EUV Imaging Spectrometer

June 99, BC

A System View of EIS

Matthew Whyndham, MSSL

Hirohisa Hara, NAOJ

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Outline

- MWT
  - The core technical requirements
  - EIS subsystems (components) + documents
  - EIS interfaces
  - Flow of interface information
  - Status of the subsystems
  - EIS Development Schedule
  - Mass Budget
  - Power Budget
  - Envelope
  - Data flow – sensors to ground
- HH
  - The Solar-B Spacecraft and its environment
  - EIS interface information report (to MELCO)
  - Spacecraft Development schedule

Core Technical Requirements

Essential ... we must achieve these:

- Deliver Science
- Conform to Spacecraft Accommodation
- Feasible design (cost, schedule and risk)

Desirable: these factors are to be considered where possible:

- enhancements to science return
- technology development (strategic directions)
- nice ideas

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Science Requirements

	Requirement	Value	Priority
1	Modes	Slit spectroscopy Secondary: Monochromatic imaging, movies …	
2	Wavelength Range	1. 250-290 Å 2. 170-210 Å	
3	Temporal Resolution	commensurate with evolution of features Control of exposure time is required	
4	Spatial Resolution	< 2 arc sec	
5	Spectral Resolution	< 20 km/s per pixel = 0.0203 Å per pixel	
6	Field of View	Spectroscopy : 4’ × 4’ (scanned) Imaging: 4’ × 2’ × 2 fields	
7	Sensitivity	Maximum Throughput ~ 0.5 cm^2 at 270 Å	
8	FOV misalignment	TBD arcsex	
9	Alignment measurement	TBD arcsec	
10	Pointing (scanning)	TBD fraction of EIS pixel	

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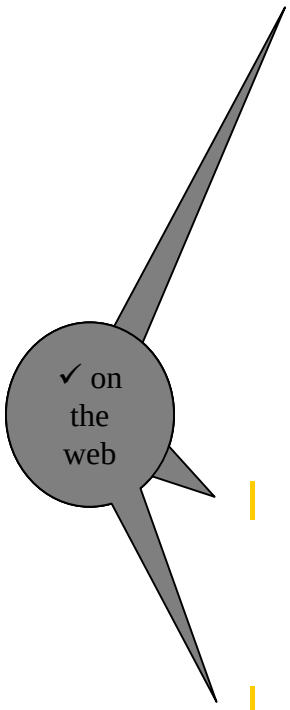
EIS Subsystems - Components

- A definitive list of subsystems is given in the "System Hierarchy" document : *EIS-sys-des-hierarc* - e.g. hierarc3.pdf

  Is there a document which explains the nature of each subsystem in relation to the whole and the functionality of each element and the responsibility for its design and manufacture? - NO, not yet !



- But see "System Hierarchy" and "Master Interface List" *EIS-sys-des-mintlist*
- The system block diagram is "EIS Physical View" *EIS-sys-des-physview*
  - This diagram does not show any dimensions
- These are core documents and will be maintained

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System Hierarchy

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Title	System Hierarchy
Doc ID	EIS-sys-des-hierarc
Ver	4
Author	Matthew Whyndham
Date	13-Jun-99

Instruments	Mnemonic	Group	Element Name	Components	Components	WBS code	Remarks	Institute	spacecraft interfaces mech.	thrml.	elec.	ICU interface (e)
	STR	**Spectrometer**					***Out in space***	**(all)**	**x**	**x**		**x**
	ENC		Structure			1100		BU		x		
	BFn		Baffles									
	LOK		Launch Lock			1100		BU	x	x		x
	RAD		Radiator			1922		BU		x		
	DOR		Door Assy			1200		BU		(x)		
	CLM		Clamshell									
	FFA		Front Filter Assembly			1410		NRL				
	FPF		Focal-plane Filter Assembly									
	MIR		Mirror Assy			1300		NRL				
				Mirror		13xx						
				Scan Mech		13xx						x
	SLA		Slit Assy			1500		NRL				
				Mechanism		15xx						x
				Slit								
	GRA		Grating Assembly			1300		NRL				
	SHT		Shutter Assembly			1600		MSSL				
				Motor								
				Encoder								
				Vane								
	FPA		Focal Plane Assembly			1700		MSSL		((x))		
	QCM		Contamination Monitor			1800	*Quartz Crystal Microbalance*	RAL				
	MHC		Mechanism/Heater Controller			1d		?	?	?		x
	MLI		Multilayer Insulation			1912						
	HAR	**Harness**				1B00	***Connects STR and ICU***	**MSSL**	**x**	**x**		**x**
			connectors			1Bxx						x
			cables			1Bxx			x	x		
	PUR	Purge Harness				1e						
	ICU	**Instrument Control Unit**				1A00	***Situated in the electronics compartment***	**MSSL**	**x**	**x**	**x**	
			Housing			1a20			x	x		
			Power Conditioning			1a30					x	
			Data Processing			1a40, 1a80						
			Science / HK interface			1a50, 1a60					x	
			Command Interface			1a50					x	
			Test Interfaces			1a40						
			HCU interface			1a40						
			Mechanism Power			1a30					x	
			Mechanism Control			1a70						
			Camera Interface			1a40						

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EIS Interfaces

- Flight Equipment
  - External - with spacecraft
  - Internal - between components
  - Internal - same institute
  - Test / GSE - non-flight configuration
- Ground Segment

  similar breakdown ...
- Master Interface List only shows Flight (External, Internal)
  - Test and Ground Segment interfaces not shown

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Master Interface List

Title	Master Interface List
Doc ID	EIS-sys-des-mintlist
Ver	2
Author	Matthew Whyndham
Date	27-May-99

See "System Hierarchy" for explanations of acronyms
EIS-sys-des-hierarc (iss 3)

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	I/F TY	Item	Item	Provider	Responsible Engir	Item 2	Item	Provide	Responsible Enginee
1020	MT	STR	Structure	BU	Saad Mahmoud	DOR	Door	BU	Saad Mahmoud
1030	M	STR	"	BU	Saad Mahmoud	"Optics"		NRL	Clarence Korendyke
1031	MT	STR	"	BU	Saad Mahmoud	MIR	Mirror	NRL	Clarence Korendyke
1032	MT	STR	"	BU	Saad Mahmoud	GRA	Grating	NRL	Clarence Korendyke
1041	MT	STR	"	BU	Saad Mahmoud	FFA	Front Filter	NRL	Clarence Korendyke
1042	MT	STR	"	BU	Saad Mahmoud	FPF	Rear Filter	NRL	Clarence Korendyke
1050	MT	STR	"	BU	Saad Mahmoud	SLA	Slit Assy	NRL	Clarence Korendyke
1060	MT	STR	"	BU	Saad Mahmoud	SHT	Shutter	MSSL	Wilf Oliver
1070	MT	STR	"	BU	Saad Mahmoud	FPA	Focal Plane	MSSL	Chris McFee
1080	MT	STR	"	BU	Saad Mahmoud	QCM	Quartz Contamination M	RAL	Jim Lang
1091	MT	STR	"	BU	Saad Mahmoud	MLI	Multilayer insulation	BU	Saad Mahmoud
1092	MT	STR	"	BU	Saad Mahmoud	RAD	Radiator	BU	Saad Mahmoud
10B0	MT	STR	"	BU	Saad Mahmoud	HAR	Harness	MSSL	Alec McCalden
10C0	MT	STR	"	BU	Saad Mahmoud	CLM	Clamshell	TBD-2	TBD-2
10D0	MT	STR	"	BU	Saad Mahmoud	MHC	Mechanism&Heater Cor	MSSL	Alec McCalden
10E0	MT	STR	"	BU	Saad Mahmoud	PUR	Purge Harness	TBD-1	TBD-1
7092	MT	FPA	Focal Plane Assembly	MSSL	Chris McFee	RAD	Radiator	BU	Saad Mahmoud
A070	E	ICU	Instrument Control Electr	MSSL	Alec McCalden	FPA	Focal Plane	MSSL	Chris McFee
D020	E	MHC	Mechanism&Heater Cont	MSSL	Alec McCalden	DOR	Door	BU	Saad Mahmoud
D031	E	MHC	"	MSSL	Alec McCalden	MIR	Mirror	NRL	Clarence Korendyke
D032	E	MHC	"	MSSL	Alec McCalden	GRA	Grating	NRL	Clarence Korendyke
D050	E	MHC	"	MSSL	Alec McCalden	SLA	Slit Assy	NRL	Clarence Korendyke
D060	E	MHC	"	MSSL	Alec McCalden	SHT	Shutter	MSSL	Wilf Oliver
D080	E	MHC	"	MSSL	Alec McCalden	QCM	Quartz Contamination M	RAL	Jim Lang
XM10	E	MDP	Mission Data Processor	NAOJ	Hirohisa Hara	STR	Structure	BU	Saad Mahmoud
XM20	E	MDP	"	NAOJ	Hirohisa Hara	DOR	Door	BU	Saad Mahmoud
XMA0	E	MDP	"	NAOJ	Hirohisa Hara	ICU	Instrument Control Elect	MSSL	Alec McCalden
XMB0	E	MDP	"	NAOJ	Hirohisa Hara	HAR	Harness	MSSL	Alec McCalden
XMC0	E	MDP	"	NAOJ	Hirohisa Hara	CLM	Clamshell	TBD-2	TBD-2
XS10	MT	S/C	Spacecraft	MELCO (NAC	Hirohisa Hara	STR	Structure	BU	Saad Mahmoud
XSA0	MTE	S/C	"	MELCO (NAC	Hirohisa Hara	ICU	Instrument Control Elect	MSSL	Alec McCalden
XSB0	MTE	S/C	"	MELCO (NAC	Hirohisa Hara	HAR	Harness	MSSL	Alec McCalden
XSE0	MT	S/C	"	MELCO (NAC	Hirohisa Hara	PUR	Purge Harness	TBD-1	TBD-1

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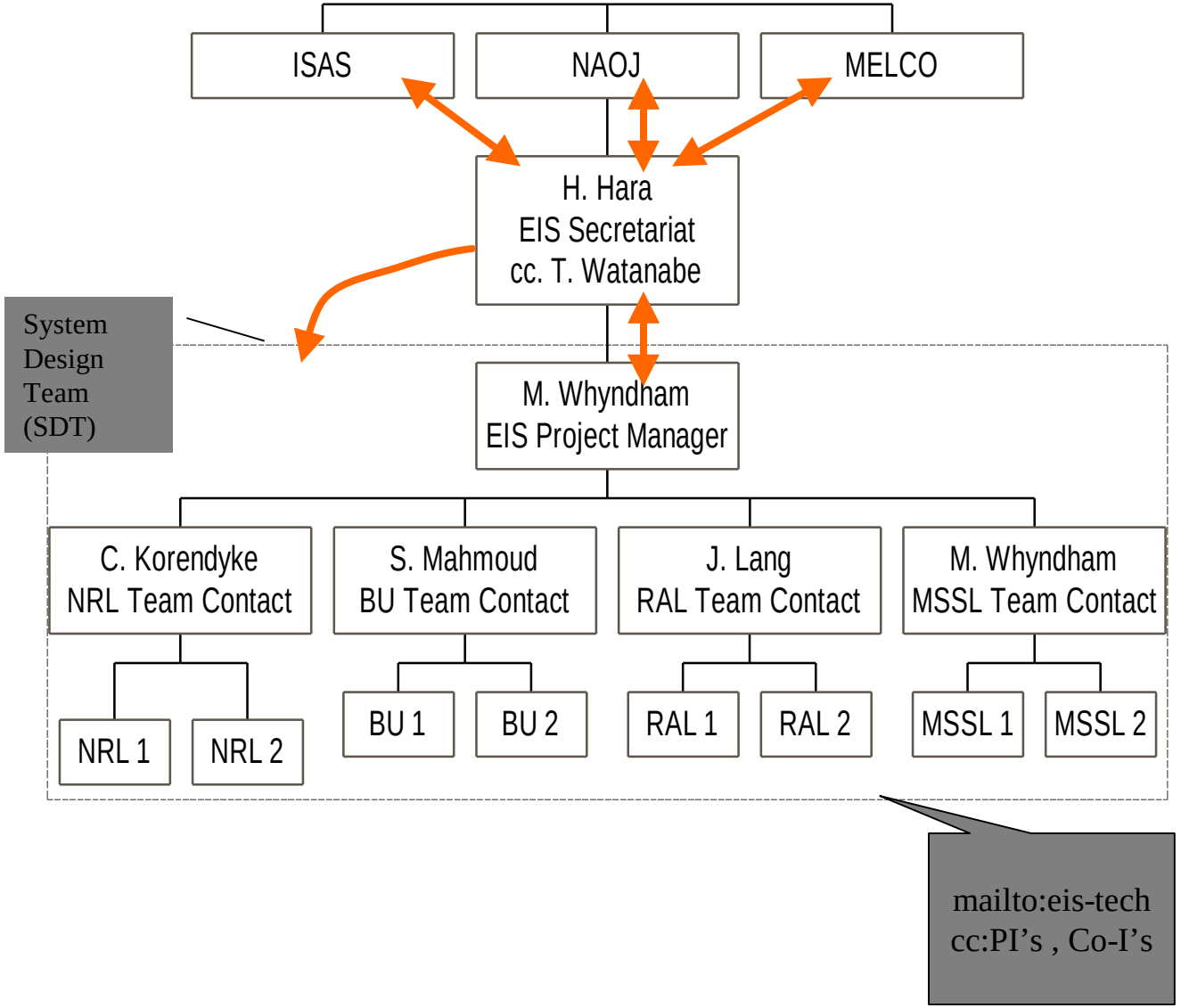
Flow of Interface Information

Flow of Technical Data / Interface Information



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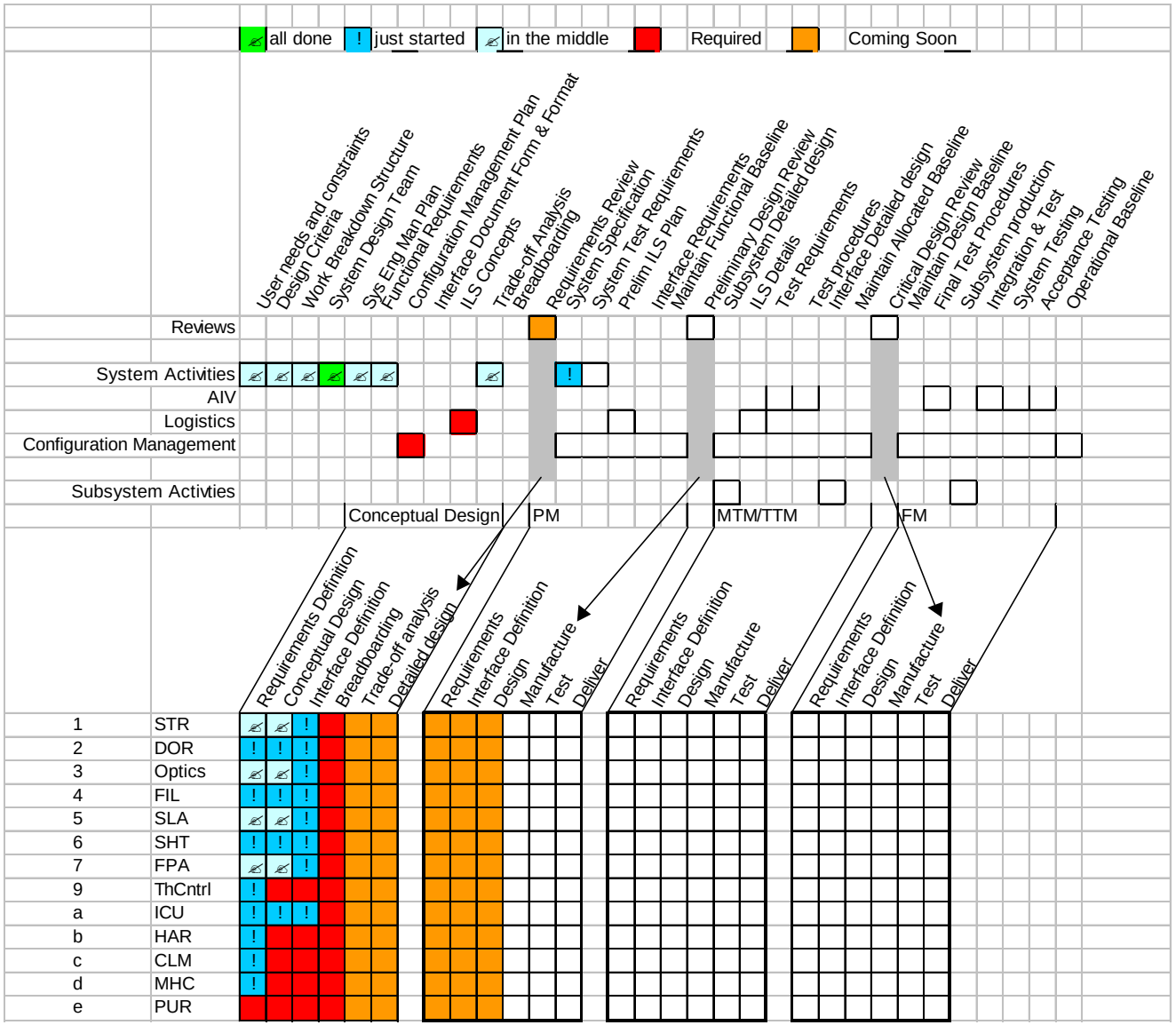
Status of the subsystems



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EIS Development Schedule

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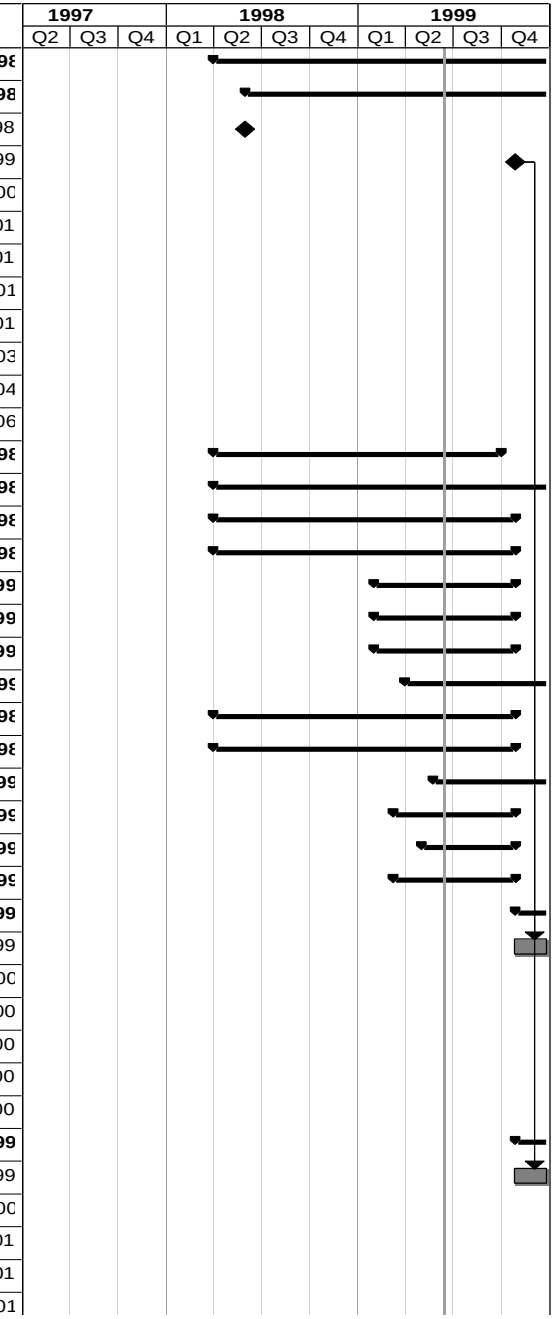
ID	Task Name	Start
1	**EIS Overview Schedule**	**01 Apr '98**
2	**Major Milestones**	**01 Jun '98**
3	UK Funding Start	01 Jun '98
4	End of Phase A	29 Oct '99
5	End of Phase B (PDR)	03 Apr '00
6	PM Delivery	14 Jan '01
7	PM delivery required	01 Feb '01
8	MTM/TTM Delivery	04 Apr '01
9	MTM/TTM delivery required	01 May '01
10	FM Delivery	01 Apr '03
11	Launch	02 Aug '04
12	End of nominal mission	04 Aug '06
13	**System Definition**	**01 Apr '98**
24	**Breadboarding/Feasibility/Preparation**	**01 Apr '98**
25	**1 - STR Structure**	**01 Apr '98**
27	**2 - DOR Door**	**01 Apr '98**
29	**3 - MIR, GRA Optics**	**01 Feb '99**
31	**4 - FIL Filters**	**01 Feb '99**
33	**5 - SLA Slit**	**01 Feb '99**
35	**7 - FPA Focal Plane Assembly / Came**	**01 Apr '99**
76	**8 - QCM Quartz Contamination Monit**	**01 Apr '98**
78	**9 - Thermal Control**	**01 Apr '98**
80	**A - ICU Instrument Control Electroni**	**25 May '99**
114	**C - CLM Clamshell**	**10 Mar '99**
116	**D - MHC Mechanism & Heater Contro**	**03 May '99**
118	**E - PUR Purge Harness**	**10 Mar '99**
120	**PM**	**29 Oct '99**
121	Design	29 Oct '99
122	Manufacture	03 Apr '00
123	UK AIV	02 Oct '00
124	Transport	27 Nov '00
125	Delivery	08 Dec '00
126	Japan AIV & test	11 Dec '00
127	**MTM/TTM**	**29 Oct '99**
128	Design	29 Oct '99
129	Manufacture	03 Apr '00
130	UK AIV	08 Feb '01
131	Transport	22 Mar '01
132	Delivery	04 Apr '01



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Mass Budget

EIS Mass Budget

EIS-sys-des-masbud

Iss	Date	Author	Changes
3	11-Jun	mwt	Headings and data revised with current Acronyms
	05-Mar-99	mwt/sm	add Str-mass column
	05-Feb-99	ck	preliminary

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ref #	Acronym	item	mass (kg)	basis for estimate
1	STR	**Structure**	25.0	composite structure
	LOK	launch lock	1.0	typical for LASCO type
2	DOR	Door	1.4	based on LASCO door mechanism
3	Optics	Primary Mirror	5.0	Calc May 99
		Mirror Mount		included
		Scan Mechanism		included
		Grating	1.0	Calc May 99
		Grating Mount		included
		grating focus mech.		included
4	Filter	Filters	0.2	typical thickness and stiffness
5	SLA	Slit Assembly	1.0	May-99
6	SHT	Shutter	0.3	typical for direct drive shutter
7	FPA	Focal Plane Assembly	3.0	*comprised of:*
				CCD mount
				Shielding
				ROE
				Radiator
8	QCM	contamination monitors	0.4	
9		Thermal Control		
		Sensors and heaters	0.2	*guess*
	MLI	Multilayer Insulation	4.0	15 layer blankets with alternating mesh
a	ICU	Instrument Control Unit	6.0	*estimate*
b	HAR	Harness	4.0	scaled from LASCO cables
c	CLM	Clamshell	2.5	18x18x5 evacuated cavity
d	MHC	Mechanism/Heater Cor	2.5	*guess*
e	PUR	Purge Harness	3.0	*guess*
		subtotal	60.5	
		margin	9.0	
		total	69.5	
	Not included			
		flyable alignment items		

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Power Budget

- Estimate
  - preliminary 6/99
  - 45.5 W Average
  - 84.19 W Peak
  - AJM -> detailed breakdown
- Allocation
  - ?

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Envelope

- Quasi rectangular envelope assumed
  - 3200 X 250 X 550
  - based on strawman design
  - Evolving ...
    -> SM structure concepts

- size of thruster tank and space for momentum wheels may increase, the size and shape of bus structure will be affected by those. When the size and shape of bus structure change, EIS interface points will also be affected. The system side wants to know the size and shape of EIS structure by this reason. If there is a small room in the EIS envelope region which was sent on May 24, the system side can use it as a freedom for the bus structure.

Data Flow - Sensors to Ground

- Possible constraints of data flow
  - FPA -> ICU
  - ICU framestore -> ICU output packets
  - ICU -> MDP
    - MDP processing rate
  - MDP -> DHU
  - DHU capacity
  - Ground station link
  - Ground segment interfaces

  - Explored in more detail later (Software, RAG)