Design a methodology for the development IT and efficient construction using small satellites based on Cobit 5.0 in the District University Francisco José de Caldas

UNIVERSIDAD DISTRITAL FRANCISCO JOSE DE CALDAS

BOGOTA-COLOMBIA

GITEM-LIDER: DOCTORAL ENGINEERING
Ph.D LILIA EDITH APARICIO PICO
Ph.D ROBERTO FERRO ESCOBAR
Ph.D LEONARDO PLAZAS

AGENDA

UNIVERSIDAD DISTRITAL FRANCISCO JOSE DE CALDAS

1. INTRODUCTION
Colombian Aerospace Agenda

PUMPKIN INCORPORATED
design MASSIF

- **Population:** 47.000.000
- **Capital:** Bogotá, D.C
- **Language:** Spanish.
- **Money:** Colombian peso.
- **Main Cities:** BOGOTA, CALI, MEDELLIN, BARRANQUILLA, CARTAGENA

Surface:

1.141.178 Km^2 Territorial

928.660 Km^2 Maritimes

- **Location:** *South America*.
- **Limits:** 12 FRONTERAS

5 Terrestrial y 7 Maritimes

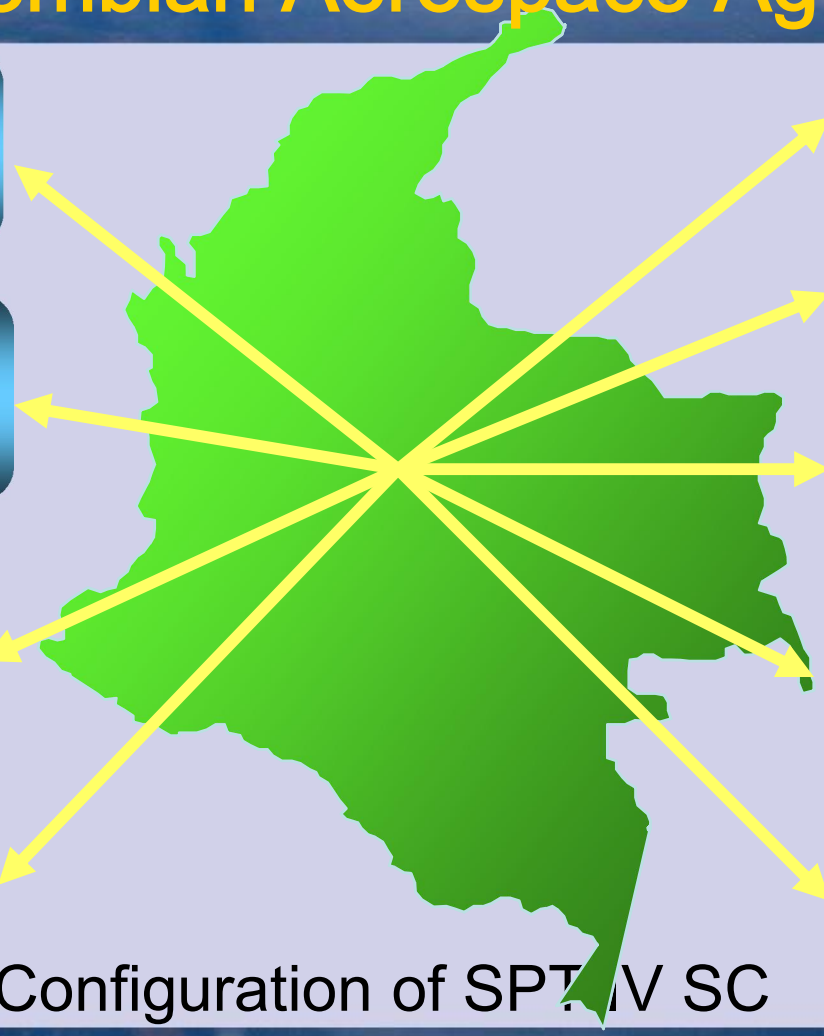
1. INTRODUCTION
Colombian Aerospace Agenda

-Backwards

What has been the Colombia History on Space Affaires?. Some important aspects are:

- Since 1978 Colombia has been part of United Nations- Office of Outer Space Affaires
- Colombia has not signed any of the Space Treatment
- From 2002 to 2006 Colombia was Secretariat Pro-Tempore of the Fourth Space Conference for the Americas **SPT IV SC** to develop a plan of action on the Space field and in benefit of the American Region
- Since July 2006 **Colombia** has an **Space Agency** represented by the Colombian Space Commission and with the approval of Colombia President.

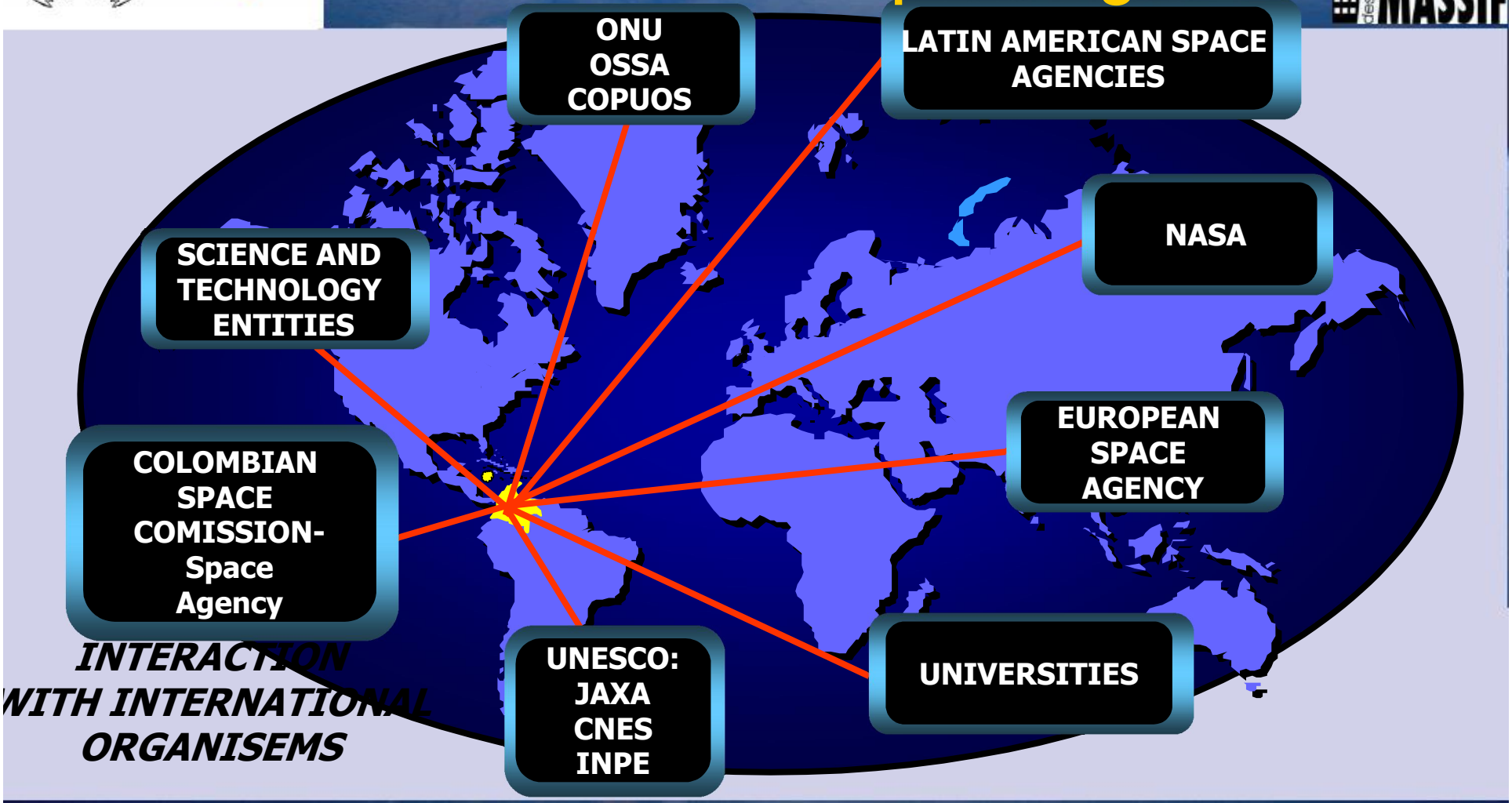
1. INTRODUCTION
Colombian Aerospace Agenda



- MINISTRY OUTER AFFAIRES
- GEOGRAFICAL INSTITUTE AGUSTIN CODAZZI
- TRANSPORTATION MINISTRY
- DISASTER PREVENTION DIRECTION
- CIVIL AVIATION OF COLOMBIA
- COLOMBIA AIR FORCES
- EDUCATION MINISTRY
- PRIVATE PUBLIC UNIVERSITIES
- OTHER INSTITUTIONS

Configuration of SPTMV SC

1. INTRODUCTION
Colombian Aerospace Agenda



INTERACTION WITH INTERNATIONAL ORGANISEMS

1. INTRODUCTION
Colombian Aerospace Agenda

COLOMBIA AS SPT IV SC

A. Focal point: Civil Aviation of Colombia: Engineer Msc Satellite Based CNS. Leader PicoSatellite Program in Colombian.

B. PLAN OF ACTION OF SPT IV CEA

   A. Sustainable Development

   B. Disaster Prevention

   C. Education

   D. Political

   E. Broadcasting

1. INTRODUCTION
Colombian Aerospace Agenda

PUMPKIN INCORPORATED MASSIF

Libertad y Orden

PROGRAM ORGANIZATION

Carrier provider

CAL POLY

AERONAUTICA CIVIL

Subsystem Provider

CUBE SAT KIT

Expected to search for Sponsors

Dnepr Launch Vehicle Services

2. PDR GENERAL SCENARIO

2.1 MISSION STATEMENT

- **To develop, an academic pico satellite, endowed with the specific technical requirements that allow the training of the human resource in Science and Space Technology and the infrastructure establishment that allows to develop Telemedicine applications in order to improving the quality of life of the communities.**

2. PDR GENERAL SCENARIO

- **2.2 OBJECTIVES**
- **To built a pico satellites for training and development of a space program that it is reverted in the academic environment under Cobit Framework.**
- **To implement a telemedicine pilot project with space technology, for transmission and reception of ECG signals.**

2. PDR GENERAL SCENARIO

2.3 . MISSION

PRIMARY MISSION

- The primary mission is telecardiology –test-bed between Bogotá to French Space Center located at Tolouse for telemedicine research.

SECUNDARY MISSION

- Uplink -Downlink Telemetry and control through the establishment of Ground Segment

2. PDR GENERAL SCENARIO

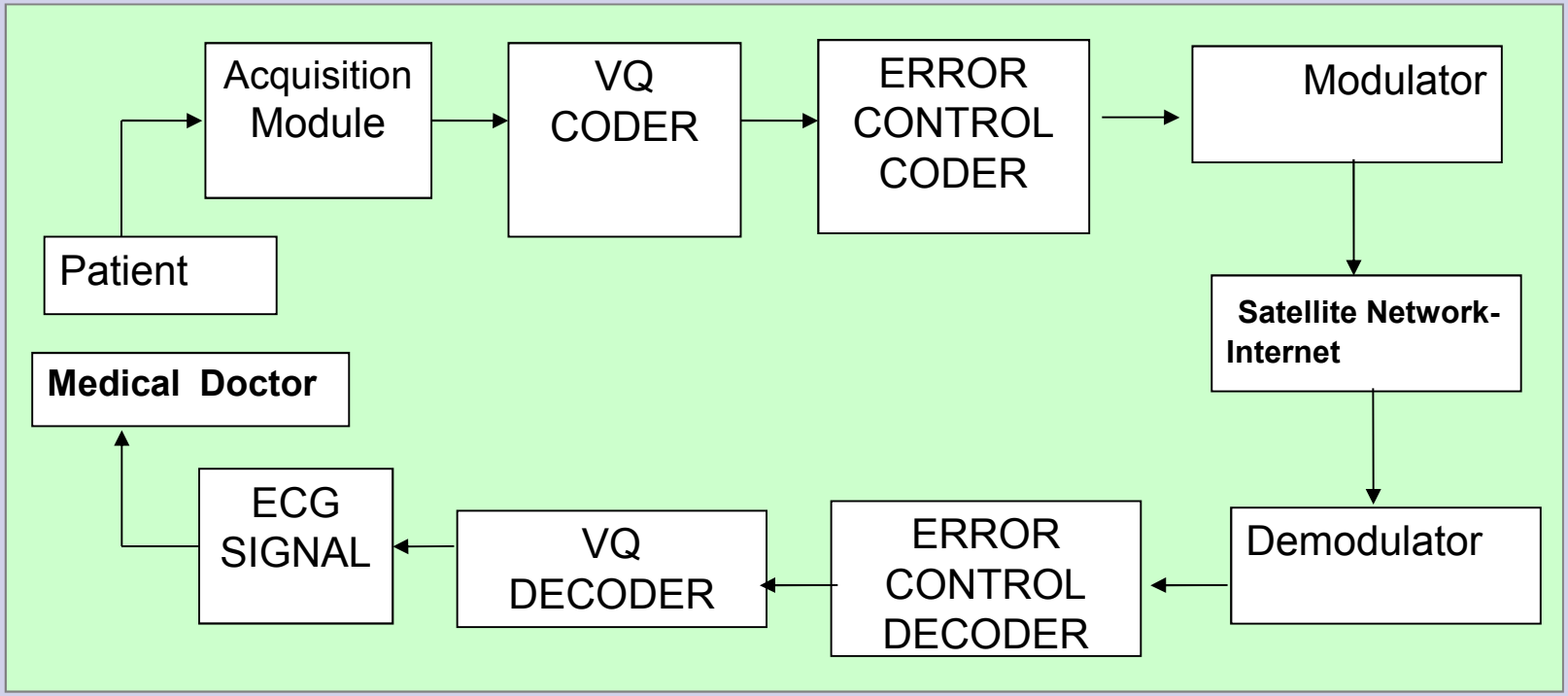
- **2.3 MISSION**
- **PRIMARY MISSION**
- **Background:** We have designed an experiment to research the performance of the telecardiology system using internet the principal interest is to bring medical services to isolated communities through satellite networks.

2. PDR GENERAL SCENARIO

- **2.3 MISSION**
- **PRIMARY MISSION**
- **Objective**: The objective of this research is to evaluate the performance of a telecardiology system on internet and picosatellite networks using cubesat-ud

2. PDR GENERAL SCENARIO

2.3 MISSION
PRIMARY MISSION



Telecardiology System

2. PDR GENERAL SCENARIO

2.4. MININUM SUCCESS CRITERIA

Cubesat Project

To deliver CubeSat-UD.

Mission

To transmit a virtual patient cardiology information set between Bogotá-Neiva-Tunja

2. PDR GENERAL SCENARIO

- 2.5. OPERATION CONCEPT

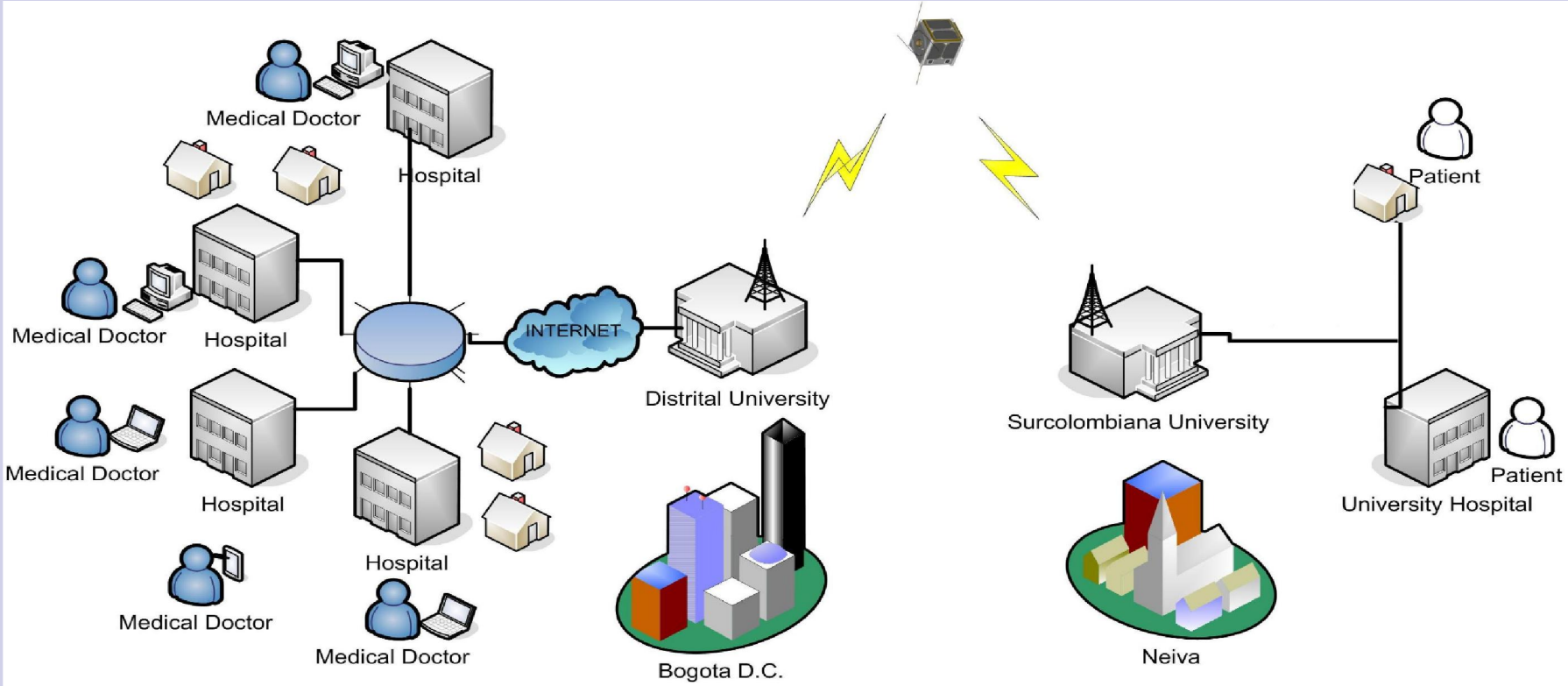
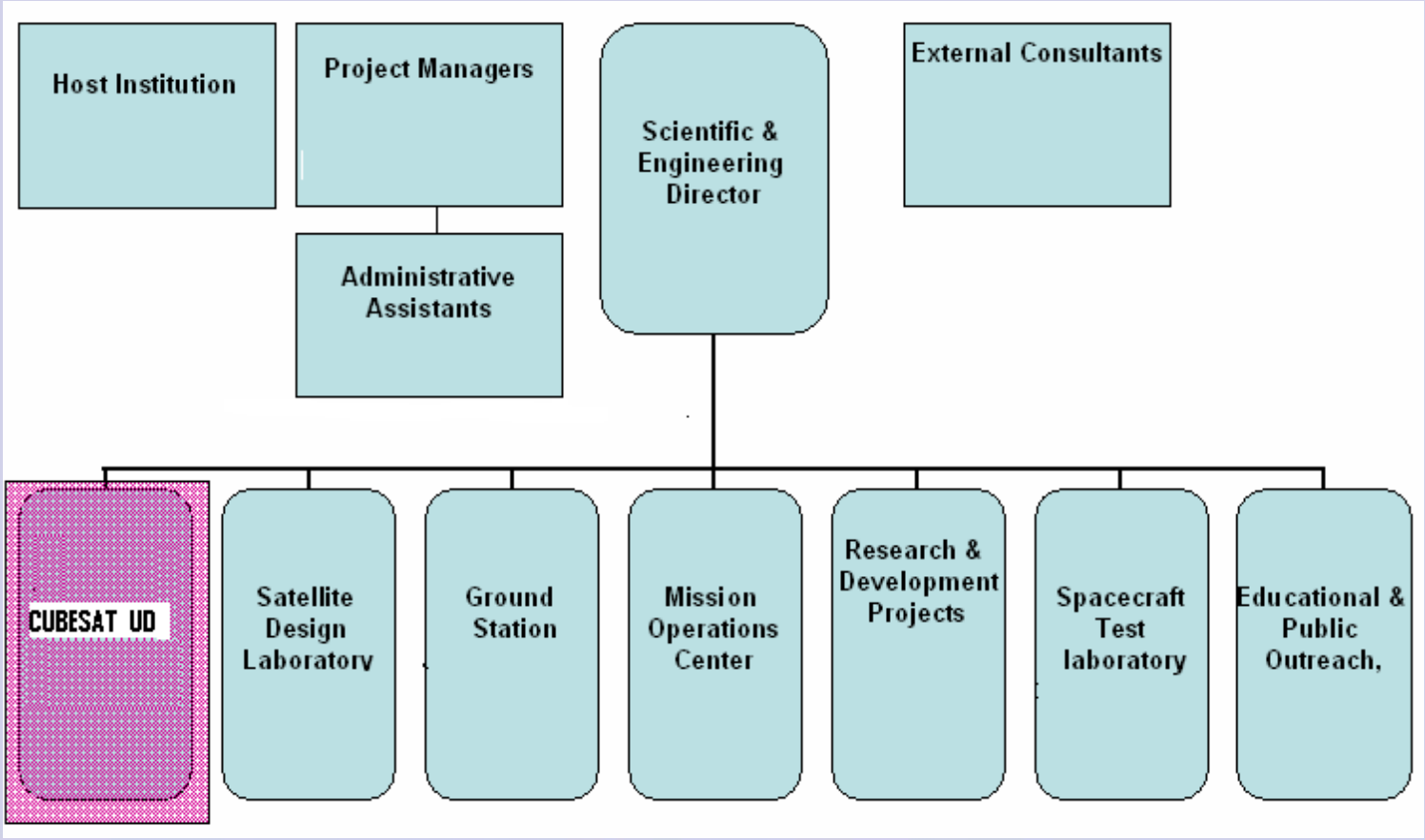


Figure 2: Telecommunications Network for Telecardiology system

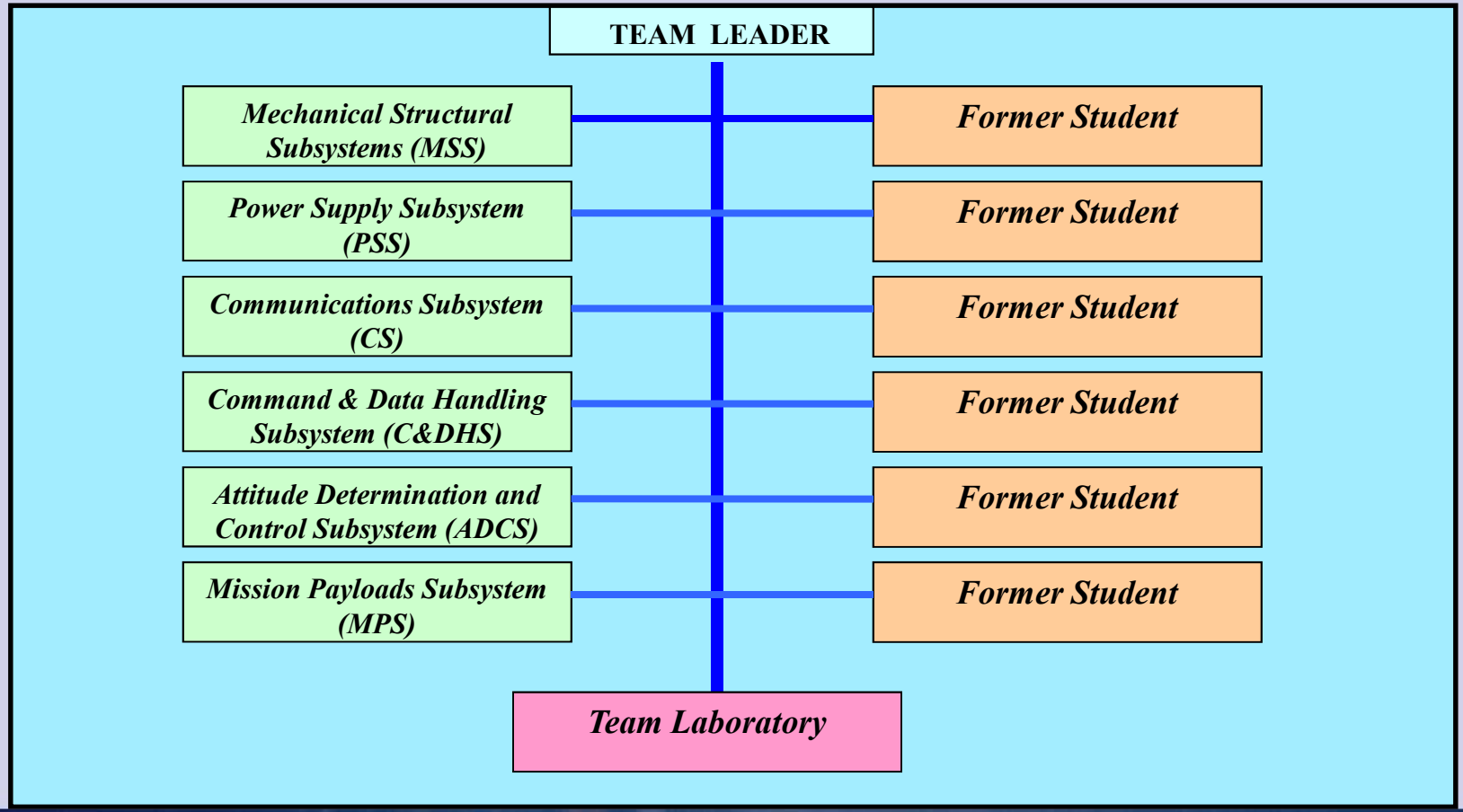
2. PDR GENERAL SCENARIO

• 2.6. ORGANIZATION MANAGEMENT



2. PDR GENERAL SCENARIO

• 2.6. ORGANIZATION MANAGEMENT



2. PDR GENERAL SCENARIO

- **2.6. ORGANIZATION MANAGEMENT UNDER COBIT:**

At the university and the research group aims to emphasize a strategic improvement in Information Management and Technology Assets of Organizations, to meet the needs of stakeholders, and aligned to current trends and techniques of government IT-related management also provide a proper regulatory compliance, to increase its value through technology, and their alignment with business objectives covering.

2. PDR GENERAL SCENARIO

- **2.6. ORGANIZATION MANAGEMENT UNDER COBIT:**
- Internationally accepted best practices
- Oriented management of information technology
- Complete with tools and training
- Training on the benefits Cobit 5
- Backed by a community of experts
- In permanent evolution
- Mapping with other standards-oriented processes, based Domain Accountability in management and information security

2. PDR GENERAL SCENARIO

• 2.6. ORGANIZATION MANAGEMENT UNDER COBIT

- Starts from the premise that IT needs to deliver the information that the enterprise needs to achieve its objectives
- Promotes process focus and process ownership
- Divides IT into 34 processes belonging to four domains and provides a high-level control objective for each
- Considers fiduciary, quality and security needs of enterprises, providing seven information criteria that can be used to generically define what the business requires from IT
- Is supported by a set of over 300 detailed control objectives

- Plan and Organise
- Acquire and Implement
- Deliver and Support
- Monitor and Evaluate

- Effectiveness
- Efficiency
- Availability
- Integrity
- Confidentiality
- Reliability
- Compliance

2. PDR GENERAL SCENARIO

- **2.6. ORGANIZATION MANAGEMENT UNDER COBIT STAKEHOLDER:**

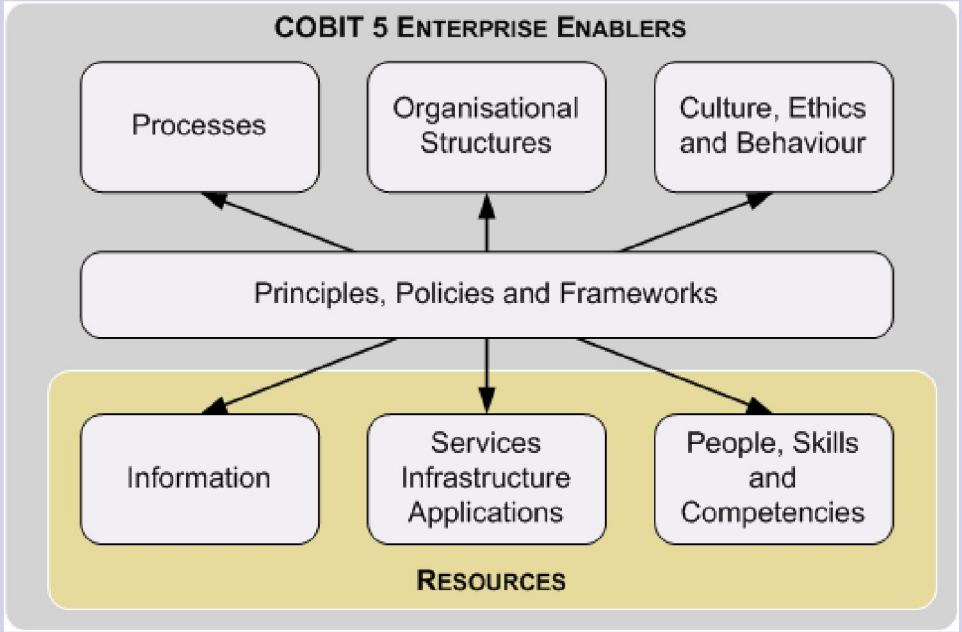
Delivering enterprise stakeholder value requires good governance and management of information and technology (IT) about Cubesat project.

Enterprise boards, executives and management have to embrace IT like any other significant part of the business.

External legal, regulatory and contractual compliance requirements related to enterprise use of information and technology are increasing, threatening value if breached, (QB50).

2. PDR GENERAL SCENARIO

- **2.6. ORGANIZATION MANAGEMENT UNDER COBIT: PRINCIPLES**



From: ISACA 2012

2. PDR GENERAL SCENARIO

- **2.6. ORGANIZATION MANAGEMENT UNDER COBIT:**

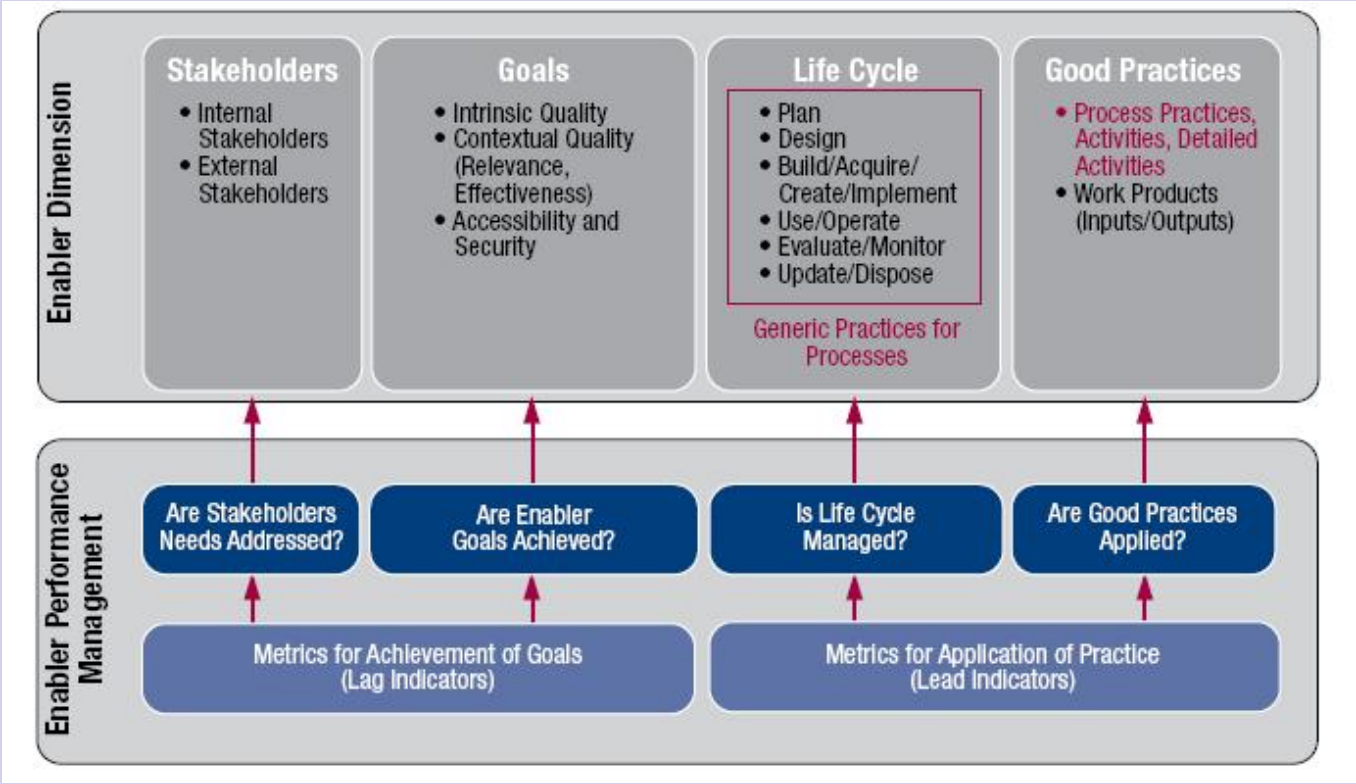
The five COBIT 5 principles:

- Meeting Stakeholder Needs, University, Sponsor, Research Group
- Covering the Enterprise End-to-End, All modules and
- Applying a Single Integrated Framework
- Enabling a Holistic Approach, all designs and focal point
- Separating Governance from Management Improve now

2. PDR GENERAL SCENARIO

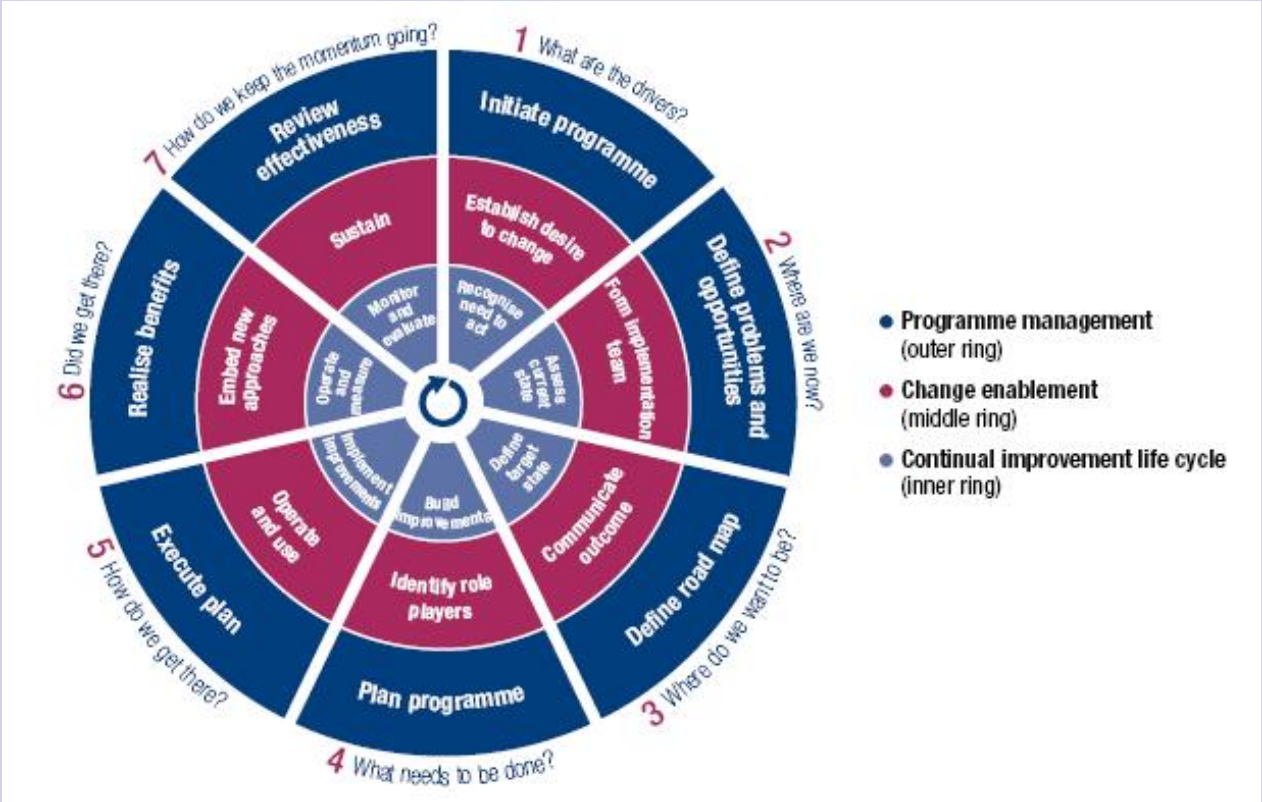
- **2.6. ORGANIZATION MANAGEMENT UNDER COBIT Enablers:**

PDAC



2. PDR GENERAL SCENARIO

- **2.6. ORGANIZATION MANAGEMENT UNDER COBIT IMPLEMENTATION CUBESAT-UD:**



2. PDR GENERAL SCENARIO

2.6. ORGANIZATION MANAGEMENT UNDER COBIT IMPLEMENTATION CUBESAT-UD:

- The improvement of the governance of enterprise IT (GEIT) is widely recognised by top management as an essential part of University governance.
- Information and the pervasiveness of information technology are increasingly part of every aspect of business and public life.
- The need to drive more value from IT investments and manage an increasing array of IT-related risk has never been greater, the Cubesat project have many risk.
- Increasing regulation and legislation over business use of information is also driving heightened awareness of the importance of a well-governed and managed IT environment.

2. PDR GENERAL SCENARIO

- **2.7 SATELLITE SUBSYSTEMS**

Subsystem

-Power Supply Subsystem (PSS),
-Communications Subsystem (CS),
-Mechanical Structural Subsystems (MSS),
-Attitude Determination and Control Susbsytem (ADCS),
-Command & Data Handling Subsystem (C&DHS)

2. PDR GENERAL SCENARIO

- **2.7 SATELLITE SUBSYSTEMS**
- ***Power Supply Subsystem (PSS)***

-Scientific Director:Lilia Edith Aparicio Ph.D

Team Members:

- Ph.D. Roberto Ferro

2. PDR GENERAL SCENARIO

- **2.7 SATELLITE SUBSYSTEMS**
- ***Power Supply Subsystem (PSS)***
- **The main purpose of the PSS is to take power from the solar cells on the sides of the satellite and store it in the batteries as well as deliver it to the other subsystems of the satellite on a 5V power-bus and protect these users from latch-ups caused by radiation. The PSS consists of solar panels, electronics and batteries.**
- **A conservative estimate of average input power is about 1.4 W. This power estimate constitutes one of the major constraints in the design and has been the driving force behind many design decisions.**
- **The acquired energy is either consumed by the other subsystems or stored in the battery pack. The batteries are 4 Lithium-Ion polymer cells with a capacity of 940mAh each, giving a total capacity of almost 4Ah.**

2. PDR GENERAL SCENARIO

- **2.7 SATELLITE SUBSYSTEMS**
- ***Mechanical Structural Subsystems (MSS)***
- The MSS team is responsible for the thermal, thermal stress, and dynamic modeling of the satellite, as well as for the design and fabrication for all of the support structures for the on-board components. The thermal modeling effort includes the development of a computer code written specifically to simulate heat transfer in the CubeSat.
- The numerical code features a hybrid resistance-capacitance finite volume formulation that accounts for heat transfer by conduction and external radiation as well as transient effects. The inclusion of internal radiation in the model is based on the resulting temperature gradients and a resistance criterion. The numerical analysis is then used to optimize the thermal design, which is based on the restrictions of the electronic components.

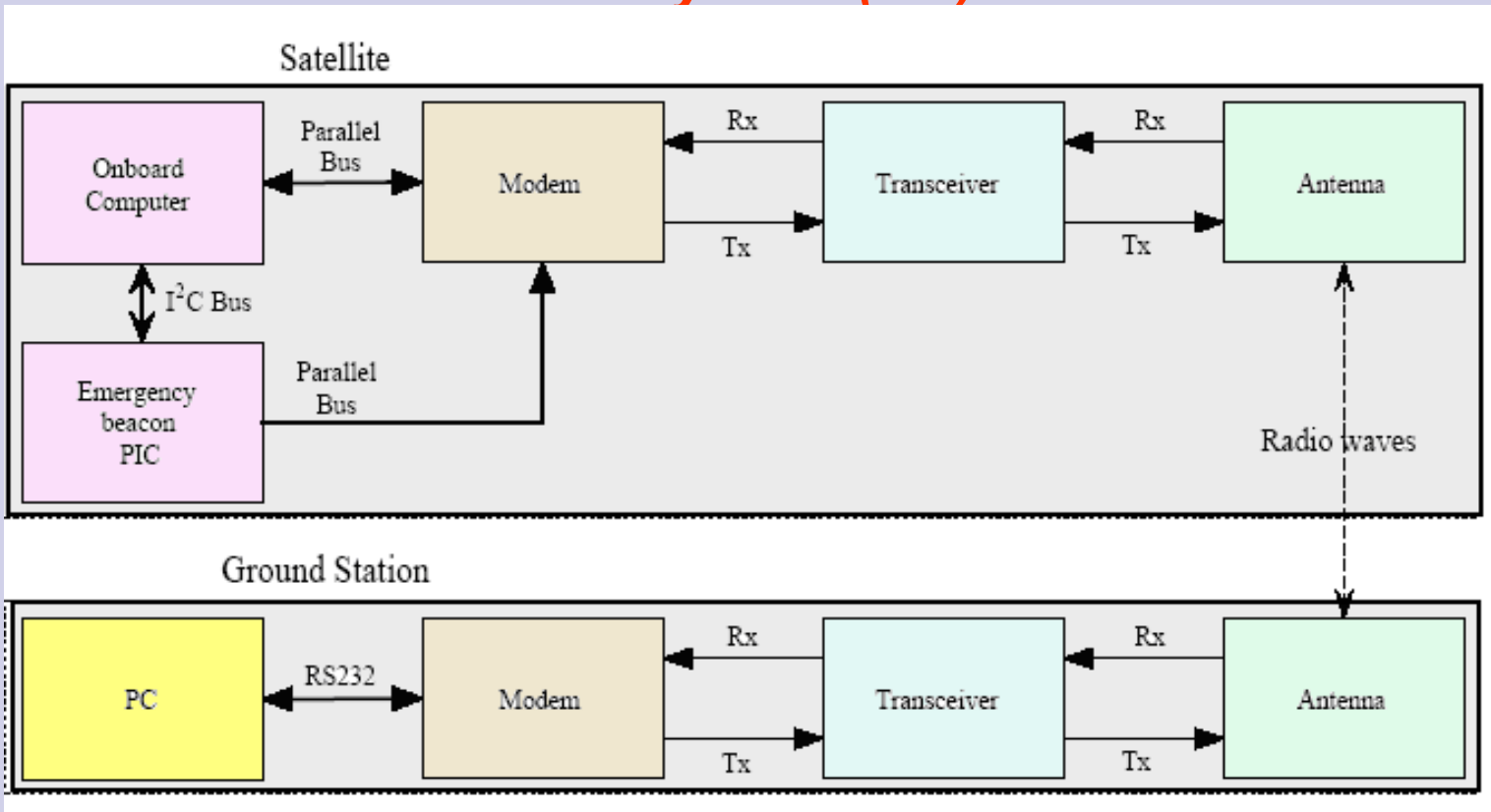
2. PDR GENERAL SCENARIO

- **2.7 SATELLITE SUBSYSTEMS**
- ***Communications Subsystem (CS)***

Modulation:	FSK
Protocols:	AX.25
Transmission:	1.200 bps, 9.600 bps
Downlink:	435 MHz
Uplink:	145 MHz.
Beacon:	436 MHz.

2. PDR GENERAL SCENARIO

- **2.7 SATELLITE SUBSYSTEMS**
- ***Communications Subsystem (CS)***



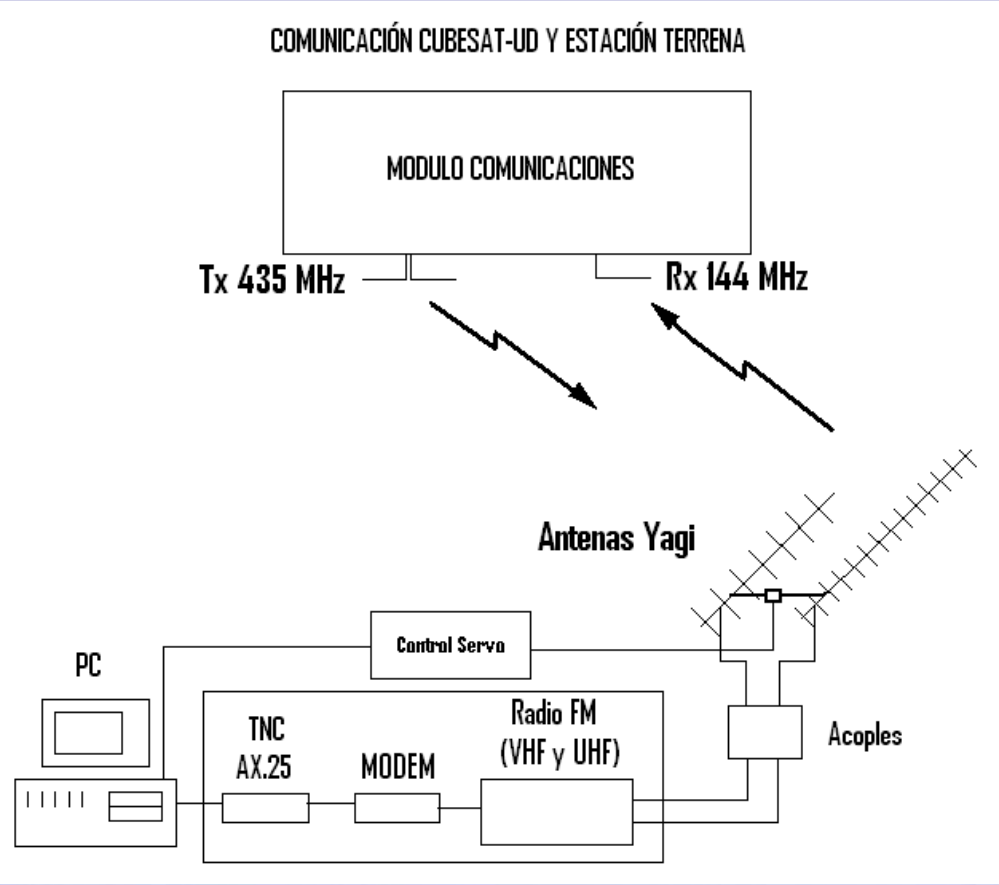
2. PDR GENERAL SCENARIO

- **2.7 SATELLITE SUBSYSTEMS**
- **Communications Subsystem (CS)**
- The main purpose of CS is to receive signs of telemetry of the satellite like internal, external temperature, quantity of light, temperature of batteries, load of batteries, space in memory, data of electrocardiographical signal for passing.
- Ground Station: the main part is the antenna, Radio from RF-connections was chosen. This is a 2X18 element crossed yagi directional antenna, with a gain of 14 dB. Since this is to small a gain to uphold the requirements of 15 dB, two of them where acquired and set up in a parallel configuration, as can be seen and thereby raising the gain with 3 dB and ending up with a total gain of 17 dB.

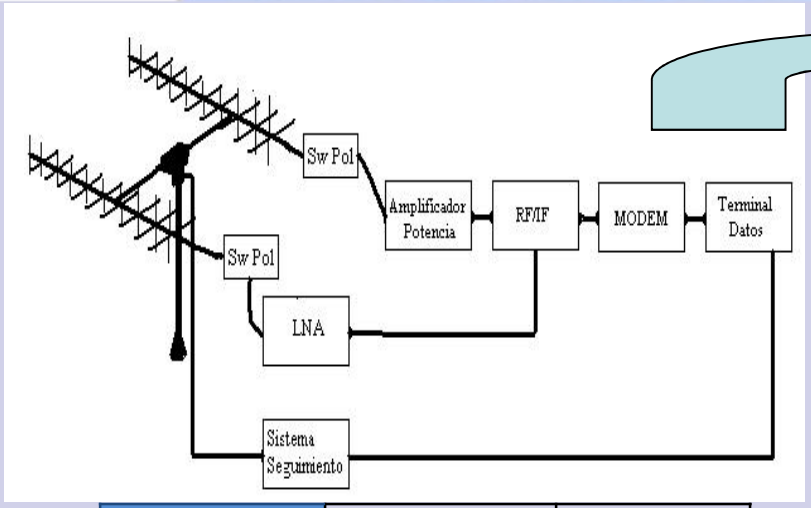
2. PDR GENERAL SCENARIO

- **2.7 SATELLITE SUBSYSTEMS**
- **Communications Subsystem (CS)**

Ph.D Leonardo plazas



CUBESAT-UD COL-1
UNDERGROUND ESTATION



LATITUDE	04º 37' 41.1" N	4,628075
LONGITUDE	74º 03' 56.3" W	-74,06563
ALTITUDE	2615	Mts

Team Members: Ing. MSc. Eduardo Gaona, Ing. Cesar Perdomo.

The frequencies for the connection according to the Colombian legislation are:
- Uplink 145 MHz, Downlink 435 Mhz.
- Full duplex, Modulación M-FSK. They are some characteristics that make of transmitter with 8-MSK a robust technique, it maintains the spectrum sent originally and it also improves it.

2. PDR GENERAL SCENARIO

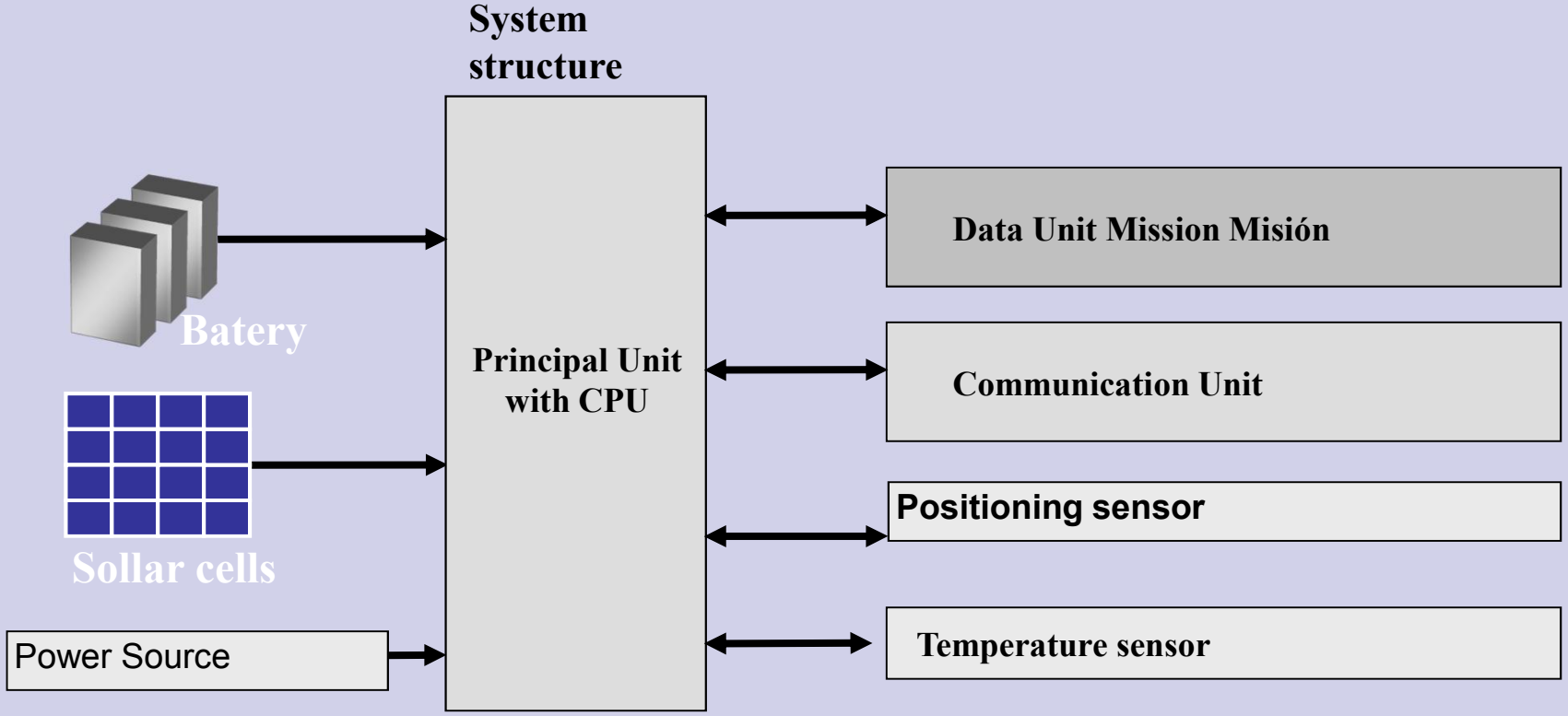
- **2.7 SATELLITE SUBSYSTEMS**
- ***Attitude Determination and Control Subsystem (ADCS)***
- Stability
- Localization of the satellite in orbit
- Orbital mechanics
- Control System
- Attitude determination
- Software development
- Interferences

2. PDR GENERAL SCENARIO

- **2.7 SATELLITE SUBSYSTEMS**
- ***Command & Data Handling Subsystem (C&DHS)***
- This is the ,Interfaz between the communication subsystem and the microcontroller, data mission, power control, temperature sensor, position control, diagnosis control of solar panels. It contains: principal processor, microcontroler MSP430, CPU de 16-bits RISC technology, 3.3Mhz clock, 16KB in memory, RAM 512, Communications input/outut ports, 3.3 – 5.0V operation voltage. Development software is Salvo Pro RTOS and development tools are CrossWorks for MSP430 de Rowley Software.

2. PDR GENERAL SCENARIO

- **2.7 SATELLITE SUBSYSTEMS**
- ***Command & Data Handling Subsystem (C&DHS)***



4. CONCLUSIONS

In conclusion the CubeSat project has achieved three major results:

1. A large group of students and professors will leave the university with a great deal of ”Hands-on experience” within satellite design and experience with working with a large project that requires cooperation between everybody that are involved.
2. It is important the satellite system provides facilities for solving social impact problems as they are those of the health field.
3. The development of small satellites it can begin a space career for countries that have not incurred in these scientific fields using a Cobit 5 Framework.

THANK YOU VERY MUCH

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