FINAL

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NATIONAL TRANSPORTATION SAFETY COMMITTEE

Aircraft Accident Investigation Report

PT. Lion Mentari Air (Lion Air)
Boeing McDonnell Douglas MD-90 ; PK – LIO
Hang Nadim Airport, Batam, Riau Islands
Republic of Indonesia
23 February 2009

NATIONAL TRANSPORTATION SAFETY COMMITTEE
MINISTRY OF TRANSPORTATION
REPUBLIC OF INDONESIA
2012

This Final Report was produced by the National Transportation Safety Committee (NTSC), Ministry of Transportation Building 3rd Floor, Jalan Merdeka Timur No. 5 Jakarta 10110, Indonesia.

The report is based upon the initial investigation carried out by the NTSC in accordance with Annex 13 to the Convention on International Civil Aviation Organization, Aviation Act (UU No.1/2009), and Government Regulation (PP No. 3/2001).

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GLOSSARY OF ABBREVIATIONS

AD	Airworthiness Directive
AFM	Airplane Flight Manual
ALAR	Approach-and-landing Accident Reduction
AOC	Air Operator Certificate
ATC	Air Traffic Control
ATPL	Air Transport Pilot License
ATS	Air Traffic Service
Avsec	Aviation Security
CAMP	Continuous Airworthiness Maintenance Program
CASO	Civil Aviation Safety Officer
CASR	Civil Aviation Safety Regulation
CPL	Commercial Pilot License
COM	Company Operation Manual
CRM	Cockpit Recourses Management
CSN	Cycles Since New
CVR	Cockpit Voice Recorder
DFDAU	Digital Flight Data Acquisition Unit
DGCA	Directorate General of Civil Aviation
EFIS	Electronic Flight Instrument System
EGT	Exhaust Gas Temperature
EIS	Engine Indicating System
FL	Flight Level
F/O	First officer or Copilot
FDR	Flight Data Recorder
FOQA	Flight Operation Quality Assurance
GPWS	Ground Proximity Warning System
Hrs	Hours
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
Kg	Kilogram(s)
Km	Kilometer(s)
Kts	Knots (NM/hour)
Mm	Millimeter(s)

MTOW	Maximum Take-off Weight
NM	Nautical mile(s)
KNKT / NTSC	*Komite Nasional Keselamatan Transportasi /* National Transportation Safety Committee
°C	Degrees Celsius
PIC	Pilot in Command
QFE	Height above aerodrome elevation (or runway threshold elevation) based on local station pressure
QNH	Altitude above mean sea level based on local station pressure
RESA	Runway End Safety Area
RPM	Revolution Per Minute
SCT	Scattered
S/N	Serial Number
TS/RA	Thunderstorm and rain
TSN	Time Since New
TT/TD	Ambient Temperature/Dew Point
TTIS	Total Time in Service
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

INTRODUCTION

SYNOPSIS

On 23 February 2009, a Boeing McDonnell Douglas MD-90 aircraft, registered PK-LIO, operated by Lion Air as flight number LNI-972, was scheduled to depart Polonial Airport Medan at 16.35 LT (09.35 UTC[1]) for Hang Nadim Airport – Batam (Kepulauan Riau). The crew consisted of two pilots and four flight attendants. There were 156 passengers; 148 adults, four children, and four infants.

After takeoff, during the landing gear up procedure, the pilot noted one red light illuminate (nose gear) on the landing gear panel. During the investigation the pilots reported that they recycled the landing gear and the subsequent cockpit indication was that the landing gear was in the up and locked position. The pilots continued the flight to the planned destination Hang Nadim Aiport, Batam.

During final approach at Batam, the pilots noted that the red light nose gear indicator was illuminated. The pilot in command (PIC) decided to conduct a go around and hold to perform the emergency checklist to attempt to extend the nose landing gear. After many attempts to extend the landing gear, the nose landing gear red indicator light remain illuminated. The PIC decided to make an emergency landing on runway 04 without the nose landing gear extended. The aircraft subsequently stopped on the runway 04 on the centre line.

Emergency personnel and vehicles from Hang Nadim Airport prepared for the emergency, and laid foam on the runway before the aircraft landed, to eliminate fire hazard.

The passengers and crew evacuated via the left front door escape slide. None of the occupants were injured.

The initial investigation found that the nose landing gear spray (water) deflector had fractured, jamming the nose landing gear in the up position.

The investigation is continuing and will include the operational procedures used during the flight to address the landing gear malfunction, and analysis of the mode of failure of the nose landing gear spray deflector.

With the issue of the Preliminary Factual Report, the NTSC made recommendations covering the inspection of nose landing gear spray deflectors fitted to MD-90 aircraft.

[1] The 24-hour clock used in this report to describe the time of day as specific events occurred, is in Coordinated Universal Time (UTC). Local time, Western Indonesian Standard Time (WIB) is UTC + 7 hours

1 FACTUAL INFORMATIONS

1.1 History of Flight

On 23 February 2009, a Boeing McDonnell Douglas MD-90 aircraft, registered PK-LIO, operated by Lion Mentari Air (Lion Air) as flight number LNI-972, departed Polonia Airport, Medan at 16.35 LT (09.35 UTC) for Hang Nadim Airport, Batam, Riau Islands[2]. The crew consisted of two pilots and four flight attendants. There were 156 passengers; 148 adults, four children, and four infants.

After takeoff, during the landing gear up procedure, the pilot noted one red light illuminate (nose gear) on the landing gear panel. During the investigation the pilots reported that they recycled the landing gear and the subsequent cockpit indication of the landing gear was in the up and locked position. The pilots continued the flight to the planned destination.

During approach at Batam, after the landing gear selector down, the pilots noted that the red light nose gear indicator was illuminated. The pilot in command (PIC) decided to conduct a go around and hold to perform the emergency checklist. Pilots attempted several times to extend the landing gear without success. Before initiate an emergency landing the pilot over fly the runway at the low altitude to check to landing gear condition with the ATC.

Emergency personnel and vehicles from Hang Nadim Airport prepared for the emergency, and laid foam on the runway before the aircraft landed.

The PIC decided to make an emergency landing on runway 04 without the nose landing gear extended. The aircraft subsequently stopped on the runway 04 on the centre line.

The passengers and crew evacuated via the front left door escape slide. None of the occupants were injured.

[2] Hang Nadim Airport, Batam, Riau Islands, will be called as Batam for the purpose of this report.

Figure 1: PK-LIO on runway at Hang Nadim Airport, Batam after accident

1.2 Injuries to Persons

Injuries	Flight crew	Passengers	Total in Aircraft	Others
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	6	156	162	-
TOTAL	**6**	**156**	**162**	**-**

1.3 Damage to Aircraft

The nose-section lower fuselage area of the aircraft was damaged due to contact with the runway surface.

1.4 Other Damage

There was no damage to other property.

1.5 Personnel Information

1.5.1 Pilot in command

Gender	:	Male
Nationality	:	Indonesia
Marital status	:	Married
Date of joining company	:	2007
License	:	Air Transport Pilot License

Validity period of license	:	Not provided by operator
Type rating	:	MD-80's, MD-90's
Instrument rating	:	30 June 2009
Validity of medical certificate	:	30 June 2009
Date of last medical	:	8 January 2009
Last line check	:	8 January 2009
Last proficiency check	:	22 January 2009
FLIGHT TIME		
Total time	:	± 21.000
This make & model	:	MD 90 : ± 4000 Hours
Last 90 Days	:	142 Hours
Last 60 Days	:	67 Hours
Last 24 Hours	:	1 Hour 30 minutes

1.5.2 First Officer

Gender	:	Male
Nationality	:	Indonesia
Marital status	:	Married
Date of joining company	:	2005
License	:	Commercial Pilot License
Validity period of license	:	5 July 2009
Type rating	:	HS-748, MD-80's, MD-90's
Instrument rating	:	Exp. 28 Feb 2010
Validity of medical certificate	:	5 July 2009
Date of last medical	:	5 January 2009
Last line check	:	22 January 2009
Last proficiency check	:	7 February 2009
FLIGHT TIME		
Total time	:	± 5000 Hours
This make & model		MD 90 : ± 2500 Hours
Last 90 Days	:	233 Hours
Last 60 Days	:	76 Hours 30 minutes
Last 24 Hours	:	1 Hour 30 minutes

1.6 Aircraft Information

1.6.1 Aircraft Data

Registration Mark	:	**PK-LIO**
Manufacturer	:	Boeing McDonnell Douglas
Country of Manufacturer	:	United State of America
Type/ Model	:	MD-90-30
Serial Number	:	5390
Date of manufacture	:	1996
Certificate of Airworthiness issued	:	14 June 2009
Certificate of Registration issued	:	14 June 2009
Compass Swing valid to		29 May 2009
Radio Permit Valid Until		20 June 2009
Time Since New	:	18,933 hours 45 minutes
Cycles Since New	:	15,475 cycles
Last Major Inspection C Check	:	9 July 2008

1.6.2 Landing gear information

Nose landing gear		
Part number	:	5940497-501
Serial number	:	CPI021
TSN	:	20,770 hours
CSN	:	16,795 cycles
Inspection system overhaul interval	:	10 years

Brace and links of Nose Landing Gear inspected during the last C check (CAMP MD-90).

There was no mandated inspection period for the nose landing gear water spray deflector.

1.6.3 Weight and balance

The aircraft was being operated within the approved weight and balance limitations.

1.7 Meteorological information

Weather conditions were not a factor in this accident

1.8 Aids to Navigation

Not relevant to this accident

1.9 Communications

The crew had no difficulty communicating with air traffic control during the occurrence.

1.10 Aerodrome Information

Airport Name	:	Hang Nadim
Airport Identification	:	WIDD / BTH
Elevation	:	126 feet
Airport Operator	:	Directorate General Civil Aviation
Class	:	1
Runway Direction	:	04 – 22
Runway Length	:	4,025 meters
Runway Width	:	45 meters
Surface	:	Asphalt

1.11 Flight Recorders

The flight recorders were recovered from the aircraft under the supervision of NTSC investigators. The data download and analysis was conducted by the Australian Transport Safety Bureau in Canberra, Australia.

1.11.1 Digital Flight Data Recorder

Manufacturer	:	Fairchild
Model	:	FA2100
Part Number	:	2100-4042-00
Serial Number	:	000448

1.11.2 Cockpit Voice Recorder

Manufacturer	:	Fairchild
Model	:	A100A
Part Number	:	93-A100-80
Serial Number	:	55097

1.11.3 Notable facts from the CVR

Electrical power was left applied to the recorder after the aircraft came to a stop on the runway, parts of the CVR data for the flight was over written. The last eight minutes of the flight was available, in which covered the final approach and landing.

1.11.4 FDR readout

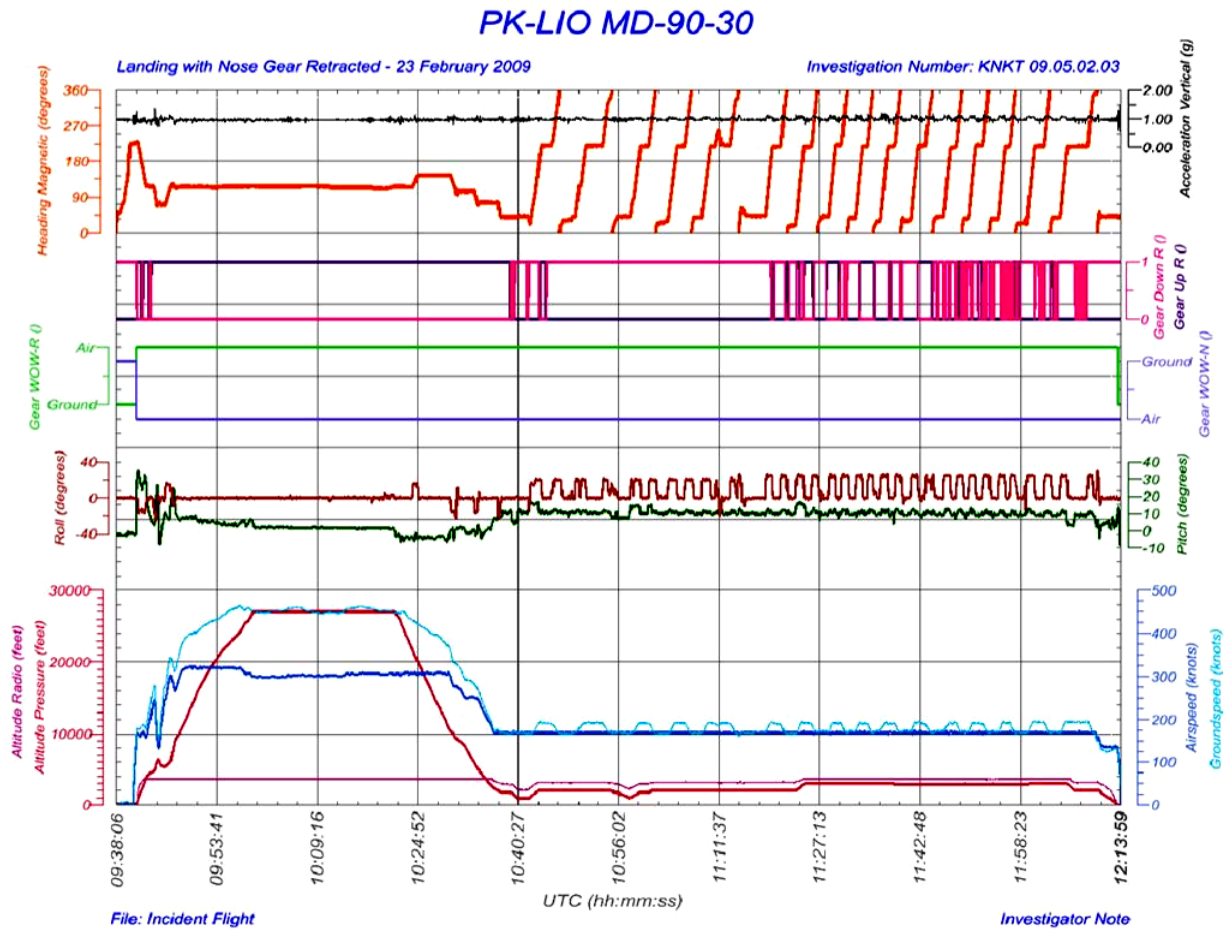

Figure 2: FDR readout

1.11.4.1 Gear Cycles

Regarding the gear position parameters, the right gear is the only one recorded and selected as an indication of nose gear position. Gear cycles shortly after takeoff indicates that pilot realize there was an issue concerning nose landing gear up or down position. The procedure was repeated after descent between 10:39:17 – 11:19:37 UTC and the decision to perform go-around manoeuvre indicates the problem persist. Other numerous attempts to cycles the landing gears were performed during holding flight.

1.11.4.2 Holding maneuver

The holding maneuver was performed using a right circuit between 10:42:17 – 12:10:45 UTC at an average altitude of 2,402 feet and average speed of 170 knots. Numerous attempts by the pilot to cycle the landing gear and the length of the maneuver indicated that they were unsuccessful in lowering the nose landing gear and therefore tried to burn fuel in preparation for an emergency landing.

1.11.4.3 Landing roll

The aircraft touched down at 12:13:30. This was indicated by the right landing gear weight-on-wheel parameter as ‘Ground’. The nose landing gear weight-on-wheel parameter was appeared as ‘Air’ which means no force applied to the gear and indicated that the nose gear was in ‘up’ position. The touchdown speed was 120 knots and the aircraft travelled for another 26 seconds. The final position attitude was -8 degrees pitch angle and -1 roll angle, as a result of the forward fuselage resting on the runway without nose landing gear.

1.12 Wreckage and impact information

The nose landing gear right water spray deflector fractured and detached. The center deflector was broken.

Figure 3: The fracture surface shows a dark colored portion indicating a pre-existing crack

1.13 Medical and Pathological Information

Not relevant to this accident.

1.14 Fire

There was no pre or post-accident fire.

1.15 Survival aspects

Not relevant to this accident.

1.16 Test and research

Not relevant to this accident.

1.17 Organizational and Management Information

1.17.1 PT. Lion Mentari Airline (Lion Air)

Aircraft Owner	:	CLS SMAP Leasing Limited
Aircraft Operator	:	PT. Lion Mentari Airline
Address	:	Lion Air Tower Jl. Hayam Wuruk No 5, Jakarta
Air Operator Certificate Number	:	AOC/121-010

1.17.2 Maintenance

PT. Lion Mentari Air has a maintenance facility named Lion Technic. The rating of the Lion Technic was limited to engine, airframe, accessories, and NDT. The aircraft has been maintained in accordance with approved Continuous Airworthiness Maintenance Program (CAMP).

There was no evidence of landing gears problems as recorded in maintenance log.

1.18 Additional information

1.18.1 Nose gear water deflector

To give better understanding about water deflector system during aircraft operation, the following pictures may provide ground clearance and the obstruction by wheel chuck, which could cause the damage of nose gear water deflector.

Figure 4: Showing the ground clearance of water deflector relative to the surface

Figure 5: The association of wheel chuck to the ground clearance which usually used on nose gear during park, could cause the damage of the water deflector

Figure 6: an example of the many possibilities of object which may strike by the deflector during Aircraft Park.

The pictures above show that the ground clearance of the water deflector is quite low. The low ground clearance might be an object during taxi and may cause the deflector rear attachment damage.

The nose gear could not be put in to gear-down position due to the damage and distortion of the nose gear water spray deflector. The distortion of nose gear water spray deflector moved out to the nose wheel well structure, preventing the nose gear to be down.

1.19 Useful or effective investigation techniques

The investigation was conducted in accordance with NTSC approved policies and procedures, and in accordance with the standards and recommended practices of Annex 13 to the Chicago Convention.

2 ANALYSIS

2.1 The failure of the nose landing gear

During the aircraft evacuation process, it was found that the left portion of the broken nose water spray deflector was stuck at the nose landing gear bay structure. This condition prevented the nose landing gear to extend.

Figure 7: Damaged and distorted nose landing gear spray deflector

If damage to landing gear suspected or if previous gear malfunction has been indicated, do not cycle gear as this may cause further damage and make it impossible to re-extend gear (QRH: Red light illuminated with landing gear handle up page: AP.70.6. published date June 2005).

2.2 Water spray deflector damage

The right side of water spray deflector was detached at the center of water spray deflector. The attachment flange of the center deflector was broken. (Figure 8) The fracture surface shows a dark colored portion indicating a pre-existing crack.

Figure 8: The broken attachment flange

The dark colored portion in the crack area has a longer side at the right edge (Figure 9), indicating banding moment acted upward at the right deflector, and this colored portion is a fatigue crack.

Figure 9: crack area at the right edge

Dent and wear were observed on the rubber part of the right deflector (Figure 10).

Figure 10: rubber part of the right deflector

A sign of over-torque was found on one of the flange hole edge (Figure 11).

Figure 11: The flange hole edge was over-torque

The evidence at the pre-existing crack indicated that extraneous upward bending acted on the flange. The evidence at the right deflector (i.e. dent and wear at the rubber liner) suggested that an upward force could have acted at the deflector.

The cause of the damage (upward bending) of water spray deflector could not be accurate determined (Figure 4).

The nose gear could not be put down because of the part of the damage deflector obstructed the nose gear.

2.3 Operation aspect

The FDR data revealed that during take off and climb from Medan the aircraft performed three times in recycling the landing gear. It indicated that there was a problem in extended the landing gear. After the third recycle the landing gear could be extended.

Upon the approach in Batam the landing gear could not be immediately set in down and lock position. The number of recycles to make the gear down and lock was about two – three times. However the nose landing gear did not go down until the aircraft touch the runway.

The PIC had done emergency procedure of landing, even the nose gear physically was not in down position.

3 CONCLUSIONS

3.1 Finding

- The aircraft was certified, equipped and maintained in accordance with existing regulations and approved procedures.
- The aircraft was certified as being airworthy when dispatched for the flight.
- The pilots were licensed and qualified for the flight in accordance with existing regulations.
- The damage of water spray deflector indicated a fatigue crack which growth from its attachment hole.
- The nose gear could not be extended due to the damage and distortion of the nose gear water spray deflector. The distortion of the nose gear water spray deflector moved out to the nose wheel well structure, preventing the nose gear to be down.

3.2 Causes

The nose gear water deflector was broken and moved out to the nose wheel well structure.

4 SAFETY ACTION

4.1 PT. Lion Mentari Airline (Lion Air)

On 20 April 2011, Lion Mentari Airline (Lion Air) informed the National Transportation Safety Committee that it had taken the following safety actions.

Referred to the Quality Notice No. 078/LA-QN/II/2009 dated 24 February 2009 Subject Nose Landing Gear Water Deflector Inspection issued the Engineering Authorization No. MD80-EA-32-315, dated 24 February 2009 Subject Nose Landing Gear Water Deflector Inspection (see Appendix).

5 SAFETY RECOMMENDATIONS

On this final report the NTSC not issued the others recommendation.

On 22 April 2009 the NTSC issued the following recommendations with the issue of the Preliminary Report

5.1 Recommendation to Lion Air and operators of MD-90 aircraft

The National Transportation Safety Committee recommends that Lion Air and others Indonesian operators of MD-90 aircraft review the nose landing gear inspection procedures to ensure:

a) The nose landing gear spray deflector fitted to MD-90 aircraft is inspected for cracks at each nose wheel tire change.

b) The adequacy of the crack inspection/detection procedures.

5.2 Recommendation to the Directorate General of Civil Aviation

The National Transportation Safety Committee recommends that the Directorate General of Civil Aviation mandate an inspection requirement, specifying inspections procedures and intervals for crack detection of the nose landing gear spray deflector fitted to MD-90 aircraft.

- An inspection on the flange is recommended to detect a crack at the flange. The inspection should be performed at the time of tire change.

6 APPENDIXES

Lion air

QUALITY NOTICE

Subject:

Inspeksi pada Nose Landing Gear Water Deflector

No.	:	078/LA-QN/II/2009
Date	:	24 February 2009
References	:	Lihat kolom referensi
Attention	:	MCC, LM, HM, QALT, TS.

Latar Belakang:

- Kejadian Pesawat MD 90 PK-LIO di Batam mendarat darurat dengan Nose Landing Gear Up.

Referensi:

- **Continues Airworthiness Maintenance Program (CAMP) MD90** Doc.No.LA-MD90-01- MSG3 Rev.01. January 2006.

Rekomendasi:

Mengacu pada referensi dan latar belakang penerbitan Quality Notice ini dapat disampaikan sebagai berikut :

1. Bahwa segera setelah tanggal diterbitkannya Quality Notice ini dapat dilakukan Inspeksi pada Nose Landing Gear Water Deflector semua pesawat MD90 dan MD80 Lion Air
2. Kepada Engineering untuk dapat dikeluarkan Engineering Authorization (EA) yang terkait dengan pelaksanaan inspeksi tersebut.
3. Agar dalam melaksanakan Quality Notice ini tetap berpegang teguh pada peraturan yang berlaku saat ini.

Demikian disampaikan agar dapat dilaksanakan dengan sebaik-baiknya, atas perhatiannya kami ucapkan terima kasih.

Hormat kami,

Quality Assurance Manager

Distribution : **JKTDEJT, JKTMCCJT, JKTMQLT, JKTMMLT, JKTMCCLT, Technical Service.**

Lion Technic

ENGINEERING AUTHORIZATION

SUBJECT : **Inspection of Nose Landing Gear Water Deflector**		NO.	:	MD80-EA-32-315
		DATE	:	February 24, 2009
		REFERENCE	:	MD-80-FTD-32-03011 MD-80-FTD-32-01012 AMM MD90 Ch.05, 32
PRIORITY	: Recommended			
SECTION	: Airframe	A/C TYPE	:	MD80 Series
TYPE	: Visual Inspection	EFFECTIVITY	:	All
DUE DATE	: See *Compliance*	WT/ARM CH.	:	NONE
CATEGORY	: LM	MANHOURS	:	See *Man Power*

REASONS

Based on the incident report due to the Nose Landing Gear of PK-LIO was unable to extend, and the aircraft were experiencing "Nose Gear Up" landing.

DESCRIPTIONS

This Engineering Authorization provides instructions to perform a general visual inspection (GVI) of the Spray Deflector assy area to check it's condition.

COMPLIANCE

This Engineering Authorization should be considered to be performed once (one time inspection) – to assure that the Nose Landing Gear Spray Deflector assy –and adjacent area– are in good/normal condition. Perform this Authorization Engineering ASAP *before* or *prior to* next flight.

MAN POWER

To be determined.

MATERIALS INFORMATION

Deflector Assy-Spray-Nose Landing Gear (*Polyurethane Style*)
– Boeing Part Number : 5930194-525 and -527
Deflector Assy-Spray-Nose Landing Gear (*Metal Style*)
– Boeing Part Number : 5930194-511 thru -527.

SPECIAL TOOLS AND EQUIPMENT

Magnifying Glass (*if required*).

PREPARED BY,	CHECKED BY,	APPROVED BY,	CUSTOMER

DISTRIBUTION	DE	MQ	MM	File

ENGINEERING AUTHORIZATION

NO. : MD80-EA-32-315	DATE : February 24, 2009

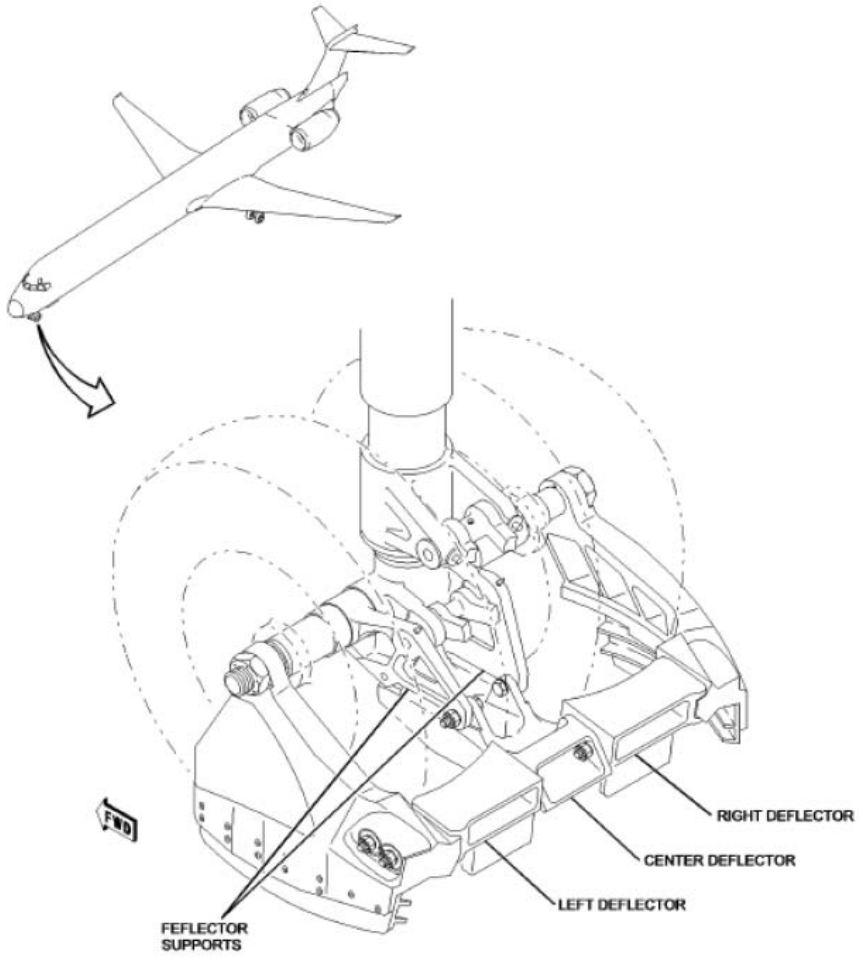

FIGURE 1

INSPECTION AREA (TYPICAL)