BIOTECHNICAL DEVICES OF BIRD SCARING

Victor Y.Biryukov, Zigurds Lapinskis
Riga Aviation University, AIR LATVIA Ltd.,
Riga,Latvia.

Abstract:

This paper summarizes the last ten years of research in the USSR with bioacoustic devices. Attention is paid to the construction of new generation microprocessor technology based synthesizers. The research has been carried cut by the specialists of the research team «Ptitsa». Recommendations as the use of bioacoustic devices at aerodromes are presented in the appendix. The added photos show the developement of the research.

In the 60ies and the 70ies the bioacoustic devices for bird control were constructed on the basis of mass-produced electric acoustic equipments meant for reproduction of speech or music. The first bioacoustic device (BAD) «Bars» constructed with the aim of bird scaring at aerodromes was accomplished in 1982 (photos 1,2). Research with these devices was carried out at several airports. The aim was to specify the standards for bioacoustic equipment series production.

The basic characteristics of the BAD «Bars» were the following: frequency coverage 0,3-18 kHz,maximum output power of the amplifier 180 W,maximum sound pressure 134 dB at 1 m distance on the loudspeaker axis. Two medium frequency and two high frequency horn loudspeakers constituted the loudspeaker system of BAD. The casset tape recorder used in the BAD had 30% tape speed acceleration and provided frequency coverage up to 20 kHz. Tests of BAD «Bars» with a signal handler (photo 15) showed that frequency coverage could be reduced to 0,6-7 kHz. That is explained by the fact that no component in the distress calls of bird species dangerous for aircraft (Laridae;Corvidae) are lower than 0,8 or higher than 7 kHz. The signal handler proved it necessary to introduce amplitude frequency predistortions in the transmitted signal.

Further on the BAD"Bars"was modernized (photo 3) by adding a digital synthesizer of «discomfort» signals. To obtain and tape distress calls from birds,namely, crows,an electric stimulation device constructed in 1985 (photo 16) was used. Impulses of voltage up to 300 V and frequency range from 2-20 Hz were transmitted to the electrodes. Amplitude and frequency of the impulses could be changed with the help of buttons on the front panel.

The research results helped in the construction of the series bioacoustic device «Bercut» (photo 4);production started in 1988. Simultaneously 8 different constructions of compact bioacoustic devices were worked out in the research team «Ptitsa» laboratory; of those BAD-8 (photo 7) was considered the most successful. Its characteristics were: maximum output power 120 W,frequency range 0,5-7 kHz,maximum sound pressure 134 dB at 1 m distance on the loudspeaker axis, voltage of the car battery 13,5 V. BAD-8 comprised a cassette tape recorder and discomfort signal synthesizer.The appendix gives recommendations for ornithologists as to its application.

The portable BAD-7 (photo 5) was meant for outdoors research. It comprised a synthesizer,outdoors player,and silver batteries for power supply,maximum output power 50 W. With the help of this device experiments on efficiency of different synthesized signals directed at flocks of birds were carried out in places difficult for access.

With the help of the vehicle-borne BAD-8 by way of regular gull distress call and added synthesized discomfort signal emission plus roof-based blinking orange and blue light signals a lake gull flock was eliminated from the vicinity of a monument by a pool. The maximum length of the signal was 10 s, repeated in case part of the birds returned.

A new,exceedingly powerful biotechnological device was manufactured and erected in 1990 at the Vnukova airport in Moscow (photo 9-11). It was meant for bird control on the territory of the airfield and adjacent territories. To achieve high speed of the procedure of bird scaring there were two acoustic systems installed bilaterally on the roof of a car (UAZ-452 B); the systems had 12 and 50 W horn loudspeakers. The total power of the amplifiers was 1,2 kW, and voltage from the battery of the car-13,5 V. The maximum sound pressure at the distance of 1 m from the loudspeaker heads-148 dB. This vehicle- borne device is the most powerful one in the territory of the USSR, and actually can claim to be recorded in the Guinness book of records as the loudest «scarecrow». The sound signals may be combined with flashes of light. When observing the device in action,it can be compared to a street-watering machine,only instead of dust brushed aside there are birds. Within a short span of time it was possible to free from birds a vast territory of the airfield.

For scaring birds from territories of pools a radio-controlled catamaran has been constructed (photo 12) with a built-in bioacoustic device, a synthesizer, and a moving model of prey bird. The operator manouvers the catamaran from the bank with the help of a long-distance control board built in a transmitter with code division of channels.

To assist the acoustic signals two radio manipulated flying bird of prey models were constructed in 1987 (photos 13,14). They differed in colour. Testing at aerodromes showed low efficiency,as they could be and operated only by a specialist on the condition of good weather. Disregarding the fact that the models imitated the flight of a hawk, birds showed fast habituation.

Beginning with 1982 great attention was payed to engineering of digital bird repellent signal synthesizers (photos 17-18). The characteristics of frequency, silent period length,frequency and depth of modulation frequency,the synthesized signal front growth speed,as well as the synthesized signals consisting of five formants could be changed (photo 18).

As a result of experiment series the kinds of synthesized discomfort signals, that work efficiently in scaring gulls, corvids and even pigeons,were stated.

New generation synthesizer was created in 1989 (photo 19-21). The test sample was the bioacoustic synthesizer «Skvorets» ("Starling"), emitting starling distress call coded with the help of timing frequency matrix. The equipment comprised a timer having phonation duration of up to 6 s for a silence period of up to 30 min. It was sufficient to locate the synthesizer «Skvorets» in bushes or on a tree and settle the emission period for 3 s and the off-period for 20min to keep thrush flocks away from the territory for some weeks. As the power use during the off-period is insignificant and the emission period is short, the batteries work for a month.

The newest equipment of this kind is a single chip microcomputer-based synthesizer (photo 22). Distress calls of gulls,corvids and starlings are

taped in the memory and can be chosen by pressing the corresponding button. It is also provided with stop and start buttons. In this synthesizer bird voices are transformed into a discreet impulse frequency by the delta modulation decoder MC3417 with discreditization frequency 64 kHz. Control is provided by a single chip microcomputer of the series 1816 which alloows to form repellent signals of different length on the basis of a limited amount of EPROM stored information by way of compilation synthesis. The memory amounts to 64 kilobytes. The mikroscheme M2764 is used as memory equipment. It is possible to increase the amount of taped signals using instead a M27512 microscheme.

The programming of ROM microschemes is carried out on a microprocessing programmer (photo 23). For taping the acoustic signals of the birds in open air there exists a reflector microphone (photo 24) together with a signal processing equipment (photo 15) that let to achieve a quality phonogram of distresss calls without noise, useful for programming into the ROM.

Bibliography.

1.Ilyichev V.D. Birds deteriorating equipment,materials,raw materials, constructions over the USSR teritory.In Birds and Mammals Deteriorating Equipments and Constructions. M.Nauka,1990. pp7-141.

2.Birjukov V.Y.,Vjaznov A.E. Survey of bioacoustical complexes developed in the USSR. Baltic Birds-5. Riga,1990.Vol.1.pp45-48.

3.Birjukov V.Y. Handling of Aural Signals in Bioaccoustics.Engineering Ethology,Bioacoustics and Biolinguistics of Birds.M.Nauka,1991.pp50-56.

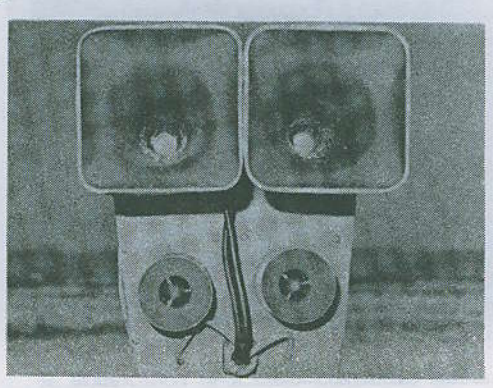
4.Birjukov V.Y. Minimization of Bioacoustic Synthesizers.Engineering Ethology, Bioacoustics and Biolinguistics of Birds.M.Nauka,1991.pp57-60.

1. THE FIRST SOVIET BIO

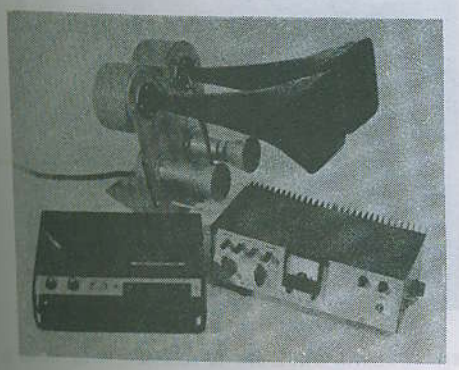
3. MODER

5. THE

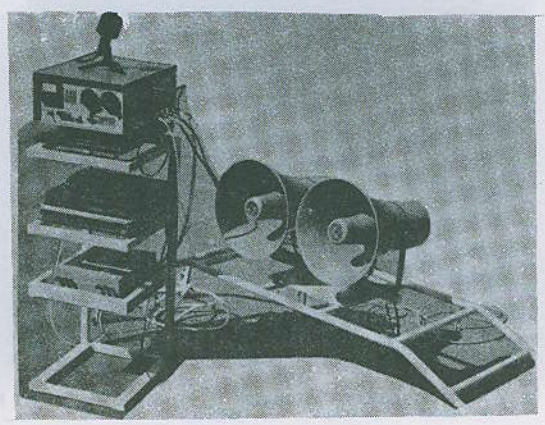
1. THE FIRST SOVIET BIOACOUSTIC DEVICE (BAD) «BARS»



2. BINARY—BAND ACOUSTICAL SYSTEM BAD «BARS»



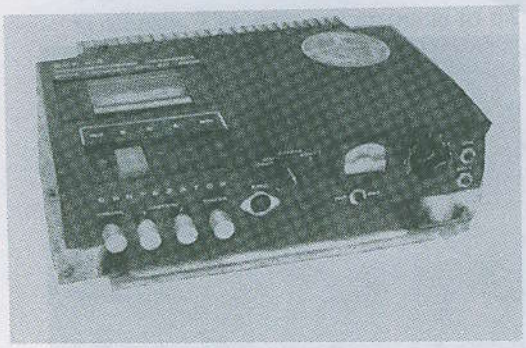
3. MODERNIZATED BAD «BARS»



4. THE SERIES BAD «BERCUT»

5. THE PORTABLE BAD-7

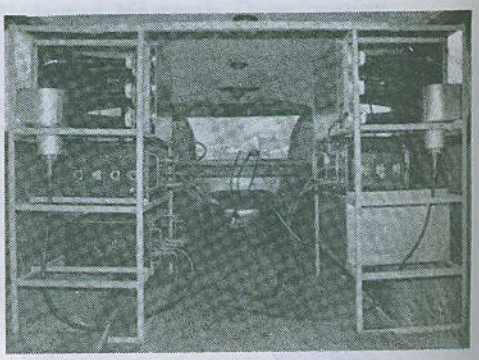
6. EXPERIMENT BAD-7



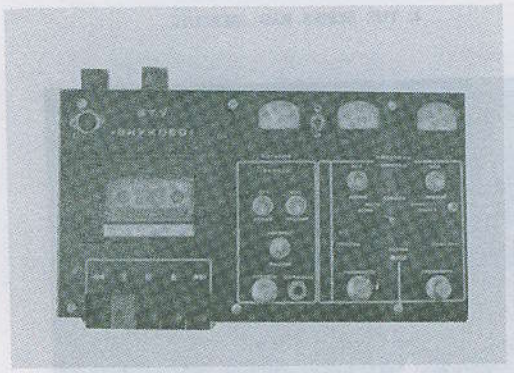
7. BAD-8

8. BAD-8 VEHICLE-BORNE VERSION

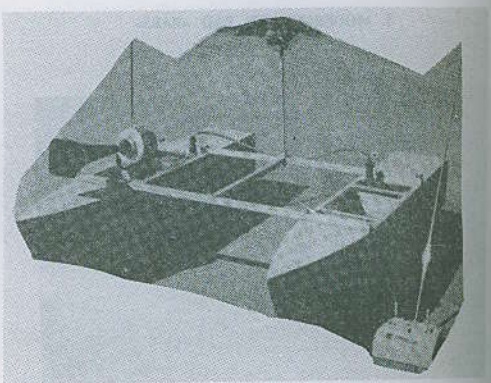
9. BIOTECHNOLOGICAL DEVICE (BTD) «VNUKOVO»



10. BTD «VNUKOVO» (PLACEMENT OF EQUIPMENT IN THE UAZ 452 B)



11. THE CONTROL BOARD OF THE BTD «VNUKOVO»

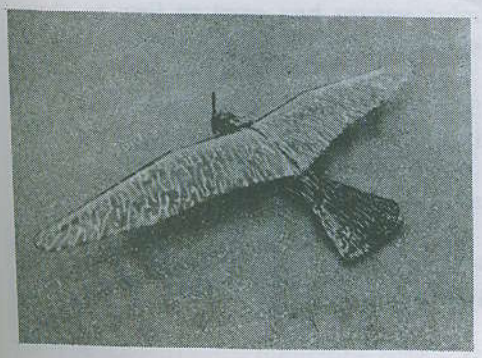


12. RADIO-CONTROLLED CATAMARAN

13. RADIO CONTROLL

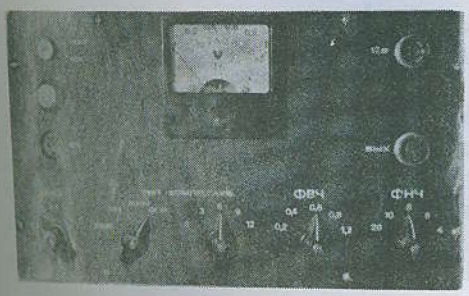
15. ACOUSTIC

17. THE FIRS

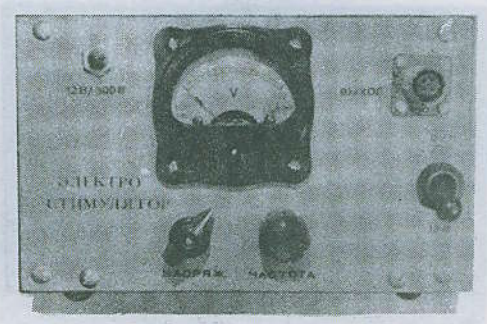


13. RADIO CONTROLLED MODEL OF A PREDATORY BIRD

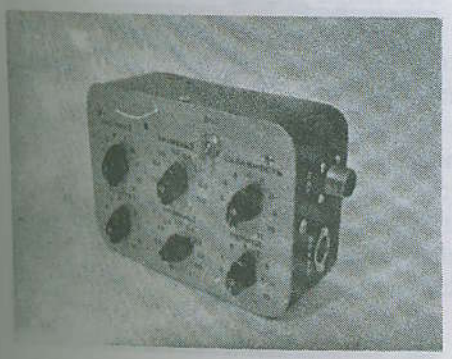
14. MODIFICATION OF A RADIO—CONTROLLED MODEL



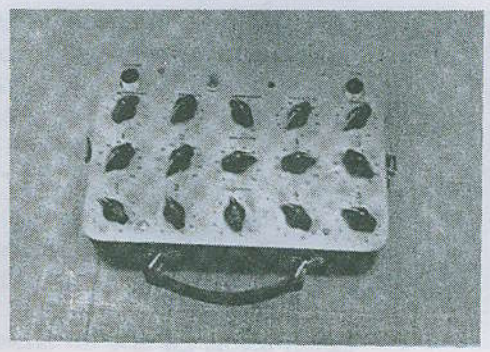
15. ACOUSTIC SIGNAL PROCESSING DEVICE



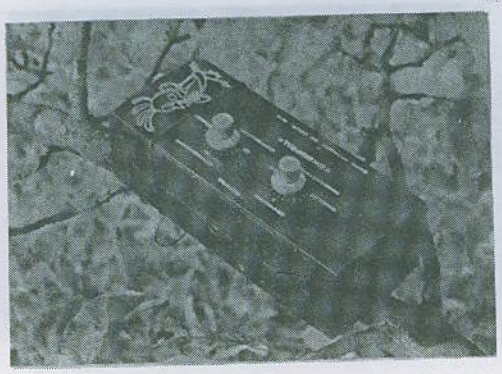
16. ELECTRIC BIRD VOICE STIMULATION DEVICE



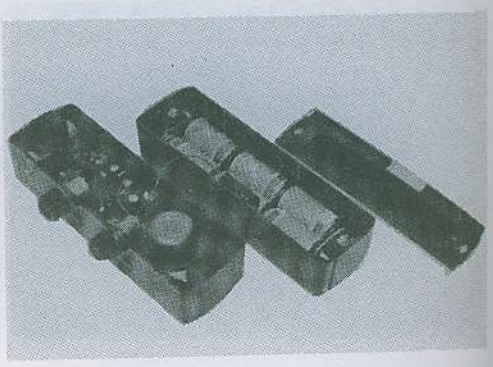
17. THE FIRST MODEL OF A SYNTHESIZER



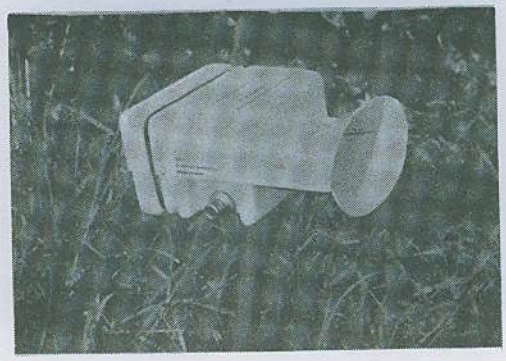
18. THE 5 FORMANT'S SYNTHESIZER



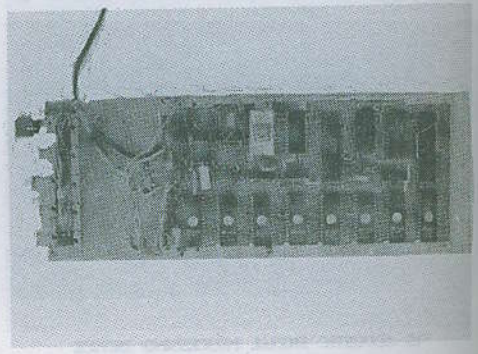
19. BIOACOUSTIC SYNTHESIZER «STARLING»



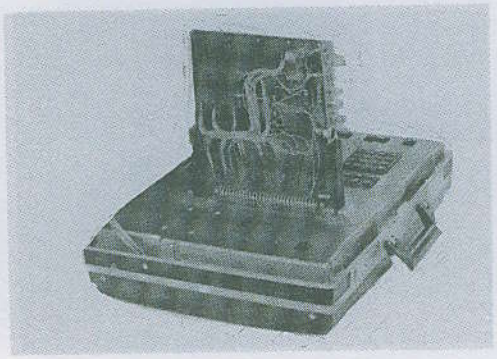
20. SYNTHESIZER «STARLING» IN AN OPEN VIEW



21. THE SECOND MODEL OF THE SYNTHESIZER «STARLING»



22. SINGLE-CHIP MICROCOMPUTER-BASED SYNTHESIZER



23. MICROPROCESSING PROGRAMMER

24. BIRD VOICE TAPING WITH THE HELP OF A REFLECTING MICROPHONE

APPENDIX

RECOMMENDATIONS USAGE OF THE VEHICLE-BORNE BIOACOUSTIC DEVICE BAD-8

1. The vehicle-borne bioacoustic device (BAD) allows to efficiently scare birds as well as tame and savage animals by way or distress and alarm call and syntethized repellent signal emission.

2. On condition the temperature exceeds 45 deg C the uninterrupted phonation period should not be more than 30 s.

3. It is most efficient to use BAD against flocks of birds.

4. Before emission it is required to approach the flock untill the distance is satisfactory and follow that the loudspeaker ax is directed at the birds.

5. The uninterrupted phonation period should not exceed 10-15 s to escape bird habituation. If the birds after taking wing and circling in the air try to return, it can be repeated 3-4 times. If that does not scare the birds away, it means that the bioacoustic signals do not function. The possible causes can be lack of correspondence between the distress (a regional or species difference), low quality phonogram or that the signal is not an alarm or distress call for the given species.

6. To help the distresss calls it is advisable to change them with discomfort signals, sirens and to shoot from flare pistols or guns.The flare pistols should not be aimed at the centre of the flock but at wings,taking into consideration the best direction for birds to leave.

7. The optimal silence period and repellent signal tone should be chosen through tests. There exists a correlation between bird size and the syntethized signal structure: the less the size,the more effective would be a shorter silence period and a higher tone.

8. If the operator lacks the signal tape of a certain species,it is possible to use syntethized discomfort signals and sirens as repellent signals. During the emission it is advisable to reach the maximum repellent effect by adjusting accordingly the potentiometer dials «Period»,"Frequency-1", «Frequency-2" and »Total". When emitting the discomfort signals it is advisable to start at a long silence period, then shorten it gradually with the help of the «Period» dial. The dial «Frequency-1" changes the lower formant frequency, the frequency increases, if the dial is turned clockwise. The dial »Total" ballances formant signal levels; the correlation is chosen through tests with the aim of optimal repellent effect.

9. Any distress call of Corvidae species is useful for scaring mixed flocks of these species.

10. For pigeons the repellent signal is craw voices and syntethized discomfort signals.