

CASSINI AND OTHER REMOTE INVESTIGATIONS OF OUR SOLAR SYSTEM AND BEYOND



Earth

The Moon

Fred Busche

PUTS US IN PERSPECTIVE

By Stephan Pastis

PEARLS BEFORE SWINE

RAT, THIS IS MY FRIEND, BOB. HE WON AN EMMY FOR A T.V. SHOW.

OH, WOW.

SO HE ENTERTAINED A TINY FRACTION OF THE POPULATION IN ONE COUNTRY ON A SMALL PLANET IN AN INSIGNIFICANT SOLAR SYSTEM ON A NON-DESCRIPT ARM OF AN UNREMARKABLE GALAXY IN A UNIVERSE OF OVER 100 BILLION GALAXIES.

HE'S CRYING IN THE BATHROOM.

PERSPECTIVE IS CRUEL.



**NOT SURE WHY THIS ALWAYS HAPPENS
WITHIN DAYS OF AN OLLI PRESENTATION**

**Last year it was the discovery of gravity
waves that was announced just two days
before I gave a presentation about the big
bang**

This year – well I guess I'll just show you

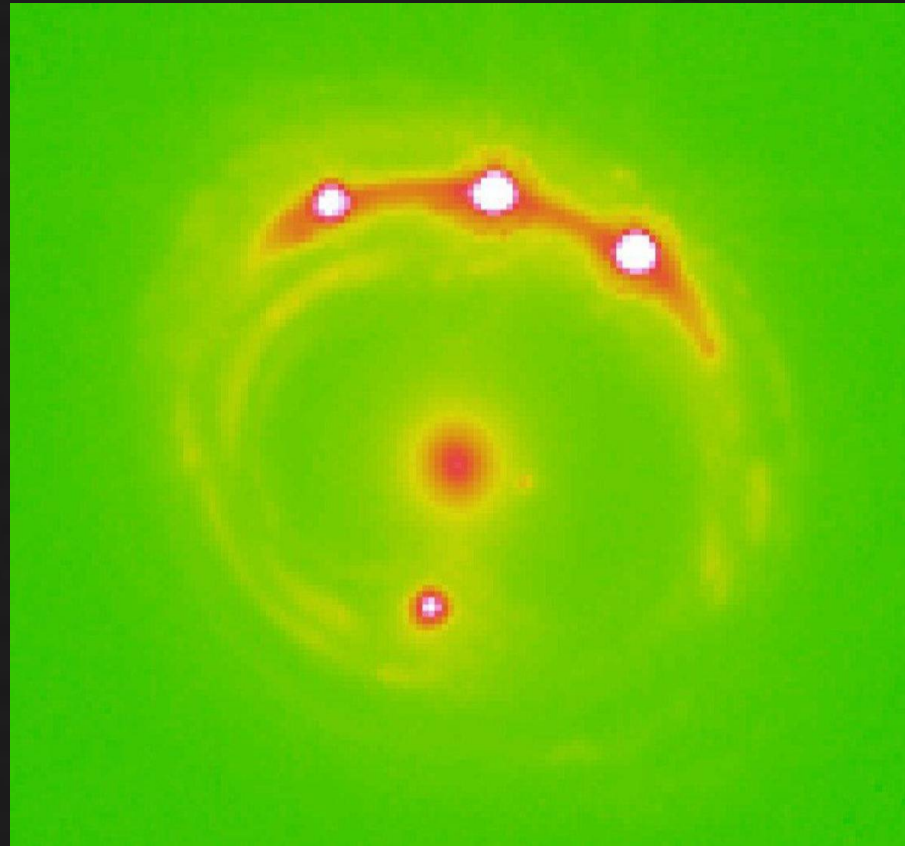
I NEVER THOUGHT I WOULD SEE THIS



**I DIDN'T DO THIS INTENTIONALLY BUT THIS JUST IN
MORE THAN A TRILLION PLANETS MAY EXIST
BEYOND OUR GALAXY**



NEW EXOPLANETS DISCOVERY ANNOUNCED THIS PAST MONDAY



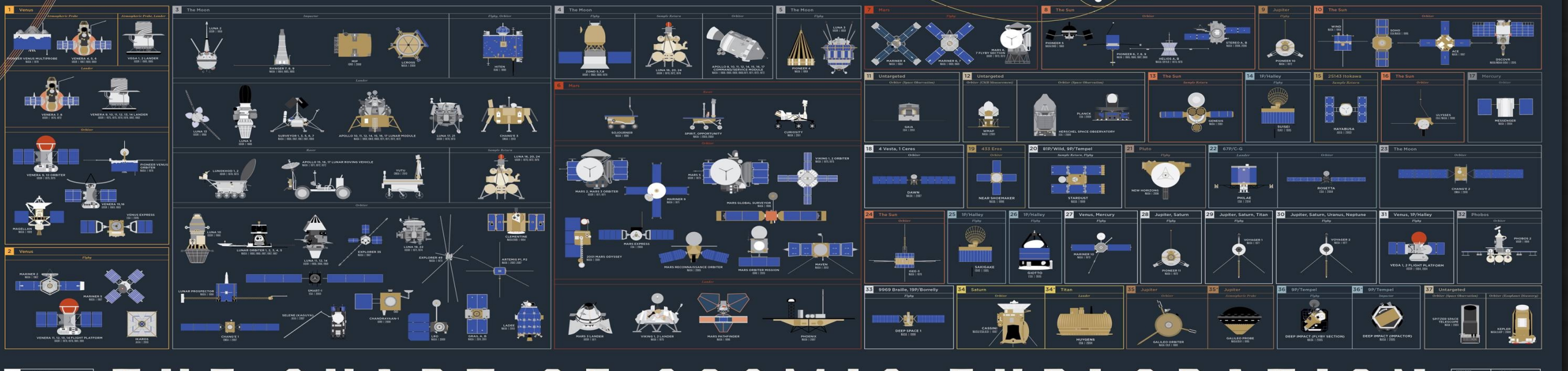
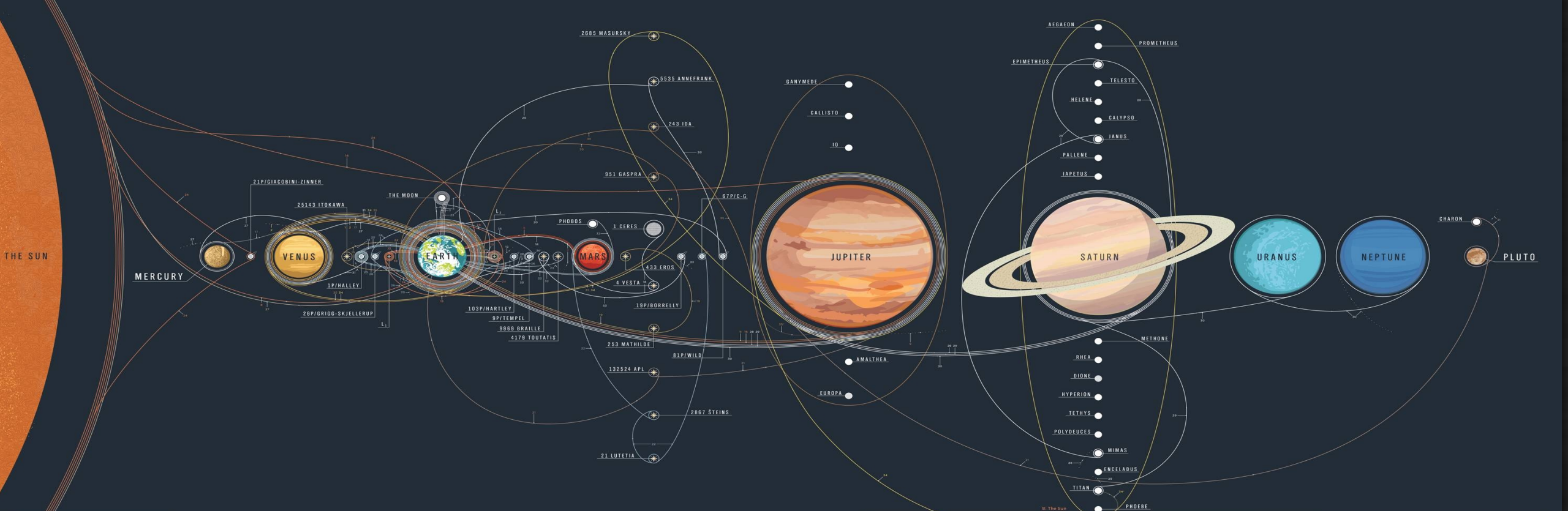


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A LONG TIME AGO IN A GALAXY FAR FAR AWAY



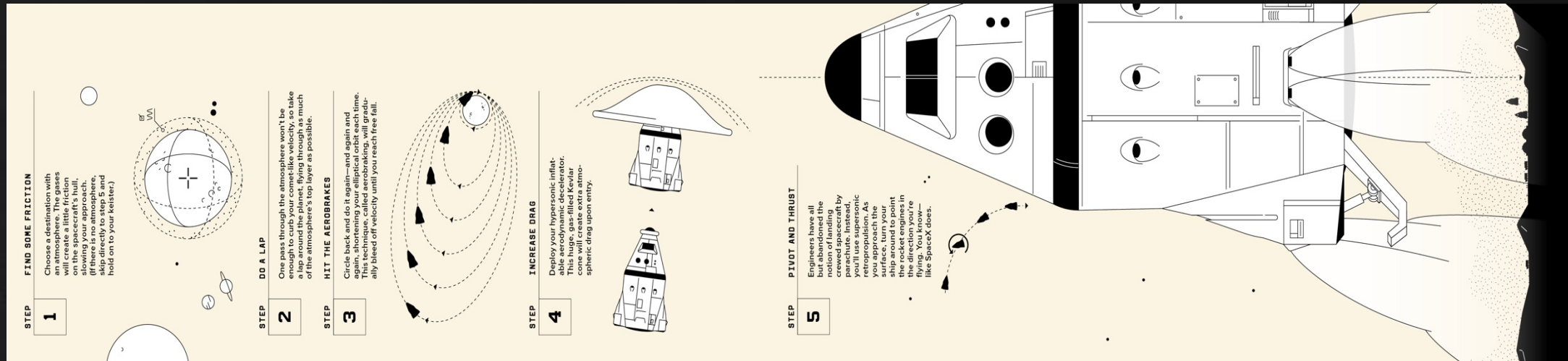
ISSUES ASSOCIATED WITH OUR PASSIONS

- Obviously it is associated with the fact something is there so we must go.
 - True when we left Africa 94,000 years ago (new date)
 - True when we sailed with little real expertise from islands to others that we could not even see
 - All the new products that will result – Teflon pans etc.
 - Man forever looking to see what he can find just over the ridge
- Gravity is a drag
 - Must exceed 25,000 miles per hour to escape gravity
 - Its 200 Million dollars just to launch the Mars Curiosity Rover
 - Reusability is now cutting that cost dramatically
- We travel at an extremely low velocity – going anywhere takes forever
 - To reach the moons of Jupiter takes 5 to seven years and Jupiter is only 13% of the way to the outer edge of our Solar System.



ISSUES ASSOCIATED WITH OUR PASSIONS CONTINUED

- Space trash is everywhere – hurtling at 17,000 miles per hour and if you count them there are about 500,000 objects that could damage a space craft
- Navigation – Guess what, there is no GPS in space
 - Radio waves travel at light speed but light speed would require over 5.7 years one way to our closest star at that distance from earth
- Finally as a start lets look at landing the thing.



SIZE OF THE UNIVERSE

BuzzFeed

**209 SECONDS THAT
WILL MAKE YOU QUESTION YOUR
ENTIRE EXISTENCE**



0:01 / 3:33



HOW SIGNIFICANT ARE WE?



LETS LOOK AT GOING THERE QUICKLY



PRETTY COOL RIGHT? WHY NOT?



WHO REMEMBERS THIS?

October 4, 1957

www.thefeverof57.com

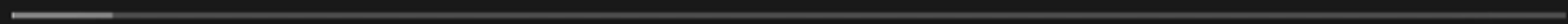
PIONEER AND OTHER MISSIONS



VOYAGER 1 AND 2



00:00



03:06



ALL THE VOYAGERS



ENGINEER|8



0:03 / 5:02



I GUESS WE HAVE A WHILE BEFORE STAR WARS WINS. NOW FOR THE SLOW MISSIONS




- Cassini – A long drive on a small horse.
- What have we found and what is next.
 - NASA's Cassini spacecraft ended its journey on Sept. 15 with an intentional plunge into the atmosphere of Saturn 
 - New details about the whimsically named ring features called propellers, which are wakes in the rings created by small, unseen moonlets. The propellers are analogous to baby planets forming in disks around young stars, as they obey similar physical processes.
 - In its last images of the rings (taken the day before the spacecraft's plunge into Saturn), Cassini successfully imaged all six of the propellers
 - Outward creep of rings controlled by Saturn's Moons 
 - The probe found evidence of subsurface oceans of liquid water on some of the moons, spotted geysers and other geologic activity, and even found indications of prebiotic chemistry (more on that further on in the countdown).

CASSINI ADDITIONAL FINDINGS

- Titan is a moon with a solid surface dotted with lakes, oceans and rivers made of hydrocarbons (mostly methane and ethane). Huygens, probe from Cassini, also gave scientists a lot of information about Titan's environment, from the winds in the upper atmosphere to the dunes on the surface.
- The spacecraft provided scientists with strong evidence that Enceladus possesses a worldwide liquid-water ocean underneath a shell of ice 19 to 25 miles (30 to 40 kilometers) thick, and this is very likely the source of the liquid in the plumes.
- Just a few months ago, Cassini discovered that there is hydrogen in these plumes, which is a hint that there could be hydrothermal vents in the ocean, creating a warm, friendly place for life to congregate, similar to the undersea vents in Earth's oceans.



CONTINUED

- Phoebe's ring of debris (the F ring), and because it is tidally locked, one side always faces the incoming debris and gets covered. These dark particles absorb more sunlight than the brighter, default surface of Iapetus. As sunlight strikes the dark regions, it melts away the ice. Then water vapor from the melting region goes to the nearest cold area, freezing on the brighter spots and amplifying their brightness.
- Excluding Saturn's ice- and rock-filled rings, the planet hosts 53 known moons and eight provisional (unconfirmed) moons, according to NASA. The mind-blowing thing is that when the mission began in 1997, scientists only knew of 18 moons around Saturn. Even while Cassini was en route, Earth-based telescopes discovered 13 more. 
- The V shape of Pac-Man's gaping mouth, cut out of a featureless, circular head, shows up in a heat signature detected on both moons. The two satellites are tidally locked, meaning one side always faces Saturn. Scientists theorize that the shape occurs because high-speed electrons smash into the leading side of each moon's surface, transforming the soft terrain into hard-packed ice, which is more reluctant to cool down at night — or to heat up during the day — than "fluffier" terrain, according to NASA. The cooler regions seen in the infrared images are the hard-packed ice; the rest of the terrain warms up faster in the daytime, to create the Pac-Man silhouette. 
- Saturn's hexagon pole is due to possible vortex streets, a series of spiraling vortices not observed in Saturn's hexagon. Simulations show that a shallow, slow, localized meandering Jetstream in the same direction as Saturn's prevailing clouds is able to match the observed behaviors of Saturn's Hexagon with the same boundary stability. 

SUMMARY

- Man has wondered about what is out there for most of his existence
- Man began to understand something about what is a Universe less than 120 years ago
- Man only began “going out there” about 61 years ago
- Missions started over 50 years ago are still ongoing
- The Universe is a very large place
- Warp Drive may be the only way that we will be able to escape our local space and see what else may be out there
- Let’s hope we have the sense to work together for the future rather than racing to be “the first”

QUESTIONS



CASSINI MISSION

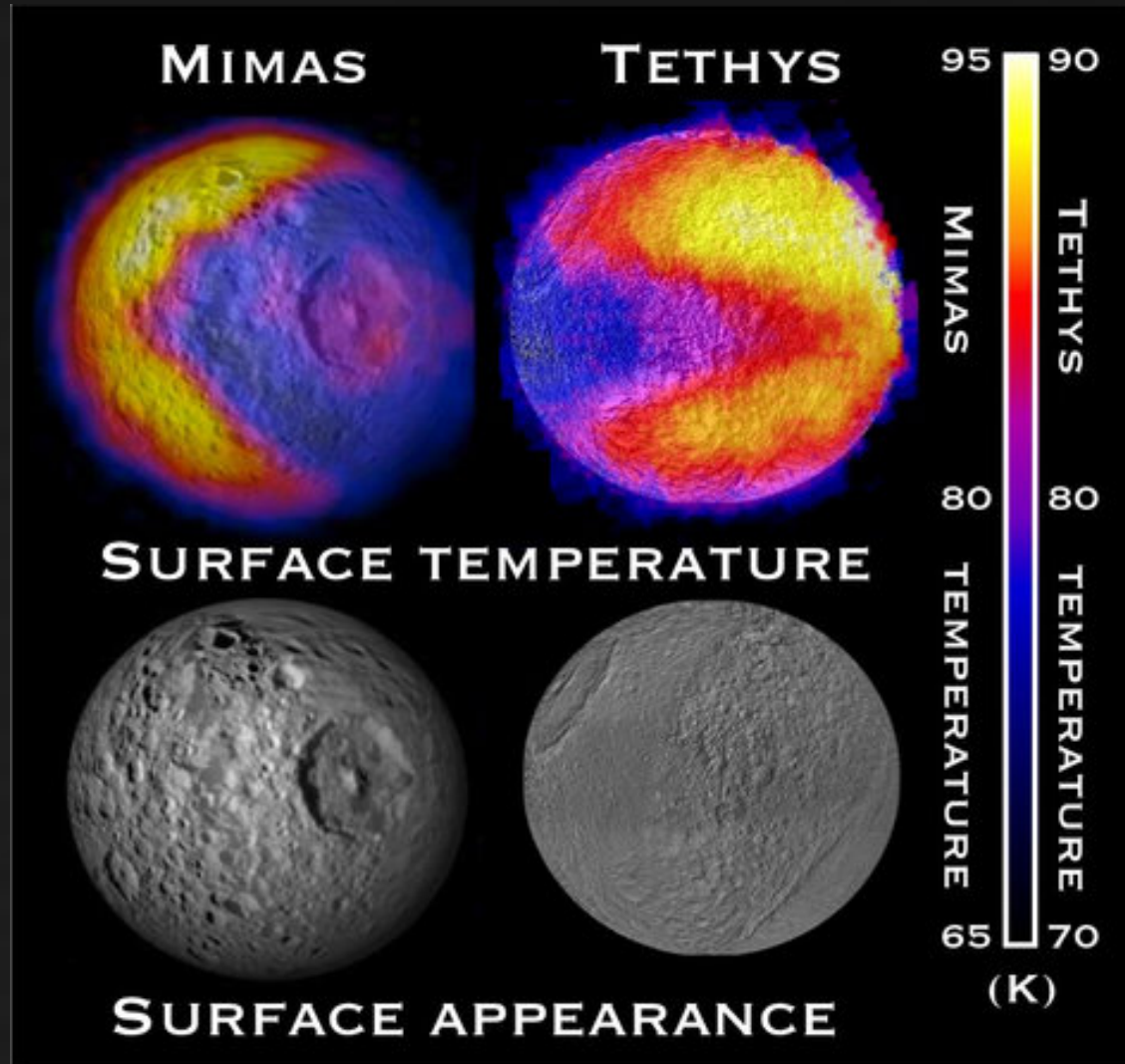
ONE BILLION MILES AWAY



Jet Propulsion Laboratory
California Institute of Technology



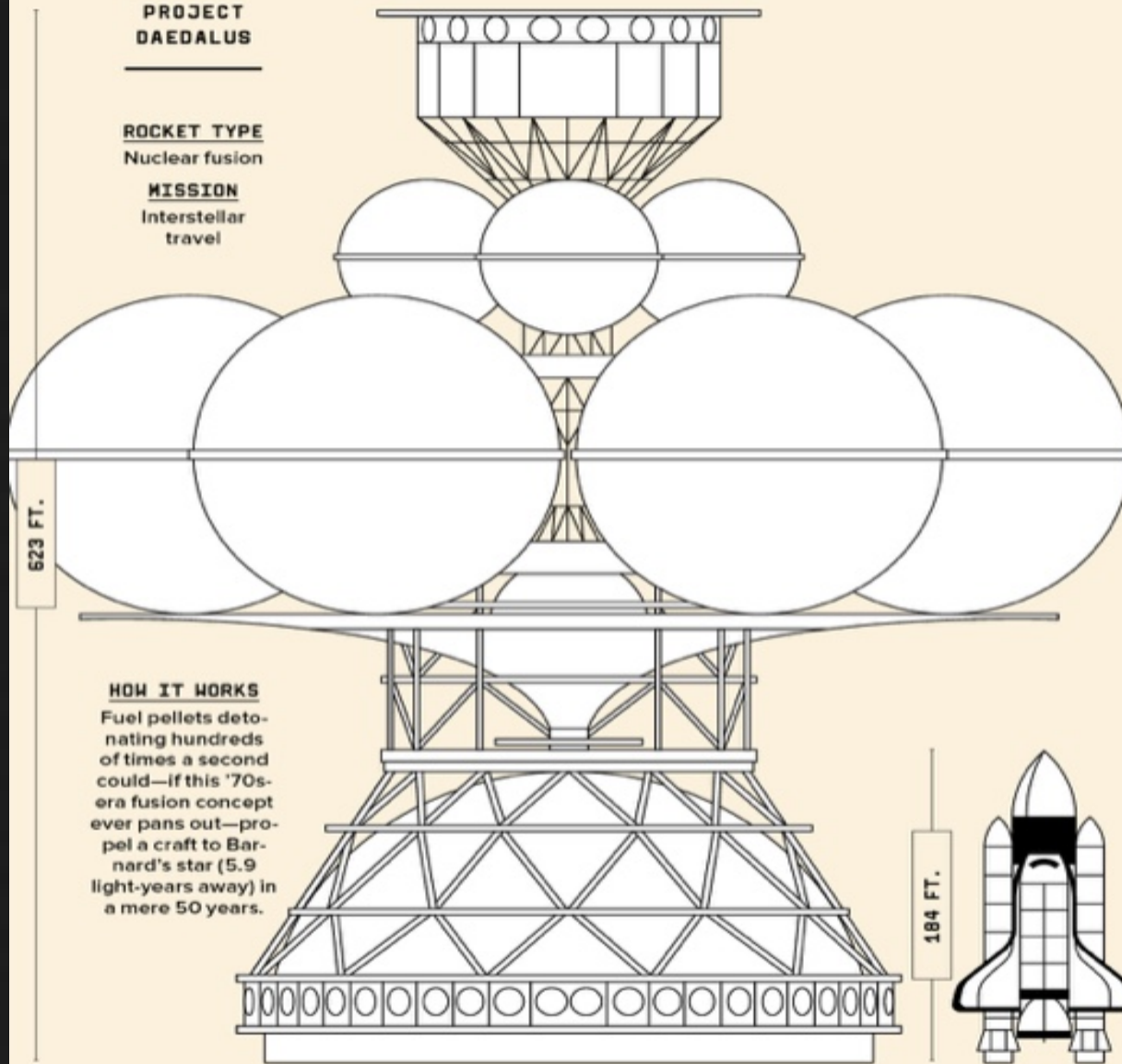
PACMAN



**PROJECT
DAEDALUS**

ROCKET TYPE
Nuclear fusion

MISSION
Interstellar
travel

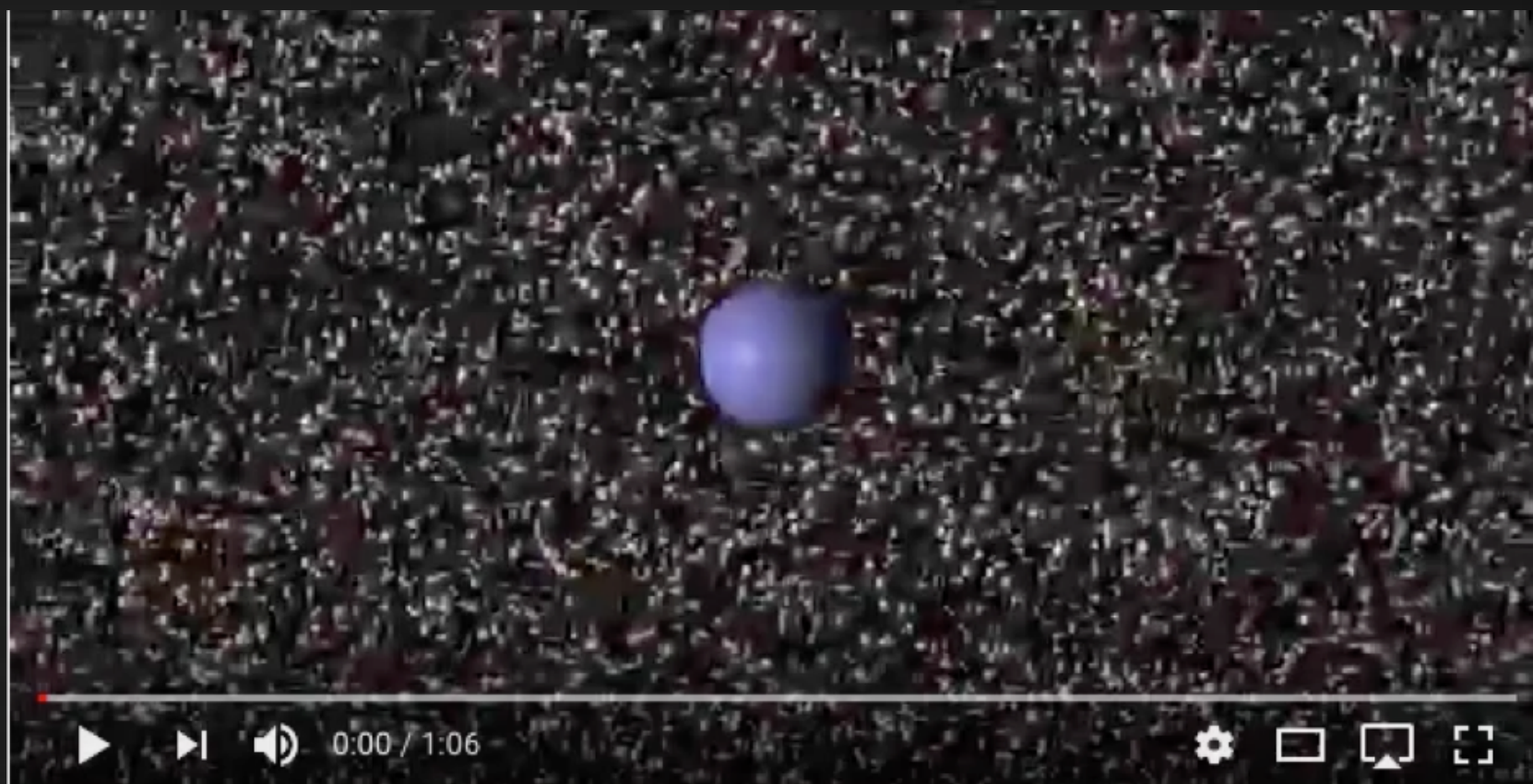


HOW IT WORKS
Fuel pellets deto-
nating hundreds
of times a second
could—if this '70s-
era fusion concept
ever pans out—pro-
pel a craft to Bar-
nard's star (5.9
light-years away) in
a mere 50 years.

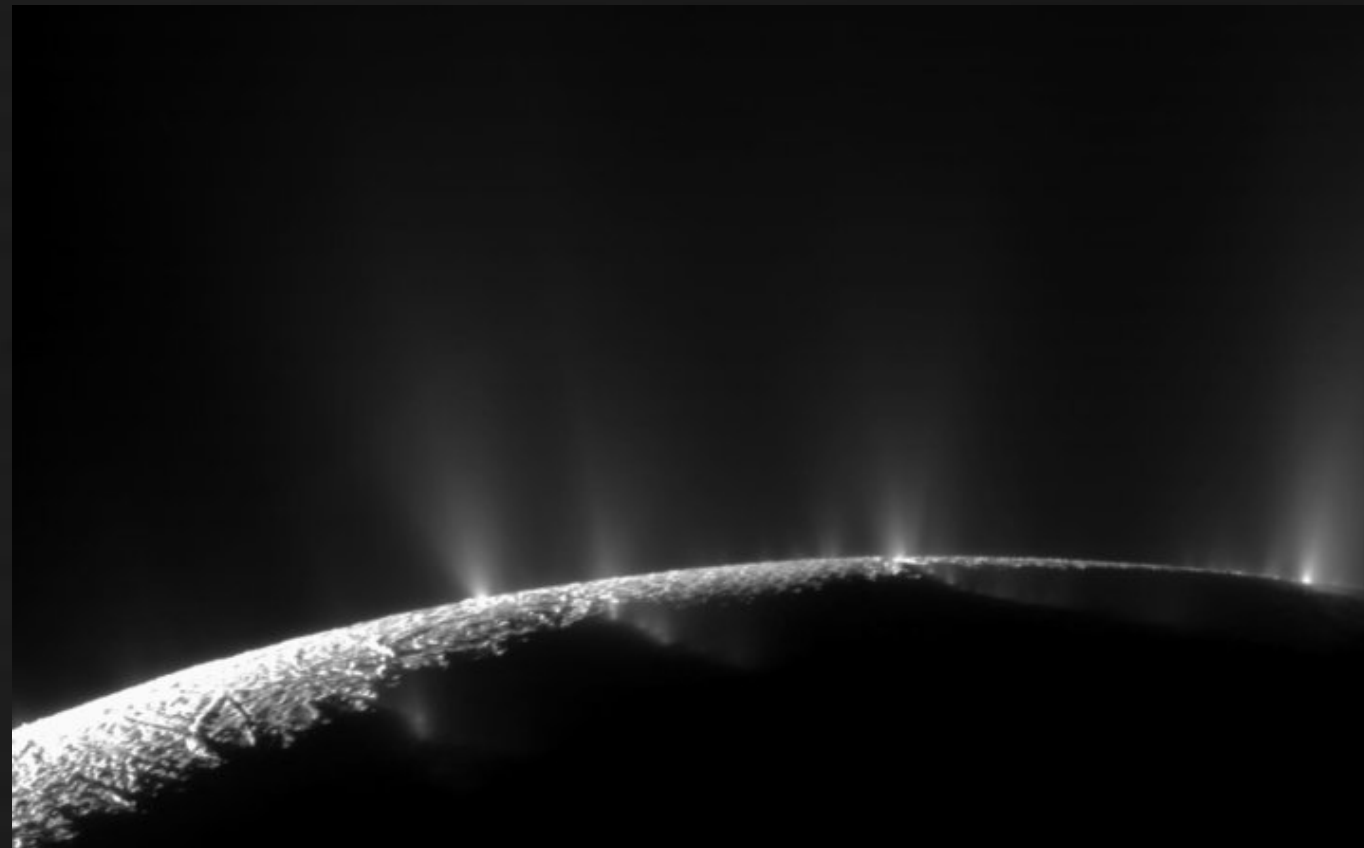
Fuel pellets
Thought up in the
70s
Goes at about 8% of
light year in speed
Closest star in about
40 to 50 years



PROPELLERS



GEYSERS ON ENCELADUS



LAPETUS



HEXAGON POLE



