

Transportation Safety Board  
of Canada



Bureau de la sécurité des transports  
du Canada

## AVIATION INVESTIGATION REPORT

A04A0050



### MAIN ROTOR OVERSPEED — DIFFICULT TO CONTROL

ROYAL CANADIAN MOUNTED POLICE  
EUROCOPTER AS350-B3 C-FMPH  
TABUSINTAC, NEW BRUNSWICK 2 NM E  
15 MAY 2004

Canada

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

## Aviation Investigation Report

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### *Summary*

The AS350-B3 (Astar) helicopter (C-FMPH, serial number 3683) was conducting aerial surveillance of a lobster fishing dispute off the coast of Tabusintac, New Brunswick, at an altitude of 700 feet above sea level. During a right turn, at approximately 1600 Atlantic daylight time, the cockpit alarm sounded, accompanied by illumination of the red GOV (governor) warning light. The pilot continued the right turn and headed toward the shore for a precautionary landing. Seconds later, the rotor rpm increased above the maximum limit, and a severe rotor vibration developed. The pilot lowered the collective and reduced twist grip throttle, but there was no apparent reduction in rotor rpm. Believing that manual control of the throttle was lost, the pilot reopened the throttle to the "FLIGHT" detent, and tried to reach the overhead fuel control mode selector switch to move it to the manual position; however, the severe vibrations made it difficult to activate the caged switch. The pilot then raised the collective, attempting to decrease rotor rpm, but there was no apparent change. The aircraft was in a rapid descent and nearing the ground, so the pilot focused on landing the aircraft. After landing, a severe ground resonance developed, and the pilot lifted the helicopter into a hover to stop it. The vibrations continued, so the pilot landed a second time then pulled the ceiling-mounted fuel shut-off lever to shut down the engine. After the main rotor came to a stop, the pilot and two passengers exited the helicopter uninjured.

## *Other Factual Information*

Other than bending of the right skid tube, there was no structural damage to the helicopter. The helicopter's vehicle and engine multi-function display (VEMD) recorded severe overspeeding of the dynamic components by at least 510 rpm, which is the highest value that the VEMD will capture. Because of the overspeed condition, some of the power train components were to be removed from service.

Fuel flow to the Turbomeca Arriel 2B engine is controlled automatically by the digital engine control unit (DECU), also referred to as the full authority digital engine control (FADEC). The DECU monitors engine and flight control parameters and sends a signal to the stepper motor in the hydro-mechanical unit (HMU). The stepper motor then positions the fuel metering valve appropriately. If the DECU detects a discrepancy in any of the monitored parameters, it will illuminate the red GOV warning light and sound an aural warning to indicate a failure of the fuel metering system. Moving the mode control switch from the auto position to the manual position also illuminates the red GOV light. In either instance, the stepper motor freezes fuel flow at the last setting prior to the red GOV light illumination. The sole purpose of the two-position (auto and manual) mode control selector switch is to provide a means of simulating a failure in the automatic fuel metering system for training purposes. In the event of an actual failure of the fuel metering system, it is not necessary to move this switch to the manual position to have manual twist grip throttle control.

In the event of a red GOV light illumination, the emergency section of the flight manual calls for the following pilot actions:

- Check flight parameters.
- Maintain the Nr (main rotor rpm) in the green arc.
- Unlock the "FLIGHT" notch, the fuel flow can be increased or decreased by turning the twist grip.
- Only apply small amplitude adjustments, synchronized with the collective pitch control in order to maintain Nr in the green range.
- Fly the approach at 40 knots and adjust the fuel flow rate to maintain Nr within the upper section of the green range. Slowly reduce the speed if necessary adjust the fuel flow rate slightly on the twist grip to maintain Nr within the green range. On final approach, when the collective pitch is increased on reaching the hover, let the Nr drop for touchdown. After touchdown, reduce the fuel flow rate before lowering the collective pitch.

The HMU (serial number 970B) and DECU (serial number 857) were removed from the aircraft and forwarded to Turbomeca-USA in Grand Prairie, Texas, where they were examined under the supervision of a TSB investigator. The HMU was placed on a test bench and a full functional test was run. The HMU met the test criteria in all but four areas where it was found to be slightly outside the limits, none of which would have caused the red GOV light to illuminate or prevent

manual fuel metering with the twist grip throttle. The data from the DECU were downloaded, and the only failure listed was fault code 14–stepper motor–with associated location code 45–DECU or stepper motor. The DECU was forwarded to Turbomeca–France to determine a cause for the red GOV light illumination. Examination of the DECU confirmed that its operation did not conform to specifications. At about 70°C, a stepper motor command did not operate. Further testing by the manufacturer (Thales) confirmed the DECU’s internal component “U 13 optocoupler” as the origin of the GOV light. However, nothing was found that would have prevented manual control of the fuel flow to the engine during the occurrence.

The pilot had approximately 15 000 hours of helicopter flight time, the majority of which was on the Bell Helicopter 206 series. The pilot had not flown a helicopter equipped with an electronic engine fuel management system (DECU or FADEC) prior to his initial AS350-B3 training in September 2003.

The pilot’s initial AS350-B3 training consisted of one day of ground school and two hours of flight training at Eurocopter–Canada’s facility, located at Fort Erie, Ontario. The Eurocopter training syllabus calls for FADEC/GOVERNOR FAILURES emergency procedures training to be conducted in flight at high, medium and low power settings. Neither the occurrence pilot nor another RCMP pilot who attended the same training session could recall completing any in-flight governor failure training at the Eurocopter facility; however, they did recall that governor failures were discussed during ground school. It was established that all the other RCMP B3 pilots had received in-flight FADEC governor failure training during their initial course at Eurocopter–USA.

In early November 2003, at the request of RCMP Air Services management, an experienced AS350-B3 RCMP pilot from another detachment spent a week in Moncton to follow up on the initial training. The focus of the visit was to familiarize the Moncton pilots with the use of the helicopter’s optional systems. In-flight emergency training was not planned and was not conducted; however, all caution lights were discussed during ground sessions. The visiting pilot was satisfied with the operational performance of the Moncton pilots. However, as a result of the visit, a number of recommendations were made in a memo, dated 18 November 2003, to RCMP Air Services management. One of the recommendations was that all pilots transferring to the AS350-B3 should be provided with the standard three-day ground school, three flying-hour course offered at the Eurocopter–USA factory, where most of the other AS350-B3 pilots had received their training.

Later in November 2003, the occurrence pilot attended recurrent training at Canadian Helicopters in Penticton, British Columbia, where he received seven hours of ground school and 2.5 hours of flight training. The flight training, however, was on an AS350-B, which is a substantially different helicopter from the B3. Among other differences, the AS350-B does not have a FADEC (DECU). Because of this, FADEC emergency procedures for the AS350-B3 could not be simulated in flight. As part of the AS350-B emergency flight training at Penticton, pilots are advised to land as soon as possible for any red warning light.

The RCMP Air Services operate their aircraft under a Private Operators Certificate (POC) issued by the Canadian Business Aircraft Association (CBAA). An audit conducted prior to the issuance of the POC found that the RCMP Air Services Operations (Ops) Manual met the requirements of the CBAA operational safety standards. The RCMP Air Services Ops Manual (6.2.4) requires that

all fixed-wing pilots fly either a pilot proficiency check (PPC) or a pilot competency check (PCC) every 24 months; however there was no requirement for helicopter pilots to fly a PPC or PCC, and the occurrence pilot had not flown a proficiency ride on the B3.

## *Analysis*

The pilot applied the general rule for red warning lights that he had learned in Penticton, and immediately began a precautionary landing. However, during the approach, he did not carefully follow the flight manual procedures necessary to manage a red GOV light emergency: slight adjustments to fuel flow, and only apply small amplitude adjustments, synchronized with the collective pitch control in order to maintain Nr in the green range. The initial decrease in twist grip throttle setting was accompanied by both a descending turn and the lowering of the collective. The descending turn and decreased collective masked the effect of the decreased throttle, resulting in too high a fuel setting for the flight regime, a corresponding increase in rotor rpm, and the subsequent overspeed. By returning the throttle to the "FLIGHT" detent, the pilot increased fuel flow, setting the fuel metering valve to the position it was in just prior to the illumination of the GOV light. This exacerbated the overspeed and reinforced his belief that the fuel system had failed to switch to manual mode.

The amount of initial type flight and ground training provided to the occurrence pilot was less than that normally received during the recommended factory training course. The mishandling of the governor problem, and the lack of recall of any related in-flight training, suggests that the level of flight training the occurrence pilot received on governor failures was insufficient to allow him to understand and respond appropriately to the red GOV light illumination.

RCMP Air Services management were not aware that the two Moncton-based pilots had not received sufficient and appropriate in-flight emergency training. Because a proficiency or competency check was not conducted, there was no opportunity to verify the effectiveness of the training or the competency of their helicopter pilots. If the pilot had been required to fly a competency check prior to the commencement of line operations, the deficiencies in flight training may have been detected.

## *Findings as to Causes and Contributing Factors*

1. The pilot had not received adequate flight training for the red GOV light emergency and did not realize that the twist grip throttle still controlled fuel flow to the engine. Consequently, the emergency was mishandled, resulting in a severe overspeed of the aircraft's dynamic components.
2. Examination of the digital engine control unit (DECU) confirmed the origin of the red GOV light to be an internal component "U 13 optocoupler" of the DECU.

## *Findings as to Risk*

1. At the time of the occurrence, the RCMP Air Services operations manual did not require either a pilot proficiency check or a pilot competency check for their helicopter pilots, which would help detect deficiencies in flight training and any lack of proficiency.
2. The RCMP Air Services management was not aware that the pilot had received less than adequate training on the occurrence helicopter type.

## *Safety Action Taken*

The RCMP Air Services have taken the following action:

- Immediately following the occurrence, a memorandum explaining the meaning of a red GOV light was sent to all their AS350-B3 pilots.
- Arrangements were made for all pilots who did not have a current proficiency check ride to have one done.
- The operations manual has been amended to reflect a requirement for their helicopter pilots to have a proficiency check ride every two years and a route check on alternate years.

*This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 22 December 2004.*

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