# "Space technology development: Challenges and Opportunities"

Dr. Ahmad Sabirin Arshad

sabirin@atsb.my

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ASTRONAUTIC TECHNOLOGY (M) SDN. BHD (ATSB)

# Introduction

Activities related to space technology developments in Malaysia have grown enormously and has become the primary means of delivery for many businesses and public services

Communication

Navigation

Small Satellite

Science Experiments

Ground infrastructure

# Technology developments: Communication and Navigation

Both Communication and Navigation activities have been focusing on  downstream activities. Communication dominates the space technology applications.

Technology development is very much R&D at the universities; development with no immediate commercialization and minimal industry cooperation. Require strategic road R&D roadmap.

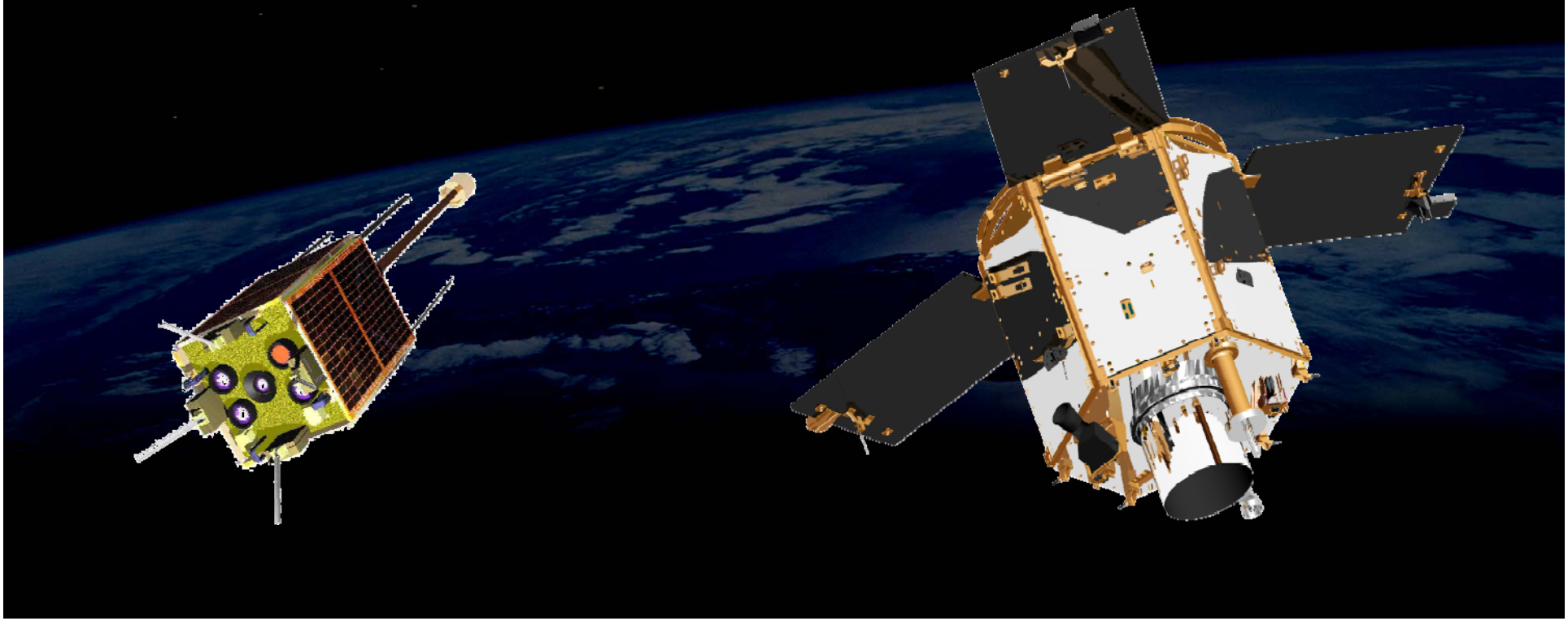
# Space Sciences

- The development has been encouraged especially during the launch of Malaysian angkasawan in 2007.
- Pools of expertise developed.  Some of the experiments carried out is to be patented. Require programmes to continue developing expertise with international cooperation
- Continuing programmes
- Zeronaut programme

# Small Satellite Technology Developments

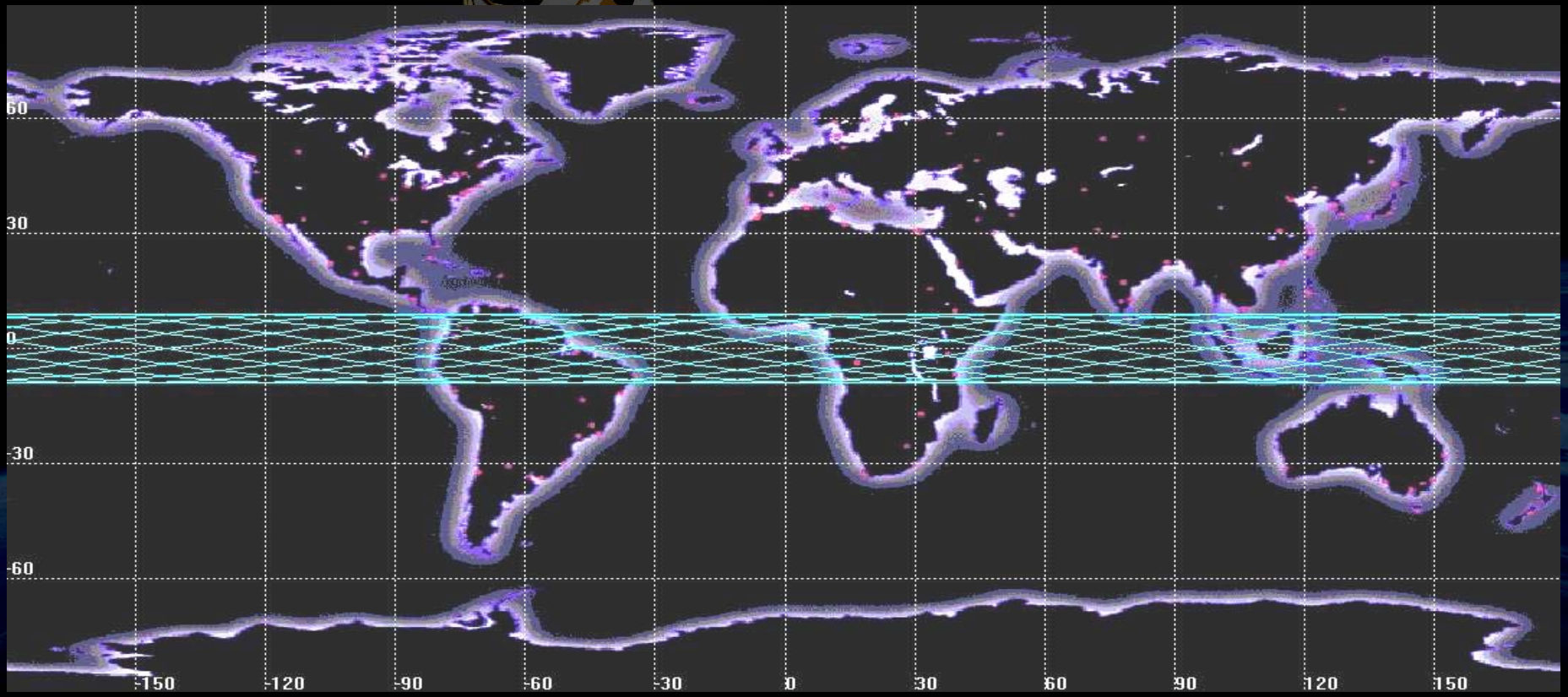
- Significant progress achieved in past few years.

- Development strategies started with technology transfer programme, joint collaboration, outsourcing and partnership, and technology acquisition through transfer of shareholding



# The most exciting programme for Malaysia…….til now! (NEqO)

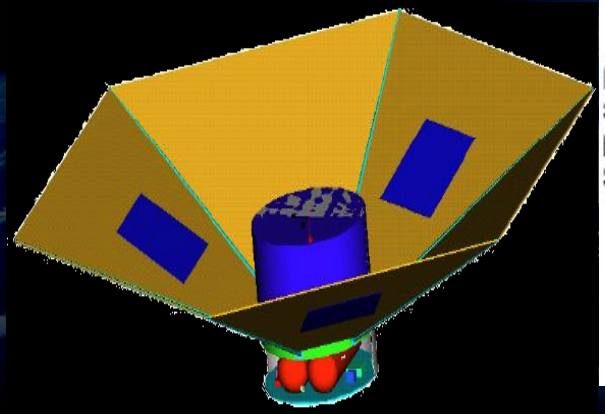
# Emerging nations need to identify niche areas and unique proposition to space



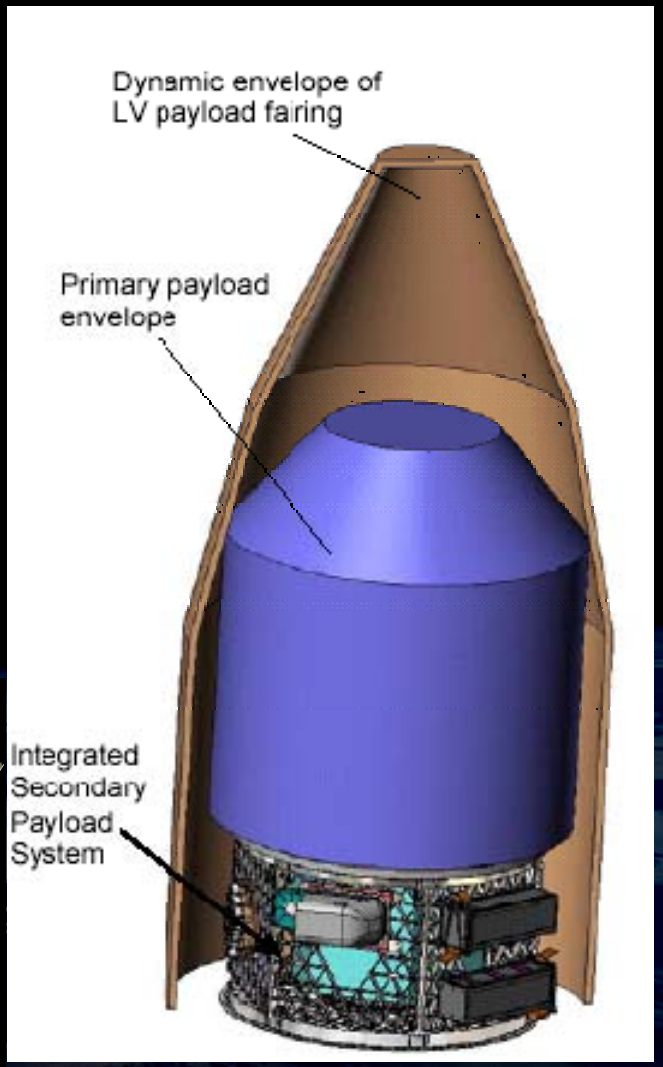

Foot-print coverage of NEqO at 9 degrees

# Technology programmes with lots of asscociated progammes

**RazakSAT® Satellite**



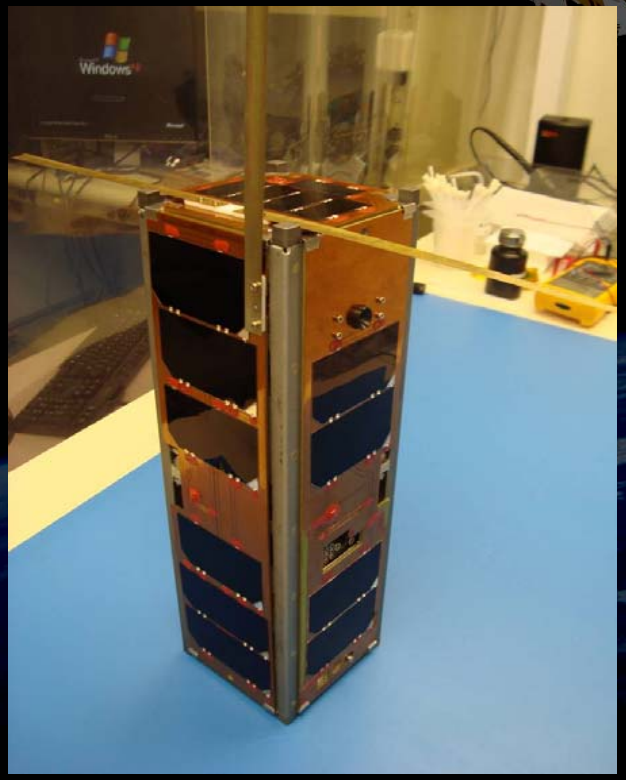
**Small Payload Orbit Transfer (SPORT)**




**Secondary Payload Adapter and Separation System**

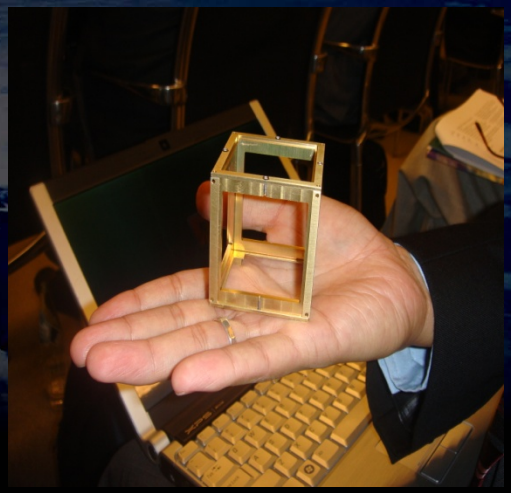
# CubeSAT and InnoSAT

- Designed and developed by Malaysian® Engineers
- Full integration and testing completed. Excellent start for space programmes. Low cost and without expensive equipments.



**CubeSAT FM ready for launch**

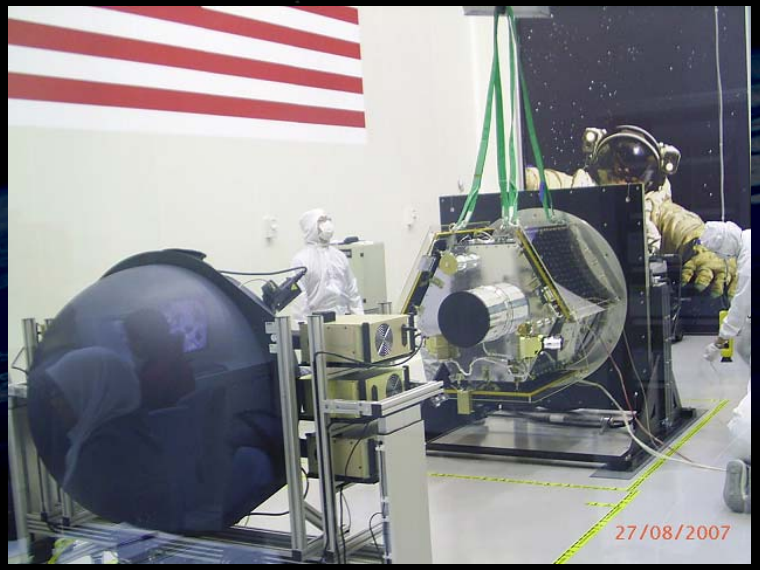

CubeSAT FM during camera test

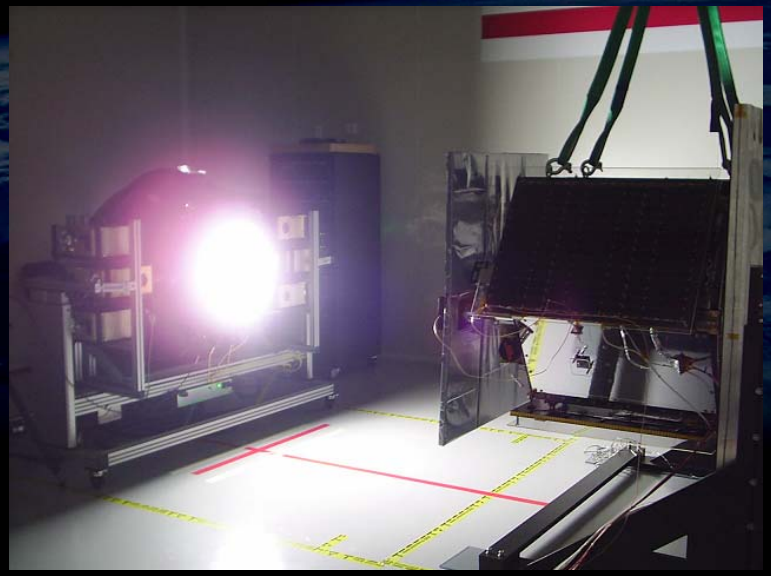


**FemtoSAT**

# RazakSAT Pre-flight calibration measurement

- RazakSAT® Pre-Flight Radiometric Calibration
- Measurement cases completed:
  - Stray light investigation
  - Dark Response Test
  - Case measurement

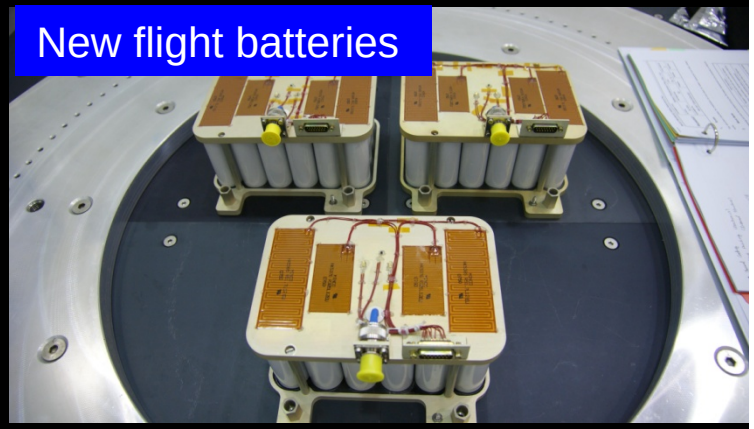


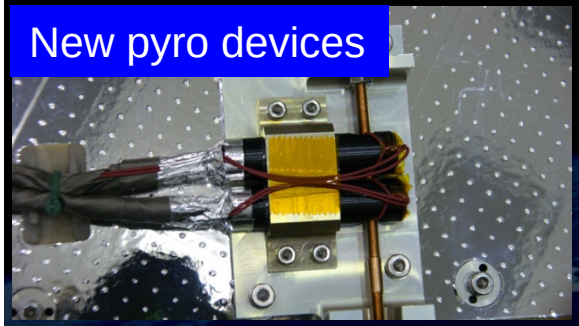
# Pre-launch activities

- RF end-to-end test
- Launch vehicle separation switch fit check
- Components replacement (long storage)

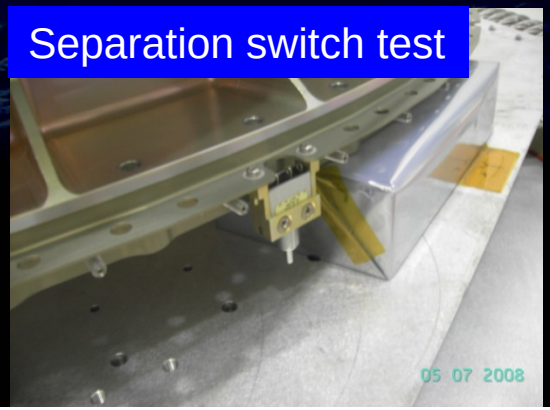
New flight batteries



New pyro devices



Separation switch test




S-band test

X-band test

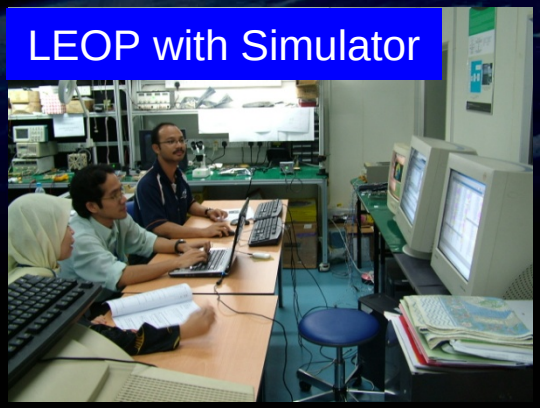
# RazakSAT Pre-launch activities

- LEOP rehearsal with satellite & simulator
- Regular SW update and checks
- Full circle test with RazakSAT and MCS

LEOP Test and Rehearsal with Satellite

SW Test and Regular Tests

LEOP with Simulator



Integrated LEOP with Satellite and Ground Station

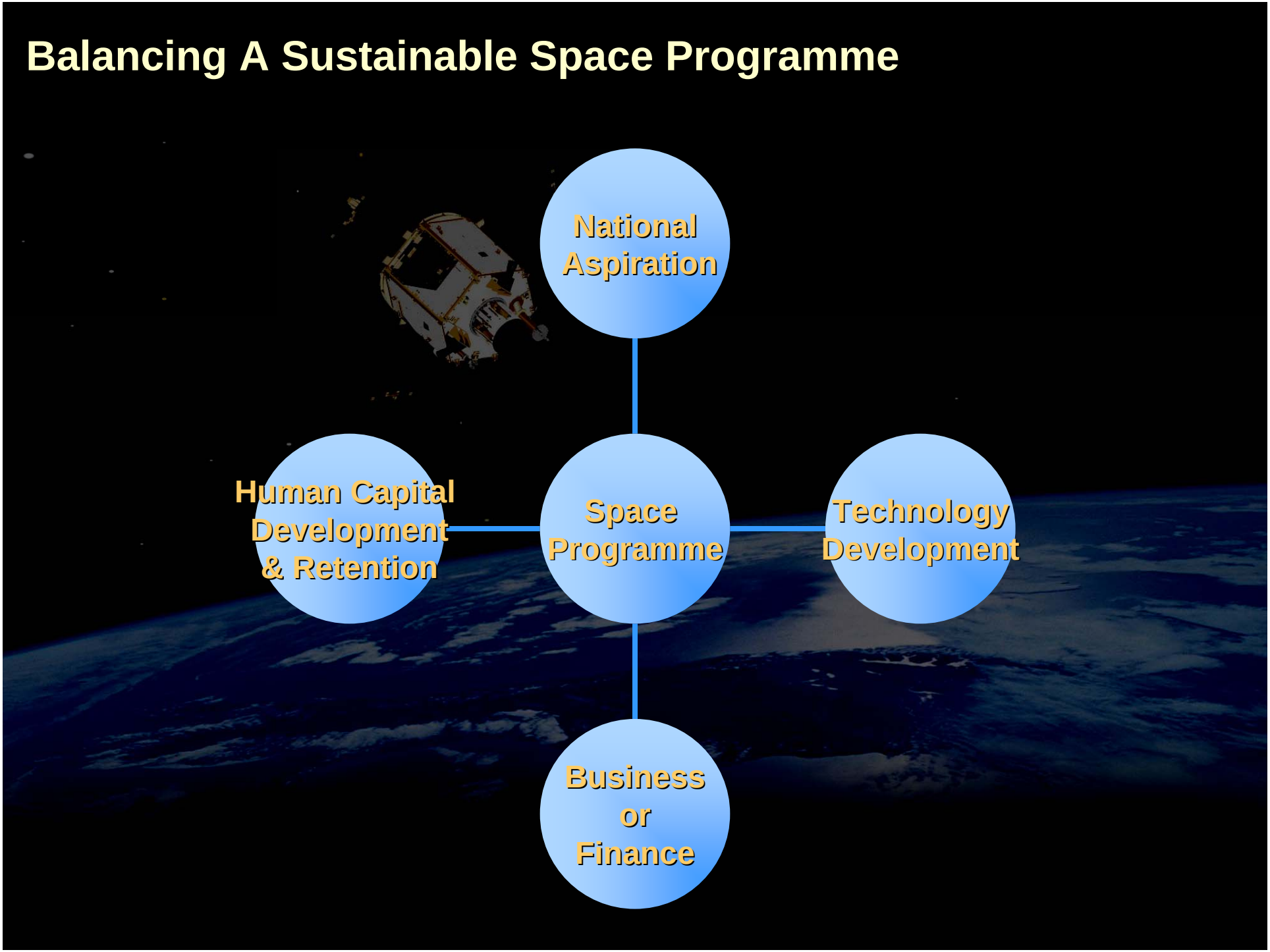
# Why do we want a Space Programme?

- Strategic Reasons
  - Public Aspirations towards Developed Nation status
  - Technological Independence and Increased International Stature
  - Financial Potential
  - Strategic (though not really feasible for developing nations)
- Garnering Public Support
  - Knowledge Generation – the Mind
  - Wealth Creation – the Pocket
  - Societal Well Being – the Heart

## Institutionalization of Space Technology Development

- University
  - Open Culture with Diverse Focus
  - Low Compatibility with National Scale Programmes
  - Luxury to Fail!
- Government Agency/Research Institute
  - Funding Reasonably Assured
  - Low Commercialization Awareness
  - Better Suited for Policies and Infrastructure
- Company
  - Funding Not Assured
  - High Commercial Awareness and Discipline
  - Flexible in Operations
  - Pressure to commercialize R&D and satellite!

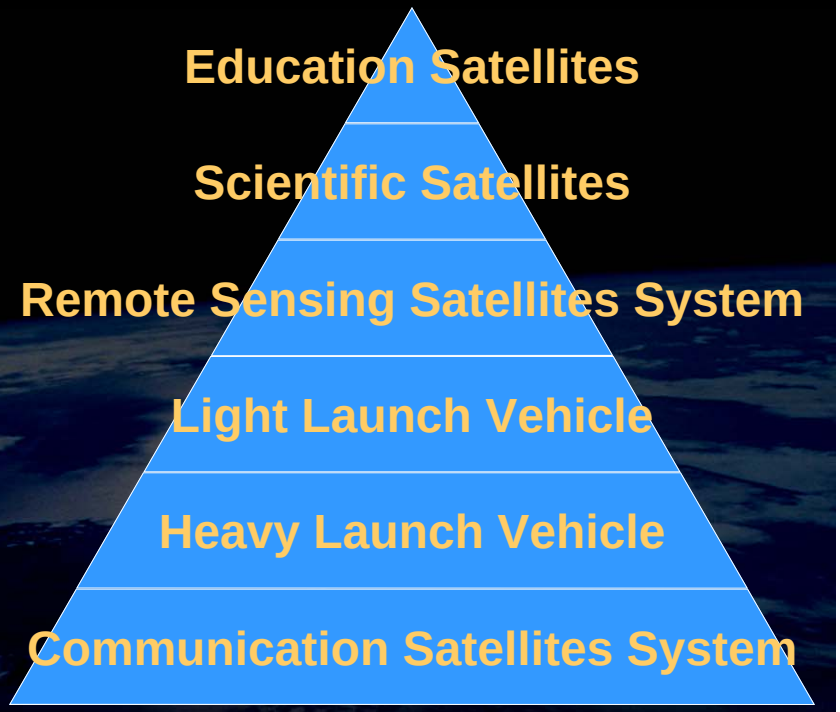
# Balancing A Sustainable Space Programme



# Potential Revenue vs Technological Complexity

Money Tree


Technology Tree




Disclaimer: Malaysian Perspective

## Options for Development

- Transfer of Technology
  - Excellent for starting off especially with partners having similar experiences
  - Lowest Risk and shortest time with minimal development
  - Usually incomplete as recipient is not sufficiently technologically mature
- Joint Venture
  - Best done with partners of reasonably equal technology
  - Risk is shared with moderate development time
  - Balance between partners technological and financial sharing is complex
  - Technology acquisition thru acquisition of shares
- Own Initiative
  - Usually takes the longest time to implement
  - Risk is highest as unknowns are abundant
  - Competent HCD needs to be developed

# Fickle Factors of Space Technology Development

- Changing National Aspirations and Allocation of Assets
  - Maintain Space as a National Priority over long periods is a major challenge
  - A solid Space Policy  and Technology Road map is critical
  - International Representation must be driven to be effective (eg ITU)
- Creation and Retention of Human Capital
  - Length of Space Programmes can mean turnovers of key staff
  - High learning curve for new nations with limited human capital supply
- Technology Development
  - Long Lead Times to Establish Competency. Balance needs as required
  - Indigenous subcomponent manufacturing is almost impossible unless underlying local industry is strong
  - There is no “volume” for space manufacturing
- Sustainable Finances
  - Capital Intensive for development
  - Business Case for Remote Sensing generally still unproven
  - Space is considered a luxury in a recession
  - Long time for Return of Investment


Driving Results

# Breaking out and Becoming a Leader

- Innovative Approach
  - Utilize Each Nation uniqueness for strength
  - Malaysia's Unique Value Proposition for RazakSAT® is the Near Equatorial Orbit (NEqO) concept that we have operationalized
  - No risk, no gain: No one said it was easy
- Credibility
  - Who will trust you internationally? – Foresight of potential pitfalls
  - Are they there just for the money? – Evaluate partners carefully
- Competition
  - Developed Nations – Become their Partner
  - Neighboring Countries – Become their Partner
  - Establish Working Groups or Partnerships/Associations to Strengthen Position Internationally
- International Restrictions
  - ITAR/MTCR – Focus on possible workarounds early in any programme

## Measuring Institutional Performance

- Key Performance Indicator
  - Must be measureable and controllable
  - Focus on Finance, R&D, and HCD
- Financial Reports
  - Use Standardized Statements
  - Do not distort pricing (eg concealing subsidies/salary under university or government allocation) as this prevents the creation of a truly sustainable programme

## Research, Development and Commercialization

- What is the target?
  - Research for the sake of Research is best left to Universities
  - Focus on Product Development
  - Niche Area

- Pain of Failure
  - Accept the risks but must be calculated risk
  - Even success can bring heart attacks (eg launch of RazakSAT®)
  - Accept that it will take time to develop….and this cpuld be a long time!

## Spin Off and Product Diversification

- Why? Why Not?
  - Potential for other revenue streams
  - Could be a distraction from initial focus of Space Technology
- Is it possible to be idealistically focus purely in Space?
  - In most cases probably not as pragmatism and practicality rules
  - Be careful of complacent mind set preventing innovation
- Is your organization funding secure? How about during recession?
  - HCD Retention
  - Continued and Sustained R&D
- Standard Business Practices
  - Is the institution ready for it?


THANK YOU