• Steam propulsion was known in Greece before 400 BC
• Hero engine in 100 BC
• True rockets have internally stored propellants and energy

• Chinese started with true gunpowder rockets in 13th Century
  – Wan Hu tried manned flight (Unsuccessfully)
“The Earth is the cradle of mankind, but one cannot live in the cradle forever.”
Konstantin Tsiolkovsky
Kennedy Space Center
A Wildlife Refuge
The International Space Station
Size Comparison of Mir and International Space Station

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Mir</td>
<td>108 ft</td>
<td>98 ft</td>
<td>89 ft</td>
<td>90 metric tons</td>
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<tr>
<td>ISS</td>
<td>290 ft</td>
<td>358 ft</td>
<td>131 ft</td>
<td>406 metric tons</td>
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Space Station Mobile Servicing System

Mobil Transporter
8A Mission

Mobil Base System
UF-2 Mission

Arm
Remote Manipulator System
6A Mission

Special Purpose Dexterous Manipulator
UF-4 Mission

Canadian technology... it's out of this world.
Comparisons of Mars and Earth orbits
1. Ascent Vehicle and Cargo Arrival
2. Ascent Propellant Production
3. Arrival of Surface Habitat
4. Backup Ascent Vehicle and Exploration Systems
5. Crew Positions Habitation System
6. Outpost Overview
7. Crew Departs Mars
8. Rendezvous with Earth Return Vehicle

Mars Mission Storyboard
An Exploration Mission Concept