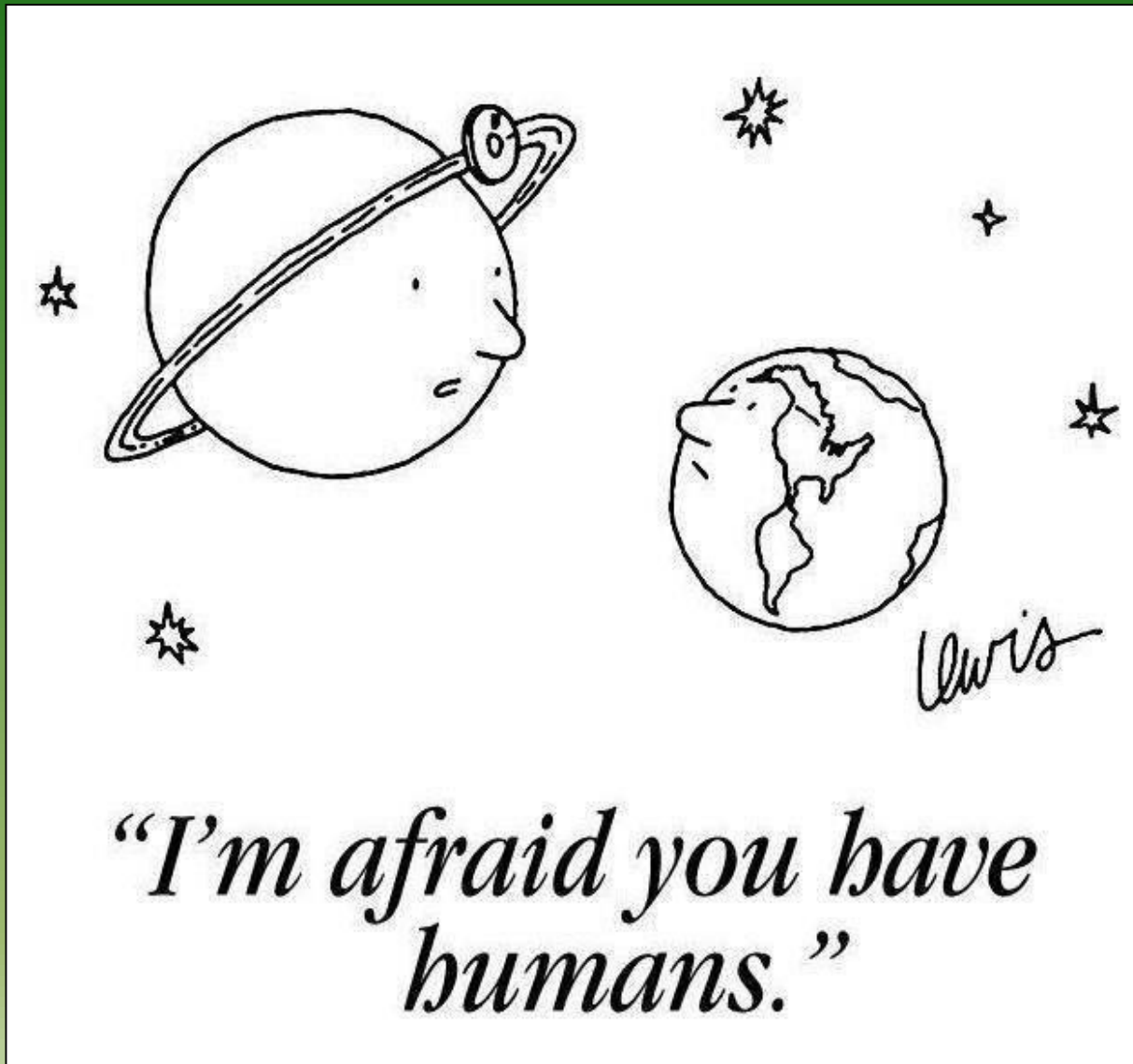


Space: To Go or Not to Go?



“I’m afraid you have humans.”

Roger Worthington



Why Boldly Go? *Stave Off Extinction*

- Asteroid impact (natural).
- Sun Burns Out. 5.8 B years from now (natural).
- Planet burns up (CO2) (Man).
- Epidemic, eg, GMO virus (Man).
- Nuclear War (Man).
- Habitat Destruction (Man).
- Alien Invasion (?)
- A.I. Robots go rogue (?)
- Reseed Human Race Off Colony?



Why Boldly Go? “*Manifest Destiny.*”

- Exploration in our DNA:
“Because it’s there.” Poetic Nonsense? No Choice?
- Colonialism/Imperialism in DNA, too?
Conquer, extract treasure, feed mother country.
 - Dominate, pillage, plunder, expand “mother country.”
- NASA doesn’t validate romantic notion.
- Some humans like to stay close to home.



Why Boldly Go?

Capitalism – Follow the Money

- **Public Subsidies drive tech innovation.**
Computers, electronics, life support, Propulsion/Rockets, Software, solar, alloys, GPS, insulation, planes, etc.
*Economic stimulus – \$20 ROI for every \$1 public?
- **Satellites.**
2400 in space now.
1200 operational.
Boeing/Space X et al seek permission to launch 15,000 more.
- **Space Ferry (privatization)**
Deliver material/humans to ISS (SpaceX).
- **Space Tourism**
Bragging rights for the Super Rich.
- **Asteroid Mineral Extraction**
(Platinum, gold, water)



Why Boldly Go?

National Security – War is Peace.

- **Military Industrial Complex.**
Another driver of Tech.
Control the land, sky, space, Heavenly objects.
Opens door to fat subsidies.
- **Space Race with China, Russia.**
Historical arms race (Nazis/rockets, USSR/Sputnik, Star Wars).
“Aim for the stars but sometimes fall on London” Werhner von Braun, Father of the V-2 and Saturn Rockets
- **Politics**
Ego, nationalism, power, leadership.
Selfie with the flag?
Bragging and naming rights?



Why Boldly Go?

Promote Science

- Stimulate Scientific/Engineering Curiosity and Innovation?
- Creation of Intellectual capital for future generations.
- Get kids excited about science and engineering

Foster Cooperation

- Among Earthlings, eg ISS.

Appreciate Beauty

Inspire Humility and Perspective

Ponder Genesis



Why Boldly Stay Put?

10 Arguments



Overcoming Gravity Costs (more than) a Ton

- \$1B per launch (NASA budget +\$22B/yr).
- Mars trip would cost around \$10 B per traveler for short stay.
- Apollo cost between \$150-200 B so a few could walkabout.
- Ship needs to be fast and light (fuel, composites, payload).
- Space travel easy, blasting off and landing and returning, not.
- Re-usable rockets bring costs down.
 But need big fuel and oxygen tanks.
 Still in Design phase. Orion spacecraft?
 Nuclear propulsion?
- Mars landing cost = 1 year total US GDP.
- Cost per astronaut to stay alive
 one year ISS: \$100 million +



The Cosmos is Carcinogenic

- Beyond womb of Mother E's atmosphere and magnetic field, space rad zapping everything. DNA not safe.
- Collide with ship, blow up nuclei, emit more secondary radiation.
- 6 months on ISS radiation dose vastly exceeds DOE radiation annual limits.
- 10x greater exposure on ISS than on Earth.
- Exposure in transit and where flag planted.
- Need to travel many generations, but shortened life span.



Space Sucks the Life Out of You

- Zero G Bad for the Blood, Brain and Bones
- Gravity forces body to work hard. Zero G causes laziness.
 - *immune cells thwarted
 - *red blood cells explode
 - *lose bone mass, even if exercise 2 hours a day on treadmill
 - *blood flows up to brain (dementia, cataracts, optic nerve)
 - *heart goes flaccid
 - *kidney stones
 - *hearing loss
 - *Hello permanent motion sickness
- Need to exercise religiously.
2/3 Americans obese/overweight.
- Dust on Mars/Moon more toxic than asbestos/silica?
- “Like world’s worst hangover.”
Tim Peak, NASA



Space Brain Madness

- Cramped and confined
- Bad food, drink recycled urine
- Big Brother watching 24-7 (totalitarian state)
- No sex or privacy, with forced friends
- Anxiety, depression, insomnia
- Adapted to Earth (but not Gobi, Everest, Mid-A Trench)
- Spaceship is a lifeboat. Freedom an unaffordable luxury
- What's it like knowing you can't come home?
- Do humans thrive when ordered how to live?
Who to hang with?
- Permanent enclosure, exile,
physical-mental health deterioration.
- How long can you sit in a crowded plane,
bus or boat?



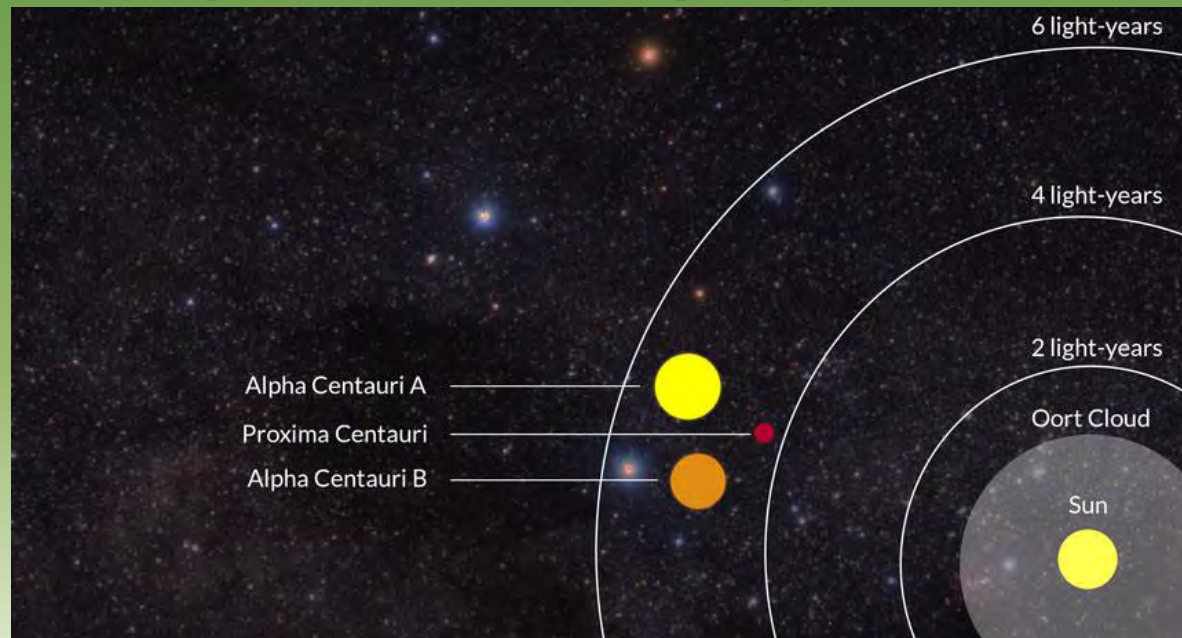
An Exoplanet Too Far

- Space is Vaster than Vast
- 2 trillion galaxies
- 40k+ exoplanets in our Milky Way Galaxy, but nearest is 4.37 LY away
Proxima B – might be like Earth (orbit, atmospg, mag field, H2O)
- Local resources? Extractable? (O₂, H, C, H₂O, etc).
Goldilocks planet must mimic Earth. Won't really know until get there.

Huge role for robotics and probes

No NASA budget for visiting or colonizing an expolanet.

Planet Hopping – requires building way stations, propellant plants



WARP Drive Not a Thing

- Sci Fi. Nothing human made travels speed of light.
- Impossible. Techno Blasphemy?
- Need Power. Need to develop fusion engines. Poison crew?
- Matter-Anti-matter smashing too dangerous an experiment (Star Trek)
- Solar power – need sails bigger'n Texas
- Need thousands of Einsteins around the clock to tackle this with budget bigger than DOD et al



An Ark Too Slow

- Alpha Centauri star system
- 4.3 LY away (25 Trillion miles). 300k x further than Sun to Earth.
1 LY +5.88 Trillion miles.
- Voyager (unmanned) launched 1977 (39k mph)
Just passed Pluto.
20 light hours in 40 years.
Batteries about to expire.
- Apollo rockets (manned) around 24,800 mph
32 x speed of sound.
0.0037% speed of light. (1960s rockets)
- Fastest probe – Helios 2. 157,000 mph
- At that speed it would take
19,000 years to reach Alpha Centauri



An Ark Too Tiny

- You have to take it with you
 - No grocery, drug store, gas station. Crises a Certainty.
 - Food, water, seeds, oxygen, fuel, animals, plants, equip, tools
 - Need fuel to slow down or become very expensive crater.
- Closed System – risks of microbe mutations, contamination and contagion
- No answer to need for large scale farm operation
- Humans need on avg. 11 Lb food, water, oxy per day
- Miniaturization the key to speed
 - Heavier the ark, more fuel/O₂ required.
 - Is there a happy medium?
 - No ark exists.



Just Landed. Now What?

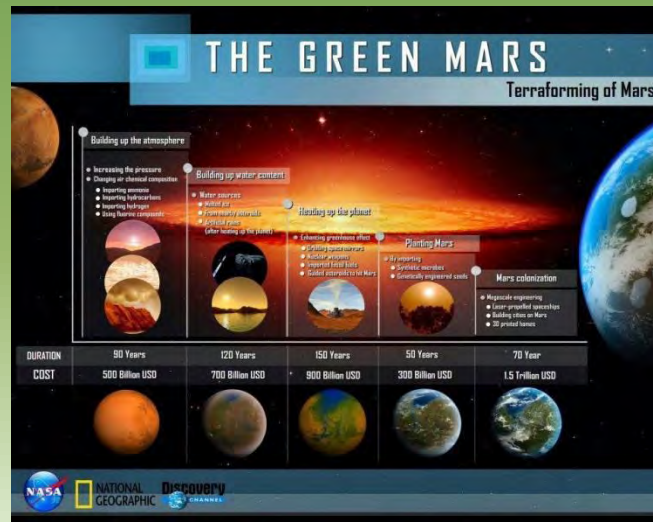
- Is planet alive or dead?
- If alive, impact of alien bio?
- Can we resupply? How far away?
- Terraform using local resources and imported power
- Would take thousands of years (T, Gravity, Mag Field, Air)
- Hubris – breathing life into dust. Is this possible?

It would have to proceed perfectly.

Requires Patience. Luck. Careful Planning.

No safety cushion.

Upside: Humans good at creating excess carbon



The Mothership Must Abide

- For multi-phase, guaranteed failure risk experiment, we need a stable home base.
- We must supply orbiting spacecraft and colonies.
- Practice orbiting the arc around sun and other planets.
- What can go wrong, how to fix it? Need a successful “proof of concept.”
- Launch multiple robotic probes gather data on habitability.
- We may have the curiosity, drive and materials. But do we have the time?



Can We Go and Stay?

- Buy time like cancer patient
- Reinvest in saving Mother Earth
 - *EPA- restore and increase budget for studying impact greenhouse gases, melting ice caps, loss of plankton, etc. And reverse trend!
 - *Reduce Carbon Pollution
 - *Reduce food waste
 - *Reduce loss habitat
 - *Reduce Military Industrial Budget – crippling.
 - *Increase budget for space exploration
 - Drive research on new tech, energy, life sustainability, climate, weather, robotics.
 - Invest in curiosity.



Can We Go and Stay? (Cont.)

Experiment with Probes

- Increase knowledge Base – progress from trial and error
- Step wise Proof of Concept – use robots, inhabit moon, then mars?
Not real colony unless humans reproduce and thrive independently.
- Dangerous to envision mass emigration from Earth. Disposable?
- Expensive to make Mars more like Earth.
Cheaper and Easier to make Earth more like Earth. (Neil Degrasse Tyson)
- Fun to get excited about big trip.
But eventually we yourn to return.
- No Place Like Home (Wizard of OZ).

We are Earthlings!





"Yes, the planet got destroyed. But for a beautiful moment in time we created a lot of value for shareholders."

