



Defence Safety Inspectorate
Ministry of Defence

Investigation into aviation accident NH-90 Aruba 19 July 2020



Summary

On Sunday 19 July 2020, an NH-90 maritime helicopter with a four-person crew carried out a one-hour patrol flight over the Dutch Caribbean. After the patrol, the crew flew back to the ocean-going patrol vessel HNLMS Groningen to practise approaches and deck landings. The purpose of these manoeuvres was to train the cockpit crew and the patrol vessel's flight deck officer, and to maintain their skills in executing and guiding approaches and deck landings. During the execution of a deck landing circuit, the helicopter crashed into the sea. The two crew members who were in the back of the helicopter managed to get out of the helicopter and survived the accident. The two crew members in the cockpit did not survive the accident.

Immediately after the accident, the Defence Safety Inspectorate (*Inspectie Veiligheid Defensie*, IVD) launched an investigation for the purpose of understanding exactly what happened and why it happened and determining what could be improved so that the Netherlands defence organisation could learn from the accident. The IVD did not investigate only the accident (flight operation). It also focused on the escape from the helicopter (survival aspects) and the rescue operations conducted from HNLMS Groningen and by the coastguard (search and rescue operations).

Flight operation

In the last phase of the circuit, the helicopter was flying with a tailwind and at low altitude when it began to descend because of the selection of insufficient power. Four seconds before the crash, the pilot lowered the pitch of the nose and reduced power. While the helicopter accelerated as a result, the rate of descent also increased. An attempt by the pilot to pull up with almost full power when the aircraft was just above the water could no longer prevent the aircraft from hitting the water. The investigation did not find any indications that external factors, such as the weather and conditions around the patrol vessel, or a technical failure of the helicopter caused the accident.

In the chain of events preceding the accident, the IVD identified a number of factors that may explain the acts or omissions of the crew, such as reduced situational awareness, a limited risk awareness and the possibility that the pilot thought that the helicopter was in a vortex ring state. A crew's ability to assess the actual situation and take the appropriate action is largely determined by training and experience. Whether a novice shipboard helicopter pilot has gained sufficient experience prior to going on deployment with a single crew is open to question. In a context in which a single crew operates independently for months without the supervision of (more experienced) colleagues, sufficient experience in decision making and the ability to handle challenging flight manoeuvres are of crucial importance in ensuring that flight operations are conducted safely and regulations are interpreted and applied correctly.

Survival aspects

Immediately after the helicopter crashed into the sea, its crew had to escape from the aircraft unaided. The two crew members who were at the back of the cabin managed to exit the helicopter and reach the surface of the water. They survived the accident. The cockpit crew did not manage to reach the surface. Although the pilot managed to exit the cockpit, she did not manage to free herself from the helicopter. It is likely that although she escaped from the helicopter, the safety line connecting her to the life raft got caught on one of the seat adjustment levers. Possibly as a result of injury suffered on impact, the tactical coordinator (TACCO) did not manage to free himself from his seat. Both cockpit crew members died as a result of drowning.

A helicopter crew's chances of survival following a ditching at sea are greater the more realistic survival training is and if training is conducted with survival equipment that is identical to the survival equipment that is on board the helicopter. On the basis of the investigation, the IVD finds that there is room for improvement in terms of management and feedback within the Netherlands defence organisation in relation to developing

and maintaining the right skills for underwater escapes. This matter concerns the requirements set by the Netherlands Military Aviation Authority and the Royal Netherlands Air Force with respect to the training, the equipment to be used, the management method and monitoring in this regard.

Search and rescue operations

The helicopter crashed into the sea approximately 130 metres from the patrol vessel. Those on board HNLMS Groningen immediately undertook efforts to save the helicopter crew and the coastguard was alerted. The patrol vessel's crew demonstrated resilience during the rescue operations, which had to be carried out in difficult circumstances. However, the investigation also identified elements that delayed and complicated the rescue of the helicopter crew.

Action taken on board is primarily aimed at rescuing those inside a crashed helicopter. Crews of rescue vessels are expected to free victims from a crashed helicopter that may be partly submerged. This means that there must be a repertoire of actions that enables rescuers to act decisively, knowledgeably and with the right equipment. The incident shows that despite its efforts and resilience, the crew of HNLMS Groningen was inadequately equipped for the rescue. This matter concerns the level of training of rescue vessel crews, the equipment of rescue vessels, the provision of appropriate care to people rescued from the sea and the effect of stacked roles within a ship's crew on the deployability of that crew.

Conclusions

On Sunday 19 July 2020, an NH-90 maritime helicopter of Defence Helicopter Command of the Royal Netherlands Air Force crashed into the sea near Aruba, resulting in the deaths of two crew members. The IVD investigated what caused the accident and why it could occur. It investigated the factors that played a role in the escape of crew members from the helicopter and the course of search and rescue operations conducted from HNLMS Groningen and from Curaçao and Aruba.

The cause of the accident

In the last phase of the circuit, the helicopter was flying with a tailwind and at low altitude when it began to descend because of the selection of insufficient power. Four seconds before the crash, the pilot lowered the pitch of the nose and reduced power. While the helicopter accelerated as a result, the rate of descent also increased. An attempt by the pilot to pull up with almost full power when the aircraft was just above the water could no longer prevent the aircraft from hitting the water.

An explanation of the accident

The investigation into the flight operation did not provide a conclusive answer to the question as to why the accident could have occurred. The investigation did not find any indications that external factors, such as the weather and conditions around the patrol vessel, or a technical failure of the helicopter caused the accident.

In the chain of events preceding the accident, the IVD identified a number of factors that may explain the acts or omissions of the crew, such as reduced situational awareness, a limited risk awareness and the possibility that the pilot thought that the helicopter was in a vortex ring state.

During the fatal circuit, crew resource management was inadequate. While the core of this concept is that crew members complement or correct each other to ensure an effective flight operation, during the fatal circuit, no words were exchanged about the difference in altitude, the anti-torque pedal input, the decrease in speed in the turn and the descent.

Training and experience largely determine a crew's ability to assess the actual situation and anticipate developments in the flight operation. The entire crew had successfully completed the prescribed training courses for deployment in the Caribbean.

The investigation identified a number of elements that leave room for doubt regarding the experience of cockpit crews, particularly pilots in command, in making decisions and their flying skills.

- During their training, co-pilots and TACCOs gain only limited familiarity with advanced aircraft handling manoeuvres; that is, with manoeuvring at low altitude at varying speeds. This relative unfamiliarity limits the possibilities of a co-pilot or a TACCO to assess situations and support the pilot in command during such manoeuvres.
- There is no insight into the actual flying hours that have been flown as pilot flying and without autopilot. It is therefore not possible to determine whether the pilot flying quantitative experience requirements, as standardised by the Netherlands defence organisation for obtaining additional qualifications, have actually been met.
- The discontinuation of the search and rescue task that made it possible for young pilots to gain experience under the guidance of more experienced colleagues has generally had a negative effect on the qualitative accumulation of experience of co-pilots and novice pilots in command

before they are posted on board ships. Inherent opportunities to gain experience in all facets of a mission, including risk assessment and complex flight manoeuvres, have decreased.

In a context in which a single crew operates independently for months without the supervision of (more experienced) colleagues, sufficient experience in decision making and the ability to handle challenging flight manoeuvres are of crucial importance in ensuring that flight operations are conducted safely and regulations are interpreted and applied correctly.

Escaping from the crashed helicopter

Immediately after the helicopter hit the water, its crew had to escape from the aircraft unaided. The two crew members who were at the back of the cabin managed to exit the helicopter and reach the surface of the water. They survived the accident. The cockpit crew did not manage to reach the surface. Although the pilot managed to exit the cockpit, she did not manage to free herself from the helicopter. It is likely that although she escaped from the helicopter, the safety line connecting her to the life raft got caught on one of the seat adjustment levers. Possibly as a result of injury suffered on impact, the TACCO did not manage to free himself from his seat. Both cockpit crew members died as a result of drowning.

A helicopter crew's chances of survival following a ditching at sea are greater the more realistic survival training is and if training is done with survival equipment that is identical to the survival equipment that is on board the helicopter.

Although the way in which three of the four crew members managed to escape from the helicopter and the actions that they performed to do so can be attributed to their survival training, that training has its limitations. The difficulties that the crew experienced when escaping from the helicopter can be partly attributed to the differences between training equipment and operational equipment. The Netherlands Survival, Evasion, Resistance and Extraction (SERE) School does not have all of the vest types that are used by helicopter crews in practice in the correct configuration. Furthermore, the use of equipment such as quick-release mechanisms and seat belt cutters in non-standard evacuations is not part of the training. On the basis of the investigation, the IVD finds that there is room for improvement in terms of the management and evaluation of the training provided to develop the skills necessary for underwater escapes. This matter concerns the requirements set by the Netherlands Military Aviation Authority and the Royal Netherlands Air Force with respect to the training, the equipment to be used, the management method and assessment of the quality of the training provided.

The organisation could respond more promptly to potential safety risks. The possibility of the safety line getting caught on protruding parts of the cockpit during disembarkation from the helicopter, thus hindering egress, was identified as a risk when the new survival vests were introduced in 2012. This situation was not resolved, despite repeated individual attempts to that end.

The course of the search and rescue operations conducted from the patrol vessel

Proper preparation for emergency situations is necessary to enable a rapid response and thereby limit injury and damage to the greatest extent possible. Emergency drills were regularly conducted on the patrol vessel. Together with other preparations, these drills resulted in the rapid deployment of personnel and materiel after the helicopter hit the water.

The patrol vessel's crew demonstrated resilience during the rescue operations. However, the investigation also identified elements that delayed and complicated the rescue of the helicopter crew. The rescue operations had to be carried out in difficult circumstances, for example. The crew was also not optimally equipped to deal with this emergency situation in an effective way.

Crews of rescue vessels are expected to free victims from a crashed helicopter, even if the helicopter is partly submerged. However, the Fast Raiding, Interception and Special Forces Craft (FRISC) crews lacked the necessary knowledge about the helicopter. Furthermore, they were not trained to perform underwater actions and they did not have all of the equipment required.

Medical care provided on board

Care of people rescued from the sea is a complex and intensive kind of care for which a ship's doctor is not trained. There is no equipment on board to provide care to people rescued from the sea and training exercises in the medical evacuation of such people to a hospital on shore are not conducted.

Stacked roles; no redundancy

Personnel capacity on board ocean-going patrol vessels like HNLMS Groningen is limited. The stacking of roles and tasks that characterises the modular crew concept can introduce, in different ways, vulnerabilities into the organisation on board, also in the area of safety. As this investigation shows, these vulnerabilities become especially apparent during emergencies.

Recommendations

This investigation underscores the importance of the training provided to military personnel to enable them to perform their tasks and secondary tasks in the right way. They must also have the appropriate equipment and the knowledge to use the equipment correctly. These are necessary conditions to be able to respond decisively and knowledgeably when unforeseen events occur or in the event of an emergency or a crisis.

In connection with the foregoing, the IVD makes the following recommendations:

- **Experience of shipboard pilots**

Although the IVD was unable to establish a causal link in the investigation between the pilot's experience and the accident with the NH-90, the accumulated experience of NH-90 shipboard helicopter pilots should be reviewed. To ensure that flight operations are conducted safely, it is of crucial importance that shipboard pilots have sufficient experience in decision making and that their flying proficiency is adequate, particularly in terms of handling challenging flight manoeuvres. This also means that the Netherlands defence organisation must have insight into the extent to which pilots meet the experience requirement that the Netherlands defence organisation has itself standardised.

- **Survival of helicopter crews**

A helicopter crew's chances of survival following a ditching at sea are greater the more realistic survival training is and if training is done with survival equipment that is identical to the survival equipment that is on board the helicopter. The training and the equipment used should reflect operational circumstances on board to the greatest extent possible. Use the supply and demand management process to encourage user direction and feedback in order to improve the design and content of survival training courses. Take measures to ensure that the Netherlands defence organisation responds appropriately to identified safety risks.

- **Search and rescue operations from a ship**

Rescues at sea pose risks to a ship's crew and to victims. Equip crews of rescue vessels such that they can consciously weigh potential health benefits to victims against risks to the crew of the ship, the rescue vessel and the helicopter. This means that there must be a repertoire of actions that enables rescuers to act decisively and knowledgeably. To this end, provide rescuers with the right knowledge and equipment.

- **Medical assistance**

In urgent cases, a patient benefits from the most rapid and best available care in the right place. Organise the care available on a ship such that it is appropriate in relation to operational circumstances and foreseeable situations (scenarios). In this regard, make what the Netherlands defence organisation deems acceptable and unacceptable explicit. Adapt the training of medical personnel accordingly.

- **Stacked roles**

Personnel capacity on board ocean-going patrol vessels like HNLMS Groningen is limited. Especially in emergency situations, the resulting stacking of roles can introduce vulnerabilities into the organisation on board, certainly if crew members have conflicting roles. The IVD recommends that the Netherlands defence organisation assess the roles plan in terms of conflicting roles that may in certain cases impede effective action.

Report the results of the implementation of the above recommendations to the IVD no later than six months following the publication of this report.

Defence Safety Inspectorate

The Defence Safety Inspectorate supervises the physical and social safety in the Defence organisation. It evaluates the efficacy of policies, the implementation of regulations in practice and investigates serious incidents. In exercising this control, the inspectorate aims to strengthen the Defence organisation's safety culture and its ability to learn. Making the working environment as safe as possible is a shared objective throughout the Defence organisation. Every member of the workforce must be aware of safety risks. Safety requires attention, again and again.

What is the Defence Safety Inspectorate?

The Defence Safety Inspectorate (Inspectie Veiligheid Defensie, IVD) was set up in 2018. It supervises:

- the standard of task performance;
- compliance with laws and regulations concerning physical and social safety.

Its supervision also extends to mission areas.

Approach and working methods

The IVD conducts three types of investigation:

- **System supervision** Is the work done to a good standard, and is it done safely? Are safety and safety management organised properly, and is it working?
- **Theme-based supervision** Theme-based investigations look into specific aspects of safety, such as the transport of dangerous goods. These themes can arise from incidents, risk analyses, political and social news or findings from previous investigations.
- **Incident investigation** The Defence organisation has four categories of incidents: category 1 is the least serious and category 4 is the most serious. The inspectorate is responsible for conducting investigations into category 4 incidents, and can investigate incidents in the other categories if needed.

Team

The inspectorate is made up of military personnel and civilians (men and women) from the defence elements and employees who have gained experience with other supervisory bodies. The Inspector General for Safety (Inspecteur-Generaal Veiligheid) directs the IVD. Employees are deployed flexibly. Where necessary, expertise and knowledge is brought in from the defence elements or from other supervisory bodies. External hiring is also possible.

Independence

The Netherlands Minister of Defence has declared the ministerial regulation 'Instructions on government inspections' applicable to the IVD. This regulation ensures that the IVD is independent and determines how it is organised and how it works. Like the other state inspectorates, the IVD is positioned directly under the Secretary-General. The IVD is independent in its choice of subjects for investigation and the way in which it conducts investigations. It informs the minister and the state secretary directly about findings, conclusions and recommendations. The IVD is independent of policy and implementation. The IVD is transparent in its way of working. The IVD's annual work programme, annual report and reports are made public when the minister presents them to parliament.

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