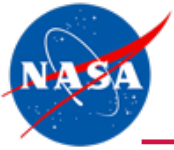


Behavioral Components of NASA's 2017 Astronaut Selection

Aerospace Medicine Association
89th Annual Scientific Meeting
Dallas, TX
May, 2018

Gary Beven, M.D.
Albert Holland, Ph.D.
James Picano, Ph.D.
Ronald Moomaw, D.O.
Kelley Slack, Ph.D.
Steven Vander Ark, M.S.



Behavioral Components of NASA's 2017 Astronaut Selection



Disclosure Information *87th Annual Scientific Meeting*

I have no financial relationships to disclose.

I will not discuss off-label use and/or investigational use in my presentation.



Behavioral Components of NASA's 2017 Astronaut Selection



JSC's Behavioral Health and Performance Operations Group (BHP)

- BHP Operations is a component of the JSC Space Medicine Operations Division
 - ISS mission psychological/behavioral health support (primary mission)
 - **Astronaut applicant psychological and psychiatric screening**
 - Clinical evaluation and care of astronauts and their dependents
 - Occupational mental health evaluation of NASA divers, pilots and flight controllers
 - Consultants to the NASA Human Research Program
 - Consultants to NASA flight surgeons, ISS crew surgeons, the Astronaut Office, and JSC management
 - Consultants to the JSC Employee Assistance Program Office



Behavioral Components of NASA's 2017 Astronaut Selection



- NASA's Mercury 7
 - Alan Shepard USN
 - Gus Grissom USAF
 - John Glenn USMC
 - Scott Carpenter USN
 - Wally Schirra USN
 - Gordon Cooper USAF
 - Deke Slayton USAF

Requirements – experienced military test pilots; 5'11" or less in height and 180 lbs. maximum

- 500 applications
 - 110 qualified
 - 18 finalists
 - 7 selected
(1.4% selection rate)





Behavioral Components of NASA's 2017 Astronaut Selection



- Project Mercury astronaut candidate selection committee (1959)
 - 1 senior management engineer
 - 1 test pilot engineer
 - 2 flight surgeons
 - 2 psychologists: Allen O. Gamble (NASA HQ) and Robert Voas (US Navy)
 - 2 psychiatrists: George E. Ruff and Edwin Z. Levy (both active duty USAF physicians)



Behavioral Components of NASA's 2017 Astronaut Selection



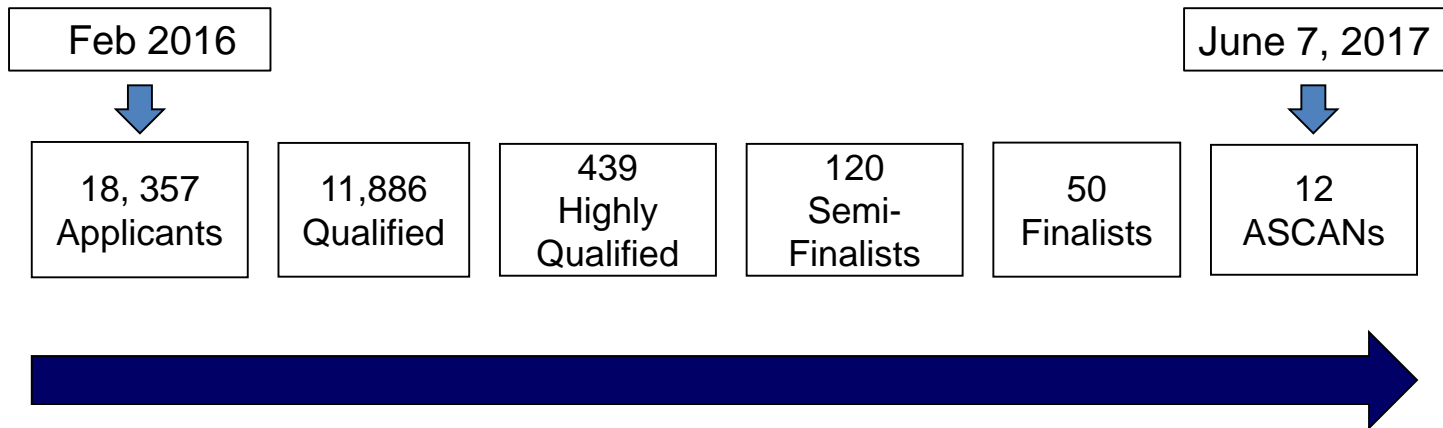
- 22 Astronaut Classes from 1959 to 2017
- 359 astronaut candidates selected in 59 years
- 1996 largest class: 44
(height of Space Shuttle Program era)
- Current active astronauts: 44
- 6200 Applications for class of 2013
 - 49 finalist candidates for class of 2013
 - 8 astronaut candidates selected in 2013
(0.13% selection rate)
- Over 18,300 applications for the 22nd astronaut class of 2017



Behavioral Components of NASA's 2017 Astronaut Selection



2017 Astronaut Selection Schedule



0.065% selection rate (all applicants)

0.10 % selection rate (qualified applicants)

2.7% selection rate (highly qualified applicants)

Additional factors that drove up application interest included the movie *The Martian* and NASA's use of social media to advertise the job opening.



Behavioral Components of NASA's 2017 Astronaut Selection



- Planning for the 2017 astronaut selection cycle began in 2015
- Comprised approximately 50% of workload over two years for those on the team directing and planning the selection process
- Close coordination with JSC Human Resources, Astronaut Office, Facilities Management, and Space Medicine Operations Division Management
- NASA Psychologist Albert Holland, PhD led the overall team
 - NASA psychiatrist Gary Beven, MD led the psychiatric evaluation component



Behavioral Components of NASA's 2017 Astronaut Selection



Two complementary but different processes:

- Psychiatric qualification
 - According to current NASA medical standards
 - Diagnosis/No Diagnosis
 - Recommendation made to Aerospace Medical Board (AMB)
 - Historically a 2% disqualification rate
- Psychological suitability for space missions
 - Mission demands of ISS and deep space exploration up to 12 months
 - Based on desired behavioral competencies specific for spaceflight
 - Advisory information to Astronaut Selection Board (ASB) with a suitability rating provided



Behavioral Components of NASA's 2017 Astronaut Selection



BHP Astronaut Selection Select-In Suitability Proficiencies 2009 and 2013

- Family Issues and ability to cope with prolonged family separations
- Ability to perform under stressful conditions
- Group living skills
- Teamwork skills
- Self-Regulation
- Motivation
- Judgment and Decision Making
- Conscientiousness
- Communication Skills
- Leadership Skills

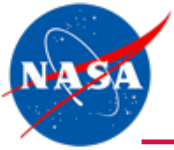


Behavioral Components of NASA's 2017 Astronaut Selection



- BHP Astronaut Selection Select-In Suitability Proficiencies 2017
- Target competencies were identified and prioritized via a systematic analysis of future mission profiles, conducted in 2014 by BHP and using veteran ISS astronauts as SMEs
 - Self-regulation
 - Resilience
 - Teamwork
 - Small Group Living
 - Operational Problem Solving
 - Leadership-Followership

Note: Suitability sub-competencies not shown to protect integrity of the selection process.



Behavioral Components of NASA's 2017 Astronaut Selection



- Multiple different methods look at each suitability competency (e.g., psych testing, team tasks, groups tasks, individual tasks, structured interviews, peer ratings)
- Multiple different assessors observe each applicant
 - Use of DoD-experienced psychologists and psychiatrists with aerospace psychiatry/psychology and operational experience
 - Investment in the orientation and calibration of raters



Behavioral Components of NASA's 2017 Astronaut Selection



- Team of external consultant psychologist and psychiatrist examiners with vast experience
 - USAF Aeromedical Consultation Service Neuropsychiatry Branch Chief and staff psychiatrists
 - Naval Aerospace Medical Institute Chief of Psychiatry
 - Mayo Clinic aerospace medicine fellowship psychiatrists
 - Active duty and retired military operational psychologists with many years of special forces selection and consultation expertise
 - Several external examiners have decades of prior astronaut selection experience
 - Valued professional attributes include
 - military service as a psychiatrist and flight surgeon or as an operational psychologist in deployed setting
 - prior selection program work
 - aerospace psychiatry and psychology training and experience
 - forensic psychiatry training
 - provision of psychological and psychiatric services in deployed environments
 - prior astronaut selection experience



Behavioral Components of NASA's 2017 Astronaut Selection



- Round 1 semi finalists (n =120)
 - Psychological testing
 - Structured observations in Astronaut Selection Board (ASB) Phase 1 Interview
 - No suitability assessment or psychiatric diagnostic screening occurs
- Round 2 finalists (n=50)
 - 5 weeks; 10 applicants each week
 - Individual Exercise
 - Team Simulation Exercise
 - Team Reaction Exercise
 - Behavioral and psychiatric interviews
 - Peer ratings
 - Psychologist consultation to the ASB with a suitability rating



Behavioral Components of NASA's 2017 Astronaut Selection



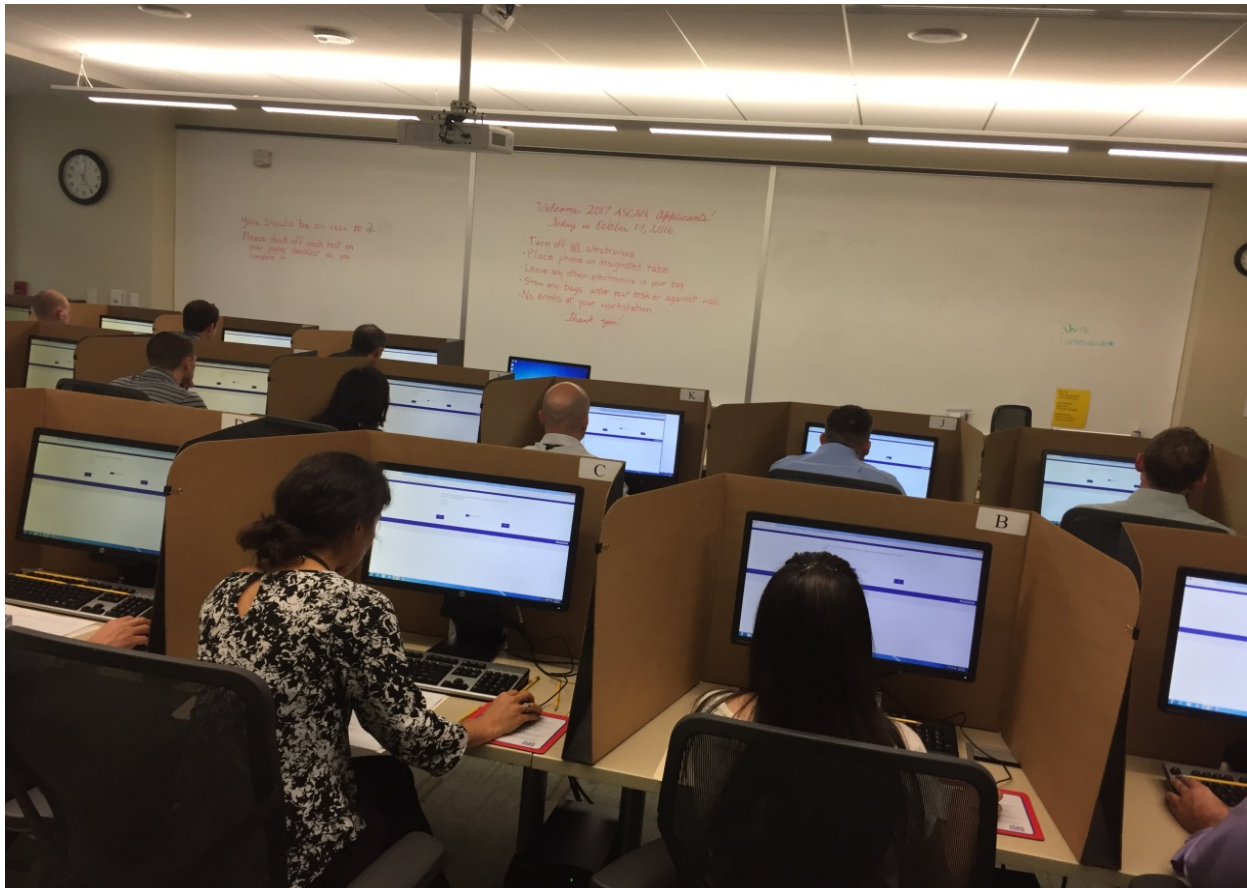
- Psychological testing
 - General personality, cognitive and situational judgment tests
- Inform/direct the Behavioral and Psychiatric Interview
 - Areas to explore in more detail
 - Relative strengths/weaknesses
 - Potential psychopathology noted
- Norms for general population, applicants, and selected astronauts
- Test battery kept confidential to preserve integrity of the selection process

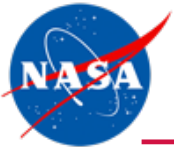


Behavioral Components of NASA's 2017 Astronaut Selection



- Psychological Testing
 - Approximately 6 hours

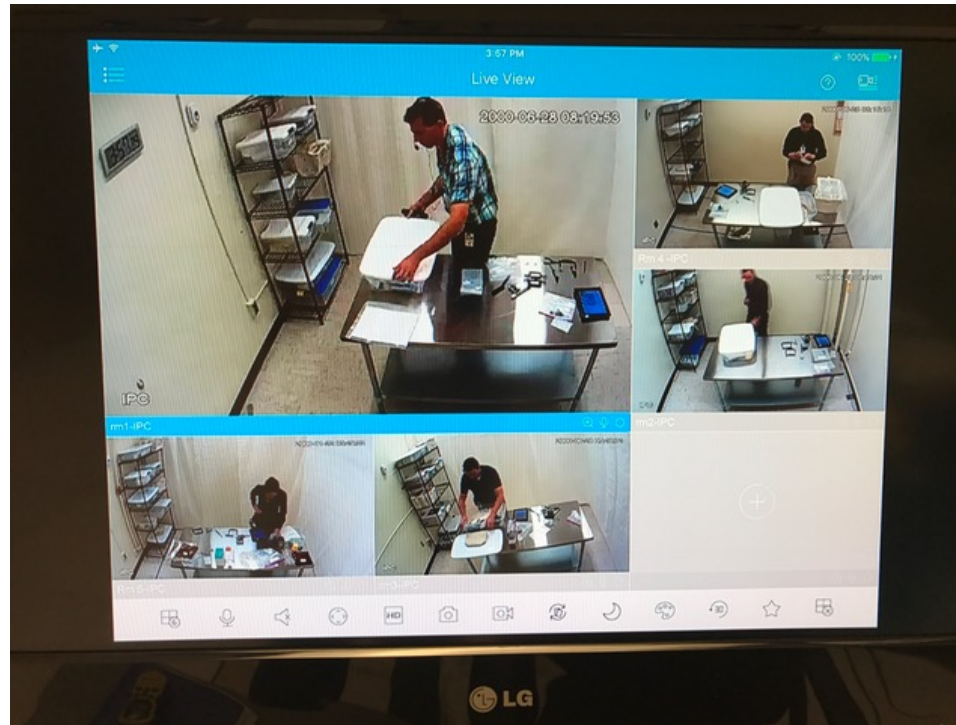


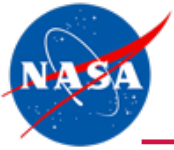


Behavioral Components of NASA's 2017 Astronaut Selection



- Applicant Individual Exercise
 - Suitability competency driven
 - Individual tasks performed under time pressure
 - Observed by psychologist rater
 - Debrief with applicant afterward

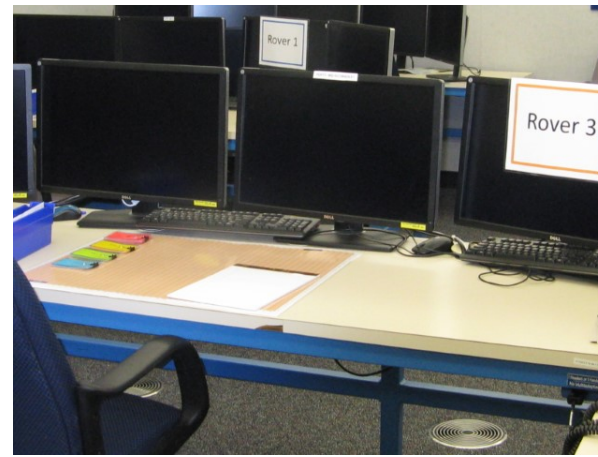




Behavioral Components of NASA's 2017 Astronaut Selection



- Applicant Team Simulation Exercise
 - Suitability competency driven
 - Team tasks with very high cognitive load
 - Observed by psychologist raters
 - Debrief with each applicant afterward

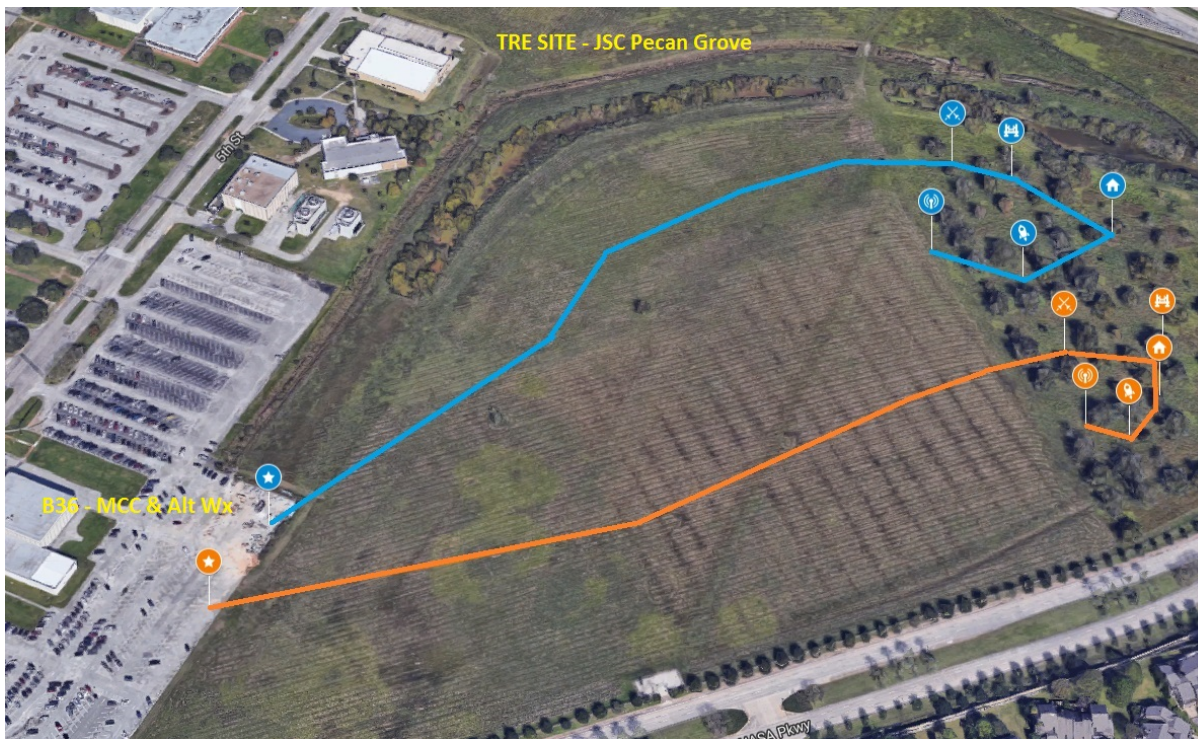


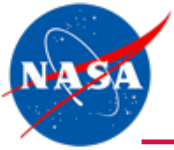


Behavioral Components of NASA's 2017 Astronaut Selection



- Team Reaction Exercise
 - Suitability competency driven
 - Observed by psychologist raters
 - Debrief with each applicant afterward





Behavioral Components of NASA's 2017 Astronaut Selection



- Behavioral and psychiatric interviews:
 - Psychologists and psychiatrists undergo a day of training and also applicant record reviews
 - 3.5 hour interviews (five interviews in am/five in pm)
 - 2 interviewers per applicant (psychologist and psychiatrist)
 - 3 NASA floaters move from room to room and spend 30 min observing each interview (2 NASA psychologists and 1 NASA psychiatrist) – for calibration and consistency
 - Any psychologist or psychiatrist in training observes the process in the am interview and then conducts the interview in the pm
 - Combination of structured interview components covering all behavioral spaceflight competencies and a structured psychiatric diagnostic interview covering a major DSM 5/ ICD-11 diagnostic criteria
 - Psychologist and psychiatrist form a consensus opinion regarding a suitability rating and psychiatric diagnosis



Behavioral Components of NASA's 2017 Astronaut Selection



- Behavioral and psychiatric interviews (*continued*):
 - Psychiatrist presents the applicant to the entire group and provides a psychiatric diagnostic opinion
 - Psychologist presents the suitability assessment information and recommended suitability rating
 - Entire group of psychiatrists and psychologists discuss the applicant in depth and a group consensus opinion is formed
 - NASA psychologists discuss the suitability rating with the Astronaut Selection Board
 - NASA psychiatrists present the applicant's case to the Aerospace Medical Board



Behavioral Components of NASA's 2017 Astronaut Selection



- Summary of lessons learned/recommendations
 - Early initiation of the planning process (i.e., two years prior)
 - Adequate staffing and budget plus administrative and organizational support
 - Leads of selection process with significant astronaut selection experience
 - Alignment of the process with spaceflight job analysis derived suitability competencies
 - Use of current medical standards and psychiatric diagnostic classifications and diagnostic methods
 - Multistage process with variety of applicant views and raters
 - External consultants with appropriate training and experience
 - Understanding and acceptance of fact that the Board makes the final decision



Behavioral Components of NASA's 2017 Astronaut Selection



NASA Astronaut Class of 2017—"The Turtles"



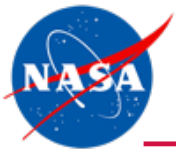


Behavioral Components of NASA's 2017 Astronaut Selection



Astronaut Classes from 2017 (#22) and 1959 (#1)





Behavioral Components of NASA's 2017 Astronaut Selection



Class of 2017 Physician Astronauts



Jonny Kim, MD
Navy SEAL



Frank Rubio, MD
Army Blackhawk Pilot



Behavioral Components of NASA's 2017 Astronaut Selection



2017 Astronaut Selection BHP Team





Behavioral Components of NASA's 2017 Astronaut Selection



48 Total Support Personnel

BHP/KBRwyle

Karen Adkins
Gabrielle Cole
Kelley Slack
Jim Picano
Ron Moomaw
Pam Baskin
Monica Travis
Kim Seaton
Brooke Loofboro
Jessica Hughlett
Beth Turner
Kelly Curtis
Steve Vander Ark
Brandon Vessey
Lauren Landon

KBRwyle

Terry Guess
David Ham

BHP NASA

Al Holland
Gary Beven
Tom Williams
Rebekah Reed

NASA JSC HR

Anne Roemer
Shelia Collins
Brandy Braunsdorf
Sam Henry
Bill Kerneckel

KBRwyle Logistical Support

Group Sim	Joe Whitney
Group Sim	Larry Genzer
Group Sim - Facility	Jerry Swain
Group Sim - Facility	Marilyn Simmons
Group Sim - Video	Matt McGee
Mowing & Dumpster	Yong Yi
SD IT	Carmen Hollins
iPads - ACES	Ray Kennerson
Survey Crafter	Susan Curry
Survey Crafter	Michael Meeks
Survey Crafter	Mike Peri
Building 35 Manager	Bill McCormick
IE – Training/Procedures	Elisca Hicks
IE - CSA-CP	Christine Dubbert
Weather	Angel Plaza
Weather	Tim Garner
TRE - tires	Tim Taylor
Kubotas & Connex	Randy Redford
Flight Doc	Bill Tarver
Mars Sim Rater	Therese Huning
Mars Sim Facilitator	Dan Nelson
SAIT - tablet & laptop support	Roger Tigner