aibn Accident Investigation Board Norway

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REPORT SL 2013/11

REPORT ON AIR ACCIDENT AT MOSS AIRPORT RYGGE, NORWAY, 16 JULY 2008 WITH EUROCOPTER AS 350 BA, LN-ORK

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This report has been translated into English and published by the AIBN to facilitate access by international readers.
As accurate as the translation might be, the original Norwegian text takes precedence as the report of reference.

The Accident Investigation Board has compiled this report for the sole purpose of improving flight safety. The object of any investigation is to identify faults or discrepancies which may endanger flight safety, whether or not these are causal factors in the accident, and to make safety recommendations. It is not the Board's task to apportion blame or liability. Use of this report for any other purpose than for flight safety should be avoided.

Photos: AIBN and Trond Isaksen/OSL

Statens Havarikommisjon for Transport

REPORT

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This investigation has had a limited scope, and the AIBN has therefore chosen to use a simplified report format. This report format, in accordance with the guidelines given in ICAO Annex 13, is only used when necessitated by the scope of the investigation.

All hours stated in this report are local time (UTC + 1 hour) unless otherwise indicated.

Aircraft:	
- Type and reg.:	Eurocopter AS 350 BA, LN-ORK
- Year of manufacture:	1979
- Engine:	Turbomeca Ariel 1B
Operator:	Midtnorsk Helikopterservice AS, Norway
Date and time:	Wednesday 16 July 2008 at 1122 hrs
Incident site:	Moss airport Rygge (ENRY)
ATS airspace:	Controlled Class D airspace
Type of incident:	Air accident, fractured rotor head Starflex in connection with autorotation landing
Flight type:	Commercial, non-scheduled
Weather conditions:	Wind: 210º 09 kt. Visibility: more than 10 km. Clouds: few at 3 000 ft, scattered clouds at 10 000 ft. Temperature: 17 ºC. Dewpoint: 9 ºC. QNH: 1005 hPa
Light conditions:	Daylight
Flight conditions:	VMC
Flight plan:	None
Persons on board:	3 (instructor, candidate and passenger)
Injuries to persons:	None
Damage to aircraft:	A break in rotor head (Starflex) and “rubbing-damage” inside the engine
Other damage:	None

	Instructor	Candidate
- Gender and age:	Male, 49 years old	Male, 32 years old
- Licence:	ATPL(H), IR(H), ME and FI(H)	CPL(H)
- Pilot experience:	7 080 flight hours in total, of which ca. 2 500 hours on the aircraft type in question. Ca. 60 hours last 90 days, of which 10 hours on the aircraft type in question.	Ca. 5 500 flight hours in total, of which ca. 2 100 hours on the aircraft type in question. 70 hours last 90 days, all on the aircraft type in question.

Sources of information: The commander's report (NF-2007), report from Turbomeca, as well as AIBN's own investigations.

FACTUAL INFORMATION

In order to perform the company's periodical Operator Proficiency Check – OPC, the helicopter with two pilots from the helicopter company Midtnorsk Helikopterservice flew from Ås in Akershus to Rygge. The helicopter was cleared to land on runway 30 and the instructor prepared a straight-in autorotation approach. Initially, the height was 1 200 ft and the speed 100 kt. The plan was to apply power and end the autorotation when passing the threshold.

The instructor explained that he moved the Fuel Flow Control Lever (FFCL)[1] from flight gate so that the engines gas generator speed (Ng) vent down to 73 – 74 %. Subsequently the candidate entered autorotation. Ng remained stable at 73 – 74 %, the rotational speed on the rotor (Nr) was ca. 395 RPM and the airspeed 70 – 80 kt (IAS). Approximately 25 m above the ground the candidate started to flare and the rotor speed increased to about 420 RPM. At the same time the instructor pushed forward FFCL while supervising Ng. Instead of an increase in Ng as anticipated, he experienced a decrease. At the same time the rotor speed started to decrease and as it passed 390 RPM on its way down the instructor realized that the engine no longer supplied the expected power. Consequently he informed the candidate that they lacked engine power and that they had to conduct a full autorotation all the way down to the ground.

The instructor helped out with the controls, but this did not prevent the landing from being somewhat harder than normal. When white smoke was observed coming from the helicopter in connection with the landing, the personnel in the tower contacted the crew to hear if everything was OK. The engine was shut down; the electricity turned off and after an external inspection of the helicopter that did not reveal any problem, the helicopter was restarted. To fly it away from the runway it was lifted up in hover position. Straight away the crew noticed low-frequency vibrations and they landed the helicopter on the grass about 30 m to the right side of the runway. An inspection of the helicopter after landing revealed that the rotor head was seriously damaged with a fracture in the Starflex (see Figure 1).

Following the accident, the Accident investigation board contacted Skytec AS at Sandefjord Airport Torp so that they on behalf of AIBN could examine the damage to the helicopter and find out what had caused the engine to seemingly lose power under the autorotation training. Skytec AS found a minor fault with the rigging of the "anticipator", but the helicopter manufacturer Eurocopter does not support that an improper setting of the anticipator could result in an engine power loss. Skytec AS could not find any other damage on the helicopter than that to the rotor head.

[1] A handle placed on the cabin floor on AS 350 BA that regulates the power take-off from the engine.

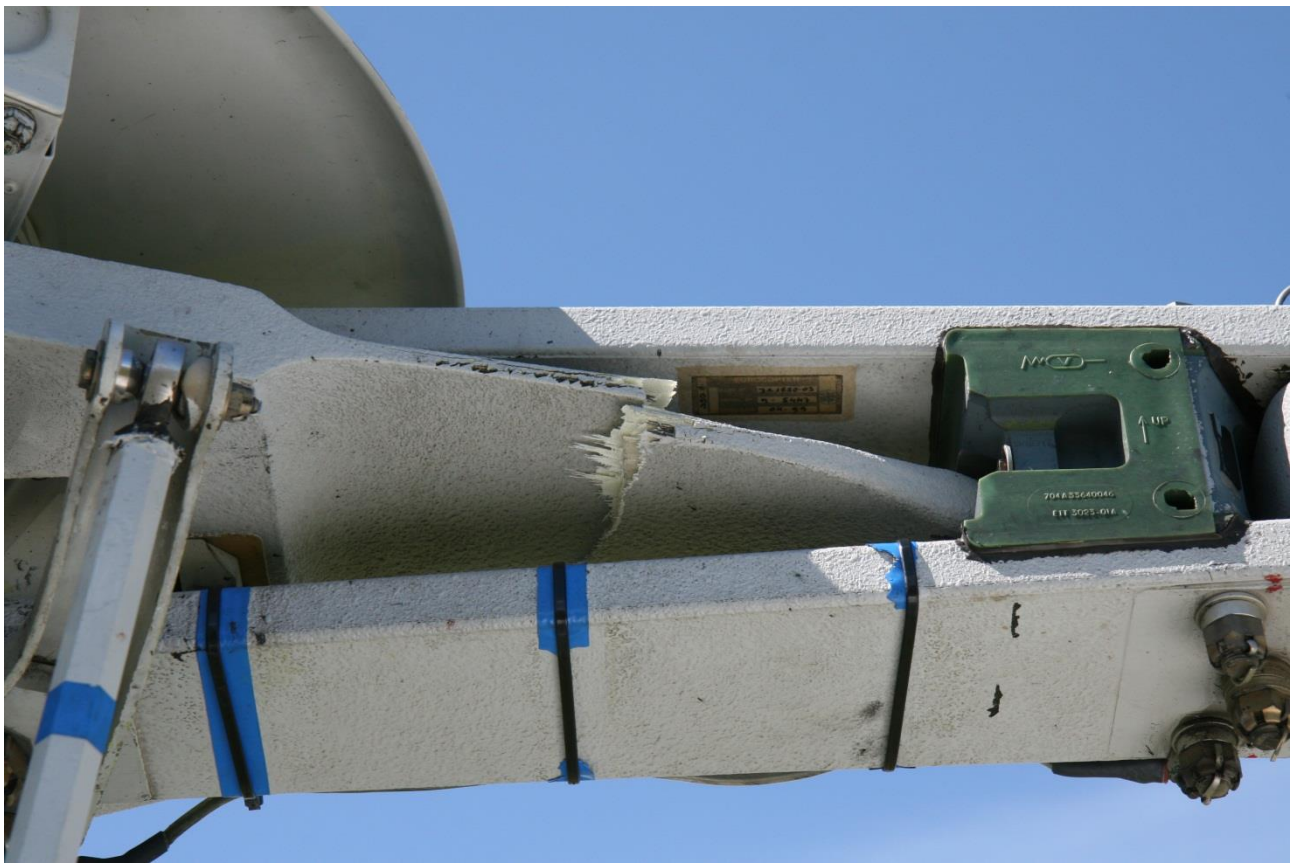

Figure 1: Rotor head with a fracture in Starflex. *Photo: Midtnorsk Helikopterservice AS*

The engine was sent to the manufacturer, Turbomeca, in France for further investigation. In test bench some minor deviations were found, amongst others on the Compressor air flow check (P3Q2), but it was not possible to reproduce a loss of power like the one experienced during the autorotation training. The engine was then disassembled and when doing this, further non-conformities were found which could not be related to the power loss, but rather a consequence of a hard landing with low engine speed. As a result of this a whole range of components in the engine had to be replaced.

After the engine was examined Turbomeca prepared a report. The report states the following:

> *Turbomeca highlights the fact that the autorotation training as performed during this occurrence is not allowed by the Flight Manual procedures: Section 3.1 EMERGENCY PROCEDURES 2.4 Autorotation landing training procedure.*

At the time of the accident, the current Flight Manual chapter 3.1 stated the following:

- *Reduce collective pitch to establish autorotation configuration*
- *Monitor and control rotor r.p.m.*
- *During final approach, shut down the engine, or reduce power, maintaining the Ng above 67 %*
- *After touch-down, still at low collective pitch, apply the normal starting procedure.*

Following the accident, in January 2009, Eurocopter issued Flight Manual AS 350 BA supplement SUP.6.P1 with the following procedure:

> *CAUTION: A QUICK POSITIONING OF THE FUEL FLOW CONTROL LEVER ABOVE THE FLIGHT POSITION CAN LEAD TO A ROTOR AND ENGINE OVERSPEED.*
>
> - *Lower the collective to enter autorotation.*
> - *Maintain NR within the green range of the NR indicator.*
> - *Reduce power maintaining the Ng above 67%.*
> - *Apply autorotation procedures SECTION 3.1, paragraph 2.1. page 1 of the present Flight Manual except for the engine, fuel shut-off cock and electrical items.*
> - *After landing, with the collective at full low pitch, bring the fuel flow control lever to the "flight" detent. Rotor speed accelerates to the Normal governed value*
>
> *IMPORTANT: Autorotation training shall be conducted within gliding distance to a landing site suitable for running landing.*

European Aviation Safety Agency (EASA) states the following about autorotation training with AS 350 in version 3 of Operational Evaluation Board Report released 8th February 2012:

> ***8.9.1 Pilots training methodology:***
>
> ***Autorotation / Engine off landing***
>
> *Autorotation training shall be performed with a Trainee and Instructor only. Autorotation training as mentioned in the RFM shall be conducted within gliding distance of a running landing suitable area.*
>
> *The engine reduction to idle position shall be completed when the helicopter is in autorotative descent and established on the glide path for the appropriate suitable area:*
>
> - *Perform first attempt Power on (Fuel Flow Lever or twist grip on flight position), execute the flare then go around then,*
> - *Perform the autorotation training / Engine off landing (FFCL at 67/70 % Ng or twist grip on idle position).*
> - *Check engine rating.*
>
> *Notes*
>
> *On AS 350 Series, equipped with FFCL fitted on the cabin floor: from 67/70 % Ng to the Flight position, the lever must be managed cautiously.*
>
> ---
>
> *On B3 Arriel 2B1, B3e and EC 130 B4* [does not apply to this specific helicopter], *if needed it is possible to quickly switch back to the flight detent of the twist grip, at any time and for any NR value.*

Eurocopter states that the note mentioned above is included because there is no stop position on the FFCL quadrant. Thus there is a risk of an inadvertent shut-down of the engine while reducing the FFCL to set the engine at idle. There is also a risk of damage to the engine when repositioning the handle to “flight gate” (T4 exceedance or engine surge). The main rotor might also over-speed if the pilot does not maintain a constant rate of acceleration.

The engine, with serial number 369, had a total of 7 647 flying hours and 16 340 cycles when the accident occurred. The last major work on the engine took place on module 5, 493 hours before the accident occurred.

THE ASSESSMENTS OF THE ACCIDENT INVESTIGATION BOARD

If the plan is to end autorotation before the helicopter has touched the ground, FFCL is to be left untouched in Flight position on the AS 350 BA and most of the other models of the AS 350. On the other hand if you are planning on a landing, FFCL should be set to approximately 67% Ng or the engine must be completely shut down. The engine is not to be restarted until the helicopter is stationary on the ground. This is supported by the warning from EASA. An important lesson drawn from this accident is that autorotation training always must be conducted in such a manner that a safe landing can be performed.

Based on the information above it is less likely that a failure in the engine caused a loss of engine power during the landing. The damage found in the engine after the accident is compatible with damage as a result of hard landing in combination with a low engine speed.

The Accident Investigation Board Norway

Lillestrøm, 21 March 2013