

# REPORT ON SERIOUS INCIDENT

(Law on Aircraft Accident Investigation no. 35/2004)

**M-07404/AIG-35**

**TF-SYN**

**Fokker F-27-200**

**Vaagar, Faroe Islands**

**October 1, 2004**



The aim of the aircraft accident investigation board is solely to identify mistakes and/or deficiencies capable of undermining flight safety, whether contributing factors or not to the accident in question, and to prevent further occurrences of similar cause(s). It is not up to the investigation authority to determine or divide blame or responsibility. This report shall not be used for purposes other than preventive ones.

(Law on Aircraft Accident Investigation, No. 35/2004)

## 1 HISTORY OF FLIGHT

<b>Place:</b>	Vaagar Airport (EKVG), Faroe Islands.
<b>Date and time:</b>	October 1, 2004 at 09:35 local time.
<b>Aircraft:</b>	
- type	Fokker F-27-200.
- registration	TF-SYN, registered Special Coast Guard.
- year built	1976.
- serial number	10545.
- CoA	Certificate of Airworthiness not valid.
<b>Type of flight:</b>	Passenger flight.
<b>Total on board:</b>	5 crew, 12 passengers.
<b>Injuries:</b>	None.
<b>Damage:</b>	Nose landing gear wheel lever sub-assembly fractured.
<b>Incident description:</b>	Nose landing gear collapsed during landing run.
<b>Owner:</b>	Icelandic Coast Guard.
<b>Operator:</b>	Icelandic Coast Guard.
<b>Weather:</b>	Daylight, visibility more than 10 km, wind 130°/10G15 knots and temperature 10°C. Clouds scattered 500 feet, broken 700 feet, few 1200 feet.
<b>Flight Rules:</b>	Instrument Flight Rules.
<b>Captain:</b>	
- age, sex	61-year-old male.
- license	Holding a valid ATPL/A license issued by the Icelandic CAA.
- experience	Total flight hours: 13,275:55 Total flight hours on type: 11,341:10 Hours flown 90 days before incident: 38:35 Landings 90 days before incident: 6
<b>Pilot:</b>	
- age, sex	48-year-old male.
- license	Holding a valid ATPL/A license issued by the Icelandic CAA.
- experience	Total flight hours: 5,476:50 Total flight hours on type: Not available Hours flown 90 days before incident: 109:55 Landings 90 days before incident: 24

## History of flight

TF-SYN landed at 09:35 local time on runway 13 at Vaagar Airport. During the landing run the crew felt a bump and when the aircraft was taxied from the runway the nose of the aircraft tilted downwards and the aircraft came to a stop. Inspection revealed that the nose landing gear had collapsed, as can be seen in Figure 1. The collapse was due to a fracture in the nose wheel lever sub-assembly, as can be seen in Figure 2.



**Figure 1: Nose landing gear**

The Icelandic AAIB was notified of the incident by the Icelandic Coast Guard shortly after the incident. The Icelandic AAIB notified the Danish AAIB. The Danish AAIB was in agreement that the Icelandic AAIB would conduct the investigation.



**Figure 2: Wheel lever sub-assembly**

Field inspection by Icelandic Coast Guard technicians revealed that the wheel lever sub-assembly had fractured at the attachment points for the shock absorber. The fracture allowed the wheel lever sub-assembly to overrotate so that it clamped the nose wheel between the pivot bracket sub-assembly and the ground (see Figure 1 and illustration in Appendix A).

## **Additional Information**

### *Landing Gear Exchange*

TF-SYN is a Fokker F-27-200 fitted with Messier-Dowty landing gears. The nose landing gear carries the part number 200490001 and the main landing gear the part number 200063007. The landing gears ("The Original Landing Gears") have a first and repetitive overhaul cycle life limit of 12,000 cycles and a calendar overhaul limit of 12 years, whichever comes first, as established by the Icelandic Coast Guard F-27-200 Maintenance Program (based on Dowty Service Letter No. A.28/30.11.84).

The nose landing gear ("The Original Nose Landing Gear") and the left main landing gear ("The Original Left Main Landing Gear") were to be overhauled in 2004. During the fall of 2003 the Icelandic Coast Guard started looking for an overhaul facility that could supply them with landing gears while the Coast Guard landing gears were being overhauled. Quotes were received from several suppliers.

Lux Aerospace, a parts supplier in Luxemburg, was selected for the project as it could supply the Coast Guard with loaner landing gears. Lux Aerospace contracted the overhaul of the Coast Guard Original Landing Gears to Florida Aviation Repair Services (FAA CRS# F4PR415X). Florida Aviation Repair Services also inspected and issued a release certificate (FAA Form 8130-3) for the loaner nose landing gear ("The Loaner Nose Landing Gear"), the first loaner left main landing gear ("The First Loaner Left Main Landing Gear") and the second loaner left main landing gear ("The Second Loaner Left Main Landing Gear") that came from Lux Aerospace unserviceable stock.

The Coast Guard had planned on performing the landing gear replacement during scheduled maintenance (B check) that took place at the end of March 2004. During the maintenance period the Coast Guard received The Loaner Nose Landing Gear (serial number AD1008) and the First Loaner Left Main Landing Gear (serial number GS/DRG/31/69) from Florida Aviation Repair Services (see Table 1, rows 1 and 2). Receiving inspection found the condition of the First Loaner Left Main Landing Gear unairworthy although it was accompanied by a FAA 8130-3 form. The First Loaner Left Main Landing Gear was among other things dirty and bolts and pins were stuck in their seats. However, visual inspection of the Loaner Nose Landing Gear revealed

nothing abnormal and it was received and issued a serviceable tag. The First Loaner Left Main Landing Gear was rejected by the Coast Guard and Lux Aerospace was notified. Lux Aerospace responded by providing The Second Loaner Left Main Landing Gear (see Table 1, row 3) once again through Florida Aviation Repair Services.

The FAA 8130-3 forms did not list the complete back-to-birth traceability of the landing gears as is required in Block 13 on the form (see forms in Appendix C). The back-to-birth traceability could be established for The First Loaner Left Main Landing Gear and The Second Loaner Left Main Landing Gear from records from a previous overhauler, as listed in the footnotes for Table 1. Complete traceability was not available for The Loaner Nose Landing Gear as the exact overhaul date was missing (assumed to be January 1, 1988).

<b>Gear</b>	<b>Part No.</b>	<b>Serial No.</b>	<b>CSN</b>	<b>CSO</b>	<b>Calendar<sup>1</sup></b>
The First Loaner Left Main Landing Gear	200063007	GS/DRG/31/69	58,744	8,040	5,285 days <sup>2</sup>
The Loaner Nose Landing Gear	200490001	AD1008	47,215	10,745	5,915 days <sup>3</sup>
The Second Loaner Left Main Landing Gear	200063007	GS/DRG/36/65	44,398	8,040	5,507 days <sup>4</sup>

**Table 1: Loaner landing gears**

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<sup>1</sup> CSN – Cycles Since New  
CSO – Cycles Since Overhauled  
Calendar – Days Since Last Overhaul. Days from last overhaul until date on 8130-3 release certificate (Block 23).

<sup>2</sup> 14 years, 5 months, 19 days  
(Last overhaul September 22, 1989 and 8130-3 signed March 11, 2004)

<sup>3</sup> 16 years, 2 months, 11 days  
(Only had information on overhaul year being 1988. Assumed overhaul January 1, 1988 and 8130-3 signed March 11, 2004). Traceability is questionable.

<sup>4</sup> 15 years, 28 days  
(Last overhaul May 11, 1989 and 8130-3 signed June 7, 2004)

The Icelandic Coast Guard notified the Icelandic Civil Aviation Administration (ICAA) in a letter dated April 1, 2004 that The First Loaner Left Main Landing Gear was unairworthy and requested an extension to the overhaul life limit of The Original Landing Gears that were already installed on the aircraft. The intention was to postpone the replacement to a later date when all parts would be available. The Original Left Main Landing Gear was due in February 2004 as the gear had been overhauled by Icelandair in February 1992. The Original Nose Landing Gear was due in April 2004. The letter also indicated by an attachment that The Original Left Main Landing Gear (serial number GS/DRG/7/76) was overdue on the calendar overhaul period. Details on The Original Landing Gears can be found in Table 2 below.

<b>Gear</b>	<b>Part No.</b>	<b>Serial No.</b>	<b>CSN</b>	<b>CSO</b>	<b>Calendar due<sup>5</sup></b>
The Original Left Main Landing Gear	200063007	GS/DRG/7/76	5.460	3.493	Due March 2004
The Original Nose Landing Gear	200490001	GS/DRG/864/76	5.459	3.542	Due April 2004

**Table 2: Original Landing Gears installed on aircraft**

The ICAA granted an extension to the calendar overhaul life of The Original Landing Gears in Table 2 on April 2, 2004. The ICAA extension allowed the use of The Original Nose Landing Gear until July 2004 and The Original Left Main Landing Gear until June 2004. In a letter dated May 27, 2004, the Coast Guard applied for a further extension of the landing gear replacement, until July 15. The letter stated difficulty in obtaining spare parts as the reason for the extension. The ICAA granted the extension on May 28, 2004.

After the replacement had been postponed the Coast Guard Technical Director contacted Florida Aviation Repair Services and asked for their shop capability list and a list of companies who had done business with them in order to assure himself that the shop was a capable and qualified overhauler. The Technical Director also

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<sup>5</sup> Exact calendar due dates could not be established

contacted a company in New Zealand which recommended Florida Aviation Repair Services.

In June of 2004 The Second Loaner Left Main Landing Gear (serial number GS/DRG/36/65) was received from Florida Aviation Repair Services, accompanied by a FAA 8130-3 form. The attached work order and release certificate noted that The Second Loaner Left Main Landing Gear lower swivel was bent and the left hand and right hand door operating bars were worn to limit.

The condition of The Second Loaner Left Main Landing Gear was found to be unsatisfactory during receiving inspection and the Coast Guard questioned the airworthiness of the landing gear. An outside aircraft technician consultant was brought in to give his opinion on the condition of the landing gear. Following that consultation the Coast Guard decided to replace the defective parts on the landing gear and move forward with the replacement.

On July 14, 2004 the Coast Guard sent a letter to the ICAA requesting an extension to the overhaul life limit of The Loaner Nose Landing Gear and The Second Loaner Left Main Landing Gear. The Second Loaner Left Main Landing Gear (serial number GS/DRG/36/65) had last been overhauled more than 15 years previously and The Loaner Nose Landing Gear had last been overhauled more than 16 years previously (the recommended calendar period for overhaul should not exceed 12 years, as prescribed by Messier-Dowty Service Letter No. A.28) The ICAA approved the extension on July 15, 2004. The approved extension was valid until September 28, 2004 for The Loaner Nose Landing Gear, and December 14, 2004 for The Second Loaner Left Main Landing Gear.

The Original Nose Landing Gear and the Original Left Main Landing Gear were replaced during a maintenance stop from July 15 until July 20, 2004. Functional and operational tests were carried out in accordance with the Aircraft Maintenance Manual and the replacement was signed off without any anomalies noted. The removed gears (The Original Landing Gears) were sent to Florida Aviation Repair Services for a complete overhaul.

Before starting the landing gear exchange the Coast Guard discussed their plan of action with the ICAA. The plan was to secure the loaner landing gears from Lux Aerospace and send them to an approved overhauler for inspection as described

above. Based on this plan the ICAA said they would be able to grant extensions to the calendar overhaul life of the loaner landing gears. The Coast Guard failed to inform the ICAA of the actual conditions of the landing gears that they received and the internal debate they had on the airworthiness of the landing gears.

The incident in the Faroe Islands occurred on October 1, 2004, three days after the extension granted by the ICAA for The Loaner Nose Landing Gear expired. The aircraft was at the time of the incident unairworthy.

### *Overhauled Landing Gears*

In the first week of October 2004 the Coast Guard received The Original landing Gears (see Table 2) from overhaul by Florida Aviation Repair Services. The Original Landing Gears were received by Air Iceland on behalf of the Coast Guard. Receiving inspection revealed that maintenance instructions from the manufacturer's component maintenance manual (CMM) had not been followed during the overhaul. The landing gears were rejected by the Coast Guard as unserviceable and reported to the ICAA who inspected the landing gears. The Air Iceland receiving report included the following findings (not a complete listing from the receiving report):

- *The gear was painted with straps, identification plate, installation plate still attached.*
- *Bolts and brackets had not been removed making the CMM mandatory non-destructive testing (NDT) impossible.*
- *Parts were found with old JC5A anti-corrosion compound, sealant and grease.*

The Original Landing Gears were sent to Smith's Harlow Aerospace in England where the landing gears were overhauled in accordance with the manufacturer's component maintenance manual. The strip report from Smith's Harlow for The Original Nose Landing Gear (serial number GS/DRG/864/76) included among the following findings:

- *The landing gear leg had been painted with the wrong type of paint*
- *Steering Ram Mounting bores full of paint.*
- *Pivot Bracket End Fitting Bearing is corroded.*



- *The Lower Bearing, the Dowels and bolt holding the End Fitting have been painted over, we can see old grease under the paint.*
- *The Hinge Pin Bushes are badly corroded.*
- *Wheel Lever, Shock Absorber Lug Bushes are worn and damaged.*
- *One of Axle Bush is missing.*

The strip report for the Original Left Main Landing Gear in Table 2 contains similar findings.

## **Organizational and Management Information**

### *Coast Guard Technical Management*

During the replacement of The Original Landing Gears in July 2004 there was a disagreement between the base technicians and the technical management on the airworthiness of The Loaner Nose Landing Gear and The Second Loaner Left Main Landing Gear. The base technicians refused to install the landing gears as they judged them as being unairworthy. The technical management staff sought outside consultation to evaluate the status of the landing gears. Following that consultation the Deputy Chief Mechanic and his assistant made the necessary repairs and carried out the landing gear replacement. The Technical Director inspected the work and the Deputy Chief Mechanic released the aircraft back into service.

### *Regulations*

At the time of the incident the Coast Guard was not JAR approved as a maintenance provider but was working on obtaining a JAR-145 approval. The Coast Guard had drafted a handbook (Maintenance Management Exposition) to support its JAR-145 approval.

The Icelandic Coast Guard was operating TF-SYN in a Special Coast Guard category as listed on the Airworthiness Certificate. The Icelandic Coast Guard did not hold a JAR-OPS 1 approval as an air operator. The certificate of airworthiness was restricted to operations in accordance with Icelandic law no. 25/1967 (Law about the Icelandic Coast Guard). Furthermore Icelandic law on aviation no. 60/1998 were applicable to the Icelandic Coast Guard. These laws do not provide any details

on common technical requirements and administrative procedures for ensuring continued airworthiness of aircraft, including any component for installation as the JAR-145 and JAR-OPS 1 approvals detail. As stated in law no. 25/1967 the Icelandic Civil Aviation Administration should supervise the operation. Records collected indicate that the ICAA audited the Coast Guard on several occasions but there were no working procedures on how the ICAA supervised the Coast Guard. The ICAA also approved extensions of maintenance tasks. It is therefore unclear how the ICAA supervised the Coast Guard's maintenance and operations.

### *Icelandic Civil Aviation Administration Reactions*

The ICAA reported its findings on the landing gear inspections and overhaul to the FAA in a letter dated October 14, 2004. The letter explained the condition of The Loaner Nose Landing Gear and the First Loaner Left Main Landing Gear and that they were unserviceable although they were accompanied by a FAA 8130-3 form. The FAA opened a Suspected Unapproved Parts (SUP Case No. 2005-00077) case to investigate Florida Aviation Repair Services. The FAA investigation synopsis described the following:

*“The Landing Gear components that were sent to Florida Aviation Repair Services, Inc., were found not to be properly overhauled in accordance with the Manufacturers Maintenance manual as required. The discrepancies noted in the report of SUP teardown reports were accurate in their description. The Landing gear components were approved parts that were not correctly overhauled. The Landing gear assemblies were sent to another overhaul facility and were overhauled correctly and have been returned to service. All of the landing gear components that were overhauled have been returned to the Icelandic Coast Guard to be reinstalled on their aircraft. This was determined to be an isolated incident because procedures were immediately put into place at the repair station to prevent this type of occurrence from happening again. An enforcement investigation report has been opened in this matter against Florida Aviation Repair Services, Inc., CRS#F4PR415X.*

*This case is recommended for closure.”*

The FAA SUP case was closed on July 15, 2005 with the following close-out synopsis.

*“Landing gear assemblies were sent to a certificated repair station for overhaul. Landing gear assemblies were received after overhaul and it was determined that the assemblies were not correctly overhauled. Investigation revealed the repair station who approved the landing gear for return to service failed to correctly perform the overhaul.*

*The landing gear assemblies were sent to another repair station who overhauled the landing gear and approved them for return to service issuing a EASA Form 1.”*

The FAA opened an enforcement investigation report against Florida Aviation Repair Services. In closing the report the FAA issued a letter (see Appendix B) to Florida Aviation Repair Services as a matter of record. In the letter the FAA reprimanded Florida Aviation Repair Services for not following procedures in the manufacturer’s overhaul manual.

### *Coast Guard Maintenance Procedures*

The drafted Maintenance Management Exposition (MME) that the Coast Guard had submitted for approval contains a supplier evaluation procedure and a procedure for the acceptance of aircraft components and material from outside contractors. The supplier evaluation procedure (MME 2.1) states the following:

*“By using approved parts and trustworthy suppliers, safety and reliability of an aircraft and its systems and components can be increased considerably.*

*It is the policy of the Icelandic Coast Guard, to purchase, overhaul, repair, and test parts at the aircraft manufacturer, his suppliers, approved JAR-145 organizations, or organizations that are working under a quality management system of an approved JAR-145 organization.*

*For a part to be accepted by the Icelandic Coast Guard, the supplier must produce a certificate with all applicable data: part number, serial number or batch number if applicable, name of manufacturer, historical records if applicable, and the modification status.*

*The certificate shall be JAA Form One, FAA 8130-3 or TCA Form 24-0078 (Canada) and signed by a person authorized by the supplier.”*

The acceptance of parts procedure (MME 2.2) states the following for acceptance of parts.

*“On receipt of any part or material an inspection will take place by an assigned CRS Technician who will unpack the material and inspect for external general condition. The part number, and the serial number, if applicable, and the quantity must be verified against the pertaining purchase order. A JAA Form One or other valid documentation must also be available. If all the relevant papers and certificates are available and the general condition of the material is satisfactory the CRS Technician will issue a serviceable tag or an identification sticker. A serviceable tag will be used for all components and an identification sticker will be issued for all hardware and expandable parts. The serviceable tag or the ID sticker will always reflect the original purchase order number. The material nomenclature will be entered into the Computerized Inventory System and the material placed in its proper location in the stock room with the serviceable tag or ID sticker attached.*

*Parts that are sensitive to static charge are kept in the original anti-static wrapping. If the component has its own log card, that card will be attached to the serviceable tag along with the vendor's certificate of release to service. All other certificates and shipping papers will go into the purchase order master file folder. If any abnormalities are noted with the material or its certificates the CRS Technician will advise the Chief Engineer who will determine further processing.*

*Fokker F-27 parts manufactured prior to the introduction of the JAR regulations can be issued with an ICG serviceable tag providing the parts meet the following requirements, which are stipulated in the JAA AGM leaflet 10:*

- 1. A maintenance history record should be available for all used serialized aircraft components.*
- 2. An acceptance test report or statement should be available for all used and unused aircraft components that are subjected to acceptance testing after manufacturing or maintenance as appropriate.*
- 3. The aircraft component should be inspected for compliance with the manufacturers instructions and limitations for storage and condition including any requirement for limited storage life, inhibitors, controlled climate and special storage containers. In addition or in the absence of specific storage instructions the aircraft component should be inspected for damage, corrosion and leakage to ensure good condition.*
- 4. Compliance with known applicable airworthiness directives should be established.*
- 5. Compliance with known modifications and repairs should be established.*
- 6. For used aircraft components the flight hours/cycles/landings as applicable of any life limited parts including time since overhaul should be established.*
- 7. The storage life used of any storage life limited parts should be established. In this case the serviceable tag must refer to a workorder where the part is declared serviceable in accordance with this procedure."*

The Coast Guard did not follow either of the above mentioned procedures. The Technical Director visited Florida Aviation Repair Services in August 2004 after the replacement of the landing gears had taken place. The Coast Guard did not verify that full back-to-birth traceability of the landing gears was available when the relationship with Florida Aviation Repair Services was established and also not during the receiving inspection. The Coast Guard did not open a work order to test the aircraft components as the procedure above stipulates.

### *Changes at the Icelandic Coast Guard following incident*

The operating environment and maintenance at the Icelandic Cost Guard has changed since the incident in 2004. In September of 2005 the maintenance department obtained a Part 145 approval from the European Aviation Safety Agency as well as a EASA Part M approval for Continuing Airworthiness. During the fall of

2006 the flight operations department obtained JAR OPS 1 (Commercial Air Transportation, Aeroplanes) and JAR OPS 3 (Commercial Air Transportation, Helicopters) approvals that allows them to carry commercial passengers on both aeroplanes and helicopters. The Icelandic Coast Guard thus has an approved quality system that is audited regularly by the ICAA. These changes have increased the manpower at the Coast Guard and the number of employees have doubled since 2004.

The Coast Guard's draft MME is now an approved Continuing Airworthiness Management Exposition. The acceptance of parts procedure 2.2 has been changed considerably from the draft MME and now ensures that all parts from FAA and Transport Canada approved repair stations carry a dual release statement as required by US/European Bilateral Aviation Safety Agreement and Maintenance Implementation Procedures (MIP-G).

#### *Coast Guard and the Ministry of Justice and Ecclesiastical Affairs*

A committee was formed by the Ministry of Justice and Ecclesiastical Affairs in 2003. The committee's tasks were to review the financial budget process and financial position of the Coast Guard. The committee was to analyze problems that the Coast Guard was facing and find ways to enable targeted financial planning, develop ways for the Coast Guard to notify the ministry of its financial status, and to use the budget as a management tool. The committee was also asked to review the human resources planning and the organizational structure of the Coast Guard.

The committee assisted the Coast Guard in budgeting for the years 2003 and 2004. In numerous meetings various methods were discussed to lower cost to meet the appropriation set by the government and the ministry. The ministry made it clear to the Coast Guard that it would have to work within the allocated financial resources. The ministry was also reluctant to accept ideas of lowering costs by laying off employees or limiting the operational hours of Coast Guard aircraft and vessels.

The Technical Director expressed concern in a letter in July 2003 that it would be impossible to operate the aircraft and perform maintenance with the given financial resources. In an e-mail dated October 6, 2003 the Flight Safety Officer warned that the continuous budgetary cuts were affecting the operational environment at the Coast Guard. He warned that the spare parts stock was being depleted because of

insufficient financial resources. He pointed out that the Coast Guard sought out least expensive options in the purchase of overhaul for spare parts, which also led to excessive turnaround times for parts. He also warned that flight crews were not getting enough training hours as they were limited by financial resources and further reductions in training would threaten flight safety. He encouraged the ministry, the ICAA, and the Coast Guard management to reverse this process so that the Coast Guard could continue safe operations.

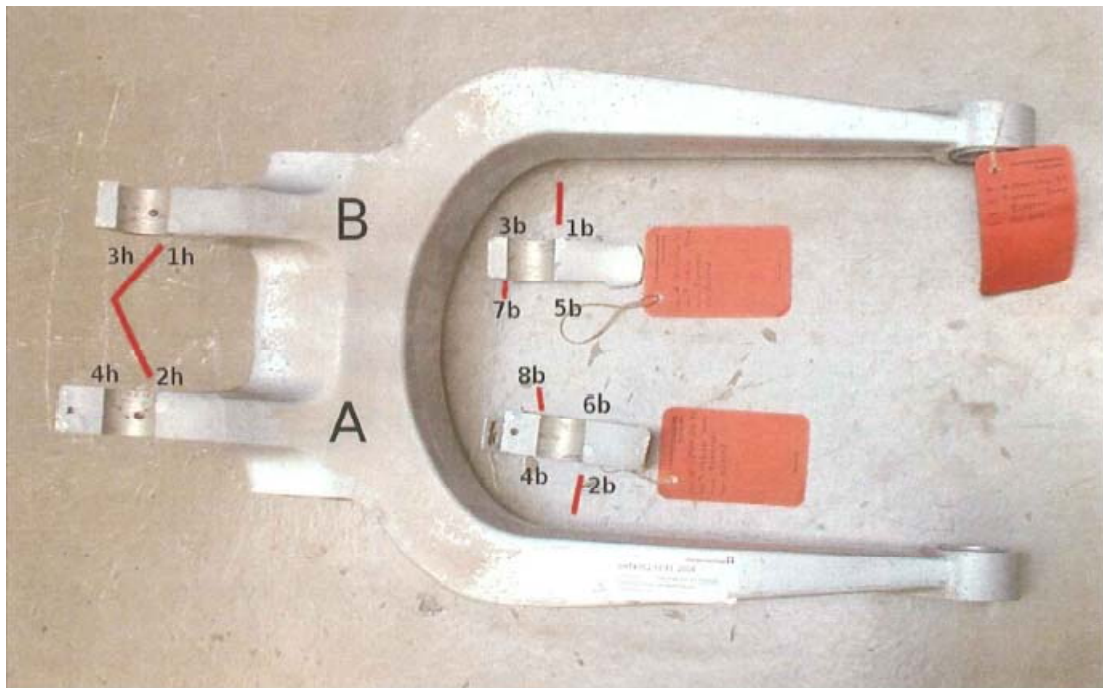
In a committee memo dated January 12, 2004 the Flight Operations Director stated that the flight operations department could not be sustained given the funds allocated for the year 2004. He pointed out that purchase of aircraft spare parts and maintenance had been postponed in 2003 in order for the Coast Guard to stay on budget and that those expenses were unavoidable in 2004. He also stated that helicopters had been flown although maintenance on them had been postponed.

On April 2, 2004 an e-mail was sent to the technical management from the Quality Manager to express safety concerns regarding the maintenance management at the Coast Guard. His concerns were that budgetary cuts and financial issues were threatening safety at the Icelandic Coast Guard. He pointed out among other things that purchase of spare parts were primarily cost driven to keep the cost as low as possible and that was not in accordance with the Coast Guard policy to use only approved parts and trustworthy suppliers as described in the Maintenance Management Exposition section 2.1. An example of such a purchase was the ongoing landing gear replacement. Furthermore he pointed out that the Coast Guard repeatedly delayed maintenance and used extensions to the utmost because of financial reasons.

The Coast Guard Management repeatedly asked the Ministry of Justice and Ecclesiastical Affairs for permission to apply for a JAR-145 and JAR OPS 1 and 3 approvals. A formal request for funding was sent from the Coast Guard to the ministry on July 15, 2002. Several other written requests were made to the ministry both in writing and in meetings. The ministry was more concerned of the budget overruns instead of placing the Coast Guard operations and maintenance in a regulatory environment where the ICAA would be able to actively monitor them and safety would be improved. The ministry would not approve such a change because of increased financial expenditures. Following the incident the ministry granted the Coast Guard approval to apply for JAR operations and maintenance approvals.

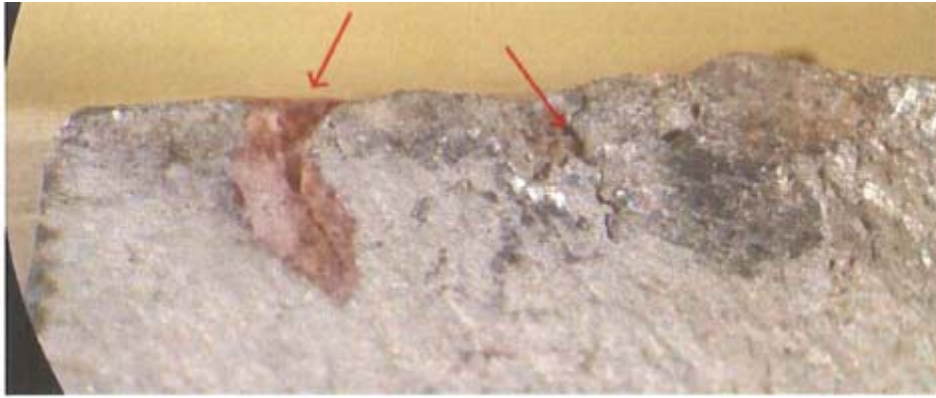
## Tests and research

The AAIB sent The Loaner Nose Landing Gear wheel lever sub-assembly to IceTec (Technological Institute of Iceland) for an independent metallurgical analysis. The fractured pieces (made of aluminum) were visually inspected and photographed using a stereoscope. The fractured surfaces were also inspected using an electron microscope. Figure 3 below is an overview of the fractured surfaces on the wheel lever sub-assembly. Position 1h matches with position 1b and so on.



**Figure 3: Overview of fractured surfaces**

The analysis determined that the fracture was a brittle fracture on both surfaces. Figure 4 shows where corrosion has formed in cracks (crevice corrosion) close to the fracture surfaces with pitting close to the surface. Figure 5 shows a side view of the same area. Chemical analysis of the fracture surfaces found traces of chlorine. Chlorine is a highly corrosive agent in aluminum.



**Figure 4:** Starting point of fracture can be seen in figure 3 marked as 1b. The left arrow points to a crack where corrosion has collected (the area has been dyed slightly red). The right arrow points to a crack.



**Figure 5:** Position 1b seen from the side. Corrosion pits are visible on the surface.

Close to area 1b a deformation can be seen. As this deformation is not visible on area 1h it can be assumed that it occurred after the incident. Such deformation is visible in other areas as well. The engineer performing the metallurgical analysis was of the opinion that the most likely reason for the fracture was a combination of overstress and weakening of the material due to corrosion.



## 2 ANALYSIS AND CONCLUSIONS

The Fokker F-27-200 aircraft was maintained and operated under Icelandic law on aviation no. 60/1998 and law on the Icelandic Coast Guard no. 25/1967. The Coast Guard aircraft was thus maintained and operated just as any general aviation aircraft in Iceland. Maintenance was performed under the privileges contained in the aircraft technicians individual license (JAR-66 AMT license or ICAO Type 2 license<sup>6</sup>) and the aircraft was operated by qualified pilots holding valid ATPL/A licenses.

The Coast Guard was working on getting a JAR-145 (Approved Maintenance Organization) approval. The Coast Guard was using procedures from its draft Maintenance Management Exposition including procedures for supplier evaluation and component acceptance. The AAIB could not find documented evidence of how the receiving inspection was performed and how a serviceable tag was issued for the landing gears which had questionable back-to-birth traceability.

The Loaner Nose Landing Gear, The First Loaner Left Main Landing Gear, and the Second Loaner Left Main Landing Gear inspected by Florida Aviation Repair Services were unserviceable as they were missing back-to-birth traceability among other things and it is unclear how the repair station could issue a FAA 8130-3 form stating them as airworthy/serviceable parts.

The Coast Guard did not follow procedures in establishing a trustworthy supplier and continued to work with the supplier even after it was evident that the supplier did not inspect the loaner landing gears in accordance with the manufacturer's component maintenance manual and verify back-to-birth traceability.

The Coast Guard furthermore did not follow its own MME procedure 2.1 on the acceptance of aircraft components. According to MME procedure 2.1, parts manufactured before the introduction of JAR regulations should go through a special receiving inspection. The receiving inspection is quite detailed and a work order should be opened to carry out tests on components before a serviceable tag can be issued. No such work order was opened.

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<sup>6</sup> JAR-66 Aircraft Maintenance Technician License  
ICAO Type 2 Maintenance Technician License issued by the ICAA

The procedure the Coast Guard used to issue a serviceable tag involves verifying the part number and serial number against the purchase order. If all relevant papers and certificates are available and the general condition of the material is satisfactory a serviceable tag can be issued by a certified technician (CRS). The procedure does not detail how the receiving inspection should be performed for life limited parts, such as ensuring the part has back-to-birth traceability.

The Coast Guard technical management was under pressure from the Ministry of Justice and Ecclesiastical Affairs to reduce financial expenses in 2003 and 2004 and the investigation revealed that the Coast Guard employees had concerns that management was too focused on operational cost instead of safety.

It is commendable that the base technicians stood firm on their refusal to install the landing gears whose airworthiness they questioned. The actions of the management to install The Loaner Nose Landing Gear and the Second Loaner Left Main Landing Gear themselves was questionable and not in accordance with normal procedures.

The AAIB made the following findings during the investigation:

- The flight crew was licensed and qualified for the flight in accordance with existing regulations.
- The aircraft was unairworthy at the time of the incident as The Loaner Nose Landing Gear assembly had exceeded the extension granted by the ICAA on the overhaul life limit.
- The Loaner Nose Landing Gear wheel lever sub-assembly fractured during landing at Vaagar Airport in the Faroe Islands.
- The aircraft was operated in a Special Coast Guard category with a restricted Certificate of Airworthiness limited by law no. 25/1967.
- The Loaner Nose Landing Gear and The Second Loaner Left Main Landing Gear installed on the aircraft at the time of the incident were unairworthy.
- Florida Aviation Repair Services and the Icelandic Coast Guard neglected to verify the life limited history of The Loaner Nose Landing Gear, The First Loaner Left Main Landing Gear, and the Second Loaner Left Main Landing Gear.
- Florida Aviation Repair Services held a valid FAA Air Agency Certificate as a repair station and a valid JAR-145 Acceptance Certificate.

- Florida Aviation Repair Services did not overhaul or inspect any of the landing gears in accordance with the manufacturer's component maintenance manual and instructions.
- The Coast Guard issued serviceable tags for The Loaner Nose Landing Gear, The First Loaner Left Main Landing Gear, and The Second Loaner Left Main Landing Gear assemblies without knowing the complete life limited history.
- The Coast Guard issued serviceable tags for The Loaner Nose Landing Gear, The First Loaner Left Main Landing Gear, The Second Loaner Left Main Landing Gear that were in unairworthy condition.
- The Coast Guard aircraft technicians refused to perform the landing gear replacement as they considered The Loaner Nose Landing Gear and the Second Loaner Left Main Landing Gear unairworthy.
- The Coast Guard sought outside consultation on the condition of the Loaner Nose Landing Gear and the Second Loaner Left Main Landing Gear although the consultation had no bearing on the airworthiness of the landing gears.
- The Coast Guard technical management performed the landing gear exchange and released the aircraft back into service.
- The Loaner Nose Landing Gear wheel lever sub-assembly failed due to overstress and weakening of the metal due to corrosion.
- The Coast Guard did not follow procedures for supplier evaluation or aircraft component acceptance in their draft Maintenance Management Exposition.
- The Coast Guard technical management was under pressure to undertake budgetary cuts for the years 2003 and 2004.
- Maintenance tasks/activities were delayed for financial reasons.
- The ICAA safety overview of the operator's procedures and operations was inadequate.
- The Coast Guard applied for extensions to the overhaul life limit of the landing gears to the ICAA without informing them of the actual conditions of the landing gears.

The AAIB determines the probable cause of this incident to be the Coast Guard's failure to follow their own maintenance procedures. The AAIB also determines these to be contributory causes of the incident:

- The Ministry's of Justice and Ecclesiastical Affairs failure to supply the Coast Guard with adequate funding to maintain and operate their aircraft.

- The Ministry's of Justice and Ecclesiastical Affairs failure to grant permission for the Coast Guard to gain JAR operations and maintenance approvals.

### **3 Safety Recommendations**

The Icelandic AAIB makes the following Safety Recommendation to the United States Federal Aviation Administration:

1. The Icelandic AAIB recommends that the FAA review SUP case number 2005-00077 to determine if proper action was taken by the FAA. The FAA determined the incorrect overhaul and inspection to be an isolated event although it involved three main landing gears and two nose landing gears.

The Icelandic AAIB makes the following Safety Recommendation to the Icelandic Coast Guard:

1. The Icelandic AAIB recommends the Icelandic Coast Guard to follow their approved maintenance procedures at all times.

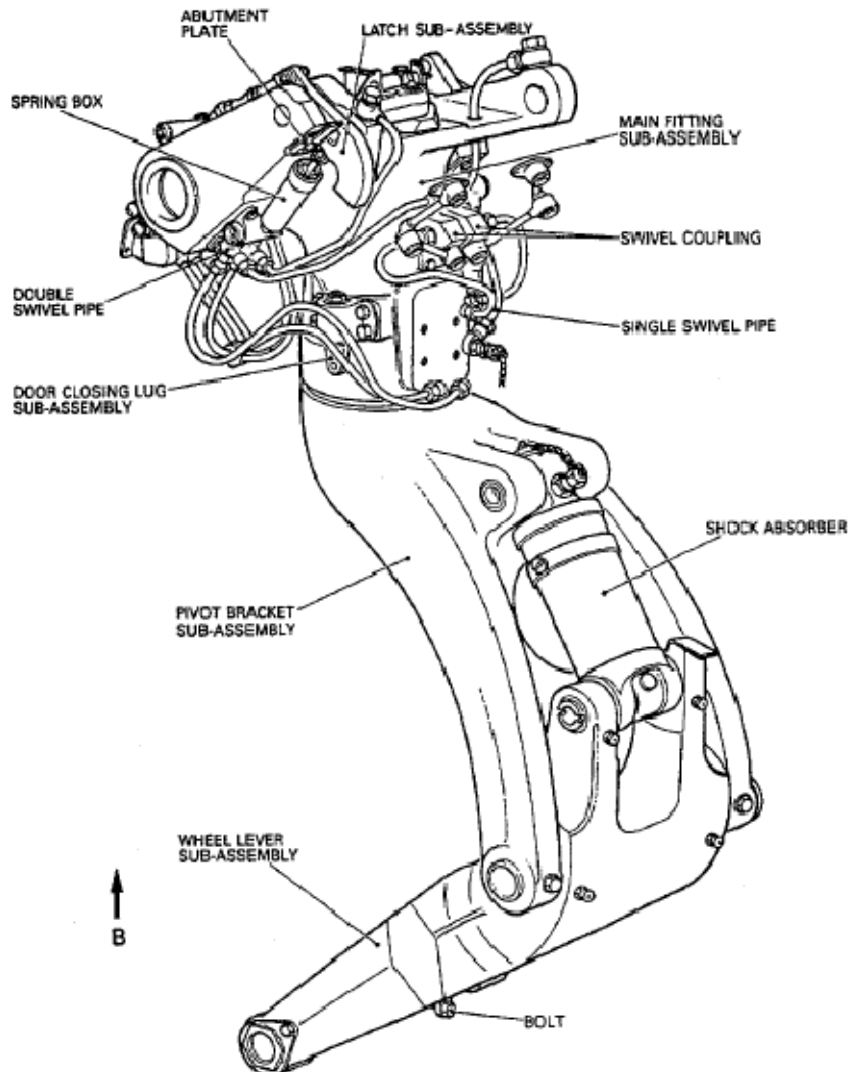
*AAIB Iceland  
Reykjavík, Iceland May 21, 2008.*

## Appendix A – Nose Undercarriage (Nose Landing Gear) CMM 32-20-37

**MESSIER-DOWTY**

Messier-Dowty Ltd  
200170002 COMPONENT MAINTENANCE MANUAL

①



Nose Undercarriage  
Figure 1

F2704102K

**32-20-37** Page 2  
Mar 31/98

## Appendix B – Enforcement action by FAA



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Flight Standards District Office-17  
1050 Lee Wagener Blvd., Suite 201  
Fort Lauderdale, Florida 33315  
(954)356-7520, Fax: (954)356-7531

April 5, 2005

**CERTIFIED MAIL—RETURN RECEIPT REQUESTED**  
**File No. 2005SO170058**



Dear 

This letter is in regard to the overhaul of F-27 landing gear for the Icelandic Coast Guard.

On September 28, 2004 your repair station overhauled and returned to service landing gear assemblies without completing the process as outlined in the Manufacturers overhaul manual. You have been advised and agree that such an operation is contrary to Federal Aviation Regulations.

This is to confirm our discussion in which immediate corrective action was implemented to avoid further problems of this nature.

In closing this case, we have considered all available facts and concluded that legal enforcement action will not be pursued. In place of such action, we are issuing this letter which will be made a matter of record.

Sincerely,



Aviation Safety Inspector

# Appendix C – FAA 8130-3 forms for landing gears The First Loaner Main Landing Gear

1. Approving National Aviation Authority/Country: UNITED STATES		2. <b>AUTHORIZED RELEASE CERTIFICATE</b> FAA Form 8130-3, AIRWORTHINESS APPROVAL TAG				3. Form Tracking Number: W04-0054	
4. Organization Name and Address: Florida Aviation Repair Services, Inc. FAA Certified Repair Station #F4PR415X 10133 N.W. 46 Street, Sunrise, Florida 33351 Phone: (954) 741-5550; Fax: (954) 741-7447						5. Work Order/Contract/Invoice Number: W04-0054	
6. Item: 1	7. Description: Main LG	8. Part Number: 200063007	9. Eligibility: * T.B.V. By Installer	10. Quantity: 1	11. Serial/Batch Number: GS/DRG/31/69	12. Status/Work: Inspected	
13. Remarks: Work Order W04-0054 attached. All work is explained in detail and performed in accordance with the manufacturer's current specifications. Unit inspected per Dowty technical publication 32-10-43. Unit is in serviceable condition. C.S.N. 58744 cycles. C.S.O. 8040 cycles.  JAA Acceptance Certificate # JAA.5572							
14. Certifies the items identified above were manufactured in conformity to: <input type="checkbox"/> Approved design data and are in condition for safe operation. <input type="checkbox"/> Non-approved design data specified in Block 13.			19. <input checked="" type="checkbox"/> 14 CFR 43.9 Return to Service <input type="checkbox"/> Other regulation specified in Block 13 Certifies that unless otherwise specified in Block 13, the work identified in Block 12 and described in Block 13 was accomplished in accordance with title 14, Code of Federal Regulations, part 43 and in respect to that work, the items are approved for return to service.				
15. Authorized Signature:		16. Approval/Authorization No.: F4PR415X		20. Authorized Signature: <i>Jim Bevan</i> <b>FAR</b>		21. Approval/Certificate No.: F4PR415X	
17. Name (Typed or Printed)		18. Date:		22. Name (Typed or Printed): Jim Bevan		23. Date (m/d/y): 03/11/2004	
<b>User/Installer Responsibilities</b>							
<p>It is important to understand that the existence of this document alone does not automatically constitute authority to install the part/component/assembly.</p> <p>Where the user/installer performs work in accordance with the national regulations of an airworthiness authority different than the airworthiness authority of the country specified in Block 1, it is essential that the user/installer ensures that his/her airworthiness accepts parts/components/assemblies from the airworthiness authority of the country specified in Block 1.</p> <p>Statements in Blocks 14 and 19 do not constitute installation certification. In all cases, aircraft maintenance records must contain an installation certification issued in accordance with the national regulations by the user/installer before the aircraft may be flown.</p>							

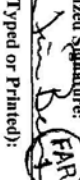
FAA Form 8130-3 (6-01)

\*Installer must cross-check eligibility with applicable technical data.

NSN: 0052-00-012-9005



# The Loaner Nose Landing Gear


1. Approving National Aviation Authority/Country: UNITED STATES		2. <b>AUTHORIZED RELEASE CERTIFICATE</b> FAA Form 8130-3, AIRWORTHINESS APPROVAL TAG				3. Form Tracking Number: W04-0053	
4. Organization Name and Address: Florida Aviation Repair Services, Inc. FAA Certified Repair Station #FAPR415X 10153 N.W. 46 Street, Sunrise, Florida 33351 Phone: (954) 741-5550; Fax: (954) 741-7447						5. Work Order/Contract/Invoice Number: W04-0053	
6. Item:	7. Description:	8. Part Number:	9. Eligibility: *	10. Quantity:	11. Serial/Batch Number:	12. Status/Work:	
1	Nose LG	200490001	T.B.V. By Installer	1	AD1008	Inspected	
13. Remarks: Work Order W04-0053 attached. All work is explained in detail and performed in accordance with the manufacturer's current specifications. Unit inspected per Dowty technical publication 32-20-37. Unit is in serviceable condition. C.S.N. 47215 cycles.							
JAA Acceptance Certificate # JAA.5572							
14. Certifies the items identified above were manufactured in conformity to: <input type="checkbox"/> Approved design data and are in condition for safe operation. <input type="checkbox"/> Non-approved design data specified in Block 13.				19. <input checked="" type="checkbox"/> 14 CFR 43.9 Return to Service <input type="checkbox"/> Other regulation specified in Block 13 Certifies that unless otherwise specified in Block 13, the work identified in Block 12 and described in Block 13 was accomplished in accordance with title 14, Code of Federal Regulations, part 43 and in respect to that work, the items are approved for return to service.			
15. Authorized Signature:		16. Approval/Authorization No.:		20. Authorized Signature: 		21. Approval/Certificate No.: FAPR415X	
17. Name (Typed or Printed)		18. Date:		22. Name (Typed or Printed): Jim Bevan		23. Date (m/d/y): 03/11/2004	
<b>User/Installer Responsibilities</b>							
It is important to understand that the existence of this document alone does not automatically constitute authority to install the part/component/assembly. Where the user/installer performs work in accordance with the national regulations of an airworthiness authority different than the airworthiness authority of the country specified in Block 1, it is essential that the user/installer ensures that his/her airworthiness accepts parts/components/assemblies from the airworthiness authority of the country specified in Block 1. Statements in Blocks 14 and 19 do not constitute installation certification. In all cases, aircraft maintenance records must contain an installation certification issued in accordance with the national regulations by the user/installer before the aircraft may be flown.							

FAA Form 8130-3 (6-01)

\* Installer must cross-check eligibility with applicable technical data.

NSN: 0052-00-012-9005

# The Second Loaner Left Main Landing Gear

1. Approving National Aviation Authority/Country:		2. <b>AUTHORIZED RELEASE CERTIFICATE</b> FAA Form 8130-3, AIRWORTHINESS APPROVAL TAG				3. Form Tracking Number: W04-0118	
UNITED STATES							
4. Organization Name and Address:		Florida Aviation Repair Services, Inc. FAA Certified Repair Station #FAPR415X 10153 N.W. 46 Street, Sunrise, Florida 33351 Phone: (954) 741-5550; Fax: (954) 741-7447				5. Work Order/Contract/Invoice Number: W04-0118	
6. Item:	7. Description:	8. Part Number:	9. Eligibility: *	10. Quantity:	11. Serial/Batch Number:	12. Status/Work:	
1	Main LG	200063007	T.B.V. By Installer	1	GS/DRG/36/65	Inspected	
13. Remarks: Work Order W04-0118 attached. All work is explained in detail and performed in accordance with the manufacturer's current specifications. Unit inspected per Dowty technical publication 32-10-43. Unit is in serviceable condition. C.S.N. 44398 cycles. C.S.O. 8040 cycles. Lower Swivel bent. L/H and R/H door operating bars worn. Unit released as loaner unit.							
JAA Acceptance Certificate # JAA.5572							
14. Certifies the items identified above were manufactured in conformity to:		19. <input checked="" type="checkbox"/> 14 CFR 43.9 Return to Service <input type="checkbox"/> Other regulation specified in Block 13					
<input type="checkbox"/> Approved design data and are in condition for safe operation. <input type="checkbox"/> Non-approved design data specified in Block 13.		Certifies that unless otherwise specified in Block 13, the work identified in Block 12 and described in Block 13 was accomplished in accordance with title 14, Code of Federal Regulations, part 43 and in respect to that work, the items are approved for return to service.					
15. Authorized Signature:	16. Approval/Authorization No.:		20. Authorized Signature:	21. Approval/Certificate No.:			
				FAPR415X			
17. Name (Typed or Printed)	18. Date:	22. Name (Typed or Printed):		23. Date (m/d/y):			
		Jim Bevan		06/07/2004			
<b>User/Installer Responsibilities</b>							
It is important to understand that the existence of this document alone does not automatically constitute authority to install the part/component/assembly. Where the user/installer performs work in accordance with the national regulations of an airworthiness authority different than the airworthiness authority of the country specified in Block 1, it is essential that the user/installer ensures that his/her airworthiness accepts parts/components/assemblies from the airworthiness authority of the country specified in Block 1. Statements in Blocks 14 and 19 do not constitute installation certification. In all cases, aircraft maintenance records must contain an installation certification issued in accordance with the national regulations by the user/installer before the aircraft may be flown.							

FAA Form 8130-3 (6-01)

\*Installer must cross-check eligibility with applicable technical data.

NSN: 0052-00-012-9005