

## OPERATION OF RADIO-CONTROLLED MODEL AIRCRAFT

## FOR EXPELLING BIRDS

from Ben-Gurion International Airport and Surroundings

Israel, 1981-82

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1. Introduction

The Birdstrike Prevention Unit in Israel is operated by the Nature Reserves Authority, under the auspices of the Airports Authority and with their financial aid. Comprising two permanent staff, the Unit is occasionally augmented by temporary staff when specific professional work or concentrated technical operations require to be carried out during limited periods. The Unit's activities are centered chiefly on the Ben-Gurion International Airport, and take place in full co-ordination with its Management. Lately these activities have been expanded, and they now embrace all the interior airports, and to a certain extent also the Air Force bases in Israel. One of the outstanding successes of the Unit's work is reflected in the growing awareness of the subject on the part of all the factors concerned, and in particular the Ben-Gurion International Airport Management, who are making every possible effort towards a solution of this problem.

Among the sites attracting birds that the Unit has to contend with are two garbage dumps which constitute a continual hazard to aircraft movement to and from Ben-Gurion Airport. Notwithstanding explicit requests for removal of the garbage dumps to a reasonable distance from the airport, neither suitable sites nor the necessary funds for removing the dumps have been found. Hence, the Unit found itself obliged to develop a variety of means for expelling the birds from the existing garbage dumps.

## 2. The Garbage Dumps and the Birds

### a) The Modi'im Garbage Dump

Situated some 6 km north-east of the airport, the garbage dump is in straight line with one of the runways, and at it some 400 tons of garbage from the settlements to the east of this region are unloaded every day.

Here, the most prominent birds are: Cattle Egrets (*Bubulcus ibis*), Domestic Pigeons (*Columba domestica*) and 3 species of Doves (*Streptopelia turtur*, *S. decaocto*, *Streptopelia senegalensis*) throughout the year; Black-headed Gulls (*Larus ridibundus*) and sometimes other gull species, Jackdaws (*Corvus monedula*) and Starlings (*Sturnus vulgaris*) in winter. Their number does not exceed a few thousands (see Table No. 1), but it is during their movements between roost and garbage dump, when part of them - and in particular Gulls and Egrets - fly over the airport runways, that these birds present the greatest danger.

### b) The Hiri'a Garbage Dump

This is the country's largest garbage dump, at which are unloaded daily some 1300 tons of garbage from Tel Aviv and the neighbouring towns in the western part of the district. Situated some 4 km to the west of the airport, the dump is in straight line with one of the runways, which means that departing and landing aircraft require to overfly this area.

The composition of the bird population here differs somewhat from that at the other garbage dump, the most prominent species being: Cattle Egrets, Rock Partridges (*Alectoris chukar*), Hooded Crows (*Corvus corone corax*), Pigeons and Doves - throughout the year; and in winter, in addition: Black-headed Gulls (as well as other gull species), White Storks (*Ciconia ciconia*) (of which some are staying throughout the year), Starlings, Ducks and others. The number of birds here, particularly in winter, reaches many thousands (see Table No. 1), with some 30 000 Gulls having been observed at the beginning of January 1982 ! And indeed, a number of birdstrikes have occurred above this garbage dump.

### 3. Means of expelling birds from the Hiria Garbage Dump

As already stated, no way has been found to carry out the plan for the removal of the Hiria Garbage Dump (which is the more dangerous one), but as a result of pressures assurances were obtained from its owners to have the garbage covered with soil every day. This, however, is in fact being done only in summer, whereas in winter - during which season the birds are more numerous - weather conditions preclude this, and the hazards are thus increased.

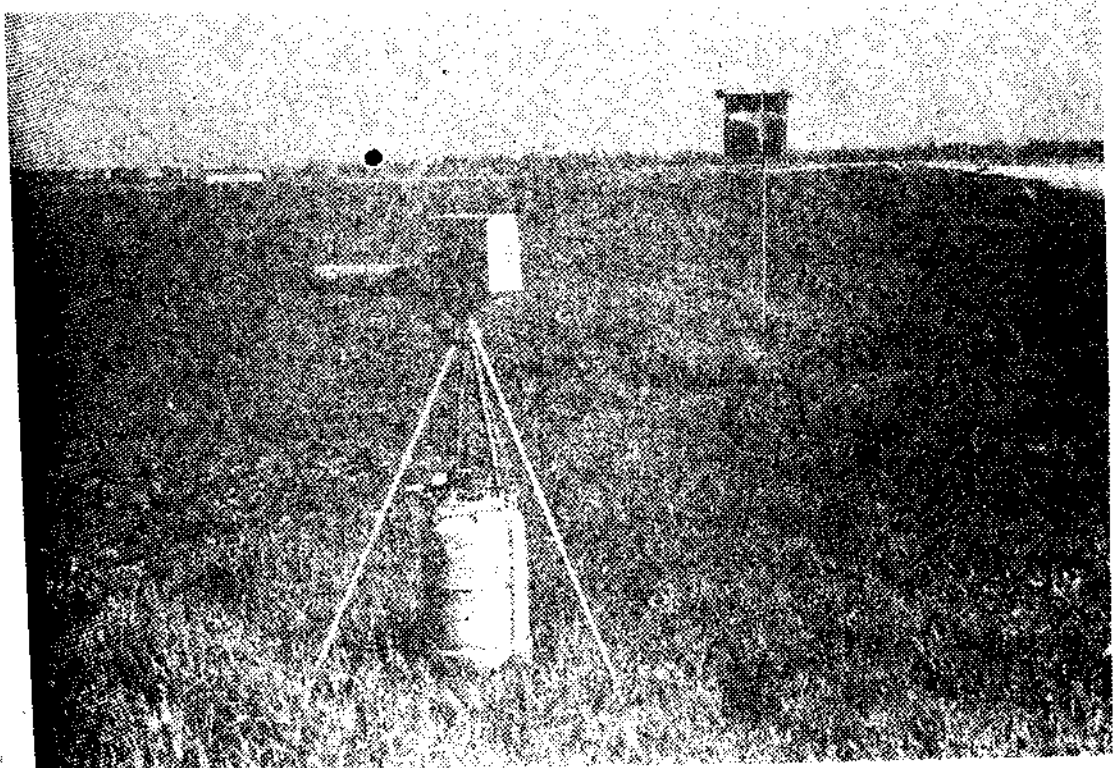
Consequently, a number of measures were adopted during the last few years in an endeavour to limit the presence of birds at the Hiria Garbage Dump as far as possible. In addition to conventional methods, such as the broadcasting of bird distress- and alarm calls, firing of gas cannons and scare-shell crackers, and use of coloured scare-windmills (Flash Harry), means directed at discouraging the birds from roosting in the vicinity of the garbage dump were also tried out:-

- a) Sowing of grain crops in all the areas which are habitual resting places of gulls and egrets, so that on arrival of the winter birds these areas will be covered with a dense, ca. 25 cm high growth.
- b) Criss-crossing strings over the surfaces of water puddles surrounding the garbage, with a view to preventing the birds from drinking there.

Although, as was proved in 1979, these methods are efficacious, they are not in themselves adequate for solving the problem in all its aspects, and it was therefore proposed to try an additional means, i.e. a big net under which the garbage is concentrated (with sufficient clearance for the movement of tractors pushing the garbage from the garbage trucks on to the site at which the newly arrived refuse is accumulated).

However, for mainly technical reasons, it has so far not been found possible to put this plan into action.

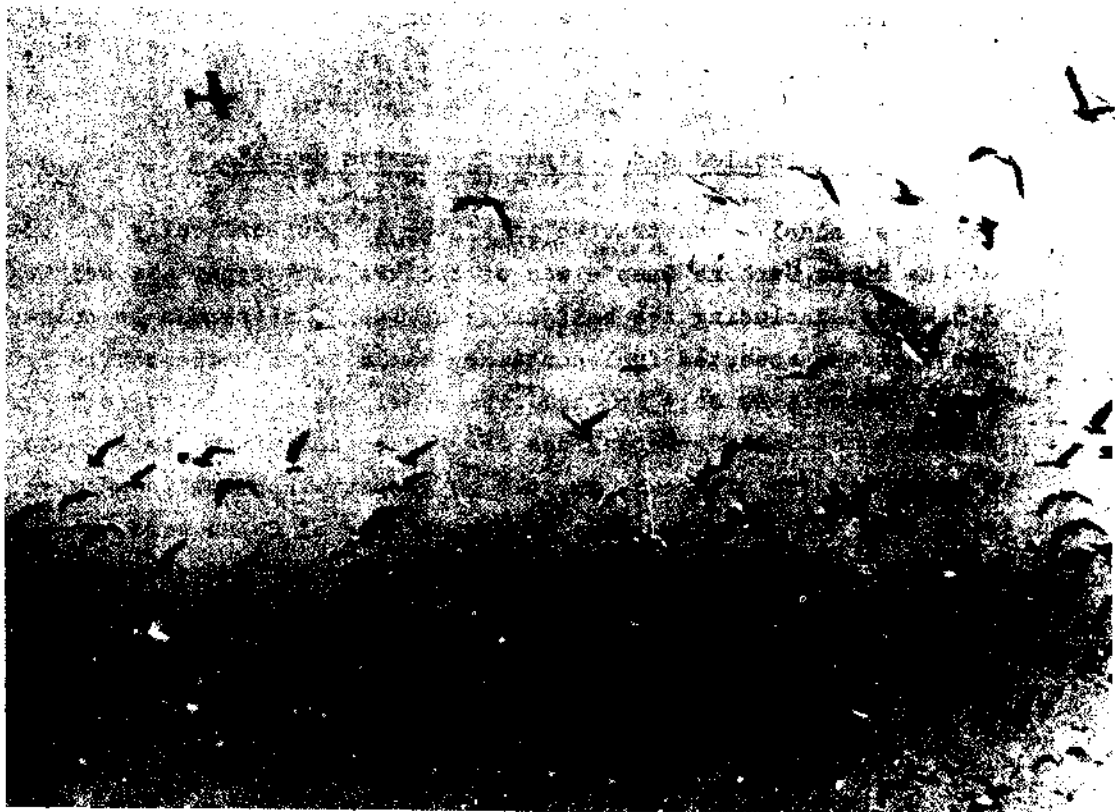
In the same year we decided to make a brief experiment (lasting only one hour) of having a Radio-Controlled Model Aircraft operated by an enthusiastic aviation amateur, and the results of this experiment convinced us that this device would most likely give good results. Thanks to the high awareness and willing cooperation on the part of the Airports Authority people, a budget was obtained for wider and more fundamental experimenting in 1981, and this was continued with considerable momentum also in 1982, with part of the budget being contributed by the Dan Regional Municipal Federation, who are the owners of the Hiria Dump.



Gas Cannon and Colourd Scare-Windmill



Radio-Controlled Model Aircraft at the Hiria Garbage Dump



4. Operation of Radio-controlled Model Aircraft at the Hiria Garbage Dump

a) Aim

Following the, usually not very successful, experiments carried out in various places in the world, when tame Falcons were used to put the birds at airports to flight, the idea of operating a falcon-shaped model aircraft (which is actually a Radio-controlled Model Aircraft in the shape of a raptor) was developed. This device was tried out mainly in New Zealand and Canada ( Blokpoel,1976) but there, too, with little success, and in particular when applied within the air space of the airport, causing difficulties and also great apprehension among airport personnel, so that the matter was dropped.

Also in Israel the airport control people were apprehensive of having a Radio-controlled Model Aircraft operate within the confines of the airport, but we decided to give it a try precisely on the biggest bird concentration at the Hiria Garbage Dump, with the affirmed aim of causing a reduction in the numbers of birds there.

b) The Radio-controlled Model Aircraft and its operators

The first model - constructed in winter 1981 specifically for use at the Hiria Garbage Dump - was of the "Falcon" type. It weighed 3.5 kilos, including the half litre of fuel ( it should be pointed out that the accepted fuel-container capacity in Radio-controlled Model Aircraft is only 250 cc). The model comprised a radio battery receiver and four Servo engines for rudder operation, an elevator, a throttle, and ailerons, as well as 3 special pneumatic wheels affording soft landing. The body consisted of Balsa wood, and wingspan was 1.50 m. The model was operated by four-channel transmitter radio control, and the taking-off and landing strip was relatively short.

To facilitate its operation in the field, the model-aircraft operators equipped themselves with an electric fuel pump, an electric starter, and a connection lead to the special sparking plug for starting the engine. The source of energy for all these instruments was a car battery.

In the winter of 1982, a lighter model was built (2.8 kilos, including fuel), in order to ensure a softer impact on landing. This time a bigger engine was installed to afford the model-aircraft a speedy ascent in the absence of a suitable take-off strip. No engine muffler was installed in the model-aircraft, as is usually done, in order to exploit the noise factor for disturbing the birds. Furthermore, special steps were taken to make the vulnerable parts of the model-aircraft impervious to rain. The model-aircraft is a modular one, and can be assembled and dismantled in a short time. Its cost is \$ 650.

In addition - and in accordance with our request - the model-aircraft was painted red, on the assumption that this colour perturbs the gulls. From our work experience we found that this colour is also of considerable use to the aeromodellers in keeping track of the model-aircraft when it is moving among flocks of gulls, or among clouds.

The model-aircraft was built, and is being operated, by experienced people, who have been engaged in this field for many years as a hobby.

c) Method of operation

Our method of operating the model-aircraft was dictated to us by a number of factors, and these were mainly:

- 1) Environmental factors ( e.g. flowing stream, structures, road traffic, etc.)
- 2) Winter weather conditions
- 3) Potential damage to model aircraft relative to its high price and operation costs
- 4) The model-aircraft operators' professional technical approach as compared to the approach of us "bird people"

We had notable success with the merging and adaptation of "approaches" because the model operators, too, were inspired by their motivation towards the subject in general, and this in despite of grave apprehensions with regard to possible damage to the model aircraft during operation (high tension wires, collision with birds, radio interference, etc). It was therefore necessary to find a way of minimal operation of model in the air. The basic idea was to chase the gulls (which, apart from representing the majority of the bird population in this season, also constitute the main problem at the garbage dump), and drive them off the site as soon as they arrive there, and thus preventing them, as well as the other birds, from feeding during the morning hours when they are particularly hungry, thereby producing an effect of what we call "famine oppression", in the hope that this would reduce the number of gulls arriving to feed the next morning, it not being "worth their while" to come, and induce them to find alternative feeding places.

In order to prolong the period of the model aircraft's stress effect on the birds even after termination of operation, the model was used together with other devices (in different combinations), among which the most suitable - chosen mainly because of low cost and easy operation - were: Gas Cannons and Scare-shell crackers. These combinations proved themselves later as yielding the best results (as described below).

d) First experiment with Radio-controlled Model Aircraft

Together with a seasoned model aircraft operator, we carried out our first experiment, which lasted about one hour, on 3 March, 1979. The experiment proved that the model aircraft is able to chase the gulls (and also other birds present at the garbage dump) and bring about a variety of situations - dispersal, concentration, rising, descending, approaching, departing - in almost complete accordance with any and every request. Its navigation potential and its sudden and rapid appearance, accompanied by the droning of its engines, creates great panic among the birds. At the same time, however, we realised that a considerable budget would be needed for massive operation of the model aircraft in view of its high operation costs.



As a result of this experiment we were able, as already stated, to secure wide application of the model aircraft for a number of years at both garbage dumps, with the main emphasis on Hiria.

e) Hours and duration of operations

The model aircraft's operation hours are determined mainly with a view to coinciding with the activities of the Black-headed gulls, and to a certain extent also with those of other birds.

From their roosts on the coast of the Mediterranean (some 10-15 kms away), the gulls habitually arrive at sunrise - or later, on cloudy days. They usually come in waves, each numbering between a few dozens to several thousands of birds. On arrival, the gulls do not immediately swoop down on the garbage but circle above it for some time (about half an hour), apparently because of vehicle movement and human activity on the site, and only after having got used to the situation - or perhaps more correctly, when hunger prevails over fear, do the first gulls dare to land on the fresh garbage, with many others following suite at once. This we consider to be a suitable moment for applying the model aircraft, so that fear may again prevail over hunger, and for driving them off the fresh garbage which holds such attraction for them - and this indeed is what happens on most days. On several occasions, when model aircraft operations were split - at one garbage dump in the morning and at the other in the afternoon, and vice versa, with hours of operation being changed - a situation was brought about which can be called a "deception act", when the birds (or at least part of them) were moving from one place to another, demonstrating growing reactions to other methods, too. (as under).

We generally made do with the presence of the model aircraft and its team every morning during an average of 3 1/2 hours per day, with the model being in the air 4-5 times on most occasions for an average of 12 minutes, adding up to a daily average of about one hour. When it became clear that we were succeeding in driving off the birds in the morning with the sole aid of gas cannons and scare-shell crackers, the model aircraft's operation periods were moved to a later hour (Table No. 2).

The length of time during which the model aircraft remains in the air is contingent on a number of factors:

- 1) Bird activities and behaviour
- 2) Weather conditions ( clouds or strong winds render operation difficult)
- 3) Active radio frequencies which are likely to interfere
- 4) Limitation of maximal continuous air activity of model aircraft (not due to technical hitches)
- 5) Tractor-and garbage truck activity
- 6) Changes on ground-surface, making landing of model aircraft difficult

f) Combined operation of model aircraft and other devices

In an endeavour to derive maximum benefits, and in order to improve on the results, and at the same time reduce operation costs, we carried out a number of experiments with a view to combining other methods with the model aircraft, or without it.

1) Broadcasting of calls:

Calls are used in different ways. We initially sent out distress calls of Black-headed Gulls. These were effective during the first hour or so, and occasionally even after this. There was no need for using distress calls while the model aircraft was being applied, seeing that the gulls themselves started screaming and causing a panic as soon as the model aircraft was put into operation. Furthermore, the gulls were affected by the noise of the model aircraft before it took off, and this gave us the idea of tape-recording the aircraft noises together with distress calls of gulls and other birds, thus obtaining a mixture of noises and calls which was tried out on several occasions without the model aircraft itself, with good results. While this is a satisfactory achievement in itself, it is important for us to experiment with this method at the beginning of next season with the return of the gulls to the garbage dump, prior to operating the model aircraft itself.

## 2) Gas Cannons:

Very easy to operate, this method is relatively inexpensive, and it would be important therefore to include it in our various experiments. Generally speaking, its effectiveness, which is high at the beginning, tends to fall off when the birds get used to the device, and for this reason we have been using gas cannons only in very limited areas and during very limited periods of time, and endeavouring to vary the hours and sites of their operation. We have tried to bring about a situation in which the birds, on hearing the cannon 'booms', would connect them with the model aircraft, and here, too, we achieved good results, in particular when combining this means with scare-shell crackers (see under), ensuring, of course, proper and effective location of the cannons relative to their distance from the birds' centres of activity, but mainly having regard to the direction of prevailing winds at the time of operation.

## 3) Scare-shell Crackers:

Hitherto we have been using two kinds of scare-shell crackers - one for a small 9 mm-calibre revolver, exploding some 30 m from the person firing it, and the other for an ordinary 15 mm-calibre hunting rifle, exploding about 80 m from the operator. Lately we have in fact been using only hunting-rifle crackers, because not only were we unable to procure additional revolver ammunition (from Germany), but also because hunting-rifle crackers proved more effective as concerns distance and noise-impact.

Scare-shell crackers were successfully used also on their own, causing much panic even among the pigeons, which are considered problematic birds in view of the great difficulty experienced in making an impact on them by other means in use here.

The use of scare-shell crackers in combination with other means usually takes two forms: i) in cases where birds, and particularly gulls, are clinging to the food, when the model aircraft is unable to approach them, a single scare-shell cracker shot suffices to raise them into the air, at which point the model aircraft swoops down and chases them away with the greatest of ease; ii) when the model aircraft is not in operation and the birds are approaching the garbage to feed, volleys of scare-shell cracker- and gas cannon shots are fired at one and the same time, causing greater "respect" on the part of the birds for gas cannons even when, later on, they continue firing on their own.

No doubt there is room for improvement of the various present possibilities of method-combination, and perhaps alternative ones, with a view to achieving more lasting results.

g) Famine Oppression, and ways of achieving it

In order to dislodge the birds - and most particularly the gulls - from the abundant food at the Hiria Garbage Dump, we applied starvation methods, as already stated, on the assumption that these would force the birds to seek - on the same day and during the following days - alternative feeding places.

The harassment of the birds, especially during the morning hours, brought about in them a state of "Famine Oppression", which waxed and grew with continued operation, reaching its peak, in general, between 0700 and 0800 hrs, and again round about 1000 hrs. At the beginning, and mainly during the first few days, the model aircraft was used on fewer occasions and for shorter periods, but with the growing prevalence of "Famine Oppression" it was put into operation more frequently and for comparatively longer periods (Table No. 2). The model plane's average time of operation in the air on any one occasion is 12 minutes. However, we quite successfully tried dealing with the birds also during the peak hours of "Famine Oppression". Operations were generally carried out by a team consisting of an ornithologist and two aeromodellers, working in co-ordination. The ornithologist was usually stationed at an elevated observation point from where he could scan the situation and, depending on developments, tell the aeromodellers when to apply the model aircraft, and follow the whole operation through recording of data and by giving instructions to the aeromodellers as required by conditions in the field. The aeromodellers developed, and tried out, different methods of operating the model plane in the air, making effective use also of its navigation potential and the engine din's impact, depending on the model aircraft's angle of approach. In addition to all this, the ornithologist also brought the gas cannons and the scare-shell crackers into play as he saw fit. During the following days the operation of the model aircraft was curtailed again.

To illustrate our work at the Hiria Garbage Dump on one of the first days of the 1982 winter season, we give hereunder a pattern of the team's activities:

11 January 1982 - (cloudy day)

0642 hrs - First flock of Black-headed Gulls (about 80) arrives from the west, from the direction of the seashore south of Tel Aviv, followed almost immediately by an additional flock (about 70), apparently continuing in an easterly direction. However, beyond the site, they merge into one flock, wheeling over and around the garbage dump. The waves of Black-headed Gulls from the direction of the seashore are increasing.

0648 hrs The first gulls approach the fresh garbage, hovering over it and trying to descend, though not yet landing on it.

0710 hrs Model aircraft takes off, drives all the gulls (several hundreds) away from garbage, and lands after some five minutes.

0720 hrs Once again, gulls (some 500) approach the fresh garbage although they do not yet land to feed. At the same time a few pigeons can be seen descending on the garbage from time to time to feed.

0735 hrs A single scare-shell cracker is fired, driving off all the birds at once, but only for a minute or two, when they return in an endeavour to land on garbage and feed.

At this point the model aircraft is put into action, and as soon as its droning becomes audible, all the gulls and pigeons rise from the garbage, remaining however hovering in the vicinity. The model aircraft takes off, chasing and dispersing the birds in different directions, without however allowing them to gain height (aircraft traffic is seen from time to time). Within a matter of 10 minutes the garbage site is free of birds and model aircraft is grounded.

0810 hrs Garbage site as well as nearby roosting places are still free of birds, except for a flock of gulls (dozens) that can be seen circling in the air. With gulls' approach to the garbage, gas cannon No. 1 is fired off to the east of the garbage dump, driving off at once all the gulls. The pigeons, too, can be seen rising from the garbage after each "boom".

This state of affairs continues for some time, and this in spite of the fact that fresh garbage keeps arriving in abundance, containing also offal from slaughterhouses (food very much sought after by the gulls).

0900 hrs A small flock of gulls (50) approaches the garbage again, though the birds are not descending to feed because gas cannon No. 1 is in action and frightens them off. The gulls withdraw, but the number of pigeons has increased (several hundreds), though they don't succeed in making a permanent landing to feed. The gulls' resting places around the site are also bare.

1015 A flock of gulls (several hundreds) is in the air, soaring in a thermal. The model aircraft takes off, forcing the birds to lower their flight and dispersing them in different directions. Model aircraft is grounded after 10 minutes or so.

1110 So far no gulls are to be seen in vicinity (there are only pigeons). Operation of gas cannon No. 1 is discontinued and cannon is moved north (because of westerly winds).

1112 Several flocks of gulls (hundreds) are approaching and soaring in a thermal overhead. Model aircraft takes off, dispersing the gulls within 15 minutes and causing a panic among them, and also among the pigeons that are hovering around. At this point, gas cannon No. 2 is also brought into action (from the south) while gas cannon No. 1 is operating intermittently (from the north). Model aircraft discontinues operation for the day.

1210 hrs From time to time gulls and cattle egrets are trying to approach garbage, but the two cannons, which are shooting alternately, manage to drive them off. Only the pigeons, whose numbers in the meantime have risen to about 600, are making occasional attempts at feeding, but are rising from the garbage with every "boom". With the approach of yet another flock of gulls ( about 250 ) that are attempting to descend upon the garbage, 2 scare-shell cracker shots are fired in co-ordination with the gas cannons, and all the gulls are driven off ! The pigeons, too, are fluttering around restlessly.

1230 hrs The situation here remains unchanged - and all our activities cease.

## 5 Harassment of Birds in other places

Although our main activities involving the model aircraft were concentrated on the Hiria Garbage Dump, we also tried harassing the gulls in two additional places:-

### a) The Modi'im Garbage Dump

As already stated, this garbage dump is situated some 6 kms to the north east of the Airport. At the beginning of the season some 5000 gulls gathered here; also several hundred cattle egrets and a great number of different other birds. The aim of our activity here was to prevent, chiefly gulls, but also cattle egrets, from moving over the runways on their flight to and from the garbage dump, and furthermore to preclude the possibility of this site becoming an alternative for birds expelled from the Hiria Dump (the distance in the air between the two dumps is only about 15 kms). Here, the model aircraft was operated only partially, though in the second week of February it was used more intensively and on a more continuous basis (Table No. 3).

On the other hand, 1-2 gas cannons were operated here by local workers, and hence with less control on our part, but with considerable effectiveness thanks to the special geographical features of the environment - the garbage dump is situated in a little valley between two hills, and the cannon shots produce strong echoes here. In this place, too, we often used scare-shell crackers to augment the effects of the cannon shots.

b) The Gulls' roosting places on the seashore

From observations we made over the last years, it is clear that the gulls that are coming to the airport and the garbage dumps assemble for overnight-roosting along the Tel Aviv seashore, notably to the north and the south of the city. Apart from the problem presented by the close vicinity of the gulls' roosts (some 20 kms from Ben-Gurion Airport), there is a small airport north of Tel Aviv, where inland flights are similarly endangered by the gulls. This meant that at least part of the gulls were making a nuisance of themselves in "two shifts" - during the daytime at Ben-Gurion Airport, and at night at the small Tel-Aviv Airport - a situation which necessitated immediate, special reaction on our part. Regrettably, the single experiment with the model aircraft tried out by us at the latter place was not successful because of massive radio disturbances in the region at the time. Our object was to harass the gulls immediately on arrival at their roost, and this we have so far been able to achieve only with the aid of gas cannons and scare-shell crackers, but we are planning to try and activate the model aircraft here also in the coming season, in accordance with requirements.



Table No.1

Peak number of birds at the Hiria and Modi'im  
Garbage Dumps during the year 1981-1982, prior  
to operation of model aircraft (round figures)

Bird Species	Hiria Garbage Dump		Modi'im Garbage Dump		Date
	1981	1982	1981	1982	
Cattle Egret ( <i>Bubulcus ibis</i> )	500	700	800	100	6.1
White Stork ( <i>Ciconia ciconia</i> )	100	250	-	-	7.1
Teal ( <i>Anas crecca</i> )	20	30	-	-	8.1
Mallard ( <i>Anas platyrhynchos</i> )	20	20	-	-	9.1
Rock Partridge ( <i>Alectoris chukar</i> )	several	20	several	several	10.1
Spur-winged Plover ( <i>Hoplopteryx spinosus</i> )	several	30	several	-	11.1
Black-headed Gull ( <i>Larus ridibundus</i> )	30,000	30,000	5,000	5,000	12.1
Herring Gull ( <i>Larus argentatus</i> )	100	100	several dozens	-	13.1
Turtle Dove ( <i>Streptopelia turtur</i> )	several	several	several	several	14.1
Palm Dove ( <i>Stigmatopelia senegalensis</i> )	several	30	-	several	15.1
Domestic Pigeon ( <i>Columba domestica</i> )	500	800	hundreds	several	16.1
Crested Lark ( <i>Galerida cristata</i> )	several	several	several	several	17.1
White Wagtail ( <i>Motacilla alba</i> )	many dozens	200	dozens	many dozens	18.1
House Sparrow ( <i>Passer domesticus</i> )	many dozens	many dozens	dozens	many dozens	19.1
Starling ( <i>Sturnus vulgaris</i> )	500	50	500	500	20.1
Jackdaw ( <i>Corvus monedula</i> )	several	several	20	several	21.1
Hooded Crow ( <i>Corvus corone cornix</i> )	dozens	20	several	several	22.1

Table No. 2 Details of Model Aircraft Operation at the Hixia Garbage Dump, and daily peak number of gulls - Winter 1982 (round numbers)

Dump	Date	Starting time (on days model aircraft was operated)	Number of times in air	Length of time in air (minutes)	Number of Gulls	Remarks
	6.1	-	-	-	30,000	Gull count on day prior to model-aircraft operation
100	7.1	07.12	2	23	many thousands	
-	8.1	06.50	8	108	thousands	
-	9.1	07.50	7	75	3,000	
-	10.1	07.34	5	42	3,000	
-	11.1	07.10	4	40	1,000	
-	12.1	08.30	3	40	3,250	
several	13.1	07.30	3	35	1,000	
-	14.1	07.45	3	35	500	Significant decrease within one week
-	19.1	07.15	4	115	500	Start of model-aircraft activity also at Modi'im (p m)
5,000	16.1	09.30	3	34	3,000	Pause in Model Aircraft operation
-	24.1	-	-	-	3,000	Only gas cannons and scare-shell crackers applied
several	25.1	11.20	4	60	10,000	Model aircraft also at Modi'im (a m), and this is connected with increase in numbers here.
several	26.1	-	-	-	7,000	Only gas cannons and scare-shell crackers applied
several	27.1	14.20	3	30	4,000	
several	28.1	-	-	-	several hundreds	Only gas cannons applied.
many dozens	3.2	10.00	4	65	4,000	
many dozens	4.2	10.00	4	70	8,000	Model aircraft was damaged by gull, subsequently repaired, and continued operating at Modi'im (p m)
500	5.2	11.45	4	50	1,000	Model Aircraft also at Modi'im (a m)
several	6.2	12.00	3	40	6,000	Model Aircraft also at Modi'im (a m)
several	7.2	09.30	3	40	?	
	8.2	10.30	4	50	?	
	9.2	10.30	4	40	1,000	
	10.2	-	-	-	250	Only gas cannons used
	11.2	-	-	-	150	Only gas cannons used (smallest number of gulls !)
	12.2	12.00	3	30	2,000	Model aircraft also at Modi'im (a m)

Table No. 2

(continued)

Date	Starting time (on days model aircraft was operated)	Number of times in air	Length of time in air (minutes)	Number of Gulls	Remarks
13.2	-	-	-	1,000	Only gas cannons and scare-shell crackers used
14.2	08.00	2	25	1,000	Only gas cannons and scare-shell crackers used
15.2	-	-	-	500	
21.2	-	-	-	3,000	Only gas cannons and scare-shell crackers used
23.2	-	-	-	1,000	No means applied at all
26.2	-	-	-	3,000	Only gas cannons and scare-shell crackers operated
27.2	-	-	-	4,000	No means applied at all
1.3	-	-	-	3,000	Only gas cannons and scare-shell crackers operated.
3.3	-	-	-	3,000	ditto
4.3	-	-	-	4,000	ditto
17.3	-	-	-	2,500	ditto
18.3	-	-	-	thousands	ditto
21.3	-	-	-	1,000	ditto
24.3	-	-	-	3,000	ditto
25.3	07.30	3	30	3,000	Model aircraft operation was resumed
26.3	10.30	3	45	3,000	Cessation of model aircraft operation
27.3	08.20	5	62	2,000	
28.3	-	-	-	1,000	Gas cannons and scare-shell crackers
29.3	-	-	-	1,000	ditto
30.3	-	-	-	1,000	ditto
31.3	-	-	-	1,000	ditto
2.4	-	-	-	0	Final observation - end of Gull season



Black-headed Gulls (*Larus ridibundus*) at the Hiria Garbage Dump



Table No. 3

Details of Model Aircraft Operation at Modi'ia Garbage Dump,  
and daily peak number of Gulls - Winter 1982 (round numbers)

Date	Starting time (on days model aircraft was operated)	Number of times in air	Length of time in air (minutes)	Number of Gulls	Remarks
4.1	-	-	-	1,000	
12.1	-	-	-	5,000	Model aircraft already working 5 days (at Hiria only)
14.1	14.28	2	20	3,000	Start of Model aircraft operation here, after having been used at Hiria in the morning
15.1	-	-	-	5,000	Only gas cannons and scare-shell crackers applied
25.1	07.21	3	21	3,500	Model aircraft operated also at Hiria in the morning
26.1	-	-	-	2,000	Only gas cannons and scare-shell crackers used
3.2	-	-	-	Thousands	ditto
4.2	12.00	-	-	2,500	
5.2	09.20	3	20	2,000	Also gas cannons and scare-shell crackers used. Afternoon at Hiria.
6.2	09.30	3	20	1,500	Model aircraft at Hiria in the afternoon
10.2	11.05	2	10	3,000	Also gas cannons and scare-shell crackers used
11.2	11.00	3	15	2,000	ditto
12.2	11.00	3	25	4,000	Last time model aircraft was used here. Operated at Hiria in the afternoon
13.2	-	-	-	3,000	Gas cannon operated
16.2	-	-	-	1,000	ditto
24.2	-	-	-	1,000	ditto
11.3	-	-	-	4,000	Only scare-shell crackers used
26.3	-	-	-	200	Model aircraft operated at Hiria
29.3	-	-	-	400	
2.4	-	-	-	0	Final observation - end of Gull season

6. General Discussion

Before the final summing-up we must once again examine the results we achieved by means of the various devices minus the aid of the model aircraft, and this with deliberate disregard of any possibility of the garbage dumps being removed to a reasonable distance, or modern garbage disposal equipment being used - solutions which are not relevant at present.

Covering the garbage with soil appears to be a satisfactory solution during the summer season when conditions permit this to be done quite easily on a daily basis. In the light of our experience in the past few years however this method does not appear feasible during most of the winter season when the tractors are unable to meet the requirements. For this reason, and also because in winter the birds are coming to the garbage dumps in greater numbers, these places need be given attention almost only in winter, which means that the problem remains chiefly one of gulls.

The behaviour of the gulls - and in particular that of the Black-headed gulls which make up the majority of the bird population in winter (in the whole area, and not only at the garbage dumps) - is based on a certain daily routine of movement in the morning from their roosts to the feeding sites, and back at dusk. It is thus possible to apply against them harassment devices both at the feeding sites (in this case the garbage dumps) and at the roosts (i.e. the seashore, as we tried to do on a single occasion last season). Incidentally, a similar operation was set up this year against a breeding colony of Cattle Egrets (some 3000 pairs of breeding birds), situated within the confines of the "Safari" Park in Ramat Gan (about 1 km north of Hiria), whence we managed to drive them off with the sole aid of scare-shell crackers fired over the colony at dusk on a number of days.

If the gulls were harassed at both sites (roosts and feeding places) in a coordinated manner, excellent results could be expected. This would involve two teams, and possibly two model aircraft, and afford massive simultaneous harassment. At this stage it is perhaps worth mentioning that during operations of the two harassment teams it would be necessary for an additional team to be present, on full alert, within the confines of the airport itself, because as a result of the pressure brought to bear on the birds,

both at the garbage dumps and at the roosts, irregular movements of birds also over the airport runways, and perhaps even landings on them, between them, and on the fields, can be expected during the first few days at least. We would emphasize that during the operation of the model aircraft at one of the garbage dumps, we were alerted to the runways a great many times following sudden appearances of birds at unusual hours.

Notwithstanding the fact that the operation of the model aircraft involves problems (cost, weather conditions, radio frequencies, etc), we must ponder the question whether it would indeed be worth developing devices such as the giant net planned for covering part of the site at which fresh garbage is unloaded on any one day, or whether we should perhaps content ourselves with the combinations of simple devices as tried out during the two preceding seasons.

We must bear in mind that we must not content ourselves with expelling the birds from a certain place with the aid of a certain device, but that we should reach a stage where the birds would consider it being "not worth their while" to return to that site but would look for other places - with a view to exploiting the possibility of making a long-term impact on the birds whose effects would make themselves felt also at the beginning of the next season.

We believe that the application of the devices we have tried out - broadcasting of distress- and alarm calls, gas-cannon and scare-shell crackers, scare windmills (Flash Harry) - and their various and numerous combinations with or without the model aircraft - will yield useful results, always of course leaving room for simple additional means. On the other hand, we shall be able to renounce the use of other aids - such as covering puddles, or sowing roosting areas with grain crops - aids which in the past have been applied, with greater or smaller measures of success, within the confines of the site, because the model aircraft and the other devices described above are likely efficiently to cover these places as well.

7. Summary

- a) At the garbage dump - and particularly that of Hiria - there is abundant food which attracts many birds, and in particular gulls, in the winter.
- b) Our summer birds are drawn to the garbage dumps to a lesser degree, and this is especially true for Hiria, where the garbage during this season is daily covered with soil.
- c) The danger to aircraft overflying the garbage dumps is greatly increased in winter (October-April).
- d) We must not be satisfied with dislodging the birds from the garbage, but require to prevent their coming back, and to this end we must harass them also at their roosts as well as their feeding places.
- e) Of all the devices tried out at the garbage dumps, the model aircraft has brought the best results - and these were obtained during the last two seasons.
- f) The model aircraft's disadvantages are attributable to its operation being contingent chiefly upon the following factors:-
  - a massive budget
  - professional operators
  - weather conditions
  - radio disturbances
- g) Because of the aforementioned reasons it is necessary to limit operation of the model aircraft without losing, as far as possible, its effects - and this by combining it with other devices.
- h) Of all the means that have been tried out lately, the broadcasting of distress calls, the firing of gas cannons and scare-shell crackers in combination with the model aircraft appear likely to be the most effective in bringing about positive results. Coloured scare-windmills can also be relied on to contribute something to these combinations.



- i) Many combination possibilities exist, whose effectiveness increases with their multiplications. We of course should consider also including additional means in these combinations, such as the broadcasting of a mix of bird alarm calls and engine noises of the model aircraft itself.
- j) Use of the model aircraft in combination with the other above-listed devices will lessen the need of applying other means that were tried in the past, such as covering of water puddles, sowing roosting areas with grain crops, etc.
- k) In order to make the Birdstrike Prevention Unit's work more effective, operations require to be based on 3 work teams, who will be in a position simultaneously to carry out various operations in accordance with requirements, with a view to protecting the airport runways from sudden arrivals of birds.
- l) We should aim at having the aeromodellers form a permanent part of the unit, or at least having one of the team members trained as an aeromodeller, and this in order to ensure continuous operation according to requirements.

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