

Space commercialization and more

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Ever wanted to be an astronaut?

Space now

- Manned missions are not “as popular as used to be”
- Lot’s of unmanned missions
 - Let’s check few recent of them

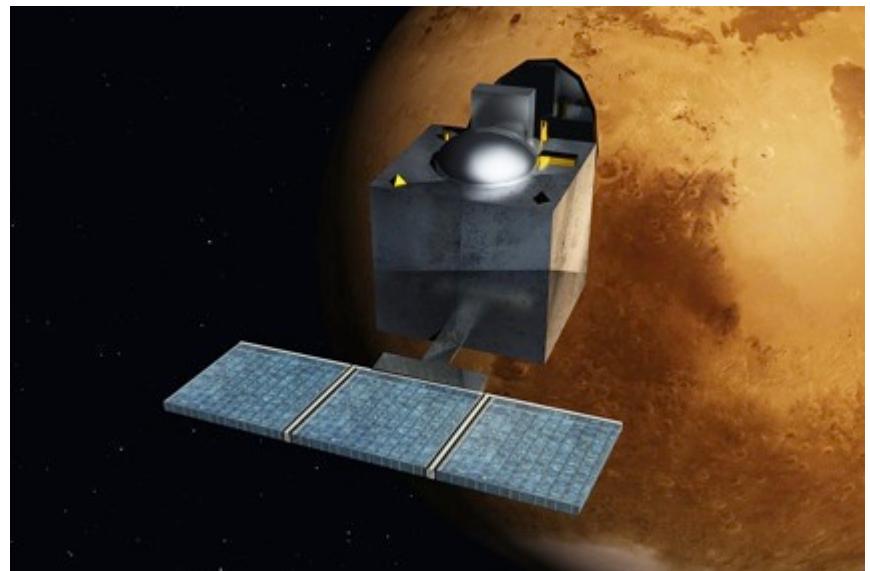
China National Space Administration

- Lunar exploration
 - Chang'e 3: lander
 - goddess of the Moon in Chinese mythology
 - Yutu: rover
 - Moon rabbit
- Landed on Moon 14 December 2013
 - Since 1976



Indian Space Research Organisation

- To Mars!!!
- Mars Orbiter Mission
 - Mangalyaan
(Sanskrit): Mars-Craft
- Planned to put into orbit 24 September of 2014



European Space Agency

- Moon is gone, Mars is gone,
so let's **travel to Galaxy** ☺
- Build **3D map of Milky Way**
 - Gaia: Mother of the Earth and Universe
- Observe **~1 bn astro objects**
 - ~1% of the Milky Way population ☹
- ... measure the **diameter of a hair from 1000 km away** ...
 - Space is huge too



More nations joining space “club” ...

Companies too!



Elon Musk

PayPal™

SPACEX



SpaceX – reusable rockets

<http://www.youtube.com/watch?v=ZxKWh7kLDzw>



Why reusable rockets?

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ENTREPRENEURSHIP INTERVIEWS WITH ENTREPRENEURS

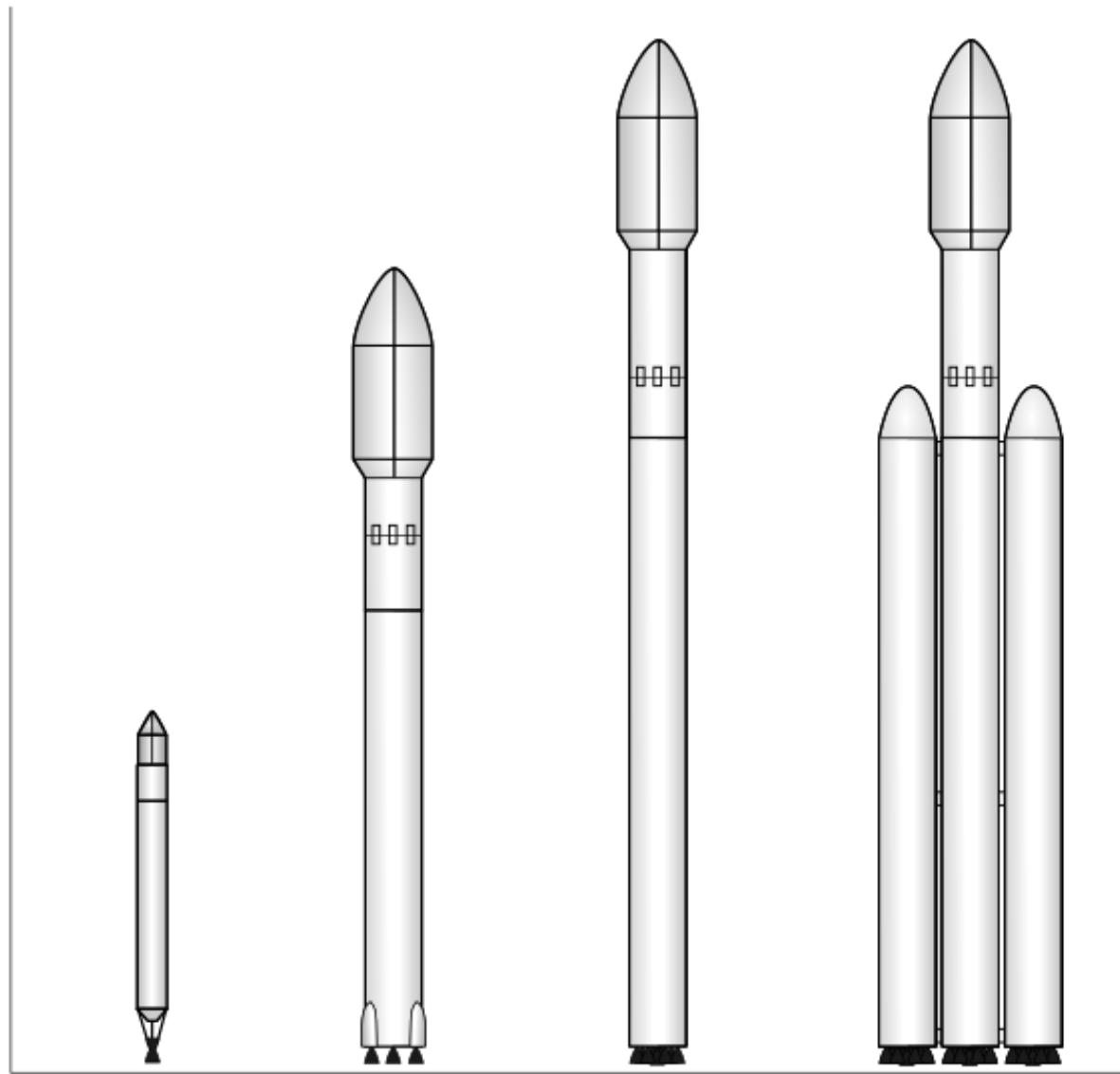
Elon Musk - CEO of Tesla Motors and SpaceX

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▶ Next section:
Marc Ecko - Founder of Ecko Unlimited

A video player showing a conversation between Elon Musk and Sal Khan. Elon Musk is on the right, wearing a dark jacket, and Sal Khan is on the left, wearing a red sweater. They are sitting in front of a whiteboard with some writing on it. The video player has a play button in the center, a progress bar at 00:00 / 48:42, and a 'Khan Academy' logo. Below the video are control buttons for Options, Share, and Info, along with a progress indicator showing 750 of 750.

Falcon line rockets cost 60 million dollars
Fuel is only 200 K => 0.00034 % of the cost!



Falcon 1
Satellites to orbit

Falcon 9 v1.0 and v1.1
Cargo to ISS

Falcon Heavy
Crew to ISS and from
there to Moon, Mars

Golden Spike – Train to the Moon



Mount A Lunar Expedition With Us... *It's The 21st Century.*



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Expeditions to the Moon ...

For Sale to Countries, Corporations,
and Individuals.

Golden Spike seeks nations, companies, and individuals
seeking to explore the Moon.

[BUSINESS OBJECTIVES](#)

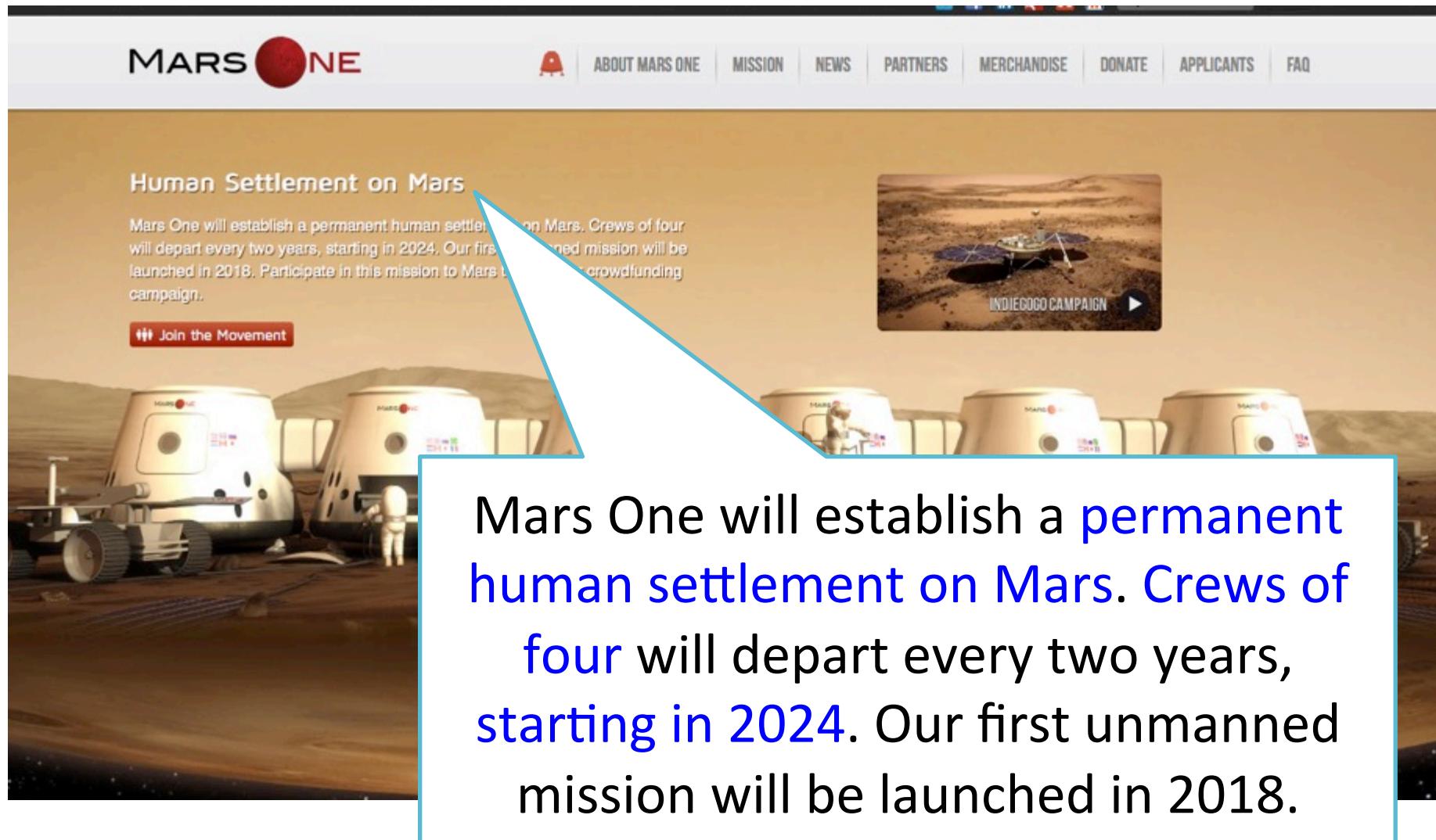
Serious? Who is backing them up?

- Mr. Gerry Griffin - Apollo Flight Director, former **NASA** Johnson Space Center
- Dr. Alan Stern - planetary scientist, former **head of all NASA science missions**
- Mr. Jeff Ashby - former **NASA space Shuttle commander**
- ...

More about Golden Spike

- Dialog:
 - Golden Spike: we can give a ride to NASA, if they want.
 - NASA: Go for it!
- Company need to raise around \$8 billion to set up operations.
- Round trip cost to the Moon for one is about \$1.5 billion
 - round trip ~750,000 km
- Golden Spike's market research identified 25 nations that are in a position to afford and have the desire for lunar expeditions...
- ... make money with advertising, marketing and media deals, including naming rights for its spaceships ...

MarsOne



The screenshot shows the MarsOne website homepage. At the top, there is a navigation bar with the MarsOne logo on the left and links for About Mars One, Mission, News, Partners, Merchandise, Donate, Applicants, and FAQ. Below the navigation bar, there is a large banner image of a Mars surface with several white cylindrical habitats and a rover. Overlaid on this image is a call-to-action text: "Human Settlement on Mars" followed by a detailed description of the mission plan. A red button labeled "Join the Movement" is visible. To the right of the main banner, there is a smaller video thumbnail titled "INDIEGOCO CAMPAIGN". A blue callout box with a triangular pointer is overlaid on the page, highlighting the text about the permanent human settlement on Mars.

Human Settlement on Mars

Mars One will establish a permanent human settlement on Mars. Crews of four will depart every two years, starting in 2024. Our first unmanned mission will be launched in 2018. Participate in this mission to Mars by supporting our crowdfunding campaign.

[Join the Movement](#)

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Roadmap

2011 Mars One Founded	2013 Start Crew Selection	2015 Start of Crew Training	2018 Demo & Comsat Mission	2020 Rover Mission Launched	2022 Cargo Missions Launched	2023 Outpost Operational	2024 Departure Crew One	2025 Landing Crew One	2026 Departure Crew Two

Foundations of mission plan laid

In 2011 Bas Lansdorp and Arno Wielders lay the foundation of the Mars One mission plan. Discussion meetings are held with potential suppliers of aerospace components in USA, Canada, Italy and United Kingdom. Mission architecture, budgets and timelines are solidified from feedback of supplier engineers and business developers. A baseline design for a mission of permanent human settlement on Mars achievable with existing technology is the result.

Unfortunately it's one way 😞

- Project costs \$6-billion
- Company's public announcement
 - Who wants to fly to Mars, it's a free ride!
- ~200.000 already applied, from 140 countries
- 7000 Canadians too
- Application fee \$5~75 depending on country
 - Average \$50 x 200 K = 10 million already 😊
 - Reality show is planned to select the candidate
 - ... and other ways of making money ...

Martian time

Earth “day” = Mars
“sol” (from *solar day*)

1 sol = 24 hours 39
minutes 35 seconds

Sol = Day + 40 mins

David Oh - Lead Flight
Director for the Mars
Science Laboratory
rover Curiosity, NASA





Followed Mars sol
over a month
starting from the
first day of
Curiosity's landing



List of NASA planet observations

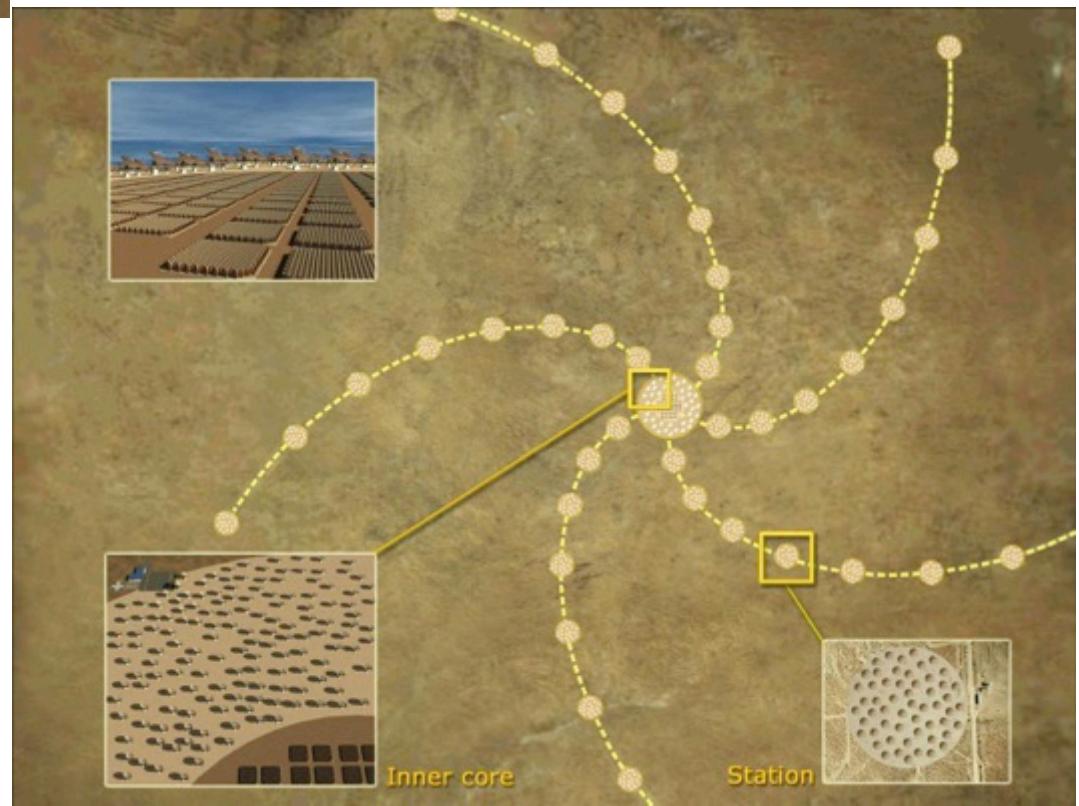
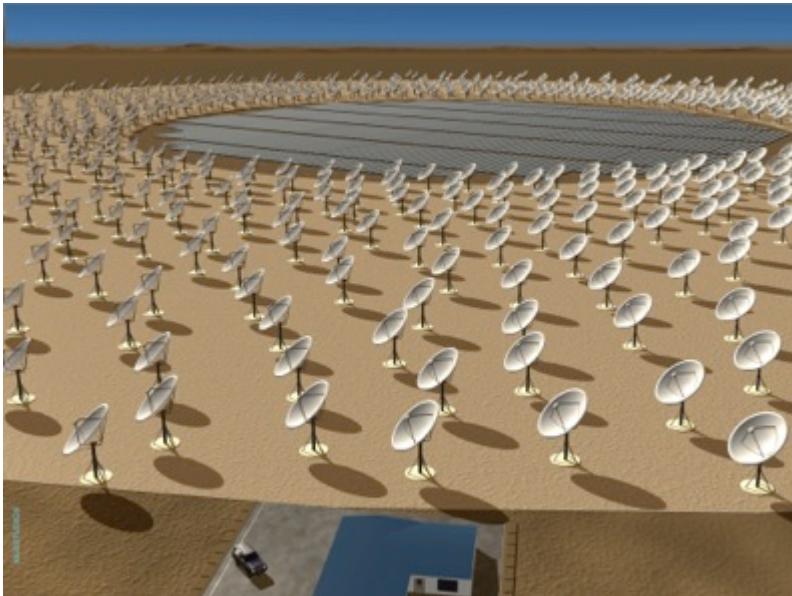
	Earth	Moon	Mars	Mercury	Venus	Sun	Universe and others
Past (from 1958)	14	16	15	1	3	1	10
Current	14	1	4	0	0	0	15
Future	6	0	2	0	0	0	3

Source: <http://www.jpl.nasa.gov/missions/>

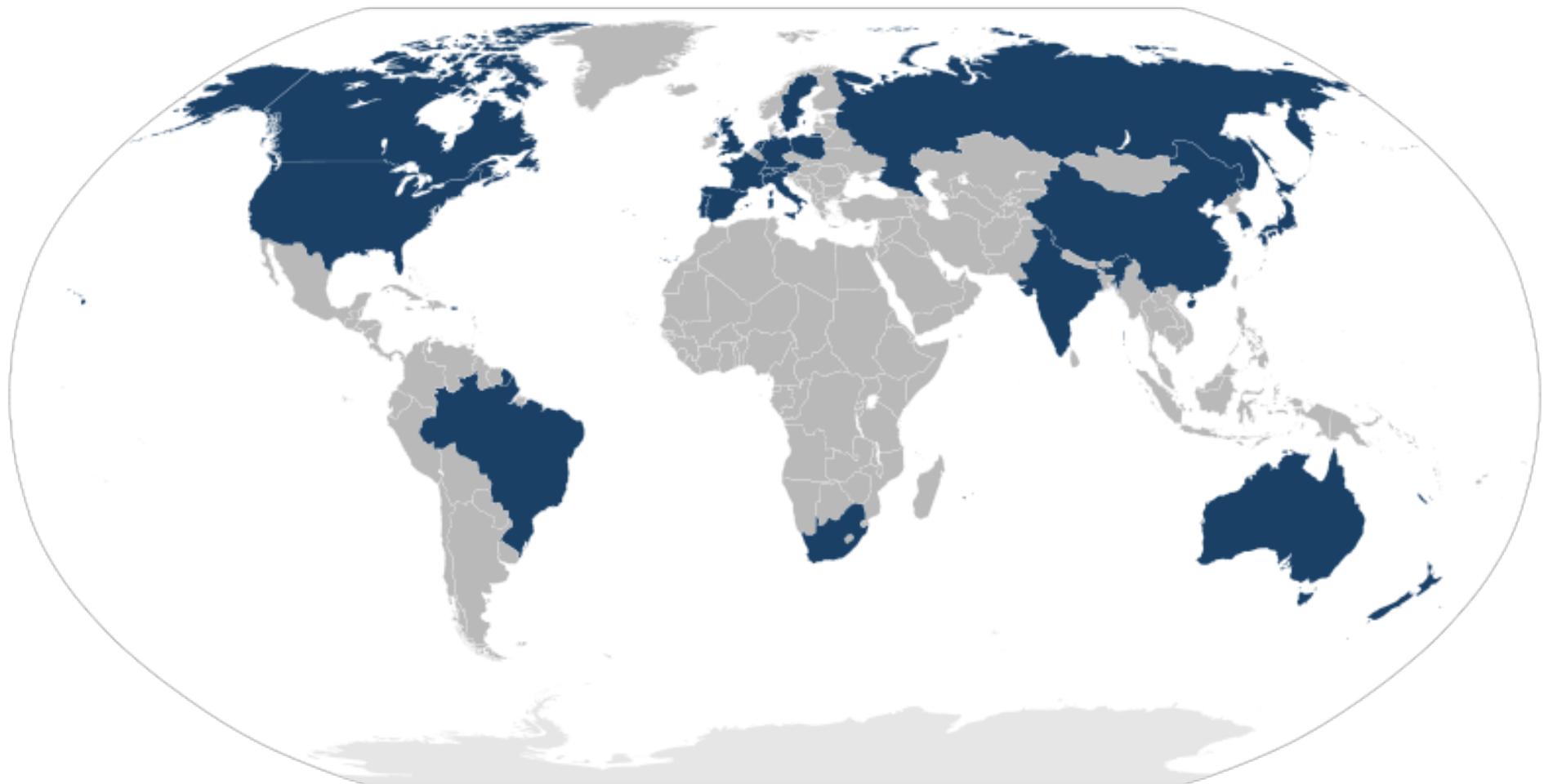
My favorite



- SKA is a radio telescope in development in [Australia](#) and [South Africa](#) which will have a total collecting area of approximately [one square km](#)



Participant countries



Sensitivity



Optical cables



AMAZING

4

SKA FACT

The dishes of the SKA will produce
10 times the global internet traffic.



10x

AMAZING

6

SKA FACT

The aperture arrays in the SKA could
produce more than *100 times the*
global internet traffic.



100x

Why important?

- Key projects
 - Galaxy evolution, dark matter and dark energy
 - The origin and evolution of cosmic magnetism
 - Extreme tests of general relativity
 - Extraterrestrial life and habitable planets



Don't explore, fix Earth!!!



Stephen Hawking at TED 2009

- I'm convinced that one day we human will have to **colonize the other planets** in order to survive.
- Space travel will become an **everyday necessity**.
- ...
- To confine our attention to terrestrial matters would be **to limit the human spirit**.

Aim high, keep exploring 😊

Thanks for listening &
enjoy your weekend!