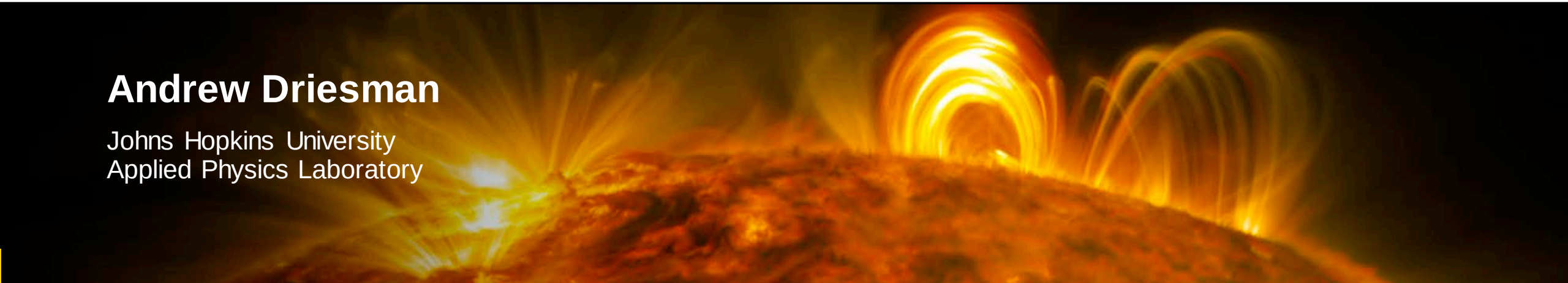
JOHNS HOPKINS APPLIED PHYSICS LABORATORY

National Aeronautics and Space Administration

Parker Solar Probe Lessons Learned for Planetary Science Decadal Survey – Panel on Mars

January 5, 2021



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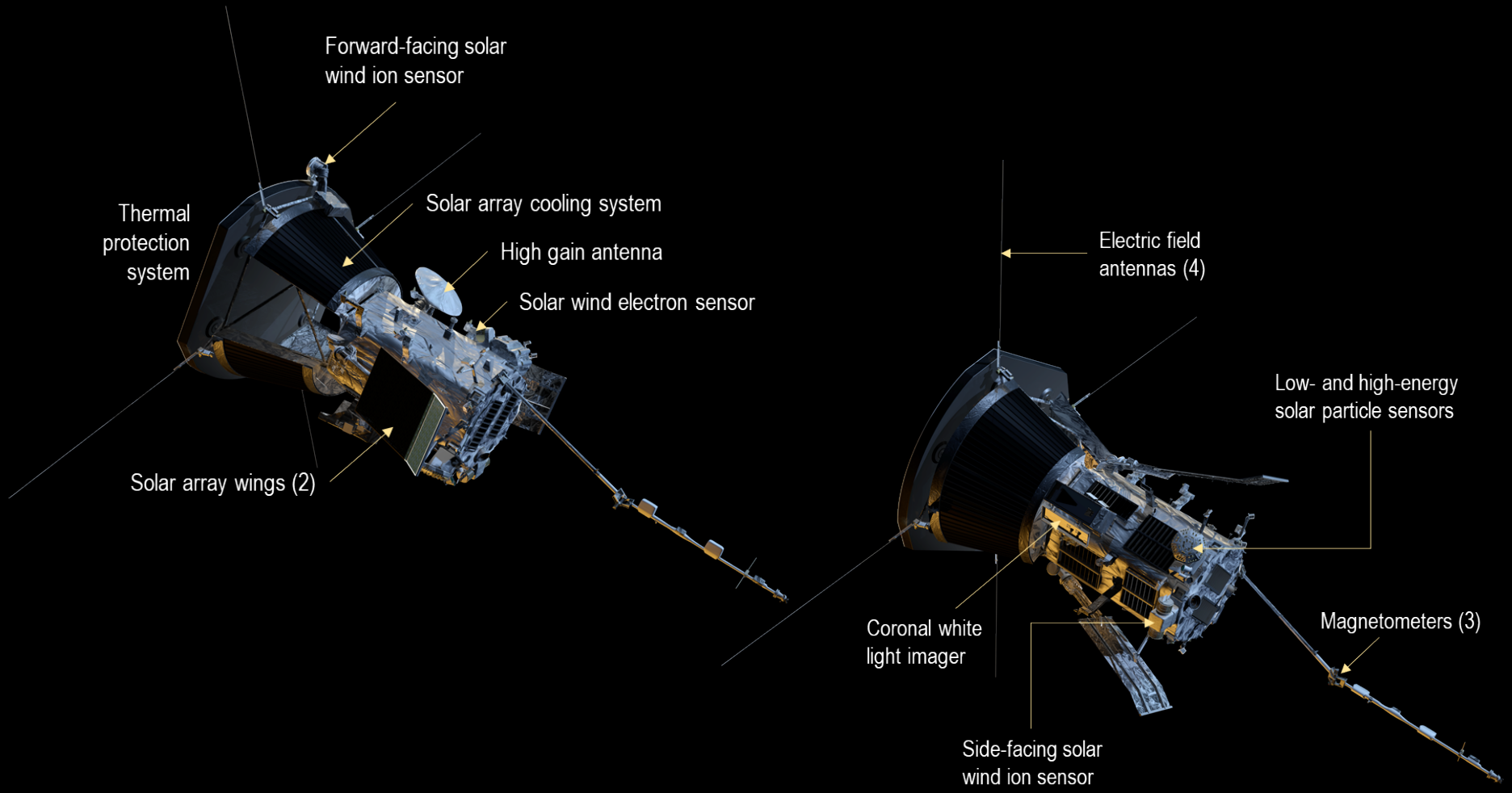
Agenda

- Parker Solar Probe: an Historical Perspective
- Mission and System Overview and Status
- Enabling Lessons Learned and Lessons Learned the “Hard Way”
- Summary
- Discussion

Parker Solar Probe's History

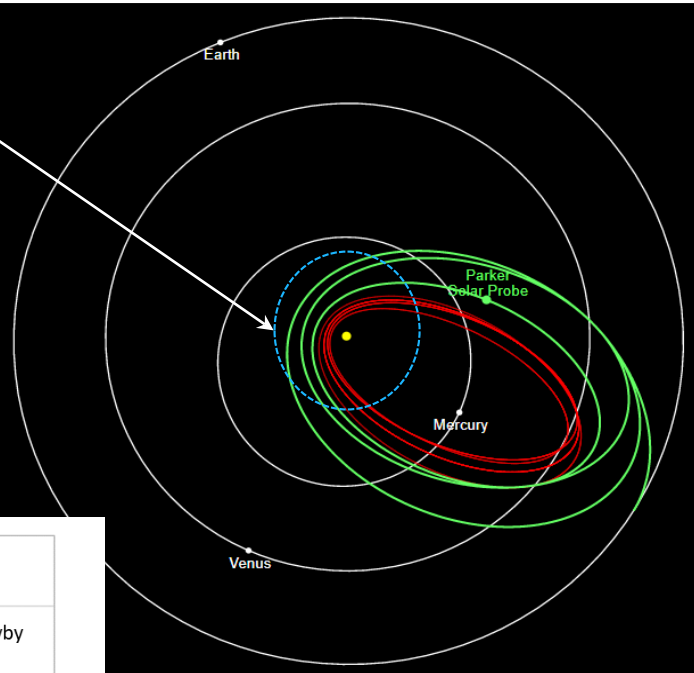
- First proposed in 1958
- Concept studies for 5 decades (1958-2007) – "Solar Probe"
- Re-designed in 2007 – "Solar Probe Plus" – became flight project
- Mission development for 10 years (2008-2018)
  - Pre-Phase A: Jul 2008 – Nov 2009
  - Phase A: Dec 2009 – Jan 2012
  - Phase B: Feb 2012 – Mar 2014
  - Phase C: Mar 2014 – Jun 2016
  - Phase D: Jun 2016 – Sep 2018
  - Launch Aug 12, 2018, 3:31a
- "Solar Probe Plus" ➤ "Parker Solar Probe" in 2017

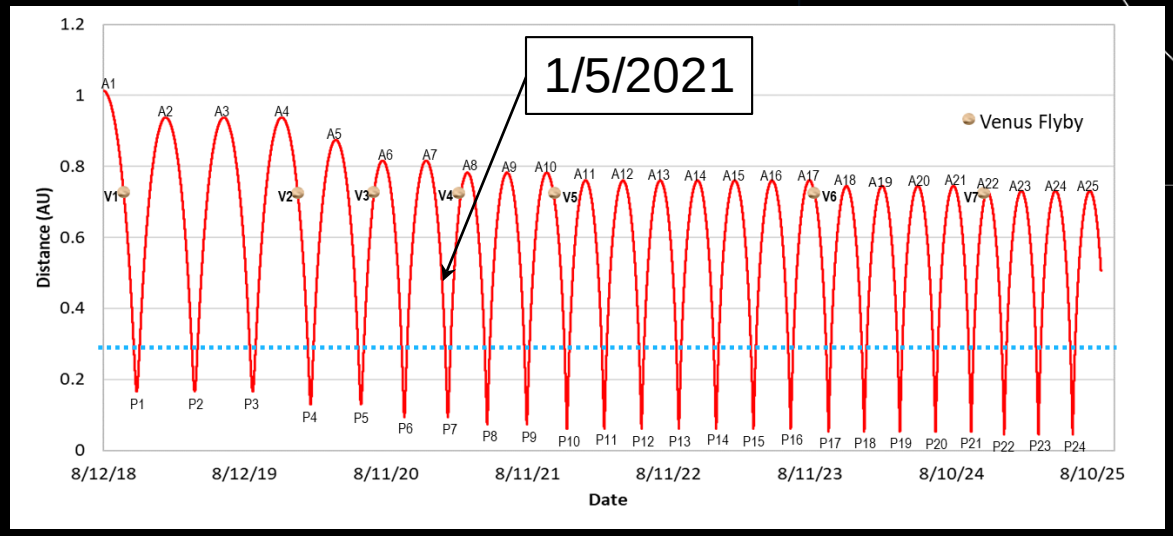
Flight System and Payload



Solar Distances and Implications

Perihelion of Helios-B, 0.29 AU, 1976

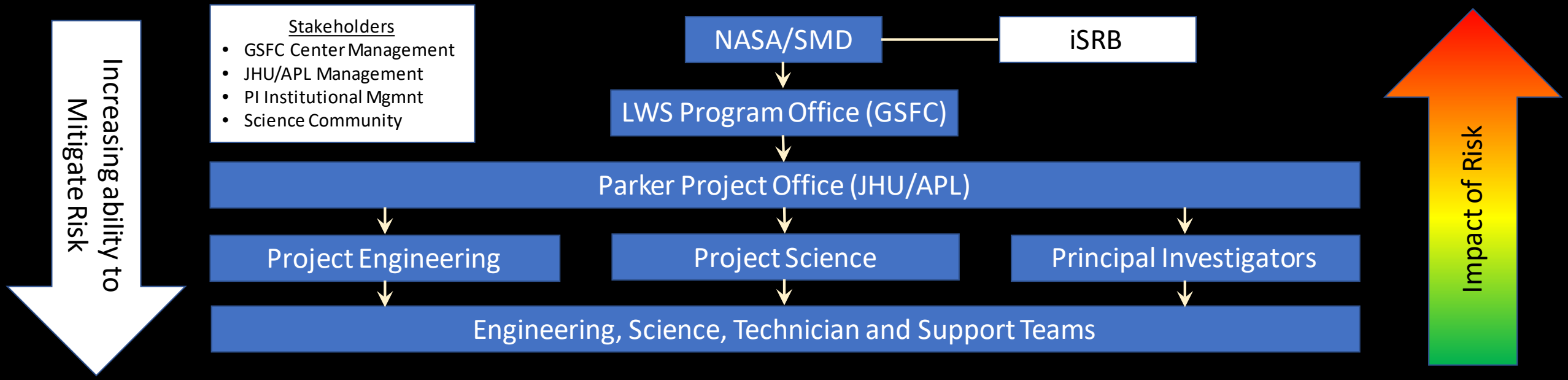




- Unknown and Unexplored region of the solar system
- Highly Dynamic
- Hyper-velocity dust
- Unforgiving
- Poor/No communications
- Short cruise

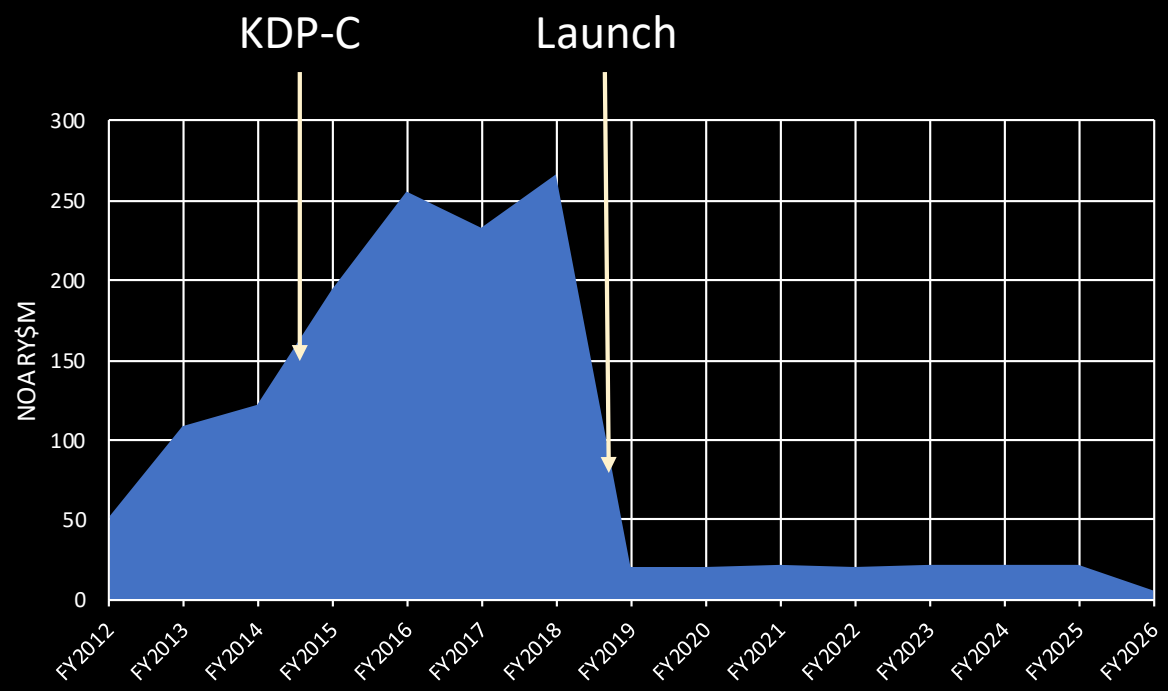
LL #1 – One team with Mission Success as a Single Objective

Everyone understood and played their part



- The impact of risk on this structure goes to the inverse of their ability to mitigate risk
- Developing trust and communication is paramount
- Emphasize the importance of cross-institution team building

LL #2 – the funding profile set at KDP-C was nearly ideal



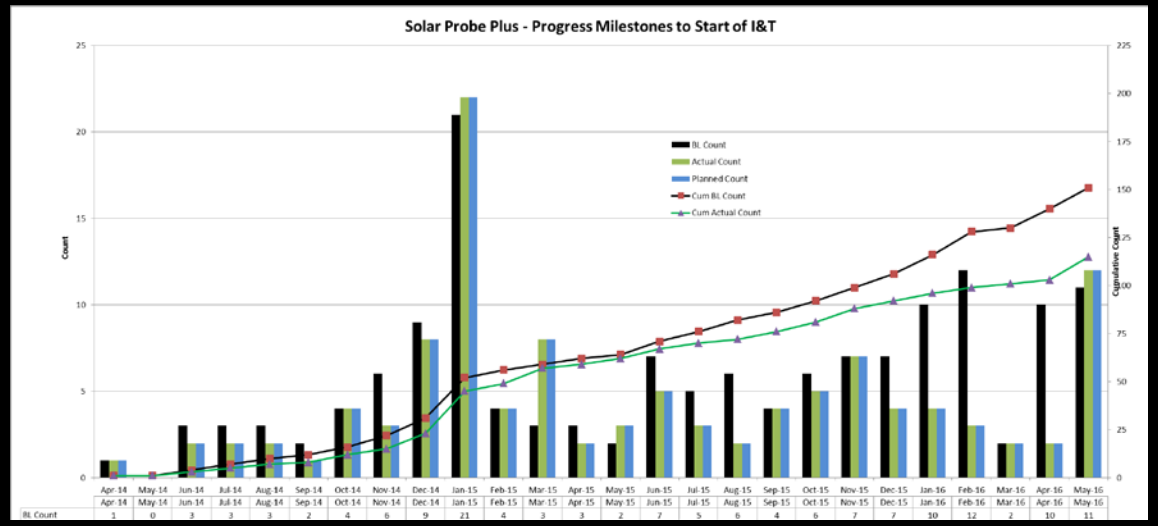
- The budget established at KDP-C, Confirmation (base, reserves and UFE) for PSP was almost ideal
  - Huge push up for NASA
- The Project never slowed work due to funding concerns
- Focus was on schedule performance, not cost performance
  - Cost will follow schedule

LL #3: Parker benefited from significant technology investment during Pre-Phase A, Phase A and B

- Approximately $80 RY$M was invested in Pre-Phase A and Phase A to develop technology along with the rest of the system
- Developing technologies by themselves is insufficient to reduce risk across a complex system
  - The spacecraft was matured along with the technologies
- When necessary - science performance was traded for technology stability/realism
- Held ourselves accountable for “true” TRL maturity. Used “independent assessment teams”.

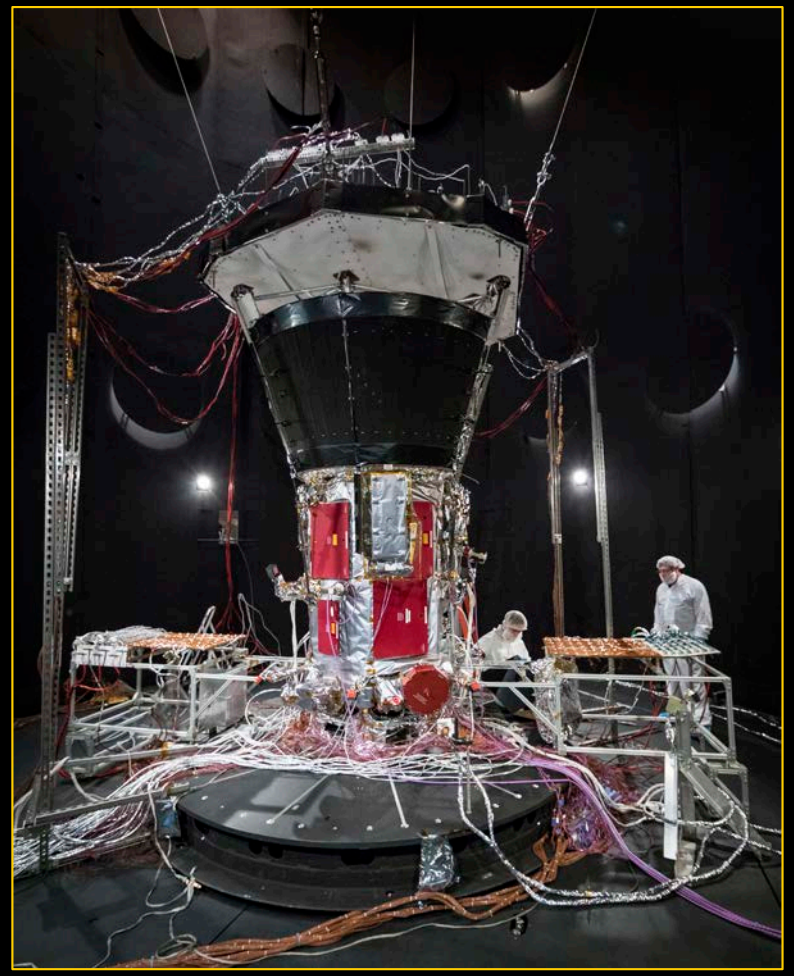
LL #4: Early milestones are just as important as the later milestones

- Be a hard critic of the quality of the progress being made and make the hard calls early
- The Project team learned this lesson, the hard way, just in time
  - Started double shifts two years prior to launch
- Net result: On time launch at a cost well below Agency Budget.



LL #5: Complexity and Institutional/Team Experience with Complexity is a Knife that cuts both ways

- Parker, in hindsight, was significantly more complex than originally thought
  - Outside team's experience base
- Positive impacts:
  - Allowed for innovative solutions with minimum overhead
  - Forced institutional growth
- Negatives impacts:
  - Lack of complexity sensitive processes and organizational structures led to surprises and impacted schedule
- Managing complexity is paramount

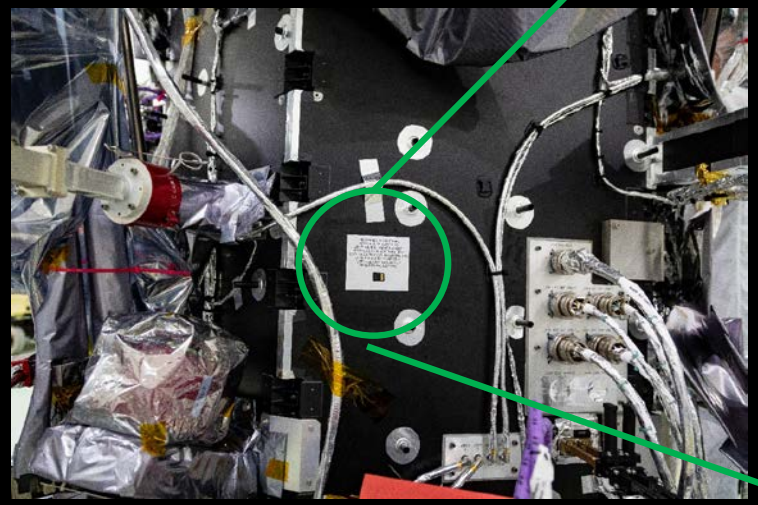


Summary

- Parker Solar Probe is realizing the vision established 60+ years ago
- The spacecraft is fully operational
- The mission has recovered ~3x more data than originally planned
  - This should continue
- Every orbit is yielding new discoveries and insights

Daring, high technology missions of exploration CAN BE successfully done within established cost and schedule commitments

Discussion




THE PARKER SOLAR PROBE
MISSION IS DEDICATED TO
DR. EUGENE N. PARKER WHOSE
PROFOUND CONTRIBUTIONS HAVE
REVOLUTIONIZED OUR UNDERSTANDING
OF THE SUN AND SOLAR WIND.
"LET'S SEE WHAT LIES AHEAD"
GENE PARKER, JULY 2017

JOHNS HOPKINS
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National Aeronautics and
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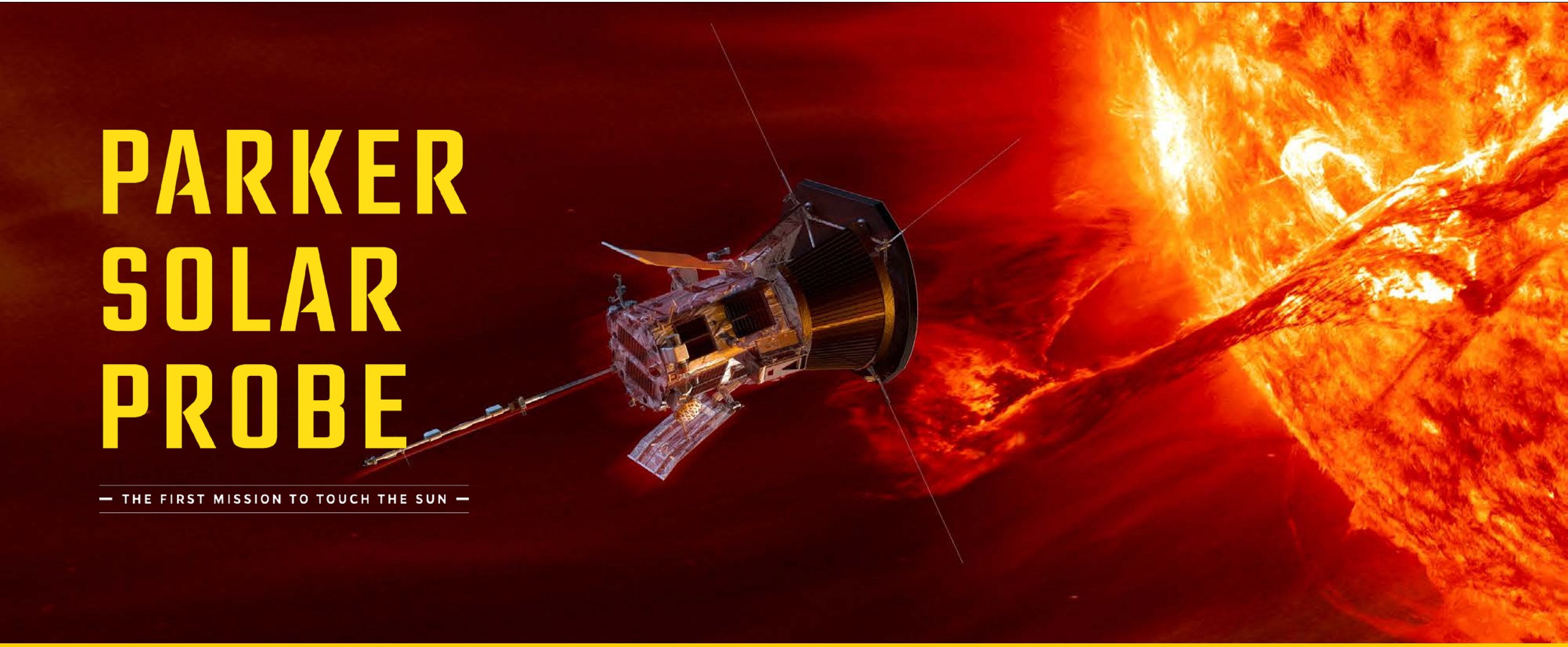
NASA



PARKER SOLAR PROBE

— THE FIRST MISSION TO TOUCH THE SUN —

Andrew Driesman