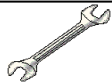


SAFETY PROMOTION NOTICE

SUBJECT: GENERAL

Enhancing Aviation Safety with proper Maintenance procedures and a Human Factor analysis campaign

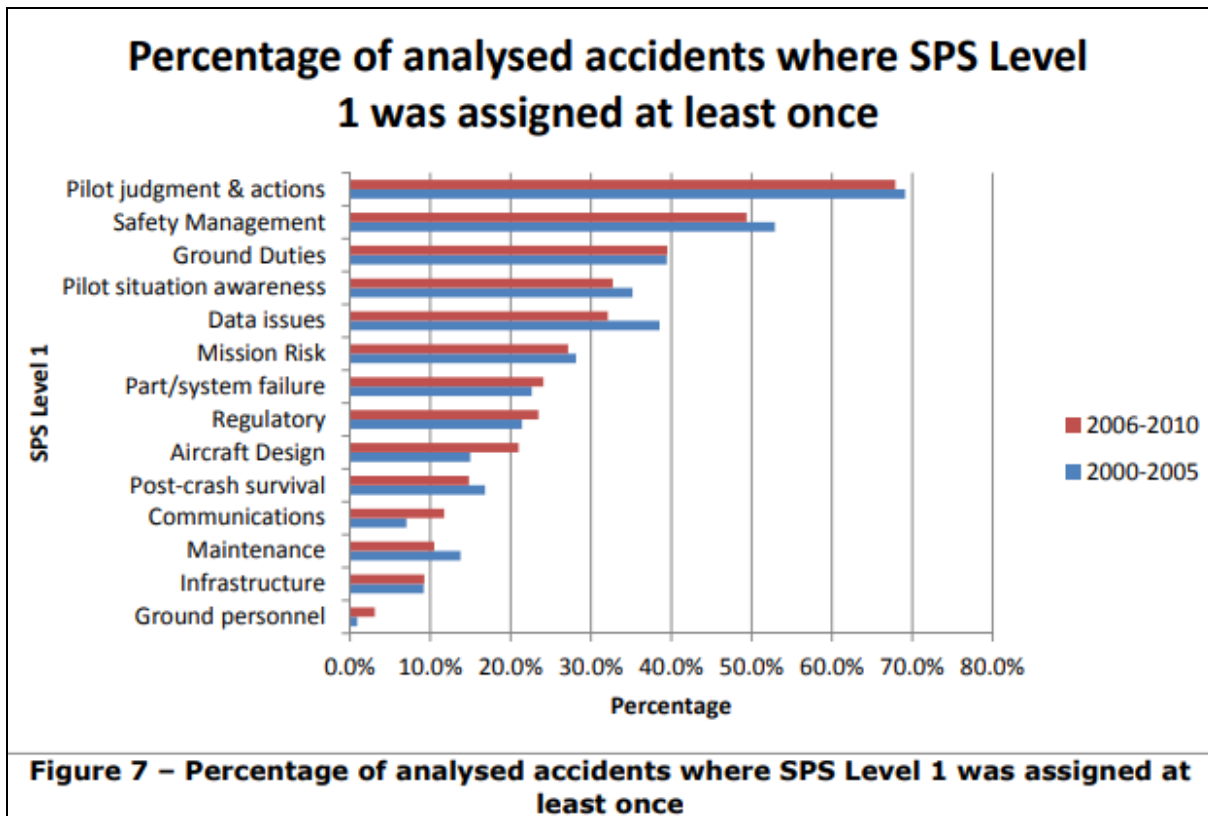
For the attention of


AIRCRAFT CONCERNED	Version(s)	
	Civil	Military
EC120	B	
AS350	B, BA, BB, B1, B2, B3, D	L1
AS550		A2, C2, C3, U2
AS355	E, F, F1, F2, N, NP	
AS555		AF, AN, SN, UF, UN, AP
EC130	B4, T2	
SA365 / AS365	C1, C2, C3, N, N1, N2, N3	F, Fs, Fi, K, K2
AS565		MA, MB, SA, SB, UB, MBe
SA366		GA
EC155	B, B1	
SA330	J	Ba, L, Jm, S1, Sm
SA341	G	B, C, D, E, F, H
SA342	J	L, L1, M, M1, Ma
ALOUETTE II	313B, 3130, 318B, 318C, 3180	
ALOUETTE III	316B, 316C, 3160, 319B	
LAMA	315B	
EC225	LP	
EC725		AP
AS332	C, C1, L, L1, L2	B, B1, F1, M, M1
AS532		A2, U2, AC, AL, SC, UE, UL
EC175	B	
EC339		KUH/Surion
BO105	C (C23, CB, CB-4, CB-5), D (DB, DBS, DB-4, DBS-4, DBS-5), S (CS, CBS, CBS-4, CBS-5), LS A-3	CBS-5 KLH, E-4
MBB-BK117	A-1, A-3, A-4, B-1, B-2, C-1, C-2, C-2e, D-2, D-2m	D-2m
EC135	T1, T2, T2+, T3, P1, P2, P2+, P3, EC635 T1, EC635 T2+, EC635 T3, EC635 P2+, EC635 P3, T3H, P3H, EC635 T3H, EC635 P3H	

The purpose of revision 1 of this Safety Promotion Notice is to extend its content to the entire Airbus Helicopters fleet.

1 - Introduction: Safety starts in the hangar

Various study groups have looked at the impact of maintenance on aviation safety. The report published by ESPN-R (formerly EHEST) show that for Europe, all OEMs taken into account, maintenance was a contributor to 12% of accidents from 2006 to 2010.



From: EHEST ANALYSIS published in 2015. [LINK](#)

The NTSB has posted a video "[Helicopter Safety starts in the hangar](#)" and a [Safety Alert](#).

They highlight the importance of maintenance for Aviation Safety.



As an OEM, Airbus Helicopters' prime goal is the Safety of the Operators using their aircraft. We investigate incidents and support accident investigations to make sure that technical precursors are identified and worked on. The continuous improvement of our design and the resulting continued airworthiness are only a part of our Safety actions. We also take part in various Safety Awareness campaigns and partnerships, and in the pooling of lessons learnt within the scope of these investigations.

The goal of this Safety Promotion Notice is:

- to provide some good Maintenance Procedures & Practices
- to introduce the Human Factor Analysis campaign launched by Airbus Helicopters in partnership with HeliOffshore
- to share some lessons learnt from the analysis of some real cases.

2 - Presentation of real cases:

To underline the importance of correctly performed maintenance, Airbus Helicopters wishes to share with Operators and Maintenance Centers two examples of real accidents in which Maintenance was a strong contributing factor.

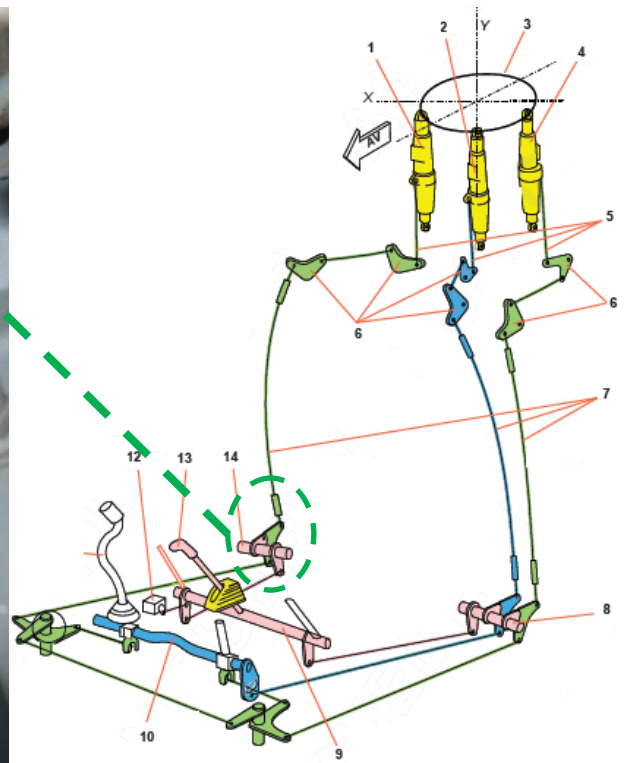
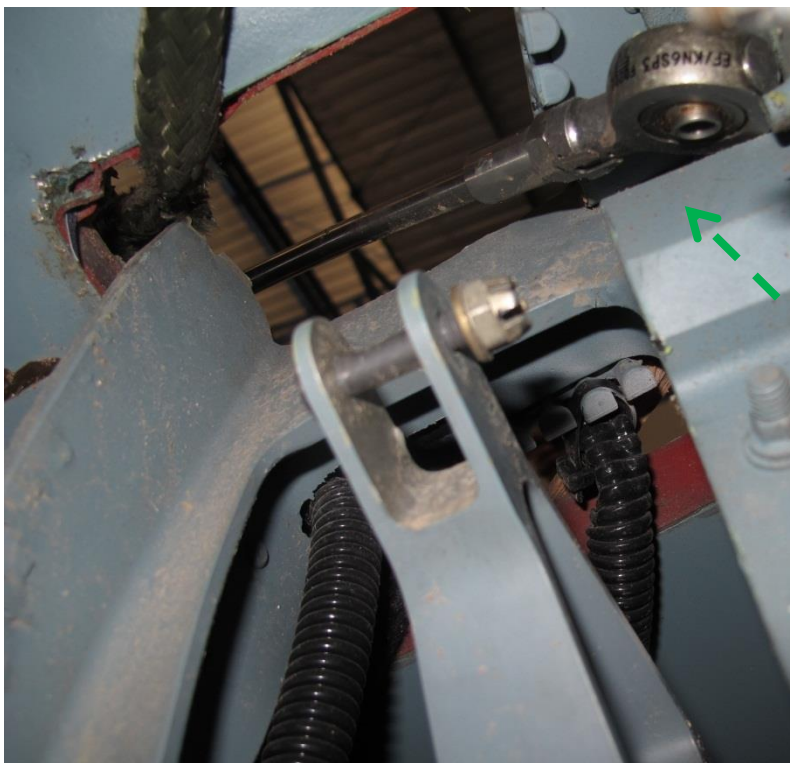
For each case, a short description of the actual in-flight event is provided, followed by an analysis of the root cause. Some accidents were followed by the publication of a Safety Information Notice, which is issued to inform about a recent occurrence and to give a reminder on applicable procedures and inspections designed to prevent this specific scenario.

Case 1:

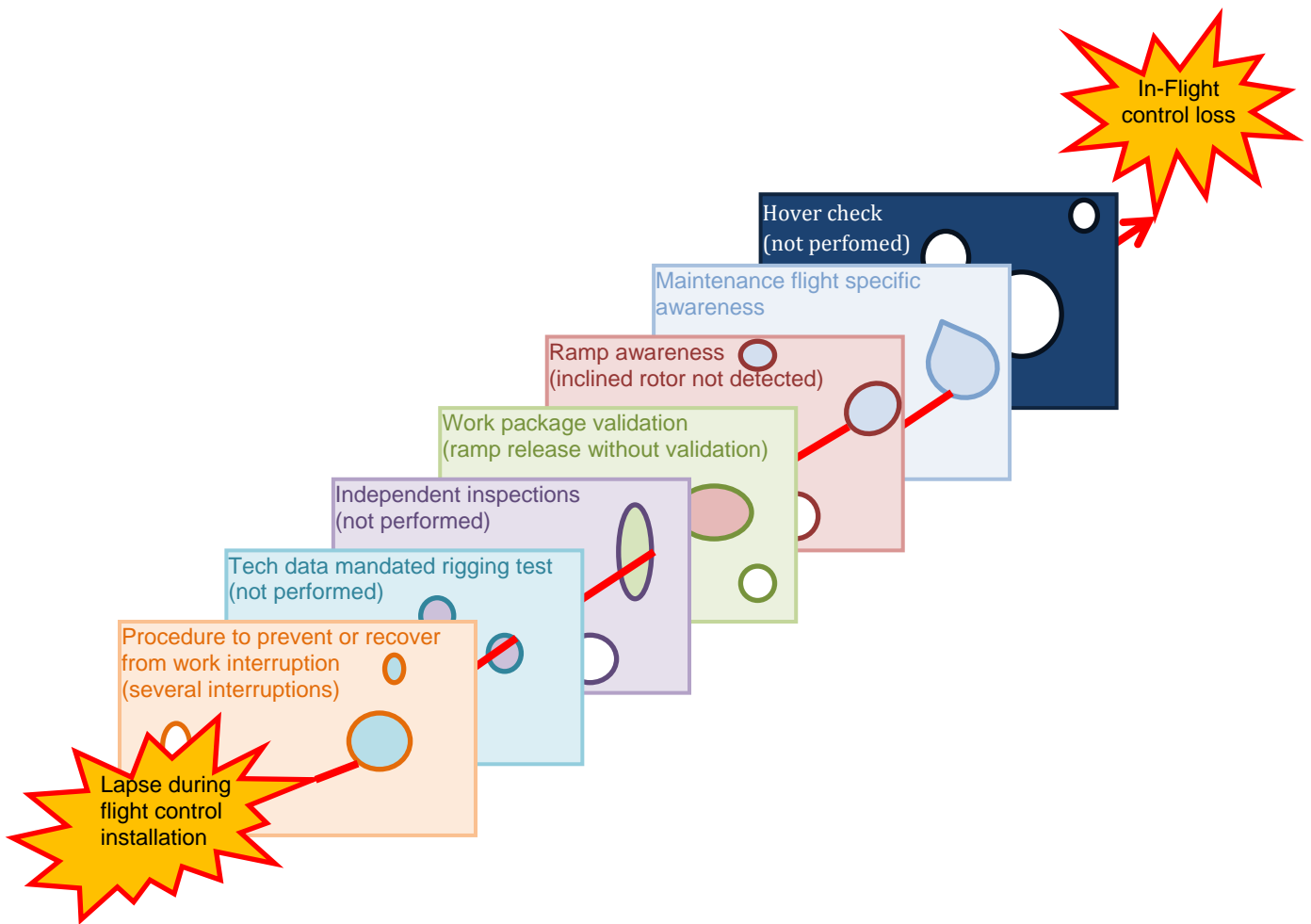
Event: The aircraft performed a first maintenance test flight after an in-depth maintenance operation when the aircraft fell vertically, shortly after take-off. The aircraft was destroyed.

Cause: During the course of the investigation, it was determined that the end fitting of the RH ball-type flexible control and the bellcrank/control lever that lead the RH main rotor actuator were not connected. It is not possible to control the rotating swashplate with only two actuators out of three.

Other contributing factors were work interruptions during the course of the maintenance, missing records attesting the task acceptance by the inspector, the presence of non-essential staff during a maintenance flight.



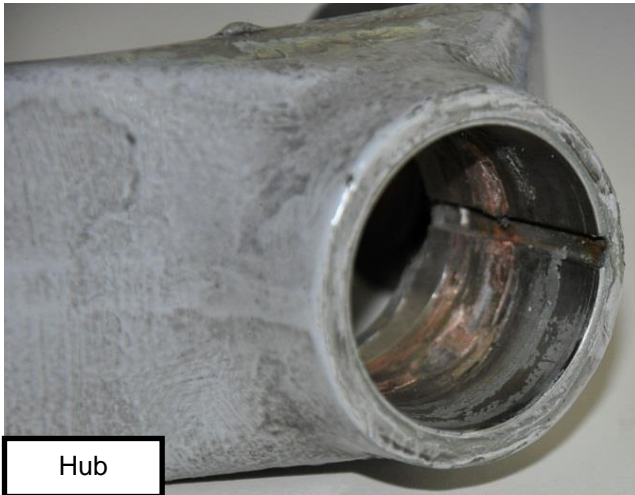
The following chart shows some of the contributing factors to this event.



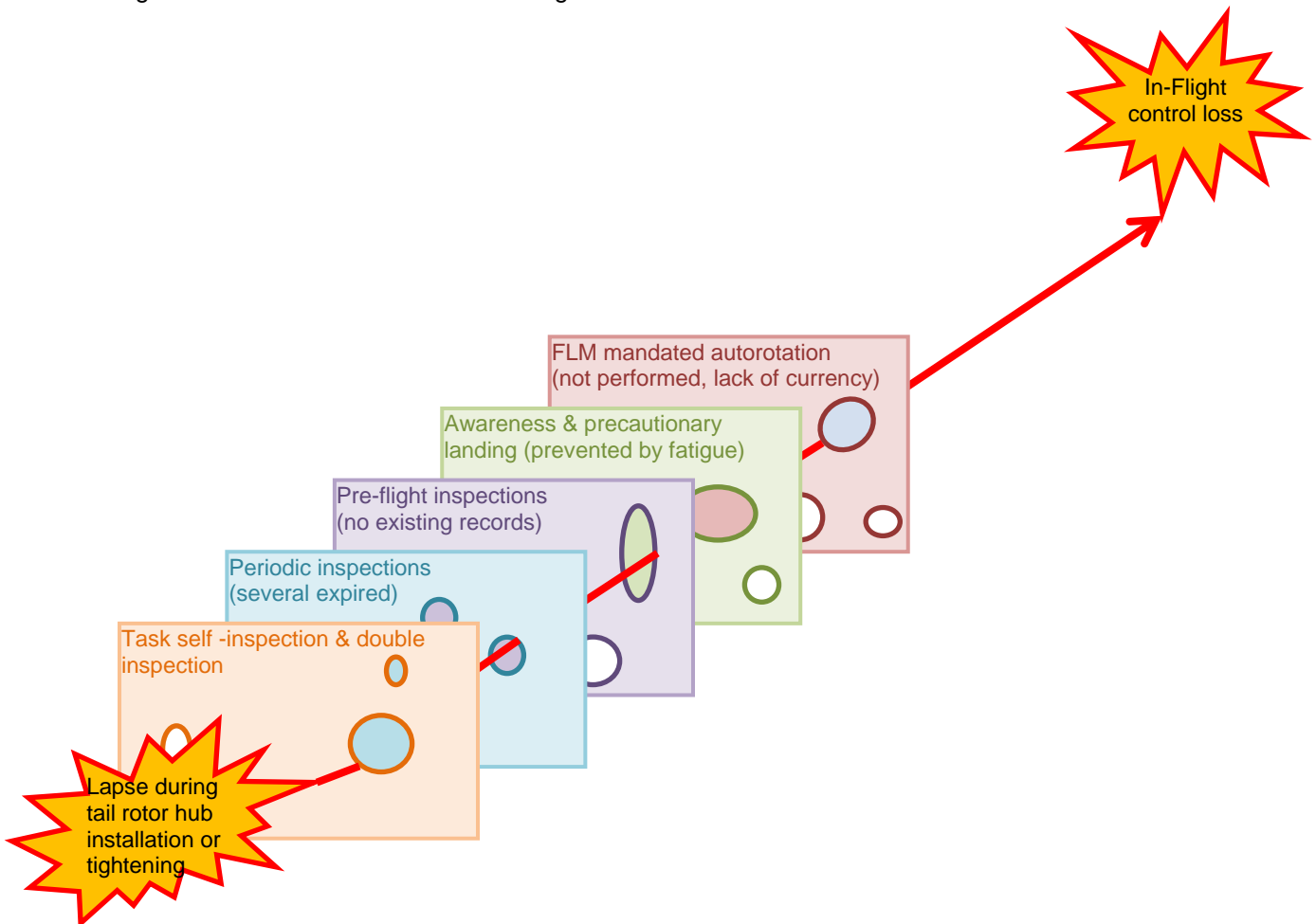
Case 2:

Event: The pilot reported in-flight issues with the tail rotor control. After seven minutes of forward flight, the pilot prepared an emergency landing. The coupling of the tail rotor drive shaft and the hub broke in flight and the pilot lost the control of the helicopter. The aircraft was destroyed.

Cause: During the course of the investigation, it was determined that the coupling of the tail rotor drive shaft was lost in flight. The tail rotor hub was not correctly installed on the shaft during the last maintenance intervention: the key of the shaft was not positioned inside the hub groove during the tightening of the coupling nut or the tightening nut was improperly tightened. As a consequence, the conical coupling was not properly tightened and the shaft key was gradually abraded by the hub until complete wear. Other contributing factors were pilot fatigue, the pilot's need for recurring training, the fact that the pilot was not supposed to try a hover flight before landing (as per flight manual), the fact that the aircraft had expired dates for the intermediate inspections (7 days, 10 hours, 25 hours, 30 hours and 50 hours) and that there were no records of pre-flight inspections.



The following chart shows some of the contributing factors to this event.



3 - Recommendations:

We invite Safety Management System Managers & accountable Managers to use this content to support their risk mapping and their Human Factor training. We hope that this analysis will help you convey safe maintenance. As a manufacturer, we commit to taking into account your remarks aimed at improving Safety and are open to your questions and remarks.

In both of the cases described above, a number of safety barriers were either missing or not effective. Airbus Helicopters wishes to highlight a number of organizational recommendations and good practices that can contribute to the prevention of such events.

Remarks on the Maintenance Program

The maintenance tasks defined by the manufacturer can be of two types:

- Procedures for the installation/removal of a component, which can include calibrations and tests.
- Procedures for inspection, which are mostly periodic inspections.

Maintenance inspections have been defined to monitor and change components with a serviceability and safety margins that are the direct result of their design and their use-induced aging. Proper compliance with the maintenance program ensures the airworthiness of the aircraft.

The Maintenance Program is not meant to detect maintenance lapses during previous maintenance operations, even if later operations or flight data can bring to light some anomalies. This is why performing all tasks in a strict manner is so important, and a complete record-keeping and documentation of tasks performed is mandatory.

Team work

For the most critical maintenance tasks, Human Factor investigations in aeronautics suggest having inspections or checks performed by another technician, thus preventing the non-detection of lapses.

Returning the aircraft to service after maintenance involves post-work inspections, the ground runs and/or functional checks requested by the maintenance tasks. It needs good communication between the maintenance crew and the aircrew to inform about all items recorded in the maintenance logbook. In this way, a safe and airworthy aircraft is delivered to the flight crews.

Emergency Procedures

Flight crews are trained in a number of emergency procedures. These procedures are defined to cover anomalies that were conceivable beforehand. These procedures are usually not meant to cover technical anomalies considered "extremely improbable" given aircraft design, or lapses. A proper maintenance is part of preventing difficult situations for the flight crews.

International Workgroups

While it is undeniable that with time a lot of progress has been made to improve maintenance operations (technical data, tools, training, etc.), we must keep working jointly on this industry-wide. Awareness varies significantly worldwide, reflecting the variety of countries, regulations, standards and missions in which helicopters are used. Airbus Helicopters supports the activity of local branches of the IHST promoting safety awareness.

We also wish to raise awareness of two FAA documents:

- The FAA "Personal Minimums" checklist applied to Maintenance: [Before](#) and [After task completion](#).
- The [FAA leaflet called "The dirty dozen"](#) that highlights the twelve most frequent human factors involved in Maintenance accidents.

Good practices

To tackle the factors listed in the FAA Dirty Dozen, there are known and documented good practices for risk mitigation, such as:

- the implementation or contracting of a Continuous Airworthiness Management Organization (CAMO);
- the implementation of a Safety Management System (SMS), with systematic danger identification and risk analysis, assessment and mitigation;
- compliance with the Maintenance Program, the use of proper procedures and tooling, up-to-date e-documentation;
- and management and organization practices such as briefings and debriefings, check-lists and to-do-lists, double checks and cross-checks, team work and communication, organized shift handover, prevention of Foreign Object Damage/Debris (FOD).

The Human Factor Analysis Campaign described in the next chapter has also enabled the development of a reminder on safety rules as a video. Refer to the link on the next page.

4 - Human Factor Analysis Campaign:

To work proactively on Human Factors in Maintenance, Airbus Helicopters has also triggered a Human Factor Analysis Campaign. The goal is to reduce the risk of improperly performed maintenance by improving task design & description, tool design, task ergonomics.

a - Objectives:

The objective of the Human Factor analysis is to improve **Safety** during maintenance operations by:

- reducing the risk of human errors
- improving the operators' safety and health.

b - Methodology:

Airbus Helicopters has defined a new process derived from the one used by Airbus on fixed wings aircraft. It consists in:

- The identification of all the maintenance tasks linked to parts for which malfunction has major consequences
- The selection of the tasks showing a risk of human error
- A full analysis of the selected tasks on aircraft with maintenance operators
- The definition and incorporation of barriers that reduce the probability of human errors



c - Implementation on H225 / H225M:

About two hundred maintenance tasks have been studied in order to list the tasks that show a risk of mistake. The study named "Human Error Mode and Effect Analysis" was performed during workshops with customers, maintenance operators and HeliOffshore* specialists.

A first batch of fifteen maintenance tasks has then been deeply analyzed on aircraft with maintenance operators in order to study the physical dimension (force, posture, heart ratio, etc.), the cognitive dimension (mental work load, visual field, perception, etc.) and organizational dimension (material flow, task preparation, etc.).

The analysis has led to:

- An introduction warning to identify the sensitive tasks with specific instructions.
- A recall of the safety rules through a video :



<https://dai.ly/k4jDNBhTaE1DuYrewSD>



- Specification of the need to perform the task with two operators, if necessary.
- Specification of the need to perform a duplicate inspection, if necessary.
- In some cases, recommendation to take a break.
- Specification of the need to use an endoscope.
- Request for area protection to perform the maintenance task safely for the operators and for the helicopter.

From a documentation point of view, a number of maintenance tasks have been updated (refer to Information Notice No. 3406-I-00) to take into account the human factor analysis results. This work is still in progress, other batches of tasks will be improved over the coming years.

d - Outlook:

Airbus Helicopters has initiated a similar initiative with HeliOffshore partners on the H175.

* HeliOffshore is the global, safety-focused association for the offshore helicopter industry.

Conclusion:

Airbus Helicopters recommends - as part of normal Safety Management System routines - to the maintenance staff management to organize safety briefing sessions to make sure that the changes are understood and applied by the maintenance personnel.

The O.R.I.O.N. tool also allows you to:

- 1/ Identify new changes rapidly.
- 2/ Spread related internal notes within your organization.

Airbus Helicopters would like to thank all the HeliOffshore partners that contributed to this study.