

OPERATION GRANITE

by SQUADRON LEADER D. WEST

This is the story of the measures taken by the Royal Air Force and the Royal Observer Corps to prevent aircraft flying into high ground. It appeared, originally, in AERONAUTICS, and, because of its wide interest, we have asked and received the consent of the Editor, Oliver Stewart, to reproduce it here.

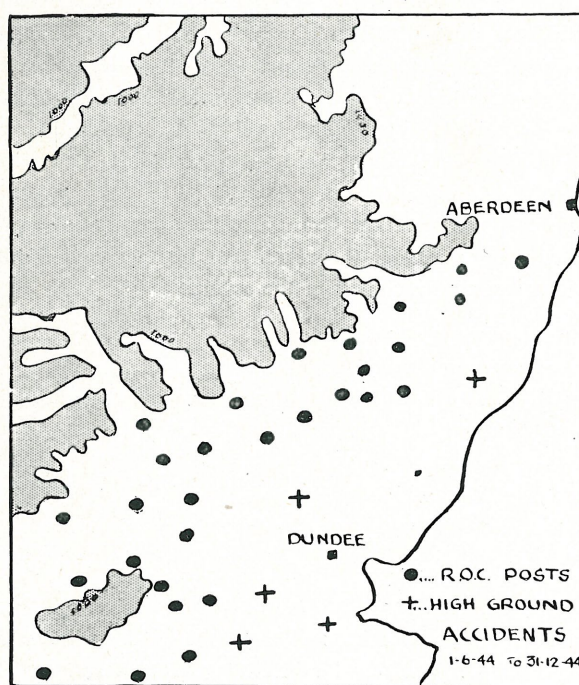
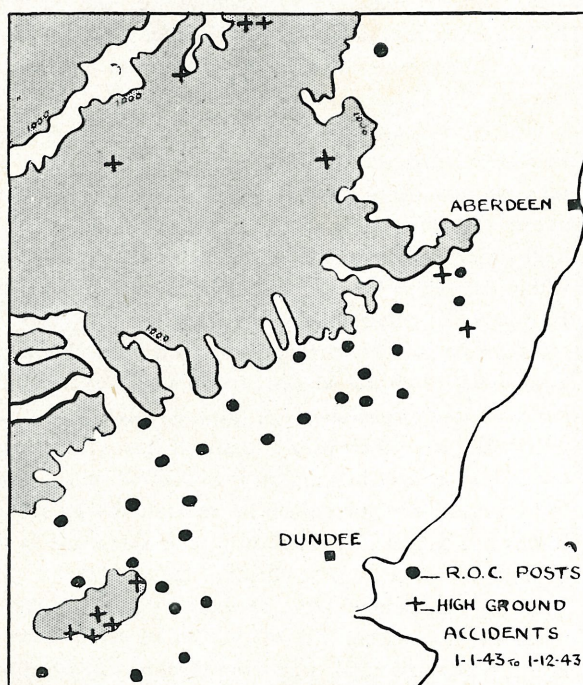
The Granite scheme, or as we call it "Operation Granite" is not so well known amongst those whose posts were situated in the non-hilly regions of our Island, and this account of it will serve to illustrate one other aspect of the R.O.C.'s varied war-time tasks. To those who have worked the scheme and know all about it, there will be the satisfaction of seeing just how valuable their long weary watches really were in the matter of saving lives of members of aircrews, and in saving aircraft.

The story shows that the experience gained in its use may well mean the revival of this operation or something very much like it, if the Royal Observer Corps is again called to "action stations". Operation Granite will eventually be brought within the scope of the training plans of the R.O.C.

DURING 1946 many civil and service aircraft were lost through flying into high ground, and the public naturally asked what was being done about it. The only official answer was to the effect that experiments with radar as a means

of warning aircraft that obstructions were ahead were under way, but they had not been perfected.

During the late war large numbers of aircraft were lost each year in the British Isles through flying into high ground, but

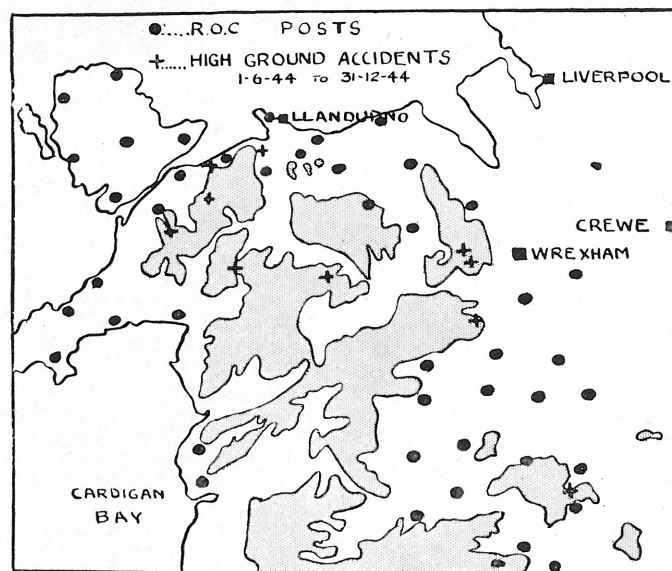
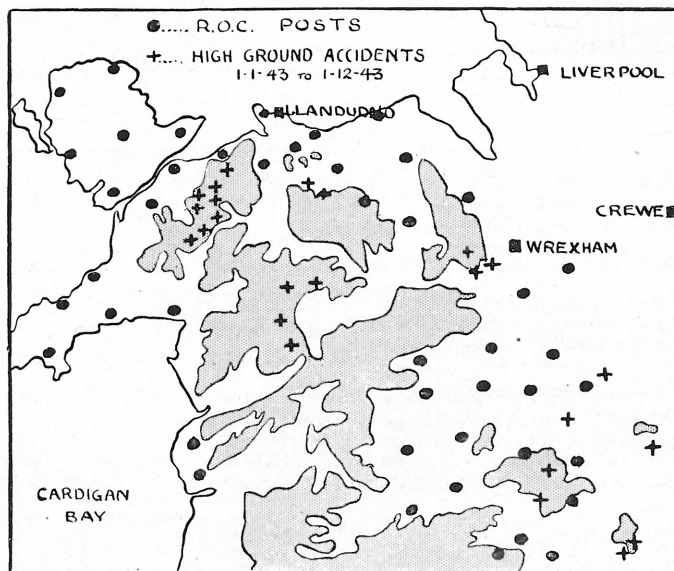


High ground of 300 metres (1,000 feet) or more is indicated by the shaded areas in these illustrations. In the shaded areas (left) it will be seen that there were 10 high ground accidents. After Operation Granite had been working for a period, no high ground accidents occurred between the 1st of January and the 31st of December, 1944 (right). The two charts give a good example of the deployment of the Royal Observer Corps posts.

the Royal Air Force were eventually in a position, with the help of the Royal Observer Corps, to combat this menace with a scheme known as "Granite." The idea was to light powerful red ground flares in the path of an aircraft observed to be flying towards high ground, so that the necessary avoiding action could be taken by the pilot.

By the 26th of April, 1945, 340 ROC posts were ready to take part in Granite.

The procedure necessary to bring Granite into operation was as follows : When by day the observer at an ROC post from which the 300 metre (1,000 feet) contour of nearby hills was visible, saw low cloud down to this contour, he informed the ROC



These two illustrations cover the North Wales area. Before Operation Granite high ground accidents were common in this area (left). Afterwards they were markedly reduced (right).

The Royal Observer Corps, through the medium of their observer posts, were ideally situated to see when an aircraft was running into trouble, and those posts in the vicinity of hills and high ground were issued with a quantity of red flares (Flare, ground warning, Mark 1), which would burn for about three minutes. One flare was lit at night, but in order to get the same degree of brilliancy by day, it was found necessary to light four. They were arranged in the form of a rectangle 9 by 1 meters (30 by 3 feet). They were replenished with new flares as long as they were required.

At the start of Operation Granite, which was in full swing at the beginning of 1944, the regions of high ground in the following areas were included in the scheme :

- North and north-west Wales.
- The east boundary of the Welsh hills.
- The east and west sides of the Pennines.
- The Lake District.
- South-west Scotland.
- The Isle of Arran.
- The hills north and west of Montrose.
- The Ochill hills.

The following number of ROC posts were equipped with flares in their respective areas : Derby area 16, Manchester 6, Leeds 20, York 17, Wrexham 19, Shrewsbury 18, Caernarvon 13, Lancaster 15, Durham 11, Carlisle 21, Ayr 20, Glasgow 4, Dunfermline 13, and Dundee area 13.

The Granite scheme was gradually extended to cover all the hilly districts in England, Scotland and Wales. This brought in the Exeter area, which had 16 ROC posts equipped with flares.

centre, who in turn instructed all posts in the area concerned to report all aircraft movements, and all posts equipped with flares to have them ready for immediate use.

By night it was the responsibility of the Flying Control liaison officer at the appropriate Fighter Group to instruct the ROC liaison officer to order Granite to be put into operation through the appropriate ROC centre.

Granite was also put into operation when an aircraft was known to be moving towards high ground at such a height and on such a course that the pilot did not obviously intend to land at any airfield in the area, and might be in danger of flying into high ground. A red flare or flares would be lit at each post within 16 kilometres (10 miles) in front of the aircraft, and 16 kilometres either side of the track.

As can be seen from the diagrams on page 21, the posts were located close together so that a pilot would be warned by many flares while approaching high ground. Observers were allowed to light flares on their own initiative if it was a matter of saving time. During flight briefing prior to take-off, pilots were warned to turn on to a reciprocal course as soon as they saw the flares. It was not sufficient to turn to port or starboard as dangerous high ground might still lie ahead of the aircraft.

Scores of instances were recorded of aircraft taking action when the flares were lit. On the 7th of April, 1945, at 09.43 hours, a Fortress north-west from Hucknall flying at 600 metres (2,000 feet) increased height to 1,500 metres (5,000 feet) and continued on course. On the same day at 13.59 hours another Fortress flying at 150 metres (500 feet) changed course to south-east, and at 14.05 hours a Fortress at 240 metres (800 feet) climbed to 300 metres (1,000 feet) and continued on course.

Between 09.14 and 10.05 hours on the 12th April, 1945, of six aircraft, five increased height and one turned on its reciprocal course and on the 26th of the same month, of twelve aircraft, five changed course and seven gained height and proceeded on their course.

A large number of positive results were noted from the flight reports of pilots. One worthy of notice occurred in the Pennines area in March, 1945, when a Hudson with a V.I.P. on board climbed steeply from 300 to 1,200 metres (1,000 to 4,000 feet), a safe height in this area. Another case occurred the following month when a Wellington from Dalcross flying south-east towards the Grampians at 600 metres (2,000 feet) subsequently increased height to 2,000 metres (7,000 feet) and returned to Dalcross. On this occasion four flares were lit. Satisfactory results were recorded when observers at ROC posts lit flares on their own initiative.

At 13.48 hours on the 10th of October, 1944, an observer seeing a Domini flying at 90 metres (300 feet) towards high ground immediately lit a flare. The aircraft was seen to turn on to its reciprocal course and was traced through other observer posts to its base. The pilot afterwards reported that he had seen red flares and realised he was flying into high ground due to bad weather and changed course. On another occasion earlier in the same year an observer lit a flare when he spotted an Anson at 90 metres (300 feet) flying towards high ground. The aircraft immediately turned eastwards and increased height to 600 metres (2,000 feet).

Up to the end of March, 1945, flares had been lit on 521 occasions and 261 aircraft had been observed to take various forms of action. Details are shown in the table on page 24.

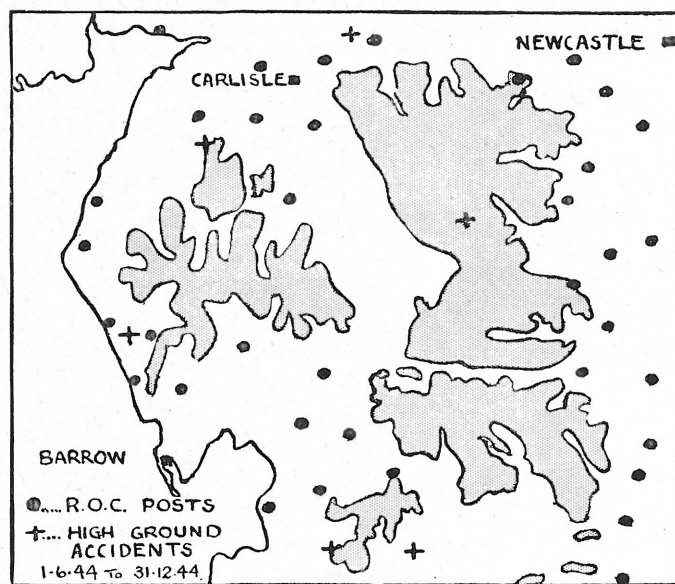
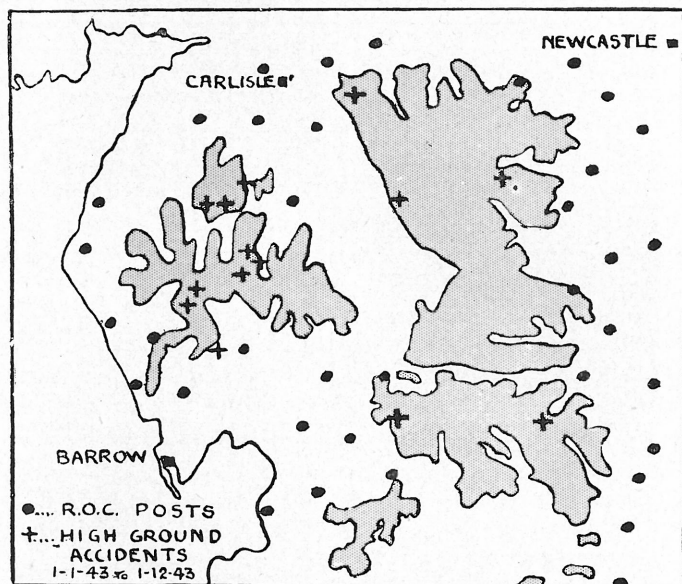
enclose high ground of 300 metres (1,000 feet) or more. These illustrations are typical of the Granite scheme for the rest of the country, and they show a marked drop in high ground accidents. The periods covered are from the 1st of January 1943, to the 1st of December, 1943, and the 1st of June, 1944, to the 31st of December, 1944. (The figures from the 1st of January, 1944, to the 31st of May, 1944, are not available.)

Eleven months against six may not be considered a fair comparison, but the number of aircraft airborne during the shorter period is said to have been twice that for the same period in the previous year.

The Royal Air Force were not content that Granite should be the only means of warning aircraft of danger ahead, and from time to time they introduced other methods to augment the scheme. The most important of these other aids was the installation on high ground of a wireless transmitter which emitted a note lasting half a second, every six seconds, on the common 6,440 kilocycle Darky frequency. A pilot on hearing this signal would be warned, and would exercise extreme caution and take the necessary action.

In the Scottish area mountain warning beacons were established at Auldgirth, Porton and Bargrennan. In the north-west and Caernarvon areas, beacons were installed at Snowdon, Overton, Llanymech, Llanfairfechan and Portmadoc, and others were placed at Broughton, Kendal, Staveley, Ripley (Derby), Dalston, Allonby, Scawfell, Skiddaw, and in the Isle of Man.

The maintenance and servicing of these transmitters was done by the appropriate group in whose area they were installed. Those in the Scottish area, for instance, were maintained by 33 Group. Some ROC posts were also fitted with R/T



The area containing the Pennine Chain south-west of Newcastle and the high ground south of Carlisle are shown here. Most of the accidents in this area between the 1st of January, 1943, and the 1st of December, 1943, occurred in the hills south of Carlisle, in Cumberland, where Skiddaw, 1,030 metres (3,054 feet), and Scafell, 1,062 metres (3,162 feet), are situated. There are 13 high ground accidents shown in the left diagram and three in the right. By March, 1945, 91 observer posts equipped with flares were established covering the Pennine Range area. The high ground accidents shown befell R.A.F. aircraft only. Casualties to United States Army Air Force aircraft are not included in any of the diagrams illustrating this article.

The aircraft not accounted for in the figures shown probably did not come into the visual range of the observer posts, and their actions could not therefore be recorded.

In the diagrams shown on pages 21, 22 and 23 the contours

transmitting sets, so that observers could pass warnings to aircraft where possible.

Flying Control liaison officers at fighter groups would also try to contact aircraft in danger by passing warnings on the

Darky frequency, by instructing rockets to be fired from airfields, or by ordering the searchlight homing procedure for lost aircraft to be put into operation.

The Granite scheme was dependent for its success on the co-operation of the large personnel of the ROC and when this organization was disbanded at 17.00 hours on the 12th of May, 1945, Granite died.

If such a scheme could be revived in England and adopted by other countries, it would go a long way towards eliminating high ground accidents. The Granite scheme required a large number of people to operate it, and even if it could be re-established in a modified form with, say, 250 observation posts instead of the 340 that were partaking in the scheme in April, 1945, it would require four people at each post to ensure a twenty-four hour watch. This would mean 1,000 people employed, and if they received £5 a week each it would mean an outlay of £5,000 a week in salaries alone. This may be considered too high a price to pay for the results that would be obtained. An alternative method might be devised which would incorporate the use of powerful red neon lights in place of flares.

They could be illuminated in groups and operated from key observation posts. In the illustration on page 21, for example, the 28 posts could be divided into four convenient groups. The substitution of neon lights for red flares might also prove more economical. It is not known whether the Ministry of Civil Aviation has given the matter any consideration, but it may be worth their while to investigate the possibility of reviving the Granite scheme until a better one is found.

HOW PILOTS REACTED TO "GRANITE" WARNING

This table gives an analysis of the action taken by pilots as a result of the lighting of 521 red flares at Royal Observer Corps posts up to the 31st of March, 1945. It is a progressive table, and it will be seen that the greatest number of flares were lit in the dangerous winter months.

	Total Flares Lit	Aircraft Took No Action	Aircraft Changed Course	Aircraft Gained Height	Changed Course and Climbed
To 30th April, 1944	92	24	31	22	15
To 31st May, 1944	100	27	34	24	15
To 30th June, 1944	116	31	37	30	18
To 31st July, 1944	132	35	44	32	21
To 31st August, 1944	143	38	47	37	21
To 30th Sept., 1944	170	46	54	43	27
To 31st October, 1944	235	54	63	59	30
To 30th Nov., 1944	250	56	64	65	32
To 31st Dec., 1944	289	64	65	75	36
To 31st Jan., 1945	336	71	69	92	42
To 28th Feb., 1945	450	149	90	104	45
To 31st March, 1945	521	176	99	115	47

Spotting Test No. 3

- Rule 6. The complete list of answers, headed Spotting Test No. 3, must be sent to reach Group Headquarters by 10th September, 1947.
- Rule 8. Group Headquarters will forward the answers so as to reach the Area Training Officer before the 16th September, 1947.
- Rule 9. Solutions will be published by Headquarters R.O.C. for Groups to circularise. A copy of the results will also be inserted in the next available issue of the *Inter Services Aircraft Recognition Journal*.

The fact that the R.O.C. Gazette is issued every other month makes this course necessary if delay in publishing results is to be avoided.

R.O.C. Spotting Test No. 3

