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A Perspective on Space Programs beyond North America

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A perspective on

Space programs beyond North America

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Raymond Francis
1950s and 60s: Space Race

1957: Sputnik 1
1950s and 60s: Space Race
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1969: Apollo 11
Meanwhile…

1962-69  Canada, UK, Italy, Australia, Germany collaborate with USA to launch own satellites

1965  France launches Astérix on indigirous rocket (Diamant) as well as a second, unnamed satellite

1968-71  ELDO launches Europa rocket four times

1970  Japan launches Ohsumi on indigirous rocket (L-4S) for 7 hours

1970  China launches Dong Fang Hong 1 on Long March rocket. It takes ionospheric readings for 28 days and broadcasts a patriotic song.

Alouette 1
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1970 Japan launches 2nd Ohsumi on indigenous rocket (L-4S) for 28 days
### Meanwhile...

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|       | It takes ionospheric readings for 28 days  
|       | (and broadcasts a patriotic song) |
Today

Many countries have space programs with a variety of capabilities and goals.

Space is big business.

Countries with launch capability:

- China
- Europe (ESA)
- Japan
- India
- Iran
- Israel
- Russia
- USA
- Ukraine
Russia

- Major, established player
- Inherited from USSR
Russia

- Major, established player
- Inherited from USSR
- Commercial launches
- Space tourism
Russia

- Major, established player
- Inherited from USSR
- Commercial launches
- Space tourism
- New reinvestment
“Now we have the real chance to move from exploiting and supporting previous, often Soviet, 'space capital' to carrying out new, ambitious projects in space,”

- Vladimir Putin, 11 Apr 2008 at the United Nations
Vostochny National Cosmodrome

Construction began: Jan 2011
First launch: 2015
Manned launch: 2018

Cost (announced):
82 Billion roubles
~ C$ 2.7 B
“With the new space centre, Russia will become a truly self-sufficient space power, able to launch all types of spacecraft, including cargo spacecraft and space station modules. The facilities of Vostochny will also be used through the programmes for manned flights and missions to the moon and Mars. We hope to strengthen Russia’s position on the global market of space technology and services, where we clearly have a competitive edge.

-  Vladimir Putin, 25 Jan 2011
  at a meeting of the Government Presidium
“Despite the positive figures in general, the population of Far Eastern regions is still declining. The main reason here is not the birth rate or the mortality rate – this is the old reason – but migration. As in the past, more people leave the Far East than come here. However, I'm convinced that together, we will be able to change this situation…”

- Vladimir Putin, 6 Dec 2010
  *at a political conference in Khabarovsk*

“We expect that this project will foster the development of the Far East, attracting highly-qualified specialists to the region and getting local manufacturing companies involved.”

- Vladimir Putin, 25 Jan 2011
  *at a meeting of the Government Presidium*
India

- Newer player
India

- Newer player
- Began by co-operating with USSR, USA, Europe
  First satellite: 1975 (USSR launch)
  First launch: 1979
India

- Newer player
- Began by co-operating with USSR, USA, Europe
  First satellite: 1975 (USSR launch)
  First launch: 1979
- Now over 50 satellites launched
- Plans for $\mu g$ science and Human spaceflight
Why does India invest in space?

There are some who question the relevance of space activities in a developing nation. . . . But we are convinced that if we are to play a meaningful role nationally, and in the community of nations, we must be second to none in the application of advanced technologies to the real problems of man and society.

- Dr. Vikram Sarabhai, ‘Father of the Indian Space Program’
African space programs

<table>
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<tr>
<th>Country</th>
<th>Satellite</th>
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<tr>
<td>South Africa</td>
<td>SUNSAT-1</td>
<td>2000</td>
</tr>
<tr>
<td>Algeria</td>
<td>AlSat-1</td>
<td>2002</td>
</tr>
<tr>
<td>Nigeria</td>
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<td>2003</td>
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- Space activities associated with remote sensing and communications
- International co-operation
- International Charter on Space and Major Disasters
– 18 Member States (+ Canada)
– Headquartered in Paris
– Mission control centre “ESOC” in Darmstadt, Germany
– Other sites across Europe
Science
Space Astronomy

Hubble Space Telescope
Joint with NASA

James Webb Space Telescope
Joint with NASA and CSA
Launch Date: 2013

XMM-Newton
X-Rays – Launched December 1999

INTEGRAL
Gamma – Launched October 2002

Herschel & Planck
IR & Microwave
Launched May 2009

Gaia
Astrometry
1 Billion stars to micro-arcsec
All stars to magnitude 20
Launch date: 2012
Science
Solar System
Mars Express
Venus Express
Science

Solar System

Mars Express

Venus Express

Huygens – Titan lander

Giotto – Comet flyby (Halley)

Rosetta – Comet rendezvous and land

(67P/Churyumov-Gerasimenko)
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Earth Observation

Earth Explorers

**GOCE**
Gravity field and Ocean Circulation  
Launched March 2009

**SMOS**
Soil Moisture and Ocean Salinity  
Launched November 2009

**CryoSat**
Earth Cryosphere  
Launched April 2010

**ADM-Aeolus**
Atmospheric Dynamics and wind  
Launch: 2013

**EarthCARE**
Clouds, Aerosols, and Radiation  
Launch: 2013
Launchers

Ariane 5

Launch site:
Kourou, French Guyana

Cryogenic main stage
Restartable upper stage
Solid boosters

Payload mass:
GTO 10 t
LEO 20 t
SSO and Earth-escape also possible

To be joined soon by:
Vega 1-2 t LEO/SSO
Soyuz (all orbits)
Human Spaceflight

International Space Station

Columbus Laboratory
Automated Transfer Vehicle
Node-2 & -3 with Cupola
Russian segment computers
Navigation

Galileo

Global Satellite Navigation System

30 Satellites (incl. 3 on-orbit spares)
- Under civilian control
- Service guarantee
- SAR signal return capability

Accuracy:
<4m Open Service
<0.1m Commercial Service

Anti-jamming and fault reporting for Safety of Life Service

GIOVE-A and -B testbeds in orbit now
Full system deployment planned by 2013
Earth Observation

GMES

Global Monitoring for Environment and Security

Sentinel-1
- **Synthetic Aperture Radar**
- Ice monitoring
- Marine surveillance
- Mapping: routine and emergency

Sentinel-2
- **High-resolution multispectral**
- Land use
- Rapid imaging
- Emergency services

Sentinel-3
- **Large-swath optical with altimetry**
- Surface temperature,
- Ocean colour and topography
- Vegetation
“Space reinforces Europe’s position as a key player on the world stage and as a bridgebuilder between current and emerging powers...

Space is helping Europe to prepare for tomorrow’s challenges, whether in protecting our environment, preserving natural resources, strengthening the competitiveness of our economy or facing new threats.”

- European Space Agency

“Space technology will increasingly serve Europe’s domestic and global policy ambitions. It can help to achieve important European objectives. Environment and security policies including the response to global climate change is an outstanding example. Others are transport, research, agriculture, fisheries, development aid and weather forecasts.”

- European Commission