Jet Propulsion Laboratory
California Institute of Technology

Why Do We Explore?

RAMS® 2017 Banquet

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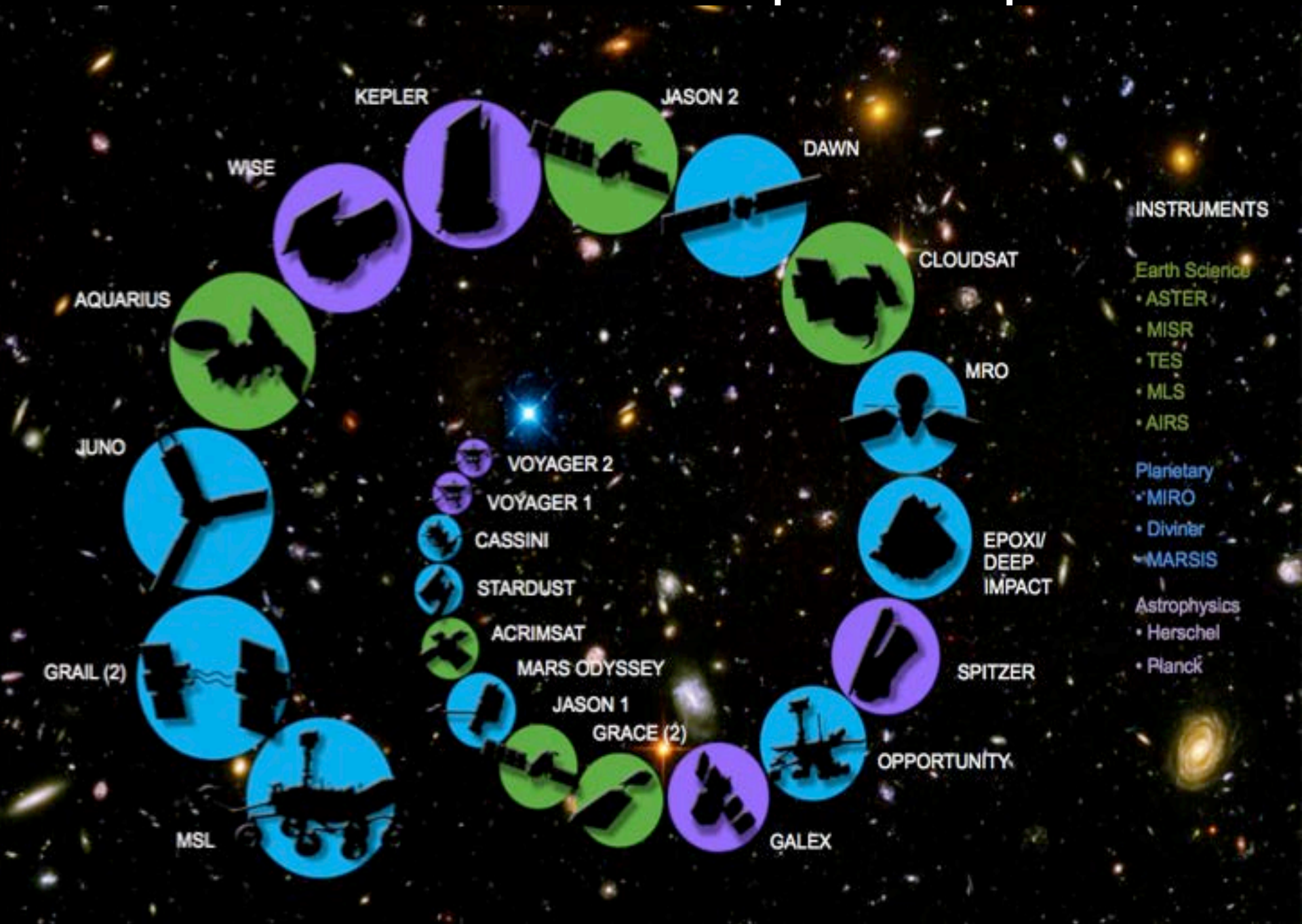
DARE MIGHTY THINGS

50TH ANNIVERSARY OF PLANETARY EXPLORATION

2013

47 JPL Missions Now in Development or Operation



Why do humans explore?

Fear and pride?

Return on Investment

Ultra-Extreme Environments: Role of Reliability Engineering

- Mars has a <u>hostile</u> environment in terms of pressure, temperature extremes, thermal cycling, radiation, winds, dust, terrain (rocks, cliffs, quicksand); there's also high <u>uncertainty</u>
  - Design must encompass uncertainty/worst case environment
  - Curiosity rover's wheels are wearing out faster than expected

Curiosity is unexpectedly encountering a lot of immobile, pointy rocks

- The Mars Exploration Rovers' design life was 90 days
  - But the "Spirit" rover lasted 6 years,
  - and the "Opportunity" rover is still active after 13 years (today)

Dare Mighty Things

“Far better is it to **dare mighty things**, to win glorious triumphs, even though checked by failure...than to rank with those poor spirits who neither enjoy much nor suffer much, because they live in a gray twilight that knows not victory nor defeat.”

- Theodore Roosevelt, 26th President of the United States

Apollo 8: Earthrise

First photo of Earth from the Moon