FINAL REPORT
MA-60, XY-AIP, RUNWAY EXCURSION
ACCIDENT KAWTHAUNG AIRPORT (VYKT)
ON 10 JUNE 2013

Executive Summary

On 10 June 2013,11:10 Local time, Myanmar Airways MA-60 aircraft registration number XY-AIP (MSN-0807) departed from Mawlamyine (VYMM) to Kawthaung (VYKT)with 4 crews and 60 passengers domestic passenger schedule flight. At about 12:55, aircraft final approach from Runway 02 and touchdown about 500 ft from runway threshold. During landing roll at about 3127 ft of runway aircraft veer off to runway left side.

Aircraft strike with two fence pillars (with Nose wheel, Left & right propellers) and tree (with left wing). Left & right engine propellers tips were broken, left engine casing was cracked and left wing leading edge and fuselage were dent. Aircraft was stopped after turning 90 degree.

Flight crews initiated emergency shut down procedure, at the same time cabin crews performing emergency evacuation procedure. All the crews and passengers were survived.

- Registered owner and operator	- Myanma Airways
- Air craft type	- MA-60
- Nationality	- Myanmar
- Registration	- XY-AIP (MSN – 0807)
- Place of Accident	- Kawthaung Airport(VYKT) Latitude N 10° 02′ 58.55″ Longitude E 98° 32′ 17.25″
- Date & Time	- 10 June 2013 at 12: 55 (local time)
- Type of operation	- Passenger scheduled flight
- Phase of operation	- During landing roll

1) FACTUAL INFORMATION

1.1) History of the flight

1.1.1) Departure and En-route

On 10 June 2013, at 6:55 local time, Myanma Airways MA-60 (XY-AIP) departed from Yangon to Mawlamyine- Kyawthaung- Mawlamyine and back with 4 crews and 27 passengers. During climbing, hydraulic pressure low warning (LEDPL), intermittently illuminated and aircraft returned back to Yangon. After snag rectification, aircraft departed to Mawlamyine at about 10:15 local time. During final apporach, while landing gear down hydraulic pressure low warning illuminated and disappeared at aircraft parking.

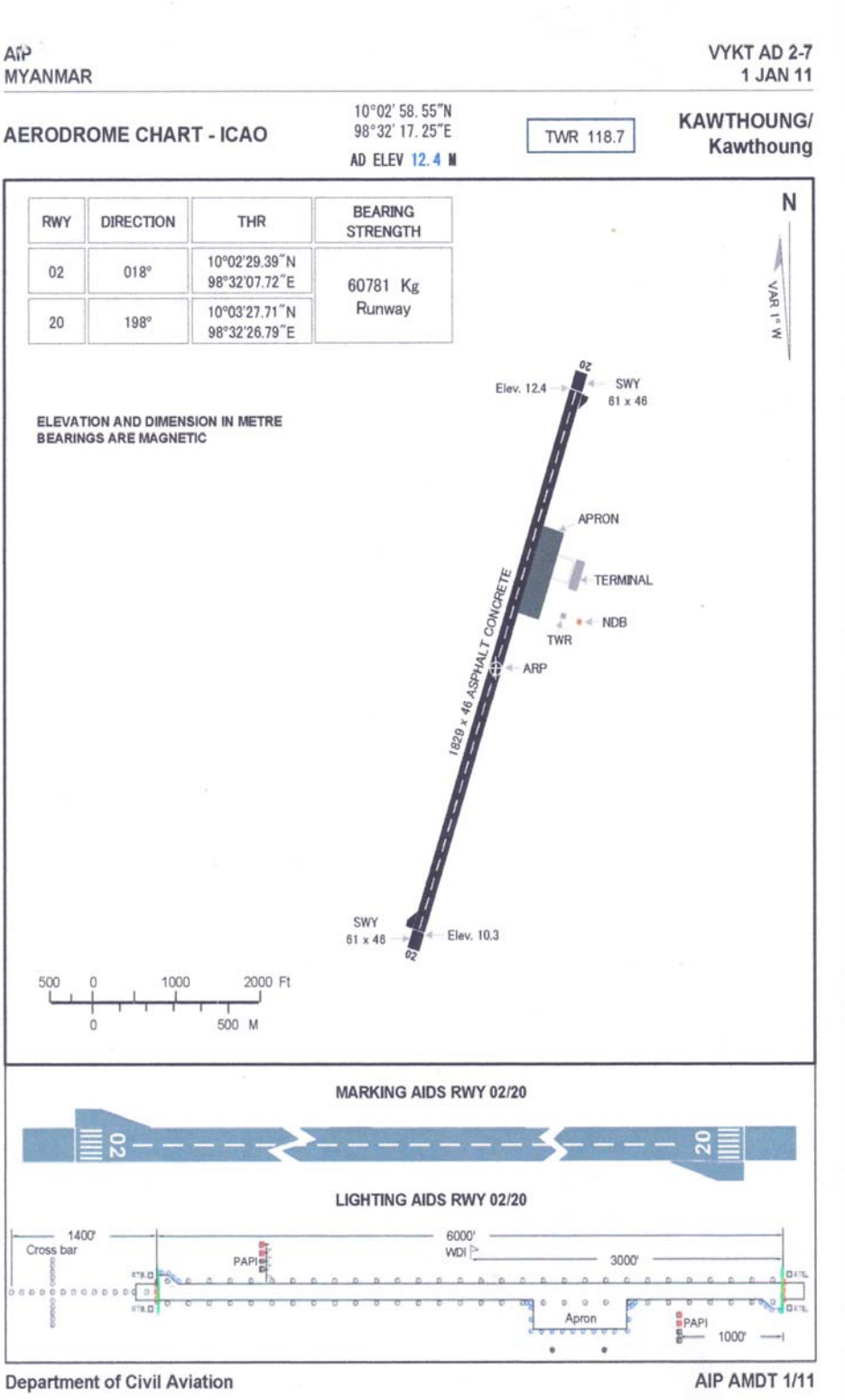
At about 11:10, aircraft departed from Mawlamyine with 4 crews and 60 passengers. During the route Mawlamyine to Kawthaung, no warning light illuminated. While approaching to Kawthaung RW, PIC check hydraulic quantity and flap down to 5˚, landing gear down and final turn to runway 02.

Figure. (1) Myanma Airways MA-60 (XY-AIP)

1.1.2) Veer off run way

During final approach, LEDPL warning light was come again. PIC set flaps 15˚ to 30˚ respectively, but he noticed flaps position was not fully extended. As soon as aircraft touch down, PIC apply reverse power at about 2500 ft from runway end. After recognition of aircraft swing, PIC changed power lever to GI position and applied brake and changed nose wheel to taxi mode and steering.

Aircraft cannot able to steer and veer off left side of runway at about 3200ft. Firstly aircraft striked to fence pillars with propellers and nose wheel, then aircraft turned 90˚ to left and stopped after striking to tree with left wing.



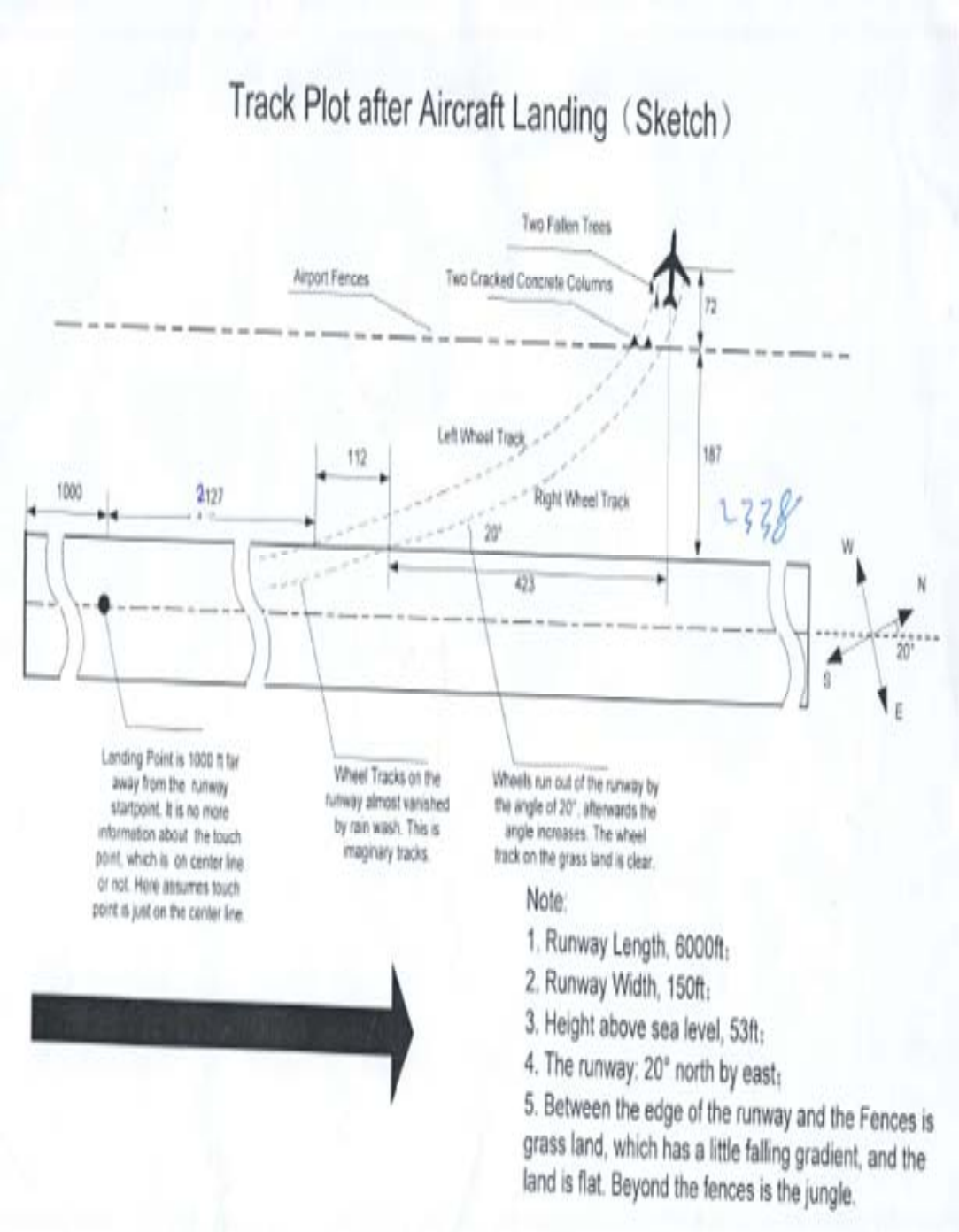

Track Plot after Aircraft Landing（Sketch）
Two Fallen Trees
Airport Fences
Two Cracked Concrete Columns
72
187
Left Wheel Track
112
1000
2127
Right Wheel Track
20°
423
W
N
20°
S
E
Landing Point is 1000 ft far away from the runway startpoint. It is no more information about the touch point, which is on center line or not. Here assumes touch point is just on the center line.
Wheel Tracks on the runway almost vanished by rain wash. This is imaginary tracks.
Wheels run out of the runway by the angle of 20°, afterwards the angle increases. The wheel track on the grass land is clear.
Note:
1. Runway Length, 6000ft;
2. Runway Width, 150ft;
3. Height above sea level, 53ft;
4. The runway: 20° north by east;
5. Between the edge of the runway and the Fences is grass land, which has a little falling gradient, and the land is flat. Beyond the fences is the jungle.

Figure (2). Accident site

1.2) Injury to persons

There was no injury to crews and passengers due to accident.

Injuries	Crews	Passengers	Other	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
Nil	4	60	0	64
Total	4	60	0	64

1.3) Damage to aircraft

The left and right engines propellers blades were damaged, left engine casing cracked, left wing leading edge was dent, and lower fuselage frame was dent. Aircraft need to be major repair.

Figure (3). Damage to Aircraft

1.4) Other damage

The airport fence pillars (Ea-2) broken due to accident.

1.5) Personnel information

1.5.1) Pilot in command

Personal details	Male, years of age 48
Type of license	Airlines Transport pilot (aeroplane) (296)
Total flying hours	7815:05 hours
Total flying hours last 90 days	79:11 hours
Total flying hours last 30 days	30:15 hours
Total flying hours (MA-60) Command hours	2502:45 hours 2484:18 hours
Last line check	31 March 2012
Last proficiency check	19 May 2013
Last instrument rating check	19 May 2013
Medical Expiry	20 Nov 2013
Marital status	Married.

Prior experience

The pilot in command obtained ATPL license (296) valid to 20 November 2013. Joined to airline on 20 April 2010, as a F/O. On 18 September 2010 he was assigned as a MA- 60 commander.

Crew Resource Management and Dangerous good training accomplished on 17 August 2012. Last flying date was 8 June 2013 and Medical status class1.

1.5.2) First Officer

Personal detail	Male, 40 years of age
Type of license	ATPL - 494
Total flying hours	3169:55 hours
Total flying hours (MA-60)	361:00 hour
Total flying hours last 90 days	101:07 hours
Total flying hours last 30 days.	35:20 hours
Last line check	30 April 2012
Last proficiency check	12 Feb 2013
Last instrument rating	12 Feb 2013
Medical Expiry	14 Aug 2013
Marital Status	Married

Prior experience

The first officer obtained CPL license valid on 14 August 2013. Joined to airline on 9 Feb 2011. On 2 February 2012 he was assigned as MA- 60 First officer. Crew Resource Management and Dangerous Good training accomplished on 17 Aug 2012. Last flying date was 01 June 2013 and Medical status class 1.

1.5.3) Crew relationship

There was different in MA-60 flying experience between PIC (2484) hrs and FO (361) hrs. Based on log book entries and Myanma Airways roster, the pilot in command and first officer operated together (15) days before and they flew together on that same route. There was no tension between the pilot in command and the first officer.

1.6) Aircraft information

1.6.1) Aircraft data

Registration mark	XY-AIP
Manufacture	Xian Aircraft Manufacture, China
Type/model	MA-60
Manufacture S/N and date	0807, Sept 2010
Received date	28 Sept 2010
Certificate of Airworthiness due	26 Feb 2014
Total airframe hours	4395:52 hours
Total airframe cycle	3711 cycles
Last line check (125 hr)	22 Dec 2012
Last 'A' check (A-6 inspection)	26 Feb 2013
Last Base check (C-2 + 6 yrs)	26 Feb 2013

Remark: Aircraft received with (13:02) hours time since New.

MA-60 is a twin- engine turboprop aircraft designed for short and medium range operation. Maximum take of weight 21, 800 kg (48,060 lb) and the maximum operation altitude is 25000 ft. Pressurized fuselage with 6 emergency exists. There was passenger entry door, two cargo doors, two emergency exit hatches on each side of passenger compartment and one emergency exit in cockpit .

Ailerons, rudder and elevators are hydraulically operated and pitch trim is obtained the horizontal stabilizer. Flaps comprise two trailing edge section of each wing and flaps, speed brake and lift dumper doors are hydraulically operated.

The landing gear consists of a forward retracting nose gear and two forward retracting main gears. Each gear is equipped with a shock absorber and two wheels with skid-control brake unit. The nose gear is equipped with a nose wheel steering and centering system.

1.6.2) Engine Data

Engines	Left Engine	Right Engine
Manufacture	P&W 127J	P&W 127J
Serial number	0140	0170
Total flying hour	2526:15 hours	3216:35 hours
Total flying cycle	2241 cycle	2835 cycle

The aircraft is equipped with two P&W 127 J turboprop (2750 shp) engines mounted one on each side of the wing. (Normal take off power 2475-shp if one engine fail another engine automatically increase power to 2750-shp). The P&W engines is a twin- spool gas generator, a free turbine, concentric shaft and reduction gear box assembly. Main components are centrifugal low- compressor, centrifugal high- compressor, annular backflow combustion chamber, axial-flow high-pressure turbine, axial-flow low-pressure turbine and axial-flow power turbine.

Propellers model are 247F- 3 (Hamilton Sundstrand) with four blades with feathering and reversing system controlled by propeller control unit and over speed governor. Maximum speed of propellers are 1200 rpm and variable pitch range + 80 degree to - 19 degree.

1.6.3) Weight and Balance

MCAR Part. 8, para 8.7 (Aircraft operating and performance limitations) an aircraft may not fly without ensuring that the maximum allowable weight. For a flight does not exceed the maximum allowable take off or landing weight or any applicable on route performance or landing distance limitations considering.

Myanma Airways flight operation Manual (MA-60) chapter 10 (weight and Balance) stated to be loaded in accordance with an approved loading schedule weights and associated center of gravity limits special care should be taken to ensure that the loading limitations of the floor and compartment strength are not exceeded.

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care should be taken to ensure that the loading limitations of the floor and compartment strength are not exceeded. Maximun weight loading 21800 Kg C.G limit within (15-31%) MAC.

The copy of the load and trim sheet for the accident flight from Mawlamyine (VYMM) to Kawthaung (VYKT) on 10 June 2013 was indicated within take off allowable 21,800 kg (48,060-lb) **(Appendix-A)**

Dry Operation weight	-	14557 kg
Take off fuel	-	2637 kg
Crews, passengers, baggage	-	4571 kg
TOW	-	21765 kg
Trip fuel	-	1136 kg
Landing weight		20629 kg

1.6.4) Flight/ Navigation Instrument

Four display units are installed at the main instrument panel, two in front of each pilot, display light and navigation information in colour. As part of EFIS they are described under FLIGHT/NAVIGATION INSTRUMENTS. The other two units which are installed at the center panel, engine parameter, alert, procedures and message in colour.

Two air data computers received information from the respective Pilot static system, outside air temperature probe and angle-of-attack sensor. The QNH reference pressure can be set at the altimeter set panel. The inputs are converted into electrical signals which are supplied to;

- Automatic flight control augmentation system (AFCAS)
- Flight Management System (FMS)
- Attitude and Heading System
- Electronic Flight Instrument System (EFIS)
- Flight Warning System
- Enhanced Ground Proximity Warning System (EGPWS)
- Flight Data Recording System
- ATC Transponders

1.6.5) Communication

-3100 Audio System

3100 audio system consists of interphone system, passenger address and entertainment system, and air/ ground crew call system.

-KHF-950 HF SSB Communication Radio

KHF-950 HF/SSB radio is the airborne equipment for distance communication between an aircraft and the ground or other aircraft.

-KTR908 VHF Communication Radio

KTR 908 very high frequency (VHF) communication radio is used for short-distance communication between an aircraft and the ground or among aircraft.

1.6.6) Navigation

-VIR-32 Very High Frequency Omni directional Range/ Instrument Landing System-

VIR-32 Very high frequency omni directional range/ Instrument Landing System is composed of the function of very high frequency omni directional range, Localizer, Glide Slope and marker becon receiver.

-DME- 42 Distance Measuring Equipment System

DME- 42 Distance Measuring Equipment, when cooperates with a ground station, can continually measure the slant distance between an airplane and the ground station.

- **ALT-55B LOW-Altitude Radio Altimeter System**

ALT-55B low-altitude radio altimeter system provides the real altitude from ground to aircraft, which can be used for approach, landing and flight. The ALT-55B low- altitude radio altimeter system can measure the altitude from 0 to 2500ft accurately.

- **WXR-350 Weather Radar**

  WXR-350 color weather radar mounted on MA-60 aircraft is made by Collins company, USA. WXR-350 weather radar is mainly used to detect weather conditions enroute and in front of aircraft concerned with rainfall cloud and shows a color image on digital color display the strength and area of a thunder storm, distance from and azimuth relative to the aircraft.

1.6.7) Enhanced Ground Proximity Warning System (EGPWS)

Enhanced Ground Proximity warning (EGPWS) Type- MARK viii (part No- 965-1206-003) gives the pilots visual and voice warning. When the aircraft's flight path and position with respect to the terrain needs immediate attention from the pilots. It is only operative at the altitudes in the range of the low range altimeter. EGPWS has a computer with Basic EGPWS function 6 modes of operation with automatic-

- Mode 1: Excessive descent rate
- Mode 2: excessive terrain closure rate
- Mode 3: altitude loss after take-off
- Mode 4: unsafe Terrain Clearance
- Mode 5: excessive descend below glide slope deviation
- Mode 6: Advisory callouts
- Mode 7: wind shear

Forward look Terrain Avoidance (FLTA) function

- Below defined terrain clearance
- Approach to collision with terrain

Too early descent function (PDA)

- Terrain awareness
- Terrain display

Each mode has its own voice warning EGPWS system also calls the altitudes of the aircraft during an approach. EGPWS gets data from (Automatic flight control system, stall warning, flap position indication, landing gear position indication, Avionic switching panel, Air data computing, Inertial reference

system, EFIS, ILS, RA, TCAS, FMS). The EGPWS sends data to (Audio management, Flight data recording, Flight warning system, TCAS). The program pins select mode envelops and warnings.

These selections are-

- Visual alert steady
- Audio level selection
- Envelop selection
- In habit all modes selection
- Envelope modulation
- FMS data available
- Audio alert menu selection
- wind shear
- alternate mode 4
- altitude call out enable
- altitude call out menu (500-200-100-50-40-30-20-10)
- mode 6 volume
- AC type

1.6.8) Automatic Flight Control

AFC is digitalized dual channel. Combine of auto pilot, flight guidance system, dual digitalized electronic flight instrument system, dual air data system and dual navigation attitude system.

1.6.9) Aircraft Airworthiness and Maintenance

A review of aircraft maintenance documentation showed that the aircraft (MSN-0807 and manufacture date Sept 2010) received from X'ian Aircraft Manufacture, China on 28 Sept 2010 with aircraft total flying hours (13:02) and (6) landings. Certificate of Airworthiness issued by Department of Civil Aviation, Myanmar on according with Myanmar Civil Aviation Requirement (MCAR) Part-21 and renewal every year.

Line check (125 inspection), A check (A-6 inspection) Base check (C-2 inspection) performed in accordance with MCAR part M.

Review on last maintenance recorded last line check performed on 22 Dec 2012 and A check on 26 Feb2013. Certificate of Airworthiness renewed on 26 Feb 2013. Aircraft was no accident recorded and no significant snags with engines. Manufacture service bulletin No. MA- 60- 29- SB 338 & SB- 339, Service information letter SIL- 2011- MA- 6004 had been performed.

1.7) Meteorological Information

The weather reported at Kawthaung airport at 12:20 MST was temperature 32° C, surface wind 5-8 miles (south- west190), QNH 1007 mb, Visibility 3-4 nm mile, cloud partly.

1.8) Aid to Navigation

Kawthaung airport was equipped with a Non-Direction Bacon (NDB) Brand (Nautel ND 500II) for use on approach to runway 02. NDB is a radio transmitter at a known location used as an aviation navigation aid with detect the automatic direction finder (ADF) equipment on the aircraft.

Kawthaung runway equipped only NDB (non-precision approach runway) with frequency 290 KHz. The NDB was determined to be functioning normally. All domestic aircraft operation in to airport reported any abnormalities with the NDB.

1.9) Aerodrome Communication

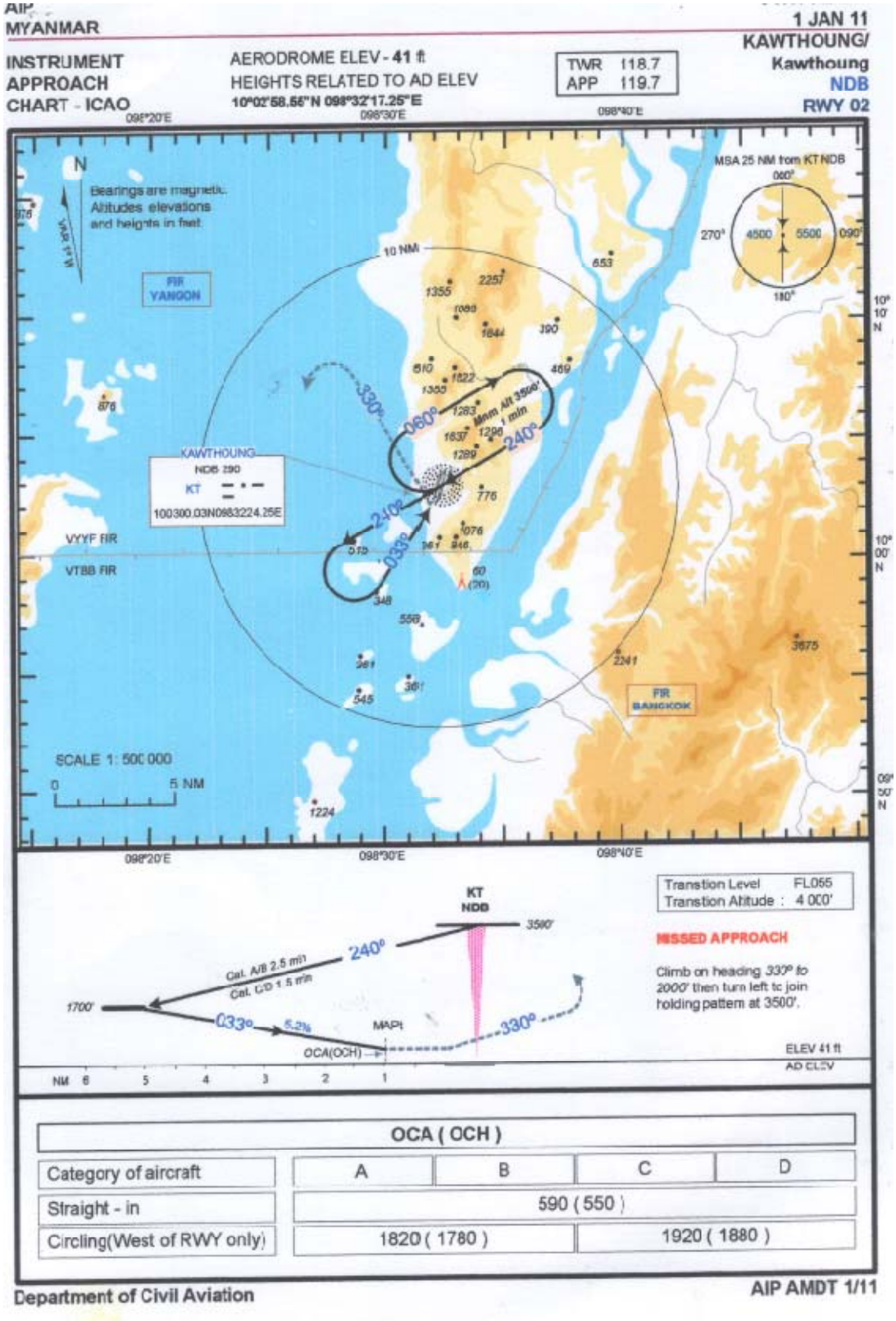
Kawthaung airport installed HF Brand (Barrett & Codan) and VHF Brand (Exicom Dual) main and stand by. It had two ATC frequencies for approach (119.7 MHz) and tower (118.7 MHz). There were no recording facilities for either frequency.

1.10) Aerodrome Information

Airport name	-	Kawthaung Airport
Airport	-	VYKT
Type of Traffic permitted	-	IFR/VFR
Aerodrome reference point	-	N 10° 02' 2″, E 98° 32' 10
Minimum sector altitude (25) NM	-	5500 ft
Transition sector altitude	-	4000 ft
Transition level	-	FL-55
Obstacle clear high (OCH)	-	590 (550) ft
Runway Dimension	-	6000 x 150 ft
Elevation	-	41 ft
Runway direction	-	02 / 20

Type of pavement - Asphalt concrete

The Airport had an Air Traffic Control (ATC) control tower controlling Class C airspace with no radar surveillance capability.



Fig(6). Instrument approach chart

1.11) Flight recorders

1.11.1) Flight Data Recorder (FDR)

Myanmar Civil Aviation Requirement (MCAR), part-7 mentioned requirement FDR and CVR. The aircraft was equipped with a China made FDR Part No- FB- 30C. It was found seriously deformed at the rear fix point of the casing. (Attach photo)

Fig (7). FDR Casing

The data was downloaded with FZJ-1 (FDR) integrated data processing equipment. Before the downloading, the FB-30C (FDR) conducted self-test, the FDR worked normally. The size of the downloaded file was 32MB. For FB-30C FDR (S/N 0710006), the latest recording was "22 Sept 2011", no recording of the accident flight. The FR-30C Quick Access Recorder PC card was read by FDK-1 PC cards downloading device. The downloading was uneventful, but found it was stopped recording since March 24, 2013 (the data recording was stopped since FDR (S/N-0710006) installation). This FR-30C PC card was also downloaded in Myanmar, and the same result as done in CAST laboratory and there were also no data of accident flight. **(Appendix- B)**

Figure (8). FDR (S/N- 0710006) self-test record.

1.11.2) Cockpit voice recorder

The aircraft was equipped with a Honeywell solid state cockpit voice recorder part No-980-6022-001 (S/N-CVR 120 -12183). The CVR was recovery at accident site. It appearance was intact, no mark of mechanical impact or stretch, neither deformation nor damage and successfully downloaded. CVR information recorded (1-5) channels, (1-3) channels have about 30 min audio files respectively and (4-5) channels are mixed channels (area microphone channels) which hole recording of 2 hours and 5 min for each. **(CVR transcript, Appendix-C)**

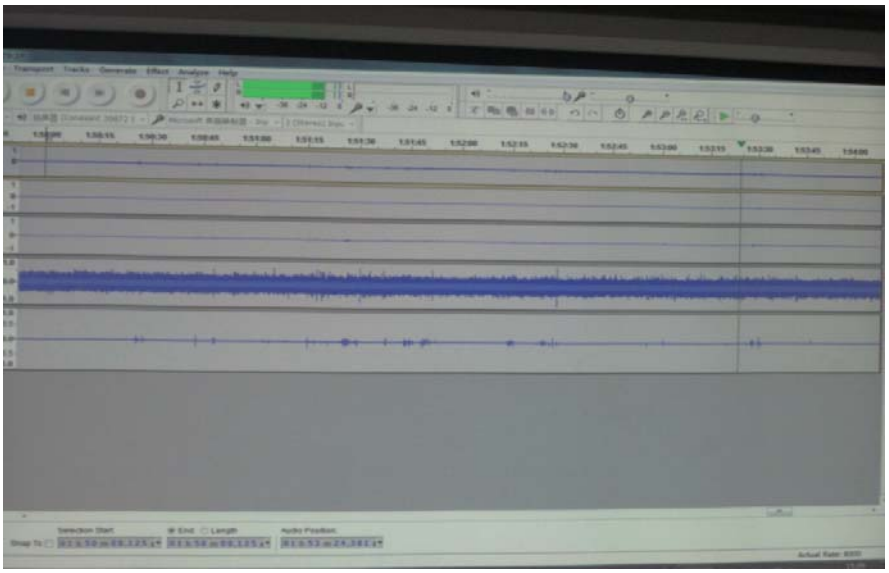


Figure (9). Cockpit Voice Recorder Downloaded

1.12) Wreckage and impact information

The accident site was located in a small bushes area (200) ft from runway left side. Aircraft veer off runway left side and struck to fence pillars with nose and left landing gears, left engine. Aircraft came to rest after striking to tree with left wing.

The following components information was noted

- Both of the propellers were damaged.
- The landing gears was fully extended (down and locked).
- Flap position was extended about (27) degree.
- Nose wheel was steering position.
- Left wing leading edge was dent due to strike with tree. Lower fuselage was dent.
- Left engine casing was crack due to strike with fence pillar.
- The aircraft was needed to major repair.

1.13) Medical and pathological information

4 crews and 60 passengers were survived in crash site and no injured. All of crews and passengers were medical checked. The test results of both pilots for drugs and alcohol were negative.

Within the limitations imposed on the samples because of their conditions, there was no evidence of in-flight incapacitation of crews or passengers from either toxic fumes of fire.

1.14) Fire

There was no evidence of pre and post fire.

1.15) Survival aspects

The cabin crew initiated an emergency evacuation as soon as the aircraft came to rest. The MA-60 aircraft has 5 emergency exit door and 1 rear cargo door. Front cargo compartment door, rear cargo compartment door, cockpit emergency exit hatch, left and right passenger cabin emergency exits and passenger entry door. The passenger entry door was opened.

Kawthaung airport had an aircraft rescue and fire-fighting vehicle. That vehicle deployed to the scene immediately. Local authority, military, police assist to surviours.

Figure (10). Google map of Kawthaung Airport

1.16) Test and Research

1.16.1) Flight Data Recorder

The rear fix point of FB- 30 FDR (S/N- 0710006) is seriously deformed. Before the downloading, it was conducted self - test and worked normally. FDR was download with FZJ-1, FDR integrated data processing equipment in China Academy of Civil Aviation Science and Technology lab, CAAC.

On FB - 30C, FDR (S/N- 0710006), the latest recording was 22- Sept 2011, No recording of the accident flight. This FDR (S/N - 0710010) was removed from (XY-AIP) aircraft in same date and sent back to China for repairing. Then FDR (S/N- 0710006) was reinstalled on (XY-AIP) on 24- March 2013 (No further data recorded since installation).

(XY-AIP) Quick access recorder (FR-30 C PC card) was download in Myanmar and China. It data also stop since 24 March 2013 (This was previous removed FDR, S/N 0710010 data). That mean, there was no new data recorded since FDR (S/N- 0710006) installed on (XY-AIP)

The result of the data recording was as the following-

- XY- AIP (MSN- 0807) FDR, S/N (0710010) was removed due to FDR fail warning on 24 March 2013 and FDR (S/N- 0710006) was installed same date on 24 March 2013. (FDR was no recorded new data since installed on 24-03-2013).
- FDR (S/N- 0710006) data was only last removed data from aircraft (XY-AIQ) since 22 Sept 2011. On 22 Sept 2011, FDR (S/N- 0710006) was removed from MA- 60 (XY-AIP) for it clock battery defect.
- After surveying on aircraft, no proper installation of FDR was found (Gap between the rear panel of the FDR (S/N - 0710006) and electrical plug of installation bracket longer than normal). It was due to seriously deformed at the rear fix point of the casing.
- FR-30 C, Quick Access Recorder QAR data was stopped 24 March 2013. (Data was only FDR (S/N 0710010) removed date. No data for S/N - 0710006).

1.16.2) FDR Testing

FDR (S/N- 0710006) was installed and check on XY-AIO (MSN- 0806) and XY-AIP (MSN- 0807). After installation of FDR, power on the system, FDR warning come on continuously in warning pannel. Which reminds that flight record system is under failure. After surveying, no proper installation of FDR was found (gap between the rear panel of FDR and plug of installation bracket longer than normal, not proper fitting).

Figure (11). Gap between FDR and Plug of installation bracket

1.16.3) Aircraft hydraulic quantity test

On 10 June 2013, during checking at accident site the hydraulic tank hydraulic fluid level is about 31 liter. On 19 June 2013, CAAC advisor team check hydraulic tank level at Kawthaung apron found 33 liter. Which is more than normal limitation (28- 29 liter).

On 20 June 2013, Xian aircraft industry (Group) company Ltd tested MA- 60 aircraft hydraulic system. MA- 60/ MA- 600 aircraft hydraulic system tank filled hydraulic oil overfull (33 Liter) condition to hydraulic system function. After starting the hydraulic pumps and landing gears extend/retract several time hydraulic low pressure warning occurred frequently. (With too much hydraulic oil, the air

pressurization area decrease causing the hydraulic system low pressure). **(Appendix- D)**

[Note: Xian aircraft industry company ltd issued Service information letter No- SIL- 2013- MA 60- 11 **(date -28 Jun 2013)** for hydraulic tank Oil level.] **(Appendix- E)**

1.16.4) On site test and research

On 28 July 2013, during on site test, main accumulator nitrogen pressure 7 MPa, the brake accumulator ~ 1 MPa, the anti- humidity sands of drying fitter have become powder and caused the blockage to the pipe. The nose wheel steering, flaps up & down, normal brake and emergency brake are operated normal function. Xian Aircraft Industry company Ltd issued SIL- 2011- MA.60- 04 (Periodical exhaust of MA.60 Hydraulic System), Service Bulletin No- MA.60- 29- SB- 338 Hydraulic System Check, Service Bulletin No- MA.60- 29- SB 339 (Hydraulic Oil Tank Pressurization System- Check). Myanma Airways had been performed.
(Appendix F)

As per the principal of hydraulic system hydraulic fluid quantity is more, tank compress air area will less and pressurize air pressure also low, which cause EDP lower efficiency and cannot able to meet the requirements for normal operation. In addition the crews did not operated the emergency electric pump. It the emergency electric pump operated the brake accumulator may ensure at least 10 twice of complete braking or the emergency pump application can make a safe land of the aircraft. **(Appendix- G)**

1.17) Organization and management information

1.17.1) The Operator Myanma Airways

Myanma Airways was formed in (1948). It has an Aircraft Operator Certificate number (001/90) dated (4- 4- 1990). Following Myanmar Civil Aviation Requirement part 1, part 7 and part 8. It has deposited standard operation procedure and MA-60 flight operation manual approved by Department of Civil

Aviation, Myanmar on 25 November 2010. The last authority audit was performed in 8 Oct 2011 for operation in Myanmar.

The fleet is composed of 3 MA- 60, 1 ATR-42-, 2 ATR -72, 2 Embraea 190, 2 Beach 1900D, 13 pilots are authorized to perform public transport MA-60 operations. The company is organized as follow. **(Appendix- G)**

- Managing Director
- General Managers
- Chief of department (Flight operation, Engineering, Human resources and admin, Finance and account, commercial)
- Manager (training, Quality Assurance, Airline safety, Airline security, cabin crews)

The company operation manual includes operational information, regulation information and instructions in orders to carry out flight operations and ensure supervision of the services with trained personnel and adequate means.

1.17.2) Aircraft systems of company policy

Myanma Airways Flight Crew operating Manual (MA-60) issued dated 25 November 2010 stated that:

Para 2.14, During landing phase flap extend (5 , 15 , 30) degree orderly and Pilot flying and Pilot Monitoring have to be check.

Para 2.16 When the main wheel touchdown, PLA shall be placed in G.I position. **(Appendix -F)**

QRH, abnormal check list in para (9-3) mention, if normal hydraulic system fail, to operate emergency electrical hydraulic pump immediately. **(Appendix- F)**

1.17.3) Regulatory information

Department of Civil Aviation noticed Aeronautical Information Publication (AIP, Myanmar) for Kawthaung airport instrument approach chart.

1.18) Additional Information

1.18.1) Testimony of the pilot and cabin crew

The captain explain that after preparation for aircraft, departed Yangon-Mawlamyine- Kawthaung and back route. During climbing, LEDPL warning light intermitted on at center warning panel. He returned back to Yangon and mechanics performed snags rectification. At about 10:15 aircraft departed to Mawlamyine, for this route PIC was PF. During landing gear down, LEDPL warning on and disappeared. At about 11:10 aircraft departed to Kawthaung with 4 crews and 60 passengers.

In the route no sign for hydraulic warning light and PIC check hydraulic quantity is ok. During final turning with landing gear down to Kawthaung runway 02, LEDPL and REDPL warning light come on again. PIC set flap 30, but he noticed flap indicator showed between 15 ~ 30. After touch down, he apply reverse power at about 2500 ft. Due to aircraft swing, he retracted power lever to GI position and applied brake. He noticed anti-skid light on and aircraft veer left, so as nose steering S/W change to taxi mode. But aircraft cannot steering and veer off runway left side and struck to fence pillars.

1.18.2) Testimony of the ATC Traffic Controller

The Cabin crew explains that about 11:10 local time aircraft departed Mawlamyine to Kawthaung with 4 crews and 60 passengers. At about (12:55), aircraft veer off runway left side and strike to fence pillars and pass through to small bushes. As soon as aircraft stopped, She notice there was smoke from left engine, then opened passenger door and evacuated passengers. All the passengers were survived.

1.18.3) Testimony of the Witness

He was assigned security for airport. At about 12:55, he noticed aircraft veer off from runway and struck to fence pillars. Then struck to tree near security port and stopped after 90° turning. As soon as aircraft stopped, cabin crews opened door and evacuated passengers with the assistance of airport staffs, and Military persons.

1.18.4) Testimony of the witness

He was assigned emergency fire fighting section. He noticed, aircraft landed to runway 02 and veer off runway left side at about 3000.ft. Fire fighting vehicle immediately deployed to accident site and assist to cabin crews. No passengers was injury.

2 ANALYSIS

2.1) Introduction

The analysis showed that, accident were due to unsafe condition and unsafe act. To improve operational safety, we need to focus not just on individuals, but on the local hazards and local threats.

2.2) Occurrence events

2.2.1) Related information

The accident was almost the result of runway excursion, the flight crews normal landed to runway, probably aircraft hydraulic system problem during final approach phase and the crews can not recovery with emergency check list-

- **Engine** Information available from CVR and witness statement provided strong evidence that the aircraft's engines were complete functional.
- **Hydraulic System** Information available from Tech: record and witness statements provided that the aircraft hydraulic system had problems. (Hydraulic pressure low warning intermitted illuminated). After snag rectification, it is also appearance during landing gear and flap operation, on site hydraulic system check, hydraulic quantity more than normal range 28-29 liter.
- **Flight Control** Information available from witness statement there was no problem with elevator, rudder, aleron control. For flap operation during landing to Kawthaung flap cannot fully extended 30˚ (On site check approximately 27˚).

- **Potential for pilot incapacitation** Information available from FDR and witness statements provided strong evidence there was no potential for pilot incapacitation in flight.

2.2.2 Other Potential technical problems consider by investigation

There was no indication that EGPWS, Airspeed, pressure altimeter were not functioning correctly prior to the accident and weight and balance were within allowable limit. On 28 July 2013, during on site investigation with Chinese experts found following-

- Hydraulic quantity is more than normal quality 28- 29 liters (32-33 liters)
- Nose accumulator pressure 1 MPa
  Main accumulator pressure 7 MPa and the anti-humidity sands of drying fitter have become powder.

On 20 July 2013, Xian aircraft industry company Ltd test MA- 60 aircraft hydraulic system with filling hydraulic oil overfill (33- liter). After starting the EDP hydraulic pumps and landing gears extend/ retract several time, hydraulic low pressure warning occurred frequently.

MA- 60 Service Bulletin No. MA- 60 29- SB.339 mentioned to check tank pressurization system (dry fitter conditions and pipe time check). Service Bulletin No. MA- 60- 29- SB.338 mentioned to check hydraulic system (accumulators nitrogen pressure check) MA- 60, service information letter SIL-2011- MA- 60- 04 mention Periodical exhaust of MA- 60 Hydraulic system (Due to Hydraulic system low pressure warning when extending and retracting landing gears and flaps) Myanmar Airways already perform service Bulletins and service information letter.

However MA-60 (XY-AIP) hydraulic low pressure warning intermittently illuminated during retracting/extending landing gears and flaps.

As per the principal of hydraulic system hydraulic fluid quantity is more, tank compress air are less and the blockage of air fitter and dry fitter would cause

the tank pressurization air pressure low. (For this reason Xian aircraft industry company Ltd reminded with service information letter SIL- 2013- MA- 60- 11, **dated on 28 June 2013.)**

2.3 Overview of the flight

2.3.1 Handling of pilot

During final approach to Kawthaung runway (02) hydraulic low pressure warning illuminated and flaps position was not reached fully extended (27). As soon as aircraft touchdown, PIC apply reverse power. However PIC didn't operated emergency hydraulic system. (MA-60 Pilot checklist if normal hydraulic system fail, operate the emergency hydraulic pump immediately). **(Appendix- H)**

2.3.2 Action during landing roll

Due to aircraft swinging, PIC changed power lever to G1 position and put nose wheel steering S/W to taxi mode and steering.

However, due to normal hydraulic system pressure low, nose wheel steering and braking is not effective and aircraft veer off runway left side.

2.3.3 Potential scenarios

The investigation considered different scenarios to explain altitude was conducted -

(a) A potential scenario is that hydraulic system pressure low while hydraulic fluid level more than normal and tank pressurization air pressure low due to filters blockage.

(b) A second potential scenario is due to hydraulic system pressure low nose wheel steering mechanism and braking action are not effectively.

(c) A third potential scenario is PIC didn't apply the emergency hydraulic. (it can maintain the brake system (10) time).

Summary

It was considered very unlikely that the runway excursion (veer off) was unsafe condition and unsafe act. The above scenarios considered contributory factors, these have led to veer off to runway left side and struck to fence pillars.

2.4 Local condition

Maintenance concept

Xian aircraft industry company ltd issued SB-MA.60-29-3B-338 and 339, SIL- 2011- MA- 60- 04 with Hydraulic pressurization system. However Myanmar Airways need to efficiently implementation of SB.

Crew resource management conditions

Operating a multi-crew aircraft, particularly in high workload situations, requires the two pilots to work in a coordinated manner and effectively communication with each other, cross-checking and detection of errors several factors that influenced the potential for CRM-

2.5 Risk Control

Several risk controls were identified as being safety factors_

Pilot training

- The available evidence indicates that there was lack of recurrent or simulator training, under the abnormal/ emergency situation, Since MA-60 aircraft initial and type training finished on 21 September 2010.

2.6 Organizational influences (Myanma Airways)

Organization structure of Myanma Airways is Managing Director, General Managers, Chief of Heads (Flight Operation, Maintenance, Admin, Finance) and Manager (Flight Operation Security, Ground Operation, Training, Quality Assurance). etc.

During installation of FDR(S/N-0710006) there was gap between the rear panel of FDR casing and plug of installation bracket longer than normal, it can not electrical circuit energized.

However Myanma Airways has not proper checking during FDR maintenance and flight operation flight data analyze programme.

2.7 Organizational influences (DCA)

An air operator's certificate (AOC) holder had a clearly defined responsibility under the Myanmar Civil Aviation Requirement (MCAR) to ensure the safety of its operations. MCAR, part 8 and AOC Manual mention about FDR analysis programs. The regulator audit was performed for over sighting surveillance activities.

However DCA need to ensure Myanma Airways implementation flight data analyses programs.

3 CONCLUSIONS

3.1) Findings

- There are no indication of engines problem and potential for pilot incapacitation before accident.
- The crews are completed related training and medical status class 1.
- The PIC and FO proficiency checks and instrument checks are valid.
- The limits on crew duty time were complied with.
- The flight crews had been working together for (15) days prior to the day of accident and no tension between then.
- The CVR data could be analysed.
- The FDR(S/N- 0710006), the latest recordings was 22 Sept 2011. No recording of the accident flight. This data was since last FDR (S/N-0710010) removed date from MA-60 (XY-AIQ).
- The QAR data, the latest recording was 24 March 2013. No further data recorded since FDR(S/N- 0710006) installation on XY-AIQ.
- The FDR (S/N- 0710006) was found seriously deformed at the rear fix point of the casing.

- No proper installation of FDR was found (Gap between the rear panel of FDR and plug of installation bracket longer than normal, not proper fitting.
- During maintenance FDR was not proper self-test.
- Airline was not flight data analyze programme.
- Although airline had performed Service Bulletins and Service Letter but it is need to efficiently implement.
- During site investigation hydraulic fled level was more than normal (28-29) liter and tank compress air dry filter was found powder: Flaps down position (27˚) only.
- Hydraulic low pressure warning intermittently illuminated during landing gears operation.
- Hydraulic system pressure low and nose wheel steering mechanism and braking action is not effective.
- PIC did not operated the emergency hydraulic pump.
- Myanma Airway need recurrent simulator training for MA.60 fleet pilots.
- DCA need to ensure the Myanma Airway implementation of FDR data analyses programmer.

3.2) Primary Cause

- During landing roll, due to hydraulic system pressure low, nose wheel steering mechanism and braking action are not effectively operated and aircraft veer off runway left side.
- PIC did not operated the emergency hydraulic pump while hydraulic low pressure warning come on.

3.3) Secondary Cause

- Hydraulic system pressure low due to hydraulic tank fluid level more than normal and tank pressurize compress air line filter blockage.

4 SAFETY RECOMMENDATION

To reduce and eliminate of accidents and serious incidents, MAIB recommended following recommendation-

- Myanma Airways maintenance ensure to perform through snag rectification and proper action on company service bulletins and service information letters.
- Myanma Airways maintenance ensure to perform proper installation of FDR and self-test.
- Myanma Airways operation ensure the flight crews to perform the emergency procedure.
- Myanma Airways ensure to perform the FDR analyze programme and pilot recurrent simulator training.
- DCA need to ensure it air line operators implementation of FDA data analyze programme.

Investigator- in-Charge