



MINISTÉRIO DAS OBRAS PÚBLICAS, TRANSPORTES E COMUNICAÇÕES
GABINETE DE PREVENÇÃO E INVESTIGAÇÃO DE ACIDENTES COM AERONAVES
GPIAA

FINAL INCIDENT REPORT

EMA
(EMPRESA DE MEIOS AÉREOS)
KAMOV KA-32A 11BC

CS-HMN

Vilamoura - Loulé
20th of February 2008





NOTE

This report states the technical findings regarding the circumstances and probable causes which led to this incident.

In accordance with Annex 13 to the International Civil Aviation Organisation Convention, Chicago 1944, Council Directive 94/56/EC, 21st NOV 1994, and article 11th n^o 3 of Decree-Law n^o 318/99, 11th AUG 1999, the sole purpose of this investigation is to prevent aviation accidents. It is not the purpose of any such investigation and the associated investigation report to apportion blame or liability.

The only aim of this technical report is to collect lessons which may help to prevent future accidents.

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SYNOPSIS

On the 20th of February 2008, by 11:15 UTC¹, a Kamov helicopter, model KA-32A 11BC, registration CS-HMN, was operating a hoist and rescue operators training flight, 2NM south of Vilamoura, when a malfunction occurred with the hoist operation. During the recovering process, the cable inverted upward movement and started descending, forcing rescuer & victim to fall in the water.

Because it was impossible to resume hoist operation (the cable remained 10m extended and it was recovered manually) they had to be recovered by the support boat in place and the helicopter returned to base, cancelling that training mission.

Training resumed later, in the afternoon, with another helicopter, same model with similar equipment.

There were no victims and no damages to the aircraft or third party were reported.

***This report has been released in Portuguese and English Languages.
In case of conflict, Portuguese version will take precedence.***

¹ - All time references made in this report, unless other specified, are UTC (Universal Time Coordinated) timings. By that time of the year, in Portugal (continent) official local time was equal to UTC time.

1. FACTUAL INFORMATION

1.1 History of the Flight

By 09:50, on the 20th of February 2008, EMA helicopter, Kamov KA-32A 11BC, S/N 9904, registration CS-HMN, carrying five people on board, departed from Loulé heliport, for a sea rescue training mission, with an external electric hoist (Goodrich 44311-10-2 model, S/N 00028).

Mission purpose was the training of rescuers (R/S) and hoist operator (OPG), on this particularly type of air platform, recently introduced into service. As there was no qualified hoist operator with the company, a military instructor was acting as instructor for company operators. The helicopter flew from Loulé heliport to the sea (about 2NM south of Vila-moura), where a support boat was attending with three presumed victims, to be recovered, on board (*picture nr. 1*).



Picture Nr. 1

After target identification, the helicopter was positioned over it and the rescuer (R/S) descended into the boat.

While he was preparing the first victim to be rescued, the cable was rewound and the helicopter flew around until a signal was received and it was positioned again overhead for the rescue manoeuvre, descending the cable.

With two people suspended, the cable started to be rewound, bringing the men up to the helicopter. When they were 4m above the water, approximately, the cable movement stopped and it started to descend, at normal speed, letting the men fall into the water and being dragged, while the instructor tried to regain control and the helicopter recovered the hover again.

With the helicopter hovering and having regain hoist control, the instructor transferred control, again, to the trainee OPG who resumed the recovering process, bringing the *victims* up to the platform (50/60 feet ASL). When allowing a short cable extension, in order to grant the rescues to enter the helicopter, the cable started to descent freely until the men fell into the sea again. The cable was, then, disconnected from the harnesses and the support boat signalled to recover the victims.

The instructor OPG took-over and rewound the cable completely. He decided, then, to test the equipment and proceeded with some descents and recovers of the cable, until, by he's fourth operation, the hoist stopped operating, with cable $\pm 10\text{m}$ extended and hoist "over-heat" warning light on. The cable was manually recovered inside the helicopter, the men that fell in the water were recovered by support boat and the helicopter returned to base (Loulé heliport) where it landed at 11:35.

That same day, in the afternoon, the mission has been completed using another helicopter (CS-HMM), same model, equipped with same model hoist.

1.2 Injuries

No injuries were registered among all involved people.

1.3 Aircraft Damage

There was no damage to the aircraft.

1.4 Other Damage

There was no third party damage reported.

1.5 Persons Involved

1.5.1 Flight Crew

Flight crew was composed by two pilots (Captain and F/O) with following references:

Reference	Captain	F/O
Personal: Sex: M Age: 57 Nationality: Portuguese Flight License: ATPL(H) Validity: 16-10-2012 Ratings: AS 350/365; KA-32 Last Medical Examination: 12-10-2007 Limitations: VDL		M 35 Portuguese PCH 12-12-2012 HU 269; KA-32 11-09-2007 Nil
Flight Experience: Total: 10 203:45 On Type: 55:20 Last 90 days: 40:15 Last 28 days: 05:30 Last week: 01:45 Last 24 hours: 01:45		230:15 41:00 39:00 20:55 01:45 01:45

1.5.2 Hoist Operator (OPG)

The operator (EMA) recently started operations and had no qualified OPG to grant fulfilment of it's missions. In order to close that gap it started with training of it's own staff, calling for the assistance of military experts. That's the reason why, involved in that training mission, there were a military instructor and an EMA OPG.

1.5.3 Rescuer/Saviour (R/S)

Rescuers belong to local fire department and are integrated with helicopter flight crews, being submitted to regular training over land and sea. During training they use to act alternatively as rescuers and victims.

As that one was a new type of helicopter working for Rescue Services, it was necessary for them to perform some training with that new equipment.

1.6 Equipment

1.6.1 Aircraft

The aircraft, Portuguese state property operated by EMA – Empresa de Meios Aéreos, S.A., had no Airworthiness Certificate, as it was not certified outside Russian States. In order to allow it to fly, it was issued a special flying authorization, by Portuguese Aeronautical Authority (INAC), by force of Dispatch Nr. 5154/2008, of 28th of January, from Internal Affairs and Transport Ministries, which considered that helicopter as a state aircraft when committed to some special missions, as described in referred legislation.

It was a twin engine, twin counter-rotating main rotor helicopter, tail rotor less, with capacity for 15 people on board and a Maximum Take-Off Mass (MTOM) of 11000kgs, with following references:

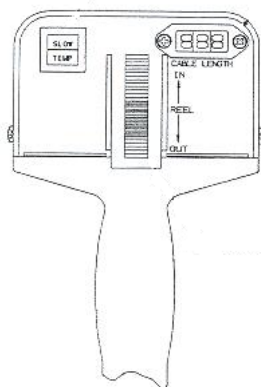
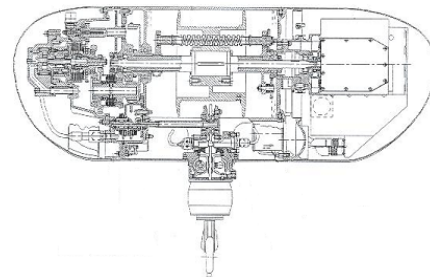
Reference	Airframe	Engines		Rotors	
		# 1	# 2	# 1	# 2
Manufacturer:	Kamov	Motor-Sich JSC		Kamov	
Model:	KA-32A11BC	Klimov TV3-117VMA		D2B2000-0/OB PS	
Serial Nr.:	9904	3877892702115/3877892702116		301D2B2070003	
Year of Manufact.:	2007	N/D		N/D	
Flight Time:	39:36	39:34/39:09		39:36	
Landings / Cycles:	N/D	N/D		N/D	
Last Inspection:	N/D	N/D		N/D	

1.6.2 Hoist

On helicopter CS-HMN there was an exterior electric hoist installed, manufactured by Goodrich Hoist & Winch, model 44311-10-2, s/n 00028, with 600lb capacity, with the following main components:

Hoist Assembly:

- P/N: 00462ASSY44311-10-2
- S/N: 00028
- CPN: 78286 SOC N: 92850/02805
- S/N: B 447

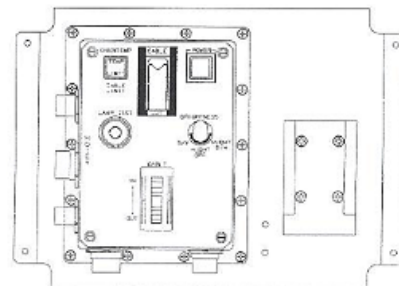


Operator Manual Control:

- P/N: 3HRL4ASSY49500-721
- S/N: 00003

Operator Control Panel:

- P/N: 44311-705



The 290' long cable has been manufactured by "Lifesaving Systems, Tampa, FL, USA", with stainless steel, type 1, anti-rotating, specification MIL-W-83140, attached to Ref.#10, Lt 506, p/n D389983, s/n 398 hook .

1.7 Meteorology

By the time, the weather was fine, with good visibility, scattered at 2000' and wind calm. Sea surface showed a slight southwest waving.

1.8 Navigation Aids

Not applicable.

1.9 Communications

Not applicable.

1.10 Aerodrome

Not applicable.

1.11 Flight Recorders

Flight recorders installed didn't record any hoist related parameters.

1.12 Wreckage & Impact

Not applicable.

1.13 Medical or Pathological

Not applicable.

1.14 Fire

There was no fire.

1.15 Survival Aspects

Because the men fell in the water in a vertical position, they suffered no injuries, even after they were dragged along, when the helicopter left the hover with them suspended.

Their evacuation was accomplished almost immediately, because there was a support boat nearby, being used as the rescued ship.

1.16 Tests & Research

1.16.1 General

Goodrich hoist 44311-10-2, s/n 00028 has been removed from the helicopter in order to investigate the reasons for its malfunction.

Manufacturer has been advised and a technical team travelled to Portugal to carry out several tests relating the hoist, the helicopter and the integration of equipment and platform.

1.16.2 Helicopter

As that type of helicopter was not certified by EASA or any other West European Authority, there was no certification for hoist integration in that airborne platform, even if it was operating in other different aircraft types. In order to evaluate operational conditions, manufacturer technicians had to perform some tests related with aircraft and hoist performance in different scenarios.

Aircraft electrical system has been investigated, with frequency, amperage & voltage measurements, along different phases of operation. Some voltage variation was detected, but was considered not serious enough to cause the failure or any malfunction.

Considering the hoist was located in the downstream of engine, APU and gear box heat-exchange hot gases, they proceed with evaluation of temperature striking hoist assembly. The highest value found (53°C) was very close to the maximum allowed ambient operating temperature (60°C) and has been registered during translation flight right turnings.

1.16.3 Hoist

A – Preliminary examination

At first sight, one could notice sooting marks and missing paint on hoist assembly cover (*picture nr. 2*) caused by a heat source. Once the cover was removed, colour changes were noticed on some electronic components, revealing the equipment has been submitted to extreme temperatures. Hoist was reassembled and sent to the factory for deeper investigation.



Picture Nr. 2

B – Historic record

That hoist model could be seen on several air platforms (helicopters and aircrafts) and there was no registry of serious malfunctions, but with those installed on Kamov KA-32 helicopters, which installation has not been accompanied by Goodrich, independent of its availability.

In fact, three of the four hoists installed on EMA's Kamov helicopters exhibited unusual behavior. Two of them have been repaired in loco (by manufacturer technicians) and the other one had to be sent to the factory. By that time some concerns were raised on electrical interfaces.

S/n 00028 history shows two repairs in less than five hours of operation (Feb 5th and 14th, 2008). On the last one (at 3.8 hours of operation) one electric terminal was found disconnected and has been re-welded.

C – Traction test

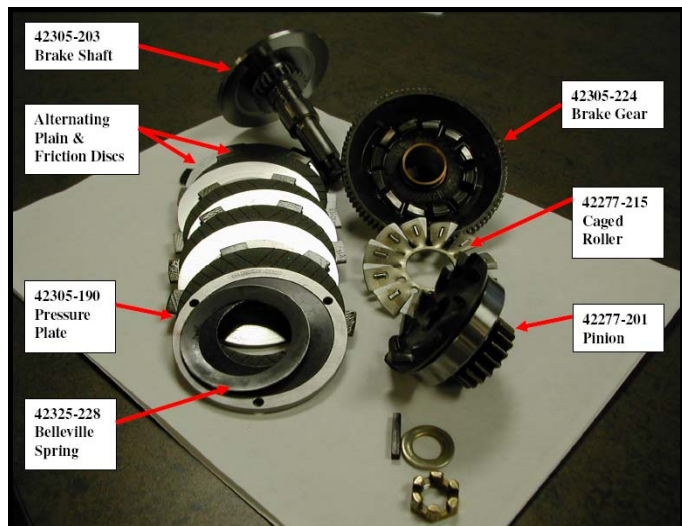
When received at factory, hoist 00028 was installed on the Test Stand and force applied. It was observed that hoist brake system would not support a load greater than 300lb, instead of the rated 600lbs, which confirmed the reported failure.

D – Brake system components

Picture nr. 3 shows the main parts that form Goodrich hoist model 44311-10-2 brake system, p/n 42325-200.

This picture will be helpful to illustrate and clarify what will be exposed forward (paragraphs E & F).

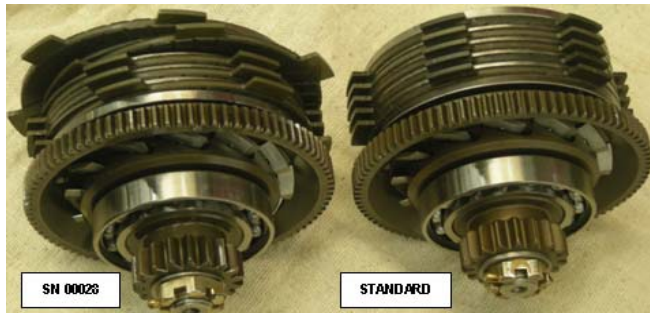
Hoist 00028 brake system has been disassembled at Goodrich – Diamond Bar factory, for investigation.



Picture Nr. 3

E – Findings

Along such investigation, at manufacturer facilities, some unusual facts were observed, related to parts appearance and functionality, as follows:



Picture Nr. 3

◀ 1st - Two discs were loose and out of place. When manipulated they returned into normal position.

2nd – Several components showed wearing and colouring indicating they were exposed to temperatures greater than 550°F.



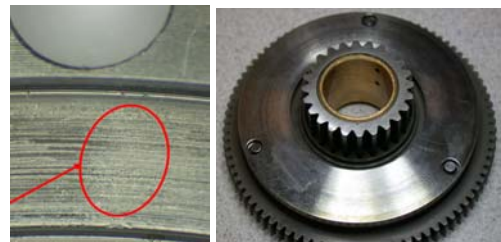
Picture Nr. 4



Picture Nr. 5

◀ 3rd - Brake shaft (42305-203) and pinion teeth (42277-201) showed damage and two broken teeth, separated by a four teeth interval, meaning there were two different overload impacts.

4th – There were some abrasive marks on pressure plate (42305-190) contact surface, associated with some fretting under all three Dowel pin holes, only possible due Belleville spring (42325-228) loss of elasticity when subjected to a force greater than 2810lb. Micro pitting was observed where pressure plate contact brake gear (42305-224), signalling that Belleville spring was flat.



Picture Nr. 6



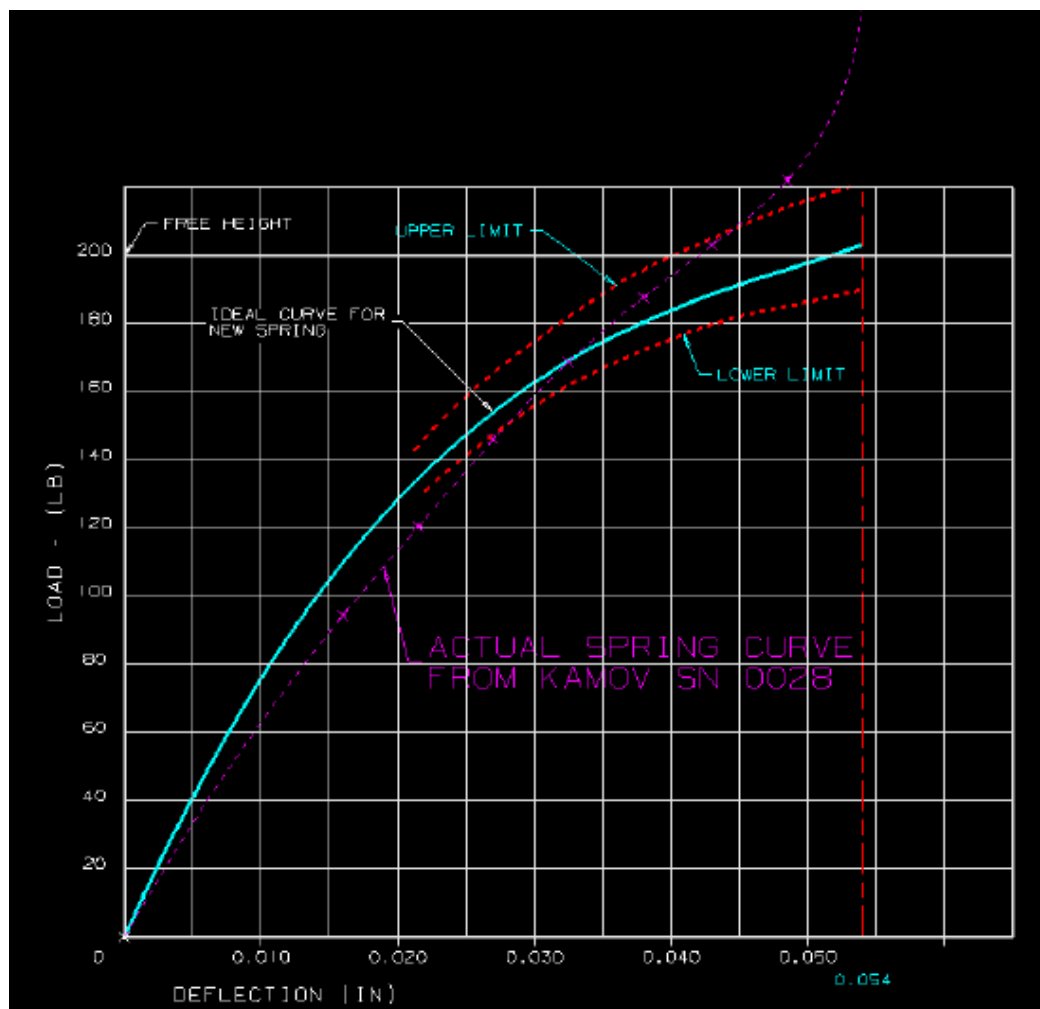
Picture Nr. 7

◀ 5th - It was noticed the existence of friction marks and that some chafing had occurred on the three Dowel pins, which was only possible at very high temperatures.

F - Conclusions

Manufacturer's investigations on hoist 00028 brake system assembly concluded that:

1st – There was an alteration of 42325-238 Belleville spring performance due continued operation under high temperatures, leading to an elasticity degradation (*picture nr. 8*);



Picture Nr. 8

- 2nd – That elasticity degradation allowed the discs to slide and have a relative rotation between them and pressure plate (42305-190) causing a temperature increase, which caused the Dowel pins to expand and contact the rotating brake gear (42305-224), increasing temperature even more and reducing spring (42325-228) elasticity to a minimum;
- 3rd – That lack of elasticity reduced more the system braking capacity and, when movement was reversed to allow people to enter the helicopter, cable descent couldn't be stopped;
- 4th – Trying to stop descent, reverting hoist operation, could be the cause for pinion teeth fracture;
- 5th – Men fall couldn't be avoided because spring limited elasticity was not enough to compress braking discs and stop cable movement.

1.17 Organizational & Management

1.17.1 The Operator

The operator, EMA – Empresa de Meios Aéreos, S.A., is a state enterprise, formed by Government law, in order to fulfil public missions attributed to the Ministry of Internal Affairs, through operational management of state owned aircrafts.

As a standard, all helicopter operators wishing to get a Air Work Operator Certificate (AWOC) must present to the Authority (INAC) a Flight Operations Manual, in accordance with JAR-OPS 3, subpart “P”, for approval.

EMA, being not an AWOC holder didn't show a Flight Operations Manual, but got a State Operations Manual approved by INAC on 01/10/2007, which didn't cover all chapters and requirements of JAR-OPS 3.

That Manual didn't refer operating procedures for aircraft and equipments used for rescue missions, or crew requirements for such operations.

1.17.2 The Operation

Asked about Goodrich 44311-10-2 electric hoist Operating Manual, a hoist Maintenance Manual (part 25-00-19-1) was provided.

There was no evidence that the hoist Operating Manual was available to the crew, but informal contacts with personnel revealed a certain lack of information of flight & support crews, on hoist operating procedures.

Answering our request for company approved procedures, regarding rescue missions with hoist usage, the operator sent a copy of on board checklist, only (picture nr 9).

Hoist cleaning & maintenance products found were not those recommended by the manufacturer and they didn't correspond to required specifications.

EMA
EMPRESA DE MEIOS AERÉOS S.A.
OPERATOR CHECK LIST

WINCH (hoist) EXTERIOR CHECKS

Fuselage RH side

HOIST ROOM	.....STOWED
HOIST BOOM PINS	.....ATTACHED
SWIVEL HOOK	.....CHECK
ELECTRICAL CONNECTORS	.....CHECK
SLIPRING CABLE	.....STOW

WINCH (hoist) INTERIOR CHECKS

AC EXTERNAL POWER	.....ON
HOIST CABLE (use portable control)	.....
EXTENSION	.....CHECK
RETRACTION	.....CHECK
COM -ICS (interphone)	.....(check) ON
INTERIOR LIGHT	.....AS REQUIRED
HOIST POWER (PWR)	.....OFF
ΦP-9 LIGHT (hoist light)	.....AS REQUIRED
CABL CUT (PWR)	.....OFF and GUARDED
CABL CUT (START)	.....GUARDED
SEARCH LIGHT	.....AS REQUIRED
LOAD LIGHT	.....AS REQUIRED
SCISSOR CABLE CUTTER	.....ON PLACE
EMERGENCY LIGHTS	.....AS REQUIRED
OPG EQUIPMENT	.....CHECK
SAFETY BELT	.....CHECK
GLOVES	.....CHECK
LIFE JACKET	.....AS REQUIRED

WINCH (hoist) EXTERIOR CHECKS

Fuselage RH side

HOIST ROOM	.....STOWED
HOIST BOOM PINS	.....ATTACHED
SWIVEL HOOK	.....CHECK
ELECTRICAL CONNECTORS	.....CHECK
SLIPRING CABLE	.....STOW

WINCH (hoist) INTERIOR CHECKS

AC EXTERNAL POWER	.....ON
HOIST CABLE (use portable control)	.....
EXTENSION	.....CHECK
RETRACTION	.....CHECK
COM -ICS (interphone)	.....(check) ON
INTERIOR LIGHT	.....AS REQUIRED
HOIST POWER (PWR)	.....OFF
ΦP-9 LIGHT (hoist light)	.....AS REQUIRED
CABL CUT (PWR)	.....OFF and GUARDED
CABL CUT (START)	.....GUARDED
SEARCH LIGHT	.....AS REQUIRED
LOAD LIGHT	.....AS REQUIRED
SCISSOR CABLE CUTTER	.....ON PLACE
EMERGENCY LIGHTS	.....AS REQUIRED
OPG EQUIPMENT	.....CHECK
SAFETY BELT	.....CHECK
GLOVES	.....CHECK
LIFE JACKET	.....AS REQUIRED

AFTER OPERATION

COM -ICS (interphone)	.....(check) ON
INTERIOR LIGHT	.....AS REQUIRED
HOIST POWER (PWR)	.....OFF
ΦP-9 LIGHT (hoist light)	.....AS REQUIRED
CABL CUT (PWR)	.....OFF and GUARDED
CABL CUT (START)	.....GUARDED
SEARCH LIGHT	.....AS REQUIRED
LOAD LIGHT	.....AS REQUIRED

MAINTENANCE

(SALT WATER)

AC EXTERNAL POWER	.....ON
HOIST CABLE (use portable control)	.....
EXTENSION (salt water)	.....LUB/CLEAN
RETRACTION	.....CHECK
SCISSOR CABLE CUTTER	.....ON PLACE
OPG EQUIPMENT	.....CHECK
SAFETY BELT	.....CHECK
GLOVES	.....CHECK
LIFE JACKET	.....AS REQUIRED

BEFORE OPERATION

INTERIOR LIGHT	.....AS REQUIRED
HOIST POWER (PWR)	.....ON
ΦP-9 LIGHT (hoist light)	.....AS REQUIRED
CABL CUT (PWR)	.....ON and GUARDED
CABL CUT (START)	.....GUARDED
SEARCH LIGHT	.....AS REQUIRED
LOAD LIGHT	.....AS REQUIRED

EMERGENCY OPERATION

CABL CUT (START)	.....OPERATE
(Operation under captain or OPG control)	

Picture Nr. 9



1.18 Additional Information

This hoist model is fitted on several aircraft types & models, around the world and there were no reports of major problems or serious incidents with its operation.

The brake system installed is common to other hoist types, equipping more than 1400 unities in service, the majority of them with a lower capacity.

According manufacturer records, since the beginning of operation (1978), never such anomaly was detected, with any in service model. Even so, considering that friction of pins on pressure plate (42305-190) against brake gear (42305-224) caused a significant temperature increase, the manufacturer recommended 42325-200 brake system model replacement by newly conceived compatible 44301-200 brake system model, which may support higher operating temperatures and be less prone to binding.

1.19 Investigation Techniques

All laboratory tests, necessary to determine the reason for equipment malfunction, were carried out by qualified technicians in manufacturer laboratories.

2. ANALYSIS

2.1 Flight Planning

The scope of that flight was the training of hoist operators (OPG) and Rescue/Saving Operators (R/S) alike, in order to be able to operate that hoist model, aboard that type of aircraft, for offshore rescue missions.

For that purpose, a small boat, with three stand-in victims to be rescued by the helicopter, was positioned about 2NM south of Vilamoura.

In the absence of qualified civilian people, a military OPG was called, to provide training to EMA personnel, in that kind of “horse-back” rescue exercises.

It was not possible to evaluate the quantity & quality of exercises or manoeuvres to be performed, because a training programme was never shown and nothing was written in company State Operations Manual, regarding that type of training & qualification.

2.2 Flight Progress

The first descent of the R/S was uneventful. Cable was recovered and the helicopter flew around while R/S prepared the *victim* to be rescued.

Once ready, the R/S signalled the helicopter and it came to hover 50/60' above the boat, descending the hook to be clamped on victim and R/S horse-collars. Recover started and, about 4m above the water, the trainee OPG probably stopped the hoist motor, which should command the brake system to actuate. Because suspended weight ($\pm 330lb$) was above brake system reduced capacity ($< 300lb$), the cable started to unwind and both people fell in the water.

Instructor OPG took control, immediately, and tried to recover hoist operation, while the helicopter started flying away, dragging the victims, and the instructor shouting for the crew to hover the helicopter.

Regained the hover, the instructor OPG managed to get the hoist functional and passed it again to the trainee, who continued the rescue until the men reached the helicopter (50/60' above the water).

When he released the cable, to allow men entrance into helicopter's cabin, the cable restarted to unwind, at normal operating speed, and people fell in the water for the second time.

Only then the hook was released and the boat signalled to recover the men.

The mission has been suspended, only because the hoist stopped operation with some meters extended.

2.3 Equipment

Goodrich exterior electric hoist, model 44311-10, has been certified by several Aeronautic Authorities and, that certification covers the integration on different airborne platforms, but its integration on Kamov KA-32 helicopter was certified by Russian Authority (IAC AR), only.

According hoist manufacturer technician's declarations, despite their declared availability, helicopter manufacturer never requested their cooperation or advice for the installation.

From in-flight measurements, taken after the incident, highlights the fact that hoist position choice puts it in a zone of engine exhaust and gear box heat exchanger hot gas circulation, where temperature rounds equipment recommended maximum operating temperature.

2.4 Operational Procedures

INAC Aeronautical Information Circular (CIA) Nr. 12/98, from June 04, states the minimum requirements for civil aircrafts involved in search & rescue flights. Those requirements pretend to grant operational maximum safety standards, defining procedures and crew qualifications & experience, which should be included in Flight Operations Manual.

EMA didn't issue a Flight Operations Manual, but got a State Operations Manual approved by INAC, where those requirements & procedures should be clearly exposed, as other types of operation had been referred (like fire fighting, for instance).

The omission of those procedures, didn't account for R/S & victim's safety, allowing the crew to put their physical integrity in danger, when they were plunged into the sea, due an equipment malfunction and an insistence in operating unworthy equipment.

We have no certainty about helicopter leaving the hover, before rescue has been completed, is a normal procedure or if it was accidental. Anyway that movement could inflict serious injuries to the men, if they were dragged along over land or a ship deck.

Contrary to safety basic principles, after the incident, hoist training has not been suspended. By the contrary, it has been continued on another helicopter, with similar equipment, before any investigation, even before reporting to GPIAA.

3. CONCLUSIONS

3.1 Findings

Based on what has been exposed, we may conclude that:

- 1st The flight was intended for Hoist Operators (OPG) qualification training and Rescue/Saviour (R/S) recurrent training;
- 2nd The aircraft had no Airworthiness Certificate, but a special Flight Permit, issued by the Authority, suitable to fly inside national airspace and performing state assigned missions;
- 3rd Aircraft/Hoist integration was not certified by the Authority; but could be considered as included on special Flight Permit issued, as it was an integral part of aircraft configuration for rescue missions;
- 4th The s/n 00028, model 44311-10-2 hoist, installed on that helicopter, registered some malfunctions on previous missions and has been submitted to fixing actions twice;
- 5th Along that mission, the equipment showed some abnormal operation, starting with first "horse-back" recover manoeuvring;
- 6th Subsequent manoeuvres dragged R/S & victim along, in the water, before the helicopter regained hover;
- 7th Insisting with the rescue, both men were uplifted to 50/60' above the sea, from where they fell back into the water, due another hoist failure;
- 8th Only when hoist stopped operation, due overheating, even without load, the training mission was suspended;
- 9th Even so, after an helicopter change, the training continued, using a similar equipment;
- 10th From all such failures, a brake system malfunction should be assumed;
- 11th Laboratory tests confirmed braking system incapacity to perform normal function, due previous off-limits operation;
- 12th Unprepared personnel, for hoist operation & maintenance, clues were detected during investigation;
- 13th Hoist cleaning & maintenance products used didn't comply with manufacturer recommended specifications;
- 14th Observations and measurements taken aboard, recommended some alterations on brake system and hoist installation aboard the helicopter;

15th Hoist manufacturer suggested changing actual brake system p/n 42325-200 by new p/n 44301-200, capable of operation under higher temperatures environment.

3.2 Causes of the Accident

3.2.1 Primary Cause

The primary cause of this incident was the reduced capacity of hoist brake system, which couldn't bear more than 50% of nominal load. Unable to support two suspended people, the cable started unwinding and people fell in the water.

3.2.2 Contributory Factors

For that lack of capacity, the following were considered as contributory factors:

- 1st Equipment previous exposure to extremely high temperatures, which affected components' elasticity (Belleville Spring, p/n 42325-228);
- 2nd Equipment irregular operation, submitting it to loads well above operational limitations (> 2810lb).

For final results, uncontrolled fall of people in the water, the following were considered as contributory factors:

- 1st Insistence in operate a defective equipment, even after several abnormal behaviour clues were positively identified;
- 4th Operator's lack of technical information spreading and operational procedures definition (nothing referred on company State Operations Manual).

4. SAFETY RECOMMENDATIONS

Considering that cable 42325-200 retention system braking capacity reduction, on s/n 00028 Goodrich 44311-10-2 hoist, may be connected with an irregular operation, which didn't comply with equipment standard limitations & procedures;

Taking into account that it was not found a company policy defining standard operating procedures & limitations, associated with maintenance malpractices for that kind of equipment;

Being now available the new 44301-200 brake system, which is compatible and grants improved operational reliability, under higher temperatures;

The following safety recommendations are forwarded to

EMA – Empresa de Meios Aéreos, S. A.:

1st “To define and implement hoist requirements & operational procedures, for safety & rescue operations and to develop a training programme for pilots, hoist operators and rescuers/saviours, including them on company State Operations Manual”;

(SR Nr. 03/2009)

2nd “To provide for the replacement of old 42325-200 brake system, equipping Goodrich 44311-10-2 hoist, in service on Kamov KA-32 helicopters, by the new compatible 44301-200 brake system”.

(SR Nr. 04/2009)

Lisbon, 15th of April 2009

The Investigator In Charge,

António A. Alves