THE REPUBLIC OF KENYA

MINISTRY OF TRANSPORT, INFRASTRUCTURE, HOUSING, URBAN DEVELOPMENT AND PUBLIC WORKS

STATE DEPARTMENT FOR TRANSPORT

AIRCRAFT ACCIDENT INVESTIGATION DEPARTMENT

INVESTIGATION REPORT 01/02/2021

REPORT ON THE ACCIDENT TO AGUSTA WESTLAND AW119 MK II REGISTRATION 5Y-NPW OPERATED BY THE NATIONAL POLICE SERVICE AIR WING AT MERU, KENYA ON 13 JUNE 2020

OBJECTIVE

This report contains factual information that has been determined up to the time of publication. The information in this report is published to inform the aviation industry and the public of the general circumstances of accidents, serious incidents, and incidents.

This investigation has been carried out in accordance with The Kenya Civil Aviation (Aircraft Accident and Incident Investigation) Regulations, 2013, and Annex 13 to the ICAO Convention on International Civil Aviation.

The objective of the investigation of an accident or incident under these Regulations shall be the prevention of accidents and incidents. It shall not be the purpose of such an investigation to apportion blame or liability.

The information contained in this report is derived from the data collected during the Investigation of the Accident.

INVESTIGATION PROCESS

The occurrence involved an Agusta Westland AW119 passenger helicopter, registration 5Y-NPW, and was notified to the Aircraft Accident Investigation Department (AAID), State Department for Transport (SDT), Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works through a phone call and affirmed by the Manager, Air Traffic Control (ATC).

Inspector General of the National Police Service (NPS) delegated the Investigation to AAID through a letter REF: NPS/IG/SEC/2/16/VOL.XXVII (10) dated 14 June 2020. A team of AAID investigators was dispatched to the site on 15 June 2020 to conduct initial onsite investigation and witness interviews.

After the initial on-site investigation phase, the occurrence was classified as an 'Accident' owing to the substantial damage to the Aircraft and serious injuries suffered by two occupants.

AAID notified the Italian Agenzia Nazionale per la Sicurezza del Volo (ANSV),being the Civil Aviation Safety Investigation Authority of the State of the Manufacture and Design, and the Canadian Transport Safety Board (TSB), is the authority of the State of Manufacture of the engines. Accredited Representatives were assigned and assisted by Advisers from Leonardo Helicopters.

AIRCRAFT ACCIDENT INVESTIGATION

OPERATOR:	National Police Service Air Wing
AIRCRAFT TYPE:	Agusta Westland AW119MKII
MANUFACTURER:	Leonardo Helicopters
YEAR OF MANUFACTURE:	2014
AIRCRAFT REGISTRATION:	5Y-NPW
AIRCRAFT SERIAL NUMBER:	14946
DATE OF REGISTRATION:	02 March 2018
TYPE OF ENGINE:	One Pratt & Whitney Canada PT6B-37A Turboshaft Engine
DATE OF OCCURRENCE:	13 June 2020
TIME OF OCCURRENCE:	0530 (0830)
LOCATION OF OCCURRENCE:	Cyompiou, Kaithe area, Meru 0.108674° N, 37.683443° E
TYPE OF FLIGHT:	Special Flight
NUMBER OF PERSONS ON BOARD:	06
INJURIES:	Two serious and four minor
NATURE OF DAMAGE:	Substantial
CLASS OF OCCURRENCE:	Accident
PIC'S FLYING EXPERIENCE:	CPL (H) /987.4 Hours

All times given in this report is Coordinated Universal Time (UTC), with East African Local Time in parenthesis.

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ABBREVIATIONS

AAID	-	Aircraft Accident Investigation Department
AD	-	Aerodrome
AGL	-	Above Ground Level
AIP	-	Aeronautical Information Publication
AMSL	-	Above Mean Sea Level
ANSV		Agenzia Nazionale per la Sicurezza del Volo of Italy
ATC	-	Air Traffic Services
ATIS	-	Automatic Terminal Information Service
ATPL	-	Airline Transport Pilot License
AW	-	Agusta Westland
CPL (H)	-	Commercial Pilot License (Helicopter category)
CRM	-	Crew Resource Management
CVR	-	Cockpit Voice Recorder
EDU		Electronic Display Unit
ELT	-	Emergency Locator Transmitter
FAA	-	Federal Aviation Administration
FDR	-	Flight Data Recorder
FM	-	Flight Manual
ft	-	feet
HKJK	-	Jomo Kenyatta International Airport
HKNW	-	Wilson Airport
ICAO	-	International Civil Aviation Organization
ICS	-	Integral Control System

IFR	-	Instrument Flight Rules
IG	-	Inspector General
IR	-	Instrument Rating
KAA	-	Kenya Airports Authority
KCAA	-	Kenya Civil Aviation Authority
kg		kilogram
KMD	-	Kenya Meteorological Department
kt		knot
LT	-	Local Time
m		metre
MFD		Multi-Function Display
MTOW		Maximum Take Off Weight
NEAL	-	North East Access Lane
nm	-	Nautical mile(s)
NOTAMS	-	Notices to Airmen
NPS	-	National Police Service
NPSAW	-	National Police Service Air Wing
OVC		Overcast
PF	-	Pilot Flying
PFD		Primary Flight Display
PM	-	Pilot Monitoring
PPL (H)	-	Private Pilot License (Helicopter category)
QNH	-	Altimeter setting related to sea level
ROD	-	Rate of Descent
S/N	-	Serial Number
SDT	-	State Department for Transport
TCAS	-	Traffic Collision Avoidance System
TSB	-	Transportation Safety Board of Canada
TSN		Time Since New
VFR	-	Visual Flight Rules

SYNOPSIS

The Agusta Westland AW 119 MKII helicopter type registration 5Y-NPW operated by the National Police Service Air Wing (NPSAW) departed Wilson Airport for a Visual Flight Rules (VFR) flight to Badan Arero in Marsabit via Embu and Wajir on June 13, 2020 with three occupants.

The aircraft made a precautionary landing four miles west of the Ndula marker due to bad weather, but took off again when the weather conditions improved and landed at Embu where three more passengers embarked. The helicopter then took off for Isiolo to refuel before flying to Badan Arero. However, while enroute to Isiolo, the weather conditions deteriorated below VFR minima, prompting the crew to initiate a precautionary landing. The helicopter collided with trees in fog while attempting to land.

The two pilots and the four passengers were extricated from the wreckage; two with serious injuries and four with minor injuries of varying degree. There was no pre or post impact fire, but the helicopter was damaged after colliding with trees and terrain.

The investigation identified the probable cause of the accident as the pilot's lack of situational awareness, and the decision to continue the flight into deteriorating weather conditions that occasioned spatial disorientation after inadvertent entry into instrument meteorological conditions and subsequent loss of helicopter control.

The investigation further established that the NPSAW Standard Operating Procedures did not provide guidance in a number of areas, which contributed to poor decision-making and coordination.

Intentionally left blank

1.0 FACTUAL INFORMATION

1.1 History of the Flight

On 13 June 2020 at about 0530 (0830), Agusta Westland AW119 MKII helicopter registration 5Y-NPW operated by the National Police Service Air Wing (NPSAW) was involved in an accident in Kaithe, Meru. The sector was being flown by the Pilot in Command (PF) and a Copilot (PM) and had 4 passengers on board.

As per the adopted practice in the organization for carrying out such missions, the Commandant of the organization informs the crew about the flight program for the next day in advance. The team was aptly briefed by the Commandant on 11 June 2020 about the Eastern and North Eastern Peace Mission two days before the day of the operation. The mission was to involve two helicopters; AW 139 and AW 119, which were to ferry North Eastern and Eastern security teams respectively. The first helicopter, AW139 was to lift off from Wilson airport, fly to Garissa, Wajir, and then Badan Arero in Marsabit. The second helicopter AW 119, flight was to originate from Wilson airport via Embu to pick up three passengers, then route to Marsabit before ending at Badan Arero.

The planned peace mission was to reconcile two communities that were embroiled in cattle rustling in the region. The two teams; the North Eastern and the Eastern each led by the Respective Regional Commissioners were to congregate in Badan Arero in Marsabit where the reconciliation of inter-communal conflicts was to take place. The AW 119 was to pick up the officials of the Eastern team from Embu and fly them to the appointed venue of the Peace Mission, while the AW 139 was to pick up the officials of the North Eastern team from Wajir and fly them to Badan Arero.

After filing the flight plan from HKNW to Wajir via Embu, the crew familiarized themselves with the NOTAMS and the weather before lifting off at Wilson airport at 0357 (0657) with the two flight crew and one passenger. They were cleared to route via the North East Access Lane (NEAL) through the Ndula Marker (the Visual Navigation aid). All these events were uneventful, and as per the cockpit crew, there were no

abnormalities observed on the helicopter during preflight checks, weather briefing, and subsequent lift-off. The lift off of AW 139 was preceded by the lift off of AW 119.

AW 119 crew reported that while routing through the NEAL, the weather ahead of the flight path appeared to deteriorate, prompting them to execute a landing at a position about four miles to the west of Ndula marker at about 0414 (0714).

After liftoff, the crew of AW 139 maintained 6200 m while routing along the NEAL, in fog. They kept monitoring AW 119 on TCAS and observed that it was not headed to Embu as expected. On enquiry, they were informed that AW 119 had landed due to bad weather. After the Ndula Marker, AW 139 climbed to 7500 ft and got out of fog and noticed that visibility and weather to Embu was good and clear at that level. AW 139 crew subsequently relayed the experiential weather information to the crew of AW 119.

The AW 119 helicopter lifted off a few minutes after 0440 (0740) when the weather conditions improved and the crew elected to fly at low level to Embu, where three more passengers embarked the helicopter before setting course for Isiolo to refuel, instead of Wajir as earlier filed in the flight plan.

At one point, the weather conditions appeared to depreciate along the flight path at a distance ahead, prompting the captain to hand over the flight controls to the copilot, while he made various telephone calls to establish the weather conditions at their destination, before he regained control of the aircraft.

At around Meru area, the weather conditions deteriorated prompting the crew to contemplate landing at an identified field within the vicinity, but opted to continue flying hoping that they will be able to break through the clouds for better visibility. Within a short time, they were engulfed in clouds and decided to approach and make a landing in another location identified suitable for landing, with better but deteriorating visibility. As they approached the landing area, in poor visibility, the pilot flying stated that he noticed overhead electric power line ahead of the flight path at approximately 100 ft above

ground level, banked to the left to avoid the same. He elected to land on the second identified landing area to the right. He further stated that the aircraft rate of descent was high, he therefore flared to reduce the ROD. He additionally indicated that though he avoided the cables, the main rotors of the helicopter contacted the trees that led to severe vibrations in the cabin. The helicopter collided with two other trees before it impacted the ground and came to rest on its starboard with the main rotor blades impacting the terrain while still rotating.

The PF shut off the fuel valve and switched off the battery. The cockpit crew exited the helicopter from the left side. All the passengers were evacuated from the helicopter from the left emergency window. Two passengers were seriously injured, the rest of the occupants were reported to have suffered injuries of varying degrees. The helicopter sustained substantial damage after the impact. There was no fire.

The accident site was located at N 0.108674° E 37.683443°, in a plantation with a mixture of banana and maize plants at an elevation of 4711ft. The accident site was a positive gradient towards Kamithagana hill located in a residential area surrounded by *Gravillea robusta* type of trees with approximate height of 15m.

1.2 Injuries to Persons

Table 1 : Injury chart

Injuries	**Crew**	**Passenger**	**Others**
Fatal	0	0	0
Serious	0	2	0
Minor/none	2	2	0
Total	**2**	**4**	**0**

1.3 Damage to Aircraft

The cabin of the helicopter was generally intact after the accident. All occupant seats were neither damaged nor distorted. The cockpit doors and cabin doors were intact without deformation and their function was normal. The nose section exhibited significant structural damage. All components were recovered and accounted for at the accident site.

The four glass-fibre composite blades, severed from the main hub at the root. Pitch links and the damper still connected from the main hub. The port side of the helicopter did not exhibit deformation.

Figure 1: Wreckage of the damaged aircraft

Figure 2: Main rotor blades distorted from the main rotor hub

Figure 3: Damaged trailing edge of one of the main rotor blades

Figure 4 : The damaged section of the fuselage

1.4 Other Damage

Trees around the accident site and in the path of the flight were cut from the top by the main rotor blades of the helicopter. Both the surrounding trees and part of the ground suffered lesions after contacting the main rotor blades.

Figure 5 : The wreckage at the accident site.

1.5 Personnel Information:

1.5.1 Pilot Flying, PF and Pilot Monitoring, PM

Table 2: Crew information

Crew information		
	Captain, PF	**Copilot, PM**
Age	33	29
Type of license	CPL (H)	CPL (H)
License Validity	26 August 2020	15 March 2021
Instrument Flight Rating	Nil	Nil
Rating	AW119	R44, AW119
Total flying time (hours)	987.4	623.4
Total on this type (hours)	764.3	351.5
Total last 90 days (hours)	118.7	110.1
Total last 30 days (hours)	38.1	86.2
Total last 14 days (hours)	19.6	45.1
Total last 7 days (hours)	13.7	21.7
Total last 24 hours (hours)	0	0
Last proficiency check	11 November 2016	27 December 2016
Last line check	30 June 2016	26 July 2016
Medical class	1	1
Medical Validity	14 August 2020	15 March 2021

1.5.2 Professional information

1.5.2.1 PIC

The Captain of the accident aircraft joined the National Police Service in 2011, underwent 15 month basic recruit course before being posted to Habaswein in Wajir. He was then absorbed by the NPSAW in 2013, where he initially trained as a fixed wing pilot, before proceeding to South Africa in 2016 where he attained PPL (H) and CPL (H). In 2017, he went through AW 119 kx factory training in Philadelphia in the United States of America before training with NPSAW pilots in 2018. He was elevated to a captain and promoted to the rank of Inspector of Police in 2019.

1.5.2.2 Copilot

The PM joined the National Police Service in 2011, underwent 15 month basic recruit course. She was then absorbed by the NPSAW in 2013, where she proceeded to South Africa in 2015 where she attained PPL (H) and CPL (H). She was promoted to the rank of Inspector of Police in 2019.

1.6 Aircraft Information

1.6.1. Aircraft specifications

5Y-NPW was AW 119 MK-II type of helicopter with single-engine certified in the transport category with subcategory Passenger, for day operation under VFR. The maximum operating altitude was 15,000ft density altitude and the maximum take-off weight was 2850 Kgs. The cabin includes the crew compartment (cockpit) and the passenger compartment. Seating is provided for the pilot (right side) and a passenger (or co-pilot) in the cockpit, and up to six passengers in the rear compartment. The aircraft was

fitted with a Garmin G1000H Primary Flight Displays (PFD)/FlightMax (MFD) display system.

Figure 6 : AW 119 Passenger cabin configuration.

The aft section accommodates the fuel tanks, the electrical and electronic equipment compartment, and the baggage compartment. The landing gear skid is secured to the undersides of the cabin and rear sections. The tail boom is bolted to the forward fuselage and supports the tail rotor and the relevant drive system. The tail boom includes the stabilizers, the upper and lower vertical fins, the tail skid, and the tail cone. The helicopter was fitted with four-bladed fully articulated main rotors, two-bladed tail rotors, and a fixed landing gear skid.

Figure 7 : 5Y-NPW at Wilson airport

Table 3: Aircraft data at the time of the accident

Aircraft data at the time of the Accident	
Manufacturer:	Leonardo Helicopters
Model:	AW119MKII
MSN:	14946
Date of manufacture:	26 October 2017
Nationality and registration mark:	Kenya, 5Y-NPW
Certificate of airworthiness	N/A
Number: Issue date: Valid to:	N/A N/A N/A
Certificate of registration	
Number: Issue date:	14946 02 March 2018
Date of delivery	01 November 2017
Total hours since new	925:38

Total cycles since new	856
Last major inspection and date:	100 hours/1 year, 30 May 2020 at 907:51 hours Times Since New (TSN)
Total hours since last inspection:	26:56
Total cycles since last inspection:	34

1.6.2 The Engine

The accident helicopter was powered by a single Pratt & Whitney PT6B-37A turbo-shaft engine. The engine is a free turbine turbo-shaft propulsion engine incorporating a compressor consisting of 3 axial stages and 1 centrifugal impeller driven by a single-stage compressor turbine. Power is managed by an electronic-hydro pneumatic control system. Engine data at the time of the accident is illustrated below.

Table 4 : Engine data

Engine Data	
Manufacturer	Pratt & Whitney Canada
Model	PT6B-37A
Serial number	PCE-PU0306
Date installed	20 September 2017
Time since new (hours)	925:38
Cycles since new	858

Time since last inspection (hours)	26:56
Cycles since last inspection	34

The helicopter was fitted with an electronic engine control (EEC) model; EEC37-1 (Part number: 1000670-1-006), Serial Number; 17040106, manufactured by Pratt and Whitney Canada.

1.6.3 Weight and Balance Data

The load & trim sheets for all the sectors were not available, neither were they prepared before the flight (or each segment of the flight) as per the pilot`s interview.

1.6.4 Fuel Information

The type of fuel used was Jet A-1 as captured by the fuel receipt sheet 2439 dated 13 June 2020 that indicated the helicopter was fueled with 460 l, however, the same was not entered in the Technical Log Record Sheet No. 282 dated 13 June 2020. As engine operations were normal prior to the accident as per the crew, fuel samples were not taken for contamination check as there was no such need.

1.6.5 Means of Emergency Evacuation

The passenger cabin was fitted with a cabin door on each side of the fuselage. These two cabin doors are normally used for embarkation and disembarkation of passengers. In case of emergency, both doors can be used as emergency exits for passenger evacuation. When the cabin doors cannot be opened, all cabin windows on the doors can be jettisoned to allow rapid evacuation of the passengers. The helicopter was fitted with a cockpit door on each side. The upper part of the door was equipped with a push-out type emergency exit

window, allowing rapid evacuation of the flight crew. After the accident, the copilot pushed out the left side emergency exit window, where both crew evacuated.

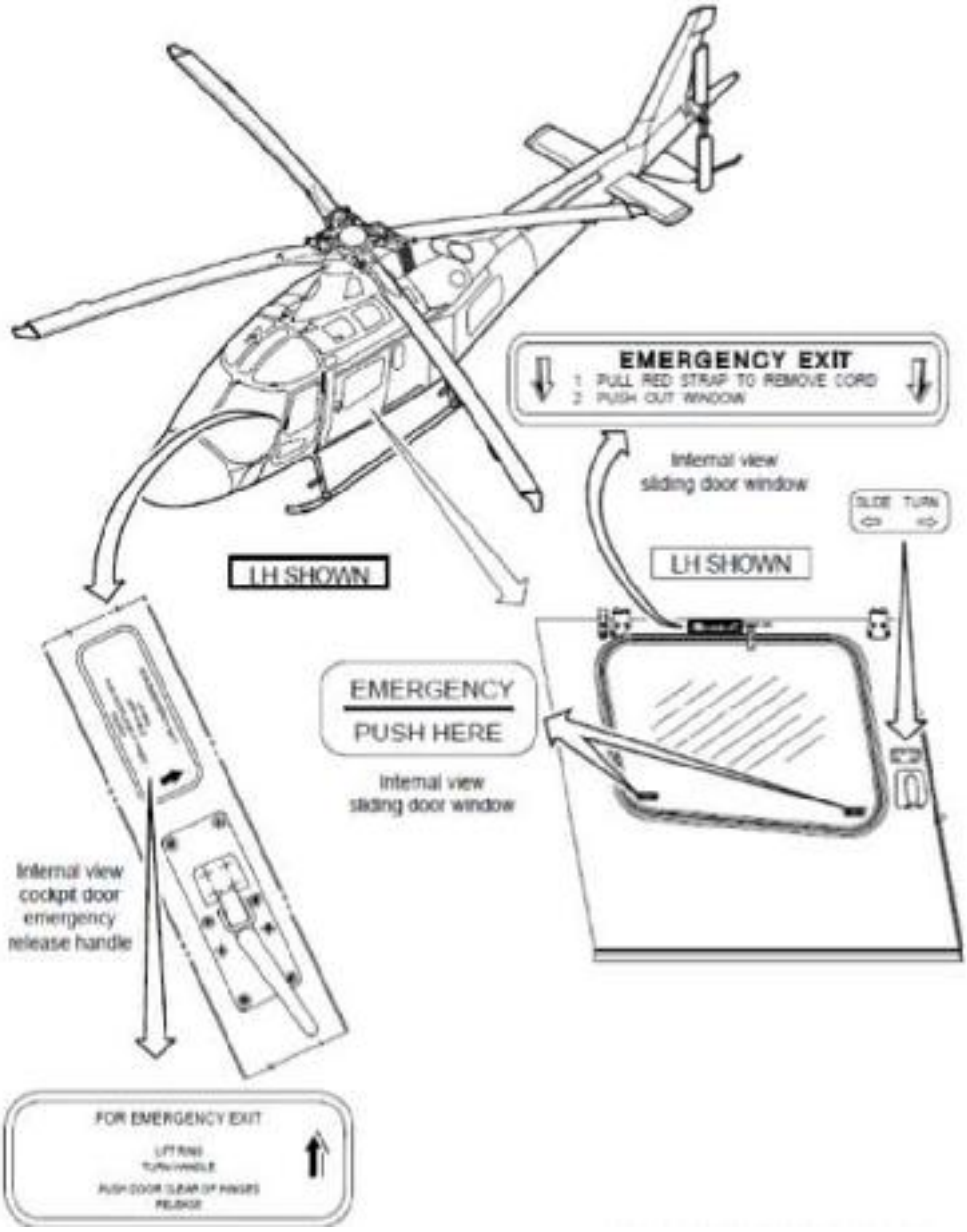

Figure 8: Location and markings of AW 119MKII Emergency Release Mechanism on LH side

1.6.6 Radio communication system

The helicopter was equipped with four radios (designated COM 1 to 4). COM 1 and COM 2 were very high frequency (VHF) radios used by the pilot for communication with air traffic control units.

COM 3 and 4 were low frequency.

Figure 9 : ICS control panel

1.7 Meteorological Information

1. The Forecast by the Kenya Meteorological Department for 13 June 2020 valid from 1700 (2100) for 24 hours issued on 12 June 2020 for Meru and other areas was stated as; “Showers are expected over a few places tonight. Cloudy morning with

light rains breaking to sunny intervals expected tomorrow. Showers expected over a few places in the afternoon."

2. The reported weather by the Kenya Meteorological Department indicated that the weather condition at the location of the accident at the time of the occurrence was: generally calm winds, the total cloud cover was overcast OVC (8/8 Oktas) at a height of 1000 ft from the surface in fog.

Figure 10 : A picture taken by one of the witnesses moments after the accident depicting fog in Kaithe

1.8 Aids to Navigation

The accident flight was operated under VFR, during which the aircraft was required to remain clear of cloud and the pilots had to maintain in sight of the surface, so visual contact with the surface was the principle method of navigation.

1.9 Communication

The area around Meru where the helicopter was to execute a landing is uncontrolled airspace; therefore the helicopter was not in contact with any ATC unit. After the accident, the PF relayed the information regarding the accident through the telephone to the commandant.

1.10 Aerodrome Information

Not Applicable

1.11 Flight Recorders

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder. Neither recorder was required by the Kenya Civil Aviation Regulations.

The EEC was recovered with no visible damage and was sent to TSB for download and technical analysis. The full report is as follows:

TSB ENGINEERING LABORATORY REPORT LP164/2020

NVM DATA RECOVERY

Occurrence A20F0108
Augusta AW119 Helicopter
13 June 2020

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TSB Engineering Laboratory Report LP164/2020

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1.0 INTRODUCTION

1.1 Occurrence details

Occurrence details relevant to this engineering report appear in Table 1.

Table 1: Occurrence details

Operator	Type	Registration	Flight	Departure	Arrival	Phase
Kenya Police	Augusta AW119	5Y-NPW	n/a	Embu Airport (HKEM)	n/a	n/a
On 13 June 2020, an Augusta AW119 helicopter, registration 5Y-NPW, was on a flight from Embu Airport (HKEM), Kenya, to Jomo Kenyatta International (HKJK) with 2 crew members and 4 passengers on board. The helicopter crashed in a banana plantation approximately 6 NM from the town of Meru, Kenya. All occupants were injured and the helicopter sustained substantial damage.						

1.2 Engineering services requested

An electronic engine control (EEC) was recovered from the occurrence site by the Aircraft Accident Investigation Department (AAID) of Kenya and sent to the Transportation Safety Board of Canada (TSB) Engineering Laboratory to extract any data relevant to the occurrence.

As Canada is the state of manufacture for the system recovered from the occurrence aircraft, the TSB appointed an Accredited Representative to this investigation in accordance with the International Civil Aviation Organization (ICAO) Annex 13, Section 5.24. Pratt and Whitney Canada (P&WC), as the equipment manufacturer, was appointed as technical adviser to the TSB Accredited Representative.

1.3 Parts received

Details of the item recovered are provided in Table 2.

Table 2: Parts received

Item	Model	Serial number	Manufacturer
EEC	EEC37-1 (p/n: 1000670-1-006)	17040106	Hamilton-Sundstrand (for Pratt & Whitney Canada)

2.0 EXAMINATION

2.1 EEC

The EEC received (Figure 1) appeared undamaged other than some superficial scratches to the case. The case was opened and the circuitry was microscopically examined (Figure 2) prior to any recovery attempts to ensure it would not be damaged when power was applied to the unit; no damage was noted to the circuit board, connections, or any of the components.

Figure 1: EEC as received.

Figure 2: EEC circuit board.

After the detailed physical examination, the EEC was sent to P&WC to perform a download of the unit's non-volatile memory.

Due to current travel restrictions, it was not possible to be physically present for the download of the unit, but a virtual examination was performed with live video between the TSB and P&WC participants. The download occurred at the P&WC facility in St. Hubert, Quebec, on 20 November 2020.

The unit was connected to the test equipment and was powered up without any issue. All data was then extracted successfully. After downloading the data, it was determined that limitations with the equipment presently available at P&WC, it was not possible to decode data from this version of EEC

The occurrence EEC is a model which only stores minimal information in a circular buffer. It does not record any exceedances, trends and does not reference time. There are some faults

which are recorded however the only parameters recorded related to engine operation is NF, CLP and NR. Due to the limitations in the recoverable data, no further attempts were made to decode the data. This limited data is normal for this model of unit.

From the bench download, it was possible to determine that the unit did store data, although limited as per the unit design. The EEC was able to communicate successfully, so there was no indication during the testing that the unit was not working properly.

All data was sent to the Kenyan Investigator-in-charge (IIC).

3.0 CONCLUSIONS

All data was successfully extracted from the EEC, however it was not possible to decode the data.

All data was sent to the IIC.

1.12. Wreckage and Impact Information

1.12.1 General Description of the Site of the Accident

The wreckage was confined within the same area.

Figure 11: The helicopter collided with terrain at Kaithe location 5nm South East of Meru town close to Cyompiou hill

1.12.2 Impact Sequence

According to what was learned by the Initial response team, several witnesses (twelve in total, none of them with any specialized aviation knowledge) had sighted the aircraft moments before it crashed into the ground characterized by poor visibility. The sequence of events as reported by the crew and eyewitnesses was consistent with the evidence at the accident site. The majority of the accounts told of an aircraft on a low altitude controlled flight in fog, flying from North East made a sudden right

hand turn to avoid an aerial mast before the blade clipped a tree, then nosedived. It then collided with another tree and tumbled to the ground.

The passengers indicated that they boarded the helicopter in Embu just before 8am local time. The weather was cloudy, but visibility was good. Moments before the accident, they narrated that the helicopter had flown in fog for about 15 to 20 minutes, and during this time, they noticed the copilot was nervous. They heard a loud bang and noticed that the helicopter had hit a tree before they tumbled to the ground.

Figure 12: The aircraft evaded the mast shown in the picture

Figure 13: The tree branch that first came in contact with the main helicopter rotors

Figure 14: The wreckage and the trees that were involved in the occurrence

1.12.3 Distribution Pattern of the Wreckage

The helicopter was basically intact, except a portion of the main rotor blade which was strewn 15 metres along the flight path from the main wreckage. All the helicopter parts were accounted for at the accident location. There was no evidence of inflight breakup. The antennae remained attached to the belly of the fuselage. The tail boom was still attached to the fuselage.

Figure 15: Part of the main helicopter rotor.

Figure 16: The helicopter tail rotor still intact

The exam of the damage sustained by the main rotor blades showed that, at the moment of the collision with the ground, the 5Y-NPW rotors were turning at high speed; just on account of aerodynamic and inertial forces indicated by the shearing off of the blades but still attached to respective pitch control levers. All the four composite main rotor blades had fractured from the root. The severed blades were consistent with blade failure on impact with the ground.

Figure 17: The sheared off main rotors

The swash plate assembly remained installed on the main rotor shaft centering plate. The cabin was intact. The cyclic, collective, throttle, and the pedals appeared normal with no visible deformations. The cockpit and the instrument panel were generally intact. Both the Electronic Display Units (EDUs) 1 and 2 (primary and secondary) were still in place. Pitch link fractures exhibited signatures consistent with overload.

Figure 18: The aircraft cabin, with EDU 1 and 2

Figure 19: Throttle and collective control

Figure 20: The cyclic control and pedals

All significant components of the helicopter were located within the wreckage area. Examination of the main assembly found damage consistent with powered rotation at the time of impact. The tail rotor assembly was intact with no visible damage. The initial point of impact consisted of a tree towering at 15 m that made contact with the main rotors as per the witness mark. The helicopter then contacted a second tree 8 m away, that broke off possibly due to the airplane's weight, before contacting a third tree and coming to rest on its starboard side.

Visual inspection of the engine did not display pre-impact anomalies that would have precluded normal operation. Witness marks on ground consistent with the lengths and widths of a main rotor blade and containing fragments of rotor blade skin and honeycomb was positioned in the direction of the helicopter.

Flight control continuity was established from the cockpit controls to the associated components. There were no discrepancies noted that would have prevented or degraded normal operation before impact.

The helicopter was salvaged, transported to Wilson airport, Nairobi and further examined. The sponson was removed prior to shipment to Nairobi. The fuselage skin belly skin panels generally did not exhibit deformations. The antennae remained attached to the tail boom.

Figure 21: 5Y-NPS at Wilson airport NPSAW hangar after recovery

Figure 22: 5Y-NPW tail boom at NPSAW hangar at Wilson airport after recovery

1.13 Medical and Pathological Information

There was no evidence that physiological factors or incapacitation affected the performance of the crew.

1.14 Fire

There was no pre or post-impact fire.

1.15 Survival Aspects

1.15.1. Collision Impact

The account of the pilot indicated that they had identified an area to execute landing, and therefore just before the main rotor blades contacted the trees, the helicopter was at low altitude at low speed. Onsite examination of the wreckage revealed that the aircraft collided with terrain at low impact owing to the fact that the helicopter`s momentum was cushioned by the two trees. The accident was survivable.

1.15.2. Search and rescue

After impact with the terrain, the pilot switched off the engine. The second pilot opened the left upper glass console and disembarked unassisted. Members of the public who witnessed the occurrence broke the left rear window and extricated all the passengers. The Captain was the last to evacuate from the wreckage through the left emergency exit unassisted. The vehicle which was within the crash site was used to transport the injured to the hospital.

1.16 Organizational and Management Information

The National Police Service Air Wing is a fully-fledged unit under the National Police Service headed by a Director who reports to the Inspector General. Under the commandant is a deputy commandant. NPSAW has four sections namely Operations, Engineering, Personnel/Logistics and Support Services. Operations and Engineering sections are headed by a Chief Pilot and Chief Engineer respectively. The Unit was established to support the following functions of the NPS.

i. Providing air support to the Service.
ii. General government communication flight facilities and carriage of V.I.Ps.
iii. Transport air support for the Service, government ministries, and other authorized agencies.
iv. Casualty evacuation

Besides the accident helicopter, the NPSAW operates other types of fixed and rotary wing aircraft (Total 13) without an Air Operator’s Certificate these include: four MI-17, two AW 139, four Agusta Bell 206B, and two Cessna 208B.

NPSAW is not a holder of Air Service License or Air Operator License. KCAA states that it does not oversight the NPSAW operations, although the NPSAW aircraft are operated on the Kenya civil aircraft register as required by the Force Standing Orders. Further, the Orders require compliance with the Kenya Air Navigation Regulations as stipulated in the NPSAW Operations Manual. ICAO and the Kenya Civil Aviation Legislation classify aircraft used in Police work as State aircraft. Therefore, falls outside the civil aircraft regulatory regime.

1.16.1 Aircraft Maintenance Organization

The NPSAW has an aircraft maintenance facility at Wilson airport, where all the fleet undergoes maintenance. The Maintenance Procedure Manual that was provided to investigators was dated 1st January, 2011. The manual was not approved and not up to date. The manual includes thirteen aircraft: two Cessna 208B, one Cessna 402C, three Cessna 310R, three MI-17 MB-3, one Bell 206 L-I, one Bell 206 L-4, one BO-105 CBS-4 and AS 350 Be. NPSAW no longer operate certain aircraft types such as: Cessna 402C, Cessna 310R, BO-105 CBS-4 and AS 350 Be. After acquiring AW 119 and AW 139, no provision for an Addendum, to include the Agusta Westland aircraft types was made.

1.16.2 Operational Procedures

NPSAW Standard Operating Procedure Manual discusses the VFR weather minimums and states that, for passenger day flight operations, a cloud base of 500ft above the highest ground or obstacle with 5nm of track or a horizontal visibility of ½ nm or 900m.

2. ANALYSIS

2.1 Crew Qualifications and Training

The Pilot Flying was certified by the KCAA and qualified to fly the AW 119 MK-II aircraft. He held a CPL (H) without Instrument rating and had accrued 987.4 hours of flying on the aircraft type with

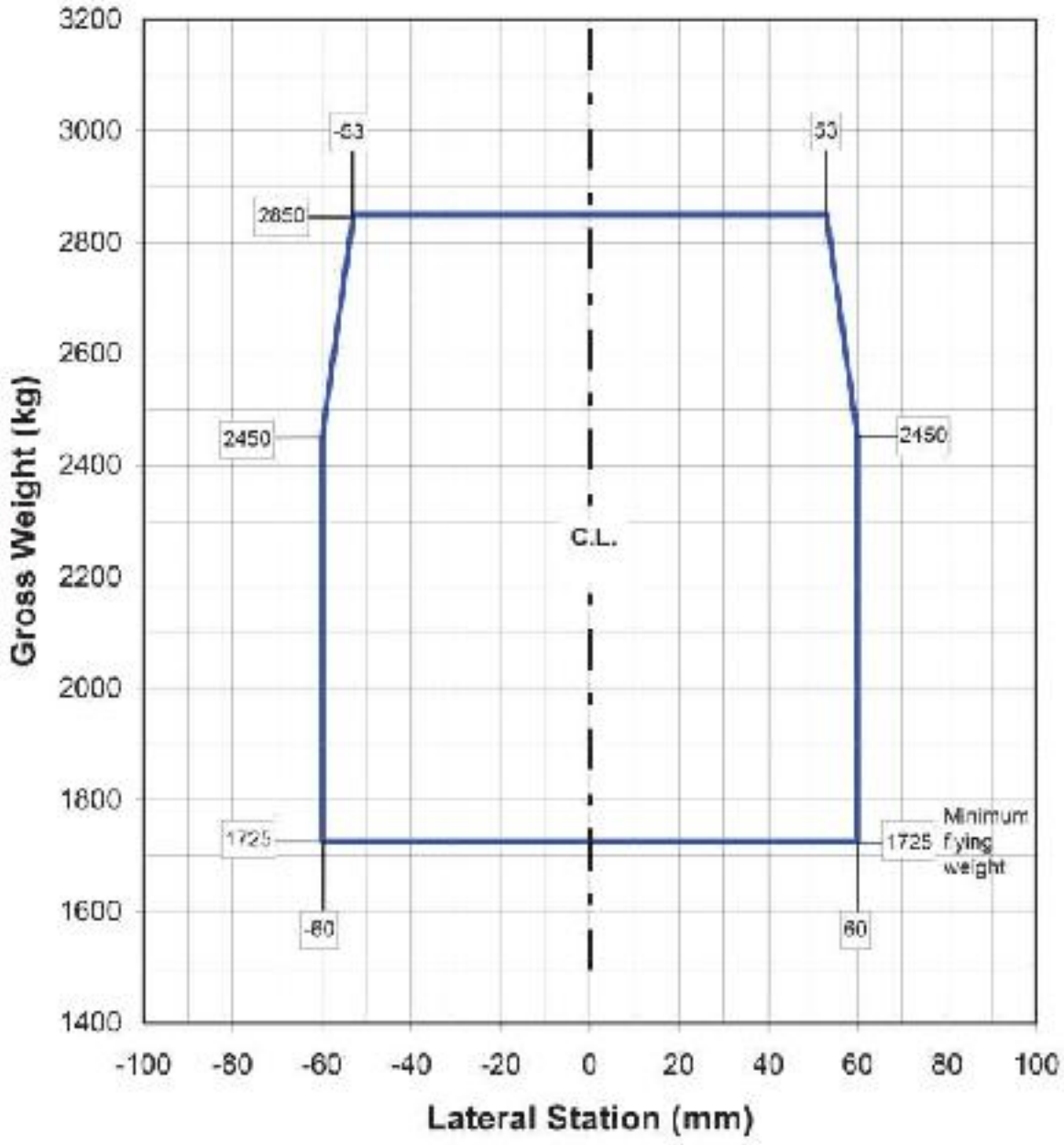
a total of 987.4 flight hours. The Pilot Monitoring held a CPL (H) was also certified by the KCAA and qualified to fly the AW 119 MK-II aircraft. She had 351.5 flight hours on AW 119 MKII aircraft with a total of 623.4 flight hours.

Interview with the NPSAW Commandant revealed that the Air Wing conducts cockpit Crew Resource Management; however, there was no evidence of documented procedure or training program in support of this. The investigation established that the crew members were not trained on Crew Resource Management (CRM).

2.2 Aircraft Airworthiness

The aircraft adhered to the maintenance schedule as itemized by the manufacturer with its last major inspection was performed on 30 May 2020. The helicopter had accumulated 907.51 hours since manufacture. The Total hours since the last major inspection before the incident were 26.56 hours. Review of its maintenance history did not identify evidence of overdue items nor significant defects recorded on the helicopter.

2.3 Weight and Balance



Graph of the AW119 MKII weight

The investigation established that the aircraft weight and balance data was not prepared before the flight or before each leg of the flight. The helicopter took off from Wilson airport with three

occupants and full tanks of fuel before three more occupants embarked in Embu with no luggage. The computation of weight and balance on take-off from Embu is as follows;

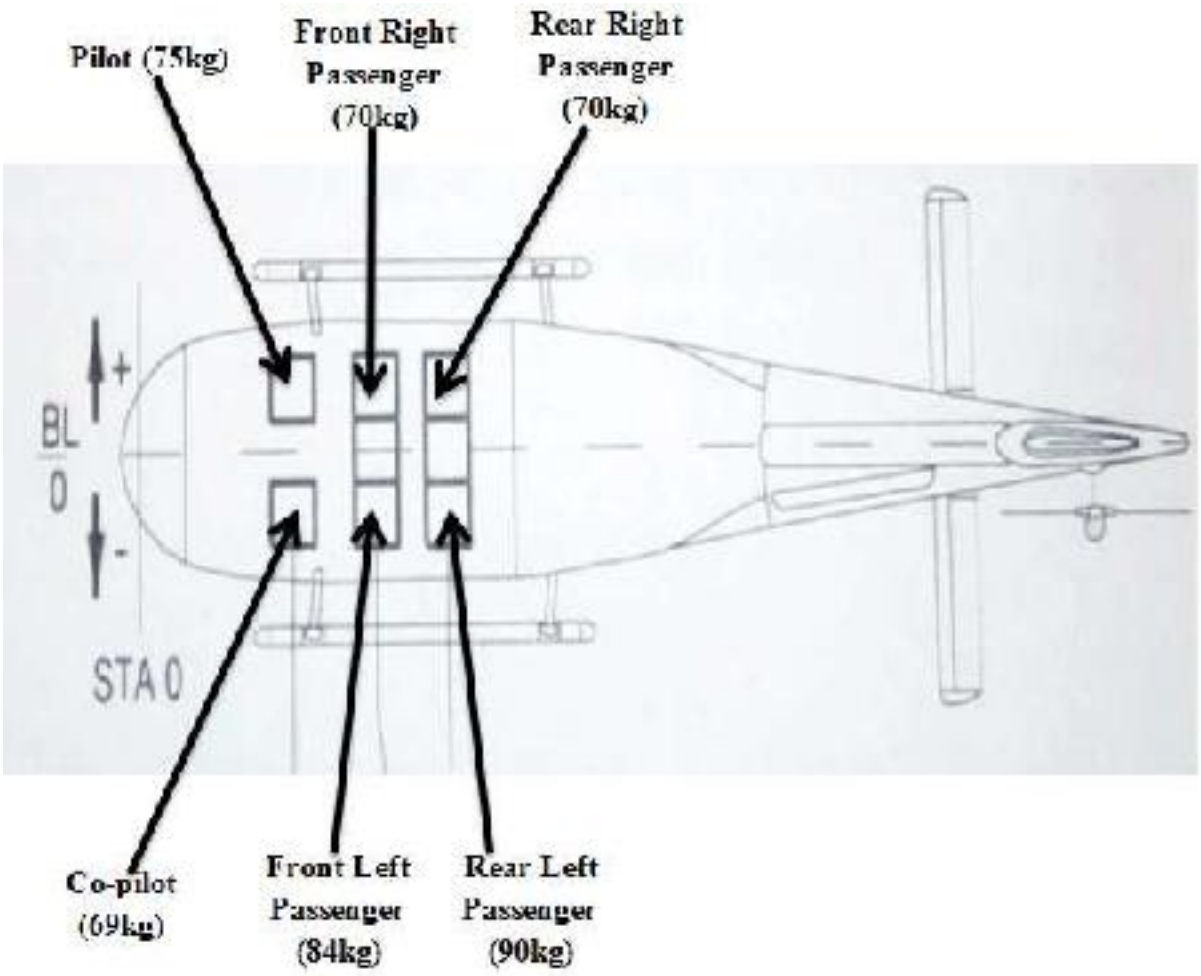


Figure 24: The seating configuration of the event flight

i. The empty weight of the aircraft AW119 MK 11 was 1765.5 Kg;

ii. The longitudinal and lateral arms for the empty weight were 3645mm and -3.06mm respectively. Figures obtained from Chart C in Section 6 of the Aircraft flight manual;

iii. The weight of the fuel was obtained as 424.04 Kg. The density of the fuel is 0.804 Kg/l.

iv. The lateral arm for the fuel is zero (0) since the fuel weight was above 240 kg as depicted from Table 6-8 on Section 6 of the flight manual. The longitudinal arm of the fuel was approximately 3883.434 mm. To get the longitudinal arm of the fuel, figures in Table 6-3 were interpolated. Since the fuel weight was between 420 to 440 kg, therefore, the longitudinal arm was;

$$3880 + \left[\left(\frac{424.04 - 420}{440 - 420}\right) \times (3897 - 3880)\right] = 3883.434\ mm$$

v. The longitudinal (STA) and the lateral (BL) arm of the passengers obtained from figure 6-1 in Section 6 of the flight manual. The longitudinal arm of the Pilot and Copilot was 1585mm. The lateral arm of the Pilot was 350mm while that of the Copilot was -325mm. The longitudinal arm of the front passengers was 2455mm and their lateral arms were 430 mm for the right seat and -430 mm for the left seat. The longitudinal arm of the back passengers was 3200mm and their lateral arms were 430 mm for the right seat and -430 mm for the left seat.

2.3.1 Longitudinal Loading Computation

Table 5: Longitudinal loading Computation

ITEM	WEIGHT (kg)	CG Arm (mm)	Moment (kg mm)
Empty weight	1765.5	3645	6435247.5
Pilot (male)	75	1585	118875
Copilot (female)	69	1585	109365
Passenger (1 male right front seat)	75	2455	184125
Passenger (1 female left front seat)	69	2455	169395
Passenger (1 male right back seat)	75	3200	240000
Passenger (1 male left back seat)	75	3200	240000
Fuel (JET A-1)	424.04	3883.434	1646731.35
Take-off weight	**2647.54**	**22008.434**	**9200288.85**

The weight-CG combination computed above falls within the approved limits.

2.3.2 Lateral Loading Computation

Table 6: Lateral loading Computation

ITEM	WEIGHT (kg)	CG Arm (mm)	Moment (kg mm)
Empty weight	1765.5	-3.06	-5402.43
Pilot (male)	75	350	26250
Copilot (female)	69	-325	-22425
Passenger (1 male right front seat)	75	430	32250
Passenger (1 female left front seat)	69	-430	-29670
Passenger (1 male right back seat)	75	430	32250
Passenger (1 male left back seat)	75	-430	-32250
Fuel (JET A-1)	424.04	0	0
Take-off weight	**2647.54**	**21.94**	**-16197.43**

The aircraft was operated within both longitudinal and lateral C of G limits and below the MTOW. Weight and balance is considered not relevant to the cause of the accident.

2.4 Fuel

The aircraft tanks were topped up with 460 liters of JET A-1 fuel on 13 June 2020. The aircraft's endurance was 2.2 hours and had flown 1 hour 13 minutes up to the time of the accident. Fuel in the tanks at the time of the accident was 225 litres.

When the helicopter impacted the ground, the main rotor propellers were still turning with power. This is consistent with evidence at the site and the witness account. Fuel was therefore not a factor in this accident.

2.5 Meteorology

The weather forecast for 13 June 2020, valid from 1700 (2100) for 24 hours and issued on 12 June 2020 for Meru and other areas; "Showers are expected over a few places tonight. Cloudy morning with light rains breaking to sunny intervals expected tomorrow. Showers expected over a few places in the afternoon."

The reported weather by the Kenya Meteorological Department indicated that the weather condition at the location of the accident at the time of the occurrence was: generally calm winds, the total cloud cover was overcast OVC (8/8 Oktas) at a height of 1000 ft from the surface in fog.

The prevailing weather conditions at the time of the accident as reported by the crew was marginal and kept deteriorating for VFR operation. This necessitated an impromptu landing at Kaithe in Meru that subsequently resulted to the accident.

The witness account on weather conditions at Meru at the time of the accident and the pictures taken just after the accident is consistent with the reported weather by the Kenya Meteorological Department.

In Kenya, Automatic Terminal Information Service (ATIS) is a continuous broadcast of recorded aeronautical information that is available at airports. ATIS broadcasts contain essential information, such as current weather information, active runways, available approaches, and any other information required by the pilots, such as important NOTAMs. Pilots usually listen to an available ATIS broadcast before contacting the local control unit, which reduces the controllers' workload and relieves frequency congestion.

There is need for aviators in remote area in Kenya to receive real time weather forecast that provides inflight weather briefing services and weather advisories to flights. There's need for such services to be easily accessed either through a system of automated telephone recordings of meteorological and aeronautical information, that will include area and route briefings, airspace procedures, and special announcements. The recordings may be automatically updated as changes occur or phone call to KMD specialist for the briefing.

2.6 Flight Plan

A briefing by the NPSAW Commandant two days before the scheduled flights and subsequent filed flight plans for AW 119 and AW 139 indicated that the aircraft were to depart Wilson airport and pick up senior security teams from Embu and Wajir respectively and drop them at Badan Arero in Marsabit for the anticipated Peace Mission.

The Agusta Westland AW139 is a twin-engine helicopter built to be operated by two flight crewmembers but was also designed to enable single-pilot operations under instrument flight rule conditions. The pilot who was flying the AW 139 held an ATPL with instrument rating. After takeoff from HKNW, routed via SEAL at 6200ft, climbed to 7500ft at the zone boundary and was clear off the clouds.

AW 119 MK-II aircraft is a single-engine helicopter certified in the transport category with subcategory Passenger, for day operation under VFR. The two flight crewmembers for 5Y-NPW were not instrument rated. After lift off from HKNW, through SEAL, the crew reported that the weather depreciated. In response to deteriorating weather conditions, the crew made a landing and waited for the situation to improve. While waiting for the visibility to improve, the crew deliberated on the way forward. The original plan to route via Embu to Wajir was revised to route to Isiolo via Embu. After lift off from Embu, the helicopter was enroute to Isiolo, when the accident occurred in Meru.

The crew might have not planned adequately for the revised Embu-Isiolo route following the midway reconsideration of the original route.

2.7 The Event Flight

The mission was to involve two helicopters; AW 139 and AW 119, which were to ferry North Eastern and Eastern security teams respectively. The first helicopter, AW139 was to lift off from Wilson airport, fly to Garissa, Wajir, and then Badan Arero in Marsabit. The second helicopter AW 119, flight was to originate from Wilson airport via Embu to pick up three passengers, then route to Marsabit before ending at Badan Arero.

The planned peace mission was to reconcile two communities that were embroiled in cattle rustling in the region. The two teams; the North Eastern and the Eastern each led by the Respective Regional Commissioners were to congregate in Badan Arero in Marsabit where the reconciliation of inter-communal conflicts was to take place. The AW 119 was to pick up the officials of the Eastern team from Embu and fly them to the appointed venue of the Peace Mission, while the AW 139 was to pick up the officials of the North Eastern team from Wajir and fly them to Badan Arero.

5Y-NPW was conducting a VFR flight from Wilson airport to Embu made a precautionary landing 4 miles to the west of Ndula marker when the prevailing weather conditions deteriorated to a level

which was unsuitable for VFR operation. The aircraft lifted off at about 0440, for Embu, when the weather conditions improved, where three more passengers embarked before setting course for Isiolo. While enroute from Embu to Isiolo, the weather conditions appeared to depreciate along the flight path at a distance ahead, prompting the captain to hand over the flight controls to the copilot, while he made various telephone calls to establish the weather condition at their destination.

The FAA-H-8083-21, states: There are numerous classic behavioral traps that can ensnare the unwary pilot. Pilots, particularly those with considerable experience, try to complete a flight as planned, please passengers, and meet schedules. This basic drive to achieve can have an adverse effect on safety and can impose an unrealistic assessment of piloting skills under stressful conditions. These tendencies ultimately may bring about practices that are dangerous and sometimes illegal and may lead to a mishap. Pilots develop awareness and learn to avoid many of these operational pitfalls through effective single pilot management training.

AAID postulate that the crew may have suffered from "get-home-itis", or "plan continuation bias", i.e. following "the plan" even when evolving circumstances justify adaptation.

The tendency to want to continue, despite the situation having changed, seems to have more compelling and stronger as the end of a task approaches. It is especially flying under VFR conditions that increase the risk of accidents, where in order to arrive, and one fly into such poor visibility conditions that visual references are lost. In such circumstances, the danger of losing control of the aircraft increases dramatically.

This may explain that they continued the flight even though the visibility and weather conditions appeared to deteriorate below defined VFR weather minima. It may be that a combination of "plan continuation bias" and lack of instrument ratings for the pilots could be factors that have contributed to the accident.

The accident occurred when the pilot was executing a precautionary landing after they cited a landing area. Perhaps the need and urgency to land due bad weather created added pressure to complete the landing.

The weather conditions kept deteriorating below VFR minima, compelling the flight crew to initiate a precautionary landing at an area they had sited. As the helicopter initiated descent to land at the landing spot identified; the aircraft was engulfed in fog. The rate of descend increased considerably prompting the copilot to advise the PF to reduce the rate of descend.

The investigation found that the approach for precautionary landing was performed at short notice in fog without adequate visual reference to the ground. In addition, the flight crew did not conduct the required briefings.

As a result, neither crew member had developed a correct or complete understanding of the characteristics and challenges of the landing site.

When the pilot flying realized that the mast was closer than expected during the approach profile, the large control inputs made to adjust the rate of descent resulted in a hazardous approach profile, which went unrecognized as both flight crew members were occupied with maintaining visual reference.

The PF tried to arrest the sink rate, only to become aware of the power cables and masts which he thought might obstruct his path; he raised the collective and yawed to the left. With a weight of 2573kg at 4711ft above mean sea level, the power setting was probably not adequate to sustain flight and the PF felt the natural sink which he tried to arrest by raising the collective.

The helicopter main rotors contacted a tree that stood at a height of 15m, impacted two other trees along the flight path before it finally came to rest on ground on its right-hand side.

The damages suffered were accident consequential with no component showing a progressive failure mode or indications of pre-existing failures.

Several witnesses heard the airplane pass over their location at low level in fog and feared that it was going to crash on them, prompting them to scamper for safety. Some of the witnesses reported that the engine was making loud sound intermittently, and then it sounded like the engine power was reduced to prepare for landing. All these time, some of them reported that they had observed the airplane descending out of the low overcast cloud layer, while others reported that they were unable to see the helicopter due to heavy fog.

The airplane appeared to evade hitting electricity power lines by turning to the left, before the main rotor blades contacted a tree. The aircraft crashed a few m away from their location, after colliding with two other trees before it came to rest on its starboard on ground. These witnesses also reported that there had been rain just prior to the accident, and the overcast cloud layer was up to the ground level.

The FAA Handbook of Aeronautical Knowledge (FAA-H-8083-25B) states:

...Under normal flight conditions, when there is a visual reference to the horizon and ground, the sensory system in the inner ear helps to identify the pitch, roll, and yaw movements of the airplane. When visual contact with the horizon is lost, the vestibular system becomes unreliable. Without the visual reference outside the aeroplane, there are many situations where combinations of normal motions and forces can create convincing illusions that are difficult to overcome.....unless a pilot has many hours of training in instrument flight, flight in reduced visibility or at night when the horizon is not visible should be avoided.

When 5Y-NPW inadvertently entered the clouds in Meru, the pilot recognized how close they were to the electric poles on the flight path as he prepared to execute a precautionary landing. He yawed to the left, at the same time the ROD was quite high. The pilot flared and the helicopter experienced a sink before the main rotor blades collided with trees.

Given the lack of an instrument rating and the transition from visual meteorological conditions to instrument meteorological conditions, it`s highly likely that when the VFR pilot entered the clouds; in the absence of the horizon, with changes in flight attitude, and manoeuvres that may have resulted in g forces, while trying to reduce the ROD, the pilot`s sense of balance was affected that resulted to spatial illusions and disorientation (somatogravic and somatogyral illusion) that may have caused spatial disorientation.

2.8 NPSAW Standard Operating Procedures

NPSAW Standard Operating Procedure Manual discusses the VFR weather minimums and states that, for passenger day flight operations, a cloud base of 500 ft above the highest ground or obstacle with 5nm of track or a horizontal visibility of ½ nm or 900 m.

A review of NPSAW documentation found no operational procedures or guidance specified in standard operating procedures (SOPs) or operations manual for flight crew to deal with deteriorating VFR weather conditions (such as reduced visibility and ceilings), inadvertent instrument meteorological conditions (IIMC) avoidance procedures, or IIMC recovery procedures.

The investigation further established that the SOPs provided little guidance in a number of areas, which contributed to poor decision-making and coordination by the crew. NPSAW had not established an effective safety management system (SMS) that would have assisted the organization identify and mitigate the risks associated with its operations.

3. CONCLUSION

3.1 Findings

1. The pilots' aviation medical certificates and license certificates were valid;
2. The pilots were qualified and had enough experience for the flight;
3. The pilot and copilot were non-instrument-rated;
4. The flight was VFR;
5. The accident occurred after loss of visual references;
6. The helicopter and its engine were being maintained under continuous maintenance programme in accordance with the manufacturer's recommendations;
7. At the moment of the accident, the aircraft weight and Center of Gravity were within the limits established by the manufacturer;
8. The aircraft departed from HKNW with full load of JET A1 fuel;
9. At the moment of the accident, the aircraft had approximately 180.9Kg of fuel;
10. There was no evidence of pre-existing medical or physical conditions that might have adversely affected the flight crew performance during the flight;
11. The impact with the terrain was with little energy.

3.2 Probable cause

The crew's lack of situational awareness and the decision to continue the flight into deteriorating weather conditions that occasioned spatial disorientation, and subsequent loss of helicopter control.

3.3 Contributing factors

The major contributing factors were;

1. Internal (personal-self-induced) and external (social), real or perceived pressure may have influenced the pilots' decisions to continue the flight even when objective assessment of the situation suggested they should do otherwise;

2. The crew's decision to operate into an area surrounded by rising terrain in fog;

3. Failure to conduct risk assessment before flight;

4. Lack of an effective SMS.

4. SAFETY RECOMMENDATIONS

AAID recommend that;

1. Safety Recommendation number 01/01/02/2021 NPSAW to implement Training programs that needs to embrace:
   i. Plan an appropriate CRM training to facilitate implementation of NPSAW missions.
   ii. Enhance the training of the flight crew in threat management, situation awareness, and decision making.
   iii. Safety Management System

2. Safety Recommendation number 02/01/02/2021 NPSAW to review and approve at an appropriate level the Standard Operating procedure and Maintenance manuals.

3. Safety Recommendation number 01/01/02/2021 NPSAW to develop and implement an effective Safety Management System with emphasis on adequate risk assessment programs.

Martyn Lunani
CHIEF INVESTIGATOR OF ACCIDENTS
KENYA

APPENDIX

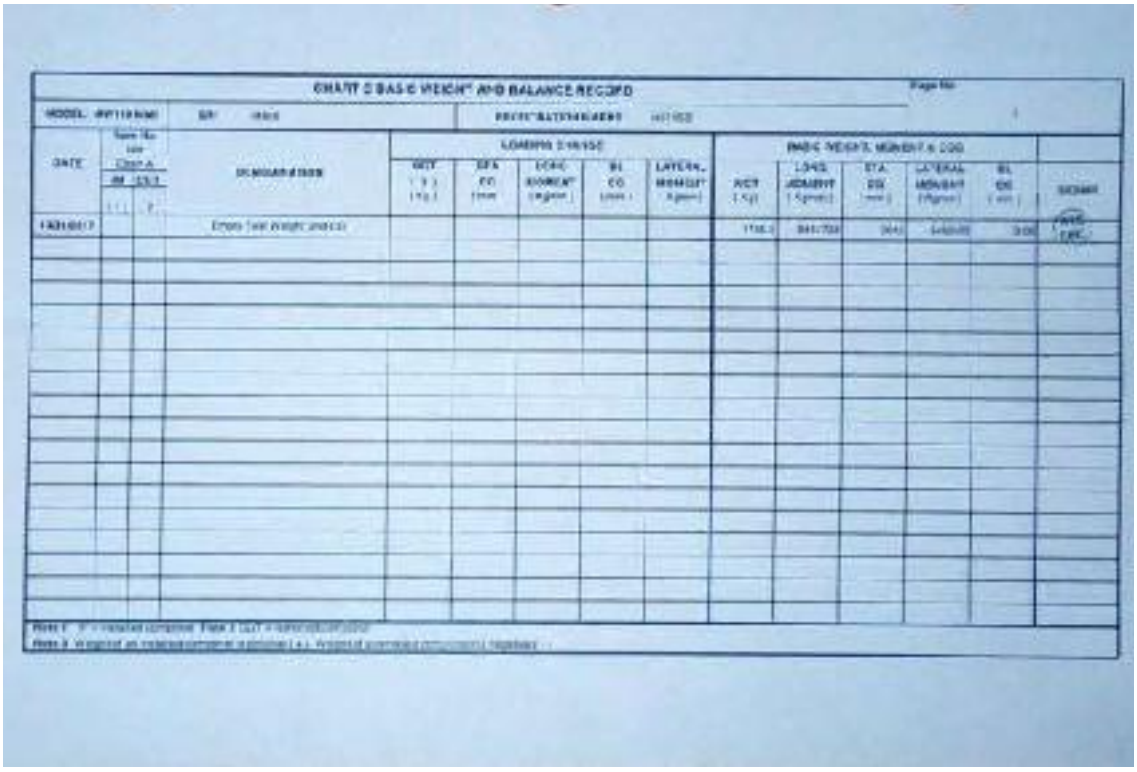


Figure 21: Photo of Aircraft's Flight Manual Section 6 Chart C

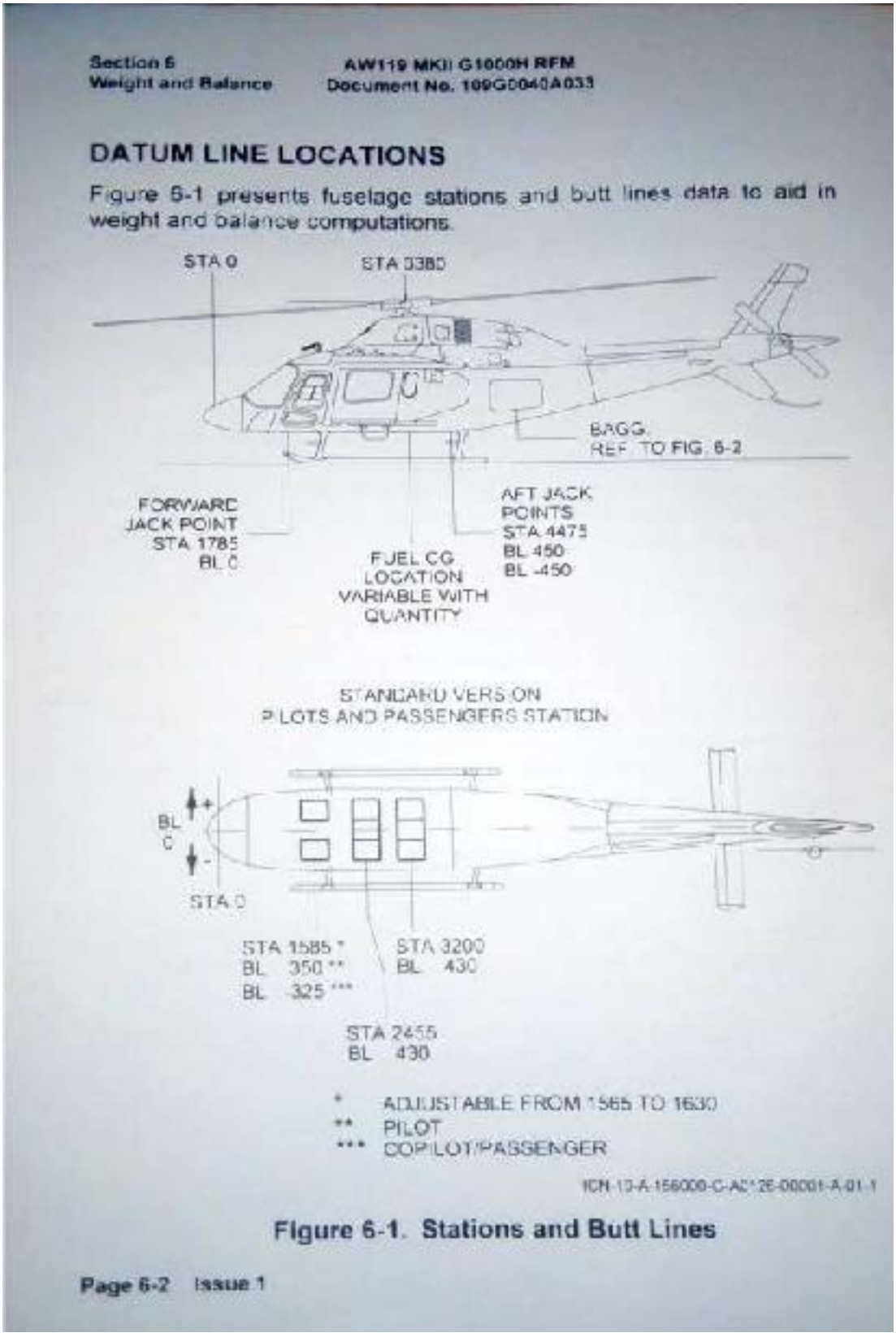


Figure 22: Photo of figure 6-1 in section 6 of the Aircraft Flight Manual.

AW119 MKII G1000H RFM
Document No 109G0040A033

Section 6
Weight and Balance

Table 6-3. Usable fuel - Main fuel tank

Weight (kg)	Capacity l (0.8 kg/l)	Arm (mm)	Moment (kg mm)
20.0	25.0	3324	66480
40.0	50.0	3327	133080
60.0	75.0	3329	199740
80.0	100.0	3331	266480
100.0	125.0	3399	339900
120.0	150.0	3451	415320
140.0	175.0	3505	490700
160.0	200.0	3539	566240
180.0	225.0	3543	637740
200.0	250.0	3551	710200
220.0	275.0	3571	785620
240.0	300.0	3614	867360
260.0	325.0	3662	952120
280.0	350.0	3703	1036840
300.0	375.0	3739	1121700
320.0	400.0	3770	1206400
340.0	425.0	3797	1290980
360.0	450.0	3821	1375560
380.0	475.0	3843	1460340
400.0	500.0	3863	1545200
420.0	525.0	3880	1629600
440.0	550.0	3897	1714680
460.0	575.0	3911	1799060
478.0	595.0	3912	1852112

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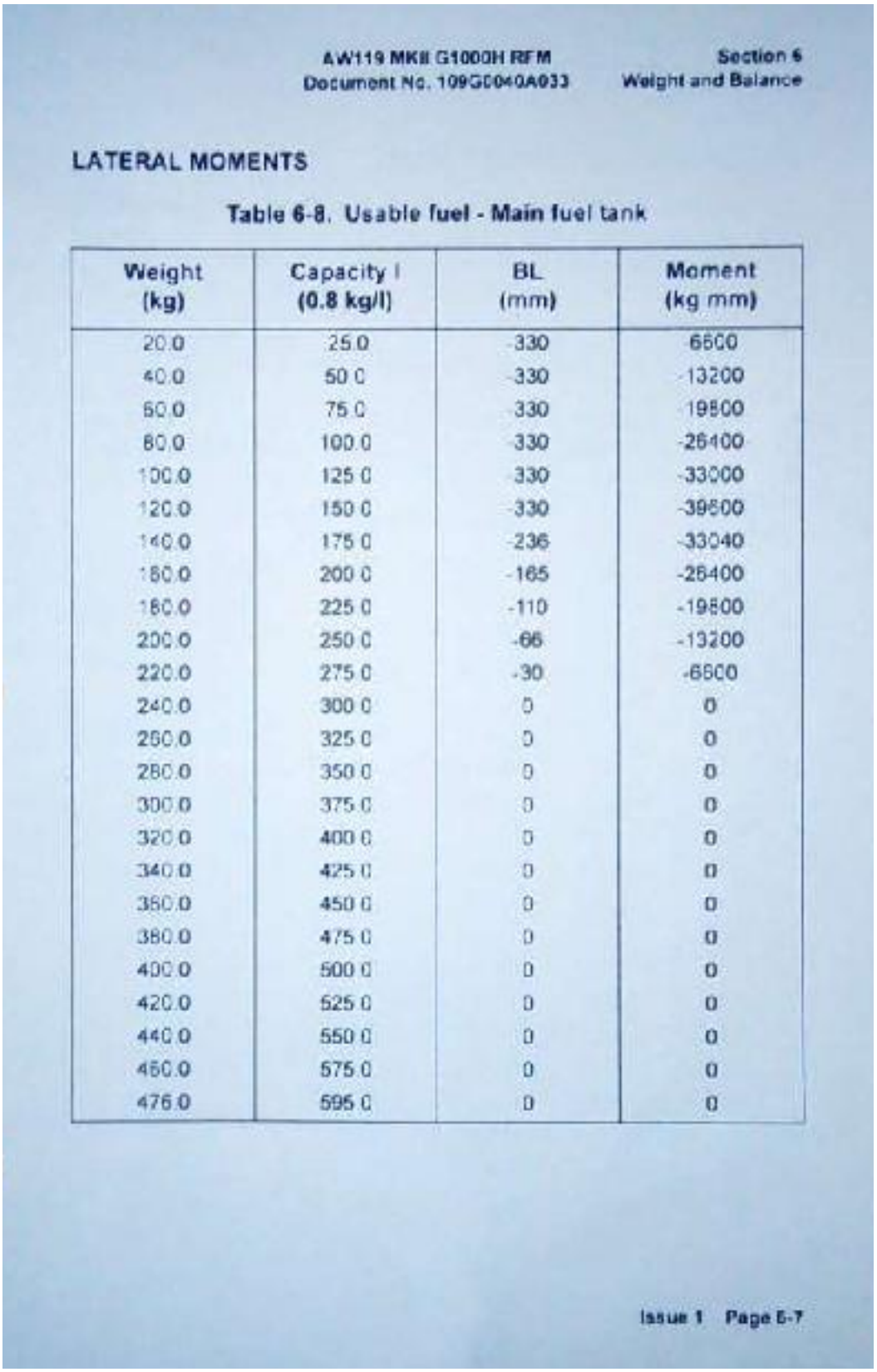
Figure 23: Photo of Table 6-3 in Aircraft's Flight Manual Section 6.



LATERAL MOMENTS

Table 6-8. Usable fuel - Main fuel tank

Weight (kg)	Capacity l (0.8 kg/l)	BL (mm)	Moment (kg mm)
20.0	25.0	-330	6600
40.0	50.0	-330	-13200
60.0	75.0	-330	-19800
80.0	100.0	-330	-26400
100.0	125.0	-330	-33000
120.0	150.0	-330	-39600
140.0	175.0	-236	-33040
160.0	200.0	-165	-26400
180.0	225.0	-110	-19800
200.0	250.0	-66	-13200
220.0	275.0	-30	-6600
240.0	300.0	0	0
260.0	325.0	0	0
280.0	350.0	0	0
300.0	375.0	0	0
320.0	400.0	0	0
340.0	425.0	0	0
360.0	450.0	0	0
380.0	475.0	0	0
400.0	500.0	0	0
420.0	525.0	0	0
440.0	550.0	0	0
460.0	575.0	0	0
476.0	595.0	0	0

Figure 24: Photo of Table 6-8 in Aircraft's Flight Manual Section 6