

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON 25, D.C.



REPLY TO
ATTN OF: AFCSG-11

SUBJECT: Report of TDY

24 May 1960

TO: AFCSG-10

1. PURPOSE OF VISIT - The purpose of this trip was attendance at a Symposium on Closed Circuit Respiratory Systems given at the Dayton Biltmore Hotel, Dayton, Ohio, on 28 and 29 April 1960. The Symposium was sponsored by the Air Research and Development Command and the Wright Air Development Division.

2. I departed Bolling AFB, 27 April 1960, and traveled to Wright-Patterson AFB via the Kitty Hawk. I returned from Dayton to the Washington National Airport via commercial air line 29 April 1960.

3. KEY PERSONS CONTACTED were Colonel John P. Stapp, the Symposium Chairman; Col. James Humphries, Wright-Patterson Air Force Base Surgeon; Col. Andres Karstens of the Aerospace Medical Laboratory; the residents in the Aviation Medicine Program at Wright-Patterson Air Force Base; and numerous other representatives of military and commercial establishments having an interest in the development of closed circuit respiratory systems. Other representatives from the Washington area included Major Grady Wise and Dr. Herman Chinn. This Symposium was attended by approximately 250 people.

4. The titles of the various papers and their presenters are listed in the attached program. It is expected that the entire proceedings of the meeting will be distributed within one month. I have requested two copies for this office.

a. Col. Stapp discussed the new organization of WADD and the establishment of the Aerospace Medical Laboratory as a Division under WADD. An organizational chart of the laboratory is attached, and I have requested organizational charts for WADD and the Aerospace Medical Division with names of assigned personnel. These, plus a phone book, will be forwarded as soon as they are available. The remainder of Col. Stapp's presentation concerned a philosophical discussion of man in his environment and the need to switch our efforts from concern with aviation to concern with space.

b. Mr. Nelson Hartz, of Mine Safety Appliances, discussed the need for continuous atmospheric measurements for monitoring of such cabin atmosphere constituents as oxygen and carbon dioxide.

Instruments for the monitoring of certain other air contaminants, such as methane, hydrogen sulfide, fuel and hydraulic fumes, refrigerant agents, etc., are available and in use in air pollution studies. A single unit is needed for measuring many impurities and a program is needed to develop a stable of such instruments now. Types which he discussed included an infrared (using?) device and alpha ionization chamber and a device utilizing the catalytic oxidation principle.

c. Mr. Carl Nisser, Beckman Instruments, discussed the device to be used in Project Mercury cabin monitoring. It is an electrochemical cathode polarographic oxygen electrode. It consists of a platinum cathode, a silver anode, and either a polyethylene or teflon membrane. This cell is sensitive only to oxygen and it has a 90% response in one minute with an accuracy of 10%. A CO_2 electrode utilizing the reaction, hydroquinone to quinone, has also been developed. This has a response time of three minutes with an accuracy of 90%. It has a limited operational life of 72 hours without drift. It is approximately 1" x 2", weighs 4 ounces, has no power requirement, operates at a range of 1 to 20 millimeters with an alarm at 8 millimeters CO_2 .

d. Mr. O'Hallonan, of Bendix Corporation, discussed a small portable mass spectrometer. The Bendix time of flight mass spectrometer weighs approximately 600 pounds and requires much maintenance and a competent operator. They have now developed a 17" unit requiring 15 watts of power which can determine all the known gases and also even any unsuspected gases which might be present. This device has been flown in satellites and uses space as its vacuum source. There will be some problem in operating it at lower altitude due to the lack of vacuum source. This appears to be a very promising instrument.

e. Dr. J. W. Severinghaus, of the University of California, discussed a carbon dioxide electrode which had been developed originally for the measurement of CO_2 levels in brain tissue. This electrode utilizes a cathode membrane with a silver reference electrode and PH sensitive glass. It has a linear response down to 1% CO_2 . The weight of all the equipment necessary is less than one pound and it requires 1 to $1\frac{1}{2}$ watts of power. The problems center around an electrolytic cell and the fact that the membrane may have to be replaced and the solution refilled during flight. There is also a long-term drift in the readings.

f. Mr. Oliver, of the Fluor Corporation, discussed the use of aqueous carbonate and separate cooling and high boiling ethylene amine as two new methods of recovering the CO_2 of cabin atmospheres. Potassium carbonate was the substance used in the carbonate method. These two methods would

require 61.2 pounds of equipment per man day for the carbonate method and 63.7 pounds per man day for the ethylene amine method. It is felt that additives might be developed which could reduce these over-all weights. The problem of amine toxicity still remains to be studied.

g. Mr. Walter Arnoldi, of the Hamilton Standard Division, discussed regenerable solid adsorbents. Such adsorbents would be of value only in long-term space flight and should be independent of gravity, simple, have a low power demand, and minimal heat rejection requirements. The Linde molecular sieve possesses many of the required characteristics. This can be combined with the use of silica gel in a two-stage system and it is felt an ideal system could be developed having a weight of 55.3 pounds for a five-man crew.

h. Dr. Sol Weller, of the Aeronutronic Division, Ford Motor Company, discussed the recovery of oxygen from carbon dioxide. A series of chemical methods were outlined using ultraviolet and various other catalysts. The production of methane in carbon monoxide is a complicating factor in many of these reactions.

i. Dr. John Foster, of the Battelle Memorial Institute, discussed the reduction of CO_2 to elementary carbon by the use of a hydrogen catalyst. This has been accomplished by the use of a reactor two feet in length and one inch in diameter and about the size of a man's fist. Such a device can produce 500 liters of carbon dioxide per minute with collection of carbon in the reactor as the limiting factor. Again the side reactions or the production of carbon monoxide and methane are the greatest worry.

j. Mr. Acker, of the Boeing Airplane Company, discussed an analysis of four methods of achieving closed circuit respiratory support. These methods were hydrogenation, a closed ecological system (algae), a photochemical system, and a storage system. The analyses were prepared on the basis of 100-day flight.

k. Several Navy speakers discussed the method of controlling the atmosphere in submarines and much of this material was repetitious. A Mr. Pecoraro of the U. S. Naval Training Device Center discussed an experimental model of an interior environment simulator for space crews. Although there had been no delineation of the Navy's space role as yet, in November 1959 they had let a contract for the development of a device to simulate the craft they might be using ten years from now. This seemed a little odd for there is certainly no agreement whatsoever as to the type of environmental control system that will be used in any

vehicle of the present, let alone one in the future. He did have some very intriguing view-graphs which created movement through the use of a disk placed near the light source.

5. Col. Humphries called and asked that I visit him at the hospital to discuss the assignment of an aviation medicine specialist to replace Captain Haworth who is programmed for the Air Academy. Col. Humphries has no desire to stop Captain Haworth's assignment but was quite emphatic in pointing up the need for a replacement. This was previously discussed with Col. Smith and Col. Nuttall and it was felt that Maj. Shirley could be moved from AMC headquarters to this base slot. It appears that Gen. Braswell and Col. Humphries have decided that it would be unfair to move Shirley back to this slot and therefore are at present programming a Maj. Freedman to this slot. He presently is assigned as Chief of Internal Medicine and his experience in the field of aviation medicine is somewhat limited as he has spent the majority of his time in the field of internal medicine. A review of this situation is in order in light of the fact that there will be no aviation medicine specialists assigned to the base to either supervise the aviation medicine consultation service or the aviation medicine residency training program. The review on the spot of the local situation reveals that the specialist assigned to Headquarters AMC can in fact offer little help or personal supervision to the residents assigned to the base.

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2 Atch
1. Program
2. Org. Chart, Aerospace
Med. Div. under WADD