Exoplanet Imaging Using Solar Gravitational Lensing

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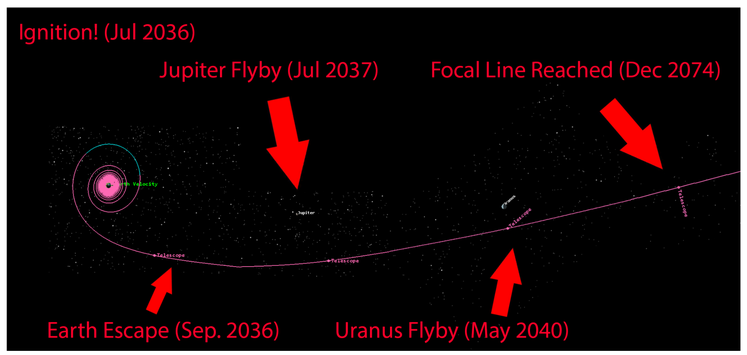
Mission Statement

As of 2021, there are 59 potentially habitable planets discovered through the use of space telescopes and ground systems. However, no images of said planets have been taken beyond the precision of a pixel. There is a need for precise exoplanet imaging for further investigation of these potentially life-bearing planets to answer the question, “are we alone in the universe?” Additionally, secondary interstellar wind readings and imaging of bodies within our system as the spacecraft travels to its destination would be beneficial for scientific research.

Requirements

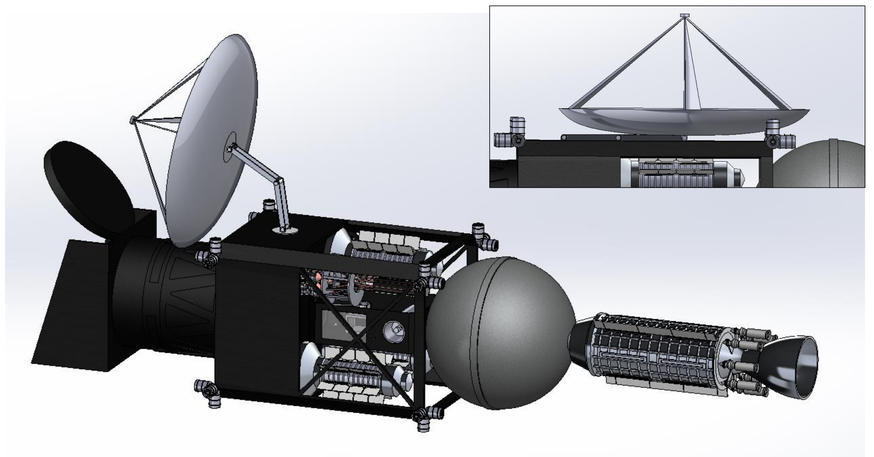
- 2 m aperture telescope shall reach (1000x1000) pixel image in an integration time of~ 6 years
- Painted Black
- 2m^2 Area radiators
- Star Tracker accuracy of < 10 arc seconds
- Reaction Wheel supply voltage of 28 V
- Reaction Thruster torque of < 6 Nm
- The Transmitter shall be able to transmit and receive signals to and from Earth via NASA’s DSN

Spacecraft Trajectory



Burn	Delta V
Earth Escape Burn	~15000
Interplanetary Burn	~50000

Spacecraft Design



Spacecraft Name: Einstein 1

Attitude Determination and Control:

- Star Trackers, Reaction Wheels, Hydrazine Reaction Thrusters

Thermal Subsystem:

- Louvers, Heating Pipes, Heaters

Propulsions Subsystem:

- Nuclear Thermal

Power Subsystem:

- Two-stage power supply: Initial GPHS-RTG (30+ yr), transfer to KRUSTy Nuclear Reactor (20+ yr)

Communications and OBDH Subsystems:

- 3.7 m antenna diameter
- X-Band frequency at 12GHz
- Process Speed of 150kbps - 150 bps

Budget

Item	Cost
RDE&T	$940.72 M
First Unit	$7594.64 M
Launch Operations	$465 M
Maintenance & Operations	$36.67 B
Total Mission	$45.67 B

Payload

Instrument	Mass [kg]	Power Cost [W]
Workhorse Camera + 2m aperture Telescope	6000	500
Solar Wind Plasma Sensor	5.4	7.7 (Peak)
Communications System	150	100
Raptor Imager (Wide-angle Camera)	45	Imaging mode: < 45 Readout Mode: < 25
Magnetometer	3	3.10
Coronagraph	250	87

Acknowledgements

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Meet the Team

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