AI AND THE NEW SPACE AGE: FROM SCIENCE FICTION TO REALITY

Alicia Kavelaars, PhD

SPACE COLONIZATION

HISTORY OF HUMAN SPACEFLIGHT

BEYOND LEO

LEO

1961 - 1968
Yuri Gagarin's first space excursion followed by Alan Shepard
Space race begins

1968-1972
Apollo Program
Human missions to the Moon

1971 - 1986
Salyut Program
Space Stations

1973 - 1979
SkyLab

1981 - 2011
Space Shuttle Program

1986 - 2001
MIR
Space Station

1998 - Today
ISS Program bringing Multinational crew to LEO

2003
China
Manned Space Program puts first taikonaut Yang Liwei in orbit

2020
SpaceX Crew Dragon crewed flight to ISS

2021
SpaceX Crew Dragon Inspiration4
first tourist flight

2021 - Today
China
CMS Program Tiangong Space Station

Today

SPACE COLONIZATION

MOON LANDING, 1969

NASA

SPACE COLONIZATION

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BEYOND LEO

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No human mission beyond LEO since 1972*

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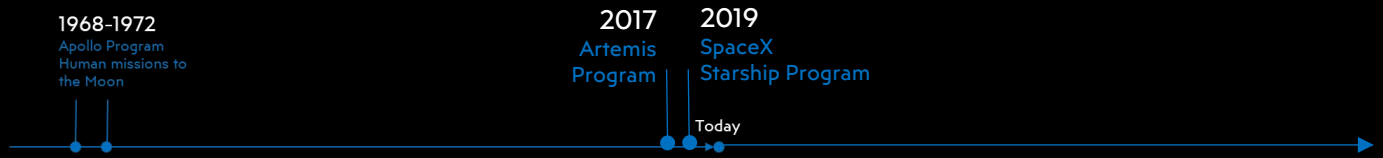
SPACE COLONIZATION

WHY THE BIG GAP?

BEYOND LEO



- Focus on LEO scientific development and International cooperation
- Space Race no longer a priority
- No reliable space transport beyond LEO
- Unclear mission objectives (industrial, scientific, strategic)
- Unclear means to settle (hazardous environment, sustained colonization)

- Expansion of LEO scientific development and International cooperation
- 21st Century Space race has begun
- Low-cost space transport beyond LEO possible in the next decade
- Emerging mission objectives
- 4th Industrial Revolution (4IR) with robotics and AI at the forefront enabling space colonization

First human EVA beyond LEO since 1972

SpaceX Polaris Dawn Mission

AND NOW?

CAN WE AVOID ANOTHER 50 YEAR GAP?

SPACE COLONIZATION TODAY

EMERGING MISSION OBJECTIVES ENABLED BY AI & 4IR

BEYOND LEO

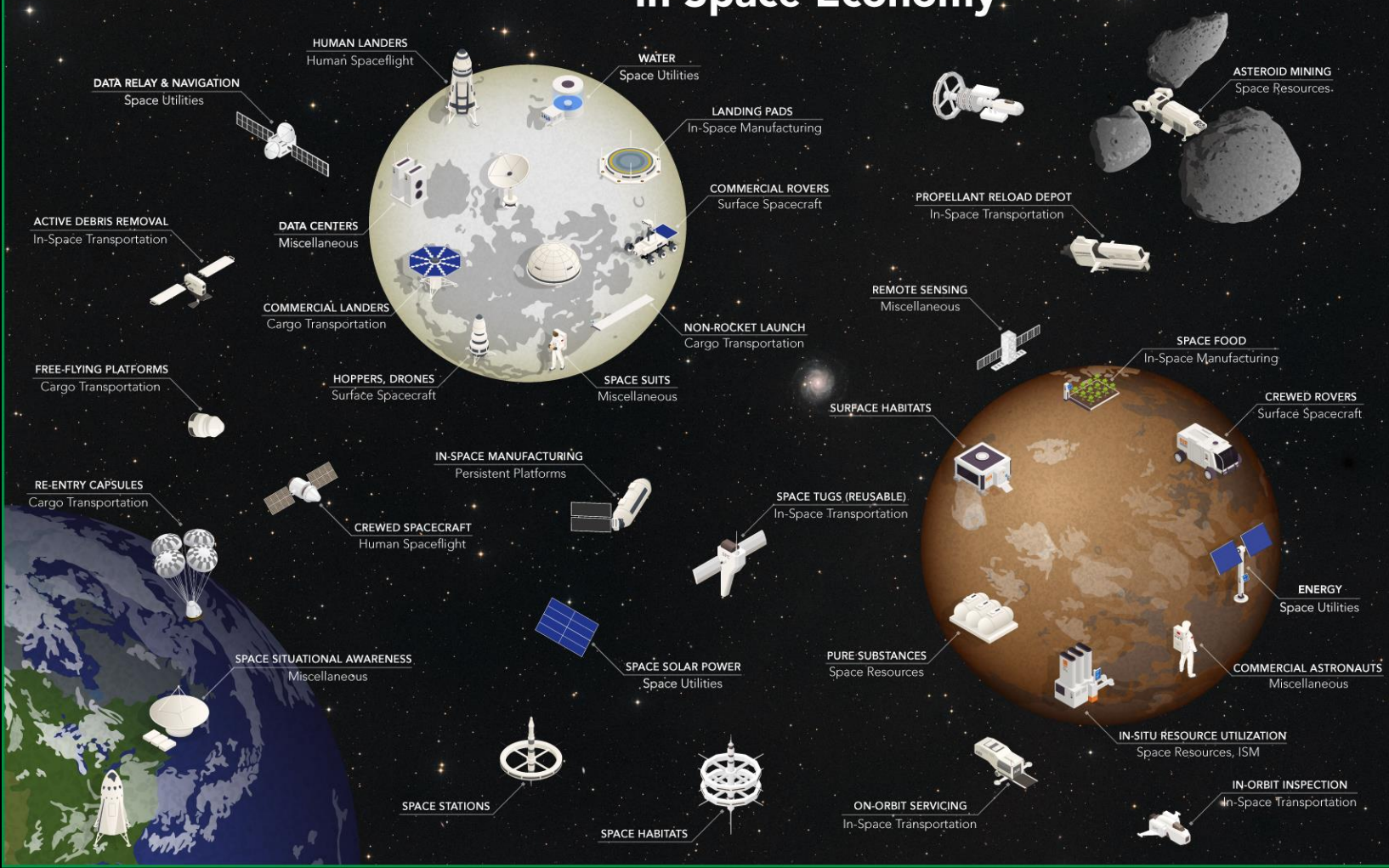
- Lunar Mining
  - Lunar Ice Extraction
  - Helium-3 Mining
- Cislunar Industries
  - Lunar Ice Processed Propellant Depots
  - Micro-g and Lunar additive manufacturing
  - Lunar tourism
- Free space and Lunar science and astronomy missions
  - Lunar non-polluted skies radio astronomy
  - Medical and bioscience experiments
  - Low gravity bioponic farms
  - Lunar Martian analog
  - Space solar Power
- Cislunar Space Domain Awareness
- Martian Terraforming
- Asteroid Resource Mining

The emerging cislunar economy driven by commercial space and key advancements in robotics and AI is the missing link

Factories in Space

In-Space Economy

factoriesinspace.com
2024-04-01



In-Space Economy Classification:

1) Human Spaceflight
   - Crewed Spaceships & Shuttles
   - Crewed Landers
2) Cargo Transportation & Landers
   - Robotic Landers (Moon, Mars)
   - Re-Entry Vehicles & Capsules
   - Cargo Resupply Services
   - Reusable Satellites
3) Surface Spacecraft
   - Surface Mobility
   - Robotic Rovers
   - Drones, Hoppers
4) Space Stations & Habitats
   - Persistent Platforms
   - Robotic Space Stations
5) Surface Habitats & Structures
   - Surface Facilities, Infrastructure
6) In-Space Manufacturing (ISM)
   - In-Space Production
   - Space Food, Space Agriculture
   - Microgravity Manufacturing
   - In-Space Assembly & Construction
   - Geoengineering
7) Space Resources
   - ISRU (In-Situ Resource Utilization)
   - Pure Substances (Ice, O2, Metals)
   - Space, Lunar & Asteroid Mining
   - Prospecting, Processing, Recycling
8) Space Utilities
   - Energy, Power Beaming
   - In-Space Internet, Data Relay
   - Navigation
   - Water, Propellant
9) In-Space Transportation
   - Space Tugs, Space Trucks
   - Orbital Transfer Vehicles (OTV)
   - On-Orbit Servicing
   - Propellant Reloading Depot
   - Active Debris Removal (ADR)
   - In-Orbit Inspection
   - In-Space Mobility, Space Logistics
   - Satellite Life Extension
   - Last Mile Delivery
10) Miscellaneous
   - Microgravity Payload Services
   - In-Orbit Computing, Storage
   - Space-Flown Items
   - Space-Suits & Garments
   - Commercial Astronauts
   - Space Entertainment, Advertising
   - Space Traffic Management
   - Space Tourism Support, etc.

*By Erik Kulu since 2020

SPACE COLONIZATION TODAY

21ST CENTURY SPACE RACE

SPACEX

SIERRA SPACE

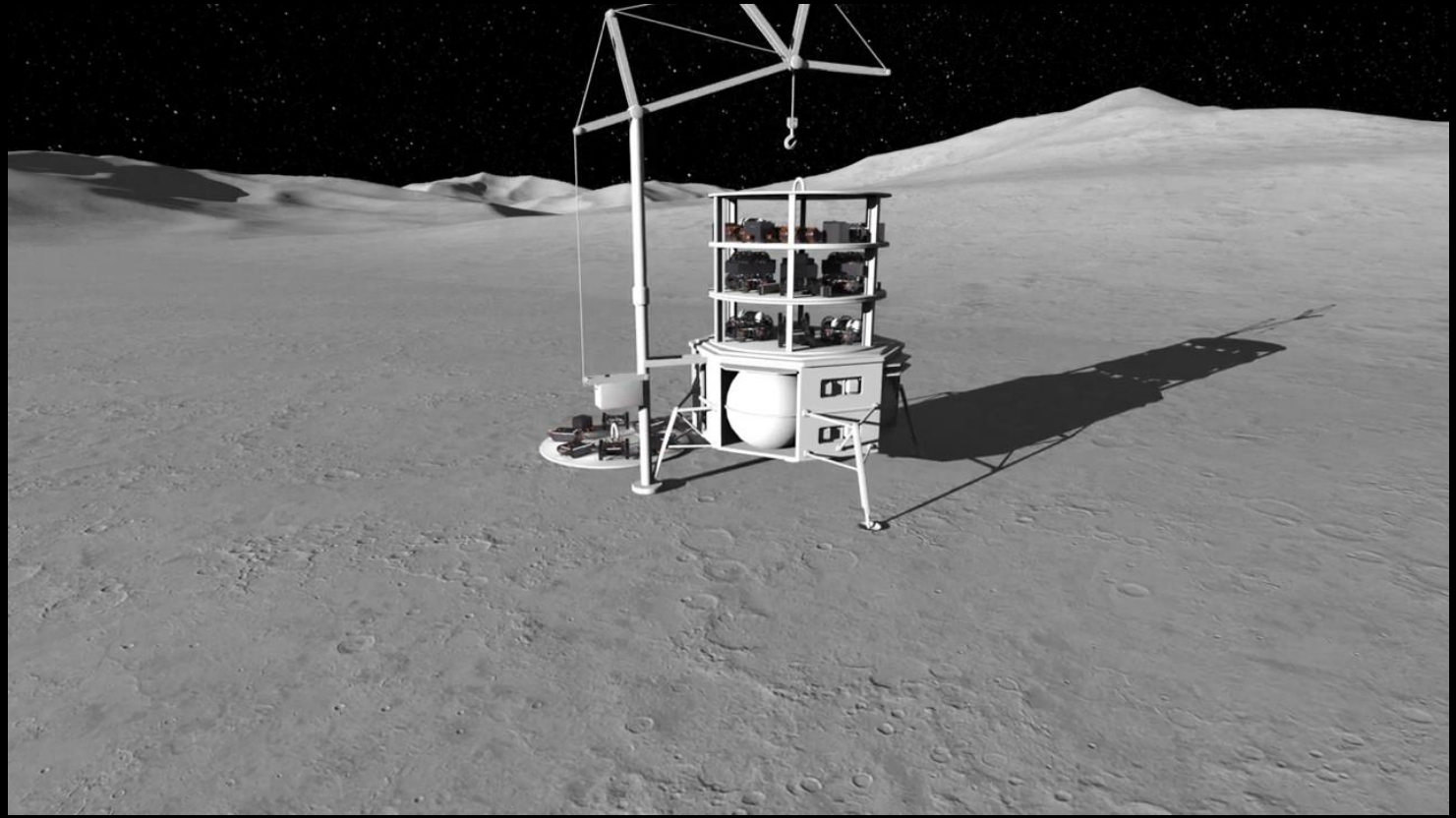
BLUE ORIGIN

INTUITIVE MACHINES

AXIOM

FIREFLY AEROSPACE

SPACE ROBOTIC ARCHITECTURES



THE NEW SPACE AGE

HOW AI BRIDGES THE GAP

AI

- Training

GENERATIVE AI

- Inference

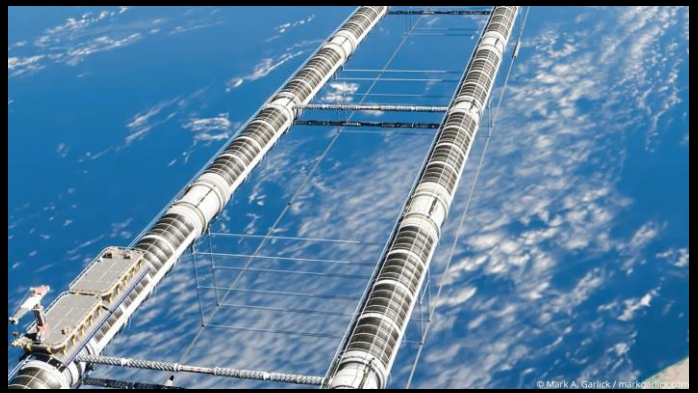
AGENTIC AI

- Multimodal Reasoning

THE NEW SPACE AGE

AI UNLOCKING REAL HUMAN PRESENCE IN SPACE BEYOND LEO

NASA ISS Digital Twin support robot

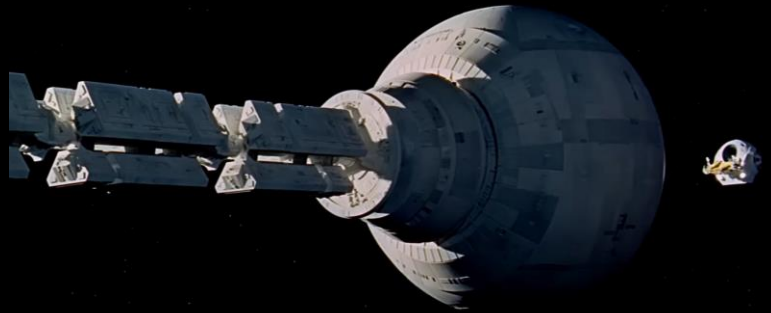


Space Infrastructure concept, MarkGarlick.com

- Resilient human missions
  - Self-improving habitat and human monitoring, contingency management and avoidance
  - Human mental and physical health management
  - Adaptive habitats constantly improving human conditions
- Resilient space robotics
  - Mobile and dexterous, ruggedized and robust
  - Scalable in-situ manufacture, resource utilization
  - Robust embodied AI with matured, retrainable and adaptive AI agents
    - Minimum human supervision
    - Optimized thruster and orbit maneuvering
    - Optimized mission control, health and housekeeping
    - Enhanced and reliable human-machine interface
    - Easily reconfigurable and adaptable to new environment conditions

THE NEW SPACE AGE

HOW AI BRIDGES THE GAP



2001: A Space Odyssey (1968)
Warner Bros., MGM, UA, Warner Bros. Home Entertainment

Passengers (2019)
Columbia Pictures, United International Pictures, Sony Pictures

THE NEW SPACE AGE

HOW AI BRIDGES THE GAP

Open AI and Figure (2024)

HOW AI BRIDGES THE GAP

TODAY WE CAN BUILD SCIENCE FICTION

SPACE IS AT THE FOREFRONT OF THE ADVANCEMENTS AND ETHICAL QUESTIONS SURROUNDING AI


OUR DREAM TO BE IN SPACE IS WITHIN GRASP


IT IS MANKIND'S FUTURE AND
ONLY LIFE INSURANCE POLICY
TO CONTINUE THRIVING ON
EARTH

OFFWORLD

THANK YOU