Budget Bureau No. 104-6604
Expiration date: January 31, 1967

NATIONAL ACADEMY OF SCIENCES—NATIONAL RESEARCH COUNCIL
in cooperation with the
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

APPOINTMENT OF SCIENTIST AS ASTRONAUT

Application

Please Type or Print. Deadline for filing this Application is January 8, 1967.

1. Name in full: Dr. / Mr. / Mrs. / Miss ... Thornton (last), William (first) Edgar (middle)
2. Present address ... 5131 Lancelot Dr., San Antonio, Texas
3. Permanent address ... 5131 Lancelot Dr., San Antonio, Texas
4. Phone number ... OL 54763 (home) LE 28811 Ext. 6283 (office)
5. Age 37 Date of birth 4-14-29 (month, day, year) Place of birth Goldsboro, N.C. (city, state or foreign country)
6. Will you be a United States citizen on March 15, 1967? ☑ Yes ☐ No
7. Height 6'0" (feet inches) Weight 200# Sex: ☑ M ☐ F Social Security Number [redacted]
8. Marital status: ☐ Single ☑ Married Number and ages of dependent children 2, 5 and 7
9. Major field ... Medicine Specialized field Aerospace Med. Field of doctorate Medicine
10. Highest degree earned: ☐ Ph.D. or Sc.D. ☑ M.D. ☐ Other ... (specify)
11. Degree expected: ☐ Ph.D. or Sc.D. ☐ M.D. ☐ Other ... (specify) Date expected ...
12. Colleges or universities attended including the one in which you may be currently enrolled. Arrange in sequence, listing your current (or last-attended) institution first:

College or University and State in which Located	Inclusive Dates of Attendance	Degree Earned or Expected	Date Awarded or Expected	Major Field of Specialization
Univ. of North Carolina	59-63	M.D.	3 June '63	Medicine
Univ. of North Carolina	48-52	B.S.	2 June '52	Physics
N.C. State College	47-48	—	—	Elec. Eng

13. List academic honors, including scholarships or fellowships, held, with dates of each: 1 . . 1 , . . .

13. 1st Prize, Scientific Exhibit on patient monitoring, 1960, American Society of Anesthesiologists
1st Prize, Scientific Exhibit on EKG diagnosis, 1961, Aerospace Medical Association

* American Society of Anesthesiologists

(over)

14. Teaching, research and other *relevant* positions held:

POSITION	PLACE	DATES
Tech. Adviser to Director, Crew Test & Eval. (MOL Bioastronautics) Capt, MC, USAF	AMD, Brooks AFB, Tex	'64-Present
Capt, MC, USAF (Interne)	Wilford Hall USAF Hosp, Lackland AFB	'63-'64
Chief Engr, Electronics Div	Del Mar Eng., Los Angeles, Cal	'56-'59
Full-time consultant to	Air Proving Ground Command	'55-56
1st Lt USAF OIC of Photo Optics	Flight Test Lab, Eglin AFB, Fla	'53-'55

15. Names and addresses of four persons who know your academic and professional experience and ability whom you are requesting to submit a Reference Report. *At least two* of the four should be persons with whom you have worked in your major field; the others listed should be in closely allied fields. Include your thesis adviser, if applicable.

☐ (thesis adviser) Col A.G. Swan ~~Director, Rich + Dulany~~ AMD (AMRL) BAFB Tex 78235

Dr. ED Palmatier, South Bldg., Univ. of N.C. Chapel Hill, N.C.

Dr. D.A. Davis, N.C. Memorial Hospital, Chapel Hill, N.C.

Mr. Bruce Del Mar, Del Mar Eng. Labs. 6901 Imperial Highway Los Angeles Calif

16. List any special certificates or licenses (e.g., pilot, radio operator), skills or field experience you possess that may be relevant to this application.

1) Flight medical officer, graduate primary course in aerospace medicine, Apr 65. 2) Study and practice of electronics (since early high school) has proven more than practically equal to BS in EE. 3) Extensive experience in organization and direction of flight test of aircraft and small missile ~~programs~~ Programs, data reduction and analysis, 1000+ hours' participation in flight test, including zero G, in various crew functions including cameraman, radar and weapons system operator. 4) Extensive experience in use and design of medical instrumentation. 5) Two plus years' experience in space medicine problems including development and design of instruments and techniques for use on MOL and NASA programs.

17. List any special qualifications not covered elsewhere in the application (e.g., membership in professional or scientific societies, patents or inventions).

Have organized and directed two successful commercial efforts, Electronics Division of Del Mar Eng. Labs (aerospace electronics) and Avionics Research Products (medical electronics), which included development, design, production, test, and maintenance of complex instruments. Personally designed radar systems and subsystems, radio receivers and transmitters, 'scopes, and medical instrumentation. Can operate and maintain complex electronic (radar, radio, etc.), optical and electromechanical devices and instruments, reasonably skilled as electrician and mechanic with knowledge of machine shop practice. Have performed valid experiments in unusual environments including high performance A/C, zero gravity, centrifuge and high altitude chambers; have provided solutions to complex physical problems in a variety of fields. Seven years' varsity collegiate and service football.

Inventions: U.S. Patents:

2,869,120	I.R. Target System	3,161,877	Doppler Radar Scoring System
2,909,772	Scope Recorder	3,267,934	Electrocardiographic Computer
2,938,201 } 2,983,915 }	Radar-Optical Scoring Systems	Pending	Non-gravimetric Mass Measurement System
2,971,274	Missile Simulator	In Application	Multi-channel Densitometer System and Ergometer
3,149,328	Pulsed Light "radar"		

Signature of Applicant ..... Date .....

Return to Scientist as Astronaut, National Academy of Sciences—National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418

PREVIOUS AND CURRENT RESEARCH

1965 - Present -- Aerospace Medical Division, San Antonio, Texas

Performed an extensive investigation of the problems of determination of mass under zero gravity, especially as related to physiological balance studies of man. In particular, I have studied the use of a spring/mass oscillator theoretically and experimentally. As a resulf of this work, it has been possible to design a series of flight instruments with accuracies on the order of .01% - .02% for rigid masses to .1% or better for non-rigid masses, including humans, over the range of 50 grams to 100+ kilograms. I have taken the smaller instrument through successful flight testing on zero G aircraft profiles. Hardware is currently being designed and flight qualified under my direction for proposed NASA and MOL programs. These are the first mass scales ready for flight use and at least one design is tentatively scheduled for use in a NASA Apollo Applications experiment.

Collaborators - Dr. E. D. Palmatier, South Building, University of North Carolina, Chapel Hill, North Carolina, and

Mr. William Oakey, Southwest Research Institute, San Antonio, Texas

1966 - Present -- Aerospace Medical Division, San Antonio, Texas

Analysis of physical aspects of the problems of ergometry and crew conditioning in space flight which includes mathematical analysis of conventional movements and is planned to include measurement of efforts of muscle groups and total energy cost of various tasks under zero G trajectory. Effectiveness of various programs for conditioning is to be investigated. Design of prototype ergometer, ~~which~~ it will allow accurate measurement of energy and work under variations in type and ~~[illegible]~~ amount of loading for a variety of motions was an important portion of the program and has been accomplished.

Collaborators - Lt Colonel J. W. Ord, Aerospace Medical Division, San Antonio, Texas

1965 - Present -- Aerospace Medical Division, San Antonio, Texas

Experimental investigation of feasibility of on-line automatic sleep staging (Dement-Kleitman criteria) by EEG is underway and is

1965 - Present

Aerospace Medical Division

An extensive experimental and theoretical investigation has been performed to determine the feasibility of obtaining arterial oxyten saturation, cardiac output and blood volume under conditions of orbital flight with peripheral dye injection and a three wavelength earpiece densitometer. I have designed prototype earpiece densitometers including a flight prototype in test.

Collaborators - Lt Col J. W. Ord Aerospace Medical Division

planned to include design of flight-qualifiable analyzer and associated gear such as personal telemetry link and electrodes.

Collaborators - None

1965 -- Aerospace Medical Division, San Antonio, Texas

Theoretical and experimental analysis of personal telemetry problems in orbiting laboratory performed with design of practical miniature transmitter with battery life of 30+ days demonstrated.

Collaborators - None

1962 - 1963 -- University of North Carolina, Chapel Hill, North Carolina

The use of conditioned G.S.R. response for audiometric threshold testing in children and/or uncooperative subjects was investigated and a system designed which yields results comparable to standard direct procedures and at great reduction in complexity over previous indirect procedures.

Collaborators - Dr. Newton Fischer and Dr. Grady Thomas, Department of Otolaryngology, University of North Carolina, Chapel Hill, North Carolina

Begin Here

1962 - 1963 -- University of North Caroline, Chapel Hill, North Carolina

Study of muscle action in unrestrained motion of the lower extremities in normal subjects and subjects suffering muscular atrophy from various causes were made with multichannel, telemetered E.M.G.'s, integrators and continuous goniometry. Design of the apparatus was a significant portion of this program.

Collaborator - Miss ~~Margaret Moore~~ Sally Farrand, Department of Physical Therapy, University of North Carolina, Chapel Hill, North Carolina

1955 - 1963 -- University of North Carolina, Chapel Hill, North Carolina

Study of improved methods of clinical monitoring of patients during and post surgery/anesthesia. Improved devices for respiratory studies,

blood pressure, blood flow, temperature and electrophysiological signals were designed and constructed and/or investigated. These devices included rheographs, optical and displacement plethysmographs, EEG and EKG systems, gas flow transducers and samplers, blood flow meters, blood pressure transducers, analog operators for signal processing and improved display and recording devices. Literally thousands of cases were followed with various combinations of monitors and results analyzed such that a definitive monitoring system was designed and telemetered with EKG digital pulse pressure routinely monitored on a 2-channel scope in every O.R. suite with telemetered EEG and respiratory studies available for special cases. System remains in continuous use to date.

Collaborators - Drs. D. A. Davis, K. Sugioka, and D. Grosskreutz, North Carolina Memorial Hospital, Chapel Hill, North Carolina

1959 - 1962 -- University of North Carolina

A study of improved methods of diagnosis of suspected heart disease was made using some of the above techniques. A radio telemetry system with magnetic tape recording and an on-line analyzer of selected EKG parameters was designed and constructed. This equipment allowed unrestricted study time and activity and demonstrated a marked increase in positive diagnoses of chronic, intermittent arrhythmias and transient myocardial ischemia. Effects of drugs and various activities were also documented with these techniques.

Collaborators - Dr. T. C. Gibson, University of Vermont Medical School, Burlington, Vermont

Dr. Isadore Rosenfeld, Cornell University, New York, New York

1961 - 1963 -- University of North Caroline, Chapel Hill, North Carolina

Effects of activity, especially normal activity, athletics, and abnormal metabolic states such as thyrotoxicosis and psychic stress on heart rates were investigated by means of unrestrained recording of heart rate with telemetry and cardiotachometers.

Collaborator - Dr. Gordon Ira, Duke University, Durham, North Carolina

1959 - 1960 -- Del Mar Engineering Laboratories, Los Angeles, California

Investigation and development of UHF Doppler and simple electronic computation techniques were performed. This work was later incorporated in a successful missile scoring Navy tow target.

Collaborator - Mr. C. Sanctuary, Del Mar Engineering Laboratories

1956 - 1959 -- Del Mar Engineering Laboratories, Los Angeles, California

Development and tests of radar optical scorers were continued with production design and subsequent standardization by USAF (TDU 4B) and USN (Aero 39). Production items were procured in quantity by U.S., Canadian, and Allied Air Forces.

Collaborators - Del Mar Engineering Laboratories, Production Engineering Staff

1956 - 1959 -- Del Mar Engineering Laboratories, Los Angeles, California

An investigation of I.R. sources resulted in sources and controls suitable for use in small target vehicles which became standard with the military services.

Collaborators - Mssrs. Lolmaugh and Smith, Del Mar Engineering Laboratories

1958 -- Del Mar Engineering Laboratories, Los Angeles, California

The behavior of regenerative and super-regenerative R. F. detectors were analyzed and marked improvements made in bandwidth and detection efficiency. Practical designs based on this work were used in command receivers produced in quantity.

Collaborators - Del Mar Engineering Laboratories, Production Engineering Staff

1958 -- Del Mar Engineering Laboratories, Los Angeles, California

Investigation + development of non-coherent, nano-second U.V. light sources, filters and detectors resulted in high resolution "optical radar" several years prior to similar application of lasers.

Collaborators - None

1952 - 1955 -- Eglin AFB, Florida

Extensive investigations were made in radio, optical, and radar methods of tracking small missiles which included work in improving camera lens, ultraspeed recording materials and high resolution pulsed radar. This work had practical application in several radar optical scoring systems which allowed the first operational evaluation of a variety of air-to-air missiles. Received USAF Legion of Merit for this work.

Associates were: Mr. J. J. Bauer, PGVED, Eglin AFB, Florida
Mr. J. Schauble, Physical Sciences Laboratory, Eglin AFB, Florida

BIBLIOGRAPHY

A formal thesis was not required by the University of North Carolina Medical School. A "paper" on some research project was done in the senior year. Mine was entitled, "A Brief Summary of Developments for the More Extensive Application of Electrocardiography" and was a summary of my work with electrocardiographic technology while in medical school. Improved techniques including electrodes, personal telemetry systems, long term recording and automatic analysis designed by me with examples of successful application to clinical medicine were described.

a. Published Papers

Thornton, William E., Interim Report on Development and Evaluation of Firing Error Indicator Project # APG/ADA/49-A-4, published by Air Proving Ground Command, 1954.

Thornton, William E. and Benton Bejack, "Performance and Application of a Commercial Blood Flow Meter," Transactions of the IRE Professional Group on Medical Electronics, Vol. ME-6, pp. 237-240, December 1959.

Davis, David A., William E. Thornton, Doris C. Grosskreutz, Kenneth Sugioka, and Rodney McKnight, "Radio Telemetry in Patient Monitoring," Anesthesiology, Vol. 22, pp. 1010-13, November-December 1961.

Gibson, Thomas C., William E. Thornton, William P. Algary, and Ernest Craige, "Telecardiography and the Use of Simple Computers," The New England Journal of Medicine, Vol. 267, pp. 1218-24, December 1962.

Moore, Margaret, William E. Thornton, et al., "Use of Radio Telemetry for Electromyography," Journal of the American Physical Therapy Association, Vol. 43, pp. 787-791, November 1963.

Thornton, William E. and David A. Davis, "Comments," I.E.E. Transactions on Biomedical Engineering (BME), Vol. 11, pp. 54-55, January/April 1964.

Davis, David A. and William E. Thornton, "Radiotelemetry in Anesthesia and Surgery," International Anesthesia Clinics, Vol. 3, pp. 533-545, May 1965.

b. In Press

Thornton, William E., Grady Thomas, and Newton Fischer, "Telemetered G.S.R. in Clinical Audiometry"

Thornton, William E., D. Everett Palmatier, and William Oakey, "A Device for Non-Gravimetric Mass Determination."

c. Published Abstracts

Thornton, William E., David A. Davis, Kenneth Sugioka, and Charles Fowler, "An Application of Analog Computational Methods to Physiological Measurements," Anesthesiology, Vol. 20, No. 1, pp. 137, January-February 1959.

Davis, David A., Thomas C. Gibson, and William E. Thornton, "The Clinical Applications of Telecardiography," presented and abstracted in Digest of the 1962 Fifteenth Annual Conference on Engineering in Medicine and Biology, November 1962.

Thornton, William E., Thomas C. Gibson, and David A. Davis, "Computer Analysis of the Electrocardiogram," presented and abstracted in Digest of the 1962 Fifteenth Annual Conference on Engineering in Medicine and Biology, November 1962.

d. Unpublished Reports

"Some Practical Aspects - Telemetry in Clinical Medicine," presented, National Telemetry Conference, June 2, 1964.

"An Example of Analog Computation in Clinical Diagnosis," presented at Annual North Carolina IRE Convention, October 1962.

I have some unpublished memos on various phases of my work, as well as military and commercial technical manuals and reports on production equipment designed by me including:

Evaluation of (Del Mar) D-100B Scorer Capabilities---AFSC-TR-57-71

Technical Manual NAVWEPS 28-10A-4 on USN Aero 39 Radar-Optical Scorer (Del Mar) D-100A

USAF Manual TO-43E7-4-1 on USAF SXU-1/A Scorer (Del Mar) D-100B

USAF Manual TO-43E11-12-1 on Infrared Target

Navy Manual NAVWEPS 28-10A-A on Advanced Infrared Target

Avionics Research Products Manuals on Mark I Electromagnetic Flowmeter and Mark 1A Integrator

"Direct Measurement and Computation of Effective Cardiac Power and Work" - Avionics Research Products Memo, 1959

"Proposal for Experiment with Non-Gravimetric Mass Determination Devices," AMD Memo, September 1965

"A Preliminary Report on Some Aspects of a Non-Gravimetric Method for Mass Determination," AMD Memo, December 1965