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# Long Term Behavioral Health Surveillance of Former Astronauts at the NASA Johnson Space Center

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Long Term Behavioral Health Surveillance  
of Former Astronauts at the NASA Johnson Space Center

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Disclosure Information  
*90<sup>th</sup> Annual Scientific Meeting*

I have no financial relationships to disclose.

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



## Long Term Behavioral Health Surveillance of Former Astronauts at the NASA Johnson Space Center

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- NASA has not previously performed longitudinal assessment and surveillance of astronauts' behavioral health after they departed the active Astronaut Corps.
- This presentation will provide a brief summary of the behavioral health implementation plan for long-term longitudinal surveillance of former NASA astronauts at the Johnson Space Center.



## Long Term Behavioral Health Surveillance of Former Astronauts at the NASA Johnson Space Center

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- The Behavioral Health and Performance Operations Group (BHP) at the NASA Johnson Space Center is comprised of aerospace psychiatrists, operational psychologists and behavioral health specialists that provide comprehensive behavioral health and performance services to astronauts throughout the breadth of their active astronaut career.
- Components of BHP operations include astronaut candidate selection, training, mission preparation, and annual, elective, preflight, inflight, and postflight behavioral health assessments.



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## 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
  - Flight analog study crew selection/screening and analog mission support
  - 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



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- Multifaceted, career spanning, behavioral health program for active astronauts
  - Astronaut candidate (ASCAN) selection
  - ASCAN training participation
  - Annual BHP evaluations
  - Preflight BHP training and evaluations
  - Inflight BHP evaluations
  - Inflight neurocognitive assessments
  - Postflight BHP evaluations
  - Elective BHP services



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- Historically, BHP has ended its service provision once an active astronaut leaves flight status to become a management astronaut or departs the space agency.
- Therefore, a significant knowledge gap has formed over the past 60 years of NASA's existence, as until now there has been no dedicated behavioral health evaluation of former astronauts allowing for an analysis of potential behavioral health occupational risks, the initial signs of which may occur later in life.



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- Initiation of the Johnson Space Center's behavioral health plan for long-term longitudinal surveillance began in late 2018
- This comprised the development of a concept of operations and implementation plan including NASA's hiring of an experienced clinical neuropsychologist to implement the behavioral health evaluation elements of this plan
- A comprehensive psychological evaluation will be developed that will provide clear understanding of the former astronaut's psychological health and wellness





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- Components of this evaluation will include a diagnostic interview, neurocognitive assessment, and psychological screening measures.
- Longitudinal surveillance for behavioral health conditions that include depression, anxiety, dementia, traumatic stress disorders, substance use, and any other behavioral health concerns of significance.
- The ultimate goal being the understanding of how a career as an astronaut, and spaceflight in particular, affects behavioral health and wellness until the end of life.



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- The psychologist's responsibilities will also include:
  - Provide behavioral health consultation/liaison services to Flight Medicine for former astronauts receiving care at JSC (outside of annual evaluation), including management astronauts
  - Deliver behavioral health interventions to former astronauts willing to travel to JSC (as time, funding, and clinical capabilities may permit)
  - Provide care coordination for former astronauts requiring behavioral health services in their home communities



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- This process will assess, detect and monitor cognitive and behavioral health conditions in former astronauts through comprehensive evaluations at specified intervals:
  - **Baseline**- Comprehensive behavioral health diagnostic interview and psychological/neurocognitive assessment upon leaving active Astronaut Corps (likely 4+ hours of initial patient contact)
  - **Annual** – Updated behavioral health diagnostic interview and screening measures and neurocognitive screening exam, depending on age or complaints, with follow-up as needed (likely 1.5 to 2.0 hours of patient contact)
  - **Periodic** – Extended neuropsychological assessment (frequency based upon age and clinical status; likely 4+ hours of patient contact)



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- Upon leaving the active astronaut corps and until age 60:
  - Initial Baseline Comprehensive Evaluation: Extensive behavioral health diagnostic interview and psychological/neurocognitive assessment (likely 4+ hours of face to face patient contact)
  - Annual Evaluation: Behavioral health diagnostic interview and screening measures (e.g., anxiety, mood, substance use, quality of life, sleep, psycho-social factors (e.g., marriage/family), neurocognitive screening exam--depending on complaints) with follow-up as needed (likely 1.5 hours of face to face patient contact)
- Age 60 to Age 75:
  - Annual Evaluation
  - Comprehensive evaluation every FIVE years
- Over age 75:
  - Annual Evaluation
  - Comprehensive evaluation every THREE years



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- Potential Behavioral Health Screening Measures (depending on age) include:
  - Center for Epidemiologic Studies Depression (CES-D)
  - Symptom Checklist 90 (SCL-90R)
  - Beck Anxiety Scale
  - AUDIT (Alcohol Use Disorders Identification Test)
  - Dementia Rating Scale-2
  - Geriatric Depression Scale



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- Potential Neuropsychological Baseline Battery:
  - Boston Naming Test
  - NAB Naming
  - California Verbal Learning Test
  - WAIS IV Vocabulary Test
  - WAIS IV Similarities Test
  - WAIS IV Block Design Test
  - WAIS IV Matrix Reasoning Test
  - WAIS IV Digit Symbol Test
  - NAB Digit Span Test
  - WMS IV Logical Memory
  - WMS IV Visual Reproduction
  - Benton Visual Retention Test
  - Grooved Pegboard
  - Delis-Kaplan Executive Function Scales:
    - Trail-Making Test
    - Verbal Fluency: Category and letter naming



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- Hypothetical case example #1 (Initial Comprehensive Evaluation)
- A recently retired female astronaut is seen by BHP for her initial evaluation as part of her annual medical evaluation in the JSC Flight Medicine Clinic.
- She is veteran of two Space Shuttle flights and one ISS long duration expedition for a total of 212 days in space including 5 EVAs. She currently works for a NASA contractor in the commercial space industry. She is happily married with children in college. She recently turned 60, has no major health problems and no significant medical or behavioral health complaints.



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- An initial BHP Comprehensive Evaluation is performed:
  - Neuropsychological assessment including 1.5 hour clinical interview and approximately 2.5 hours of neuropsychological tests. This serves as a baseline for all future evaluations.
  - Neuropsychological Assessment: Core evaluation comprising measures of executive functioning (e.g., attention, working memory, abstract reasoning), verbal and non-verbal memory, spatial analytic processing, naming and verbal fluency.
  - Baseline clinical interview – comprehensive psychosocial interview with additional screening measures for anxiety, depression, substance use, quality of life, and sleep.





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- Hypothetical case #2 (annual behavioral health assessment)
- A 73-year-old male former astronaut is seen by BHP for his third annual behavioral health assessment. He flew on four Space Shuttle flights for a total of 38 days in space with 6 EVAs before leaving NASA to return to his alma mater to teach aerospace engineering. He retired from that academic position three years ago. He has mild hypertension and hyperlipidemia which is controlled with medication, but is otherwise healthy and fit.
- BHP Annual Evaluation: An update to his existing comprehensive psychosocial interview occurs to track changes in his life over the period since his last evaluation, with additional screening measures for anxiety, depression developed for older adults (e.g., Geriatric Depression Scale), and a brief screening of cognitive functioning due to age.



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- The evaluation reveals he has been depressed since the death of his wife 11 months ago. His family physician placed him on an anti-depressant medication approximately 3 months ago, with only partial benefit. He continues to experience significant symptoms of depression (including positive result on GDS) but denies suicidal ideation or intent.
- The psychologist provided him with education about grief and depression, assisted him in finding a behavioral health provider in his home community for more intensive treatment, later conferred with that local provider, and provided details of the evaluation performed in Houston.
- The former astronaut continues to be seen annually for behavioral health evaluation in Houston.