Advanced Technology Unit (UAT)

School of Engineering UNAM, 2024

Space facilities to develop space systems in México: National Laboratory of Space and Automotive Engineering (LN-INGEA)

UAT - FI
Unidad de Alta Tecnología - Facultad de Ingeniería

INGENIERIA

LN-INGEA
Laboratorio Nacional de Ingeniería Espacial y Automotríz

Introduction

Mexico has four satellites: **Satmex-5, Satmex-6, Satmex-8 and QuetzSat-1.**

Since 2019, Mexico launched 5 nanosats: *Painani I and II (3U), AztechSat I (1U), NanoConnect-2 (2U), D2/Atlacom-1 (6U).*

Next Nanosat projects: *Koto (1U), Gxiba (1U), AztechSat II (1U-6U), Ixaya (3U).*

Introduction

Mexican Space Agency: Regional Center for Space Development (CREDES) ▲

CONAHCyT: LANCE, LANOT, LN-INGEA ■

Universities: IPN (CDA), UPAEP ●

Introduction

The School of Engineering at the National University Autonomous of Mexico (FI-UNAM) is an educational institution of excellence, a national reference, and international prestige. It forms professionals at the Bachelor and Graduate levels, highly competitive and demanded by all productive sectors thanks to their engineering knowledge. 225 years after its creation, the school combines tradition and modernity.

FI-UNAM is the oldest engineering school on the continent and has academics of recognized prestige and state-of-the-art facilities. With an academic offer of 15 undergraduate, 7 doctoral, and 10 master's programs, where the B.S. in Aerospace Engineering program was approved in 2020. The Faculty of FI-UNAM serves a population of almost 15 thousand students providing a solid background in basic sciences and socio-humanistic. Its extensive infrastructure includes the majestic Palace of Mining and facilities in the states of Morelos, Querétaro, and Nuevo León. Figure 1 shows the location of the FI-UNAM main campus and its facilities across the nation.

http://www.ingenieria.unam.mx

Introduction

Advanced Technology Unit (UAT) @ Querétaro

Department of Automotive Engineering

Department of Aerospace Engineering

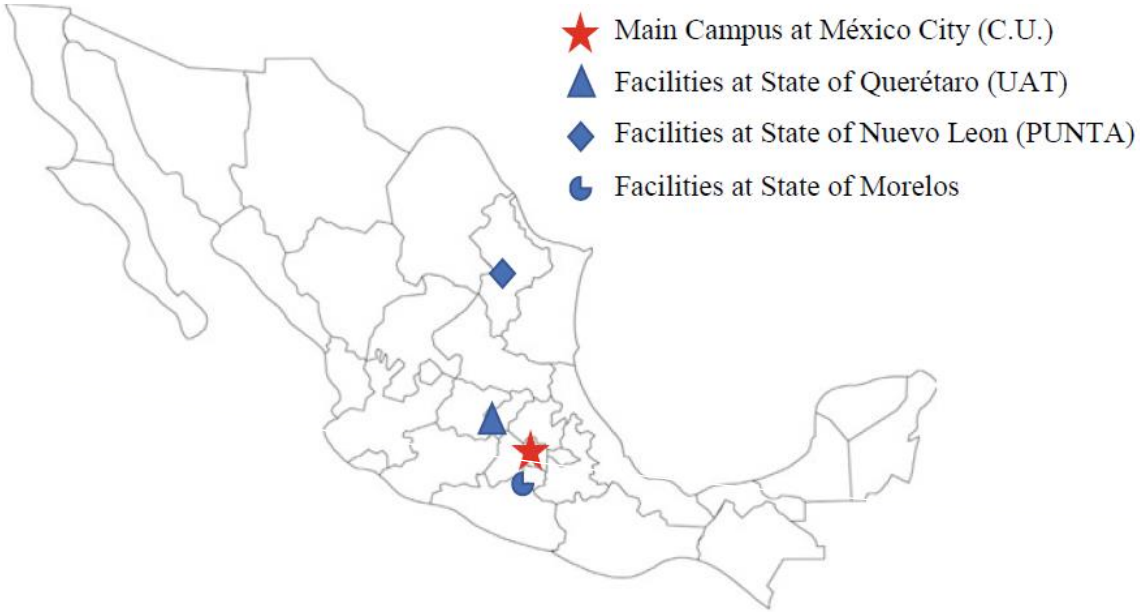


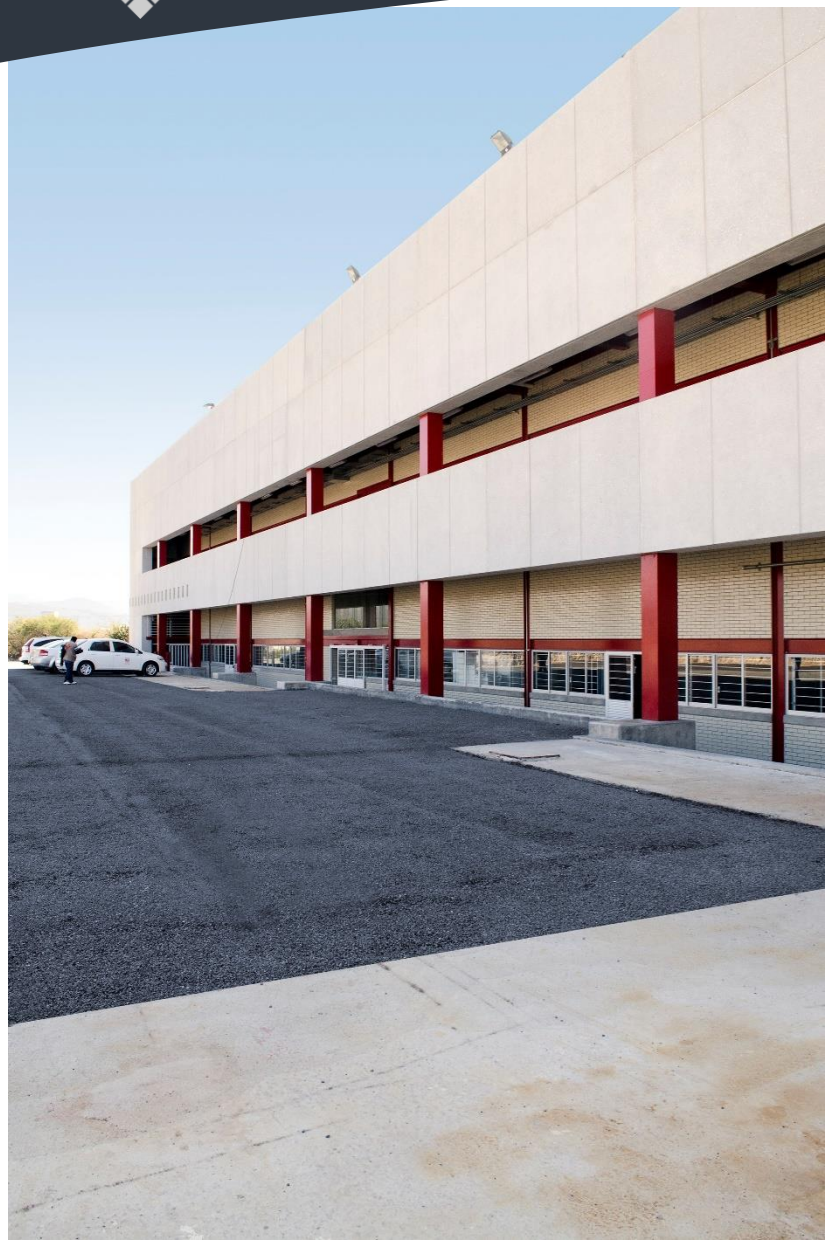
Figure 1

Research Fields:

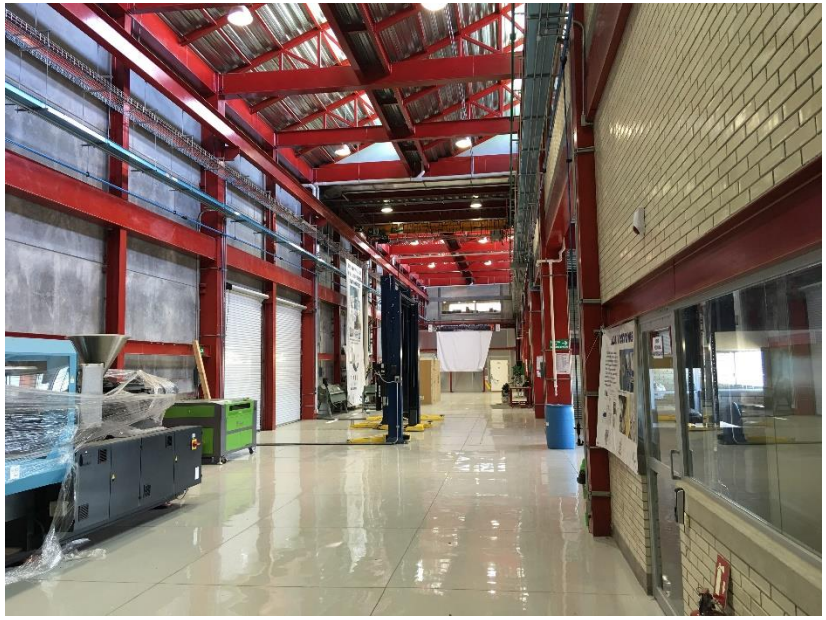
1) **Mechatronics and robotics.**
2) **Vehicle Dynamics.**
3) **Mathematical and computational modeling of automotive and space systems.**
4) **Characterization and plastic injection processes.**
5) **Acoustic noise and vibrations.**
6) **Radiofrequency systems for automotive and space systems.**
7) **Electromagnetic compatibility in aerospace, automotive, aeronautical, and home appliance systems.**
8) **Thermofluids / Thermal vacuum tests.**
9) **Embedded systems, SIL& HIL techniques.**

Introduction

Introduction



Introduction



Introduction

The Nacional Laboratory of Automotive and Space Engineering (LN-INGEA) was sponsored by a joint venture between FI-UNAM and CONACyT in 2014. Its main purpose is to design, fabricate, integrate and test automotive and space systems

LN-INGEA
CONACYT 232660
Laboratorio Nacional de Ingeniería Espacial y Automotríz

http://www.ingenieria.unam.mx/uat/laboratorio-nacional.html

CONACyT: National Council of Science and Technology (NFS analogous government organization in México).

LN-INGEA laboratories

Principal laboratories to develop space systems:

- Vibrations.
- Space propulsion and thermal vacuum.
- Electromagnetic compatibility.
- Embedded systems.
- Software and Hardware in the Loop.
- Ground station.

Vibrations Lab

- Polytec 500 vibrometer for non-contact measurement tests with laser technology.
- Three vibration shakers
- Sample weight up to 35 kg.
- Noise and vibration analysis.

Space propulsion and thermal vacuum Lab

- Dimensions: 2 m diameter times 3.5 m long
- Projected for military standard (-10E-4 Torr)
- Vacuum environment target: 10E-8 Torr.
- Temperature range: -80 °C to 120 °C.
- Projected for microsatellites testing (1 m x 1 m x 1 m).

ISO 5 Clean room

Space systems integration and training laboratory

Electromagnetic Compatibility Lab.

Lab. EMC

Laboratorio de Compatibilidad Electromagnética

CONACYT

205012

Electromagnetic Compatibility Lab.

Anechoic chamber dimensions:

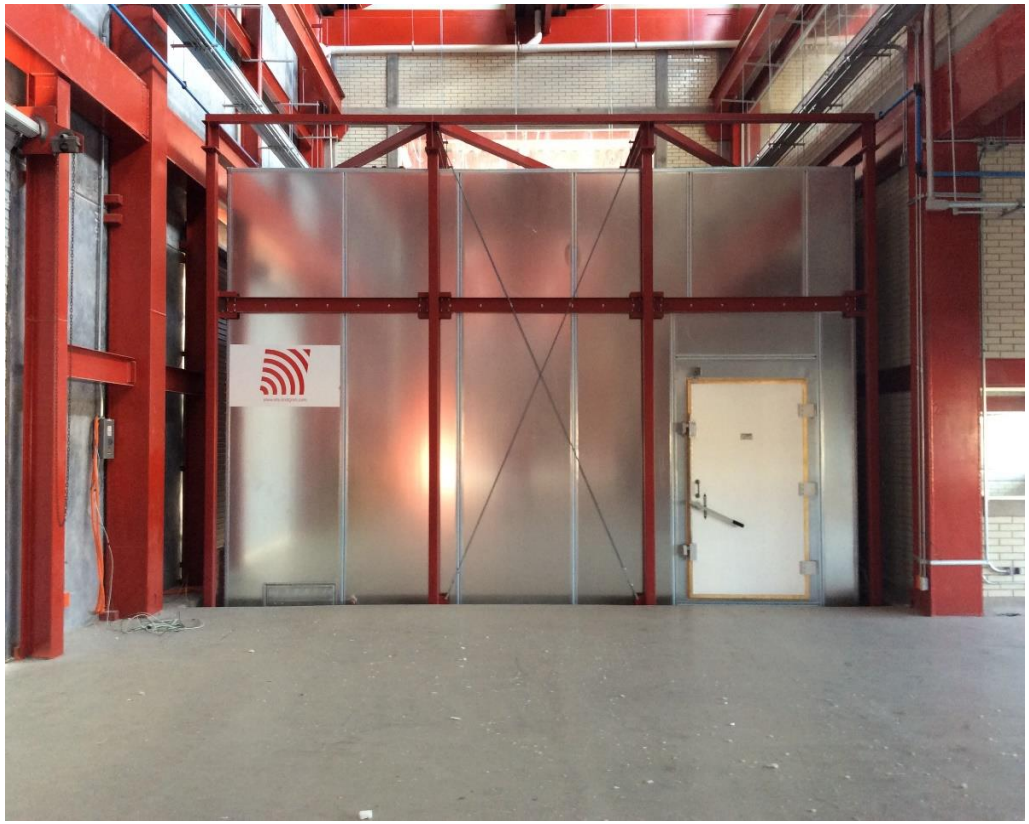
- Internal dimensions

  7.0 x 6.7 x 4.3 m (LxWxH)

- External dimensions

  7.3 x 7.0 x 4.8 m (LxWxH)

- Effective work area
- 5.8 x 4.9 x 3.4 m (LxWxH)



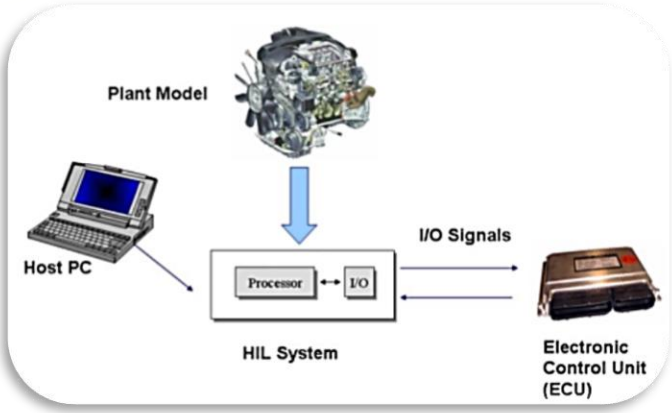
The standards used in this chamber cover different industries such as: space, aeronautics, automotive and home appliances.

Embedded systems Lab.

- Work surface: 300x400 mm
- Capacity for processing multi-layer circuits up to 14 layers
- Track resolution: better 150µm
- Galvanic Through hole plating (PTH)

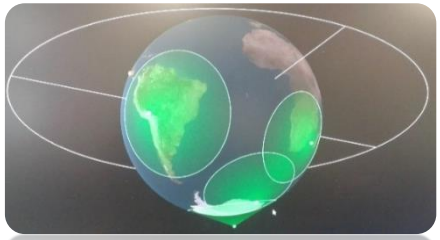
Software and Hardware in the Loop Lab.

SIL & HIL can be applied to a wide variety of systems, from relatively simple systems, such as temperature control or more complex systems such as a satellite's flight control system.



CPU	Intel® Xeon® E5 series available with 4 Cores, 3.0 GHz
FPGA	Xilinx® Artix®-7 FPGA, 200T
Software Compatibility	RT-LAB and HYPERSIM suites RT-XSG support for custom FPGA applications
High speed communications	4x SFP socket, 1 to 5Gbps, duplex multi-mode optical fiber (50/125 or 65/125µm), Xilinx Aurora compatible Up to 5 PCI or PCIe interface cards
Performance	Up to 120 3-phase buses by core on 3.2 GHz CPU
I/O boards (8 slots per system)	Analog - 16 channels per slot (max. of 128 per system) Digital - 32 channels per slot (max. of 256 per system)
I/O monitoring	Mini-BNC for up to 16 Analog/Digital channels

Ground station



ECXSAT

The station covers frequency ranges (VHF and UHF, S and X) authorized by IFT, ITU and IARU

Final Remarks

-Certification tests for space systems allow the validation of technology developed on Earth to survive in space,

-The facilities needed to run environmental tests are often expensive and restricted,

- The National Laboratory of Space and Automotive Engineering (LN-INGEA) is the entity in México that has unique laboratories at the national level aimed at developing space systems from scratch,

-Facilities located in the same building allow the integration of an assembly line to design, manufacture, integrate, and test space systems under the same roof, thus improving transportation logistics and cost optimization.

-LN-INGEA is emerging as a national for space tests under international standards, offering opportunities to different aerospace sector actors to develop space projects locally with high-impact national talent.

Thank you!

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