United Arab Emirates

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

AAIS Case Reference: 02/2011

AIR ACCIDENT INVESTIGATION SECTOR

FINAL

AIR ACCIDENT INVESTIGATION REPORT

CRASH SHORTLY AFTER TAKEOFF

McKinnon G-21G
Registration Mark: N221AG
Triple S Aviation
Al Ain International Airport
The United Arab Emirates
27 February 2011

General Civil Aviation Authority
of
The United Arab Emirates

United Arab Emirates

Air Accident Investigation Sector
General Civil Aviation Authority
The United Arab Emirates

OBJECTIVE

This Investigation was performed pursuant to the UAE Federal Act No. 20 of 1991, promulgating the Civil Aviation Law, Chapter VII, Aircraft Accidents, Article 48; in compliance with the UAE Civil Aviation Regulations, Part VI, Chapter 3; and in conformity with Annex 13 to the Convention on International Civil Aviation; and in adherence to the Air Accidents and Incidents Investigation Manual.

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.

AIRCRAFT ACCIDENT BRIEF

AAIS Case No.:	02/2011
Operator/owner:	Private, registered owner: Triple S Aviation LLC
Aircraft Make and Model:	McKinnon G-21G
Registration Mark:	N221AG
MSN:	1240
No. and Type of Engines:	Two, Turboprop, TPE331 Series
Date and Time (UTC):	27 February 2011, 1607 UTC
Location:	Al Ain International Airport, Taxiway "F", between Taxiway "K" and "C" N 24° 15' 30.941'' E 055° 36' 40.541''
Type of Flight:	General Aviation
Persons on Board:	Four
Injuries:	Four fatalities
Nature of Damage:	Aircraft completely destroyed

The Accident was notified to the General Civil Aviation Authority (GCAA) on 27 February 2011 at about 1610 UTC. An Investigation Team was dispatched and reached the Accident site within one hour. The Team coordinated with all authorities on site by initiating the accident investigation process according to prepared and previously exercised plans. The Air Accident Investigation Sector (AAIS) of the GCAA is leading the investigation, as the United Arab Emirates (UAE) is the State of Occurrence.

Notes:

1 Where the following words are mentioned in this Report with the first letter Capitalized, it shall mean:

(Aircraft)- the aircraft involved in this Accident.

(Airport)- Al Ain International Airport, UAE.

(Investigation)- the investigation into this Accident.

(Accident)- this investigated Accident.

(Report)- this Accident Final Report.

2 Unless otherwise mentioned, all times in this Report are Coordinated Universal Time (UTC), (UAE Local Time minus 4).

3 Photos used this Report are taken from different sources and are adjusted from the original for the sole purpose of improving the clarity of the Report. Modifications to images used in this Report are limited to cropping, magnification, file compression, or enhancement of color, brightness, contrast, or the addition of text boxes, arrows or lines.

SYNOPSIS

On 27 February 2011, A McKinnon G-21G Aircraft, Registration Number N221AG, was scheduled to operate a flight from Al Ain International Airport, the United Arab Emirates (UAE), to Riyadh, Saudi Arabia.

At approximately 15:48:58 UTC, the Aircraft was given engine start and taxi clearance to the holding point of Runway 19. The Pilot In Command (PIC) intended to complete a single closed local circuit to check the Aircraft before continuing Instrument Flight Rule (IFR) flight to the destination.

At 15:57:53, the tower advised the PIC to complete the closed circuit, to route to the destination via the ROVOS flight planned route on departure Runway 19, and to make a right turn and maintain 6,000 ft.

At 16:05:37, the Aircraft was cleared for takeoff and completed the takeoff acceleration roll, lifted off and continued initial climb normally. When the Aircraft reached 300 to 400 ft Above Ground Level (AGL), at approximately the midpoint of RWY 19, it turned to left while the calibrated airspeed (CAS) was approximately 130 kts. The Aircraft continued turning left with increasing rate and losing height until it impacted on a taxiway in a slight nose down attitude with slight left roll.

The Aircraft was destroyed due to the impact forces and subsequent fire. All four occupants were fatally injured.

The cause of the Accident, as determined by the AAIS, was a PIC lapse in judgment and failure to exercise due diligence when he decided to enter into a steep left turn at inadequate height and speed.

The contributing factors to the Accident were the PIC's self-induced pressure to rapidly complete the post-maintenance flight, his desire to expedite the requested circuit in the pattern, his lack of recent experience in the Aircraft type and also that the flight was single pilot IFR which requires a high standard of airmanship.

Two safety recommendations are issued to the Federal Aviation Administration (FAA) of the United States: one to enhance "General Aviation" aircraft airworthiness certification and oversight procedures in order to ensure that N-registered aircraft are in type conformity with the Federal Aviation Regulations (FARs) prior to being issued a Certificate of Airworthiness, second to enhance, through robust oversight and enforcement systems, airman licensing practices to ensure proper implementation of the FARs related to type recency requirements.

Three safety recommendations are issued to the General Civil Aviation Authority (GCAA) of the UAE: one to improve the regulations to govern foreign aircraft operations in the UAE territory, second to enhance the foreign aircraft safety assessment system to ensure that any aircraft parking in any UAE airport for a pre-specified period submit certain documents to assure that the aircraft is airworthy before a clearance of departure is issued, and promulgate a requirement that the GCAA certificated airports establish procedures to report to the GCAA any aircraft parking for a pre-specified period.

One safety recommendation is issued to civil airports in the UAE to establish procedures to report to the GCAA any aircraft parking for a pre-specified period.

ABBREVIATIONS AND DEFINITIONS

AAIS	The Air Accident Investigation Sector
ADC	Aerodrome Controller
AFM	Airplane Flight Manual
AMM	Aircraft Maintenance Manual
ATPL	Air Transport Pilot License
CAS	Calibrated Air Speed
CAMI	Civil Aerospace Medical Institute
CAVOK	Ceiling and Visibility are OK
C.G.	Centre of Gravity
cm	Centimeter
CoA	Certificate of Airworthiness
CoR	Certificate of Registration
CPL	Commercial Pilot License
CVR	Cockpit Voice Recorder
CSN	Cycles Since New
DOI-OAS	Department of Interior of the United States- Office of Aircraft Services
EAS	Equivalent Air Speed
ETD	Estimated Time of Departure
E.W.	Empty Weight
FAA	The Federal Aviation Administration of the United States
FAR	The Federal Aviation Regulations
FD	Flaps Down
FDR	Flight Data Recorder
ft	Feet (distance unit)
FU	Flaps Up
FWS	Fish & Wildlife Service, a bureau within the DOI
GCAA	General Civil Aviation Authority of the United Arab Emirates
GD	Gear down
GMC	Ground Movement Controller
GNS	Global Navigation System
GU	Gear Up
Hp	Horsepower (power unit)
hPa	Hectopascal (pressure unit)

hrs	Hours
IAS	Indicated Air Speed
Investigation	The investigation into this Accident
IFR	Instrument Flight Rules
kts	Knot(s)
lb	Pound(s) (weight unit)
LG	Landing Gear
LH	Left Hand
LT	Local time of the United Arab Emirates
M	Meter(s)
MAC	Mean Aerodynamic Chord
METAR	A format for reporting weather information
MLG	Main Landing Gear
Mph	Miles per hour (speed unit)
MSN	Manufacturer Serial Number
MTOW	Maximum Takeoff Weight
NLG	Nose Landing Gear
NM	Nautical Miles (distance unit)
No.	Number
NTSB	The National Transportation Safety Board of the United States
OAT	Outside Air Temperature
PIC	Pilot-in-Command
PPL	Private Pilot License
psi	Pounds per square inch (pressure unit)
QNH	The barometric altimeter setting that will cause the altimeter to read airfield elevation when on the airfield.
QFE	The barometric altimeter setting that will cause an altimeter to read zero when at the reference datum of a particular airfield.
RH	Right Hand
RPM	Revolution Per Minute
RWY	Runway
s	Second(s)
SPIFR	Single Pilot Instrument Flight Rules
STC	Supplemental Type Certificate
TAS	True Air Speed
TAWS	Terrain awareness and warning system

TC	Type Certificate
TSLO	Time Since Last Overhaul
TSN	Time Since New-flight hours
TWY	Taxiway
UAE	The United Arab Emirates
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
$\mathbf{V_A}$	Design maneuvering speed
$\mathbf{V_{FE}}$	Maximum flap extended speed
$\mathbf{V_{LE}}$	Maximum landing gear extended speed
$\mathbf{V_{LO}}$	Maximum landing gear operating speed
$\mathbf{V_{MC}}$	Minimum control speed with the critical engine inoperative
$\mathbf{V_{MO}}$	Maximum operating limit speed
$\mathbf{V_{NO}}$	Maximum structural cruising speed
Vp	Maximum design maneuvering speed
$\mathbf{V_s}$	The stalling speed or the minimum steady flight speed at which the airplane is controllable
$\mathbf{V_{so}}$	The stalling speed or the minimum steady flight speed in the landing configuration
$\mathbf{V_{s1}}$	The stalling speed or the minimum steady flight speed obtained in a specific configuration
$\mathbf{V_Y}$	Speed for best rate of climb

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1. FACTUAL INFORMATION

1.1 HISTORY OF FLIGHT

On 27 February 2011, at approximately 12:12:20 UTC, a mechanic working on McKinnon G-21G[1], registration mark N221AG, called the operational telephone line of Al Ain International Airport tower and informed the Aerodrome Controller (ADC) that the Aircraft would depart that evening. The Aerodrome Controller requested the estimated time of departure (ETD) and the mechanic stated that the departure would not be before 1400 outbound to Riyadh, Saudi Arabia. The ADC asked if the flight crew were still planning to perform a test flight before departure to the planned destination. The mechanic answered that *they have not flown the Aircraft for a while and they want to stay in the pattern to make sure everything is "okay"* prior to departure on the cleared route. The ADC advised that they could expect a clearance to operate in the circuit until they were ready to depart. The mechanic advised that there would be no need land, they only wished to stay in the circuit and to go straight from there towards the cleared route.

The ADC asked the mechanic about the Aircraft type, the mechanic answered that it is *Grumman Goose* equipped with turbine engines and it would be heading back to the United States for an autopilot installation and annual inspection and "*everything*". The mechanic commented to the ADC that the Aircraft was *unique in the world with the modifications that it had*.

At 13:53:15, the ADC contacted the mechanic and requested an ETD update. The mechanic advised that there would be a further one-hour delay due to waiting for fuel.

A witness, who is an instructor at the flight academy where the Aircraft was parked, stated that he had formed the impression that the maintenance personnel[2] "*…looked stressed out and they were obviously behind schedule and were trying to depart as soon as possible for the test flight so everything would go as planned and they could depart to Riyadh the same evening*".

At approximately 14:10, the Aircraft was pushed out of the hangar, and the two mechanics moved luggage from inside the hangar and loaded it onboard the Aircraft. The mechanics also loaded a bladder extra fuel tank onboard and placed it in the cabin next to the main passenger door.

At 14:17, the Aircraft was fueled with 1,898 liters of Jet-A1 which was 563 liters less than the 650 USG (2,461 liters) requested by the crew.

At approximately 15:00, and after performing exterior checks, the male, 28 year old pilot in command (PIC), and another male, 61 years old pilot boarded the Aircraft and occupied the cockpit left and right seats, respectively. The two mechanics occupied the two first row passenger seats. The PIC and the other pilot were seen by hangar personnel using torchlights while following checklists and completing some paperwork.

At 15:44:48, the PIC contacted the Airport Ground Movement Controller (GMC) on the 129.15 MHz radio frequency in order to check the functionality of the two Aircraft radios. Both checks were satisfactory as advised by the GMC. Thereafter, and while the Aircraft was still on the

[1] As shown in the last Certificate of Airworthiness

[2] The two mechanics accompanying the Aircraft including the one who communicated with the ADC

hangar ramp, the PIC informed the GMC that he was ready to copy the IFR clearance to Riyadh. The GMC queried if the Aircraft was going to perform local circuits and then pick up the IFR flight plan to the destination. The PIC replied that he *would like to make one circuit in the pattern, if available, then to* [perform] *low approach and from there* he (the PIC) would be able *to accept the clearance to destination.* The GMC acknowledged the PIC's request and advised him to *expect a left closed circuit not above two thousand feet and to standby for a clearance*. The PIC read back this information correctly.

At 15:48:58, the GMC gave engine start clearance and, at 15:50:46, the PIC reported engine start and requested taxi clearance at 15:52:16. The GMC cleared the Aircraft to taxi to the holding point of Runway (RWY) 19. The GMC advised, again, to expect a left hand (LH) closed circuit not above two thousand feet VFR and to request IFR clearance from the tower once airborne. The GMC instructed the squawk as 3776, which was also read back correctly.[3]

At 15:55:13, the PIC requested a three-minute delay on the ramp. The GMC acknowledged and instructed the crew to contact the tower once the Aircraft was ready to taxi. At 15:56:03, the PIC called the GMC and requested taxi clearance; he was re-cleared to the holding point of RWY 19.

At 15:57:53, the GMC advised that, after completion of the closed circuit, route to the destination via the ROVOS flight planned route on departure RWY 19 and to make a right turn and maintain 6,000 ft. The PIC read back the instructions correctly.

At 16:02:38, and while the Aircraft was at the holding point of RWY 19, the PIC contacted the ADC on 119.85 MHz to report ready-for-departure for a closed circuit. The ADC instructed to hold position then he asked the PIC if he was going to perform only one closed circuit. The PIC replied that it was "*only one circuit, then* [perform] *a low approach and from there capture the IFR to Riyadh*."

At 16:03:56, the ADC instructed the PIC "*to line up and wait"* RWY 19 which, at that time, was occupied by a landing aircraft that vacated the runway at 16:05:23.

At 16:05:37, the Aircraft was cleared for takeoff. The ADC advised the surface wind as 180°/07 kts and requested the crew to report left downwind which was acknowledged by the PIC correctly.[4]

The Aircraft completed the takeoff acceleration roll, lifted off and continued initial climb normally. When the Aircraft reached 300 to 400 ft AGL at approximately the midpoint of RWY 19, it turned to the left while the calibrated airspeed (CAS) was approximately 130 kts.

The Aircraft continued turning left with increasing rate and losing height.

At approximately 16:07:11, the Aircraft impacted the ground of Taxiway 'F', between Taxiway 'K' and 'L' with a slight nose down attitude and a slight left roll. After the impact, the Aircraft continued until it came to rest after approximately 32 m (105 ft) from the initial impact point.

There was no attempt by the PIC to declare an emergency.

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[3] GMC and ADC where functioned by one person, the ADC occupant was trainee. Whenever the GMC and ADC are mentioned, they mean the frequency of both positions rather than the persons functioning on these frequencies

[4] As an airfield traffic pattern in Al Ain International Airport, joining downwind of RWY 19 is usually performed by left circuits

The Aircraft was destroyed due to the impact forces and subsequent fire. All the occupants were fatally injured.

Figure 1 illustrates the departure runway and the point of initial impact.

Figure 1- Crash site location

1.2 INJURIES TO PERSONS

Table 1 shows the number of injuries, all fatalities were nationals of the United States of America.

Table 1- Injuries to persons

Injuries	Flight Crew	Cabin Crew	Other Persons Onboard	Passengers	Total Onboard	Others
Fatal	1	0	3	0	4	0
Serious	0	0	0	0	0	0
Minor	0	0	0	0	0	0
None	0	0	0	0	0	0
TOTAL	**1**	0	**3**	0	**4**	0

1.3 DAMAGE TO AIRCRAFT

The Aircraft was destroyed due to significant impact forces and subsequent fire.

1.4 OTHER DAMAGE

None.

1.5 PERSONNEL INFORMATION

The Aircraft was certified as "single pilot" operation for both VFR and IFR (SPIFR). During the Accident flight, the PIC was occupying the left seat.

The PIC held the following licenses/certificates issued by the Federal Aviation Administration (FAA):

1. Flight Instructor with Airplane Multiengine and Instrument Airplane Ratings originally issued on 25 August 2003, renewed on 14 August 2005 and expired on 31 August 2007.
2. Air Transport Pilot Certificate with Airplane Multiengine- Land Rating, originally issued on 8 January 2010. Type Ratings were CE-500 and G-111.
3. Commercial Pilot Certificate with Airplane Single Engine- Land and Airplane Single Engine and Multiengine Sea Rating, renewed on 8 January 2010.

At the time of the Accident, the PIC had an active FAA medical certificate that was issued on 6 October 2009 (it was a first class that had reverted to effectively a third class medical under FAR Part 61.23- "Medical certificates: Requirement and duration"). On 1 December 2010, the PIC applied for a FAA first class medical certificate. His application was deferred to the Civil Aerospace Medical Institute (CAMI) because of information he provided regarding an alcohol related event. Subsequently, the FAA requested additional information (driving record, report from a substance abuse counselor, etc.) before a final decision could be made on his application. The FAA did not receive any of the requested information. As a result, the FAA denied his application in a letter dated 28 February 2011 under the provisions of FAR Part 67.413 because he failed to supply the requested information.

Two logbooks belonging to the PIC were provided to the Investigation, the new logbook had a few months overlap with the old but indicated 1,000 more hours. It also showed less than 50 hours in the Aircraft type, and that the last time he flew the Aircraft was on 24 August 2010 in a flight from Dubai International Airport to Al Ain International Airport. Since that flight and until 22 January 2011, the PIC flew more than one General Aviation N-registered type not including the Accident Aircraft type or any other similar aircraft type. The new logbook ended at the 22nd January 2011 flight.

It could also be noted that, with the exception of some flights in a B-24. The PIC's recent experience was all on small single and multi-engine airplanes (M-20, PA-31, QU-22, BE-55).

The PIC was the beneficial owner of the Aircraft.

1.6 AIRCRAFT INFORMATION

1.6.1 Aircraft General Information

Table 2 illustrates general information on the Aircraft based on the records provided to the Investigation.

Table 2- General information of the Aircraft.		
Make and model (as shown in the CoA)		McKinnon G-21G
MSN (as shown in the CoA)		1240
Year of manufacture		1944
Registration		N221AG
TSN **CSN**		9926 hours Unknown
Last inspection		10 June 2010
Maximum Takeoff Weight		12,500 lb
Empty weight		7,980.64 lb
C.G in % MAC		Empty Weight Arm 16.92 inch, Moment 135003.99 inch-lb 12,500 pounds gross weight: 19.61 inches (14.3% MAC) to 23.5 inch (18.3% MAC).
Last Weight and Balance		28 May 2010
Engines		Two Turboprop Garrett AiResearch Manufacturing Company of Arizona, TPE-331-2UA-203D engines.
S/N	**No. 1 engine**	97002, 73 hrs Since Last Major Overhaul The engine's records showed that it was overhauled and issued FAA Form 8130-3 on 27 January 2009, at 8876.4 TSN and 4325 CSN.
	No. 2 engine	97001, 73 hrs Since Last Major Overhaul The engine's records showed that it was overhauled and issued FAA Form 8130-3 on 18 January 2009, at 8775.5 TSN and 4343 CSN.
Propellers		Two Hartzell, constant speed, 3-blades propellers, HC-B3TN-5E
S/N	**No. 1 propeller**	BVA 7076, 73 hrs TSLO Blade Model: T10282NS-6R S/N : H97329 : H97323 : H97327 The propeller's records showed that it was overhauled and issued FAA Form 8130-3 on 7 January 2010.
	No. 2 propeller	BVA 7078, 73 hrs TSLO Blade Model: T10282NS-6R S/N : H53728

		: H61585 : H55186 The propeller's records showed that it was overhauled and issued FAA Form 8130-3 on 7 January 2010.

1.6.2 Aircraft Last Maintenance Work

On the day of the Accident, two mechanics arrived at the hangar in the early morning and started maintenance and inspection work on the Aircraft.

Later, a truck carrying a number of bags, suitcases and boxes including one box containing the extra bladder fuel tank, arrived at the hangar and was offloaded by the mechanics.

During their work, one of the mechanics spoke with another person working in the hangar and informed him that they (the two mechanics) had many "*things*" to finish by 1200 UTC.

During their maintenance service work, the mechanics requested assistance and logistics from hangar personnel such as the use of a hacksaw, tire inflation equipment, workbench, impact adhesive, windscreen cleaner, waste fuel containers, ground power supply, etc.

During their fabrication of a hose, as part of their work on the extra bladder fuel tank, the mechanics requested certain "AN" fittings[5] from hangar personnel but they were not provided as they were not in the stock in the hangar store.

At approximately 1440 UTC, and after loading the luggage, including the bladder extra fuel tank, which was positioned next to the main door, the mechanics performed a visual external check of the Aircraft using torchlights. A witness stated that he heard one of the four persons onboard saying that they need to check the hydraulic system where another person asked: "*do you mean that I have to move all of those bags?*" The first person replied: "*No, we can check the cockpit*".

Later on, while the Aircraft was being refueled, the four persons were seen inside the Aircraft using torchlights and completing some paperwork and checklists.

1.6.3 Aircraft Type and Airworthiness Certification and Modifications History

The Aircraft was originally built as a Grumman JRF-5 military model before being issued a registration number and serving with the Fish and Wildlife Service (FWS).[6] Since November 1970, many modifications, including major modifications, were performed on the Aircraft by the FWS team without any certification, approval or oversight by the FAA since the FARs are not applicable to public aircraft.

[5] The AN thread is a particular type of fitting used to connect flexible hoses and rigid metal tubing that carry fluid. It is a US military-derived specification that dates back to World War II and stems from a joint standard agreed upon by the Army and Navy

[6] FWS is a bureau within the organization structure of the Department of Interior of the United States

In November 1970, the Aircraft was entered into a conversion project from the original military version to the first civilian Grumman G-21A model. Subsequently, an application for Standard Certificate of Airworthiness (CoA) 'Normal' category was submitted by the FWS to the FAA who issued the first Standard CoA for the Aircraft on 6 January 1971.

On 22 January 1971, a Special CoA 'Experimental' category was issued after installation of Garrett AiResearch TPE331-2UA-203D turboprop engines to replace the original Pratt & Whitney Wasp Model R-985-AN-6 direct drive, nine-cylinder, radial, 450 hp rated engines.

On 5 March 1974, an application for a new Certificate of Registration (CoR) was submitted by the FWS "*due to changes in the make and model*" which, according to the FWS, converts the Grumman G21A to McKinnon G-21G, the same application reflected a change in the MSN from B-72 to 1240.

With many modifications accomplished on the Aircraft, a hand written conformity statement was submitted by the quality specialist of the Aircraft owner on 18 March 1974 stating that: "*Grumman G-21A, Serial No. B-72, N780 has been converted to a McKinnon G-21-G as per Type Certificate 4A24 and has been issued a McKinnon Serial Number 1240. We request a new certificate of aircraft registration be issued as per enclosed application".* Six FAA 337 forms were attached to that application.

A new Special CoA 'Experimental' category was issued on 29 March 1974 reflecting N-780 registration mark, MSN 1240, and McKinnon G-21G model, the expiry date was 29 March 1975.

On 3 November 1974, an application for STC approval for TPE331 engines and 40-inch fuselage extension was submitted to the FAA.

On 5 August 1975, an application was submitted to the FAA for Special CoA 'Experimental' for the: "*purpose of showing compliance to CAR-3*[7] *for our* [FWS] *McKinnon Model G-21G, Serial No. 1240, Registration N780"*. The application letter added: *"this aircraft has been modified to incorporate an extended fuselage, turbo-prop engines, and numerous other changes. An application for Supplemental Type Certificate has been previously submitted to the FAA. This aircraft has been flown as a Public Aircraft for a total of 1643 hours. Based on the number of hours flown and the type of operations the aircraft has been subjected to, we certify that this aircraft meets the requirements of FAR 91.42(b)(1) and (2). The aircraft is controllable throughout its normal range of speeds and throughout all maneuvers to be executed and the aircraft has no hazardous operating characteristics or design features…."*. Subsequently, a Special CoA 'Experimental' was issued on 11 August 1975 reflecting N-780 registration mark, both Grumman B-72 and McKinnon 1240 MSNs, and Grumman G-21A and McKinnon G-21G models, the expiry date was 11 August 1976.

On 7 November 1975, STC SA2809WE was issued to cover the TPE331 engine installation and fuselage extension. The STC reflected McKinnon G-21G as the make and model, and Original Product-TC No. 4A24. Under the STC's "*Description of Type Design Change*" title, it was stated: "*the STC was issued for installation of AiResearch TPE331-2UA-203D engines, increase in fuselage length and related changes in accordance with FAA Sealed McKinnon Master Drawing List No. MPD-BLW-001, Revision October 10, 1975,*

[7] CAR-3: Civil Air Regulations, Part 3, the historical version of the FARs

or subsequent FAA Sealed revision thereto". The STC was limited to the Aircraft MSN 1240 only.

On 16 December 1975, applications for a Standard CoA 'Normal' and a CoR were submitted to the FAA, and a Standard CoA 'Normal' was issued on the following day for the application reflecting McKinnon G-21G make and model.

During the period from 17 December 1975 to 31 May 1990, a number of modifications were embodied on the Aircraft, ten FAA 337 forms were issued in that regard.

On 22 October 1992, an application for change of registration was submitted by the DOI-OAS, reflecting Grumman G-21A, MSN 1240. On 29 and 30 December 1992, two consecutive bills of sale were issued with a change in the operation type from "public use" to "private", the make and model shown in those documents was Grumman G-21A in the registration application and Grumman Goose in the bill of sale. The registration mark was N-780.

On 11 January 1993, a new Standard CoA was issued under McKinnon G-21G make and model. That CoA was a re-issue of the CoA issued on 17 December 1975. The Aircraft registration mark was N-780. Three days later, the new owner submitted an aircraft registration application to change the registration mark to N83MT. The make and model in that application was Grumman Goose. One FAA 337 form was issued on 25 February 1993 reflecting McKinnon G-21G as make and model.

During the period from 8 April to 23 September 1993, the Aircraft was issued two bill of sales, and two applications of registration were submitted on 23 September 1993, a special registration number of N92MT was assigned to the Aircraft.

On 24 September 1993, a Statement of Compliance with FARs for avionics installation was submitted to the FAA, accordingly FAA 337 form was issued on the same date.

Another Standard CoA was issued on 1 November 1993 under registration N92MT and McKinnon G-21G type and model. Three FAA 337 forms were issued after that date.

A new standard CoA 'Normal' was issued on 7 December 1993 with the same type and model but under the N-780 registration mark.

The Aircraft was de-registered from the FAA civil aircraft registry on 15 September 1994. On 13 November 1995, a re-registration application was submitted to the FAA, the registration mark, Aircraft make and model were N92MT and Grumman Goose, respectively.

The Aircraft continued in the records under N86MT registration mark until 25 April 2001. During the previous period, the Aircraft was issued a Standard CoA 'Normal' and two bills of sales with different type and model identifications. Some modifications were embodied and approved by FAA 337 forms.

On 29 May 2001, the Aircraft registration was changed to N221AG. A Standard CoA 'Normal' was issued on 26 October 2001 with the McKinnon G-21G make and model.

Four FAA 337 forms were issued on 20 June 2002 for Garmin navigation system installations.

On 20 October 2004, an aircraft registration application was submitted by the owner to the FAA.

On 31 March 2005, two FAA 337 forms were issued to upgrade Garmin GNS 530 to include TAWS and Garmin GNS 430 software, two relevant AFM supplements were approved by the FAA next day of the 337s approvals.

The last CoR was issued on 17 December 2009 reflecting McKinnon G-21G, MSN 1240, and N221AG registration mark after a bill of sale dated 1 December 2009 where the purchaser was the last owner of the Aircraft.

In revision 9 of Type Certificate Data Sheet (TCDS) No. 4A24, dated 14 April 2008, two United Aircraft of Canada Ltd. PT6A-27 (or United Aircraft of Canada Ltd. PT6A-28 as another option) were the applicable engines on G-21G model. Although MSN 1240 is within the range of eligible serial numbers in the TCDS, the current type certificate holder has no record of MSN 1240 being certified under TC 4A24. According to the current type certificate holder, only two G-21C (MSN 1201 & 1202), one G-21D (MSN 1251), two G-21G (MSN 1205 &1226), and one G-21E (MSN 1211) were certified under TC 4A24.

McKinnon G-21G is a conversion of the basic Grumman G-21 or G-21A. McKinnon G-21G type certification history revealed that the latest TC holder of the G-21G model is Atlantic Coast Seaplanes LLC.[8] The same records showed that the A.G. McKinnon transferred 4A24 to Viking Air Limited on 6 June 1984, Viking Air Limited transferred TC 4A24 to Aero Planes Inc. on 4 September 1998, TC 4A24 was reissued to Aero Planes, LLC on 5 May 2000. Aero Planes, LLC transferred 4A24 to Atlantic Coast Seaplanes LLC on 27 September 2007, accordingly TC 4A24 was reissued to Atlantic Coast Seaplanes LLC on 7 March 2008.

1.6.4 Fuel Tank Capacity

The Aircraft contained six fuel tanks distributed as below:

- Two auxiliary outboard tanks of 124 gallons each;
- Two inboard auxiliary tanks of 110 gallons each;
- One main (wing centre) tank of 120 gallon; and
- One main (hull) tank of 120 gallon.

The total capacity was 708 gallons.

1.6.5 Weight and Balance

The last weight and balance report was performed on 28 May 2010, the below weights were recorded in the report:

- Basic empty weight: 7,980.64 lb
- Useful load: 4,519.36 lb

The AFM contained the following weights:

- Basic empty weight: 7,970 lb

[8] Doing business as “Antilles Seaplanes LLC”, North Carolina, the USA.

- Max gross takeoff weight: 12,500 lb
- Max useful load: 4,530 lb
- Max landing weight (land): 12,500 lb
- Max zero wing fuel weight: 10,182 lb
- New empty weight C.G.: 17.0%

Under "Centre of Gravity Limits", the AFM stated that at 12,500 lb gross weight, the C.G. range is 19.61 inches to 23.5 inches (14.3% to 18.3%).[9]

1.6.6 Engine and propeller control system (AFM Section V)

Engine Control System

The engine control system comprises a basic two-level system consisting of an Engine Speed Control which sets the desired RPM and Engine Power Control which establishes the power level for the RPM selected by the Engine Speed Lever. The operating RPM range of the engine is 65% to 100% of maximum continuous RPM for ground operations and 85% to 100% for flight operations.

Movement of the power plant controls should be smooth and deliberate during all modes of engine operation to ensure satisfactory engine response.

1. RPM Control:

   This lever is marked with three basic positions: taxi, cruise, and takeoff speed. It is linked to the fuel control unit underspeed governor and propeller governor speed control lever. The taxi position sets the fuel control underspeed governor to 65% engine speed and the propeller governor to 85% engine speed for taxi operation. Since the propeller is not governing in the ground range, the engine is controlled by the underspeed governor.

   In the cruise position, the propeller governor is set at 85% RPM and the underspeed governor at 82% RPM. The takeoff engine speed position sets the fuel control underspeed governor at 97% engine speed and the propeller governor at 100% engine speed for takeoff, climb and landing operations.

   Selection of a speed lever position between takeoff and minimum cruise will adjust the propeller governor accordingly between 100 and 85%. The RPM range may be used as desired by the pilot, depending upon aircraft power requirements and cruise limits.

2. Power Lever:

   The quadrant for this lever is marked with from forward to rear to indicate takeoff, flight idle, ground start, and reverse power positions. The area from takeoff to flight idle is the flight or governing range, and all flight operations must be limited to this area. The area from just aft of the flight idle stop position to full reverse is the ground operating range and is used for normal taxi, reverse and ground starting operations.

[9] Rreference datum is wing leading edge at fuselage. Leading edge of MAC is at +5.7 inches aft of datum.

In the flight range, the power lever serves two functions, the first being to directly schedule fuel into the engine to provide the power required by the pilot. In response to any power change, the propeller governor increases or decreases blade angle to maintain the selected engine governing RPM. The second function of the power lever is to schedule a variable minimum in-flight blade angle to which the propeller can move in the event of a propeller governor failure or engine failure during flight, thus restricting the resulting drag caused by the failed engine or propeller governor.

The Flight Idle position has a stop associated with it which warns the pilot that he has reached the minimum in-flight power setting; operation below this position in flight is prohibited.

Propellers

The Aircraft was equipped with three-bladed Hartzell flange mounted, constant speed, full feathering, and reversible propellers.

In this type of propellers, blade angle changes are accomplished by oil pressure and spring and counterweight forces. Control, in the normal cruise flight regime, is by a constant speed governor. However, during ground operation the propeller blade angle is controlled directly by the pilot with the power lever through a hydraulic servo system in the engine.

The propeller incorporates start locks which are normally engaged at engine shutdown in order to provide low propeller drag for engine ground starting. Engagement is accomplished by moving the power levers to the Reverse Thrust setting as the engine is shut down. If this not done, the propellers will automatically feather. To unfeather the propeller prior to ground starting, the appropriate ENGINE BUS shall be energized and the POWER LEVER shall be moved toward reverse and held in UNFEATHER BUTTON until blades unfeather and the start locks are heard to latch.

1.7 METEOROLOGICAL INFORMATION

Table 3 shows the METAR Report as of 27 February 2011, 1605 UTC, RWY 19.

Table 3- METAR Report

Wind:	180°/06 kts
Weather	CAVOK
OAT	28 °C
Dew Point	09 °C
Relative humidity	31%
QNH	1014 hPa
QFE	984.2 hPa

Reviewing the data contained in the METAR and TAF reports as received from the Abu Dhabi International Airport Meteorological Services, there were no records of significant meteorological conditions in the area at the time of the Accident. Additionally, no pilot reports indicating any significant meteorological event were transmitted.

On the day of the Accident, sunrise time was at 0642 LT UAE, and the sunset was at 1818 LT. The time of the flight was classified as a "night flight" since the time of departure was after sunset by more than one hour (2005 LT in comparison with 1818 LT).

1.8 AIDS TO NAVIGATION

Not a factor.

1.9 COMMUNICATIONS

The voice recordings of the ATC-to-Aircraft dual communications was split by the Investigation into four periods. The first two periods were by landline between the ADC and one of the two Aircraft mechanics who were working on the Aircraft inside the hangar. The third and fourth periods were between the PIC and the GMC on 129.15 MHz and ADC on 119.85 MHz, respectively. The last two periods were clear and at almost strength "five" over the entire period.

The first contact was at 12:12:20 by telephone call from the ADC to the mechanic enquiring about the ETD. That call ended at 12:14:41.

The second contact was at 13:53:15 by telephone call from the ADC to the mechanic asking for an update on the ETD. The mechanic informed the ADC that there would be one-hour delay awaiting fuel. The ADC adjusted the ETD for one more hour. The call ended at 13:53:43.

The third contact was at 15:44:48 when the PIC called the GMC to check the Aircraft radios. The last recorded communication ended a few seconds after 16:02:27 when the PIC advised the GMC, by mistake instead of advising the ADC, that the Aircraft was ready for departure instead of advising the ADC.

The fourth contact was at 16:02:38 when the PIC switched the radio frequency to 119.85 MHz and informed the ADC that the Aircraft was ready for departure from the holding point of RWY 19 for a closed circuit. The call ended few seconds after 16:05:42 when the PIC read back the takeoff clearance correctly.

1.10 AERODROME INFORMATION

Al Ain International Airport is a GCAA certificated airport located 8 NM from Al Ain City, capable of IFR/VFR 24 hrs operation.

The Airport's elevation is 869 ft, equipped with one asphalt runway 01/19 with concrete ends. The elevation of RWY 19 is 257 m (842 ft), Takeoff Run available (TORA) is 4,000 m (13,123 ft), Takeoff Distance Available (TODA) is 4,400 m (14,435 ft), Accelerate-Stop Distance Available (ASDA) is 4,000 m and Landing Distance Available (LDA) is 4,000 m, and the width is 45 m (148 ft). The true and magnetic bearing are 187°/186° respectively, with 1.3°E magnetic variation. The runway slope is variable over the whole length from 0.62% to 0.07%. 1.3°E.

Appendix A illustrates the layout of the Airport.

1.11 FLIGHT RECORDERS

According to the FAR Parts 23 and 91, the Aircraft was not required to be equipped with flight recorders.

1.12 WRECKAGE AND IMPACT INFORMATION

The main body of wreckage consisted of: the wings, flight controls and engines.

The engines were damaged but had remained attached to their attachment points on the mainframe.

The two propellers and the LH tire were found at various locations but close to the main wreckage.

The cockpit was severely damaged with the windows shattered and the seats ripped off their places.

The cargo and passenger doors disintegrated and departed the Aircraft. Most of passenger seats also departed their attachment points.

The post impact fire consumed the majority of the Aircraft left side structure, whereas the right side exhibited less damage and burnt metal.

The nose of the Aircraft was aligned on a heading of about 060°.

Green smears and narrow scars were observed at the yellow edge line of the asphalt paved Taxiway F, and broken green rivet heads where found next to the smears which indicated that the smears and scars were caused by the Aircraft nose belly area skin which was painted green.

Another impact scar was observed at a lateral distance of approximately 8.4 m (27.6 ft) to the left of the green smear mark. The measured matched the Aircraft wing dimensions (both floats-up configuration)[10] which indicated that the scar was engraved by the left wing float.

Three propeller slash marks were observed to the left of the green smears whereas two were noticed to the right. The pitch distances of the right and left slash marks were almost identical with an average of 50 cm (19.7 inches).

Neither scars nor smears were noticed along a straight distance of approximately 26 m (85.3 ft) from the final impact mark, which was engraved by the right hand (RH) propeller, to the point where the Aircraft came to rest.

All the wreckage was removed and preserved in special containers located in a quarantine area accessible only to the Investigation Team.

Examination of the wreckage revealed that the landing gear was in the 'Retract' position. There was no possible way to identify the flap position prior to impact.

[10] For the Aircraft, the wing span was 50.94 ft (15.53 m), half the span was 25.47 ft (7.77 m)

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

The toxicology testing that was performed on the collected samples of the PIC did not reveal significant psychoactive substances that could have affected his performance. No other medical or pathological information was provided to the Investigation.

1.14 FIRE

Neither the eyewitnesses' statements nor the fire damage exhibited by the wreckage were consistent with an in-flight fire. The evidence was consistent with a post impact fire with a significant amount of fuel onboard contributing to the severity of the fire damage.

1.15 SURVIVAL ASPECTS

The Accident was non-survivable.

1.16 TESTS AND RESEARCH

1.16.1 Engines

Both engines were shipped to the engine manufacturer for teardown and laboratory forensic examination.[11]

The examination discovered rub marks on different rotating and stationary parts in the compressor and turbine sections of both engines indicating that the engines were running at relatively high speed prior to impact.

For example, in the No. 1 engine compressor, the 1st and 2nd stage impellers and shrouds showed heavy rubbing at the exducer. The rotors and stators of the three turbine stages showed heavy rubbing at different locations with various intensities.

In the No. 2 engine, rub marks were also observed on the 1st and 2nd stage compressor impellers and shrouds. The rotors and stators of the turbine's three stages' showed heavy rubbing at different locations with various intensities in addition to metal sprays.

1.16.2 Instruments

The following recovered indicators were shipped to the NTSB labs for forensic examination[12]:

- Attitude.

[11] Reference- Honeywell Teardown Notes, Report No. DCA11WA032, dated 4 October 2011. The examination was attended by an NTSB investigator and an FAA inspector. Photos included in this Report are examples showing observable marks on the rotating and stationary engine hardware. Numerous photos were taken during the engines' teardown

[12] Reference- NTSB Material Laboratory Factual Report No. 11-127, dated 16 December 2011

- Air speed.
- Turn.
- Oil pressure of No. 1 and 2 engines.
- Fuel pressure of No. 1 and 2 engines.
- Fuel computer.
- EGT limit.
- Exhaust temperature of No. 1 and 2 engines.
- Torque of No. 1 and 2 engines.
- RPM of No. 1 and 2 engines.
- One unidentified indicator.

Except for the No. 1 engine torquemeter, all the indicators were either obscured by heavy soot or did not exhibit any witness mark. The No. 1 engine torque indicator exhibited a witness mark next to the 25 psi marker.

According to the latest Torque-Chart plotted during the last major maintenance check, at 12 January 2010, the 25 psi is equivalent to approximately 7,700 inch-lb raw torque or 6,400 inch-lb Compensated Torque. (Appendix B).

The Investigation could not determine whether that value is equivalent to the takeoff torque value or not.

1.16.3 Propellers

The LH propeller

One blade of the LH propeller had fractured and separated post impact. The pitch change mechanism components (piston/feather spring/cylinder assembly, link arms) had separated from the propeller and were missing. The spinner, although fragmented, remained attached to the propeller.

The spinner dome was severely crushed and fragmented. It contained a hole created by impact with a blade counterweight, the blade counterweight was at a blade angle in the normal operating range when the hole was created (not in feather, not in reverse).

The spinner bulkhead had multiple bends and was torn. Two start lock housings were missing. The third start lock housing was fractured and the pin was jammed in the high RPM position.

The reverse pitch stop and feather pitch stop were missing. The start locks were partially missing. The start lock plates, attached to the blade clamps, did not have indications of engagement at impact.

The mounting flange was bent and cracked and had damaged bolt holes. The cylinder attachment threads were damaged.

Blade 1 was fractured/sheared at the blade retention shoulder. It was bent forward approximately 30° with a large radius bend. It had extensive leading edge damage, gouges and tearing. The outer 1/3 of the leading edge was curled aft. It had severe rotational scoring on the camber side and light rotational scoring on the flat side.

Blade 2 was bent forward approximately 45° at 1/4 radius and it was bent aft at 3/4 radius. The blade exhibited leading edge damage. The outer 1/4 span of the blade was torn off and was missing.

Blade 3 was bent forward approximately 45° with a large radius bend. It had leading edge damage. The tip was curled aft and the blade had rotational scoring on the flat side.

The RH Propeller

The pitch change mechanism (piston/feather spring/cylinder assembly) had separated from the propeller hub. The spinner remained attached to the propeller. One blade was rotated 180° from its normal position, the other two blades were in a flat/reverse position.

The spinner dome was severely crushed and deformed. It contained a hole created by impact with a blade counterweight, the blade counterweight was at a blade angle in the normal operating range when the hole was created (not in feather, not in reverse).

The spinner bulkhead had multiple bends and was torn. All three start lock housings were broken and one pin was jammed in the high RPM position.

The engine mounting flange was bent and partially fractured. One mounting bolt was broken.

The other bolt holes were deformed or stripped.

There were no witness marks from blade butts that could be used to calculate a blade angle.

Blade 1 was bent forward with a large radius bend aft approximately 30°. The tip was bent aft, twisted toward lower pitch, and had rotational scoring. The blade exhibited leading edge damage. The paint was scored on the flat side along the outer 1/2 span of the blade.

Blade 2 was bent aft approximately 30° at 1/3 radius. It was severely curled aft along the leading edge with deep gouges along the leading edge.

Blade 3 was bent forward approximately 90° at 1/4 radius. The blade had severe damage along the leading and trailing edges. The outer 1/3 of the blade was severely torn and twisted. The blade had rotational scoring on the camber side.

From the shape of the scores, gouges and curly damaged tips, both propellers were rotating and were not feathered at the time of impact. The blade damage also indicated that both propellers were operating at high power at the time of impact.

1.17 ORGANIZATIONAL AND MANAGEMENT INFORMATION

Not investigated.

1.18 ADDITIONAL INFORMATION

1.18.1 The Aircraft Manuals

The manuals provided to the Investigation contained information that had not been updated to reflect the actual Aircraft modification state.

For example, the AMM contained information relative to the MLG when it was mechanically operated and before it became hydraulically powered following modification.

Another example was that the AMM charts depicted instrument panels that were inconsistent with the modifications made to the Aircraft's indicating and navigation systems.

The engine power control system described in the AMM was related to the previously installed piston engines and the propeller described was of a different type and model.

The Pilot Handbook contained out of date checklists referring to actions inconsistent with the modification standard of the Aircraft.

1.18.2 The Aeroplane Flight Manual

The AFM provided to the Investigation indicated an FAA approval date of 7 November 1975 as shown at the covering page of Section I- *Operating Limitations*, the applicability showed N-780 as the Aircraft registration mark.

The AFM contained V_{MO}, Normal Operating Range[13], Maximum Design Manoeuvring Speed, Flap Operating Range, Maximum Speed for Landing Gear Extension, and Minimum Control Speed (Single Engine). Table 4 shows these speeds.

Table 4- Speeds limitations as shown in the AFM

Speed	definition	Range/limit (kts)
V_{MO}	The maximum operating speed that shall not be exceeded at any time	- (197) IAS RED Radial Line - (196) CAS
Normal Operating Speed	The normal operating range extends from the stalling speed fully loaded, with the landing gear and flaps retracted to the maximum operating speed	- (83 to 197) IAS - (83 to 196) CAS
Maximum Design Manoeuvring Speed (VP)	The maximum speed at which full deflection of flight controls can be used without exceeding the structural limitations of the airplane	- (155) IAS - (154) CAS
Flap Operating Range	The flap operating range extends from the stalling speed fully loaded, with the landing gear and flaps extended to the structural limiting speed of the flaps in the extended position	- (70 to 125) IAS - (70 to 125) CAS
Maximum Speed for Landing Gear Extension	The maximum speed at which the landing gear may be raised or lowered	- (140) IAS - (139) CAS

[13] As defined in the AFM, the normal operating range extends from the stalling speed fully loaded, with the landing gear and flaps retracted to the maximum operating speed

V_{MC}	Maximum Control Speed (Single Engine)	- (85) IAS - (85) CAS

In Section IV of the AFM- *FAA Performance*, the V_s was tabulated as Table 5.

Table 5- Aircraft Stall Speeds on Different Configuration and Weights

Power off stall speeds at 12,500 lb (kts, CAS)					
Configuration	**Altitude Loss During Stall for 0° Bank**	**Angle of Bank**			
		0°	**20°**	**40°**	**60°**
Gear up, flaps down	350 ft	83.5	86	95	118
Gear up, floats down and flaps down	300 ft	72			
Gear down, flaps up	300 ft	70			
Power on gear up, flaps up	125 ft	73			

Stall Speed vs. Weight at Bank		
Weight (lb)	**GU/FU**	**GD/FD**
12,500	83.5	70
12,000	81.86	68.6
11,500	80.1	67.1
11,000	79.3	65.7
10,500	76.5	64.2
10,000	74.7	62.6
9,500	72.8	61.0
9,000	70.8	59.4
8,500	68.9	57.7
8,000	66.8	56.0

1.18.3 UAE'S CIVIL AVIATION REQUIREMENTS ON FOREIGN AIRCRAFT OPERATIONS

The UAE is exercising its oversight obligations on foreign air transport operations through the GCAA, which is the UAE's Competent Authority, as per the UAE Legislation, to ensure the safety of the state.

The requirements, which were effective at the time of the Accident, are still contained in CAR Part III, Chapter 6 that contains some additional provisions applicable to foreign air transport operations within the UAE.

These regulations require the same documents, certificates and licenses required from UAE local operators. Equipment related to radio, navigation, and Aircraft Collision Avoidance Systems are given specific paragraphs in the regulations.

From the perspective of air traffic rules and procedures, the regulations prescribe generic requirements from pilots such as familiarity with the applicable rules, the

navigational and communications facilities, and the air traffic control and other procedures, of the areas to be traversed by him within the UAE.

The regulations require the flight crew to be able to speak English language sufficiently in order to maintain communications with the Air Traffic Services (ATS) and understand the necessary clearances, documents and instructions. The regulations also require the crew to carry current enroute, letdown and approach charts applicable to the aerodrome of operation.

Showing compliance with the regulations is required to be by following Information Bulletin (IB) 17/2006 titled "Form 025 A- Data Sheet for Foreign Operators and Form 025 B- Data Sheet for Foreign Registered Aircraft", which was published by the GCAA on 2 August 2006. The objective of the IB was towards compliance of foreign operators in completing Forms 025A and 25B.

According to the IB, copies of these completed forms shall be endorsed by the aircraft's States of Registry and shall be submitted to the respective airport authority who shall maintain the Forms and their attached records, either manually or electronically, readily available to the GCAA upon request. There were no completed Forms 025A and 25B provided to the Investigation.

1.19 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES

None.

2. ANALYSIS

2.1 GENERAL

The rub marks, bent compressor blades and metal sprays on the turbine section indicated that the engines were producing power and rotating at high speed on impact. The power settings of both engines could not be determined by the Investigation.

The propellers exhibited rotation marks, the curled blade tips, the broken blade, the heavy scores, gouges and scratches on the leading edges of the propeller blades indicated that the propellers were rotating before touching the ground.

The slash marks on both sides of the main fuselage wreckage, and the identical pitch distances between the slashes indicated also that both propellers were rotating at almost the same speed.

The broken blade of No. 1 propeller exhibited extensive leading edge damage, gouges and tearing. The outer 1/3rd of the leading edge was curled aft, and there was severe rotational scoring on the camber side and light rotational scoring on the flat side, in addition, the spinners of both propellers suffered impact marks caused by blade counterweight; all indicated that the blades were in a normal operating position and not in feather nor in reverse and that the propellers were rotating at relatively high speed.

The examination of the flight control surfaces, cables, rods, links, pulleys, the integrity of the entire control hardware within the wreckage, and the associated controls in the cockpit did not reveal any mechanical anomalies that might have contributed to control difficulties or caused an inadvertent attitude of the Aircraft.

The lack of the Aircraft technical logbook prevented the Investigation from determining whether any mechanical defect contributed to any Aircraft controllability problem.

The witnesses' statements did not indicate that maintenance or repairs were performed during the time that the Aircraft was on the ground at Al Ain Airport until the day of the Accident. The maintenance was limited to general maintenance services and extra bladder fuel tank work. The Investigation believes that there were no major mechanical defects that could have contributed to the Accident.

On the night of the Accident, the meteorological conditions did not reveal any significant weather that could have contributed to the Accident.

2.2 THE TAKEOFF MASS

If the uploaded 3,359 lb of fuel were added to empty tanks, the takeoff mass would have reached 11,328 lb that was 1,172 lb below the MTOW which was left for the four passengers and baggage. Average weight for passengers, 170 lb, for a total of 680 lb leaving about 492 lb for baggage, the bladder tank, the boxes and the remaining fuel (left onboard from previous flight).

The difference between the requested fuel and the uploaded may also lead to the assumption that the added fuel had topped up the tank as could be concluded from the difference between the requested and actually uploaded fuel. The sum of the basic

empty weight and the added fuel would be 12,697 lb[14], which would have exceeded the MTOW even without the payload.

The Investigation believes that the MTOW was exceeded due to one of the above-mentioned assumptions. Specifically with the first assumption, the query of the mechanic who asked the PIC "*do you mean that I have to move all of those bags?*", to check the MLG hydraulic installation, would imply that the boarded bags in the aft cargo compartment were more than two as was also observed from the collected cargo remains. Other cargo remains were also collected near the middle of the fuselage such as tools, clothes and bags. The original location of those cargo items could not be determined.

Four picnic chairs, of approximately 20 lb in all, were observed next to the nose cargo compartment area where they were most probably loaded.

The wreckage observation showed that there were no fuel traces around the extra bladder tank located in the middle of the fuselage and the fire pattern of the tank gave no indication of heavily burned fuel.

Although the site observation revealed that the aft cargo compartment and the cabin were loaded more heavily than the nose compartment, the Investigation could not determine whether there was a significant aftward shift of the C.G that could have affected the longitudinal stability of the Aircraft. The Investigation believes that the Aircraft took-off with an unknown weight exceedence.

According to a pilot who has extensive experience in flying a similar type, the McKinnon G21G with PT 6-27 engines rated at 680 hp will climb at over 1,500 ft per minute at full gross weight at 130 mph or 113 kts. This aircraft would be capable of climbing even if it were 1,000 lb over the prescribed takeoff mass. The aircraft would need about 2,200 ft to become airborne at gross weight. Therefore, the Investigation believes that the short runway distance used by the Aircraft for the takeoff was due to the high engine power even considering the overweight takeoff condition of the Aircraft.

2.3 THE LEFT TURN

According to the eyewitnesses, the Aircraft had rotated at approximately 1,000 m (3,280 ft) from the threshold of RWY 19.

Referring to the radar sweeps, the left turn started when the Aircraft height was approximately 300 ft AGL, 130 kts ground speed and CAS.[15]

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[14] Basic empty weight= 7,970 lb

Maximum fuel capacity= 708 Gal= 2,680 liters= 2,144 kg= 4,727 lb (@0.8 specific gravity)

Basic empty weight + Maximum fuel capacity= 7,970 lb+4,727 lb= 12,697 lb

[15] As per Al Ain radar sweeps, the ground speed was 130 kts. At 180°/06 kts wind direction and speed, TAS=GS - WS= 130 - (-6 x cos 10°)= 136 kts

Taking into consideration the density effect from sea level up to 1,200 ft altitude (300 + 900 ft runway elevation) with ISA +15°C, EAS= TAS x $(\rho/\rho_0)^{0.5}$ = 136 x $(0.92)^{0.5}$= 130 kts
Since there was no compressibility effect for the 1,200 ft altitude and Aircraft speed, EAS was almost the same as CAS.

Since the AFM showed the CAS and IAS almost the same value, the IAS would approximately be the same as CAS, therefore, the IAS of the Aircraft when it entered into the turn was approximately 130 kts.

The slash marks that were engraved on the taxiway were used by the Investigation to determine the ground speed of the Aircraft at impact. The distance between the consecutive slashes was 50 cm (1.64 ft), the number of blades was three, and the maximum takeoff propeller speed was 2,000 RPM[16]; the ground speed was calculated to be approximately 97 kts.[17] Taking into consideration the 060° Aircraft nose heading at impact, the derived TAS was 94 kts and IAS was 90 kts.

There was no evidence of any anomalies related to engines, propellers, or flight controls that could have caused an inadvertent turn. The Aircraft had made two flights at another airport in the UAE before the August 2011 positioning flight to Al Ain Airport. No abnormal operational performance was observed by witnesses or any of the ATC controllers. The Investigation believes that it is probable that the left turn was performed by the PIC's intentional control inputs.

Although the characteristics of the left turn and the sequence of events from the moment the Aircraft entered into the turn until impact could not be specifically determined by the Investigation; the Investigation believes that the probabilities behind the Aircraft loss of height and impact were: a steep turn that exceeded the Aircraft performance envelope resulting in a stall and a Loss of Control (LOC), or improper management of the flight controls and power inputs resulting in Controlled Flight Into Terrain (CFIT).

To determine the stall speed after the generated G-load resulting from the Aircraft banking during the turn, V_s during the climb must be determined first.

Mathematically, the V_s during the turn is equal to the V_s during climb divided by the cosine of the bank angle.

As shown in the AFM, V_s during climb is dependent on the takeoff mass and the flaps, floats and landing gear configurations.

The MLG was retracted prior to the impact and the floats were stowed but the wreckage examination did not reveal the exact flap configuration nor did the records reviewed show any indication related to the Aircraft takeoff mass. However, a type-experienced pilot stated that the normal takeoff configuration for the Aircraft type is 30**°**, i.e. mid-flap position.

From the perspective of takeoff mass, the relatively normal Aircraft takeoff roll from the threshold, as well as the positive rate of climb, could indicate that the takeoff

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[16] Reference AFM, Section IV.

[17] The Investigation determined the Aircraft ground speed at the time the propeller made the slash marks as follows:

(a) The following logical assumptions were made:
- The propellers were running at the maximum (2,000 RPM)
- Both propellers were running at the same speed.
- The Energy loss after the Aircraft initial impact was minor since the Aircraft impacted the ground with shallow nose down and left bank attitude.

(b) For each propeller, the marks were approximately 50 cm (0.5 m) apart.

(c) 2,000 RPM= 33.33 Revolution Per Second.

(d) The time required for 1 revolution= 1/33.33= 0.03 s.

(e) The time required for each between the three blades slashes=
The time required for 1 revolution/3 blades= 0.03/3= 0.01 s.

(f) The Aircraft ground speed= distance between slashes/time= 0.50/0.01= 50 m/s= 97 kts.

mass was, most probably, below the published maximum takeoff mass. However, since the exact actual takeoff mass was not determined, the Investigation had to apply a range of different possible takeoff masses and revert to the AFM to address the corresponding V_s for each (reference AFM Section IV, Appendix D).

The AFM illustrates only two configurations versus variable takeoff mass: 1. LG up/flaps up 2. LG down/flaps down.

With the above configuration, the Aircraft was configured with LG up/flaps down which was not a covered configuration in the AFM "stall speeds" table. However, the same table shows that the effect of the LG configuration on the stall speed is more than the effect of flap configuration, therefore the Investigation directed its attention to the figures under the LG up/flaps up versus a logical range of takeoff masses.[18] Table 6 illustrates the stall speeds with LG up/flaps up versus takeoff masses and bank angles.[19]

Table 6 illustrates hypothetical "coordinated turn" that could be achieved by a maximum bank angle that could be entered with 130 kts IAS (column 3) before Aircraft stall. This type of coordinated turn requires excessive power to be added in order to keep speed and altitude simultaneously.

Colum 4 of the same table illustrates the stall and the associated bank angle assuming that the airspeed had decayed until it reached the stall before impact while the Aircraft was at some stage of the turn.

The table only have 12,000 lb and above weights shown, the lower weights are ignored because the Investigation believes that the Aircraft had took off near or above its MTOW.

Table 6- Stall speed vs weight during coordinated the turn at 130 and 97 kts

Weight (lb) (1)	V_s at 0° bank (2)	Maximum ϕ before stall (in degrees rounded to the first decimal) (3) at 130 kts	Maximum ϕ before stall (in degrees rounded to the first decimal) (4) at 90 kts
12,500	83.5	50.0	21.9
12,000	81.8	51.0	24.7

The characteristics of turns are dependent on a combination of roll, yaw, pitch and power inputs. In steady, level and coordinated turns, the required lift is the result of the weight divided by the cosine of the bank angle. In order to increase the lift to the amount required to maintain level, the Aircraft should have required elevator input that would reduce airspeed due to the increase in the angle of attack. However, for both airspeed and altitude to remain constant, more thrust is required to overcome the increase in the induced drag due to the increased nose up attitude. That additional thrust was not attainable since the engine power was set to takeoff power with no additional margins.

The objective of any maneuver is to develop the smoothness, coordination, orientation, division of attention, and control techniques necessary for the execution of maximum performance turns when the airplane is near its performance limits.

[18] Logically hypothesized range of the takeoff masses as could be assumed from the lifted fuel, the witnessed luggage and the four persons' masses and taking into consideration that the takeoff mass would be heavier than the 8,000 lb E.W

[19] V_{s1} during the turn= V_{s1} in during climb/cosϕ

Smoothness of control use, coordination, and accuracy of execution are the important features of the maneuver.

One air traffic controller stated that: "…*the Aircraft had lift off normally and half way* [along] *the runway started turning left and then* [there was] *a noticeable left wing drop down towards the ground. The Aircraft impacted the ground with nose first…*". Another air traffic controller stated that he observed the Aircraft "*side slipping"* and the heading was changing along the turn. Therefore, the Investigation believes that in the first stages of the turn, the rudder control was still effective as indicted by the witnessed sideslip.

In steep turns, the bank angle is greater than 45°, the G-load is usually noticeable. The aircraft tendency to bank over towards the bank direction usually requires opposite rudder action. Once the bank is established, opposite aileron to the direction of turn may be required to maintain a constant bank. Significant pitch up elevator is needed to sustain steady flight. After the selected bank angle is reached, a considerable force will be required on the elevator control to hold the aircraft in level flight and maintain altitude. Because of the increase in the force applied to the elevators, the load factor increases rapidly as the bank is increased. Additional back-elevator pressure increases the angle of attack, which results in an increase in drag. Consequently, power must be added to maintain the entry altitude and airspeed.

An aircraft's turning is characterized by the rate and radius of turn which are dependent on both airspeed and angle of bank. Each aircraft's turning performance is limited by the amount of power its engine is developing, its limit load factor (structural strength), and its aerodynamic characteristics. However, the limiting load factor determines the maximum bank, which can be maintained without stalling or exceeding the airplane's structural limitations. Moreover, the pilot should realize the tremendous additional load that is imposed on an aircraft as the bank is increased. If the altitude begins to increase, or decrease, relaxing or increasing the back-elevator pressure will be required as appropriate. This may also require a power adjustment to maintain the selected airspeed. A small increase or decrease of 1° to 3° of bank angle may be used to control small altitude deviations. All bank angle changes should be ensured by coordinated use of aileron and rudder.

In the Accident flight, the nature of the turn, which was started at low altitude and not as per the standard operational procedures, would have required at least being coordinated in order to vacate the runway heading safely.

The Aircraft's shallow attitude at impact, as indicated by the marks and smears left at the paved taxiway was due to one of the following probabilities:

1. The PIC's action on the Aircraft controls and/or engine power setting during the course of the left turn.

   When the Aircraft entered into the left turn, with no excessive power, the Aircraft had either lost altitude to maintain airspeed or the airspeed started to decay to maintain altitude.

   The airspeed of the Aircraft at impact was lower than the airspeed of the Aircraft when it entered the left turn. The probability of this scenario was that the PIC was trying, at the beginning of the turn to climb, while the Aircraft was climbing the decaying airspeed could not be compensated for by excessive power.

During the turn, the Aircraft flew towards the tower. Accordingly, the PIC added sudden left control column and rudder in order to steer away from the vicinity of the tower as soon as possible.

With probable rapid left rudder and aileron, the Aircraft started to lose both altitude and speed, thus the PIC would have needed to re-gain airspeed and/or altitude. At the time of his input to re-gain speed or altitude by either more nose down or right controls, the remaining altitude was not adequate and the Aircraft hit the ground while it was still controllable (CFIT).

2. Natural tendency of the Aircraft when recovering from a stall.

   During the turn, in order to avoid the tower, the PIC made more left inputs leading the stall speed to rapidly increase and the Aircraft entered into a stall which was not recoverable (LOC).

The only available data from the wreckage, the eyewitnesses and hardware forensic examination did not enable the Investigation to determine what sequence of events had occurred, and whether the impact was due to CFIT or LOC, but the Investigation believes that the turn was performed at an improper height and location, and that it was not managed safely.

2.4 PILOT PERFORMANCE

The toxicology testing performed on the specimens of the PIC's remains did not reveal any alcohol, drugs or any traces of psychoactive material. Moreover, there was no evidence to the Investigation of any medical, mental or physical influence that might have adversely affected the performance of the PIC. The communication with ATC was clear and the tone of voice was normal.

On the day of the Accident, the PIC was placed in a demanding situation to reach his destination as soon as possible. The Investigation finds that the following events indicate that the PIC had rushed the departure:

- The initial information passed by the mechanic to the ADC about the crew intention to stay in the pattern for a test flight since, as justified by him, the Aircraft had not been flown "*for a while*", was later on minimized by the PIC to only "*one circuit in the pattern"*. The extent of the closed circuit and what systems and performance would be tested after the long storage time could not be determined by the Investigation.
- After arriving at the Aircraft for preparation for departure, there was a dialogue amongst the four persons about the Aircraft final ground check, especially the hydraulic system, which was initially determined to be a visual check and then minimized to be only a cockpit check as the PIC said to one of the mechanics. The extent of that check could not be determined by the Investigation.
- On his way to the holding point of RWY 19, and after approximately three minutes from correctly copying the expected IFR clearance as given by the GMC; the PIC did not switch the radio frequency from the GMC to ADC to advise "ready for departure".

In SPIFR operations, where the PIC has to accomplish all the cockpit functions, the load on the PIC is significant in critical phases of flight such as takeoff and emergency situations. That level of workload, probably, prevented the PIC from declaring any emergency to ATC since he was focusing on handling the abnormal situation rather than communicating with the tower controller, or that the PIC was not aware of the abnormal situation.

After liftoff, and during the initial climb, the PIC should have paid more attention to monitoring the Aircraft's flight path and cockpit indicators. What added to the SPIFR workload was that the PIC was not current on the Aircraft type because he had not flown it for the preceding six months during which he flew other types outside the UAE.

Referring to Sections 61.2(b)(1) and 61.57(b)[20] of the Federal Aviation Regulations (FAR), the Investigation found that the currency of the PIC had expired three months before the Accident flight.

Although the license recency was not proved to be contributory to the Accident, the long gap between the last flight and the Accident flight, and the noticeable difference between the various aircraft types flown by the PIC during the preceding six months, was probably a factor for the false hypothesis by the PIC that the Aircraft was capable of making the turn within its performance envelope.

There was no pressing reason for the PIC to perform the left turn so hastily. The PIC could have climbed to a higher altitude to help him establish his position and then perform the left turn when the speed and altitude were adequately maintained. The Investigation believes that this Accident was a result of a perceived time-related pressure resulting in rushed actions and consequent errors, this condition is usually referred to as the "*hurry-up*" syndrome leading to, most probably, failure to adequately clear the area by improper control inputs (refer to Errors of Commission)[21].

Based on the evidence obtained, the Investigation concludes that the Aircraft was put into a situation from which recovery was not possible.

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[20] FAR Section 61.2(b)(1), last amendment dated 21 August 2009, states that:

"……

(b) Currency. No person may:

(1) Exercise privileges of an airman certificate, rating, endorsement, or authorization issued under this part unless that person meets the appropriate airman and medical recency requirements of this part, specific to the operation or activity."

FAR Section 61.57, issued on 21 August 2009, states that:*"*

(a) General experience.

(1) Except as provided in paragraph (e) of this section, no person may act as a pilot in command of an aircraft carrying passengers or of an aircraft certificated for more than one pilot flight crewmember unless that person has made at least three takeoffs and three landings within the preceding 90 days, and--

(i) The person acted as the sole manipulator of the flight controls; and

(ii) The required takeoffs and landings were performed in an aircraft of the same category, class, and type (if a type rating is required), and, if the aircraft to be flown is an airplane with a tailwheel, the takeoffs and landings must have been made to a full stop in an airplane with a tailwheel.

(b) Night takeoff and landing experience.

(1) Except as provided in paragraph (e) of this section, no person may act as pilot in command of an aircraft carrying passengers during the period beginning 1 hour after sunset and ending 1 hour before sunrise, unless within the preceding 90 days that person has made at least three takeoffs and three landings to a full stop during the period beginning 1 hour after sunset and ending 1 hour before sunrise……."

[21] **The Hurry-up syndrome** occurs when a pilot's performance is degraded by a perceived or actual need to hurry tasks or duties (Reference: Jeanne McElhatton and Charles Drew, *Hurry-Up Syndrome*, Issue Number 5: March 1993).

Errors of commission are those in which pilots carry out some element of their required tasks incorrectly, or execute a task that was not required and which produce an unexpected and undesirable result.

2.5 AIRCRAFT TYPE AND AIRWORTHINESS CERTIFICATION AND MODIFICATIONS

The records showed that the Aircraft had gone through two major packages of modifications: the first one was when it was converted from military to public aircraft and the second was when it was in public use with the FWS.

Although the FAA had issued STC SA2809WE for McKinnon Enterprises on 7 November 1975, and that STC was applicable to the Aircraft only, the major modifications listed in the STC were not supported by FAA 337 forms nor was their place of implementation an FAA approved organization. Furthermore, at the time of conversion, there was no requirement by FAR Part 21 that a public aircraft be issued a Standard CoA.

When the Aircraft was then transferred from public to private ownership, it was required according to FAR Part 21 to be issued a Standard CoA or Special CoA 'Experimental' category in case conformity with the type design is not proved.

At the time of the Accident, the Aircraft was shown in the FAA civil aircraft registry as McKinnon G-21G, MSN 1240, registration mark N221AG, but according to the records provided to the Investigation, there is no record that McKinnon Enterprise Inc. (the STC SA2809WE owner) had issued a data tag for the Aircraft.

In addition, although STC SA2809WE was amended by the FAA in order to be applicable to the specific MSN 1240, there was no evidence that the STC was embodied on the Aircraft as required to be officially documented by FAA Form 337 "Major Repair or Alteration" as prescribed in FAR Part 43, Appendix A.[22]

Many applications were submitted to the FAA by different owners in which the Aircraft type and model identifications contained in those applications were not consistent. Grumman G21A and/or McKinnon G21G were haphazardly entered in the specified make and model fields of the CoA applications without appropriate concern being displayed by the FAA certification office. Consequently, various Standard and Special CoA were issued for the same Aircraft by the FAA which referred to different types and models. Although there is no evidence that this was contributory to the Accident, the Investigation believes that the certification history of the Aircraft was not in compliance with the FARs requirements.

According to the Director of Customer Service & Product Support of the last TC holder (Atlantic Coast Seaplanes LLC), the Aircraft was never actually converted by McKinnon Enterprises Inc., and thus was not in compliance with the model G-21G type design. He added that the Aircraft was converted by FWS and "*would have been more accurately and properly identified and registered as a (Fish & Wildlife Service G-21F)",* that specific G-21F was not converted by an approved Original Equipment Manufacturer (OEM) under 14 CFR Part 21, neither by a form of approved manufacturing Quality system, such as a Production Certificate (PC) or an Approved Production Inspection System (APIS). In addition to that, the G-21F type design was not approved by the FAA.

[22] FAR 43- Maintenance, Preventive Maintenance, Rebuilding, and Alteration

2.6 UAE'S CIVIL AVIATION REQUIREMENTS

The current regulations as described in CAR Part III, Chapter 6, and IB 17/2006 have some are applicable to foreign air transport operators. However, the current regulations could not have prevented the Accident as there was no specific requirements are prescribed in the regulations in respect to inspections on General Aviation (GA).

The Safety Assessment of Foreign Aircraft (SAFA) program, which was running at the time of the Accident, used to be performed while aircraft are parking on airports' ramps. The type of inspections and the period within which these inspections are performed, are limited and might delay the normal operation.

Moreover, there was no specific requirement in the current regulations to oblige the foreign operators to leave copies of maintenance and flight documents, especially the last technical logbook sheet, in cases of longtime parking, neither the regulation require the airport authorities to obtain such documents and process it with the GCAA before issuing departure clearance, therefore the Investigation could not identify the Aircraft exact loading and the exact maintenance and/or repair actions performed on the Aircraft prior to the departure.

However, in order to minimize the risk associated with any flight operation, a more proactive approach could be implemented before the aircraft enters the UAE or if the aircraft is parked for a long time at a UAE airport.

3. CONCLUSIONS

3.1 GENERAL

From the evidence available, the following Findings, Causes and Contributing Factors were determined with respect to this Accident. These shall not be read as apportioning blame or liability to any particular organisation or individual.

To serve the objective of this Investigation, the following sections are listed under the "Conclusions" heading:

- **Findings-** statements of all significant conditions, events or circumstances in the sequence of this Accident. The findings are significant steps in this Accident sequence, but they are not always causal or indicate deficiencies.
- **Causes-** actions, omissions, events, conditions, or a combination thereof, which led to this accident.
- **Contributing Factors-** actions, omissions, events, conditions, or a combination thereof, which, directly contributed to this Accident and if eliminated or avoided, would have reduced the probability of this Accident occurring, or mitigated the severity of its consequences.

3.2 FINDINGS

(a) The PIC possessed a valid ATP certificate issued by the FAA.

(b) There was no evidence of any medical, mental, or psychoactive influence that could have adversely affected the performance of the PIC during the flight.

(c) The PIC possessed a valid FAA first class medical certificate that had effectively reverted to a third class medical certificate because it had been more than 1 year since it was issued.

(d) The PIC's most recent medical application for a first class certificate was denied by the FAA due to a previous violation.

(e) Two logbooks belonging to the PIC had a few months overlap between the new and old logbooks. The new logbook indicated 1,000 more hours that was not supported by the flight log.

(f) The Aircraft was certified as a "Single Pilot" airplane, and the flight was a "Single Pilot" flight.

(g) Examination of the wreckage and maintenance records did not reveal any evidence of pre-existing Aircraft structural or mechanical anomalies that would have contributed to the Accident.

(h) The flight was a night flight.

(i) On the day of the Accident, the PIC was not current on the Aircraft type as required by FAR sections 61.2(b)(1) and 61.57(b)(1) and therefore could not carry passengers, as he had not conducted 3 takeoffs and landings in the previous 90 days in a similar class airplane (i.e. multiengine tailwheel).

(j) The estimated time of departure was changed three times due to delays in maintenance work and waiting for refueling.

(k) The Aircraft accelerated normally during the takeoff roll.

(l) The Investigation believes that the Aircraft took off on or above MTOW, but the Investigation could not determine whether a significant shift of the C.G had occurred and adversely affected the controllability of the Aircraft.

(m) After liftoff and during the initial climb, the Aircraft entered into an uncoordinated turn commenced at a low height and out of standard runway position.

(n) The left turn was performed in a rushed manner in order to head to the planned destination as quickly as possible and was not performed at a stable continuous rate where control inputs were made to avoid the tower as soon as possible.

(o) There was no pressing situation on the PIC to perform the left turn so hastily. The PIC could have climbed to a higher altitude to help him establish his position and then perform the left turn when the speed and altitude were adequately maintained.

(p) The Investigation believes that this Accident was a result of "hurry-up" syndrome.

(q) The Investigation could not determine the sequence of events, and whether the Accident could be classified as CFIT or LOC.

(r) The Aircraft was initially a military Aircraft, then it was converted to the civilian "public use" category.

(s) At the time of conversion, the FAR did not require "public use" aircraft to be issued a Standard CoA by the FAA nor to be maintained under FAR Part 43.

(t) After many "Experimental" category CoA were issued by the FAA, the Aircraft was designated as a McKinnon G21G from a Grumman G21A.

(u) Standard CoA "Normal" category were issued by the FAA more than once based on improper implementation of FARs Part 21.

(v) McKinnon Enterprises Inc. did not accomplish the Aircraft conversion work.

(w) The Aircraft conversion work was accomplished by a non-FAA approved organization/person. The major alteration FAR Part 43 requirements were not properly documented on the conversion work.

(x) The certification process of the Aircraft was not consistent with the FARs.

(y) The AMM was not consistent with the modifications made on the Aircraft.

(z) There was no maintenance accomplished on the Aircraft during the six months parking period in the hangar.

(aa) The only maintenance work accomplished on the Aircraft was on the day of the Accident and it was limited to installation of an extra bladder fuel tank and some servicing work.

(bb) There was no evidence that the installed extra fuel tank was connected to the fuel system.

(cc) There was no FAA Form 337 provided to the Investigation regarding the FAA approval of the installation of the extra fuel tank.

(dd) Examination of the wreckage and maintenance records did not reveal any evidence of pre-existing Aircraft structural or mechanical anomalies that could have contributed to the Accident.

(ee) The meteorological conditions were not contributory to the Accident.

(ff) At the time of the Accident, the Investigation could not obtain the relevant maintenance and flight documents since none of them was left on ground.

(gg) There were no completed Forms 025A and 25B provided to the Investigation by Al Ain International Airport authority according to the GCAA's promulgated IB 17/2006.

(hh) At the time of the Accident, there was no GCAA requirement that long-parking aircraft's maintenance and flight documents are obtained and properly checked prior to issuing departure clearance by the airport authority.

3.3 CAUSES

The Air Accident Investigation Sector determines that the cause of the Accident was the PIC lapse in judgment and failure to exercise due diligence when he decided to enter into a steep left turn at inadequate height and speed.

3.4 CONTRIBUTING FACTORS TO THE ACCIDENT

Contributing factors to the Accident were:

(a) The PIC's self-induced time pressure to rapidly complete the post-maintenance flight.

(b) The PIC's desire to rapidly accomplish the requested circuit in the pattern.

(c) The PIC's lack of recent experience in the Aircraft type.

(d) The flight was SPIFR requiring a high standard of airmanship.[23]

[23] Reference- www.skybrary.aero: "Airmanship is the consistent use of good judgment and well-developed skills to accomplish flight objectives. This consistency is founded on a cornerstone of uncompromising flight discipline and is developed through systematic skill acquisition and proficiency. A high state of situational awareness completes the airmanship picture and is obtained through knowledge of one's self, aircraft, environment, team and risk."

4. SAFETY RECOMMENDATIONS

4.1 FINAL REPORT SAFETY RECOMMENDATIONS

The Safety Recommendations listed in this Report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation, and are based on the Findings listed in Section 3 of this Report. The GCAA expects that all safety issues identified by the Investigation in the Findings will be addressed by the appropriate States and organizations.

4.1.1 The Federal Aviation Administration of the United States, to-

SR 72/2013

Enhance "General Aviation" aircraft airworthiness certification and oversight procedures in order to ensure that N-registered aircraft are in type conformity with the FARs prior being issued a Certificate of Airworthiness.

SR 73/2013

Enhance, through robust oversight and enforcement systems, airman licensing practices to ensure proper implementation of FAR Sections 61.2(b)(1) and 61.57(b)(1) related to type recency requirements.

4.1.2 The General Civil Aviation Authority of the United Arab Emirates, to-

SR 74/2013

Improve the regulations to govern foreign aircraft operations in the UAE territory.

SR 75/2013

Enhance the foreign aircraft safety assessment system to ensure that any aircraft parking in any UAE airport for a pre-specified period submit certain documents to assure that the aircraft is airworthy before a clearance of departure is issued.

SR 76/2013

Promulgate a requirement that the GCAA certificated airports establish procedures to report to the GCAA any aircraft parking for a pre-specified period.

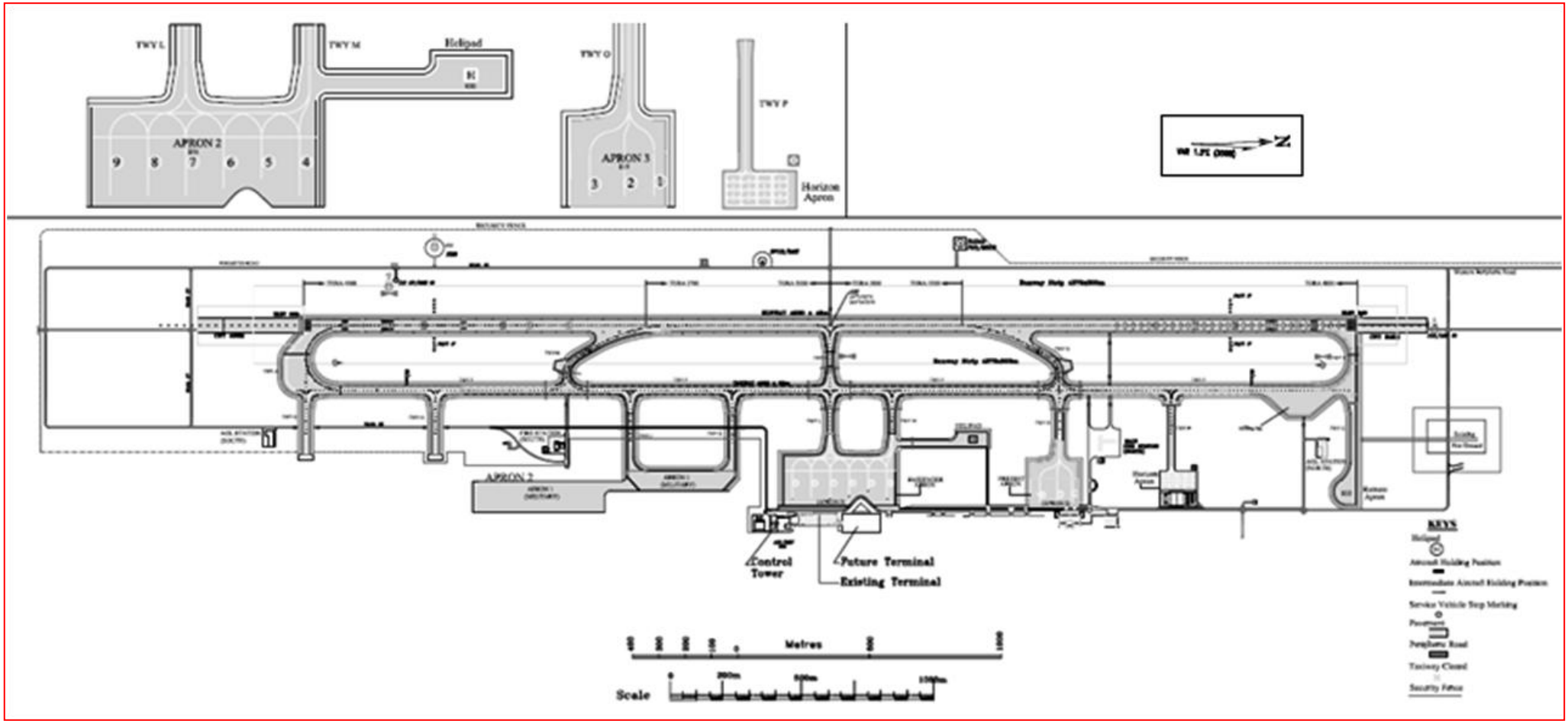
4.1.3 Civil Airports in the United Arab Emirates, to-

SR 77/2013

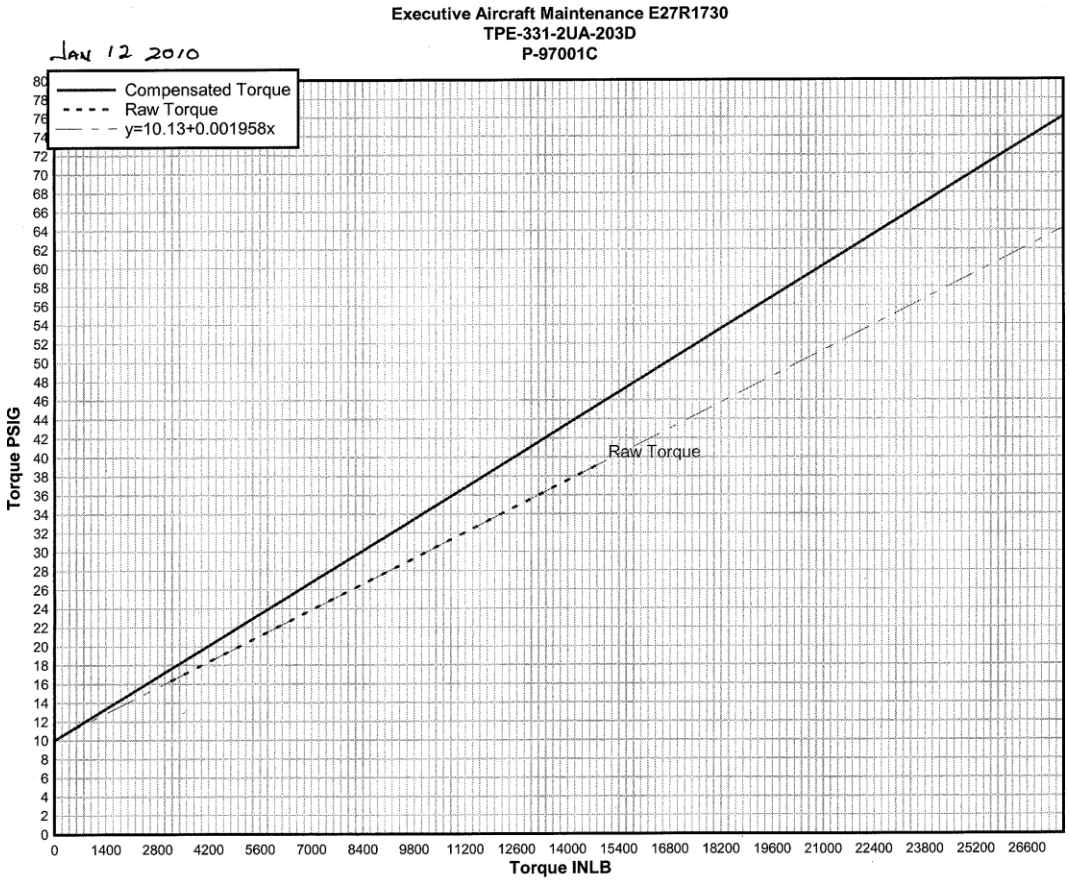
Establish procedures to report to the GCAA any aircraft parking for a pre-specified period.

AIR ACCIDENT INVESTIGATION SECTOR
GENERAL CIVIL AVIATION AUTHORITY
THE UNITED ARAB EMIRATES

APPENDIX A- AERODROME CHART



APPENDIX B- TORQUE CHART



APPENDIX C- FLIGHT PLANS

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-OMAL1100
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-OMAL0046 OMDB
-OPR/TRIPLE S AVIATION +97142996633 REG/N221AG SEL/ZZZZ NAV/RNP5
RNP10
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SEL/ZZZZ NAV/RNP5 RNP10 DOF/110227 RMK/OERK LDG 11 GACA 621B)

APPENDIX D- STALL SPEEDS

FAA PERFORMANCE

STALL SPEEDS

POWER OFF
STALL SPEEDS AT 12,500 LBS (KNOTS, CAS)

Configuration	Alt. Loss During Stall for 0° Bank	Angle of Bank 0	20	40	60
Gear up, flaps down	350 ft.	83.5	86	95	118
Gear up, floats down and flaps down	300 ft.	72			
Gear down, flaps up	300 ft.	70			
Power on GU/FU	125 ft.	73			

STALL SPEED VS. WEIGHT AT 0° BANK

	GU/FU	GD/FD
12,500	83.5	70
12,000	81.8	68.6
11,500	80.1	67.1
11,000	79.3	65.7
10,500	76.5	64.2
10,000	74.7	62.6
9,500	72.8	61.0
9,000	70.8	59.4
8,500	68.9	57.7
8,000	66.8	56.0