3 August 1976

GENERAL

1. Work on this project has, to date, demonstrated the following:

A. Birds are capable of being trained to perform an operational useful task carrying an adequate payload.

B. Training can insert a specified "detour" leg into the birds' usual homing behavior.

C. The ability to translate the above behavior from a training location to a distant operational target area seems likely.

Therefore, the work proposed here is directed at increasing our understanding of the processes and best methods involved in A and B above. We further propose to devise methods, test, and if possible, demonstrate the behavior described in C, above.

CONDITIONS OF TRAINING

1. The prime condition of training will be that, once a training cycle (see below) has started, the sequence and methods will remain as constant as field conditions permit. The decision to change sequence or methods may be made between training cycles upon the mutual agreement

of Contractor and Sponsor's representative if results call for such changes. This condition is made not to restrict the freedom of methodological choice, but to ensure that data obtained during a given cycle of training will not be clouded by contaminating variations in procedures.

2. Data will be kept in written, systematic form on each bird and each training session and test. The actual data to be so recorded will be determined by mutual agreement of Contractor and Sponsor's representative but will include, as a minimum, that specified in the work statement. All data so gathered will be provided to Sponsor at the completion of the project and is made a deliverable item.

3. Insofar as conditions permit, clandestinity will be observed in all operations conducted in public view. it is, of course, impossible to meet this requirement in many of the training operations which will not take place in the actual clandestine operational mission but as a minimum, all training operations which have counterparts in the actual mission will be conducted under conditions of clandestinity.

4. Movement of the birds from the training base to the simulated operational sites (see below) will be by means of whatever [redacted] mechanisms are decided upon. Details of site selection of these simulated operational sites will be at the mutual agreement of Contractor

and Sponsor's representative. It is understood that these sites will be progressively farther removed from the training base site; the last such site being in the Washington, D.C. area.

5. A large pool (approximately 100) birds will form the initial population from which trained birds will be drawn. These birds will first be given an "aptitude" test for search-and-find behavior. Those which do particularly well will be assigned to training as "specialist" birds whose function is to lead in finding the target (see below). Other birds will be trained to carry a payload through the full mission sequence. At any stage of training, as individual birds show behavior which is inappropriate or detrimental such birds will be eliminated from the training. Through this process of retention of only the best field performers it is expected that the final pool of trained birds will be composed of about eight in each of the two categories to be described below. The best of these will be selected for performance in the last cycle which simulates, in the Washington, D.C. area, the full operational mission.

6. In all training flights the full-mission birds will always carry a simulated payload package whose weight and configuration will be that of the real payload. The "specialist" birds will not be so burdened since they will not be required to perform payload-carrying duty in the operational mission.

TRAINING PROTOCOL

BEHAVIORAL ANALYSIS

1. The task to be performed by the birds is, from the behavioral standpoint, composed of two essentially different kinds of acts. The first part of the sequence consists of a kind of search-and-find behavior over the relatively short distance of two miles. No burden is placed on the birds' homing abilities by this task since the target location is novel for both training trials and the operational mission. The common factors for all training trials and the operational mission are to be found in the shape of the target and its bearing from the release point. If the release point is designated "A" and the target is designated "B" this first part of the total behavior to be trained can be referred to as the "A-B" portion.

2. The second portion of the total task calls heavily upon the birds' homing abilities. Having found the target they must then abandon their search-and-find behavior and, using their homing skills, fly approximately thirty miles in a designated direction to the location at which they will be retrieved. If the final retrieval location is designated as "C", the second part of the sequence can be designated as the "B-C" portion.

OVERVIEW OF TRAINING PROTOCOL

1. The protocol described in detail below contains the following essential elements:

A. The training of two kinds of birds:

(1) "Specialist" birds that will be intensively trained solely in A-B behavior.

(2) "Full Mission" birds that will be trained in both A-B and B-C behavior.

B. The systematic movement of performance testing sites from one geographical location to another will be incorporated into the training procedures. The final operational mission would then be just one more repetition of the behaviors they have been doing all along. This will improve reliability and provide a basis for ~~quantitatively~~ predicting the probability of success for a given mission.

TRAINING OF "SPECIALIST" OR A-B BIRDS

1. The "Specialist" or A-B birds will be used in both training and the operational mission to increase the reliability of the A-B portion of the mission. These birds will be allowed out of the loft only to practice search-and-find behavior on a fixed bearing. They will receive food only at the target, whose location will be changed for each trial. Their sole experience in free flight will be

restricted to exhibiting A-B behavior; thus the designation "Specialists". In training, they will be retrieved at either the target or back at the release point, "A", to which, (it has been found) they will often return. In the operational mission the specialist birds will not carry payloads and thus are expendable after having performed their function of acting as leaders of the search-and-find portion of the mission. They are also used in helping to train A-B-C birds as indicated below.

TRAINING OF FULL-MISSION (A-B-C) BIRDS

1. The operational requirement for the A-B-C birds is that, they are to be transported to an actual target location to perform their mission in a setting with which they have only limited familiarity. The training protocol is designed to replicate the combined training and mission profile sequence several times over. This procedure has the double advantage of preparing the birds to perform in an operational setting and also allows us to obtain the statistics with which to make an estimate of the expected reliability with which the mission will be performed.

2. Several sites will be used. One, the base site, will be the main training site. Other sites, which can be at any location logistically permissable, will comprise a series of simulated operational sites to which the birds will be sequentially transferred for testing of the operational behavior. In the actual operational scenario the

true operational site would (to the birds) be merely one more of the same kind of training experiences they have become accustomed to. This sequential training protocol permits the replication of the "training/mission sequence" through as many cycles as time and resources permit. Detailed performance records will be kept so that improvement can be measured quantitatively. Reliability can then be predicted for any "next cycle" including the operational one.

3. Appendix I shows graphically the sequence of events to which the birds will be subjected. Note that the "specialist" birds will be introduced and removed to reinforce A-B behavior at appropriate points in the cycle. At all other times, the A-B birds' training continues uninterrupted.

4. A mobile loft (possibly a trailer) will be outfitted to serve as a portable "home", although several buildings may prove better, the distance from release to both the base site and the mobile sites will be identical to that to be used at the real operational location while all other aspects except an air conditioner entry port will be changed as much as possible to accustom the birds to change in all other aspects of the simulated "C" location.

RATE OF TRAINING

1. In animal training the time involved generally takes a subservient role to the number of training trials administered. The more complex the behavior and the higher the required level of experience, the more trials are necessary to achieve success. This principle is as true in human as in animal learnings; it takes more practice to play Tchaikowski's "4th Piano Concerto" than "Chopsticks". In general, simple behaviors can be learned by animals such as the pigeon in about 25 trials if conditions are as optimal as one finds in a laboratory. In the field where many factors cannot be controlled this number should be at least doubled.

2. If one extrapolates to the operational setting and tasks involved here, it is probably reasonable to assume AB behavior can be trained in some pigeons to a criterion of twenty consecutive perfect trials in about fifty sessions. BC behavior can probably be trained in about fifty trials and combined AB-BC behavior in about thirty additional trials. This is equivalent to a total of eighty trials since AB and BC training goes on simultaneously. Assuming 3.5 trials per bird per week, this means the training program takes about 23 weeks or approximately six months. Losses of birds or personnel could easily extend this to nine months. It should be both apparent and understood that this time requirement

is a system constraint imposed by the limits of the biological organism chosen: the pigeon. Human desires or demands will not be influential in reducing it.

WORK STATEMENT

1. Acquire and train according to the methods and procedures described herein, at least fifteen package-qualified birds to exhibit the behavior described below. Performance of the birds is to be at the highest level possible under the constraints of available time and resources.

Behavior To Be Exhibited: Birds will, upon release fly to a designated location at least two miles distant on a bearing to be designated prior to initiation of training (A to B). Birds will then continue, flying at least thirty miles on another designated bearing to a retrieval location, (B to C).

Conditions For Behavior:

(1) The bearings of the A to B and B to C legs of the flight path are to form an acute angle not to exceed ___ degrees.

(2) The birds will not have had more than ___ days of experience with the location of the final (test) retrieval location. This experience may include not more than __ homing practice flights under simulated clandestine conditions.

(3) Full-mission birds are to perform the ABC behavior carying ___ gm. payloads.

2. Conduct a final test and demonstration of the behavior described above in the Washington, D.C. area under conditions to be specified prior to initiation of training.

3. Supply to Sponsor documentation including:

A. Training procedures.

B. Data on reliability of performance.

C. Environmental conditions for all training/ test sessions.

D. Times of flight for each bird on each leg for all training/test flights and description of their departure/arrival behavior..

E. Weights and deprivation level for each bird for each training/test flight.

4. Maintain surveillance and search, as appropriate, for the bird and package lost during the last demonstration of the project phase now completed.