

FINAL REPORT

AAIU Synoptic Report No: 2008-006

AAIU File No: 2007/0057

Published: 10/04/08

In accordance with the provisions of SI 205 of 1997, the Chief Inspector of Air Accidents, on the 24 June 2007, appointed himself as the Investigator-in-Charge to carry out a Field Investigation into this Serious Incident and prepare a Synoptic Report.

Aircraft Type and Registration:	EHI Merlin HC Mk 3, ZJ 137
No. and Type of Engines:	3 x Rolls Royce Turbomeca RTM322 turbines
Aircraft Serial Number:	50195
Year of Manufacture:	2002
Date and Time (UTC):	24 June 2007 @ 18.06 hrs approx
Location:	Salthill, Co. Galway
Type of Flight:	Military
Persons on Board:	Crew - 3 Passengers - Nil
Injuries:	Crew - Nil Others - 2 (Minor)
Nature of Damage:	Minor, to Emergency Egress Hatch
Commander's Licence:	Military
Commander's Details:	Male, aged 35 years
Commander's Flying Experience:	Military
Notification Source:	Salthill Gardaí
Information Source:	AAIU Field Investigation AAIU Report Form submitted by Pilot

SYNOPSIS

On departure from the static display park at the Salthill Airshow 2007, an emergency egress hatch separated from the right-hand side cargo sliding door of a Merlin helicopter and fell to earth. The Investigation found that the locking mechanism of the egress hatch had been interfered with by an unknown member of the viewing public during the course of the day. This unlocked condition, remained undetected during the pre-flight inspection by the aircrew. Two spectators reported receiving minor injuries.

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1. FACTUAL INFORMATION

1.1 History of the Flight

1.1.1 Background Information

Following a general request by the organising committee for international participation at the Salthill Airshow 2007, the UK Ministry of Defence (MOD) offered a number of aircraft for both the flying and static displays.

Two helicopters, namely a Royal Air Force (RAF) Merlin and Royal Navy (RN) Sea King helicopter (which are both State aircraft) were tasked to provide a static display at the assigned static display park at Salthill.

At 14.15 hrs on the 23 June 2007, the Merlin helicopter flew into Galway Airport from its base in the UK with a total of seven military personnel onboard. The helicopter was serviced and secured overnight at the airport.

The following morning, the day of the Airshow, the helicopter departed Galway Airport at 11.10 hrs with four military personnel onboard and routed to the Salthill static park where it landed at 11.30 hrs. The helicopter was then tasked by the Airshow Director to transfer members of the Typhoon Display Team to their aircraft at Shannon Airport and return to the static park. Following this crew transfer, the Merlin arrived back via Galway Airport to the static park (12.45 hrs approximately) and the crew prepared the helicopter for viewing by the public.

1.1.2 The Incident

In preparation for the static display, the rear cargo ramp door was lowered to allow supervised public access to the interior of the main cabin, the left side main cabin “grill door” was locked in the open position and the right-hand side cargo sliding door was also locked in the open position. Public access commenced at approximately 13.00 hrs and terminated shortly after 17.15 hrs. A second helicopter, a Royal Navy Sea King, was also in position at the static park, but no public access was allowed to the interior of the helicopter (**See Section 1.6**). Throughout this period the four members of the Merlin helicopter crew alternated different positions in and around the helicopter and responded to questions asked by the general public. An estimated 400 members of the public entered the interior of the helicopter and many more viewed the helicopter from the outside.

At the end of the public viewing, the helicopter was “closed up” to the public. The rear cargo ramp door, the port side grill door and the right side main cargo door were all closed and locked. The Merlin crew then watched the USAF Thunderbirds Display Team perform their routine. During this routine the Merlin crew were advised that they should be airborne following the Thunderbirds display.

The co-pilot was designated as the Pilot-Flying (PF) for the return journey to Galway Airport and as such he performed a walk-around check (external) of the helicopter. The aircraft commander also performed a pre-flight “walk-around” inspection of the helicopter. No defects were noted. In preparation for lift off, the right-hand side cargo sliding door was latched in the open/locked position to enable the crewman to clear visually above and behind the helicopter in accordance with Standard Operational Procedures (SOP’s).

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On departure, the PF performed a vertical hover out of ground effect (HOGE) to approximately 130 feet, pedal turned the helicopter 180° to the right and transitioned away south towards the beach area. During this transition the rear crewman unlocked the latched sliding door and slid the door rearwards (to the right) towards the closed position. As the door came into view, the crewman observed and then reported to the flight deck that the emergency egress hatch was missing. The aircraft commander immediately reported this to the Airshow Director, who in turn advised back that he had seen the hatch separate from the helicopter and fall to the beach. The aircraft commander then elected to return to Galway Airport where it landed a short time later without further incident.

1.2 Static Display Park

The Static Display Park (**Photo No. 1**) was located in the public park at Salthill close to the promenade. A member of the Airshow Organising Committee met with the flightcrew of the Royal Navy Sea King on its arrival on the 22 June 2007 and it was determined that the helicopter would not be open to the public, but the crew would be available to speak to the public as per previous years. On the morning of the 24 June 2007, the Merlin arrived into the static park and was met by a member of the Airshow Organising Committee, who was accompanied by a senior member of the Civil Defence (Officer-in-charge of Static Park). It was determined that the Merlin would be open to the public.

The member of the organising committee confirmed to the Investigation that he received no request to cordon off any of the helicopters in the park on the day from either of the flightcrews. Had a request been made, they would have provided bollards and tape, as has been done in previous shows or closed off the static park to the public entirely.

The Irish Civil Defence and An Garda Síochána (Irish Police Force) were in attendance at the static park throughout the period in which both helicopters were present. Primarily, their task was general crowd control during the arrival and departure of both helicopters and to maintain a presence at the site during the public viewing.



Photo No. 1: View of static display park - Merlin on left side - Sea King right side
(Photo: Mark Dwyer)

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1.3 Technical Information

1.3.1 Main Cargo Sliding Door

The main cargo sliding door is located on the right-hand side of the helicopter. The cargo door is a sliding design and when fully closed it lies flush with the cabin structure. In the open position the door slides along external rails and is flush with the outer skin of the cabin. The door is made of aluminium and weighs approximately 34 kg (**Photo No. 2**).

1.3.2 Emergency Egress Hatch

1.3.2.1 General

The emergency egress hatch (**Photo No. 2**) is contained within the main cargo sliding door. The hatch is made of light aluminium/composite and weighs approximately 7 kg. The main purpose of this egress hatch is for use in an emergency evacuation where the main cargo sliding door functionality is compromised following an accident.



Photo No. 2: Emergency egress hatch contained within main cargo sliding door.
(Photo: David Reddington)

The hatch is designed so that it can be opened from the inside and the outside (**Photo No. 3 & 4**). The hatch is not hinged, but is secured by a locking mechanism comprising of 2 fixed spigots (protruding studs) on the top section of the hatch and 2 lower mechanical spigots located on the lower left and right side of the hatch. In the sealed/locked position, the 2 fixed spigots slot into the top of the hatch frame contained within the main door. The lower left and right side spigots extend mechanically into the main door/hatch frame and secures the hatch within the main door. If the locking mechanism is selected to the open/jettison position, the lower spigots mechanically retract back into the hatch and the hatch itself falls away from the main cargo door.

On the internal cabin side of the hatch, the locking mechanism contains a “tell-tale” wire lock (**Photo No. 4**). This wire lock is basically a length of light copper wire, which is stretched between the locking handle and a hard point on the hatch. When the hatch locking handle is in the closed/locked position, the wire lock is near tight. If the handle is moved away from the locked position the wire comes under tension and snaps.

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On visual inspection the broken wire locking would be an indication that the locking mechanism or the handle had been moved from its locked position at some stage and the security of the hatch had been compromised.

When the main cargo sliding door is in the fully opened position, the egress hatch and locking mechanism is not visible from the interior of the cabin, as it is recessed against the cabin structure.

Photo No. 3: External view of egress hatch



Hatch handle in closed/locked position



Hatch handle in open/jettison position

Photo No. 4: Internal view of egress hatch



Hatch handle in closed/locked position



Hatch handle in open/jettison position

1.3.2.2 Technical examination of egress hatch

An Garda Síochána preserved the scene where the hatch was found on the beach and a “Scene of Crime Team” recorded the site. Following consultation with the AAIU, permission was given to recover the hatch back to Salthill Garda Station. Later that evening the AAIU examined the hatch. In general, the hatch was found in very good condition and had only suffered some slight impact damage with the beach. No blood or human tissue was apparent on the hatch. The locking mechanism was found in the open/jettison position and when tested the locking mechanism functioned as designed.

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As the AAIU were satisfied that the hatch and the locking mechanism were not a factor, the focus of the Investigation concentrated on determining the condition of the locking mechanism prior to the loss of the hatch.

1.4 Photographic and Video Examination

The AAIU made a general media request for spectators and members of the public to send in photographs or video clips pertaining to this particular occurrence. The following information was determined through examination of this material:

- There was extensive public activity around both helicopters, but in particular the Merlin Helicopter, throughout the day.
- Public access was allowed, via the rear ramp, into the main cabin of the Merlin helicopter under RAF personnel supervision.
- There was a general presence of Gardaí, Civil Defence and military personnel around both helicopters throughout the day.
- At 16.47 hrs the egress jettison handle was photographed in the closed/locked position (**Photo No. 5**).
- At 17.01 hrs the egress jettison handle was photographed in the open/jettison position (**Photo No. 6**).
- On lift-off/departure (18.05 hrs approximately) for its return flight to Galway Airport the helicopters emergency egress jettison handle of the main cargo sliding door is photographed in the open/jettison position (**Photo No. 7**).
- Following an 180° right pedal turn and transition away, the rear crewman unlocked the main sliding cargo door from its opened/locked position and slid the cargo door towards the right/rear.
- At the halfway point of travel the egress hatch was seen to separate (18.06 hrs approximately) from the sliding cargo door and falls to earth.
- The hatch is seen to fall in a “falling leaf” pattern making it difficult for persons below to determine its true trajectory.
- Spectators and members of the public were seen to scatter in different directions on the beach in an effort to avoid the falling hatch.
- One female spectator was seen falling to the ground having collided with another spectator in an effort to avoid the falling hatch.
- One male spectator was seen to crouch over just prior to the hatch glancing off his shoulders and then the hatch impacts the beach. This spectator rises immediately.

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Photo No. 5: Emergency egress hatch handle in closed position
(Photo: Alan Hennessy)



Photo No 6: Emergency egress hatch handle in open/jettison position
(Photo: Alan Hennessy)

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Photo No. 7: Emergency egress hatch handle in open/jettison position just prior to lift-off
(Photo: Leo Daly)

1.5 Injuries

1.5.1 Three spectators were recorded as having been taken to hospital. Two of these spectators reported minor injuries.

1.5.1.2 Spectator No 1.

This spectator, a male, reported the following:

'I was leaving the Airshow and was walking across the sand (beach) when I saw the RAF helicopter taking off. I stood where I was on the sand and watched the helicopter flying. I saw an object drop from the helicopter. It looked as though it was a piece of paper fluttering from side to side. It was only as it was almost on the ground that I realized it was a door due to its shape. Just as it was about to hit the ground, I turned away and crouched down. The door hit my head. I temporarily lost vision. I got up straight away and jumped away. I was taken to the Galway University where a doctor examined me. I was released at approximately 9 pm that evening.'

1.5.1.3 Spectator No 2.

This spectator, a female, reported the following:

'I was standing close to rocks on the beach. I recall a helicopter idling nearby out of view. Shortly afterwards I saw a big green helicopter fly from behind me, that is, from the big green area near the amusements. As the helicopter flew directly over the area where I was standing, at this stage it was travelling in the direction of the sea, I saw a large green object floating like a feather. It was not falling, it was spinning. It hit the ground with a big thud and impact and bounced back into the air after impact with the ground. I saw a lady wearing a red coat. I did not see the door hit her, however I saw her falling backwards. I was very shocked even though I was not hit by the door. I was taken to hospital, shortly afterwards I was discharged. As I say I have no injury.'

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1.5.1.4 Spectator No 3.

This spectator, a female wearing an orange jacket and blue jeans reported the following:

I attended the Galway Airshow in Salthill with my sons and a number of friends. I went to the beach, the one opposite the park at about 16.30 hrs. I watched the display from there. We were getting ready to leave at about 18.00 hrs, when I heard people screaming. My son was beside me at the time. I looked up and saw an object, which I now know to be a door coming towards me. I moved backwards to avoid the object, but it struck me on the chin and knocked me backwards. I can't say with any clarity whether it hit the ground before hitting me. I was brought to University College Hospital Galway by ambulance and was given medical attention immediately. I was later discharged from hospital, but am still feeling the affects of the impact'.

1.6 Royal Navy Sea King Helicopter

The Commander of a Royal Navy Sea King Helicopter, which was also located at the static park, reported that the crew were tasked to land the helicopter (Sea King) in the static park, shut down for the day, until completion of the Airshow.

The aircrew mixed with the public and spoke to them about the helicopter and flying in general. While the helicopter was parked, it was tampered with on at least two occasions. First occasion was at approximately 14.00 hrs. The cargo door window emergency release handle had been rotated 90 degrees. This had been reported to the Commander by one of his crewmembers. The window was re-secured. The Commander advised that he had informed one member of the Civil Defence staff who had been tasked with crowd management. The Commander requested one of the Civil Defence people to be more vigilant in relation to people tampering with aircraft.

During the pre-departure flight checks, it was noticed the jettison handles on the left hand window had been partially activated (discovered at approximately 18.30 hrs). This panel was re-secured prior to flight. Also during these pre-departure checks, the Commander noticed two further minor panels (DC electrical power socket supply and one other panel) had been opened. These panels were both re-secured prior to flight.

The Investigation determined from the Commander of the RAF Merlin Helicopter that he had not been made aware of this interference to the Royal Navy Sea King helicopter while he was located at the static park.

1.7 Regulations and Guidance Material

1.7.1 General

The Irish Aviation Authorities (IAA) Operations Advisory Memorandum (OAM) No 06/07 covers the Organisation and Safe Conduct of Flying Displays in Ireland.

The document is based on both the Joint Aviation Authorities (JAA) Information Leaflet No. 5, "The Organisation and Conduct of Flying Displays" (previously published as Information Leaflet No. 22) and also the Civil Aviation Publication (CAP) 403, "Safety and Administration Arrangements at Flying Displays, Air Races and Rallies" as issued by the UK Civil Aviation Authority (CAA).

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The intention of these documents is to provide guidance material to organisers of Flying Displays, which will assist them in meeting their responsibilities for the safety of spectators and participants at the Flying Display and of any persons and property in its vicinity.

A review of these publications has determined that the documentation is primarily focused towards the organisation and conduct of the actual Flying Display itself. No specific guidance is provided in relation to the organisation and conduct of the Static Display Park.

1.7.2 Military Regulations and Guidance Material

The RAF has a number of Regulations and Guidance material relating to Flying and Static Displays including:

Joint Service Publication (JSP) 550 Regulation 335 – Flying Displays and Special Events.
NATO Standardisation Agreement (STANAG)¹ 3533 FS Edition 6 – Flying and Static Displays.
Joint Helicopter Command (JHC) Flying Order Book Edition 1 335-1 Flying Displays, Flypasts, and Role Demonstration. Specific reference and guidance relating to the organisation and conduct for Aircraft Static Displays are provided for in each of these documents.

1.8 Flying Display Permit

As per the OAM an application to hold a Flying Display had been applied for by the Salthill Organising Committee. This was granted by the IAA and a valid Flying Display Permit was in place for the duration of the Salthill Airshow.

1.9 Additional Information

1.9.1 Board of Inquiry

The Joint Helicopter Command (UK) convened their own investigation into this incident in the form of a Board of Inquiry. The Board of Inquiry Team presented their Final Report to the Commander Joint Helicopter Command on 17 September 2007. In response to the Report, the Joint Helicopter Command have implemented the following actions to reduce the risk of a further similar occurrence:

- Investigation of the Jettison Handle markings to ascertain whether these could cause a visual illusion leading to misinterpretation.
- Investigation of potential solutions to cover the external release lever on the cabin door so as to prevent any inadvertent movement.
- Incorporation of the information pertinent to static displays into the Joint Helicopter Command Flying Order Book.
- Dissemination of warnings, reminding all personnel of the need to be meticulous with external and internal checks, especially when members of the public have had access to their aircraft.
- The provision of comprehensive pre-deployment briefings to all personnel involved with any public event.

¹ As ratified by the RAF and reflected in the NATO Standardization Document Database (NSDD)

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- The development of a method of crowd control consisting of a pre-packed temporary fence designed to create a control point and maintain a clear area around any display aircraft.

1.9.2 Airshow Audits

The Defence Aviation Safety Centre (DASC) – Ministry of Defence (UK) carried out DASC monitoring of the Salthill Airshow in June 2005 and August 2006. On both occasions the DASC found all audited aspects of the Airshow satisfactory and in general gave praise to the organising committee on how well the event was run.

2. ANALYSIS

Following a technical examination of the emergency egress hatch, it was found that the locking mechanism functioned as designed and was serviceable. The presence of a wire locking seal (which was found broken) indicates that the hatch handle normally remains in the locked position during its service life and would not normally be moved except in the case of an intentional emergency jettison or when the hatch is examined during specific maintenance schedules.

With the cargo sliding door in the opened and locked position, the hatch can only be opened from the outside of the helicopter. Therefore, it is clear that the hatch handle was opened from the outside and not while members of the public were viewing the interior of the cabin.

Photographic evidence shows that the hatch handle was interfered with by an unknown member of the public while the helicopter was positioned at the static display park. The helicopter took off with the hatch handle in the open/jettison position. As it transitioned away, the hatch ejected from its stowed position and fell to earth.

While the reported injuries were minor in nature, the event was none-the-less real for the individuals concerned. There was potential for the injuries to be more serious, but even more importantly, had the hatch been injected into the main rotors or struck the tail rotor, the safety of the helicopter, the persons on board and the spectators below could have been severely compromised.

The RAF and the Royal Navy, through the auspices of the UK Ministry of Defence, provided both static display helicopters to the Airshow Organising Committee in good faith and allowed members of the general public close access to both craft. The Salthill Airshow itself is the one premier Airshow held in Ireland each year, attracting crowds in excess of 100,000 spectators for the duration of the one-day show. While the static display is a relatively small aspect of the entire show, it does attract significant interest from spectators. This is primarily because the general public in Ireland would rarely have the opportunity to observe such large military helicopters at close quarters. The lack of any direct physical damage to either helicopter is an indication to the Investigation that the interference to the hatch was a mindless act of curiosity, as opposed to malicious intent.

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Both military helicopters are recognised as “State Aircraft”², and while documentation pertaining to operation and conduct of these State Aircraft during a static display have been reviewed by this Investigation, the relevancy and adherence to, of such documentation is not a matter for comment by the AAIU. The Investigation does acknowledge and support the actions identified by the Joint Helicopter Command Board of Inquiry Report.

The Investigation does however have concern regarding the degree of general access allowed to both helicopters within the static park. A review of regulatory documentation pertaining to the organisation and safe conduct of Flying Displays provides no specific guidance and direction with regard to the protection of aircraft/helicopters contained within the static display park.

The Airshow Organising Committee did provide a significant presence at the static park in the form of Garda Síochána and the Civil Defence personnel. While the Investigation fully recognises that no request was made by either flightcrew to provide a cordon for the helicopters, it is considered, that the sheer volume of spectators was such that it would have been virtually impossible to ensure full protection of both helicopters from interference or malicious damage, without having a cordon in place. One way to reduce the risk of interference or malicious damage is to adopt the “view but don’t touch” principle through use of barriers. There are inherent risks associated with airshows and public displays and while no one wants to interfere in the enjoyment of such occasions, a balance needs to be struck between allowing public access and maintaining the integrity/safety of the aircraft and the public in general. The Investigation considers that guidance on such an action should be incorporated in the relevant documentation and a Safety Recommendation is made to that effect.

Ultimately, the responsibility for the safe operation of helicopter lies with the aircraft Commander, and in this regard it was unfortunate that the pre-flight inspection did not identify the condition of the emergency egress hatch. This is particular relevant when you consider that significant numbers of the general public had virtually free access to the exterior of each helicopter throughout the afternoon. Under these circumstances, the entire aircrew of the Merlin should have been more alert to the fact that the helicopter could have been interfered with during that period. It is also unfortunate that, in the light of known interference to the Royal Navy Sea King helicopter, that this message was not conveyed to the Commander of the RAF Merlin.

3. CONCLUSIONS

(a) Findings

1. The Merlin Helicopter was on static display at the static display park at Salthill between 13.00 hrs and 17.15 hrs approximately.
2. Supervised access to the public was permitted to the interior of the rear cabin of the Merlin and general access to the exterior of both helicopters.
3. Significant numbers of spectators visited the static display park throughout the day.
4. While RAF, Royal Navy, Civil Defence and Garda Síochána personnel maintained a continuous presence beside each helicopter, the spectator numbers and free access were such that it would have been virtually impossible to ensure security of both helicopters without a barrier/cordon being in place.

² State Aircraft means an aircraft of any country, including the State, used in military, customs or police services.

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5. Between 16.47 hrs and 17.01 hrs the locking handle for the emergency egress hatch was moved from its locked/closed position to the open/jettison position by an unknown member of the public.
6. The open/jettison condition of the hatch handle was not observed by the flightcrew during their pre-flight “walk-around” inspection.
7. During the transition away from an out of ground effect (OGE) hover, as the main cargo sliding door was being “closed-up”, the unsecured hatch “detached” from its stowed position and fell to earth.
8. Two members of the public suffered minor injuries, with one being struck by the hatch and the other in her attempt to evade being struck.
9. The Investigation does not consider this event to be the result of a malicious act, but more a mindless act of curiosity on the part of an unknown spectator.
10. A review of regulatory documentation associated with the organisation and safe conduct of flying displays determined that no specific guidance is given with regard to protection of aircraft at static display parks.

(b) Cause

The emergency egress hatch ejected in flight from its stowed position as a result of the hatch handle being interfered with by an unknown member of the public.

(c) Contributory

1. The unsecured condition of the emergency egress hatch was not detected by the flightcrew during their pre-flight inspection.
2. Full public access was allowed to the general exterior of both helicopters in the static display park

4. SAFETY RECOMMENDATIONS

It is recommended that:

1. The Joint Aviation Authorities (JAA) provide specific guidance for static display parks in the Information Leaflet No. 5, “The Organisation and Conduct of Flying Displays”. **(SR 04 of 2008)**
2. The Irish Aviation Authority (IAA) provides specific guidance for static display parks in the Operations Advisory Memorandum (OAM) No 06/07, which covers the Organisation and Safe Conduct of Flying Displays in Ireland. **(SR 05 of 2008)**

Response:

The IAA accepts the recommendation in relation to OAM 06/07.

- END -