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MERCURY ASTRONAUT SELECTION FACT SHEET

BACKGROUND

Many of the conditions expected in orbital space flight are similar to those experienced by military test pilots. NASA, therefore, went to this field to seek volunteers for the Mercury astronaut training program. More than 100 military test pilots meet the general qualifications; of these, 69 were interviewed in Washington, D.C., and 80 per cent volunteered to proceed. Personal consultations and interviews followed, and the list of candidates was narrowed to 32.

In this initial phase, and in the following selection steps, evaluation was extremely difficult because of the high caliber and motivation of the candidates. During the course of the selection program it was determined that seven is the optimum number of Mercury astronauts so that each can have full participation in all phases of the Mercury development.

PHYSICAL FITNESS

Immediately following their Washington interviews the candidates were assigned to groups, five of six men each and one of two. One group at a time reported to the Lovelace Clinic in Albuquerque, New Mexico, for an exhaustive series of exami-

nations. The other men returned to their home stations to await the call for their groups. The first contingent entered Lovelace February 7, and the others on succeeding Saturdays. Each candidate spent seven and one-half days and three evenings at the Lovelace facility.

General physical requirements were established by the NASA Life Sciences Committee; since all those examined are active test pilots it was not anticipated that any would be disqualified as physically unfit. Rather, degrees of physical soundness were obtained and evaluation was dependent upon a comparison of each man to his fellow candidates.

To establish a comparative yardstick, the Lovelace program began with a complete aviation and medical history and extended to these areas:

- Hematology and pathology (blood and study of tissues)
- Roentgenology (X-ray consultations)
- Ophthalmology (eyes)
- Otolaryngology (ears, nose and throat)
- Cardiology (heart and circulation)
- Neurology and Myology (nerves) and muscles)
- General internal medicine
- Related laboratory studies

Special consultations were provided if indicated by the candidate's medical history or any of the general examinations. These examinations were given under normal clinical procedures, while the subject was in a resting condition. To assess the candidate's abilities under load, Lovelace physicians developed a series of dynamic tests which were used for the first time in the Project Mercury selection process.

Capacity under load, or body efficiency, was determined from a correlation of the subject's physical competence with

his pulmonary function, total body radiation count, specific gravity of the body, blood volume, water volume, lean body mass and detection of tiny congenital openings between the chambers of the heart.

Results of the static and dynamic tests were recorded on special computing cards developed by the Lovelace Clinic for the astronaut program. These cards are mark-sensed so they may be read directly by the examining physician and contain the candidate's complete aviation and medical histories and examination findings.

PSYCHOLOGICAL AND STRESS EVALUATION

The next step in the selection process was a minute determination of the candidate's psychological makeup and an estimate of his ability to cope with stresses expected in space flight.

Basis for this part of the selection took into consideration previously developed studies made in anticipation of the need for a program to select and precondition pilots for extreme high altitude flights. The program was tailored to meet the specific requirements foreseen for orbital flight.

The Air Force, with the assistance of Army and Navy specialists, conducted psychological and stress measurements at the Wright Air Development Center Aeromedical Laboratories, Wright-Patterson Air Force Base, Dayton, Ohio. The examinations were in these general areas:

Personality evaluation
Behavioral sciences
Stress and fatigue
Accelerative forces
Equilibrium and vibration
High energy noise
Low barometric pressure
Thermal stress
Anthropology

Testing at WADC was conducted with candidates in six groups of five men each and one group of two. The first group entered February 15; each man was evaluated six days and three evenings.

A complex appraisal of both clinical and statistical test results went into the WADC evaluation of candidates. As in the case of the Lovelace examinations, results were not a matter of passing or failing, but instead were measures of how one candidate compared with all others.

Because manned satellite flight is without precedent, Mercury astronauts will be pioneers not only in space flight but also in the development of a program which will determine qualities best suited for such special missions.

FINAL SELECTION

Data from the Lovelace and WADC examinations were compiled and forwarded to the NASA Space Flight Activity, Langley Field, near Hampton, Virginia, for the fourth and final step in the selection process. At Langley, a group representing both the medical and technical fields evaluated the previous examinations. The seven ultimately selected were chosen as a result of physical, psychological and stress tolerance abilities and because of the particular scientific discipline, or specialty, each represents.

APPENDIX I TO MERCURY ASTRONAUT SELECTION FACT SHEET

Clinical Examinations Given by the Lovelace Clinic

-Medical history and physical examination including internal examinations and orthopedic or other specialty consultations as indicated.

-Laboratory tests: hemoglobin (measure of oxygen carrying red pigment); hematocrit (examination of blood by use of a centrifuge); grouping; Rh factor; serology (examination of blood serums); sedimentation rate (analysis of urine deposits); stool examinations; urinalysis; gastric analysis; cholesterol (substance present in gallstones, heart ailments, etc.); liver function test; urinary steroid excretion (measure of the hormones, acids and poisons); blood nitrogen; blood protein; protein-bound iodine; special serum studies; throat culture, and chemical examination of body outputs, and blood counts.

-X-rays: chest, large intestine, sinuses, spine, stomach, esophagus, teeth and heart. Moving pictures were taken of the heart to determine any artery calcification.

-Eyes: history, dilation, visual fields, tonometry (measure of inner pressure on the eyes), slit lamp, dynamic visual acuity, depth perception, night vision, and photography of conjunctival vessel (eye membrane) and retina.

-Ears, nose and throat: examination of throat and nasal passages; audiogram with and without background noises; speech discrimination and voice tape recording.

-Heart: cardiograms of heart muscle contraction, heart stroke volume and heart sounds; measure of the chest which overlies the heart.

-Nerves and muscles: general neurologic examination with muscle testing; electric stimulation of the nerves to determine response; measure of any nerve abnormality; tracing of electric currents produced by the brain

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APPENDIX II TO MERCURY ASTRONAUT SELECTION FACT SHEET

Special Dynamic Examinations Given by the Lovelace Clinic

To Measure Body Efficiency

-Physical competence: measured by an ergometer, a device similar to a bicycle. Subject pedals increasing amount of weight while wearing an oxygen mask. Heartbeat and oxygen consumption determined. Evaluation is made by the amount subject can pedal by the time his heart reaches 180 beats per minute.

-Pulmonary function: lung capacity and breathing efficiency determined by measuring the amount of oxygen subject breathes normally and during exercise.

-Lean body mass: a correlation of the following:

Total body radiation count, conducted by the Atomic Energy Commission Los Alamos Laboratories to determine the amount of potassium in the body. Specific gravity, weighing the subject in air and while he is totally immersed in water.

Blood volume, measured by inhaling a small amount of carbon monoxide and observing the amount absorbed by the blood after a specified time.

Water volume, determined by swallowing a small amount of tritium and observing its rate of dilution.

-Presence of heart chamber openings: amount of blood oxygen is measured during and after a Valsalva maneuver. The Valsalva exercise is accomplished by blocking the nose and blowing into a tube.

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APPENDIX III TO MERCURY ASTRONAUT SELECTION FACT SHEET

Stress Tests Conducted at the Wright Air Development Center

-Harvard step: subject steps 20 inches to a platform once every two seconds for five minutes to measure his physical fitness.

-Treadmill maximum workload: subject walks at a constant rate on a moving platform which is elevated one degree each minute. Test continues until heart reaches 180 beats per minute. Test of physical fitness.

-Cold pressor: subject plunges his feet into a tub of ice water. Pulse and blood pressure measured before and during test.

-Complex behavior simulator: a panel with 12 signals, each requiring a different response. Measure of ability to react reliably under confusing situations.

-Tilt table: subject lays on steeply inclined table for 25 minutes to measure ability of the heart to compensate for body in an unusual position for an extended time.

-Partial pressure suit: subject is taken in pressure chamber to a simulated altitude of 65,000 feet in an MCl partial pressure suit. Test lasts one hour. Measure of efficiency of heart system and breathing at low ambient pressures.

-Isolation: subject goes into a dark, soundproof room for three hours to determine his ability to adapt to unusual circumstances and to cope with the absence of external stimuli.

-Acceleration: subject is placed in a centrifuge with his seat inclined at various angles to measure his ability to withstand multiple gravity forces.

-Heat: subject spends two hours in a chamber with the temperature at 130 degrees Fahrenheit to measure reaction of heart and body functions while under this stress.

-Equilibrium and vibration: subject is seated on a chair which rotates simultaneously on two axes. He is required to maintain the chair on an even keel by means of a control stick with and without vibration, normally and while blindfolded.

-Noise: subject is exposed to a variety of sound frequencies to determine his susceptibility to tones of high frequency.

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APPENDIX IV TO MERCURY ASTRONAUT SELECTION FACT SHEET

Psychological Tests Administered by Wright Air Development Center

-To determine personality and motivation: interviews; Rorschach (ink blot); apperception (tell stories suggested by pictures); draw-a-person; sentence completion; self-inventory based on 566-item questionnaire; officer effectiveness inventory; personal preference schedule based on 225 pairs of self-descriptive statements; personal inventory based on 20 pairs of self-descriptive statements; preference evaluation based on 52 statements; determination of authoritarian attitudes, and interpretation of the question, "Who am I?".

-To determine intelligence and special aptitudes: Wechsler adult scale; Miller analogies; Raven matrices; Doppelt mathematical reasoning test; engineering analogies; mechanical comprehension; officer qualification test; aviation qualification test; space memory; spatial orientation; hidden figures perception; spatial visualization, and peer ratings.

APPENDIX V TO MERCURY ASTRONAUT SELECTION FACT SHEET

Members of NASA Life Sciences Committee

Chairman, Dr. W. Randolph Lovelace II, Director of the Lovelace Foundation for Medical Education and Research, Albuquerque, New Mexico; Members: Capt. Norman L. Barr, (MC) Director, Astronautical Division, Navy Bureau of Medicine and Surgery, Washington, D. C.; LCDr. John H. Ebersole, (MC) Medical Officer, USS Seawolf, Fleet Post Office, New York, New York; Brig. Gen. Donald D. Flickinger, (MC), Surgeon and Assistant Deputy Commander for Research, Headquarters, Air Research and Development Command, Washington, D. C.; Lt. Col. Robert H. Holmes, (MC) Chief of Bio Physics and Astronautics Branch, Army Medical Research and Development Command, Washington, D. C.; Dr. Wright H. Langham, Los Alamos Scientific Laboratory, University of California; Dr. Robert B. Livingston, Director of Basic Research in Mental Health and Neurological Diseases, National Institutes of Health, Bethesda, Maryland; and Dr. Orr Reynolds, Director of Science, Office of the Assistant Secretary of Defense for Research and Engineering, Washington, D. C. Boyd C. Myers II, NASA Headquarters, is secretary of the committee.

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