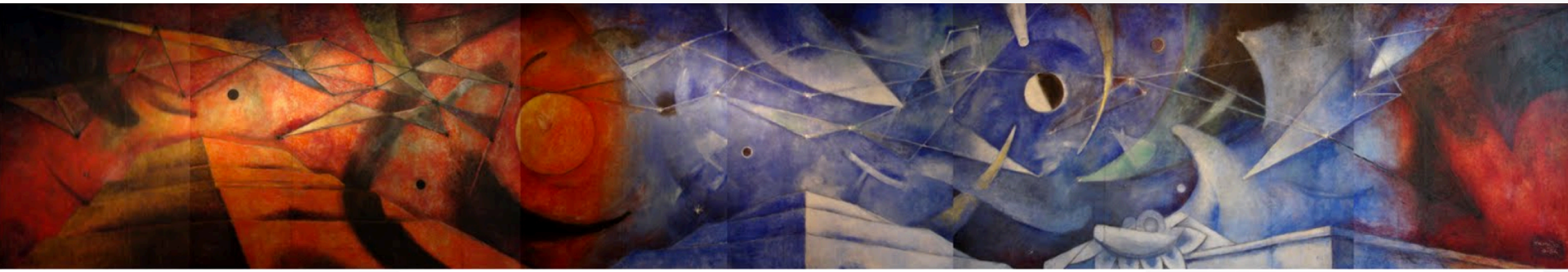


Capacity development in the space field. The Mexican Experience

UN/Austria Symposium on Access to Space: Holistic Capacity-Building for the 21st Century

Graz, Austria
September 7, 2017

SCT
SECRETARÍA DE COMUNICACIONES Y TRANSPORTES

AEM
AGENCIA ESPACIAL MEXICANA

Outline

- Capacity building
  - Capacity building in Mexico
  - Building or development capacities?
- Engage stakeholders
- Asses capacity
- Formulate & implement response
- Evaluate capacity development
- Final remarks

SPACE AS A PUBLIC POLICY

CAPACITY

- ATTRACTION
- DEVELOPMENT
- RETENTION
- UTILIZATION

"...capacity-building encompasses the country's **human**, **scientific**, **technological**, **organizational**, **institutional** and **resource capabilities**. A fundamental goal of capacity-building is to enhance the ability to evaluate an address the crucial questions related to **policy choices** and modes of implementation among **development options**, based on an understanding of environment **potentials and limits** and of need perceived by the people of the country concerned"

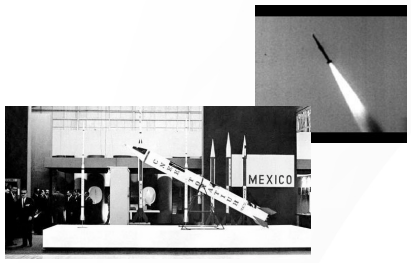
ECOSOC

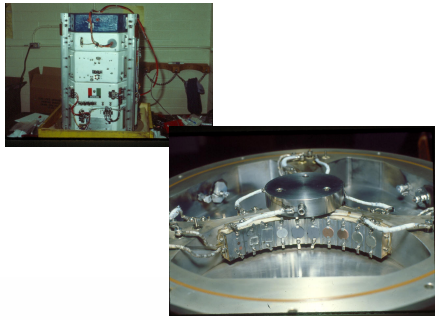
SPACE POLICY

NATIONAL PRIORITIES & DESIRED RESULTS

MISSION, VISION

Capacity building in Mexico





1970s: National Comission of Outer Space. Sounding rockets

1980s: "Morelos" Satellites System, contracted with Hughes & NASA. Development of space experiments for the NASA space shuttle container program, in collaboration with USA universities

2000s: SATMEX Satellites System, contracted with Hughes, Boeing, Loral & ESA.
Diverse small satellite projects: SATEDU, CONDOR, SENSAT.

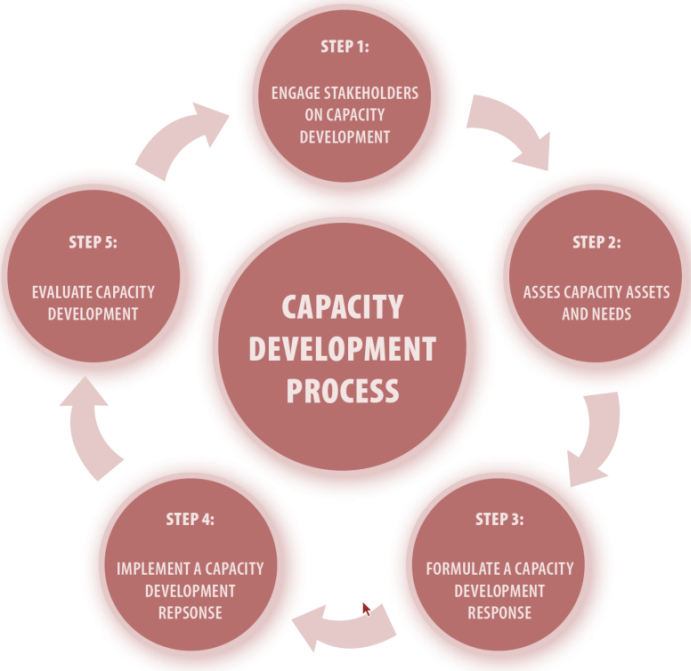
AEM AGENCIA ESPACIAL MEXICANA

CRECTEALC

Building or development capacities?

Capacity Development is much **more than supporting training programs** and the use of national expertise –these are necessary and on the rise, but we **must include** response and support strategies for **accountable leadership, investments in long-term education and learning, strengthened public systems and voice mechanism between citizen and state and institutional reform** that ensures a responsive public and private sector that manages and delivers services to those who need them most"

ECOSOC



Source: UNDP

Capacity Development: process through which individuals, organizations and societies **obtain, strengthen and maintain** the capabilities to set and achieve their own development objectives over time

UNDP

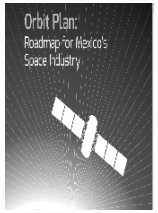
Forums

- Space policy GUIDELINES

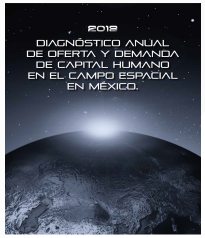
- Establishment of AEM

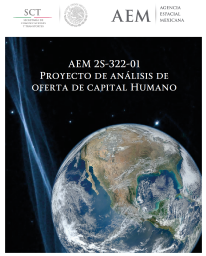
- Space Activities National Plan

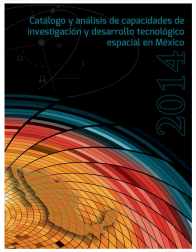
- Orbit Plan : Roadmap for Mexico's space Industry



Asses capacity





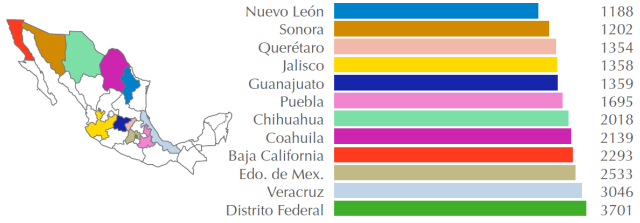


Source: aem.gob.mx

Diagnosis on **supply and demand of specialized human resources** in aerospace in order to propose alternatives for its development

Academia

Engineers graduated in space related areas



Fuente: ANUIES 2012

Government

- Social development
- Agriculture
- Disaster management
- Security
- Natural resources
- Telecommunications
- Energy

Private sector

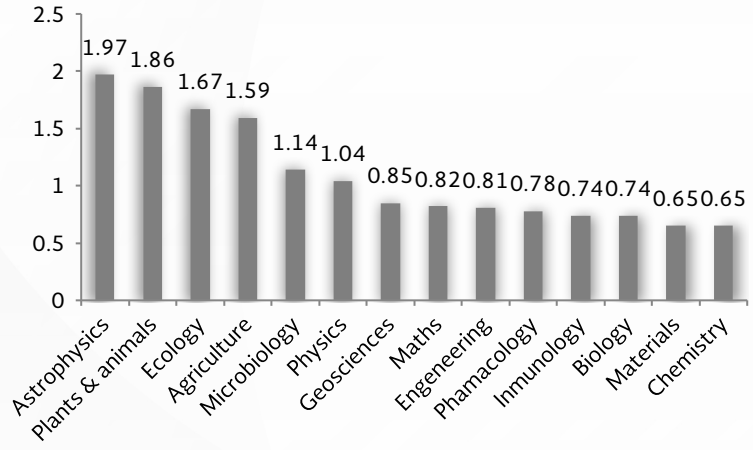
http://www.educacionespacial.aem.gob.mx/mapa_nacional.html

RESEARCH

883 researchers

- 86% academia and public research centers
- 9% private
- 5% Other public centers

AREAS



SOURCE: CONACYT, INFORME GENERAL DEL ESTADO DE LA CIENCIA, LA TECNOLOGÍA Y LA INNOVACIÓN 2014 BASED ON THOMSON REUTERS. DATABASE INCITES GLOBAL COMPARISONS RESEARCH AREAS, 2015

INFRASTRUCTURE

INSTITUTION	FACULTY/UNITS/ DEPARTMENTS	INFRASTRUCTURE	LOCATION
University of Sonora Hermosillo Campus	Astronomy	Carl Sagan Observatory	Sonora
University of Sonora Agricultural Field	Astronomy	Solar observatory	Sonora
Advanced Materials Research Center	Nanotechnology Institutional Program	National Nanotechnology Laboratory Metrology laboratory Laboratory on electrics Laboratory on volume Laboratory on pressure Laboratory on temperature Laboratory on dimensions Laboratory on mass Laboratory on humidity	Chihuahua
Guadalajara Autonomous University	Astronomy Institute	Fluids laboratory	Guadalajara
NAUM - Engineering	High Technology Center	Failure resilient systems for space use Analysis on reliability of space systems Computers on-board space devices Potency systems on-board space devices Space and earthbound telecomunication systems Electromagnetic compatibility of space systems Telemetry systems on-board space devices Structural and thermic design of space systems Instrumentation design on-board space devices Propulsion systems	Mexico City
NAUM - CCADET		Anechoic chamber	Mexico City
CIESE		Satellites laboratory Wireless communications laboratory Control laboratory High frequencies laboratory Signal processing for communications laboratory Robotics laboratory Bioinformatics laboratory Mobile and ubiquitous informatics laboratory Geomatics laboratory Imagery digital processing laboratory	Lower California
INAOE		Large millimetric telescope High Altitude Water Cherenkov Guillermo Haro Astrophysics Observatory Science Trailer Biomedic optics laboratory Aspherical surfaces laboratory Robotics laboratory Schmidt Chamber Solar telescope	Puebla
IPN ESIME		Materials and materials testing laboratory Numerical control and manufacture process laboratory Aeronautic operations laboratory Aircraft and helicopter systems laboratory	Mexico City
NAUM - OAN		National Tonantzintla Astrophysics Observatory San Pedro Martir National Astronomy Observatory	Puebla
NAUM - Geophysics		Environmental Geophysics University Laboratory Digital cartography laboratory Plasma spectrometry laboratory 5-meteres radio telescope Solar radio astronomy observatory Cosmic rays observatory Large millimetric telescope High Altitude Water Cherenkov Guillermo Haro Astrophysics Observatory 5-meters radio telescope Solar radio astronomy observatory Cosmic rays observatory	Mexico City
NAUM - Geography		Geospatial analysis laboratory	Mexico City

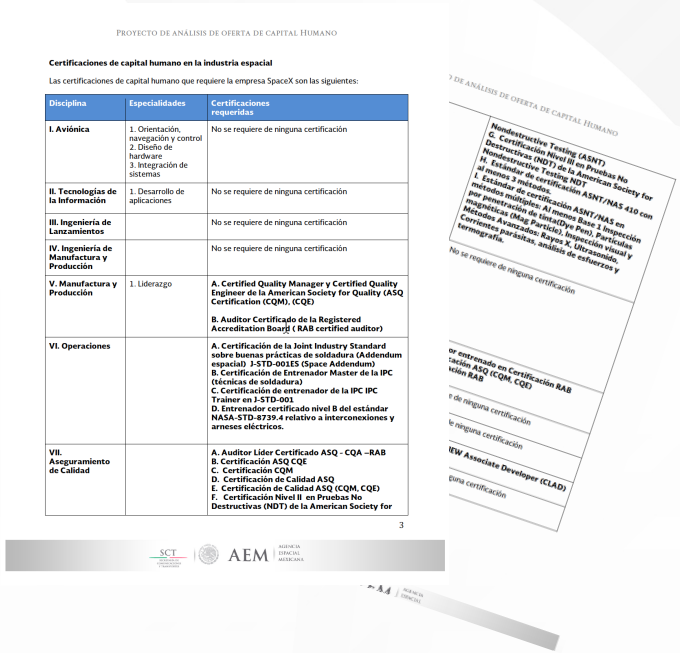
Source: aem.gob.mx

HUMAN CAPITAL CERTIFICATION ANALYSIS

Technical training

Space X job analysis

- Quality management
- Assembly of electrical components and welding
- Development of non-destructive test
- Use of advanced software tools: LabVIEW, CATIA, MATLAB



PROYECTO DE ANÁLISIS DE OFERTA DE CAPITAL HUMANO

Certificaciones de capital humano en la industria espacial

Las certificaciones de capital humano que requiere la empresa SpaceX son las siguientes:

Disciplina	Especialidades	Certificaciones requeridas
I. Aviónica	1. Orientación, navegación y control 2. Diseño de hardware 3. Integración de sistemas	No se requiere de ninguna certificación
II. Tecnologías de la Información	1. Desarrollo de aplicaciones	No se requiere de ninguna certificación
III. Ingeniería de Lanzamientos		No se requiere de ninguna certificación
IV. Ingeniería de Manufactura y Producción		No se requiere de ninguna certificación
V. Manufactura y Producción	1. Liderazgo	**A. Certified Quality Manager y Certified Quality Engineer de la American Society for Quality (ASQ Certification (CQM), (CQE)** **B. Auditor Certificado de la Registered Accreditation Board (RAB certified auditor)**
VI. Operaciones		**A. Certificación de la Joint Industry Standard sobre buenas prácticas de soldadura (Addendum espacial) J-STD-001ES (Space Addendum)** **B. Certificación de Entrenador Master de la IPC (técnicas de soldadura)** **C. Certificación de entrenador de la IPC IPC Trainer en J-STD-001** **D. Entrenador certificado nivel B del estándar NASA-STD-8739.4 relativo a interconexiones y arneses eléctricos.**
VII. Aseguramiento de Calidad		**A. Auditor Líder Certificado ASQ - CQA –RAB** **B. Certificación ASQ CQE** **C. Certificación CQM** **D. Certificación de Calidad ASQ** **E. Certificación de Calidad ASQ (CQM, CQE)** **F. Certificación Nivel II en Pruebas No Destructivas (NDT) de la American Society for**

3

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Source: AEM

"Capacity development responses and investments that are not grounded in a rigorous capacity assessment are often limited to training. While often necessary, training is not sufficient for sustained results"

PNUD

TRAINING

SKILLS
ABILITIES
KNOWLEDGE

COMPETENCES

EDUCATIONAL SYSTEM

- Basic & advanced training
  - Bachelor, Masters, PhD
- Courses, workshops, seminars
  - Water rockets
  - Best practices for CubeSat design
  - Introduction to Space Systems
  - Introduction to Satellite images interpretation
  - Cansat mission planning
- Communities of practice
- Publications

http://www.educacionespacial.aem.gob.mx

MARKET DRIVEN

On the job training
Internship
Mentoring

Technical assistance

INTERNATIONAL COOPERATION

NASA
cnes CENTRE NATIONAL D'ÉTUDES SPATIALES
asi agenzia spaziale italiana
UNITED NATIONS Office for Outer Space Affairs UN-SPIDER www.un-spider.org

Formulate & implement response (2)

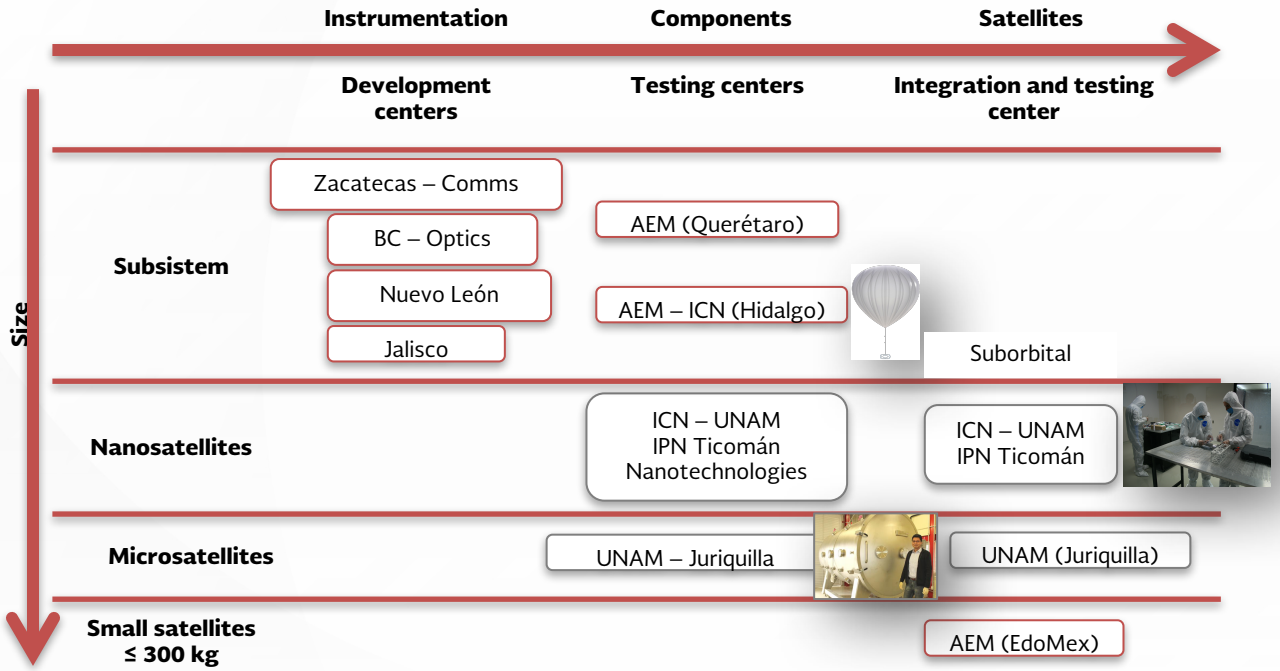
Human capital

- Enterprises
- Suppliers Clients
- Education & financial institutions

Business

- Property rights
- Corporate governance
- Competence policy
- Labor markets

Infrastructure: IT, roads, ports, transportation, logistics



Space development Centers

- Zacatecas
- Estado de México
- Hidalgo

M&E privilege budget

Need to measure progress (indicators)

Ownership of evaluation

DEVELOP CAPACITIES IN SPACE SCIENCE AND TECHNOLOGY IS MANDATORY, BUT OTHER DISCIPLINES COULD BE INCORPORATED TO SPACE COMMUNITY

INTERNATIONAL COOPERATION HAS BEEN FUNDAMENTAL TO BUILD CAPACITIES AND WE NEED TO KEEP DOING IT AND ENCOURAGE NEW APPROACHES SUCH AS SOUTH-SOUTH COOPERATION