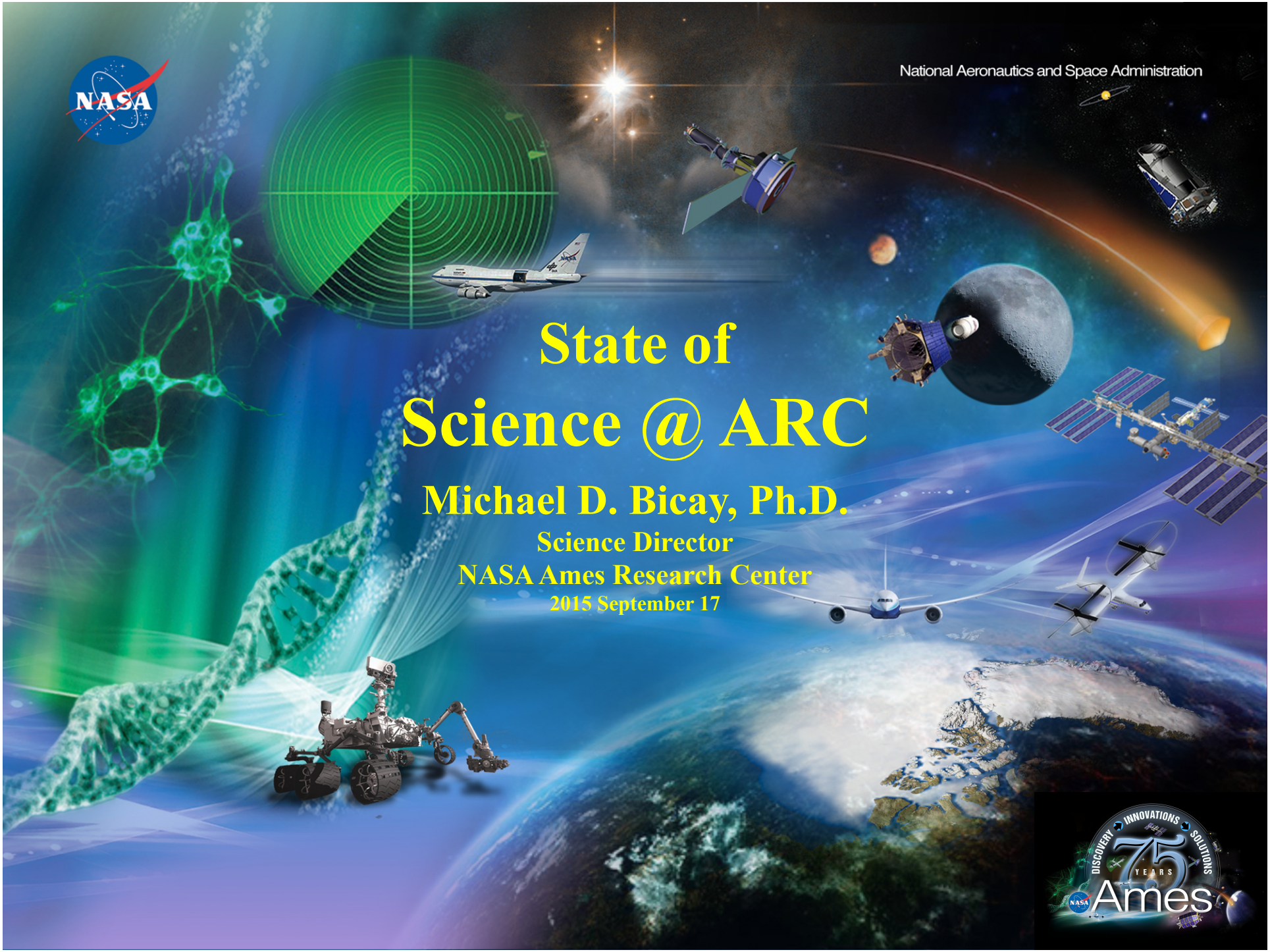

State of Science @ ARC

Michael D. Bicay, Ph.D.
Science Director
NASA Ames Research Center

2015 September 17

Looking Back: Directorate Objectives for FY15

- ✓ **Continue to produce solid foundation of world-class research**
- **Continue to replenish workforce**
- ✓ **Complete commissioning of the SOFIA/EXES science instrument**
- ✓ **Transfer SOFIA Program Office to ARC from AFRC**
- ✓ **Initiate closeout Kepler mission, operate K2 mission & contribute to development of TESS**
- ✓ **Successfully manage Agency Earth Science airborne campaigns**
  - IceBridge, ATTREX, HS3 + others TBD
- **Build up a Center of Excellence for Small UAV Research**
- ✓ **Continue AJAX flights in support of ARC & NASA science programs**
- ✓ **Compete for meaningful roles in new Agency flight programs**
  - $450M Discovery, $175 Small Explorer, $150M Earth Venture (EV), others
- ✓ **Build portfolio of bioscience payload flight opportunities in post-Shuttle era**
  - Launch RR-1, Seedling Growth-2, Micro-8 & AFEx on SpX-4 to ISS in September
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  - Launch Rodent Research-2, Seedling Growth-2 on SpX-6 to ISS in February
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- ✓ **Complete design for new BioSciences Lab building (N288)**
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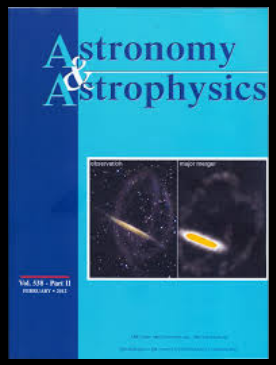
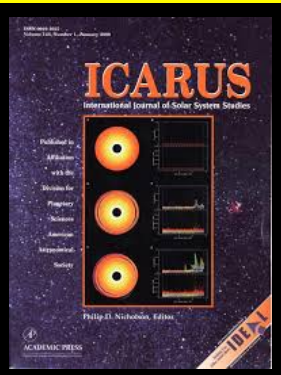
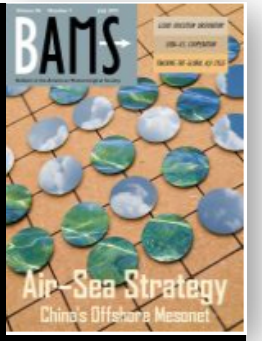
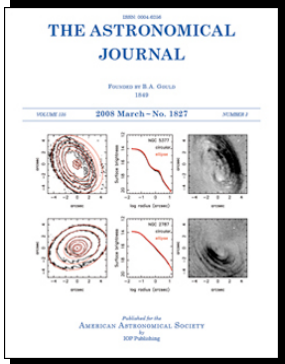
Peer-Reviewed Publications









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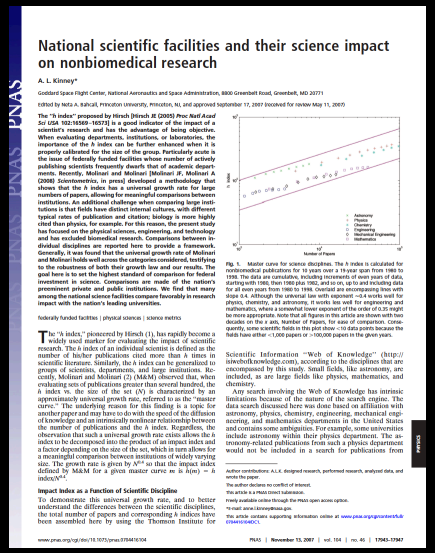
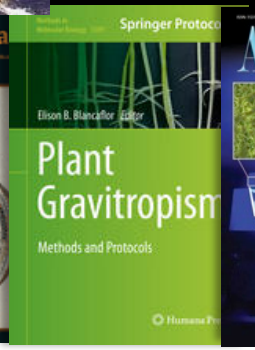
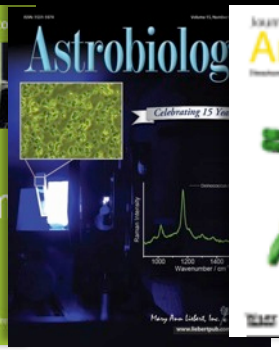
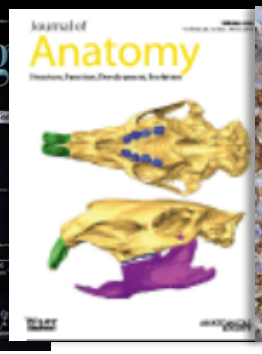
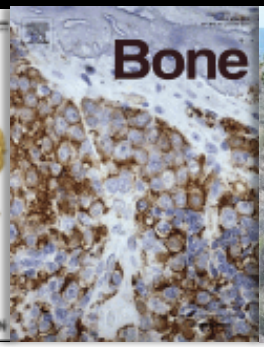
- Code SS 192

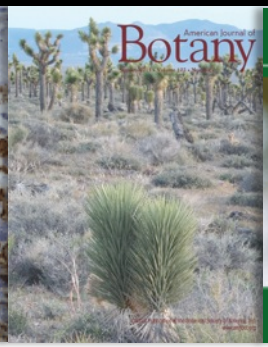












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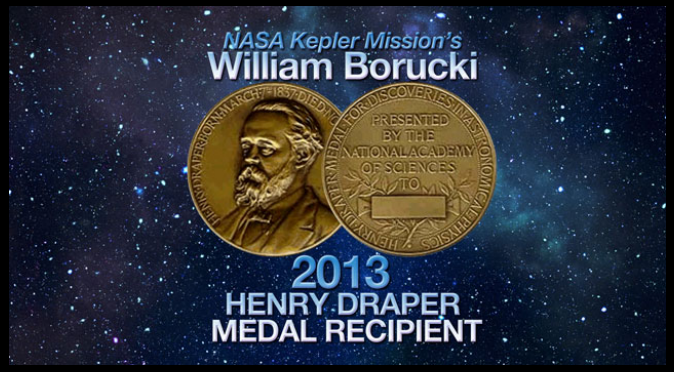
William J. (Bill) Borucki



2015 Ames Fellow

Honorary 2-year designation to acknowledge distinguished scientific research or outstanding engineering

William J. Borucki

2015 National Air & Space Museum Award

Kepler's Six Years In Science (and Counting)

By The Numbers*

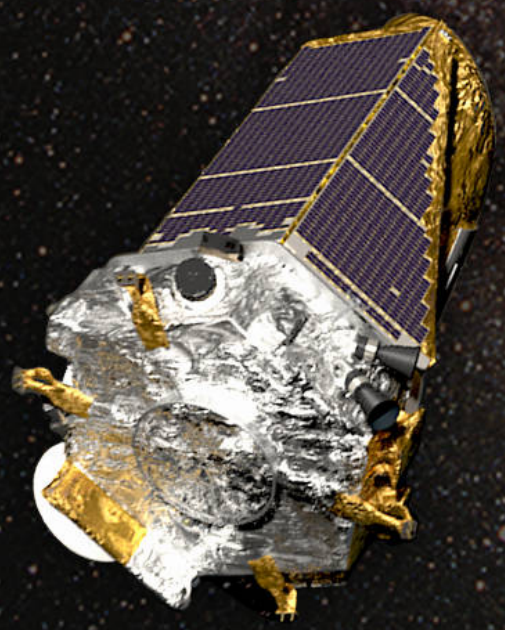
2,258 DAYS IN SPACE

2 MISSIONS
Kepler and K2

306,604
STARS OBSERVED

4,601
CANDIDATE
exoplanets

12.5 BILLION
brightness
measurements of stars



1,024
CONFIRMED
exoplanets

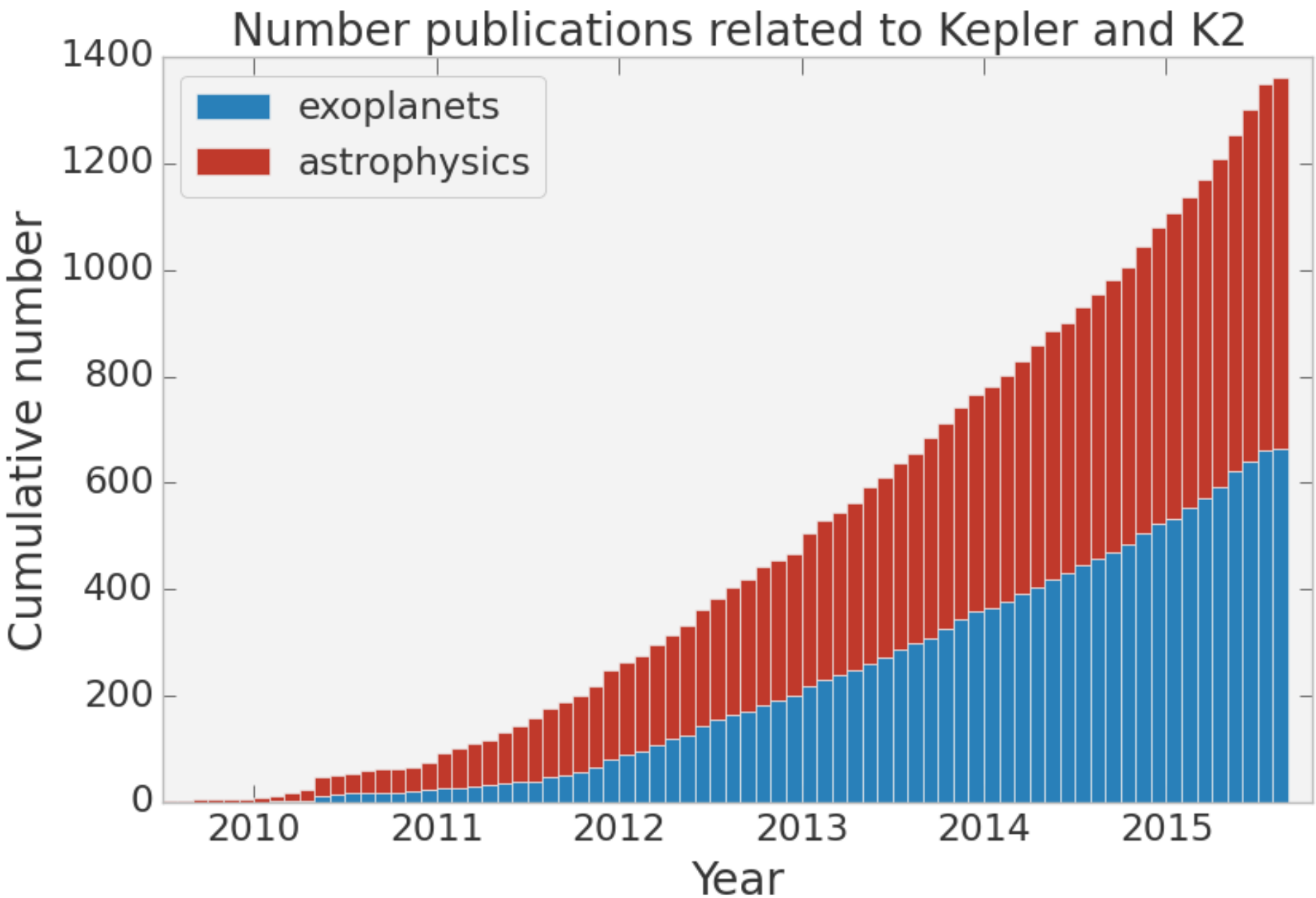
20.9
TERABYTES
publicly available data

8 CONFIRMED
SMALL HABITABLE ZONE
EXOPLANETS

64 MILLION MILES AWAY
trailing Earth around the sun

www.nasa.gov/kepler

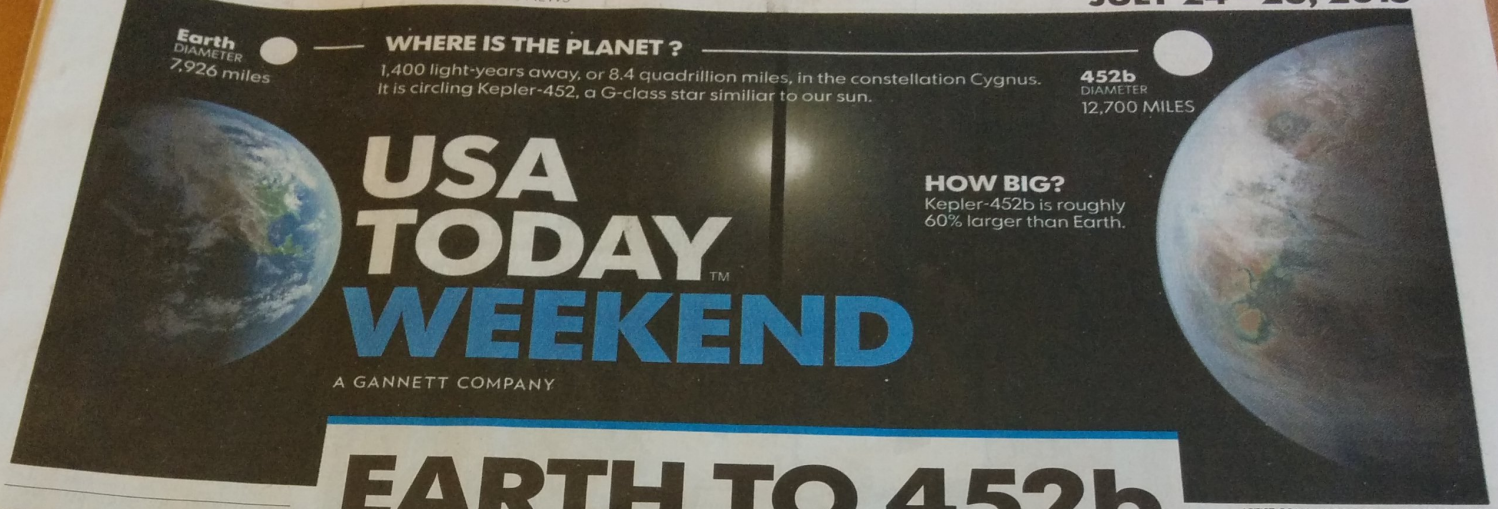
* As of May 12, 2015


Number publications related to Kepler and K2
exoplanets
astrophysics
Cumulative number
0
200
400
600
800
1000
1200
1400
2010
2011
2012
2013
2014
2015
Year

$2.00

THE NATION'S NEWS

JULY 24 - 26, 2015



USA TODAY™ WEEKEND

A GANNETT COMPANY

ARTIST CONCEPT OF EARTH AND 452b BY NASA

EARTH TO 452b

New planet found outside our solar system could harbor life

Traci Watson
Special for USA TODAY

Scientists have spotted a planet much the same size as our Earth orbiting a star that closely resembles our sun, making it the most likely known place outside our solar system to harbor life.

The newfound planet, Kepler-452b, "is the closest thing we have to another place that somebody else might call home," Jon Jenkins of NASA's Ames Research Center told reporters Thursday. The planet has been at just the right temperature to boast liquid water for some 6 billion years, "a considerable time and opportunity for life to arise somewhere on its surface or in its oceans," assuming the place has all the necessary ingredients for life, Jenkins said.

Researchers have found other planets outside the solar system that are nearly the same

probably rocky, as Earth is. But those planets circle dim, cool stars very different from our own sun, whereas 452b is hitched to a star very much like ours. If we could send plants to 452b, Jenkins said, they could comfortably photosynthesize.

The new planet is about 60% bigger in diameter than Earth,

> **"We're getting closer and closer to a true Earth analog."**
>
> **Joshua Pepper,** astronomer

the researchers said. It has a better-than-even chance of having a rocky surface, which would make a good platform for life to gain a foothold. Assuming it's rocky, it would have active volcanoes and perhaps a thick atmosphere.

This new Earth cousin was spotted by NASA's Kepler telescope, which watched for barely

of light coming from stars in the constellations Lyra and Cygnus. The planet, which is some 1,400 light-years from Earth, is described in a new article in *The Astronomical Journal*.

Other scientists who were not involved in the research called 452b an exciting example of a planet in the "Goldilocks" zone, where it's neither too hot nor too cold for liquid water to persist. "You could say this is the first viable 'Goldilocks' planet — with dozens more potentially," said MIT astronomer Sara Seager via email.

All the same, it's not clear that 452b is rocky. It could be made of ice, or it could have a thick hydrogen envelope that would choke off the possibility of life, said astronomer Joshua Pepper of Lehigh University.

"We're getting closer and closer to a true Earth analog," Pepper said. "But it's going to take a long time before we can confirm whether these planets

NEWSLINE

IN NEWS

Chemo doesn't help end-stage cancer, study says
Quality of life actually made worse for some.

Angry Greeks say #BoycottGermany
Germany took lead in demanding tough bailout terms.

IN MONEY

Whew! Earnings season not so bad
72 of 104 in S&P 500 that have reported earnings exceeded expectations.

IN SPORTS

41,500 VA HEALTH POSITIONS UNFILLED

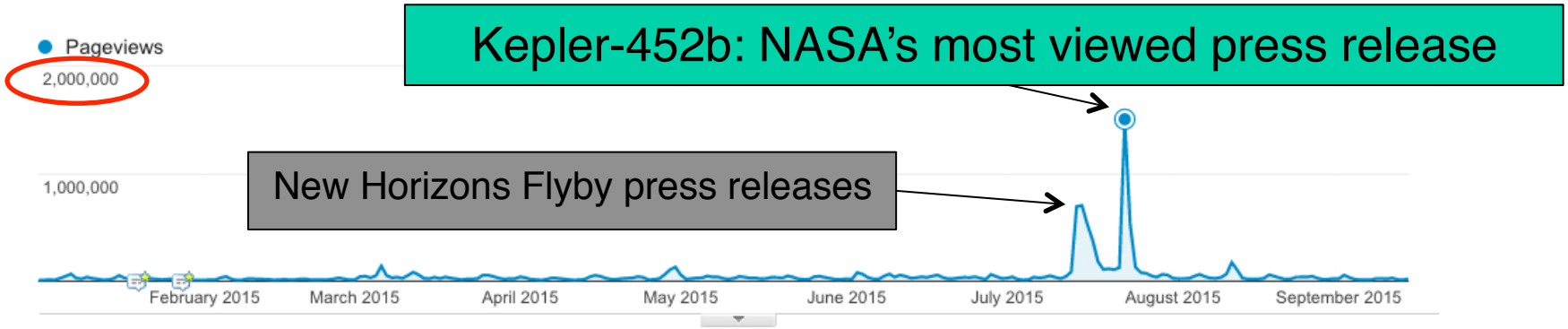
Lack of medical staff pushes vets to costlier care

Meghan Hoyer and Gregg Zoroya
USA TODAY

The Veterans Health Administration has 41,500 job vacancies for doctors, nurses and other medical professionals across its sprawling health care system while it struggles to provide timely medical care for veterans, according to records analyzed by USA TODAY.

The failure to fully staff hospi-

The Power of Public Affairs



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1.	www.nasa.gov/press-release/nasa-kepler-mission-discovers-bigger-older-cousin-to-earth/	1,910,599 (14.41%)
2.	www.nasa.gov/press/2015/february/nasa-spacecraft-returns-new-images-of-pluto-en-route-to-historic-encounter/	695,112 (5.24%)
3.	www.nasa.gov/press-release/from-mountains-to-moons-multiple-discoveries-from-nasa-s-new-horizons-pluto-mission/	611,773 (4.62%)
4.	www.nasa.gov/press-release/nasas-three-billion-mile-journey-to-pluto-reaches-historic-encounter/	477,251 (3.60%)

Space Biosciences

NASA AMES RESEARCH CENTER

Space Biosciences
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Space Biology

Conducting research to understand how life responds to the unique environment of space

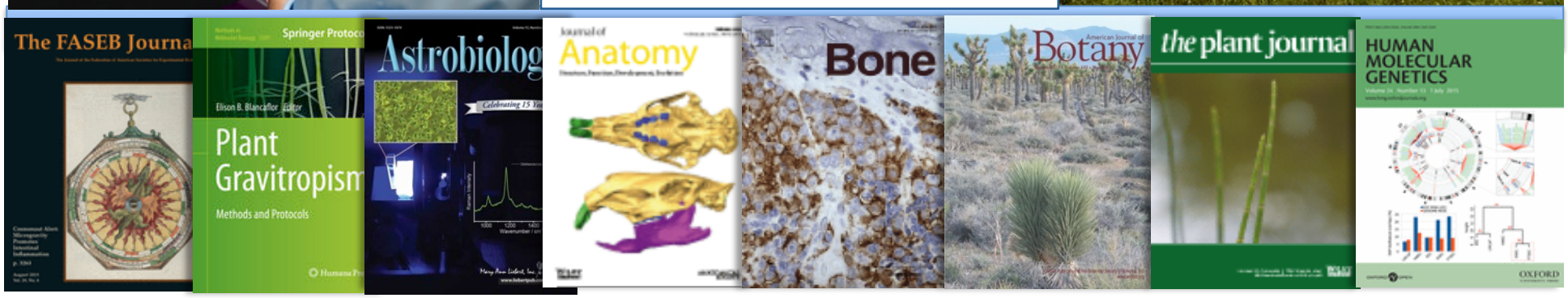
10 Space Biology research proposals selected

8 Life science experiments launched into space

9 Scientific meetings and **3** events supported through outreach

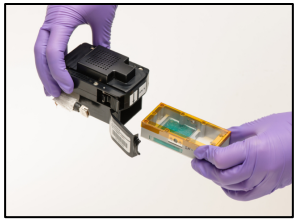
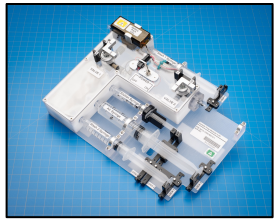
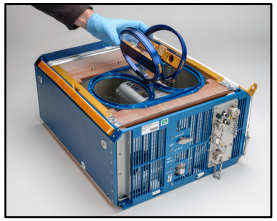
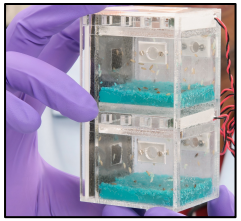
79 Publications in peer-reviewed journals by FSB-funded researchers

Micro-5: Gut Reactions In Space



Space Biosciences
NASA AMES RESEARCH CENTER

International Space Station

Ames Student Fruit Fly Experiment – Designed and built by students to study oxidative stress and neurobehavioral adaptation to microgravity.

Seedling Growth-2 – The second in a series of joint NASA-ESA science missions to study light- and gravity-signaling in plants.

Micro-8 – A study of how spaceflight affects potentially infectious microorganisms.

Micro-5 – A study of how microgravity alters the host–pathogen infection process.

Microbial Tracking-1A and -1B – Parts 1 and 2 of the first study to use high-throughput molecular analysis to characterize populations of microorganisms aboard the ISS and to assess how they change over time.

T-Cell Activation in Aging – Part 2 of an NIH-sponsored investigation of the genetic and molecular mechanisms underlying immune system dysfunction.

Rodent Research-1 – First flight of Rodent Research System. NASA's first 30-day rodent study on ISS. Successful validation experiment and completion of ISS National Labs (Novartis) study of the molecular basis of muscle atrophy.

Rodent Research-2 – 60-day ISS National Labs (Novartis) investigation of the effects of the spaceflight on musculoskeletal and neurological systems.

Fruit Fly Lab-01 – First flight of Ames Fruit Fly Lab hardware system for ISS. NanoRacks equipment issues prevented successful completion of the validation experiment

Three experiments lost on SpaceX-7 will be re-flown in the coming months: Micro-9, WetLab-2, Microbial Tracking-1C.

GeneLab:
Open Science for Exploration

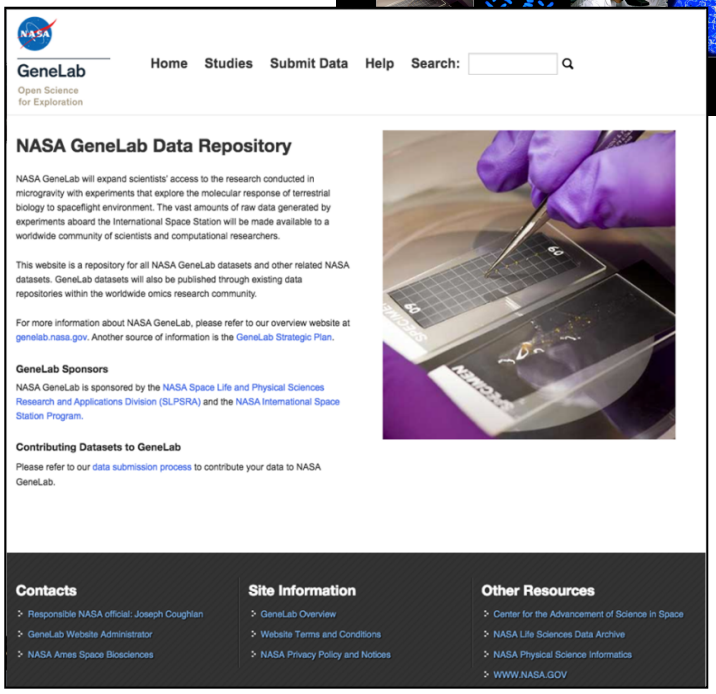
The science of GeneLab examines the fundamental building blocks of life itself. DNA. RNA. The structure of proteins. Molecular signaling processes.

GeneLab is a centralized, open access collaboration space for data deposition, retrieval, analysis and modeling of biological experiments from space. GeneLab users will perform novel scientific investigations and develop new testable hypotheses for future experiments.

GeneLab Strategic Plan

2015:

- Phase I data system completed and online
- 22 datasets posted to data repository
- The first GeneLab collaborative experiments on ISS were flown in space and completed
- Samples from recent BRIC and Rodent Research missions are being analyzed and will lead to new datasets that will be posted
- Webby Award: 2015 Web Best Navigation/ Structure



http://genelab.nasa.gov

Human Research Program

HRP Mission

To enable space exploration beyond LEO by reducing the risks to human health & performance through a focused program of basic, applied & operational research

Exploration Medical Capability

Dry Electrode ECG System:

- EMSD ECG Ground Demonstration testing completed. (This system provides a 12-lead diagnostic ECG capability for ISS that is reusable and requires no skin prep and associated consumables)

EMSD System:

- Completed delivery of ECG integration software for the Exploration Medical System (EMSD) Ground Demonstration

Exploration Medical Capability

Exploration Laboratory Analysis (ELA) System:

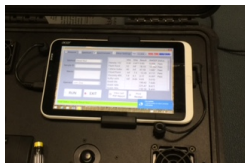
- Selected ELA technology platforms
  - Intelligent Optical Systems in Torrance, CA; Cell Phone-based Lateral Flow Assay for Blood Biomarker Detection
  - DNA Medicine Institute, Cambridge, MA rHEALTH X platform
- Phase II E SBIR was awarded to Intelligent Optical Systems

Image courtesy of DMI

Image courtesy of IOS

Medication Stability:

- Real-Time Analyzers, Inc. Low Gravity Drug Stability Analyzer; was provided test samples from flight for analysis.



Human Research Program

Program Science Management

- Finalized HRP Evidence Reports for review by Institute of Medicine (FY15 IOM) and the 2015 HRP Standing Review Panels
- Coordinated and supported HRP's Program Status Review held 8/17-19/15
- Invited Book Chapter Published and a paper in Press (T. Straume)

Human Health & Countermeasures

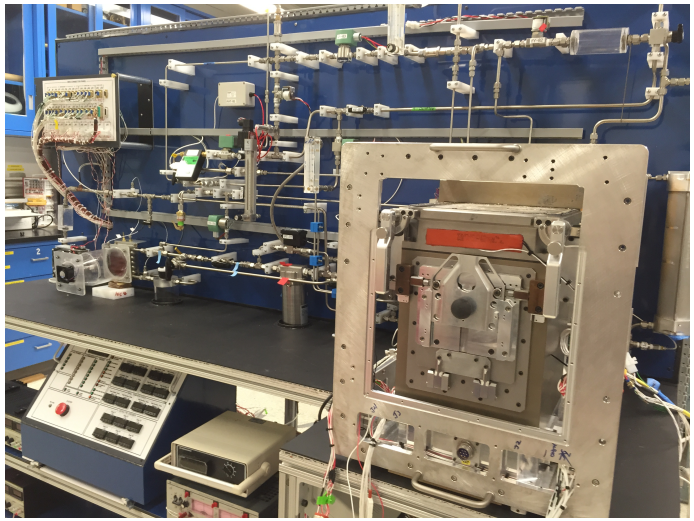
- 9 Publications
- 3 Presentations; (given by R. Boyle, P. Parsons-Wingerter, and Ann-Sofie Schreurs)
- Organized and conducted 1 Workshop and 2 Symposia on the topic of Translational Research
- 2 HHC Grants awarded to ARC PI's
- Loan Agreement established with the Canadian Space Agency for the use of the Astroskin Garment for vestibular research

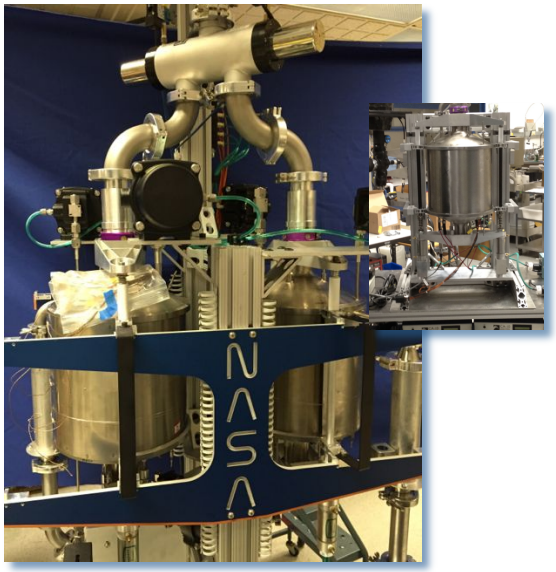
Life Sciences Data Archiving

- Successfully implemented a NASA.gov Cloud solution to effectively manage and distribute video and telemetry to projects of HRP and SLP Space Flight Payload Projects
- Established a collaborative effort between GeneLab, Ames Life Science Data Archive and HRP HHC Tissue Sharing Project to develop a shared biobank solution to manage biospecimens being stored in the Biospecimen Storage Facility (BSF) at Ames.

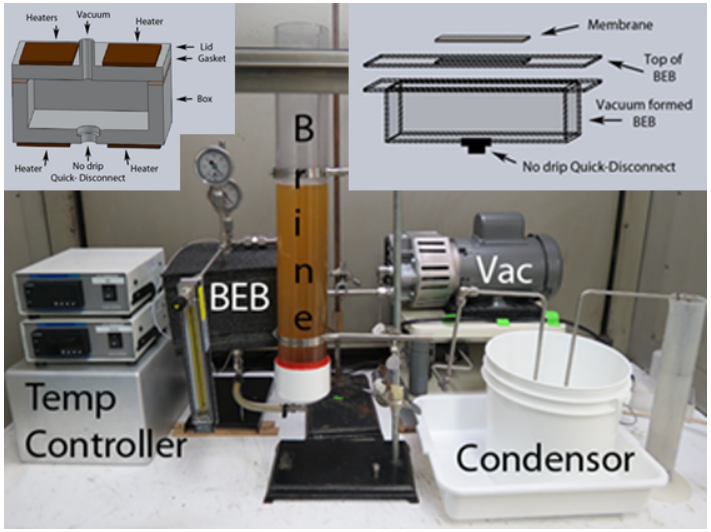
Life Support

Waste: Heat Melt Compactor project achieved HQ Milestone of assembled and operational with limited automation. [John Fisher]





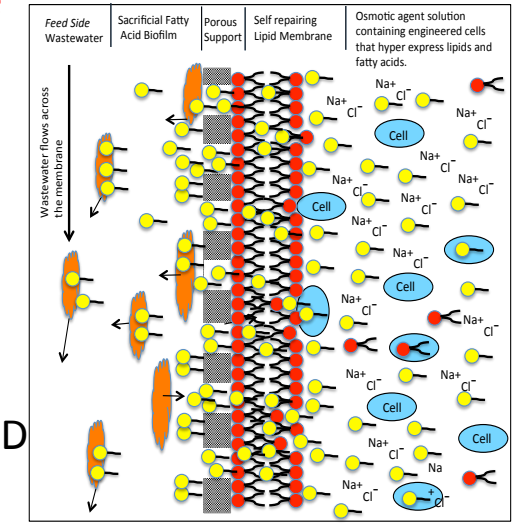
Air: Tested single unit CO2 Removal and Compression System and began construction of integrated dual unit system. [Darrell Jan]



Water: The continuous-fill Brine Evaporation Bag (BEB) was developed and tested for the FY16 down-select flight project. Begin testing of engineered brine containment bags for the Ionomer Water Processor. [Michael Flynn, Lance Delzeit]

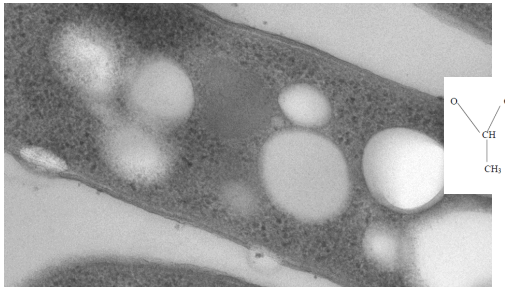
Synthetic Biology

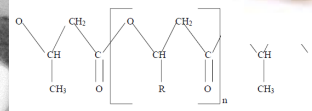
- In FY15 HQ seeded four projects to demonstrate the ability of synthetic biology to impact mission architectures by reducing upmass, enabling greater *in situ* resource utilization, and validating the ability to produce high value products on demand.

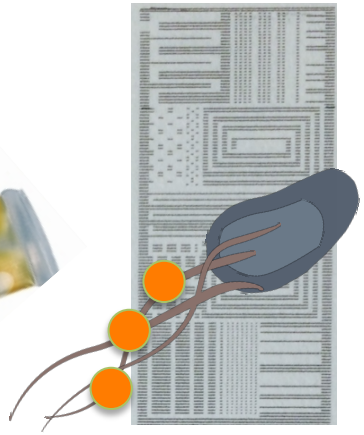


- STMD/GCD is funding the Synthetic Biomembrane project that uses synthetic biology develop a new type of regenerable water processing membrane for exploration missions (Michael Flynn)

- HEOMD/AES is funding three projects to use synthetic biology to:
  - remediate wastewater and produce bioplastics that can be used in 3D printing to support in space manufacturing (John Hogan)
  - produce fresh (timely), high value nutrients that can be used to supplement nutrients of concern in crew food supplies (Masood Hadi)
  - biologically acquire metals that can be used in advanced manufacturing techniques (Lynn Rothschild).

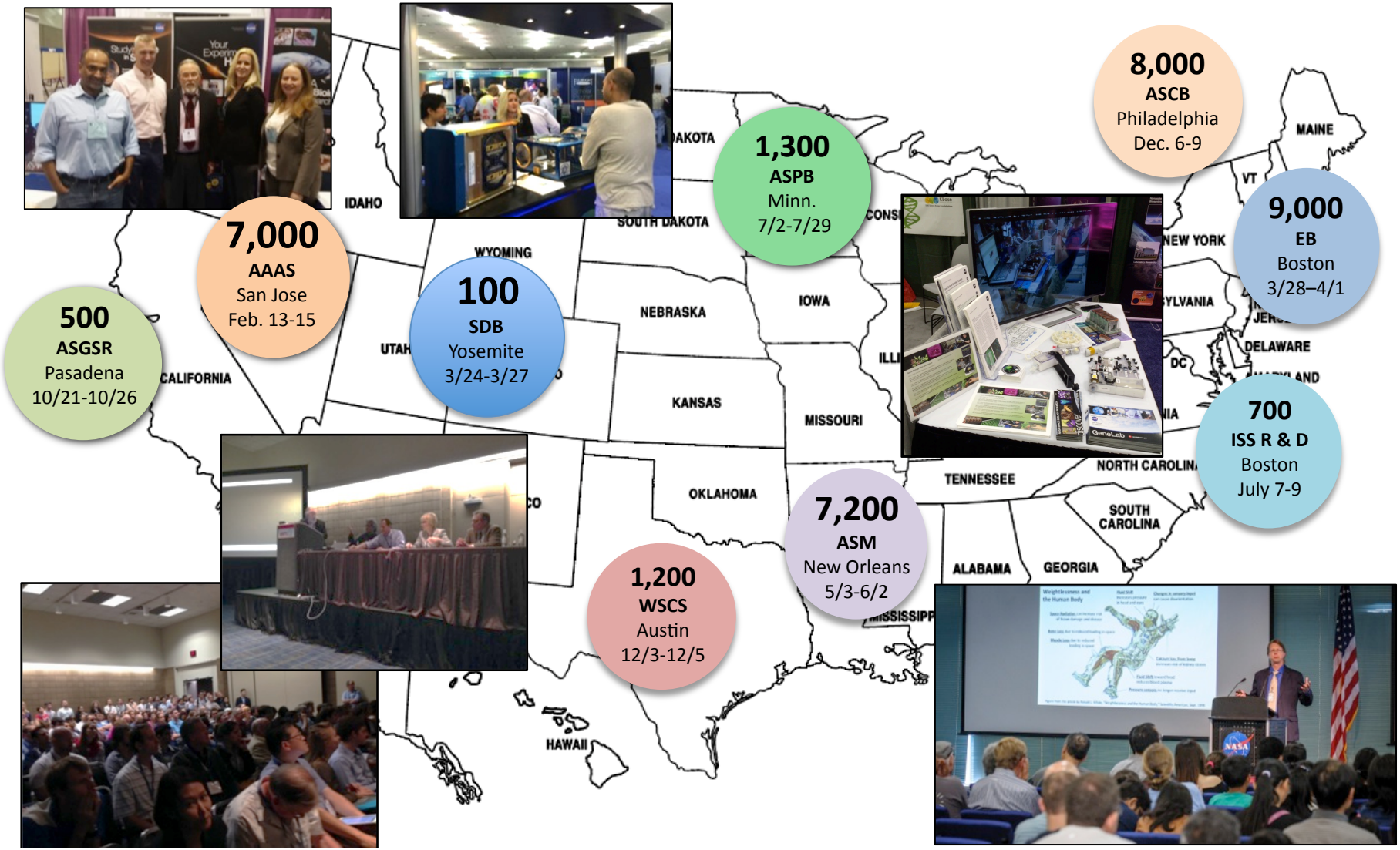






Space Biosciences
NASA AMES RESEARCH CENTER

Scientific Outreach



Ames staffed booth exhibits & seminars at meetings throughout the US. Over **35,000** students, professors, post-docs, and junior researchers were introduced to space biology research and funding opportunities with NASA .

Distinctions

- April Ronca - President, International Society for Developmental Psychobiology

- April Ronca – President-Elect, American Society for Gravitational Space Research

- Dana Bolles – selected to be featured in Women@NASA website

- GeneLab – Webby Award in the Best Navigation/Structure category

Space Biosciences Funding

	Directed ($M)	Competed ($M)
AES	5,662	-
STMD	1,810	-
HRP*	9,936	468
ISS*	27,906	
Space Biology	8,818	4,000
CMO	1,330	98
Other		505
Subtotal	55,462	5,071

Total Division Funding*	60,533

*Includes ISS budget that funds work in codes R and T, and HRP budget that funds work in code T

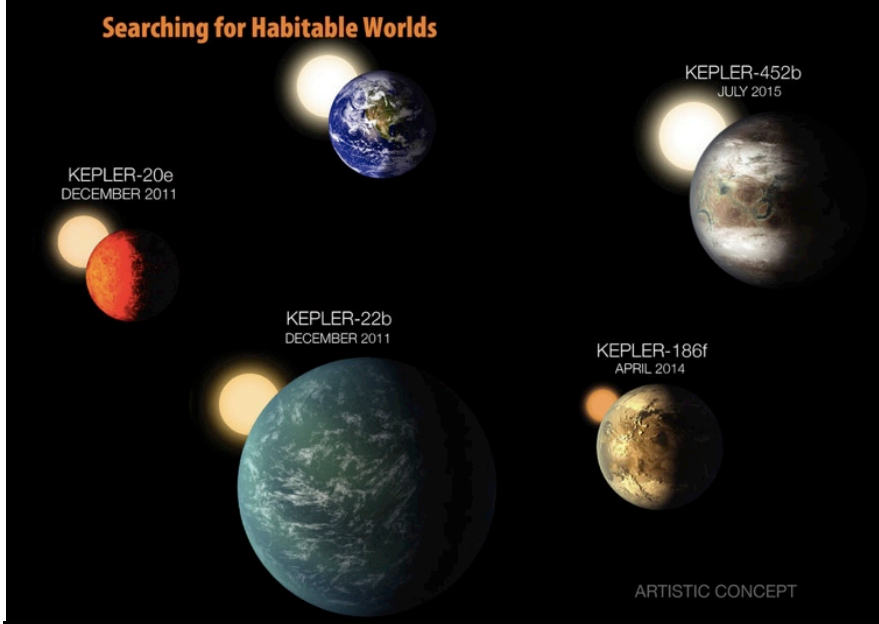
Looking Ahead to FY16

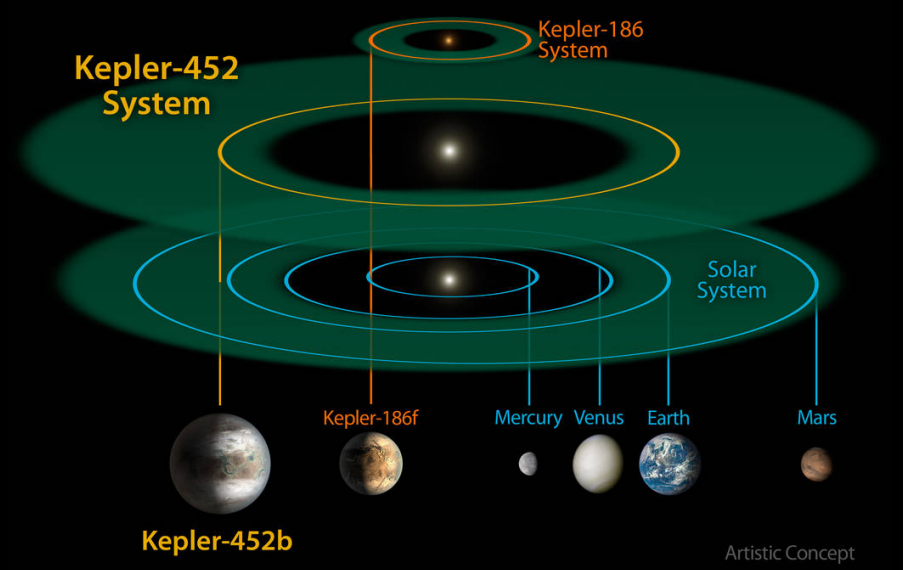
- Starting with SpaceX-8 (November 2015), Space Biosciences will deliver 11 experiments onboard the ISS in the next year.
- The GeneLab phase 2 data system will be coming online, and GeneLab Science Definition Team NRA will be released.
- Space Biology will start the "Gravity as a Continuum" research program.
- Human Health and Countermeasure engages in Artificial Gravity studies.
- Exploration Medicine will be preparing a new electrocardiograph and dry electrode harness for demonstration on ISS.
- Continue to support the development of new instruments for ISS: Life Sciences Glovebox, Rodent Centrifuge, Snap Freezer, Small Mass Measurement Device, Fruit Fly Lab Phase II System.
- Continue development of air, water and waste processing technologies for human missions beyond low Earth orbit.

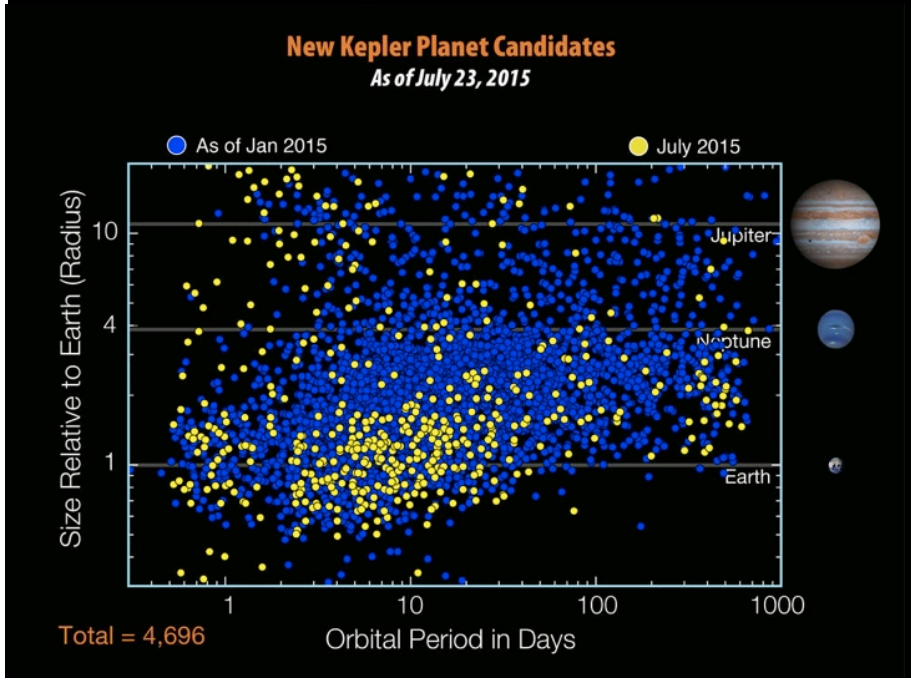
- American Society for Gravitational Space Research Meeting – November 2015 in Alexandria, VA
- Human Research Program Investigators Workshop - February 2016 in Galveston, TX
- 46th International Conference on Environmental Systems – July 2016 in Vienna, Austria

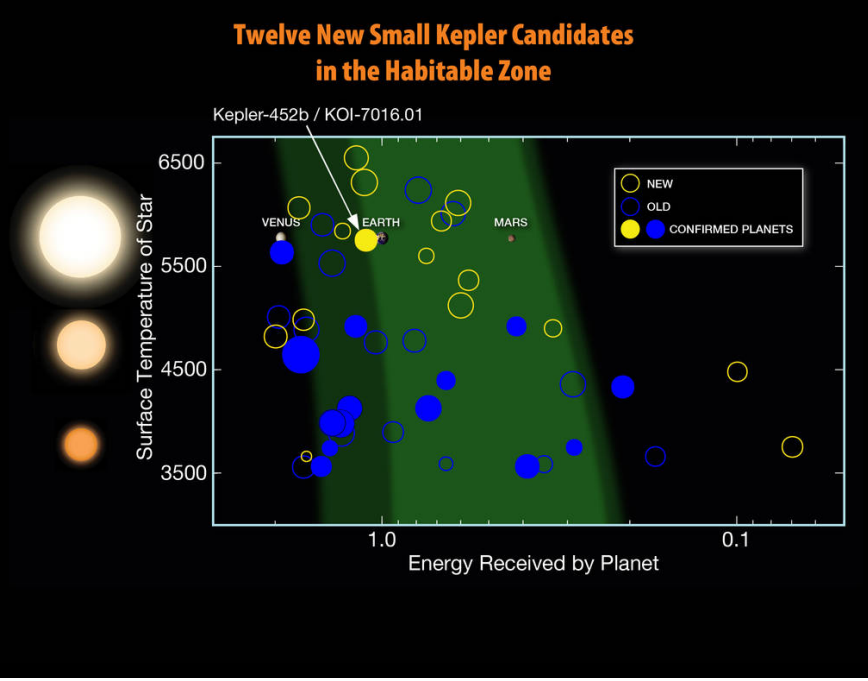
Space Science & Astrobiology

Kepler Discovers Bigger, Older Cousin to Earth









Failure of 2nd reaction wheel in May 2013 made it impossible to continue to view original Kepler field.

Team identified a new operating mode possible with 2 reaction wheels, solicited science ideas from community, wrote successful Senior Review proposal and ran successful engineering campaigns to demonstrate feasibility.

K2 was approved in June 2014 for operations in FY15 and FY16.

As of July 1, 19 peer reviewed publications and 20 papers are in press using K2 data.

Science topics include exoplanets, solar system objects, variable stars, brown dwarfs, red giants, and star spots.

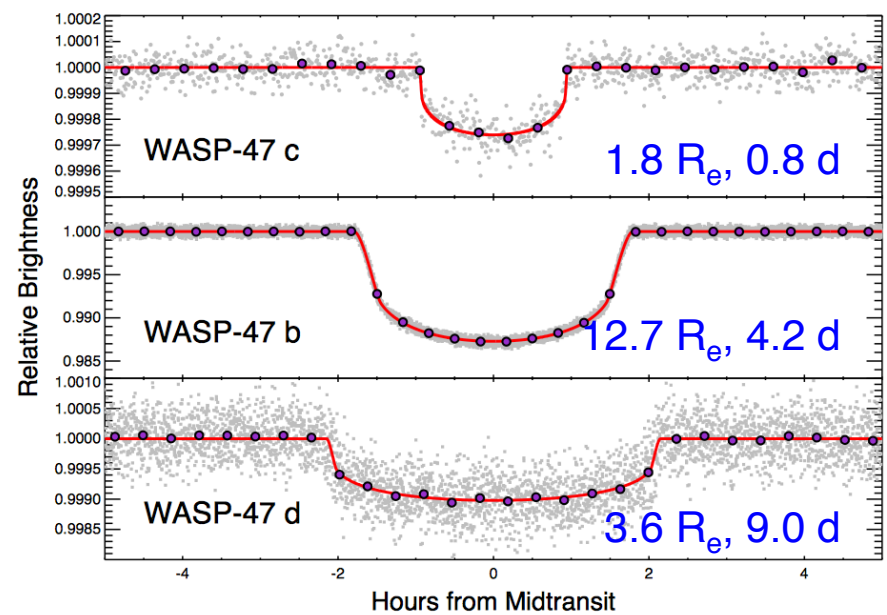
WASP-47: A HOT JUPITER SYSTEM WITH TWO ADDITIONAL PLANETS DISCOVERED BY K2

Juliette C. Becker[1,2], Andrew Vanderburg[2,3], Fred C. Adams[1,4], Saul A. Rappaport[5], Hans Martin Schwengeler[6]

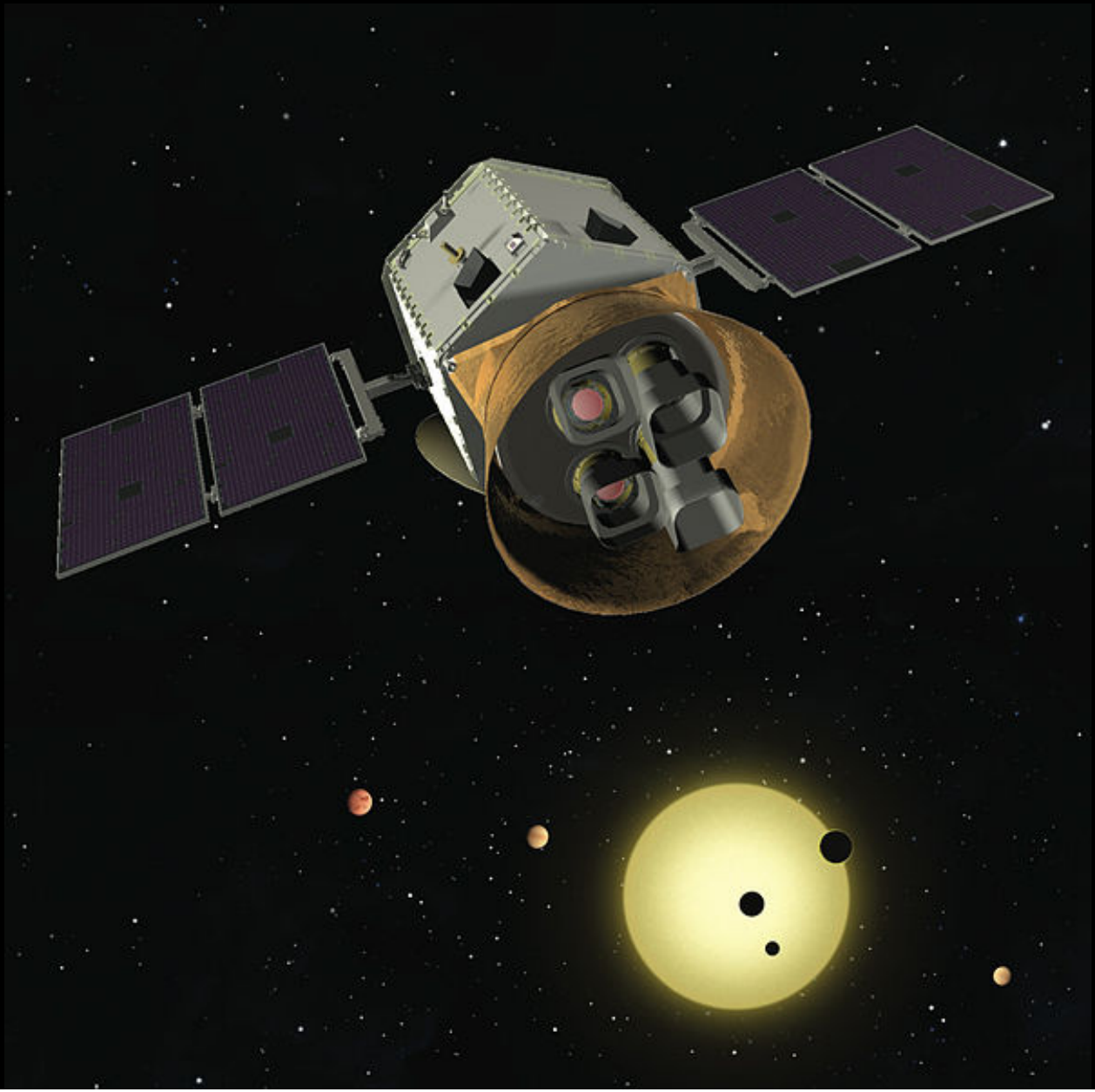
ABSTRACT

Using new data from the K2 mission, we show that WASP-47, a previously known hot Jupiter host, also hosts two additional transiting planets: a Neptune-sized outer planet and a super-Earth inner companion. We measure planetary properties from the K2 light curve and detect transit timing variations, confirming the planetary nature of the outer planet. We performed a large number of numerical simulations to study the dynamical stability of the system and to find the theoretically expected transit timing variations (TTVs). The theoretically predicted TTVs are in good agreement with those observed, and we use the TTVs to determine the masses of two planets, and place a limit on the third. The WASP-47 planetary system is important because companion planets can both be inferred by TTVs and are also detected directly through transit observations. The depth of the hot Jupiter's transits make ground-based TTV measurements possible, and the brightness of the host star makes it amenable for precise radial velocity measurements. The system serves as a Rosetta Stone for understanding TTVs as a planet detection technique.

Subject headings: planets and satellites: detection — planets and satellites: dynamical evolution and stability — techniques: photometric

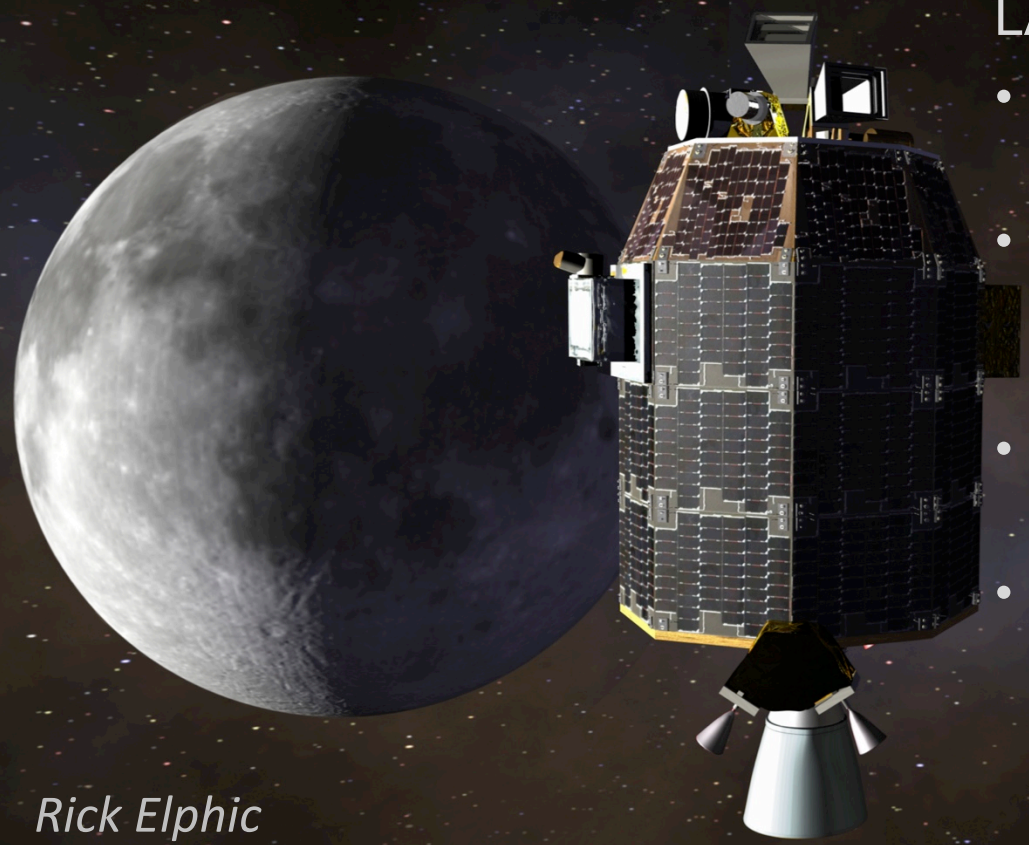


TESS: Transiting Exoplanet Survey Satellite



2017 launch

Lunar Atmosphere and Dust Environment Explorer (LADEE)



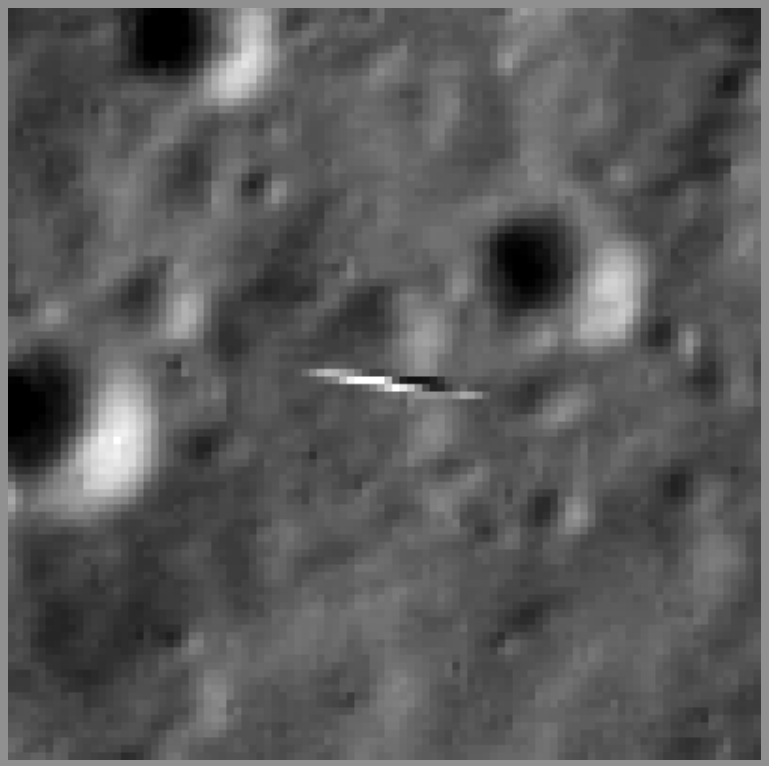
LADEE Mission:

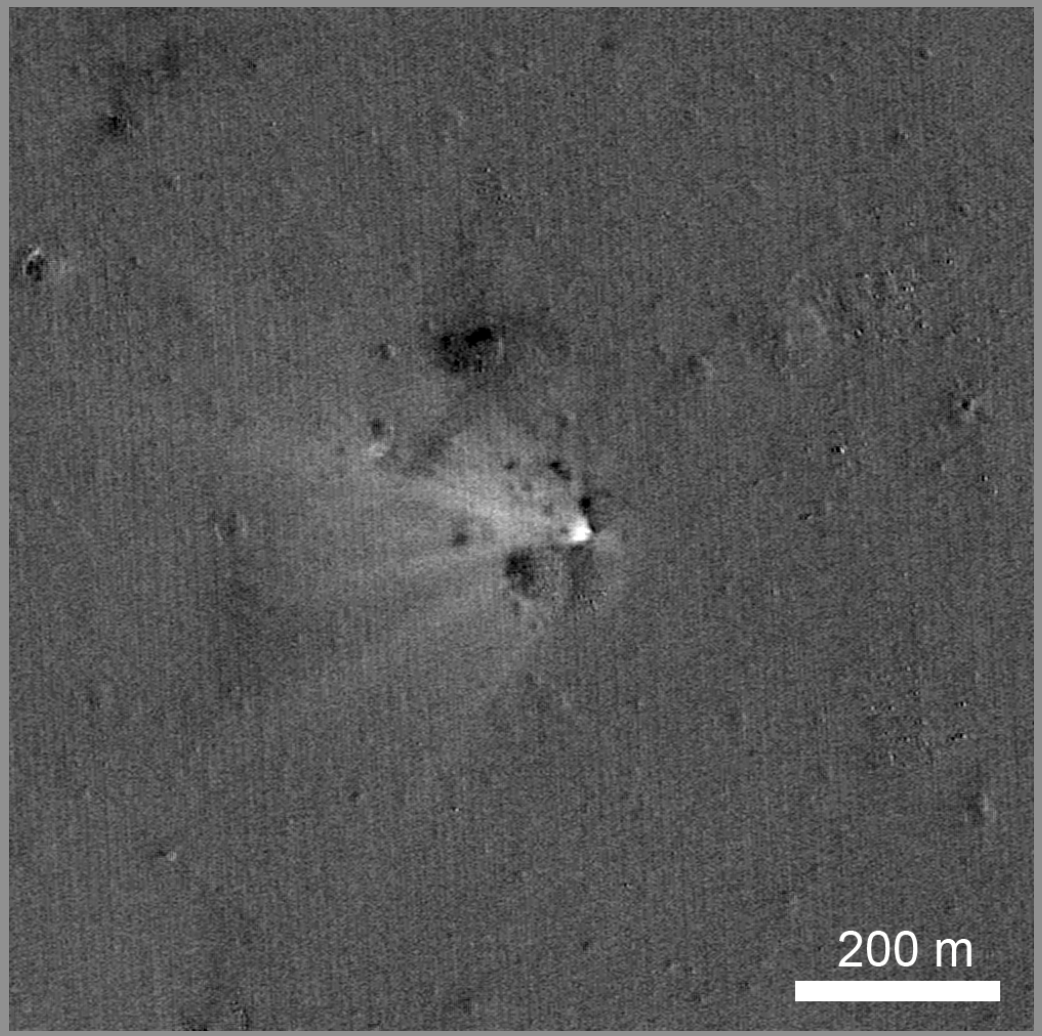
- First use of Ames' low cost spacecraft design
- First mission devoted to studying Moon's thin atmosphere, dust environment
- First deep-space laser communications demonstration
- Less than half of cost of a traditional NASA planetary mission

Rick Elphic
LADEE Project Scientist

NASA Ames Research Center
NASA Goddard Space Flight Center

LRO Observes LADEE





LRO image of LADEE impact site (2014.04.18) on far side of Moon

First LADEE Results

Geophysical Research Letters

RESEARCH LETTER
10.1002/2015GL064120

Key Points:
- Exospheric He is controlled by solar wind and by an endogenous radiogenic source
- Neon is present on the nightside at levels comparable to He
- Localized Ar enhancement is present at the western maria

Supporting Information:
- Text S1, Figures S1–S3, and Tables S1 and S2

Correspondence to:
M. Benna,
mehdi.benna@nasa.gov

Citation:
Benna, M., P. R. Mahaffy, J. S. Halekas, R. C. Elphic, and G. T. Delory (2015), Variability of helium, neon, and argon in the lunar exosphere as observed by the

Variability of helium, neon, and argon in the lunar exosphere as observed by the LADEE NMS instrument

M. Benna[1,2], P. R. Mahaffy[1], J. S. Halekas[3], R. C. Elphic[4], and G. T. Delory[4]

[1]NASA Goddard Space Flight Center, Greenbelt, Maryland, USA, [2]CSST, University of Maryland, Baltimore County, Baltimore, Maryland, USA, [3]Department of Physics and Astronomy, University of Iowa, Iowa City, Iowa, USA, [4]NASA Ames Research Center, Moffett Field, California, USA

Abstract The Neutral Mass Spectrometer (NMS) onboard the Lunar Atmosphere and Dust Environment Explorer (LADEE) provided the first global characterization of He and Ar along with the discovery of Ne in the lunar exosphere. The mapping of the equatorial distribution of these noble gases revealed new selenographic and temporal variations. Helium was found to be controlled by the supply of solar wind alpha particles and by the presence of an endogenous source that supplies the exosphere at a rate of 1.9×10^{23} atoms s^{-1}. Neon was detected over the nightside at levels comparable to He and was found to exhibit the spatial distribution of a surface accommodated noncondensable gas. The global measurements of NMS revealed the presence of a localized Ar enhancement that has never been identified before at the western maria. The variability resulting from this local enhancement is coupled to a more global but transient source.

LETTER

doi:10.1038/nature14479

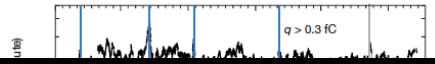
A permanent, asymmetric dust cloud around the Moon

M. Horányi[1,2,3], J. R. Szalay[1,2,3], S. Kempf[1,2,3], J. Schmidt[4], E. Grün[1,3,5], R. Srama[6] & Z. Sternovsky[1,3,7]

Interplanetary dust particles hit the surfaces of airless bodies in the Solar System, generating charged[1] and neutral[2] gas clouds, as well as secondary ejecta dust particles[3]. Gravitationally bound ejecta clouds that form dust exospheres were recognized by *in situ* dust instruments around the icy moons of Jupiter[4] and Saturn[5], but have hitherto not been observed near bodies with refractory regolith surfaces. High-altitude Apollo 15 and 17 observations of a 'horizon glow' indicated a putative population of high-density small dust particles near the lunar terminators[6,7], although later orbital observations[8,9] yielded upper limits on the abundance of such particles that were a factor of about 10^4 lower than that necessary to produce the Apollo results. Here we report observations of a permanent, asymmetric dust cloud around the Moon, caused by impacts of high-speed cometary dust particles on eccentric orbits, as opposed to particles of asteroidal origin following near-circular paths striking the Moon at lower speeds. The density of the lunar ejecta cloud increases during the annual meteor showers, especially the Geminids, because the lunar surface is exposed to the same stream of interplanetary dust particles. We expect all airless planetary objects to be immersed in similar tenuous clouds of dust.

yearly meteoroid showers generated sustained elevated levels of LDEX impact rates, especially those where the majority of the incoming meteoroids hit the lunar surface near the equatorial plane, greatly enhancing the probability of LADEE crossing their ejecta plumes. The Geminids generated the strongest enhancement in impact rates for ±1.5 days centred around 14 December 2013.

The distribution of the detected impact charges remained largely independent of altitude, and throughout the entire mission it closely followed a power law: $p_q(q) \propto q^{-(1+\alpha)}$ (Fig. 2). This alone indicates that the initial mass distribution of the ejecta particles is, to a good approximation, independent of their initial speed and angular distributions (Methods subsection 'Dust ejecta clouds'), and that the number of ejecta particles generated on the surface per unit time with mass greater than m follows a power law: $N^+(>m) \propto m^{-\alpha}$. The LDEX measurements indicate $\alpha \approx 0.9$, surprisingly close to the value $\alpha_G = 0.8$ suggested by the Galileo mission at the icy moons of Jupiter[12]

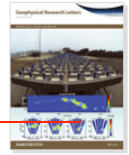


Geophysical Research Letters
AN AGU JOURNAL

Research Letter

The search for electrostatically lofted grains above the Moon with the Lunar Dust Experiment

Jamey R. Szalay, Mihály Horányi



Volume 42, Issue 13
16 July 2015
Pages 5141–5146

First published: 14 July 2015 Full publication history

DOI: 10.1002/2015GL064324 View/save citation

Cited by: 0 articles Check for new citations

Funding Information

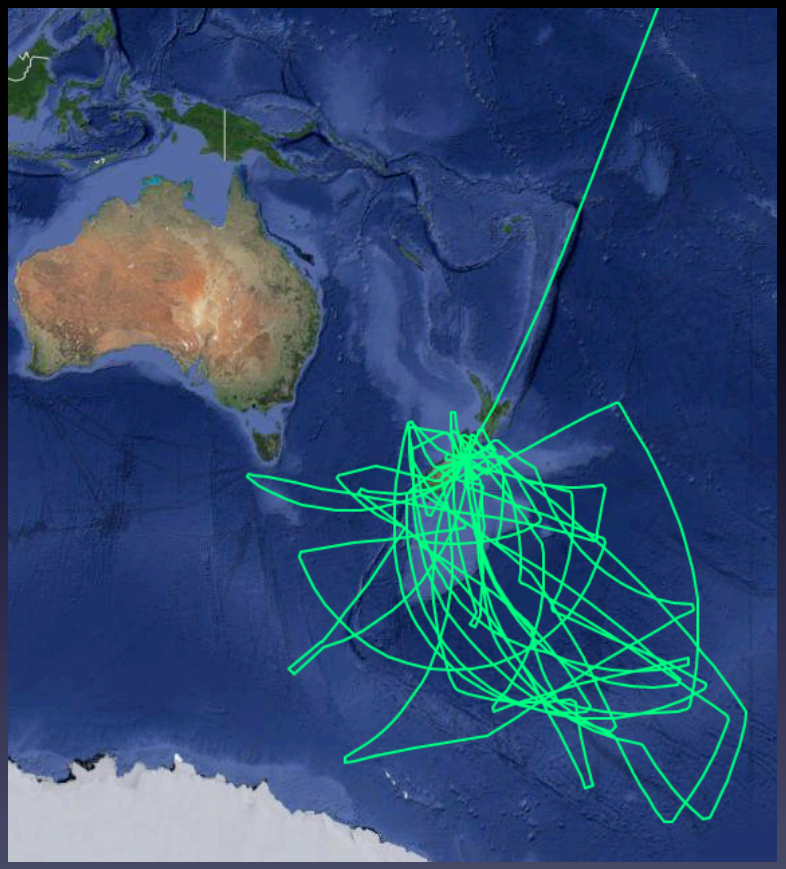
Abstract

The Lunar Dust Experiment (LDEX) on board the Lunar Atmosphere and Dust Environment Explorer mission was designed to make in situ dust measurements while orbiting the Moon. Particles with radii $a >\sim 0.3\mu m$ were detected as single impacts. LDEX was also capable of measuring the collective signal generated from dust impacts with sizes below its single-particle detection threshold. A putative population of electrostatically lofted grains above the lunar terminator with radii of approximately 0.1 μm has been suggested to exist since the Apollo era. LDEX performed the first search with an in situ dust detector for such a population. Here we present the results of the LDEX observations taken over the lunar terminator and report that within LDEX's detection limits, we found no evidence of electrostatically lofted grains in the altitude range of 3–250 km above the lunar terminator.

2015 SOFIA Southern Hemisphere Deployment
June 12 – July 24, 2015

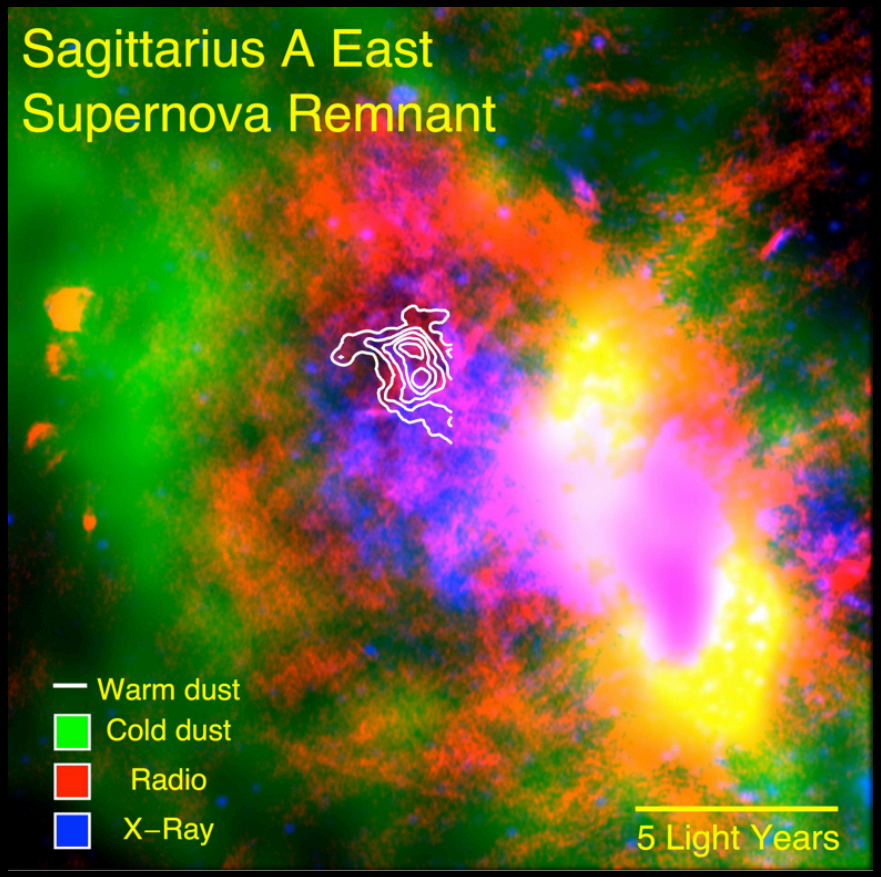
Southern Hemisphere Deployment

- Six weeks duration, successfully completed 14 of 18 science flights
- US and German ambassadors visited SOFIA in NZ on July 17th
- Four science instruments – 3 US, 1 German (*the first time any SIs have been swapped out on the aircraft while away from Palmdale*)
  - ***FORCAST Mid-IR Camera and Grism Spectrometer***
    - 10 Flights (7 completed, 3 were cancelled: 1 due to weather & 2 due to mechanical problems)
    - 11 GI programs with 37 targets
    - 1 GTO program with 5 targets
    - 85 science hours
  - ***FLIPO combined visible and near-IR photometer/cameras***
    - 2 flights for Pluto occultation (both completed, including practice flight)
    - 9 science hours
  - ***GREAT heterodyne sub-mm spectrometer***
    - 6 flights (5 completed, 1 cancelled due to weather, 1 flight return-to-base due to Telescope power failure)
    - 11 GI programs with 15 targets
    - 1 GTO program with 17 targets
    - 51 science hours



One of the deployment highlights was the nearly perfect execution of Pluto occultation observation!

SOFIA Finds Missing Link Between Supernovae & Planet Formation



Lau et al. (2015), Science 348, p413.

- FORCAST observations
- SN explosion 10,000y ago produced enough dust to form 7000 Earths
- Answers question of whether dust particles could survive inward ‘rebound’ shock wave generated when initial shock (from SN explosion) collides with surrounding ISM
- Dust endures far longer than expected
- Suggests SNe may be dominant dust-production mechanism in dense environment of galaxies in early universe.

New! ‘Uhura’ Flies Aboard SOFIA

Locals cheer successful mission to Pluto
Due to overcrowding, audience members listen to Director of Science Michael D. Bicay speak in a separate room during the New Horizons Pluto flyby event held at NASA Ames Research Center on July 14, 2015. Photo by Michelle Le

Locals cheer successful mission to Pluto
With Planetary Scientist David Morrison to his right, Director of Science Michael D. Bicay speaks to a crowd gathered for the New Horizons Pluto flyby event held at NASA Ames Research Center on July 14, 2015. Photo by Michelle Le

Locals cheer successful mission to Pluto
Planetary Scientist Chris McKay speaks to a crowd gathered for the New Horizons Pluto flyby event held at NASA Ames Research Center on July 14, 2015. Photo by Michelle Le

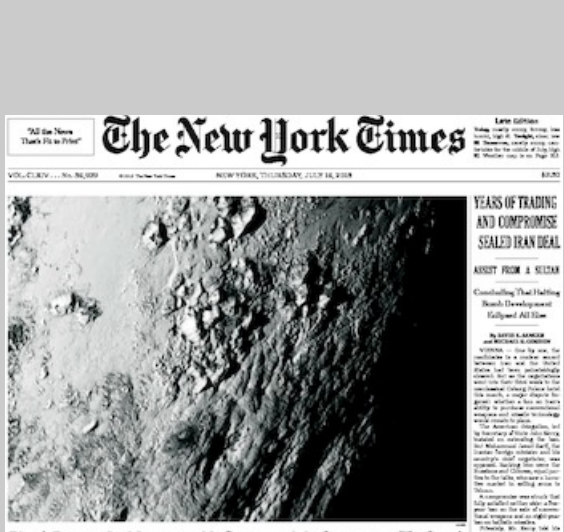
I ♡ PLUTO

New Horizons is the first …..

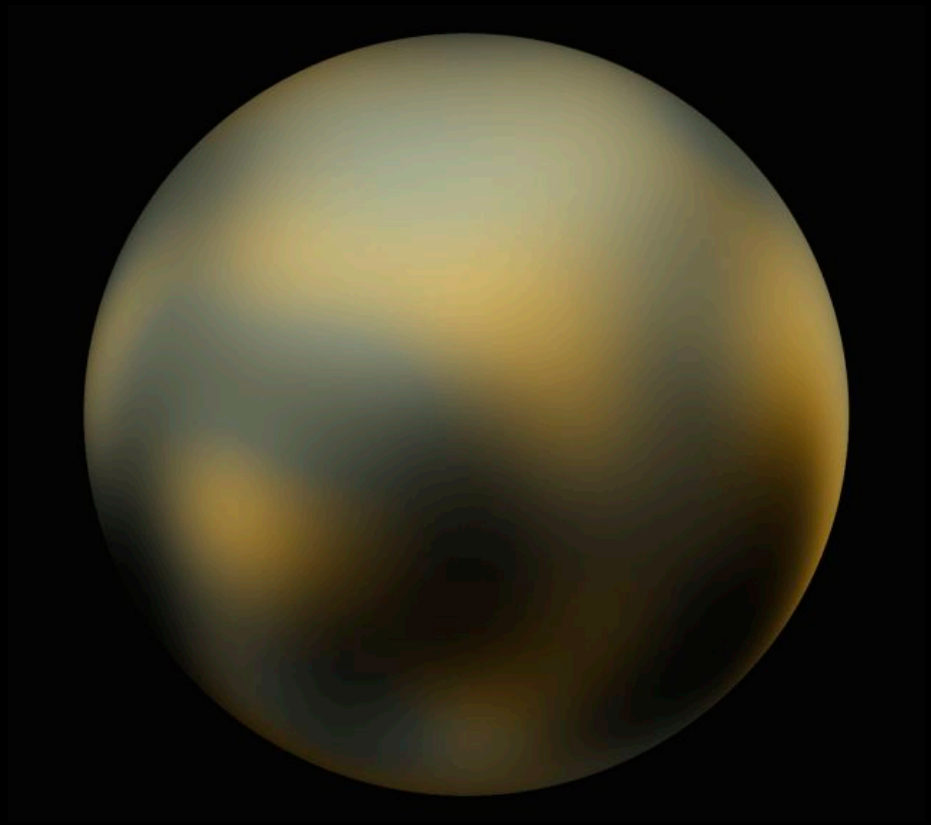
- Mission to Pluto
- Mission since Voyagers (1977 launch) to visit an unexplored planet
- Mission to a Double Planet (Pluto/ Charon)
- Mission to an Ice Dwarf Planet
- Mission to study Kuiper Belt Objects
- PI-led mission to the outer planets
- Planetary mission to carry a student experiment
- NASA "New Frontiers" mission
- Outer planets mission led by JHU/APL and SwRI

Alamy E78REG

New Horizons Pluto Flyby



Best Image of Pluto – Before July



Hubble Space Telescope

Newest Image of Pluto

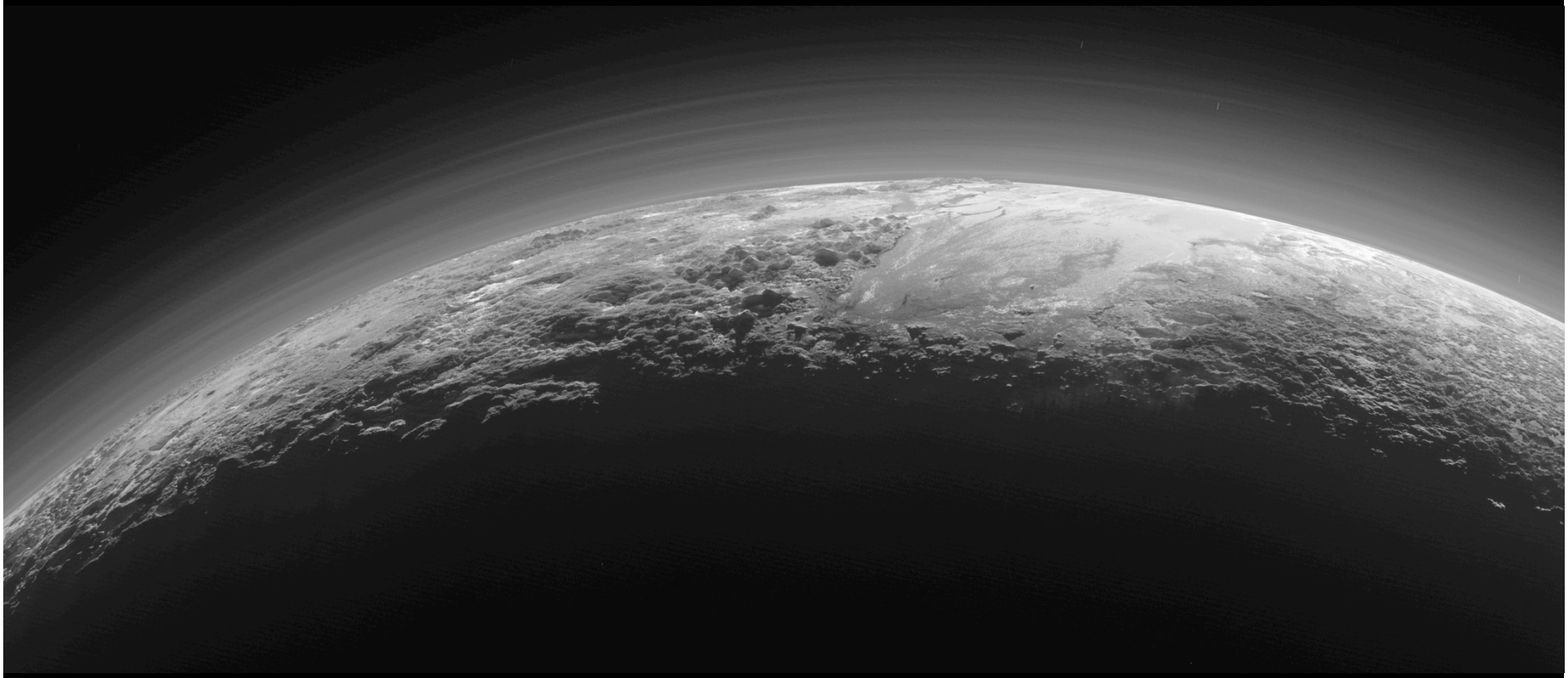


Image Released Earlier Today

New Horizons

Resource Prospector

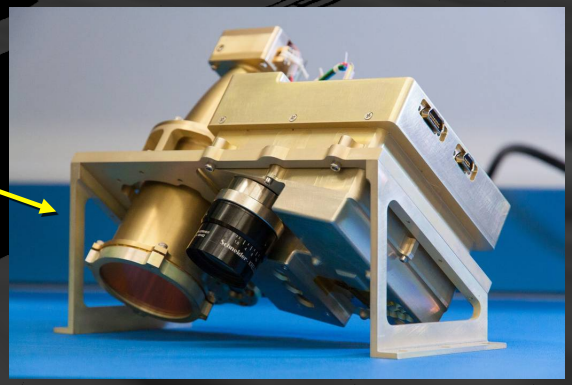
A lunar volatiles prospecting and ISRU demonstration mission

NSS on Rover

Code S Involvement:

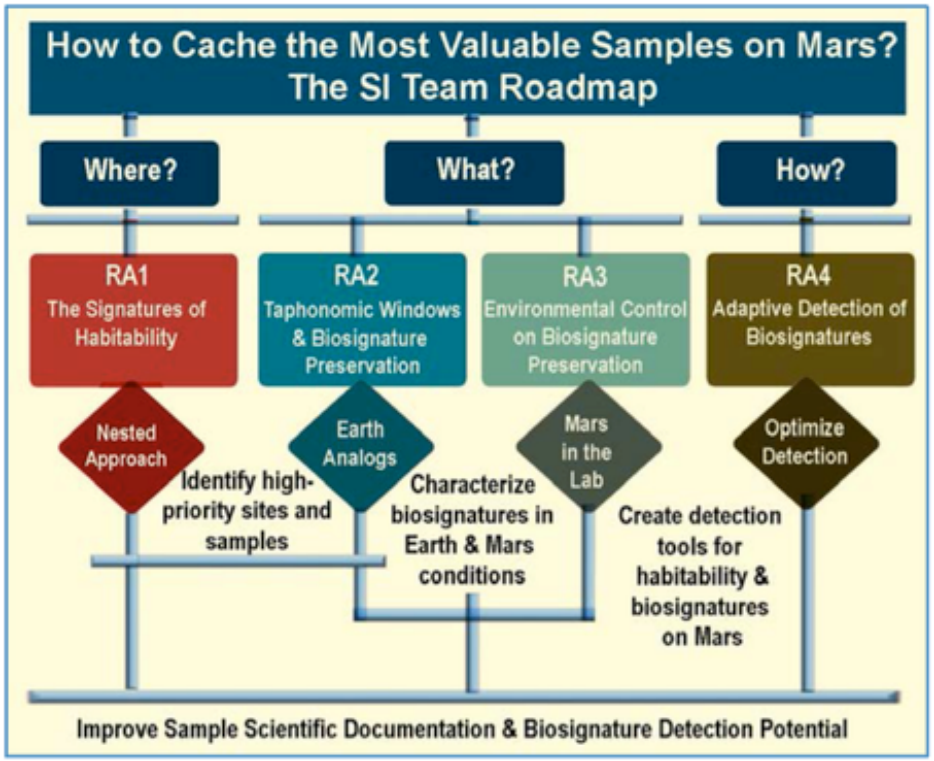
- Rick Elphic – Neutron Spectrometer System PI; RP Science Team
- Anthony Colaprete – NIR Volatiles Spectrometer System PI, Project Scientist
- Ted Roush – NIRVSS Lead Instrument Scientist
- Kim Ennico – NIRVSS Instrument Scientist
- Carol Stoker – RP Science Team
- Jennifer Heldmann – RP Science Team, Surface Planning Lead
- Ross Beyer – RP Science Team
- Amanda Cook – NIRVSS Science Team; I&T Lead

NIRVSS Observation Bracket Assembly



The Evolution of Prebiotic Chemical Complexity and the Organic Inventory of Protoplanetary Disks and Primordial Planets

Laboratory, computational and observational studies aimed at understanding the chemistry of protoplanetary disks from beginning up to the formation of primordial planets.



Changing Planetary Environments & the Fingerprints of Life
(Natalie Cabrol, PI)

SERVI SOLAR SYSTEM EXPLORATION RESEARCH VIRTUAL INSTITUTE

NASA

FINESSE: Field Investigations to Enable Solar System Science and Exploration (Jennifer Heldmann, PI)

(1) Understand the effects of volcanism and impacts as dominant planetary processes on the Moon, near-Earth asteroids, and Phobos/ Deimos. (2) Understand which exploration ConOps and capabilities enable and enhance science return.

BASALT RESEARCH PROJECT

BASALT: Biologic Analog Science Associated with Lava Terrains (Darlene Lim, PI)

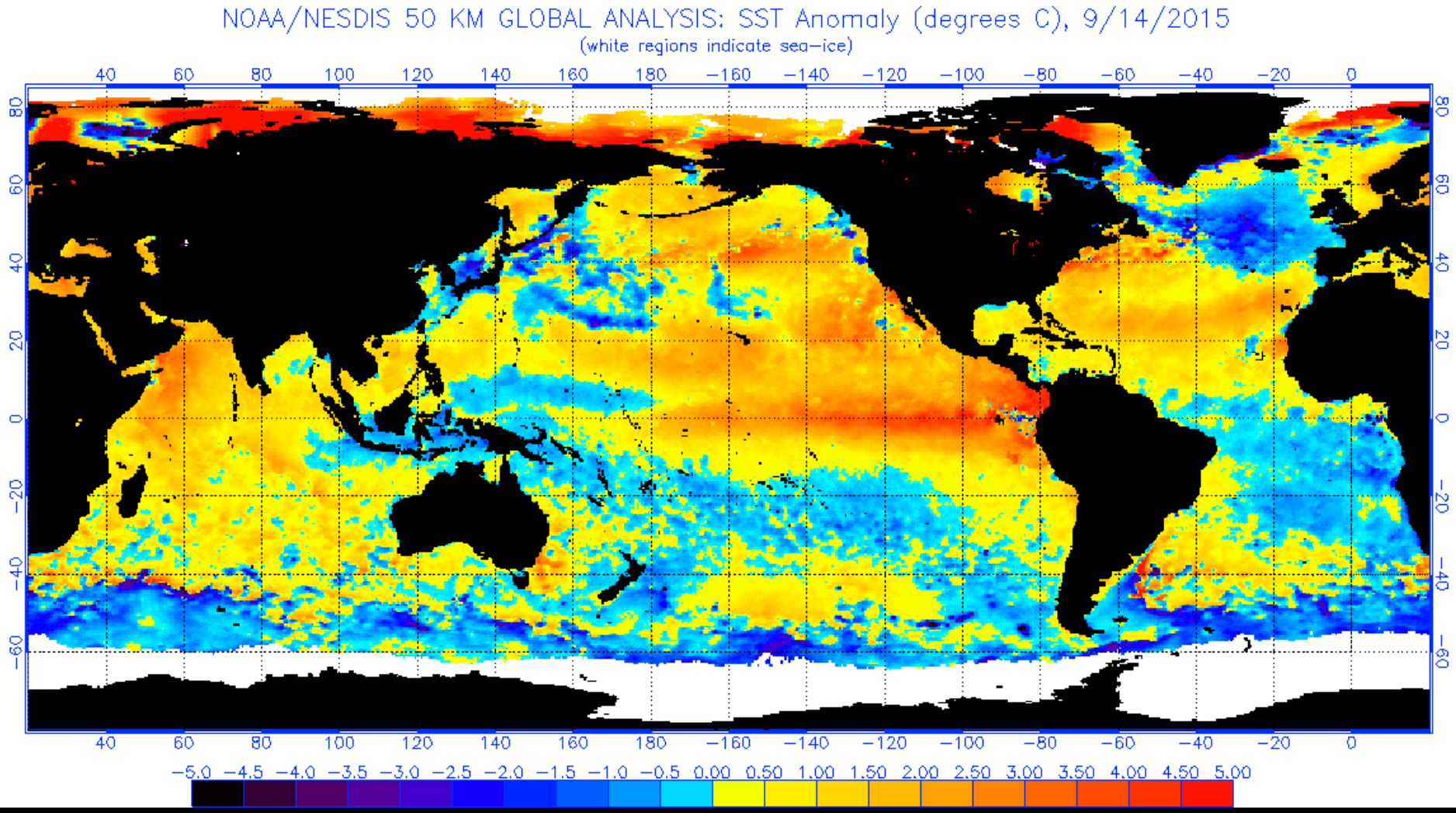
Focus on science-driven exploration in planetary and terrestrial-analog environments & conditions. Builds upon a decade of work at the Pavilion Lake Research project.

Third Annual SS Jamboree:
(March 3, 2015)

- 48 submitted abstracts
- Two 1 hour lectures
- Twelve 20 minute talks
- 93 attendees
- Abstract booklet available on the Division website

  (spacescience.arc.nasa.gov)

Fourth Annual SS Jamboree
March 8, 2016
Save the date!!!


NOAA/NESDIS 50 KM GLOBAL ANALYSIS: SST Anomaly (degrees C), 9/14/2015
(white regions indicate sea-ice)
40 60 80 100 120 140 160 180 −160 −140 −120 −100 −80 −60 −40 −20 0
80 60 40 20 0 −20 −40 −60
−5.0 −4.5 −4.0 −3.5 −3.0 −2.5 −2.0 −1.5 −1.0 −0.5 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00

Thanks to R. Steve Hipskind!

Partnerships

National Oceanic and Atmospheric Administration
Joint NASA/NOAA Marginal Ice Zone Observations and Processes Experiment (MIZOPEX)

Desert Research Institute
Unmanned Aircraft Systems for Fire Operations and Research

US Geological Survey
- *Innovation Center for Earth Sciences*
- *Development of Soil Bulk Density Measurement Technology*

USDA Forest Service
Collaborative Research and Applications in Airborne and Space-borne Platform Technology, Communications, Data Processing, Sensor Development, Education/ Training & Demonstration & Technology Transfer in Support of Disaster Response

USDA Agriculture Research Service
Remotely Sense & Monitor Environmental Characteristics that Affect Weed Growth in the California Delta

Amazon, Inc.
Prototyping the Use of the Amazon Cloud Platform for the NASA Earth Exchange (NEX) Geosciences Community

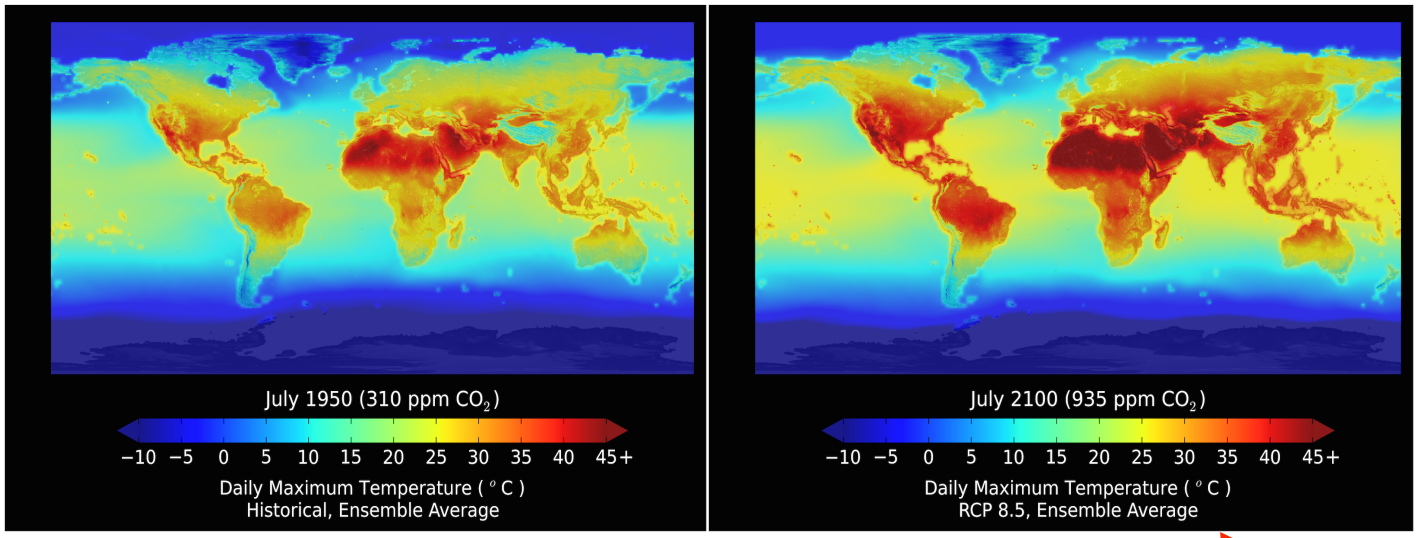
USDA, US Forest Service, Nevada System of Higher Education, and Others
The Great Basin Research and Management Partnership

US National Geospatial Intelligence Agency
Water Security--Remote Sensing of Water Quality Support

California Department of Forestry and Fire Protection (CalFire)
Wildfire Monitoring and Disaster Response Tools, Techniques, and Systems

UAV Collaborative
Development of Unmanned Aerial Systems for Applications in the National Airspace System

NEX Supports National Climate Assessments



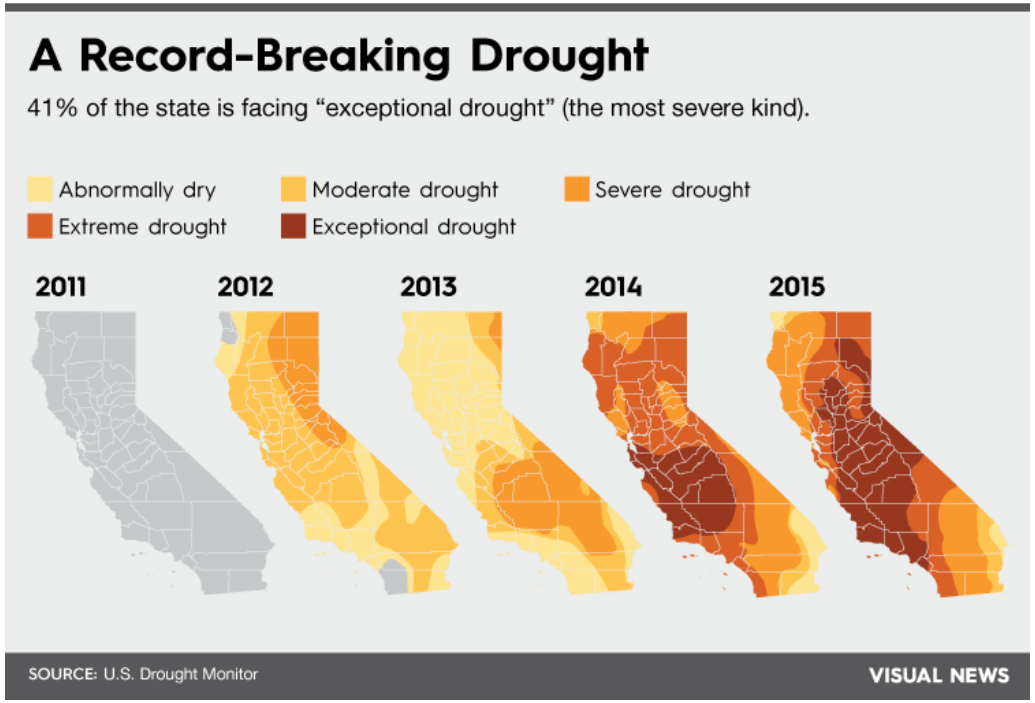
NEX
NASA Earth Exchange

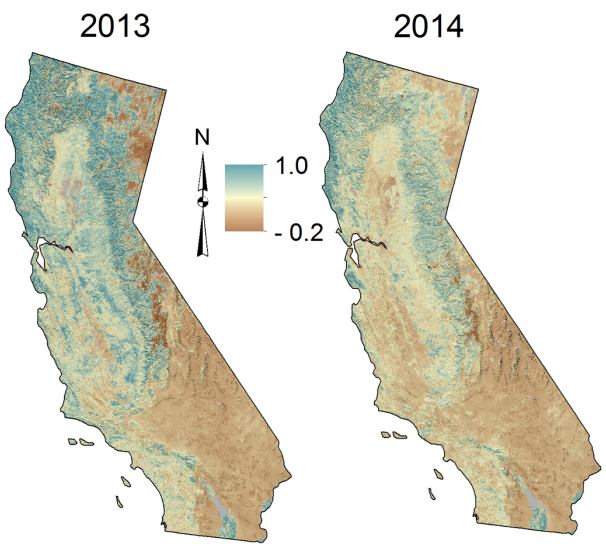
POCs:
Rama Nemani (Code TN)
Jennifer Dungan (Code SGE)
Piyush Mehrotra (Code TN)

- **Global daily temperature and precipitation scenarios were computed using NEX from 1950-2100 at 0.25 degree spatial resolution (~25km x 25km)**
- **21 coupled General Circulation Models (global climate models) were downscaled using the Bias Correction and Spatial Disaggregation (BCSD) approach** (Wood et al., 2002; Thrasher et al. 2012)
- **2 Representative Concentration Pathways (RCPs) - RCP 4.5 and RCP 8.5 were used**

Worst Case

- **The data were described in press releases by the White House and by NASA on June 9**
- **Highlighted in the White House Progress Report in July highlighting "Federal Actions Addressing the Recommendations of the State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience"**





Vegetation Index from Suomi/VIIRS Data

Los Angeles Times

Sierra Nevada snowpack is much worse than thought: a 500-year low

Gov. Jerry Brown announces mandatory drought restrictions while standing in a snowless Sierra Nevada meadow on April 1. (Rich Pedroncelli / Associated Press)

By MONTE MORIN
contact the reporter

SEPTEMBER 14, 2015, 8:22 PM

When California Gov. Jerry Brown stood in a snowless Sierra Nevada meadow on April 1 and ordered unprecedented drought restrictions, it was the first time in 75 years that the area had lacked any sign of spring snow.

Now researchers say this year's record-low snowpack may be far more historic — and ominous — than previously realized.

In a paper published Monday in the journal Nature Climate Change, scientists estimate that the amount of snow in the Sierra Nevada was the lowest in more than 500 years.

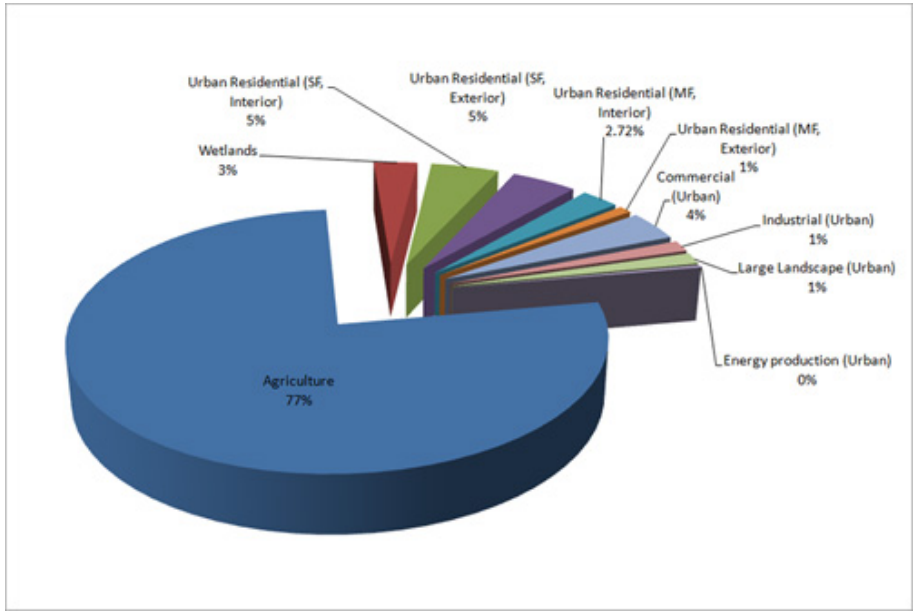
The New York Times

SCIENCE

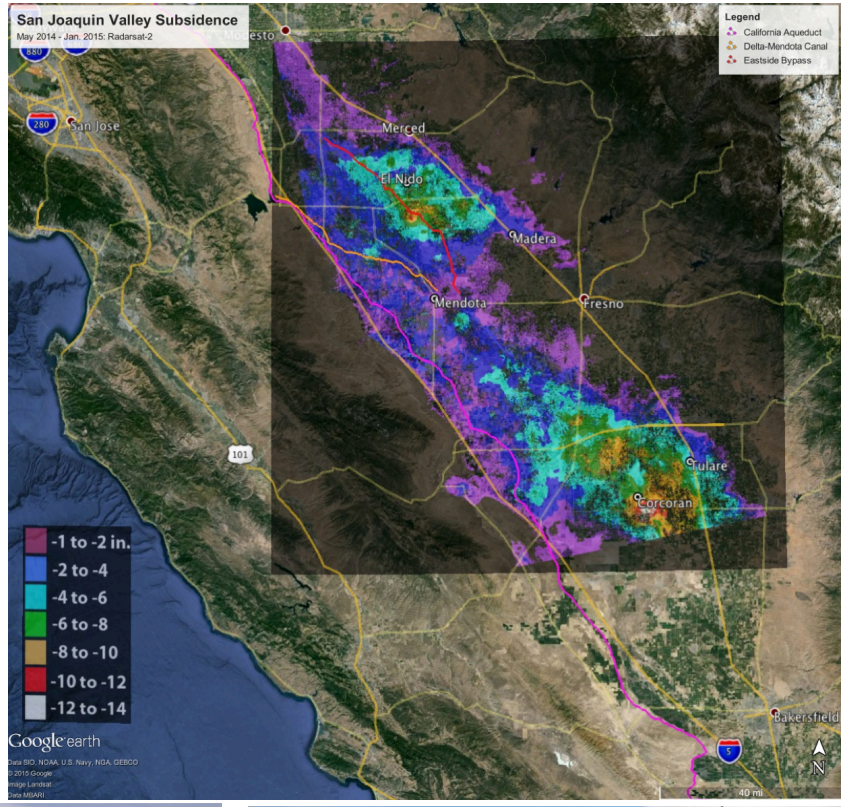
Study Finds Snowpack in California's Sierra Nevada to Be Lowest in 500 Years

By NICHOLAS ST. FLEUR SEPT. 14, 2015

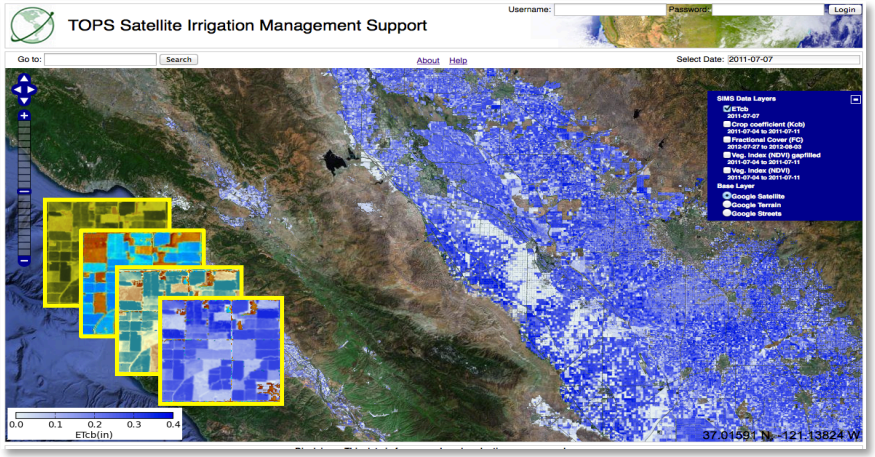
Freshwater Use in California



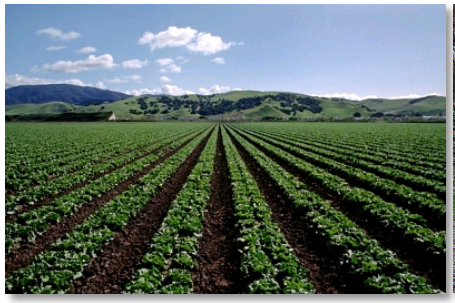
Ground Subsidence in California



Mapping Crop Water Requirements to Assist Growers in Optimizing Irrigation



NASA SIMS web and mobile data services puts irrigation demand across 8 million acres of farm land directly into the hands of farmers and water managers



California is the largest producer of food in the U.S. ($46.4B/year) yet has less than 4% of the farms in the U.S.

Students work hand in hand with growers to validate the system and quantify benefits

NASA satellite data + ground networks + supercomputer + scientific understanding = improved agricultural water use efficiency (“crop per drop”)

Mapping Idled Cropland from Space

From Landsat, Terra and Aqua satellite data, NASA and USDA estimate that **~15% of the 7 million acres of irrigated farmland in California's Central Valley have been fallow during all of 2015**. <u>This represents a 3x increase in idle agricultural acreage since 2011</u>, which was the last calendar year following a winter with average or above average precipitation across the state.

NASA Deputy Administrator Dava Newman and the USDA Deputy Secretary Krysta Harden visited Ames on July 16 for a special Interagency Agreement signing event covered by Ames PAO. Forrest Melton (Code SGE) highlighted this USDA-relevant work displayed on the NAS Hyperwall.

Monitoring Invasive Plants

Using Satellite Remote Sensing to Map Changes in Wetland Plant Cover in the Sacramento-San Joaquin River Delta of California

Christopher Potter, Senior Research Scientist, National Aeronautics and Space Administration—Ames Research Center

Delta waterways (foreground) and native wetlands (background) infested by Water Hyacinth, surrounding abandoned farming equipment in 2014. / Chris Potter

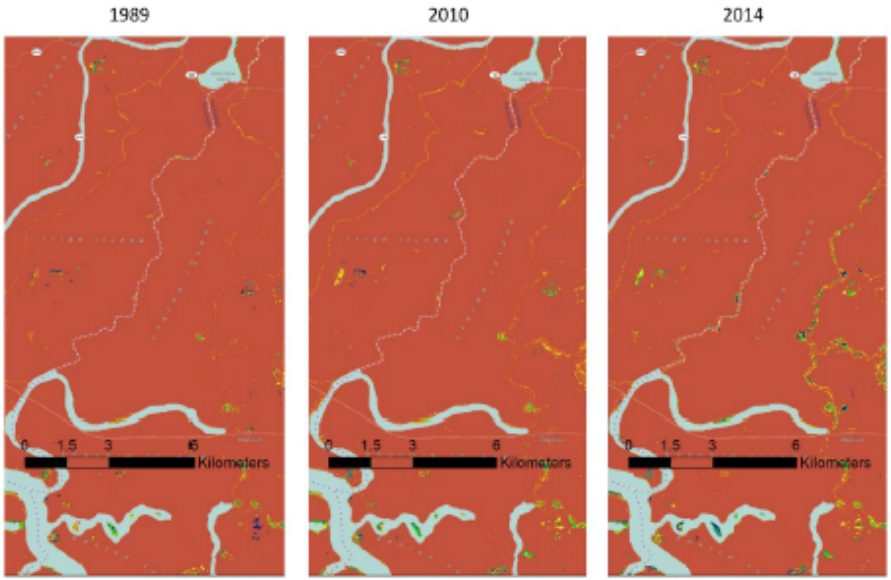


Figure 2. Landsat image products from 1989 to 2014 for the Delta area around Staten Island. Color legend: Brown – Cropland, Yellow/Green – Low biomass wetlands, Dark Blue – High biomass wetlands, Light Blue – Open waterways. / Chris Potter

Human Impacts to Coastal Ecosystems in Puerto Rico

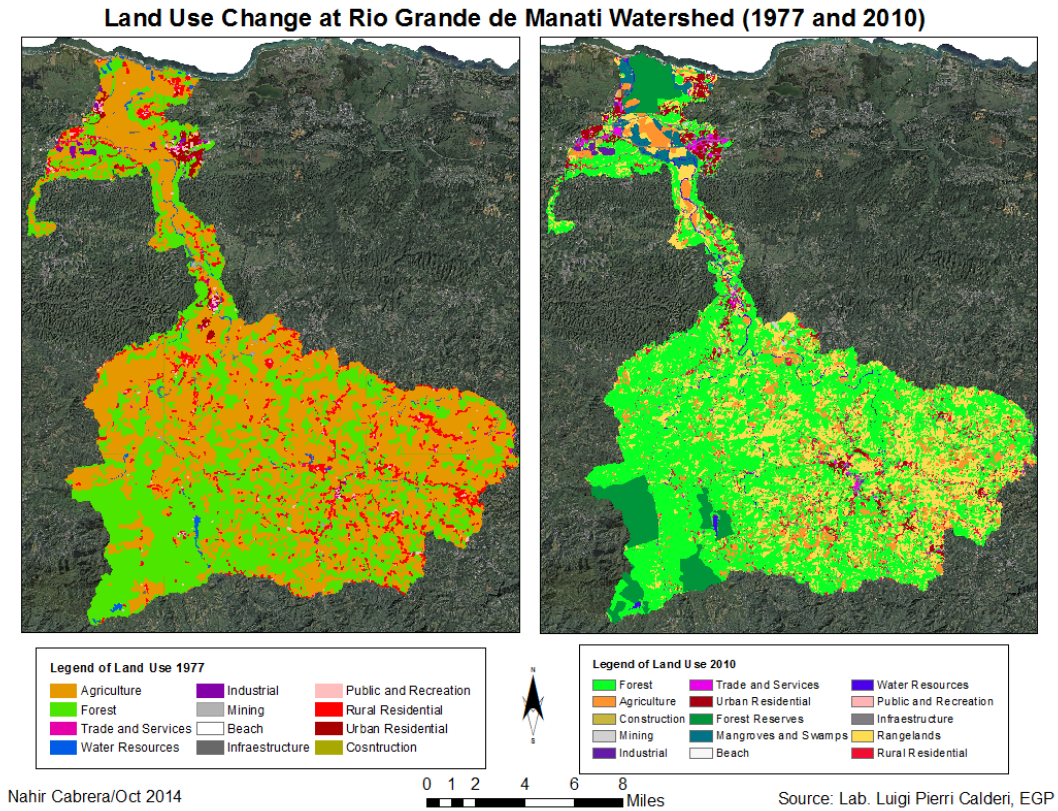
Remote sensing, hydrologic, ecologic & socio-economic assessment with policy implications

Project Lead: Dr. Juan L. Torres-Perez

Interdisciplinary study conducted using integration of remote sensing, field work and hydrological modeling techniques to infer how anthropogenic activities related to land cover/land use changes have modified riverine inputs into the coastal and marine ecosystems (CMEs) associated with two priority watersheds in the north and south coasts of Puerto Rico.

Use remote sensing capabilities (MODIS from terra & Aqua) with diverse imagery to define CMEs distribution and changes over time (1970-2014).

The study includes the characterization of CMEs (coral reefs, seagrasses, mangroves and beaches), ecological and hydrological modeling & the use of economic valuation methods to assess degradation and stakeholders opinion of the CMEs associated with the selected watersheds.



Above: These sites allow the assessment of contrasting scenarios of anthropogenic impacts and to infer the corresponding effects on selected CMEs associated with these two important watersheds of the Island. These areas have differed for decades in their exposure to human-related activities such as urban expansion, agriculture, tourism, increase of terrigenous sediments in beaches and benthic components, and eutrophication.

Coastal Ecosystems and Water Quality Research: Bringing the Coastal Ocean into Finer Focus

Accomplishments TODAY:

- Coastal water quality validation from aircraft
- Airborne remote sensing of coral reefs
- In-water field spectroscopy of coral reefs

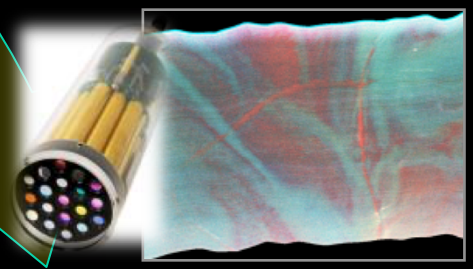
Year 1 (2002): … humble beginnings with DDF funds procured a spectroradiometer and underwater housing…

Collecting spectra of elkhorn coral with spectroradiometer, Andros Is., with Navy AUTEC and RSMAS.

Year 2004, 2005: … Airborne missions of coral reefs of FL Keys, Puerto Rico, and USVI

2004 AVIRIS hyperspectral image (ER-2) with 2005 AVIRIS flight lines (Twin Otter) of La Parguera, PR patch reefs.

Years 2011, 2013: … First flights of the ARC C-AIR radiometers over Monterey Bay capturing algal bloom events



COAST novel instrument suite and flight plan, red tide with red streaks from ship tracks, and OCEANIA C-AIR focused radiometers for satellite validation of water quality (algal blooms, red tides, river plumes, oil spills).

Tomorrow: … Rapid response distributed sensor network linking hyperspectral imager and radiometers on high altitude aircraft to in-water and satellites instruments - bringing the coastal ocean and ecosystems into finer focus with a path to orbit.

Airborne Sciences

Airborne Science Office
(Matt Fladeland)

- Requirements Analysis
- Advanced Planning: 5-year plan, ESTO coordination
- Program Development – (e.g., OIB planning)
- Independent Program reviews

Earth Science Projects Office (Michael Craig)

- Field Campaign management
- Flight request management
- Lessons learned

Payloads and Instrumentation
(UARC & ARC-CREST/NSERC)

- Engineering support and mission planning
- Next generation airborne sensor network (EIPs, NASDAT, Link Module)
- Calibration facility (NIST traceable) – funded by EOS Program

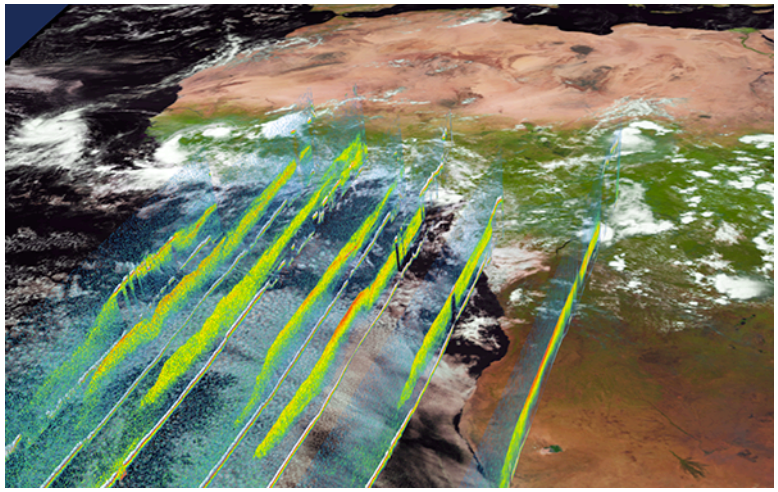
New Technology

- Mission Tools Suite
- Small, low-cost UAVs
- Onboard networking and SATCOM (130+ Iridium modems and INMARSAT)
- Ground based radar

ORACLES selected November 2014!

Principal Investigator: Jens Redemann
Project Manager: Bernadette Luna

- ObseRvations of Aerosols above CLouds and their intEractionS
- 5-year EV-2 Suborbital Program, $30M
- Involves 5 NASA Centers + 8 universities



Composite CALIPSO lidar backscatter curtains show pervasive transport of Biomass Burning aerosol transport during the first week of September 2008 as well as the underlying cloud tops.

Science Goal: to understand the processes that control the radiation balance and cloud properties over the South East Atlantic, which impact the regional and global distribution of surface temperatures and precipitation.

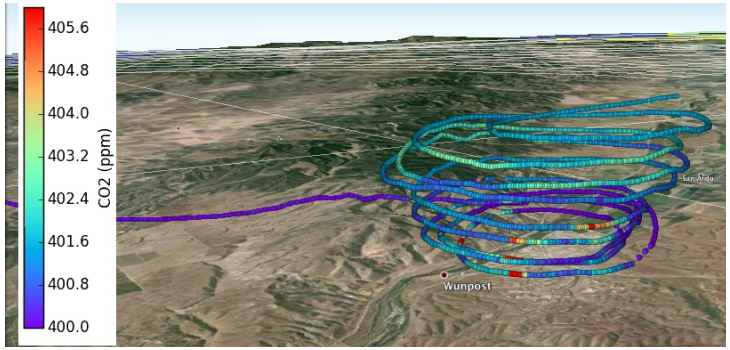
- Southern Africa produces 1/3 of Earth's Biomass Burning (BB) aerosol particles
- ORACLES will study climate impacts of BB
- Particles lofted into mid-troposphere transported over SE Atlantic, one of 3 permanent subtropical stratocumulus cloud decks ion world
- ORACLES will study aerosol-induced solar heating & microphysical effects

AJAX: Alpha Jet Atmospheric Experiments

Science and Project Lead: Laura Iraci

- OCO-2, GOSAT & other satellites measure GHG from space.
- AJAX validates remote sensing measurements by sampling in a column below satellites
  - *Railroad Valley, NV: more than 50 profiles to date coincident with GOSAT satellite; several coincident with OCO-2. Can measure over land and water to aid in satellite validation over variety of surfaces/reflectances*
  - *AJAX also ties TCCON up-looking spectrometer at NASA-AFRC to international standard*
  - *Collaboration with GSFC will bring a new formaldehyde instrument that can be used for validation of AURA/OMI data and future TEMPO mission*

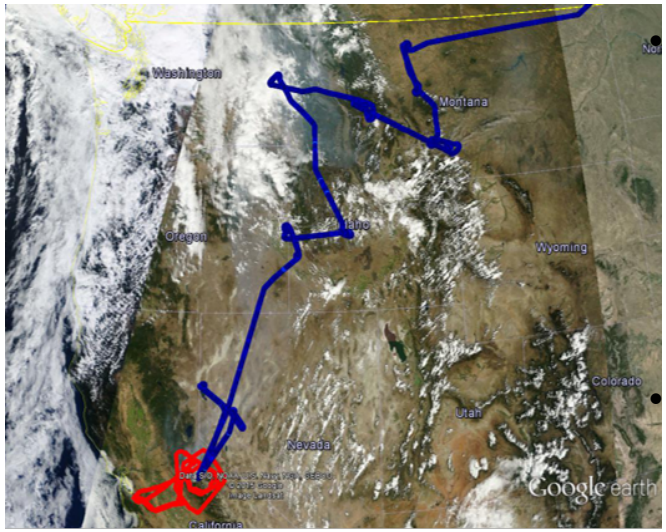
- Measuring GHGs and calculating fluxes from urban, fossil fuel, and other sources allows "top down" comparison to emissions inventories produced by governments and industrial sectors
  - *Collaborating with Stanford/Carnegie Inst. to optimize sampling pattern and minimize uncertainties in calculated fluxes.*
  - *AJAX data suggests California methane inventories are too low for livestock in particular (Johnson et al. 2014, 2015).*



- Have supported NOAA, EPA and local air quality agencies by assessing trans-Pacific transport of ozone

Greenhouse Gases and Trace Constituents from California Yosemite Rim Wildfire

Dr. Emma Yates and Dr. Hanwant Singh

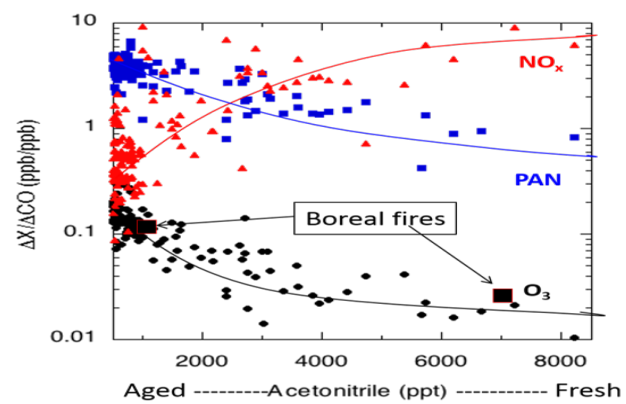


AJAX and **SEAC^{4}RS** flight paths downwind of the Rim fire and location of the smoke plume as viewed by Terra/MODIS (corrected reflectance, true color), plotted in Google^{TM} Earth.

The 2013 Rim wildfire that burned 250,000 acres of California forest was sampled by the NASA DC-8 and Alpha Jet, as part of its SEAC^{4}RS and AJAX campaigns. During the flaming and smoldering phases of fire, provided detailed information on the constituent emission ratios (ER's) and emission factors (EF's).

Methane ER's were 7 ppb CH_4 (ppm CO_2)$^{-1}$ during the intense burning phase and 18 ppb CH_4 (ppm CO_2)$^{-1}$ during the <u>smoldering phase indicating substantial increases as the fire intensity subsided</u>. This behavior was typical of all volatile organic compounds.

- Fresh wildfire plumes contained negligible O_3 and peroxyacetyl nitrate (PAN) and high levels of NO_x. As the plumes aged NO_x was rapidly depleted in association with PAN and ozone formation. This behavior was also observed in Boreal Fires.

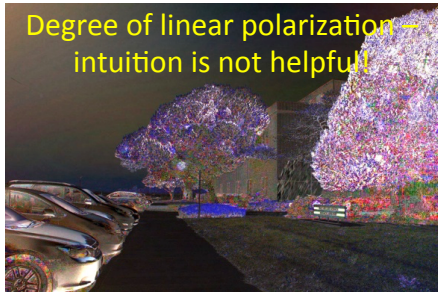


Evolution of key constituents in the Rim fire plume during 0-3 day transport time. Y-axis represents the ratio of **ΔNOx/ΔCO**, **ΔPAN/ΔCO** and **$\Delta O_3/\Delta CO$** and X-axis shows mixing ratio of CH_3CN (a fire tracer) as an indicator of air mass age from wildfire emissions measured during SEAC^{4}RS.

Remote Sensing of Aerosol/Clouds with Passive Polarimetry

PI: Dr. Kirk Knobelspiesse

Remote sensing with **linear polarization** to study **atmospheric aerosols, clouds**, land surfaces, oceans… but relating observations to environmental state is difficult!



Tools

- Polarized radiative transfer software
- Optimal estimation software
- Bayesian information content analysis
- Machine learning with neural networks

Applications

- Algorithm development
- Instrument design studies
- Extract new data from old instrumentation

ACE Mission: Leading the polarimetry WG; comparison of airborne polarimeter data, streamline calibration & characterization

Information content analysis of polarimeter prototypes *New Investigator Program*

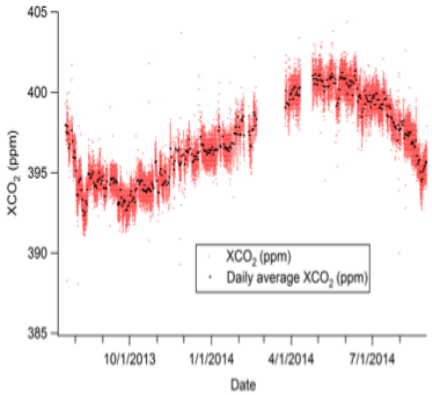
Science team contribution to PACE mission for ocean color remote sensing, atmospheric correction

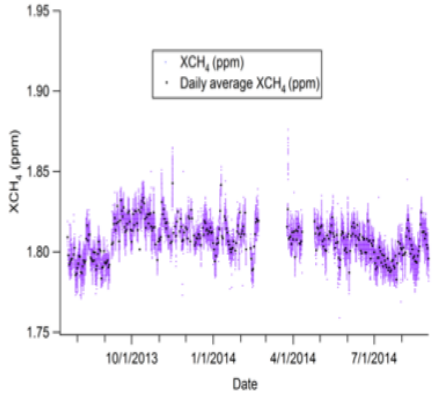
New use of AERONET polarized observations to find cloud thermodynamic phase + new Cimel radiometer for ARC

Neural Network algorithm development for ORACLES for aerosols above clouds as observed by airborne polarimeters

Total Carbon Column Observing Network

Project Lead: Dr. Laura Iraci





The AFRC TCCON data were processed with GGG2014 according to standard protocol. The plots display CO_2 and CH_4 data for the time period of 07/20/2013-08/31/2014 along with daily average values.

A Fourier Transform Spectrometer (FTS) as part of TCCON deployed to AFRC in July 2013.

Continuously collecting solar spectra to extract column average mole fractions of CO_2 and CH_4 as well as other gases.

Providing long-term monitoring of gas concentrations in conjunction with other TCCON sites around the world as well as providing calibration data for OCO-2.

Collaborated with AJAX, SEAC^{4}RS and Student Airborne Research Program (SARP) missions to obtain aircraft measurements above the TCCON location to verify the data quality of the FTS.

Education and Outreach

DEVELOP

High risk, fast paced, and product-oriented Earth Science projects

FY 15 Projects:

- Navajo Nation Climate
- Great Basin Climate
- Lake Erie Water Resources
- Mexico Water Resources
- Sierra Nevada Water Resources

End Products:

- Custom online Standard Precipitation Index (SPI) Tool
- Fire Severity Zonal Statistics Tool
- Analysis of NASA EOS data in regions with little in-situ data
- Modeling drivers for Hypoxic events in the GoM
- Geospatial assessment of wildfire severity to snowmelt

End-Users and Partners:

National Aeronautics and Space Administration
Where We Stand

ARC Organization

Center Management

Director	Eugene Tu
Deputy Director	Tom Edwards
Associate Director for Technical Programs	Steve Zornetzer
Associate Director for Mission Support	Deb Feng

NASA Institutes

Astrobiology Institute	Carl Pilcher (act)
SolSys Exploration Research Inst.	Yvonne Pendleton
Aeronautics Institute	Michael Dudley

Office of the Director

Chief Engineer	Tina Panontin
Chief Scientist	Jacob Cohen
Chief Counsel	Tom Berndt
ISS Utilization	Carol Carroll
Diversity / Equal Opportunity	Barbara Miller
NASA Research Park	Meighan Haidar (act)

Technical

Aeronautics
Huy Tran (act)

Science
Michael Bicay

Exploration Technology
Rupak Biswas (act)

Programs & Projects
Jay Bookbinder

Engineering
David Korsmeyer

Mission Support

Partnerships
Gary Martin

Center Operations
Charles Duff

Human Capital
Janice Fried

Information Technology
Jerry Davis (*)

Safety, Environment & Mission Assurance
Michael Liu

Strategic Communications & Education
Dolores Beasley

Chief Financial Officer
Paul Agnew (*)

* Direct HQ report

Science Directorate
(Code S)

Management

Director	Michael D. Bicay
Deputy Director	Carol Carroll
Assoc. Director for Management Operations	Karen Tambua
Assoc. Director for ISS	Steve Smith

Cross-Directorate Programs

ATAP Lead	Jim Arnold
Space Biology Program Office	Scott Richey (act)
SOFIA Project Scientist	Pam Marcum
Kepler/K2 Project Scientist	Steve Howell

Support

Executive Assistant	Marlowe Primack
Resource Analyst	Ben Varnell
Human Capital	Jason Gillis
Public Affairs	Michele Johnson

Space Biosciences Division (Code SC)
Sidney Sun, Chief
A. Chris Maese, Deputy

Bioengineering Branch
Mark Kliss, Chief
Marilyn Murakami, Assistant

Flight Systems Implement. Branch
Paresh Bhavsar, Chief
B J Navarro, Assistant

Space Biosciences Research Branch
[Vacant], Chief
Nathan Carrillo, Assistant

Earth Sciences Division (Code SG)
David Alfano, Chief (act)
David Alfano, Deputy (act)

Atmospheric Science Branch
Warren Gore, Chief
Chris Scofield, Assistant

Biosphere Science Branch
Jim Brass, Chief

Airborne Science Office
Matt Fladeland, Airborne Science Manager
Mike Craig, ESPO Director

Space Sciences/Astrobology Division (Code SS)
Tim Lee, Chief
Mark Fonda, Deputy

Astrophysics Branch
Jessie Dotson, Chief
Christine Martinez, Assistant

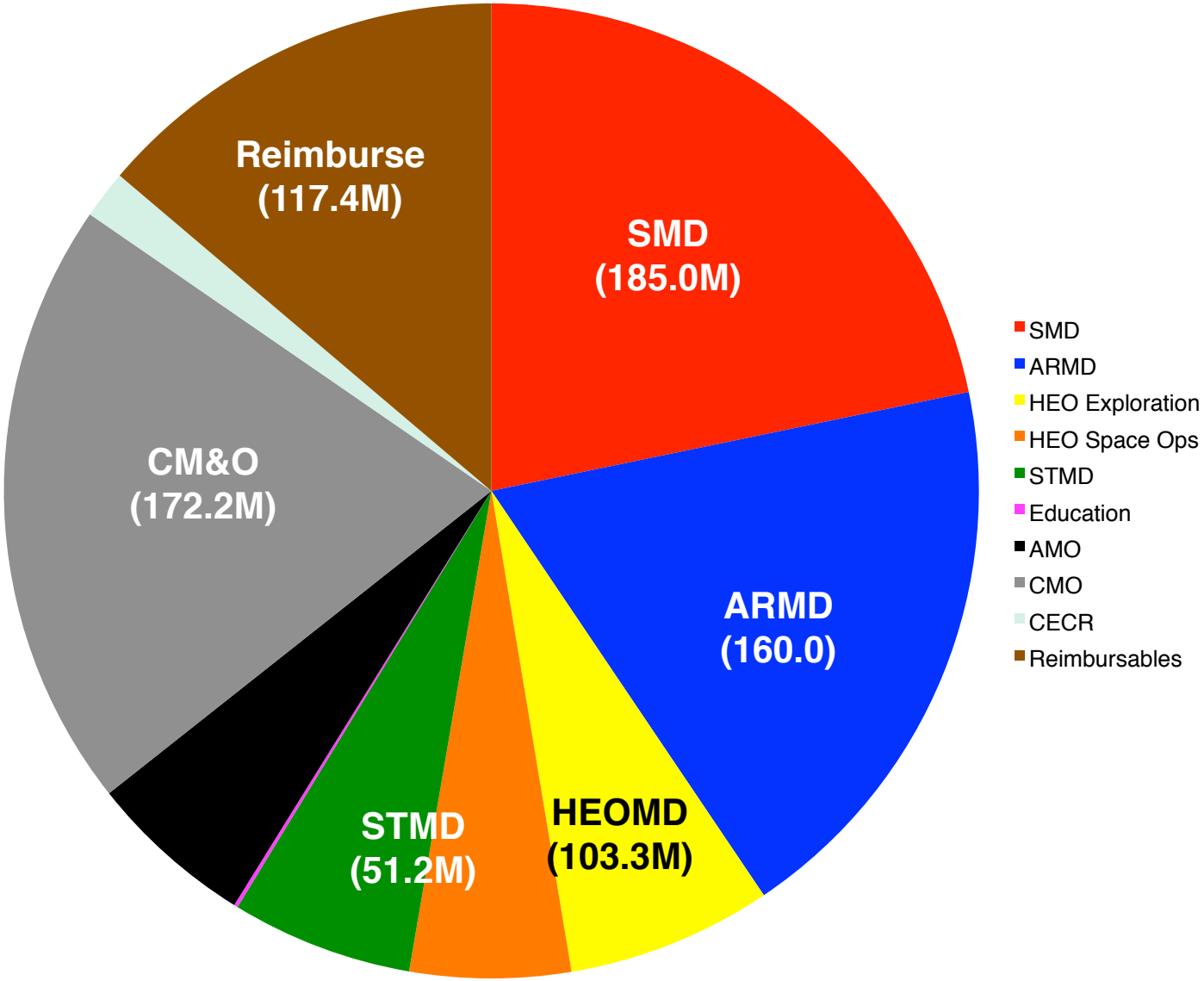
Planetary Systems Branch
Jeff Hollingsworth, Chief
Sandra Owen, Assistant

Exobiology Branch
[Vacant}, Chief

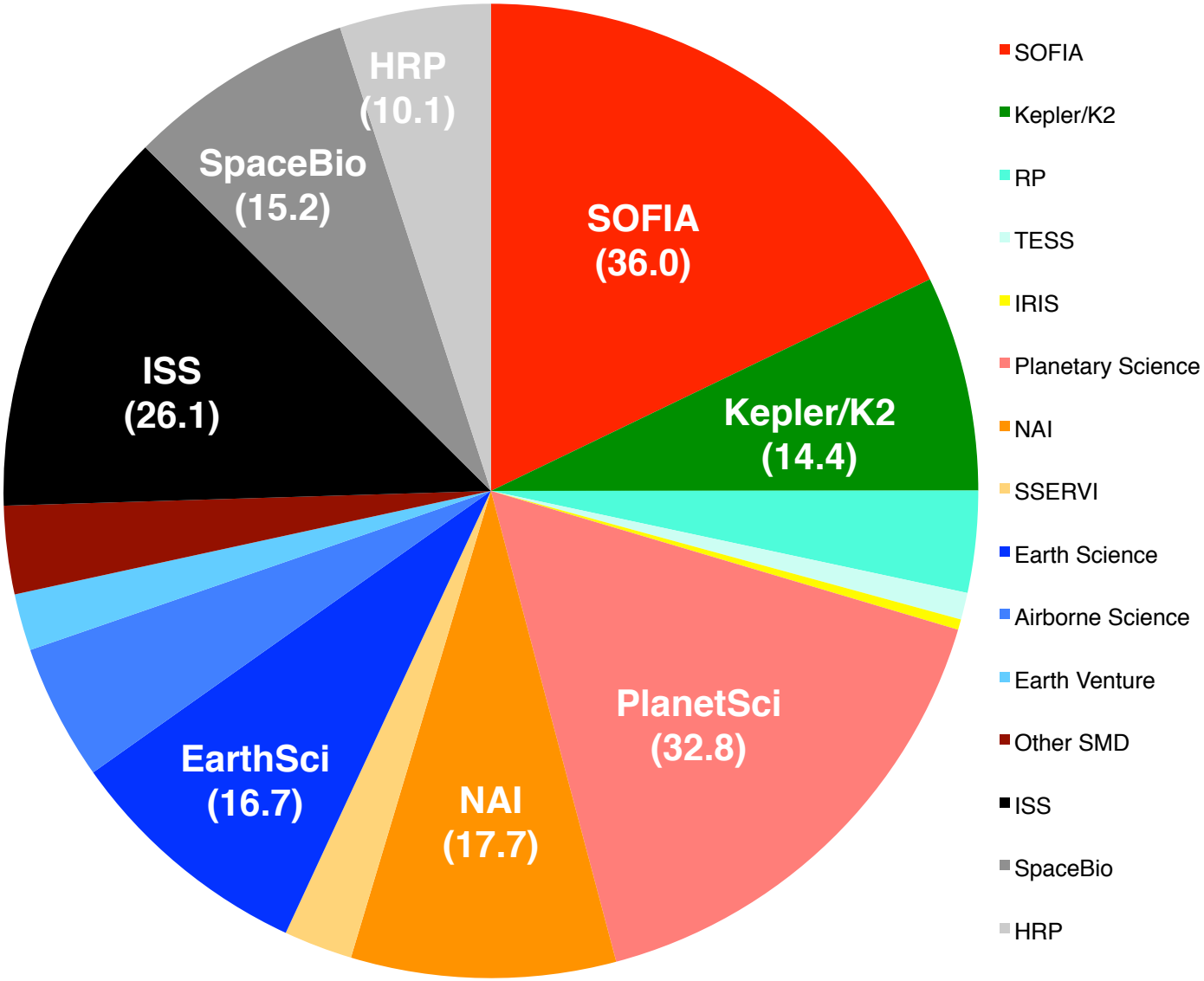
Ames Center for Exoplanet Studies
Tom Greene, Director

Mars Climate Modeling Center
Jeff Hollingsworth, Director

FY15 Funding @ ARC: $850.6M



"Science" Funding @ ARC: $201.7M

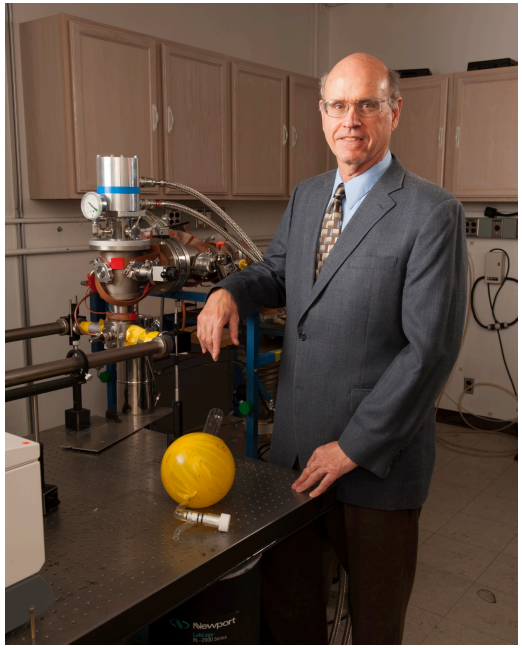


Excludes:
- HECC/NAS

Includes:
- ISS
- SpaceBio
- HRP
- RP

National Aeronautics and Space Administration
Awards & Honors

2015 Presidential Rank Awards



Lou Allamandola

- Presidential Rank for Meritorious Senior Professional

Carol Carroll

- Presidential Rank for Meritorious Executive

2015 NASA Honor Awards

- **Exceptional Achievement Medal**
  - Janet Beegle (SCF)
- **Exceptional Service Medal**
  - Mark Fonda (SS)
  - Phil Russell (SG, retired)
- **Exceptional Engineering Achievement Medal**
  - David Pletcher (SCF)
- **Exceptional Scientific Achievement Medal**
  - Ruth Globus (SCR)
  - Jennifer Heldmann (SST)
  - Tori Hoehler (SSX)
  - Jack Lissauer (SST)
- **Outstanding Leadership Medal**
  - Sid Sun (SC)
  - Cecilia Wigley (SCF)
- **Group Achievement Awards**
  - Hurricane & Severe Storm Sentinel Team
  - IceBreaker Team
  - Mojave Volatiles Prospector Team
  - Rodent Research – 1 Team

Ceremony 2015.10.07 @ 2pm

2015 Ames Honor Awards

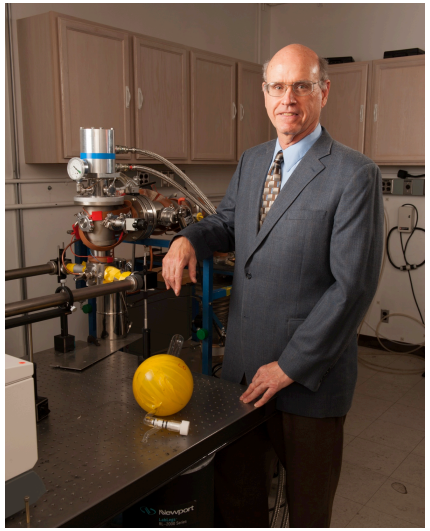
New!

- **Scientist/Researcher**
  - Ruth Globus (SCR)
- **Contractor Employee**
  - Christopher Burke (SSA/SETI Inst)
  - Robert Morris (SSA/SETI Inst)
- **Student**
  - Lisa Hildebrand (SSA/USRA)
- **Group Achievement Awards**
  - Fruit Fly Lab Team
  - ISS Payloads Flight Processing Team
  - ISS Bioculture Anomaly Resolution Team
  - Kepler/K2 Flight Planning Team
  - LADEE UV/Vis Spectrometer Instrument/Science Team
  - SOFIA/EXES Instrument Team
  - UAS-NAS Project IT&E Team
  - WelLab-2 RNA Extraction Team

Ceremony 2015.11.05 @ 2pm

External Awards (1 of 2)

- **AAS Laboratory Astrophysics Award (inaugural)**
  - Lou Allamandola



- **AAS Education Prize**
  - David Morrison

- **Meteoritical Society Leonard Medal**
  - Jeff Cuzzi
- **Nevada Medal**
  - Chris McKay

External Awards (2 of 2)

- **2014 LATC Lupe Ontiveros Dream Award**
  - Elisa Quintana
- **2015 HENAAC Scientist of the Year**
  - Elisa Quintana
- **APS Fellow**
  - Farid Salama
- **American Humanist Association Isaac Asimov Award**
  - Lynn Rothschild

National Aeronautics and Space Administration
Ten Years On

Early 2005 slide

ISSUE: World-Class Scientists Rapidly Losing Competitiveness Due to High Cost & Selection Bias

- **FACTS**
  - Ames space scientist must raise 318K annually to cover salary & overheads (excl. travel & procurements)
  - Need >400K if hiring postdocs or students
- **CONSEQUENCES**
  - Scientists forced to segment time into small (inefficient) pieces to avoid costly 'appearance' in peer review
  - Typical 4:1 oversubscription forces impossibly large proposal-writing demands
    - *16 proposals @ 100K, or 5 proposals @ 300K*
    - *Insufficient NASA opportunities*
    - *Inadequate (and unfunded) time available to write proposals*
    - *Proposal writing effort similar to publishing paper*

- **FACTS**
  - Vast majority of peers are subsidized in academia
    - *Need only 0-2 months salary*
  - Peers at JPL & GSFC subsidized by mission $$$
    - *Need only ~25% support*
- **CONSEQUENCE**
  - Ames scientists increasingly un-competitive & unfunded under Full Cost Accounting (FCA)
- **ADDITIONAL FACTS**
  (confirmed by interviews of HQ staff)
  - No uniform training/guidance provided to Code S PgmScientists about FCA application
  - Previous CS salary account now disbursed to PgmScientists
    - *Up to 90% of CS salaries now flow to non-NASA researchers*

Early 2005 slide

Observations

High G&A costs and NASA's implementation of FCA makes Ames space science proposals increasingly non-competitive

- Proposal success rate starting to decrease
- 'Accepted' proposals are often inadequately funded
  - *Many winning proposals are not properly credited with FCA funding*
    - > Example: Ames scientists were very successful in winning Spitzer Cycle-1 observing time, but received only 946K of needed $1.8M
- NASA's failure to make timely commitments, combined with late arrival of funds at Ames, makes planning difficult

Prediction

Without change,
Space Science half-life at Ames is 2-3 years

Proposed Solutions (Feb 2005)

- **Replace Full-Cost Recovery with Properly Implemented Full-Cost Accounting (Agency action required)**
  - Off-load strategically-important Agency facilities to corporate account
  - Re-establish CS salary/travel accounts, separate from R&A funds
    - > Bundling them results in most of former CS support now flowing to external scientists
  - Ensure uniform training of SMD Program Scientists in conducting fair proposal reviews & in augmenting awards with CS salary support

- **Reduce Reliance on R&A Awards (Agency & Center actions required)**
  - Increase the missions & projects revenue at Center
  - Directed funding required to transition to flight project competitiveness

- **Reduce Costs (Center action required)**
  - Continue to squeeze unnecessary G&A and ASP costs
  - Transform workforce, as necessary, to implement new programs

- **Increase Access to R&A Funds at Center (Center action required)**
  - Exempt R&A funds, once they have arrived at Ames, from the current "hold" in RMO to support a pool for CS salaries

National Aeronautics and Space Administration
Personnel & Hiring

Comings and Goings

- **Arrivals**
  - Jonathan Galazka (SCR)
  - Karen Tambua (S)
  - David Smith (SCR, transfer from KSC)
  - Steve Smith (S)
  - Elizabeth Taylor (SCF, transfer from JSC)

- **Departures**
  - Lou Allamandola (SS, retired)
  - William Borucki (S, retired)
  - Meryl Lee Corcoran (SCR, retired)
  - Garret Fitzpatrick (SCF, separated)
  - Masood Hadi (SCB, separated)
  - R. Steve Hipskind (SG, retired)
  - Cristina Milesi (SGE, separated)
  - Nicole Rayl (SC, now HQ)
  - Orlando Santos (SSX, retired)
  - Fred Van Wert (S, retired)
  - Bob Walker (SSA, retiring)
  - Rob Whalen (SCR, retired)

Comings and Goings

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  - Karen Tambua (S)
  - David Smith (SCR, transfer from KSC)
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  - Fred Van Wert (S, retired)
  - Bob Walker (SSA, retiring)
  - Rob Whalen (SCR, retired)

Hiring Data: Past 5 Years

Perspectives on the data:

- Our attrition rate has doubled this year
- Gains and losses in MSD and PARTS are almost equal
- Only FY15 has concentrated on early career hires

	FY11	FY12	FY13	FY14	FY15	Total
Hires	28	39	42	39	26	174
Losses	49	56	49	44	83	281

	MSD	PARTS
Hires	84 (48%)	90 (52%)
Losses	128 (46%)	153 (54%)

Actuals: Early Career Hiring

FY11	FY12	FY13	FY14	FY15
11%	12%	26%	23%	42%

Other Topics

under new management

ELT/TAE Opportunities & Needs

- **Meetings**
  - Formats, Cadence
- **Processes**
  - Hiring
  - Investments
- **Governance**
- **Center Strategy**
  - Portfolio
  - Capability management
  - New business
  - Competed/negotiated/directed work
- **Reorganization?**

Governance: Philosophy and Values

- **Decision-making delegated to the lowest sensible level**
- **Decision-maker possesses the span of authority necessary to implement decisions**
- **In most cases, consensus is the preferred approach to arriving at controversial decisions**
- **Provide stakeholders the opportunity for input and the context for decision**
- **Leaders support decisions made at lower levels even if they don't entirely agree with them**
- **Governance culture supports innovation and doesn't stifle it**
- **No dead messengers – foster openness, tolerance for bad news, model a learning organization**
- **Center level priorities well communicated and understood throughout the organization to promote alignment and empower decision-making**

EC Retreat: Strategic Directons

- **Portfolio (Feng)**
  - In what areas do we want to generate revenue and deliver results?
- **Investments (Korsmeyer)**
  - Director's investment fund, as applied to efforts that will benefit the Center's vision and strategy. Includes investments into technical opportunities as well as infrastructure and business processes
- **Physical Plant/Infrastructure/NRP (Zornetzer)**
  - Ames campus, horizontal infrastructure, NRP
- **Workforce/Capabilities/Resources (Carroll)**
  - How to realize our workforce vision, how to maintain robust capabilities and develop new ones, how to leverage financial resource management and human capital management
- **Communications & Relationships (Bicay)**
  - Internal and external communications, interactions with employees, on-site contractors, community, HQ, industry, politicians, etc.

There will be increased scrutiny of compliance with NASA STI standards in the Directorate in FY16.

NASA Scientific and Technical Information (STI) Program

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NTRS News!

January 16, 2015 Updated STI Contact Information

The new STI address is:
NASA STI Program STI Support Services
Mail Stop 148
NASA Langley Research Center
Hampton, VA 23681-2199
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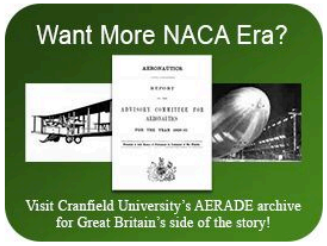
Highlights



RSS: New NASA STI

- Development and Performance Verification of Fiber Optic Temperature Sensors in High Temperature Engine Environments September 14, 2015
- Seasonal Variations of the James Webb Space Telescope Orbital Dynamics September 14, 2015
- Use NASA GES DISC Data in ArcGIS September 14, 2015

What is the NASA STI Program?

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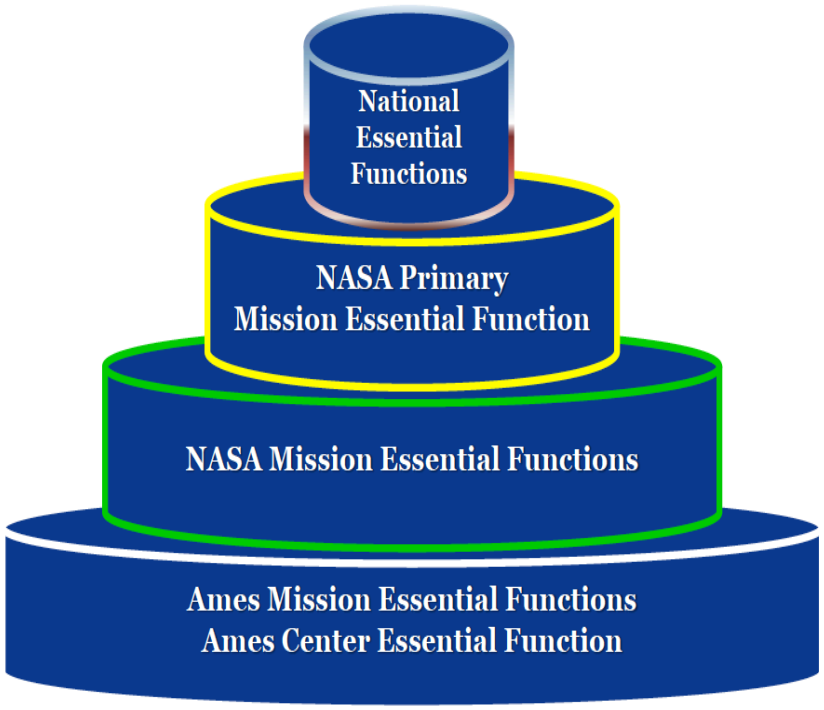
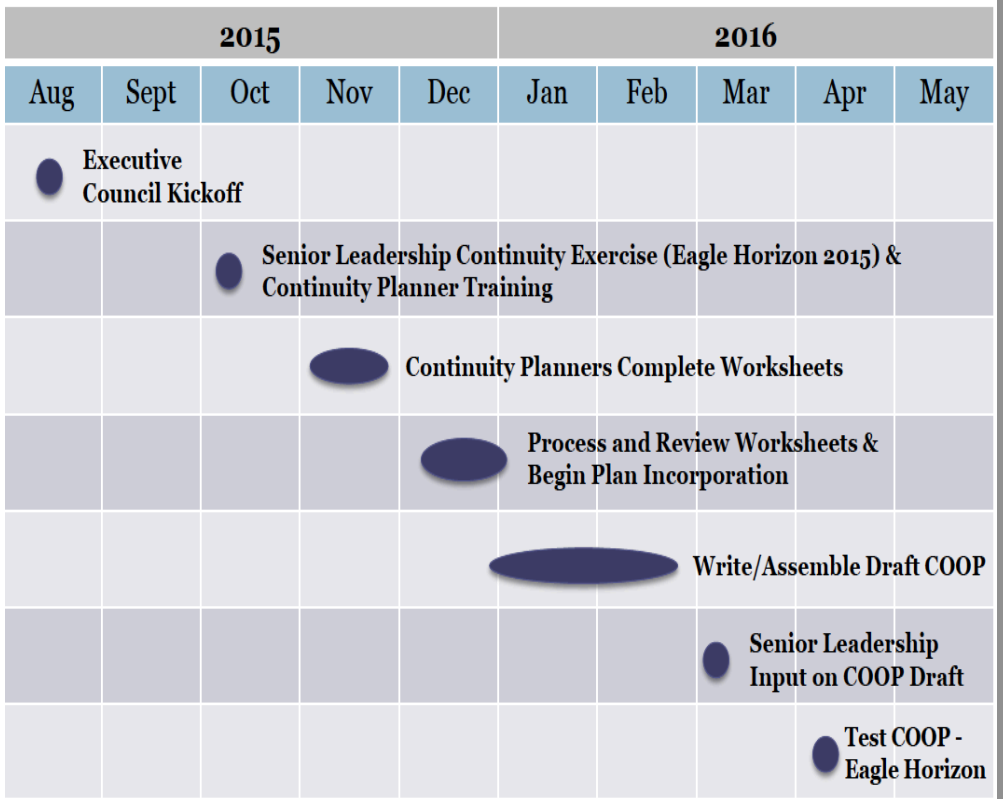
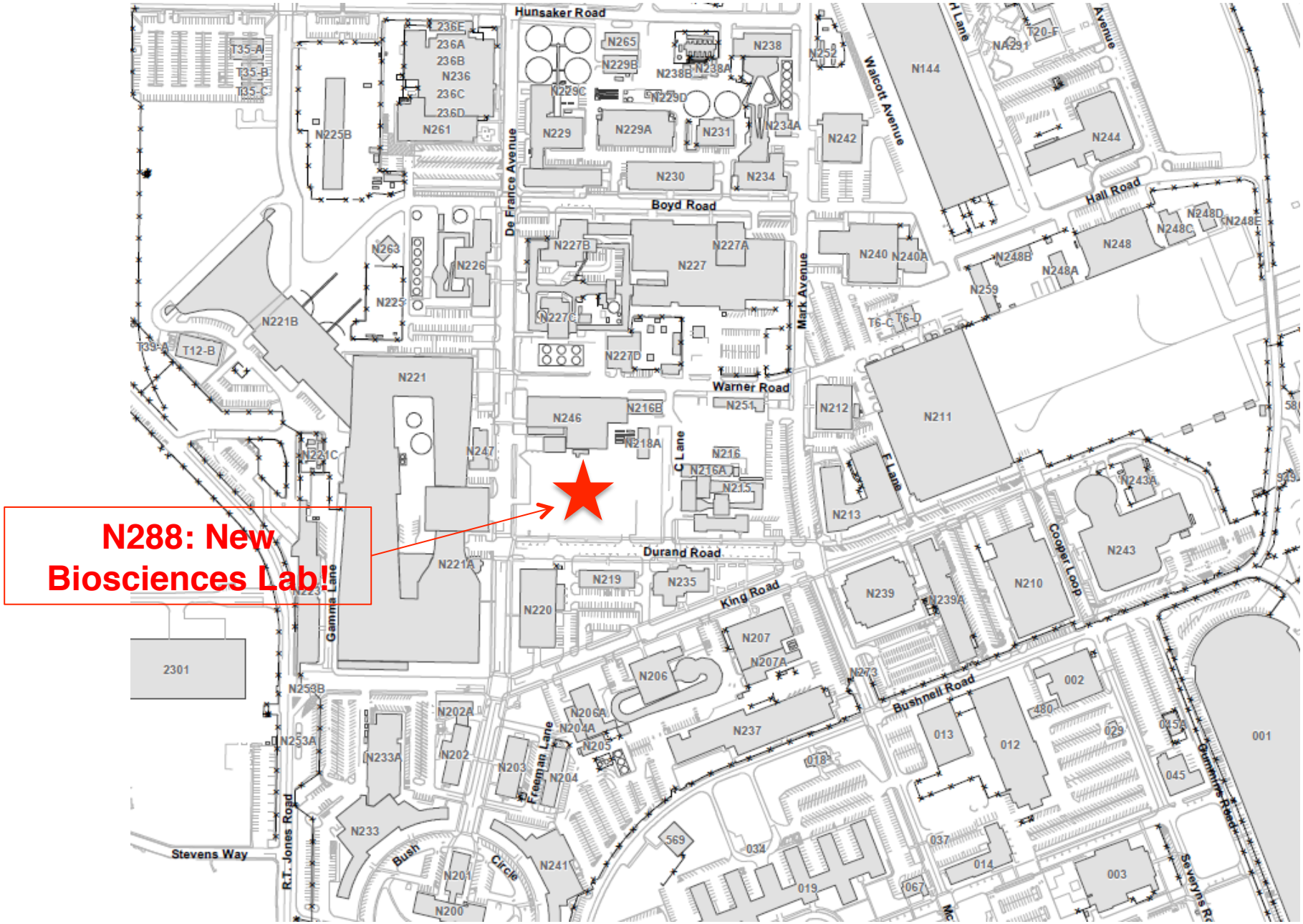
Continuity of Operations Planning (COOP)

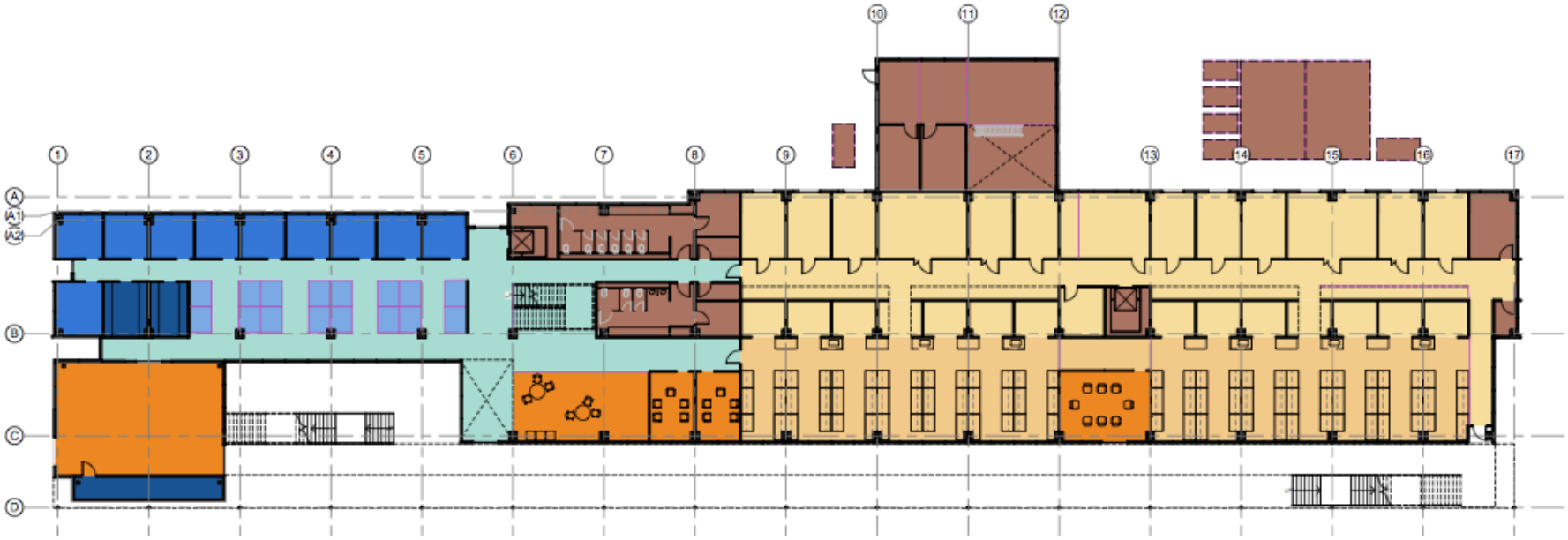




New BioSciences Laboratory (N288)

BioSciences @ ARC Core





level 1 floor layout

1" = 40'-0" 0 20 40 80 ft

Program Summary

	Lab	Lab Support	Office	Other	Total NSF
Chemistry Research	2,324	1,505	740	200	**4,769**
Microbial Research	2,324	1,505	740	200	**4,769**
Cellular Research	2,324	1,505	740	200	**4,769**
Organismal Research	2,324	1,505	740	200	**4,769**
Shared Facilities	0	1,240	400	2,030	**3,670**
Subtotal	**9,296**	**7,260**	**3,360**	**2,830**	**22,746**

Assignable Area to Gross Area Ratio **0.60**

Total Gross Area **37,910**

RfP Issue Date: 2016.05.16

Proposals Due: 2016.07.05

Selection: 2016.09.30

Construction Start: ~2016 Dec

NASA

National Aeronautics and Space Administration
FY16
Directorate
Objectives

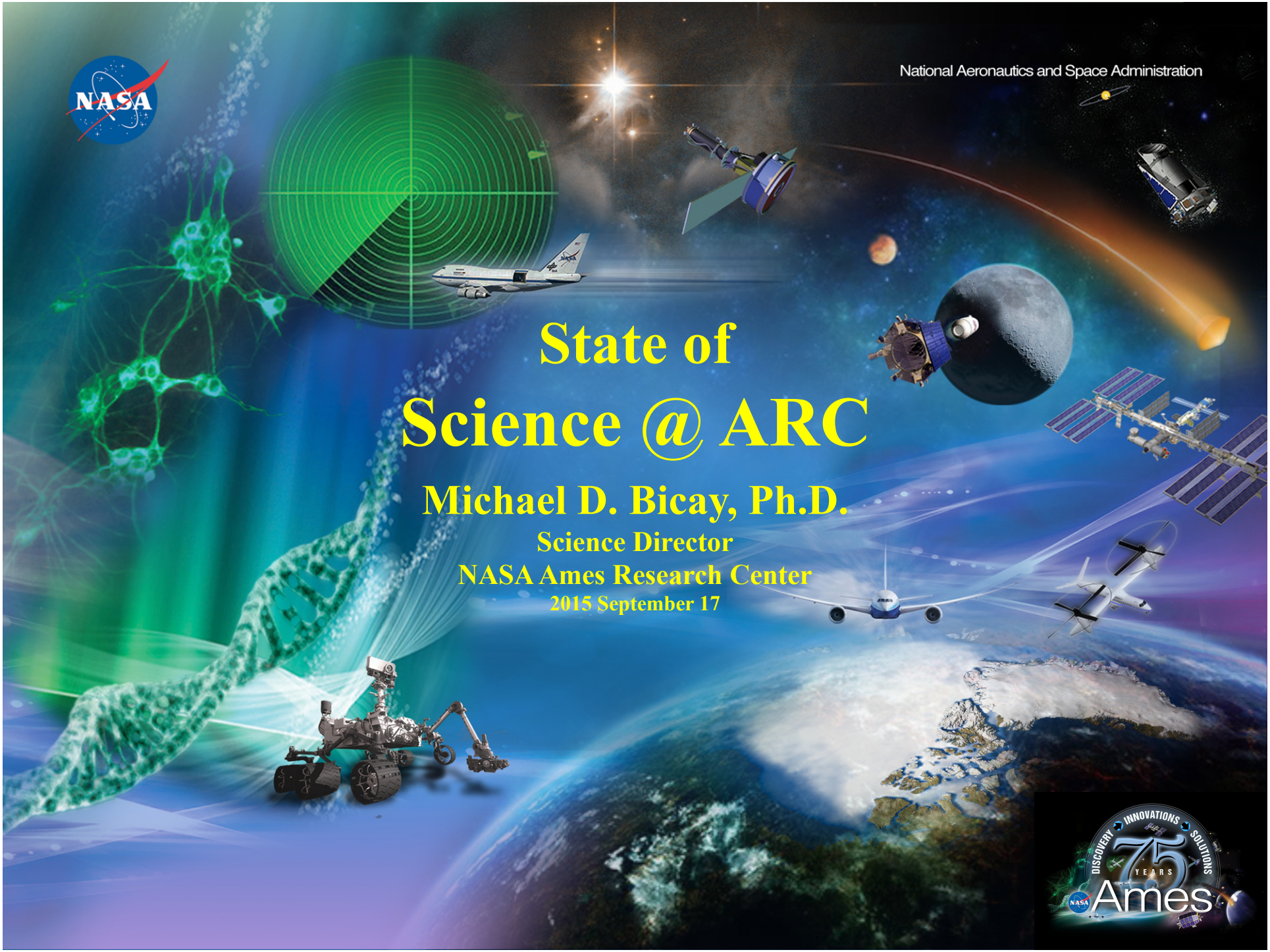
Directorate Objectives for FY16

- **Continue to produce solid foundation of world-class research**
- **Replenish workforce through increased hires**
  - FY16 focus on rebuilding astrobiology/exobiology
- **Complete transfer SOFIA Program Office to ARC from AFRC**
- **Closeout Kepler mission, operate K2 mission, submit K2 Senior Review proposal**
- **Build out & test the data processing system for TESS, in preparation for 2017 launch**
- **Successfully manage Agency Earth Science airborne campaigns**
  - IceBridge, ORACLES, ATom, KORUS-AQ
- **Build up a Center of Excellence for Small UAV Research**
- **Continue AJAX flights in support of ARC & NASA science programs**
- **Compete for meaningful roles in new Agency flight programs**
  - $350M Astrophysics Explorer, $175M Heliophysics Explorer, $90M Earth Venture (EV) instrument, $750M New Frontiers, $60M Planetary Sciences MoO
- **Expand portfolio of ISS bioscience payloads and capabilities**
  - Launch RR-3, Microbial Tracking-1c, Micro-9, Micro-10 on SpX-8 to ISS in November (NET)
  - Launch Cell Science-1 and Seedling Growth-2 on SpX-9
  - Launch RR-4 on SpX-10
  - Launch Cell Science validation, Fruit Fly Lab-2, Seedling Growth-3 on SpX-11
- **Expand portfolio of bioscience payloads beyond ISS**
  - Develop EuCROPIS payload (PowerCell), in preparation for March 2017 launch
  - Develop Biosentinel science payload, in preparation for October 2018 launch
- **Continue to apply bioengineering & SynBio concepts to next-generation ECLSS**
- **Complete acquisition process for new laboratory building (N288)**

A Sincere Thanks

- **Marlowe Primack**
- **Yvonne Ibarra**
- **Vicky Godinez**
- **Jo Serrano**
- **Irene Stock**

- **All of You !**



State of Science @ ARC

Michael D. Bicay, Ph.D.
Science Director
NASA Ames Research Center

2015 September 17

ARC Science in the Headlines

- Drilling for Data: Simulating the Search for Life on Mars (2015.08.19)
- LADEE Spacecraft Finds Neon in Lunar Atmosphere (2015.08.17)
- NASA's Kepler Mission Discovers Bigger, Older Cousin to Earth (2015.07.23)
- NASA and USDA Sign Interagency Agreement (2015.07.15)
- Kepler's Borucki Retires After Five Decades at NASA (2015.07.01)
- SOFIA Points Telescope Toward Pluto Occultation (2015.06.26)
- Moon Engulfed in Permanent, Lopsided Dust Cloud (2015.06.17)
- NASA Releases Detailed Global Climate Change Projections (2015.06.09)
- NASA Spacecraft Capture Rare, Early Moments of Baby Supernovae (2015.05.20)
- Kepler Observes Neptune Dance with Its Moons (2015.05.14)
- Kepler Wins National Air and Space Museum Trophy (2015.03.23)
- SOFIA Finds Missing Link Between Supernovae and Planet Formations (2015.03.19)
- Ames Reproduces the Building Blocks for Life in Laboratory (2015.03.03)
- Micro-5: Gut Reactions in Space (2015.02.17)
- Kepler Marks 1000th Exoplanet Discovery, Uncovers More Small Worlds in HZ (2015.01.06)
- Kepler Reborn, Makes First Exoplanet Find of New Mission (2014.12.18)
- Northern California NASA Scientists Bring Drought Home (2014.12.14)
- Lights, Camera, Artificial Gravity! The Premiere of NASA's Fruit Fly Lab (2014.12.12)