ROYAL NETHERLANDS AIR FORCE COMMAND

Flight Safety Department

Air Accident Investigation Report nr: CLSK/Mi-8/2006-001

Aircraft type: Mi-8 MTV-1

Tailnumber: YA TAD

Date: 26 July 2006

Location: Afghanistan, N 33° 34.225´ E 069° 47.717´

(Preliminary) report of the investigation of the accident with the Tryco Mi-8 MTV-1 helicopter, registration YA TAD, on the 26th of July 2006 in East Afghanistan.

In accordance with STANAG 3531 the purpose of the accident investigation by the Investigation Team of the Dutch Armed Forces is accident prevention and not to apportion blame or determine liability.

The Team leader,

G.M.P.R. Kierkels
Lieutenant-Colonel RNLAF

Accident investigation report nr: **CLSK/Mi-8/2006-001**

INVESTIGATION TEAM MEMBERS

Name	Grade	Duty Station
G.M.P.R Kierkels	OF-4	Royal Netherlands Air Force Command
R.J.W. Schoonderwoerd	OF-4	Royal Netherlands Air Force Command
R.V. Legue	OF-4	Netherlands Military Aviation Authority
A. Nijhof	OF-3	Netherlands Defense Materiel Directorate

Unless noted otherwise, all times in this report are local time (UTC + 4,5 hrs).

TABLE OF CONTENTS

ABBREVIATIONS

ABP	Afghan Border Police
AOC	Air Operator Certificate
ANA	Afghan National Army
CAA	Civil Aviation Authority
CJTF (76)	Combined Joint Task Force
CRCC	Combined Rescue Coordination Center
CRM	Crew Resource Management
CVR	Cockpit Voice Recorder
DIT	Disaster Identification Team
FDR	Flight Data Recorder
HQ	Headquarters
IAP	International Airport
ICAO	International Civil Aviation Organization
IMC	Instrument Meteorological Conditions
ISAF	International Security Assistance Force
KAIA	Kabul International Airport (Military designator)
LH	Left hand
LRU	Line Replaceable Unit
OAKB	Kabul International Airport (ICAO designator)
PRT	Provincial Reconstruction Team
RH	Right hand
RNLAF	Royal Netherlands Air Force
SAR	Search and Rescue
VMC	Visual Meteorological Conditions
UTC	Universal Time Coordinate (equals Greenwich Mean Time)

GENERAL INFORMATION CONCERNING THE ACCIDENT

Location	: Afghanistan, app. 18 Nautical Miles NW of Khost
Location wreckage	: N 33 34225 E 069 47717
Date and time	: Approximately 10:00 hrs, 26 July 2006
Aircraft	: Mi-8 MTV-1
Crew	: 3 (Pilot in Command, Co-pilot and Flight Engineer)
Passengers	: 9
Phase of flight	: En-route from Kabul to Khost
Type accident	: (Un)controlled flight into terrain

THE INVESTIGATION

For lack of national capabilities, the Afghan Ministry of Transport authorized an Investigation Team of the Netherlands Armed Forces to conduct the investigation. However, due to national considerations, a visit to the actual crash site was not conducted. This decision was supported by the assumption that, in the almost two weeks between the accident and the arrival of the Investigation Team in theatre (during which time the crash site went unguarded), most, if not all useful clues as to the cause of the accident would have disappeared. Such from weather influences and / or the removal of usable items by third parties.

SUMMARY OF THE ACCIDENT

On 26 July 2006 at approximately 10:00 hours, a Civilian Mi-8 helicopter with registration YA TAD, owned and operated by the Afghanistan based and registered fuel company, Tryco International Inc., crashed in the mountainous area northwest of the city of Khost, in eastern Afghanistan. The helicopter was completely destroyed after the impact and post crash fire. None of the 12 occupants survived the crash. Due to this and because the actual flight and voice data recorders were not recovered (contrary to initial believe), the investigation team was unable to determine with any certainty the cause of the accident.

The helicopter departed Kabul International Airport (KAIA or OAKB) at 09:15 hours, en-route to an US-led construction site of future ANA barracks near the city of Khost. On board were 3 crewmembers and 9 passengers. Following normal procedures they were to follow a straight line, locally known as route 150 (due to its course of 152 degrees), to their destination, which would lead them over a high mountain range in between the two locations. The helicopter was operated under Visual Flight Rules. Although the weather at Kabul and Khost was good and fair respectively, conditions in the mountainous area were marginal at best with low clouds, rain- and possible thundershowers.

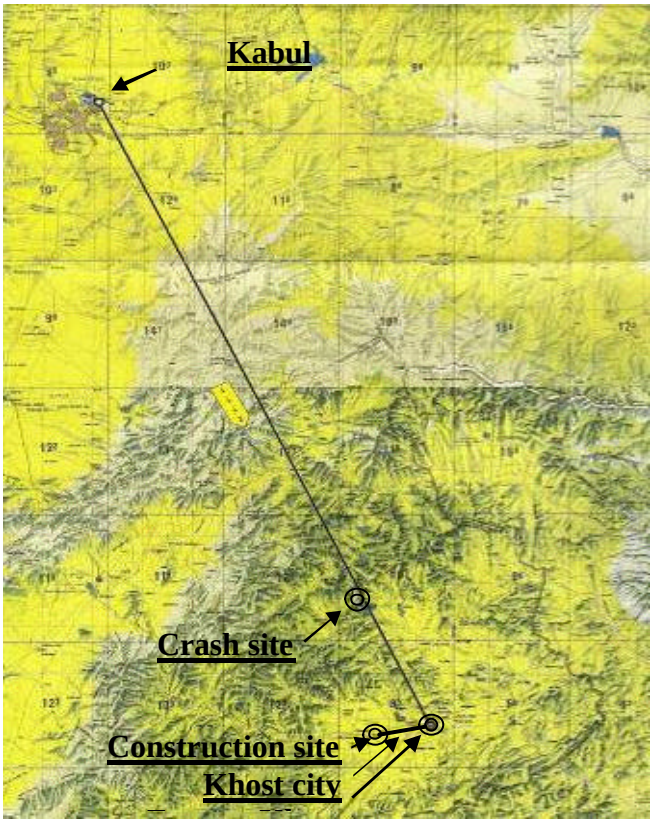
Since the helicopter did not arrive at Khost at the expected time, a call was made to Tryco around 11:20 hrs. Tryco subsequently informed the German Police Project in Kabul, which in turn informed ISAF HQ of a possible missing helicopter. ISAF HQ initiated a missing aircraft response at approximately 13:30 hrs. Search activities by air were hindered by bad weather in the area. Eventually, the crash site was located and at 19:15 hrs secured by Afghan Border Police and Afghan National Army units. A US (Search and Rescue or SAR) ground party arrived at the crash site and commenced recovery of the bodily remains on 27 July 2006.

Based on the location of the wreckage and remains, together with markings on the side of the mountain, the investigation team concludes that the helicopter was flying in a north-northwesterly direction at the time of the accident. It collided with the mountain range just below a slight indentation in the ridgeline. A statement from a local national that the helicopter crashed into the mountainside, made to the SAR unit, further sustains this conclusion. The team was unable to determine with any certainty why the helicopter was on a 180-degree course opposite to its destination. Most likely causes are either bad weather conditions (inadvertent IMC or failure to clear the ridgeline in trying to remain VMC) or a diversion because of hostile activities from the ground. Also, due to unconfirmed witness reports, the possibility that the helicopter became uncontrollable due to small caliber or RPG fire cannot be completely ruled out, nor can the possibility of a technical failure as main or contributing factor in the accident.

PART 1 - FACTUAL INFORMATION

1.1 ***History of the flight.***

The Tryco International Inc. (hereafter Tryco) Mi-8 MTV-1 helicopter, with Afghan registration YA TAD, departed Kabul International Airport (KAIA or OAKB) at 09:15 hrs (see Annex A, Transcript of radio transmissions between YA TAD and KAIA Tower), en route to Khost. Final destination was an US-led construction site of future ANA barracks, west of the city of Khost. On board were 3 crewmembers and 9 passengers with hand luggage only. Following normal procedures they were to follow a straight line, locally known as route 150 (based on compass course)[1], to the former Khost airfield and from thereon westward towards their final destination. This would lead them over a high (tops over 10.000ft) mountain range in between the two locations.



The helicopter was operating under Visual Flight Rules. The weather in the mountain area was marginal at best with low clouds, poor visibility, rain- and possible thundershowers (see Annex B for weather details). This was deemed a fairly regular flight, along a well-known route, flown many times before by the crew involved. Along this route no Air Traffic Control for flight following or radar tracking is available. A local civilian reportedly witnessed the actual crash but provided no information on the helicopter's flight path prior to it. Also, no relevant flight data or voice recorder data have become available. It is therefore impossible to determine with certainty the actual route flown and the final flight path of the accident helicopter. However, the location of the wreckage turned out to be only slightly south of the planned route 150, indicating that the pilots probably did follow this route until shortly before the accident. Furthermore, from the location of the wreckage in a small valley on the south side of a high mountain ridge, as well as from the visible traces of impact, fire and explosion, it can be determined that the helicopter was flying in the opposite direction, i.e. 180 degrees away from Khost, at the time of impact.

As the helicopter did not arrive at or shortly after their expected arrival time, a call was made by one of the companies at the construction site to Tryco around 11.20 hrs. Tryco employees located and contacted the Vice-President who was travelling abroad at the time. She in turn informed the German Police Project in Kabul, which subsequently informed ISAF Headquarters (HQ) about a possible missing helicopter. ISAF HQ initiated a missing aircraft response at approximately 13.30 hrs.

Search and Rescue activities.

Search and Rescue activities were initiated by the ISAF HQ Combined Rescue Coordination Center (CRCC) and conducted by sub-units of Combined Joined Task Force 76 (CJTF-76), including reconnaissance flights by two A-10 aircraft. Two helicopters owned and leased by Tryco also participated in the search operations.

The wreckage and bodily remains were eventually discovered at a location north-northwest of Khost at coordinates N 33° 34.225´ E 069° 47.717´ and at 19:15 hrs secured by Afghan Border Police and Afghan National Army units. Approximately 1 hour earlier, at 18:15 hrs a possible sighting of something burning was reported by one of the searching A-10 aircraft pilots. At 16:57 hrs a report from Afghan Border Police was received about a downed helicopter at a location previously reported at 15:42 hrs by one of the A-10 aircraft conducting search flights in the area. As this is the earliest indication of the possible crash site

[1] Two routes were used to the construction site. One direct from Kabul (KAIA) to the helicopter landing pad at the construction site, known as route 153, the other via the former Khost airfield, known as route 150. According to Tryco, the crew planned to use route 150 for this particular flight.

and the search activities did not start until some hours after the initial missing aircraft report, the exact time of the crash cannot be determined. Based on the location of the wreckage, the estimated en-route and arrival time at Khost and the likeliness of the crew having flown the intended route as planned, the time of the accident can be estimated to have been around 10:00 hrs.

Due to the poor weather conditions, neither the CJTF-76 Search and Resue (SAR) helicopters nor the Tryco helicopters were able to reach the crash location. In the mean time, a CJTF-76 sub-unit moved to the area by road. To avoid friendly fire between troops due to poor light conditions and lack of radio communications with the ANA unit already at the crash site, this SAR unit set up camp 1 kilometer from the site at 22:20 hrs. By this time 3 independent reports had been received at CJTF-76 HQ that there were no survivors. The next morning, 27 July 2006, at 07:00 hrs the CJTF-76 SAR unit moved into the area and reported location of the wreckage at 08:00 hrs. The unit subsequently located and recovered the bodily remains, aided by local civilians. The bodily remains were transported by road to the CJTF-76 main location near Khost and from there were transported onward by air to Bagram Airport (a US led Airfield north of Kabul). A Disaster Identification Team (DIT) from the Netherlands was flown in to Bagram and identified the remains of the 12 occupants at this location.

1.2 ***Injuries to persons.***

Injuries	Crew	Passengers	Other
Fatal	3	9	-
Serious	-	-	-
Minor/none	-	-	-

Note 1. Although already reported by Tryco in an early stage, the exact number of persons on board, i.e. 12, was not confirmed at ISAF HQ until approximately 16:00 hrs on 27 July 2006. This was partially due to the fact that several reports of missing or supposedly crashed aircraft reached the ISAF HQ on the 26th of July. Furthermore, the passenger manifest provided by Tryco showed 13 persons one of which turned out to be a flight manager, employed by Tryco. This flight manager is responsible for releasing the helicopter before flight but did not board the helicopter on this particular flight[2]. Finally, two days after the crash, additional bodily remains were recovered and transported to Bagram. As confirmed by the DIT, this did not change the total number of casualties.

Note 2. From a national (i.e. Netherlands) perspective, it is noted that the fact that two NL military were onboard the accident helicopter was initially unknown at ISAF HQ. The reason for their travel to Khost concerned a national issue and travel arrangements were made through the office of the NL Contingent Commander and not through ISAF HQ. The first report of the possibility that two NL Military were involved in the accident reached ISAF HQ during the afternoon of July 26th.

1.3 ***Damage to aircraft***. The aircraft was completely destroyed at impact.

1.4 ***Other damage.*** The impact occurred in rural mountainous terrain. No private property was damaged.

1.5 ***Personnel information.***

a) Pilot in Command. The pilot in command, male, age 43, was deemed an experienced chief pilot. As a former Afghan Air Force pilot, who graduated from the Air Force University in 1983, he served 4 years as co-pilot and 18 years as pilot in command on Mi-8 and Mi-17 type helicopters. He was decorated for his service as a pilot in the Afghanistan Air Force by the Islamic Transitional Government of Afghanistan (President Karzai) in 2003. Tryco employed the pilot since 2003.

Flying hours:
Total : 8722 hrs
Tryco Inc. : 545 hrs (on Mi-8 MTV-1)
Last 30 days : 25 hrs 39 min

Last (documented) flight before accident: 22 July 2006

[2] According to Tryco, depending on destination and nature of mission and passengers, the flight managers will or will not join the flight at hand on a basis of necessity.

License: Military license only with a Temporary Authorization Letter to act as Mi-8 Pilot in Command for period 1 June 2006 until 30 November 2006, issued by the Civil Aviation Authority of Afghanistan (Ministry of Transport of the Islamic Republic of Afghanistan, Civil Aviation Operation).

Last proficiency check: 12 August 2005 by Afghan Air Force instructor pilot

Last Pilot Health Check: 1 June 2006 (Kaisha Health Care, Kabul)

b) Co-pilot. The Co-pilot, male, late-thirties, was also deemed an experienced pilot. A former Afghan Air Force pilot, who graduated from the Air Force University in 1991, he served 11 years as co-pilot and later pilot in command on Mi-8 type helicopters. Tryco employed the pilot since 2003.

Flying hours:

Total	:	8062 hrs
Tryco Inc.	:	571 hrs (on Mi-8 MTV-1)
Last 30 days	:	25 hrs 01 min

Last (documented) flight before accident: 21 July 2006

License: Military license only with a Temporary Authorization Letter to act as Mi-8 Pilot in Command for period 1 June 2006 until 30 November 2006, issued by the Civil Aviation Authority of Afghanistan (Ministry of Transport of the Islamic Republic of Afghanistan, Civil Aviation Operation).

Last proficiency check: 11 August 2005 by Afghan Air Force instructor pilot

Last Pilot Health Check: 1 June 2006 (Kaisha Health Care, Kabul)

c) Flight-engineer (FE). The Flight-engineer (FE), male, age 41, was a former Air Force helicopter technician, trained by Mil. The FE was an experienced military technician on Mi-8 and Mi-35 type helicopters and qualified for pre and post flight inspections and 50 hours inspection on Mi-8 MTV-1. Tryco employed the FE since 2003.

Flying hours:

Total	:	None found before Tryco
Tryco Inc.	:	265 hrs (on Mi-8 MTV-1)
Last 30 days	:	22 hrs 47 min

Last (documented) flight before accident: unknown

License: Military diploma dated 1989 only.

Last proficiency check: not applicable

Last Health Check: 1 June 2006 (Kaisha Health Care, Kabul)

Notes:

The Afghan Civil Aviation Authority is a relatively new institution, which is not yet adequately staffed to perform all regulatory and controlling functions in conformity with ICAO regulations. To date no formal pilot licenses were issued to civil aircraft operators but a temporary authorization letter was issued instead. The validity of such a letter to act as a license and prove of competency could not be determined by the investigation team. Likewise, for lack of a civil alternative, proficiency checks are performed by the Air Force for the former Air Force pilots working with Tryco Inc.

It has not been established whether the medical examination was performed by an Afghan CAA appointed/approved institute. Tryco management has specifically chosen the Indian clinic, Kaisha Healthcare, because of its relatively high standard of quality.

1.6 ***Aircraft information.***

a) Airworthiness and maintenance. The accident helicopter, registration YA TAD, factory serial # 93441, was manufactured at the Mil Kazan Helicopter Plant (Russia) as Mi-8MT and put in commission June 1983. It operated in the Russian and later Kazakhstan Army until 2002. It received its first overhaul in

1988. In 2002 it was sold to a private proprietor, demilitarized and removed from the Kazakhstan State military register. In 2004 it was overhauled at the Mil certified Aircraft Repair Plant #405, Almaty, Kazakhstan, and converted to Mi-8MTV-1 modification. Subsequently the helicopter was sold to Tryco and delivered in Kabul on 28 September 2004 with an Export Certificate of Airworthiness, issued by the Republic of Kazakhstan (Annex C). A Certificate of Registration and a Certificate of Airworthiness were issued/renewed by the Afghan Civil Aviation Authority in 2005 (Annex D).

The Tryco owned helicopters are inspected locally every 50 hours and at a Mil certified maintenance plant every 300 hours. The other two helicopters operated by Tryco are wet-leased and hence fully maintained and operated by the Tajikistan owner/operator, Tajikistan Airlines.

b) Performance. According to the technical specifications, the maximum gross weight for this type of helicopter equals 12,000 kg, the normal take off weight 11,100 kg. According to the weight and balance sheet prior to take off the total weight of the YA TAD was 10,331 kg and hence well within limits. The service ceiling is 4.500 meters (14.763ft).

c) Fuel. The helicopter was refueled at Kabul Airport with Jet A-1, which is an authorized fuel type for this helicopter. Several other aircraft, including the second Tryco owned and operated helicopter, were serviced that day from the same fuel truck (see Annex E). To the best knowledge of the investigation team, none of the aircraft experienced any trouble with the fuel provided.

1.7 ***Meteorological information.*** The accident occurred during daytime hours. The provision of meteorological information for the Khost area is very limited at best. No meteorological (observer) stations exist along the route to Khost. No detailed information on actual cloud base and visibility at the crash location at the time of the accident was available either before or after the accident. Based on information gained from several resources (ISAF HQ, RNLAF Meteorological organization, CJTF-76, satellite pictures, other Tryco crew and US recovery team), the weather at Kabul and Khost was good and fair respectively, but conditions in the mountainous area were marginal at best with low clouds, rain- and possible thundershowers (see Annex B).

1.8 ***Aids to navigation.*** No en-route navigational aids were available in this region, nor was the accident helicopter IFR capable. A basic GPS system was installed as an aid to VMC flight operations only.

1.9 ***Communications.*** En-route radio communications and air traffic services are not available in the region. Therefore no contact was possible after departure from Kabul. The crew did have a Satellite Phone at its disposal, which normally would not be used in the air.

1.10 ***Aerodrome information.*** Not applicable.

1.11 ***Flight recorders.*** Initially it was reported that both the Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) were recovered. Further investigation by the team disclosed that none of the actual recorders were recovered but only two separate tape cartridges from the FDR system.

The helicopter was equipped with a SARPP-12DM type FDR and a MC-61 type CVR, manufactured in Russia and commonly used on this type of helicopter. Both recorders were located in the tailboom section of the helicopter. The FDR was situated on the RH side at the root of the tailboom, the CVR also at the RH side but in the middle of the tailboom (see figures 1-3).

Fig 1. Flight Data Recorder

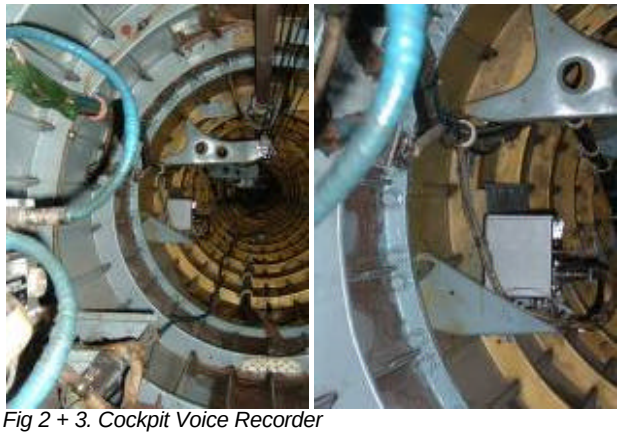


Fig 2 + 3. Cockpit Voice Recorder

The FDR consists of an actual recording unit and a separate tape cartridge, combined in one overall unit (fig 4), covered with a quick disconnect access panel. The tape cartridge (fig 5) has a recording capacity of 5 to 6 hours. The cartridge installed in the recorder unit therefore needs to be replaced accordingly. To this end, the crew carries some spare tape cartridges in a crate in the rear of the cabin area.

Fig 4. FDR unit with cover removed, consisting of recording unit (left) and tape cartridge (right)

Fig 5. FDR tape cartridge (sample of the two recovered units)

Although it was deemed unlikely that either of the recovered cartridges was actually installed in the recording unit at the time of the accident (it was more likely these were two spare cartridges), both were send to a facility in Kazachstan, i.c. Alt Air, for data download and analysis. No data was found on either tape upon analysis by said facility (see report in Annex F). To date, neither the FDR nor the CVR are recovered. They may have been either destroyed completely by the impact and post crash fire or removed from the location by an unauthorized party.

1.12 ***Wreckage and impact information.*** The helicopter and bodily remains were found in a ravine at the southern base of a ridgeline, situated roughly from west to east (Fig 6). Helicopter parts were scattered throughout a widespread area. In the opinion of the investigation team the helicopter flew into the mountainside horizontally, after which it broke down in to several parts and an explosion and fire of the remaining fuel occurred. On the mountainside traces of the post impact explosion and fire were present. Furthermore, some helicopter parts showed intensive fire damage were other parts show no such traces at all (Figs 7-10). As the investigation team did not visit the crash site itself, findings are based on photographs taken by the US recovery team upon their arrival the next day and statements made by said team and Tryco employees that visited the crash site.

Fig 6. Composition of ravine with impact markings and main location of major parts

Fig 7. Nosewheel

Fig 8. Fuselage

Fig 9. RH Landing gear + RH engine

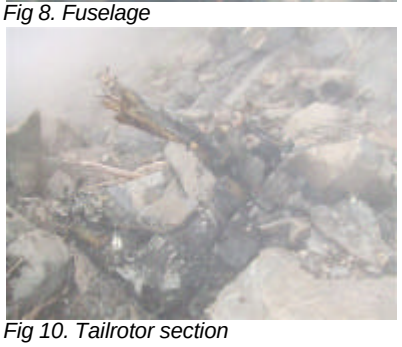


Fig 10. Tailrotor section

1.13 ***Medical and pathological information.*** Because of the condition of the bodies upon recovery, no toxicological fluid samples were taken. All occupants suffered extreme impact trauma, and most sustained fire damage. Autopsies were not performed. Shortly after the recovery of the remains a Disaster Identification Team (DIT) from the Netherlands arrived in theatre for the sole purpose of identification. Their task did therefore not include a closer examination as part of the crash investigation nor the determination of the exact cause of death.

1.14 ***Fire.*** Parts of the helicopter suffered extensive fire damage. This fire is believed to have originated on impact rather then having occurred first and being a causal factor in the crash itself. During the search efforts on the day of the accident, one of the search aircraft reportedly saw something burning from a distance at the suspected crash location. The pilot was unable to reach this location due to bad weather conditions. If this was indeed the location of the crash and the fire observed that of the wreckage, both of which are highly likely, it indicates that the fire continued for several hours after the crash. This is not uncommon for these kinds of fire.

1.15 ***Survival aspects.*** The Mi-8 is a multi-role transport helicopter capable of carrying cargo and passengers. The (folding) seats are troopseat-style and placed along the sides of the helicopter, facing sideways. Cabin occupants use a standard two-point safety belt. This construction provides limited protection and survivability in case of a (high velocity) forward impact. Due to the nature of the crash involved, the type of seats and safety belts installed are deemed irrelevant from a survivability perspective, as was any other survival equipment present in the helicopter: the impact was not survivable.

1.16 ***Tests and research.*** No specific tests or research were conducted regarding the accident other then the attempted read-out of the recovered FDR tape cartridges.

1.17 ***Organizational and management information.***

General

Tryco is one of the primary fuel providers in Afghanistan. It started its business as a key service provider in Afghanistan in the early 1990's. In 2002 sales of diesel and jet fuel to US and coalition forces commenced. For its own transportation needs throughout Afghanistan, Tryco started to use helicopters in 2003. Capacity not used for Tryco´s own purpose was made available to other customers. Initially two helicopters were leased and in 2004 two additional helicopters, including the accident helicopter, were bought. Initially, air transport services were provided for the Office of Military Cooperation -Afghanistan, transitioning in 2005 into other services for US governmental agencies, subcontracted through the Lockheed Martin Company. Other customers include the United Nations and the Kohst based Fluor Company. In 2004, the formerly mentioned Office of Military Cooperation presented Tryco with a Certificate of Appreciation for services rendered (see Annex H).

Nature of operation

<u>VFR only</u>
Tryco executes VFR day and night operations; the Tryco owned MI-8 helicopters are not IFR equipped conform ICAO-standard. The 'basic-six' instrument panel only allows 'basic-IFR' maneuvering. For navigation purposes the MI-8 helicopters are equipped with a stand-alone GPS. The pilots involved in the fatal accident, according to documentation provided by Tryco, both had over 8000 flying hours (captain: 8788 hrs, co-pilot 8062 hrs). According to Tryco-management and colleague airmen, the accident-crew knew their way around Afghanistan very well due to the many flights they'd carried out all through the country while in the airforce.

<u>Corporate/commercial</u>
The Air Operator Certificate (AOC, see documentation) allows 'official and commercial air transport for Parcels, Cargo, Passenger and Mail'.

Organization/staff

<u>Director of operations (Focal point)</u>
Focal point is Mrs. Doris Simon-Langer. Mrs. Simon-Langer is also vice-president of Tryco. She has no experience in aviation, but shows close involvement in and great concern for operating 'her' helicopters. She flew along with Tryco's helicopters herself, and with the accident crew in particular, on many occasions, including during a one week Red Cross disaster relief-operation in Pakistan after the 2005 earthquake.

Flight safety officer
The Safety training manager is an ex-captain with Ariane Airline who according to Tryco (and himself) has 40 years of experience in aviation.

Crew resources
Besides a safety-training manager, Tryco has appointed a chief pilot, a co-pilot, a flight engineer, and a flight manager for each crew. The flight manager is responsible for the coordination between customer, flight crew and Tryco concerning a specific flight and acts as a cabin attendant when required. Each crew is also appointed a ground engineer; the latter is not a flight crewmember but performs technical platform duties on the helicopter. The flight engineer can also perform ground engineer duties.

Location
Company operations are based in Kabul, next to the airport. Normal day to day parking of the helicopters is at the airport, however, a helicopter landing spot with possibility of parking is also available at the (walled and secured) Tryco location (Fig 11). Partially open hangar space (fig 12) is available for local maintenance purposes. A well-organized and equipped planning and briefing room is available for flight preparation (Fig 13). The latter is also the location were all helicopter specific documentation is stored.


Fig 11 Tryco platform location


Fig 12. Hangarspace


Fig 13. Planning and briefing room

Documentation

Operations manual.
Tryco has an operation manual (OM) available in the flightplanning room. The OM is written in the English language and its organization and contents follow the ICAO Annex 6 standard.

Air Operator Certificate
Tryco was issued an Air Operator Certificate (AOC) by the Afghan Civil Aviation Authority (AOC nr. 4107817181, issued 1 October 2002, valid through 1 October 2012, Annex G). The AOC does not state the type(s) of aircraft operated and is in this respect ICAO non-standard. Also, no terms, conditions or limitations are attached. Likewise, no quality assurance accreditationon could be presented.

Training

Company training program
In the operations manual a company training-program is laid down.

Means of training
Tryco makes no use of a flightsimulator for flight crew training. The actual MI-8 helicopters are the only (training) means available.

Crew Resource Management (CRM) training program
Tryco does not provide its flight crew with (company) CRM-training.

1.18 ***Additional information.***

(Limited) investigations are also being conducted by:

- Afghanistan Ministry of Transport – Investigator in Charge Mr. A.Q. Basharyar, President of Civil Aviation Operations (provided assessment of FDR tapes through Alt Air Ltd. in Kazakhstan).

- Tryco employees (visited crash site, provided photo material, and searched for recorders and other useful parts). No actual committee was formed but Mrs Doris Simon-Langer (vice-president Tryco and flightops focal point) has appointed herself as person of contact for this incident.
- Dr. S. Prosvetov from the Scientific and Technical Center for Independent Investigation and Claims in Aviation on behalf of the insurance company (provided detailed explanation with several photographs of parts of the wreckage).
- Mr. T. Pasquarelli, Fluor Security Advisor for Afghanistan (investigation with regard to liability issues).

To date, no specific investigation results are known from any of the above.

PART 2 - ANALYSIS

2.1 *Operator´s qualifications*

Regulating Authority
The regulating Civil Aviation Authority (CAA) is the Ministry of Civil Aviation and Tourism of Afghanistan. It is a relatively new organization with to date limited resources and infrastructure. According to Tryco the Authority regularly carried out company oversight inspections; however, no inspection dates, lists of inspected items, nor lists of findings could be presented. The CAA of Afghanistan itself has no ICAO-oversight record by which their status as competent Authority can be established. Various parties shared the view that the Afghan CAA is both quantitatively and qualitatively not yet adequately staffed to execute their oversight-task in a proper manner.

Sub-conclusion. The Afghan CAA is a relatively new organization, lacking adequate resources to perform all oversight functions in a proper manner (e.g. issuing of licenses). Findings regarding the operator's qualifications therefore had to be based on other criteria then ICAO standards alone.

Flight operations
Tryco acts as much as possible in accordance with international regulations. The Afghan CAA does not issue licenses as per ICAO standard. Competence of the crew can therefore only be based on other relevant information in the personal files such as military graduation certificates, registered flying hours and line-checks still performed by the Afghanistan Air Force.

It could not be confirmed by observation of the investigation team whether Tryco's personnel is sufficiently familiar with the contents of the companies Operator Manual (OM) and is operating accordingly. Afghan CAA review, acceptance, or approval of this OM, as required by ICAO Annex 6, could not be established. It could also not be confirmed to what extend the companies training program was properly executed.

Sub-conclusion. The Investigation Team was unable to determine competence based on ICAO standards. Based on the established experience of the accident crew by means of other (Air Force) documents, said crew should have been able to conduct flight operations on the Mi-8 Helicopter under Visual Meteorological Conditions in a safe and responsible manner. Aforementioned experience however, could also have contributed to overconfidence in continuing along the route in spite of (deteriorating) weather conditions.

Maintenance
Maintenance on the Tryco owned helicopters is performed in accordance with the Mil Design Bureau maintenance and inspection program per the applicable maintenance manuals:

25 ± 5 flight hours, locally
50 ± 10 flight hours, locally
100 ± 20 flight hours, locally
300 ± 20 flight hours, at Mil plant
500 ± 20 flight hours, at Mil plant
1000 flight hours, complete overhaul at Mil plant

The manuals came with the helicopter in 2004. There is no subscription on revisions and changes of the maintenance manuals. It is unknown if revisions and changes are issued by Mil. Troubleshooting is performed as per the Maintenance Manual. Only Line Replaceable Units (LRU´s) are used for corrective actions. LRU´s are stored in lockable storage rooms.

Tryco maintenance crews have 18-25 years of experience on the Mi-8 (and similar type, Mi-17), were trained by Mil and have served in the Russian/Soviet Military. According to Tryco, recurrent training for maintenance personnel is performed every three years at the factory plant.

Maintenance performed by Tryco is limited to pre and post flight inspections and 25/50 hour inspections. For higher maintenance and intermediate inspections the helicopter is send to a Mil facility[3]. If the Mil certified maintenance facility has any indication that pre and post flight inspections and 50 hour

[3] The State Unitary Aviation Enterprise (SUAE) "Tojikiston" in Dushanbe, Tajikistan.

inspections are not performed as per the Mil approved maintenance manual and procedures the helicopter will be refused for maintenance.

Sub-conclusion. Again, full conformity to ICAO regulations could not be established but it is the opinion of the investigation team that Tryco maintains the Mi-8 helicopters according to Mil standards, acting as much as possible in line with ICAO intent.

2.2 *Aircraft considerations*

Maintenance status
The accident helicopter, registration YA TAD, was properly maintained according to the above and held both a certificate of airworthiness and a certificate of registration from the Afghan Civil Aviation Authority. Upon sale, Kazakhstan Authorities also issued an export certificate of airworthiness. An intermediate level 600 hours inspection (2 x 300 hours) was conducted earlier that month by the Mil approved maintenance plant in Tajikistan.

Sub-conclusion. In the opinion of the investigation team, based on the maintenance standard adhered to by Tryco, the helicopter involved was properly maintained prior to the accident and should have been completely airworthy at that time. Due to the lack of flight and voice recorder data however, the possibility of a technical malfunction as cause or contributing factor in the accident, cannot be ruled out completely.

Helicopter performance
The Mi-8 MTV-1 helicopter is especially designed to operate at higher altitudes, up to an altitude of 14.490ft (4.500m). The highest point in the vicinity of the crash site is 9086ft. Major parts of the wreckage were found at an altitude of 7808ft. The weight of the helicopter at the time of the accident as well as prior to take off was well within limits. According to the performance graphs in the flight manual for the applicable weight, the Mi-8 MTV-1 is able to reach a vertical speed of 0,8m/s up to 8050ft (at 20°C OAT), and of course also able to fly straight and level at that altitude.

Even if one of the engines (partially) failed during flight, the helicopter should have been able to land at the nearest, suitable location, and this should not have resulted in the horizontal impact with the mountainside by its own right. Likewise, if both engines failed during flight, this would have resulted in a downward (autorotating) motion rather then a horizontal impact. However, a combination of unexpected heavy turbulence and downward wind sheering (downdraft), encountered at the very last moment, may have caused a lack of sufficient power to clear the ridgeline, resulting in the impact.

Sub-conclusion. Helicopter performance is not considered a primary factor in its own right for this accident but may have been a contributing factor in combination with turbulence and downdrafts.

Fuel
An approved type of fuel was used. Several other aircraft were refueled from the same fuel truck, none of which reportedly experienced any trouble. However, due to the time between the accident and arrival of the investigation team, an actual test of the fuel involved was no longer possible. According to Tryco, all jet fuel is purchased from Air BP Dubai, which is doing the quality control at the Rawalpindi refinery. All of Tryco's refueling staff is trained by Air BP at Sharjah airport and the fuel is handled according to Air BP quality control. The Tryco tank farm and procedures have been checked regularly by airlines, DESC and ISAF. All tanks are drained on regular basis - tank farm tanks, bowser tanks and helicopter tanks. Before refueling a sample is taken and a water test performed (using Shell capsules). Based on this, an appropriate level of fuel quality assurance appears to be in place.

Sub-conclusion. Bad fuel is not considered a likely factor in this accident.

2.3 *Weather*

Weather conditions at the time of the accident were marginal. Detailed weather information was not available before take-off, due to the lack of weather stations along the route to Khost. Based on several sources (Annex B) the investigation team concludes that at least part of the mountain ridge involved was probably covered in clouds, thunderstorms may have been present in the vicinity of the crash site, visibility was poor and high wind velocities were present. The latter most likely also induced severe turbulence and downdrafts in the mountainous area.

As can be deduced from figures 14 and 15, photographs taken at the accident site during the recovery within a very short timeframe from one another, weather condition in the area can change in a very short

period of time. The photographs also indicate that low clouds could have occurred at one side of the mountain ridge while the other side could have remained relatively clear. An illustration of the poor visibility in case of a cloud layer surrounding the area is shown in the last photograph (Fig 16).


Fig 14


Fig 15


Fig 16

Sub-conclusion. Weather conditions (low clouds, poor visibility, possible turbulence/downdraft) are considered a possible cause or contributing factor in this accident.

2.4 *Wreckage, impact and fire*

As stated before, the investigation team did not conduct an actual on-site investigation. Analysis is therefore solely based on photographic material and input from other sources such as photographs, interviews, a witness statement, personnel involved with the search and recovery actions (American SAR unit), condition of the bodily remains and third party investigations.

Based on the location of the wreckage, the wide spread of parts down the valley and an eyewitness report from a local villager, the Investigation Team believes that the helicopter flew, i.e. impacted, into the side of the mountain, just below the ridgeline. It then broke into several pieces and tumbled down in a ball of flames. The wreckage was strewn for more then 1000m (330ft) down the ravine. The reason for this flight into the mountainside, however, remains unclear, as does the question whether this was during controlled or uncontrolled flight. Based on the dispersal of the wreckage and condition of the bodily remains, it is also believed that the crash occurred with a relatively high, horizontal impact (i.e. speed).

As mentioned, the reasons for the controlled or uncontrolled flight into the mountain remain unclear. What puzzles the team most is the fact that the helicopter at the time of impact appeared to be returning into the direction it came from. The fatal crash happened after the last ridgeline had already been cleared and the final, fatal flight path was 180° in the opposite direction from the route to Khost. Several causes can be identified for this:

- Weather: disorientation due to poor visibility or running into bad weather unexpectedly after crossing the last ridgeline;
- Hostile fire: evasive action because of a hostile threat or actual engagement from the valley below;
- Technical: Los of control or power (lift), caused either by a malfunction or actual hit by either small arms or rocket fire, or an explosion from an explosive attached to the helicopter before departure;
- Malicious act by one of the occupants;
- Any combination of the above.

<u>Weather</u>
As mentioned before, weather conditions are considered a possible cause, especially in combination with turbulence and downdrafts leading to a lack of power to clear the ridgeline at the very last moment.

<u>Hostile fire</u>
Based on unconfirmed witness reports, the possibility of the helicopter having been shot down has been considered and further investigated. No indications were found of a specific threat to this particular mission, nor of any actual damage to the helicopter caused by small arms or rocket fire. The Dutch military intelligence organization concluded that the statements made by local nationals were most likely false. Although means and intent were present with the opposing forces, there were no indications of an actual engagement. The chances of success in hitting and downing a helicopter with a so-called RPG (rocket propelled grenade) are deemed small, especially in combination with bad weather conditions. Though Taliban sources did claim this “helicopter kill”, the organization is hardly present in the area. Furthermore, virtually every accident involving ISAF or coalition troops is claimed by this organization. In the past, successful hits always came with photo and film coverage showing Taliban celebrating their

success. No such footage has been released to date, nor did the Taliban reiterate the claim later on. Another terrorist movement mentioned by local nationals, the Heb-e-Islami Gulbuddin, is active in the area of the accident, but never claimed the accident as a successful “kill”, which is considered unlikely had this been true.

Technical

Although the Tryco helicopters appear to be maintained at a suitable standard and the accident helicopter is to be considered airworthy at the time of the accident, a technical malfunction can always occur during flight. It is not very likely however, that a mere technical failure would result in such a loss of control of the helicopter that it would impact horizontally against the mountain ridge, flying 180° in the opposite direction of the planned route and destination. Based on the location of the wreckage and impact point, it is more likely that the crew was flying towards a slightly lower part of the ridgeline on purpose, with the intent to re-cross the mountain ridge. In the unlikely event that loss of control was indeed the cause of the impact into the side of the mountain, this would probably have been caused by a problem with the tail rotor. The crew could have lost either control (whether or not because of a problem with the tail rotor) due to a technical malfunction, a hit from small arms fire or rocket fire or even a pre-attached explosive. The latter is deemed unlikely, as an attached explosive would most likely have been noticed by the crew during the pre-flight inspection prior to departure from Kabul. Furthermore, due to the construction of the helicopter (main rotor turning clockwise), loss of tail rotor effectiveness or control would have resulted in a left hand turn. Based on the assumption that the crew was following route 150 and on the location of the crash site just west of this route, the helicopter must have made a right hand turn before the impact into the mountainside.

Malicious act by helicopter occupant

No indications were found of any malicious act by any of the occupants. Besides the two Dutch military, all passengers were in some way related to the main contractor at the site, Fluor Company, or one of its sub-contractors (Yuksel and SSSI). Three were relatives of a Fluor employee who was not onboard the helicopter himself but awaiting the arrival of his family at the destination. The four remaining passengers were two employees of SSSI and Yuksel respectively. The crew was a dedicated Tryco crew, working for Tryco since their retirement from Afghan military services in 2003. Both pilots, a former General and Colonel of the Afghanistan Air Force, were formerly part of the presidential detail, responsible for the transport of President Karzai by helicopter. The President had decorated the former General, the pilot in command of this flight, for his merits upon retirement from active service in 2003. There is not a single reason to believe that any of these occupants chose this routine, low value flight as target for a suicidal mission out of a terrorist or any other motive.

Sub-conclusion. The crew may have attempted to retrace its path over the ridgeline in order to reach safety (for whatever reason) and could then have been hindered by severe downdrafts in the valley, leaving insufficient power to clear the ridgeline. Again, these are mere possibilities, which cannot be determined with any certainty.

PART 3 - CONCLUSIONS

Based on the analysis of the relevant information as presented above, few and only limited conclusions can be drawn by the Investigation Team. In the opinion of the Investigation Team, the helicopter flew into the mountainside just below the ridgeline with substantial horizontal speed. Following the impact, an explosion and post-crash fire occurred. The exact reason for the flight into the mountain and whether or not the crew was at that point still in control of the helicopter could not be established with any certainty.

The overall qualifications of Tryco International Inc., could not be fully measured against internationally agreed ICAO standards. The local circumstances and the to date limited resources of the national, Afghan Civil Aviation Authority are the main contributing factors in this regard. As a result, internationally accepted documents such as commercial pilot licenses were and are not available for the crewmembers. However, based on its findings and overall impression, the Investigation Team is under the impression that Tryco aims to provide air transport services in a safe and professional manner, within the bounds of current possibilities. The aircraft are kept and maintained in accordance with Mil standards and procedures. The flight crewmembers, being former Air Force employees, appear to have been experienced and dedicated to their duties. Nevertheless, as with any accident, human error during maintenance or flight operations cannot be ruled out as cause or contributing factor. Although the helicopter is considered to have been properly maintained and completely airworthy at the time of the accident, a technical malfunction cannot be ruled out completely either as cause or contributing factor.

As for the helicopter, some issues can be ruled out with a reasonable degree of certainty. Given the circumstances of the flight, performance of the helicopter is not considered an issue other then in combination with severe turbulence or wind sheer causing a downdraft when trying to clear the fatal mountain ridge. Primarily based on the fact that no other aircraft suffered from any known problems with the fuel, provided by the same fuel truck, bad fuel is not deemed a likely factor in this accident.

With regard to a possible hostile threat, resulting in damage and / or evasive maneuvers, ultimately leading to the impact in to the mountain, the Investigation Team consulted both local authorities and national and international military experts. Based thereon and on the lack of any evidence other then unconfirmed witness reports, such a scenario is considered highly unlikely. Again however, the possibility could not be ruled out either as possible cause or contributing factor, leading to loss of control or an evasive action by the crew. A malicious act by any of the helicopter occupants is deemed highly unlikely.

PART 4 - (PROBABLE) CAUSE

Because of the lack of data from either data or voice recorder and the limited possibilities to investigate the actual crash site, the investigation team is unable to reach a definite conclusion as to the (probable) cause for the accident. This may alter if any additional information becomes available in the future, at which point the investigation will be reopened as appropriate.

PART 5 - SAFETY RECOMMENDATIONS

The Investigation Team considers it beyond its mandate to issue any safety recommendations, let alone directives to any of the non-Netherlands organizations involved. Besides, due to the lack of a fully established (probable) cause, this would be difficult at best. With regards to the use of third party air transport by Dutch military personnel, national recommendations will be made but these are also deemed beyond the scope of this investigation.