



دولة الامارات العربية المتحدة
الهيئة العامة للطيران المدني
UAE General Civil Aviation Authority

ACCIDENT INVESTIGATION REPORT

General Civil Aviation Authority

Regulation and Investigation Department

Dubai, UAE

AIRCRAFT ACCIDENT REPORT 02/2008

Bell 212, A6-ALV

Rashid Drilling Rig, MAERSK RESILIENT

September 3rd, 2008

United Arab Emirates

ACCIDENT BRIEF

MANUFACTURER : Bell Helicopter Textron, Inc.
AIRCRAFT TYPE : Helicopter Bell 212
REGISTRATION : A6-ALV
LOCATION : 25°21'1.5085"N 54°29' 1.6888"E
(Rashid Drilling Rig, MAERSK RESILIENT)
DATE & TIME : 03 September 2008, 20:23 Local Time

Notes:

1. All times in this report are Local (Local time in UAE was UTC+ 4h).
2. At the time of the accident the end of Civil Evening Twilight was 18:57.
3. The word "Helicopter" in this report implies the accident helicopter.
4. The word "Team" in this report implies the Accident Investigation Team.
5. The words "Pilot" and "Co-Pilot" in this report refer to the TRE and the Captain receiving the check respectively

This Accident Investigation is performed in accordance with the UAE Federal Act No 20/1991, Promulgating the Civil Aviation Law, Chapter VII, Aircraft Accidents, Article 48, and in conformity to ICAO Annex 13 to the Chicago Convention.

The sole objective of this Investigation is to prevent aircraft accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

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ABBREVIATIONS

ATC	Air Traffic Controller
ADDR	Acceptable Deferred Defects Record (item deferred under an MEL)
ADI	Attitude Direction Indicator (Artificial Horizon)
AFCS	Automatic Flight Control System
AHRS	Attitude Heading Reference System
AMS	Approved Maintenance Schedule
Assy	Assembly
ATA	Air Transport Association
ATPL	Air Transport Pilot Licence
Att	Attitude
ATT	warnings flags-attitude
Capt.	Captain
CMT	Control Motion Transducer (part of SAS system)
C of A	Certificate of Airworthiness
Comm	Communications (Radios)
CMR	Certificate of Maintenance Release
CVR	Cockpit Voice Recorder
Dual TQ	Torque (instrument displaying both engine torque)
DP	Dubai Petroleum
ECT	Evening Civil Twilight
FAA	Federal Aviation Administration
FDR	Flight Data Recorder
FO	First Officer
GCAA	General Civil Aviation Authority of the United Arab Emirates
GPS	Global Positioning System
GS	Glide slope
h	Hours
HLO	Heliport Landing Officer
HMM	Helicopter Maintenance Manual
IND RT	Indicator Rate
Inop	Inoperative
MCT	Morning Civil Twilight
MCTOM	Maximum Certified Take Off Mass
MEL	Minimum Equipment List
MSN	Manufacturer Serial Number
N1	Gas Producer RPM
NATO	North Atlantic Treaty Organization
OMC	Operating Manual Part C
OMD	Operating Manual Part D (Training Manual)
Ops Chk	Operational check
P1	Pilot
P2	Copilot
Ref	Reference
RPM	Revolutions per Minute

RT	Rate of Turn
SAS	Stability Augmentation System
Satis	Satisfactory
SCAS	Stability Control Augmentation System
S/N	Serial Number
SOP	Standard Operating Procedure
SMS	Safety Management System
ST/Gen	Starter Generator
STC	Supplemental Type Certificate
TCDS	Type Certificate Data Sheet
TSLO	Time Since Last Overhaul
TSN	Time Since New
TT	Total Time
VHF	Very High Frequency (radios)
UAE	The United Arab Emirates
UTC	Universal Coordinated Time

SYNOPSIS

On September 3rd, 2008, at approximately 19:48, a Bell 212 helicopter, registration A6-ALV, departed from Dubai International Airport to Rashid Drilling Rig with 2 crewmembers and 5 passengers onboard, where it landed. Prior to takeoff from the Drilling Rig's landing area, the crew entered a hover and moved rearward while executing an approximately 180 degree left turn. The crew positioned the aircraft near the edge of the landing area facing into the prevailing wind, ready, for departure. During the lift-off, the Helicopter travelled aft wards, for approximately 50 meters, contacted the vertical crane of the Drilling Rig, lost altitude and crashed on the platform. The Helicopter was separated in two major parts. The cabin area part caught fire and was totally destroyed and the part containing the cockpit, fell through the centre of the rear jackup leg and became submerged, near the rear jackup leg . All onboard were fatally injured.

The GCAA was notified of the accident the same day and formed an Accident Investigation Team "Team" by the GCAA Decree number 08/2008, consisting of a the Team Leader (Mr. Ismaeil Abdul Wahed) and members comprising a Flight Operations Inspector (Capt. Anaziaz Zikir), an ATC Investigator (Mr. Khalid Al Raisi) and an Engineering Inspector (Mr. Walid al Rahmani). The Team commenced the investigation upon the notification and dispatched to the accident site, the next day, due to security restrictions.

FACTUAL INFORMATION

1.1 History of the Flight

On September 3rd, 2008, at approximately 19:48, a Bell 212 helicopter, registration A6-ALV, departed, after completing the necessary preparation for the intent of night time transfer flight from Dubai International Airport to various locations (Maersk Resilient Drilling Rig located at Rashid "A" Platform, Living Quarters, Nobel Mark Burns on Falah B and South West Fateh) with 2 crewmembers and 5 passengers onboard.

According to the Dubai Petroleum Passenger and Freight Manifest, the purpose of the planned Helicopter flights were:

- a) on its first stop, to drop off twenty six pounds of freight,
- b) on its second stop, to pick up two passengers and drop off one passenger,
- c) on its third stop, to drop off three passengers,
- d) on its fourth stop, to drop off three passengers (with the intention of night stop) and
- e) returning to Dubai International Airport (next day).

Whilst the Helicopter flew towards the Rig it received clearance from the Rig Radio Room to approach and land on the landing area. From eyewitnesses' statements, the Helicopter crew, after given signals from the HLO, landed on the Maersk Resilient's landing area (see figure 1), at an approximate heading of approximately 045 degrees, without any reported anomalies. The pilot gave "thumbs-up" signal to the HLO for him and his assistants to approach the Helicopter. The freight was unloaded, the Helicopter's doors were closed and then the HLO gave "thumbs-up", as per the company's procedures, indicating that the Helicopter was cleared to depart. The Helicopter then lifted off approximately two meters vertically, and stayed in hover for two to three seconds, then turned counter clockwise approximately 180 degrees having the landing area behind it. The Helicopter subsequently climbed at take off power to a height of approximately twenty two meters while travelling backwards, in reverse, for approximately fifty meters. Whilst moving backwards, the main rotor blades collided with the vertical crane of the Drilling Rig, broke up and fell down into two major fuselage pieces, with one of the pieces falling onto the exhaust pipes from the port engine room of the Rig. The other major fuselage piece containing the cockpit area separated from the main wreckage and became submerged after falling through the centre of the rear jackup leg (see Figure 1).

Shortly after the Helicopter caught fire, the Drilling Rig's fire alarm was activated and the deck crew were successfully mobilised to suppress the developed fire. None of the flammable and explosive materials in the vicinity of the Helicopter impact area was ignited. The Helicopter was totally destroyed, with the majority, subsequently burned. The part of fuselage containing the cabin area wreckage was scattered over the deck of the Drilling Rig(see Appendix 2 eye witnesses' statements).

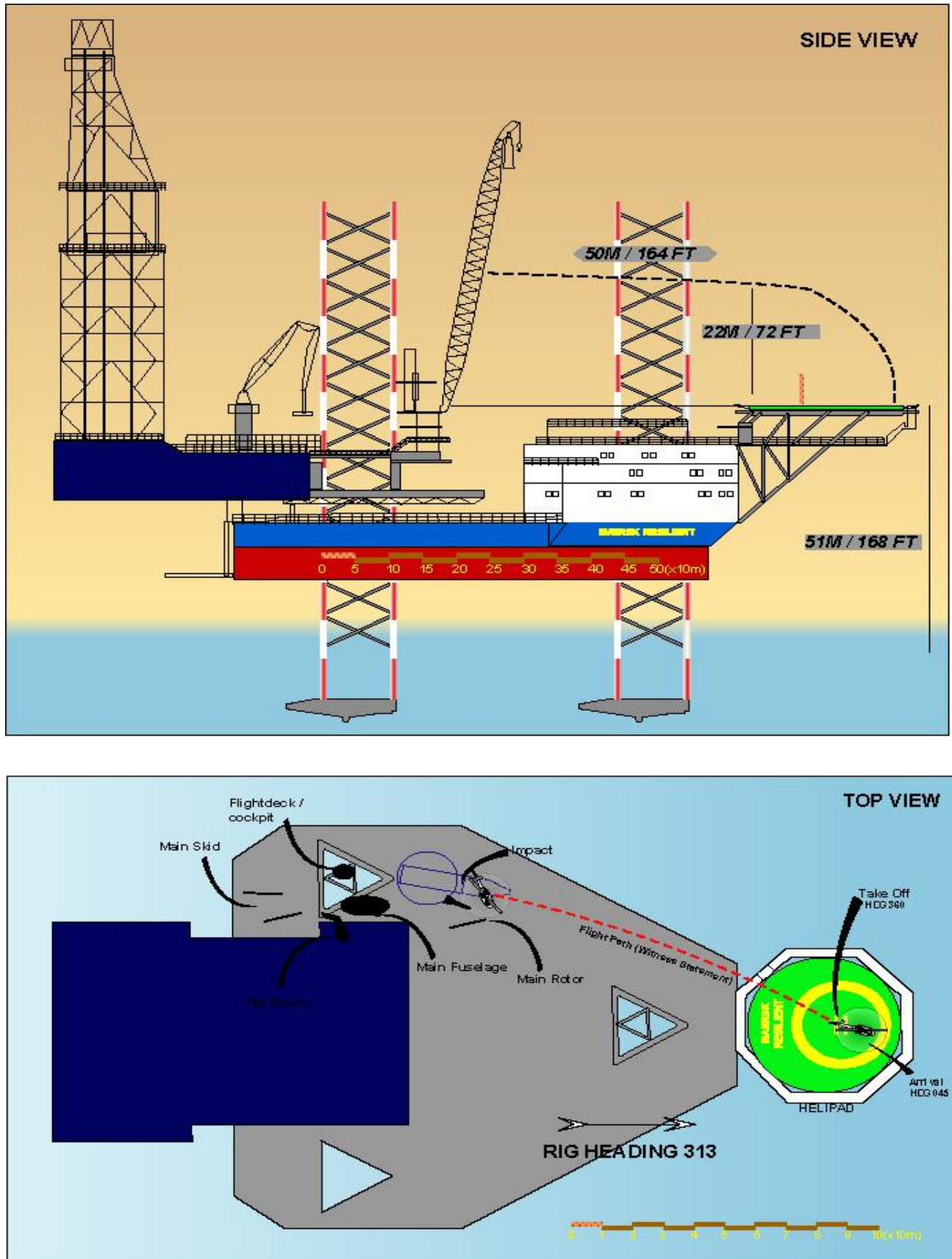


Figure 1 (approximate flight path and approximate location of main wreckage)

1.2 Injuries to Persons

All occupants were fatally injured in the crash.

Injuries	Flight Crew	Cabin Crew	Passengers	Other	Total
Fatal	2	-	5	-	7
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	-	-	-	-	-
Total	2	-	5	-	7

Table 1

1.3 Damage to Aircraft

The aircraft was totally destroyed as a result of significant impact forces and subsequent fire.

1.4 Other Damage

The parts of the leg in the vicinity of the fire (approximately bays 9 and 10 counting from the top) were partially covered by soot. Climbers, who have inspected the legs more closely, reported that all paint in that area appeared to be intact.

An anode located higher up in the leg (in leg bay 7, counting from the top) has been removed. It was found loose, after having been hit by a part of the Helicopter. The shape and direction of scratches to paint in the area around the anode indicated that the area was struck by a rotor blade.

1.5 Personnel Information

1.5.1 The Pilot In Command (the Pilot)

Gender and age	: Male, 55 years old
License	: UAE ATPL 0068
Validity	: 02 March 2011
All classroom training and checking	: Current at the time of the accident
Line & Proficiency Check	: Current at the time of the accident
Medical certificate	: Class1, valid to 30 th November 2008
Ratings	: BO105, Bell 206, Bell 212, Instructor – Instrument
English Language Proficiency	: 6- Expert Speaker
Flying Experience:	
Total all Helicopter types	: 12,500 h
Total Command Hours Helicopter	: 10,950 h
Total on type	: 5,500 h
Total on BH 206	: 1,250 h
Total on other types	: 4,650 h
Total last 30 days	: 15:10 h
Total last 24 hours	: 3:20 h

Previous rest and duty period:

Off duty : 11:30 h on 2 Sep 2008
 On duty : less than 01:00 h on 3 Sep 2008

1.5.2 The Copilot

Gender and age : Male, 45 years old
 License : ATPL 15646
 Validity : 19 Nov 2009
 All classroom training and checking : Current at the time of the accident
 Line & Proficiency Check : Current at the time of the accident
 Medical certificate : Class1, valid to 30th November 2008.
 Ratings : Bell 206, Bell 212
 English Language Proficiency : Not Tested
 Flying Experience:
 Total all Helicopter types : 4,074 h
 Total Command Hours Helicopter : 3,640 h
 Total on type : 2,900 h
 Total on BH 206 : 250 h
 Total on other types : 697 h
 Total last 30 days : 54 h
 Total last 24 hours : 5.4 h
 Previous rest period:
 Off duty : 30:30 h on 3 Sept 2008
 On duty : less than 01 h duty on 3 Sept 2008

1.6 Aircraft Information

The Bell 212 Twin Huey (also known as the Twin Two-Twelve) is a two-bladed, twin-engine, single main rotor medium helicopter that first flew in 1968 and approved in October 30th, 1970 as a transport helicopter category B and on June 30th, 1971 as a transport helicopter category A, as per TCDS number H4SW. Originally manufactured by Bell Helicopter in Mirabel, Quebec, Canada, the 212 is marketed to civilian operators and has a fifteen-seat configuration. In cargo configuration the 212 has an internal capacity of 220 ft³ (6.23 m³). An external load of up to 5,000 lb (2,268 kg) can be carried.

The accident Helicopter, Manufacturer Serial Number (MSN) 30703, was configured to carry 2 pilots and 13 passengers. The Helicopter records showed that it was manufactured in May 1975 and registered in the UAE on August 11th, 1998.

1.6.1 Aircraft General Information

Date of first C of A under UAE Registry :	13/04/1999
Date of the last C of A:	13/04/2008
Last C of A expiry date:	12/04/2009

C of A category:	Transport
Radio Station License:	Issued on 03/04/2007 and valid until 02/04/2009
Insurance Validity Period effective from:	1/11/2007 to 31/10/2008
TSN:	9,754.5
Cycles Since New:	36,876
Last CMR date	29/05/2008, at 9483.4 hrs
next CMR was due on	28/9/2008
Engines	
Engine Type:	PT6T-3B (Pratt & Whitney Canada)
Engines' MSN:	No. 1 CP-PS-63405 No. 2 CP-PS-63395
Engines' TSN (h):	No. 1 3949:4 No. 2 11261:6
Total Engines' Starts:	No. 1 1,799 No. 2 2,156
Engines' TSLO (h):	No. 1 2202:8 No. 2 2591:9
MCTOM:	11,200 lb

1.6.2 Systems

1.6.2.1 Flight Control Systems

Mechanical linkage systems actuated by conventional helicopter controls, are used to control flight attitude and direction. Systems include a cyclic control stick for fore, aft and lateral control; a collective pitch control stick for vertical control; and antitorque pedals for directional control. A synchronised elevator is linked into cyclic fore-and-aft control system.

Electrically operated force trims, connected to cyclic and antitorque controls, induce artificial control feel and stabilise the control stick and pedals to prevent movement from feedback forces.

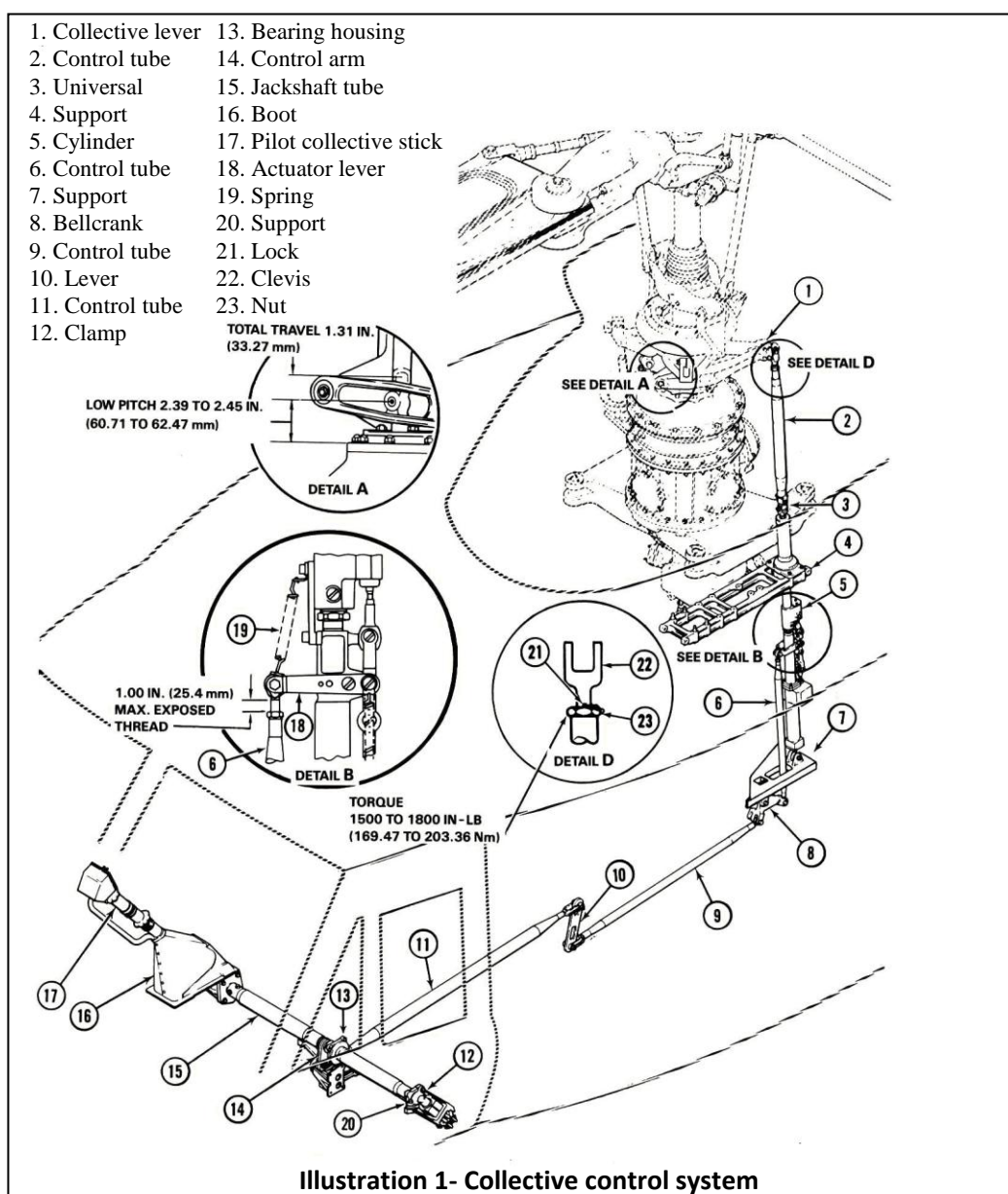
1.6.2.2 Collective Controls

The collective control system consists of a jackshaft assembly with pilot control stick, push-pull tubes and bellcranks, and a dual hydraulic power cylinder connected to a control lever below the swashplate. Movement of collective control stick is transmitted through linkage and power cylinder to main rotor pitch control mechanism, causing helicopter

to ascend or descend or to remain at constant altitude. The hydraulic power cylinder incorporates a check valve system to provide irreversibility and to reduce feedback forces to controls in event of hydraulic power failure.

1.6.2.3 Collective Control Stick and Jackshaft

Pilot collective pitch control stick extends up and forward through a flexible boot in floor at left side of seat, and is connected to a jackshaft mounted laterally under floor. A knurled collar on the stick allows adjustment of friction drag. A spring-loaded down lock is provided on floor below stick. Twist-grip type power controls, with friction adjustments, are incorporated in control stick assembly. A switch box on top of the collective stick contains control switches for engine starting, engine governor rpm, idle stop releases, landing light and searchlight (See illustration 1).

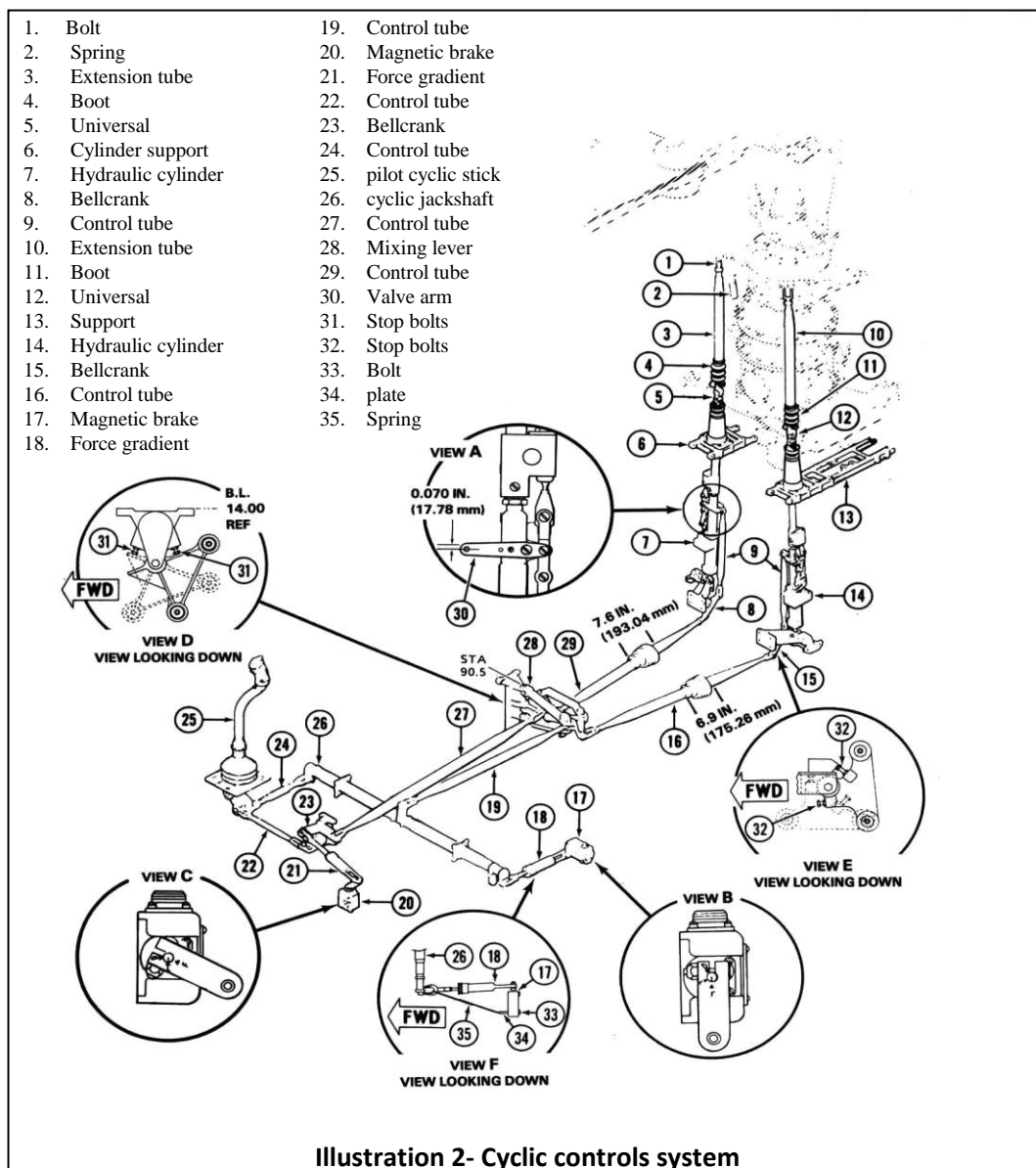


1.6.2.4 Cyclic Controls

The cyclic control system consists of pilot's cyclic control stick, push-pull tubes, bellcranks, mixing levers, two dual hydraulic power cylinders, and electrically operated force trim unit. Movement of cyclic control stick is transmitted through linkage and hydraulic cylinders to the swashplate. Fore and aft control linkage is separate from lateral control linkage from control stick to mixing levers. Two dual hydraulic power cylinders are incorporated to reduce effort required for control and to reduce feedback forces from main rotor. Two force gradient units, with magnetic brakes are incorporated for artificial control feel and stabilization of controls.

1.6.2.5 Cyclic Control Stick

The cyclic control stick is mounted through the floor in front of the pilot seat. The cyclic stick has adjustable friction and is equipped with a trigger type intercom and communication switch, a cargo hook release switch, rescue hoist control switch and a force trim switch. (See illustration 2.)

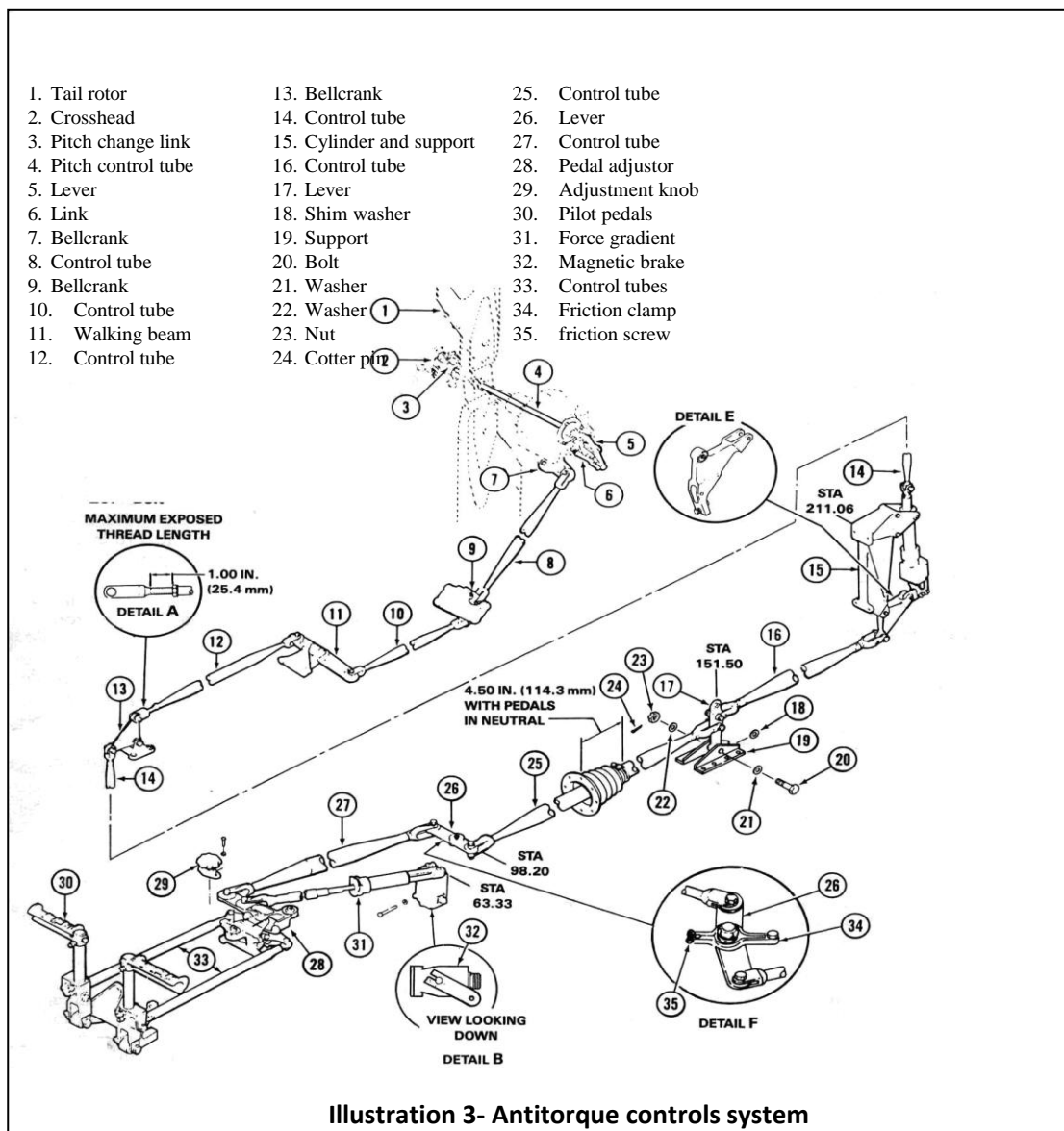


1.6.2.6 Synchronized Elevator

The synchronized elevator consists of two elevators, one on each side of tailboom. Each elevator is a horizontal airfoil section built up on a spar tube which is inserted into a projecting end of a horn assembly and secured by two bolts. The horn assembly is installed horizontally through sides of the tailboom and is secured to the structure by supports which serve as bearings for rotational movement. A control arm on the horn provides attachment for linkage from the fore-and-aft cyclic control system at the swashplate.

1.6.2.7 Antitorque Control System

The antitorque control system includes control pedals, pedal adjusters, a force gradient (centering spring) assembly with an electrically operated magnetic brake, a hydraulic power cylinder, and connecting linkage. Actuation of pedals causes a power-assisted pitch change of tail rotor blades to offset main rotor torque and control directional heading of helicopter.

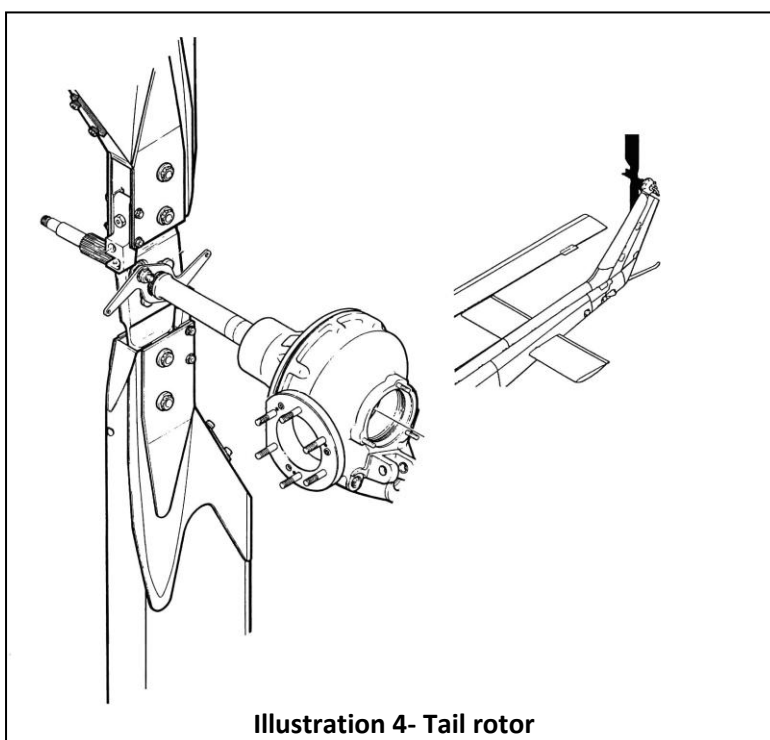


1.6.2.8 Pedals and Adjuster

A set of control pedals, supported on forward bulkhead, is connected under cabin floor to adjuster assembly. Adjuster is a bellcrank assembly with a knob on the floor for manual adjustment of pedal position according to pilot need. Force gradient and control linkage to power cylinder are connected to a bellcrank on pilot adjuster.

1.6.2.9 Tail Rotor

A two-blade, controllable pitch tail rotor hub and blade is located on the right side of the tail rotor gearbox. It is composed of two assemblies, the hub and the blades, and is driven from the transmission through the tail rotor gearbox (Illustration 4).



1.6.2.10 Fuel System

Chapter 28 of the HMM explains that the fuel supply is contained in five separate cells. The three aft cells supply fuel to two lower, independent, self-sealing cells which individually serve as supply sources for each power section. Each under-floor cell is equipped with a sump, a submerged electric motor-driven boost pump, a flow-actuated switch connected to a fuel boost (Engine 1 or 2) caution panel segment to signal if pump is inoperative, a float switch connected to a fuel flow caution panel segment, a sump drain valve, a lateral baffle with a flapper valve allowing front-to-rear flow, and an ejector-type mounted on the front wall. A manual drain valve is also provided in the forward compartment.

The last revision of the FAA Type Certificate Data Sheet (TCDS) number H4SW prescribes Avjet to be used as fuel on the Bell 212 conforming to ASTM D-1655, type A, A-1, or B; or MIL-T-5624, Grade JP-4 (NATO F-40) or JP-5 (NATO F-44); or MIL-T-83133, Grade JP-8 (NATO F-34).

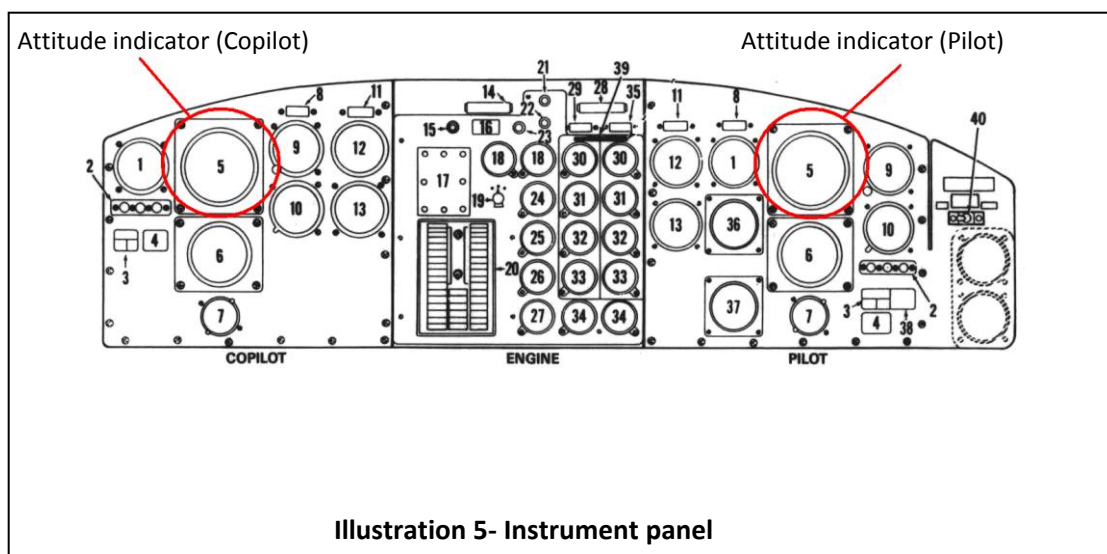
The Helicopter was fuelled with JET A-1, which was according to that specified by the approved TCDS and the HMM Chapter 28.

1.6.2.11 Attitude Indicators

Pilot and Copilot attitude indicators provide overall aircraft flight attitude information by means of the following individual displays:

1. The spheroid displays pitch attitude by vertical motion with respect to fixed reference aircraft symbol and roll attitude by rotational motion of roll pointer with respect to fixed roll scale at top of display. The attitude spheroid can be adjusted to zero indication by pitch trim and roll trim knobs.
2. The glide slope pointer displays helicopter deviation from the glide slope beam centre. The pointer represents the position of beam centre in relation to helicopter.
3. The warnings flags-attitude (ATT), glide slope (GS), and rate of turn (RT)-provide visual indication of system malfunctions. A warning flag comes into view whenever a malfunction occurs in the respective system circuit.
4. The rate-of-turn pointer indicates in which direction and at what rate the helicopter is turning.
5. The inclinometer indicates when the helicopter is in balance, either in a turn or in straight and level flight. If the helicopter is yawing or slipping, the ball will be off centre.

Illustration 5 presents the locations of the two Attitude indicators and Standby Attitude Indicator in the front instrument panel (item 37 of the illustration).



1.6.3 The Inspection Program

Chapter 5 of the HMM “Inspections and Components Overhaul Schedule” and the approved maintenance schedule (AMS) contain the requirements for Scheduled, Special, and Conditional Inspections and Component Overhaul Schedule.

1.6.3.1 Scheduled Inspection

It's stated in the HMM that *“...these inspection requirements constitute an approved inspection program for the Bell Helicopter Model 212. For the convenience of the operator, two separate Scheduled Inspections are provided as follows:*

Scheduled Inspections- Part A consists of a daily inspection, 100 hours/12 calendar month inspection, 1000 hour inspection, and a 3000 hour/5 year inspection.

Scheduled Inspections- Part B consists of a 25 hour/30 day inspection, 300 hour inspection, 600 hour/12 month inspection, and a 3000 hour/5 year inspection”.

Chapter 5 also prescribes the requirements for conversion from Part A to Part B Inspection Programs or vice versa. The accident helicopter records revealed that the operator was following Part B type.

In the same Chapter, “*Inspection Program*”, it is prescribed that the intervals of the inspections are the maximum allowable and should not be exceeded except in unusual local conditions, such as environmental conditions, utilisation, etc., but it is the responsibility of the operator to increase the scope and frequency of inspections as necessary to ensure safe operation.

The HMM also states that *“the tolerance for scheduled inspections, special inspections, or overhaul intervals unless otherwise stated, is 10 percent, OR up to a maximum of 100 hours operating time/30 days calendar time, whichever is less. Scheduled inspection or overhaul intervals required beyond the stated tolerances must be approved by Bell Helicopter Product Support Engineering. The tolerance is established for maintenance scheduling convenience only. In each case the subsequent interval will be adjusted to re-establish the original schedule. When an inspection is done more than 10 percent early, subsequent inspections will be advanced as required to not exceed the maximum tolerance. Concurrence and final approval of inspection interval tolerance by the governing civil aviation authority is the responsibility of the owner/operator”.*

The review of AMS revealed that the 25 h / 30 day Inspection was changed to 50 h/30 day as approved by Bell Helicopter Textron, Inc (letter dated 21/08/07) and GCAA letter 21265/05857/DXB/AW/07 (dated 03/09/07)

1.6.3.2 Special Inspections

Special inspections are required for certain systems or components at other than normal time intervals.

1.6.3.3 Conditional Inspection

Conditional inspection is required for certain systems, and/or components after unusual events, such as hard landings or sudden stoppage of rotor, etc.

1.6.3.4 Component Overhaul

Component Overhaul is carried out at intervals defined by Bell Helicopter Textron, Inc, Pratt & Whitney and the Original Equipment Manufacturer.

1.6.3.5 Mandatory Retirement

Mandatory Retirement of components shall be in accordance with the Mandatory Airworthiness Limitations Schedule as defined by Bell Helicopters and Pratt & Whitney. These Mandatory life limits must not be exceeded.

1.6.4 Aircraft Maintenance and Defects History

1.6.4.1 Implemented Scheduled Inspection

Maintenance Schedule: AGS-212B

Table 2 illustrates the achieved scheduled inspections of the helicopter maintenance according to the approved Maintenance Program, as well as the flying hours at which each inspection was performed.

Table 2 also illustrates the TT at which each scheduled maintenance was carried out.

Table 2- Implemented Scheduled Inspection

25hr/ 30 days	50 hrs	100 hrs	150 hrs	200 hrs	300 hrs	450 hrs	600 hrs	Date
8714.7	8714.7							10/02/07
		8723.8						12/02/07
8737.5								19/02/07
8760.9	8760.9							24/02/07
			8772.4					01/03/07
8782.1								05/03/07
8806.5	8806.5							12/03/07
8821.7		8821.7						17/03/07
8844.5	8844.5							29/03/07
8867.4								15/04/07
8883.5	8883.5			8883.5		8883.5		23/04/07
8907.9								03/05/07
8910.2	8910.2	8910.2	8910.2		8910.2	8910.2	8910.2	05/05/07
8932.1								19/05/07
8953.5	8953.5							26/05/07
8975.8								02/06/07
8999.5	8999.5							08/06/07
		9006.4						11/06/07

9022.5							18/06/07
9043.9	9043.9						25/06/07
9066.2		9066.2					02/07/07
				9076.7			05/07/07
9089.5	9089.5						11/07/07
		9100.3					16/07/07
9111.5							18/07/07
9133.1	9133.1						24/07/07
9154.4							06/08/07
9176.2	9176.2						18/08/07
9197.5							04/09/07
9206.9	9206.9	9206.9			9206.9		07/09/07
9228.7							30/09/07
9237.2							29/10/07
9254.5	9254.5						06/11/07
				9270.0			20/11/07
9275.6							25/11/07
9293.5	9293.5	9293.5				9293.5	05/12/07
9314.9							24/12/07
9318.6	9318.6						01/01/08
9341.4							20/01/08
9345.0	9345.0						01/02/08
			9354.0				06/02/08
9366.9							21/02/08
9375.1	9375.1						28/02/08
9391.6	9391.6	9391.6			9391.6		08/03/08
9412.8	9412.8						24/03/08
9435.1							16/04/08
9437.2	9437.2						22/04/08
9456.3	9456.3	9456.3	9456.3	9456.3	9456.3	9456.3	07/05/08
9477.8							25/05/08
9500.7	9500.7						08/06/08
9523.6							14/06/08
9542.1	9542.1						27/06/08
		9555.0					03/07/08
9564.9							08/07/08

9585.2	9585.2		15/07/08
9602.6		9602.6	23/07/08
9624.6			31/07/08
9633.0	9633.0		03/08/08
9647.7			06/08/08
	9653.5	9653.5	07/08/08
9669.7			10/08/08
9678.2	9678.2		12/08/08
9702.6			17/08/08
9724.2	9724.2		21/08/08
		9738.4	27/08/08

1.6.4.2 History of Defects

The self explanatory table 3 shows a list of all reported defects, as well as the maintenance corrective actions.

Because the accident sequence involved an unusual motion of the Helicopter for the specific flight, the Team reviewed the Helicopter’s technical logbook one year prior to the accident date focusing on the reported defects pertinent to aircraft controllability.

Table 3- History of all reported defects
(One year prior to the accident date)

#	Date	ATA	Description	Fly hour	Remark
1.	12/09/07	99	AFCS SCAS System Roll Channel U/S	9,207.2	ADDR Item No.3 Raised.
2.	20/10/07	96	N1 on #2 Eng failed to indicate on start.	9,231.1	Replaced #2 ST/Gen. forward Relay.
3.	22/10/07	95	Copilot's Dual TQ #1 needle stuck @ 40%	9,231.4	TQ Indicator replaced.
4.	09/11/07	97	Co-pilot Attitude Ind. RT Flag U/S.	9,261.9	Rate Gyro replaced.
5.	15/11/07	97	Garmin GPS failed.	9,267.2	Antenna replaced and connector cleaned.
6.	10/12/07	96	Bottom anti-collision light U/S	9,300.8	Anti-collision light unit replaced.
7.	18/12/07	97	#1 VHF Comm changeover button intermittent	9,311.1	Comm controller replaced
8.	11/01/08	96	#3 inverter inop	9,329.3	Inverter replaced.
9.	13/06/08	95	Pilot ADI intermittent unreliable	9,521.7	Pilot ADI swapped with Co-pilot ADI, functional ground test satisfactory. Deferred i.a.w. Operator MEL rev 8.

10.	15/6/08	95	Co-pilot erratic on flight	9,525.9	Co-pilot ADI/Tarsync circuit breaker replaced
11.	16/06/08	96	Landing light no extension	9,529.0	Landing light Assy replaced.
12.	07/07/08	99	AFCS Roll channel feedback through cyclic	9,562.9	Roll Sensor Assy replaced.
13.	09/07/08	99	Cyclic oscillation in Roll channel, both sas + att.	9,564.9	Roll channel CMT removed, lubricated and refitted.
14.	27/07/08	99	Roll channel vibrating in flight	9,603.1	Replaced connector P3007 & P3015. Check satis.
15.	04/08/08	96	Co-pilot's vent blower U/S.	9,635.5	Blower Assy replaced.
16.	06/08/08	95	Co-pilot ADI U/S	9,647.7	ADI replaced.
17.	17/08/08	96	Landing light lamp bursted.	9,702.6	Lamp replaced.
18.	20/08/08	95	P1 & P2 Attitude Indicators unreliable.	9,719.0	Swapped #1 & #2 Tarsyn. Ops chk on ground no fault.

On the previous day, the pilots operated similar routes with the Helicopter without any anomalies. Furthermore there were no abnormalities reported during the Helicopters' previous flights.

1.6.5 Mass and Balance

The Mass and Balance of the accident Helicopter was within the certified Manuals' limitations.

1.7 Meteorological Information

The weather at Dubai International Airport at the time of the accident was as follows:

Wind : 08 knots
 Cloud and Visibility : CAVOK
 Temperature : 28 degrees centigrade
 Dew point : 21
 QNH : 1001
 Forecast : No significant change forecasted.

The ATIS at Dubai International Airport at the time of the accident was identified as information Tango.

1.8 Aids to Navigation

There were no Navigation Aids in the vicinity of the Drilling Rig.

1.9 Communications

There was no recording of the communication between the Helicopter and the Drilling Rig. The communications between the helicopter and the LQ Radio Room were documented.

1.10 Landing Area

The Maersk Resilient Drilling Rig located at the Rashid A Platform, had a landing area with equipment for helicopter operations (see figure 1). At the time of the accident the GCAA had not established specific regulations for offshore operations.

1.11 Flight Recorders

According to CAR OPS 3.700 "Cockpit Voice Recorders-1", CAR OPS 3.705 "Cockpit Voice Recorders-2", CAR OPS 3.715 "Flight Data Recorders-1", CAR OPS 3.720 "Flight Data Recorders-2", and since it doesn't belong to the "date of issuance of first individual C of A" ranges; the Helicopter was not required to be equipped with FDR nor CVR.

The Helicopter was equipped with a monitoring recording device, the Altair system, which was an exceedance monitoring system which monitors at a rate of 5 times per second all the following parameters except the ITT which is measured at 50 times per second. This is all downloaded either when there is an exceedance indicated, when the memory light indicates the memory is full or at the 200 hour scheduled inspection:

1. Outside Air Temperature
2. Airspeed
3. Altimeter
4. Engine 1 N1
5. Engine 2 N1
6. Rotor RPM NR
7. Engine 1 Torque
8. Engine 2 Torque
9. Engine 1 ITT
10. Engine 2 ITT
11. Engine 1 N2
12. Engine 2 N2
13. AC Bus Voltage
14. Combined Torque
15. Static Pressure

This unit had valid data and it was downloaded and analysed. The recorder did not detect any engine related malfunction before and during the lift off until impact. Excessive engines torque values were detected due to impact with the crane.

1.12 Wreckage and Impact Information

The aircraft wreckage was found on and below the Maersk Resilient Drilling Rig.

1.12.1 Main Rotor and Tail Rotor Systems

The main rotor drive shaft was recovered and was operating at the time of the impact.

1.12.2 Power plants

The left and right engines were recovered and were operating at the time of the impact.

1.12.3 Landing Gear

The main landing gear was found in different places and showed sign of heavy damages due to impact.

1.13 Medical and Pathological Information

The remains of both pilots and all passengers were recovered. Autopsy reports were completed by the Dubai Police and communicated to the Team on June 1st, 2009. The report didn't reveal any toxic substances in the bodies of the victims.

1.14 Fire

There was no fire during the flight, the aircraft was intact prior to the impact with the crane, however the main fuselage was on fire as a result of post impact forces.

1.15 Survival Aspects

This accident was non survivable.

1.16 Tests and Research

1.16.1 The Helicopter Manufacture Lab Examinations

Table 4 shows the pieces that were sent to the Helicopter's manufacturer for lab examinations as well as a brief of examination results for each as reported by the Bell Textron lab analysis report dated December 22nd 2008. FAA personnel were present for the initial examination of components.

Table 4- Manufacturer’s Lab Examination Report

No.	Item Name	P/N	Lab observation
		S/N	
1.	Right Cycle Dual Actuator.	<p>P/N 212-076-003-5 (HRT P/N 41000470-005)</p> <p>S/N 1936 ACEFG</p>	<p>The center coupling between the top and bottom servos was bent, the spool valves were pulled out of position primarily on the top servo section. Heat damage was noted on the outside of the actuator with grommets and seals being damaged.</p> <p>Linkages were caked with debris but were not bent.</p> <p>The control tube on the top end going to the right hand cyclic on the swashplate was fractured in overload.</p> <p>Linkage and servo valves were movable.</p> <p>The rod end on the bottom end of the bottom servo actuator indicated a fracture due to overload.</p> <p>Hydraulic pressure test showed the bottom actuator had full stroke both ways with 150 psi hydraulic pressure to bottom end of right cyclic and physical motion of the input arm to the servo valve linkage approximately 0.05 inch (1.3 mm).</p> <p>The top actuator had both spool valves pulled slightly out of position as received from impact. There was uncontrolled movement of servo cylinder body when pressure was applied, but no additional movement when spool valve was moved. The cylinder body was movable on the rod by hand.</p>
2.	Collective Dual Actuator.	<p>P/N 212-076-003-009 (HRT P/N 41000470-011)</p> <p>S/N 4640 CEFG</p>	<p>The center coupling between the upper and lower servos was bent along the external threaded section.</p> <p>The spool valves were not visibly displaced and the linkages to the spool valves were not visibly damaged.</p> <p>Soot and debris was visibly caked to the surfaces of the linkage.</p> <p>All of the spool valves moved when the linkage was moved, with the exception of spool on the lower servo that was stamped “A” on the servo body.</p> <p>When moving the control arm by hand, the two top and one bottom servo spool valves moved while one lower (right side) did not move. The rod end on the bottom end servo actuator was fractured from overload.</p> <p>When initial hydraulic pressure was applied for the bottom actuator and the control arm was moved, there was no movement of servo. The piston rod could be pulled in & out by hand from the cylinder.</p> <p>There was movement of approximately 1 inch when 200 psi hydraulic pressure was applied later.</p> <p>The top actuator piston was received bent. When hydraulic pressure was applied there was a motion at 200 psi to full stroke and movement of approximately 2.1 inches (53.3 mm) to full retraction.</p>

3.	Left Cycle Dual Actuator.	212-076-003-5 (HRT P/N 41000470-005) S/N 3127 ACEFG	<p>Examination of the exterior of the left cyclic dual actuator showed that the center coupling between the top and bottom servos was fractured in overload in the threaded portion. This resulted in a separation of the top and bottom servos as well as separation and fracturing of the spool valves to the bottom servo and mechanical damage to the spool valve linkage. The rod end on the bottom end of the bottom servo actuator was also fractured from overload.</p> <p>Application of hydraulic pressure to the left cyclic dual actuators showed the top actuator was not operational since the servo valves were pulled out and fractured from impact. The piston rod was movable on the cylinder with the spool valves separated.</p> <p>Hydraulic pressure was applied to the bottom actuator and showed the piston rod retracted fully but would not move back with the limited motion of the control arm to the servo valves due to damage to the linkage.</p>
4.	Fore/AFT scas actuator.	HRT P/N 41001140-001 S/N 165	<p>The servo control tube was received bent along the threaded section. Hydraulic pressures of 300 psi to as high as 1500 psi were applied to the actuator. The actuator fully extended and retracted without binding when electrical current to the transducer and hydraulic pressure were applied to the actuator. The piston rod did not center when the electrical current to the transducer was switched to the off position. It slowly went to a retract position with the switch in the off position. Further testing showed the fore/aft SCAS servo valve was not in a null position (based on drift rate and voltage to stop motion) with no power & no pressure. A shift in the null position can result from impact or water intrusion damage.</p>
5.	Lateral SCAS Actuator	P/N HRT P/N 41001140-001, date of assy. 1-29-99 S/N 276	<p>The servo control tube was received bent along the threaded section. Hydraulic pressures of 300 psi to as high as 1500 psi were applied to the actuator. The actuator fully extended and retracted without binding when electrical current to the transducer and hydraulic pressure were applied to the actuator.</p>
6.	Swashplate Assembly.	P/N 204-011-403-1 S/N REFS-135	<p>An assembly data plate was not found on the swashplate.</p> <p>The inside diameter of the non-rotating ring was gouged by the bolts from the support lugs to the gimbal ring.</p> <p>The cast support hole for the drive link rod end trunnion assembly indicated a fracture due to overload.</p> <p>A checkered pattern mark was noted on one side of the support hole. The source of the pattern was not determined. The right hand cyclic control tube attached to the swashplate indicated a fracture in bending overload.</p>
7.	Swashplate Support.	P/N 204-011-400-124 or 129 FM S/N JI19-9281	<p>All of the upper support lugs (for the mating gimbal ring) indicated fracture due to overload. Pieces of the fractured lugs were attached to the mating gimbal ring. Sections of the fracture faces were smeared as a result of impact with the mating half of the fracture. Both rectangular windows on opposite sides of the support, that allow the collective lever to attach to the sleeve, were damaged from impact of the levers with the top of the windows.</p>
8.	Swashplate Gimbal Ring Assembly.	P/N 204-010-101-1 S/N REFS-2256	<p>All of the bearings on the gimbal ring had damage from impact. All of the bearings were movable with some effort. The swashplate drive link,</p>

9.	Swashplate Drive Link	P/N 204-011-407-1 S/N FAFS-2098	was intact and still attached to the swashplate and scissor assemblies. The other drive link was not received for examination.
10.	Scissor and sleeve assembly.	P/N 204-011-401-21 S/N EA-551	<p>One of the two scissors was missing from the assembly. The bolt threads for this missing scissor were stripped and the shaft was bent in a direction opposite rotation. The bolt head was pushed out approximately 0.13 inch (3.3 mm) and had made contact with the arm of the opposite scissor.</p> <p>The remaining scissors was still attached to the sleeve hub and to the drive link. The scissor had mechanical gouges and other damage from an unknown source. The inside of the scissor arm was gouged from contact with the bolt head from the opposite scissor that was still attached to the sleeve hub. The control tube on this scissor's arm was fractured in overload and was heat damaged.</p> <p>The outside diameter of collective sleeve tube had at least seven impact marks and impressions similar to a bolt head or nut. The source of the impression was not determined.</p> <p>The sleeve hub multiplex bearing set rotated freely by hand. The two lower bearings for the collective lever assembly rotated by hand.</p>
11.	Transmission Support Case Assembly.	P/N 212-040-054-001,or-005, or -007 (Not on parts received) S/N Not on parts received	<p>Four arm sections were examined. All of the fractures indicated overload. The initiation sites are primarily on the bottom side of the case indicating a downward force from the pylon.</p> <p>The forward left hand arm fractured as a result of overload. The fracture initiated from the two corners of a lightening hole on the bottom side and from mechanical damage origins on the top side. The top side showed mechanical damage from impact with the main driveshaft coupling.</p> <p>The forward right hand arm also indicated a fracture due to overload. One of the initiation sites was on the bottom side on the inside corner of a hole. The other was on the top surface.</p> <p>The aft left hand arm indicated a fracture due to overload. The initiation of the fracture was on the bottom aft edge of the radius corner in the casting.</p> <p>The aft right hand arm indicated also a fracture due to overload. Both initiation sites were on the bottom side at a lightening hole edge and the other on a radius corner.</p>
12.	Pylon Mount, FWD Left	P/N 204-031-927-7 (Lord P/N J-8085-8, S/N None	External examination of the forward left hand pylon mount revealed mechanical damage to the outer shell member. There was also visible heat damage to the exterior and to the elastomer approximately one half of the circumference. In the heat damaged area, a feeler gauge could be inserted between the outer shell and the elastomer for a distance of approximately 1.0 inch (25.4 mm). Beads of previously molten aluminum were found on the surface.
13.	Pylon Mount, FWD Right	P/N 204-031-927-7 (Lord P/N J-8085-8, S/N None	External examination of the forward right hand pylon mount showed heat damage to the exterior and to the elastomer approximately one half of the circumference. In the heat damaged area, a feeler gauge could be inserted between the outer shell and the elastomer over the full length. Beads of previously molten aluminum beads were found on the surface.
14.	Pylon Mount, AFT Left.	P/N 204-031-927-7 (Lord P/N J-8085-8, Cure date 05-01)	External examination of the aft left hand and aft right hand pylon

		S/N None	mount showed slight heat damage. No externally visible delaminating of the elastomer from the outer shell was noted.
15.	Pylon Mount, AFT Right.	P/N 204-031-927-7 (Lord P/N J-8085-8, Cure date 05-01)	Spring rate testing showed that the spring rates were below the average tension and compression spring rate test values, but still functional when tested.
		S/N None	Examination showed external damage to the right hand and left hand aft pylon dampers.
17.	Lift Beam Assembly.	P/N 205-030-845-367	Examination of the lift beam assembly indicated that skin and structural fractures due to overload as a result of impact.
		S/N None Visible	
18.	Annunciator Panel.	P/N 209-075-325-045 (Grimes Aerospace Co P/N 80-0203-9 Rev AU)	Examination of the bulbs showed that some filaments were intact, some were broken or separated and others had broken bulbs.
		S/N 1462	Examinations did not show any filaments that were elongated.

The Manufacturer’s lab analysis report dated December 22nd 2008, concluded that the signs of damage that were observed during the lab test of the above components were due to the impact or the post impact fire, and that they could not determine if the above parts were malfunctioning during the accident flight.

1.16.2 NTSB Laboratory Examinations

The two Tarsyns – 333 Three Axis Reference (the Pilot and the Copilot) and the three ADIs were shipped to the NTSB for lab testing and after the examination, a lab analysis report dated April 15th 2009 was prepared and sent to the Team.



Figure 2- Tarsyn – 333 Three Axis Reference P/N 2593996-333, S/N: 6093099



Figure 3- Tarsyn – 333 Three Axis Reference P/N: 2593996-333, S/N 0050220

The two Tarsyns – 333 Three Axis Reference could not be identified to each position (Pilot or Copilot).

All instruments were disassembled and inspected for signs relating to the instruments' operation. Corrosion and rust were found on many internal parts. All gyro rotors inside the instruments were inspected for signs of rotor rotation and at least some evidence suggesting rotation was found on each. The rotor P/N 4019190-13, S/N 6093099 which was fitted to the Tarsyn – 333 Three Axis Reference P/N 2593996-333, S/N: 6093099 (the left upper corner of figure 5) contained non-rotational marks that were not found on the other rotors.

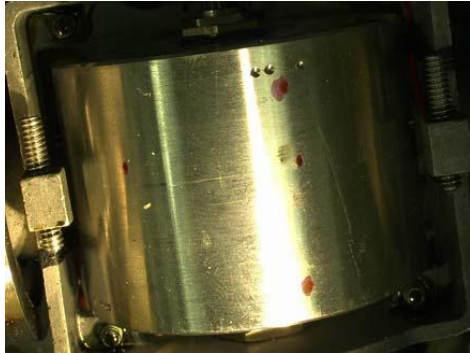


Figure 4- Gyro mass surface (P/N: 4019190-13, S/N: 6093099)



Figure 5- Gyro rotor surface P/N: 2593691 S/N: 6093099 fitted to Tarsyn – 333 Three Axis Reference P/N 2593996-333, S/N: 6093099

The pilot and co-pilot ADI's were further inspected for signatures of their positions at impact. The roll carriages for both ADI's were jammed in their position by deformed surrounding structure. Approximate attitude positions at impact were developed using these roll positions and other witness marks found on each unit. For the pilot ADI, these indications are consistent with approximately 3 degrees right roll attitude and between 0 and 10 degrees aircraft nose down pitch attitude. For the co-pilot ADI, the marks are consistent with a roll attitude of approximately 5 to 10 degrees left roll and a pitch attitude between 0 degrees and 15 degrees aircraft nose up. For the standby ADI, the marks are consistent with a roll attitude of approximately 3 degrees right roll. A pitch attitude for the standby ADI could not be determined.



Figure 6- Pilot ADI (P/N: 2593996-333, S/N 0050220)



Figure 7- Standby ADI P/N: 504-0017-901, S/N: 3942



Figure 8- Co-pilot ADI P/N: 111303-4 S/N: 1303

1.16.3 Simulator and Aircraft Test

The Bell 412 simulator at the Emirates CAE Flight Training facilities was utilized to simulate various failures which lead to ADI failures using two pilots who were not advised on the type of failure about to occur during rig departures (although they did know some type of failure was about to take place).

During the simulator test on a single ADI failure, the pilot continued flying in level flight without being aware that the ADI had failed even though instrument warning flags were showing. The ADI failed with a wings level, zero pitch indication and the pilot continued flying with reference to it with neither pilot recognizing the pilot side ADI had failed (the non flying pilot's ADI was not failed). The fact that this simulation did not end in a 'crash' or loss of control may have been due to the coincidence that the ADI froze in place upon being failed while indicating a level attitude at a time when the aircraft happened to be in a level attitude. Had any manoeuvring taken place (attempted turn, climb, or descent) there could have been a loss of control if the pilot continued flying on the failed frozen ADI without recognizing the failure.

The second simulated condition was to introduce dual ADI failure, the test was terminated as the pilot was still able to maintain level flight by looking outside with slight horizontal visibility in the vicinity. The final scenario was total electrical failure, which resulted in a complete loss of cockpit lighting except for the standby attitude indicator.

When a total electrical failure was given on a rig departure (Dual ADI Failures), both pilots focused attention on the pilot side primary ADI, although both primary attitude indicators were failed. Neither pilot was looking at the STBY attitude indicator which was the only functioning attitude instrument, and the pilots were not able to maintain normal level attitude which ended up in a crash (into the water in forward direction) right after visual cues were lost (External views).

When the Operator performed simulated ADI failures on B212's (5 aircraft tested), by removing total electrical power to the ADI, all of the ADI's remained ERECTED except on one aircraft, where the ROLL Axis indication failed (see Appendix 1 for a more detailed report on the tests performed). However, a consideration of importance is that removing power from an ADI will not necessarily have the same result as a faulty tarsyn or ADI that fails due to an internal mechanical malfunction with power still supplied to the components. Pilot reports from those who had experienced tarsyn / ADI failures on Bell 212's inflight described failures where ADI's 'fell over' or showed large changes in either pitch or roll (see Appendix 1).

1.17 Organizational and Management Information

The Operator is based at Dubai International Airport. It is a helicopter operator (Certificated under CAR OPS 3) which has its own maintenance organization approved under CAR 145. The Operator has been operating since 1976. At the time of the accident, the fleet was eight Bell 212s, one Bell 206BIII and one Bell 206L3. The company had approximately 85 employees.

The company provides offshore oil and gas support for Dubai and the Northern Emirates, and had done contract work in several different countries in the Middle East and Africa. They were the exclusive providers of all offshore oil and gas support for the Government of Dubai through contracts with Dubai Petroleum Enterprises and Dubai Gas Company. Although the majority of their operations involved offshore support, they also conduct seismic, external load, charter, tourism, photography, and aerial survey flights.

1.17.1 Documentation Review

A review of all aircraft and flight crew documentation was accomplished.

1.17.2 Standard Operating Procedures

The GCAA's approved company Operations Manual contained the generic procedures to all aircraft fleet and pilots, where the Bell Flight Crew Operating Manuals contain aircraft specific SOPs.

1.17.3 Training, experience and qualification

All Operator flight crews are experienced pilots and are required to conduct licence and Operators proficiency checks which includes instrument test every six months in the aircraft with additional recurrent training in the GCAA approved simulators. These checks were all conducted by a GCAA approved Type Rating Examiner.

The Pilot and Copilot were experienced on the aircraft type. Both were dual rated.

The Pilot had significant experience prior to joining the Operator.

During previous flights, including a flight done in the night immediately before the accident flight, the Pilot used to train the "Maximum Engines' Takeoff Power Climb Technique" to the other Operator's pilots. The technique that the Pilot was introducing was:

- Lift the helicopter to a hover into wind direction.
- Vertically lift the helicopter and climb vertically.
- Accelerate to Forward flight and climb away.
- Forward flight to altitude.

The accident flight was a check flight for the Copilot.

1.17.4 Flight Time Limitation

The Pilot and Copilot had a normal rest period before the flight and there was no infringement with respect to the limits as contained in the approved Flight Time Limitation Scheme.

1.18 Additional Information

Not Applicable

1.19 Useful or Effective Investigation Techniques

Not Applicable

2 ANALYSIS

All flights performed prior to the landing in the Drilling Rig that day, were normal without any anomalies. Maintenance records for the Helicopter indicated that it was maintained in accordance with the UAE GCAA-approved Continuous Airworthiness Maintenance Program. This program consists of regularly scheduled inspections, parts replacements, tests and uses a computer database to track the aircraft's flight and maintenance activities. The database also tracks the requirements for inspections, overhauls, replace of components, airworthiness directives, service bulletins, and survival equipment maintainability, everything was properly performed.

The pilots were properly qualified and rested for the specific flight.

2.1 General

There were no indications that the Helicopter was not airworthy prior to the accident flight.

After the lift off, the crew turned the Helicopter so they might face, into the wind which was away from the platform in their transition to depart to their next destination, then the Helicopter climbed and moved backward. At this specific moment there was no clear evidence on the reason why the aircraft moved rearwards. That's why several scenarios had to be reviewed in the CAE simulator for the purpose of identifying the one that would be closer to the rationale and the reason for the backward manoeuvre, which led to this accident.

The Team was not able to approach the Drilling Rig immediately due to the ongoing Dubai Police investigation, so valuable evidence might have been altered. In addition, the Team was only allowed to remain on the Rig for a limited amount of time.

From the initial analysis, there was evidence to believe that the aircraft was in a controlled flight, with the Helicopter responding to specific pilot inputs. That's why the Investigation has focused on the environment surrounding the Drilling Rig as well as the cockpit at the time of the accident as the Team believed that those were key elements that may have contributed to the backward reversed flight.

From witnesses' statements from the Operators pilots who flew with the Pilot, it was revealed that the Pilot had been introducing the "Maximum Engines' Power Ltoff" technique to them. That's why it was logical to believe that he was having the co-pilot perform or he was instructing the co-pilot to perform this kind of technique during the accident flight.

When the Helicopter climbed, losing the external visual reference after the cockpit lifted and turned towards the dark sea was an element that the Team has taken into consideration. During that dark night, the crew had made a reference relative to their surroundings utilising the Drilling Rig's lights, but as the cockpit moved away from and above that reference, the crew had

no other indication relevant to their position. In the absence of external/visual reference pilots' are trained to focus their attention in their instruments and not rely on their senses.

Visual illusions result from the absence or alteration of visual references, which modify the pilot's perception of his position, in terms of height, distance and/or intercept angle, relative to other objects. The aviation literature indicate that visual illusions are most critical when transitioning from Instrument Meteorological Conditions (IMC) and instrument references to Visual Meteorological Conditions (VMC) and visual references, and vice versa.

Even the best pilots will quickly become disoriented if they attempt to fly without outside visual references, because vision provides the predominant and coordinating sense that humans rely upon for stability. The most treacherous thing under such conditions is that the produced brain signals become incorrect though they may feel right thus affecting the situation awareness, creating a surrounding environment different to the existing one.

These sensory illusions occur because flight is an unnatural environment; as senses are not capable of providing reliable signals that pilots can interpret and relate to their position in three dimensions without visual reference. Pilots are normally made aware of these sensory illusions as they have to overcome them with good briefings and appropriate preparation when operating into such conditions, especially during dark nights.

This illusion can happen at night especially with no stars or moonlight over water or unlit terrain. When peripheral visual cues were not available to help the accident pilots orientate relative to the water or the platform, they might had the illusion of being upright, or not moving and might had perceived the Drilling Rig to be tilted left and or up sloping. However, if the horizon was visible the pilots could have easily orientated correctly using their central vision.

Therefore the Pilot might be indicating to the Copilot the issues associated with what he was teaching to the other pilots and as both of them had their attention inside the cockpit, the Helicopter moved unintentionally backwards/rearwards and up until it was too late for both pilots to react. This might be one possible explanation of the backward movement of the Helicopter. However there might be other possibilities such tarsyn/ADI or ADIs malfunctioning, giving a false nose down indication. Or other malfunctions might draw the pilots' attention during the critical phase of the flight.

The examination of all ADIs did not reveal the real Helicopter attitude during impact as all their casings were deformed. Having information regarding the Helicopter position could have provided valuable clues to the Investigation.

Additionally, during the Investigation, various issues regarding the legislation supporting the off-shore Drilling rig operations were reviewed and analysed in order to examine whether the existing legislation requires enhancement. Safety Management approach of the Helicopter and the Drilling Rig operators have to be reviewed further in order to research the opportunities for additional risk management processes that would minimise the possibility of similar occurrences in the future.

2.2 Training and Experience

The Pilot, who was also acting as a Training Captain on this flight and the other captain who was receiving his line check during the accident flight had adequate experience on the Helicopter. The "Towering and Maximum Engines' Takeoff Power Climb Technique", that was not described in the Operator's Manuals as discussed above, could be a contributing factor to the accident. As a fact, all pilots should implement only the procedures described in the relevant manuals of the helicopters' manufacturers and the operators' procedures approved/accepted by the GCAA.

3 CONCLUSIONS

3.1 Findings

- 3.1.1 The two pilots were properly certificated, qualified and trained.
- 3.1.2 There was no recording of the communication between the Helicopter and the Drilling Rig.
- 3.1.3 The GCAA has not established specific regulations for offshore operations
- 3.1.4 The aircraft was not equipped with FDR or CVR, which was not required by the UAE Regulations.
- 3.1.5 Flying at night in VMC conditions is permissible by the UAE Civil Aviation Regulation.
- 3.1.6 There was no evidence to indicate any medical conditions that might have adversely affected the Pilot and the Copilot performance during the flight.
- 3.1.7 The accident Helicopter was properly certified, equipped, and maintained in accordance with GCAA regulations.
- 3.1.8 The dispatcher who handled the accident flight had provided appropriate flight-tracking services.
- 3.1.9 Even though visual meteorological conditions prevailed at the time of the accident, few, if any, references outside of the aircraft would have been available to the flight crew.
- 3.1.10 The impact was at high rate of descent but relatively no speed.
- 3.1.11 The accident was not survivable for the aircraft occupants because they were subjected to impact forces that exceeded the limits of human tolerance.
- 3.1.12 The communication between the search & rescue mission and the Investigation Team, immediately after the accident, was not at its optimum level and properly coordinated.
- 3.1.13 There is a written log of the communication between the Helicopter and the Radio Room

performing Offshore flight monitoring.

3.2 Probable Cause

The Investigation Team determined that the most probable cause of this accident has to be identified as loss of situational awareness due to loss of visual reference and the inability to determine the correct attitude of the Helicopter and react to this condition.

4 RECOMMENDATIONS

The following are the recommendations made to the Regulatory Authority and the Operator:

4.1 Recommendations to the GCAA

4.1.1 SR 01/2010

The GCAA should review the current regulatory requirements in and outside control airspace by aircraft of all classes. A study should be performed on this subject before changes are made to the applicable regulations.

4.1.2 SR 02/2010

The GCAA should investigate the need to issue a mandatory rule that requires a minimum of two qualified crew with proper instrument rating when operating a multi engine aircraft during night VMC.

4.1.3 SR 03/2010

The GCAA should investigate the need to enhance the regulations regarding the landing areas on Drilling Rigs as per local and international best practises.

4.2 Recommendations to the Operator

4.2.1 SR 04/2010

The Operator should review its current procedures regarding operational control, night operations, carriage of passengers and crew training.

**BY THE UAE GENERAL CIVIL AVIATION AUTHORITY,
REGULATIONS AND INVESTIGATION DEPARTMENT
INVESTIGATION TEAM as per DG Decree No. 08/2008**

Investigator-In-Charge : Ismaeil Abdel Wahed - Chief of Regulation and Investigation Department
Member : Khalid Al Raisi – Investigator, Regulation and Investigation Department
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APPENDIX 1- TESTS AND RESEARCH-**A1.1 Attitude failures on other aircraft**

There were 5 aircraft being investigated

Aircraft tested B412	Time to ADI full erect	Stabilization time	Result after power off
A6 – ALX	45	5	no pitch & roll deviation
A6 – ALW	40	5	no pitch & roll deviation
A6 – ALA	15	5	no pitch & roll deviation
A6 – ALU	13	5	no pitch & roll deviation
A6 – ALD	24	5	Roll axis of both ADI moves 90° clockwise in stow position simultaneously

APPENDIX 2- WITNESSES STATEMENTS

Witnesses' statements

1	<p>Statement from interviewee 1 (Production operator)</p> <p>While I was monitoring the operations at choke manifold and the well was closed up to choke, suddenly I heard the chopper's sound very closely and I checked upwards to see what's happening, I saw chopper moving oppositely by its tail towards the port side leg of the rig I ran away to STBD of the rig watching on my way a pieces spreading around on my way, so immediately I proceed to master point along with my crew member.</p>
2	<p>Statement of interviewee 2 – Helideck Firefighter at approximately 23:58 03/09/2008</p> <p>I was the fireman stationed on the port fire monitor of the helideck. I saw the helicopter land, signals given and the HLO and helideck team approach the helicopter and take out the cargo from the helicopter , they shut the doors and came off the helicopter. I saw the HLO gave thumbs up and the helicopter lift off and then turn so that the tail was facing us. It continued to climb and move slightly off the helideck then it suddenly reversed and after flying over us it crashed in to the port leg. As it was flying over us, we ducked. I saw the helicopter crash and burst in to flames. I followed the rest of the team to come down to the fire station on the stbd side of the main deck.</p>
3	<p>Statement of interviewee 3</p> <p>Helideck assistant at approximately 00:10 04/09/2008</p> <p>After the helicopter landed and the HLO signalled the pilot, we were signed to follow HLO. We had to search for the Box and this took a little time. We go the box and my fellow helideck asst and I got off the helideck while the HLO signalled the helicopter and the helicopter started take off. It then turned so that the tail rotor were facing us.</p> <p>I started to move down the stairs when the helicopter was climbing. I noticed it suddenly reverse and go hit the leg. We ran down, activate the fire alarm and calling in to the quarter FIRE FIRE we ran down the stairs to startboard side maindeck.</p>
4	<p>Statement from interviewee 4</p> <p>Crane operator – HLO at approximately 23:08 on 03/09/08</p> <p>Helicopter landed on the deck after approach from STBD side and after the pilot gave Thumbs up to the HLO and 2 Helideck assistants approached the Francis Dsouza</p> <p>. Both doors were opened and after a search this item was found under the back seat (Facing forward) with two laptop bags. There were three passenger facing forwards and two facing back. As there were no passenger to get off on the things the cargo item was removed, door shut and the helideck crew went off the helideck.</p> <p>The pilot gave the thumbs up and once it was returned by the HLO the helicopter start to increase speed and lift off. At about the height of two meters, the helicopter turn around counter clockwise so that the tail was facing the port access stair to the helideck, the HLO and helideck team backed down the stairs due to the draft from the helicopter.</p> <p>The helicopter continued to climb vertically and then suddenly the helideck team noticed the helicopter moving rapidly in the reverse direction (tail heading the way) It missed the accommodation and crane and impacted against the port leg and burst in to flames.</p> <p>The helideck crew came running down and using STDB external stairs reached the maindeck and</p>

	fire station
5	<p>Statement from Interviewee 5 Asst Crane Optr – Helideck Atts at approximately 23:40 on 03/09/2008</p> <p>After the helicopter landed on the helideck and after the HLO indicated I followed him to the helicopter. The door was opened by the HLO and I looked in the rear cargo area, tail compartment and then under the seats. The cargo was under two laptop under the seat. The HLO took put the box and I took it off the helideck. The other helideck assistant got off the helideck before me and I was followed by the HLO. I observed the HLO give the Thumbs up to the Helicopter pilot. The helicopter started to climb. Then it turned so that the tail boom was facing us. All of us crouched and waited for the helicopter to take off. The helicopter then continued to climb and then suddenly reversed. When I saw the helicopter crash in to the leg, I ran down and activated the fire alarm close to the heli fuel station on D deck STBD shouting FIRE FIRE and proceed down to the starboard fire station.</p>
6	<p>Statement from Interviewee 6 Oil Company Crew Leader at 04/09/08</p> <p>While I was sitting on the SB side of the interocean boat, I saw chopper was landing safely. Then a while chopper tried to take off and around 10-20 ft of the helideck the chopper took few second on this position then instead of fly away from the rig, it moved forward to the rig closer and chopper hit on of the big leg and crash over there and that took place only one moment very quick.</p>
7	<p>Statement from Interviewee 7 At 04/09/08</p> <p>At that time I was standing on the starboard side of interocean deck and then I heard that one chopper twant to take off from the helideck.</p> <p>After few seconds flying I heard a big sound, I saw that chopper already failed to fly and hit the leg of the rig and its cause fire on the rig so I run to the mess room crew and asked oiler to start engine for casting off and move away from Rig.</p>
8	<p>Statement from Interviewee 8 At 04/09/2008</p> <p>When the seaman on duty gave the alarm that fire is on the rig floor. I the master gave orders to start the engine as I could see the fire from the aft controls then we let go the hose along Schlumberger crew then proceed to let go the rig morning lines to the water then pull away from the Rig Maersk Resilient and let from Mooring Bouy. Then rig call and we start to search for personnel in the water time was 21:00 HRS.</p> <p>At 21:20 seited object in the water we checked and it was a body reported to the rig and 21:30 HRS the body was recover on to the deck in bad condition.</p>
9	<p>Statement from Interviewee 9</p> <p>At 04/09/2008</p> <p>At 02:15 Hrs a body was picked by the Rig Maersk Resilient</p> <p>Tehn VSL instruction to standby close to the rig.</p>