



**Mission Idea Contest
for
Nano-satellite Constellation
REGIONAL SEMINAR**

**October 18, 2010
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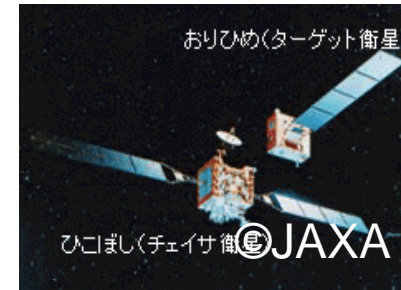
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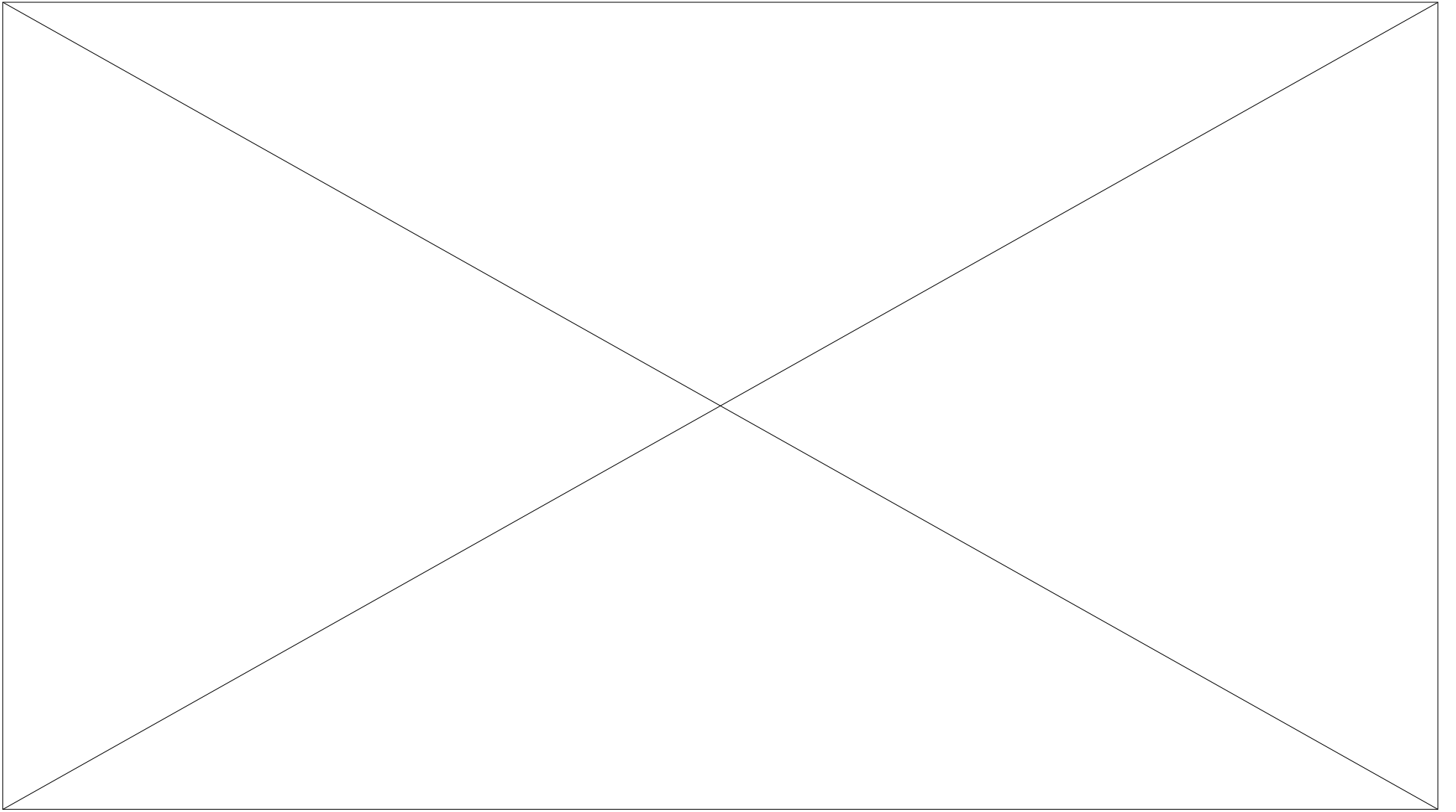
Introduction

Who am I?

Self Introduction



- **In 1994, Masters degree on Astronautics from University of Tokyo**
- **Start to work for Mitsubishi Electric Corporation in Space Application Field in 1994**
- **Project 1: (ETS-VII)
Engineering Test Satellite VII**
- **Project 2:H-II Transfer Vehicle (HTV)**



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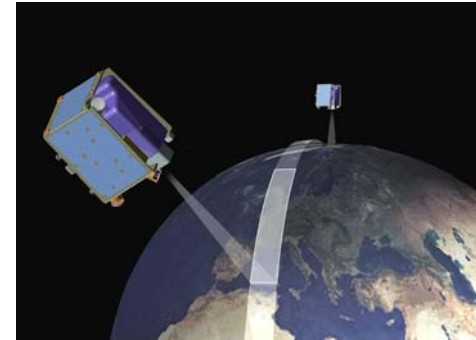
Self Introduction



- **Work for Astrium GmbH (@Friedrichshafen) as Exchange Engineer (May. 2000 to January 2002)**
- **Project 3: QZSS**
Quasi Zenith Satellite System
- **Teaching Systems Engineering at KEIO university since 2004**
- **Associate Professor at KEIO SDM from April**

Mission Idea Contest for Nano Satellite Constellation

Background



- **Governmental Funding Program (2010–2013)**

New Space Development and Utilization Paradigm by Nano-satellites Introducing Japan-oriented “Reasonable Reliable Systems Engineering”

Project Leader

Prof. Shinichi Nakasuka

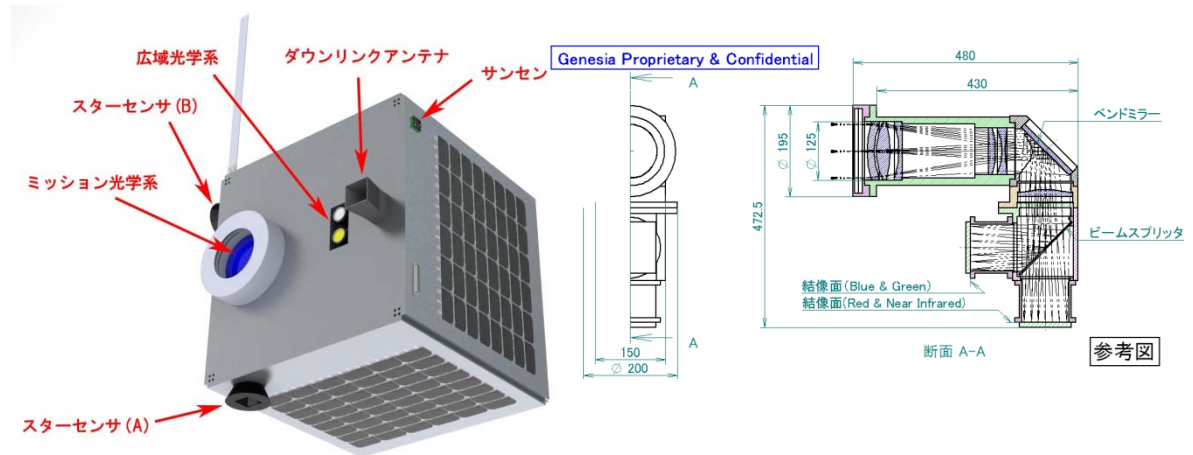
School of Engineering, University of Tokyo

- **If a good mission idea were presented, a certain budget would be allocated to realize it.**

Satellite Development Plan (5 sats within 4 years)

#1: 5m ground resolution + personal use

- Private company
- Russia and other foreign countries



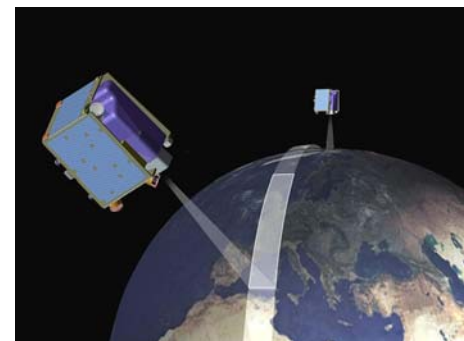
#2: Foreign science mission

- Search for foreign and domestic missions



#3: Constellation of 3 satellites for Earth observation, etc.

- Data sales, business test
- Search for mission data customers



Objectives of the contest



Encourage innovative exploitation of nano-satellites in constellations to provide useful and sustainable capabilities, services or data.

Rules



- **Eligibility: Any individual, group or company with suitable space systems expertise and an enthusiasm for nano-satellites**
- **Requirements:**
 - **Exploitation of nano-satellites e.g. Individual free-flying satellites typically < 15 kg**
 - **Exploitation of a constellation = a synergistic collection of 2 or more satellites providing a common service or multi-point data.**
 - **Mission capable of < ~2 yr development time with total lifecycle cost < ~\$6M(excluding launch)**
- **Assumptions:**
 - **Single, Secondary launch to Earth orbit to achieve initial operational capability**

Contest Steps



- **1st round: extended abstract evaluation step**
 - **The winners will be given a ticket to Japan to participate in the final presentation stage.**
- **2nd round: paper and presentation step**
 - **Finalists will submit final paper and make a presentation in Tokyo.**
 - **The best idea will be selected and awarded.**

Contest Timeline



- **June 2010: Announcement of Contest Details**
- **July – September 2010: Regional seminars to introduce the competition details in each region: Egypt, Kenya, Singapore, Korea, Germany, Spain, Mexico, Brazil, USA, and more...**
- **December 20, 2010: Submission Deadline**
- **Dec.20 - Jan.20 : Evaluation by reviewers:**
- **January 2011: Announcement of Finalists**
 - **Each team of finalists shall prepare formal paper describing their proposed idea (detailed guidelines to be provided)**
 - **Two representative from each team of finalists will be invited to Japan (expenses paid) to participate in the final presentation stage.**
- **March 1, 2011: Submit final papers for review**
- **March 14, 2011: Final Presentations and selection of winners in Tokyo**

Awards



- **2 people from 5-10 Finalists will be invited to make a final presentation in Japan at the 2nd Nano-satellite symposium.**
- **Award 1st prize: 500,000 JPY**
2nd prize: 300,000 JPY
3rd prize: 200,000 JPY
- **High visibility for your ideas**
- **Potential for future collaboration and support**

How to Apply?

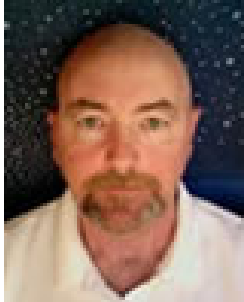
- **Submit extended abstract not to exceed 5 pages (in English) no later than 20 Dec describing:**
 - **Need your mission idea addresses**
 - **Prioritized list of Mission objectives**
 - **Concept of operations (description of key mission elements and their interfaces)**
 - **3-5 Key Performance Parameters (e.g. Resolution, data rate, coverage)**
 - **Space segment description (conceptual design, e.g. Mass, volume, power, link budget, orbit)**
 - **Implementation plan (estimated cost and schedule, infrastructure requirements)**
- **Online submission/Template available**

<http://www.axelspace.com/missionideacontest/application.html>

Evaluation Criteria

- **Original, sustainable Nanosatellite mission IDEA (50)**
 - **Originality**: Novel mission concept not yet realized or proposed, or a new implementation of an existing capability or service (20)
 - **Sustainability**: This is not intended to be a single mission but rather an on-going application providing a continuous useful capability (15)
 - **Impact** on society (15)
- **Mission FEASIBILITY (50)**
 - **Technical** (20)
 - **Programmatic** (cost estimate, development schedule, infrastructure requirements) (15)
 - **Operational** (Description of ground segment and communications architecture, e.g. planned use of existing infrastructure) (15)

Who will review?



Dr. Jerry Sellers
(Chair)
Teaching
Science &
Technology, Inc.



Prof.
Herman
Steyn
Stellenbosch
Univ.



Prof. Shinichi
Nakasuka,
Univ. of
Tokyo



Prof. Sir Martin
Sweeting
SSTL
SSC



Dr. Masaya
Yamamoto
Weathernews
Inc.



Dr. Rainer
Sandau
DLR



Prof. Hiroshi
Kawahara
Cyber Univ.

Extended Abstract (1)

➤ Need

- In **2-4 sentences** describe the fundamental need (humanitarian, business, scientific, etc.) your mission idea addresses.
 - For example “Equatorial countries need timely tsunami warnings,” and why this need is not being fully addressed by current or conventional large space systems.

➤ Mission Objectives

- List and describe **no more than 5 mission objectives** and prioritize them. These should be quantitative in nature and serve as overall measures of effectiveness for the mission.

- Originality

- Impact

- Sustainability (partial)

Extended Abstract(2)

- Operational
- Sustainability
(Operational)

➤ **Concept of Operations**

- **List and describe key mission elements (ground segments, space segments, launch, etc.) and describe their primary interfaces. Use diagrams and tables as appropriate.**

➤ **Key Performance parameters**

- **List and explain the technical rationale for 3-5 key performance parameters that enable the successful conduct of your mission idea.**
 - **Tsunami detection may depend on better than 20m spatial resolution in the visible spectrum.**

- Technical

Extended Abstract (3)

- Technical

➤ **Space Segment Description**

- **Describe the conceptual design for your satellite system or systems. List key specifications (e.g. mass, volume, peak and average power, link budget, delta-V, etc.). Diagrams or simple CAD drawings are encouraged.**

➤ **Orbit / Constellation Description**

- **Describe the orbital elements for the desired mission constellation and explain the technical rationale for its selection. Presentation of analytical results ground coverage or user access computations or simulations is encouraged.**

- Technical

Extended Abstract (4)

- Programmatic

➤ **Implementation Plan**

- **Describe how your organization, or your organization working with others could implement your idea. Provide a reasonable estimate of total life cycle cost to include design, development, assembly, integration, testing, launch operations and disposal. List any facilities or other infrastructure to be used or needed. Describe the project organization. Present a top-level project schedule starting from authority to proceed. List and describe the top 5 project risks (technical or programmatic.)**

➤ **References**

- **List any technical references for your idea.**

- Technical

1st : Idea

- **Three way to make new idea**
 - **Improvement from the current system**
 - **Observation**
 - **Create idea**

2nd : Operational Concept

- **There are four operation phase**
 - **Before nominal operation**
 - **Nominal Operation**
 - **Contingency Operation**
 - **Replacement / Retirement Operation**
- **Nominal Operation is most important.**
- **Replacement / Retirement Operation is important for sustainable system, especially mission continuity is important for real business.**
- **Components**
 - **Satellites, Ground operation system, Ground service system and user segment.**

3rd : Technical Design

- **Orbit / Constellation**
- **Space Segment**
 - **Outside: Image**
 - **Inside: Component list, Diagrams or simple CAD drawing**
 - **Performance parameters**
 - **link budget : preliminary communication link calculation (power, frequency, antenna size(?), might be Key parameter if the mission needs large data transfer)**
 - **peak and average power(?), calculated from orbit, solar panel size**
 - **ΔV (if need orbit correction or orbit change)**
 - **Mass (sum of component mass, structure and harness (10% of total mass))**
 - **Volume (foot print of components)**
 - **Pointing accuracy might be Key parameter**

4th : Implementation Plan / Cost

- List up all end-products
- List up all **enabling-products** for each end-product
- Identify all implementation **phases** for all **levels** for all items.
 - Phases : Design, Implement, test
 - Levels: System, subsystem...
 - If required introduce 'stage' , **stage** : Preliminary design for EM, Detail Design for FM
- Make Gantt Chart
- Cost Estimation
 - Human, equipment, parts