



# BCB International: Heliograph Signalling Mirror(s) **INDEPENDENT OVERVIEW REPORT (IOR)**

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Produced and released by



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## VERSION HISTORY

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Use the table below to provide the version number, the author implementing the version, the date of the revision, the name of the person approving the revision, the date that version was approved, and a brief description of the reason for creating the revised version. Revisions are indicated using **red, bold, text entries**.

Version #	Implemented By	Revision Date	Approved By	Approval Date	Reason
1.0	D Bumby	11 OCT 2021	A Radford	11 OCT 2021	Initial Submission

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## 1 GLOSSARY

The following abbreviations may be used within this report.

Aircraft	AC
BCB International	BCB
Combat Search And Rescue	CSAR
Darren Bumby	DB
Figure (image)	Fig
Gram (unit of weight measurement)	g
Key Survival Equipment Ltd.	Key SE
Managing Director	MD
Mark of Equipment	Mk.
North Atlantic Treaty Organisation	NATO
Royal Air Force	RAF
Royal Norwegian Air Force	RNoAF
Survive Evade Resist Extract Officer	SEREO

## 2 BACKGROUND

Following contact between Adrian Radford, MD Key SE, and Andrew Howell, MD BCB, assistance has been requested in the provision of an Independent Overview Report. The following items were supplied to Key SE and evaluated by Darren Bumby:

- 1: Heliograph Mirror, 2". Stock Code – MF600 ([Fig. 01](#)).
- 2: Heliograph Mirror, 4". Stock Code – MF601 ([Fig 02](#)).

Both items were supplied to Key SE for evaluation based on the following information:

- 1: Possible improvement over existing/in-use similar items.
- 2: Ease of use Vs existing items for single handed operation.
- 3: Preliminary performance-based results – initial review level only, no extensive testing required at this time.

Additional signalling mirror utilised as a comparison:

- 1: Mirror, Emergency Signalling, Mk.3 ([Fig 03](#)) – Currently fitted to RAF Typhoon Flight Jackets and extensively used by DB during environmental courses and used as follows:
  - *Desert survival course, Nevada. Used to indicate location for pick up. Target was a recovery helicopter at approx. 3 miles distance from covert hide. Contact with helicopter successful. Sun levels high.*
  - *NATO Arctic survival course, Norway. Used to indicate location of survivors to a C130 Hercules at approx. 1500 ft altitude heading away from survival site. At approx. 4 miles aircraft spotted mirror flashes and turned onto correct heading. Weather was overcast with broken cloud cover and low-level sun.*

## 3 FIGURES FOR REFERENCE

The following images have been added to enhance the details within this IOR.

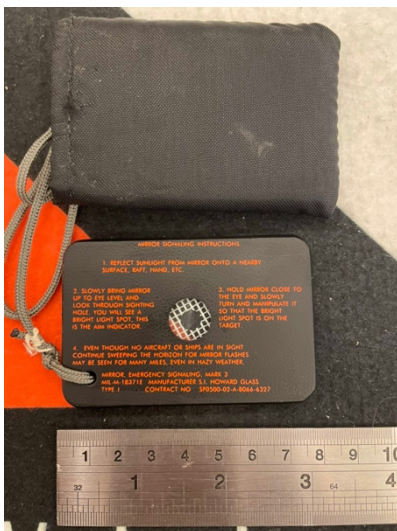
3.1 FIGURE 1 –



3.2 FIGURE 2 –



3.3 FIGURE 3 –



## 4 REQUIREMENT

Heliograph mirrors form part of the group of signalling devices that fall into the category of Visual Devices. These devices either emit or reflect light to indicate location. Signal mirrors do not rely on external power sources or other external systems for their operation. Manual interaction is required to manipulate the signalling surface area towards a light source allowing the light to be reflected in the direction required. The reflection of a bright light source is capable of being aimed to the receiving area, rescue or recovery services to ensure it attracts attention, maintains focus in the direction of light emittance and provide a visual indication of survivor/user location.

As part of the requirement to compile an IOR, Key SE will utilise the experiences of Darren Bumby (DB), Key SE Operations Director, to evaluate and compile the report. DB has gained relative experience as a former RAF Survival Equipment Technician, SERE Officer and Sea Survival instructor. During an extensive career covering both maintenance and instruction in the use of covert and overt signalling devices DB is able to fully understand the principal of operation of the signalling mirror, identify the value of these items and offer experience-based responses.

Below is a record of relative experience in the use of Overt and Covert signalling devices held by Darren:

- 1: RAF Survival Equipment Technician – Fixed and rotary wing: 1987 to 2012
- 2: In-Country Combat Survival Liaison (RAF Harrier Force), Afghanistan – 2004/2005. Responsible for:
  - *Point of contact for 66 Rescue Squadron (Combat Search and Rescue – CSAR) for UK aircrew extraction training.*
  - *Identifying and detailing equipment carried on-man and personal survival pack survival aids.*
- 2: RAF SERE Officer – Land & Sea. Permissive and none-permissive survival instructor: 2007 – 2012
- 3: RAF Environmental Survival Instructor Courses:
  - *Jungle – 2007*
  - *Desert – 2008*
  - *Winter – 2008*
- 4: RoNAF Arctic Survival Instructors Course – 2008
- 5: Lead instructor – CSAR training for RAF Typhoon Escape and Evasion course.
- 6: Operation ELLAMY Typhoon SEREO – 2011. Responsible for:
  - *CSAR planning and training – UK Typhoon Force.*
  - *Escape and Evasion planning and training – UK Typhoon Force.*
  - *Equipment familiarisation training – CSAR specific equipment carried by Typhoon aircrew.*

## 5 INITIAL REVIEW

To evaluate the items a basic 'signalling' scenario was used – this involved utilising the mirror to reflect light without need for powered light sources. Both BCB variants and a Mirror, Signalling Mk.3 (DB's personal mirror used throughout SEREO training and during environmental courses) were used within the vicinity of Key SE. Sunlight conditions were relatively bright with minor cloud cover. All observations and results are reported below.

Results are presented for initial ease of use/simplicity of operations, visible light/reflection and possibility of single-handed operation as applicable. Detailed below is the Initial Review of each item and comparison to the Mk3 referenced mirror. A more comprehensive review may be completed, however this IOR is produced as a Quick Look only at this time.

### 5.1 MF600, HELIOGRAPH MIRROR, 2”

The mirror arrived in clear packaging and consisted of the mirror and an aiming/sighting stick attached to the mirror with cord. Instructions for use are printed on the rear of the mirror.

The mirror is lightweight and unobtrusive, but may be difficult to handle with cold, gloved or injured hands as the material is relatively thin – with a weight of 10g it is easily able to be carried on-man in personal worn equipment or fitted to a larger survival kit as required – a method of attaching this to a worn item of clothing was not evident.

#### 5.1.1 Initial Use

Following the instruction printed on the rear the following was observed.

##### Instructions/Ease of Use –

Instructions: Easily understood and relative to operation of the mirror. Despite the small mirror size, instructions are logical and image for reference is good. Simple point and reflect operation.

Ease of Use: Following the written instructions, it was difficult to get a 'sight picture' as mentioned. Getting the aiming stick and reflective cross to be visible was difficult to achieve as it was close to the eye and a little cumbersome. When trying to aim the reflected cross to the aiming stick aperture it was noticed that a bright reflection off the stick top hindered visibility. After this attempt I completed a test without the stick to generate a reflection towards the target area. This was more successful than the first attempt.

##### Visible Light Reflection –

The light was, at first, difficult to discern in the target area with little reflection observed when trying to aim using the aiming stick. The small surface area produces less reflection than the alternative Mk3., this is probably due to the reflective surface material not being polished to a mirrored finish. Despite the limited reflection it was visible and signalling was achieved.



Single-Handed Operation –

Using the MF600 requires the use of the mirror and aiming stick to direct the reflection in the correct direction as per instructions. This is steering users towards having both hands available. The Mk3. used in comparison is truly single-handed in operation and does not require an aiming stick.

Alternative Aiming was achieved by reflecting the light on the free hand and guiding this towards the target area.

**5.1.2 Observations**

Although simple to operate, lightweight and fully functional, it relies on the aiming stick to generate a reflection towards the target area. This was, as described, difficult to achieve quickly and without thinking the process through. When used, the Mk.3 mirror quickly created a bright reflection (possibly due to the highly polished/mirrored surface) and was easy to guide to the target area without need for aiming stick. Aiming the mirror at a fixed point of reference would be ok when using the stick, but to signal an object that may be moving I would, personally, direct the light onto either my other hand or an object in the foreground and move back and forth towards the target.

As the mirror is small and light this makes it difficult to handle when wearing gloves – to test this I donned a pair of US Air Force issue Nomex flight gloves. Although some tactile feeling is removed, the mirror is still capable of being handled, but a method of attaching to a person or item of clothing would be an advantage if hands are wet, cold or injured.

**5.2 MF601, HELIOGRAPH MIRROR, 4”**

The mirror arrived in clear packaging and consisted of the mirror and an aiming/sighting stick attached to the mirror with cord. Instructions for use are printed on the rear of the mirror. The mirror has two additional holes – these may allow for securing to an item or user location.

The mirror is lightweight and of a size that would make it suitable for survival packs as opposed to on-man. The size, although not obtrusive, would mean it may be difficult to fit and remove from a pocket – with a weight of 40g it is easily able to be fitted to a larger survival kit as required.

**5.2.1 Initial Use**

Following the instruction printed on the rear the following was observed.

Instructions/Ease of Use –

Instructions: Easily understood and relative to operation of the mirror. Instructions are logical and image for reference is good. Simple point and reflect operation.

Ease of Use: Following the written instructions, it was difficult to get a ‘sight picture’ as mentioned. Getting the aiming stick and black dot to be visible was difficult to achieve in a similar way as mentioned for the MF600 variant, however, the increased size of the reflective surface area means that, through trial and error, you are more likely to achieve a reflective pass of the target. When trying to aim the reflected cross to the aiming stick aperture it was noticed that a bright reflection off the stick top hindered

visibility. This is detailed in the instructions and alerts users to the possibility when used in bright conditions.

As the sun was not at full strength when testing it is suggested that this reflective area may cause more issues than it solves. Again, after this attempt I completed a test without the stick to generate a reflection towards the target area. This was more successful than the first attempt.

#### Visible Light Reflection –

The light was easy to discern in the target area and a brighter reflective response was noticed. When trying to use the aiming stick I was unable to discern a positive reflection towards my target. The surface area of the 4” mirror ensures more light is reflected, however, as this is (again) unpolished when using in lower light levels it may mean diminished reflection. Despite this, it was easily visible and signalling achieved.

#### Single-Handed Operation –

Using the MF601 requires the use of the mirror and aiming stick to direct the reflection in the correct direction as per instructions and as per the MF600. This is steering users towards having both hands available. The Mk3. In comparison, as described above, achieves single handed operation with relative ease. Alternative Aiming was also achieved by reflecting the light on the free hand and guiding this towards the target area.

### **5.2.2 Observations**

Although simple to operate, lightweight and fully functional, it again relies on the aiming stick to generate a reflection towards the target area. Results, although visibly better than the MF600, were again relatively difficult to achieve without some trial and error steps being used. Aiming the mirror at a fixed point of reference would be ok when using the stick, but to signal an object that may be moving I would, personally, direct the light onto either my other hand or an object in the foreground and move back and forth towards the target. If used at sea the larger surface area allows for large target aiming and would, potentially, create a greater effective range if swept across the focused target area.

The motion of use, combined with the size, would make this an ideal back up signalling device. It is also possible to attach this device to an antenna, or pole, that allows it to be moved without manual input – this is sometimes known as a ‘Tinsel Tree’ effect and, if combined with a reflective packaging, would add to the possibility of indicating a survivors location.

## **6 SUMMARY**

Both BCB mirrors were used and reflective light was visible, with some mixed results. Both mirrors are simple to operate without need for training or awareness. Instructions are simple and images reinforce the method of operation.

Both items are light weight and made of robust materials that ensure they are capable of being used in emergency situations in the event of an incident or accident. Being light and unobtrusive means it would not hinder users during aircraft or vessel escape.

## COMMERCIAL IN CONFIDENCE

The downside of being lightweight is the mirror may be easily mishandled/dropped if hands are cold and sensation is reduced. Having a method of attaching to a worn garment or a fixed point of a life raft would negate this risk.

The comparable signalling mirror (Mk.3) is also of robust construction and has printed instructions – however, it does not have an image to reinforce this. The highly polished surface offers higher levels of light return and is more useable in lower light conditions. There is no requirement to aim against an object or sighting device when using this. The Mk3. Is slightly heavier at 75g due to its construction, but it's relative small size also means the risk of mishandling remains. This is eliminated by securing the mirror, through its protective pocket, to a fixed point on a garment.

Cost and availability have not been factored in to this IOR.

Long distance testing has not been completed at this time. Testing has not been conducted over various terrain or at sea.

## APPENDIX A: APPROVAL

The undersigned acknowledge they have reviewed the IOR and agree with the contents. Changes to this document will be coordinated and approved by the undersigned or their designated representatives.

Signature: **On Original** Date: 11 October 2021  
Print Name: Darren Bumby  
Title: Operations Director

Signature: **On Original** Date: 11 October 2021  
Print Name: Adrian Radford  
Title: Managing Director