

# SPIRE

**SUBJECT: Systems Budgets**

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## Change Record

ISSUE	DATE	
1.0	11-Jun-00	First Issue following IID meeting with ESA
1.1	14-Jun-00	Change to JFET box allocation

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## Glossary

SPIRE	Spectral and Photometric Imaging REceiver
FOB	FIRST Optical Bench
SVM	Service Module

## References

### Applicable Documents

AD1 IID-B

AD2 LOOM.KD.SPIRE.2000.002-DRAFT Optical error Budgets

### Reference Documents

RD1 Structure Mass Estimates v0.11

## **1. INTRODUCTION**

This document shows the systems budgets for the SPIRE instrument. It includes mass on the FIRST Optical Bench (FOB), mass on the Service Module (SVM), thermal loads on the FIRST cryostat levels and SVM, and data rates in all operating modes. Optical error budgets are given in AD2.

Budgets are assigned to subsystems. Contingency is held by the SPIRE systems team, and will only be released following detailed justification.

## **2. MASS BUDGETS**

### **2.1 Mass on FIRST Optical bench**

Mass Budget FOB	V1.0	All in grammes		08-Jun-00		Custodian:	Colin Cunningham		
Note: Structure estimates: V0.11 by Berend Winter									
Items	Instrument	Work-package	Responsible	Temp. K	Mass Estimate	Allocation	Difference	Contingency %	Inc Contingency
Mirrors	Photometer	OPT	LAM	4	1140	1200	60	20	1440
Mirrors	Photometer	OPT	LAM	2	511	520	9	20	624
Filters	Photometer	FILT	QMW	4	100	100	0	20	120
Filters	Photometer	FILT	QMW	2	150	150	0	20	180
Detectors	Photometer	DETP	JPL	2	1500	1500	0	20	1800
Thermal Straps	Photometer	STRC	MSSL	4	300	300	0	20	360
Thermal Straps	Photometer	STRC	MSSL	2	600	600	0	20	720
Cooler	Photometer	COOL	CEA	4	800	800	0	20	960
Cooler Straps	Photometer	STRC	MSSL	2	500	500	0	20	600
Baffles	Photometer	STRC	MSSL	4	500	500	0	20	600
Baffles	Photometer	STRC	MSSL	2	200	200	0	20	240
Calibration Source	Photometer	PCAL	GSFC	4	30	30	0	20	36
Harness	Photometer	DETP	JPL	4	500	500	0	20	600
BSM (& support)	Photometer	BSM	ATC	4	1100	1100	0	20	1320
Shutter	Photometer	SHUT	USK	4	200	200	0	20	240
RF Filters & Box	Photometer	RFFILT	JPL	4	1500	1500	0	20	1800
Cover	Photometer	STRC	MSSL	4	7430	7500	70	20	9000
Detector Box	Photometer	STRC	MSSL	2	1580	1600	20	20	1920
Mounts,clamps	Photometer	STRC	MSSL		1040	1050	10	20	1260
<b>TOTAL</b>	Photometer				<b>19681</b>	<b>19850</b>	169		<b>23820</b>
Mirrors	Spectrometer	OPT	LAM	4	1078	1100	22	20	1320
Filters	Spectrometer	FILT	QMW	4	200	200	0	20	240
Detectors	Spectrometer	DETS	JPL	2	1000	1000	0	20	1200



Mass Budget FOB	V1.0	All in grammes		08-Jun-00		Custodian:	Colin Cunningham		
Note: Structure estimates: V0.11 by Berend Winter									
Items	Instrument	Work-package	Responsible	Temp. K	Mass Estimate	Allocation	Difference	Contingency %	Inc Contingency
Baffles	Spectrometer	STRC	MSSL	4	200	200	0	20	240
Harness	Spectrometer	DETS	JPL	4	250	250	0	20	300
Mechanism	Spectrometer	FTS	LAM	4	1100	1100	0	20	1320
Cover	Spectrometer	STRC	MSSL	4	5690	5750	60	20	6900
Detector box	Spectrometer	STRC	MSSL	2	1100	1100	0	20	1320
Mounts,clamps	Spectrometer	STRC	MSSL		1060	1100	40	20	1320
Calibration Source	Spectrometer	SCAL	GSFC	4	200	200	0	20	240
<b>TOTAL</b>	Spectrometer				<b>11878</b>	<b>12000</b>	122		<b>14400</b>
Optical Bench	Common	STRC	MSSL	4	7100	7100	0	20	8520
Mounting	Common	STRC	MSSL	4	570	600	30	20	720
RF seal	Common	STRC	MSSL	4	250	250	0	20	300
Cooler I/F	Common	STRC	MSSL	4	100	100	0	20	120
Strap Baffles	Common	STRC	MSSL	4	500	500	0	20	600
<b>TOTAL</b>	Common				<b>8520</b>	<b>8550</b>	<b>30</b>		<b>10260</b>
<b>TOTAL</b>	Common				<b>9520</b>	<b>9750</b>	<b>230</b>		<b>11700</b>
<b>TOTAL FPU</b>					<b>41079</b>	<b>41600</b>	<b>521</b>		<b>49920</b>
Request to ESA (8/6/00)						<b>45000</b>		20	<b>54000</b>
Offer by ESA (8/6/00)						<b>42000</b>		20	<b>50400</b>
JFET Box	FTB	FSFTB	JPL	11	5300	6000	700	20	7200
<b>TOTAL FTB</b>					<b>5300</b>	<b>6000</b>	<b>700</b>		<b>7200</b>
Request to ESA (8/6/00)						<b>6500</b>		20	<b>7800</b>
Offer by ESA (8/6/00)						<b>6000</b>		20	<b>7200</b>

<b>Mass Budget FOB</b>	<b>V1.0</b>	<b>All in grammes</b>			<b>08-Jun-00</b>	Custodian:	Colin Cunningham		
Note: Structure estimates: V0.11 by Berend Winter									
Items	Instrument	Work-package	Responsible	Temp. K	Mass Estimate	Allocation	Difference	Contingency %	Inc Contingency
Allocations should be used as design targets. I will consider issuing contingency to each subsystem as designs mature, on a case by case basis. Any items added to the list will be allocated budgets which will come out of the contingency.									

## 2.2 Mass on Service Module

<b>Mass Budget SVM</b>	<b>V1.0</b>	<b>All in grammes</b>				Custodian:	Colin Cunningham	
Items	Work-package	Responsible	Mass Estimate	Allocation	Difference	Contingency %	Inc Contingency	
Digital Processing Unit	DPU	IFSI	10000	10000	0	20	12000	
Detector Read-out & Control Unit	DRCU	CEA	18000	18000	0	20	21600	
Warm Interconnect Harness	WIH	CEA	2000	2000	0	20	2400	
<b>TOTAL</b>			<b>30000</b>	<b>30000</b>			<b>36000</b>	
Request to ESA (8/6/00)				<b>30000</b>				
Offer by ESA (8/6/00)				<b>30000</b>				

### 3. THERMAL BUDGETS

#### 3.1 Thermal loads on FOB

##### Thermal Loads on FOB

V1.0

Needs completion: estimates and contingency

Loads in mW

Stage	Item	Mode	Estimate	Allocation	Contingency	Inc Contingency
Level 2	JFET Box	Standby		33		
		OFF		0		
		PHOT		33		
		SPEC		9.4		
Level 1	Wires	Standby		1.1		
		OFF		1.1		
		PHOT		1.1		
		SPEC		1.1		
	Radiation	Standby		0.6		
		OFF		0.6		
		PHOT		0.6		
		SPEC		0.6		
	Mechanisms & calibrators	Standby		0		
		OFF		0		
		PHOT		4.1		
		SPEC		7.4		
	Structure	Standby		6		
		OFF		6		
		PHOT		6		
		SPEC		6		
Total	Standby		7.7			
	OFF		7.7			
	PHOT		11.8			
	SPEC		15.1			
Level 0	Wires	Standby		0.1		
		OFF		0.1		
		PHOT		0.1		
		SPEC		0.1		
	Dissipation	Standby		0		
		OFF		0		
		PHOT		0		
		SPEC		0		
	Cooler (average over 48 hours)	Standby		3		
		OFF		3		
		PHOT		3		
		SPEC		3		

Stage	Item	Mode	Estimate	Allocation	Contingency	Inc Contingency
	Cooler Switch supports	Standby	0.8	1		
		OFF	0.8	1		
		PHOT	0.8	1		
		SPEC	0.8	1		
	Structure	Standby		1		
		OFF		1		
		PHOT		1		
		SPEC		1		
	Total	Standby		<b>5.1</b>		
		OFF		<b>5.1</b>		
		PHOT		<b>5.1</b>		
		SPEC		<b>5.1</b>		

### 3.2 Power Dissipation on SVM

Dissipation in W

Unit	Item	Mode	Estimate	Allocation	Contingency	Inc Contingency
FSDRC	Detector Read-out and Control Unit			<b>71</b>		
FSDPU	Digital Processing Unit			<b>10</b>		
FSWIR	Warm Interconnect Harness			<b>0</b>		
TOTAL				<b>81</b>		

## 4. DATA TRANSMISSION

TBW

## 5. OPTICAL ERROR BUDGET

See AD 2. Budget is held and controlled by LAM.