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OUTLOOK ON DEVELOPMENT OF MEANS TO REPEL BIRDS

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Abstract

The situation at the Russian aerodromes led the specialists of the Scientific and Research Institute of Civil Aviation to the development of “Halzan” device to repel birds. “Halzan” has been effectively used due to the specific scheme of bird control comprising 2 acoustical (sound impulses) and 2 optical (orange colour trail of the flying unit and burning pyrotechnic elements) components, called the effects of the first kind. The high level of sound pressure (90 decibel at a distance of 50 m) and certain additional effects (called the effects of the second kind) increase the potential capabilities of “Halzan” as a repellent device. It is determined that the improvement of this device is possibly due to the introduction of the shot filling which ensure additional touch contact harmless to birds. The following general directions of increasing the efficiency of the bird repellent devices might be proposed: 1) expansion of the control scheme by new components on the basis of principles of heterogeneity and repetition, 2) use of secondary effects complicating orientation of birds relative to these devices, 3) increase of efficiency of each procedure of bird control.

Key Words: Repellent device, Bird control scheme, Scheme component, Receptor systems, Bio-acoustical relays, Pyrotechnic cartridges, Support (assistance), Increase of efficiency of bird scarers.

1. Bird Control Situation in Russian Airports.

In the beginning of 90s the situation in the civil aviation of Russia regarding the search for solution of the problem of reducing the number of birds to avoid collisions with them has become rather complicated.

Firstly, Russia is characterised by the large number of airports. More than 750 airdromes of different classes are registered in the State Register and they have different flying intensities and ecological situations which to the great extent is determined by the availability of many economic facilities around airports which attract birds.

The large amount of airports hinders supervision by control bodies of implementation of required measures and also actually reduces the possibilities of the group of experts from the State Scientific and Research Institute of Civil Aviation (which has always been scanty) to provide consulting, procedural and practical assistance to airports.

Secondly, the country's distances from North to South and from West to East determine the great variety of natural conditions from the point of view of the character of climate, relief, proximity of sea-coasts, qualitative and quantitative composition of bird population, seasonal factors in the life of birds, etc.

Thirdly, the lack of specially trained personnel in the airports has a negative effect on the results of bird control activity. At present the responsibility for the organisation of the whole scope of activities and implementation of bird control measures, in particular, is entrusted to officials of different airport departments as additional and secondary responsibilities. The exceptions are Pulkovo airport (Saint Petersburg) with the specialised group of 7 people, Tolmachevo airport (Novosibirsk) - 1 person, Koltsovo airport (Ekaterinburg) - 1 person. In 1999 in Sheremetyevo airport a bird control group of 3 people started its work as a result of our recommendations.

In the last several years the experimental educational and training course for airport employees was launched on the basis of the State Scientific and Research Institute of Civil Aviation but at the moment the studying of its program does not have the status of requirements mandatory for every airport.

Fourthly, up to now in the Russian market the choice of repellent means is very limited and narrow.

We conducted questioning of Russian airports regarding the means to ensure flight safety from ornithological point of view. The results of the questioning showed that the only actually available solution for the airports appeared to be

the application of signal cartridges (26 mm calibre) of SPGO type, of hunting shotguns and mobile bio-acoustical device “Berkut” with the set of “alarm” and “distress” signals. This is apparently insufficient and 53% of airports stated that they needed new highly efficient means of controlling behaviour of birds.

This is connected to another factor. The effectiveness of practical application of means, as well as their choice, is becoming very important. Let’s consider that at greater length.

The bio-acoustical method of scaring birds off was introduced in the practice of operation of airports at the end of the 80s. According to the results of questioning it is used mostly only in several big airports. In reply to the question about its effectiveness, 66 % of the airports stated “not effective” or “insufficiently effective” even in combination with other means. Nevertheless the remaining 34 % maintained that they were able to successfully control the aerodrome situation using the bio-acoustical method in combination with other means.

Specialists of the State Scientific and Research Institute of Civil Aviation conducted several experimental operations to apply this method. As part of a package this method might bring results even in the most complicated cases. For example in April 1993 it became possible to liquidate in two weeks’ time the nesting colony (approximately 100 nests) of rooks (***Corvus frugilegus***) by relaying of two “disaster” cries with support of rifle shots’ recordings and single hunting rifle blank shots. After that in the last five years the birds never attempted to come back for nidification and we stopped check-visiting the colony location.

Taking into account the above-mentioned the conclusion was made that the application of the bio-acoustical method of repelling birds with the use of devices which require continuous supervision of the work process is excessively complicated for airports. In view of that the experts of the State Scientific and Research Institute of Civil Aviation in their next development made their choice in favour of pistol-fired pyrotechnic cartridges which are more simple in use, capable of effectively support the bio-acoustical relays and might be used independently.

2. Determination of the Scheme of Bird Control

For a long time the signal cartridges SPGO (which feature the sound of report and the flight of burning pyrotechnic element) were more or less successfully used against birds at the aerodromes. In certain situations these cartridges are used to give visual signals to army units, ground personnel, etc. Initially these cartridges were not intended for scaring birds but they were accepted

as the basis for future repellent in order to expand and strengthen their positive features.

At the initial stage of the operation the attempt was made to specify general principles of the scheme of bird control. It is known that the orientation capability of birds is based on receipt and processing of information about the environment by way of receptor systems, on comparison of data from various receptor systems and development of behavioural response. In many critical situations every individual receives information regarding the changes in the environment simultaneously on different information channels.

One of the examples is the process of attack of a group of potential victims (***Corvus corone***) by a bird of prey (***Accipiter gentilis***). Every bird of the group can make out the specific external features of a bird of prey, can hear and perceive the “alarm” signal informing of its appearance and also the “distress” cry of the bird caught by the bird of prey. The change in the motion pattern and the unusual posture of the actual victim are perceived also through eye-sight by the nearby birds. The victim itself experiences the physical contact with the bird of prey by means of touch. Information of the environment arrives simultaneously or consecutively without significant time lapses. The complete perception of the attack of the bird of prey is effected with the help of sight and hearing, as well as touch for the bird caught, at the same time the principal systems of senses are used repeatedly.

Thus the principles of the effect of repellent means on birds might be formulated as follows:

1) different layers and different heterogeneity of effect, i.e. reproduction of the signal information to be perceived by several systems of birds’ senses simultaneously;
2) repetition of effects, i.e. reproduction of the signal information to be perceived by the system of senses more than once.

In critical situations the intensity of information flow passing through this or that receptor system might change in time but it is known that eye-sight and hearing are the principal birds’ analysers. And it means that the basic scheme of frightening birds away must comprise 2 optical and 2 acoustical components (2+2).

Bio-acoustical relays of one frightening signal comprise the only one component of the above-mentioned scheme and a bird does not receive any confirmation of the existence of the source of danger through other receptor systems or through the repeated use of hearing. It is possible that because of that the relays do not have significant potential. Sooner or later a habituation takes place. Though in the case of consecutive additional support (for example in the form of blank rifle shots) the effectiveness of bio-acoustical

method, and to be more precise, of the package of means to scare birds and of set of components of established scheme increases greatly.

If we come back to our scheme (2+2) the question might be asked: which of the means is capable of reproducing the complete scheme during one session of application? In our opinion it is pyrotechnics, which is capable of implementing not only the 2+2 scheme but evidently even more complicated schemes of bird control. Its capabilities and simplicity in use were conducive to the fact that in many countries there are enough examples of devices related to that group.

3. "Halzan" Pyrotechnic Device

The most simple scheme of bird control was effectively realised in "Halzan" pyrotechnic device. A special PDOP-26 cartridge was developed having the same dimensions as ordinary signal cartridges used previously with 26 mm calibre pistols available in every airport. The effective scheme of ordinary signal cartridges was expanded by way of special unit placed inside the shell of PDOP-26 cartridge.

The following are the main effects observed after shooting (conditionally called effects of the first kind):

1.1. the impulse sound of report at the moment the signal tracer unit leaves the cartridge;
1.2. the smoke trail of orange colour marking the trajectory of the flight of the signal tracer unit;
1.3. the impulse sound of the burst of the signal tracer unit;
1.4. appearance after the burst and scattering of pyrotechnic elements burning with red flame.

These specific peculiarities were added to the scheme of two acoustical and two optical components.

"Halzan" was tested in the Moscow Region at the testing area for accumulation and burial of communal waste. In December with high snow cover this food source was used by up to 1000 corvine species (mostly ***Corvus monedula*** as well as ***C. corone***) and more than 500 pigeons (***Columbia livia***). Already after three days of using "Halzan" (the first day - 8 shots, second day- 4 and the third day -3) the number of birds attempting to come back to feed reduced: corvine species- by 90%, pigeons - by 80 %.

We receive positive comments from airports where these devices have been in use for several years and have helped to reduce the urgency of the problem of bird strikes, and the geography of its present day spread is from Sokol

airport (Magadan) in the east to Pulkovo airport (Saint-Petersburg) in the west.
Besides a specific control scheme the efficiency of each deterring device depends on a range of other positive factors, the so-called effects of the second kind. By introducing variety of versions into this or that method of bird control they complicate orientation of birds relative to this device slowing down the habituation.

So, pacing of events creates quicker habituation in comparison with irregular rhythm. Irregularity or erratic application is the effect of the 2 kind. One more example. The change of position of the source of sound in space. Similar effect can be observed in the work of Canadian stationary bio-acoustical facility “Phoenix Airport wailer MK 3”. The frightening signals can be heard alternately in one of the four units placed at a distance from each other.

In relation to “Halzan” the effects of the 2 kind are as follows:
2.1. spatial (horizontal and vertical) distance of 110-120 m between point sources of sound impulses and timely (within several seconds) split of their appearance (which can not be achieved with hunting rifle double shot);
2.2. possibility of changing the direction of the shot which might be fired at a angle of 35-90 degrees to the horizontal plane or even downwards (for example, from board of descending helicopter);
2.3. the signal tracer unit’s approach to the birds (visible in the air due to smoky coloured trail) with diminishing speed extrapolated by birds;
2.4. unpredictable scattering of three or four pyrotechnic elements burning in the air for 1-1,5 sec after burst of signal tracer unit.

The burst of the signal tracer unit of PODP-26 cartridge is accompanied by high level of sound pressure - 90 decibel at a distance of 50 metres from the burst point.

It is necessary to mention that the increase in absolute values of intensity of efficiency of this or that irritant might be accompanied by the increase of its bird control effectiveness. For comparison purposes: the light of headlights during the day-time might be ignored by birds. Laser beam has a much more intensive colour flow. And if it is capable of creating painful sensations in birds when they perceive it by eye-sight then it would generate an immediate defensive reaction.

In theory a limit of safe perception of range of irritation for each type of influence (beams of light, sound impulses, etc.) must exist. The increase of intensity of irritation should be considered as approaching such a threshold or surpassing it. A similar way, evidently, was taken in development of French “CAPA" cartridge which create (according to available information) the sound

pressure of 160 decibel at the distance of 10 m.

As mentioned before, PODP-26 cartridges might be fired from a pistol but within the framework of the “Halzan” project another weapon was developed. It is a rifle with detachable butt and under-barrel magazine for 4 cartridges. Reloading of the rifle is done by manually moving the forestock. The increase in rate of fire resulted in the new tactical methods to change the direction of movement of the flock in the air: “wall” - two shots in one direction but at different angles to the horizon with minimal time gap, “shepherd and herd” - two shots fired with minimal time gap at the same angle but in different directions - to the left and to the right of the flock. At present this type of weapon exists in the form of several experimental prototypes.

4. Increase in Efficiency

The problem of increased efficiency of devices to deter birds has not lost its urgency for many years. The “Halzan” project made an attempt to modernise and increase efficiency of ordinary signal cartridges. In our view the successful option for the new cartridges became the use of a scheme composing of 4 components (2+2). But this scheme, according to the principles described in section 2 of the present document, is the most basic and its expansion must become the next step in increasing its efficiency.

In the area of application of pyrotechnic devices to scare birds the use of tactile channel of birds for transmission of necessary alarm information might be of interest.

If a bird receives the majority of information about the environment with the help of eye-sight and hearing, tactile organs are employed much less frequently. It happens rather seldom in the following cases: during hatching, when touching parts of plants, while moving in the forest of dense grass, aggression with participation of intraspecific and interspecific competitors, breeding behaviour and few others, and in relation to paws and beak - when making contact with bedrock and feed. Because of that pressure on tactile organs might be perceived by birds especially keenly. In addition to that, if you recall the example with the attack of the bird of prey, you might note that the receipt of signal information through eye-sight, hearing and touch is especially characteristic of a victim bird, i.e. the species found in the worst situation and experiencing the danger of losing health and even life. The addition of tactile component to the basic scheme would enable to immediately bring birds closer to the position of victim-species.

The modified scheme looks like follows: 2+2+1, where 1 is a tactile component. The implementation of the revised scheme for “Halzan” is

possible due to the introduction of shot filling into the signal tracer unit which is activated at the last stage and provides the final link in the chain of actions.

It was not easy to reproduce in practice the scheme consisting of 5 components due to purely technological difficulties. But a small batch of cartridges was manufactured in which the burning elements (described in paragraphs 1.4, 2.4 of section 3) were replaced by rubber shots (2+1+1 scheme). During the experiments it became possible using these cartridges to additionally reduce the small amount of birds immune to influences which were left at the object after application of PDOP-26 cartridges. The shots were fired in such a way that the scattered shots “cover” the birds from above not injuring them but ensuring physical contact.

Taking into account the importance of the problem of reducing the contamination of environment it was decided to replace the rubber shots with fertiliser granules which, when getting into soil, dissolve and are assimilated by the plants.

Unfortunately the “Halzan” project works were suspended due to decrease in financing.

To sum it up, in order to improve the existing devices and to develop new devices to repel birds we propose to consider the following areas of work:

- expansion of the range of components of the scheme of bird control (effects of the first kind) in accordance with the principles of heterogeneity (different layers) and repetition;
- use of secondary effects making it difficult for birds to orient themselves relative to the said devices (effects of the second kind);
- increase in efficiency of certain types of procedures.

We hope that the described proposals are of a universal character and applicable to all types of means to repel birds and also for packages composed of various types of means of this nature.

P.S. We would be grateful to receive different comments of our colleagues in regard to the present publication.