The ESA Project Office Cost Model

ICEAA – 2014 – Denver CO

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Summary

- Rationale
- Space Segment PO cost model approach;
- Model Concepts and levels:
  - System level activities;
  - Sub-system level engineering;
  - Industrial Set Up and Sub-Contractors;
- Model graphic interface;
- Future development
- Q & A

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Rationale

Project office is a significant slice of a spacecraft industrial cost

(Typical > 20%)

Its weight increases further considering actual Cost at Completion (schedule delays affect mainly the PO)

Importance of estimating the Project Office cost.

Models previously used were based on cost-to-cost relations at system level

with complexity correction factors

Need of a more detailed parametric model to define a reference manpower allocation to compare with industrial proposal

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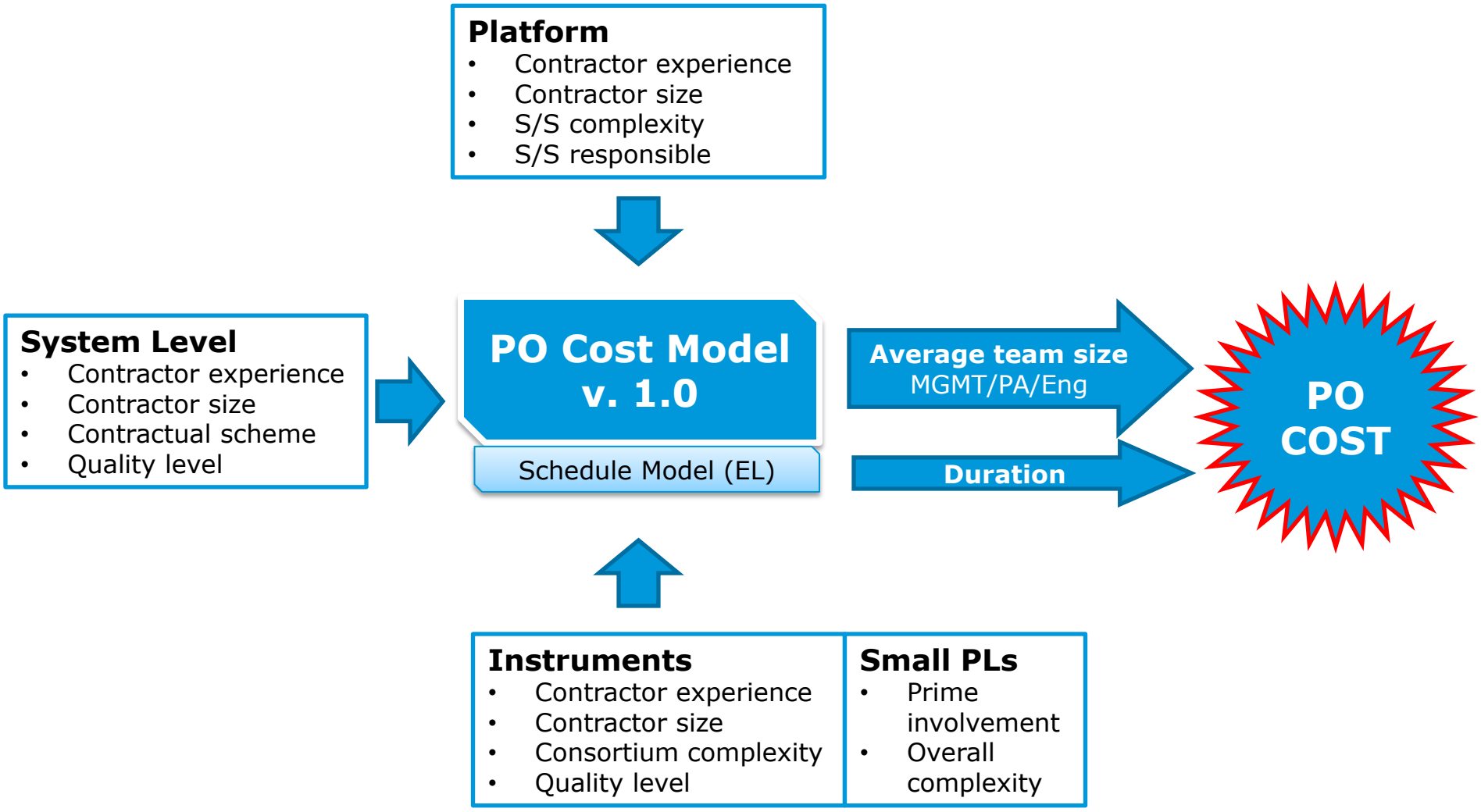
PO Cost Model Approach at a glance



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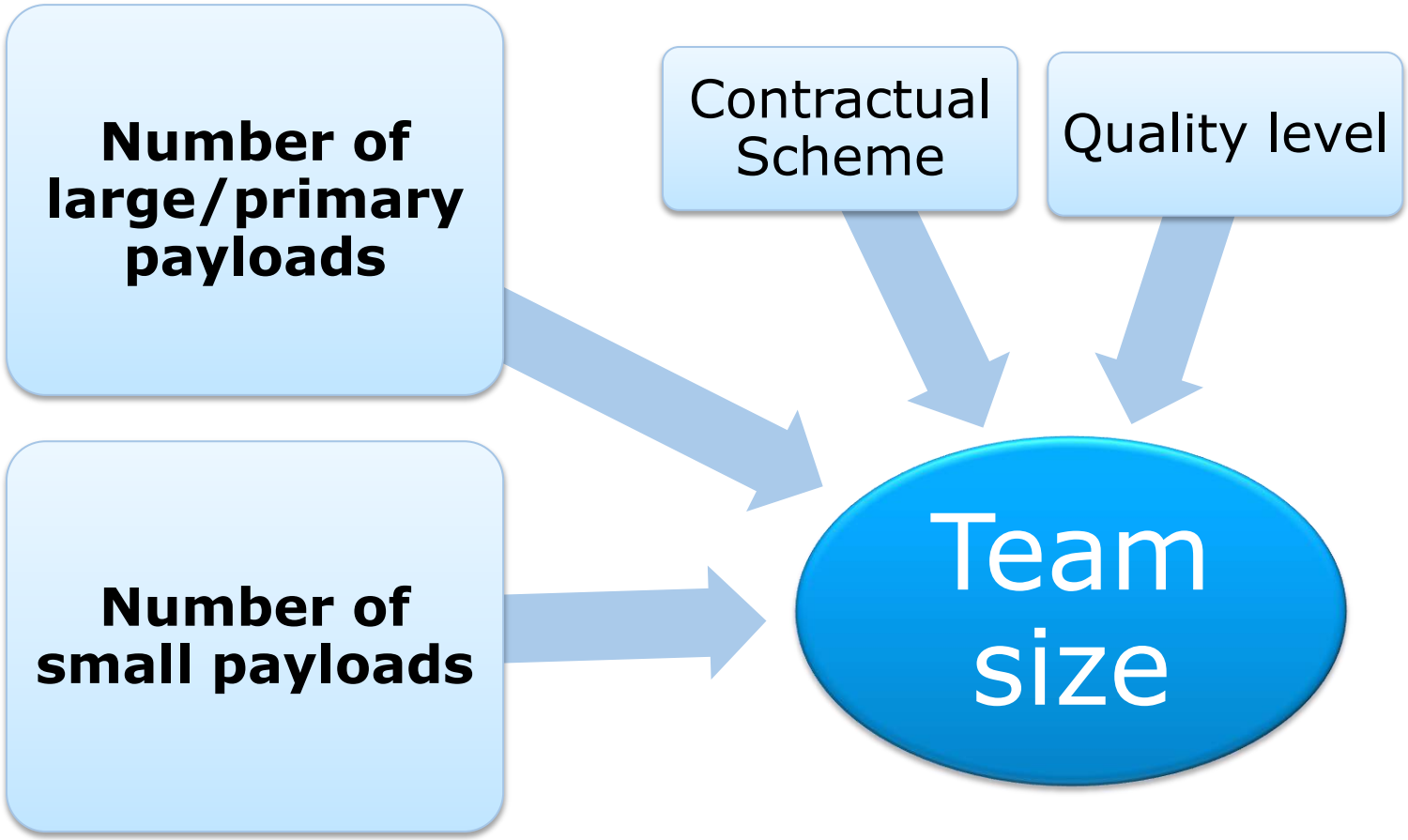
System Activities Concept
What influences team size?



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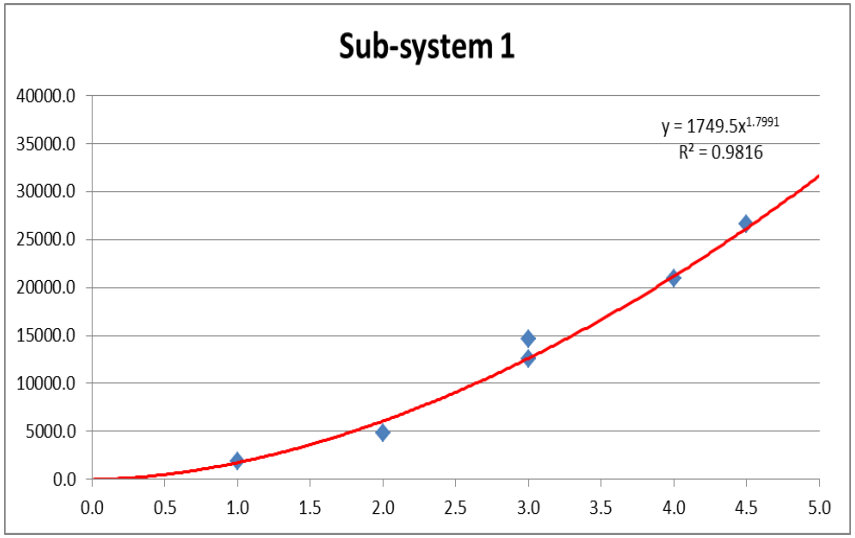
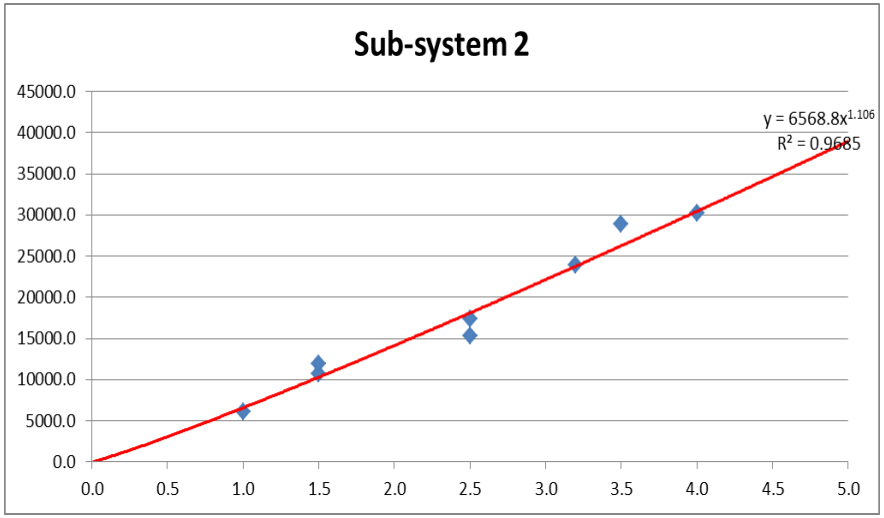
Platform S/S Engineering Model Concepts

The S/S engineering team sizes should be based on the total effort required by the design (hours) spread over the available S/S time span





This data allowed to establish parametric relationships for each S/S between the total hours for the detailed design of the S/S and its Complexity

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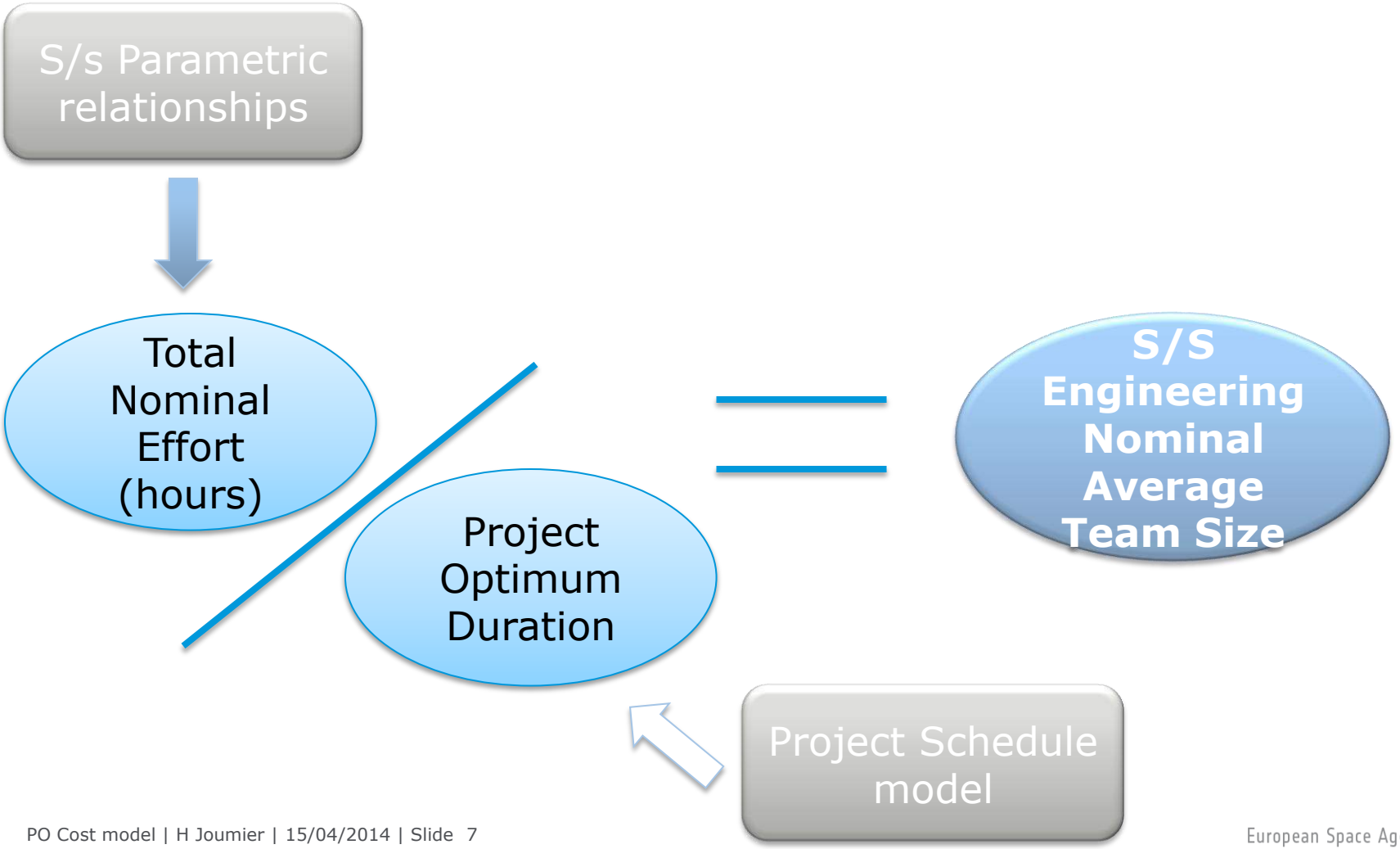
Platform S/S Engineering Model Concepts



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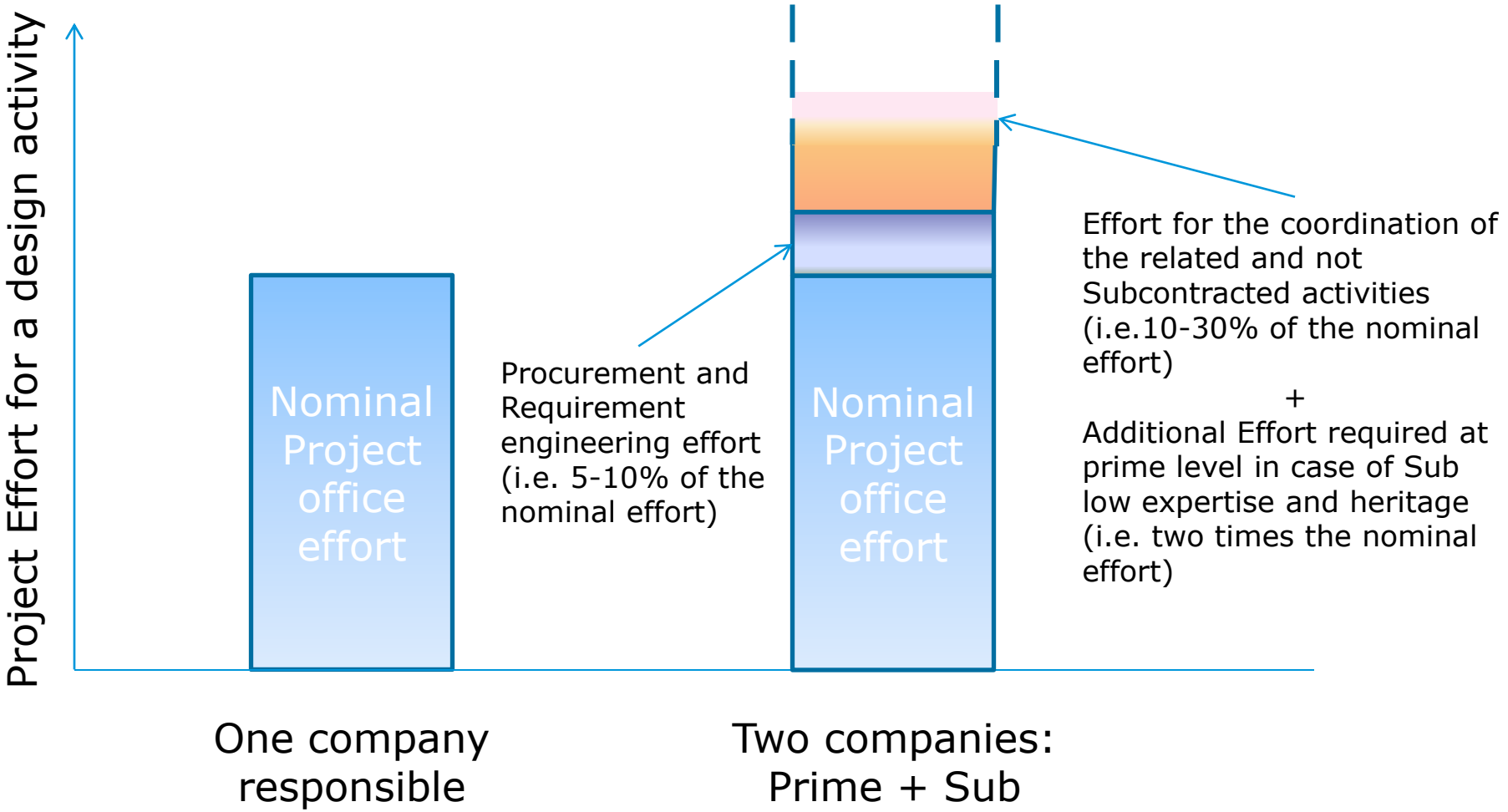
Sub Contractors Effect



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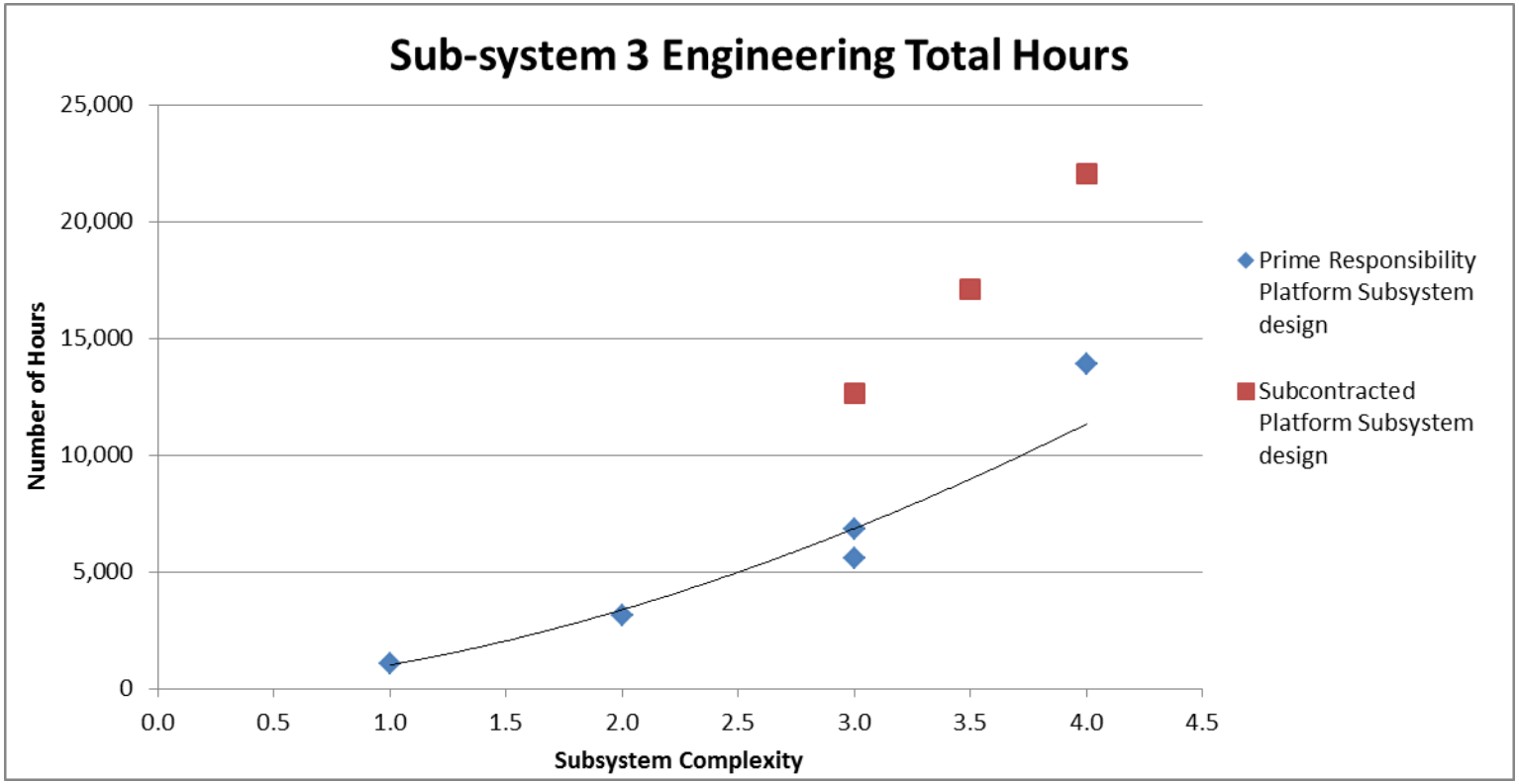
Subsystem Subcontracted example



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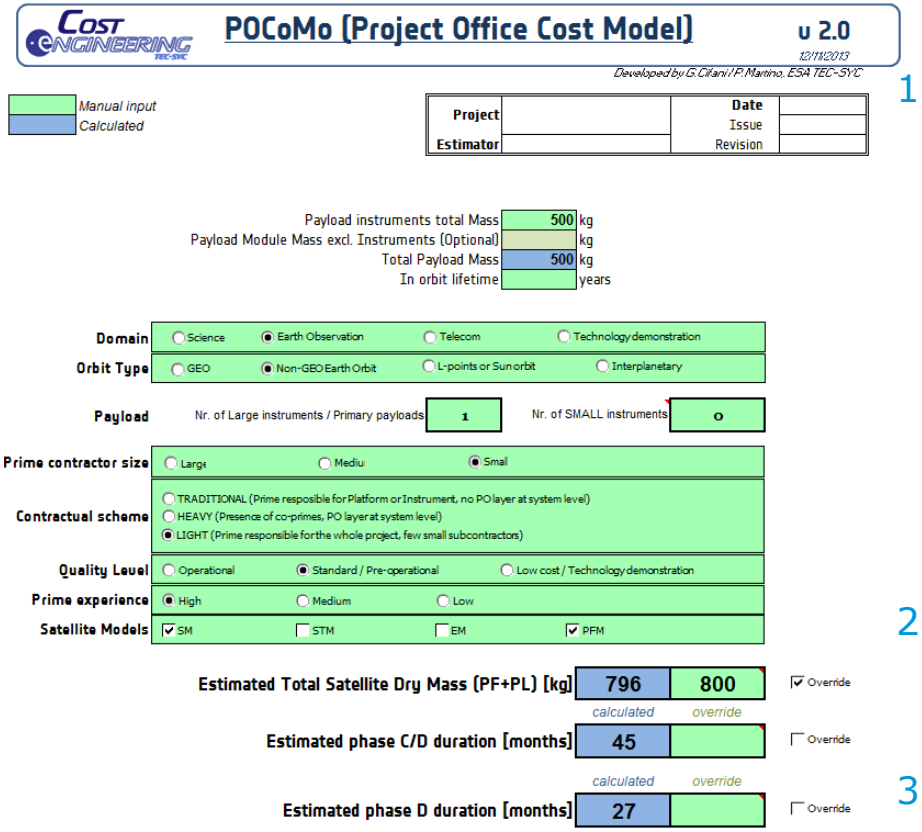
Main Menu



1. The user is driven through elementary choices covering the Project Office main cost drivers and modifiers such as:
   a. Domain, Orbit type
   b. Payload mass & characteristics
   c. Industrial team structure and experience
   d. Quality level and HW matrix
2. The model estimates the dry mass of the platform that provides an extensive parameter when needed.
3. The model performs an initial parametric estimate of the schedule duration to derive team sizes from man-hours

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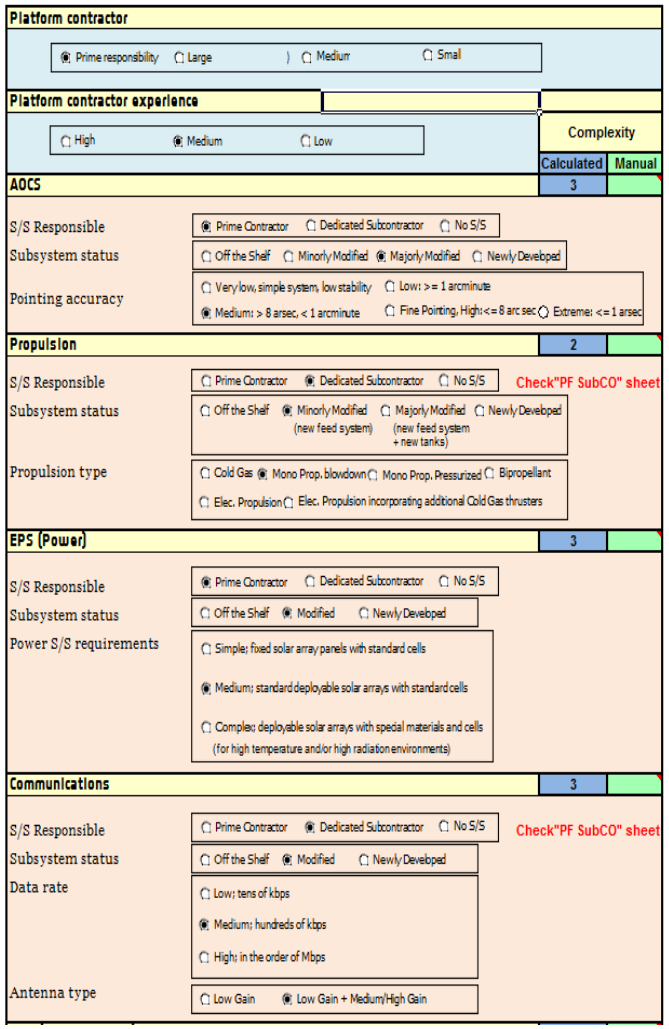
PF Complexity

Platform complexity

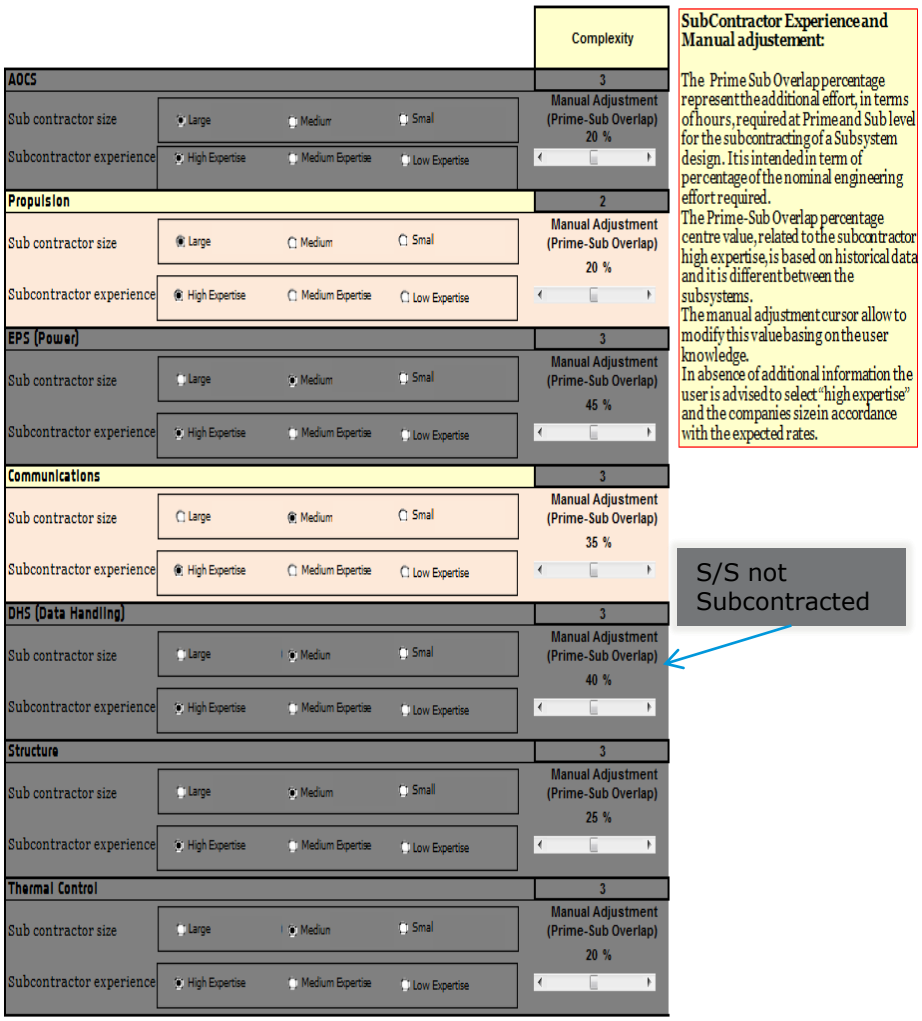


Subsystem status inputs refer to the subsystems as a whole, not to the individual equipment units.
A subsystem is only "**Off the Shelf**" if the equipment and subsystem design is completely recurrent. If all equipment is recurrent but the design/lay-out is new, the subsystem is "**Modified**".

Complexity ranges from 0 to 5:
0: None, sub-system not included
1: Simple, off-the-shelf subsystem
3: Standard, modified subsystem
5: State of the art, all equipment and subsystem design newly developed

1. Platform contractor is characterized
   a. Contractor size
   b. Contractor experience
2. Sub-systems "profiling" determines a complexity factor for each the S/s Project Office sizing (expressed in man-hours)
   a. Performance parameters
   b. Development status
3. Make-or-Buy decision is made on each of the sub-systems.
   a. Contractors of Procured Sub-systems are further qualified (see next page)

Sub Contractors



1. Greyed sub-system are directly handled by the Platform Prime contractor
2. Highlighted sub-systems are subcontracted with the following specifications:
    a. Sub-contractor size
    b. Sub-contractor experience
    c. Adjustment on the degree of overlap between the Platform prime and the sub contractor

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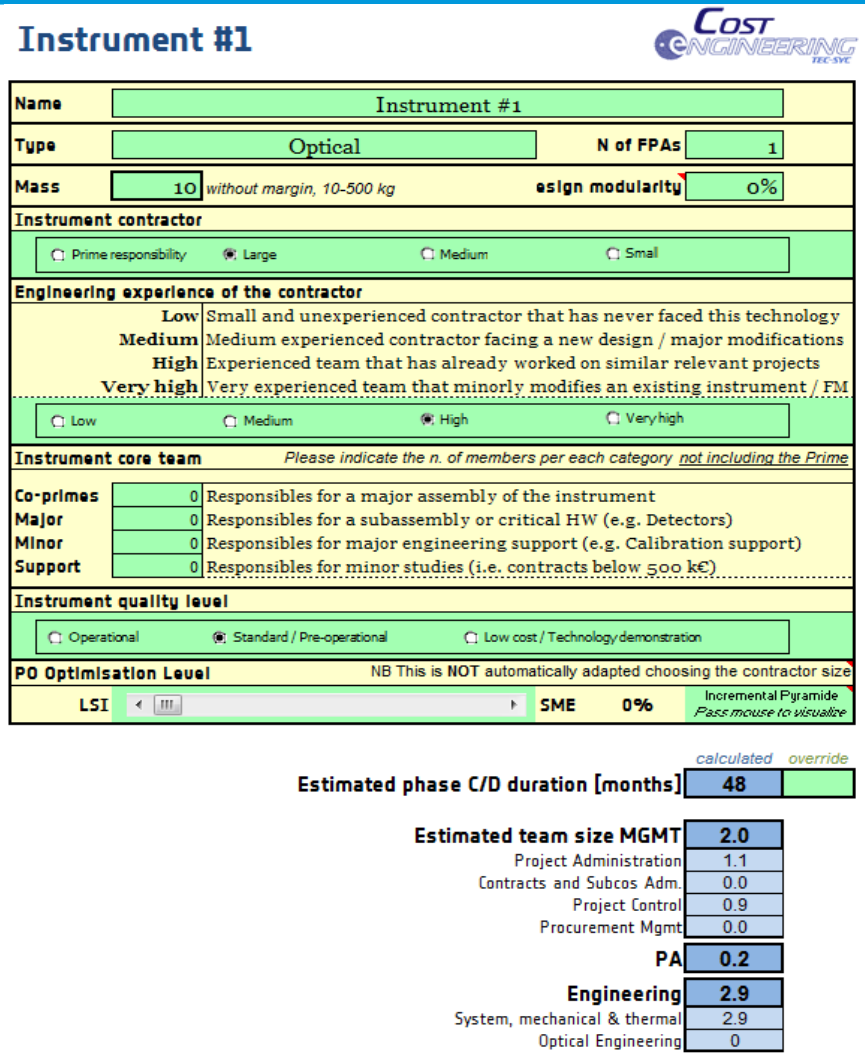
Major Instruments



Instrument #1

Name	Instrument #1		
Type	Optical	N of FPAs	1
Mass	10 *without margin, 10-500 kg*	esign modularity	0%

Instrument contractor

( ) Prime responsibility (•) Large ( ) Medium ( ) Small

Engineering experience of the contractor

Low	Small and unexperienced contractor that has never faced this technology
Medium	Medium experienced contractor facing a new design / major modifications
High	Experienced team that has already worked on similar relevant projects
Very high	Very experienced team that minorly modifies an existing instrument / FM

( ) Low ( ) Medium (•) High ( ) Very high

Instrument core team *Please indicate the n. of members per each category not including the Prime*

Co-primes	0	Responsibles for a major assembly of the instrument
Major	0	Responsibles for a subassembly or critical HW (e.g. Detectors)
Minor	0	Responsibles for major engineering support (e.g. Calibration support)
Support	0	Responsibles for minor studies (i.e. contracts below 500 k€)

Instrument quality level

( ) Operational (•) Standard / Pre-operational ( ) Low cost / Technology demonstration

PO Optimisation Level NB This is **NOT** automatically adapted choosing the contractor size

LSI ◂ ▸ SME 0% Incremental Pyramide *Pass mouse to visualize*

	calculated	override	
Estimated phase C/D duration [months]	48		☑ Override

Estimated team size MGMT	**2.0**
Project Administration	1.1
Contracts and Subcos Adm.	0.0
Project Control	0.9
Procurement Mgmt	0.0
PA	**0.2**
Engineering	**2.9**
System, mechanical & thermal	2.9
Optical Engineering	0

1. Project Office related to Main Instruments is also estimated based on:
    a. Instrument type, size, design repeat and modularity
    b. Instrument contractor experience and size
    c. Complexity of the Instrument Core Team
    d. Instrument Quality level
2. The model estimate the Project Office man-hours
3. The model provides an initial estimate of the schedule duration to determine Team size as a function of the man-hours

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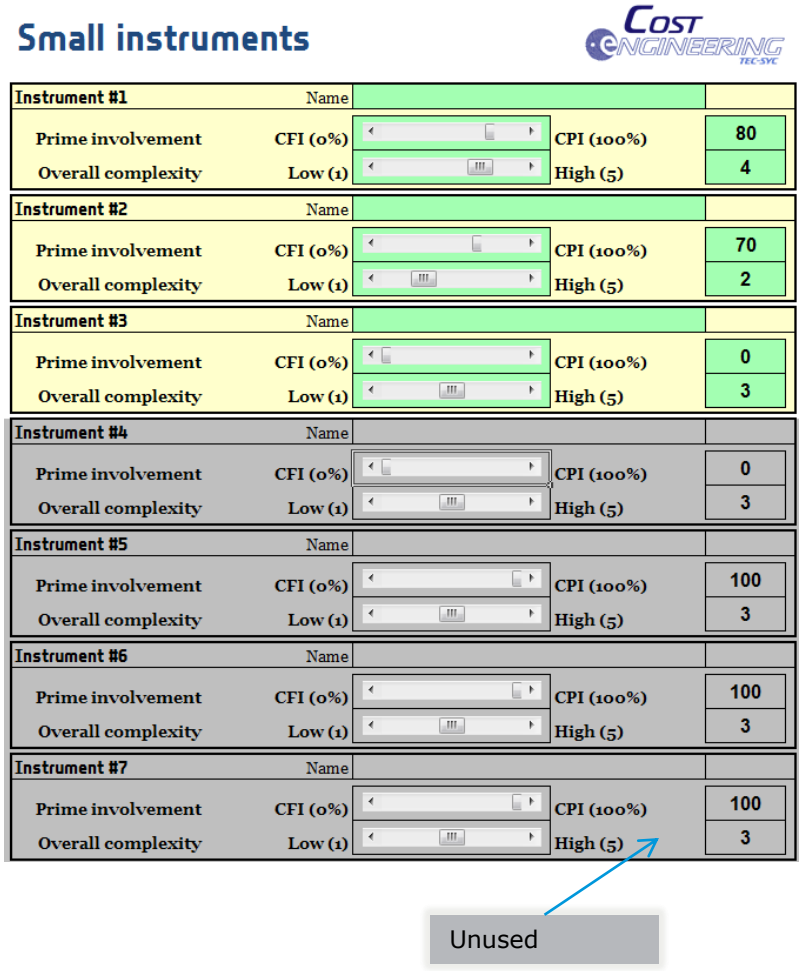
Small instruments



1. The secondary payloads (expected to be small instruments) are also identified and taken into account to adjust the Prime contractor Project Office sizing. The main parameters considered are:
2. The level of Prime Contractor involvement
    a. CFI : Company Furnished Instrument. The effort is limited to the I/F management and integration onto the Platform
    b. CPI: Company Procured Instrument. The Prime contractor holds the full responsibility for the development and integration of the Instrument.
3. The complexity of each of the Instruments

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Results screen

POCoMo Class 4 Results

COST ENGINEERING TEC-SYC

	Team Size (calculated / override)	Rate [€/h] (calculated / override)	Total Hours [h]	Total Cost [k€]	E.C. 2013
System Level	Resp: PRIME	Phase C/D duration: 45 months		Delay [months]	
Management	3	130	18,150	2360 k€	
Project Administration	1.1				
Contracts	0.6				
Project Control	0.8				
Procurement Mgmt	0.5				
Product Assurance	1.5	115	9,040	1040 k€	
Engineering	2	115	12,090	1390 k€	
Total PO			39280	4790 k€	
Satellite AIT	15.5	115	56,460	6500 k€	
AIT Coordination	4.2		15410.0		
SM/STM AIT	2.3		8290.0		
EM AIT	1.8		6420.0		
PFM AIT	7.2		26340.0		

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Further Development

- Recurring Satellites and Constellations PO estimation capability;
- Class 5 model definition for very early design phases;
- Further develop AIT activities

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Questions?

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