

The Mineseeker Airship: 'Supporting the U.N.'

The Lightship Group and the Defense Research and Evaluation Agency team up to help survey mine fields from above. Airship completed its flagship mission in 2000.

by Elizabeth A. Cramer, MAIC

From October to November 2000, people in Kosovo may have looked skyward and seen the large white airship titled "Mineseeker.com, Supporting the U.N." For nearly two months the Mineseeker Airship flew over regions of Kosovo collecting information about the mine fields below. The airship was completing its debut assignment as the first in aerial mine field survey technology. Over the course of six weeks the Mineseeker team collected over 60 hours of videotape and 500 digital images of mine sites, completing the airship's first mission—an aerial optical survey collection of 30 mine fields in Kosovo.

Background

The idea of aerial mine field survey grew from the continual advancement in demining technology.

Currently, the most reliable method for clearing a mine field involves manually probing the ground. By this method, a man with a probing device can clear 20-25 m per day. This method is both costly and timely. Experts in demining have been looking for a more time and cost-effective method of clearing the U.N. estimate of 800,000 square kilometers of land that is unusable due to the suspected presence of mines. The United Nations estimates that over 80 percent of the land worldwide currently restricted as mined is actually mine-free. In order to release restricted land for agricultural and residential development, it must first be surveyed. The original objective for an aerial survey was to complete a fast and accurate Level Two survey of the land. The goal of The Lightship Group (TLG) and the Defense Research and Evaluation Agency (DERA) using the

Mineseeker is to reduce the land to be mined by 20 percent.

The Lightship Group

TLG was formed in 1995 as a partnership between Lightship America, the operating division of American Blimp, and Virgin Lightships, part of Sir Richard Branson's Virgin Atlantic Group of Companies in Telford, UK. TLG currently operates 17 of 23 worldwide airships, making it the largest operating airship company. The Lightship Airship was created in response to the need for low-cost, high performance airships for both advertising and aerial survey. The group is known for its robust, cost-effective airships. The Lightship crew has combined for over 100,000 hours of flying experience. The Mineseeker Airship is an A60+ lightship that measures 150 feet long and 55 feet tall. With a gondola 14 by 5 feet long, it can hold up to five people.

DERA

The ground breaking new technology that makes aerial radar survey possible is called the Ultra Wide Band Synthetic Aperture Radar (UWB SAR). The UWB SAR was first developed by the U.K. Ministry of Defense for use in finding AT mines; it was originally intended to find large objects. In the last five years the Defense Evaluation and Research Agency (DERA) has taken over serious

development. The radar is designed to penetrate foliage and ground to create a high-resolution image of metal and plastic mines. The radar was developed to find smaller targets, making it suitable for survey of mines and cluster bomb units (CBUs). The UWB SAR is currently the world's highest resolution radar of its kind.

The Mineseeker Project

In response to the need for more advanced demining technology, TLG and DERA joined together to study the use of airships in humanitarian demining. They began to study the feasibility of joining two technologies, TLG's A60+ airship, and DERA's UWB SAR, to create a mine-seeking airship. Both organizations believe that the airship is the most practical aircraft for aerial survey primarily because an airship is stable, vibration-free and nonmetallic.

An airship has the following features that make it an ideal aerial platform for the use of a sensitive radar system:¹

- a mobile, stable platform;
- long endurance;
- low noise and vibration;
- no rotor downwash;
- relatively large payload capability; and
- a good operator environment.

Airships also have a low rate of critical failure. Even when shot at the airship can withstand several bullet holes before it sinks to the ground, never crashing. The payload of the aircraft is also important because the electric equipment can be both heavy and sensitive.

The Lightship Group's A60 airship has a half-ton payload, making it ideal for the sensor equipment like the UWB SAR. Using a helicopter instead of an airship was considered for the aerial survey, but was decided against for several reasons. When working in military zones, helicopters can be perceived as a threat, whereas

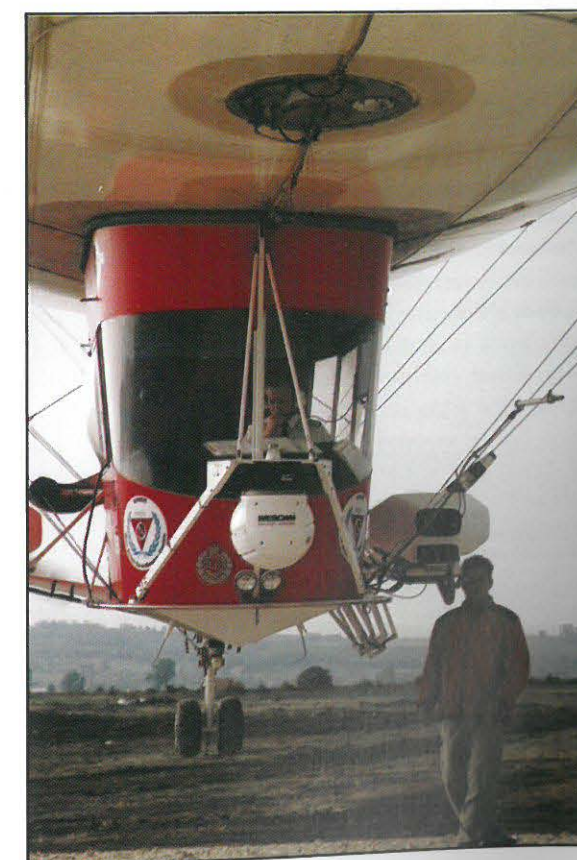


(l-r) John Flanagan, MACC program manager; Mark Finney, pilot; Sir Richard Branson; Chris Clark, operations manager; Steve Saunders, Mine Action Coordination Center; and Dr Paul Bishop, DERA. c/o The Mineseeker Foundation

airships are "friendly" to the public eye. Although helicopters have the ability to hover like airships, they also have rotor downwash, which causes strong downward air pressure that could cause mine detonation.

In January 2000, TLG and DERA officially took steps in their partnership to create and develop the Mineseeker Airship. DERA was already developing a prototype UWB SAR. The development continued until January 2000, when the prototype system was fitted in the Mineseeker airship, a Lightship A60+, recently diverted from an advertising assignment in Germany. The most serious concern that engineers faced was to

make sure the radar energy did not interfere with the electrical power of the airship, causing possible airship failure.



Wescam sensor fit. c/o The Mineseeker Foundation

Mineseeker Airship in flight. c/o The Mineseeker Foundation



Asia & the Pacific

Testing

In January 2000 the first trial run of the Mineseeker was held at a DERA site in Worcestershire, UK. The trials proved promising for the technology,

deminers, discuss the requirements for Level One and Level Two surveys and to gain understanding of specific terrain issues involved in mine clearance in order to give the team a more rounded view of the mine

left in Kosovo is the NATO-dropped CBU, a more difficult to detect munition. After some struggle to get clear, often classified information, NATO shared some coordinate maps with MACC. However, the coordinates were often unclear. For example, on some maps are a series of crosses, but there is no specific key to tell what the crosses indicate. A cross could stand for a known mine field or a reported mine field. Without more detailed information, deminers spend valuable time searching in areas that may not contain mines, instead of spending time in areas certain to be mine-infested.

During the Mineseeker team's visit to Kosovo it became evident that there was an immediate need in Kosovo for an aerial observation platform that could be used to pinpoint both landmines and CBU strikes and their UXO. Upon Flanagan's request the Mineseeker team began to prepare for immediate deployment of the Mineseeker to complete an extensive optical survey of the land. The MACC's statement of requirements for Mineseeker were:²

- Locate and identify existence of recorded mine fields and identify reference points;
- Confirm extent of mine fields;
- Strategic planning regarding the use of assets (dogs, machinery and access);
- Confirm that fences and mine-markers are still intact;
- Confirm land use and prioritization of tasks;
- Identify CBU strikes with known coordinates, and search for identifying strike areas not related to known coordinates;
- Produce detailed records, define boundaries and enable strategic planning for clearance; and
- Ensure all data collected, where appropriate, is entered into MACC's Information Management System for Mine Action (IMSMA).

problem and demining techniques.

In August 2000, the team visited Kosovo, where it met with John Flanagan, program manager of the U.N. Mine Action Coordination Centre (MACC) in Kosovo, to discuss current mine clearance. There are two types of ammunition that need to be cleared from the land in Kosovo. One type is landmines laid by Serb armies. During an initial Level One survey, maps with mine field locators were collected from the Serb Army and delivered to MACC. However, the maps do not always make the mine clearance work easier; the information is often incomplete and vague. Mine fields are not GPS referenced and the field locators are physical points such as stone piles, cement walls, or sticks. Using these maps ground deminers may have to prod through large areas of brush or forest to find the locators before they could begin clearing, wasting valuable time.

The other type of ammunition



The Mineseeker crew.
c/o The Mineseeker Foundation

as the radar was able to detect surface metal and plastic mines with at least the accuracy of ground level surveying. With aerial survey, the team detects and maps mines and UXO, including plastic mines as small as 10 cm. The Mineseeker was found to be able to scan an estimated 100 sq. m per second, a dramatic increase from the amount of land that can be covered per second during typical ground survey. By using aerial survey, large areas can be mapped in a short time and mine-free land can then be released for use, eliminating the need for an actual physical search.

Deployment in Kosovo

In order to develop a better overall understanding of the mine problem, the Mineseeker team planned a trip to visit several mine-affected countries, including Thailand, Cambodia and Kosovo. The trip objectives were to meet experienced

The Mineseeker Airship

Aerial Optical Survey

There were two phases of the Mineseeker work in Kosovo. The first phase of work was an aerial optical survey, begun Sept. 13, 2000. The airship flew over known mine fields and cluster bomb sites using Wescam camera equipment to take detailed photographs of the fields below. For six weeks the Mineseeker flew over 30 mine fields using maps and old sketches to find and zoom in on fields below. Steve Saunders, MACC threat assessment officer, flew with the team during the optical survey. Using previously collected information about mine field indicators, Saunders and pilots Mark Finney and Andy McDonald were able to zero-in on targets to take pictures and make records. By viewing the mine fields from an overhead view, the crew was able to spot mine locators more easily than ground deminers. The locators were then referenced for use by demining teams. From an overhead view, areas of cluster bomb strikes were also more easily spotted and recorded.

One of the greatest challenges in completing the aerial survey was flying the airship so low to the ground. Saunders and the pilot had to navigate hazards such as electricity pylons and mountains that usually were far below the airship. Another concern was that in case of an emergency the airship might have to land near or in a mine field. About this, David Partridge, project director, gives assurance: "In the event of a major system failure or hostile action, airships are remarkably robust and would float to (relative) safety. This aspect has been well researched and formed part of the risk register for our deployment."

Radar Testing

The second phase of the survey was a testing period for the prototype



Post conflict battle damage can be assessed for UXO risk, and associated mined areas pinpointed using aerial images and provided military records.
c/o The Mineseeker Foundation

ground-penetrating UWB SAR. The radar was tested over a former mine dog test site—its first trial in an actual mined area. The area was on a hillside in a former war zone, and contained boxes buried with several types of mines and UXO. The test site gave the Mineseeker team a chance to analyze the accuracy and system limitations of the radar. The radar had already proved to be able to penetrate foliage during the testing in United Kingdom. The team wanted to learn more about the highest level of performance of the radar. From testing it was confirmed that the radar can detect plastic and metal mines up to 10 cm below the ground—a reassuring fact for both DERA and TLG.

The results of this prototype testing will be used to develop the radar and design tests for future prototypes.

Public Awareness in Kosovo

The Mineseeker team also attempted

to promote public awareness of the Mineseeker in Kosovo through a three-part campaign. The team used a three-part method to promote public awareness. The first part was getting local television and radio coverage in the areas of surveying. The media explained that the Mineseeker was there for mine survey and not any type of military action. The second part consisted of sending a mine awareness team to speak with local people to reinforce the positive nature of the project. The third part involved conversing with village elders and inviting them to look at the airship and equipment on the ground at its base. This gave the people a chance to



The canister from a cluster bomb strike identified from 1,000 feet.
c/o Wescam

Asia & the Pacific

see the equipment up close and, according to Partridge, probably contributed to the fact that none of the equipment was intentionally damaged while at its base in Kosovo. Dr. Paul Bishop, DERA project director, said that overall media coverage was very positive and extensive and public reaction to the project was supportive.

Kosovo Results

After completing its 103.2 hours of aerial survey the team put its extensive collection of information onto CDs, which were delivered to

successful part of the mission. "All the companies we provided with information said it was very useful; so yes, it was a success," Saunders stated.

The results are currently being integrated into the MACC's IMSMA. At the time of the delivery of the CDs, local mining had stopped for the winter, so there was no immediate use for the information in the IMSMA.

Benefits of Mineseeker

Besides completing aerial survey, there are other great benefits to the Mineseeker Airship project—increased global awareness of the mine

commercial funding to support the project, believing that it is important to keep mine action in the public eye. The commercial support brings new hope that more humanitarian demining support will come from sponsors other than the government and U.N. programs. Mine awareness and support will continue to be raised in both the public and commercial sectors.

This does not discount the benefit of redirecting former military resources and technology towards humanitarian demining. The UWB SAR is the product of many years of development under the Ministry of Defense. "The most significant thing achieved by the Mineseeker is that it is providing media glare, and that we now have the license to use technology that was released from inherent military demining for humanitarian demining," Partridge explained.

Future Plans

The Mineseeker Foundation was launched on Jan. 27, 2001, as a joint partnership of DERA and TLG and includes patrons Nelson Mandela, his wife Graca Machel Mandela, Sir Richard Branson and Noor-al-Hussein, Queen of Jordan. The foundation will continue to seek commercial support for the Mineseeker project for the next two years of development and for future airships. Under the direction of Chairman Mike Kendrick, the foundation hopes to raise approximately \$14 million (£10 million) for the cause. Bishop says, "The Mineseeker Foundation is committed to looking at new technology not just in mine clearance but in mine action, to using the airship for mine awareness." He points out that the Mineseeker can be used for tasks such as road surveys, monitoring the movement of refugees, and even dropping light parcels, should the need arise.



MACC in November 2000. The CDs contain video footage and still pictures of specific areas of mine restriction. The photographs taken by the airship make visible previously unknown tracks and paths running through the mine field areas of interest—where the tripwires are most likely found. The CDs are available for NGOs for assistance in their mine clearance. Providing NGOs with aerial photos of the land they are demining is considered by Saunders to be the most

problem, a move towards commercial sponsorship for humanitarian demining and the positive contribution of military demining resources to humanitarian demining. The Mineseeker has been fully funded by sponsors Virgin Atlantic Airlines, The North Face, Wescam and Linde Gas. Through these sponsorships, the commercial world has been introduced to the mine problem and taken part to help. The Mineseeker Foundation will continue to look for

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¹Christoforato, Bishop & Thornhill. DERA. *The feasibility of operating an Ultra Wideband Synthetic Aperture Radar (UWB SAR) from an airship for the detection of mined areas in a humanitarian role.* <http://www.mineseeker.com/press-info/docs/dera/dera.html>. July 3, 2000.

²First Mineseeker Airship Deployment Declared a Success in Kosovo. <http://www.mineseeker.com/pr-archive/kosovo-deployment-success.html>. Nov. 10, 2000.

The immediate task at hand is to assess preexisting technology and the potential development of demining technology. The Mineseeker Foundation strives to determine precisely what mine action requires now and what it will require in time. Partridge says that TLG's goal is to make the Mineseeker a cost-effective aid to the global mine action community.

Future plans for the Mineseeker include a two-year development program. The first 18 months will include development to increase the performance of the radar. DERA is currently working on a new technology that would enable the radar to scan the ground surface in layers. With this capability, the team can take a set of pictures of the surface, then take another set at 2-5 cm below the surface, and another set at 10 cm below.

DERA and TLG are also looking into the development of a more complex, automated system to manage the collected data from surveys. Currently, the information is difficult to analyze and can take a long time to be organized. The information is stored by individual mine. However, the ideal management system would provide on the spot, organized output of specific mined areas, in the fashion of an advanced Level Two survey.

After the advanced development stage will come a six-month period of intensive testing. The testing will take place in the U.K. and various other

active mine testing sites throughout the world, possibly including Croatia. The Mineseeker team aims to meet the standards of the International Testing Evaluation Program (ITEP) for aerial mine survey. The tests will be done on various types of soil, water content, mines, and detection characteristics. DERA recognizes the importance of testing in actual mined areas in order to prove the capabilities of the radar before it can be deemed accurate enough for extensive use. The Mineseeker team wants to provide at least the same accuracy of current Level Two ground surveys.

After the Mineseeker meets the prescribed accuracy standards, TLG will develop the Mineseeker II. The goal of the Mineseeker Foundation is to eventually deploy five airships, one or two per year. TLG will provide and operate the technology at the request of NGOs, not as a replacement to all current clearance methods, but in hopes of radically improving mine clearance. As Partridge explains about the project, "New technology is important in terms of speeding up demining. But the most important thing is that we are not standing on a soapbox saying 'We've got the answer'; it's not a silver bullet. We've just got a program enhancement system that can be improved and used." With this in mind, the Mineseeker Foundation and its sponsors join the efforts of humanitarian demining with a whole new approach—from the sky. ■