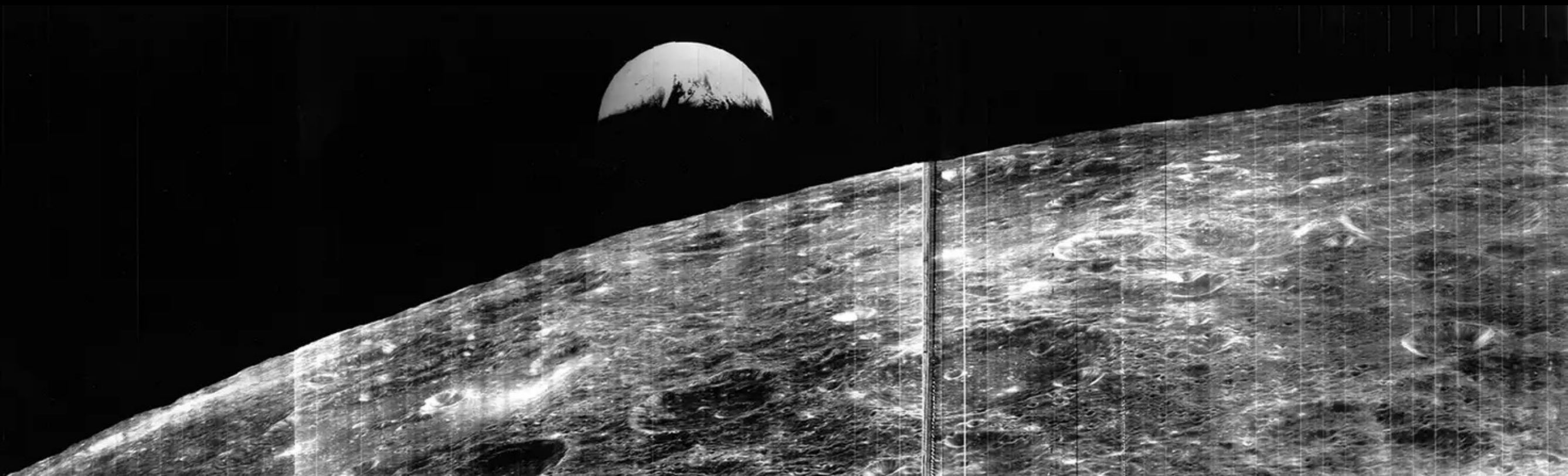


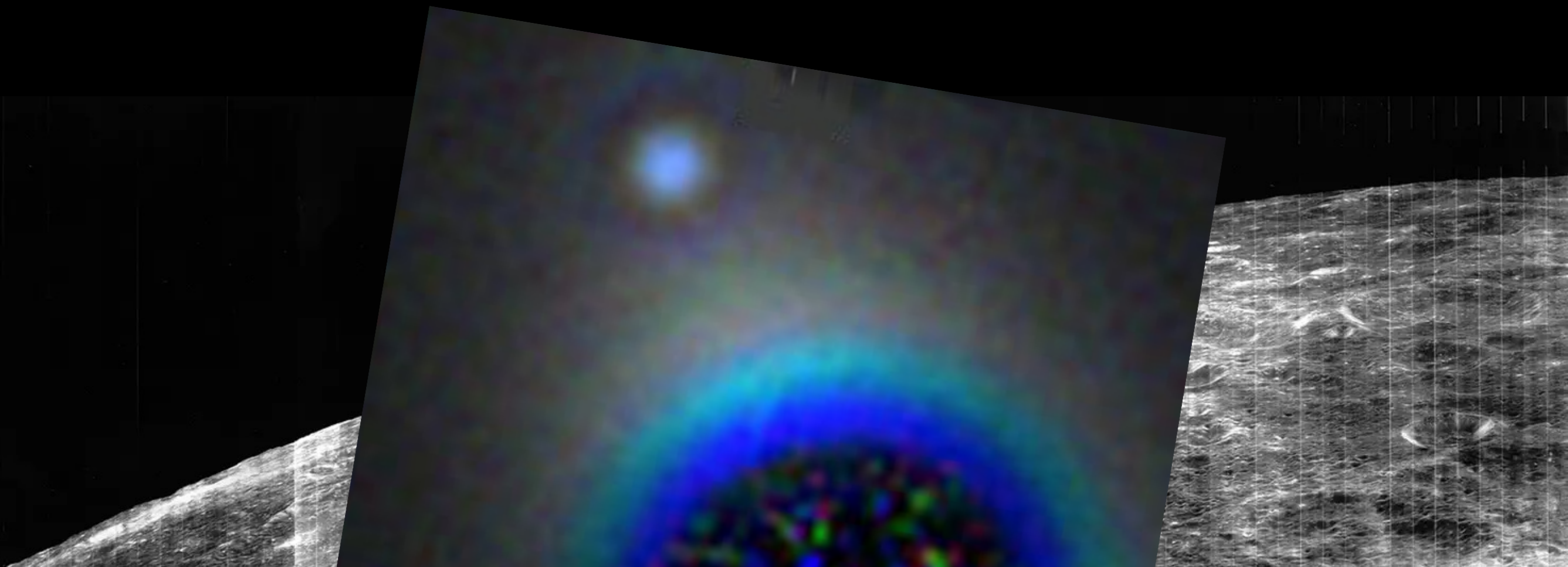
H A B I T A B L E

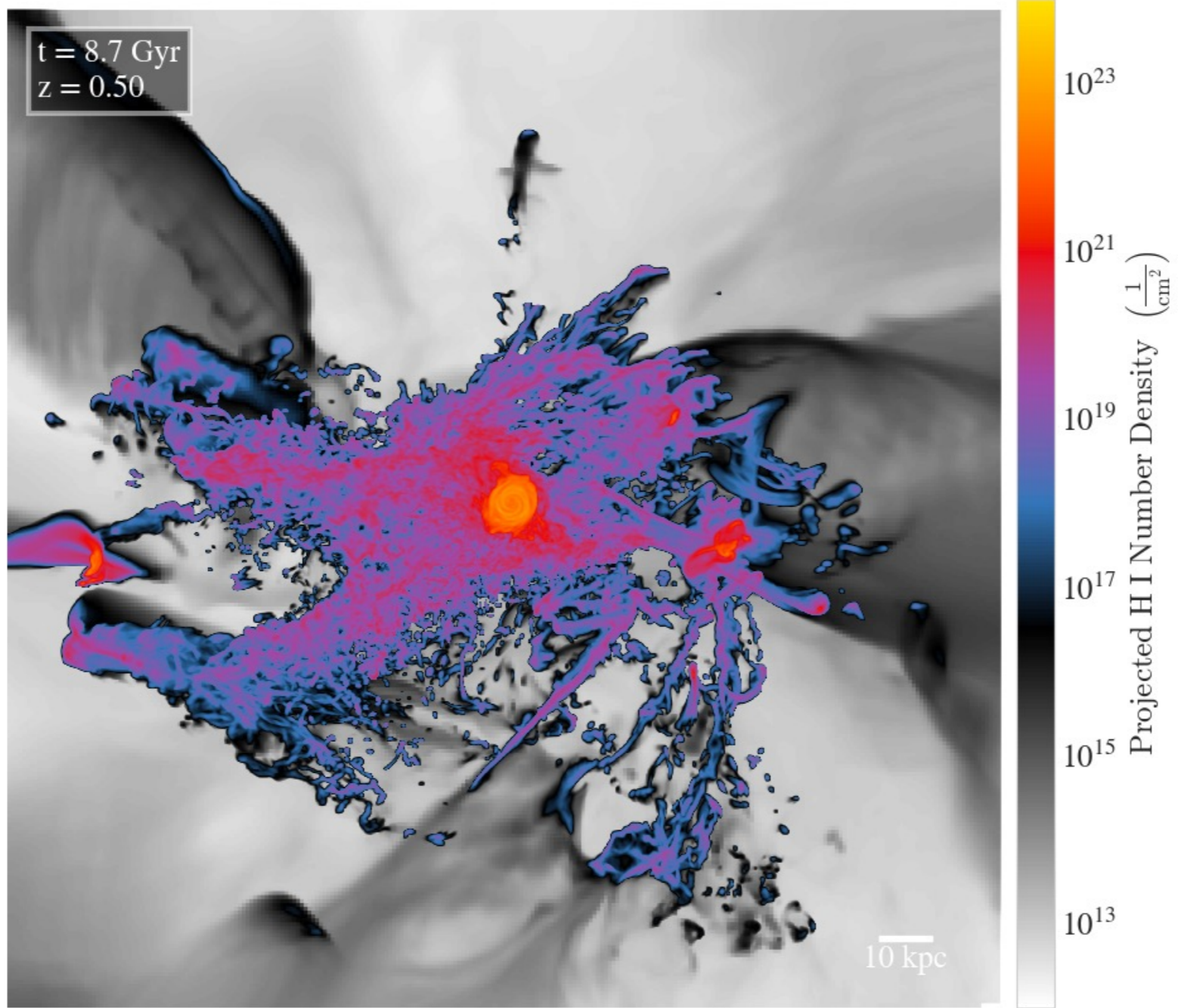
W  R L D S

O B S E R V A T O R Y

THANK YOU







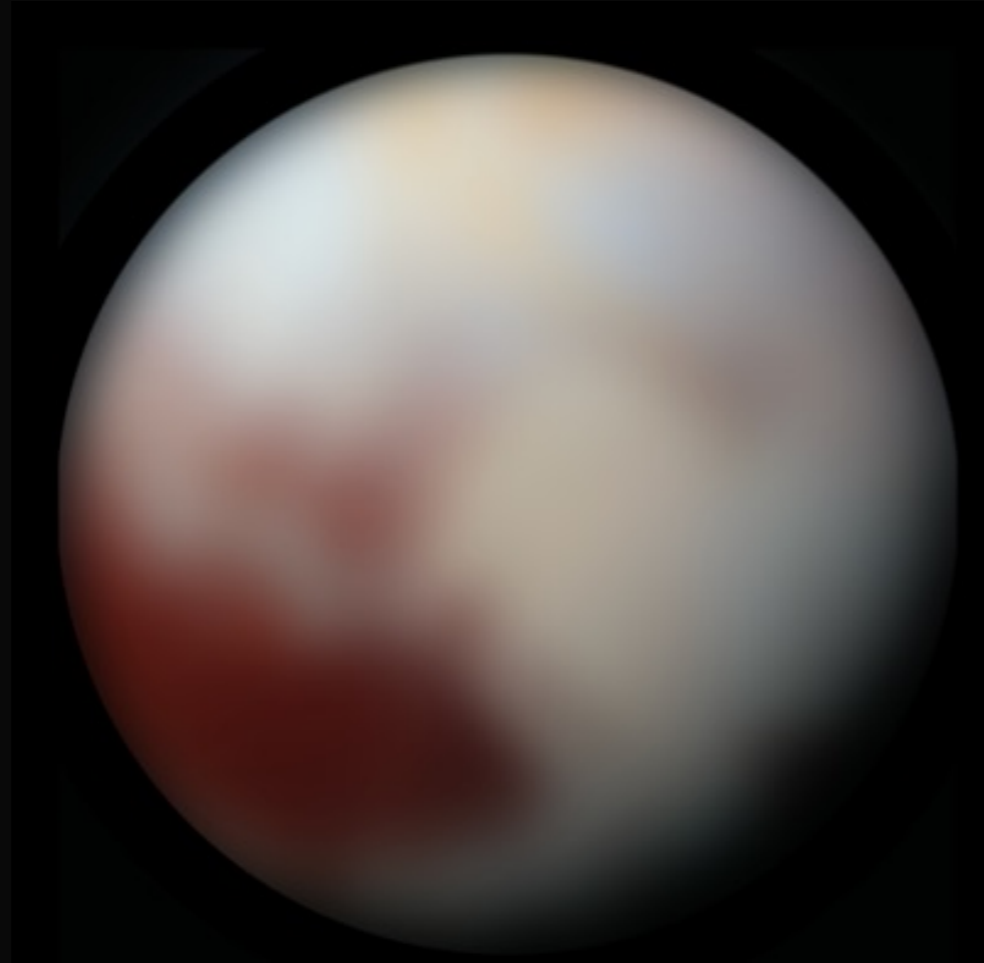
$t = 8.7 \text{ Gyr}$
 $z = 0.50$

10^{23}



10^{21}
 10^{19}
 10^{17}
 10^{15}
 10^{13}
Projected H I Number Density $\left(\frac{1}{\text{cm}^2}\right)$





O ke kahua mamua, mahope ke kūkulu.

THE FOUNDATION FIRST, THEN THE BUILDING

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001



March 11, 2016

Reply to Attn of: Director, Astrophysics Division

Dear Dr. John O'Meara,

I am pleased to inform you that you have been appointed to serve as a member of the Science and Technology Definition Team (STDT) for the Large Ultraviolet/Optical/Infrared (LUVOIR) Surveyor Mission Concept Study. NASA greatly values your expertise and time, and appreciates your willingness to participate in the STDT.

Over the coming years you will play a central role in preparing a compelling and executable mission concept for consideration by the 2020 Decadal Survey. The full charter for the STDT is available at the following site:

http://science.nasa.gov/media/medialibrary/2016/01/04/Mission_Concept_Study_and_Definition_Team_Charter-V1_2015-12-28.pdf

Your term of service begins with immediate effect and completes when all input to the 2020 Decadal Survey has been provided. You should soon expect an email from the Community Chairs of the STDT with more information about the study.

We look forward to assisting you and the rest of the STDT in developing this exciting mission concept.

Sincerely,

Paul Hertz
Director, Astrophysics Division

Ecosystems, will link observations and modeling of the stars, galaxies, and the gas and energetic processes that couple their formation, evolution, and destinies.

Within each of these broad and rich scientific themes, three priority areas motivate recommended investments over the coming decade. "Pathways to Habitable Worlds" is a step-by-step program to identify and characterize Earth-like extrasolar planets, with the ultimate goal of obtaining imaging and spectroscopy of potentially habitable worlds. "New Windows on the Dynamic Universe" is aimed at combining time-resolved multi-wavelength electromagnetic observations from space and the ground with non-electromagnetic signals to probe the nature of black holes, neutron stars, the explosive events and mergers that give rise to them, and to use signatures imprinted by gravitational waves to understand what happened in the earliest moments in the birth of the universe. "Unveiling the Drivers of Galaxy Growth" is aimed at revolutionizing our understanding of the origins and evolution of galaxies, from the nature of the tenuous cosmic webs of gas that feed them, to the nature of how this gas condenses and drives the formation of stars.

THE RECOMMENDED PROGRAM

Major leaps in observational capabilities will be realized in the coming decade when new large telescopes and missions commence science operations (Table 7.1). Recommended by previous surveys, with some undertaken with international partners, these projects and programs are an essential base upon which the survey's scientific vision is built. It is essential that these initiatives be completed, and the scientific programs be supported at levels that ensure full exploitation of their potential by the U.S. scientific community.

Going forward, this survey lays out a strategy for federal investments aimed at paving a pathway from the foundations of the profession to the bold scientific frontiers.

Large Programs that Forge the Frontiers

These scientific visions—Pathways to Habitable Worlds, New Windows on the Dynamic Universe, and Unveiling the Drivers of Galaxy Growth—require the major recommended investments in large projects to begin design and construction in the coming 10 years (Tables S.5 and S.6; Figure S.1).³ In space, achieving the community's most ambitious and visionary ideas in a sustainable way, and realizing the broad capabilities demanded by the richness of the science, requires a re-imagining of the ways in which large missions are planned, developed, and implemented. The **Great Observatories Mission and Technology Maturation Program** (Table S.5) would provide significant early investments in the co-maturation of mission concepts and technologies, with appropriate decadal survey input on scope, and with checks and course corrections along the way. Inspired by the vision of searching for signatures of life on planets outside of the solar system, and by the transformative capability such a telescope would have for a wide range of astrophysics, the survey recommends that the first mission to enter this program is a **large (~6 m aperture) infrared/optical/ultraviolet (IR/O/UV) space telescope**. The scientific goals of this mission, when achieved, have the potential to profoundly change the way that human beings view our place in the universe. With sufficient ambition, we are poised scientifically and technically to make this transformational step. This endeavor represents a quest that is on the technical forefront, is of an ambitious scale that only NASA can undertake, and it is one where the United States is uniquely situated to lead the world. If maturation proceeds as expected, the survey recommends that formulation and implementation begin by the end of the 2020 decade. To prepare for future large, strategic missions, 5 years after beginning the maturation program for the IR/O/UV mission, the survey

³ For space, large projects are defined as those with costs exceeding \$1.5 billion. For ground-based initiatives, large projects are defined as those exceeding \$130 million for the total program investment.

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Worlds Beyond:
Exoplanet Task
Force Report

2008

Astro2010
Decadal
Survey

2010

Astrophysics
Roadmap

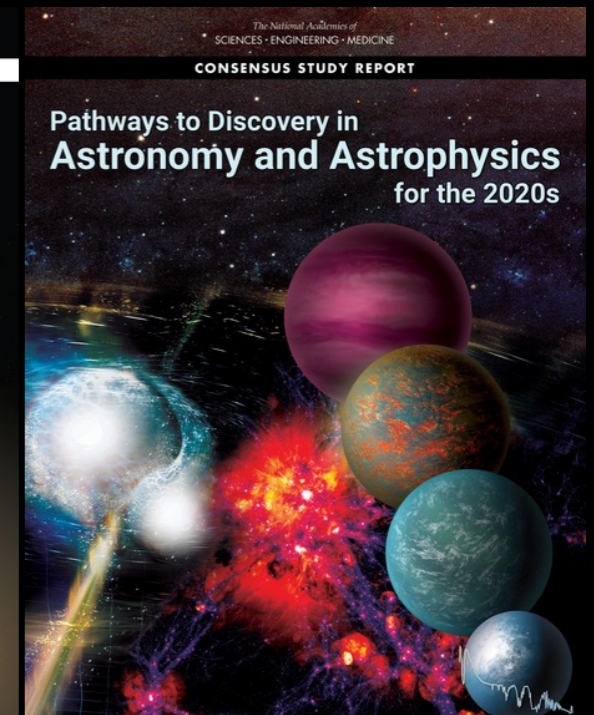
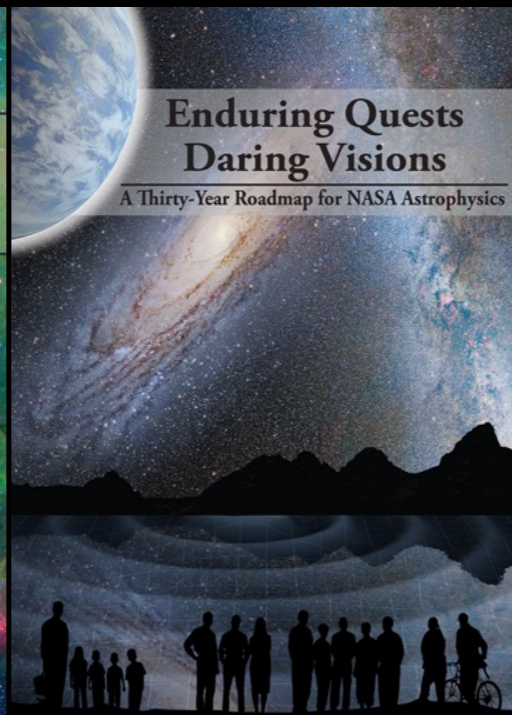
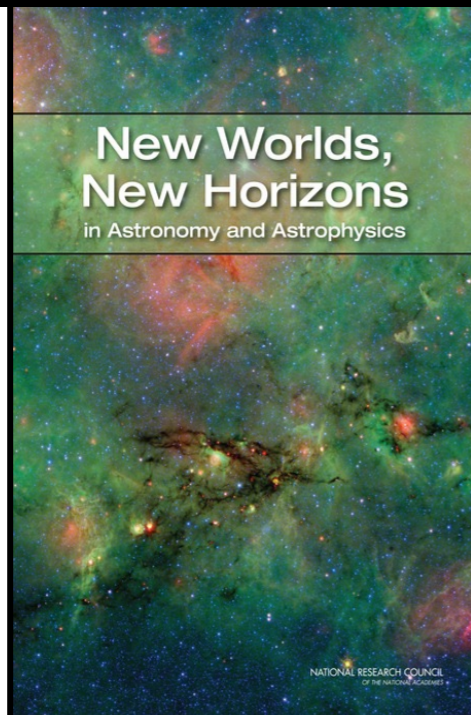
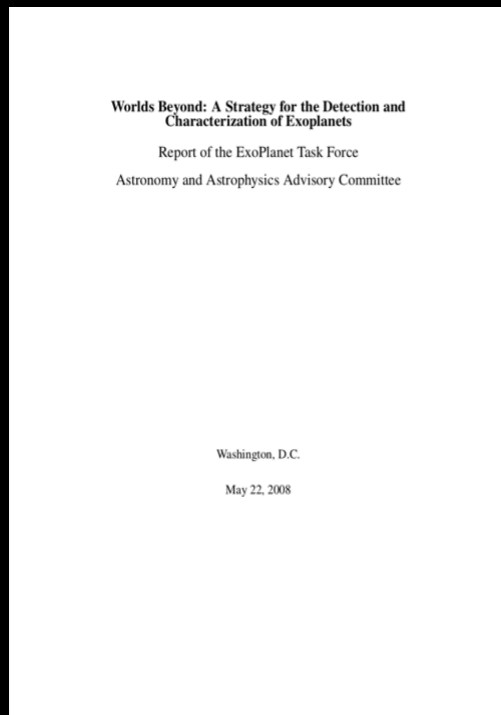
2013

Consensus
Study
Report

2018

Astro2020
Decadal
Survey

2021



Astrophysics
Advisory
Committee (APAC)

National
Academy of
Sciences

NASA

National
Academy of
Sciences

National
Academy of
Sciences

TPF

ATLAST

HDST

HABEX

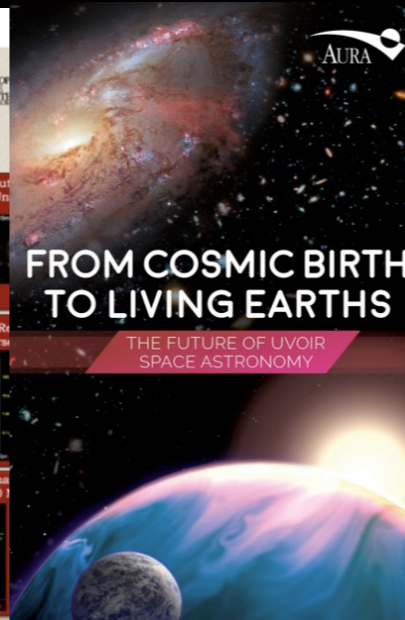
LUVOIR



2002-2011



2008-2015



2015



2016-2019



2016-2019



BREATHE

- Take time to say hello
- We know a hell of a lot, but we don't know everything
- This is our baton to pass
- It will be worth it

Ho'okahi ka 'ilau like ana

WIELD THE PADDLES TOGETHER

This finding also relates to agency-level proactive advocacy in terms of public interactions (speeches, social media, outreach events, conferences) and congressional interactions (testimony, Hill visits, talking points, industry alignment). These same programs have also faced difficult gauntlets in terms of public and administration/congressional support. During these challenging times, advocacy made the difference between success and failure.

MSR IRB report

THANK YOU

ALL OF YOU