

Over ten years ago Dr. S O'Donnell attached to the Home Office Scientific Research & Development Branch in London penned a concise thirteen-page report bearing the less than inspiring title 'The Comparative Rate of Searching by Police Aircraft and Men on Foot'. For all its drawbacks this report – 'The O'Donnell Theory' - represents one of the few scientific assessments of the value of aircraft in the rural search mode.

In all the years that the British police had agreed that it was more efficient to search using an aircraft than using large numbers of officers on foot no scientific research had been set in place to measure the exact difference. Late in 1987 the Home Office set in train a study to assess the cost-effectiveness of using aircraft for searching moorland. It appeared to them that the trial was a world first. In retrospect it is clear that it was, and remains, unique. The resultant report has remained the oft-quoted yardstick for air support efficiency.

A series of trial searches for dummy "bodies" was arranged over the extensive heathland on the Cannock Chase area of Staffordshire and

the Beaulieu Heath area of the New Forest in Hampshire. The aircraft employed were from the now defunct multi-force Midland Air Operations Unit – a Bolkow Bo105 and Pilatus Britten-Norman PBN2 Islander - and from the Hampshire Police Air Support – a Brooklands Optica. None of the aircraft or ground searchers used electronic sensors; all searching was restricted to the vision of the searcher – although the Islander crews had the use of stabilised binoculars.

Usually police searches would be only for one body or missing person ['misper'], but in the trials a number of bodies were introduced to give the searchers an element of the unknown. They were given the defined area but not the number of targets they would be expected to find. It was found useful to relate the multiple body scenario upon an aircraft breaking up in the air and shedding an unknown number of bodies in a defined area. Virtually a PanAm 103 scenario – but Lockerbie was still a year away.

The resources employed in the trial were relatively crude. The targets employed were 'bodies' represented by 2 feet by 4 feet [torso sized] sheets of black plastic pinned to the ground within a defined area. Other than the two 20 inch high white PVC characters providing a unique identity to each target, the colour was not a high contrast with the dark shade of the ground [dark green/black/grey/brown]. The unique markings ensured that targets were not counted twice by the air searchers. The choice of these in preference to other objects such as dummies was that they were easier to carry and store, were weatherproof and could be marked. Although air searches were carried out at between 300 and 500 feet they were visible up to a distance of 800 feet from the air. The searchers were aware of the confines of the area they were to search but they were not told how many bodies there were to be found. The total time taken to search the area was recorded and the accuracy of the search was measured as the % of bodies found compared to bodies present.

The main conclusions of the trial were that men on foot were 100% effective and aircraft were between 90% and 100% effective in finding objects that could be clearly seen from the air. More tellingly a helicopter could search a square mile in twelve minutes, a fixed wing aircraft 20 minutes but it would take 450 man-hours to search the same area on foot.



Type Suitability

With its high vision bubble cabin and rear engine layout, the much-maligned Brooklands Optica light aircraft was found to be the most cost-effective aircraft at the task. The helicopter and the Islander returned overall performances that were similar to each other in that each missed one target for different reasons on the second of their trial sorties. The helicopter failed to fly over the missed target due to a faulty search pattern and the crew of the Islander missed a target the aircraft flew over because of the relatively poor visibility afforded by type [visual observation to the sides only]. The high cost of the helicopter was defrayed by the additional length of time it took the cheaper to operate, but less observer friendly, Islander to complete its search pattern to find all the target bodies.

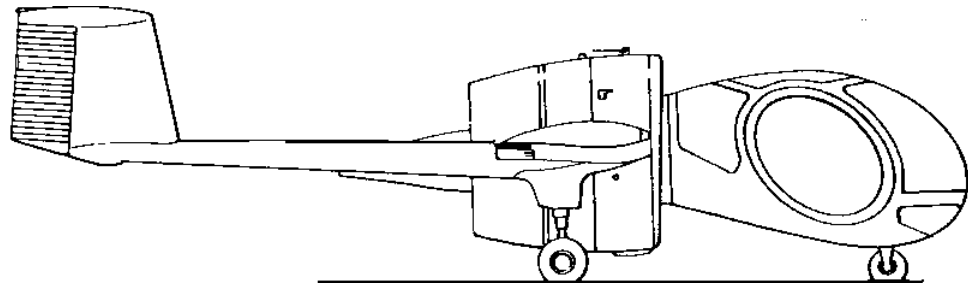
The first of the trial flights over the Cannock Chase targets took place in mid December 1987. Nine bodies were placed in an area of 1.3 sq. miles and searched by aircraft crewed by a [commercial] pilot two [police] observers and a Home Office researcher. The researcher timed the length of the search but took no part in it. The Islander flew first followed by the Bolkow. Different crews were employed but the same researcher.

The Islander took 35 minutes to find all nine targets from an altitude of approximately 800 feet. The helicopter search was likewise successful but took just 17 minutes to complete the task from a weather-induced altitude of 300 feet. The cause of the longer time required by the Islander was assessed as being due to a need for additional orbits to correctly identify targets. The greater manoeuvrability of the helicopter – the ability to hover – was apparent.

The search was repeated over the same area late in January 1988. This was largely to confirm the stark 100% success exhibited in the earlier result and involved five targets. In each case the Islander and the Bolkow managed to find only four before concluding the search objects had been met.

The trial in Hampshire took place over an area of 1.25 sq. miles on February 10, 1988. As a three-seat design, the Optica search crew was restricted to the police officer pilot and observer. The researcher was obliged to make his assessment from the ground. At 500 feet the Optica found all six bodies in a sortie lasting 23 minutes.

The pilot of the Optica G-BMPL on that occasion was the 'boss' of the unit Chief Inspector Bob Ruprecht. He recalls 'Our particular input was searching for pre-marked bundles laid out in a haphazard way at a site in the New Forest.



'Home Office Observers on the ground timed the search and marked the bundles as we found them. In our case we were 100% successful in locating the 'mispers' but took slightly longer than the Islander (90%) successful I think, although my memory maybe an unreliable factor! I do recall thinking that no mention was made of the difference in doing the task faster and leaving one body to rot, against, taking 5 minutes longer and finding all of them.'

The search by the men on foot - conducted by twelve officers assigned to an area of Cannock Chase that was a third of the size searched by the aircraft took place on February 25, 1988. Although they were thorough and found all the targets set out for them in the searched area, the small group were hindered by the terrain and unable to complete a search of even 30% of this smaller section in over four hours.



The actual costs involved in conducting these searches are now ten years out of date, but the relative values will remain similar. At the time it was stated that the leased Bolkow cost around £500 per hour to operate. A similar helicopter on lease can be assumed to cost at least double that figure today.

Based on the original figures it was concluded that the cost for searching one square mile was: -

Islander	£95
Bolkow 105	£106
Optica	£29
Ground party	£4,091



The conclusions reached by this landmark trial remain valid when related to searching for bodies or other objects lying on the surface of moorland terrain. Moorland can be equated to any area of open land surface [desert, short grass etc]. It should be borne in mind that different types of terrain including dense trees, long grass or burial of the target would degrade the success rate of a visual air search. An aircraft searching for a warm body with effective flir equipment might well cut the search time appreciably. Air search is not the panacea for all instances, there remain many instances where even the most methodical air or ground search using electrical sensor or animal assistance could still face failure. This has been demonstrated on many occasions in the past.

Although the author wished to validate the results in a wider trial it was not undertaken. Where the O'Donnell report scores is in demonstrating the differences in relative efficiency between any type of aircraft and a ground based search party. The relative values displayed by these tests are of such a magnitude that it is difficult to criticise the crudeness of the exact methodology used. The relative lack of sophistication of the resources used in 1987-88 has served to provide a meaningful baseline for future assessment.

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The Comparative Rate of Searching by Police Aircraft and Men on Foot

By Dr. S O'Donnell Scientific Research & Development Branch.
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The Aircraft

Two of the three aircraft types involved in this trial remain fairly familiar to emergency services aviators worldwide.

Bolkow BO105 Latterly known as manufactured by Eurocopter the Bolkow original was designed in Germany as a rugged tank-buster in the 1970s. It readily transferred over to the emergency service arena in the police and air ambulance role as a twin-engine helicopter providing the crew with a view second to none

and adequate accommodation. It remains in service in large numbers.

Britten-Norman BN-2 Islander. Designed in the 1960s, despite its popularity and ruggedness the ubiquitous Islander has had a chequered ownership career that even today remains in question. Nonetheless it has proved to be one of the world's great air observation platforms – in spite of many limitations in its layout. The high wing and slow loiter speed have been its positive features but a failure to develop the type, a relative lack of manoeuvrability and the intrusion of the engines into view have been the most obvious negative elements.

Brooklands OA7 Optica. How fortunes change. At the time of its launch the Optica was rightly hailed as a highly efficient air observation platform. It combined the view of the best helicopter with the economy of the light aircraft and orders flooded in from across the world. In his report Dr. O'Donnell praised the Optica as being the 'most cost-effective at this type of search'. Unfortunately within a few short years the veneer that hid the shortcomings of the type peeled away and it became clear that it was under-developed in the engineering sense. As a result sales foundered and the project collapsed. Today the type would find little favour in police service as it appears incapable of being fitted with role equipment that was not envisaged when it was designed. The aircraft – including that formerly used by the Hampshire Police-remains on offer. Production jigs and spare airframes all exist in a hangar at North Weald Airfield in Essex – awaiting a buyer.

Costs today.

In a recent public domain report to its Police Authority on the subject of search the Greater Manchester Police [GMP] calculated that the hourly cost rate of an officer was £17.97 per hour – nearly twice the figured allowed for in the original trial. Conversely, the 1999-2000 financial calculations suggested that the hourly cost for the GMP AS355F2 helicopter, complete with pilot, fuel, maintenance, observers and depreciation was just £674. The meagre cost growth in this resource being a mixture of market pressures and the fact that the GMP aircraft was owned rather than leased. The overall result was therefore that the cost differential was therefore more marked. This same report suggests that in the absence of a helicopter GMP might have assigned over £500,000 annually to foot searches that actually cost just £120,600 using air support. [Report of the Chief Constable to the Greater Manchester Police Authority 13 July 2001]