INDIRECT FIRE SIMULATION USING REMOTELY PILOTED HELICOPTER

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ABSTRACT:

This paper is a feasibility discussion of incorporating remotely piloted helicopter (RPH) into the Multiple Integrated Laser Engagement System (MILES) Exercises so as to simulate and assess casualties of indirect fire. The paper describes existing systems and current proposals for fire in engagement exercises, the problems of compatibility between MILES equipment and RPH's. A new approach is then proposed that uses an RPH to carry a receiver/transmitter which relays the MILES code from the firing weapon onto the target.

INTRODUCTION

The Multiple Integrated Laser Engagement System (MILES) is an engagement training system which employs eye-safe lasers and microelectronics to simulate the firing capabilities of rifles, machine guns, and other direct fire weapons. Battery-operated laser transmitters, attached to conventional field weapons, allow ground troops to fire coded invisible laser pulses instead of live ammunition. Receiving detectors sense the laser pulses and instantly provide audio and visual indicators of hit or near miss. The fact that the laser transmitters have to have a line-of-sight target in order to score a hit makes it impossible to simulate indirect weapon fire. Any proposed approach must of course be compatible with currently used MILES equipment. The system should immediately assess casualties and the effectiveness of the indirect fire. This would ensure realism of the exercise. Finally any proposed system should be independent as possible of exercise controllers and umpires.

Several solutions for automating the indirect fire in MILES have been suggested. In most all the suggestions, the need for an elevated observation post is mentioned. This post would be positioned so that an umpire could observe both the firer and the target, and,consequently, he could assess the hit, missess, and casualties, etc.

Using helicopters as observation posts is not a new idea; however,it was considered by many as impractical. A full-size helicopter would require considerable coordination between umpires, aircraft control personnel, and aircraft support personnel. Also even the presence of a full-size helicopter in the air above the impending target would be an unrealistic cue that indirect fire was imminent. This would, of course, give an unrealistic advantage to the target. Also high powered, non-eye-safe lasers would be required and they can present a hazard to the pilot and other aircraft personnel aboard. This paper suggests the usage of a remotely piloted helicopter (RPH) in MILES exercises to simulate and assess casualties of indirect fire which obviates these problems.

OTHER PROPOSED SYSTEMS FOR INDIRECT FIRE SIMULATION

Current plans for MILES are to use a system very similar to REALTRAIN [4] in simulating indirect fire. The only difference is that an umpire, called the Fire Marker is armed with an umpire's control gun to designate those who are indirect fire simulation casualties. The following is an example [3] for 155 mm artillery. A 155 mm artillery piece will fire a round. A ground burst simulator will be thrown by the Fire Marker into the vicinity of where the round would have struck the ground. Casualties would be designated using the umpire's control gun employing following criteria:

(1) 0-10 meters - All vehicles and their passengers are destroyed other than those in tanks. Tanks immobilized with loss of communications and any exposed personnel are casualties.

(2) 10-50 meters - Vehicles other than tanks destroyed to include passengers. Tanks only lose communications but exposed personnel are casualties.

(3) beyond 50 meters - There is no effect.

Using the umpire's control gun requires care to avoid hitting other sensors that may be at a greater range (possibly up to 1000m) beyond the intended casualty.

As demonstrated in the example scenario, this MILES indirect fire simulation is completely dependent on a large number of controllers or umpires and the radio network connecting them with the firing weapons. The required network is illustrated in Figure 1. This system has little compatibility with the successful simulation of direct fire provided by MILES equipment. In general,this approach is cumbersome, slow, unrealistic, and difficult to implement.

A recent study [2] was conducted to evaluate alternative methods of simulating indirect fire, such as mortars and artillery, as well as area effects in general in a training engagement exercises. The study suggests the following as elements of a simulation system:

- An area-scanning laser transmitter using MILES compatible codes.
- Under-fire audio-cue device mounted on all targets and triggered by the scanning laser beam.
- An under-fire visual cue generated by a special air-burst smoke round fired by an umpire from a M-79 low velocity grenade launcher.
- A position-finder and a target locater using an observers sextant and a hand-held programmable calculator.
- A communication control center for a VHF radio control network to inform the umpires and fire markers of the intended targets.
- Shell smoke is simulated using vehicle or helicopter deployed cannisters.

Figures 2 through 5 are schematic representations of the recommended system.

INDIRECT FIRE SIMULATION USING A REMOTE PILOTED VEHICLE

Of all the physical characteristics of Laser Weapon Fire Simulation (LWFS) that presents the most difficult problem of simulating indirect weapon fire is the line-of-sight propagation of the laser light. Hence,the indirect fire simulation requires an intermediate receiver and transmitter in the signal path between the firing weapon and its intended target. Such an intermediate system is commonly known as a transceiver. This transceiver could be mounted in a flying vehicle which would hover over the designated target location and provide a line-of-sight relay for the artillery's transmitter. An example of a Remotely Piloted Helicopter (RPH) which could easily fly a transceiver for indirect LWFS,is a system WIDEYE manufactured by Westland Helicopters Limited of the United Kingdom. The RPH flying is shown in Figure 6.

WIDEYE is much smaller than a conventional manned helicopter, and it can be easily stored and transported, as shown in Figure 7. The symmetry of the helicopter,along with its simple automatic stabilizing and altitude control system,allows the vehicle to be flown easily by a non-pilot with a very small amount of practice. The small dimensions of the RPH, 1.5 meters in height and 0.75 meters in diameter, make WIDEYE very difficult to see with the eye. The attention of the eye is attracted by linear motion or other changes of scene. A small non-reflecting, low contrast shape hanging motionless or moving slowly is a difficult object to detect. Also the noise of WIDEYE has been kept to a low level by using a low rotor-tip speed. WIDEYE would be virtually unnoticeable to the ground personnel and undetectable by the firing artillery.

The RPH incorporates a navigation system which is based upon the narrow beam radio command and data links between the aircraft and its ground control station. The range of the RPH is determined by the time taken by an airborne transponder to return a coded pulse sent along the command uplink. The bearing of the RPH is derived from the position of the ground control station steerable antenna.

WIDEYE can carry a range of payloads,and the incorporation of a laser for target marking has already been briefly addressed. The WIDEYE control console for SUPERVISOR is shown in Figure 8, but for the indirect fire simulation role a much simpler console might suffice.

The transceiver system aboard the WIDEYE RPH would consist of detectors mounted around the body of the helicopter and their associated electronics as part of the payload. The detector system could be a standard MILES type LWFS detector system. The transmitter on the WIDEYE vehicle would be a standard MILES low-powered, eye-safe, laser transmitter-mounted in a down-looking position co-axial with the TV camera. This would allow the WIDEYE controller to also see the target.

The artillery transmitter would be a high powered pulsed injection laser, transmitting into wide angle beam. The weapon transmitter could be bore sighted with the weapon itself. Although we have initially described a laser transmitter, a millimeter wave transmitter might be advantageous because of the possible presence of a considerable amount of smoke from the weapon firing. A millimeter wave transmitter operating at a frequency of 94 GHz can very effectively penetrate smoke and dust as well as most atmospheric consitutents. Also this transmitter would inherently be eye-safe. If such a transmitter were to be used, the receiver aboard the WIDEYE RPH would have to use a compatible detector system such as unbiased point contact diodes as opposed to solar cells used in the MILES equipment. The down-link from the RPH, would remain laser transmitter no matter what transmitter was used for the up-link, and hence remain compatible with all MILES equipment.

The engagement scenario for indirect LWFS using the WIDEYE RPH would be as follows:

1. A forward observer would call in the target coordinates to the RPH controller.
2. The controller would then fly the RPH to a point directly above the given coordinates and with a line-of-sight to the artillery battery. The controller navigates the RPH using the radio tracking system.
3. The RPH controller then calls the artillery battery to give them the target coordinates.
4. The artillery battery then lays-in direction and elevation. The transmitter attached to the gun's barrel, is simultaneously aimed.
5. The transmitter fires a kill code in a wide beam followed by near miss code in a wider beam just an instant before the gun fires.
6. If the gun was aimed correctly, the RPH will receive a kill code, if not it will receive a near miss code. Having received the weapon's transmission the RPH's transmitter would delay re-transmission so as to simulate shell flight time.
7. The RPH down-looking transmitter would fire the appropriate codes onto target area in appropriate beam widths to simulate kill and near miss zones.
8. The RPH might finally then drop noise makers and smoke to alert other troops in the vicinity that the target is taking indirect fire.

CONCLUSION

The Remotely Piloted Helicopter system called WIDEYE would be a simple and inexpensive solution to the problem of simulating indirect weapon fire. Because of its mobili and endurance it could be used in several engagement simulations in different areas of the exercises only moments apart. In additi it could be employed in area effects weapon simulation. Also, since several guns would have the same target only one RPH would be needed per target. Hence, only a very few RPH's would be needed even in the largest exercises. Since part of its payload is a TV system, it could also be used to help eva uate and supervise the exercise.

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[2] Indirect/Area Fire Weapons Effect Si lator Study, (Contract No. N61339-76 0070), International Laser Systems I Orlando, Florida.

[3] MILES System Description, Technical Library, Naval Training Equipment Ce (NTEC), Orlando, Florida.

[4] REALTRAIN, System Description TC 71- Technical Library, Naval Training Eq ment Center, Orlando, Florida.

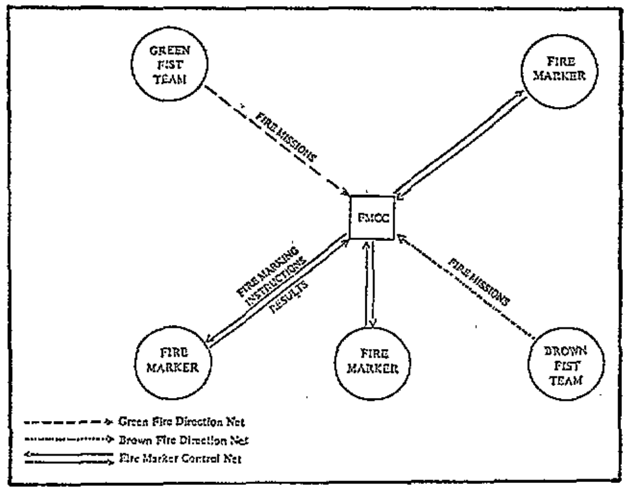


Figure 1. MILES indirect fire radio nets [3]

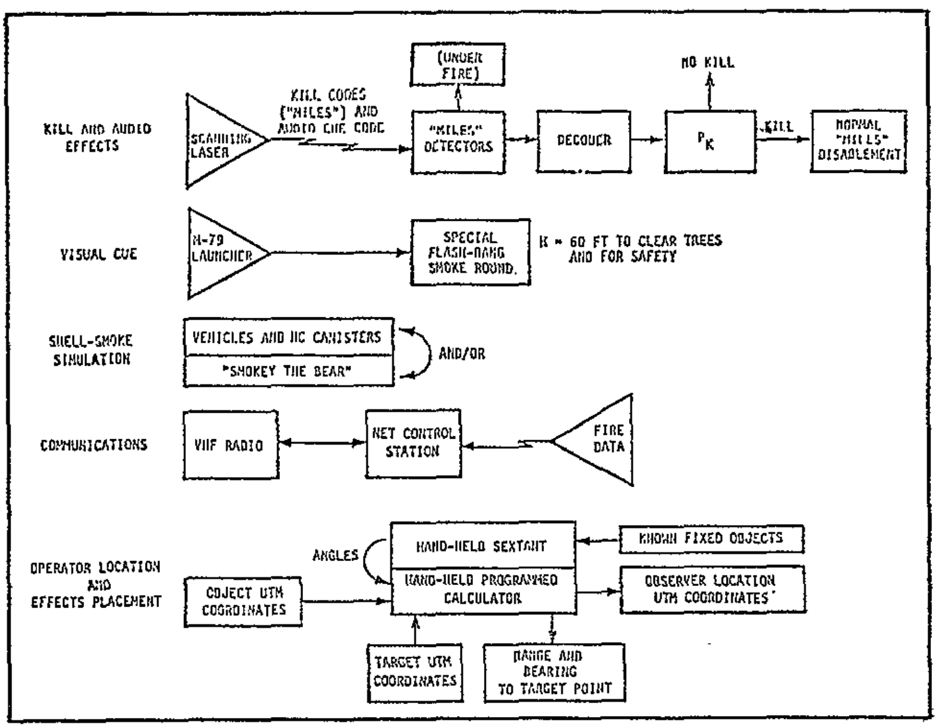


Figure 2. Schematic of recommended elements of optimal system [1]

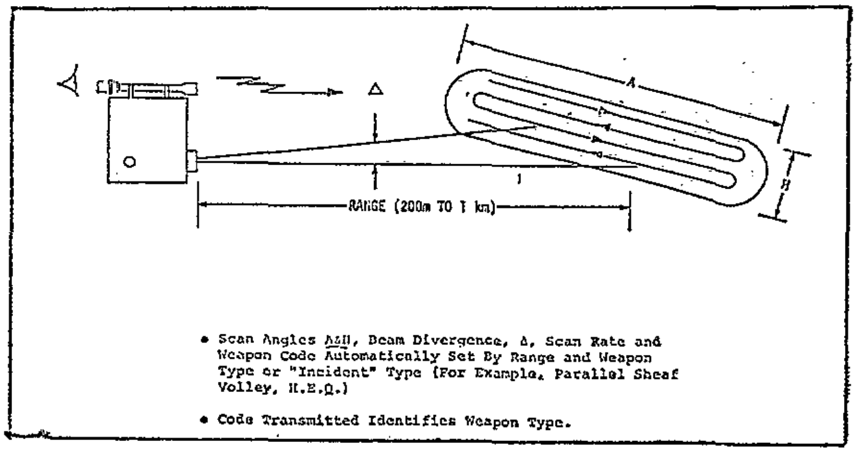


Figure 3. Scanning laser [1]

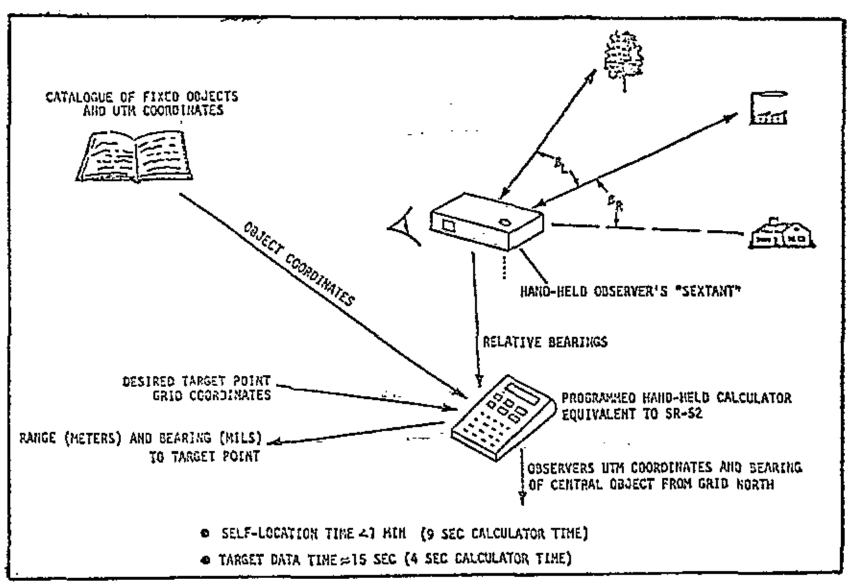
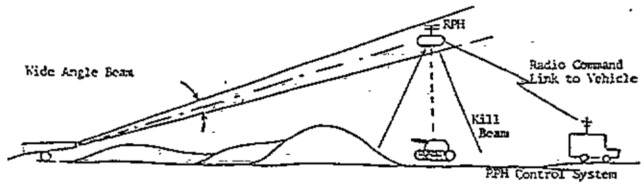


Figure 4. Position-finding and target area location via relative bearings [1]



Helicopter Control

Navigation-TV camera in RPH to give exact location.

Radio Link-TV picture using CCD, low light level camera for controller and to fire laser transmitter.

Helicopter Detectors

Standard MILES detector

Helicopter Transmitter

Standard MILES vehicle transmitter

Artillery Laser

High power pulsed injection laser with wide-angle beam

Figure 5. Suggested indirect fire simulation-schematic diagram

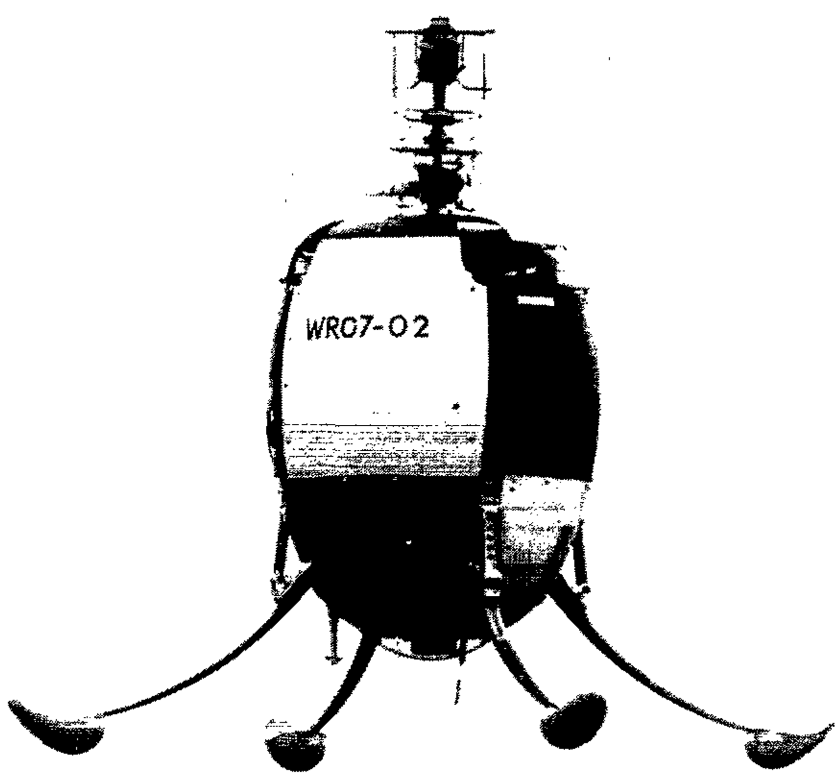


Figure 6. Westland Remotely Piloted Helicopter called WIDEYE

Figure 7. WIDEYE being prepared for launch. The system is easily transported by two men.

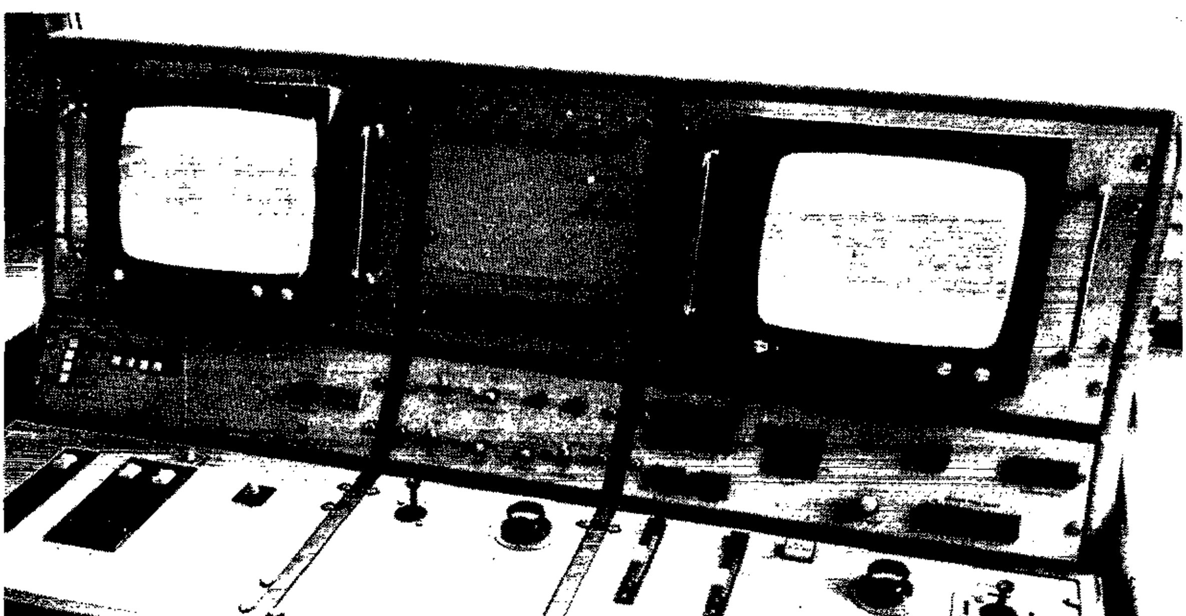


Figure 8. WIDEYE control console. TV display will allow controller to see intended target in addition to providing transceiver for laser relay in indirect weapon fire simulation.

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