EARTH OBSERVATION MISSONS REGARDING COST EFFICIENCY

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COST EFFICIENCY

Definition

Efficiency in general describes the extent to which time or effort is well used for the intended task or purpose. It is often used with the effort to produce a specific outcome effectively with a minimum amount or quantity of waste, expense or unnecessary effort.

Cost efficiency refers to the relative balance of effectively meeting reach and frequency goals at the lowest price.

Efficiency = Work Out / Assets In

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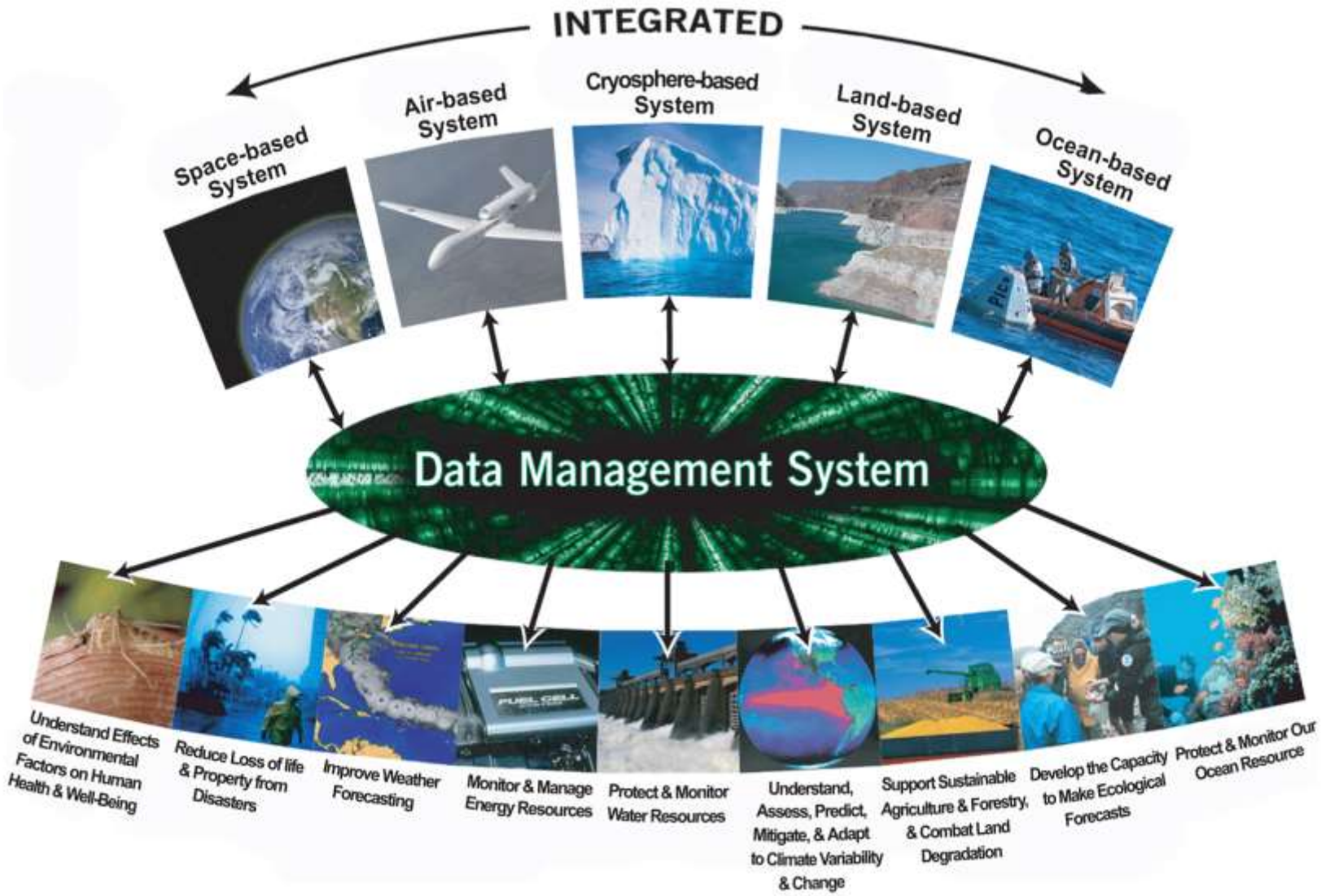
GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS

Integrated Observations & Data Management



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COST DRIVERS of Space Based Systems

1. Space Segment
   - Payload
   - Space Craft
   - Quality Assurance
2. Ground Segment
   - Satellite Comms
   - Command and Control
   - Mission Planning
   - Data Archive and Inventory
   - Data Dissemination
3. Mission Operations
   - Planning and Scheduling of Observations
   - Coordination of Observation Requests with Spacecraft and Groundstation Activities
   - Command Loading and Execution
   - Spacecraft Monitoring and Telemetry Analysis
   - Reception, Processing, Archiving and Dissemination of Payload data
4. Access to Space
5. Management and Organisational Expenses

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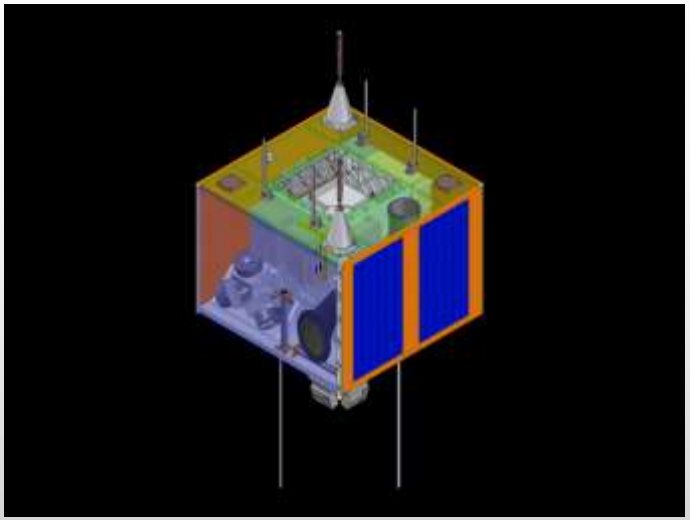
COST DRIVERS of Space Based Systems

1.Space Segment

- **PAYLOAD**

“As the smaller, is the smarter”



- Shorter mission turnaround
- Risk reduction
- Wider coverage and faster revisits (constellations)
- More suited to national and bilateral/multilateral cooperations
- Faster learning cycle and scope for applying new ideas in a shorter time frame
- Greater mission overlap
- More continious data systems by using multiple platform concepts
- Better utilisation of the engineering and science personnel
- Beneficial to operate small integrated teams of engineers with good technical experience and short decision chains
- Lower costs

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COST DRIVERS of Space Based Systems

1.Space Segment

– **SPACECRAFT**

- Modularity (instead of integration)
- Broad applicability (instead of one of a kind design)
- Re usability
- Modules that can be adapted according to the mission
- Development of interface standards
- Avoiding non recurring engineering costs (NRE)
- Use of heritage designs will help for NRE

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COST DRIVERS of Space Based Systems

1.Space Segment

– **QUALITY ASSURANCE**

- Quality Assurance and Risk Management are important for the mission costs
- It is important to assure a high mission performance according to the requirements in a cost effective way are the components and EEE-part selection.
- The selection of commercial of the shelf (COTS) EEE parts and components opens the door for flexibility and high performance to affordable prices.
- Using COTS components counts for high performance, functionality and power consumption.

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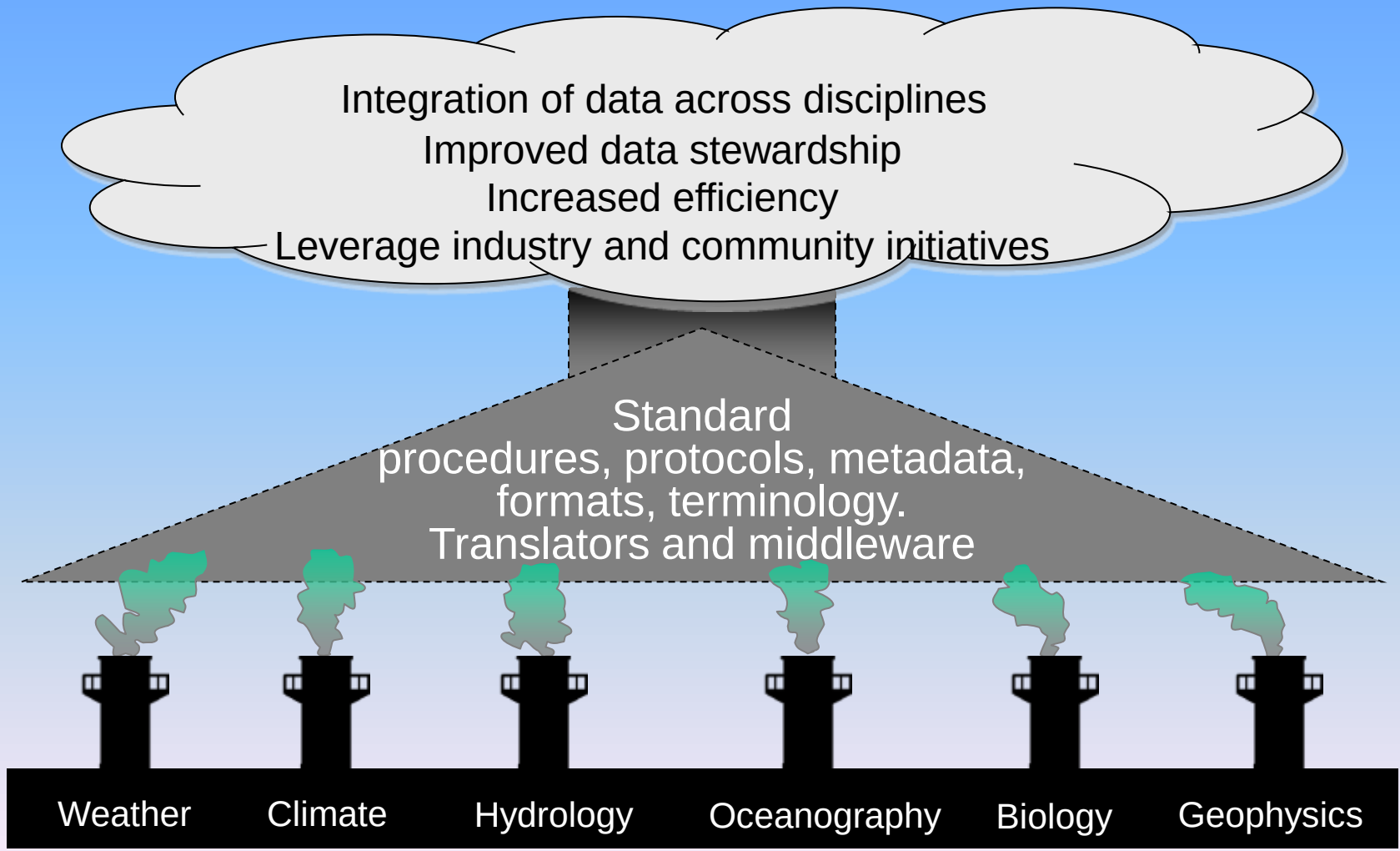
Bridging The Gaps Between Different Systems



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2. Ground Segment

- Use of small satellites as low cost platforms for the collection of EO data
- Emerging Ground Segment Technologies:
  - Open Sytems: ground segments for smallsat implementing architectures follow open standards.This also enables reuse of existing facilities.
  - Automation: has an associated cost, however it can be undertaken for excessive staff cost reduction.
  - Internet Technology: the advantage of e-commerce systems and image management (GEONetCAST)
  - Distributed Ground Segment: making use of internet enables DGS to collect data from different locations and process them.

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3. Mission Operations

- There is a clear trend towards increased onboard autonomy to reduce planning and operations efforts.
- Increased on board autonomy, in planning, control, data processing has the potential to be a key issue when the case is future EO missions, esp. commercial ones.
- Using common equipments, standards and operators for different missions is an efficient way to make mission operations cost efficient, this makes more adequate use of intellectual capacity and expertise of satellite operators, which is an important factor, esp. for safety of missions

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4. Access to Space

- Commercial launching services are available today, and increasing in number.
- The limitation is related with the orbit characteristics, since most of EO missions are at low attitude.
- Cost for secondary payloads or piggy back launch is significantly lower.

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COST ESTIMATION AND MODELING

LIFE CYCLE PHASES

- Technology Development

  +

- Research, Development, Test and Evaluation

  +

- Production

  +

- Operations and Maintanance

TOTAL SPACE MISSION COST

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COST ESTIMATION AND MODELING

WORK BREAK DOWN STRUCTURE

- Programme Level
- Space Segment
- Launch Segment
- Ground Segment

TOTAL SPACE MISSION COST

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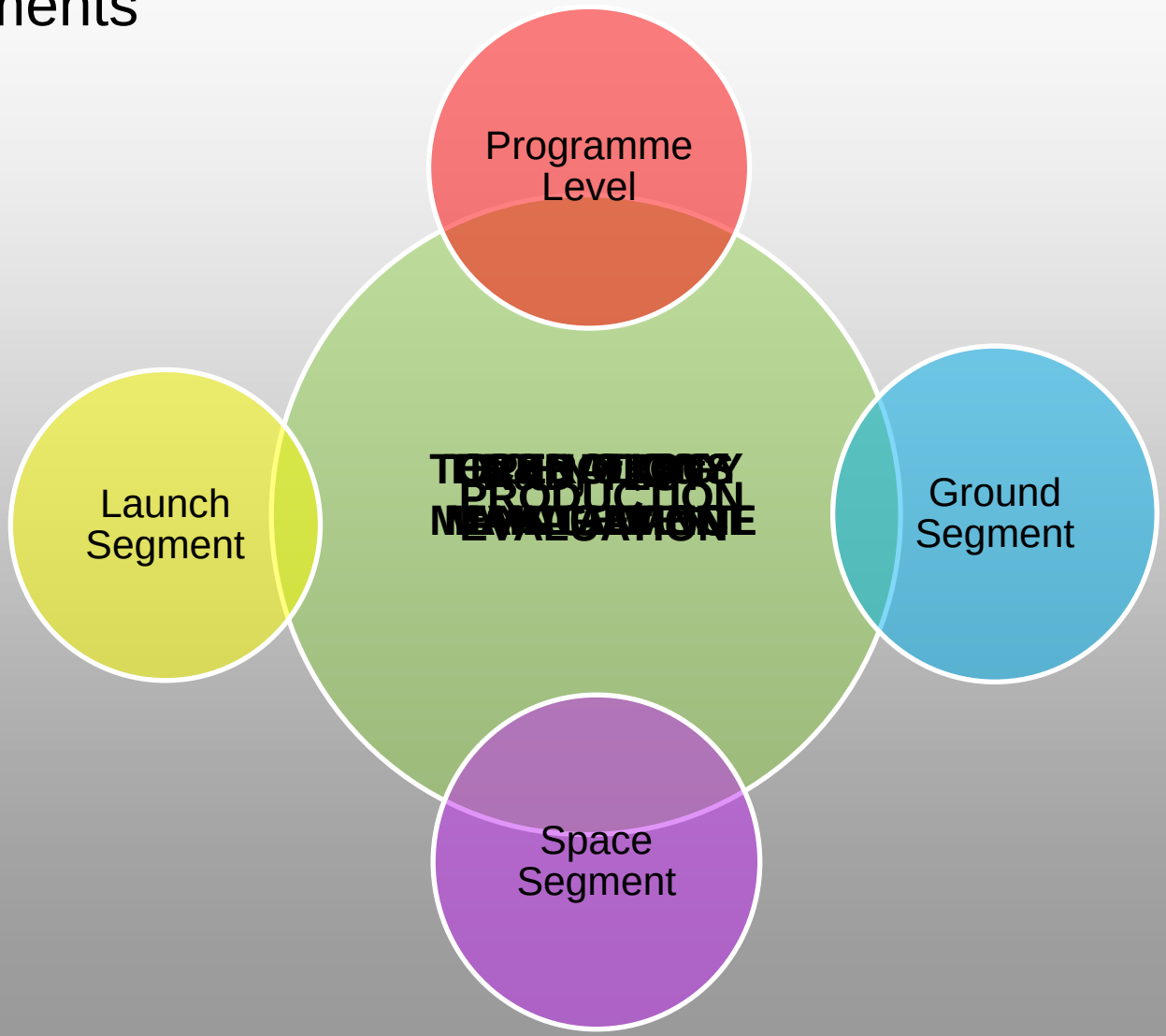
COST ESTIMATION AND MODELING

Each Lifecycle Phase is broken down into constitutent elements



COST ESTIMATION AND MODELING

COSTING MODELS

- **Bottom – Up**

  Relies on detailed break down of the system into low level components. The cost of each component is estimated individually

- **Top- Down or Parametric**

  Performed on the basis of system requirements and top level design specs. Relates mission cost to mission parameters and eliminates the need for low level information

- **Analogy Based**

  The cost of similar systems are used and adjusted for differences in size and complexity.

- **Colloborative Costing Models**

  Estimate the costs of the projects executed by a group of participants.

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HOW TO ACHIEVE COST EFFICIECY?

- There are numerous techniques which are effective in reducing costs.
- Selecting the proper one depends on the goals and objectives of the program. Therefore, first of all, these should be defined
- As the mission is simpler, it gets more cost efficient and reliable
- “Lessons learned and inheritage” will help for cost reduction.

HOW TO ACHIEVE COST EFFICIECY?

METHOD	PROS	CONS
Improved Interpersonal Communications (small teams, co-located teams)	Dramatically reduces errors, conveys understandings as well as data	It is not easy to apply for large missions
Concurrent Engineering	Allows schedule compression; reduces mistakes, increases design feedback	Non-recurring cost is high
Design to Cost	Requirements can be adjusted until the goal has been reached	Rarely used for special cases (e.g in space)
Using Large Margins	Reduces testing;flexibility; reduces cost of engineering, manufacturing and operations	Development cost increases.
Using COTS software	immediate availability, dramatically lowering costs, tested through use	Modifications may be needed, may not be optimal
Using existing spares	Reduced cost, availability,	Works as long as spares exists, it is not applicable for operational programmes
Autonomy	Reduces operations costs	May increase non recurring costs

DO YOU NEED TO OWN A SATELLITE??

- Of Course NOT!!
- There are some other ways to obtain EO data!

1. You conduct a mission and develop your own satellite (outsourcing the development of some subsystems will help!)
2. You can share a mission with some other partners (countries),
3. You can buy a satellite and ground station system in order to operate the satellite
4. You can own a ground station and use an existing satellite with a licensing agreement with the owner.
5. You can get commercial data from the suppliers.

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Service Driven Missions

- Service driven missions also need innovation in products and services, in processes and in business models
- Innovation is required to meet increasingly demanding user requirements and to compete with non-space solutions
- Users need guaranteed service, maximum availability, minimum outages. This could seem to be incompatible with the risk inherent to innovation
- Service driven missions, have created a world wide commercial market for space systems
- The industry needs to compete in this market in two leagues: the high-tech league of the traditional competitors, the league of the new low cost competitors
- Innovation is the differentiating element, “it must be better when it cannot be cheaper”

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THANK YOU

Recommendations for an Innovative Procurement Policy

1. In the endeavour of space programmes, first phases for non-compliant proposals should be examined in terms of value optimisation:

- *In many cases like 80% of the mission objectives can be met with a fraction of the budget,*
- *Deregulating the compliance rules in favour of Value analysis of combined objectives, and a pragmatic focus on user requirements, can trigger dramatic optimisation and support the concept of smaller missions*

2. Slice space programmes to become more frequent, evolutive, with probably less cummulative objectives.

Slicing programmes

- *mitigates risk,*
- *is cost effective, (budgets well below 100M€)*
- *and provides access to a larger competition, yielding a enhancement of the market*

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Recommendations for an Innovative Procurement Policy

3. Issuing less prescriptive call for proposals, where they state a problem or an area of interest and request ideas to adress the problem. This,

- *is relevant at early stage of projects*
- *encourages use of technology from a variety of sources*
- *promotes co-working between scientists and companies*

4.Inviting Technology Development Actors to propose solutions for the envisaged space segment with state of te art, in-house, developments.

- *In order to take advantage of the competitive edge of technology development, it is to be implemented as fast as possible in application missions.*
- *This should bring opportunities to new space companies since they are more focussed on new technologies.*

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