

Proposal for Colombia's First Satellite.

The Cubesat an educational program for developing academic satellite that has a navigation payload

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Proposal for Colombia's First Satellite

- Project to be directed and hosted by the Academic Sector (AS) with support from Academia, Industry, and other Government Agencies
- Project is a simple cube sat-satellite test bed spacecraft for receiving/relaying/transmitted radio signals and capturing still digital images from space; a GPS receiver will be part of this satellite. The GPS receive will only be used for orbit determination and not attitude determination. A 1 kg satellite is proposed with a minimum lifetime of 3 months. The satellite is a passive orbiter with an altitude of at least 300 km and a mission lifetime of at least 3 months.
- Project will have significant involvement from the Colombian Academic Sector
- Proposal to begin project by January 2005 and Launch by December 2005. Start to Launch = 12months. Operations > 3 months.

Proposal for Colombia's First Satellite

- The satellite will be designed, developed, and tested in Colombia by Colombian personnel.
- The satellite may be transported outside of Colombia for preliminary/critical design reviews and for launch vehicle integration and testing.
- Project can involve US based consultants from Academia, Industry, and Government.
- Project Objectives are:
 - Design, Develop, and Operate Colombia's first satellite
 - Implement the necessary infrastructure to continue development of future satellite systems, either for scientific, military, or commercial applications.
 - Train individuals in Colombia so that they may further continue the development of Colombia's Aerospace Industry or so that these individuals can participate in international space projects.

The Satellite and its Mission

- *General*
 - ✓ *Consolidation of the critical mass in Colombia*
 - ✓ *Acquisition Know how*
 - ✓ *Pre-graduate students training on the development, design and implementation of satellites*
 - ✓ *First step towards the space Colombian industry*

The Satellite and its Mission

- Primary Mission
 - ✓ Collect orbital position data from satellite
 - ✓ Testing basic operational systems from satellite: Orbit Determination (Via GPS), prediction, ground trace generation, overflight path prediction, antenna tracking control, transmit/receive/command.

The Satellite and its Mission

- Secondary Mission
 - ✓ Collecting data from satellite positioning to analyze and its proper management

The Satellite and its Mission

- *Name of Satellite*

- ✓ *Colombian Children*

- The name of satellite: ideas Esperanza, Colombia Sat -1,*

- ✓ *The purpose of the satellite, its orbit, its duration,*

- *Period:90-110 minutes*

- *Inclination: 28 to 60 degrees*

- *Coverage:+-15 latitude (maximizing time over Colombia)*

Required Infrastructure

- The Academic Sector (AS) would propose the creation of a Satellite Design and Development Laboratory (SDDL) to serve as the facility where this project will be carried out.
- This SDDL will be located at either a facility at AS or an academic institution near the main AS facilities. This space for this facility should already exist, i.e., it should not be constructed.
- The SDDL will be at least 100 square meters with basic and specialized electronics equipment for circuit board design and testing, full internet connection, several workbenches, and a clean section with positive air pressure. Machining equipment could co-exist at the facility where the SDDL is located or elsewhere within Colombia. Procedures or tasks not available at the SDDL can be contracted out to other facilities within Colombia.

Required Infrastructure

- This laboratory should be headed by a single individual; all other personnel should either be students, professors, and/or AS employees. Total staffing should be between 5-10 individuals. The head of the SDDL should be an AS employee that is fully funded to support the laboratory for at least 24 months.
- All equipment in this laboratory should be COTS (commercial off the shelf); i.e., no equipment should have to custom designed or manufactured.
- All required software should be obtained free of cost either by donations from the developers or under license from participating US universities. Any specialized software will be developed by the SDDL staff with support from the consultants if needed.
- Communications equipment will be via internet, where the SDDL will be a node; ground based antennas and time will be donated by either Colombian government facilities or US university facilities; for example communication can be relayed via the University of Texas' microsatellite antenna.

Project Schedule and Timeline

1	COL SATELLITE PROGRAM	2004 T1	2004 T2	2004 T3(99-01)	2004 T4	2005 T1	2005 T2	2005 T3	2005 T4	2006 T1(03-1)	2006 T2	2006 T3	2006 T4
2	DISIGNING												
3	SPECIFICATION DEFINITION					01-31							
4	DEVELOPMENT AND MANUFACTURE INCLUDED TESTING												
5	LAUNCHING INCLUDED SENDING CALPOLY OR ANOTHER									03-01			
6	TERMINATION OF LIFE TIME										08-31		

Project Budget and Costs

Satellite Fabrication (approximated)

Structure	US2000
Solar Cell	US4500
Batteries	US2000
CPU/C&DH	provided
Transceptor	US1000
RF Antennas (2)	US 500
GPS	provided
GPS Antennas	provided
SUBTOTAL	USD10.000

Management

Salaries, trips, etc

LDDS Equipment

Torque Ranges	
Drilling Machines	
Micrometers	
High Precision Scales	
Workstation	
P.C Board Maker	
Microscope(X20 –40 times)	
Network,spectrum,logic analizaer	
Power suplliers, multimeters	
Function,Frecuency Generator	
Thermohygrodtat	
HEPA filters Air Shower,ESD Proteccion and Electrical Test Bed	
SUBTOTAL	USD 30.000<

Project Budget and Costs

- Launching at CalPoly US 40.000

TOTAL COST OF PROJECT < US 100.000

Launch and Operations

- Satellite will be a piggy-back payload with other university cubesat-nanosatellite programs aboard a US or international launch vehicle
- The Satellite will be operated from within the Colombian SDDL with tracking support provided by both US universities and/or Colombian tracking facilities.
- Data relay to and from the satellite can be made by any of these facilities during over flight opportunities.
- Command will be only from the Colombian SDDL via the designated network.

Consultant Information and US Participation

- Possible consultants include:
 - Cesar Ocampo Ph.D, Dept. of Aerospace Engineering, The University of Texas, Austin, Texas
 - Glenn Lightsey, Ph.D., Dept. of Aerospace Engineering, The University of Texas, Austin, Texas
 - Bob Twiggs, M.SE., Dept. of Aeronautics and Astronautics, Stanford University, Palo Alto, California
 - Chris Kitts Ph.D., Dept. of Aerospace Engineering, Santa Clara University, California
 - Jordi Puig-Sari Ph.D., Dept. of Aerospace Engineering, California Polytechnic University, San Luis Obispo, California
- Possible Testing Facilities for Preliminary and Critical Design Reviews include
 - The NASA Johnson Space Center, Houston, Texas
 - The NASA Goddard Space flight Center, Greenbelt, Maryland,
 - The NASA Jet Propulsion Laboratory, Pasadena, California
 - The United States Air Force Phillips Laboratory, Albuquerque, New Mexico
 - The Applied Physics Laboratory, Johns Hopkins University, Baltimore, Maryland

Consultant Information and US Participation

- Consultants can and will be provided support to travel to Colombia for kick off meetings, design review meetings, and support.
- The satellite and the Colombian support personnel can, may, and will travel to the US to support any necessary design reviews, testing, and launch vehicle integration.

Funding and Financial Support

- The AS will be responsible for:
 - Providing, via procurement or donations, the equipment for the SDDL
 - Providing or procuring the location space for the Colombian SDDL
 - The hardware required for constructing the satellite
 - Fully staffing the Project Director and Head of the SDDL (one person/12 months)
 - Provide travel funds and lodging costs for the the US consultants when traveling to and from Colombia.
 - All clerical and secretarial support (internet connections, printing, copying/duplicating, and telephone or other communication support)
- The US universities where the consultants reside will
 - Provide all clerical, secretarial, and operating costs via either internal funds, collaborative agreements, or funded projects via the UN or State or Federal Government agencies.
 - US consultants should have all their travel and expenses paid. They should not charge for consulting services, or honorariums.
 - Provide use of in-house facilities for preliminary/design reviews, testing, and housing of the satellite and Colombian personnel.
 - Management of International Cooperation through Secretariat Pro-Tempore of Fourth American Space Conference

Funding and Financial Support

- The Colombian Government (external to the AS) should
 - Provide ground communication support for the satellite
 - Procure the cost of launching the satellite.
- Possible Funding Sources:
 - The Colombian Government
 - Colombian Private Industry
 - Colombian Academic Institutions
 - The State of Texas and/or the State of California (via there Public Universities)
 - US Private Industry
 - Unesco or the United Nations
 - Non-Profit US Organizations (example: Colombian non-profit groups in the US)
 - Non-Profit Organizations in Colombia

Expected Results and Benefits

- Brings Colombia to the club of space faring nations
- Establishes an infrastructure to support future satellite projects in Colombia
- Trains Colombian students and professionals for the development and operation of a spacecraft system

Expected Results and Benefits

- Provides an incentive for the further development of a Colombian Space Agency
- Provides the capability to commercialize the development of satellites for scientific, military, or commercial applications for both Colombia and the international community
- Public Outreach via Civil Aviation's communications mechanisms, or Colombian media, will motivate the public, professionals, and students of all levels to support and/or pursue technologies that will aid Colombia's development over the next century.

Reasons for high probability of Success of this Project

- Project is small in both cost and personnel
- Project is focused with a strict schedule for milestones and deliverables
- Project includes qualified and capable individuals
- 75% of funding for all phases will be secured before project begins
- SDDL and Satellite hardware is COTS.
- Three satellites will be developed: one for testing and experimentation; and two flight models.
- Commitment from the AS and US Consultants will be expressed in writing and with a letter of support from their host institutions.