BSCE 20 / WP 37

Helsinki 21-25 May 1990

SCARING AWAY BIRDS BY LASER BEAM

- laser rifle
- automatic laser scanning

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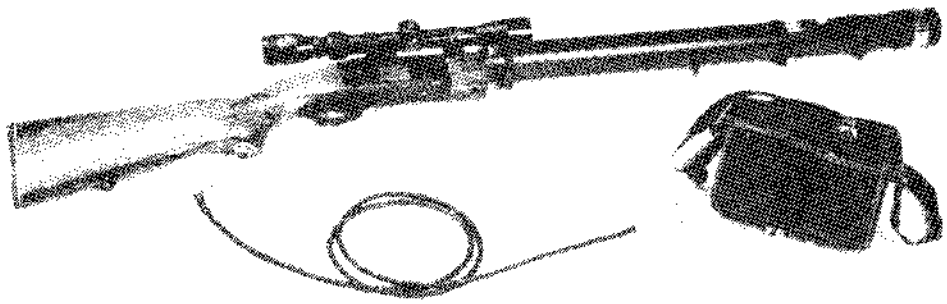
Summary :

Since December 1987 we have carried out tests in various locations using a laser rifle to scare away birds. Results have been very encouraging. This article gives details of all the trials to date and proposes a further development, a system of automatic scanning.

A - LASER RIFLE



1. EQUIPMENT USED Fig 1

The laser rifle which we have used through out our trials is portable and fitted with a helium neon laser tube which emits a red laser beam. The main advantages born out by our tests are its ease of use, its silence, its small size and lightners, and its very high aiming accuracy (approaching 100 micro radians). The rifle weighs 4,3 kg and the power pack 2,8 kg. Its range is up to 2 km, and the whole appliance confirms in every respect to the norms laid down by the international standard CEI 825 governing radiation safety of laser products (equipment classification ; requirements; user's guide). The rifle falls into class 3A of this standard.

2. USE

a) Aiming directly into the eye of the bird

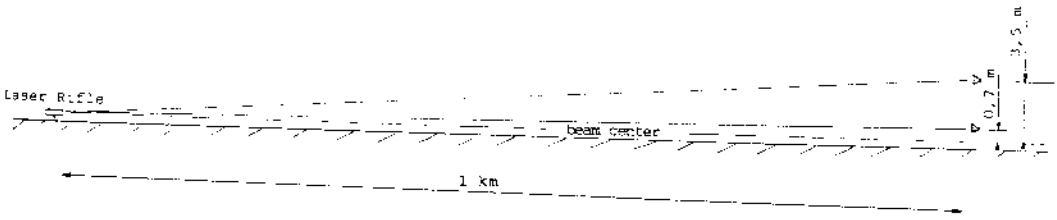
To use the laser rifle one has to line up on the birds visually first and then shoulder the rifle in the conventional way. There after one can aim at the birds the telescope sight. Simply pulling the trigger emits the laser beam whose red spot is clearly visible in the telescope sight. It is then easy to direct that spot toward the eye of the bird one wants to scare away. When the laser beam veacher the eye, there is a flash as at reflects in the eye which is clearly visible by the person giving the rifle and standing immediatly next to him. This is called the bulls' eye effect.

b) Proximity aim

If for any reason it is not possible to aim directly into the eye of the bird, one can still scare it away by aiming in its proximity. Fig 2 Experiments with animals "in situ" showed this very clearly, and we also carried out tests on the human eye : with an observer placed 1 km from the laser rifle he could perceive the beam up to 70 cm from its axis, and the actual source of the laser light up to 3,5 m from its axis. This perception of the laser beam within the immediate proximity of its geometric linear projection is significant, as it disturbs the animals environment and increases its stress.

Source perception: From 0,7 m to 3,5 m of the beam center

Laser beam perception: From beam center to 0,7 m



3. RESULTS

Over distances varying from 100 m to 1500 m successful results were obtained with following species : carrion crow, jackdaw, maypie, common buzzard, black kite, kestrel, duck, sheldrake, cormorant, grey heron, egret, pink flamings, lapwing, black-headed gull, herring gull, common gull, and others... We obtained exceptionally good results (= 100 %) with lapwings.

All these trials were carried out in real life conditions both within and outside airports.

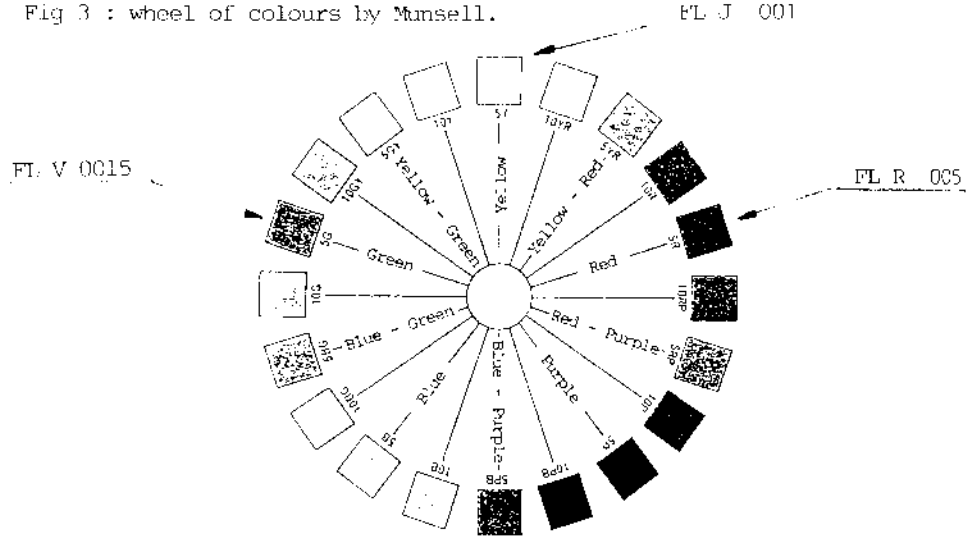
4. IMPROVEMENTS

During the tests we noted that the red laser was not 100 % effective on two species : starlings and sparrows. However, recent progress in laser beam generators has enabled us to replace the red He Ne laser with a green He Ne laser with the same dimensions. We can therefore now also supply a laser rifle emitting coherent green light.

The wavelength of green being closer to the center of the visible spectrum than red. See Fig 3.

We have high hopes of successfuly scaring away those birds which cannot perceive disturbances close to the edges of the visible spectrum.

Fig 3 : wheel of colours by Munsell.



5. OFFICIAL TESTS

The French Civil Aviation autorities have ordered several production models of the FL R 005 laser rifle which emits coherent red light.

6. AVAILABILITY OF THE LASER RIFLES

We are offering three types of rifle as standard production models :

He Ne laser rifle FL R 005 emitting red,	F.O.B price : USD 7 200
He Ne laser rifle FL V 0015 emitting green	F.O.B price : USD 10 400
He Ne laser rifle model FL J 001 emitting yellow	F.O.B price : USD 9 500

B. AUTOMATIC LASER SCANNING

The rifle described in the paragraphs above is highly effective for pin-point targeting or for actual bird perches. However, one of its disadvantages is that it requires an operator. For this reason we have designed a laser appliance with an automatic sweep scanning action

TECHNICAL DESCRIPTION GENERAL

The proposed system is capable of sweeping a landing area or any surfaced airport area 500 m by 140 m. See Fig 4

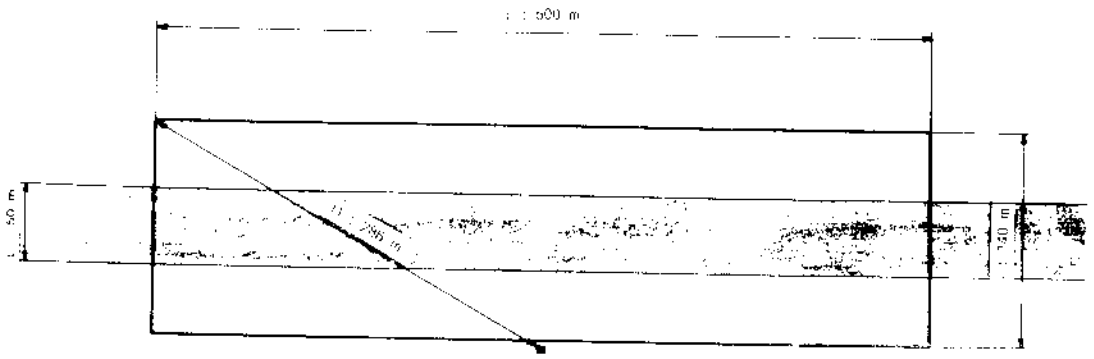


Fig 4

A 3 km landing strip would therefore require 6 appliances placed immediatly alongside the area to be cleared. The projected laser "spot" light is made up of 9 adjustable laser beams emitted by 9 laser sources.

The system consits of six elements (Fig 5) :

- the mounting frame holding the laser tubes
- the control box for the laser emission
- the motorised swivel mount (2 axes)
- The control box for the swivel mount
- the portable programming console
- the control software

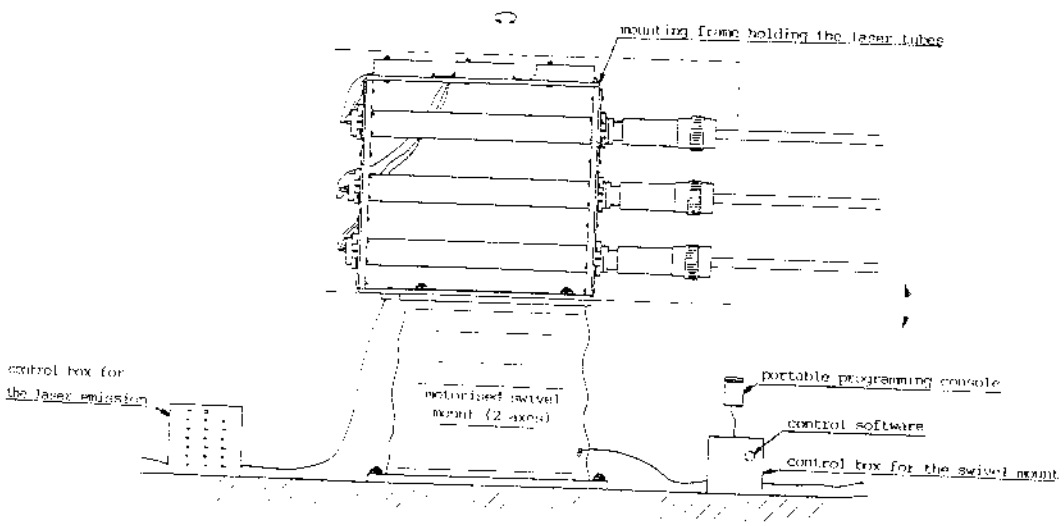


Fig 5

Some of these elements can be spaced tens of meters apart. The overall height of the appliance is between 0,7 m and 1 m. It is designed to operate in rain or spray within a range of temperatures from - 20° to 70°C ; and it conforms on all points to the requirements of standard NFC 43 - 801 regarding radiation safety of laser equipment.

a) The mounting frame holding the laser tubes

This holds 9 de Ne laser heads with attenuators, each emitting a beam of red, green or yellow light. Each head has a telescope enabling variable angles of divergence for each shaft or light. The angle of each head can be moved in relation to the median position by appropriate mechanical devices.

b) The control box for the laser emissions

There is a main circuit breaker fitted on the inside, together with a main control switch governed by a key, in keeping with the requirements of standard NFC 43 - 801 ; a push button is fitted on the outside. Each of the nine laser power supplies is fed by an independent electrical circuit which can be activated separately. A laser emision warning light is fitted to each of the nine power supply circuits. All electrical or mechanical controls for the functionning of the lasers are placed in such a way that access to them does not involve any exposure to laser radiation.

c) The motorised swivel mount (2 axes)

Externally this consists on a pedestal with a 400 mm base tapering to 300 mm, an upper mounting plate (for the mounting frame holding the laser tubes) and a bellows type protective covering between the base and the mounting plate. The swiveling movement of the mount can be controlled at variable speeds in a horizontal sweep up to 180°, and at variable vertical inclinations over a range of 50°. The accuracy of the positioning is in the order of 1/5 degree. The maximum speed of the swiveling movement is 10° per second. The mass of the swivel mount is 20 kg and its carrying load 25 kg.

d) The control box for the swivel mount

This countains the power supplies for the various devices used to control the motorised swivel mount. The computer is fitted with 2 serial interface standards RS 232 or RS 422.
Remove control by telephone is possible as an accesory, using two linked modems.

e) The portable

This uses or
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f) The control

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- continuous ci
- continuous sq
- user program
- preprogrammed
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g) Guide price

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e) The portable porgamming console

This uses one of the serial lines available from the computer. It has an alphanumeric, membrane keyboard and an LCD display for 64 characters. The keyboard is custom designed to make optimally the functions of the control programme for the swivel mount. The dimensions are approximately 200 x 110 x 50 mm and the mass is 700 g.

f) The control software

This is menu-driven software enabling the operator to choose functions, for example :

- linear sweep, point to point
- manual mode, by increment
- continuous circular pattern
- continuous square pattern
- user programmable pattern
- preprogrammed sequence stored in EPROM

Each sweep can be regulated to predetermined limits in terms of angle (θ1 and θ2) and angular velocity (θ1' and θ2'). This programming makes it possible to avoid laser beams reflecting off surfaces such as the paraboles of lights and so on. At all times a basic functions checks for any malfunction of the swivel mount. An additional control enables any breakdown of equipment to be tested and diagnosed automatically.

Note : The whole of this appliance is protected by a patent registred by us.

g) Guide price

Purchase of a complete system for automatic laser scanning would come to nearly 174 000 USD per unit for the first models. Once in strandardised production this equipment will cost 122 000 USD per unit. These prices also depend on the colour of laser beam required which, it will be recalled, is available in red or green or yellow.

C. CONCLUSION

Our tests have shown that birds can be scared away effectively by using laser beams, and this has been confirmed.

We can supply laser rifles emitting a red, green or yellow laser beam for pin-point targeting.

The automatic system would however provide greatest efficiency since the area covered by the sweeping action is large, the cost is reasonable, and no staff is required.