained the damage. Kurt was extremely helpful and removed the panels from the wing in the affected area to enable me to review the damage to the wing. I was also shown around Stanley, as to where things were.

Day 3 (Sat 22<sup>nd</sup> September) Carry on inspecting the wing, taking pictures and measuring the size of the damage in the wing. All the employees at FIGAS were extremely helpful in assessing the damage on the wing.

Day 4 (Sun 23<sup>rd</sup> September) A round robin flight, to experience the operation of the aircraft.

Day 5 (Mon 24<sup>th</sup> September) Start compiling the report of the damaged sustained along with listing the systems that would have to re-instated to enable the aircraft to be ready for flight.

Day 6 (Tues 25<sup>th</sup> September) Leaving the Falkland Islands at 0645 local time and it took about an hour to get to MPA. Kurt drove me to MPA the road is unmade in places and it had been snowing so not the easiest of drives. At 0730 I was and embarked on the aircraft at 1000, they decided to de-ice the aircraft as a precaution, and the aircraft took off at 1050.

 The logo features a stylized aircraft silhouette with the letters 'B' and 'N' on either side of the fuselage, and the word 'AIRCRAFT' below it.	<b>DESIGN OFFICE REPORT</b>	Document No.: DOR-BN2-0840 Issue A
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Note 5143 miles from Falkland Islands to Cape Verde. Cape Verde 2699 is miles to Brize. I landed at Cape Verde at 2020 Falkland Islands time 2045 in the terminal. I left Cape Verde at 2230 Falkland Islands time or 0230 UK time. I landed at Brize Norton at 0420 Falkland Islands time 0820 UK time on Day 6 (Wed 26<sup>th</sup> Sept).

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## 4. APPENDIX 2 – ‘PICTURES OF THE DAMAGE’

Below is an index of the figures contained in Appendix 2 of the key photos taken during the visit.

- FIGURE 1 - SIDE VIEW LOOKING ON STARBOARD ENGINE
- FIGURE 2 - FRONT VIEW LOOKING AFT ON STARBOARD ENGINE
- FIGURE 3 - VIEW ON STARBOARD SIDE FUSELAGE UNDER THE WING – PRIOR TO MOVING AIRCRAFT
- FIGURE 4 - RECOVERY OF THE FUSELAGE
- FIGURE 5 - RECOVERY OF THE WING
- FIGURE 6 - VIEW LOOKING ON STARBOARD OUTBOARD UPPER STARBOARD ENGINE MOUNT
- FIGURE 7 - CLOSE UP VIEW LOOKING ON STARBOARD OUTBOARD UPPER ENGINE MOUNT
- FIGURE 8 - INBOARD UPPER STARBOARD ENGINE MOUNT – CLOSE UP
- FIGURE 9 - OVERVIEW OF THE STARBOARD SIDE FLAP LOWER SURFACE
- FIGURE 10 - VIEW LOOKING DOWN OF THE TOP SKIN OF THE STARBOARD FLAP
- FIGURE 11 - VIEW LOOKING UP ON THE UNDERSIDE OF THE STARBOARD FLAP
- FIGURE 12 - VIEW LOOKING ON THE TRAILING EDGE OF THE STARBOARD FLAP
- FIGURE 13 - LOOKING AFT ON TOP – STARBOARD ENGINE COWLING
- FIGURE 14 - STARBOARD ENGINE COWLING LOOKING INBOARD
- FIGURE 15 - VIEW LOOKING UP ON THE STARBOARD ENGINE COWLING
- FIGURE 16 - VIEW LOOKING OUTBOARD ON THE STARBOARD ENGINE COWLINGS
- FIGURE 17 - VIEW LOOKING DOWN ON THE STARBOARD ENGINE COWLINGS
- FIGURE 18 - CLOSE UP VIEW LOOKING UP ON THE STARBOARD LOWER ENGINE COWLING
- FIGURE 19 - VIEW LOOKING ON THE TRAILING EDGE OF THE STARBOARD LEG FAIRING
- FIGURE 20 - VIEW LOOKING OUTBOARD ON THE STARBOARD SIDE LEG FAIRING
- FIGURE 21 - VIEW LOOKING INBOARD ON THE STARBOARD SIDE LEG FAIRING
- FIGURE 22 - ENGINE FRAME
- FIGURE 23 – UNDERCARRIAGE LEG TUBES
- FIGURE 24 - VIEW ALONG THE TOP SURFACE OF THE WING SHOWING THE REAR SPAR CURVE
- FIGURE 25 - STARBOARD SIDE, LOOKING ON TOP SKIN OUTBOARD ON TOP OF THE UNDERCARRIAGE FITTING AFT OF THE REAR SPAR
- FIGURE 26 - STARBOARD SIDE LOOKING ALONG THE SURFACE OF THE CENTRE SECTION /REAR SPAR/AREA
- FIGURE 27 - STARBOARD SIDE LOOKING OUTBOARD.
- FIGURE 28 - STARBOARD SIDE – VIEW ALONG THE REAR SPAR IN THE REGION OF THE UNDERCARRIAGE FITTING
- FIGURE 29 - VIEW LOOKING ALONG THE STARBOARD SIDE
- FIGURE 30 - OVERVIEW OF THE PORT SIDE
- FIGURE 31 - STARBOARD SIDE OVERVIEW LOOKING OUTBOARD
- FIGURE 32 - PLAN VIEW LOOKING ON THE STARBOARD SIDE WING
- FIGURE 33 - STARBOARD SIDE LOOKING INBOARD
- FIGURE 34 - OVERVIEW VIEW LOOKING ON STARBOARD SIDE INBOARD
- FIGURE 35 - STARBOARD SIDE LOOKING FWD ON REAR BAY AND NACELLE
- FIGURE 36 - STARBOARD REAR BAY / NACELLE- SHOWING THE BOW IN THE TOP OF THE WING
- FIGURE 37 - STARBOARD SIDE REAR BAY / NACELLE
- FIGURE 38 - STARBOARD SIDE LOOKING FWD ON REAR BAY AND NACELLE
- FIGURE 39 - STARBOARD SIDE LOOKING FWD ON REAR BAY AND NACELLE
- FIGURE 40 - VIEW LOOKING DOWN ON STARBOARD SIDE PORT SIDE OVERVIEW
- FIGURE 41 - PLAN VIEW ON PORT SIDE
- FIGURE 42 - WING PANEL W12 PORT SIDE OF THE CENTRE LINE IS NO LONGER FLAT
- FIGURE 43 - PORT FORWARD WING TO FUSELAGE FORWARD PICK UP POINT SIGNS OF MOVEMENT
- FIGURE 44 - VIEW ON W14 – LEADING EDGE STARBOARD SIDE
- FIGURE 45 - VIEW LOOKING UNDER W14 – THE RIB IS DAMAGED AND NOT TOUCHING THE SKIN



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FIGURE 46 - VIEW ON STARBOARD FIREWALL  
 FIGURE 47 - VIEW ON ENGINE FRAME UPPER MOUNT PAINT CRACKING  
 FIGURE 48 - VIEW LOOKING ON OUTBOARD ON STARBOARD NACELLE  
 FIGURE 49 - CLOSE UP ON STARBOARD AFT SIDE OF FIRE WALL  
 FIGURE 50 - STARBOARD SIDE LOOKING OUTBOARD ON NACELLE  
 FIGURE 51 - STARBOARD SIDE FLAP SHROUD  
 FIGURE 52 - STARBOARD SIDE LOOKING INBOARD ON NACELLE  
 FIGURE 53 - STARBOARD SIDE TWISTED TRAILING EDGE  
 FIGURE 54 - STARBOARD SIDE FLAP MIDDLE HINGE POINT IS NO LONGER ALIGNED  
 FIGURE 55 - VIEW ON PANEL W70  
 FIGURE 56 - VIEW LOOKING ON AN EXAMPLE OF PAINT CRACKING ON A LAMINATION  
 FIGURE 57 - VIEW ON PANEL W16  
 FIGURE 58 - VIEW LOOKING ON CAPPING – PAINT CRACKING – POSSIBLE MOVEMENT BETWEEN THE LAMINATION  
 FIGURE 59 - VIEW LOOKING ON CAPPING – PAINT CRACKING – POSSIBLE MOVEMENT BETWEEN THE LAMINATION  
 FIGURE 60 - VIEW ON PANEL W17  
 FIGURE 61 - VIEW LOOKING ON CAPPING – PAINT CRACKING  
 FIGURE 62 - VIEW LOOKING ON CAPPING – PAINT CRACKING – POSSIBLE MOVEMENT BETWEEN THE LAMINATION  
 FIGURE 63 - VIEW ON PANEL W8  
 FIGURE 64 - VIEW ON PANEL W7  
 FIGURE 65 - VIEW ON PANEL W9  
 FIGURE 66 - VIEW LOOKING ON CAPPING – PAINT CRACKING  
 FIGURE 67 - VIEW LOOKING ON CAPPING – PAINT CRACKING – POSSIBLE MOVEMENT BETWEEN THE LAMINATION  
 FIGURE 68 - VIEW LOOKING ON CAPPING – PAINT CRACKING – POSSIBLE MOVEMENT BETWEEN THE LAMINATION  
 FIGURE 69 - VIEW LOOKING ON CAPPING – PAINT CRACKING – POSSIBLE MOVEMENT BETWEEN THE LAMINATION

 <p>The logo for Britten-Norman Aircraft, featuring a stylized blue 'B' and 'N' connected by a horizontal line with a small square in the center, and the word 'AIRCRAFT' in blue capital letters below.</p>	<b>DESIGN OFFICE REPORT</b>	Document No.: DOR-BN2-0840 Issue A
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**Figure 1 - Side view looking on Starboard Engine**



**Figure 2 - Front View Looking Aft on Starboard Engine**

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 <p><b>B</b> <b>N</b> AIRCRAFT</p>	<p><b>DESIGN OFFICE REPORT</b></p>	<p>Document No.: DOR-BN2-0840 Issue A</p>
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**Figure 3 - View on Starboard Side Fuselage under the wing – Prior to Moving aircraft**



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**Figure 4 - Recovery of the Fuselage**



**Figure 5 - Recovery of the Wing**

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**Figure 6 - View looking on Starboard Outboard Upper Starboard Engine Mount**



**Figure 7 - Close up view looking on Starboard Outboard Upper Engine Mount**

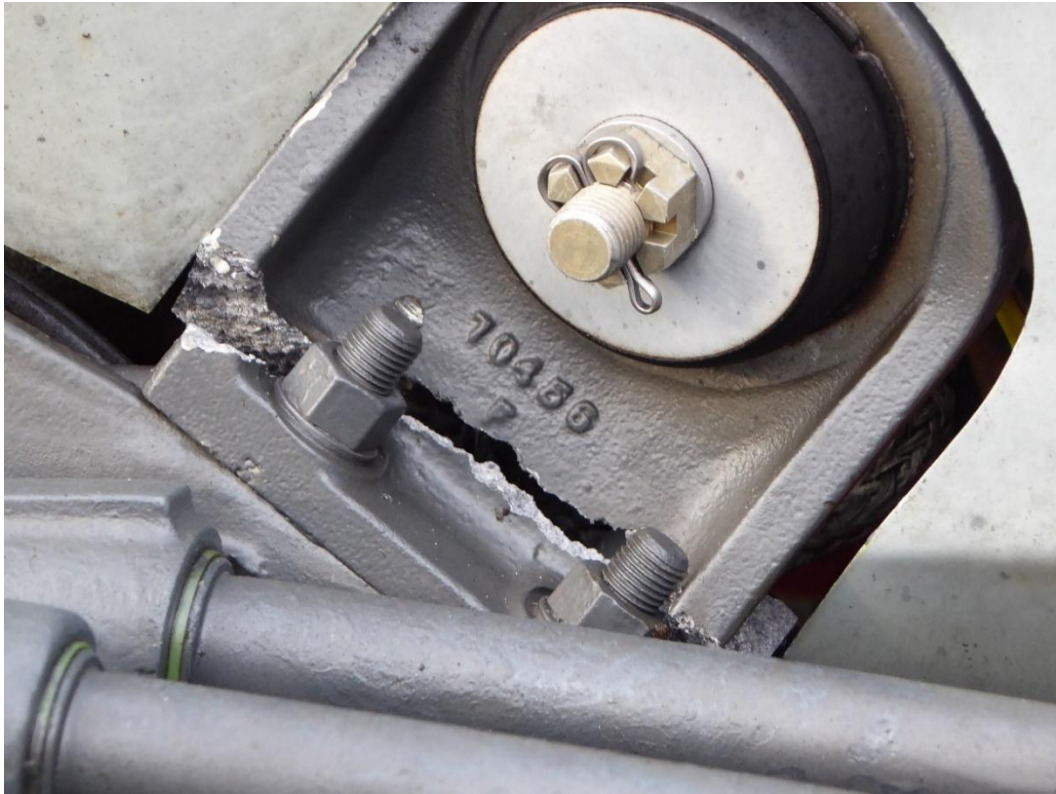
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**Figure 8 - Inboard Upper Starboard Engine Mount – Close up**

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**Figure 9 - Overview of the starboard side flap lower surface**



**Figure 10 - View Looking Down of the top skin of the starboard flap**

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**Figure 11 - View Looking up on the underside of the Starboard Flap**



**Figure 12 - View looking on the trailing edge of the Starboard Flap**

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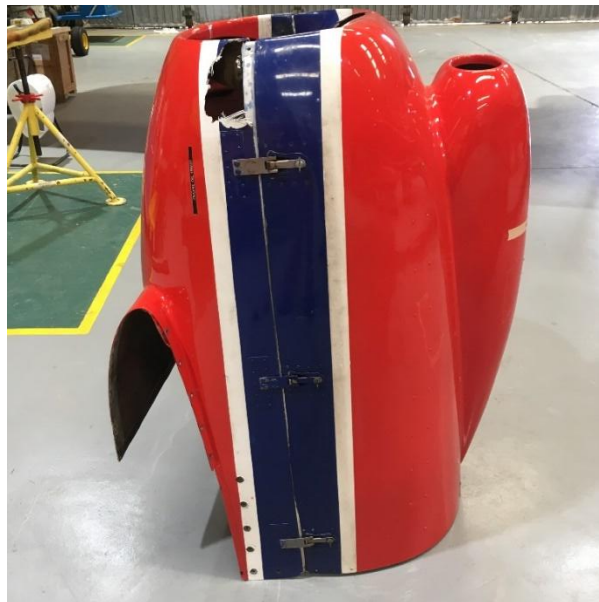


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**Figure 13 - Looking Aft On Top – starboard Engine Cowling**



**Figure 14 - Starboard Engine Cowling Looking Inboard**

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**Figure 15 - View Looking Up on the starboard Engine Cowling**



**Figure 16 - View Looking Outboard on the starboard engine Cowlings**

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**Figure 17 - View Looking Down on the starboard Engine Cowlings**



**Figure 18 - Close up view looking up on the starboard lower engine cowl**

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**Figure 19 - View Looking on the trailing edge of the Starboard Leg Fairing**



**Figure 20 - View Looking Outboard on the starboard side leg Fairing**



**Figure 21 - View Looking Inboard on the starboard side leg Fairing**

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**Figure 22 - Engine Frame**

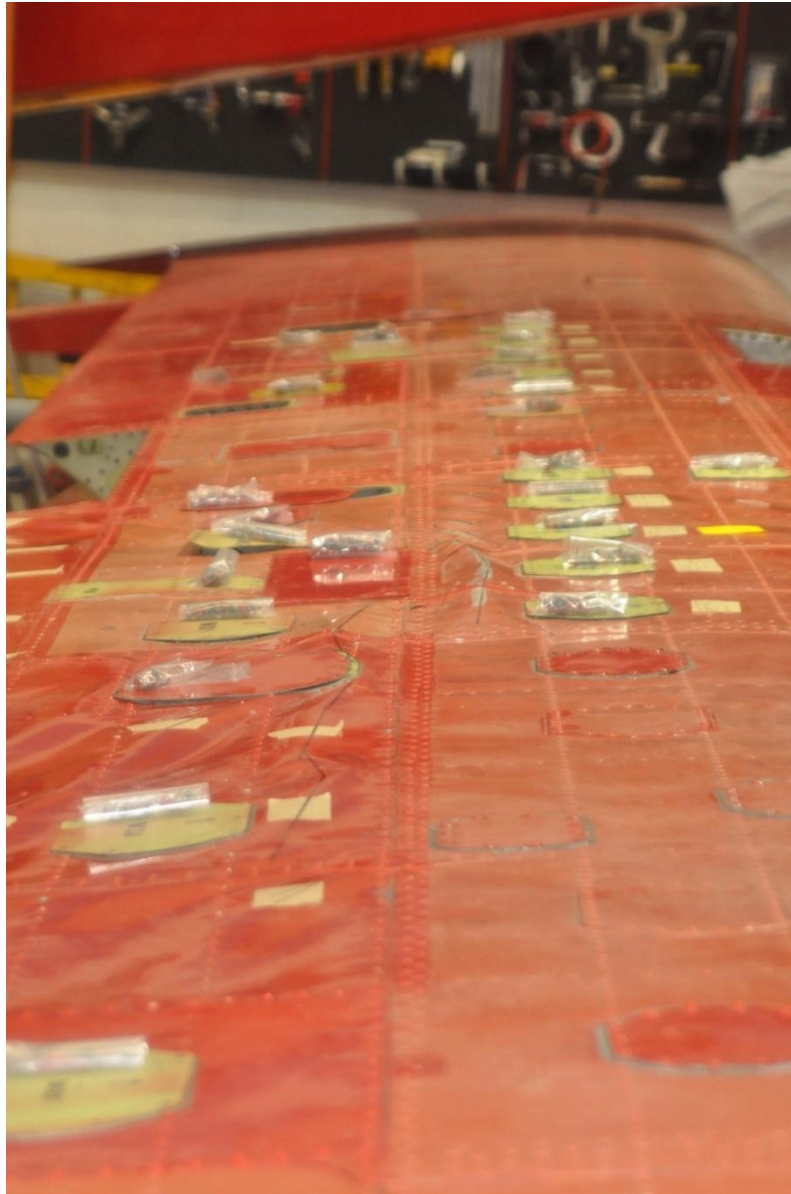
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**Figure 23 – Undercarriage Leg tubes**

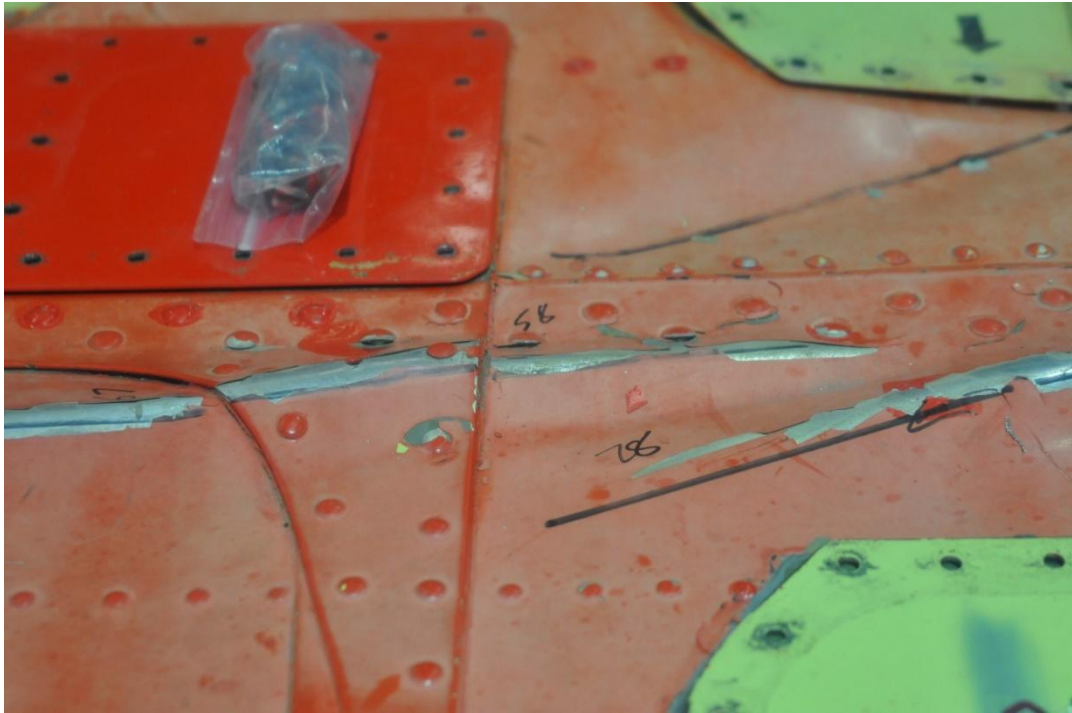
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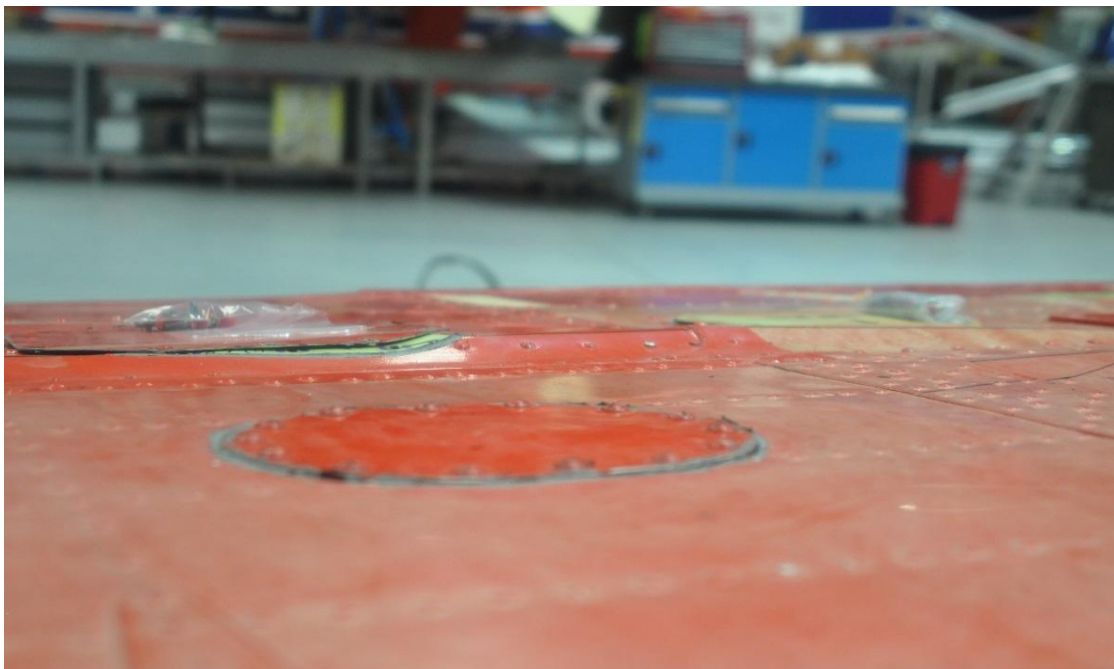


**Figure 24 - View along the top surface of the wing showing the Rear Spar Curve**

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**Figure 25 - Starboard Side, Looking on top skin outboard on top of the undercarriage fitting aft of the Rear Spar**

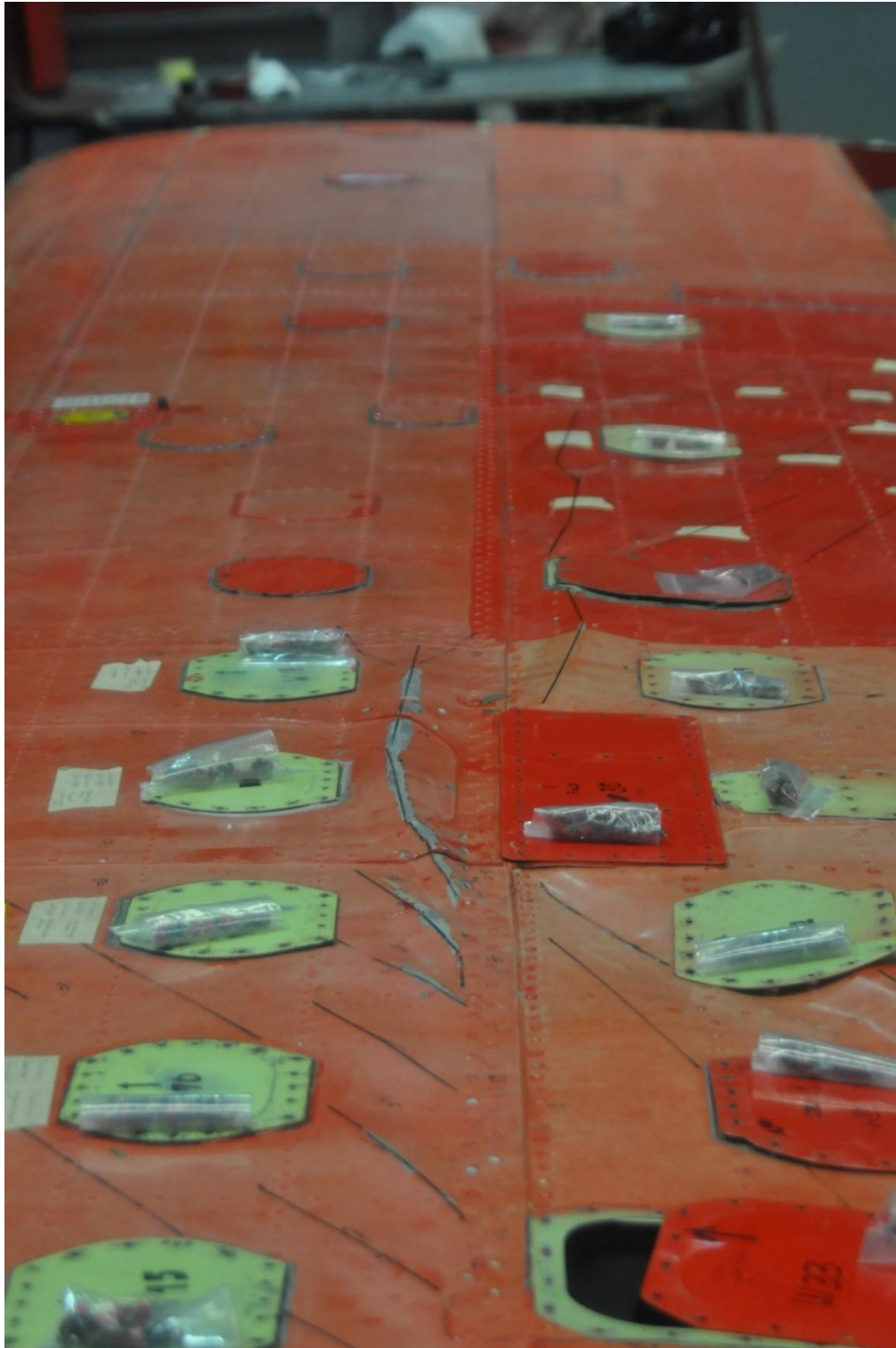


**Figure 26 - Starboard Side Looking along the surface of the Centre Section /Rear Spar/area**



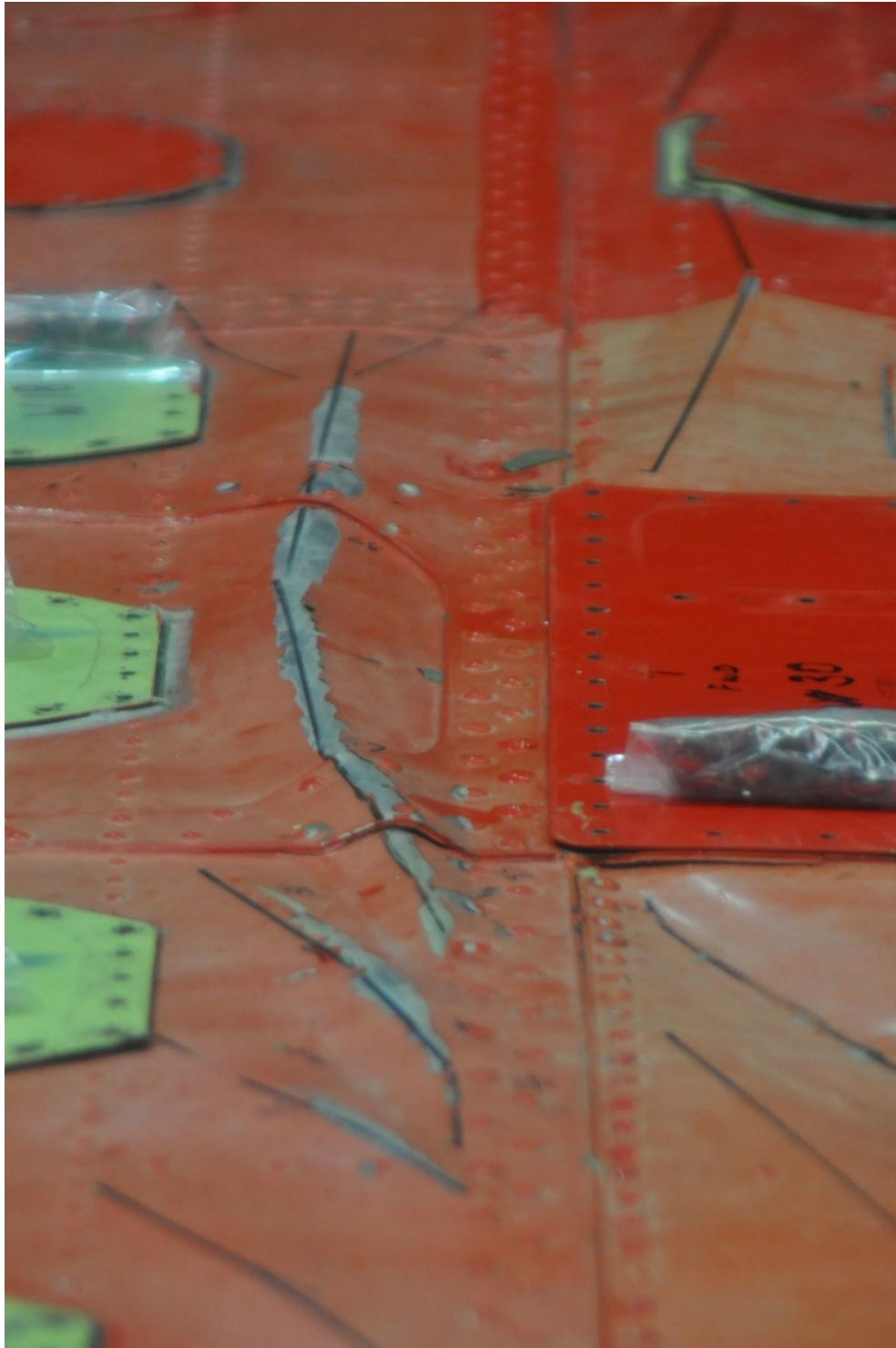
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**Figure 27 - Starboard Side Looking Outboard.  
The pen lines are showing the high points of skin rippling.**

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**Figure 28 - Starboard Side – View along the rear spar in the region of the Undercarriage fitting**



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**Figure 29 - View looking along the starboard side**



**Figure 30 - Overview of the Port Side**

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**Figure 31 - Starboard Side Overview Looking Outboard**

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**Figure 32 - Plan view looking on the Starboard Side wing**



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**Figure 33 - Starboard Side Looking Inboard**

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**Figure 34 - Overview view looking on Starboard Side Inboard**



**Figure 35 - Starboard Side Looking FWD on Rear Bay and Nacelle**

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Figure 36 - Starboard Rear Bay / Nacelle- showing the bow in the top of the wing

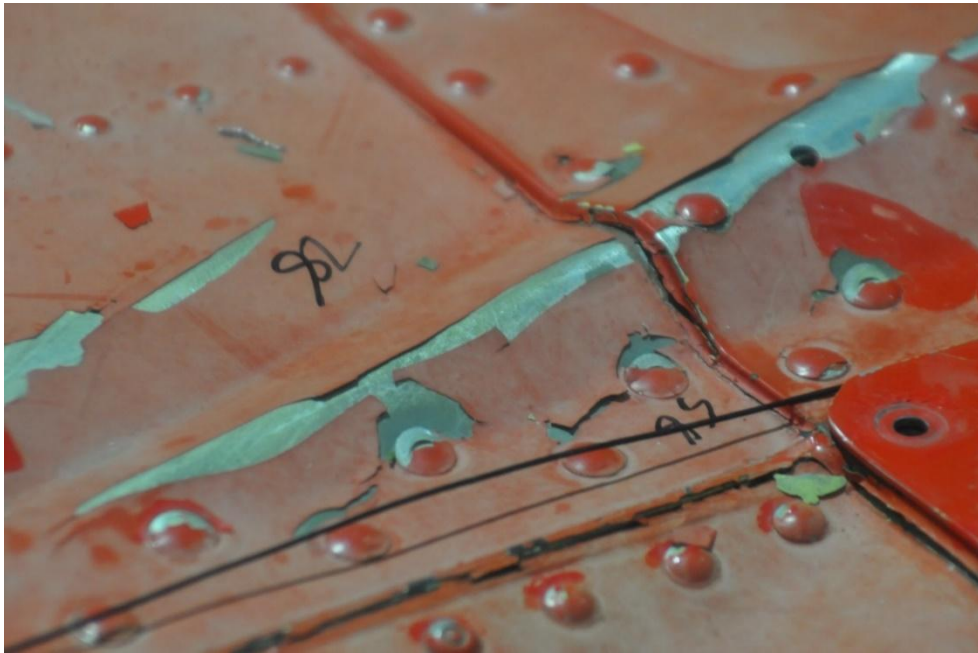


Figure 37 - Starboard Side Rear Bay / Nacelle

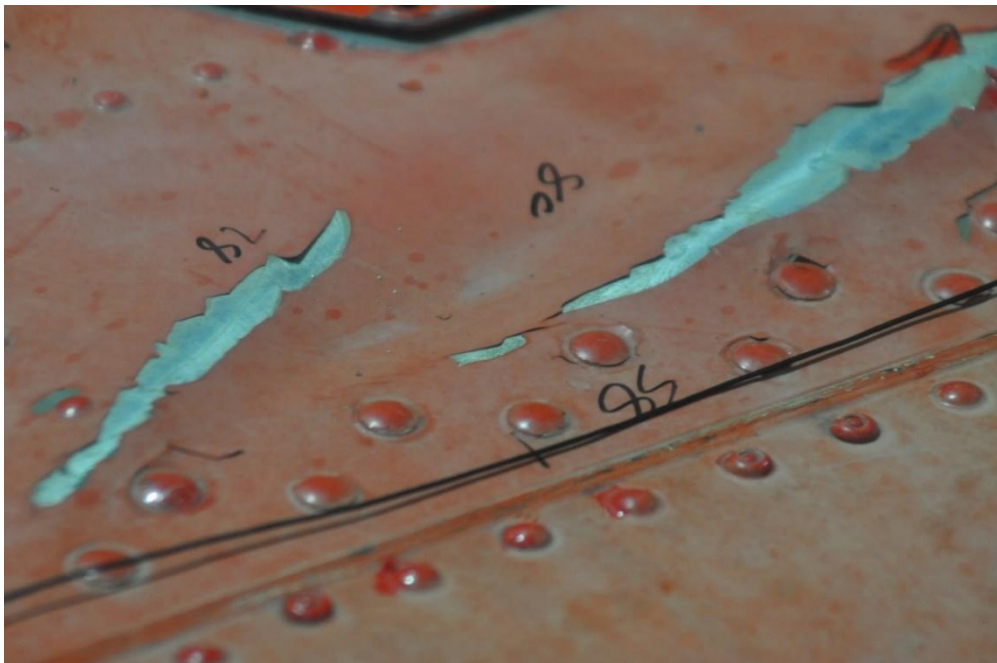
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**Figure 38 - Starboard Side Looking FWD on Rear Bay and Nacelle**



**Figure 39 - Starboard Side Looking FWD on Rear Bay and Nacelle**

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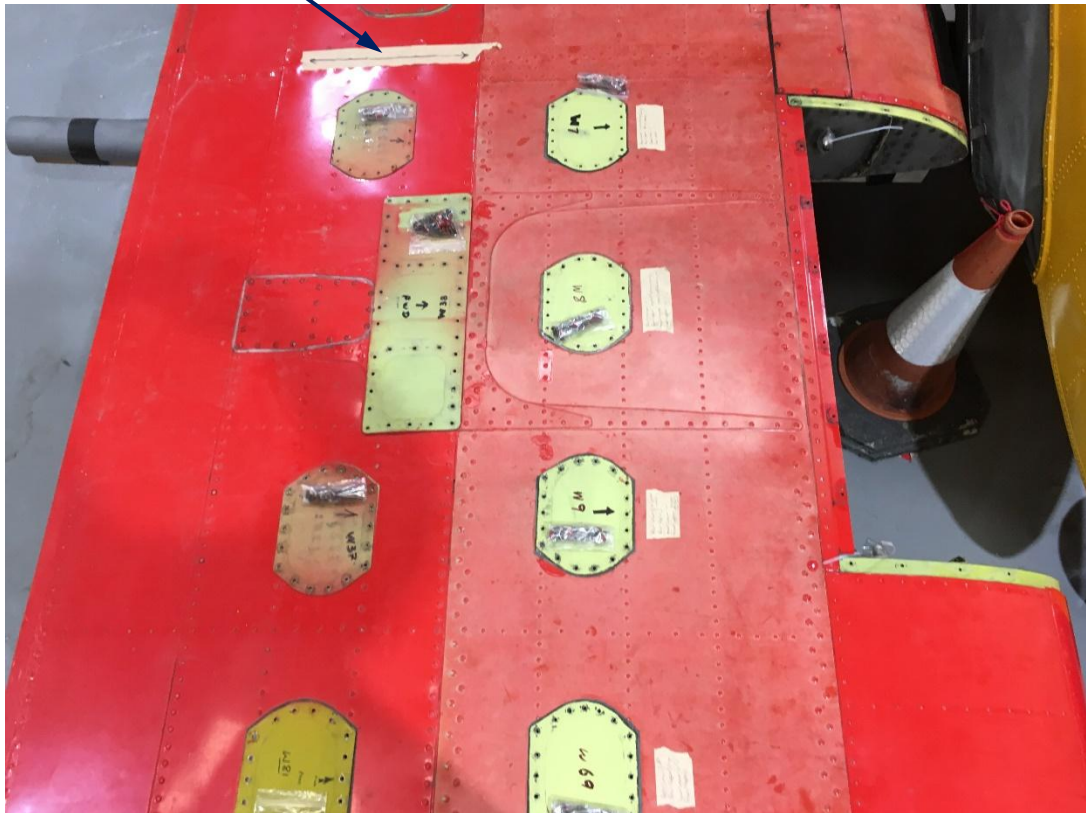
**Figure 40 - View Looking Down On Starboard Side Port Side Overview**

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Bow – not flat



**Figure 41 - Plan View on Port Side**



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**Figure 42 - Wing Panel W12 port side of the centre line is no Longer Flat**



**Figure 43 - Port Forward Wing to Fuselage Forward Pick Up Point signs of movement**

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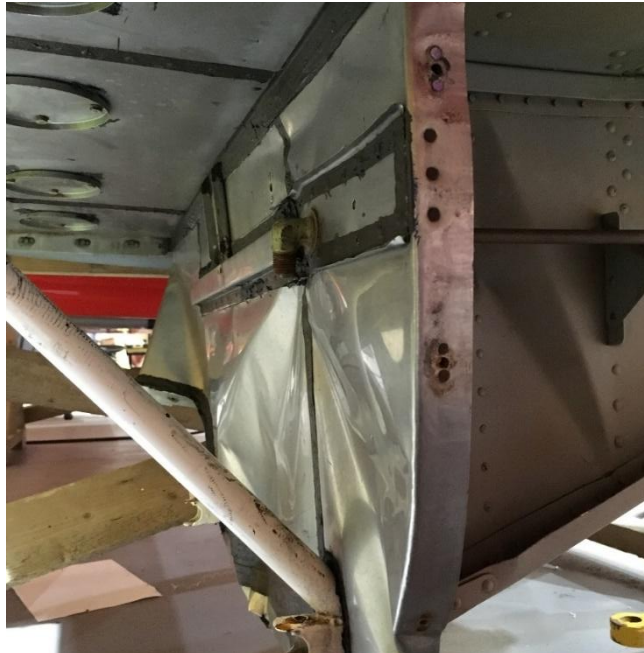
Figure 44 - View on W14 – Leading edge starboard side



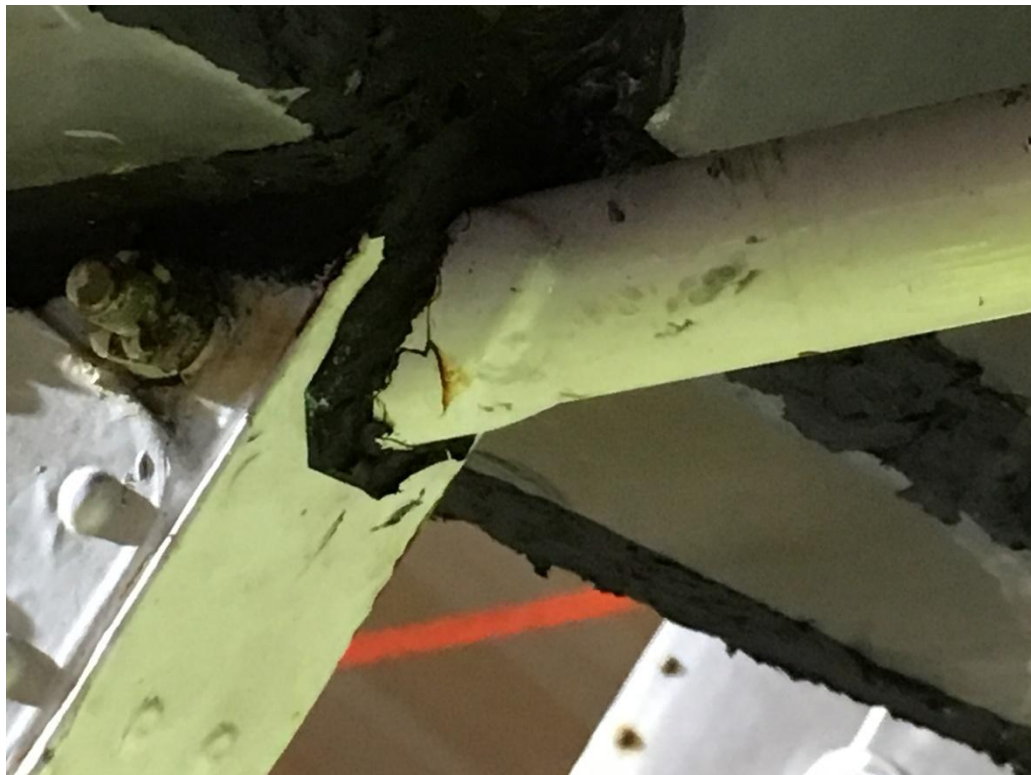
Figure 45 - View looking under W14 – The rib is damaged and not touching the skin

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**Figure 46 - View on Starboard Firewall**



**Figure 47 - View on Engine Frame Upper Mount Paint Cracking**

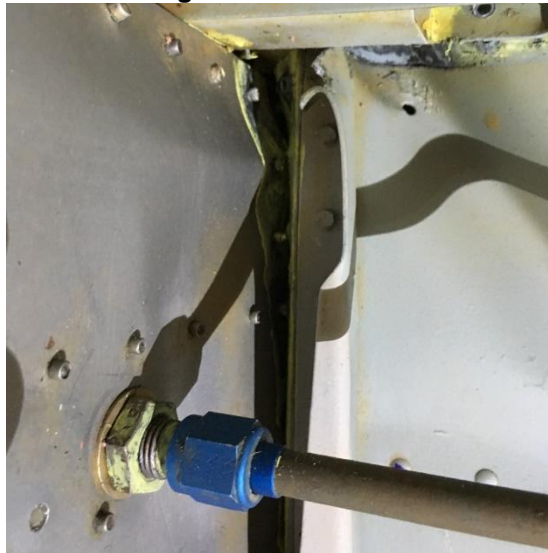
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**Figure 48 - View looking on Outboard on Starboard Nacelle**



**Figure 49 - Close Up on Starboard Aft Side of fire wall**

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Figure 50 - Starboard Side Looking Outboard on Nacelle



Figure 51 - Starboard Side Flap Shroud



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**Figure 52 - Starboard Side Looking inboard on Nacelle**



**Figure 53 - Starboard side twisted trailing edge**

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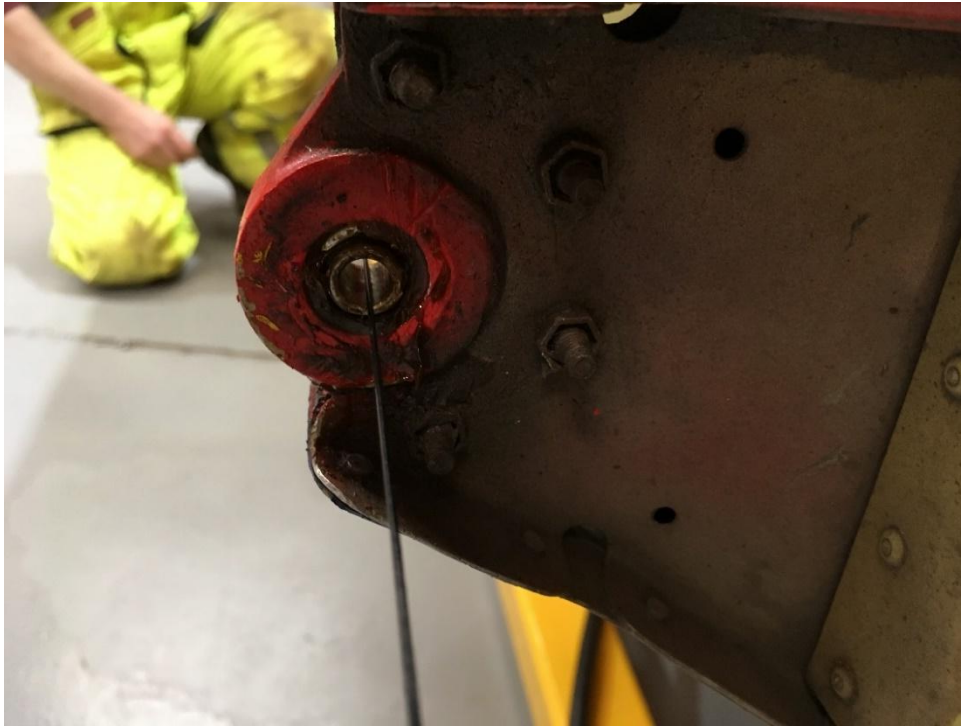


Figure 54 - Starboard Side Flap Middle Hinge Point is no Longer Aligned



Figure 55 - View on Panel W70

	<p align="center"><b>DESIGN OFFICE REPORT</b></p>	<p>Document No.: DOR-BN2-0840 Issue A</p>
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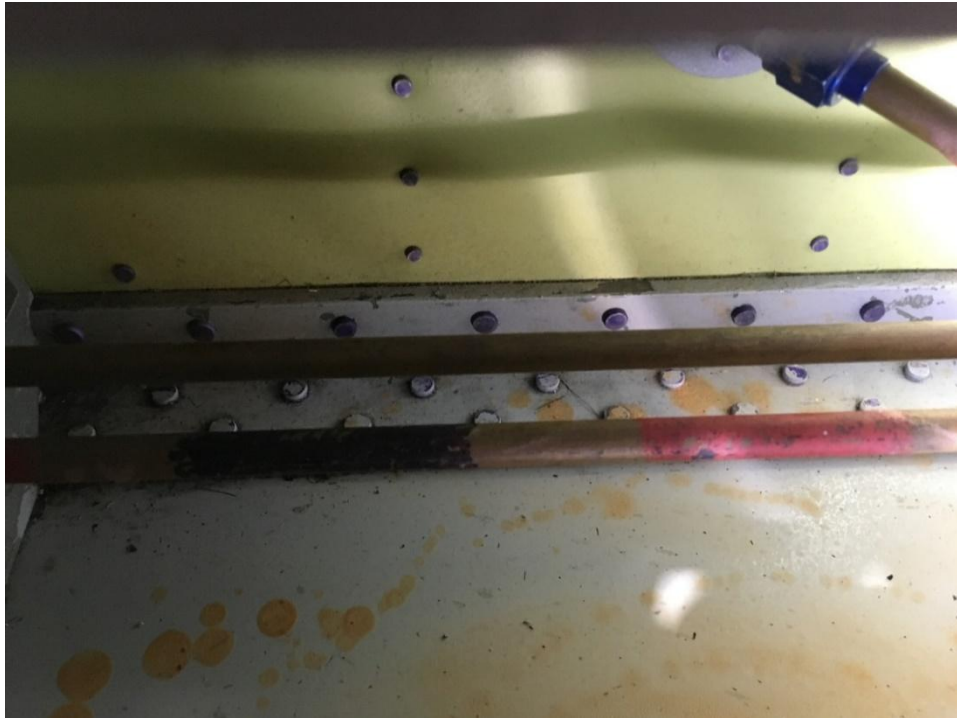


Figure 56 - View looking on an example of paint cracking on a lamination



Figure 57 - View on Panel W16



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**Figure 58 - View looking on capping – paint cracking – possible movement between the lamination**



**Figure 59 - View looking on capping – paint cracking – possible movement between the lamination**

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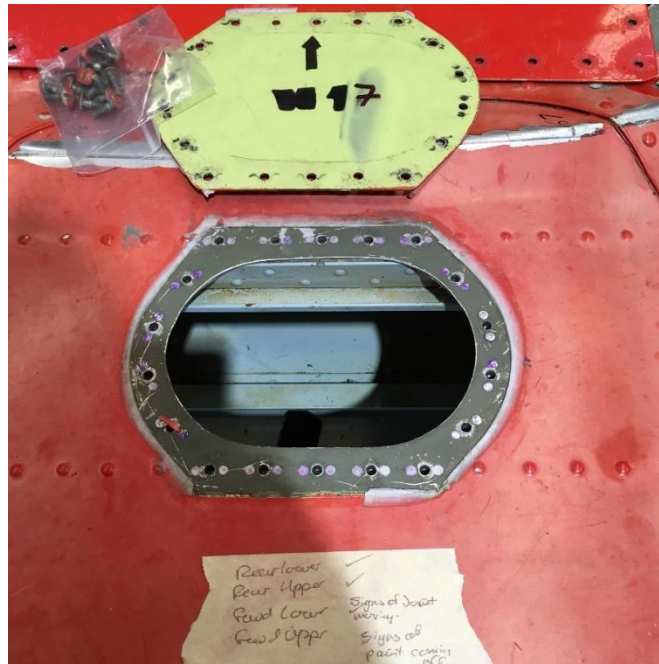


Figure 60 - View on Panel W17

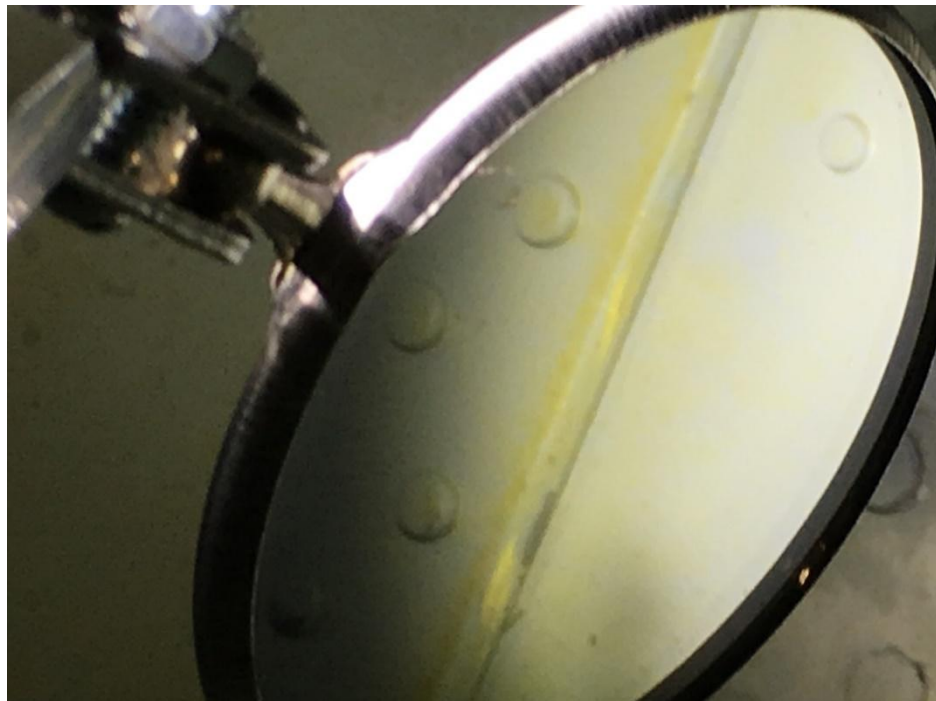


Figure 61 - View looking on capping – paint cracking



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Figure 62 - View looking on capping – paint cracking – possible movement between the lamination



Figure 63 - View on Panel W8

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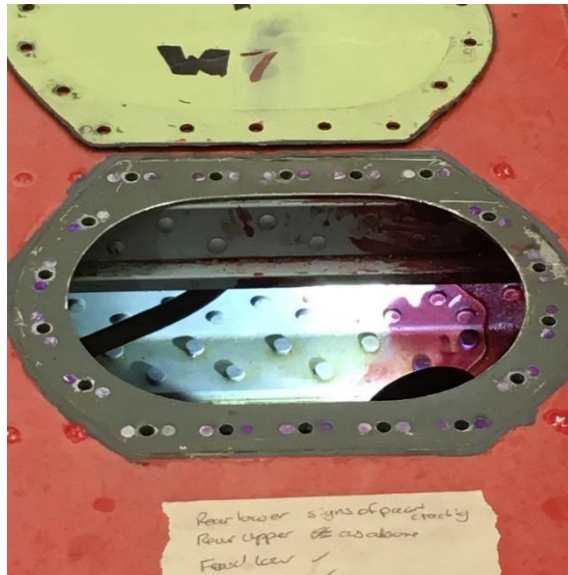


Figure 64 - View on Panel W7

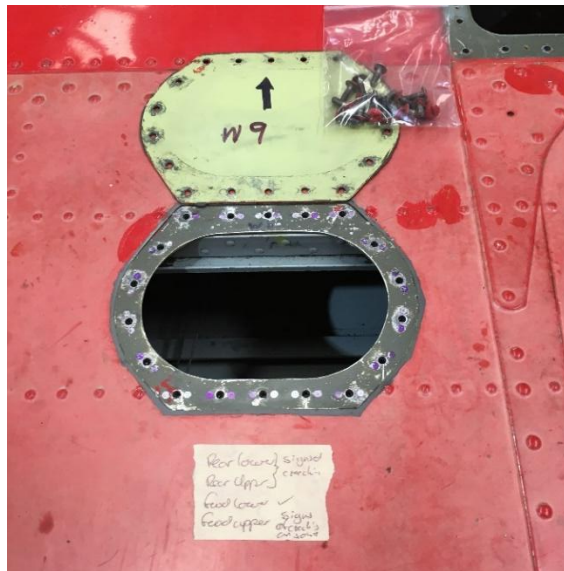


Figure 65 - View on Panel W9

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**Figure 66 - View looking on capping – paint cracking**



**Figure 67 - View looking on capping – paint cracking – possible movement between the lamination**

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**Figure 68 - View looking on capping – paint cracking – possible movement between the lamination**



**Figure 69 - View looking on capping – paint cracking – possible movement between the lamination**



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## 5. APPENDIX 3 – WORK REQUIRED

### Fuselage

Whilst the fuselage showed signs of twisting by the stretch lines between the forward and rear spar pickup points and the longitudinal stringers, when the wing was removed the area between the forward and rear fuselage wing pick up points have gone back to the normal positions. It should be noted that when the wing was being removed the rear bolts came out with no issues and slid out with ease. The forward bolts were difficult to remove and could indicate something is not aligned correctly, but no further inspections were carried out on the fuselage.

### Wing

Overall when looking down the trailing edge the wing tips are no longer aligned, that indicates the wing is twisted. Looking at the starboard side the flap centre hinge point has moved. The wing has also a bow in the top of the wing and a bow going forwards from the flap hinge point.

The Port side of the wing has sustained damage but is much more subtle. The nacelle lower angles have bent this is consent with nacelle taking more load than it should, due to the leg moving. It would be recommended that the nacelle is replaced. It should be noted that the structure has stretched beyond its original shape. For example there is a forward to aft bulge in line with the outer edge of the flap. This side also has a bulge at the forward wing to fuselage pickup point.

On the starboard side between the fuselage pickup point and the end of the flap along the wing leading edge there was only 1mm difference in height. Going aft two rows of rivets aft (mid way between the two spars) it varied 3mm difference in height. Going aft two rows of rivets aft (on the rear spar) it varied 12mm difference in height. Going aft two rows of rivets aft (in line with the rear of the fuselage) it varied 15 mm difference in height.

An inspection along the wing for SB237. In areas where the paint is flaking of the spar caps have become delaminated they will have to be repaired.

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Ref	Part Number	Description	Comment
Engine			
5.1.1	0-540-E4C5	Port Engine	The shock loading from the airframe to the engine mean this engine will need to be overhauled.
5.1.2	0-540-E4C5	Starboard Engine	The engine mounts have given way from the engine casing. The shock loading from the airframe to the engine and the broken mounts mean this engine will need to be replaced.
Engine Indication			
5.1.3	All engine controls were disconnected		
5.1.4	Manifold pressure		
5.1.5	Engine RPM		
5.1.6	Carb temperature		
5.1.7	Engine EGT	S476-1394	
5.1.8	Engine Cylinder Temperature	One unit S531.2.16 366.2	
5.1.9	Engine Oil Temperature		
5.1.10	Engine Oil Pressure		
5.1.11	Fuel Pressure		
5.1.12	Engine Voltage		
5.1.13	Ammeter		
5.1.14	Vacuum		
5.1.15	Engine Loom		
Engine Controls			
5.1.16	Engine Controls		Starboard side conduits were bent and all cables to be replaced as they got crushed
Anti Ice System			
5.1.17		Conduits disconnected	

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De-Ice System			
5.1.18		Pipes	
5.1.19		Timer port and starboard	
Engine Structure			
5.1.20	NB-20-5231	Port Engine frame	The bolts in the engine frame were bent and the engine frame has signs of the lower mount bending.
5.1.21	NB-20-5231	Starboard Engine Frame	This engine frame looks ok, however this is on the side of the aircraft with the extensive wing damage and will need to be replaced.
5.1.22	NB-20-1903	Port Diagonal engine struts	There are 2 per engine installation and on the port side these were bent and should be replaced.
5.1.23	NB-20-1903	Starboard Diagonal engine struts	There are 2 per engine installation and on the starboard side these were bent and should be replaced.
5.1.24	NB-20-1905	Port Horizontal engine struts	There are 2 per engine installation and were not reviewed but would need to be replaced.
5.1.25	NB-20-1905	Starboard Horizontal engine struts	There are 2 per engine installation and were not reviewed but would need to be replaced.
5.1.26	J7402-20	Port Mount Engine	There are 4 per engine installation and were not reviewed. This will be replaced.
5.1.27	J7402-20	Starboard Mount Engine	There are 4 per engine installation and were not reviewed. This will be replaced.
Propellers			
5.1.28	HC-C2YK-2CUF	Port Prop	Not reviewed, but need to be sent for overhaul
5.1.29	HC-C2YK-2CUF	Starboard Prop	Not reviewed, but need to be sent for overhaul
Engine Cowlings			
5.1.30		Starboard Lower Engine Cowling	The cowling should be replaced.
5.1.31		Port Lower Engine Cowling	OK to install
5.1.32		Starboard Upper Engine Cowling	There is a large hole, so the cowling should be replaced.
5.1.33		Starboard Upper Engine Cowling	OK to install
5.1.34		Port rear inner nacelle fairing	OK to install

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5.1.35		Port rear Outer nacelle fairing	OK to install
5.1.36		Starboard rear Inner nacelle fairing	Damaged require replacement
5.1.37		Starboard rear Outer nacelle fairing	OK to install
Undercarriage			
5.1.38		Port Undercarriage Leg Tube	Require replacement
5.1.39		Starboard Undercarriage Leg Tube	Require replacement
5.1.40	AIR46200-6 or AIR83002-2	Port Undercarriage	Overhaul
5.1.41	AIR46200-6 or AIR83002-2	Starboard Undercarriage	Overhaul
5.1.42	AIR46202-2	Nose Undercarriage	Overhaul
5.1.43		Port Leg fairing	OK to install
5.1.44		Starboard Leg fairing	Is crumpled and would have to be replaced. Note this is an early standard and if the later standard is supplied it would be better to have both Port and Starboard leg fairings of the later standard.
Brakes			
5.1.45		Brake pipes	Ok
Flying Controls			
Fin			
5.1.46		Fin	Serviceable. This was removed to enable the aircraft to be safety recovered and consumable parts for the installation will be required.
Rudder			
5.1.47		Rudder	Serviceable. This was removed to enable the aircraft to be safety recovered and consumable parts for the installation will be required.
5.1.48		Rudder trim tab	Serviceable. Kept with the Rudder as one assembly



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Horizontal Stabilizer			
<b>5.1.49</b>		Horizontal Stabilizer	Serviceable. This was removed to enable the aircraft to be safety recovered and consumable parts for the installation will be required.
Elevator			
<b>5.1.50</b>		Elevator	Serviceable. This was removed to enable the aircraft to be safety recovered and consumable parts for the installation will be required.
<b>5.1.51</b>		Elevator Trim tab	Serviceable. Kept with Elevator
Flap			
<b>5.1.52</b>		Flap Actuator and associated components	Sent for overhaul. The associated bell cranks and control rods require replacement.
<b>5.1.53</b>		Flap Control rods	As above.
<b>5.1.54</b>	NB-25-285	Starboard Flap	The flap has a crease in the trailing edge and the spar is bent, it looks like it is beyond repair so a replacement would be the best cause of action.
<b>5.1.55</b>	NB-25-286	Port Flap	OK to install
Electrical Removals			
<b>5.1.56</b>		Stall warning	The wiring for the stall warning has been removed from the wing and stowed in the aircraft.
<b>5.1.57</b>		Landing lights (Port and starboard)	The wiring for the Landing lights has been removed from the wing and stowed in the aircraft.
<b>5.1.58</b>		Nav lights (Port and starboard)	The wiring for the Nav lights has been removed from the wing and stowed in the aircraft.
<b>5.1.59</b>		Com antenna (Port and starboard)	The wiring for the Com antanns have been removed from the wing and stowed in the aircraft.
<b>5.1.60</b>		Fuel sender (Port and starboard)	The wiring for the fuel senders have been removed from the wing and stowed in the aircraft.
<b>5.1.61</b>		Fuel pumps (Port and starboard)	The wiring for the fuel pumps (2 per wing) have been removed from the wing and

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			stowed in the aircraft.
<b>5.1.62</b>		Aileron Cables disconnected	The wiring for the fuel pumps (2 per wing) have been removed from the wing and stowed in the aircraft.
<b>5.1.63</b>		Aileron Balance requires replacement	The wiring for the fuel pumps (2 per wing) have been removed from the wing and stowed in the aircraft.
<b>5.1.64</b>		Fuel cocks were disconnected	The wiring for the fuel pumps (2 per wing) have been removed from the wing and stowed in the aircraft.
<b>5.1.65</b>		Pitot Static System was disconnected	The wiring for the fuel pumps (2 per wing) have been removed from the wing and stowed in the aircraft.
Paint			
<b>5.1.66</b>		Re-paint the effective area	
Testing			
<b>5.1.67</b>		Weigh the aircraft on completion	
<b>5.1.68</b>		Compass swing	
<b>5.1.69</b>		Bleed the brakes	
<b>5.1.70</b>		Rig Engines	
<b>5.1.71</b>		Fuel Flow	
<b>5.1.72</b>		Engine Runs post engine installation	
<b>5.1.73</b>		Rig Ailerons	
<b>5.1.74</b>		Rig Rudder	
<b>5.1.75</b>		Rig Rudder Trim	
<b>5.1.76</b>		Rig Elevator	
<b>5.1.77</b>		Rig Elevator Trim	
<b>5.1.78</b>		Rig Flaps	
<b>5.1.79</b>		Flight evaluation	
<b>5.1.80</b>		Aircraft Alignment check	