

Making the distinctive emblem visible to thermal imaging cameras

Armed forces have for many years developed new methods of observation in order to increase their capacity to fight at any time of day or night and in any weather conditions. Some have thus equipped themselves with thermal imaging or infrared (IR) cameras,¹ which make it possible to recognize and detect people and objects not only at night but also in poor daytime visibility conditions (for example, through smoke, foliage or light rain).

IR cameras do not distinguish differences in colour; instead, they detect differences in temperature. Thus, a "standard" red cross or red crescent on a white background is not visible by means of thermal imaging, since there is no difference in temperature between the red of the cross or crescent and the white background (see also the visibility tests conducted in 1989)². However, the use of special adhesive tapes with a high thermal reflection coefficient can make the emblem visible to an IR camera. Owing to the thermal characteristics of the tapes, the red cross or red crescent has a different temperature from that of the white background, allowing it to show up in IR photographs. Thermal tapes are most effective when they are angled towards the sky as much as possible.

Furthermore, the use of thermal tapes in making red crosses or red crescents complies with the provisions of the Regulations Concerning Identification,³ which invite States parties to Protocol I additional to the

¹ "Thermal imaging": by this means, the electromagnetic energy emitted in the infrared (IR) band (8-14 µm) by objects is transformed into electrical signals which are then used to draw a map of heat distribution on the landscape, thus forming a "visible" image.

² Gérald C. Cauderay, "Visibility of the distinctive emblem on medical establishments, units and transports", *IRRC*, No. 277, July-August 1990, pp. 295 ff., in particular p. 301.

³ Regulations Concerning Identification, Annex I (amended) of the Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I).

Geneva Conventions of 1949 to agree on supplementary means designed to enhance the possibility of identification and take full advantage of technological developments in this field.

Tests

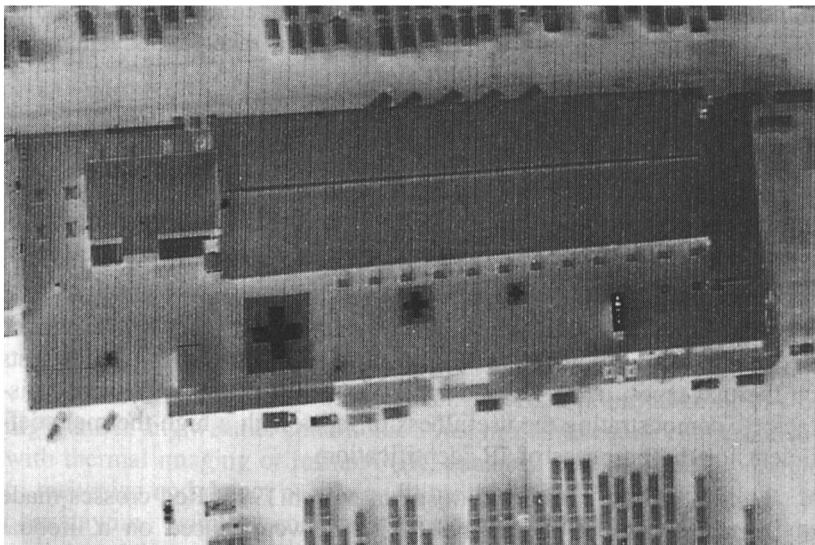
Between 1993 and 1995, the ICRC conducted several visibility tests on red crosses, using adhesive thermal tapes in conditions similar to operational reality, so as to assess the potential of this modern method of identification.

In 1993 and 1994, the ICRC, in cooperation with the Swiss Defence Technology and Procurement Agency, carried out the first visibility tests on thermal tapes, using IR cameras. The results of the tests were satisfactory, demonstrating the usefulness of tapes with a high thermal coefficient for the purposes of IR identification.

Tests were also conducted at sea in March 1995. Red crosses made of thermal tapes and measuring 1.3 sq m were placed on a lifeboat belonging to the United Kingdom's Royal National Lifeboat Institution. A helicopter equipped with an IR camera flew over the boat several times while it was at sea, both during the day and at night. The daytime tests showed that the conjunction of various unfavourable factors (uniform thermal image of the sea, relatively small dimension of the cross, continuous rain and thick cloud cover) made identification of the red crosses on the lifeboat with an IR camera difficult. In the evening the cloud cover lifted, allowing a slight improvement in identification with an IR camera, without however providing very satisfactory results.

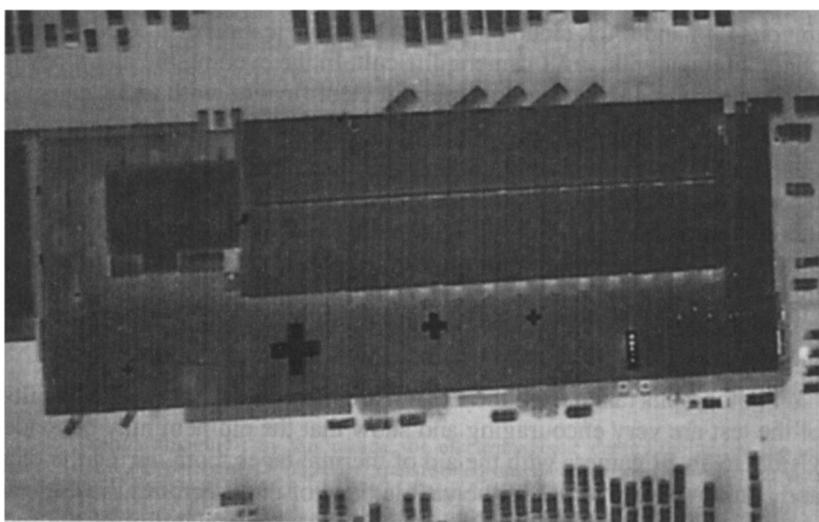
Finally, on 2 and 3 November 1995 the ICRC placed four flags on the roof of a building; the red crosses on the flags had been made using thermal tapes. The four flags were of different dimensions: 10 m × 10 m, 5 m × 5 m, 3 m × 3 m and 2 m × 2 m. An observation aircraft provided by the Swiss army and equipped with an IR camera flew over the building several times, both during the day and at night. Throughout the test period, the sky was partially cloudy but there was no precipitation.

Photographs taken from the IR film are reproduced below. The results of the test are very encouraging and show that the emblem may be made visible to an IR camera with the aid of thermal tapes, both during the day and at night. However, as in the visible band of the spectrum, the dimension of the emblem is all important. Moreover, the visibility of the red crosses in the last photograph was reduced owing to the fact that during the night of 2 to 3 November, dew covered the thermal tapes with a fine film of water.



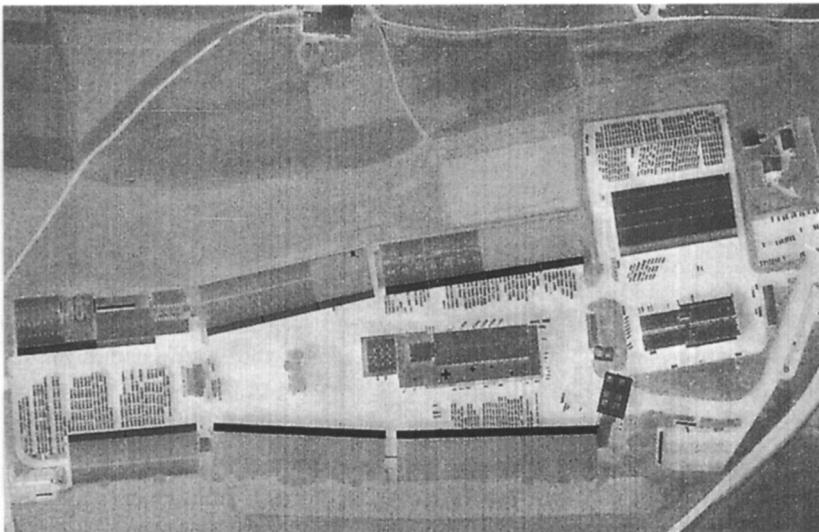
2 November 1995 at 4.10 p.m. (daylight). – Distance between aircraft and building: 100 m.
The red crosses measuring $10 \text{ m} \times 10 \text{ m}$ and $5 \text{ m} \times 5 \text{ m}$ are clearly visible.
The red crosses measuring $3 \text{ m} \times 3 \text{ m}$ and $2 \text{ m} \times 2 \text{ m}$ are not identifiable.

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2 November 1995 at 6.50 p.m. (night-time). – Distance between aircraft and building: 100 m.
The red crosses measuring $10 \text{ m} \times 10 \text{ m}$, $5 \text{ m} \times 5 \text{ m}$ and $3 \text{ m} \times 3 \text{ m}$ are clearly visible.
The red cross measuring $2 \text{ m} \times 2 \text{ m}$ is not identifiable.

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2 November 1995 at 6.55 p.m. (night-time). – Distance between aircraft and building: 400 m.
The red cross measuring $10\text{ m} \times 10\text{ m}$ is identifiable.

The red crosses measuring $5\text{ m} \times 5\text{ m}$, $3\text{ m} \times 3\text{ m}$ and $2\text{ m} \times 2\text{ m}$ are unidentifiable.

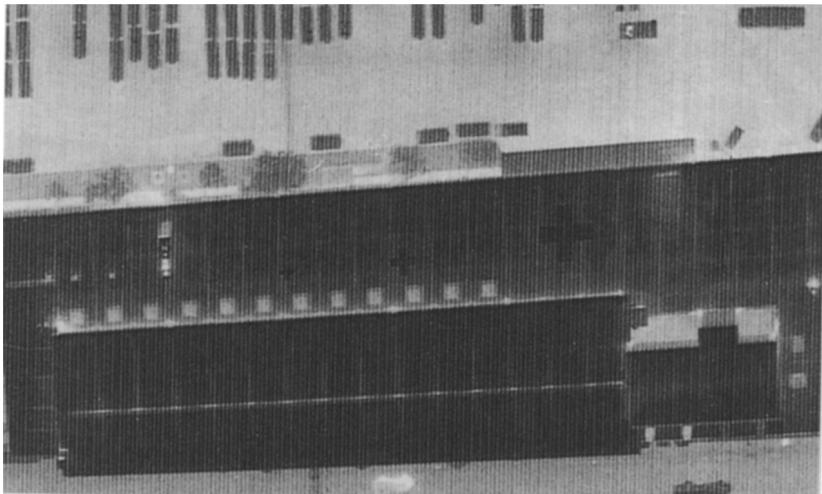
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Conclusions

The observation methods used by modern armed forces evolve and keep pace with new techniques. Such changes require additional means of identification in order to guarantee that medical units will be recognized at all times and in all weather conditions.

With regard to the visibility tests conducted by the ICRC, they showed that in many situations the use of thermal tapes made the red cross (and by analogy the red crescent) visible to thermal imaging (IR) cameras. This modern method significantly increases the probability of correct identification, both during the daytime and at night, by the parties to a conflict.

Thus, in conflict situations where armed forces use IR cameras, it has become essential for medical establishments and transports protected



3 November 1995 at 8.32 a.m. (daylight). – Distance between aircraft and building: 100 m. The red crosses measuring $10 \text{ m} \times 10 \text{ m}$ and $5 \text{ m} \times 5 \text{ m}$ are difficult to identify. The red crosses measuring $3 \text{ m} \times 3 \text{ m}$ and $2 \text{ m} \times 2 \text{ m}$ are not identifiable.

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under the Geneva Conventions of 1949 to equip their distinctive emblems with thermal tapes.

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