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Author

Corporate Author Dean of Faculty, United States Air Force Academy, Colo

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DEAN OF FACULTY

UNITED STATES AIR FORCE ACADEMY, COLORADO

Annual Research Progress Report No. 9

JULY 1974



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Covering Period

1 July 1973 - 30 June 1974

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This is the third published Annual Research Progress Report; the editions previous to 1972 were published as Semi-Annual Progress Reports. Further information desired on any project may be obtained by writing to the department listed for the principal investigator, USAF Academy, Colorado 80840.



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6. Physiologic Changes in Swine during Hypoxia

Principal Investigators: Colonel Peter B. Carter and Majors John W. Watters and Louis F. Wailly, Department of Life and Behavioral Sciences

The animal of choice for this experiment was the pig because of the similarities to cardiovascular response observed in man. The subjects were baselined under room-air conditions and then stressed on 10% and 5% respired oxygen. The following physiologic responses were monitored throughout the experimentations: blood pressure, heart rate, respiratory rate, and body temperature. Periodic blood samples were drawn to measure pO_2 , pCO_2 , pH, and Hct.

This was a pilot study for a more intensive investigation of cardiovascular kinetics during environmental stress which will be initiated in the near future.

7. Lipids and Lipoproteins in USAF Academy Cadets

Principal Investigators: Major Eugene L. Arnold, Department of Life and Behavioral Sciences

This is a continuing project to obtain data on serum lipid and lipoprotein levels in order to evaluate what changes are attributable to natural maturation, to diet, and to the environment (social pressure, exercise, altitude, etc.) of USAF Academy cadets during their four years at the Academy and during the following two years.

Blood samples are collected from cadets at the USAF Academy periodically for analyses of serum lipids, lipoproteins, and related factors. Less frequently, lean body mass is estimated for correlation

with the lipid data. Estimates are made periodically of caloric intake, of the composition of the diet, and of the degree of emotional stress experienced by the subjects of the study.

8. Radiation Dose to Specific Body Organs

Principal Investigators: Colonel Peter B. Carter and Majors Louis F. Wailly and John W. Watters, Department of Life and Behavioral Sciences

The objective of this effort is to continue the development of the Computerized Anatomical Man Model (CAM model), described in MDC G4655, for application to the analysis of space radiation hazards and radiation dose monitoring systems for Shuttle Orbiter and Shuttle payloads, i.e., Sortie Modules. This phase is devoted to generation of precise body self-shielding data for selected, radiation-sensitive body organs and to providing a general capability in the program to generate such data for body postures other than the one explicitly included in the CAM model.

The CAM model will be utilized to generate precise mass distribution data for selected body organs. These mass distribution data will be in a collapsed form in which angular orientation is not preserved. Data for spatially distributed organs will be furnished in a volume integrated form as well as for individual points within the organ.

9. Ecological Studies on a Herbicide-Equipment Test Area (TA C-52A), Eglin AFB Reservation, Florida

Principal Investigators: Lt Col William E. Ward, Major Charles E. Thalken, and Captains Alvin L. Young and William J. Cairney, Department of Life and Behavioral Sciences

Sponsored by Air Force Logistics Command/DS and Air Force Systems Command/SDWC

This project is concerned with determining the ecological consequences of applying massive quantities of military herbicides (346,117 pounds), via repetitive applications over a period of 8 years (1962-1970) to an area of approximately 1 square mile. Data have been obtained in the persistence, degradation, and/or disappearance of the herbicides and the contaminant 2,3,7,8-tetrachlorodibenzo-p-dioxin from the Test Area's soils and drainage waters and their subsequent effects (direct or indirect) upon the vegetative, faunal, and microbial communities.

Publications

One technical report (AFATL-TR-74-12, Eglin AFB, Florida) has been published on this project. An additional report will be prepared following summer 1974 efforts.

10. Disposal of Herbicide Orange by Soil Incorporation and Biodegradation

Principal Investigators: Lt Col William E. Ward, Majors Eugene E. Arnold and Charles E. Thalken, and Captains Alvin L. Young and William J. Cairney, Department of Life and Behavioral Sciences

Sponsored by Air Force Logistics Command/DS

Concern over the level of contamination of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) herbicide by the teratogen 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) may result in the disposal of selected USAF surplus inventories of herbicide Orange. A potential disposal method is that of soil incorporation. The soil incorporation method is based on the premise that high concentrations of phenoxy herbicide and TCDD will be degraded to innocuous products by the combined action of soil microorganisms and soil chemical hydrolysis.

Data from field sites in Florida, Kansas, and Utah indicate rapid degradation of Orange herbicide and its contaminant following soil incorporation at rates of 1,000-4,000 pounds active ingredient per acre. Associated ecological studies of the incorporation sites have indicated that only minimal ecological damage results from either the incorporation technique or the applied herbicide.

Publications

One report has been published on this effort. A concluding technical report is in progress.

G. Department of Mathematical Sciences

1. Strategic Command, Control, and Communications

Principal Investigators: Colonel R. R. Lochry, Lt Col J. B. Tindall, Lt Col D. G. Balish, Department of Mathematical Sciences; Lt Col C. M. Glass, Department of Electrical Engineering; Major D. Murray, Department of Political Science and Philosophy; Captain D. Willis, Department of Astronautics and Computer Science

Sponsored by the Air Force Weapons Laboratory, Kirtland AFB, New Mexico

FY 74 began with the Strategic Communications Workshop (SCW), held in August at the Air Force Academy. Major General Lee M. Paschall was the keynote speaker, and representatives of OJCS/J3/J6, USAF/SA, NORAD, SAC, USN/NESC, DCS, DNA, AFWL, NELC, and many civilian contractors participated. The purpose of the SCW was to focus on the requirements of communications modeling and to gain some exposure to the modeling efforts of other DOD agencies. Our own efforts in research have produced some notable results and promise of more to come.