Capacity Building: A Comparison of International Collaboration at Two Different Levels

by

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Technology Transfer – General

- Amongst emerging space nations are some technologically–disadvantaged ones:
  - With low human and infrastructural capacity readiness to absorb complex technology
- Several technology–disadvantaged space emerging nations procure their first satellite with technology transfer
- Collaborations to build human capacity in satellite engineering is between institutions in developing and developed nations

Classical Question – Why Space?

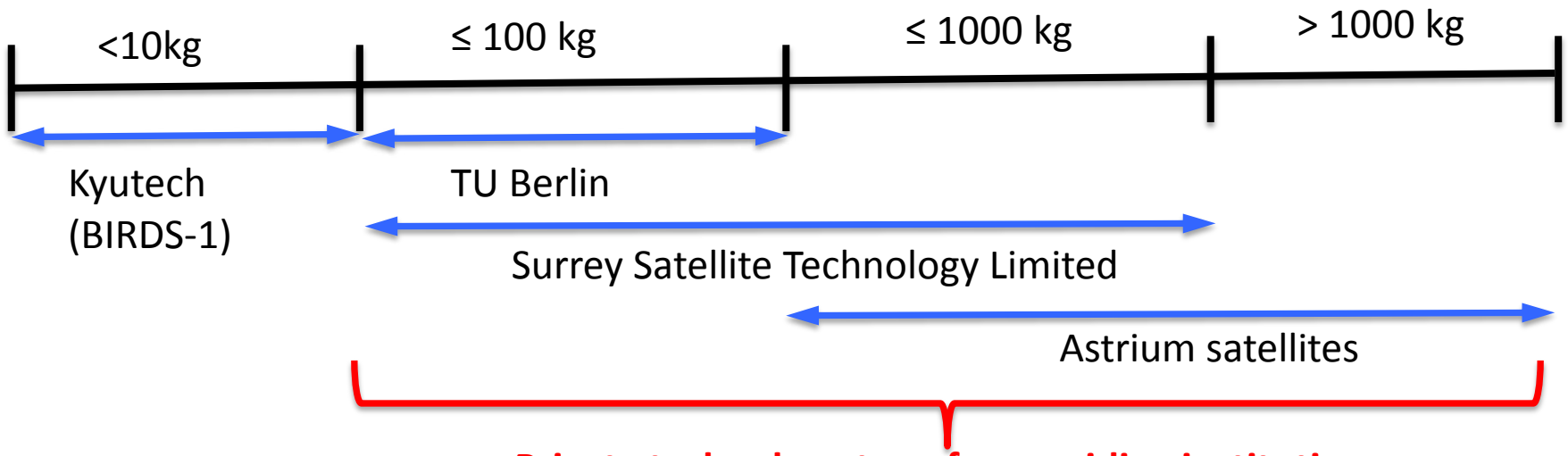
- Why space technology, satellites or micro satellites?
  - Compelling answers must be provided to decision makers and taxpayers
  - Micro satellites adequately supports larger payloads and wider functionality

- Prevailing socioeconomic challenges in most technology–disadvantaged space emerging nations almost always leads to:
  - "Leap-frogging" any proposed solution
  - Harmlessly over stating goals and favoring overly complex missions with shortest turnaround times
  - Low risk options
  - Less effort is invested in drawing up effective and efficient technology transfer program

Choice of International Partner

- How does a nascent agency of a technology-disadvantaged space emerging nation figure out what satellite category to build capacity on?
- Size of satellite influences choice of collaborating partner
- Starting small is never a bad idea – cubesats

Capacity Building Collaboration I



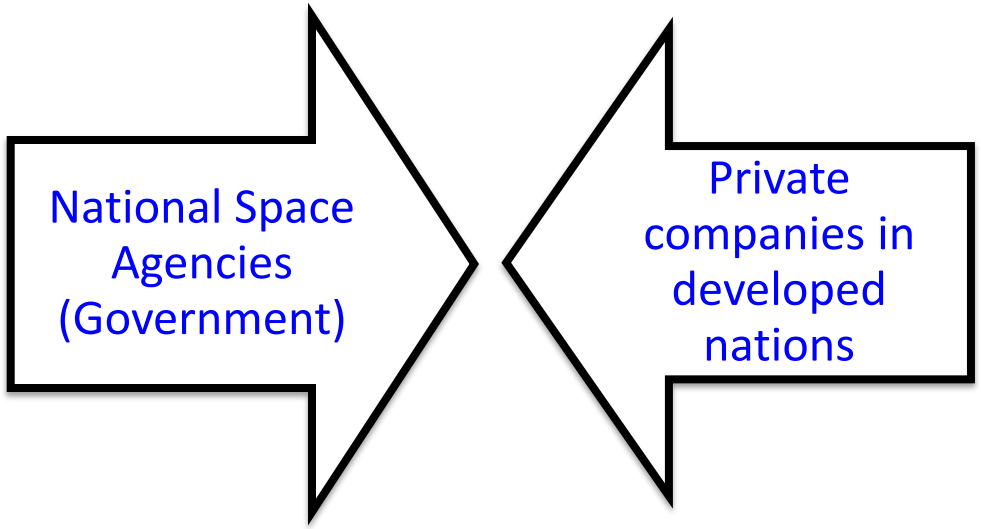
Kyutech (BIRDS-1)		Tu-Berlin		SSTL		Astrium	
Mongolia	[U-U]	Indonesia	[GA-P]	Nigeria	[GA-P]	Algeria	[GA-P]
Ghana	[U-U]	Morocco	[GA-P]	Algeria	[GA-P]	Thailand	[GA-P]
Bangladesh	[U-U]			Malaysia	[GA-P]		
Nigeria	[U-U]			Turkey	[GA-P]		
Japan*	[U-U]						

[U-U] *– University to university Capacity building collaboration*

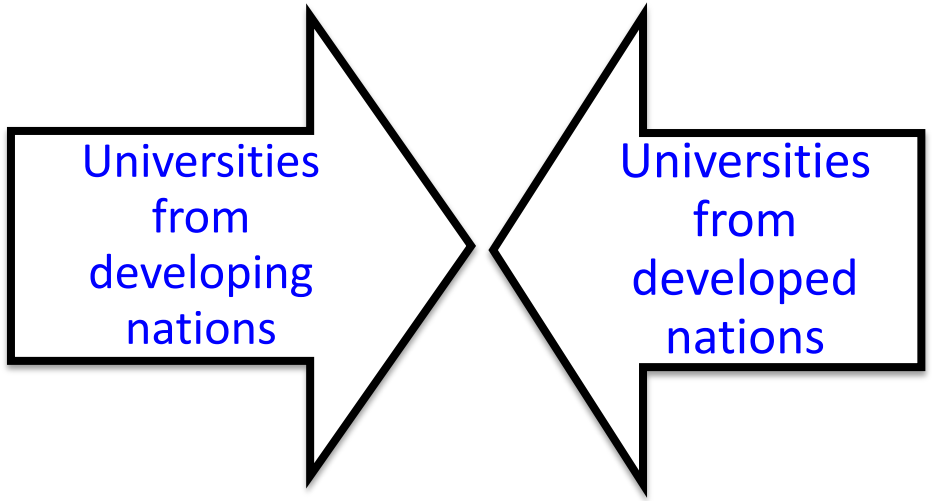
[GA-P] *– Government to private institution Capacity building collaboration*

** BIRDS host nation & also part of of the flock*

Capacity Building Collaboration II



#1



#2

Capacity Building Collaboration III

#1 Capacity building collaboration: between National Space Agencies and private companies

- Microsatellites are often used for technology transfer
- However, the larger the satellite, the harder it is for recipient nation to validate acquired skills in home country

http://fortunedotcom.files.wordpress.com/2010/10/pay-to-play.jpg

Capacity Building Collaboration IV

#1 cont. Capacity building collaboration: between National Space Agencies and private companies

- For different reasons, failure is not an option for both parties
- Focuses on training only
- Ultimately, there is little room to build adequate capacity

- For profit driven private companies, a failed satellite is bad for business because of "*our name is on it*" effect
- For nascent space agencies, a failed satellite weakens trust from taxpayers and policy makers

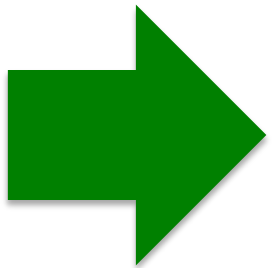
Capacity Building Collaboration V

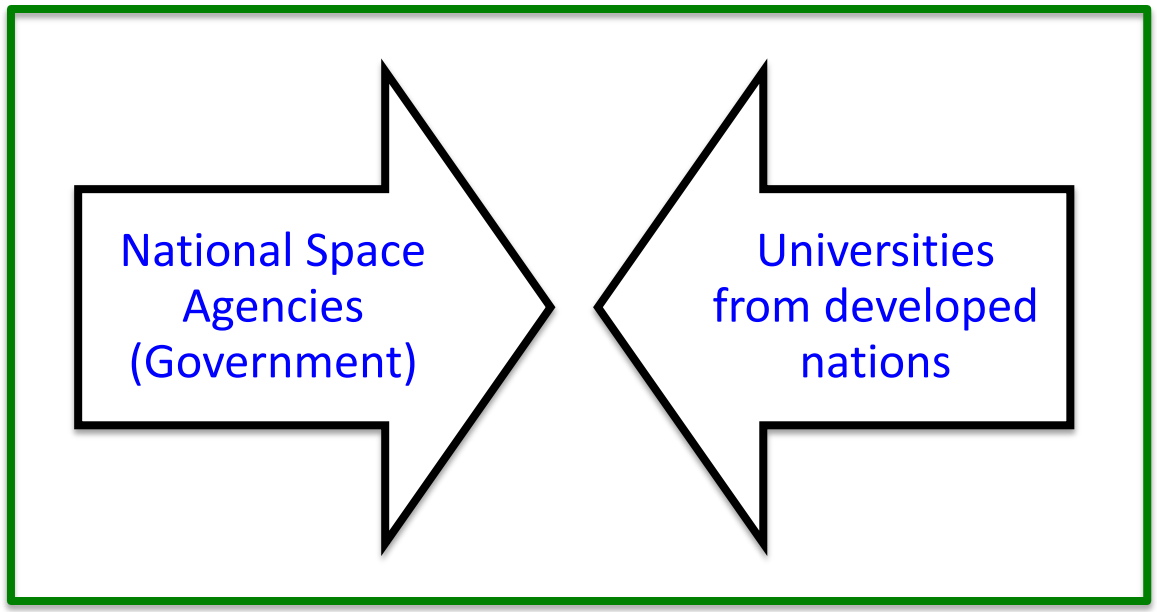
#2 Capacity building collaboration: between Universities from a developed and developing nation

- 1Kuns: Italian–Kenyan University cube satellite
- BIRDS–1: **Four** universities from **four** different **developing nations** build and test **four** cubesats in Kyutech
- Every participating individual bags a masters or PhD degree
- Education, training and validation of transferred knowledge achieved

Capacity Building Collaboration VI

#3 Recommendation for technology-disadvantaged national space institutions





http://integreatleadership.com/leadership/big-idea-great-leaders-serve/

Recommended Collaboration

#3 Capacity building collaboration: between a National Space Agency and a University

http://www.catmandu.com.au/wp-content/uploads/2014/06/cost-of-investment.jpg

- Capacity building that combines **education** and **training**
- Cubesats and low mass satellites used for training
- Space agencies of developing nations can scale missions
- A low cost – high value route for national space agencies of developing nations

Technology Transfer Routes

No	Technology Transfer category	Comment
1	Design, Assemble, Integrate & Test satellite within the country with support from international partners/consultants	An organized & matured manufacturing ecosystem must be locally existent. **(Any class satellite)**
2	Design specific subsystems locally & procure others. Assemble, Integrate & Test within the developing nation.	Huge investment in facility must be made or availability/location of such infrastructure within the nation must be known. **(Any class satellite)**
3	Design specific subsystems locally & procure others. Assemble & Integrate within a developing nation & perform Tests in facility of international partner	This route favors small, less complex satellites. **(Cubesats or low mass satellites)**
4	Design, Assemble, Integrate and Test satellite using facilities in a developed nation under supervision of engineers of partner organization	To validate acquired skills, social, cultural and infrastructural blocks will need to be overcome. **(Any class satellite)**

Technology Transferred, what next? I

- Case 1: Using a microsatellite, technology transfer is completed in partner's facility
- There is room to scale satellite size up or down
- However, the challenge of validating acquired knowledge is further complicated by the need to overcome the following:
  - Social, cultural and infrastructural blocks existing in the recipient's nation that is likely to be absent in the technology-transferring nation.

Overcome Social Block: Integrate In Home Country Test At Kyutech

Irazu Cubesat project: A case that will exemplify “designed and integrated in Costa Rica, tested in Kyutech facility”

- National space agencies looking at designing, assembling, integrating within their nation, and testing in a foreign facility.
- Low mass satellite offer this opportunity.

http://www.acae-ca.org/index.php/proyectos/misiones/93-primer-satelite-centroamericano

Technology Transferred, what next? II

- Case 2: Using a cubesat, technology transfer is completed in partner's facility
  - Minimum infrastructure is required to validate transferred skills
  - Social and cultural impediments scale down accordingly with reducing team size.
  - It is easier to organize and manage smaller teams and establish acceptable social practices
  - Subsystem goals are clearer, turnaround time is shorter and chances of completing project is higher

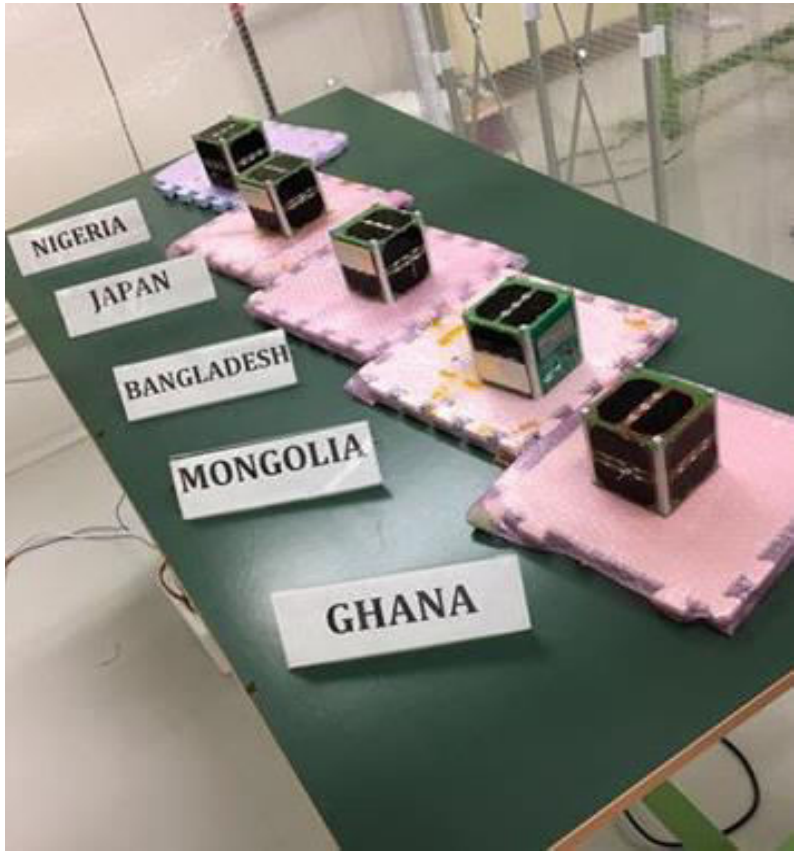
BIRDS-1 cubesat flock

Technology Transferred, what next? III

- Case 2: continued…
- Can stimulate national discourse on the use and role of space technology in creating abundance

BIRDS Project

BIRDS-1



BIRDS-2

Bhutan

Malaysia

Philippines

BIRDS-4

Conclusion

- Collaboration between Space agencies of technology-disadvantaged nations and Universities offering satellite hand-on such as Kyutech has a huge potential yet to be explored
- Such collaboration are not based on the solely “pay to play” models that profit driven companies operate
- National space agency – University capacity building collaboration model provides both education, training and validation of acquired knowledge.
- Universities are increasingly filling the education-training gap; satellites of up to 50kg can be conveniently tested in Kyutech testing facility

Recommendation

- UNOOSA should accentuate the potential benefits of low cost, high return on investment collaborations between technology–disadvantaged national space institutions and universities that offer both education and training in satellite engineering.

Thank you for your attention

Image courtesy of JAXA