Human Systems Integration at NASA Ames Research Center

Jeffrey McCandless, Ph.D.
Deputy Division Chief
Human Systems Integration Division
NASA Ames Research Center
Moffett Field, California

September 15, 2017

University of California, Berkeley
29th Annual Bay Area Vision Research Day (BAVRD)

"All the News That's Fit to Print"

The New York Times.

LATE CITY EDITION

U. S. Weather Bureau Report (Page 33): Increasingly Cloudy and cool today and tonight. Mostly fair tomorrow. Temp. range: 61—35. Yesterday: 62.4—49.2.

VOL. CVII..No. 36,414. © 1957, by The New York Times Company. NEW YORK, SATURDAY, OCTOBER 5, 1957. FIVE CENTS

SOVIET FIRES EARTH SATELLITE INTO SPACE; IT IS CIRCLING THE GLOBE AT 18,000 M. P. H.; SPHERE TRACKED IN 4 CROSSINGS OVER U. S.

HOFFA IS ELECTED TEAMSTERS' HEAD; WARNS OF BATTLE

Defeats Two Foes 3 to 1 —Says Union Will Fight 'With Every Ounce'

Text of the Hoffa address is printed on Page 6.

By A. H. RASKIN

Special to The New York Times.

MIAMI BEACH, Oct. 4—The scandal-scarred International Brotherhood of Teamsters elected James R. Hoffa as its president today.

He won by a margin of nearly 3 to 1 over the combined vote of two rivals who campaigned on pledges to clean up the nation's biggest union.

Senate rackets investigators and Hoffa critics in the union rank-and-file immediately opened actions to strip the 44-year-old former warehouseman from Detroit of his election victory.

A jubilant Hoffa exhibited, however, greater concern over the possibility that his union might be ousted from the American Federation of Labor and Congress of Industrial Organizations. He appealed for time to prove that he could make the teamsters "a model of trade unionism."

The parent organization has ordered the 1,400,000-member

Associated Press Wirephoto

IN TOKEN OF VICTORY: Dave Beck, retiring head of the Teamsters Union, raises hand of James R. Hoffa upon his election as union's president. At right is Mrs. Hoffa.

COURSE RECORDED

Navy Picks Up Radio Signals—4 Report Sighting Device

By WALTER SULLIVAN

Special to The New York Times.

WASHINGTON, Saturday, Oct. 5—The Naval Research Laboratory announced early today that it had recorded four crossings of the Soviet earth satellite over the United States.

It said that one had passed near Washington. Two crossings were farther to the west. The location of the fourth was not made available immediately.

It added that tracking would be continued in an attempt to pin down the orbit sufficiently to obtain scientific information of the type sought in the International Geophysical Year.

[Four visual sightings, one of which was in conjunction with a radio contact, were reported by early Saturday morning. Two sightings were made at Columbus, Ohio, and one each from Terre Haute, Ind., and Whittier, Calif.]

Press Reports Noted

Soviet newspapers reported several weeks ago that the Soviet satellites would broadcast on frequencies in the neighborhood of twenty and forty megacycles. More exact frequencies were given by Soviet scientists at a conference on rockets and satellites that took place here this week.

Presumably the Naval Re-

The New York Times Oct. 5, 1957

The approximate orbit of the Russian earth satellite is shown by black line. The rotation of the earth will bring the United States under the orbit of Soviet-made moon.

560 MILES HIGH

Visible With Simple Binoculars, Moscow Statement Says

Text of Tass announcement appears on Page 2.

By WILLIAM J. JORDEN

Special to The New York Times.

MOSCOW, Saturday, Oct. 5—The Soviet Union announced this morning that it successfully launched a man-made earth satellite into space yesterday.

The Russians calculated the satellite's orbit at a maximum of 560 miles above the earth and its speed at 18,000 miles an hour.

The official Soviet news agency Tass said the artificial moon, with a diameter of twenty-two inches and a weight of 184 pounds, was circling the earth once every hour and thirty-five minutes. This means more than fifteen times a day.

Two radio transmitters, Tass said, are sending signals continuously on frequencies of 20.005 and 40.002 megacycles. These signals were said to be strong enough to be picked up by amateur radio operators. The trajectory of the satellite is being tracked by numerous scientific stations.

Pass Over Moscow Today

Tass said the satellite was moving at an angle of 65 degrees to the equatorial plane and would pass over the Mos-

FAUBUS COMPARES HIS STAND TO LEE'S

Says He Will Remain Loyal to People of Arkansas—

Flu Widens in City; 10% Rate Predicted; 200,000 Pupils Out

By ROBERT ALDEN

Asian influenza continued to spread through the city yester-

ARGENTINA TAKES EMERGENCY STEPS

State of Siege Proclaimed in Buenos Aires Region

Device Is 8 Times Heavier Than One Planned by U.S.

Special to The New York Times.

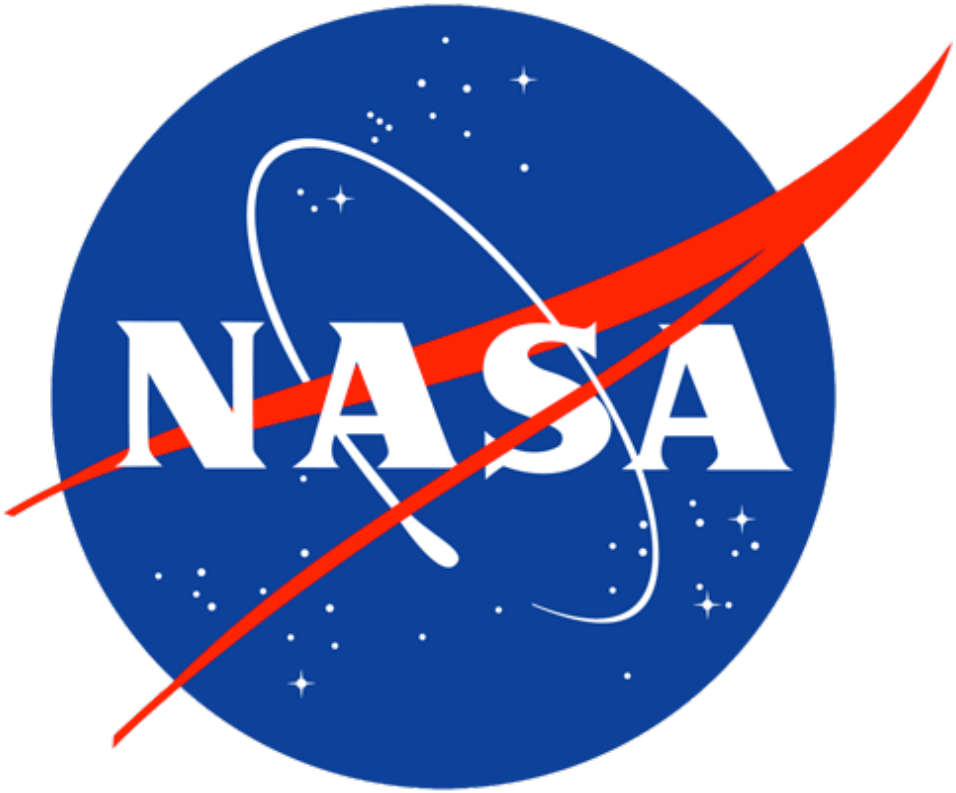
WASHINGTON, Oct. 4—Leaders of the United States earth satellite program were astonished tonight to learn that the Soviet Union had launched a satellite eight times heavier than that contemplated by this country.

Dr. Joseph Kaplan, chairman of the United States program for the International Geophysical Year, described the 184-pound weight as "fantastic." The heaviest American satel-

SATELLITE SIGNAL BROADCAST HERE

Source: columbia.edu

1957: Sputnik



1958: National Aeronautics and Space Administration

The Huntsville Times

Man Enters Space

'So Close, Yet So Far,' Sighs Cape

U.S. Had Hoped For Own Launch

Hobbs Admits 1944 Slaying

Praise Is Heaped On Major Gagarin

Soviet Officer Orbits Globe In 5-Ton Ship

Maximum Height Reached Reported As 188 Miles

To Keep Up, U.S.A. Must Run Like Hell

Source: appel.nasa.gov

1961: First man in space

The Huntsville Times

Man Enters Space

'So Close, Yet So Far,' Sighs Cape

U.S. Had Hoped For Own Launch

Hobbs Admits 1944 Slaying

Soviet Officer Orbits Globe In 5-Ton Ship

Maximum Height Reached Reported As 188 Miles

To Keep Up, U.S.A. Must Run Like Hell

Praise Is Heaped On Major Gagarin

Source: appel.nasa.gov

1961: First man in space

Source: blogs.nasa.gov

1963: First woman in space

The Huntsville Times

Man Enters Space

'So Close, Yet So Far,' Sighs Cape

U.S. Had Hoped For Own Launch

Soviet Officer Orbits Globe In 5-Ton Ship

Maximum Height Reached Reported As 188 Miles

Hobbs Admits 1944 Slaying

To Keep Up, U.S.A. Must Run Like Hell

Praise Is Heaped On Major Gagarin

Source: appel.nasa.gov

1961: First man in space

Source: blogs.nasa.gov

1963: First woman in space

Source: history.nasa.gov

1965: First spacewalk


The Huntsville Times

Man Enters Space

'So Close, Yet So Far,' Sighs Cape

U.S. Had Hoped For Own Launch

Soviet Officer Orbits Globe In 5-Ton Ship

Maximum Height Reached Reported As 188 Miles

Hobbs Admits 1944 Slaying

To Keep Up, U.S.A. Must Run Like Hell

Praise Is Heaped On Major Gagarin

Source: appel.nasa.gov

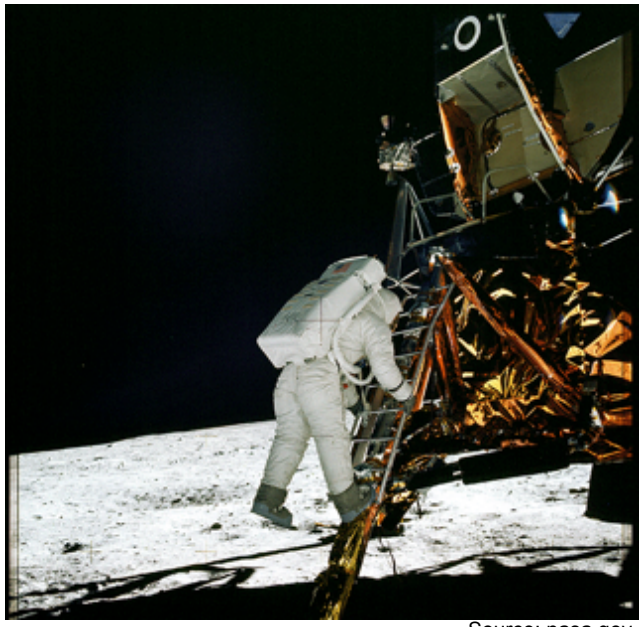
1961: First man in space

Source: blogs.nasa.gov

1963: First woman in space

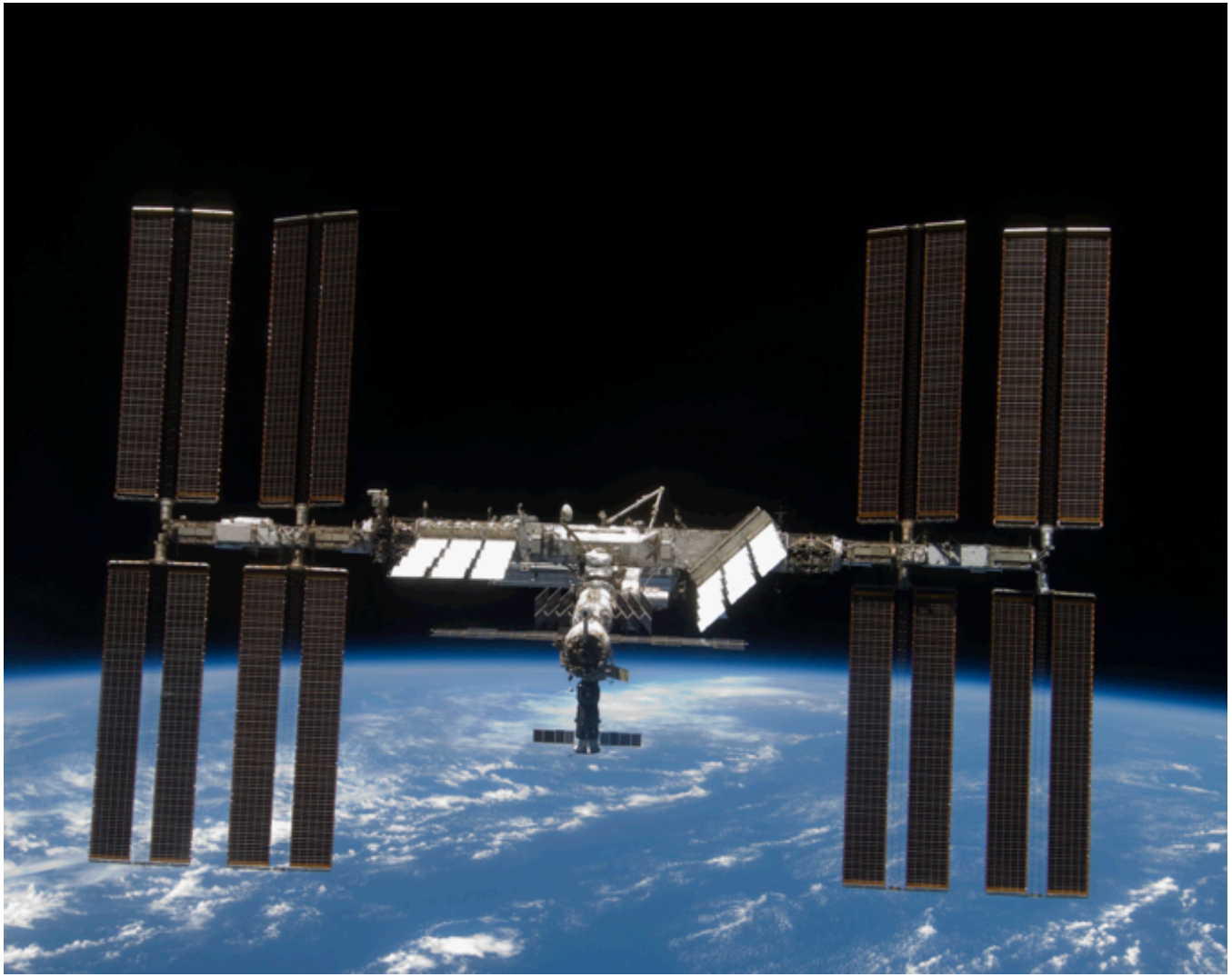
Source: history.nasa.gov

1965: First spacewalk



Source: nasa.gov

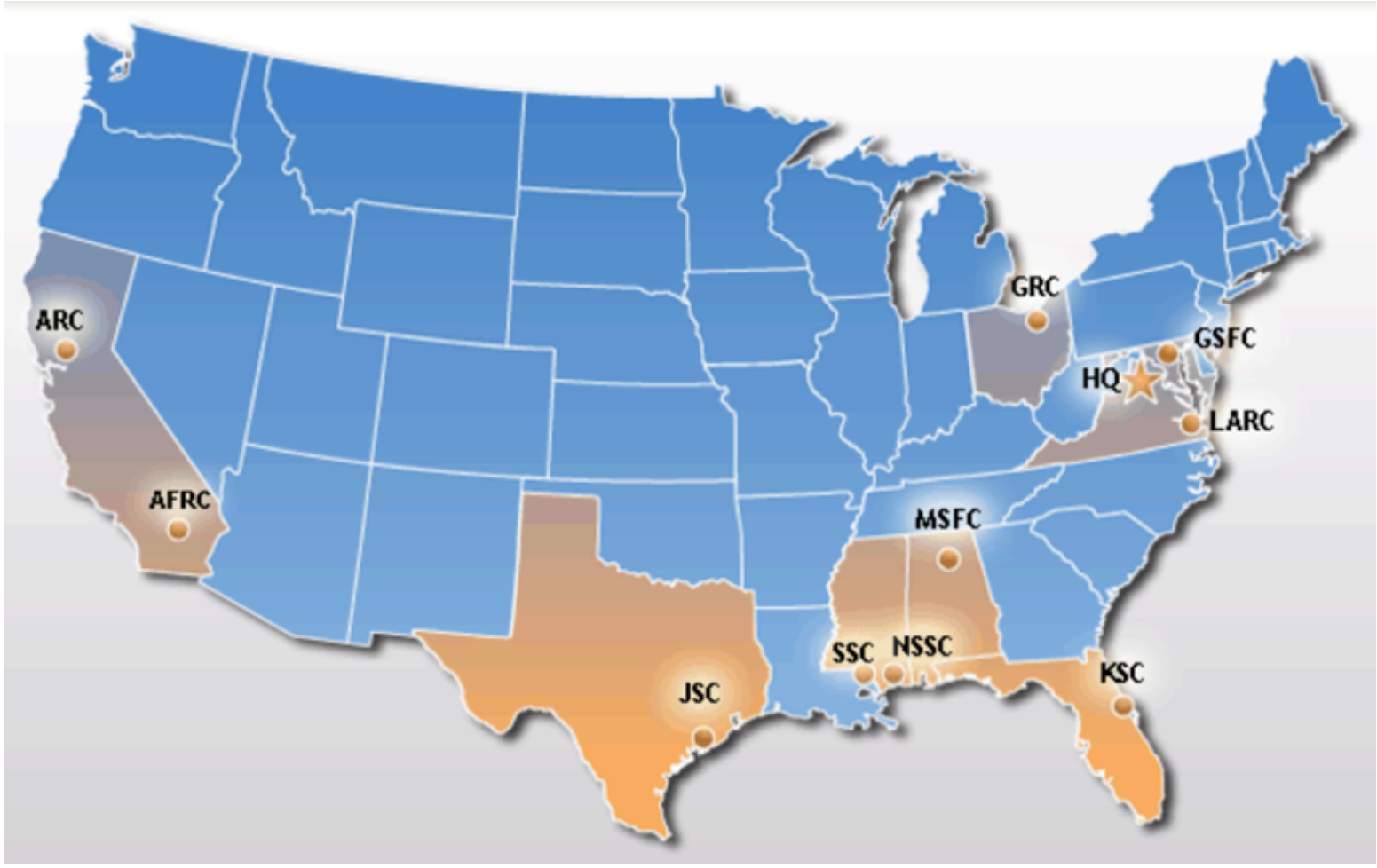
1969: First astronauts on moon



Today: International Space Station

Source: nasa.gov

Overview of NASA



Source: https://nasajobs.nasa.gov/images/map_notitle.gif

Currently: 10 centers plus headquarters

Overview of Ames Research Center

Photo credit: Jeffrey McCandless

Overview of Ames Research Center

Photo credit: Jeffrey McCandless

Overview of Ames Research Center

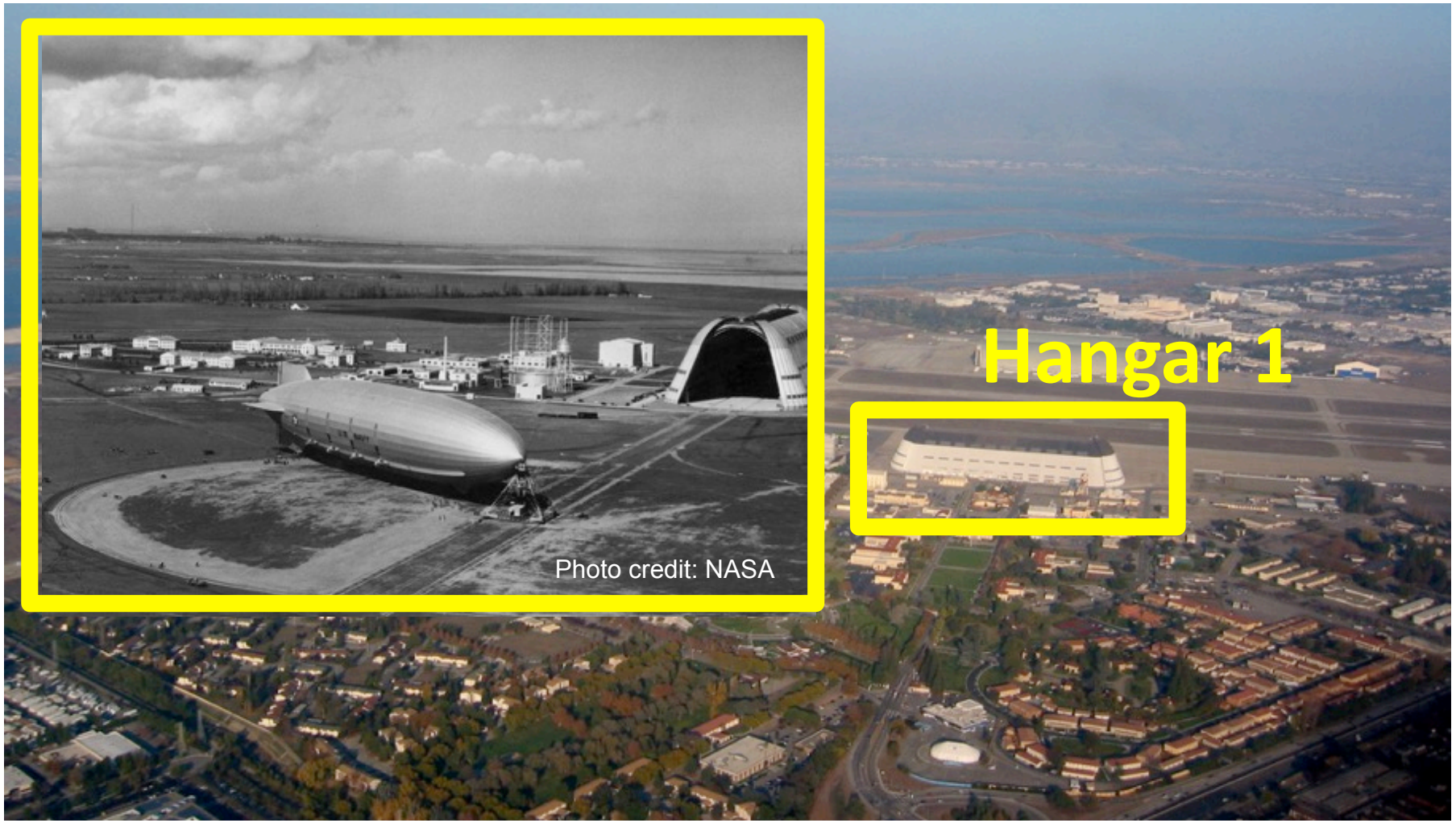


Photo credit: Jeffrey McCandless

Overview of Ames Research Center

Photo credit: Jeffrey McCandless

Overview of Ames Research Center

Photo credit: Jeffrey McCandless

Overview of Ames Research Center

Photo credit: Jeffrey McCandless

Overview of Ames Research Center

Photo credit: Jeffrey McCandless

Overview of Ames Research Center

Photo credit: Jeffrey McCandless

Overview of Ames Research Center

Photo credit: Jeffrey McCandless

Overview of the Human Systems Integration Division

- Over 120 members
- 15 labs in areas such as:
  - Airspace Operations
  - Fatigue Countermeasures
  - Human Computer Interaction
  - Psychophysiological Research
  - Vision Research

Samples of Vision Research

Influence of Vibration and Acceleration on Visual Performance (led by Dr. Bernard D. Adelstein)

Space Shuttle

- 3 G acceleration
- ±0.1 g vibration

Influence of Vibration and Acceleration on Visual Performance (led by Dr. Bernard D. Adelstein)

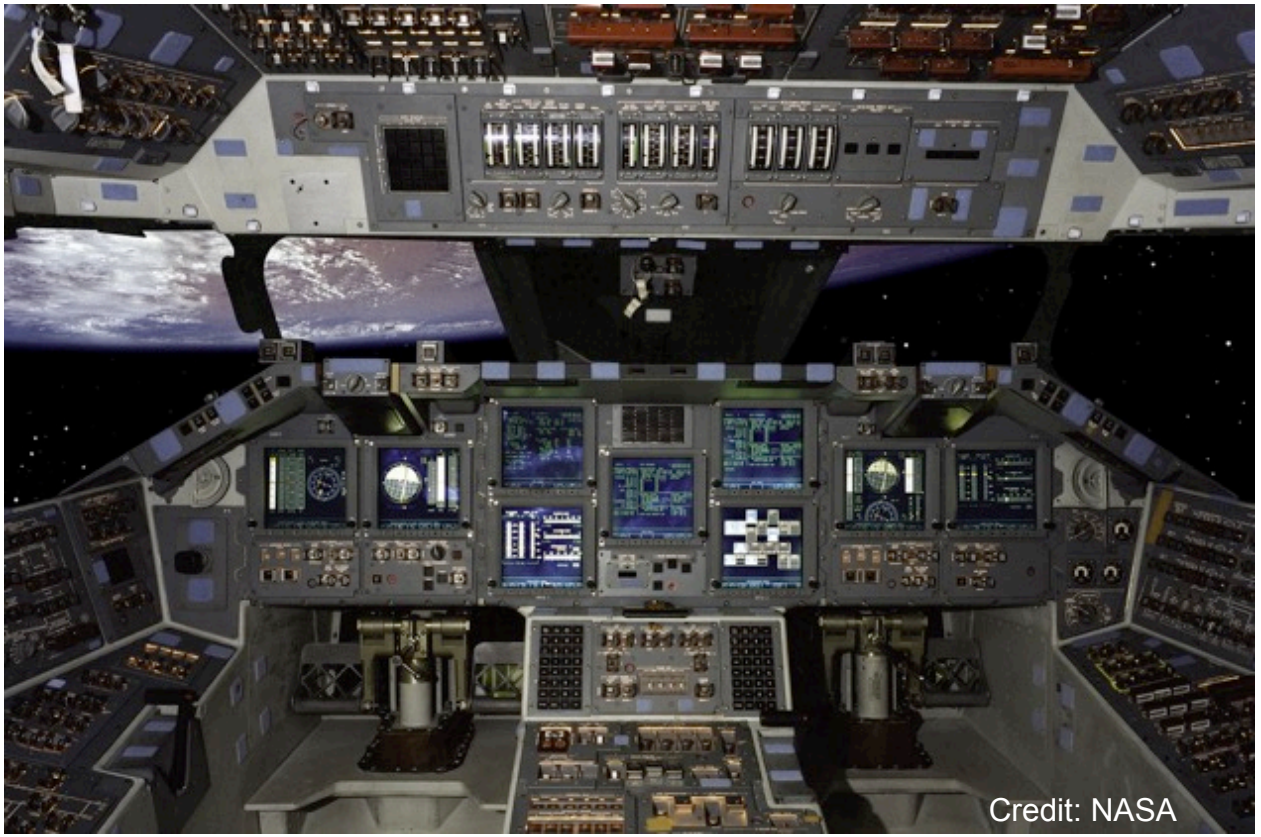
Space Shuttle

- 3 G acceleration
- ±0.1 g vibration

Proposed Ares I rocket

- 3.8 G acceleration
- ±0.7 g vibration
  (12 Hz, 2.5 mm peak to peak)

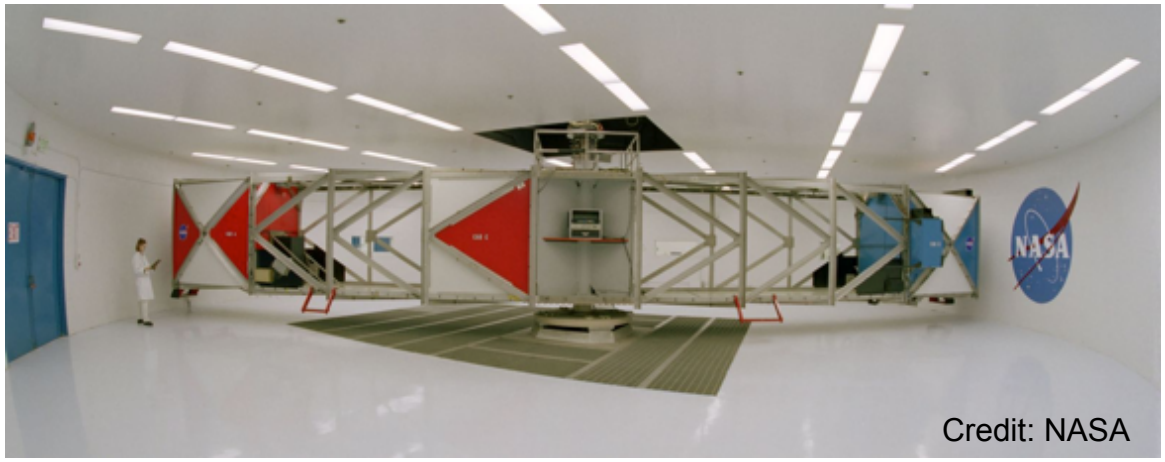
Influence of Vibration and Acceleration on Visual Performance

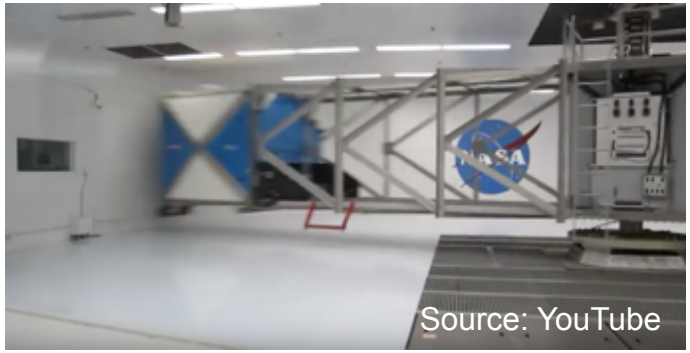


Space Shuttle cockpit

Astronauts acquire information from the myriad of interfaces to make decisions.

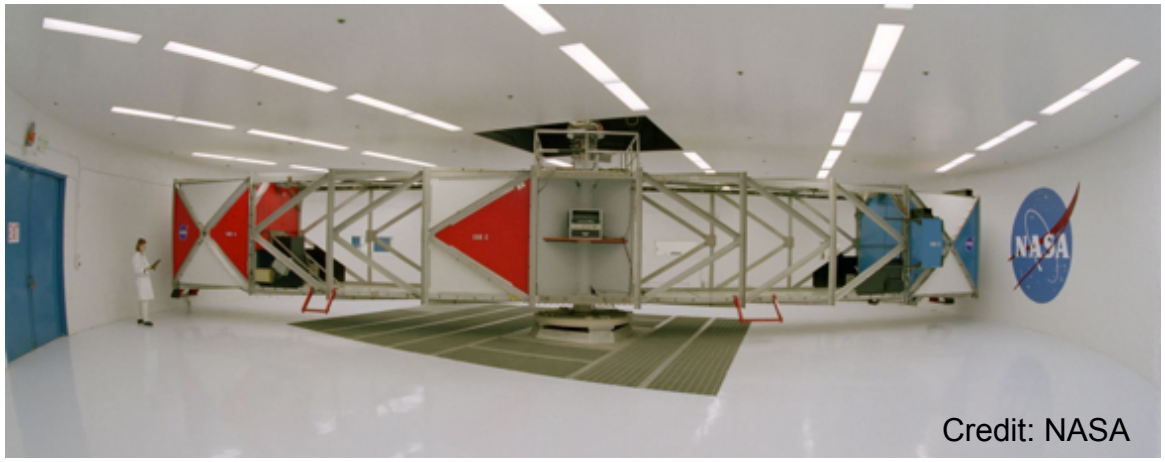
Influence of Vibration and Acceleration on Visual Performance



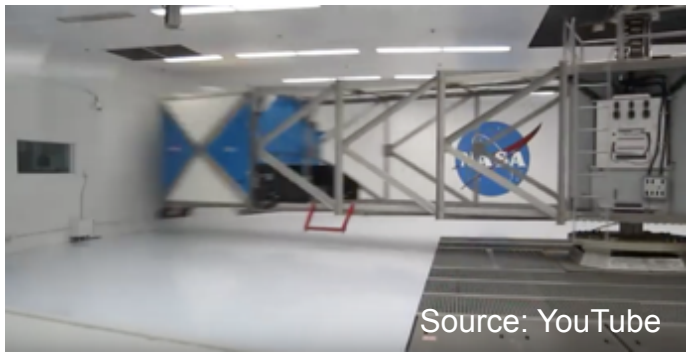


29 foot radius centrifuge with 20 revolutions per minute
(to achieve 3.8 G acceleration)

Influence of Vibration and Acceleration on Visual Performance



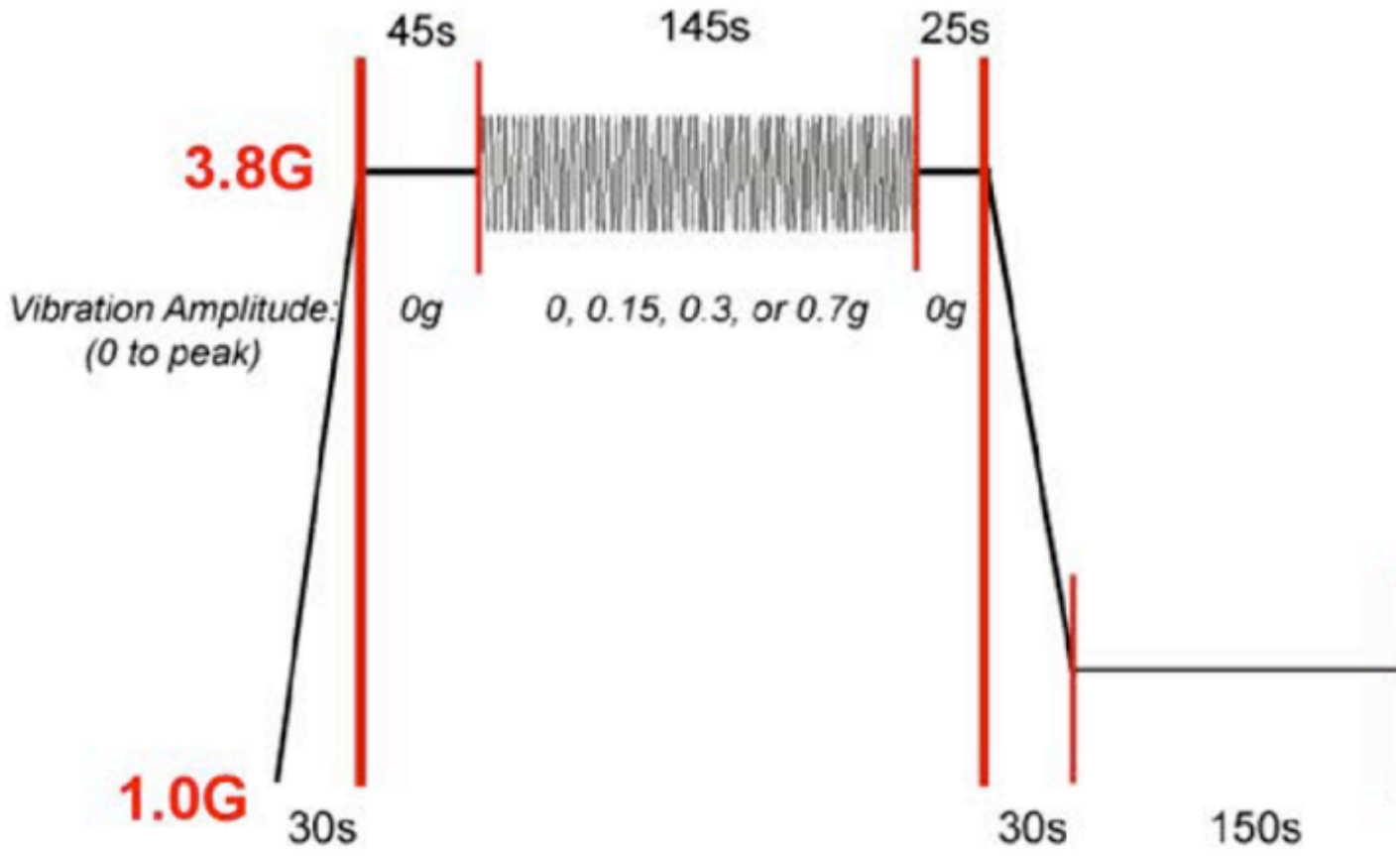
Credit: NASA



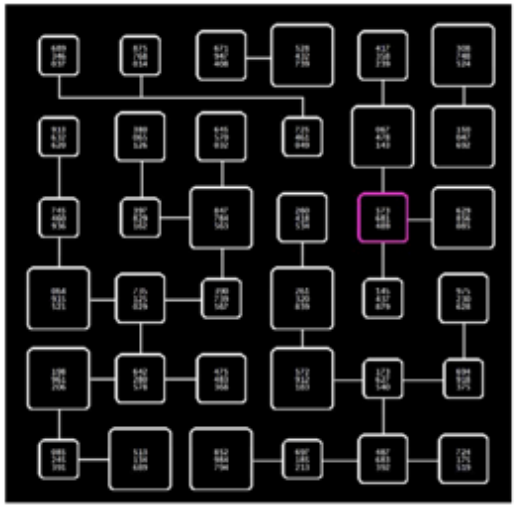
Source: YouTube

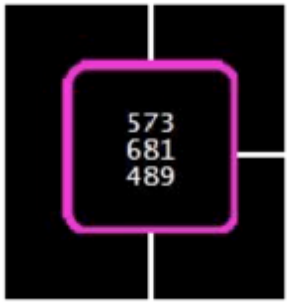
29 foot radius centrifuge with 20 revolutions per minute
(to achieve 3.8 G acceleration)

Influence of Vibration and Acceleration on Visual Performance



Influence of Vibration and Acceleration on Visual Performance





Task

1.Visually acquire the relevant information.

2.Make an eye movement to the cell.

3.Select a target string of three digits.

4.Read the digits in the target.

5.Make a two-alternative forced choice:
"yes" if a monotonic sequence,
"no" if not a monotonic sequence.

6.Press one of two response buttons.

Independent variables

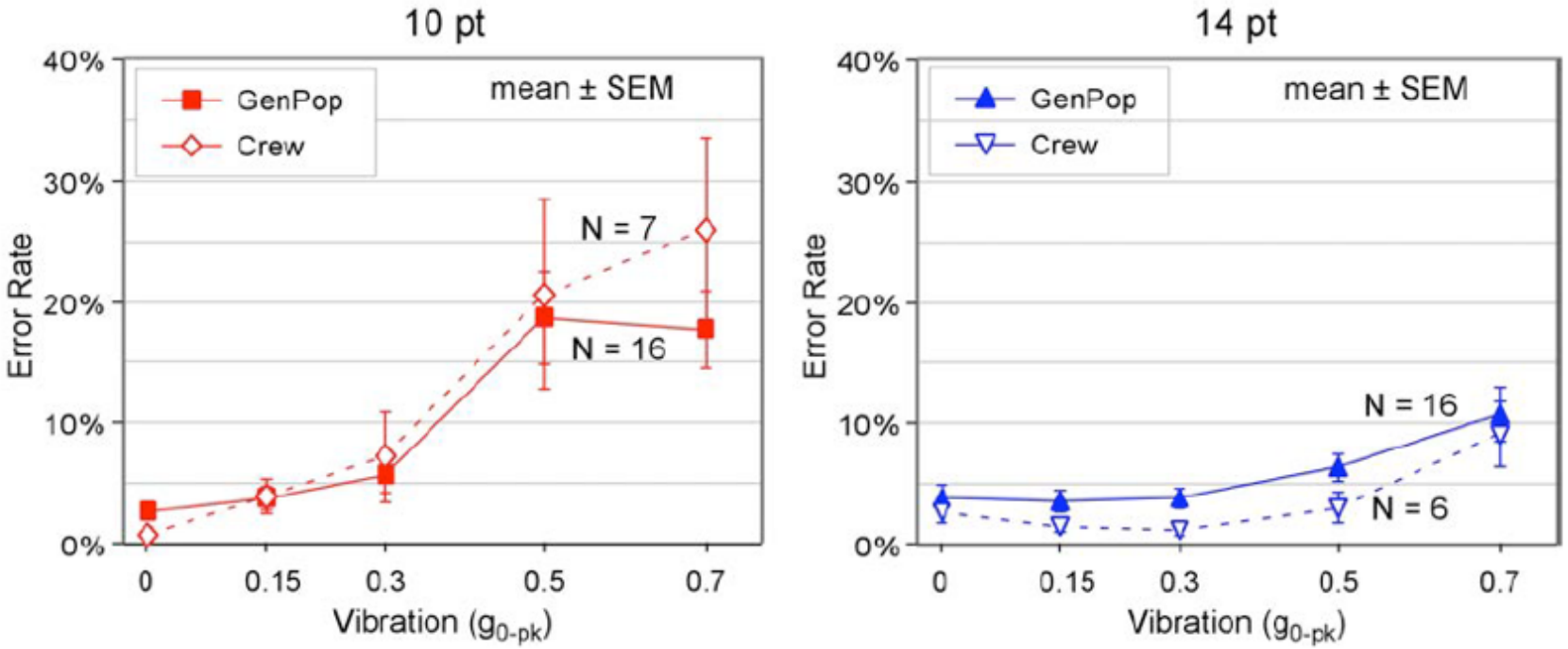
1. Font size (10 and 14 point)

2. Vibration level

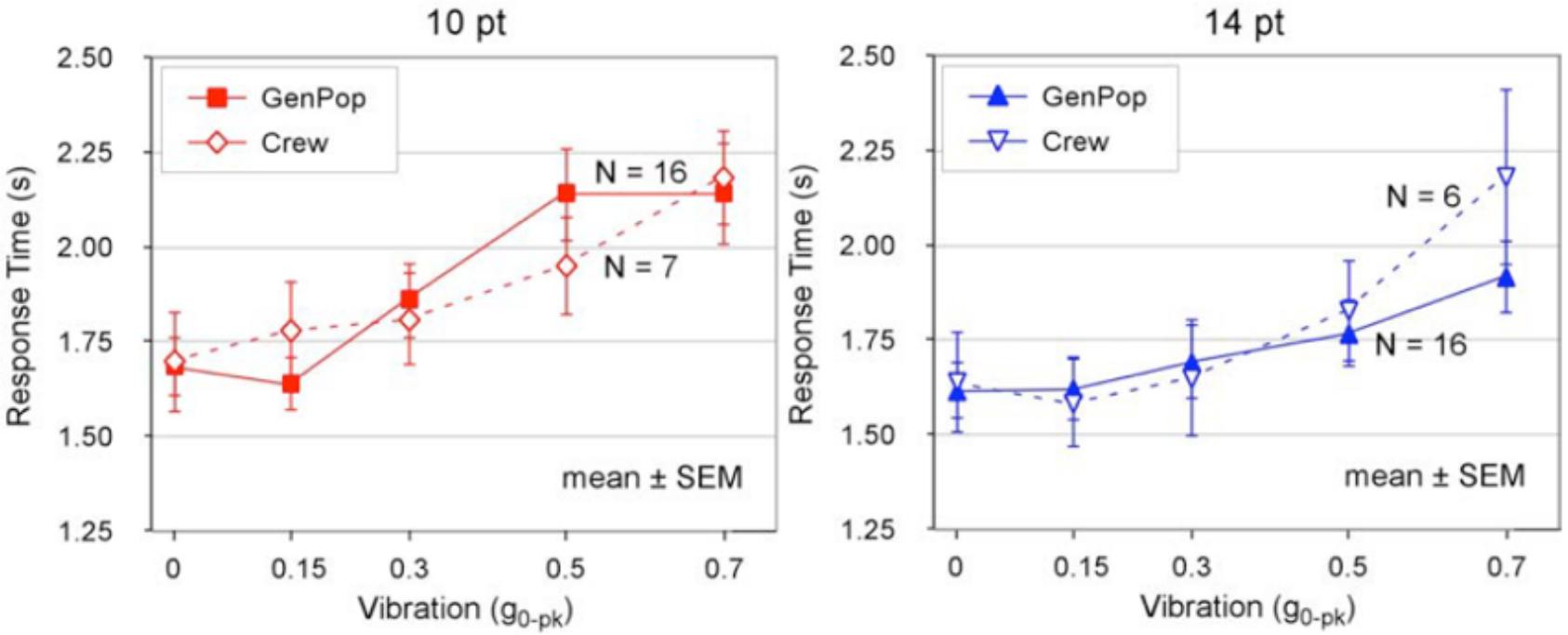
Participants

general population and crew

Influence of Vibration and Acceleration on Visual Performance

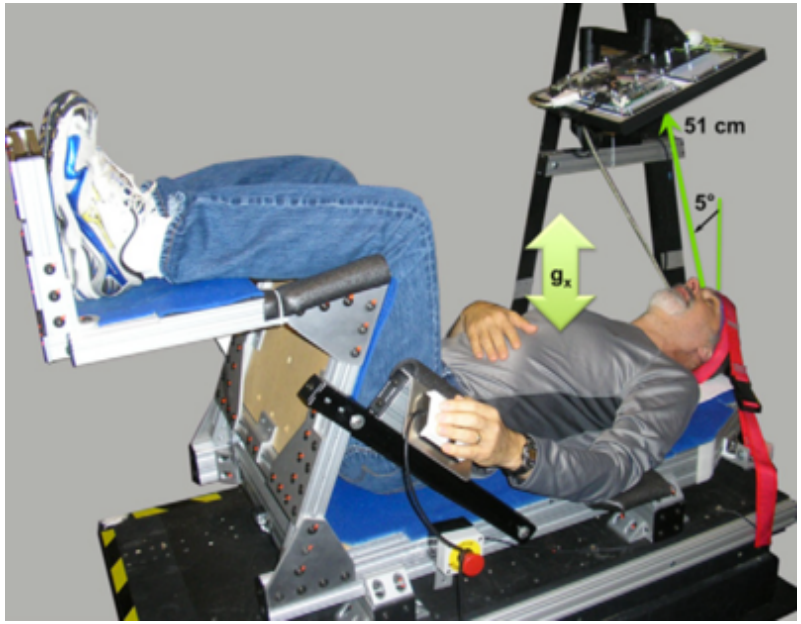


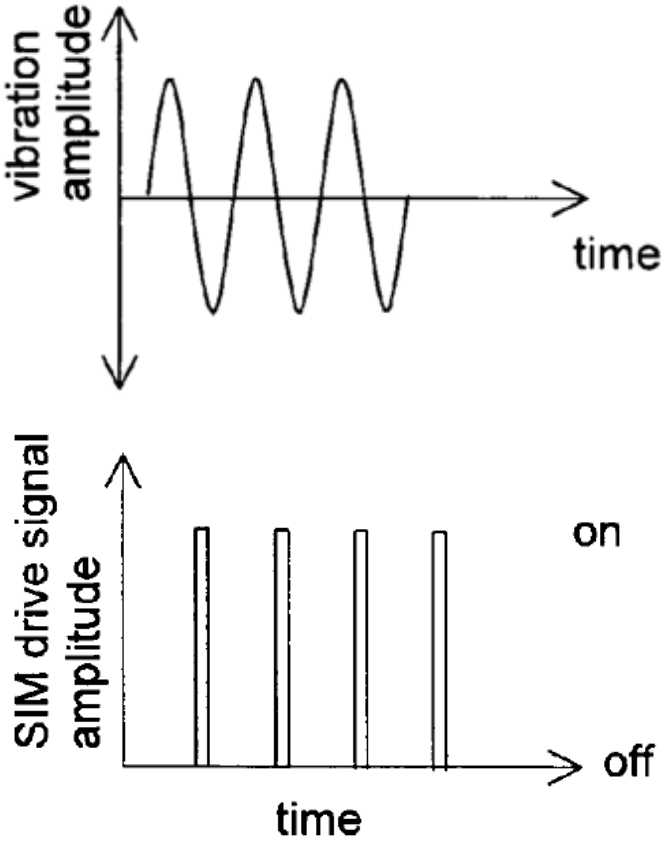
Influence of Vibration and Acceleration on Visual Performance



Influence of Vibration and Acceleration on Visual Performance

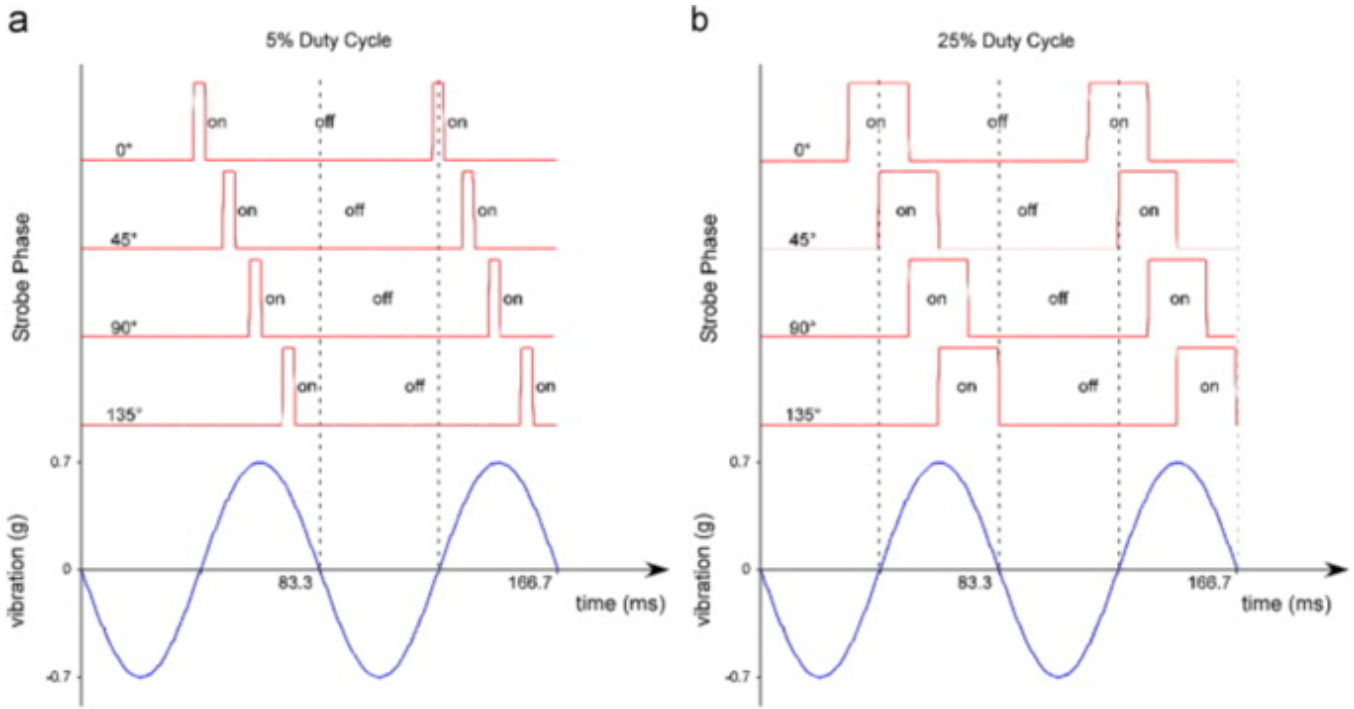
Strobing Countermeasure





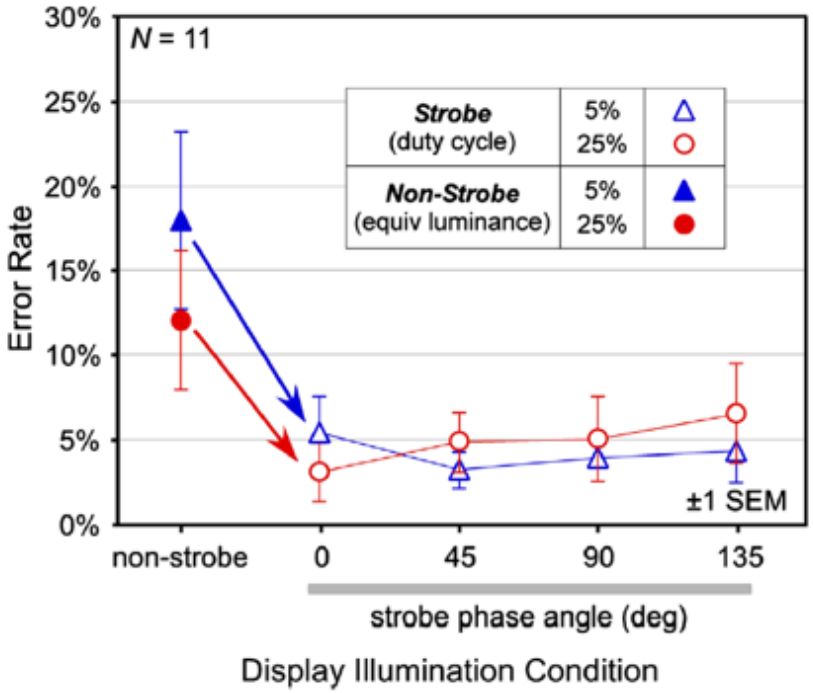
Influence of Vibration and Acceleration on Visual Performance

Strobing Countermeasure



Influence of Vibration and Acceleration on Visual Performance

Strobing Countermeasure



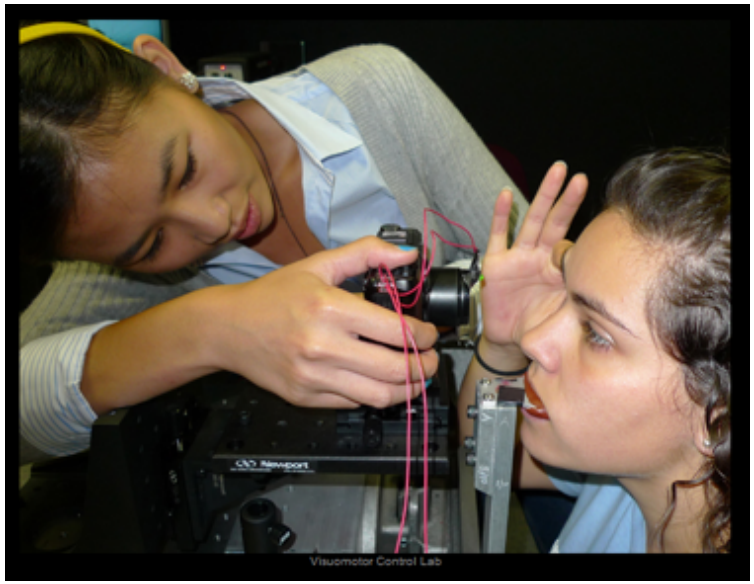
Display was strobed in time with the vibrating chair.

Display strobing was an effective compensating technique for reducing reading errors in this study.

Patent 8,711,462 awarded in 2014.

Adelstein BD, Kaiser MK, Beutter, BR, McCann RS, Anderson MR (2013) Display strobing: An effective countermeasure against visual blur from whole-body vibration. Acta Astronautica, 92: 53-64.

Comprehensive Oculometric Behavioral Response Assessment (COBRA) (led by Dr. Lee Stone)



The goal is to assess neural impairment using a short (15 minute) oculometric assessment.

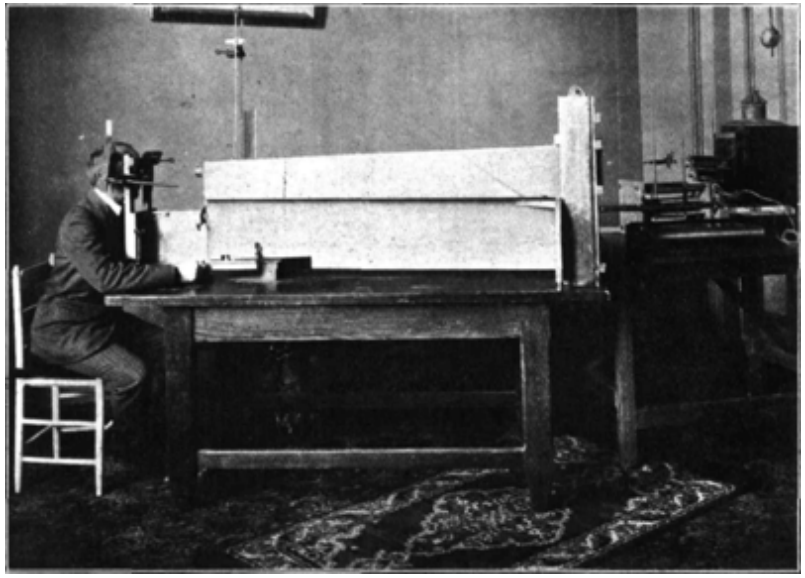
Impairment in visual processing and pursuit tracking can result from many causes (e.g., cortical lesions, brainstem damage).

Comprehensive Oculometric Behavioral Response Assessment (COBRA)

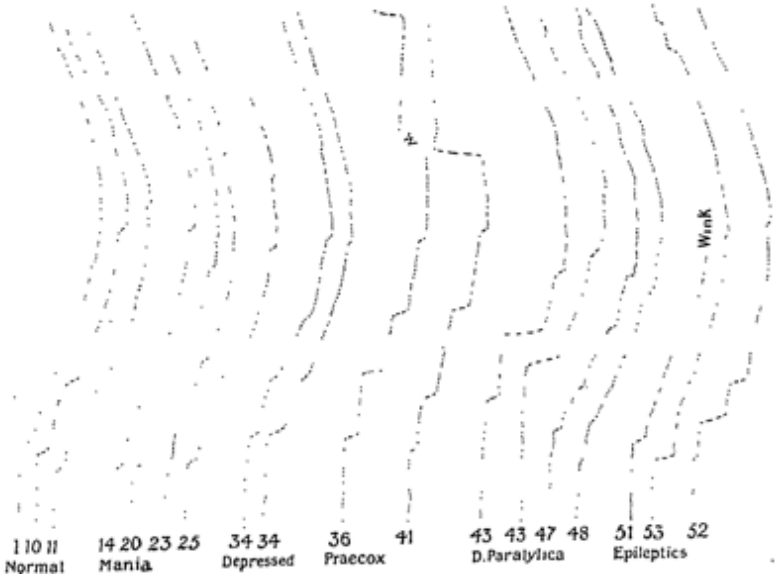
Scientists have investigated the association between oculometrics and nervous system disorders for decades.

AN EXPERIMENTAL STUDY OF THE OCULAR REACTIONS OF THE INSANE FROM PHOTOGRAPHIC RECORDS.

BY ALLEN ROSS DIEFENDORF, M.D.,
Lecturer in Psychiatry in Yale University Medical School,
AND
RAYMOND DODGE, PH.D.,
Professor of Psychology in Wesleyan University.

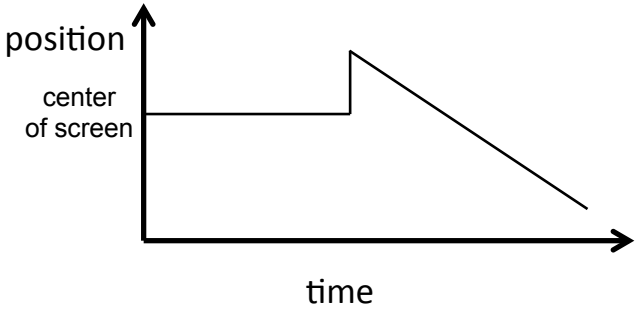


The Dodge Photochronograph, 1908



Comprehensive Oculometric Behavioral Response Assessment (COBRA)

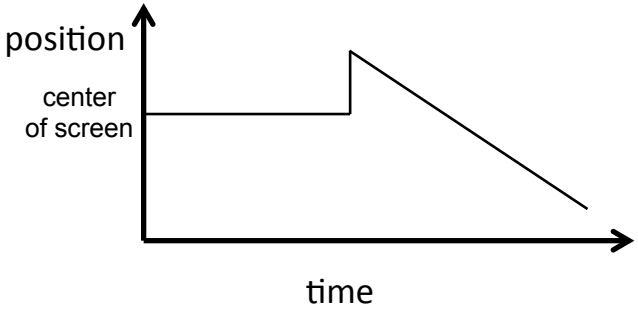
Rashbass step-ramp Stimulus



- Target speed: 16, 18, 20, 22 or 24 deg/sec.
- Target direction: 0° to 358° on the fronto-parallel plane in 2° increments.
- 180 trials
- Display: LCD high-definition monitor at 144Hz
- Eye Tracker: ISCAN video-based tracker at 240 Hz

Comprehensive Oculometric Behavioral Response Assessment (COBRA)

Rashbass step-ramp Stimulus



10 measures

Pursuit Initiation
1. Latency of pursuit initiation
2. Open-loop pursuit acceleration

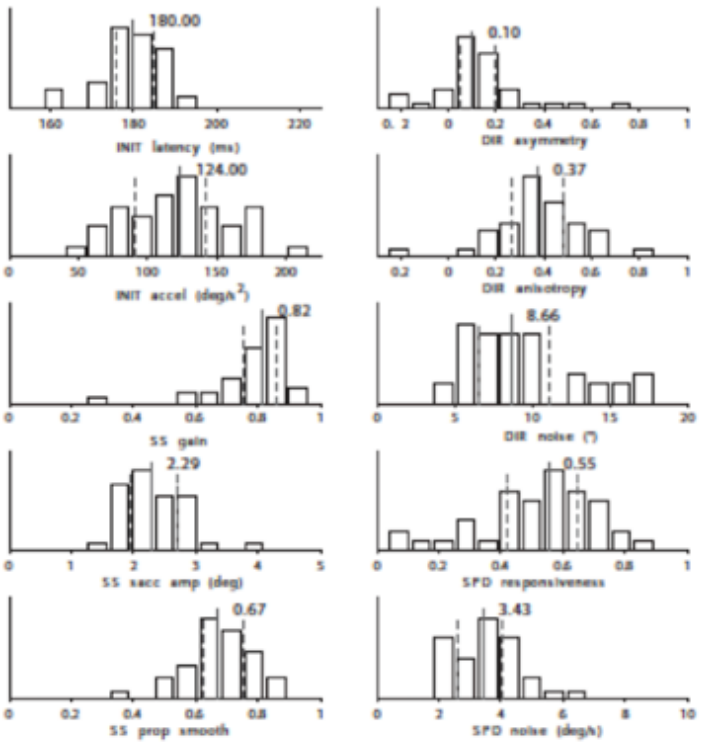
Steady state tracking
3. Gain (ratio of eye velocity to target velocity along stimulus direction)
4. Catch-up saccade amplitude
5. Proportion of the response consisting of smooth movement
(ratio of pursuit eye displacement to total eye displacement)

Direction tuning
6. Oblique effect amplitude
7. Horizontal-vertical asymmetry
8. Directional noise

Speed tuning
9. Speed responsiveness
10. Speed noise

Comprehensive Oculometric Behavioral Response Assessment (COBRA)

Results across 41 subjects



Initiation

median latency: 180 ms

median acceleration: 124 deg/s^2

Steady-state tracking

gain: 0.82

saccade amplitude: 2.31

proportion smooth: 67 %

Direction-tuning

vertical-horizontal asymmetry: 0.10

cardinal-oblique anisotropy: 0.37

noise: 8.66°

Speed-tuning

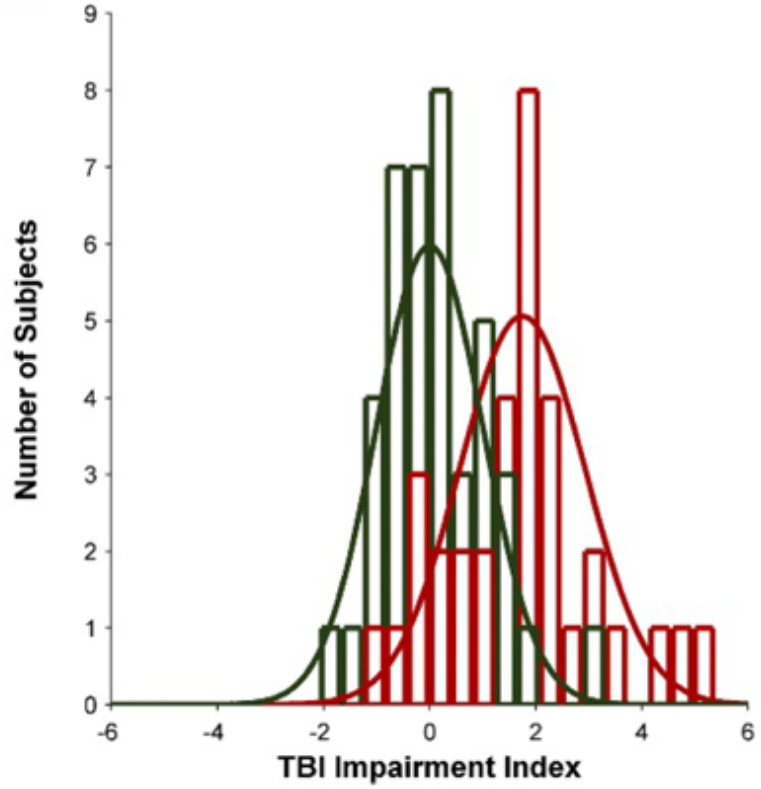
slope: 0.55

noise: 3.43 deg/s

Comprehensive Oculometric Behavioral Response Assessment (COBRA)

Example of Potential Benefit: Assessment of Traumatic Brain Injury

Compute a “TBI Impairment Index” based on z-scores for 34 TBI patients (red) and 41 control subjects (green).



Comprehensive Oculometric Behavioral Response Assessment (COBRA)

Summary

- It requires only about 15 minutes.
- This approach may be a useful quantitative screening test for pathological states.
- Specific deficits may show characteristic patterns across different metrics.
  - Example: Degenerative retinal disease may show prolonged pursuit latency but unimpaired steady-state tracking.
  - Example: Schizophrenia may show normal pursuit latency but low open-loop acceleration.
- Multidimensionality provides a relatively high overall sensitivity.

Patent 9,730,582 awarded in 2017.

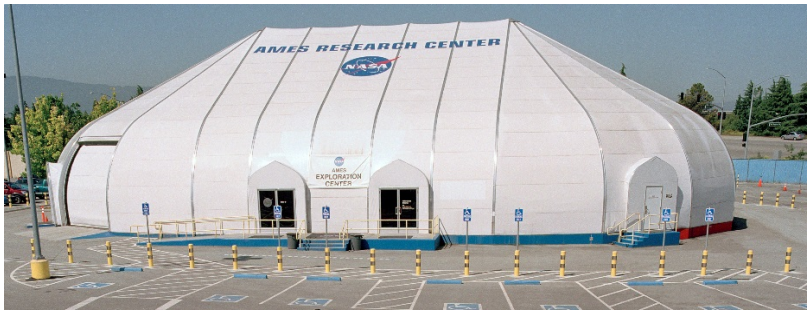
Liston DB and Stone LS (2014) Oculometric assessment of dynamic visual processing. Journal of Vision, 14: 1-17.

Liston DB, Wong LR and Stone LS (2017) Oculometric Assessment of Sensorimotor Impairment Associated with TBI. Optometry and Vision Science, 94: 51-59.

More Information

Ames Human Systems Integration Division: http://hsi.arc.nasa.gov

Ames Visitor Center: http://www.nasa.gov/ames/visitorcenter.html



Credit: NASA Ames