Space commercialization and more

Nodir Kodirov
knodir@cs.ubc.ca

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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!
SpaceX – reusable rockets

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

SpaceX - Grasshopper Vertical Takeoff Vertical Landing (VTVL) …
Why reusable rockets?

Falcon line rockets cost 60 million dollars
Fuel is only 200 K => 0.00034 % of the cost!
Falcon 1 Satellite 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.

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 button]
Serious? Who is backing them up?

- Mr. Gerry Griffin - Apollo Flight Director, former Director of 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 ...
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.
## Roadmap

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Mars One Founded</td>
</tr>
<tr>
<td>2013</td>
<td>Start Crew Selection</td>
</tr>
<tr>
<td>2015</td>
<td>Start of Crew Training</td>
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<tr>
<td>2018</td>
<td>Demo &amp; Comsat Mission</td>
</tr>
<tr>
<td>2020</td>
<td>Rover Mission Launched</td>
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<tr>
<td>2022</td>
<td>Cargo Missions Launched</td>
</tr>
<tr>
<td>2023</td>
<td>Outpost Operational</td>
</tr>
<tr>
<td>2024</td>
<td>Departure Crew One</td>
</tr>
<tr>
<td>2025</td>
<td>Landing Crew One</td>
</tr>
<tr>
<td>2025</td>
<td>Departure Crew Two</td>
</tr>
</tbody>
</table>

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### Foundations of mission plan laid

In 2011 Bas Lansdorp and Amo 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

<table>
<thead>
<tr>
<th></th>
<th>Earth</th>
<th>Moon</th>
<th>Mars</th>
<th>Mercury</th>
<th>Venus</th>
<th>Sun</th>
<th>Universe and others</th>
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</thead>
<tbody>
<tr>
<td><strong>Past</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(from 1958)</td>
<td>14</td>
<td>16</td>
<td>15</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td><strong>Current</strong></td>
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<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15</td>
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<tr>
<td><strong>Future</strong></td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

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
The SKA will be so sensitive that it will be able to detect an airport radar on a planet *tens of light years away*. 
Optical cables

The SKA will use enough optical fibre to wrap *twice around the Earth*!
The dishes of the SKA will produce \textit{10 times} the global internet traffic.

The aperture arrays in the SKA could produce more than \textit{100 times the global internet traffic.}
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!!!

- 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**.

Stephen Hawking at TED 2009
Aim high, keep exploring 😊

Thanks for listening & enjoy your weekend!