RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1 AGENCY ACCESSION	2 DATE OF SUMMARY	REPORT CONTROL SYMBOL
DA 0B6441	76 06 30	DD DR&E(AR)636

3 DATE PREV SUM'RY	4 KIND OF SUMMARY	5 SUMMARY SCTY	6 WORK SECURITY	7 REGRADING	8 DISP'N INSTR'N	8A SPECIFIC DATA - CONTRACTOR ACCESS	9 LEVEL OF SUM
75 07 01	[illegible]	U	U	NA	NL	☒ YES ☐ NO	A. WORK UNIT

10 NO CODES	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	62110A	3A762760A837	00	055
b. CONTRIBUTING				
c. CONTRIBUTING	CARDS 114F			

11 TITLE (Precede with Security Classification Code)

(U) Development and Evaluation of Improved Biological Sensor Systems

12 SCIENTIFIC AND TECHNOLOGICAL AREAS

001700 Animal Husbandry 01180 Operations

13 START DATE	14 ESTIMATED COMPLETION DATE	15 FUNDING AGENCY	16 PERFORMANCE METHOD
67 09	76 06	DA	C. In-House

17 CONTRACT GRANT

a. DATES/EFFECTIVE: NA — EXPIRATION:
b. NUMBER:
c. TYPE: — d. AMOUNT:
e. KIND OF AWARD: — f. CUM. AMT.

18 RESOURCES ESTIMATE	a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
PRECEDING FISCAL YEAR 75	5	265
CURRENT FISCAL YEAR 76	4	280

19 RESPONSIBLE DOD ORGANIZATION

NAME: Walter Reed Army Institute of Research
ADDRESS: Washington, DC 20012

RESPONSIBLE INDIVIDUAL
NAME: Joy, COL R.J.T.
TELEPHONE: 202-576-3551

20 PERFORMING ORGANIZATION

NAME: Walter Reed Army Institute of Research
Div of Bio Sensor Research
ADDRESS: Aberdeen Proving Ground, MD 21010

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic Institution)
NAME: Castleberry, COL M.W.
TELEPHONE: 301-671-3312
SOCIAL SECURITY ACCOUNT NUMBER: [redacted]

ASSOCIATE INVESTIGATORS
NAME: Linn, MAJ, J.M.; Nyland, CPT, T.G.;
NAME: Leighton, CPT, F.A.

PII Redacted

21 GENERAL USE

Foreign intelligence not considered

22 KEYWORDS (Precede EACH with Security Classification Code)

(U) Detector dog; (U) Selective breeding; (U) Mines; (U) Explosives, drugs; (U) Ambush

23 TECHNICAL OBJECTIVE, 24 APPROACH, 25 PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To better protect the combat soldier by genetic development of a more intelligent and sensually acute detector dog that was free of hip dysplasia and was temperamentally better suited for detecting the presence of the enemy than was then generally available.

24. (U) Critically evaluated AKC registered German Shepherd Dogs were purchased as foundation stock. The progeny of these and subsequent generations were closely evaluated by recognized tests designed to reveal the superior individuals. These were in turn used as breeders.

25. (U) 75 07 - 76 06 During the past two years the breeding colony of thirty-one animals was replaced with late third and early fourth generation offspring of the original stock. Almost without exception these were proven, progeny tested breeders which produced 229 fourth and early fifth generation animals. With the establishment of a stable gene pool producing consistently successful military working dogs, the project passed beyond the primary development stage and was ordered to transfer its breeding stock and their progeny to other organizations for production purposes. This was accomplished with distribution of 322 dogs during the past year. The final shipment, made on 22 June, consisted of 15 breeding dogs to Lackland Air Force Base, Texas. This organization was deactivated 30 June 1976. Two papers were written. These were "A Genetic Study of Canine Hip Dysplasia", and "The Use of Frozen Semen in Artificial Insemination of the German Shepherd Dog". A third paper, "Efficacy of Breeding Phenotypically Hip Dysplasia-free Dogs", is in manuscript. For technical report see Walter Reed Army Institute of Research Annual Progress Report, 1 Jul 75 - 30 Jun 76.

*Available to contractors upon originator's approval

DD FORM 1 MAR 68 1498 — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A, 1 NOV 65 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

Project 3A762760A837 MILITARY ANIMAL RESOURCES DEVELOPMENT

Task 00 Military Animal Resources Development

Work Unit 055 Development and evaluation of improved biological sensor systems

INVESTIGATORS.

Principal - COL Merida W. Castleberry, VC
Associates - MAJ Jeffrey M. Linn, VC
CPT Thomas G. Nyland, VC
CPT Eldin A. Leighton, MSC

OBJECTIVE. To better protect the combat soldier by genetic development of a more intelligent and sensually acute detector dog that is free of hip dysplasia and is temperamentally better suited for detecting the presence of the enemy than is now generally available.

BACKGROUND. Despite the large number of pet dogs in the nation, the acquisition of suitable working dogs for military purposes is always a problem. This is especially true during wartime because of the greatly increased demand. This project was authorized during the Vietnam conflict for the purpose of developing a line of more proficient military working dogs and to assist in relieving the shortage of acceptable dogs

APPROACH. Critically evaluated AKC registered breeding stock purchased especially for this purpose was selectively bred to produce superior progeny. These were in turn closely evaluated by recognized tests designed to reveal the superior individual. Linebreeding combined with progeny testing of each generation was used to accomplish the objective.

PROGRESS.

A. Breeding Program.

1. Twenty-three litters produced 125 puppies.
2. Present kennel population is 0.
3. Disposition of 322 dogs was made as follows:

DOD Dog Training Center, Lackland AFB, TX

Military working dogs 8 months or older	115
Puppies less than 8 months	33
Breeding stock	15
Walter Reed Army Institute of Research	109

US Customs Service	
Puppies less than 8 months of age	10
Breeders	6
Working Dogs	1
The Seeing Eye, Inc.	
Breeders	11
Working Dogs	5
US Army Scout Dog Platoon, Ft. Benning, GA	4
US Park Police	3
Civilian Police Departments	10

B. Special Projects.

1. Continuing Projects

a. No new developments occurred in the puppy diarrhea study conducted in conjunction with Veterinary Division, WRAIR.

b. Surgical repair approach to canine hip dysplasia did not prove to be of significant practical value. The one most promising of this series of six operated dogs was sent to the Air Force for training and, to date, is a completely functional sentry dog in Korea.

2. New Projects. To identify those puppies with exceptionally keen noses and to maximize their explosive detection ability, 116 puppies from 21 litters were "pre-scented" to dynamite twice weekly from their eighth week to their fourteenth week of life. These were short sessions lasting from five to ten minutes in which the puppy was rewarded with a piece of semi-moist dog food for successfully locating a small amount of commercial dynamite. This procedure provided a high degree of motivation despite the puppies having access to dry dog food ad libidum. Twenty-three of these puppies were identified as being exceptional. The Air Force and Customs dog training sections were alerted to such of these young dogs as they received. None of these is yet old enough to demonstrate their capability as trained explosive detectors.

C. Veterinary Medicine. Previously reported immunization and husbandry programs remained unchanged. Quarterly testing of breeding stock for B. canis and D. immitis continued. The kennels remained brucella-free but four D. immitis cases were diagnosed and treated.

Major surgical procedures during the past fiscal year included 55 ovario-hysterectomies, one caesarean section, one femoral fracture repair, one abdominal hernia and two umbilical hernia repairs, eight patent ductus

arteriosus surgeries and five persistent fourth right aortic arch surgeries.

D. Genetics.

1. Data derived from the pelvic radiographs of 1186 German Shepherd Dogs born in these kennels places the heritability of canine hip dysplasia in this colony at 22.0% -- a moderately heritable condition. Progeny testing to identify superior replacement breeders with final selections being limited, as far as possible, to individuals from dysplasia-free litters gave the best promise for breeding dysplasia-free dogs. During the last twelve months of this organization's operations, of the 72 fourth generation dogs receiving at least their eighth month radiograph, only two were dysplastic. Although not too comparative because of age difference, the 63.4% dysplasia rate encountered in 230 one to three year old civilian dogs radiographed for procurement by the Air Force at Lackland AFB, TX is at least indicative of the problem.(1)

The exceptionally low rate experienced by this kennel in the past 12 months is attributed to the fact that the sire or dam of 15 of the 17 litters producing these dogs were themselves from two late third generation almost dysplasia-free litters (one of the 15 dogs in those two litters became dysplastic). Prior to this, and almost without exception, the few previous dysplasia-free litters of earlier generations were not of breeding quality because of undesirable temperament, heritable physical defects, or combinations of these qualities.

2. Analyses of unpublished data examined the degree of both the phenotypic and genotypic relationships between temperament (measured by intermediate evaluation) and hip dysplasia. The phenotypic correlation between temperament and hip dysplasia was approximately -0.25. The genotypic correlation was approximately -0.35. The significance of the size and direction of the genotypic correlation became apparent when the selection of new breeders was made. As selection pressure was applied to improve the overall temperament of the dogs, there was a corresponding increase in the rate of hip dysplasia among the offspring. The reverse also occurred when selection pressure was applied to reduce hip dysplasia. Because of this correlation, overall progress in simultaneously improving both traits in this colony of German Shepherd Dogs was made more difficult.

3. A review was completed of this organization's progress in the abatement of canine hip dysplasia by mating phenotypically dysplasia-free dogs through four generations. This was based upon radiographic examination of the progeny of each succeeding generation as initiated by the original breeding stock. The rate of dysplasia experienced by each generation was as shown below.

Rates of Dysplasia Experienced by Generations

Generation	Number normal at shipment	Number Dysplastic	Total	Rate
1	257	84	341	24.6%
2	337	120	457	26.3%
3	207	74	281	26.3%
4*	139	32	171	18.7%

*During the final twelve months of this organization's operations, only two of the 72 dogs radiographed during their eighth month or beyond were dysplastic. A third case occurred in the final 33 pups receiving their initial five month radiograph. None of these 33 are included in the above figures.

Several debatable factors surround the above figures. Questions concerning the number of puppies rejected prior to being radiographed that might subsequently have become dysplastic and the number of dogs that became dysplastic following training as military working dogs are examples. Had the mission of this project been concerned solely with dysplasia eradication, these and other questions would have been answered. As can be seen no noticable progress was accomplished during the first three generations because of the interplay of unacceptable temperament, hip dysplasia, and other heritable defects. Two third generation litters, the S_{11} consisting of 8 pups, and the V_{11} consisting of 7 pups, more nearly possessed the desired qualities than any previous litters. With but one exception, all 15 of these animals possessed excellent hip conformation. One male and two bitches from each litter were introduced to the breeding line in April 1975. These animals were subsequently the sire or dam of 19 litters consisting of 92 progeny. Twelve of these litters and their 59 progeny received at least their eighth month radiograph prior to this organization's cessation of operations. Only one of these individuals proved dysplastic. Since approximately 80% of the dysplasia rate experienced in this kennel occurred by the eighth month of age, this drop was most encouraging. Establishment of pedigree depth of freedom from hip dysplasia, progeny testing, and breeding only from dysplasia-free litters will, apparently, greatly abate or perhaps eliminate canine hip dysplasia.

E. Visits.

1. Sixty-two visitors toured these facilities during the past year.

2. Consultant visits were made by Dr. W.H. Riser, (hip dysplasia).

DISCUSSION. With the development of a gene pool producing consistently successful military working dogs, the decision was made to transfer the stock to using organizations for production purposes. Per a formal Memorandum of Understanding between US Army Medical Research and Development Command and the US Customs Service six mature breeders and five young potential breeding canines were transferred to the US Customs Service at Front Royal, VA. With the concurrence of the Commanding General, US Army Medical Research and Development Command, eleven breeders were donated via contract to The Seeing Eye, Inc., for use in their breeding program. As the major gaining agency with fifteen breeders, the Air Force will be admirably situated to implement the establishment of a canine remount service at selected military installations.

PUBLICATIONS.

Three papers were prepared during the period of this report they are:

1. "A Genetic Study of Canine Hip Dysplasia" has been cleared for publication by Walter Reed Army Institute of Research Board of Review and tentatively accepted for publication by the American Journal of Veterinary Research. Principle author is CPT E. A. Leighton, MSC.

2. "The Use of Frozen Semen in Artificial Insemination of the German Shepherd Dog". The author is G. E. Lees, DVM.

3. "Efficacy of Breeding Phenotypically Hip Dysplasia-free Dogs" in manuscript. Principle author is MAJ J. M. Linn, VC.

CONCLUSION. Man's ability to breed animals for a desired genetic result was repeated with the establishment of a gene pool of the German Shepherd Dog which produced consistently successful military working dogs.

Project 3A762760A837 MILITARY ANIMAL RESOURCES DEVELOPMENT

Task 00 Military Animal Resources Development

Work Unit 055 Development and evaluation of improved biological sensor systems

LITERATURE CITED.

References.

(1) Towsend, L., Hip Dysplasia in Canine Military Candidates. In Proceedings: Canine Hip Dysplasia Symposium and Workshop. Orth. Foun. Anim., (1972): 127-130.