Solar Orbiter Programme Update

March 2012

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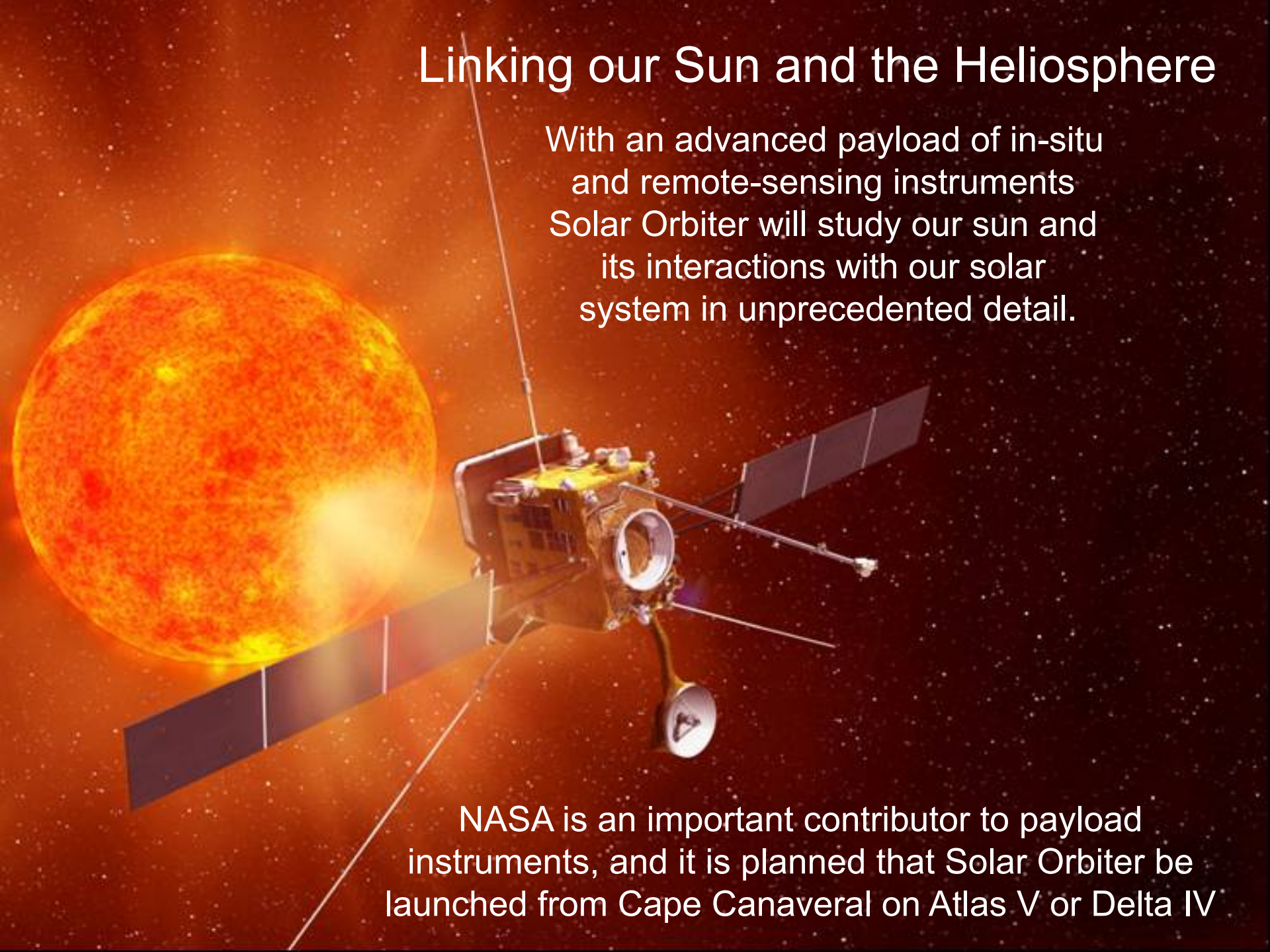
Linking our Sun and the Heliosphere

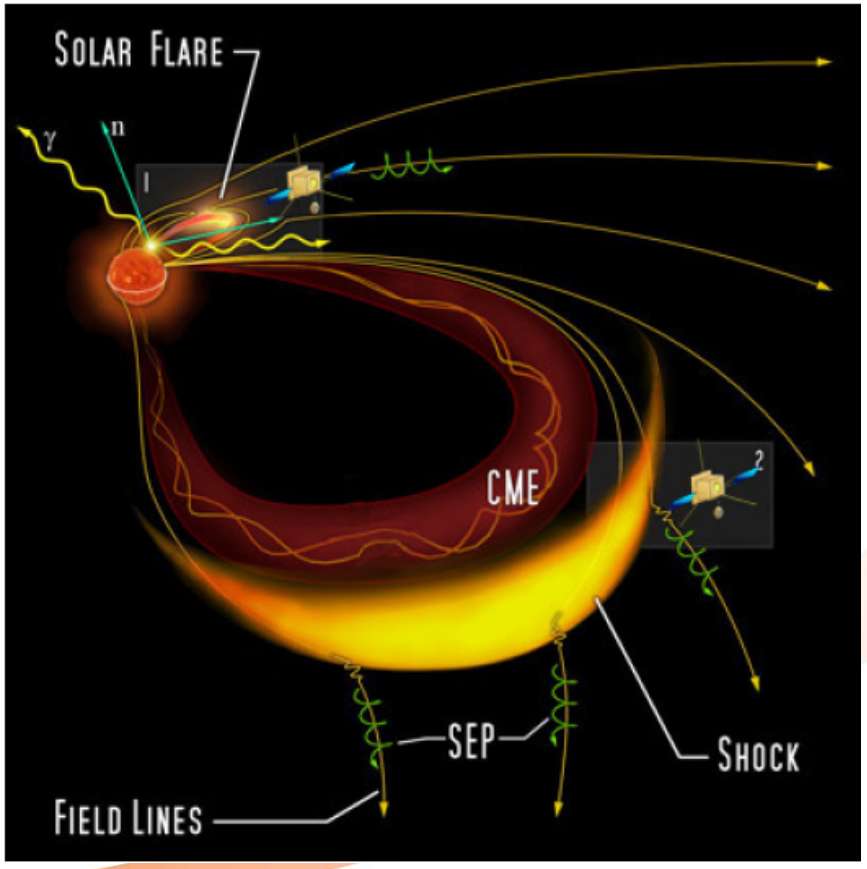
With an advanced payload of in-situ and remote-sensing instruments Solar Orbiter will study our sun and its interactions with our solar system in unprecedented detail.



NASA is an important contributor to payload instruments, and it is planned that Solar Orbiter be launched from Cape Canaveral on Atlas V or Delta IV

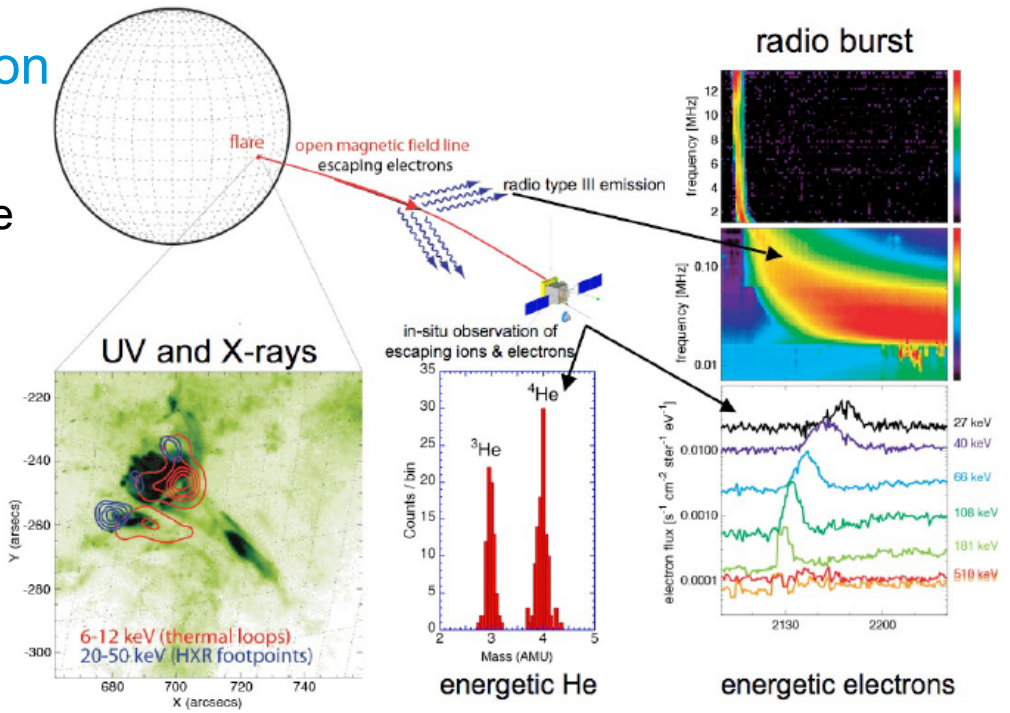
The Solar Orbiter Mission

- Unique combination of remote sensing and in-situ instruments on one spacecraft
  - Link heliospheric phenomena to their source regions on the Sun
- Remain in near co-rotation with the Sun
  - Allows the remote sensing instruments to observe a single feature on the Sun as it evolves over one solar rotation
- Observations out of the ecliptic plane
  - Allows the study of solar phenomena at latitudes previously not encountered

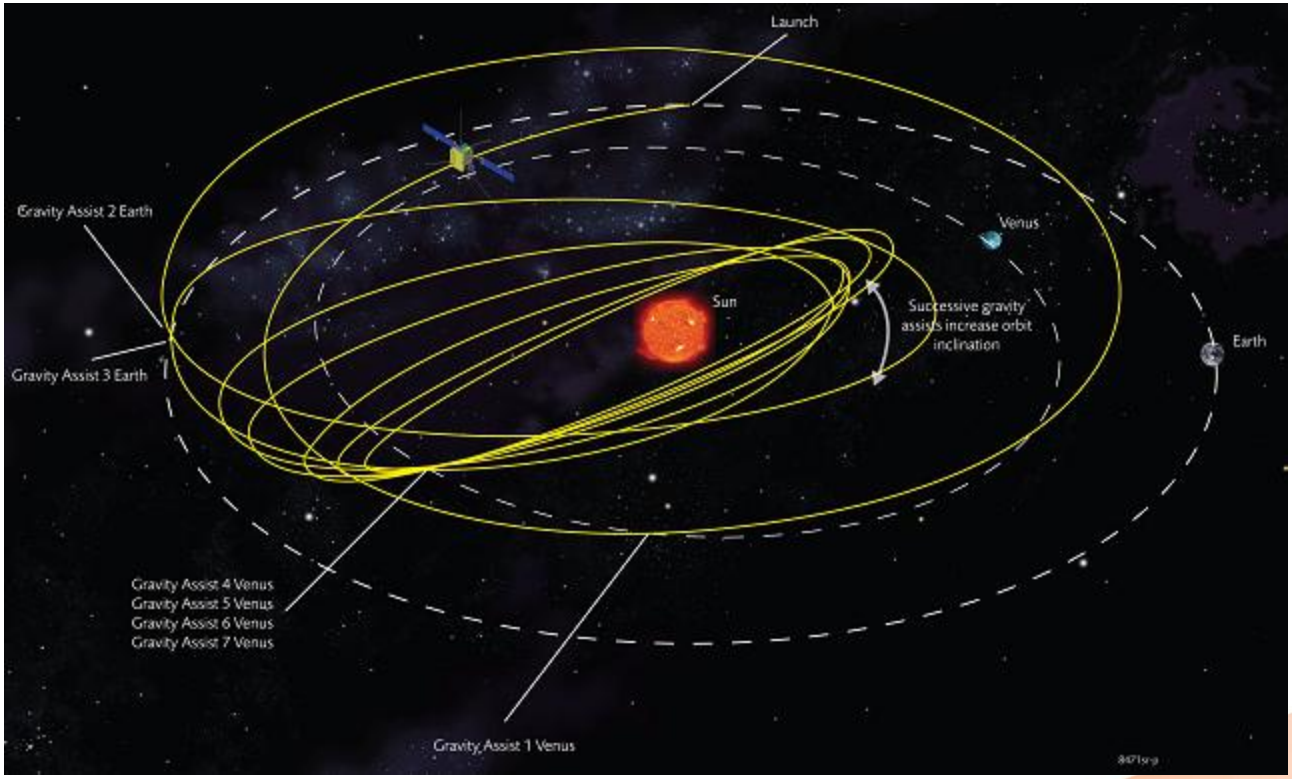


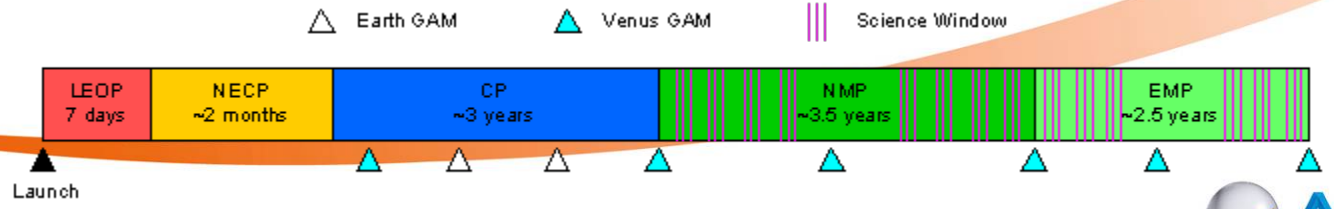
The Solar Orbiter Mission

- Solar Orbiter Objectives
  - Origins of solar wind plasma and magnetic field
  - How solar transients drive solar variability
  - How solar eruptions produce energetic particle radiation
  - How the Solar dynamo works and drives connections between Sun and heliosphere
- Remote sensing instrumentation
  - Study surface of the Sun via imaging and spectroscopy in X-ray, visible and UV wavelengths
  - Flares, Coronal Mass Ejections (CME)
  - Solar Magnetic Fields
- In-situ instrumentation
  - Heliospheric magnetic field
  - Particle environment
  - Radio emissions



Schematic of Science Orbit





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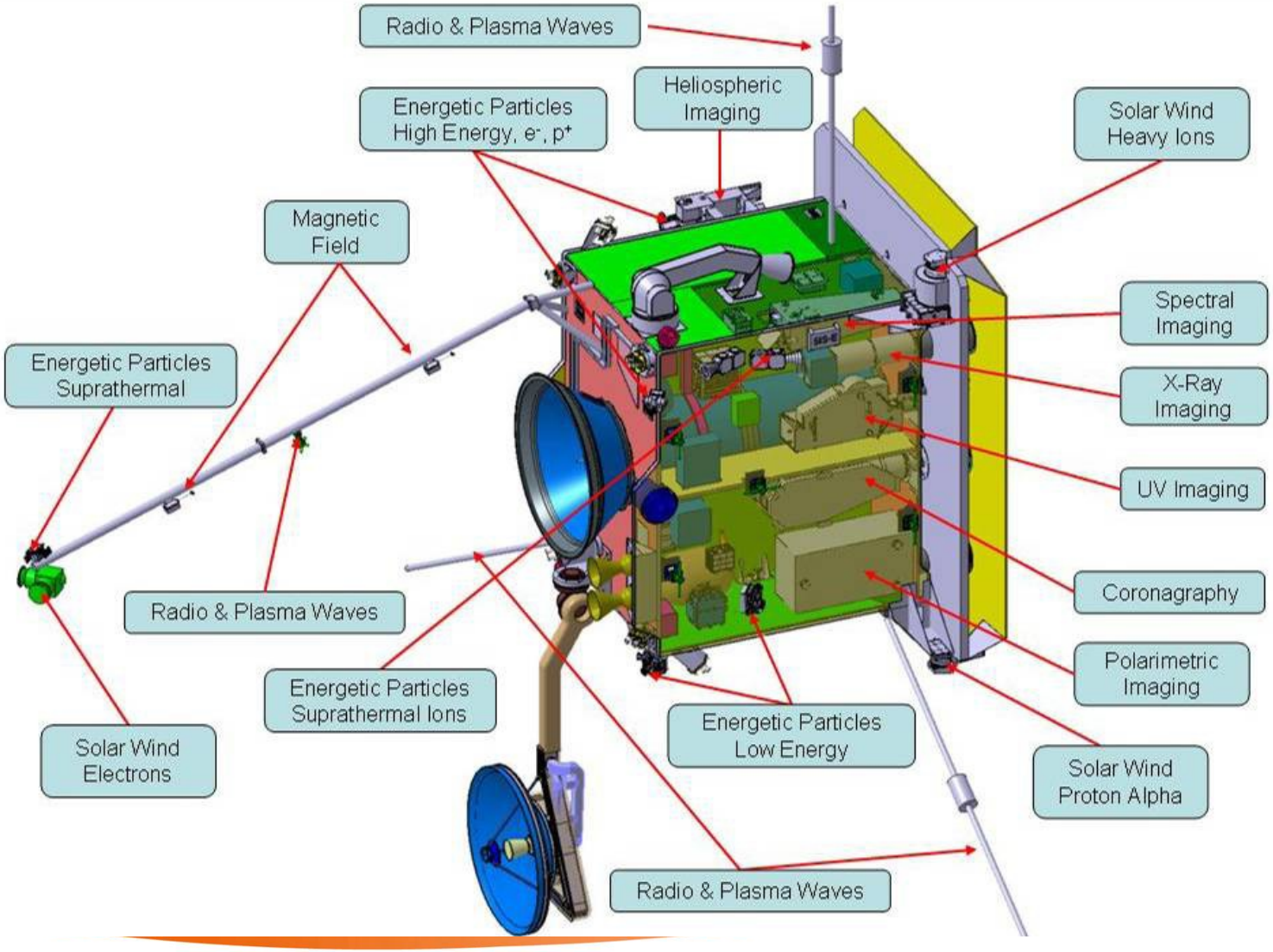
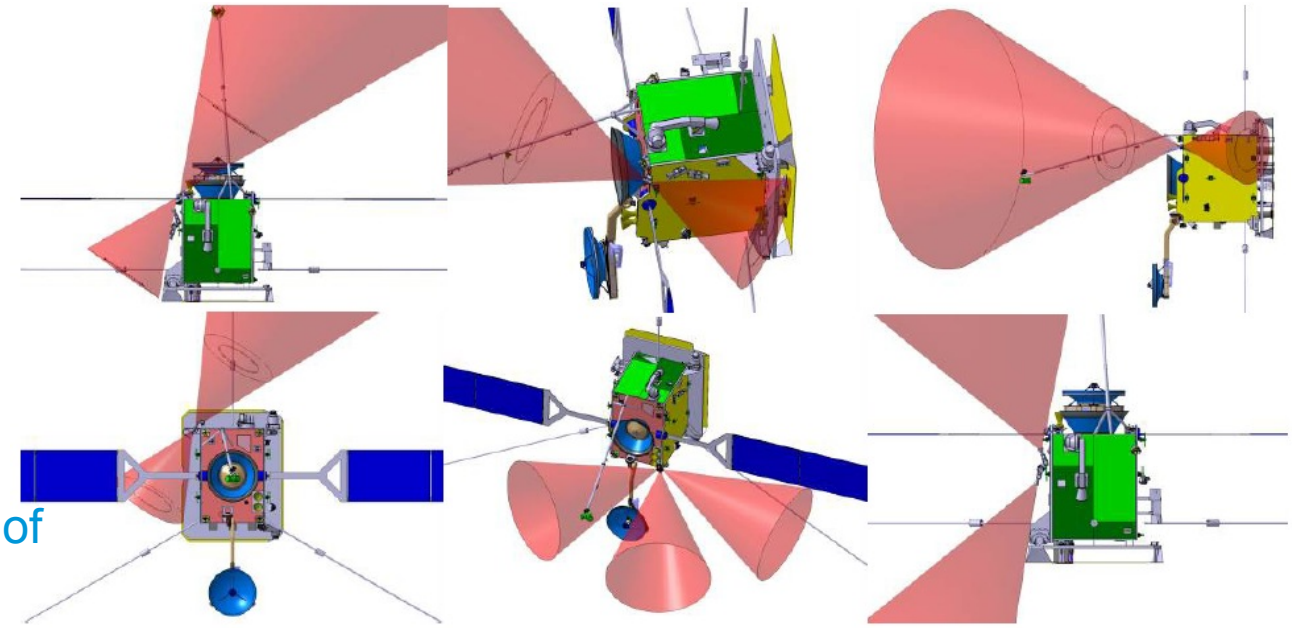
The Solar Orbiter Payload

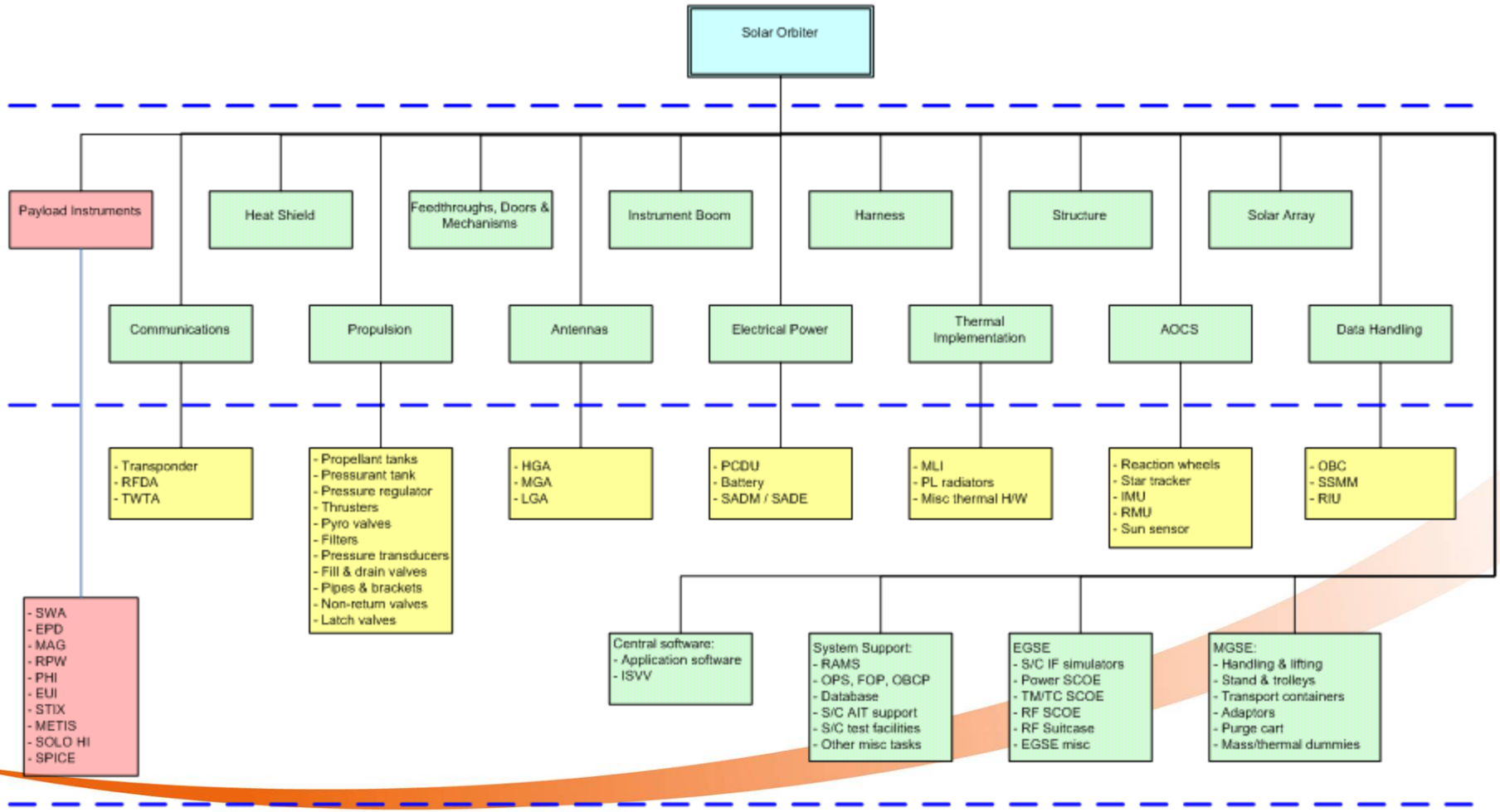


Challenges of the Mission

- 37 unobstructed fields of view
- Stringent EMC requirements from the in-situ instruments
- Strict cleanliness requirements of the remote sensing instruments
- Pointing requirements of the remote sensing instruments



Solar Orbiter Product Tree



Geo-return Requirements

- Geo-return requirements have been specified by ESA
- Cumulative geo-return in France, Germany, Italy and UK is to be <50% with German return limited to a maximum of 10%, French return limited to a maximum of 2% and UK return to be maximised
- “Strategic Initiative” to redress the geo-return of Austria, Denmark, Finland, Ireland, Norway, Sweden and Switzerland at Agency level
- “Special Measures” to redress the geo-return of Greece & Portugal

Country	Geo-return
Austria	2.30%
Belgium	4.50%
Czech Republic	> 2%
Denmark	3.80%
Finland	2.50%
France	< 2%
Germany	< 10%
Greece	> 2%
Ireland	2.10%
Italy	(see note)
Luxembourg	> 2%
The Netherlands	5.50%
Norway	4.00%
Portugal	1.70%
Spain	12%
Sweden	5.10%
Switzerland	4.50%
United Kingdom	(see note)

Programme Status

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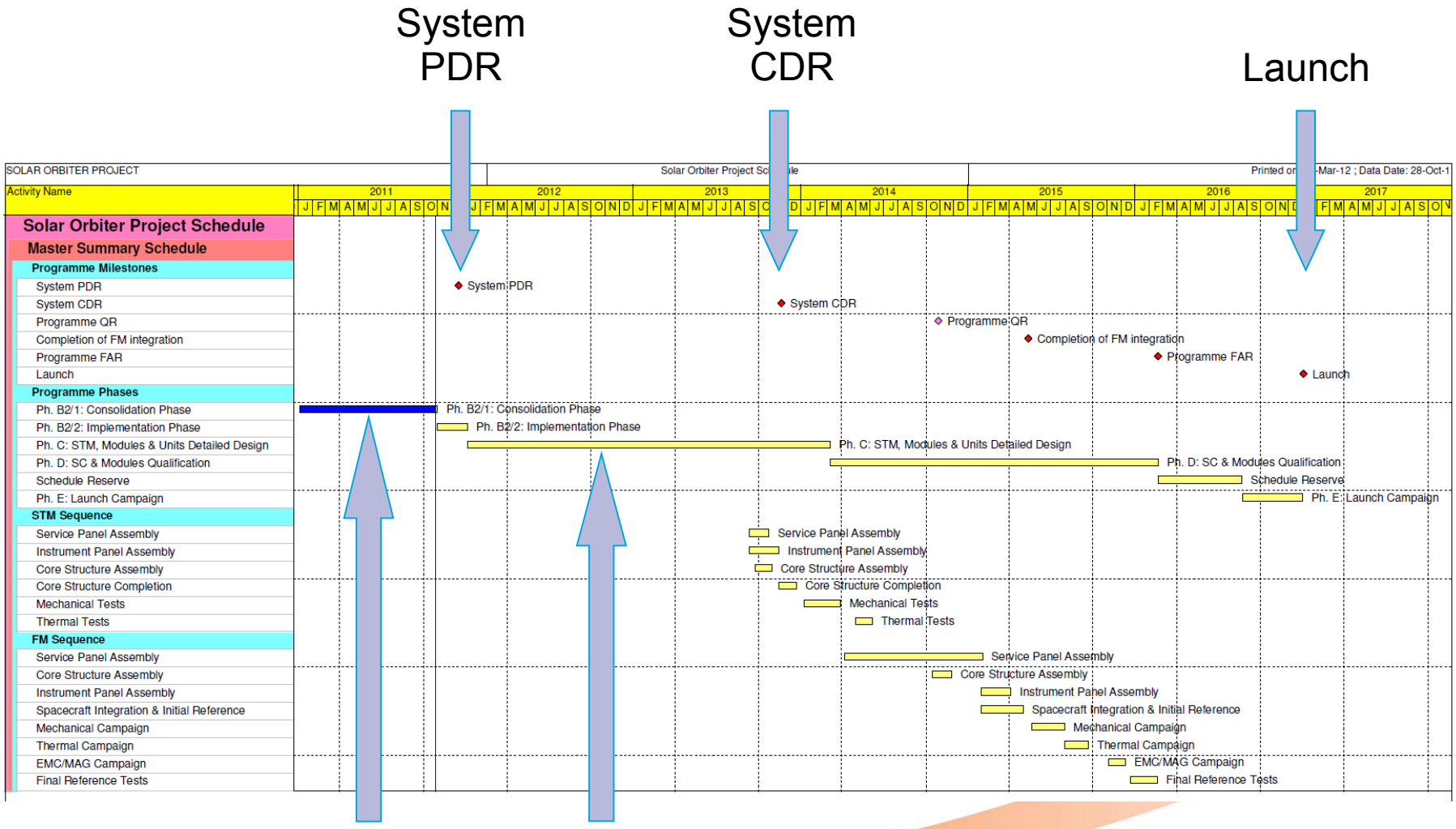

Industrialisation Status (1)

SubSystem	Procurement	Status	Company
Antennas	Subsystem lead	Kicked Off	Sener
	Antenna Reflector Assembly	Under Negotiation	
	DC-DC converters	Under Negotiation	
	Ti parts	Under Negotiation	
	Rotary Joint	Under Negotiation	
	MGA - RFA	Under Negotiation	
	HGA - RF Chain	Under Negotiation	
AOCS	Subsystem Lead	Kicked Off	OHB-Sweden
	Tech support	Kicked Off	Tessella
	Reaction wheels	Under Negotiation	
	Star tracker	Under Negotiation	
	IMU	Under Negotiation	
	Sun sensor	Under Negotiation	
	AOCS Software	Under Negotiation	
Communications	Subsystem Lead	At TEB	
	DST	At TEB	
Data Handling	OBC	Kicked Off	RUAG Sweden
	SSMM	Under Negotiation	
	RIU	At TEB	

Industrialisation Status (2)

SubSystem	Procurement	Status	Company
Feedthroughs, Doors & Mechanisms	Subsystem lead	Kicked Off	Sener
	Ti Machining	Kicked Off	Active Space
Heatshield	Subsystem lead	Kicked Off	TAS-I
I-Boom	Subsystem Lead	Under Negotiation	
Propulsion	Subsystem Lead	Kicked Off	Astrium Ltd, OHB-S
	Propellant tank	Kicked Off	MTSP
	PMD	Kicked Off	Astrium SAS
Solar Array	Subsystem Lead	Kicked Off	Astrium GmbH
Structure	Subsystem Lead	Kicked Off	RUAG CH
Thermal	Subsystem Lead	Under Negotiation	
	MLI & EEE	Under Negotiation	
EGSE	TMTC SCOE	Kicked Off	SSBV
	Power SCOE	At TEB	
	CCS	Under Negotiation	
	RTE - SimFE	At TEB	
	RTE - Models & drivers	At SPB	
MGSE	Transport Container	At TEB	

Forthcoming Procurements

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Subsystem / Grouping	Procuring Company	Equipment
Antennas	Sener	Thermal Hardware Low-Gain Antenna
AOCS	OHB Sweden	.
Communication	To be announced	TWTA RFDA
Data Handling	Astrium Ltd	.
Electrical Power	Patria	Solar Array Drive Assembly (SADM & SADE) Battery
Facilities	Astrium Ltd	S/C Solar Simulation Test
Feedthroughs, Doors & Mechanisms	Sener	.
Heatshield	TAS Italy	.
I-Boom	To be announced	.
Propulsion	OHB-Sweden	Pressurant Tank Pressure regulator Pyro Valves Filters Pressure Transducers Fill & Drain Valves Non-return valves

Subsystem / Grouping	Procuring Company	Equipment
Software	Astrium Ltd	CSW - Applications SW ISVV
Solar Array	Astrium GmbH	.
Structure	RUAG CH	.
Thermal	To be announced	Payload radiators
EGSE	Astrium Ltd	RF SCOE S/C IF Sim RF Suitcase Miscellaneous EGSE items
Harness	Astrium Ltd	Harness
MGSE	Astrium Ltd	Lifting & Handling Adaptors Stands & Trolleys Mass/Thermal Dummies Purge Cart
Support Contracts	Astrium Ltd	RAMS Support Operations support Flight Op, OBCPs Database support Other systems support AIT support (up to 4 packages)

Indicative schedule for procurements

We can advise on specific enquiries, **but please watch EMITS**

- Key ITTs are due for issue in next 4-6 months
- April
  - Harness; Spacecraft Interface Simulator; Battery
- May
  - CSW (Application SW); ISVV; SADA; RF Suitcase; MGSE Items (Stands, Trolleys, Adaptors)
  - RF SCOE will be May or later
- June
  - System Support Frame Contracts; MGSE – Thermal Dummies
- September
  - MGSE – Purge Cart

Contractor Selection Process

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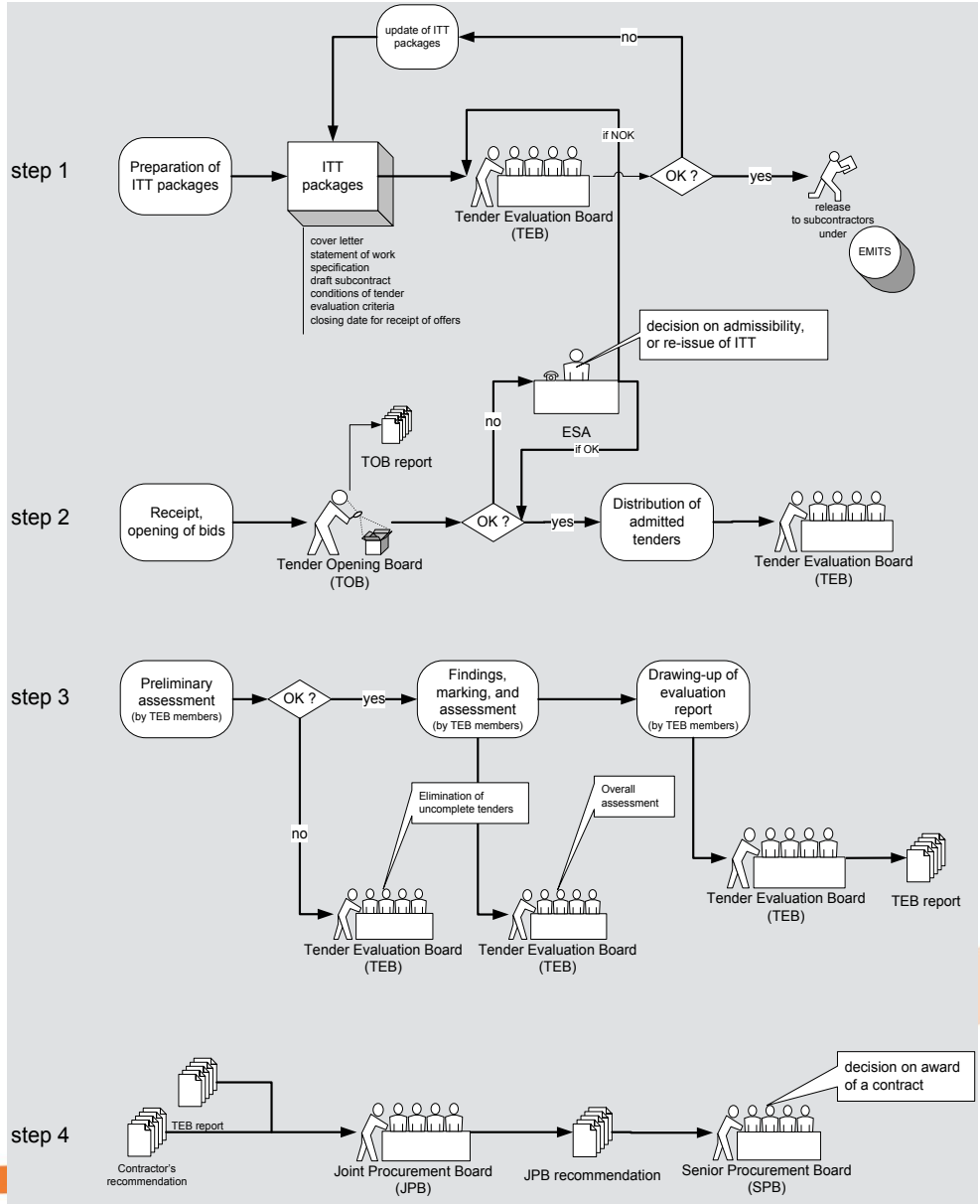
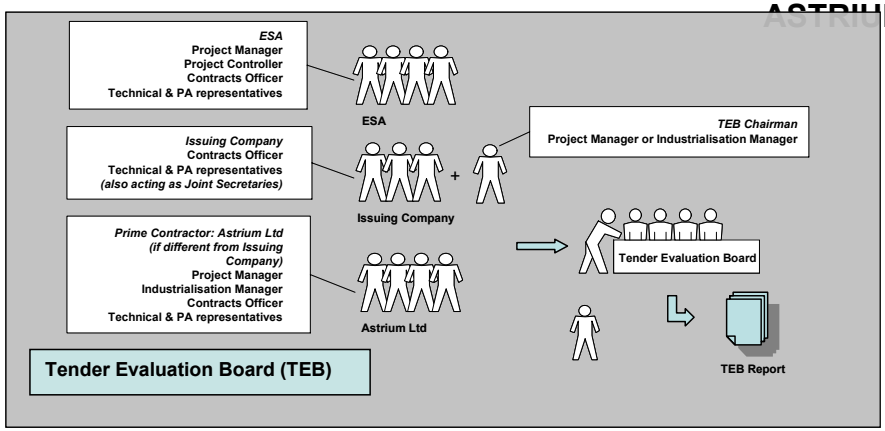
Contractor selection process

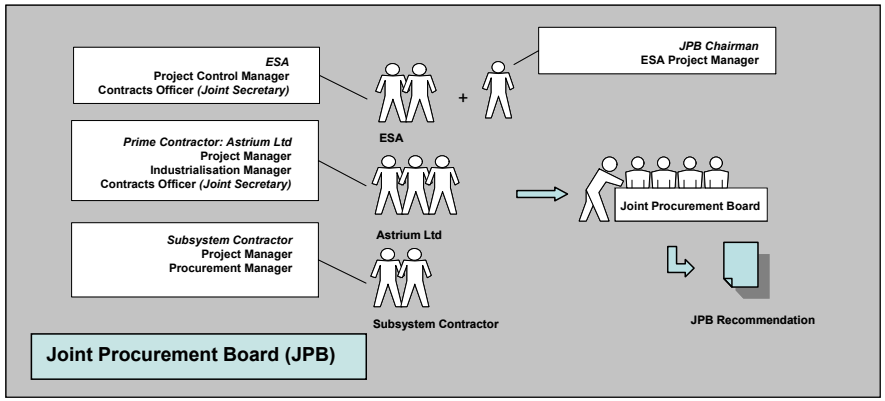
- ESA “Best Practices”
- Step 1 is ITT review, approval and release on EMITS
- Step 2 is opening and distribution of received bids
- Step 3 is tender evaluation by the TEB
- Step 4 is JPB/SPB decision on contract award

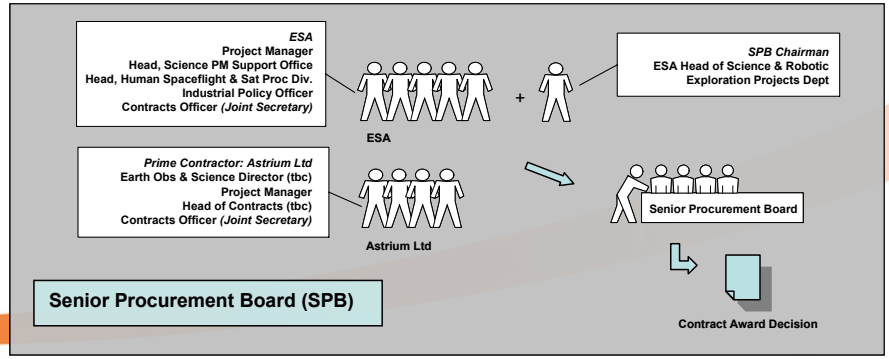


Tender Evaluation and Procurement Board Members

- The “Issuing Company” prepares the ITT
- “Issuing Company” is either the Prime or the Subsystem Contractor
- The Issuing Company is excluded from the TEB if intending to bid in response to an ITT/RFQ







Subcontractor selection process: typical durations

Steps in the selection process	Typical Duration	Explanation or comment
Draft ITT datapack available		
Review by TEB	2 to 3 wks	More than one iteration may be required
TEB meeting		Objective is to authorise release of ITT
ITT datapack update	1 to 2 wks	To implement final changes and upload into EMITS
ITT release on EMITS		Assumed to take place immediately after datapack update
Proposal preparation	6 to 8 wks	Could be extended up to 10 weeks for complex procurements
TOB and TOB report		Report to be issued on the day of the TOB
TEB kick-off and proposal evaluation	1 wk	Time to evaluate TOB report and arrange kick-off mtg
Proposal evaluation by TEB	3 to 4 wks	
TEB report available		Assumed to be issued immediately after final TEB mtg
JPB meeting and recommendation	2 to 4 wks	Assumption is one JPB mtg every 4 weeks
SPB decision for contract award	1 to 2 wks	Assumption is one SPB mtg every 4 weeks
Negotiations		Could be several iterations before final agreement
Subcontractor kick-off		Actual date of KO will depend on overall schedule need

Total throughput time: 4-6 months

Lessons Learnt

Lessons Learnt

- Companies in smaller countries have been successful in obtaining work on Solar Orbiter
  - And we expect more to be so as current negotiations are completed
- Teaming with subsystem leaders has been an entry-point
  - Although ESA & Astrium have not imposed specific requirements in ITTs, assisting ESA in achieving geo-return is a competitive motivation for such bidders
  - We will continue to encourage opportunities under Prime, subsystem & AIT not specifically identified in the procurements list
- Visibility on EMITS is important
  - By registering your desire on EMITS to be a subcontractor for a procurement, you are pressuring the lead bidders to show that they have considered all teaming / subcontracting options.
  - If you don't register, then that visibility and pressure are lost
- Be "pushy" and make bids
  - It sounds trivial, but without bids there will be no contracts