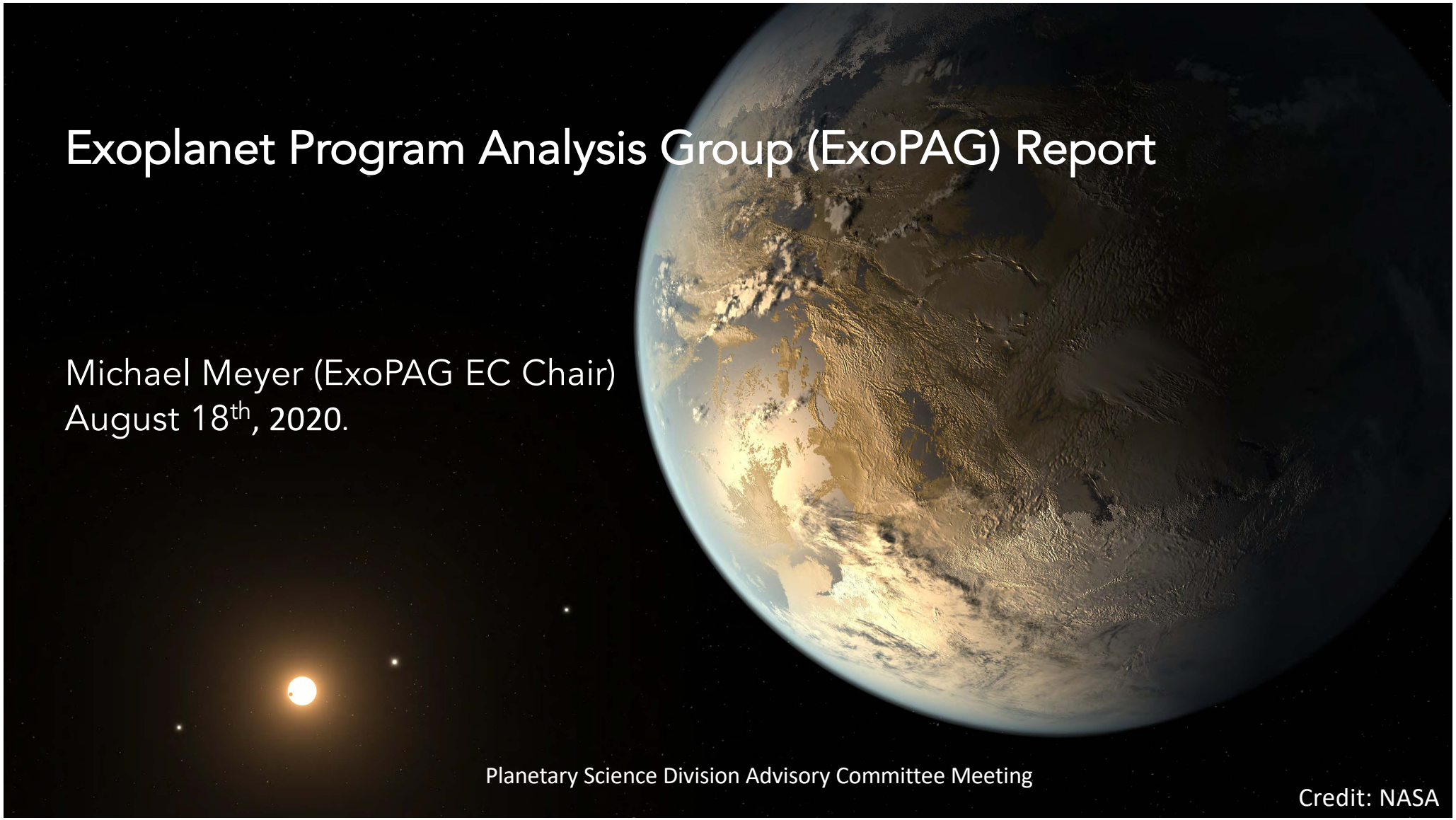
Exoplanet Program Analysis Group (ExoPAG) Report

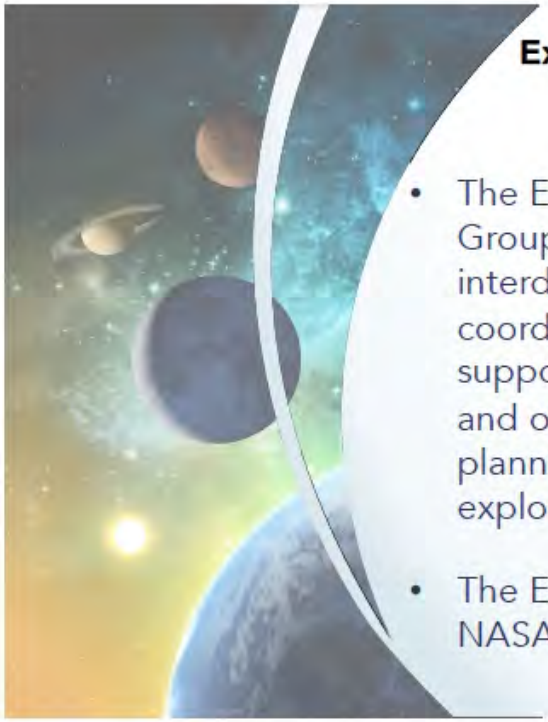
Michael Meyer (ExoPAG EC Chair)
August 18th, 2020.

Planetary Science Division Advisory Committee Meeting



Credit: NASA

Exoplanet Program Analysis Group: What is that anyway?



Exoplanet Program Analysis Group (ExoPAG)

https://exoplanets.nasa.gov/exep/exopag/overview

- The Exoplanet Exploration Program Analysis Group (ExoPAG) is a community-based, interdisciplinary forum for soliciting and coordinating community analysis and input in support of Exoplanet Exploration objectives, and of their implications for architecture planning and activity prioritization for future exploration.
- The ExoPAG reports findings of analyses to the NASA Astrophysics Division Director.

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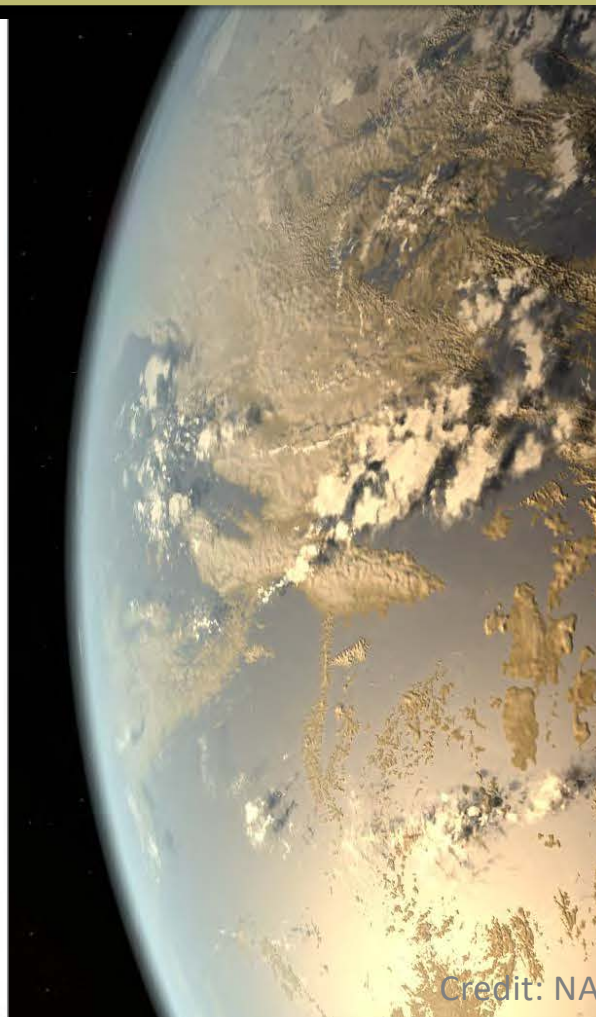

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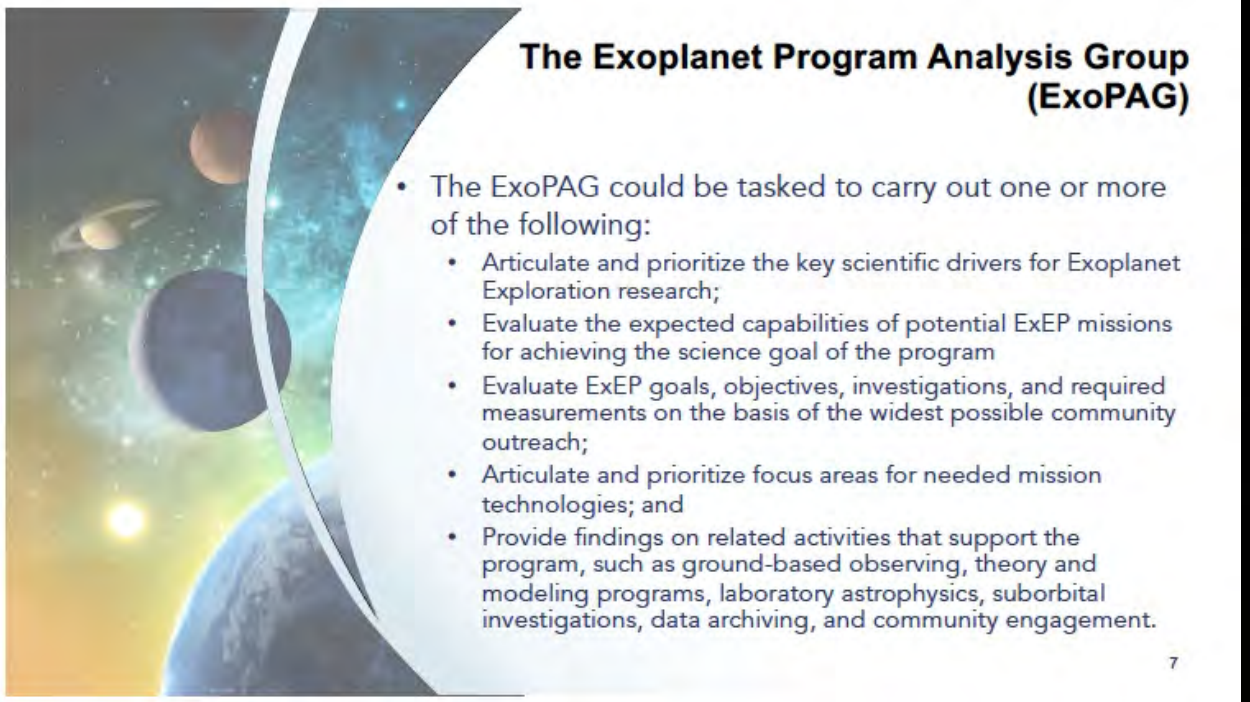

The Exoplanet Program Analysis Group (ExoPAG)

- The ExoPAG could be tasked to carry out one or more of the following:
  - Articulate and prioritize the key scientific drivers for Exoplanet Exploration research;
  - Evaluate the expected capabilities of potential ExEP missions for achieving the science goal of the program
  - Evaluate ExEP goals, objectives, investigations, and required measurements on the basis of the widest possible community outreach;
  - Articulate and prioritize focus areas for needed mission technologies; and
  - Provide findings on related activities that support the program, such as ground-based observing, theory and modeling programs, laboratory astrophysics, suborbital investigations, data archiving, and community engagement.

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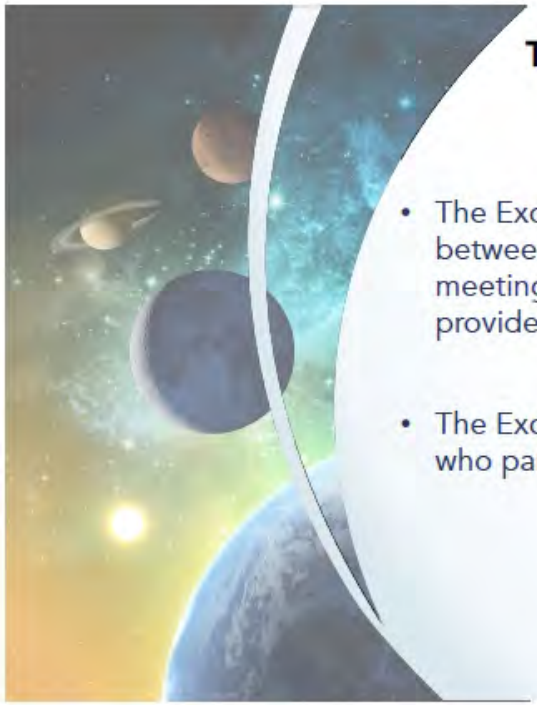
Credit: NA

Exoplanet Program Analysis Group: What is that anyway?



The Exoplanet Program Analysis Group (ExoPAG)

- The ExoPAG enables direct regular communication between NASA and the community through public meetings that give the community opportunities to provide scientific and programmatic input.
- The ExoPAG consists of all members of the community who participate in these open meetings.

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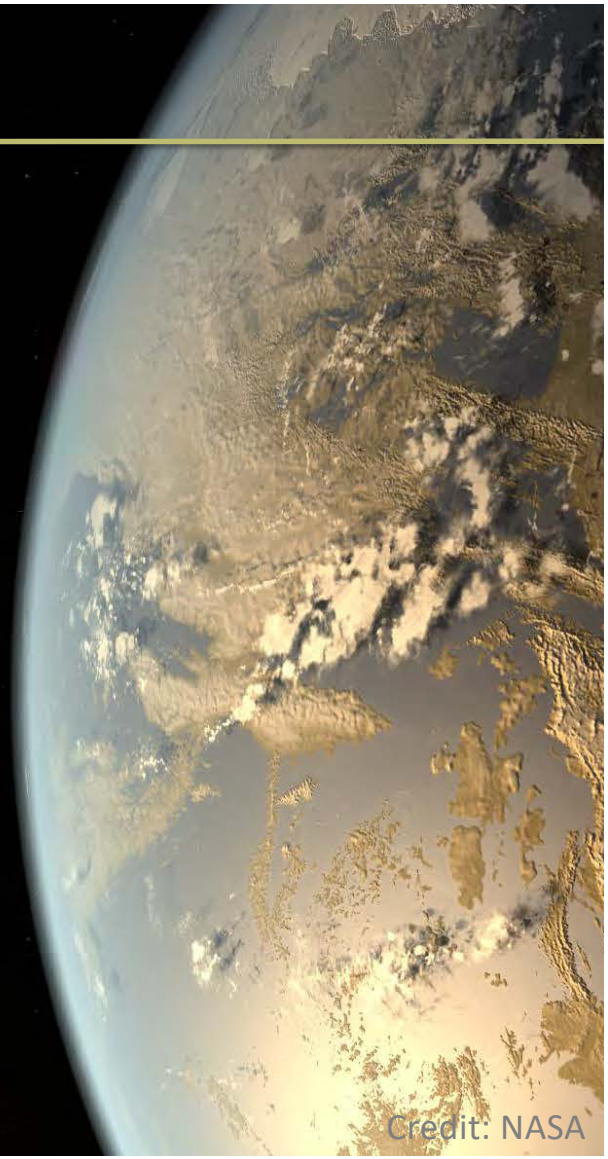
Credit: NA

ExoPAG Executive Committee

ExoPAG activities and meetings are organized through an Executive Committee

Michael Meyer (Chair)	University of Michigan
Tom Barclay	University of Maryland
Natasha Batalha	*NASA-Ames*
Jacob Bean	*The University of Chicago*
Jessie Christiansen	NExScI/Caltech
Rebecca Jensen-Clem	UC-Santa Cruz
John Debes	*Space Telescope Science Institute*
Tiffany Kataria	JPL/Caltech
Josh Pepper	Lehigh University
Dmitry Savransky	Cornell
Laura Schaefer	*Stanford University*
Vikki Meadows (Past Chair)	University of Washington
Doug Hudgins (Astrophysics)	NASA HQ
Doris Daou (Planetary Liaison)	*NASA HQ*
Richard Eckmann (Earth Liaison)	*NASA HQ*

Our newest members!

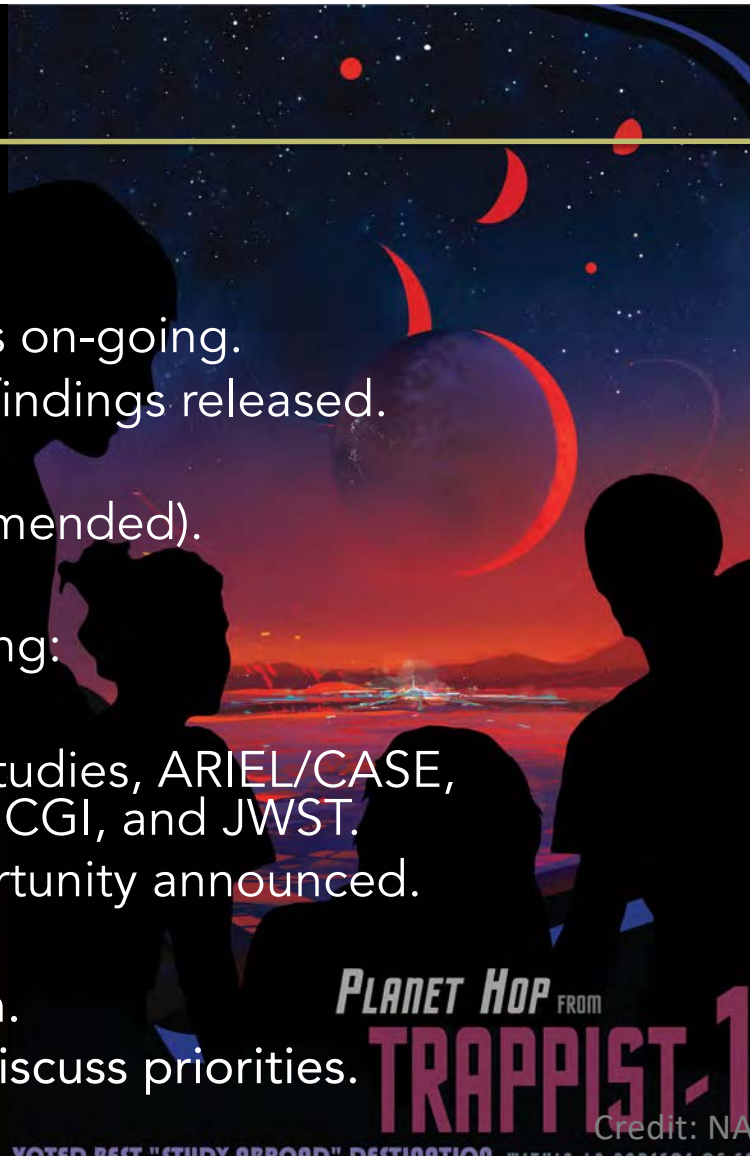


Credit: NASA

ExoPAG Recent Activities

- Adopted "Findings" at ExoPAG 21 last January.
- New EC Members appointed with monthly telecons on-going.
- Cross-PAG "Exoplanets in Our Backyard" Meeting findings released.
- Supported Planetary Decadal Survey.
- COVID-19 Survey initiated by COPAG (ADAP call amended).

- ExoPAG22 Virtual Meeting June 18-19, 2020 meeting:
  - Updates on PI Launchpad, Planetary Discovery studies, ARIEL/CASE, CHEOPS, Nancy Grace Roman Space Telescope CGI, and JWST.
  - EPRV recommendations released and new opportunity announced.
  - Four presentations by early career scientists.
  - Community concerned about institutional racism.
  - The EC + ExEP met following to ExoPAG22 to discuss priorities.



ExoPAG 21 – Findings transmitted to the Astrophysics Division

On the need to investment in databases to support programs related to achieving NASA's strategic goals.

=> We find that assembling a target catalog can potentially save significant NASA resources, and would help candidate missions …..contribute significantly to achieving NASA's strategic goals.

On the topic of ExoPAG providing input to other Divisions and programs on topics related to Exoplanets.

=> We find that multiple audiences would benefit from exposure to reports and findings generated by the ExoPAG to help shape their research programs, and that ExoPAG could benefit from receiving relevant reports and findings from other Program Analysis Groups.

On the topic of evolution in the Exoplanet Research Program (XRP) outcomes and funding lines.

=> We find that close monitoring of the program, scrutiny of success rates, along with feedback from and communication with the community might help avoid unintended consequences during this evolution.

Current Status of SAGs and SIGs

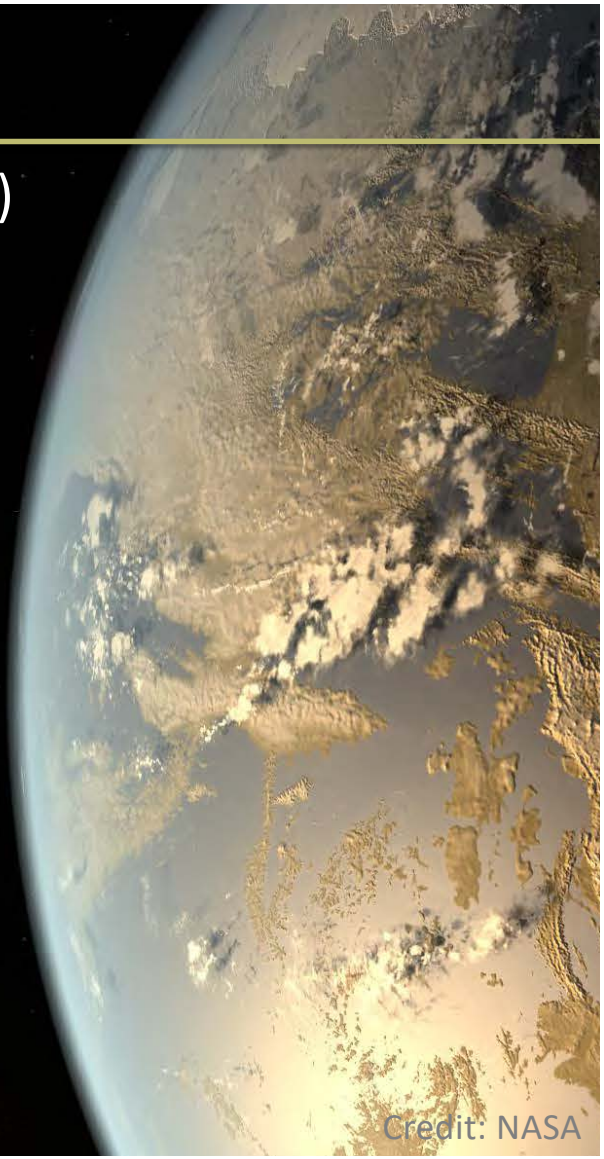
Close Year	SAG or SIG	Title	Lead
2020	SAG 19	Exoplanet imaging signal detection theory and rigorous contrast metrics (active - closeout expected soon)	Mawet & Jensen-Clem
----	SIG 2	Exoplanet Demographics (on-going)	Christiansen & Meyer
----	SIG 3	Exoplanet Solar System Synergies (approved).	Meadows & Mandt
----	SAG 21	Stellar Contamination on Transit Spectra (approved)	Rackham &Espinoza (Barclay)
----	SAG 22	Exoplanet Host Properties (approved)	Pepper, Stark, & Hinkel

Credit: NA

SIG 2 - Exoplanet Demographics

Chairs: Jessie Christiansen (NExSci/IPAC) & M. Meyer (UM)

- Successful symposium at ExoPAG 21 in Honolulu.
- Monthly telecons discuss new demographic results from multiple techniques (radial velocity, microlensing, transit, direct imaging).
- Drafting report on value of public database of demographic products.
- Curating a list of open questions/ongoing projects for the community.
- NExSci is hosting a related workshop in the fall. https://nexsci.caltech.edu/conferences/exodem/

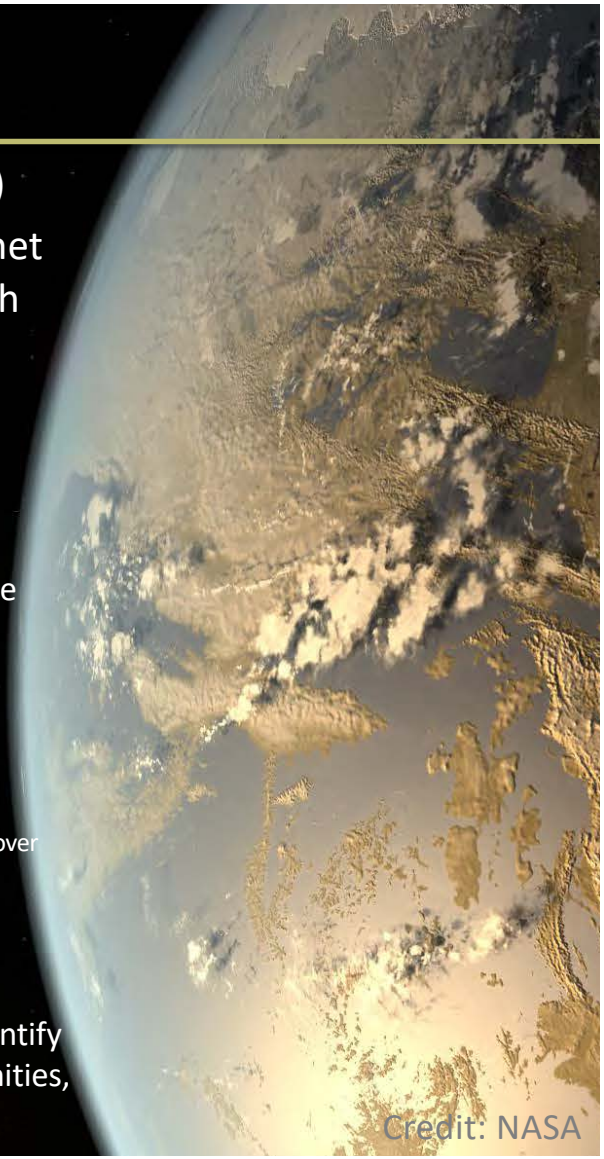


Credit: NASA

SIG 3 ExoSS Goals, Progress, Plans

- **Chairs:** Victoria Meadows (UW/NExSS/ExoPAG), Kathy Mandt (JHU/APL/OPAG)
- **Goal:** To provide a forum for interaction between the Solar System and exoplanet communities on topics of mutual interest, and to work to identify ways in which NASA and the scientific community could enhance these interactions.
- **Status:** The SIG3 is now approved and open to all.

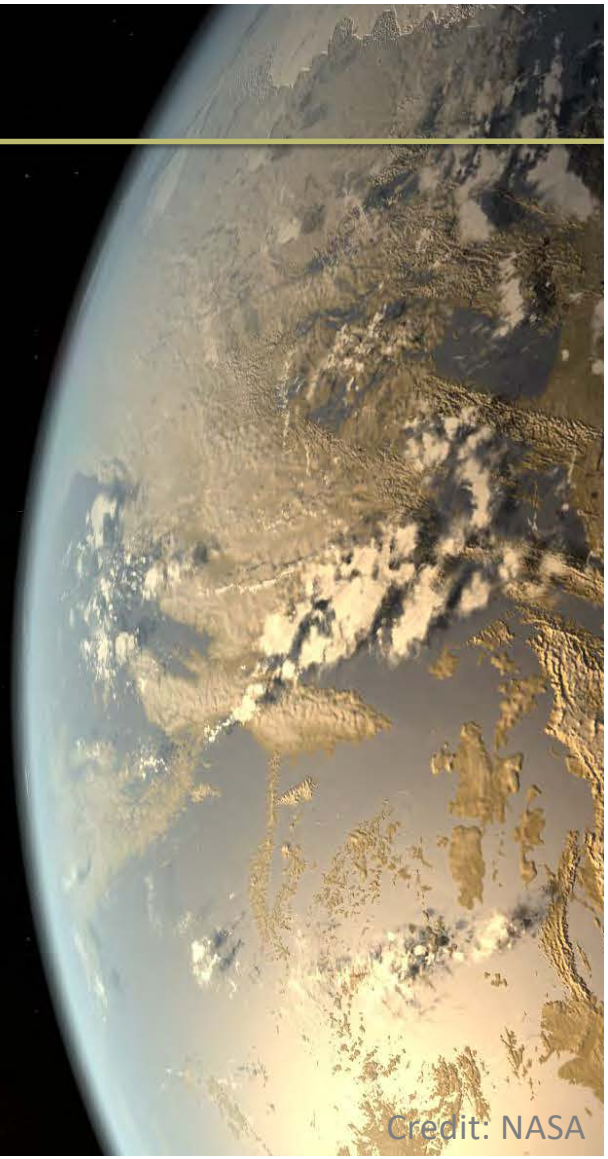
- Pre-Formation Activities:
  - Exoplanets In Our Backyard Conference, February 5-7, Houston: Findings to HQ and on website
  - Inaugural SIG3 meeting held on July 14.
- Current and Upcoming Activities
  - Promoted community-led Planetary Decadal activities: List of lists - https://bit.ly/3fu6ang
  - Initiated monthly SIG3 Tutorial/Journal Club to explain key concepts to each other
    - July tutorial on Solutions and Solubilities by Laura Schaefer, Sept tutorial on the Planetary Data System by Nancy Chanover
  - ExoSS Slack Channel – all are welcome! (If you would like to join: meadows@uw.edu)
  - Gathering community input on key ExoSS synergies: https://tinyurl.com/yxbnyfwu
  - Recruiting members from diverse scientific communities (including DPS and PEN).
  - Plan to continue to organize ExoSS webinars, develop joint SIG reports/review papers that identify beneficial avenues for future joint research between the exoplanet and Solar System communities, potential collaboration with the upcoming NExSS Hab Worlds 2 conference.


Credit: NASA

SIG 3 ExoSS Synergies – Core Team

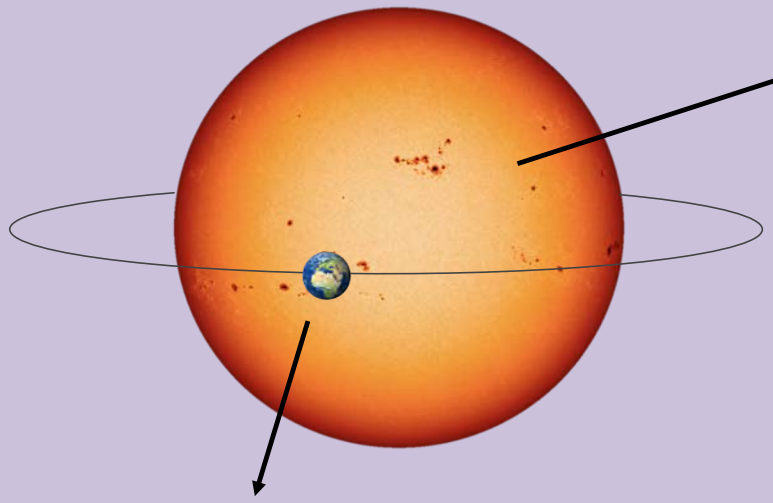
Victoria Meadows (Co-Chair)	**University of Washington, ExoPAG EC**
Kathy Mandt (Co-Chair)	**JHUAPL, OPAG EC**
Giada Arney	GSFC, VExAG EC
Chuanfei Dong	Princeton
Tony Del Genio	GISS/retired
Shawn Domagal-Goldman	GSFC
Noam Izenberg	JHUAPL, VExAG Deputy Chair
Stephen Kane	UC-Riverside
Tiffany Kataria	JPL/Caltech, ExoPAG EC
Mark Marley	NASA Ames
Niki Parenteau	NASA Ames
Abi Rymer	JHUAPL, OPAG EC
Karl Stapelfeldt	JPL/Caltech, ExEP

Spans ExoPAG, OPAG and VExAG, and include expertise in exoplanets, Solar System science, Earth science and star-planet interactions.



Credit: NASA

SAG 21: The Effect of Stellar Contamination on Space-based Transmission Spectroscopy



What do we know &
what can we learn from the star?

e.g., chromospheric activity,
photometric monitoring, polarization

What can we **learn from transits**?

Planet

e.g., transit spectroscopy

Star

e.g., unnoculted surface, occulted active regions, flares.

What will the impact be on **future studies**?

What **complementary observations** will be useful?

Coordinators: Néstor Espinoza, Ben Rackham, & Tom Barclay

SAG 22 – Exoplanet Host Properties

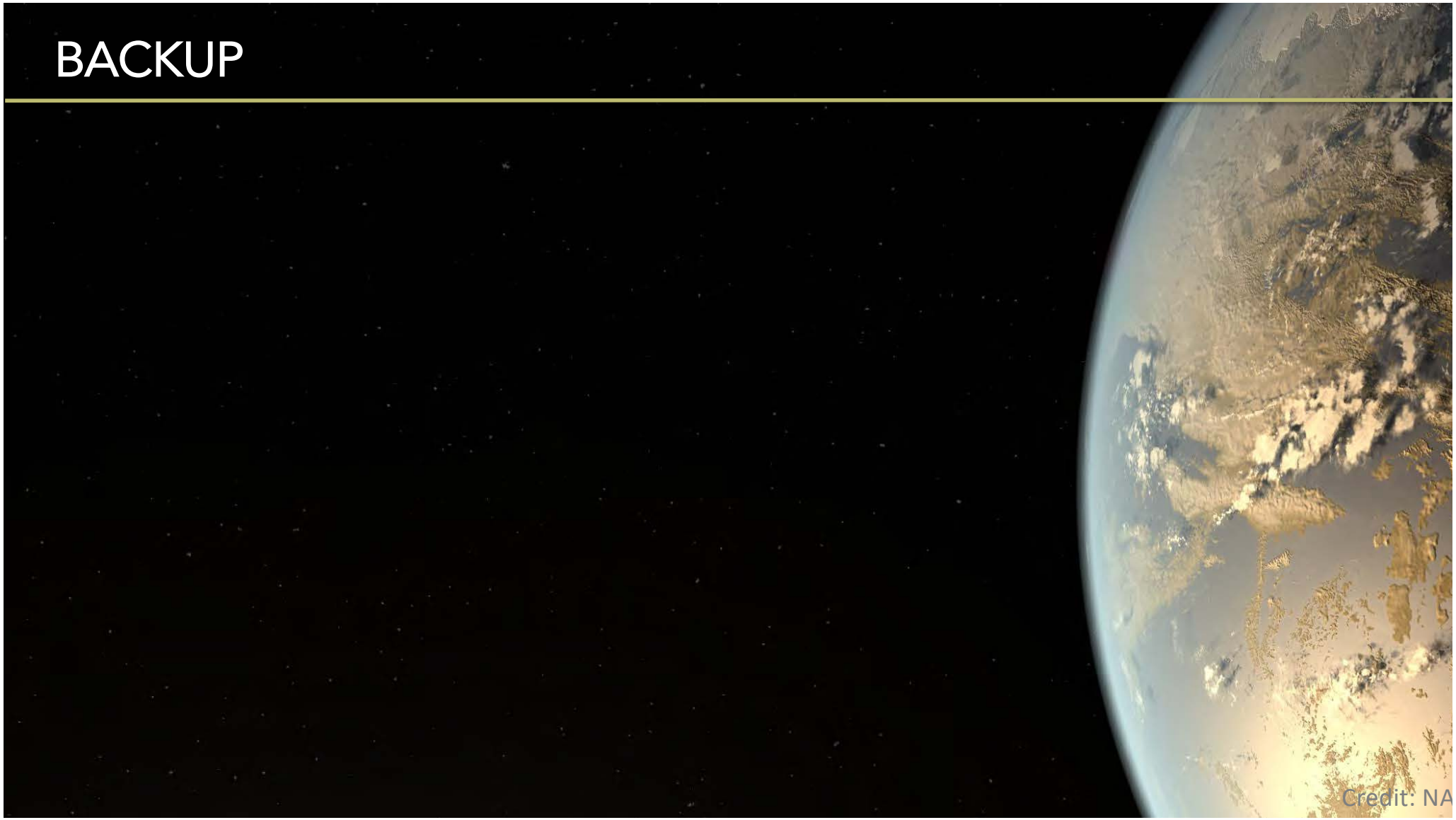
Lead by Joshua Pepper, Chris Stark, Natalie Hinkel

- Define the properties of priority stellar samples relevant to NASA as informed by exoplanet-related mission studies.
- Survey the broad exoplanet community (e.g., including planetary scientists, geologists, biologists) to determine data required for characterizing stellar and planetary systems
- Define what properties are most important to include
- Identify categories of typical end users of this catalog
- Find community consensus regarding methods for archive implementation and maintenance, based on high priority and low priority data products needed for characterization.

ExoPAG 2020 Future Activities

- New areas for action: zodiacal dust and high contrast imaging.
- Map the Science Gap List to key areas for ExoPAG effort:
  - new process to review in summer 2020.
  - New monthly seminar series (Early Career Scientists) to support this.
- Continue to collect community input via fall forum.
  (e.g. to develop findings for discussion at ExoPAG 23).
- Continue monthly ExoPAG EC, SIG2/SIG3/SAG-21/SAG-22 telecons
- Review what ExoPAG can do to help dismantle institutional barriers to realizing a truly diverse, equitable, and inclusive community.
- Update ExoPAG website.
- ExoPAG23 planned for January 5-6, 2020 (before winter AAS).

BACKUP



ExoPAG 21 – Finding #1

On the need to investment in databases to support programs related to achieving NASA's strategic goals.

Whereas candidate missions plan to observe a limited number of nearby target stars, and whereas each mission has different criteria for selecting targets, and whereas a comprehensive catalog of the physical and environmental properties of all nearby stars and their planetary systems could make future surveys more efficient (e.g. understanding the multiplicity or composition of potential targets given apparent correlations between these properties and exoplanet demographics), perhaps more cost effective, and probably lower risk,

We find that assembling such a catalog can potentially save significant NASA resources, and would help candidate missions address ExoPAG Science Gaps 06, 07, and 10, which contribute significantly to achieving NASA's strategic goals.

[61 Yes, 0 No, 1 Abstention]

ExoPAG 21 – Finding #2

On the topic of ExoPAG providing input to other Divisions and programs on topics related to Exoplanets.

Whereas ExoPAG is inherently an interdisciplinary research community whose expertise and interests are relevant to some programs covered by the Earth Science, Heliophysics, Planetary Science, and Astrophysics Divisions, and whereas some programs administered by NASA, such as XRP, draw resources from multiple divisions, and whereas new initiatives, such as the Lunar Development and Analysis Program, could benefit from input from communities such as ExoPAG,

We find that multiple audiences would benefit from exposure to reports and findings generated by the ExoPAG to help shape their research programs, and that ExoPAG could benefit from receiving relevant reports and findings from other Program Analysis Groups.

[58 Yes, 0 No, 2 Abstentions]

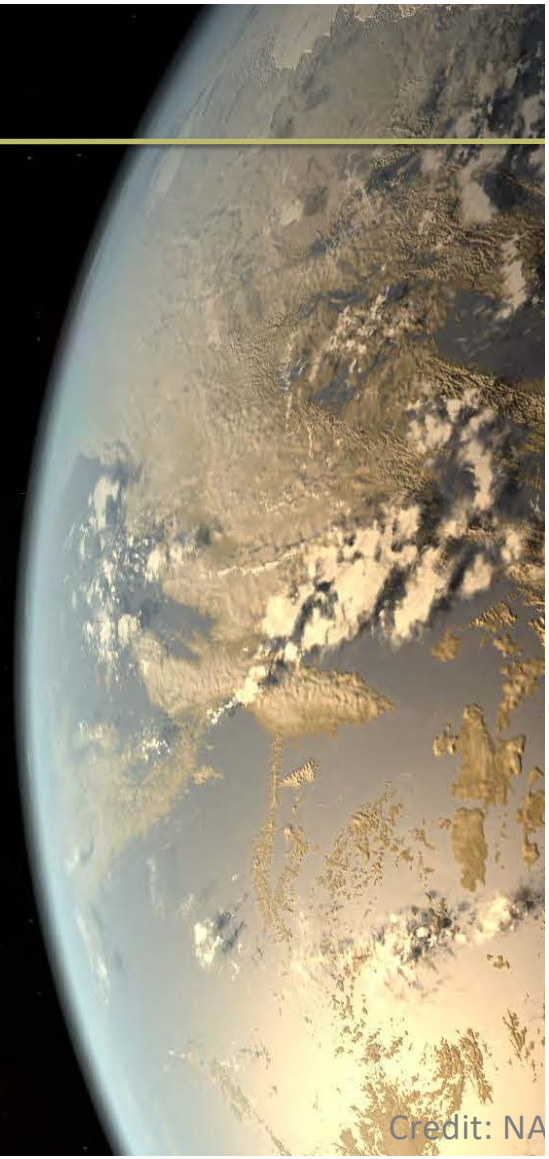
ExoPAG 21 – Finding #3

On the topic of evolution in the Exoplanet Research Program (XRP) outcomes and funding lines.

Whereas the Exoplanet Research Program (XRP) has been one of NASA's most successful R&A programs in addressing critical elements of NASA's strategic goals specifically related to exoplanet science, and whereas the research community is growing and dynamic having the highest rate of new NASA R&A PIs of any other program, and whereas the success rate has dropped to the lowest rate of any other R&A program (with the exception of the FINNEST fellowships), and whereas the funding mechanisms, as well as the scope of the calls, are expected to evolve in the coming year as other divisions participate,

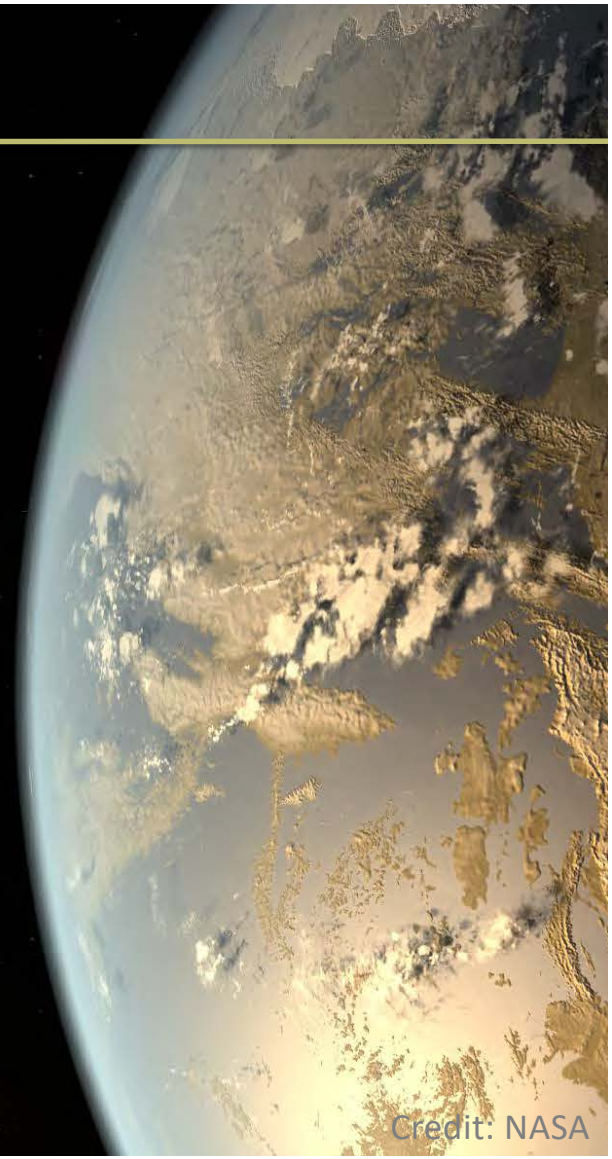
We find that close monitoring of the program, scrutiny of success rates, along with feedback from and communication with the community might help avoid unintended consequences during this evolution."

[58 Yes, 0 No, 5 Abstentions]



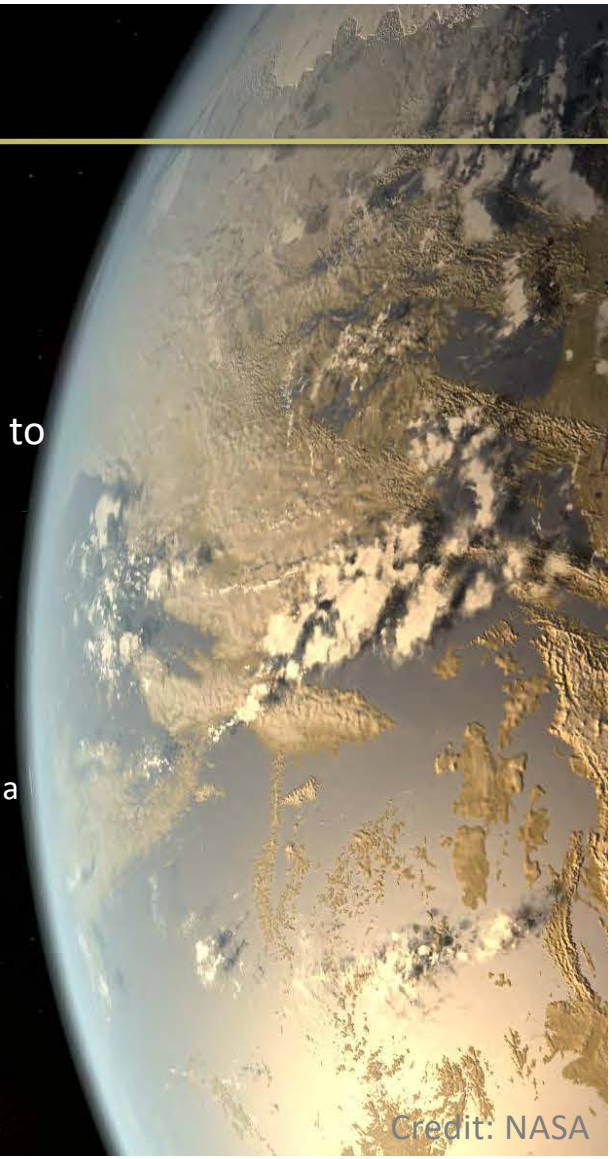
SIG 3 ExoSS Synergies – Context

- We propose to initiate an ExoPAG Science Interest Group on Exoplanet/Solar System Synergies to:
  - Provide opportunities for ongoing discussions on Exo/SS comparative planetology
  - Explore how exoplanet and Solar System missions can benefit from each other.
- In 2010 ExoPAG SAG 2 held and reported on a workshop that explored the potential for exoplanet science measurements from Solar System probes.
  - workshop completed a decade ago
  - SAG had relatively narrowly focus on exoplanet advantages from Solar System missions.
- The proposed SIG3 will be broader in scope, ongoing, and will endeavor to identify multiple initiatives that could be mutually beneficial for both communities.



SIG 3 ExoSS Synergies – Motivation

- Characterization capabilities for exoplanets is improving
  - Large statistical datasets
  - Observations of a diversity of ice giant to giant exoplanets
  - Beginning attempts to observe terrestrial exoplanet atmospheres.
- Both communities are moving towards a systems- and process-based approach to understanding planet formation, evolution, habitability, biosignatures.
  - Requires synthesis of observations, theory and laboratory research from multiple disciplines.
- The two fields have unique perspectives that can benefit each other
  - knowledge and techniques developed from detailed studies of Solar System planets, including Earth, benefit exoplanet science.
  - The diversity of worlds beyond those in our Solar System provides key statistics to understand a broader range of planetary processes, including star-planet interactions.
  - Exoplanets are the broader cosmic context for Solar System planets/architecture.
- Comparative planetology that spans Solar System and exoplanets has the potential to greatly expand our understanding of planets as a whole.
- Effort is needed to encourage communities to interact and collaborate.



SIG 3 ExoSS Synergies – Goals

- We propose to provide a forum for interaction between the Solar System and exoplanet communities on topics of mutual interest, and to work to identify ways in which NASA could enhance these interactions.

- Example activities:
  - coordination of monthly webinars with Solar System/exoplanet presenters,
  - discussion fora,
  - development of workshop proposals (e.g. Exoplanets in Our Backyard Feb 5-7, after OPAG),
  - other cross-PAG/AG activities and presentations,
  - joint SIG reports/review papers that identify beneficial avenues for future joint research between the exoplanet and Solar System communities.

- As a longer term goal, this SIG will encourage cross-disciplinary interaction between PAGs/AGs in all four NASA Divisions.
- It will report at least twice per year to the ExoPAG EC through their monthly telecons, and at least once annually at the bi-annual ExoPAG meetings.
- This SIG3 will be open to all interested community members (please contact Vikki or Kathy if interested!)