SMALL SATELLITES AS A CHANCE FOR DEVELOPING COUNTRIES

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1. SMALL SATELLITES AS A CHANCE FOR DEVELOPING COUNTRIES:
   • Definition of small satellites
   • Space emerging countries
   • Opportunities

2. USE OF SMALL SATELLITES IN VENEZUELA

3. OPPORTUNITIES FOR INTERNATIONAL COOPERATION: A REGIONAL PERSPECTIVE FOR LATIN-AMERICAN COUNTRIES

4. CONCLUSION
1. SMALL SATELLITES AS A CHANCE FOR DEVELOPING COUNTRIES

• Definition of small satellites
• Space emerging countries
• Opportunities
**Definition. Satellite mass categories**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>MASS RANGE (KG)*</th>
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<tbody>
<tr>
<td>STANDARD SATELLITE</td>
<td>&gt; 1,000</td>
</tr>
<tr>
<td>MINISATELLITE</td>
<td>100-1000</td>
</tr>
<tr>
<td>MICROSATELLITE</td>
<td>10-100</td>
</tr>
<tr>
<td>NANOSATELLITE</td>
<td>1-10</td>
</tr>
<tr>
<td>PICOSATELLITE</td>
<td>0.1-1</td>
</tr>
<tr>
<td>FEMTOSATELLITE</td>
<td>&lt; 0.1</td>
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</tbody>
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*Masses refer to in-orbit fully-fueled satellites ("wet mass"). Modified from Brian Weeden, Secure World Foundation (SWF)
Space emerging countries
OPPORTUNITIES: SATELLITE APPLICATIONS

REMOTE SENSING

- Urban planning, health, energy, agricultural planning, food security, disaster management, control of illegal crops, border surveillance, natural resource management, among others.

SCIENTIFIC APPLICATIONS

- Soil prospection (terrestrial and maritime areas), detection of water resources, minerals, oil, fisheries, monitoring of climate parameters linked to hurricane and storms, among others.
OPPORTUNITIES: CAPACITY BUILDING (HUMAN TRAINING)

UNIVERSITIES
RESEARCH AND DEVELOPMENT INSTITUTIONS
OPPORTUNITIES: INFRASTRUCTURE DEVELOPMENT

- Research laboratories
- Design, assembling, integration and testing facilities
- In-orbit operation facilities
- Data processing infrastructure

Integration and testing  Satellite operations  Data processing
OPPORTUNITIES: BOOST OF LOCAL SPACE CAPABILITIES

Material science, electronics, chemistry, telecommunications, education, computer science, geomatic, geophysics, physics, biology, mathematics, among others.

GOVERNMENTAL AGENCIES
UNIVERSITIES
RESEARCH AND DEVELOPMENT INSTITUTIONS
LOCAL INDUSTRIES
2. USE OF SMALL SATELLITES IN VENEZUELA

- Background of space activities in Venezuela
- Miranda Satellite (Venezuelan Remote Sensing Satellite, VRSS-1 Program)
- Center for Space Research and Development
- Human training
Miranda Satellite (VRSS-1 Program)

<table>
<thead>
<tr>
<th>TECHNICAL FEATURES OF VRSS-1 SATELLITE</th>
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<tbody>
<tr>
<td>WEIGHT</td>
</tr>
<tr>
<td>SIZE</td>
</tr>
<tr>
<td>ORBIT</td>
</tr>
<tr>
<td>HEIGHT</td>
</tr>
<tr>
<td>LTDN (LOCAL TIME DESCENDING NODE)</td>
</tr>
<tr>
<td>PERIOD (DAYS)</td>
</tr>
<tr>
<td>REVISIT TIME (DAYS)</td>
</tr>
</tbody>
</table>

VRSS-1 PRE-LAUNCH CONFIGURATION
Miranda Satellite (VRSS-1 Program)

House planning
Urban and rural areas
Municipal Management - Cadastre

Disaster management
Land slides, floods
Drought, Desertification
Fires

Productive systems
Basic information
Health

Security and defense
Illegal mining
Humanitarian help
Border surveillance
Control of illegal crops

Natural resource management
Biodiversity
Maritime and coastal areas

Up to date, there are 37,431 cataloged images of the Venezuelan territory
Miranda Satellite
(VRSS-1 Program)

GROUND FACILITIES

TRAINING OF 54 PROFESSIONALS
Images of Miranda Satellite (VRSS-1 Program)
Center for Space Research and Development

• Design, assembly, integration and verification of small satellites (≤1000kg)

• Earth observation and Scientific Missions

• To promote scientific networks integrated into the space sector, allowing research in strategic areas such as material science, electronics, chemistry, computer science, among others
CENTER FOR SPACE RESEARCH AND DEVELOPMENT

ASSEMBLY, INTEGRATION AND TEST FACILITIES (AITC):
- Electromagnetic compatibility
- Checkout test
- Space environmental simulation
- Acoustic test
- Leakage detection
- Alignment test
- Mass properties

DESIGN FACILITIES (DC):
- System design
- Telemetry, tracking and command
- Attitude and orbit control subsystem
- Electric power subsystem
- Onboard data handling subsystem
- Propulsion subsystem
- Thermal control subsystem

ADMINISTRATIVE FACILITIES
- Administrative activities
Since 2007 up to date, there are 2413 professionals that have been trained in space science, technology and applications.
3. OPPORTUNITIES FOR INTERNATIONAL COOPERATION: A REGIONAL PERSPECTIVE FOR LATIN-AMERICAN COUNTRIES

- Legal Framework
- Technological Framework
- Mechanisms of Regional Integration
# LEGAL FRAMEWORK

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>SPACE AGREEMENTS OF UNITED NATIONS</th>
</tr>
</thead>
</table>
| ARGENTINA | • OUTER SPACE TREATY (1967). RATIFIED  
• RESCUE AGREEMENT (1968). RATIFIED  
• LIABILITY CONVENTION (1972). RATIFIED  
• REGISTRATION CONVENTION (1975). RATIFIED |
| BOLIVIA   | • OUTER SPACE TREATY (1967). SIGNED  
• RESCUE AGREEMENT (1968). SIGNED |
| BRAZIL    | • OUTER SPACE TREATY (1967). RATIFIED  
• RESCUE AGREEMENT (1968). RATIFIED  
• LIABILITY CONVENTION (1972). RATIFIED  
• REGISTRATION CONVENTION (1975). RATIFIED |
| COLOMBIA  | • OUTER SPACE TREATY (1967). SIGNED  
• RESCUE AGREEMENT (1968). SIGNED  
• LIABILITY CONVENTION (1972). SIGNED |
| CHILE     | • OUTER SPACE TREATY (1967). RATIFIED  
• RESCUE AGREEMENT (1968). RATIFIED  
• LIABILITY CONVENTION (1972). RATIFIED  
• REGISTRATION CONVENTION (1975). RATIFIED  
• MOON AGREEMENT (1979). RATIFIED |
| ECUADOR   | • OUTER SPACE TREATY (1967). RATIFIED  
• RESCUE AGREEMENT (1968). RATIFIED  
• LIABILITY CONVENTION (1972). RATIFIED |
| MEXICO    | • OUTER SPACE TREATY (1967). RATIFIED  
• RESCUE AGREEMENT (1968). RATIFIED  
• LIABILITY CONVENTION (1972). RATIFIED  
• REGISTRATION CONVENTION (1975). RATIFIED  
• MOON AGREEMENT (1979). RATIFIED |
| PERU      | • OUTER SPACE TREATY (1967). RATIFIED  
• RESCUE AGREEMENT (1968). RATIFIED  
• LIABILITY CONVENTION (1972). RATIFIED  
• REGISTRATION CONVENTION (1975). RATIFIED  
• MOON AGREEMENT (1979). RATIFIED |
| VENEZUELA | • OUTER SPACE TREATY (1967). RATIFIED  
• RESCUE AGREEMENT (1968). SIGNED  
• LIABILITY CONVENTION (1972). RATIFIED |

Source: UNOOSA 2013. Status of International Agreements relating to activities in outer space as at 1 January 2013
TECHNOLOGICAL FRAMEWORK
MECHANISMS OF REGIONAL INTEGRATION

- Community of Latin American and Caribbean States (CELAC)
- Alianza Bolivariana para los Pueblos de Nuestra América - Tratado de Comercio de los Pueblos o (ALBA-TCP)
- Mercado Común del Sur (MERCOSUR)
4. CONCLUSION

• Advantages of implementing small satellite programs.

• Main challenges for developing countries:
  o Technology transfer
  o Space debris
  o National legal frameworks
  o Sharing of information
THANKS...

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