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WORKING PAPER

A PROGRAM FOR PROVIDING HIGH-RESOLUTION OBLIQUE PHOTOGRAPHY OVER DENIED AREA

September 7, 1976

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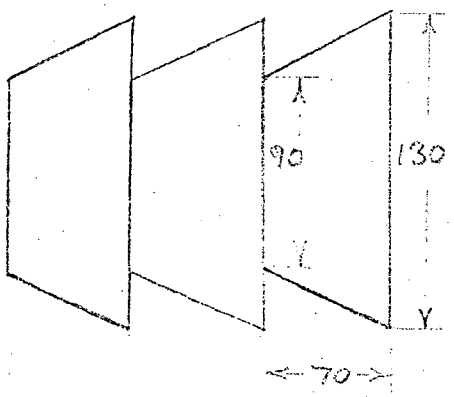
1. This system offers several unique photographic capabilities. High resolution of about one inch, combined with short range oblique target coverage, provide excellent target interpretability. Mensuration can be accomplished to an accuracy less than ~~one-tenth~~ two tenths of an inch given a large object of known dimensions (from KH-8) in the field of view. [redacted] The TACANA system can be clandestinely employed at times when there are no US photo satellites overhead; moreover, the system can be used at a time which optimizes lighting conditions for a particular target. The system is not susceptible to usual cloud cover conditions and can operate well under the low light/low sun angle conditions encountered at typical high latitude Soviet targets.

2. The attached figures illustrate the TACANA systems photo capability in terms of target coverage and resolution relative to existing satellite systems. TACANA's two and one-half mile strip of photography consists of at least 200 contiguous or overlapping frames each measuring about 70 feet in track and 90 to 130 feet cross track as shown below:



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AVIAN PROGRAM BACKGROUND INFORMATION

For several years, the Office of Research and Development has carried out various endeavors to attempt to train diferent species of birds in the task of carrying out intelligence collection for support missions. The work and types of birds employed were diverse and ranged from attempts to train hawks to fly to specifically recognizable targets over flight paths encompassing dozens of miles to the training of ravens to deliver small packages. A clandestine operation was carried out some time in the past in Europe in which an audio eavesdropping device was delivered by a bird to a designated outside window sill. This operation was not successful because the audio device would not pick up a conversation from the desired target. The bird delivery portion of the project was successful. From this background research endeavor it has been learned that the homing pigeon is the best avaian species to work with.

Within the past year, the program efforts have involved experiments with homing pigeons to determine if they could be trained to overfly to an otherwise inaccessible target location after release. An important factor in this training was the requirement for the target location to be away from the normal homing flight path so that the pigeon would

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purposely have to locate the target area and fly over it prior to taking a course to its home loft. Special lightweight cameras were successfully developed which permitted the obtainment of excellent high resolution photography (1" to 2" resolution). While the feasibility of this type of targeting and the utilization of homing pigeons for this intelligence collection application (designated as A-B-C flight) was established, certain problems in its utilization became evident. Specifically, it was determined that the length of training required to make the homing pigeons perform in flying from their release point A to their target B, prior to heading to home C, was excessive, making it operationally unattractive. Secondly, the reliability of the birds carrying out the A-B-C mission upon release was rather low, perhaps in the 25% region.

It was determined, after investigation by analysts, that a number of cases exist in which direct overflight for a homing pigeon in an A-C mission, that is, released from point A and fly directly home, would result in a high probability of overflight over an important target area from which valuable high resolution photography would have a significant impact. The feasibility and performance of the lightweight bird cameras having been established, when coupled with the natural homing instinct of select and trained homing pigeions will result in a capability to carry out missions of the A-C type with high probability of success.

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The balance of this paper addresses the program direction, manpower, and costs that would be required to bring the program to a level of demonstrable operational capability by the Spring of 1977. The effort to reach this desired state of capability would involve participation of ORD, OTS, NPIC, OWI, OSI, and other Agency support complements. A funding level of $105,000 will be required to bring the program to the proposed Washington demonstration in the Spring of 1977.

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PROGRAM OUTLINE

It is well known that homing pigeons will fly many hundreds of miles, often under adverse weather conditions, to return to their home lofts. Recent research by ORD has demonstrated the homing pigeon's ability to carry a sophisticated 16mm camera capable of taking high-resolution oblique photography. The purpose of the effort described here is to provide a scientific program for:

a. Selection of high-quality pigeons;

b. Training and documentation;

c. Testing of performance and flight path prediction accuracy;

d. Involvement and training of potential user;

e. Simulated missions in the Washington, D.C., area.

As seen in Figure 1, suppliers will provide birds to [redacted] These will be high-quality birds selected for homing, trapping and weight-carrying ability. At [redacted] extensive training and flight path accuracy tests will be conducted with user involvement and evaluation. Selected birds will then be [redacted] by the user to Washington, D.C., to undergo simulated mission tests prior to being taken to operational sites. It is also seen in Figure 1 that a test at Anchorage, Alaska, is planned in order to measure performance at extreme northern latitudes.

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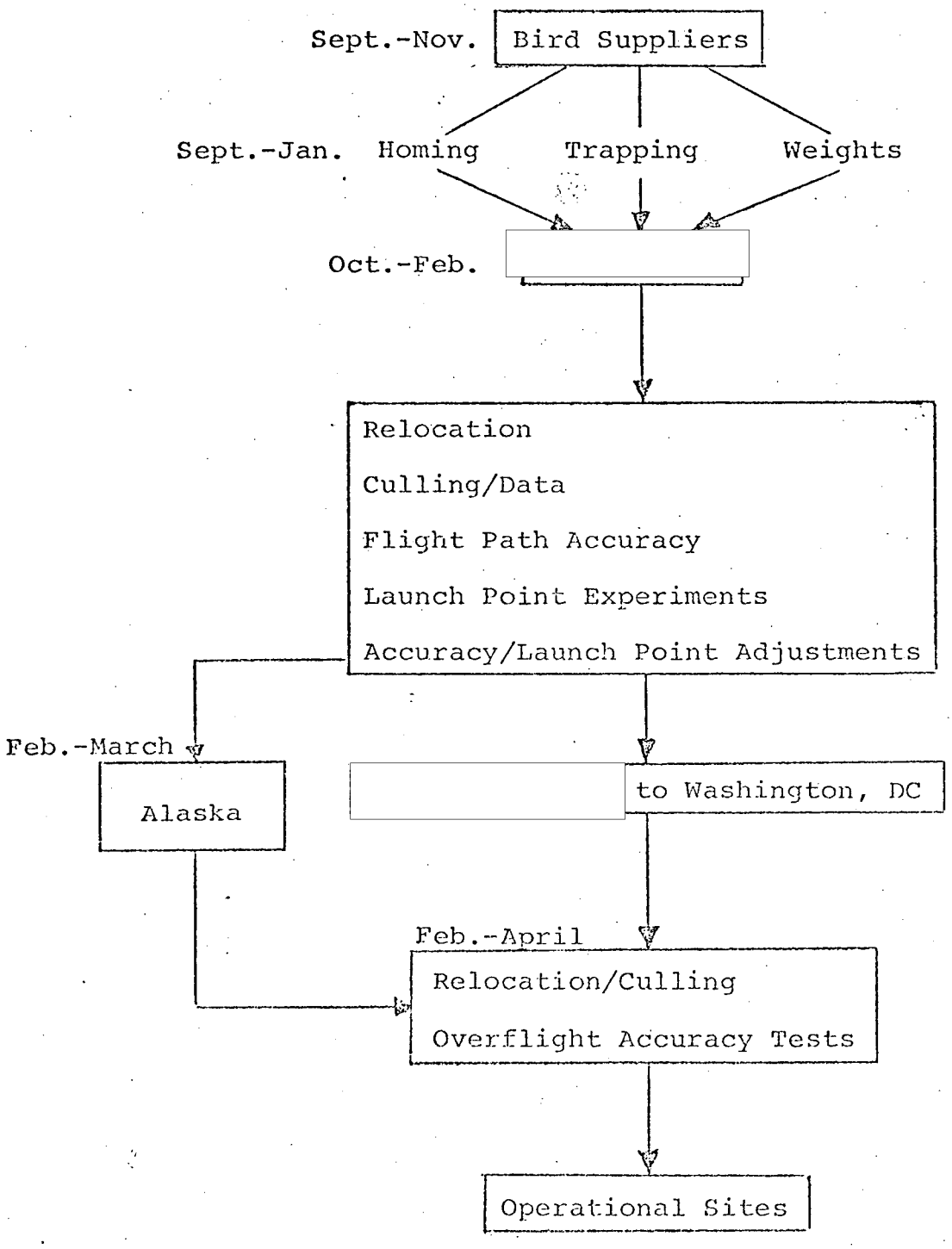
Figure 1: Program Outline



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As seen in Figure 2, there are three basic suppliers with controlled lofts [redacted] The suppliers will obtain birds from various locations from Florida to Alaska, and some relocation testing will be conducted by trading birds between the controlled lofts prior to shipment to [redacted] Figure 3 shows the scale of miles around [redacted] Overflight accuracy tests will be conducted using small DF transmitters on the birds and DF receivers located at various points along the flight path home. A light aircraft will also be fitted with a DF receiver to assist in flight path measurements. Bird-carried cameras will also be used to establish flight paths in some cases. Figure 4 shows the loft location at [redacted] A command post on top of the lab tower will provide communication for coordinating the field tests.

Table 1 shows the expected transitional quarter costs ($78,000), and Table 2 shows the expected costs for FY-77 as ($105,000) of which $70,000 is for ORD and $35,000 is for OTS. Neither office has currently budgeted for these FY-77 costs.

OTS SUPPORT

During the T.Q. a pigeon loft and facilities will be constructed at [redacted] ($3,000), and ORD will provide basic training for handlers and interested parties at both

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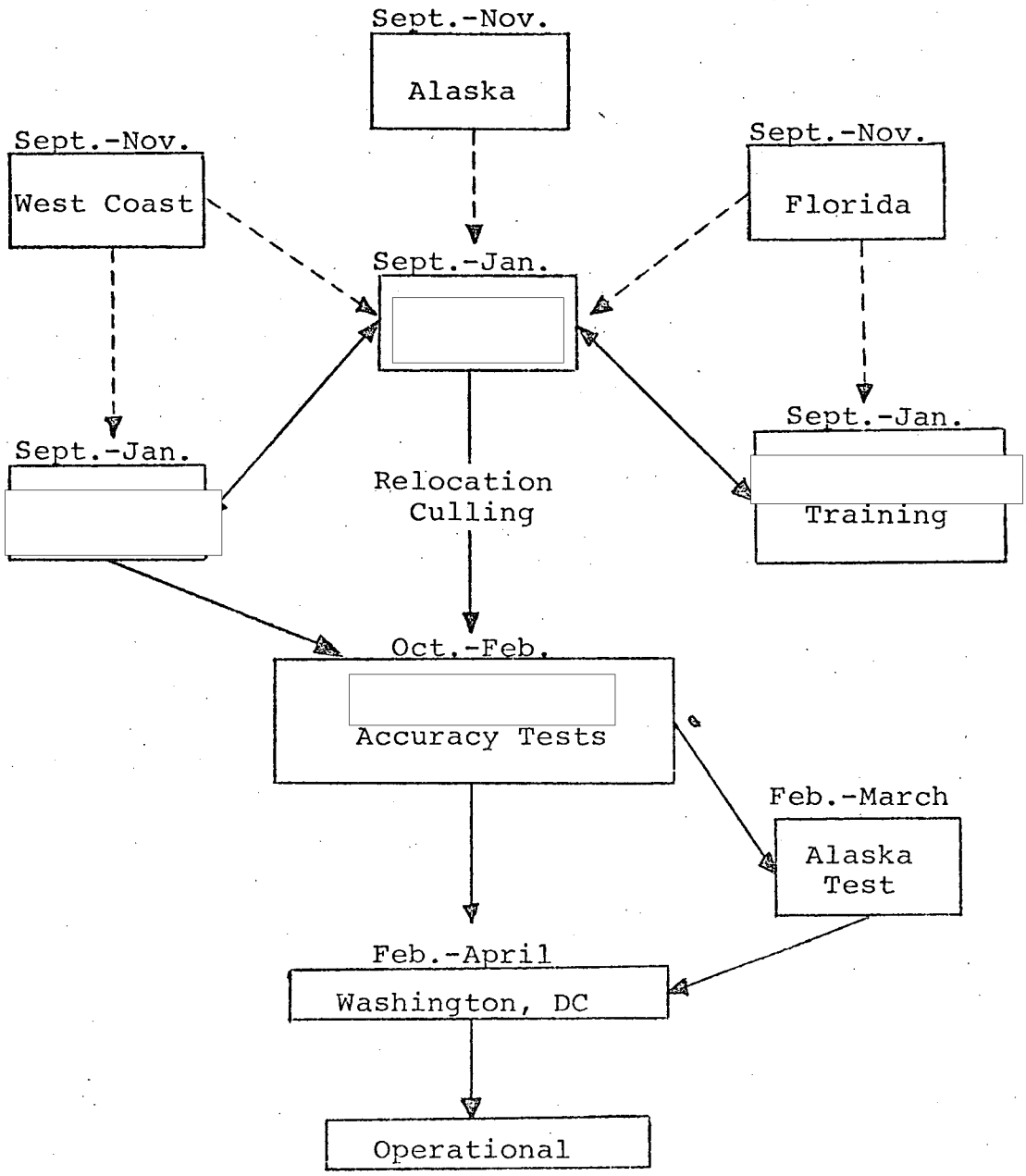
Figure 2: Suppliers



*Controlled Lofts

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TABLE 1

ORD T.Q. CONTRACT COSTS

CONTRACTOR	ITEM COST $	SUB TOTAL	RUNNING TOTAL
[redacted]			
Materials & Supplies (Bird Lofts/Training)	500		
Purchase of Birds	3,000		
Labor	3,000		
Travel and Field Support	3,500	10,000	10,000
[redacted]			
5 Cameras at $2,000 each	10,000		
Purchase of Birds	3,000		
Labor and Repair	7,000		
Travel and Field Support	5,000	25,000	35,000
[redacted]			
4 DF Receivers at $825 each	3,300		
Eight 1-gr. Transmitters at $50 each	400		
Three 6-gr. Transmitters at $65 each	200		
Commo Equipment for Field Tests	3,000		
Refit of Aircraft	1,600		
Labor	4,500		
Travel	3,000	16,000	51,000

(Continued)

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TABLE 1 (CONTINUED)

ORD T.Q. CONTRACT COSTS

CONTRACTOR	ITEM COSTS	SUB TOTAL	RUNNING TOTAL
[redacted]			
Drawings & Doc. (New Camera)	4,000		
Purchase Birds [redacted] & West Coast)	4,000		
Labor	7,000		
Travel	5,000	20,000	71,000
[redacted]			
QRC Support	4,000	4,000	75,000
[redacted]			
Building Supplies	2,300		
Labor	700	3,000	78,000

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TABLE 2 A

ORD FY-77 CONTRACT COSTS

CONTRACTOR	ITEM COST $	SUB TOTAL	RUNNING TOTAL
[redacted]			
Building Supplies	500		
Feed	500		
Two Bird Handlers	21,000		
Transport, Shipping, Misc.	1,000		
Labor	1,000		
Boat Rental	1,000	25,000	25,000
[redacted]			
QRC Support	38,000	38,000	63,000
ELMENDORF AFB (ALASKA)			
Building Supplies	1,000		
Labor	4,000		
Gen. Support	2,000	7,000	70,000

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TABLE 2 B

OTS FY-77 ESTIMATED COSTS

CONTRACTOR	ITEM COST $	SUB TOTAL	RUNNING TOTAL
15 Cameras ($2,000 each)	30,000	30,000	30,000
Construction of Lofts and D.C. Test Support	5,000	5,000	5,000
TOTAL ORD AND OTS FY-77 COSTS =			105,000

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[redacted] For FY-77, the first birds will arrive at [redacted] in early October and will continue to arrive through February 1977. [redacted] must provide feeding and exercising of the birds twice daily on a seven-day-a-week basis plus homing flight training at least three times a week. Complete records must also be kept. It is felt that the number of birds at any one time could be as large as 100, and that handlers will be required to perform this service and to assist in flight path accuracy tests to measure performance. The [redacted] FY-77 costs, including the salary for handlers is estimated at $25,000.

OTS operations personnel, concerned with operational missions, will receive preliminary training [redacted] (about one week) and participate in (or direct) simulated mission tests at [redacted] These personnel will also receive training in handling and loading of the camera equipment. Five prototype cameras will be provided by ORD for design verification and initial tests in [redacted] at [redacted] It is felt that OTS should provide 15 cameras (at an estimated cost of $30,000) to support the majority of tests at [redacted] and Washington, D.C.

OTS will assess the operational quality of tests at [redacted] and provide [redacted] to the Washington, D.C., area. OTS will be responsible for conducting all tests in the Washington, D.C., area as well as the handling of birds and the maintenance of cameras. ORD will provide assistance, consultation, and analysis upon request. It is

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suggested that OTS will wish to participate in (or direct) the test at Elmendorf AFB in Anchorage, Alaska, to verify performance at extreme northern latitudes.

Two OTS officers now at [redacted] have been identified as having previous experience in handling birds.

PROGRAM MANAGEMENT

During the previous feasibility stage of this program, the voluntary involvement of NPIC provided technical evaluation and experimental direction which considerably improved the photographic product. It is strongly felt that this final phase of development will require the involvement of OSI, OWI, and SE as well as that of OTS, ORD and NPIC in order to ensure a product of maximum intelligence value. It is recommended that the Technical Collection Team (TCT TACANA) be continued, and include [redacted] (NPIC), to properly advise and assess the efforts of the program manager (Dr. Charles Adkins) and the OTS team member during the course of this program. Figure 5 shows the recommended program management structure.

As a matter of policy, humane disposition of all culled birds will be observed at each of the controlled lofts. However, [redacted] for the bird loft at [redacted] and the use of birds in the tests at Elmendorf

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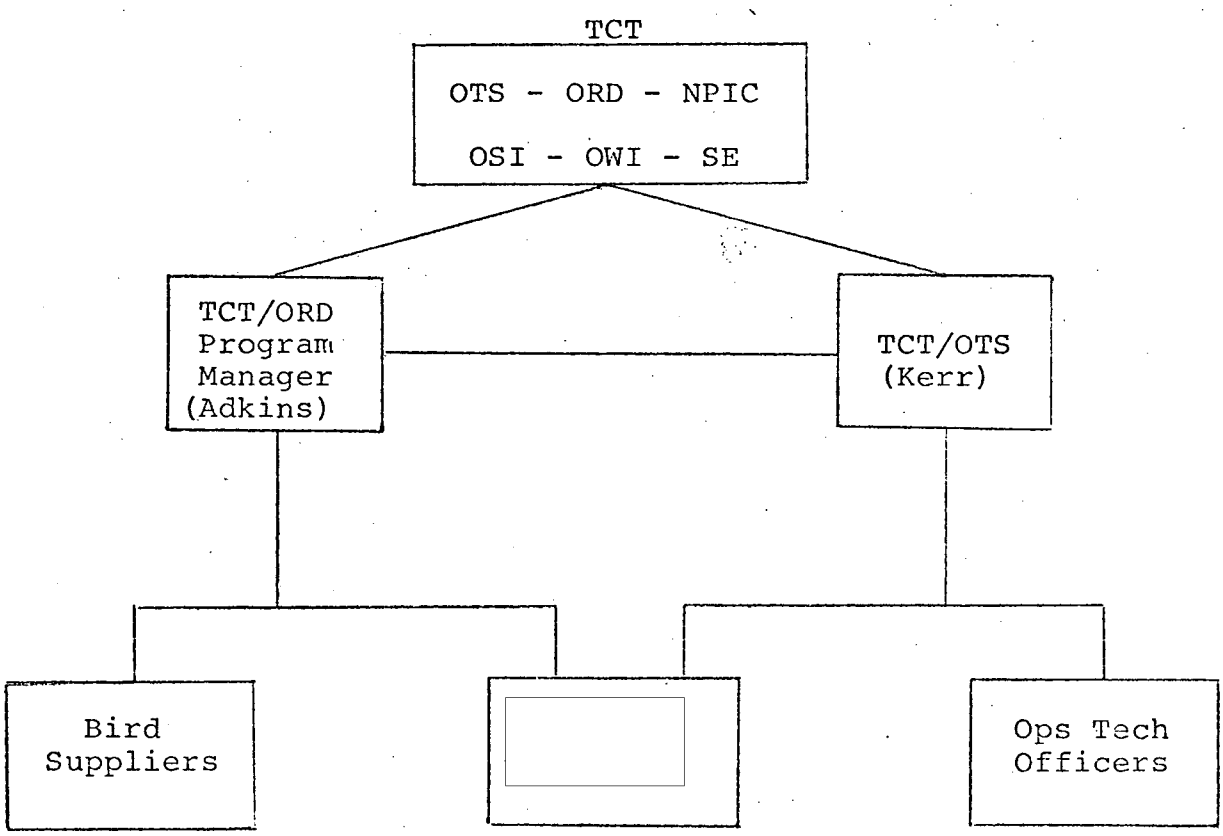
Figure 5: Program Management Structure



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AFB in Anchorage, Alaska. It is expected that some assistance will be required for the initial contact, [redacted] and arrangements with Elmendorf AFB.

OSR SUPPORT

A computer search was performed by the personnel office to locate Agency employees familiar with homing pigeons. A [redacted] was found who works in the publications Branch of OSR. His supervisor is [redacted] Chief, Publications Staff. [redacted] was interviewed, with [redacted] permission, and was found to be quite knowledgeable in the raising and training of homing pigeons. A summary of his experience is enclosed. [redacted] was quite enthusiastic about participating in the program on a full-time basis. I suggest that Mr. Noel E. Firth, Director, OSR, be approached to consider the temporary reassignment of [redacted] to ORD for the period of one year. [redacted] could be responsible for the loft designs, the training of bird handlers and operational personnel, and could supervise the selection and training of birds. I believe that [redacted] contribution to this program will be invaluable.

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