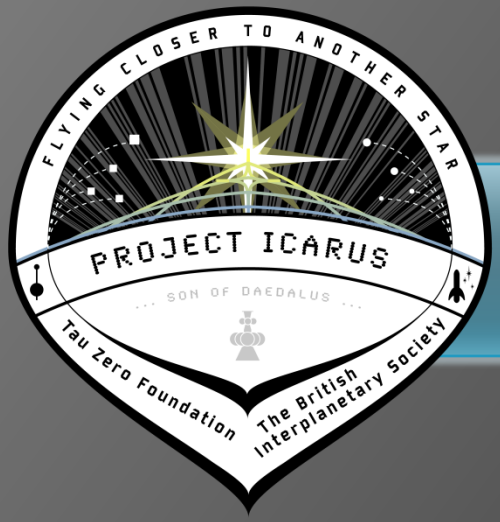


PROJECT ICARUS:

CANDIDATE TECHNOLOGIES FOR INTERSTELLAR PROPULSION

Dr. Andreas C. Tziolas | Deputy Project Leader

Overview

- Why Interstellar Space

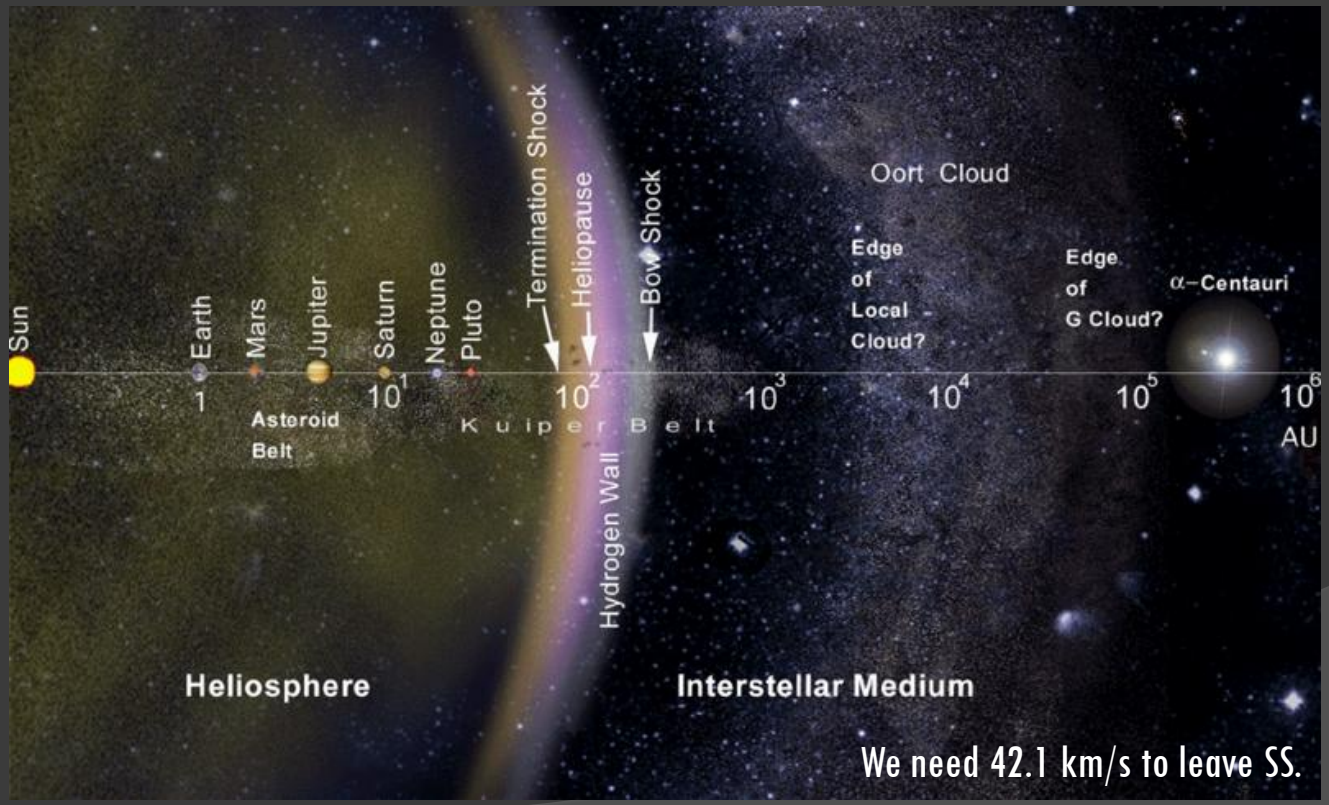
- Candidate Propulsion Technologies
- Propellant Considerations
- Hybrid Systems / Propulsion by Proxy

- More about Project Icarus
- vIcarus

Why Study Interstellar Space

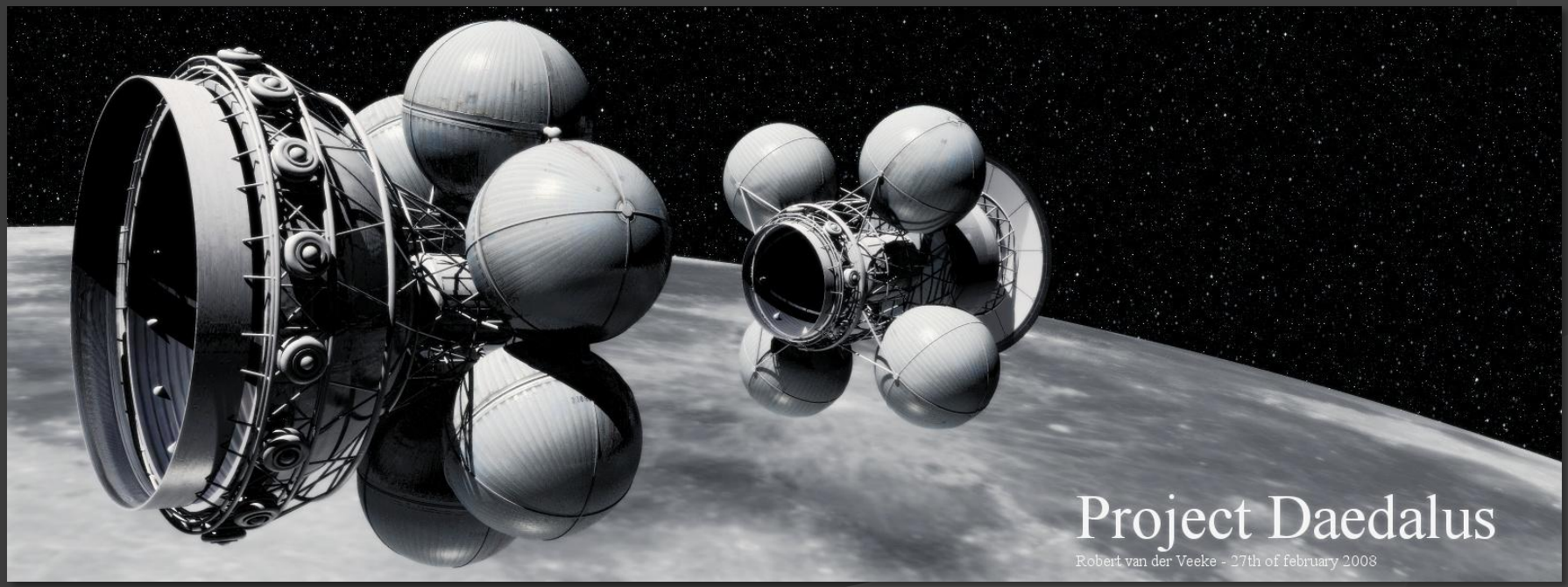
- Study Interstellar Medium
- Survey Oort Cloud Objects
- Study Heliopause

- Gravitational Lensing (550 AU)
- Pioneer Anomaly
- Galactic Cosmic Ray

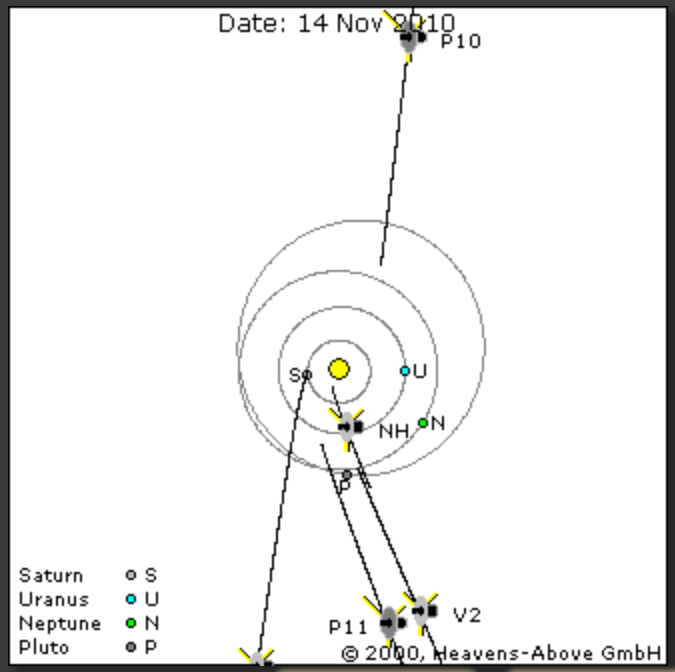


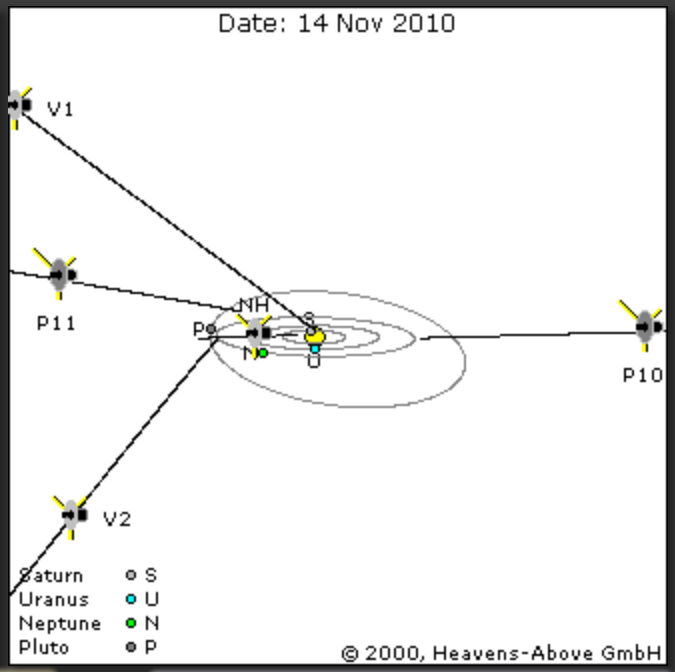
Why Project Icarus Studies Interstellar Flight

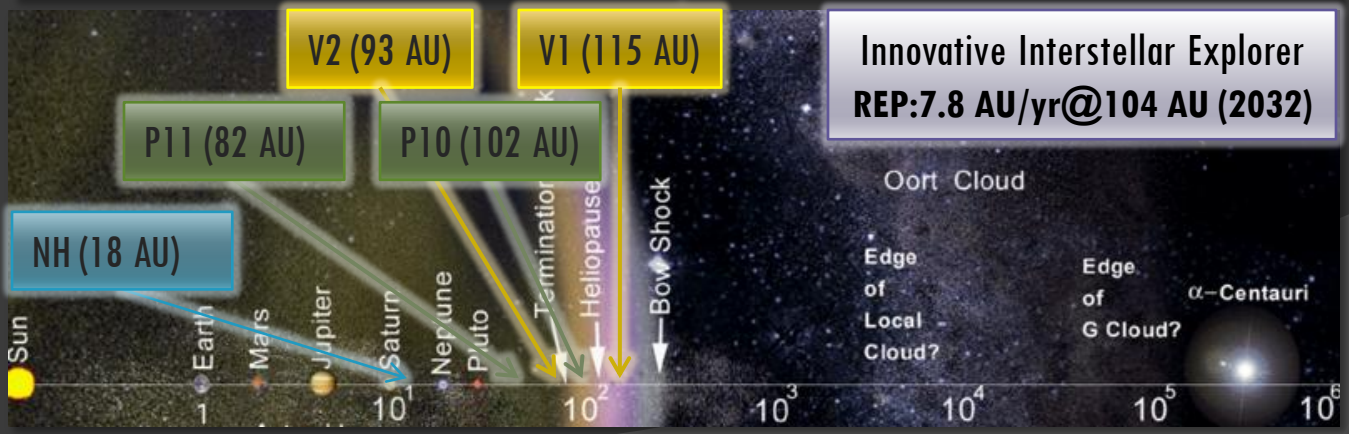
- Progress Daedalus Project Study
- Work towards in-situ Exoplanet study
- Pave the path to Interstellar travel
- Inspire (Pulsed Propulsion Prototype, Interstellar Internet, etc)



Interstellar Missions

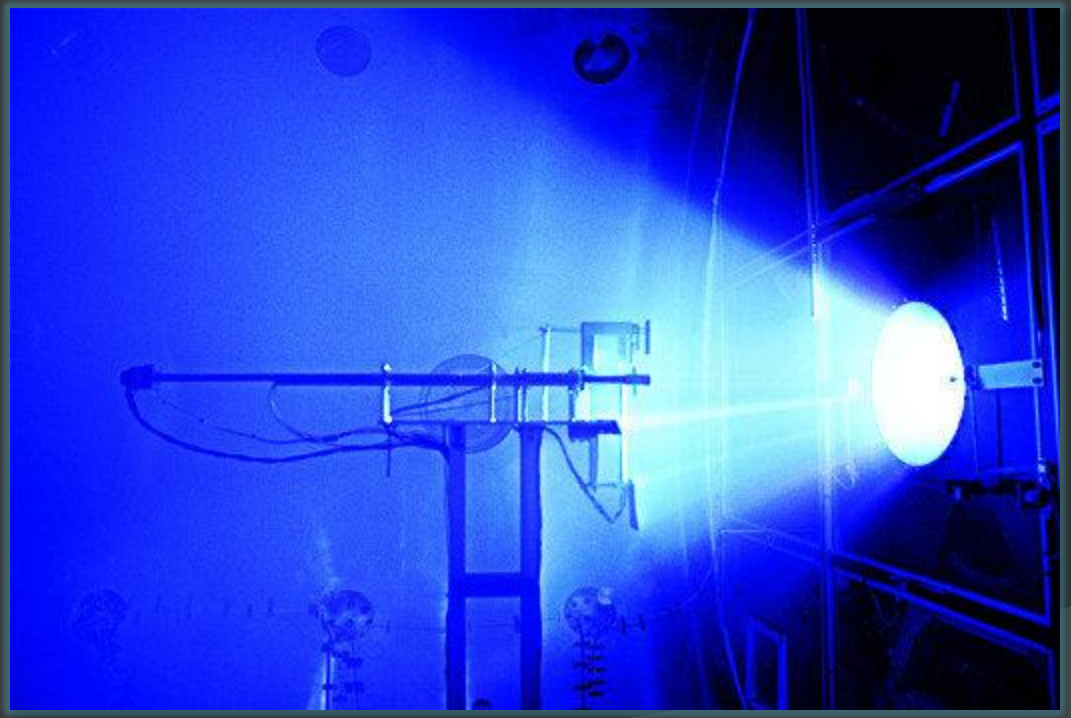






High TRL Benchmark

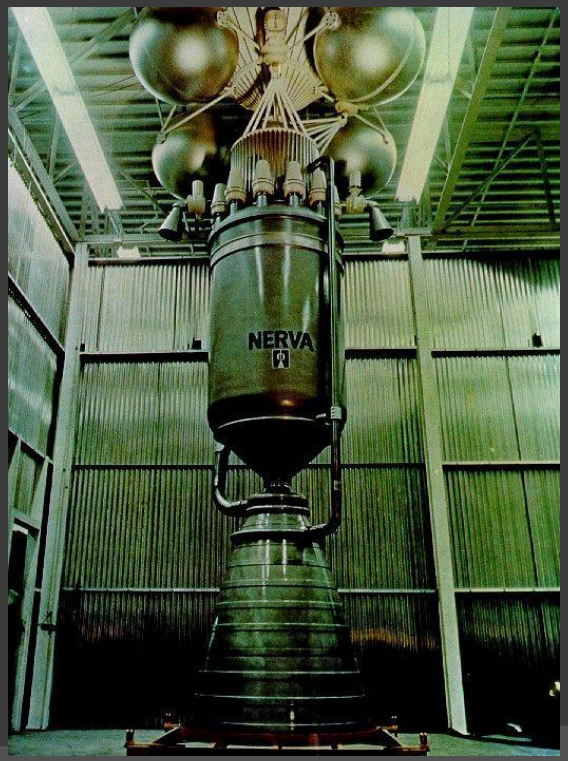
	Vexhaust (km/s)	Vfinal (km/s)	Vfinal (%c)
Space Shuttle	4.5	21	0.00007
Electrostatic Ion Thruster	210	967	0.00322
VASIMR	300	1382	0.00461

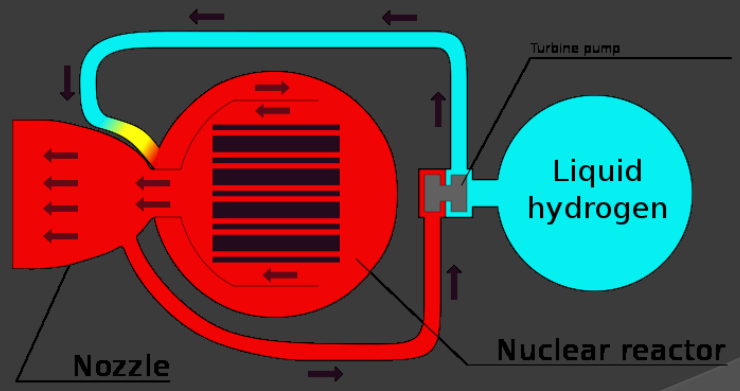


R =100
Mf=10 kg

Nuclear Powered Heat Exchange Methods

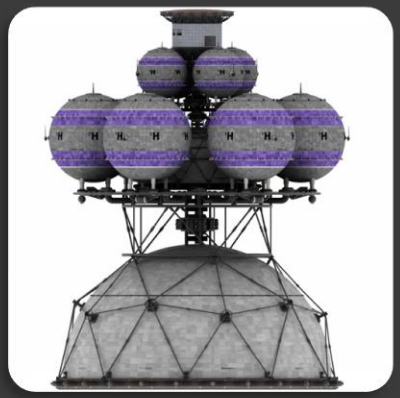
Nuclear Thermal	Vexhaust (km/s)	Vfinal (km/s)	Vfinal (%c)
Solid	10	46	0.00015
Liquid	15	69	0.00023
Gas	50	230	0.00077

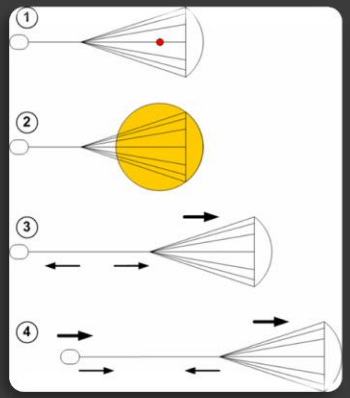


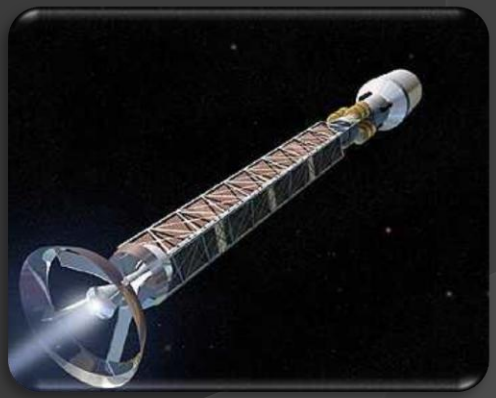


Pulsed Propulsion Methods

	Vexhaust (km/s)	Vfinal (km/s)	Vfinal (%c)
Orion	3000	13816	0.04605
Daedalus	10000	46052	0.15351
Medusa	1000	4605	0.01535
Longshot	5000	23026	0.07675
Antimatter	4000	18421	0.06140

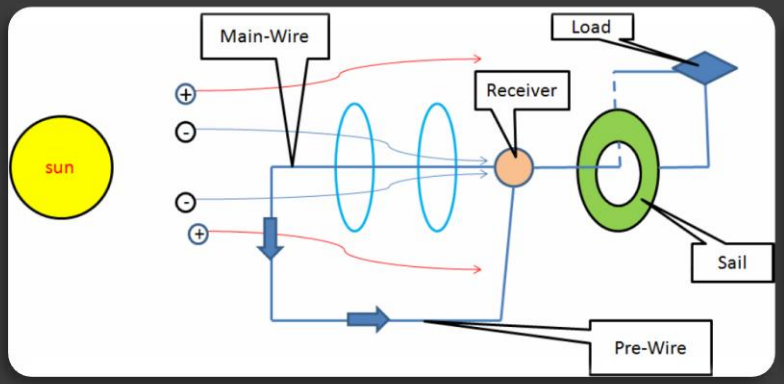


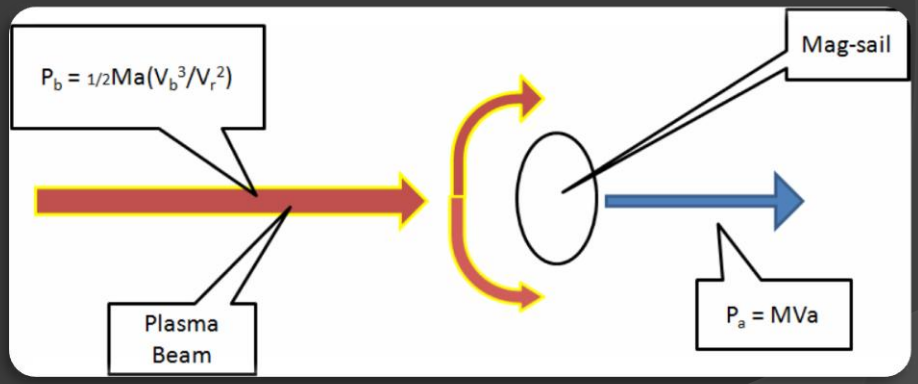




Beamed Propulsion

MagBeam:
Winglee

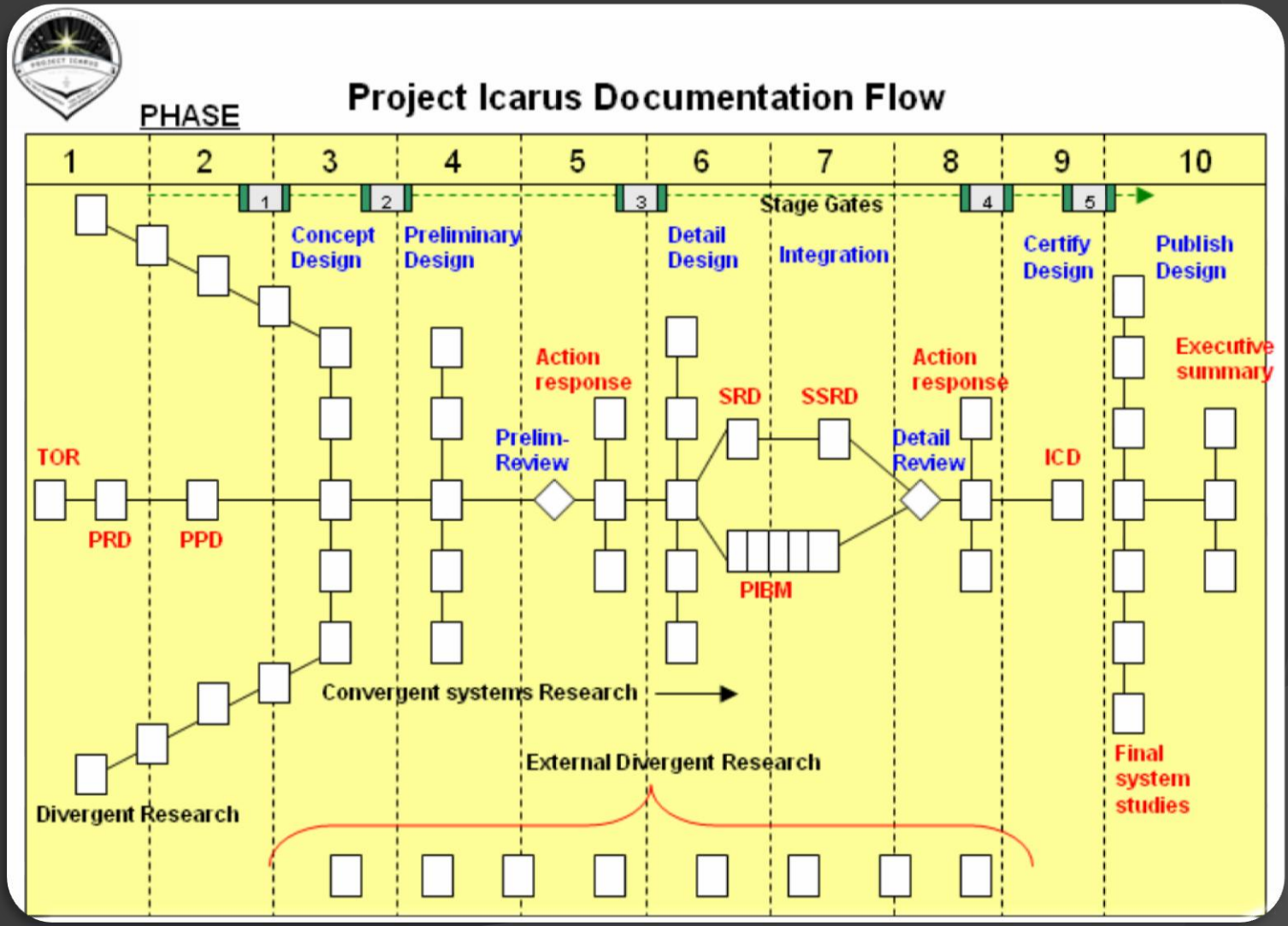




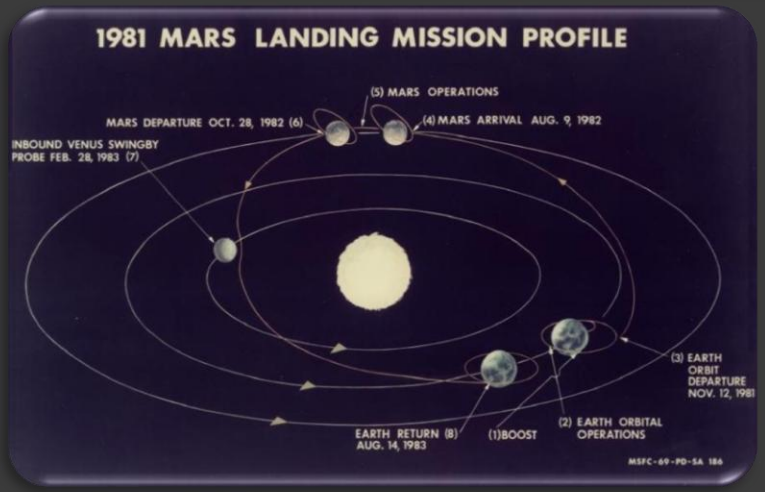
Dyson-Harrop Satellite

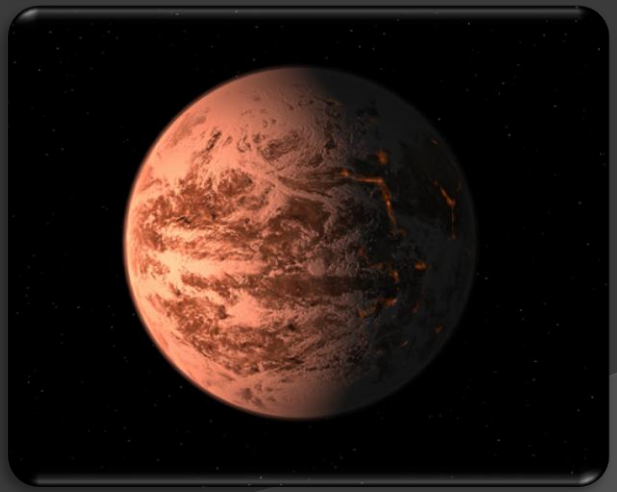
International Interstellar Spacecraft Design Team

Private Sector R&D Model



Technology Roadmap to Interstellar Flight

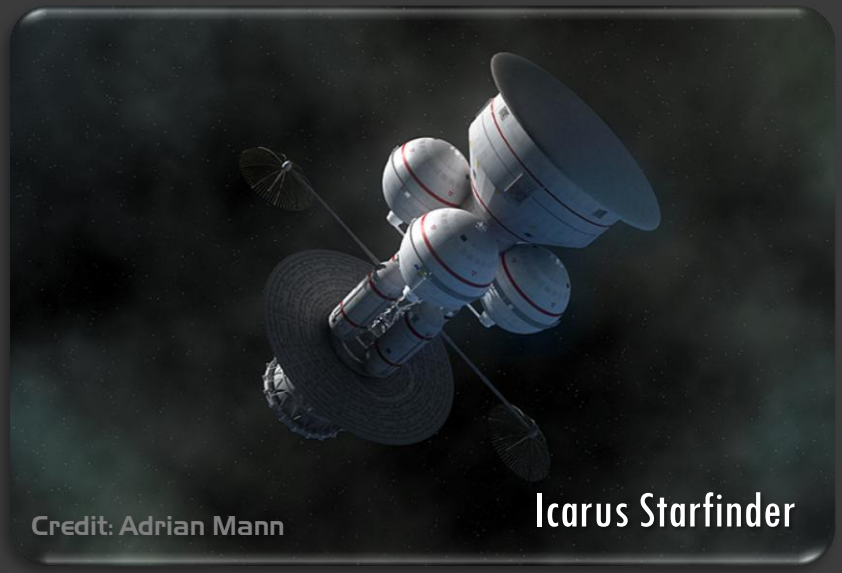




Icarus Spacecraft Pathfinder Concepts

satIcarus:

- LEO
- Radiation Hard ENL Test
- On-Board Repair Test
- Magnetic Nozzle Test



simIcarus:

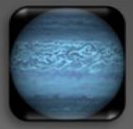
- Earth to Lunar Orbit
- Pulsed Propulsion Prototype
- Evolutionary Algorithms

The Icarus Interstellar Flight Manual

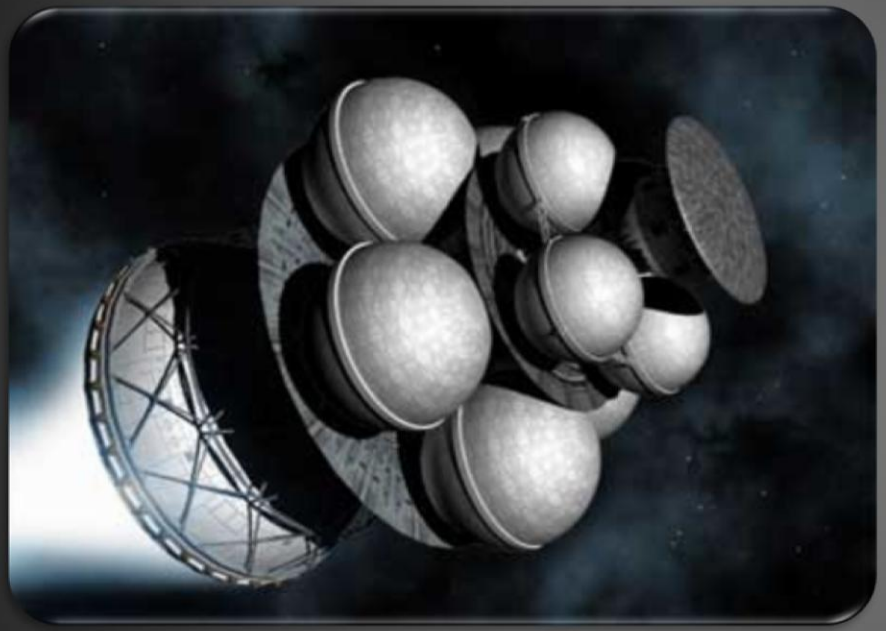
vIcarus

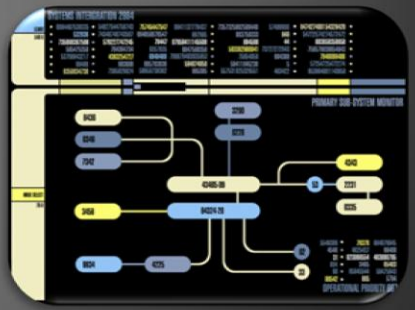
Latest Image:

Neptune at 0.2 AU



Mission Time : 3.192 yr
Speed : 0.04488 c
Distance From Earth : 384 AU
Mission Integrity : 92 %





> ARM05 reports Thermal Shunt RTG06/03 Override in effect.
> ARM05 thermal transfer rate 6.41 Joules/sec to space.
> SNR17 reports sector RTG06/03-RTG06-05 ambient temperature 47 K.
> CPU09 dispatch request received. ARM02 to sector RTG06/03. Override.
> ARM02 arrived at station RTG06/03...

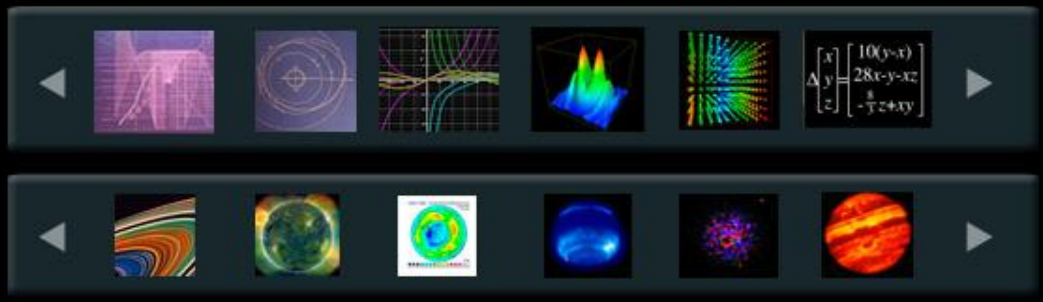
vICARUS

STATUS | PROPULSION | NAVIGATION | COMMUNICATIONS | SCIENCE

MISSION STATUS

Mission Elapsed Time: 3.192

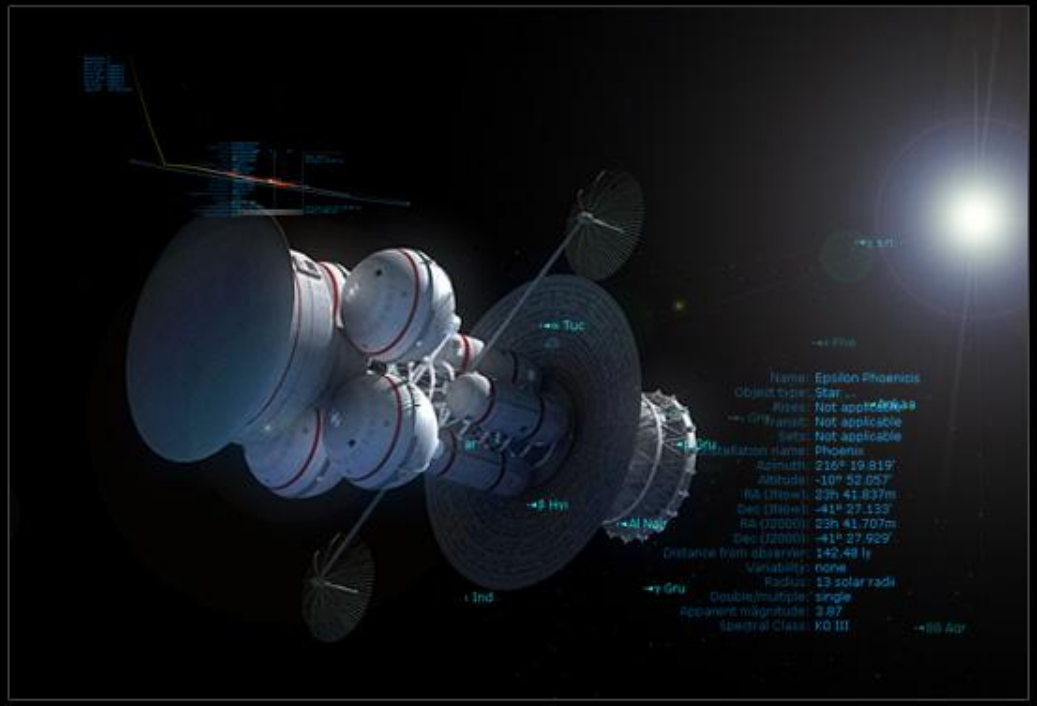
Velocity:	0.0048c
Distance:	304AU
Mission Integrity:	92%



PROCESS STATUS

> ARMOS reports thermal shunt
> RT606 / 01 Override in efefct
> ARMOS thermal transfer rate
> 6.41 Joules/sec
> SNR17 reports sector RTG60
> Ambient temp, 47K
> SNR17 reports sector RTG62
> Ambient temp, 48K
> CPU09 Transfer request
> CPU09 Despatch request
> ARM02 Arrived at station
> LAE 91358 process terminated
> Unit AE1556/1 at 97%
> FLX - OK
> 88-OTV 3/4

More....



Credit: Adrian Mann

Ad Astra Incrementis

Project Icarus is comprised of a select group of scientists donating their time and resources to research interstellar travel.

Variance Dynamical Corporation

Next Generation Radiation Tolerant Electronic Hardware for Space Exploration and Nuclear Reactor Monitoring