檔　號：115/080502/1/
保存年限：15年

便簽 日期：115年7月13日
單位：研究發展處
速別：普通件
密等及解密條件或保密期限：

一、文陳閱後，公告於電子公布欄、本組、本處及本校最新消息，並e-mail副知全校教師知照。

二、中文版公告主旨為：福衛衛星科學酬載開發與應用；英文版公告為：Development and application of FORMOSAT scientific payloads.

三、計畫主持人請於校內申請截止日115年8月13日上午10時前於國科會系統完成線上申請作業，並立即填送「國立中興大學申請國科會研究計畫計畫主持人學術倫理聲明書」至申請單位(系、所、中心)。

四、申請單位須於計畫主持人送件後儘速至國科會系統確認申請案及列印「申請名冊(樣張)」，並於115年8月14日上午10前將「申請名冊(樣張)」及「國立中興大學申請國科會研究計畫申請單位切結書」經單位主管核章後送至研發處計畫業務組。

五、計畫主持人若無法於校內申請截止日前完成申請程序，請提前來電告知本組，避免影響個人權益；另提醒申請者於提出計畫申請案前，務必更新或確認個人資料（職稱請以人事室核發之正式職稱為準）。

六、文存。

國立中興大學
研究發展處 1150014891

會辦單位：

第二層決行		
承辦單位	會辦單位	決行
本案擬公告網頁之中英文內容如參考附件。 行政組員 張明芬 0713 0952		代為決行

裝

訂

線

檔　　號：
保存年限：

國家科學及技術委員會　書函

機關地址：臺北市大安區和平東路二段106號
聯絡人：湯宗達副研究員
電話：02-27378011(吳小姐)
傳真：
電子信箱：wujy29@nstc.gov.tw

受文者：國立中興大學

發文日期：中華民國115年7月9日
發文字號：科會自字第1150048060號
速別：普通件
密等及解密條件或保密期限：
附件：徵求公告(附件1 115M0P000480_115D2018675-01.pdf、附件2 115M0P000480_115D2018676-01.pdf、附件3 115M0P000480_115D2018677-01.pdf、附件4 115M0P000480_115D2018678-01.pdf、附件5 115M0P000480_115D2018679-01.pdf、附件6 115M0P000480_115D2018680-01.pdf)

主旨：本會與國家太空中心合作公開徵求「福衛衛星科學酬載開發與應用」專案計畫，自即日起受理申請，請於115年8月17日(星期一)前，依徵求公告檢附相關文件函送到會，逾期不予受理，請查照轉知。

說明：

一、請依本會補助專題研究計畫作業要點規定之線上申請方式提出申請。計畫主持人及申請機構請務必詳閱計畫徵求公告各項規定。徵求公告說明及申請規範請詳閱附件，或至本會網站(www.nstc.gov.tw)公告區下載。

二、本計畫屬專案計畫，經費係專款專用，未獲補助案件恕不受理申覆。

三、計畫徵求說明會訂於115年7月24日(星期五)下午2時假本會2樓第12會議室，欲參加人員請於115年7月21日(星期二)前至 https://forms.gle/NiDyBoeeD5a3tRAs6 報名。

四、本案相關聯絡資訊：

(一)有關系統操作問題，請洽本會資訊系統服務專線，電話：0800-212-058，(02)2737-7590、7591、7592。

(二)有關本專案計畫申請行政相關疑問，請洽本會綜合規劃處，電話：(02)2737-7569。

(三)有關本專案計畫內容相關疑問，請洽本會自然處科技研發管理師吳貞儀博士，電話：(02)2737-8011，電子郵件：wujy29@nstc.gov.tw。

正本：專題研究計畫受補助單位（共256單位）
副本：國家太空中心、本會綜合規劃處、資訊處、自然處 115/07/10 07:53:47

國家科學及技術委員會

國家科學及技術委員會自然科學及永續研究發展處暨國家太空中心
「福爾摩沙衛星科學酬載開發與應用」專案計畫徵求公告

日期：115 年 7 月 9 日

壹、計畫目標

太空科技基礎研究與應用，是國家科技發展的重要領域，其範疇涵蓋太空、天文、大氣、地科、海洋、醫學、農業與防災等，除了可以促進科技創新、提升產業競爭力外，其跨領域整合及應用更可以有效回應我國與國際共同關注之關鍵議題，例如：地球觀測、海洋研究、大氣觀測、環境監測、太空天氣、天文研究、淨零碳排、太空農業應用與發展、太空生物醫學研究、太空資料運算技術、通訊技術發展與其他科學研究等。扣合太空計畫三期及其後續計畫的衛星發射期程，本會與太空中心合作共同推動我國「福爾摩沙衛星科學酬載開發與應用」專案計畫，藉以推動我國衛星科學研究、科學酬載系統軟硬體整合、關鍵技術應用及國際太空計畫合作等發展，回應我國重要政策議題，並有效鏈結學研與產業能量，培育未來關鍵領域人才。

貳、計畫說明

一、本次徵求計畫須明確扣合福爾摩沙衛星 8F 及福爾摩沙衛星 9B 發射期程、運行軌道，發展能回應我國重要政策議題、社會及國際需求之太空任務導向型科學酬載開發與應用 (詳見課題說明 A01、A02)。

二、本計畫僅接受單一整合型，將依實際衛星發射期程及需求，經審查後決議補助期程。

三、本計畫為專案計畫，文件不全或不符合規定者，不予受理；審查未獲通過者，恕不接受申覆；獲通過可執行之計畫，列入本會研究計畫件數計算。

參、申請機構與申請人資格

一、申請機構：須為本會專題研究計畫之受補助機構。

二、計畫主持人：須符合本會補助專題研究計畫作業要點之規定。

肆、申請方式

一、即日起接受申請，依本會補助專題研究計畫作業要點以線上申請，申請機構須線上彙整送出並造具申請名冊，於 **115 年 8 月 17 日 (星期一)** 前函

送本會 (以函送到會收件日為準)，逾期恕不受理。

二、計畫主持人循本會一般專題研究計畫之申請程序，申請「專題類-隨到隨審計畫」，計畫類別「一般策略專案計畫」，計畫歸屬「自然處」，學門代碼「M92-自然科學導向研究」。

三、計畫主持人應於申請書之「中文摘要」(CM02 表) 首段填寫計畫之徵求課題 A01 或 A02 (參見課題說明 A01、A02)。並依課題撰寫計畫內容，需包含研究目的、研究方法、預期成果、時程規劃、預計合作之公、私部門或機構之工作內容與規劃等項目，詳述計畫內容之整合性及應用性，提供預估計畫「執行前」及「執行完成後」的**科學準備度 (Scientific Readiness Level, SRL)** 及**技術成熟度 (Technology Readiness Level, TRL)** 說明 (參見附註)。

四、本專案計畫鼓勵跨校間團隊整合及國際合作，以單一整合型計畫提出申請，請於總計畫書中詳細說明各子計畫或子項工作的執行步驟、各子 (項) 計畫間之相關性與必要性及預計達成目標等。

伍、審查重點

一、計畫撰寫內容是否扣合我國重要政策，並符合徵求課題與該課題內容，設定具前瞻挑戰性之願景。若為過往已有科學酬載 (參如附表)，應有其差異獨特性。

二、國際策略性合作規劃與對我國之重要性預期成果。

三、計畫團隊之核心技術整合與分工規劃。

四、產學合作成果效益延伸。

五、科學酬載設計符合衛星介面、規格、與工程等相關細節。

六、「執行前」科學準備度 (SRL) 及技術成熟度 (TRL)。

七、「執行完成後」科學準備度 (SRL) 及技術成熟度 (TRL)。

陸、計畫考評

一、計畫核定後將召開啟動會議，與獲補助之計畫團隊說明執行期間之詳細工作時程與配合項目。

二、依本會相關規定及課題說明繳交各項報告和文件，並配合本會施政需要提供參考資料及參加活動與展會 (如衛星科學工作坊、臺灣太空國際年會)。

三、召開審查會議及工作/進度會議 (詳見課題說明)，並不定期辦理實地查核作業，實際了解計畫團隊執行進度及遇到困難與需求等。考評結果得作為調整次年度經費之參據；必要時得終止補助計畫。

柒、其他事項

一、本專案計畫核定通知、簽約、撥款、延期與變更、經費報銷及報告繳交等，皆依本會補助專題研究計畫作業要點、補助專題研究計畫經費處理原則、補助研究計畫成果報告審查作業規定、專題研究計畫補助合約書與執行同意書及其他有關規定辦理。

二、除情形特殊者外，不得於執行期間申請變更主持人或申請註銷計畫。

三、本專案計畫之目標為衛星科學與技術研究，獲通過計畫所蒐集之資料、模式與可應用落實之成果，應規劃在計畫結束後將成果公開。

四、本案各研究計畫所產出之成果均依「政府科學技術研究發展成果歸屬及運用辦法」之規定實施。

捌、聯絡窗口

一、有關系統操作問題，請洽本會資訊系統服務專線，電話：0800-212-058，(02)2737-7590、7591、7592。

二、有關計畫申請行政相關疑問，請洽本會綜合規劃處，電話：(02)2737-7569。

三、有關本專案計畫內容相關疑問，請洽本會自然處科技研發管理師吳貞儀博士，電話：(02)2737-8011，電子郵件：wujy29@nstc.gov.tw。

附註：

科學準備度 (Scientific Readiness Level, SRL) (參考歐洲 ESA)：

SRL 1：Initial Scientific Idea
SRL 2：Consolidation of Scientific Idea
SRL 3：Scientific and Observation Requirements
SRL 4：Proof of Concept
SRL 5：End-to-End Performance Simulations
SRL 6：Consolidated Science and Products
SRL 7：Demonstrated Science
SRL 8：Validated and Matured Science
SRL 9：Science Impact Quantification

技術成熟度 (Technology Readiness Level, TRL) (參考美國 NASA 與歐洲 ESA)：
TRL4：System Design Review
TRL5：Preliminary Design Review
TRL6：Critical Design Review
TRL7：Static Test Model/ Engineering Development Model
TRL8：Assembly, Integration and Test
TRL9：Launch & Operations

附表：福爾摩沙衛星系列的科學酬載

科學酬載名稱 (英文縮寫)	主要用途與科學目標
電離層電漿電動效應儀 (IPEI)	量測低緯度電離層的離子密度、溫度與漂移速度，研究太空天氣。
海洋水色照相儀 (OCI)	觀測海洋表面葉綠素分佈與水色變遷，用於漁業及環保監測。
通訊實驗酬載 (ECP)	進行台灣首次衛星通訊實驗，研究降雨對高頻訊號衰減的影響。
高空向上閃電儀 (ISUAL)	全球首次對「高空大氣閃電 (如紅色精靈、淘氣精靈等)」進行長期連續觀測。
全球定位系統氣象量測儀 (GOX)	接收 GPS 折射訊號，推導全球大氣垂直溫度、濕度、氣壓及電離層電子密度 (太空中最精準溫度計)。
小型電離層光度計 (TIP) &三頻段信標儀 (TBB)	與地面接收站配合，監測電離層的二維與三維電子密度斷層掃描。
先進電離層探針 (AIP)	量測電離層離子密度與溫度，探討地震前電離層異常 (地震前兆) 及太空天氣預報。
全球衛星導航系統無線電訊號接收器 (TGRS)	專注中低緯度 (包含颱風生成帶) 大氣掩星觀測，大幅提升颱風路徑與梅雨降雨預報準確度。
離子速度儀 (IVM) &射頻信標儀 (RF Beacon)	量測低緯度電離層電漿不均勻構造，監測干擾通訊與導航的「太空天氣閃爍」現象。
雙波段大氣瞬變影像儀 (DIAT) &電子溫度密度儀 (TeNeP)	進行大氣電學、電離層物理與高能物理研究；DIAT 記錄地表城市夜光輪廓，TeNeP 觀測電離層太空天氣。
伽馬射線瞬變事件監測儀 (GTM)	觀測宇宙中的高能爆發事件 (如伽馬射線爆、軟伽馬射線重複爆發源等)，推動太空天文物理研究。
多粒子分析儀 (Multiple Particle Analyzer)	量測台灣上空與近地軌道環境的高能帶電粒子 (電子與離子) 分佈與動態，研究輻射帶與太空天氣。
伽馬偏振監測儀 (GPM)	專注於量測伽馬射線爆 (GRB) 等高能輻射源的「偏振度」與偏振角，用以釐清高能天體的磁場結構與輻射機制。

TASA 國家太空中心 Taiwan Space Agency

FS8F-IRD-0001
Rev. 00
2026/05/28

FORMOSAT-8F
Spacecraft Bus to Science Payload Interface Requirement Document

Taiwan Space Agency
國 家 太 空 中 心

Revision/Change Record
改版/變更記錄

Revision 版次	Author 作者	Authorization Date 核可日期	Revision / Change Description 改版/變更說明	Pages Affected 影響頁次
01	薛創維		New Issue	All

TABLE OF CONTENTS

1. Introduction

This document describes the requirements for the interface between the FORMOSAT-8F spacecraft bus and science payload.

1.1. Purpose

This document defines the interface requirement between FORMOSAT-8F spacecraft bus and science payload.

1.2. Scope

This document applies to the interface requirement between FORMOSAT-8F spacecraft bus and science payload only.

This document contains the interface requirements for procurement of science payload for the FORMOSAT-8 mission, specifically confined to FS-8F.

2. Related Documents

2.1. Applicable Documents

FS8-REQ-0001	FORMOSAT-8 System Requirement Document
FS8-SPEC-0017	FORMOSAT-8 Component Environmental Specification

2.2. Referenced Documents

NA

3. Requirements

This interface requirements between FORMOSAT-8F spacecraft bus and the science payload are defined in each section.

3.1. System

3.1.1. Configuration

Figure 1 defines the configuration of science payload.

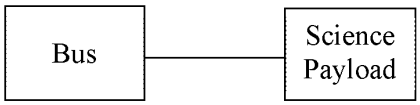

Figure 1 Science payload configuration

All communication and power lines to science payload shall go through OBC. OBC will provide electrical power to science payload for normal operation. OBC will also provide necessary command and telemetry interface to science payload. OBC to science payload harness will be provided by TASA. Any science payload internal harness shall be provided by contractor.

3.1.2. Operation Modes

Operation modes shall be POWER ON and POWER OFF. The science payload shall operate autonomously in normal operation.

3.1.3. Operation Requirements

The operation of science payload shall not interfere with RSI imaging and regular satellite normal operation.

3.1.4. Mission Life

The mission life of science payload for FS-8F shall be at least 5 years in orbit subsequent to one year of ground testing and four years of storage. (TBC)

3.1.5. Orbit

The FS-8F mission orbit is at 510 km altitude with inclination 97.44 degree as a sun-synchronous orbit. The equatorial descending time is between 10:00 to 11:00 am local time for FS-8F. The mission orbit might be changed by TASA due to program need.

3.2. Physical

3.2.1. Location Dimensions

There are two location and dimension options for science payload. The science payload shall select only one option for the design.

Option 1: The science payload shall be installed on +Z panel as shown in Figure 2 and 3.

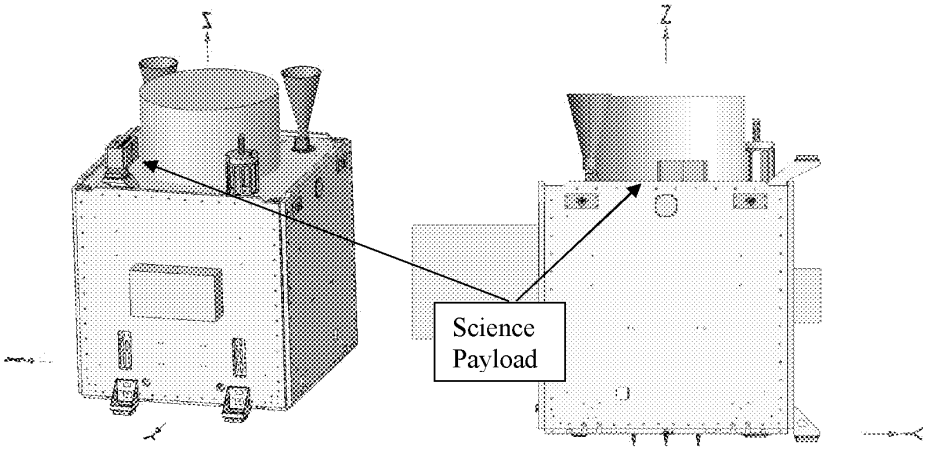

Figure 2 Science payload on +Z panel

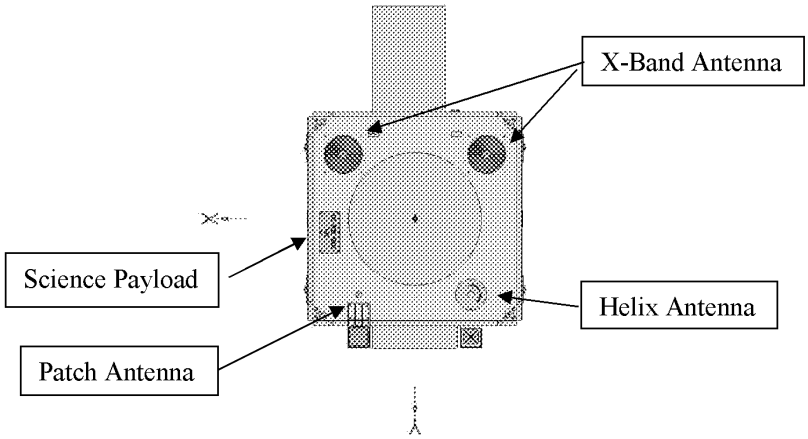

Figure 3 Science payload on +Z panel

The dimension of science payload shall not exceed 200(L)x100(W)x100(H) mm. The footprint of science payload shall follow Figure 4.

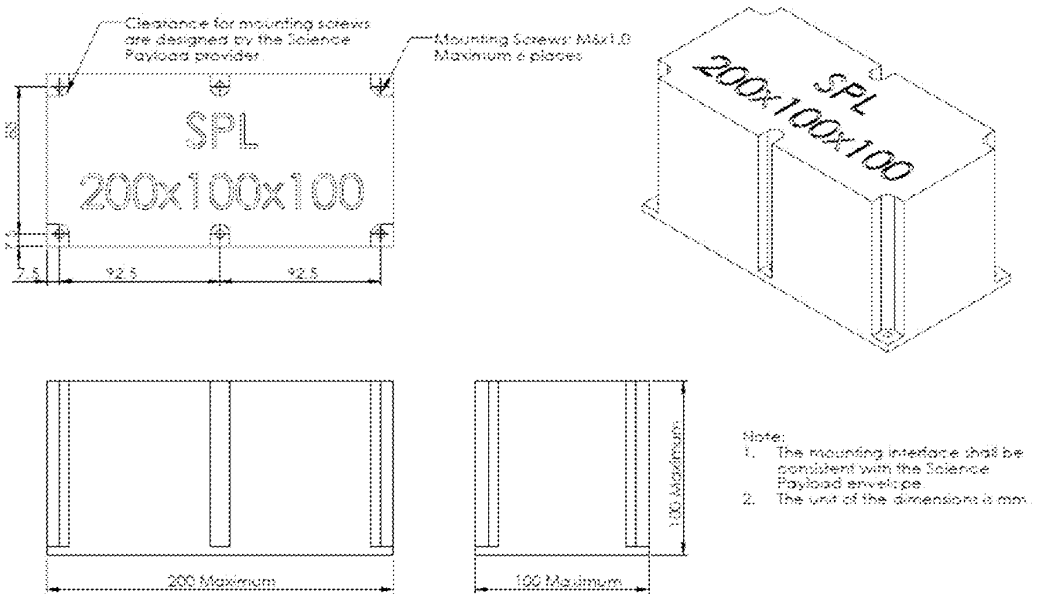

Figure 4 Footprint of science payload on +Z panel (mm)

Option 2: The science payload shall be installed on +Y (Plus Y direction) panel as shown in Figure 5.

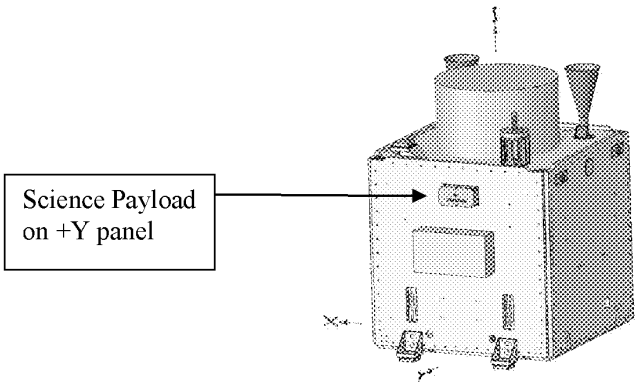

Figure 5 Science payload on +Y panel

The dimension of science payload shall not exceed 200(L)x100(W)x60(H) mm for each location. The footprint of science payload on each location shall follow Figure 6.

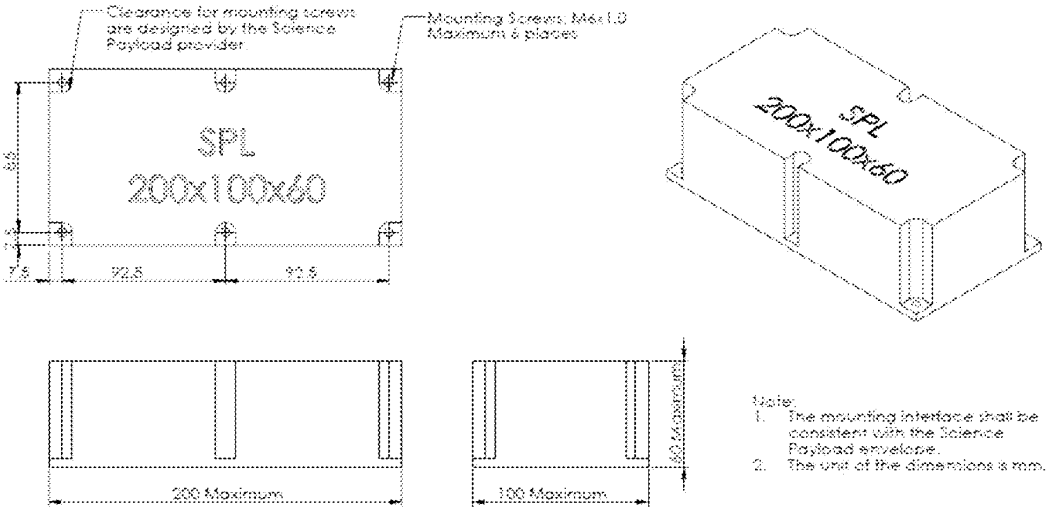

Figure 6 Footprint of science payload on +Y panel (mm)

3.2.2. Mass

Science payload including any hardware needed shall be less than 2kg (TBC).

3.2.3. Center of Gravity

The center of gravity of science payload shall be within 5% of the geometric center of the envelope.

3.2.4. Field of View

TASA will provide the field of view information based on the science payload location after the contract is awarded.

3.2.5. Deployment

No deployment mechanism in any form shall be allowed in science payload.

3.2.6. Alignment

If alignment is necessary, alignment cube shall be included on science payload design.

3.2.7. Mounting

Science payload shall have a flat mounting surface that conducts electrically and thermally to the spacecraft bus.

3.2.8. Grounding

Science payload shall be grounded in accordance with the spacecraft bus grounding scheme.

3.3. Attitude Control

3.3.1. Pointing Accuracy

The spacecraft bus will maintain the pointing accuracy less than 0.026 degree in pitch, roll and yaw axes. All values are 3 sigma.

3.3.2. Pointing Knowledge

The spacecraft bus will maintain the pointing knowledge less than 0.012 degree in pitch, roll and yaw axes. All values are 3 sigma.

3.3.3. Positioning Knowledge

The spacecraft bus will provide on-board position knowledge better than 25m(3-sigma) for each axis.

3.3.4. Operation of Science Payload

The nominal attitude of satellite is local-vertical-local-horizontal(LVLH) except during RSI imaging, ground communication and sun-pointing. The operation of science payload shall not interfere with RSI imaging and regular satellite normal operation. The science payload shall coordinate with TASA for science payload mission operation planning.

3.3.5. Pointing Stability

The spacecraft bus will provide pointing stability better than 0.147 arc second per 2.296 ms per axis.

3.4. Power

3.4.1. Orbit Average Power

The science payload shall consume less than 2W orbit average power.(TBC)

3.4.2. Input Voltage

The spacecraft bus will provide DC input voltage for +15V, -15V and +5V.

3.4.3. Peak Current Draw

The science payload current draw shall not exceed 0.2A for +15V, 0.2A for -15V and 1.5A for +5V. Spacecraft will cut off power supply to science payload if over-current protection is triggered.

3.4.4. Electrical Power Interface

Two electrical power lines will be provided to science payload for redundancy. Science payload shall provide two interface circuits and connectors as shown in Figure 7 for power interface.

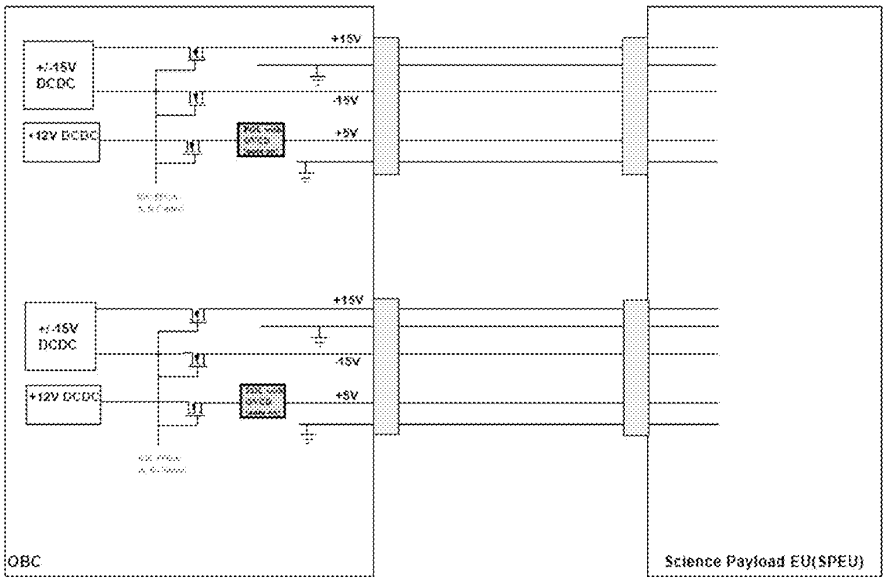

Figure 7 Electrical Power Interface

3.4.5. Connector

Science payload shall design pin assignment of the connectors according to the definition listed in this section.

J01	(15P High Density D-type)
1	+15V POWER
2	+15V POWER
3	-15V POWER
4	-15V POWER
5	TBC
6	+15V POWER RETURN
7	+15V POWER RETURN
8	-15V POWER RETURN
9	-15V POWER RETURN
10	TBC
11	+5V POWER
12	+5V POWER RETURN
13	+5V POWER
14	+5V POWER RETURN
15	CHASSIS GND

J02	(15S High Density D-type)
1	UART RX RS422+
2	UART TX-A RS422+
3	UART TX-B RS422+
4	PPS-A RS422+
5	PPS-B RS422+
6	UART RX RS422-
7	UART TX-A RS422-
8	UART TX-B RS422-
9	PPS-A RS422-
10	PPS-B RS422-
11	CHASSIS GND
12	TBC
13	TBC
14	TBC
15	CHASSIS GND

J03	(9S Micro D-type)
1	SPL_A_SPW_DIN+
2	SPL_A_SPW_SIN+
3	Inner shield
4	SPL_A_SPW_SOUT-
5	SPL_A_SPW_DOUT-
6	SPL_A_SPW_DIN-
7	SPL_A_SPW_SIN-
8	SPL_A_SPW_SOUT+
9	SPL_B_SPW_DOUT+

J04	(9S Micro D-type)
1	SPL_B_SPW_DIN+
2	SPL_B_SPW_SIN+
3	Inner shield
4	SPL_B_SPW_SOUT-
5	SPL_B_SPW_DOUT-
6	SPL_B_SPW_DIN-
7	SPL_B_SPW_SIN-
8	SPL_B_SPW_SOUT+
9	SPL_B_SPW_DOUT+

3.5. Command and Telemetry

3.5.1. Command and Telemetry Interface

The spacecraft bus will provide two RS422/PPS interfaces to science payload for science payload command and telemetry. The interface shall be RS422, UART at 115.2 kbps. Science payload shall provide two interface circuits and connectors as shown in Figure 8 and 9 for command, telemetry and PPS interface.

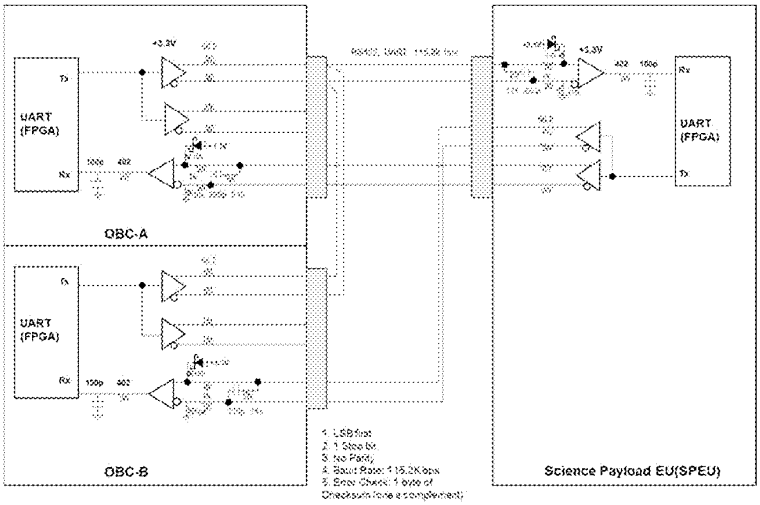

Figure 8 Command and Telemetry Interface

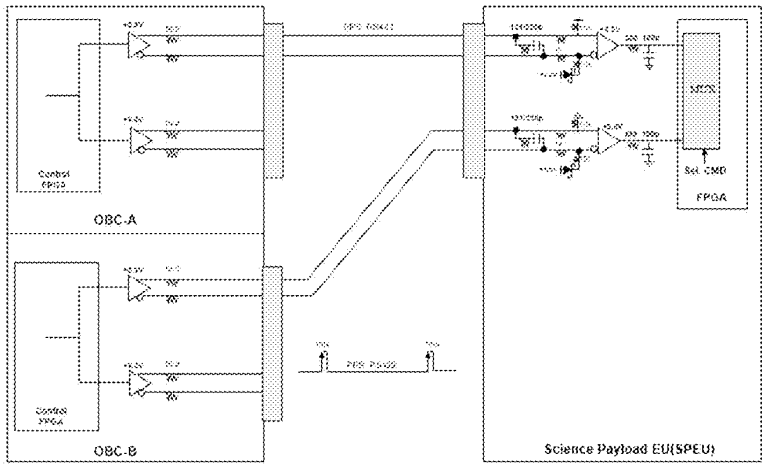

Figure 9 PPS Signal Interface

3.5.2. Connector

N/A.

3.6. Science Data

3.6.1. Science Data Interface

The spacecraft will provide two SpaceWire interfaces to science payload for science data transmission. The science data transmission rate shall not exceed 1Mbps. Science payload shall provide two sets of interface circuits and connectors as shown in Figure 10 for science data.

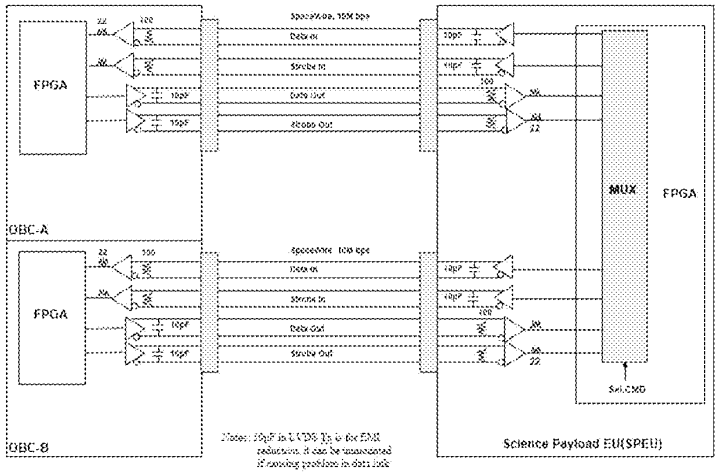

Figure 10 Science Data Interface

3.6.2. Connector

N/A.

3.6.3. Data Storage

The spacecraft bus will provide data storage capacity for science data plus EDAC data from science payload up to 2 Gbits (TBC) per day.

3.7. Thermal

3.7.1. Thermal Control

The science payload shall provide thermal control by itself if necessary. Any necessary heater or thermal monitor devices for science payload operation and non-operation stage shall be provided by science payload.

3.7.2. Thermal Power Dissipation

The science payload can be thermally conductively to spacecraft bus structure to dissipate thermal power if necessary.

3.8. Magnetic Cleanliness

Wherever possible, non-magnetic material shall be used and the utilization of permanent magnets shall be avoided.

3.9. SOCC/SDC Interface Requirement

The SOCC supports the TASA FORMOSAT-series satellite missions. The SDC interacts with SOCC and the SDC science team to plan and perform the science operations. The SDC is responsible for the science payload operation support, science data management, processing, analyzing and archiving. The SDC is also responsible for distributing the data and algorithms. Furthermore, the SDC will actively communicate with research and education communities to promote maximum usage of the science data. Figure 11 shows the data interface between SDC and SOCC.

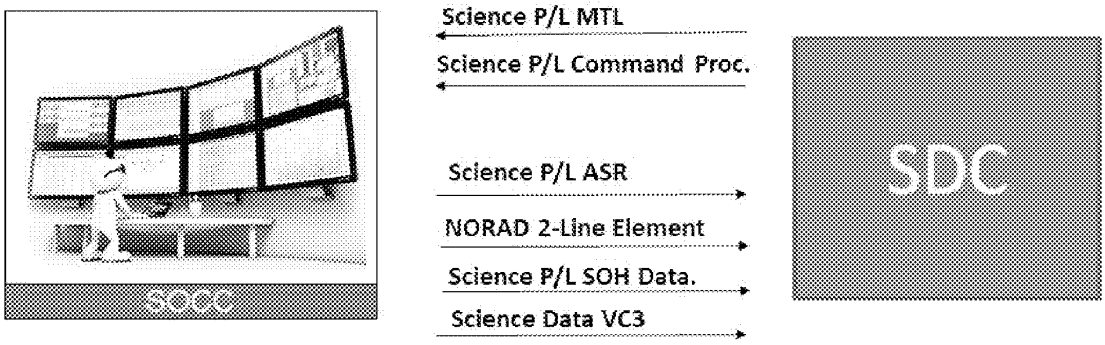

Figure 11 Data interface between SOCC and SDC

3.9.1. Science P/L MTL

	Science Payload Mission Timeline
Purpose/Description	The Mission Timeline contains sequence of on-board events regarding desired activities, including command procedure.
Originator	SDC
Destination	SOCC
Frequency/Volume	One to five times per week (TBR) / Variable data volume
File name/E-mail Subject Convention	SDC_yyyymmdd_timeline.txt (yyyy: 4 digits of year, mm: months, dd: days) Date of file name represents the date to perform measurement. For example: SDC_20191214_timeline
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	

All fields are left adjusted.

Line Number	Type/Size	Field Name	Contents/Format and Unit/Range of Values
1	string/8 bytes	LABEL_1	"SOURCE: "
1	string/variable	SOURCE	Author of File / "SDC"
2	string/13 bytes	LABEL_2	"DESTINATION: "
2	string/variable	DESTINATION	Destination of File / "SOCC"
3	string/11 bytes	LABEL_3	"FILE NAME: "
3	string/variable	FILE_NAME	file name / "SDC_20191214_timeline"
4	string/11 bytes	LABEL_4	"DATE TIME: "
4	string/19 bytes	DATE_TIME	Time to generate this file in the format of "yyyy/mm/dd hh:mm:ss"
5	string/12 bytes	LABEL_5	"SPACECRAFT: "
5	string/variable	SPACECRAFT	Satellite ID / "FS8"
6	string/12 bytes	LABEL_6	"INSTRUMENT: "
6	string/variable	INSTRUMENT	Instrument ID / "SDC"
7	string/16 bytes	LABEL_7	"REQUEST_WINDOW: "
7	string/variable	REQUEST_WINDOW	"yyyy/ddd 00:00:00– yyyy/ddd 00:00:00"
8	string/5 bytes	LABEL_8	"EVENT"/leading label of EVENT column
8	string/3 bytes	LABEL_9	"UTC" / leading label of UTC column
8	string/2 bytes	LABEL_10	"DUR" / leading label of DUR column
8	string/2 bytes	LABEL_11	"Q1"/leading label of Quaternion_1 column
8	string/2 bytes	LABEL_12	"Q2"/leading label of Quaternion_2 column
8	string/2 bytes	LABEL_13	"Q3"/leading label of Quaternion_3 column
8	string/2 bytes	LABEL_14	"Q4"/leading label of Quaternion_4 column
8	string/9 bytes	LABEL_15	"Procedure" / leading label of Procedure column for Command Procedure
9	string/2 byte	Event	The number of the requested event count
9	string/17 bytes	UTC	UTC time when the activity commences, in "yyyy/ddd hh:mm:ss" format / year, day, hour, minute, second / 2000:2050, 001:365, 00:23, 00:59, 00:59
9	string/2 bytes	DUR	Execution time of the activity in second "ss" format

Line Number	Type/Size	Field Name	Contents/Format and Unit/Range of Values
9	string/8 bytes	Q1	Quaternion_1 of satellite attitude in "sd.ddddd" format / +1.00000:-1.00000, or "NA"
9	string/8 bytes	Q2	Quaternion_2 of satellite attitude in "sd.ddddd" format / +1.00000:-1.00000, or "NA"
9	string/8 bytes	Q3	Quaternion_3 of satellite attitude in "sd.ddddd" format / +1.00000:-1.00000, or "NA"
9	string/8 bytes	Q4	Quaternion_4 of satellite attitude in "sd.ddddd" format / +1.00000:-1.00000, or "NA"
9	string/19 bytes	Procedure	The name of the Command procedure "SDC_PROCyydddFn.prc" yy:year, ddd:day of year, n:the nth command procedure of the same day or "NA"
10	same as line 9	Same as line 9	Same as line 9
11	same as line 9	Same as line 9	Same as line 9
Last	string/13 bytes	LABEL_16	"END OF REQUEST"

Sample Science P/L Mission Timeline

```
SOURCE:         SDC
DESTINATION:    SOCC
FILE NAME:      SDC_20191214_timeline
DATE TIME:      2019/12/08 19:40:00
SPACECRAFT:     FS8
INSTRUMENT:     SDC
#
REQUEST_WINDOW: 2019/348 00:00:00 ~ 2019/349 00:00:00
#
Event   UTC                     DUR   Q1 Q2 Q3 Q4     Procedure
1       2019/348 00:19:16       180   NA NA NA NA     SDC_PROC19348F1.PRC
2       2019/348 01:58:35       180   NA NA NA NA     SDC_PROC19348F2.PRC
3       2019/348 03:37:54       180   NA NA NA NA     SDC_PROC19348F3.PRC
4       2019/348 05:17:12       180   NA NA NA NA     SDC_PROC19348F4.PRC
5       2019/348 06:56:31       180   NA NA NA NA     SDC_PROC19348F5.PRC
6       2019/348 08:35:50       180   NA NA NA NA     SDC_PROC19348F6.PRC
7       2019/348 10:15:09       180   NA NA NA NA     SDC_PROC19348F7.PRC
8       2019/348 11:54:27       180   NA NA NA NA     SDC_PROC19348F8.PRC
9       2019/348 13:33:45       180   NA NA NA NA     SDC_PROC19348F9.PRC
10      2019/348 15:13:04       180   NA NA NA NA     SDC_PROC19348FA.PRC
11      2019/348 16:52:23       180   NA NA NA NA     SDC_PROC19348FB.PRC
12      2019/348 18:31:41       180   NA NA NA NA     SDC_PROC19348FC.PRC
13      2019/348 20:11:00       180   NA NA NA NA     SDC_PROC19348FD.PRC
14      2019/348 21:50:19       180   NA NA NA NA     SDC_PROC19348FE.PRC
15      2019/348 23:29:37       180   NA NA NA NA     SDC_PROC19348FF.PRC
```

3.9.2. Science P/L Command Proc.

	Science Payload Command Procedures
Purpose/Description	This file contains command mnemonics and the arguments and the time tag corresponded to the command procedure activity requested in the Science Payload Mission Timeline.
Originator	SDC
Destination	SOCC MCC
Frequency/Volume	variable / variable data volume
File name/E-mail Subject Convention	SDC_PROCyydddFn.prc (SDC: instrument name, yy: last 2 digits of year, ddd: day of year, n: the nth Command Procedure of the same day. For example: SDC_PROC19348F1.prc
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	1. The content of the Command Procedure will follow the XPSOC command format beginning with relative time tag “CMD” in each line.

Sample Science Payload Command Procedures

```
00:01:05.000- # Select
00:00:00.000^ CMD P SELPWR "A" SRC=TTQ

00:01:00.000- #   Power up on
00:00:00.000^ CMD C ESWION SRC=TTQ

00:00:55.000- # Delete file0 if existed, before Start record 30 sec
00:00:00.000^ CMD DCDSFILEDEL FILE_NAME = 'File_0' SRC=TTQ

00:00:40.000- # Create file {file0}, before Start record 15 sec
00:00:00.000^ CMD DCDSFILECRE FILE_CAPACITY = 4 FILE_DEVICE = 'SPL_1' FILE_NAME = 'File_0' FILE_TYPE = 'Linear' SRC=TTQ

00:00:25.000- # Start record {file0}
00:00:00.000^ CMD DCDSSTARTREC FILE_NAME = 'File_0' SRC=TTQ

00:00:15.000- #   Sensor on
00:00:00.000^ CMD S SENSON SRC=MPQ

00:00:10.000- #   IDMIT mode
00:00:00.000^ CMD S IDMIT SRC=MPQ

00:00:05.000- #   switch to {safe mode}
00:00:00.000^ CMD S SAFE SRC=MPQ

00:00:00.000  #   switch to {fast mode}
```

3.9.3. Science P/L ASR

	Science Payload Acquisition Schedule Report
Purpose/Description	This file contains conflict-free activities including on-board events and ground events.
Originator	SOCC
Destination	SDC
Frequency/Volume	Once per day / Variable data volume
File name/E-mail Subject Convention	SDC_yyyymmdd.sch (yyyy: 4 digits of year, mm: months, dd: days) For example: SDC_20191214.txt
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	

All fields are left adjusted.

Line Number	Type/Size	Field Name	Contents/Format and Unit/Range of Values
1	string/8 bytes	LABEL_1	"SOURCE: "
1	string/variable	SOURCE	Author of File: "SOCC"
2	string/13 bytes	LABEL_2	"DESTINATION: "
2	string/variable	DESTINATION	Destination of File: "SDC"
3	string/11 bytes	LABEL_3	"FILE NAME: "
3	string/variable	FILE_NAME	file name / "SDC_20191214.sch"
4	string/11 bytes	LABEL_4	"DATE TIME: "
4	string/19 bytes	DATE_TIME	Time to generate this file in the format of "yyyy/mm/dd hh:mm:ss"
5	string/12 bytes	LABEL_5	"SPACECRAFT: "
5	string/variable	SPACECRAFT	Satellite ID / "FS8"
6	string/12 bytes	LABEL_6	"INSTRUMENT: "
6	string/variable	INSTRUMENT	Instrument ID / "SDC"
7	string/19 bytes	LABEL_7	"UTC" / leading label of UTC column
7	string/7 bytes	LABEL_8	"DUR" / leading label of DURATION column
7	string/10 bytes	LABEL_9	"Q1" / leading label of Quaternion_1 column
7	string/10 bytes	LABEL_10	"Q2" / leading label of Quaternion_2 column
7	string/10 bytes	LABEL_11	"Q3" / leading label of Quaternion_3 column
7	string/10 bytes	LABEL_12	"Q4" / leading label of Quaternion_4 column
7	string/23 bytes	LABEL_13	"Procedure" / leading label of Procedure column
8	string/19 bytes	UTC	UTC time when the event commences, in "yyyy/ddd hh:mm:ss" format / year, day, hour, minute, second / 2000:2100, 001:365, 00:23, 00:59, 00:59
8	string/7 bytes	DUR	Elapsed duration of the event, in second / second / 000.1:999.9
8	string/10 bytes	Q1	Quaternion_1 of satellite attitude in "sd.ddddd" format / +1.00000:-1.00000, or "NA"
8	string/10 bytes	Q2	Quaternion_2 of satellite attitude in "sd.ddddd" format / +1.00000:-1.00000, or "NA"

Line Number	Type/Size	Field Name	Contents/Format and Unit/Range of Values
8	string/10 bytes	Q3	Quaternion_3 of satellite attitude in "sd.ddddd" format / +1.00000:-1.00000, or "NA"
8	string/10 bytes	Q4	Quaternion_4 of satellite attitude in "sd.ddddd" format / +1.00000:-1.00000, or "NA"
8	string/19 bytes	Procedure	The name of the command procedure "SDC_PROCyydddFn.prc" yy: year, ddd: day of year, n: the nth command procedure of the same day.
9	Same as line 8	Same as line 8	Same as line 8
10	Same as line 8	Same as line 8	Same as line 8
-	"	"	"
11	string/22 bytes	LABEL_14	"Unscheduled Request"
12	string/25 bytes	LABEL_15	"Activity" / leading label of Activity column
12	string/19 bytes	LABEL_16	"UTC" / leading label of UTC column
12	string/9 bytes	LABEL_17	"Error_MSG" / leading label of Error_MSG column
13	string/25 bytes	Activity	"SDC_PROCyydddFn.prc"
13	string/19 bytes	UTC	UTC time when the activity should commence, in "yyyy/ddd hh:mm:ss" format / year, day, hour, minute, second / 2000:2050, 001:366, 00:23, 00:59, 00:59
13	string/variable	Error_MSG	The reason of the request not being scheduled
14	Same as line 13	Same as line 13	Same as line 13
14	Same as line 13	Same as line 13	Same as line 13
Last	String/13 bytes	LABEL_18	"END OF REPORT"

Sample Science P/L ASR

```
SOURCE:              SOCC
DESTINATION:         SDC SDC
FILE NAME:           SDC_20191214.sch
DATE TIME:           2019/12/12 06:03:07
SPACECRAFT:          FS8
INSTRUMENT:          SDC
UTC                  DUR  Q1        Q2        Q3        Q4        Procedure
2019/348 00:19:16    180  NA        NA        NA        NA        SDC_PROC19348F1.PRC
2019/348 01:58:35    180  NA        NA        NA        NA        SDC_PROC19348F2.PRC
2019/348 03:37:54    180  NA        NA        NA        NA        SDC_PROC19348F3.PRC
2019/348 05:17:13    180  NA        NA        NA        NA        SDC_PROC19348F4.PRC
2019/348 06:56:31    180  NA        NA        NA        NA        SDC_PROC19348F5.PRC
2019/348 08:35:50    180  NA        NA        NA        NA        SDC_PROC19348F6.PRC
2019/348 10:15:08    180  NA        NA        NA        NA        SDC_PROC19348F7.PRC
2019/348 11:54:27    180  NA        NA        NA        NA        SDC_PROC19348F8.PRC
2019/348 13:33:45    180  NA        NA        NA        NA        SDC_PROC19348F9.PRC
2019/348 15:13:04    180  NA        NA        NA        NA        SDC_PROC19348FA.PRC
2019/348 16:52:23    180  NA        NA        NA        NA        SDC_PROC19348FB.PRC
2019/348 18:31:41    180  NA        NA        NA        NA        SDC_PROC19348FC.PRC
2019/348 20:11:00    180  NA        NA        NA        NA        SDC_PROC19348FD.PRC
2019/348 21:50:19    180  NA        NA        NA        NA        SDC_PROC19348FE.PRC
2019/348 23:29:37    180  NA        NA        NA        NA        SDC_PROC19348FF.PRC
Unscheduled Requests:
Activity             UTC                 Error_MSG
#END OF REPORT
```

3.9.4. NORAD 2-Line Element

	NORAD 2-Line Element
Purpose/Description	FORMOSAT-8 orbital parameters for SDC to compute the satellite trajectory. It is in the standard NORAD 2-line element format.
Originator	SOCC FDF
Destination	SDC
Frequency/Volume	Once per 3 days. [TBR] / 160 Bytes
File name/E-mail Subject Convention	SSSS_yyyymmdd_hhmm.nor (SSSS: S/C name in capital, yyyy: 4 digits of year, mm: months, dd: days, hh: hours, mm: minutes) For example: FS8_20151203_0232.nor
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	SOCC as the data server, SDC to retrieve the data via SFTP. SOCC: Gateway-PC, username/passwd: xxx/xxx (TBD)

Lines 1 and 2 are the standard format of Two-Line Orbital Element Set identical to that used by NORAD and NASA. The format description is:

Byte	Field Name	Description
Byte 1	Record Number	Line 1. One integer digit: Always 1
Byte 2	Blank	ASCII Space
Bytes 3-7	Satellite Number	Five integer digits: right justified with possible leading blank character.
Byte 8	Classification	One alphabetical character for classification
Byte 9	Blank	ASCII Space
Byte 10-11	Launch Year	Last two digits of launch year
Bytes 12-14	Launch Number of Year	Three integer digits.
Bytes 15-17	Piece Number	Three alphabetical characters with possible trailing blanks.
Byte 18	Blank	ASCII Space
Bytes 19-20	Epoch Year	Two integer digits: last two digits of year
Bytes 21-32	Epoch Day	xxx.xxxxxxxx: Epoch (Julian day and fractional portion of the day-12 digits including decimal point at byte 24).
Byte 33	Blank	ASCII Space
Byte 34	Sign of First Time Derivative of Mean Motion (rev/day^2)	space or -: space = positive, - = negative
Bytes 35-43	Value of First Time Derivative of Mean Motion (rev/day^2)	.xxxxxxxx (nine characters including decimal point at byte 35
Byte 44	Blank	ASCII Space
Byte 45	Sign of Second Time Derivative of Mean Motion (rev/day^3)	space or -: space = positive, - = negative
Bytes 46-52	Value of Second Time Derivative of Mean Motion (rev/day^3)	(.)xxxxx-x (seven characters; the decimal point is implied)
Byte 53	Blank	ASCII Space
Byte 54	Sign of BSTAR Drag Term (for SPG4 Theory) or Radiation Pressure Coefficient (for SDP4 Theory)	space or -: space = positive, - = negative
Bytes 55-61	Value of BSTAR Drag Term (for SPG4 Theory) or Radiation Pressure Coefficient (for SDP4 Theory)	(.)xxxxx-x (seven characters; the decimal point is implied)
Byte 62	Blank	ASCII Space

Byte	Field Name	Description
Byte 63	Ephemeris Type	One integer digit: 0 = SGP4 Theory, 3 = SDP4 Theory
Byte 64	Blank	ASCII Space
Bytes 65-68	Element Number	
Byte 69	Check Sum (Modulo 10)	letters, blanks, periods, plus signs=0; minus signs = 1
Bytes 70-80	Blank	ASCII Spaces
Byte 81	Record Number	Line 2. One integer digit: Always 2
Byte 82	Blank	ASCII Space
Bytes 83-87	Satellite Number	Five integer digits: right justified with possible leading blank character.
Byte 88	Blank	ASCII Space
Byte 89-96	Inclination (deg)	xxx.xxxx (eight characters including decimal point at byte 92)
Byte 97	Blank	ASCII Space
Byte 98-105	Right Ascension of Ascending Node (deg)	xxx.xxxx (eight characters including decimal point at byte 101)
Byte 106	Blank	ASCII Space
Byte 107-113	Eccentricity	[.]xxxxxxx (seven characters, the decimal point is implied)
Byte 114	Blank	ASCII Space
Byte 115-122	Argument of Perigee (deg)	xxx.xxxx (eight characters including decimal point at byte 118)
Byte 123	Blank	ASCII Space
Byte 124-131	Mean Anomaly (deg)	xxx.xxxx (eight characters including decimal point at byte 127)
Byte 132	Blank	ASCII Space
Byte 133-143	Mean Motion	xx.xxxxxxxx (eleven characters including decimal point at byte 135)
Byte 144-148	Revolution number at epoch (revs)	
Byte 149	Check Sum (Modulo 10)	
Bytes 150-160	Blank	ASCII Spaces

Sample NORAD 2-Line Element

```
Data for each satellite consists of two lines in the following format:
1 NNNNNU DDLLLppp YYddd.dddddddd +.tttttttt +ssssss-s +uuuuu-u T EEEEc
2 NNNNN iii.iiii rrr.rrrr eeeeeee www.wwww MMM.MMMM mm.mmmmmmmmnnnnnx
```

3.9.5. Science P/L SOH Data

	Science Payload SOH Data
Purpose/Description	This file contains the SOH telemetry data packets from Command and Telemetry Channel generated by the SDC instruments, and is extracted from XPSOC dump file.
Originator	SOCC SCC
Destination	SDC
Frequency/Volume	Whenever data is available/ variable
File name/E-mail Subject Convention	SDC_yyyydddhhmmss_ppp.dmp (yyyy: last 2 digits of year, ddd: day of year, hh: hour, mm: minutes, ss:second, ppp:packet APID) For example: SDC_2015302120103_70D.dmp
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	SOCC: Gateway-PC, username/passwd: xxx/xxx

3.9.6. Science Data VC3

	Science Data VC3
Purpose/Description	This file contains the telemetry packets of science data from Science Data Channel as generated by the SDC instruments.
Originator	SOCC SCC
Destination	SDC
Frequency/Volume	Whenever data is available/ 1.5 Gbits per day
File name/E-mail Subject Convention	yyyydddhhmmssxx.vc3 (TBD) (yyyy: digits of year, ddd: day of year, hh: hour, mm: minutes, ss:second, xx:version) For example: 201512809323101.vc3
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	SOCC: Gateway-PC, username/passwd: xxx/xxx (TBD)

FORMOSAT-8 Telemetry is compliant to CCSDS/ECSS standards.

The telemetry emission interface executes the following functions:

- The "HOUSE KEEPING" telemetry storage before transmission to the ground (playback/backup telemetry).
- SSR interface, used to dump the SPL data from the DS
- CCSDS protocol management and encoding of the frames (master frame count

management, Reed Solomon check code computation, scrambling and marker insertion).

- Virtual channels allocation to the different sources.

The VCM function (Virtual Channel Multiplexer) multiplexes the virtual channels, manages the priority between these different channels and generates Reed-Solomon check codes. The defaulted virtual channel IDs are:

- VCID = 011b, scientific data

4. Environmental Design Requirements

The science payload shall be designed to comply with FORMOSAT-8 Component Environmental Specification (FS8-SPEC-0017). The environmental specification might be changed by TASA due to program need.

5. Requirements Verification

The requirements shall be in accordance with the methods indicated in the Requirement Verification Matrix. The methods selected for verification are described below.

Inspection

Verification by inspection is a process which may be used in lieu of or in conjunction with testing to verify design features. Inspection is the process of physically measuring, examining or comparing an article to the design drawings, schematics, or other records to assure requirements compliance. This method also includes the validation of records to ascertain that correct parts, materials and processes were used.

Demonstration

Demonstration shall be the determination of properties and performance of an item involving proof-by-doing such as service and access, transportability and human engineering.

Analysis

Verification by analysis is a process used in lieu of or in addition to testing to verify compliance to specification requirements. The selected techniques may include systems engineering analysis, statistics and qualitative analysis, computer and hardware simulations, and analog modeling. Analytical techniques may be used in lieu of tests for such things as reliability assessment, life, storage, failure analysis, safety, interchangeability, and other performance requirements which are difficult or impractical to test. Analysis associated with qualification by similarity is included in this method.

Test

Test shall be the determination of properties and performance of an item by mechanical, electrical and environmental functional measurements. Tests shall be classified as follows:

Performance Testing: Comprehensive verification that the Bus meets the performance characteristics defined in Section 3 and identified in the Verification Cross Reference Matrix under both nominal conditions and environments.

Environmental Testing: Any testing performed under conditions other than the ambient environment.

Acceptance Testing: The environmental, electrical, mechanical, and other tests which all items intended for flight must pass. The tests are designed to verify proper workmanship and to demonstrate that the Bus will operate as specified when subjected to the expected worst case environmental conditions.

Protoflight Testing: The environmental, electrical, mechanical, and other tests required to verify that the Bus components will comply with design and performance requirements under anticipated operational regimes and environments. The environment of protoflight tests shall be harsher than the predicted operational environment, but below the design safety factor level so that the components need not be refurbished prior to flight. Exposure time is based on the use cycle and/or type of flight item. When several units of the same component are manufactured, only one shall be protoflight tested. Protoflight testing applies only to those component types identified below.

i. New designs
ii. Modified designs
iii. Existing designs with qualification levels that do not meet FORMOSAT-8 requirements

5.1. Requirements Verification Cross-Reference Matrix (VCRM)

VCRM of the Science Payload IRD is described in Appendix-B.

Appendix-A Acronym

AIT Assembly, Integration and Test

AUT Antenna under Test

BW Bandwidth

CCB Configuration Control Board

CCU Camera Control Unit

CDMU Command and Data Management Unit

CDR Critical Design Review

CE Conducted Emission

CFRP Carbon Fiber Reinforced Plastic

CMOS Complementary Metal Oxide Semiconductor

CS Conducted Susceptibility

CVCM Collected Volatile Condensable Material

DC Direct Current

ECR Engineering Change Request

EEE Electro mechanic, Electric and Electronic

EICD Electrical Interface Control Drawing

EIDP End Item Data Package

EMC Electromagnetic Compatibility

ESD Electrostatic Discharge

FM Flight Model

FMECA Failure Mode Effects and Criticality Analysis

HK Housekeeping

H/W Hardware

ICD Interface Control Document/Drawing

I/F Interface

I/O Input/Output

GPS Global Positioning System

LET Linear Electron Transfer

LISN Line Impedance Simulation Network

LV Launch Vehicle

MDRP Marine Data Relay Payload

MICD Mechanical Interface Control Drawing

MMU Memory Management Unit

MS Margins of Safety

NCR Non-Conformance Report

PA Product Assurance

PCB Printed Circuit Board

PCDU Power Control Distribution Unit

PFR Problem/Failure Reporting

PIND Particle Impact Noise Detection

PSLV Polar System Launch Vehicle

QA Quality Assurance

QPL Qualified Parts List

RCS Reaction Control Subsystem

RD Reference Document

RE Radiated Emission

RHCP Right Handed Circular Polarization

RS Radiated Susceptibility

RSI Remote Sensing Instrument

RMS root mean square

SCOE System or Special Check-Out Equipment

S/C Spacecraft

SEB Single Event Burnout

SEE Single Event Effect

SEGR Single Event Gate Rupture

SEL Single Event Latch-up

SEU Single Event Upset

SOCC/SDC Satellite Operation Control Center/Science Data Center

SRS Shock Response Spectrum

TB Thermal Balance

TBC To be confirmed

TBD To be defined

TC Thermal Cycling

TML Total Mass Loss

TV Thermal Vacuum

VSWR Voltage Standing Wave Ratio

Appendix-B Science Payload IRD Requirements Verification Cross-Reference Matrix (VCRM)

Requirement		Verification						Traceability
		Level	Method					
Paragraph	Title		n/a	tt	aa	ii	dd	
3	Requirements	C	X					SRD Section 3.2.4
3.1	System	C	X					Title
3.1.1	Configuration	C	X					SRD Section 1.2
3.1.2	Operation Modes	C				X		SRD Section 1.2
3.1.3	Operation Requirements	C				X		SRD Section 3.5.1.5.2
3.1.4	Mission Life	C				X		FS5 heritage
3.1.5	Orbit	C	X					General description
3.2	Physical	C	X					Title
3.2.1	Location Dimensions	C				X		SRD Section 3.5.1.5.2
3.2.2	Mass	C					X	SRD Section 3.5.1.5.2
3.2.3	Center of Gravity	C			X			FS5 heritage
3.2.4	Field of View	C	X					General description
3.2.5	Deployment	C				X		General description
3.2.6	Alignment	C	X					General description
3.2.7	Mounting	C				X		General description
3.2.8	Grounding	C	X					General description
3.3	Attitude Control	C	X					Title
3.3.1	Pointing Accuracy	C	X					General description
3.3.2	Pointing Knowledge	C	X					General description
3.3.3	Positioning Knowledge	C	X					General description
3.3.4	Operation of Science Payload	C	X					General description
3.4	Power	C	X					Title
3.4.1	Orbit Average Power	C			X			SRD Section 3.5.1.5.2
3.4.2	Input Voltage	C		X				SRD Section 3.5.1.5.2
3.4.3	Peak Current Draw	C		X				SRD Section 3.5.1.5.2
3.4.4	Electrical Power Interface	C				X		SRD Section 3.5.1.5.2
3.4.5	Connector	C				X		General description

3.5	Command and Telemetry	C	X					Title
3.5.1	Command and Telemetry Interface	C				X		SRD Section 3.5.1.5.2
3.5.2	Connector	C				X		General description
3.6	Science Data	C	X					Title
3.6.1	Science Data Interface	C		X				SRD Section 3.5.1.5.2
3.6.2	Connector	C				X		General description
3.6.3	Data Storage	C	X					SRD Section 3.5.1.5.2
3.7	Thermal	C	X					Title
3.7.1	Thermal Control	C	X					General description
3.7.2	Thermal Power Dissipation	C				X		General description
3.8	Magnetic Cleanliness	C				X		General description
3.9	SOCC/SDC Interface Requirement	E		tt				FS5 heritage
4	Environmental Design Requirements	C	X					FS5-SPEC-0017

Requirement: List out paragraph number and title of the requirement
Traceability:

1. Flowed-down requirements: list out doc/paragraph number of the parent doc
2. Heritage requirements: spell out the heritage (i.e. FS5 or …)
3. Newly created/derived requirements: list out the released memo/doc which records how the requirements were derived or created.

Verification:

6. Verification Levels

Level	Abbr	ID
Component	CMP	C
Subsystem	SUB	U
Engineering Dev. Model	EDM	D
Support Equipment	SE	E
Scientific Instrument	SI	I
Spacecraft Bus	S/C	S
Remote Sensing Instrument	RSI	R
Satellite	SAT	F
Ground Segment	GS	G
Image Signal Processing	ISP	P

7. Verification Methods

Method	Abbr	ID
Not Applicable	N/A	n/a
Test	TT	tt
Analysis	AA	aa
Inspection	II	ii
Demonstration	DD	dd

福衛八號第六顆衛星 (FS-8F)

科學酬載開發與應用

附 錄 二

文件需求清單

(Data Deliverables)

目錄

1.0 簡介

本附錄訂定福衛八號計畫預計研發之衛星酬載系統，包含其中之設計與相關測試資料，所需遞交之文件及其內容要點。受補助單位必須依本附錄的規定，準備、維護並交付所有文件至國家太空中心（以下簡稱本中心）。本計畫專案應遞交之文件係由文件需求清單（Committed Data Requirements List 以下簡稱 CDRL）所規範，文件需求清單係根據「課題說明」所規定配合各計畫進度所應遞交至本中心之文件需求。

2.0 一般需求說明

2.1 交付文件格式

除另有規定及工程藍圖外，書面文件須依下述說明為之：

2.1.1 書面文件

尺寸 - A4 影印紙

紙質 - 20 磅或以上不透明白紙

封面 - 印刷裝訂封面

單面或雙面印均可，避免空頁

避免使用超過規定尺寸大小紙張，但如有必要使用，則應折疊成 A4 尺寸大小，字跡清晰以利複製效果。

2.1.2 電子檔案

除另有規定，受補助單位應提交所有 CDRL 項目之電子檔案與隨身碟拷貝，其格式必須符合 Microsoft Office 2016、PDF 檔或雙方共同同意之上述升級版本。

2.1.3 工程圖

工程圖（Engineering Drawings）必須用 20 磅不透明白紙可影印方式複製，單面印，效果須清晰。工程圖的電腦檔案格式必須為工程軟體 AutoCAD，Pro/Engineer，IDEAS，CATIA 或雙方共同同意之格式。

2.2 文件標識

受補助單位依 CDRL 規定所提交之文件必須依本中心預設之編號系統加以編號，其中 CDRL 編號、版別、出版日期、遞交日期及 CDRL 文件名稱等為文件標示之最基本需求必須顯示在每一份文件之封面。CDRL 文件之版別為 4 碼流水號分成 Issue 與 Revision 兩段，配合各階段計畫進度審查，本中心會預先規定應遞交之文件版本（Issue），第一次版本為 Issue 00，第二次版本為 Issue 01，依此類推，除規定之遞交版本外若有修訂需要必須在下一版本（Issue）遞交前提出文件修訂（Revision）則變動後 2 碼 Revision 流水號由 01 開始，例如第一次遞交後，若有小修訂而尚未至第二次遞交，則版別應變動為 0001，如下表例說明：

CDRL 編號	CDRL 名稱	版別 Issue / Revision	意義
FS8SPL-CDRL-1006	Product Assurance Plan	0000	FIRST ISSUE (PRESCRIBED BY TASA)
		0001	First Revision After First Issue
		0100	Second Issue (prescribed by TASA)
		0101	First Revision After Second Issue

課題名稱、交付單位名稱也須同時顯示在封面頁，此外文件之作者及其單位名稱也應包含在簽署頁。另外文件編號、版別、名稱、日期及頁次號碼則必須自簽署頁起顯示在文件的每一頁。文件之修訂版與最後定版均必須依照此格式準備，修訂版及最後定版亦必須清楚的標示相較於前一版的不同處。

2.3 文件審查/核准

CDRL 中之核可碼定義如以下所述。其中需要本中心認可之文件必須在所有問題、議題及意見都得到解決並經本中心認可後才算完成。本中心所標出之錯誤及內容不詳處，受補助單位必須負責修改。

核可碼	說　　明
1（核可類）	• CDRL 項目需要受補助單位自我陳述已成功完成合約書工作內容所規定之服務工作。

	• 當受補助單位成功完成合約書任務且交送文件符合需求時，本中心將書面通知受補助單位其最後版本之 CDRL 文件已被正式接受。 • 需要本中心正式核可之文件，將在所有問題及意見均獲得解決後才會被允收。
2（完成類）	• CDRL 項目需要受補助單位自我陳述已成功完成合約書工作內容所規定之服務工作。 • 不需要本中心正式通知文件允收。 • 受補助單位仍必須更正本中心提出之任何文件上之錯誤或疏忽。

2.4 文件之遞交與分發

除非在 CDRL 表單中〝Distribution〞欄中另有規定，否則受補助單位應遞交壹份書面資料和壹份電子檔案（包含 USB 隨身碟拷貝）給本中心，資料的複製及分送將由本中心自行完成。

2.5 文件費用

除非另有提供項目，否則回應資料遞送費用亦包含於合約書價格中。

2.6 本附錄未要求之資料

於研發工作執行中所產出之資料但不屬於本附錄所規定提交者，受補助單位應配合本中心之要求而提供。至於提供之文件內容將遵照雙方共同同意來執行，受補助單位現有的格式將可以被接受。

2.7 CDRL 交付地址

除非另有規定，受補助單位必須將所有 CDRL 送達以下的住址：

國家太空中心

新竹市科學工業園區展業一路九號八樓

收文者：福衛八號計畫科學任務及酬載計畫窗口

3.0 細部需求

3.1 CDRL 表單定義

本章將對本合約書所需求之 CDRL 各項目，包括內容、格式、保存須知以及提交規定等，作詳細的規定及說明。

3.1.1 文件編號

本欄為 CDRL 的編號。

3.1.2 文件名稱

本欄為 CDRL 文件的名稱。

3.1.3 核可碼

本欄為 CDRL 的核可碼，分為 1 或 2 。

3.1.4 分發

本欄載明文件的收件單位及所需份數，所需份數規定在收件單位之後的括號中。資料的收件單位及其地址詳如本附錄第 2.7 節所述。

3.1.5 文件第一版提交日期

本欄規定各個 CDRL 文件第一版的提交日期。文件若需要作最後的修訂，則可在所規定提交的階段性審核進行時完成。

3.1.6 文件定版或修定版提交日

本欄規定各個 CDRL 文件在第一版之後各修定版的提交日期。最後一個提交日期則為最後定版的提交日期。文件若需要作最後的修訂，則可在所規定提交的階段性審核進行時完成。需本中心審核之文件（Approve Code: 1）必須於所規定之遞交日期前送達本中心進行審核。無需本中心審核之文件（Approve Code: 2）完稿則須於規定之遞交日期前遞交。

3.1.7 準備須知 (Requirement)

本欄包含適用文件遞交項目之樣式、內容與所有須知，如有變動須經本中心同意。

3.2 交付文件 (CDRL) 項目摘要

交付文件摘要如下：

工作里程	交付文件	初版遞交	最終遞交	核可碼
MDR/SDR	1. MDR/SDR Presentation		MDR/SDR	1
	2. Science Mission Definition Document		MDR/SDR	2
	3. P/L System Requirements Document		MDR/SDR	1
PDR	4. PDR Presentation		PDR	1
	5. P/L System Specification	PDR	CDR	1
	6. Product Assurance Plan		PDR	1
ISD	7. ISD User Manual	ISD	DRR	1
CDR	8. CDR Presentation		CDR	1
	9. P/L Interface Control Document		CDR	1
	10. P/L I&T Plan and Procedure	CDR	TRR / ITSS	1
	11. P/L System Operation Plan	CDR	PAR	2
DRR	12. DRR Presentation		DRR	1
	13. ISD to Spacecraft Bus Interface Test Report		DRR	1
TRR	14. TRR Presentation		TRR	1
PAR	15. PAR Presentation	PAR	PAR	1
	16. P/L Test Report	PAR	SMRR	1
	17. EIDP for P/L Flight Module		PAR	1
	18. P/L System Operation Handbook	PAR	SMRR	1
	19. P/L Verification Control Document (including Compliance Verification Matrix)	CDR、TRR、PAR	SMRR	1
SMRR	20. Science Mission Readiness Presentation		SMRR	1
	21. Science Data Center (SDC) Readiness Presentation		SMRR	1
	22. Data Processing Software Test Report	SMRR	IOCR	1
ITSS	23. ITSS Report	PAR	ITSS	1
	24. PL and Bus Integration & Test Report		ITSS	1

IOCR	25. IOCR Presentation		IOCR	1
	26. P/L IOC Test Report		IOCR	1
	27. Monthly Repot			2
	28. Quarterly Report			2
	29. Progress Report			2
	30. Achievement Report			2

3.3 交付文件 (CDRL) 詳細需求表單及文件交付時程

註：除規定應遞交之版本（Issue）及次數外，若有需要必須在下一版本（Issue）遞交前提出文件修訂（Revision）或者已提出最後版本需要再修訂者，是可以被接受。文件內容中、英文撰寫皆可。

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1001	2. Title MDR/SDR Presentation	3. Approval Code:1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 MDR/SDR		6. 文件定版或修定版提交日期 MDR/SDR	
7. Requirement: 行動要項現況 (Excel File 及相關文件) 酬載系統任務定義 酬載系統初步系統設計; 初步介面需求 ■ Size, weight, power, data, and links designed with enough margins; ■ Payload physical design layout should be given from interface; ■ Special components (long-lead items or export license issues) to be identified; ■ P/L and its component design and its accommodation to the S/C; ■ How system requirements are transformed into design elements. 會議紀錄			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1002	2. Title Science Mission Definition Document	3. Approval Code: 2	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 MDR/SDR		6. 文件定版或修定版提交日期 MDR/SDR	
7. Requirement: 任務定義 (Science Mission、Conceptual design、Description of operational capability、System Capabilities、Operations concept) 使用者需求			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1003	2. Title P/L System Requirements Document	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 MDR/SDR		6. 文件定版或修定版提交日期 MDR/SDR	
7. Requirement: 系統設計概念 系統需求 (性能、功能與操作需求) 介面需求 (TM/TC ICD、Mechanical ICD、Electrical ICD)			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1004	2. Title PDR Presentation	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 PDR		6. 文件定版或修定版提交日期 PDR	
7. Requirement: 行動要項現況 (Excel File 及相關文件) 酬載系統之初步系統規格 – 符合系統需求 酬載系統之初步介面規格– 符合介面需求 初步元件規格 會議紀錄			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1005	2. Title P/L System Spec.	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 PDR		6. 文件定版或修定版提交日期 CDR	
7. Requirement: 酬載儀器規格 元件規格			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1006	2. Title Product Assurance Plan	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 PDR		6. 文件定版或修定版提交日期 PDR	
7. Requirement: 品保執行計畫書 ■ Product Assurance Management ■ Reliability ■ Hardware Quality Assurance ■ Parts, Materials and Processes (PM&P) Program ■ Package & Shipment Plan			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1007	2. Title ISD User Manual	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 ISD		6. 文件定版或修定版提交日期 DRR	
7. Requirement: ISD User Manual (including ISD functional test report and ISD test procedure to be performed at TASA)			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1008	2. Title CDR Presentation	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 CDR		6. 文件定版或修定版提交日期 CDR	
7. Requirement: 行動要項現況 (Excel File 及相關文件) 酬載系統細部設計– 符合系統與介面規格 元件選擇與備便完成 會議紀錄			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1009	2. Title P/L Interface Control Document	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 CDR		6. 文件定版或修定版提交日期 CDR	
7. Requirement: (P/L to S/C) 酬載與衛星介面參數			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1010	2. Title P/L I&T Plan & Procedure	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 CDR		6. 文件定版或修定版提交日期 TRR/ITSS	
7. Requirement: 酬載系統測試與組裝計畫 組裝程序書 酬載儀器飛行體環境測試規劃 (包含初版測試程序書) 酬載儀器與衛星本體介面整合測試程序書 (初版)			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1011	2. Title P/L System Operation Plan	3. Approval Code: 2	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 CDR		6. 文件定版或修定版提交日期 PAR	
7. Requirement: 酬載系統操作計畫 (發射操作、早期軌道操作、一般軌道操作、資料分析、處理與儲存)			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1012	2. Title DRR Presentation	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 DRR		6. 文件定版或修定版提交日期 DRR	
7. Requirement: 行動要項現況 (in Excel File 及相關文件) ISD 驗收備便說明 ISD 設計及性能驗證結果 ISD 測試報告 會議紀錄			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1013	2. Title ISD to Spacecraft Bus Interface Test Report	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 DRR		6. 文件定版或修定版提交日期 DRR	
7. Requirement: ISD 與衛星本體介面測試結果			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1014	2. Title TRR Presentation	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 TRR		6. 文件定版或修定版提交日期 TRR	
7. Requirement: 行動要項現況 (Excel File 及相關文件) 飛行體測試備便報告 酬載儀器飛行體環境測試程序書 會議紀錄			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1015	2. Title PAR Presentation	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 PAR		6. 文件定版或修定版提交日期 PAR	
7. Requirement: 行動要項現況 (Excel File 及相關文件) 酬載飛行體驗收備便說明 酬載飛行體/工程體設計及性能驗證結果 PAR 前測試報告 會議紀錄			

Data Requirements Description			
1. Item Number FSSPL-CDRL-1016	2. Title P/L Test Report	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 PAR		6. 文件定版或修定版提交日期 SMRR	
7. Requirement: 酬載系統功能及環境測試報告			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1017	2. Title EIDP for P/L Flight Module	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 PAR		6. 文件定版或修定版提交日期 PAR	
7. Requirement: End Item Data Package (EIDP) 應收集並整理科學酬載飛行體於設計、製造、組裝、整合、測試等過程相關資料，以提供產品品質符合合約書需求之佐證與追溯記錄，EIDP 將構成產品得以允收之重要根據，內容應包括： (a). Approval signature of EIDP cover page, Certificate of Conformance for delivered flight equipment with management signature. (b). Design Package: system design documents including specifications, reports, analysis, and drawings, etc. (c). Manufacturing Package: manufacturing procedures and records, part and material Lists, critical items list, system tree (product tree), document list (spec/drawing tree), as-designed, as-built configuration list, handling, transportation and storage procedures, etc. (d). Verification Package: safety/hazard analysis report, compliance verification report, test procedures/plans, functional test reports, inspection data, analysis reports, environmental test data and reports, calibration records and evidences for test equipment and instruments, etc. (e). Product Assurance Package: Summarized of evidence of QA approval, photographs of workmanship details of all flight electrical and mechanical assemblies, NCRs list and copy of NCR reports, repair, rework, and maintenance actions, deviation / waivers log, engineering changes and CCB log, etc.			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1018	2. Title P/L System Operation Handbook	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 PAR		6. 文件定版或修定版提交日期 SMRR	
7. Requirement: 酬載系統操作手冊 (發射操作、早期軌道操作、一般軌道操作、資料分析、處理與儲存)			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1019	2. Title P/L Verification Control Document (including Compliance Verification Matrix)	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 CDR、TRR、PAR		6. 文件定版或修定版提交日期 SMRR	
7. Requirement: 酬載系統驗證矩陣 (驗證理念與程序說明、各項規格驗證方法、各項規格驗證結果與參考文件列表)			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1020	2. Title Science Mission Readiness Presentation	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 SMRR		6. 文件定版或修定版提交日期 SMRR	
7. Requirement: 行動要項現況 (Excel File 及相關文件) 任務備便報告 會議紀錄			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1021	2. Title Science Data Center (SDC) Readiness Presentation	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 SMRR		6. 文件定版或修定版提交日期 SMRR	
7. Requirement: 行動要項現況 (Excel File 及相關文件) 科學資料中心 SDC 備便報告 會議紀錄			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1022	2. Title Data Processing Software Test Report	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 SMRR		6. 文件定版或修定版提交日期 IOCR	
7. Requirement: 資料處理服務系統流程 資料處理服務程式軟體 資料處理服務系統測試結果			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1023	2. Title ITSS-Report	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 PAR		6. 文件定版或修定版提交日期 ITSS	
7. Requirement: 行動要項現況 (Excel File 及相關文件) 酬載儀器與衛星本體整合測試程序書 PAR 後測試說明			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1024	2. Title PL and Bus I&T Test Report	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 ITSS		6. 文件定版或修定版提交日期 ITSS	
7. Requirement: 酬載儀器與衛星本體整合測試報告 (PAR 後)			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1025	2. Title IOCR Presentation	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 IOCR		6. 文件定版或修定版提交日期 IOCR	
7. Requirement: 行動要項現況 (Excel File 及相關文件) 發射初期儀器操作與檢查說明 早期軌道測試結果說明 會議紀錄			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1026	2. Title P/L IOC Test Report	3. Approval Code: 1	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 IOCR		6. 文件定版或修定版提交日期 IOCR	
7. Requirement: 酬載早期軌道測試結果報告			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1027	2. Title Monthly Report	3. Approval Code: 2	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 Monthly		6. 文件定版或修定版提交日期 N/A	
7. Requirement: 本月研發進度與完成事項 下月規劃工作 預算與時程執行現況 主要問題 (包含潛在風險與對策)			

Data Requirements Description			
1. Item Number FS8SPL-CDRL-1028	2. Title Quarterly Report	3. Approval Code: 2	4. Distribution 兩份書面資料 一份電子檔
5. 文件第一版提交日期 Quarterly		6. 文件定版或修定版提交日期 N/A	
7. Requirement: 本季研發進度與完成事項 下季規劃工作 預算與時程執行現況 主要問題 (包含潛在風險與對策)			

國家科學及技術委員會自然科學及永續研究發展處暨國家太空中心
「福爾摩沙衛星科學酬載開發與應用」專案計畫

課題說明 A01：福衛八號第六顆衛星 (FS-8F) 科學酬載開發與應用

(一)研究目的/背景說明

福衛八號為光學遙測衛星，除光學遙測主酬載外，亦安裝包括科學酬載等次酬載以執行科學與其他任務。本課題為執行福衛八號第六顆衛星 (FS-8F) 科學酬載開發與應用，建立太空科學儀器的研發能量，培養研發專業人才和團隊與自主開發衛星酬載工程技術，促使國內太空科學儀器技術完整的發展。其工作內容包含任務定義、系統設計分析、軟硬體設計分析與驗證、元件製作、組裝與測試等。

本課題預計完成科學酬載飛行體研製與衛星整合測試，並於發射後完成早期軌道測試，確認科學酬載功能無誤。如本課題執行成效良好，擬後續進行科學酬載任務操作、分析校正衛星下載之觀測資料、資料處理與儲存及服務使用者等工作，將另案處理。

(二)執行期程、審查會議時程

- 執行期程自 115 年 10 月 1 日起算 70 個月內或衛星發射日起算 5 個月內完成交付項目之供應 (兩者以日期較晚者為主)。

各階段審查會議與工作會議時程與交付項目詳表一。

(三)工作內容

受補助單位應依下列各項工作內容，提供人力、設施、測試與製造設備以及其他相關資源，配合福衛八號第六顆衛星 (FS-8F) 發射時程，規劃完成 FS-8F 之科學酬載 (Payload, P/L) 系統之開發、製造與驗證等研製工作，遞交一組科學酬載模擬器 (Instrument Simulation Device, ISD) 與科學酬載飛行體 (Flight Model)，並完成各階段工作項目及工作內容。

受補助單位須依據附錄一「FS8F-IRD-0001：FORMOSAT-8F Spacecraft Bus to Science Payload Interface Requirement Document」之需求，研製發展本課題之科學酬載。

受補助單位於以下各研發階段應完成之相關報告及文件 (如表二)，依附錄二「文件需求清單」內之規範於期限內完成並遞交，除 CDRL 表單中〝Distribution〞欄中另有規定外，每項報告、文件及簡報繳交紙本 1 份及電子檔各 1 份。審查會議後仍有需改正之項目，受補助單位應於會議紀錄規定時間內 (未載明者為自通知日起 15 個日曆天) 完成改正，交付國家太空中心再行審查。

1. 各階段工作項目及工作內容簡述

受補助單位應依以下各階段所列之工作項目及內容，分階段完成科學酬載之研製工作，並配合衛星進度完成各階段之審查會議、工作/進度會議。

(1) 任務定義暨系統設計審查工作會議 (MDR/SDR, Mission Definition Review & System Design Review)

A. 完成科學酬載系統任務定義、確認系統需求與介面需求。

B. 完成符合科學酬載系統與介面需求之系統設計、完成初步品保計畫 (Product Assurance Plan, PAP)、確認使用者需求。

(2) 初步設計審查工作會議 (PDR, Preliminary Design Review)

A. 完成初步科學酬載/元件與地面系統之規格定義與設計，及完成品保計畫書 (PAP)。

B. 完成初步科學酬載系統測試與組裝規劃。

(3) 科學酬載模擬器 (ISD) 初版遞交及允收審查工作會議 (ISD Acceptance Review)

A. 為協助科學酬載與衛星本體的介面整合測試與偵錯，於科學酬載飛行體遞交至國家太空中心前，受補助單位須研發並遞交一組科學酬載模擬器 (ISD)。

B. ISD (含軟硬體及相關使用說明) 須能模擬科學酬載資料傳遞介面，模擬科學酬載硬體介面。

C. 本科學酬載模擬器需於規定期限交付至國家太空中心，國家太空中心將進行交付文件及科學酬載模擬器之數量清點。

D. 科學酬載模擬器 (ISD) 允收完成後將進行與衛星工程發展體測試；於測試期間，ISD 若有損害，受補助單位須配合執行修復工作。

E. 研製科學酬載模擬器 (ISD) 所發展之軟體，國家太空中心具有取得使用、修改及再製權利。此 ISD (含軟硬體及相關使用說明) 供國家太空

中心階段性使用後，受補助單位若有使用該軟體之需求，得依國家太空中心相關規定辦理。

(4) 細部設計審查工作會議 (CDR, Critical Design Review)

A. 完成科學酬載系統細部設計，確認系統與介面規格符合任務需求。完成科學酬載之零件選用。

B. 完成初版科學酬載系統測試與組裝計畫、初版組裝程序書、初步測試程序書撰寫 (包含科學酬載飛行體本身的環境測試程序書與衛星本體介面整合測試用的程序書)。

C. 完成初版之科學酬載系統操作計畫，包括發射操作、早期軌道操作、一般軌道操作以及資料分析、處理與儲存等。完成科學酬載與衛星、科學酬載與地面、地面與 Satellite Operation Control Center, SOCC 之介面參數定義。

(5) 完成 ISD 更新版研製審查工作會議 (DRR, Design Requirements Review)

A. 科學酬載模擬器 (ISD) 交付後，受補助單位應配合國家太空中心時程提供人力至國家太空中心進行 ISD 與衛星工程發展體之介面驗證工作。

B. 受補助單位完成並交付 ISD 與衛星工程發展體介面測試結果報告。

(6) 科學酬載飛行體測試備便審查工作會議 (TRR, Test Readiness Review)

A. 確認科學酬載飛行體已製造完成可進行環境測試。受補助單位負責科學酬載本身的性能測試與環境測試，完成科學酬載飛行體測試程序書撰寫。科學酬載層級的測試包含功能性測試 (CPT) 及環境測試。

B. 環境測試項目可包含 Vibration、Thermal Vacuum、EMC 等測試，詳細測試規格請參照附錄一「FS8F-IRD-0001：FORMOSAT-8F Spacecraft Bus to Science Payload Interface Requirement Document」。

(7) 科學酬載飛行體允收及審查工作會議 (PAR, Payload Acceptance Review)

A. 受補助單位須研發完成並遞交科學酬載飛行體 (Flight Model) 一組，經由設計、分析與測試等方法，完成此飛行體在嚴苛發射與太空環境下仍能維持正常功能及操作之驗證，包括通過功能測試與環境測試。

B. 完成科學酬載飛行體規格符合驗證與確認 (Verification & Validation)、科學酬載飛行體 EIDP 備便且通過審查。

C. 受補助單位負責科學酬載飛行體研製所需之資本設施。本飛行體在 PAR 後，與衛星本體進行測試期間，若有損害，受補助單位須配合執行修復工作。受補助單位負責完成科學酬載系統操作計畫與初版科學酬載系統操作手冊之撰寫。

(8) 科學任務備便審查工作會議 (SMRR, Science Mission Readiness Review)

A. 受補助單位應完成科學任務備便並遞交報告。

B. 受補助單位須成立「資料中心」，進行科學酬載資料之分析、校正、處理與儲存工作。對於未經處理之低階資料及已處理過之高階資料、所有處理參數以及相關技術文件，「資料中心」須負責儲存及管理。並適時提供給國內外有需求之單位及個人。

(9) 衛星整合測試支援服務工作會議 (ITSS, Integration and Test Support Service)

受補助單位須配合 FS-8F 衛星整測時程進行下列工作：

A. 受補助單位負責科學酬載與相關地面設備的整合測試，同時支援科學酬載與衛星本體的整合測試過程中的科學酬載相關工作。

B. 完成科學酬載系統測試與組裝計畫、組裝程序書、衛星本體介面測試程序書撰寫。此階段的測試包含衛星層級功能性測試 (CPT) 及環境測試 (可包含 Vibration、Acoustic、Pyroshock、Thermal、EMC 等)、酬載儀器與地面站系統的端到端測試 (End-to-End Test)、視需要而做的 RF Compatibility Test 等。

C. 受補助單位應配合國家太空中心參加 FS-8F 運送前審查會議 (Pre-Shipment Review, PSR)。

D. 受補助單位應派員於發射場負責科學酬載之檢查作業。

(10) 早期軌道運轉測試工作會議 (IOCR, In-Orbit Checkout Review)

A. 衛星升空後，衛星系統之操控任務將由國家太空中心現有之衛星操控中心 (SOCC) 與 TT&C 地面站執行。受補助單位須配合參與發射初期（約為發射日起算 3 個月內）儀器之檢查操作。

B. 若發射失敗，此階段工作將不予執行。

C. 若發射延後，以單一計畫主持人計畫件數核給基準為原則或特殊情形經本會同意者，可申請計畫執行期限展延。

(11)年度計畫審查會議及期中進度報告、研究成果報告

A. 受補助單位在各年度計畫執行期滿前 2 個月，至國科會系統線上繳交期中進度報告 (Progress Report)。

B. 受補助單位應依規定完成期末報告階段之相關工作。

C. 執行期滿後 3 個月內，必須至國科會系統繳交研究成果報告 (Achievement Report)，並辦理經費結報。

2. 計畫管理

(1) 本案執行期間受補助單位須配合 FS-8F 主計畫時程，與國家太空中心團隊共同舉辦及參與相關審查及介面會議，以及每月定期召開進度會議共同討論工作規劃、執行進度及成果報告與討論。

(2) 各階段審查會議將邀請相關人員與會審查，受補助單位必須負責進度會議/工作會議/審查會議之會議紀錄、行動要項、審查報告、簡報資料，及所有將使用、參考或交付之技術或管理文件。

(3) 依照規範完成各階段及各期工作/審查會議應完成並遞交相關文件、定期綜整之季報與月報詳附錄二「文件需求清單」之規範。

(4) 依國家科學及技術委員會相關規定繳交各項報告，並配合本會施政需要提供參考資料及參加活動與展會 (如衛星科學工作坊、臺灣太空國際年會)。

3. 系統工程

任務需求定義與系統工程由受補助單位負責，國家太空中心可提供軌道分析相關協助，視需要可召開技術會議。交付文件中之系統需求、介面需求、系統驗證、操作規劃類文件，國家太空中心可提供受補助單位參考資料。

4. 品質管理

受補助單位應依據其研擬的科學酬載之品保計畫書 (Product Assurance Plan, PAP) 執行計畫；於執行期間若發現有不符合事項，應確實紀錄。

(四)實體遞交項目與管制作業

1. 實體遞交項目

- 科學酬載模擬器 (ISD) 1 套
- 飛行體 1 套。

2. 實體遞交之管制作業

(1) 包裝與運送管制

A. 實體之運搬 (Handling) 必須極度小心，避免刮傷、碰撞、掉落等情事發生，工作人員接觸實體時必須穿戴無塵室專用乾淨手套，並做好ESD 接地處理以避免污染發生以及靜電破壞或損傷。

B. 確認實體上之所有電器接頭 (Connectors) 均已清潔乾淨無污染並套上符合 ESD 要求之防塵蓋保護。

C. 實體包裝前應完成清潔與檢驗，確保表面之潔淨度符合在目視潔淨程度 (Visibly Clean)。

D. 確認符合上述需求後，受補助單位應依照實體對運輸環境之敏感特性如溫度、濕度、振動、衝擊等，做好包裝以保護實體安全的運抵國家太空中心，包括：包裝材料、包裝方法與程序等規劃。受補助單位應依照下列方式或其它等同方式可達到防護目的來進行包裝作業：

(A) 實體應使用雙層 ESD 靜電袋 (Double Bag) 包裝，內層包裝袋先使用乾燥氮氣充填 (N2 Purge) 清除空氣後密封或以抽真空方式密封 (Vacuum Seal)。

(B) 依實體重量、衝擊敏感方向選擇適當的衝擊感測器 (Shock Watch or Shock Sensor) 貼在實體上進行運送過程的監測。

(C) 將完成內層包裝的實體再裝入第 2 層靜電袋，袋內放置濕度指示器 (Humidity Indicator) 以及乾燥劑後密封。

(D) 將完成包裝的實體放入硬殼材質、可重複使用之運送箱包裝，運送箱內部應有緩衝包裝材料經過適當剪裁符合實體之大小，以達到實體保護之目的，如實體對溫度敏感需要對溫度進行監測則運送箱內需要裝置溫度記錄器 (Temperature Logger)；另外為識別實體已確實完成所有出廠前必要的檢驗與測試，包裝箱內必須提供經受補助單位之品保或管理代表合格簽章之掛簽 (Acceptable Tag) 做為品質合格識別。

(2) 運送外箱標示 (Container Marking) 應至少包含以下資訊：

- 課題名稱
- 遞交實體名稱
- 收貨人及收貨地址
- ESD 靜電防護警告標示與易碎品小心搬運警告標示

(3) 受補助單位必須同時提供送貨單 (Packing List) 一份，詳列運交之軟體、硬體設備與相關附件、配件等清單，包括項目、品名、型號、序號，數量等，放在貨箱外部。

(五)附錄

附錄一：FS8F-IRD-0001

附錄二：FS8F 文件需求清單

表一　各階段審查會議時程

項次	會議名稱	完成時點	交付項目及內容說明 (詳附錄二)
1	啟動會議 (Kick-off Meeting)	115/10/31	工作會議簡報
2	任務定義暨系統設計審查工作會議 (MDR/SDR)	115/12/01	工作會議簡報 詳表二：文件需求清單
3	初步設計審查工作會議 (PDR)	116/7/01	工作會議簡報 詳表二：文件需求清單
4	年度計畫審查會議	116/8/31	期中進度報告 (116/7/31 前完成線上繳交) 審查會議簡報
5	科學酬載模擬器 (ISD) 初版遞交及允收審查工作會議	117/1/01	工作會議簡報 詳表二：文件需求清單 科學酬載模擬器初版一套
6	細步設計審查工作會議 (CDR)	117/4/01	工作會議簡報 詳表二：文件需求清單
7	完成 ISD 更新版研製審查工作會議 (DRR)	117/7/01	工作會議簡報 科學酬載模擬器更新版一套 詳表二：文件需求清單
8	年度計畫審查會議	117/8/31	期中進度報告 (117/7/31 前完成線上繳交) 審查會議簡報
9	科學酬載飛行體測試備便審查工作會議 (TRR)	117/11/01	工作會議簡報 詳表二：文件需求清單
10	年度計畫審查會議	118/8/31	期中進度報告 (118/7/31 前完成線上繳交) 審查會議簡報
11	科學酬載飛行體允收及審查工作會議 (PAR)	118/10/01	工作會議簡報 科學酬載飛行體一套 詳表二：文件需求清單

12	科學任務備便審查工作會議 (SMRR)	119/1/01	工作會議簡報 詳表二：文件需求清單
13	年度計畫審查會議	119/8/31	期中進度報告 (119/7/31 前完成線上繳交) 審查會議簡報
14	衛星整合測試支援服務工作會議 (ITSS)	受補助單位應配合 FS-8F 整測時程，於國家太空中心通知日起完成本項工作	工作會議簡報 詳表二：文件需求清單
15	年度計畫審查會議	120/8/31	期中進度報告 (120/7/31 前完成線上繳交) 審查會議簡報
16	早期軌道運轉測試工作會議 (IOCR)	衛星發射日起算 3 個月內完成	工作會議簡報 詳表二：文件需求清單

表二　文件需求清單 (詳附錄二)

工作里程	交付文件	初版遞交	最終遞交	核可碼
MDR/SDR	1. MDR/SDR Presentation		MDR/SDR	1
	2. Science Mission Definition Document		MDR/SDR	2
	3. P/L System Requirements Document		MDR/SDR	1
PDR	4. PDR Presentation		PDR	1
	5. P/L System Specification	PDR	CDR	1
	6. Product Assurance Plan		PDR	1
ISD	7. ISD User Manual	ISD	DRR	1
CDR	8. CDR Presentation		CDR	1
	9. P/L Interface Control Document		CDR	1
	10. P/L I&T Plan and Procedure	CDR	TRR/ITSS	1
	11. P/L System Operation Plan	CDR	PAR	2
DRR	12. DRR Presentation		DRR	1
	13. ISD to Spacecraft Bus Interface Test Report		DRR	1
TRR	14. TRR Presentation		TRR	1
PAR	15. PAR Presentation	PAR	PAR	1
	16. P/L Test Report	PAR	SMRR	1
	17. EIDP for P/L Flight Module		PAR	1
	18. P/L System Operation Handbook	PAR	SMRR	1
	19. P/L Verification Control Document (including Compliance Verification Matrix)	CDR、TRR、PAR	SMRR	1
SMRR	20. Science Mission Readiness Presentation		SMRR	1
	21. Science Data Center (SDC) Readiness Presentation		SMRR	1
	22. Data Processing Software Test Report	SMRR	IOCR	1
ITSS	23. ITSS Report	PAR	ITSS	1
	24. PL and Bus Integration & Test Report		ITSS	1
IOCR	25. IOCR Presentation		IOCR	1
	26. P/L IOC Test Report		IOCR	1
	27. Monthly Repot			2
	28. Quarterly Report			2
	29. Progress Report			2
	30. Achievement Report			2

FORMOSAT-9B Science Payload to Spacecraft Interface Requirement Document

Taiwan Space Agency

國 家 太 空 中 心

Revision/Change Record
改版/變更記錄

Revision 版次	Author 作者	Authorization Date 核可日期	Revision / Change Description 改版/變更說明	Pages Affected 影響頁次
01	張簡仲勛		Initial Issue	All

Table of Content

1 Introduction

1.1 Purpose

This document defines the interface requirements between FORMOSAT-9B spacecraft bus and science payload.

1.2 Scope

This document contains the interface requirements for procurement of science payload for the FORMOSAT-9 program, specifically confined to FS-9B mission.

2 References

2.1 Applicable Documents

In this section are defined those documents which are applicable associated to the present document. If the issue of document is not listed, the last issue is applicable.

AD1 FS9B-SPEC-XXXX FORMOSAT-9B Component Environmental Specification

2.2 Reference Documents

RD1 FS9B-ICD-XXXX FORMOSAT-9B Science Payload to Spacecraft ICD

3 System Requirements

3.1 Configuration

All communication and power lines to science payload (SPL) shall go through the on-board computer (OBC) and Power Control Unit (PCU). The PCU will provide all electric power to the SPL, and the OBC will provide necessary command and telemetry interfaces to the SPL. Harnesses between the spacecraft bus to the SPL will be provided by TASA, any SPL internal harness shall be provided by the contractor.

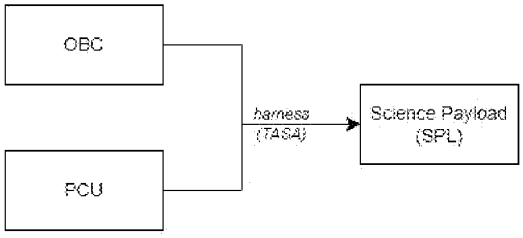

Figure 3.1-1: Science payload configuration

3.2 Operation Modes

Operation modes shall be POWER ON and POWER OFF. The science payload shall operate autonomously in normal operation.

3.3 Operation Requirements

The science payload shall be POWER OFF when it is not operated. The operation of science payload shall always not interfere with the mission payload operation.

3.4 Mission Life

The mission life of science payload for FS-9B shall be at least 3 years in orbit subsequent to 3 years of ground testing and storage.

3.5 Orbit

The FORMOSAT-9B mission orbit is at 514 km altitude with inclination 97.45 degree as a sun-synchronous orbit. The local time of descending node is set at 10:00 AM – 11:00 AM.

4 Mechanical Interface Requirement

The footprint of the SPL shall be specified in the Science Payload to Spacecraft Interface Control Document (ICD).

4.1 Location

Two location options with respected dimension constraints for the SPL are shown below in Figure 4.1-1. The SPL shall select only **one** option for the design.

Position	1	2
Location	+X-Y (lower)	+X-Y (upper)
Size (cm)	≤ 10(L) x 20(W) x 10(H) [*TBD*]	≤ 20(L) x 20(W) x 10(H) [*TBD*]

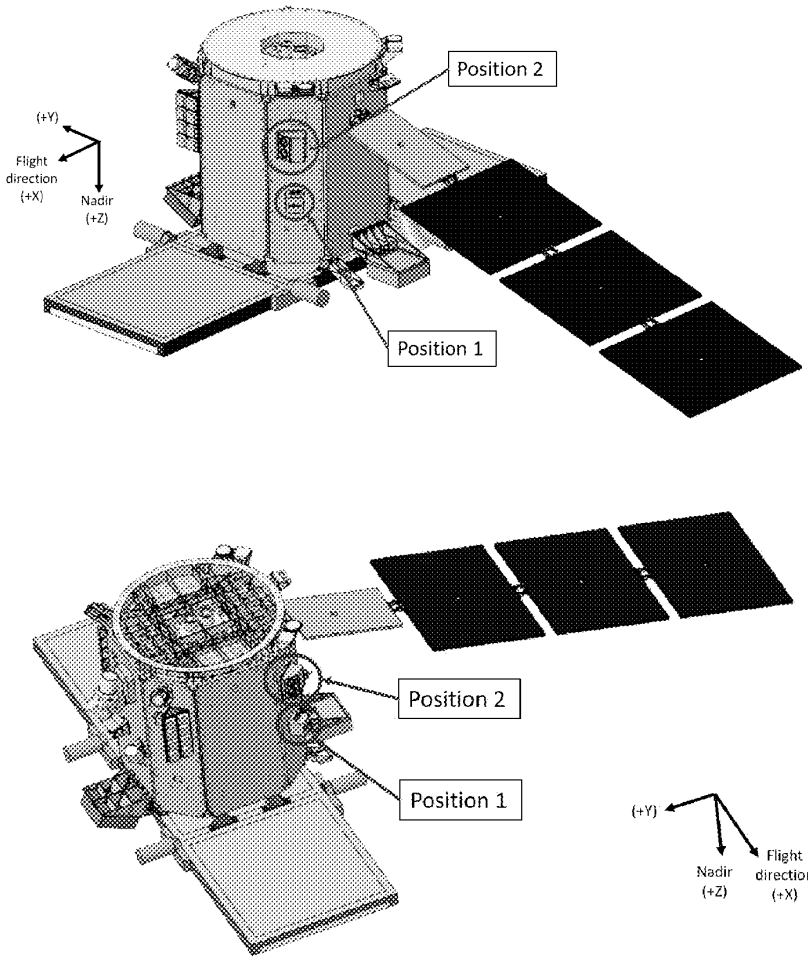

Figure 4.1-1 Science payload location in position 1 and 2

4.2 Mass

The SPL, including any necessary hardware, shall be less than 5kg.

4.3 Centre of Gravity

The center of gravity of the SPL shall be within 5% of the geometric center of the envelope.

4.4 Field of View

The field of view of both locations for the SPL are set to be ±30^0 [*TBD*] as shown below in Figure 4.4-1 and Figure 4.4-2 for two locations respectively.

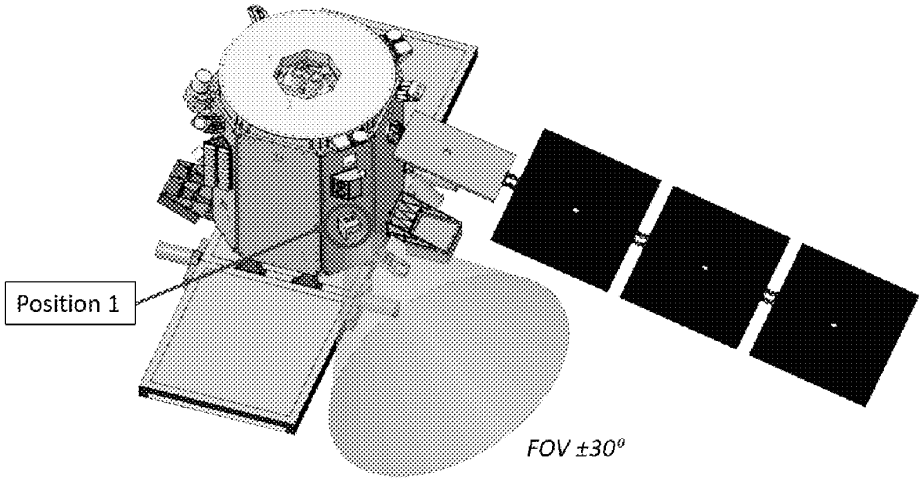

Figure 4.4-1 Field of View of SPL in position 1

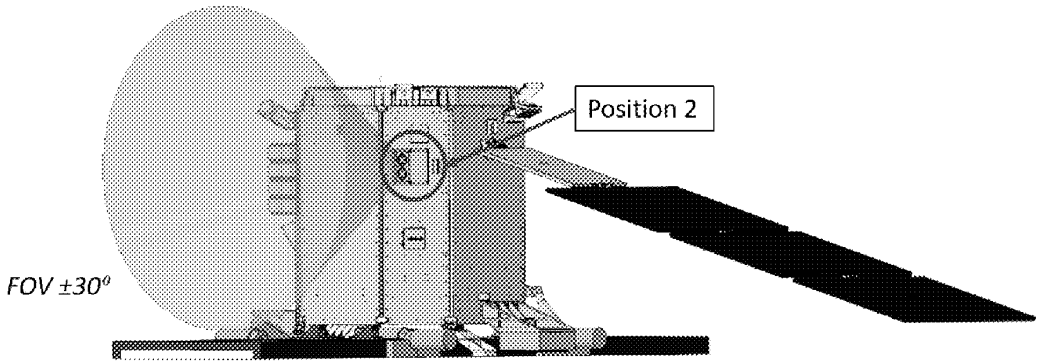

Figure 4.4-2 Field of View of SPL in position 2

4.5 Deployment

No deployment mechanism in any form shall be allowed in the SPL.

4.6 Alignment

If alignment is necessary, alignment cube shall be included on the SPL design.

4.7 Mounting

The SPL shall have a flat mounting surface that conducts electrically and thermally to the spacecraft bus.

4.8 Magnetic Cleanliness

Wherever possible, non-magnetic material shall be used and the utilization of permanent magnets shall be avoided.

4.9 Attitude Control

4.9.1 Pointing Accuracy

The spacecraft bus will maintain the pointing accuracy less than 0.03 degree in pitch, roll and yaw axes. All values are 3σ.

4.9.2 Pointing Knowledge

The spacecraft bus will maintain the pointing knowledge less than 0.02 degree in pitch, roll and yaw axes. All values are 3σ.

4.9.3 Positioning Knowledge

The spacecraft bus will provide on-board position knowledge better than 25m (3σ) for each axis.

4.9.4 Operation of Science Payload

The nominal attitude of satellite is LVLH (local-vertical-local-horizontal). The operation of the SPL shall not interfere with SAR imaging and regular satellite normal operation. The science payload shall coordinate with TASA for science payload mission operation planning.

5 Electrical Interface Requirement

5.1 Orbit Average Power

The science payload shall consume less than 12W {*TBD*} orbit average power.

5.2 Input Voltage

The spacecraft bus will provide DC input voltage for 28±6 Vdc.

5.3 Peak Power

The science payload peak power shall not exceed 20W. Spacecraft will cut off power supply to science payload if over-current protection is triggered.

5.4 Electrical Power Interface

The power interface between spacecraft and science payload includes +28V power and an over-current flag. Science payload shall implement the over-current detection mechanism to shut down itself and report to spacecraft when it occurs.

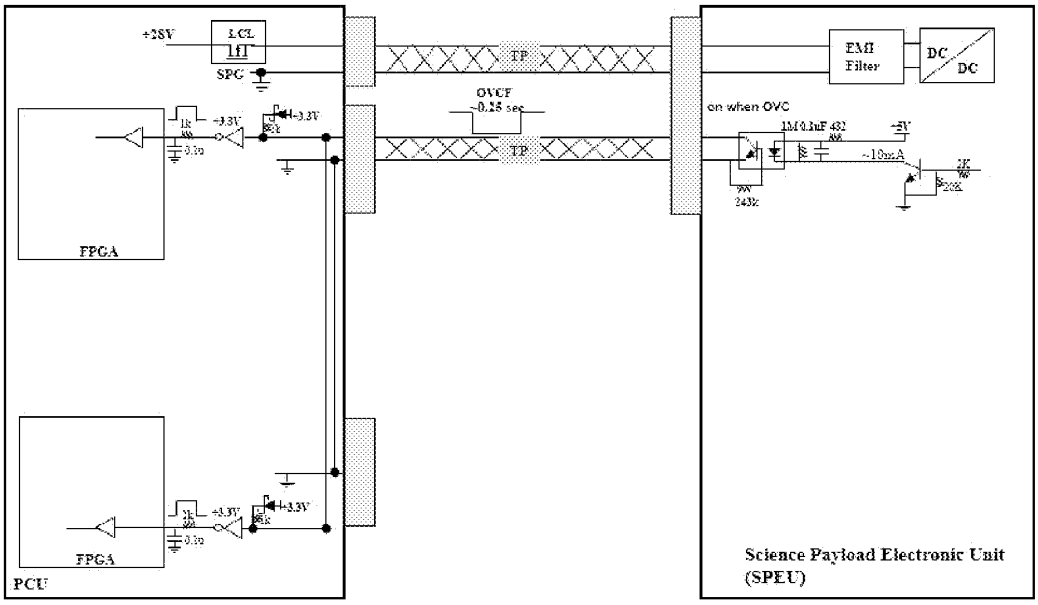

Figure 5.4-1 Electric Power Interface

5.5 Command and Telemetry Interface

The spacecraft bus will provide two UART interfaces to science payload command and telemetry. The interface shall be RS422 UART and the baud rate shall be operated at 115.2 kbps. Science payload shall provide two redundant RS422/UART interfaces for command and telemetry.

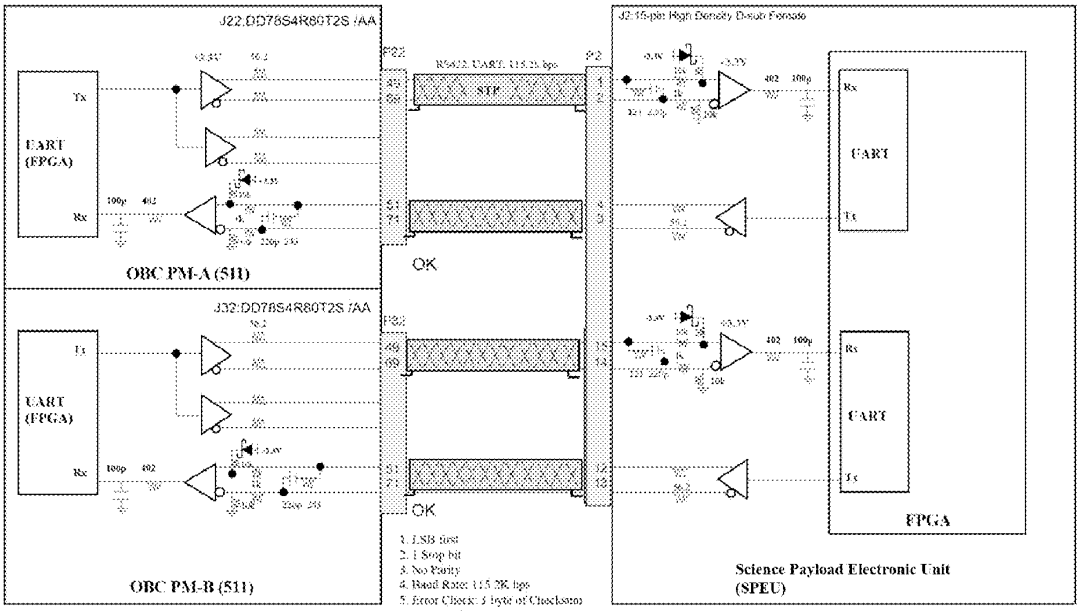

Figure 5.5-1 Command and Telemetry Interface

5.6 Time Synchronization Interface

Science payload shall provide two redundant PPS interfaces in RS422 signal for time synchronization. Science payload shall provide two interface circuits as shown in Figure 3.5-2 for PPS interface. Detail interface will be specified in the "Science Payload to Spacecraft Interface Control Document".

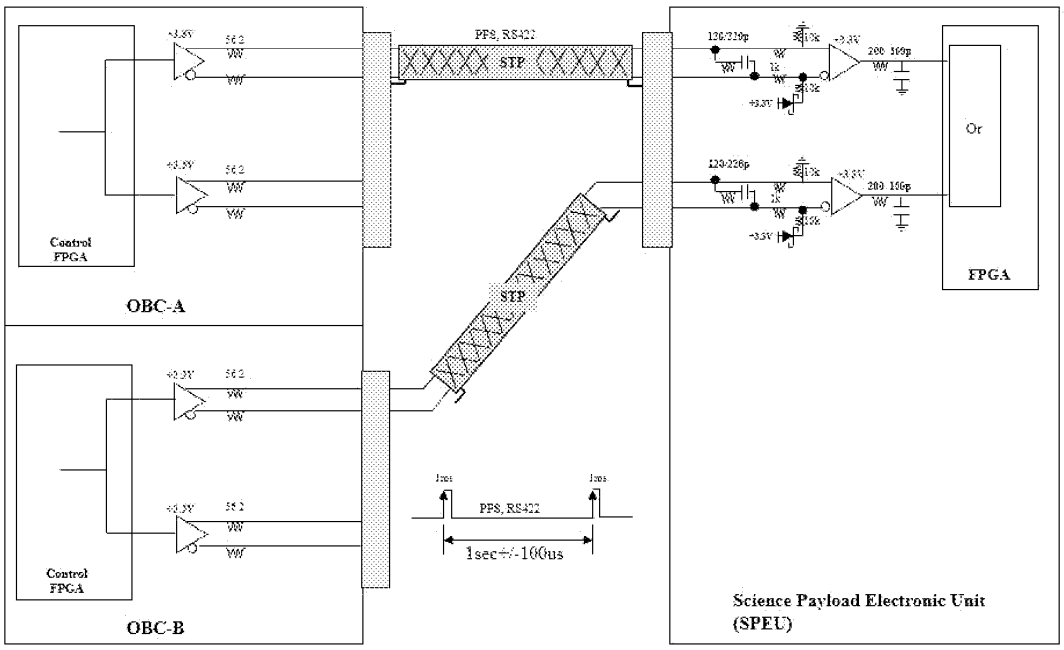

Figure 5.6-1 PPS Signal Interface

5.7 Science Data

5.7.1 Science Data Interface

Science payload shall provide two redundant SpaceWire interface for data link. The data link rate shall be operated in 10Mbps. Science payload shall provide two sets of interface circuits as shown in Figure 3.7-1 for science data.

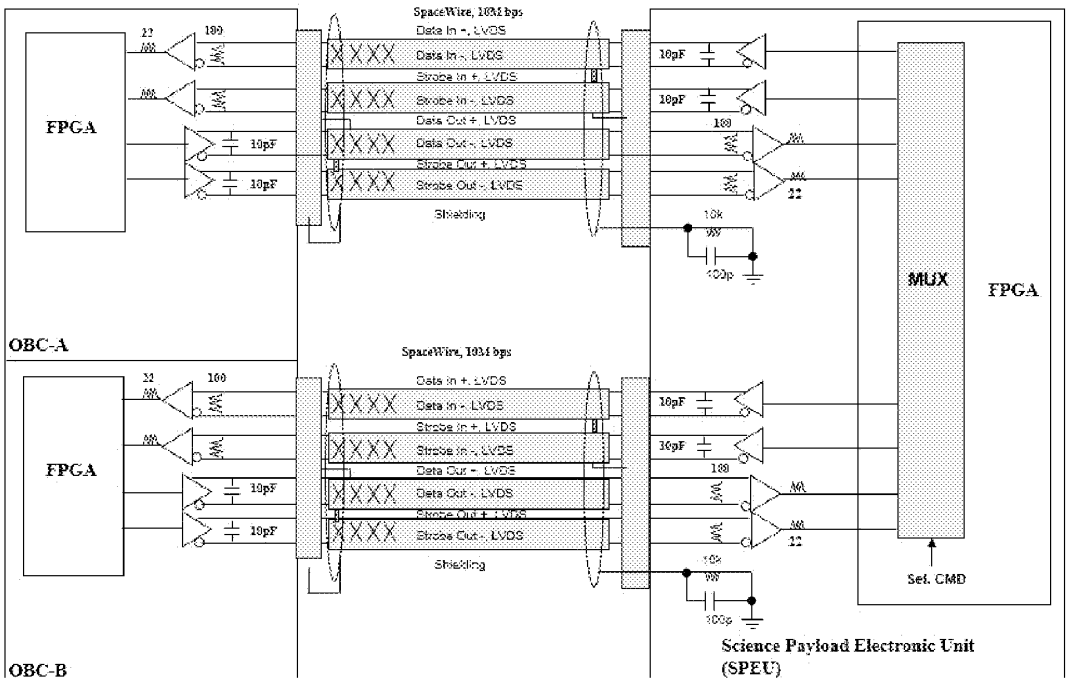

Figure 5.7-1 Science Data Interface

5.7.2 Data Storage

The spacecraft bus will provide data storage capacity for science data excluding EDAC data from science payload up to 2 Gbits per day.

5.7.3 Format of Science Data Packet

The format of the science data packet will be specified in the "Science Payload to Spacecraft Interface Control Document".

5.8 Connector

The interface connector shall use D-SUB connector for power, command and telemetry interface, and use micro-D connector for SpaceWire data interface as shown in the tables below.

J03	(9S Micro D-type)
1	SPL_A_SPW_DIN+
2	SPL_A_SPW_SIN+
3	Inner shield
4	SPL_A_SPW_SOUT-
5	SPL_A_SPW_DOUT-
6	SPL_A_SPW_DIN-
7	SPL_A_SPW_SIN-
8	SPL_A_SPW_SOUT+
9	SPL_B_SPW_DOUT+

J04	(9S Micro D-type)
1	SPL_B_SPW_DIN+
2	SPL_B_SPW_SIN+
3	Inner shield
4	SPL_B_SPW_SOUT-
5	SPL_B_SPW_DOUT-
6	SPL_B_SPW_DIN-
7	SPL_B_SPW_SIN-
8	SPL_B_SPW_SOUT+
9	SPL_B_SPW_DOUT+

5.9 Grounding

The SPL shall be grounded in accordance with the spacecraft bus grounding scheme as specified in AD1.

6 Thermal Interface Requirement

6.1 Thermal Control

The science payload shall provide thermal control by itself if necessary. Any necessary heater or thermal monitor devices for science payload operation and non-operation stage shall be provided by science payload.

6.2 Thermal Power Dissipation

The science payload can be thermally conductively to spacecraft bus structure to dissipate thermal power if necessary.

7 Operational Interface Requirement (SOCS/SDC)

The SOCS supports the TASA FORMOSAT-series satellite missions. The SDC interacts with SOCS and the SDC science team to plan and perform the science operations. The SDC is responsible for the science payload operation support, science data management, processing, analyzing and archiving. The SDC is also responsible for distributing the data and algorithms. Furthermore, the SDC will actively communicate with research and education communities to promote maximum usage of the science data. Figure 3.11-1 shows the data interface between SDC and SOCS.

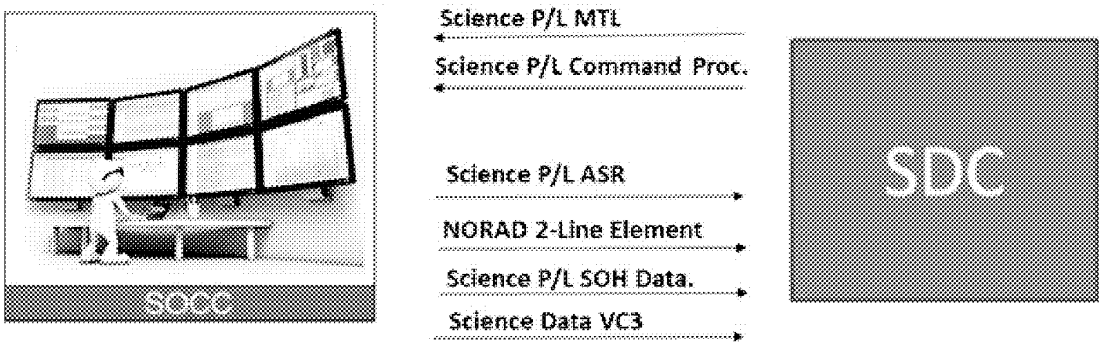

Figure 3.11-1 Data interface between SOCS and SDC

The following presented mission timeline are examples from the **FS-9A mission**

7.1 Science Payload Mission Timeline (MTL)

Purpose/Description	The Mission Timeline contains sequence of on-board events regarding desired activities, including command procedure.
Originator	SDC
Destination	SOCS
Frequency/Volume	One to five times per week (TBR) / Variable data volume
File name/E-mail Subject Convention	FS9A_SDC_yyyymmdd_timeline.txt (yyyy: 4 digits of year, mm: months, dd: days) Date of file name represents the date to perform measurement. For example: FS9A_SDC_20191214_timeline.txt
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	

All fields are left adjusted.

Line Number	Type/Size	Field Name	Contents/Format and Unit/Range of Values
1	string/8 bytes	LABEL_1	"SOURCE: "
1	string/variable	SOURCE	Author of File / "FS9A SDC"
2	string/13 bytes	LABEL_2	"DESTINATION: "
2	string/variable	DESTINATION	Destination of File / "SOCS"
3	string/11 bytes	LABEL_3	"FILE NAME: "
3	string/variable	FILE_NAME	file name / "FS9A_SDC_20191214_timeline.txt"
4	string/11 bytes	LABEL_4	"DATE TIME: "
4	string/19 bytes	DATE_TIME	Time to generate this file in the format of "yyyy/mm/dd hh:mm:ss"
5	string/12 bytes	LABEL_5	"SPACECRAFT: "
5	string/variable	SPACECRAFT	Satellite ID / "FS9A"
6	string/12 bytes	LABEL_6	"INSTRUMENT: "
6	string/variable	INSTRUMENT	Instrument ID / "SDC"
7	string/16 bytes	LABEL_7	"REQUEST_WINDOW: "
7	string/variable	REQUEST_WINDOW	"yyyy/ddd 00:00:00– yyyy/ddd 00:00:00"
8	string/5 bytes	LABEL_8	"EVENT"/leading label of EVENT column
8	string/3 bytes	LABEL_9	"UTC" / leading label of UTC column
8	string/9 bytes	LABEL_15	"Procedure" / leading label of Proced column for Command Procedure
9	string/2 byte	Event	The number of the requested event count
9	string/17 bytes	UTC	UTC time when the activity commences, in "yyyy/ddd hh:mm:ss" format / year, day, hour, minute, second / 2000:2050, 001:365, 00:23, 00:59, 00:59

Line Number	Type/Size	Field Name	Contents/Format and Unit/Range of Values
9	string/19 bytes	Procedure	The name of the Command procedure "SDC_PROCyydddFn.prc" yy:year, ddd:day of year, n:the nth command procedure of the same day or "NA"
10	same as line 9	Same as line 9	Same as line 9

11	same as line 9	Same as line 9	Same as line 9
Last	string/13 bytes	LABEL_16	“END OF REQUEST”

```
SOURCE: FS9A SOC
DESTINATION:    SOCC
FILE NAME:  FS9A_SOC_2025275_timeline.txt
DATE_TIME:  2024/02/19 01:26:27
SPACECRAFT: FS9A
INSTRUMENT: SOC
#
REQUEST_WINDOW: 2025/275 00:00:00  2025/276 00:00:00
#ACTIVITY
Event                    UTC       Procedure
1   2025/275 12:12:35    10        FS9A_SPL_PROC2025_275F1.prc

END OF REQUEST
```

7.2 Science P/L Command Procedure

	Science Payload Command Procedures
Purpose/Description	This file contains command mnemonics and the arguments and the time tag corresponded to the command procedure activity requested in the Science Payload Mission Timeline.
Originator	SDC
Destination	SOCS MCC
Frequency/Volume	variable / variable data volume
File name/E-mail Subject Convention	FS9A_SDC_PROCyydddFn.prc (SDC: instrument name, yy: last 2 digits of year, ddd: day of year, n: the nth Command Procedure of the same day. For example: FS9A_SDC_PROC19348F1.prc
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	1. The content of the Command Procedure will follow the XPSOC command format beginning with relative time tag “CMD” in each line.

```
00:01:05.000~ # Select
00:00:00.000^ CMD # SELSWG "A" SBC=TTQ

00:01:00.000~ #   Power up cb
00:00:00.000^ CMD C ESWICB SBC=TTQ

00:00:55.000~ # Delete file0 if existed, before Start record 30 sec
00:00:00.000^ CMD SCDSFILEDEL FILE_NAME = 'File_0' SBC=TTQ

00:00:40.000~ # Create file [file0], before Start record 15 sec
00:00:00.000^ CMD SCDSFILECRE FILE_CAPACITY = 4 FILE_DEVICE = 'SPL_1' FILE_NAME = 'File_0' FILE_TYPE = 'Linear' SBC=TTQ

00:00:25.000~ # Start record [file0]
00:00:00.000^ CMD SCDSSTARTREC FILE_NAME = 'File_0' SBC=TTQ

00:00:15.000~ #   Sensor on
00:00:00.000^ CMD S SENSON SBC=MPQ

00:00:10.000~ #   IDMIT mode
00:00:00.000^ CMD S IDMIT SBC=MPQ

00:00:05.000~ #   switch to [safe mode]
00:00:00.000^ CMD S SAFE SBC=MPQ

00:00:00.000  #   switch to [Test mode]
```

7.3 Science P/L Acquisition Schedule Report (ASR)

	Science Payload Acquisition Schedule Report
Purpose/Description	This file contains conflict-free activities including on-board events and ground events.
Originator	SOCS
Destination	SDC
Frequency/Volume	Once per day / Variable data volume
File name/E-mail Subject Convention	FS9A_SDC_yyyymmdd.sch (yyyy: 4 digits of year, mm: months, dd: days) For example: FS9A_SDC_20191214.txt
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	

All fields are left adjusted.

Line Number	Type/Size	Field Name	Contents/Format and Unit/Range of Values
1	string/8 bytes	LABEL_1	“SOURCE: “
1	string/variable	SOURCE	Author of File: “SOCS”

2	string/13 bytes	LABEL_2	“DESTINATION: “
2	string/variable	DESTINATION	Destination of File: “SDC”
3	string/11 bytes	LABEL_3	“FILE NAME: “
3	string/variable	FILE_NAME	file name / “FS9A_SDC_20191214.sch”
4	string/11 bytes	LABEL_4	“DATE TIME: “
4	string/19 bytes	DATE_TIME	Time to generate this file in the format of “yyyy/mm/dd hh:mm:ss”
5	string/12 bytes	LABEL_5	“SPACECRAFT: “
5	string/variable	SPACECRAFT	Satellite ID / “FS9A”
6	string/12 bytes	LABEL_6	“INSTRUMENT: “
6	string/variable	INSTRUMENT	Instrument ID / “SDC”
7	string/19 bytes	LABEL_7	“UTC” / leading label of UTC column
7	string/23 bytes	LABEL_13	“Procedure” / leading label of Procedure column
8	string/19 bytes	UTC	UTC time when the event commences, in “yyyy/ddd hh:mm:ss” format / year, day, hour, minute, second / 2000:2100, 001:365, 00:23, 00:59, 00:59
8	string/19 bytes	Procedure	The name of the command procedure “SDC_PROCyydddFn.prc” yy: year, ddd: day of year, n: the nth command procedure of the same day.
9	Same as line 8	Same as line 8	Same as line 8
10	Same as line 8	Same as line 8	Same as line 8
	“	“	“
11	string/22 bytes	LABEL_14	“Unscheduled Request”
12	string/25 bytes	LABEL_15	“Activity” / leading label of Activity column
12	string/19 bytes	LABEL_16	“UTC” / leading label of UTC column
12	string/9 bytes	LABEL_17	“Error_MSG” / leading label of Error_MSG column
13	string/25 bytes	Activity	“SDC_PROCyydddFn.prc”
13	string/19 bytes	UTC	UTC time when the activity should commence, in “yyyy/ddd hh:mm:ss” format / year, day, hour, minute, second / 2000:2050, 001:366, 00:23, 00:59, 00:59
13	string/variable	Error_MSG	The reason of the request not being scheduled
14	Same as line 13	Same as line 13	Same as line 13

14	Same as line 13	Same as line 13	Same as line 13
Last	String/13 bytes	LABEL_18	“END OF REPORT”

```
SOURCE: SOCC
DESTINATION:      FS9A SDC
FILE NAME:   FS9A_SDC_2025275.sch
DATE TIME:   2024/02/19 03:26:27
SPACECRAFT: FS9A
INSTRUMENT: SDC
#
Event                UTC                        Procedure
1                2025/275 12:12:35    FS9A_SPL_PROC2025_275F1.prc
Unscheduled Request:
Activity             UTC                        Error_MSG
END OF REQUEST
```

7.4 NORAD 2-Line Element

	NORAD 2-Line Element
Purpose/Description	FORMOSAT-9A orbital parameters for SDC to compute the satellite trajectory. It is in the standard NORAD 2-line element format.
Originator	SOCS FDF
Destination	FS9A SDC
Frequency/Volume	Once per 3 days. [TBR] / 160 Bytes
File name/E-mail Subject Convention	SSSS_yyyymmdd_hhmm.nor (SSSS: S/C name in capital, yyyy: 4 digits of year, mm: months, dd: days, hh: hours, mm: minutes) For example: FS9A_20151203_0232.nor
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	SOCS as the data server, SDC to retrieve the data via SFTP. SOCS: Gateway-PC, username/passwd: xxx/xxx (TBD)

Lines 1 and 2 are the standard format of Two-Line Orbital Element Set identical to that used by NORAD and NASA. The format description is:

Byte	Field Name	Description

Byte 1	Record Number	Line 1. One integer digit: Always 1
Byte 2	Blank	ASCII Space
Bytes 3-7	Satellite Number	Five integer digits: right justified with possible leading blank character.
Byte 8	Classification	One alphabetical character for classification
Byte 9	Blank	ASCII Space
Byte 10-11	Launch Year	Last two digits of launch year
Bytes 12-14	Launch Number of Year	Three integer digits.
Bytes 15-17	Piece Number	Three alphabetical characters with possible trailing blanks.
Byte 18	Blank	ASCII Space
Bytes 19-20	Epoch Year	Two integer digits: last two digits of y
Bytes 21-32	Epoch Day	xxx.xxxxxxxx: Epoch (Julian day and fractional portion of the day-12 digits including decimal point at byte 24).
Byte 33	Blank	ASCII Space
Byte 34	Sign of First Time Derivative of Mean Motion (rev/day^2)	space or -: space = positive, - = negative
Bytes 35-43	Value of First Time Derivative of Mean Motion (rev/day^2)	.xxxxxxxx (nine characters including decimal point at byte 35
Byte 44	Blank	ASCII Space
Byte 45	Sign of Second Time Derivative of Mean Motion (rev/day^3)	space or -: space = positive, - = negative
Bytes 46-52	Value of Second Time Derivative of Mean Motion (rev/day)	(.)xxxxx-x (seven characters; the decimal point is implied)
Byte 53	Blank	ASCII Space
Byte 54	Sign of BSTAR Drag Term (for SPG4 Theory) or Radiation Pressure Coefficient (for SDP4 Theory)	space or -: space = positive, - = negative
Bytes 55-61	Value of BSTAR Drag Term (for SPG4 Theory) or Radiation Pressure Coefficient (for SDP4 Theory)	(.)xxxxx-x (seven characters; the decimal point is implied)
Byte 62	Blank	ASCII Space

Byte	Field Name	Description

Byte 63	Ephemeris Type	One integer digit: 0 = SGP4 Theory, 3 = SDP4 Theory
Byte 64	Blank	ASCII Space
Bytes 65-68	Element Number	
Byte 69	Check Sum (Modulo 10)	letters, blanks, periods, plus signs=0; minus signs = 1
Bytes 70-80	Blank	ASCII Spaces
Byte 81	Record Number	Line 2. One integer digit: Always 2
Byte 82	Blank	ASCII Space
Bytes 83-87	Satellite Number	Five integer digits: right justified with possible leading blank character.
Byte 88	Blank	ASCII Space
Byte 89-96	Inclination (deg)	xxx.xxxx (eight characters including decimal point at byte 92)
Byte 97	Blank	ASCII Space
Byte 98-105	Right Ascension of Ascending Node (deg)	xxx.xxxx (eight characters including decimal point at byte 101)
Byte 106	Blank	ASCII Space
Byte 107-113	Eccentricity	[.]xxxxxxx (seven characters, the decimal point is implied)
Byte 114	Blank	ASCII Space
Byte 115-122	Argument of Perigee (deg)	xxx.xxxx (eight characters including decimal point at byte 118)
Byte 123	Blank	ASCII Space
Byte 124-131	Mean Anomaly (deg)	xxx.xxxx (eight characters including decimal point at byte 127)
Byte 132	Blank	ASCII Space
Byte 133-143	Mean Motion	xx.xxxxxxxx (eleven characters including decimal point at byte 135)
Byte 144-148	Revolution number at epoch (revs)	
Byte 149	Check Sum (Modulo 10)	
Bytes 150-160	Blank	ASCII Spaces

Example: NORAD 2-Line Element

```
1 25616U 99002A   00294.12500000  .00000032  00000+0  54508-3 0  3301
2 25616  34.9813 161.1594 0028712  78.5969 203.0919 14.82790364 93742
```

7.5 Science P/L SOH Data

	Science Payload SOH Data
Purpose/Description	This file contains the SOH telemetry data packets from Command and Telemetry Channel generated by the SDC instruments, and is extracted from XPSOC dump file.
Originator	SOCS SCC
Destination	SDC
Frequency/Volume	Whenever data is available/ variable
File name/E-mail Subject Convention	FS9A_SDC_yyyydddhhmmss_ppp.dmp (yyyy: last 2 digits of year, ddd: day of year, hh: hour, mm: minutes, ss:second, ppp:packet APID) For example: FS9A_SDC_2015302120103_70D.dmp
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	SOCS: Gateway-PC, username/passwd: xxx/xxx

7.6 Science Data

	Science Data VC3
Purpose/Description	This file contains the telemetry packets of science data from Science Data Channel as generated by the SDC instruments.
Originator	SOCS SCC
Destination	FS9A SDC
Frequency/Volume	Whenever data is available/ 1.5 Gbits per day
File name/E-mail Subject Convention	FS9A_yyyydddhhmmssxx.vc3 (TBD) (yyyy: digits of year, ddd: day of year, hh: hour, mm: minutes, ss:second, xx:version) For example: FS9A_201512809323101.vc3
Data Link Interface	Internet
Transport Interface	TCP/IP SFTP
Comments	SOCS: Gateway-PC, username/passwd: xxx/xxx (TBD)

FORMOSAT-9A Telemetry is compliant to CCSDS/ECSS standards.
The telemetry emission interface executes the following function:
The Header Packets and Data Packets identified by different APID have been grouped and sorted by the generation time shown in the secondary header. The packets are in sequential order and are separated into a single file by a Header Packet and its following data packets.

Default allocation of the Virtual Channel is done according to the data source of the telemetry frames:

Virtual Channel 0 for Real-time Telemetry. Virtual Channel 1 for Playback Telemetry. Virtual Channel 3 for Payload scientific data dump

8 Environment Interface Requirements

The SPL shall comply with the environmental requirements defined in the following sections as well as the detailed environmental specifications, levels, test margins, and durations provided in [AD1]. Details will also be specified in the Science Payload to Spacecraft Interface Control Document.

8.1 Sine Vibration

The SPL shall be designed to withstand the sine vibration loads as defined in the following table without degradation

Table 8.1-1 Sine vibration test levels and durations (all axes)

Hz	Qualification	Proto-flight	Acceptance
5~25	Max shaker capability	Max shaker capability	Max shaker capability
25~100	26.25g	26.25g	21g
Sweep Rate	2 Oct/min	4 Oct/min	4 Oct/min
Level	x1.25	x1.25	x1

8.2 Random Vibration

The SPL shall be designed to withstand the random vibration loads as defined in the following table without degradation.

Table 8.2-1 Random Vibration Test Levels for Component Mass Over 2kg

Component Mass > 2 kg				
Frequency Range (Hz)	Qualification / Protoflight		Acceptance	
	Out of plane	In plane	Out of plane	In plane
20 – 100	+3 dB/oct	+3 dB/oct	+3 dB/oct	+3 dB/oct
100 – 600	0.2 g^2/Hz	0.1 g^2/Hz	0.1 g^2/Hz	0.05 g^2/Hz
600 – 2000	-6 dB/oct	-6 dB/oct	-6 dB/oct	-6 dB/oct
Test Duration (per axis)	2 mins / 1 min	2 mins / 1 min	1 min	1 min
RMS (g)	13.92	9.84	9.84	6.92

8.3 Shock

The SPL shall be designed to withstand the shock load depending on the locations chosen. Each shock zone is assigned to a shock level and is shown in the following figure. Whereas Position 1 is located on the *upper side panel*, Position 2 is on the *lower side panel*.

	Qualification	Proto-flight	Acceptance
Level	+3 dB	+3 dB	+0 dB
Sets	2 sets/axis	1 set/axis	1 set/axis

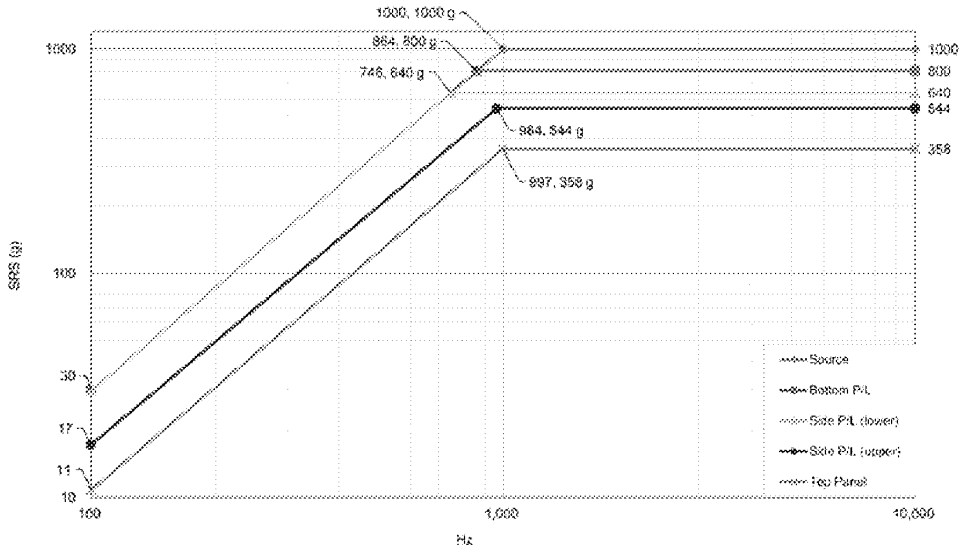

Figure 8.3-1 Shock prediction level in each zone

8.4 Thermal Test(s)

The SPL shall conduct thermal vacuum testing to demonstrate their thermal capability.

Table 8.4-1 Thermal Vacuum Test Requirements

Condition	Qualification	Protoflight	Acceptance	
Temperature	(OP/NOP) ± 10°C	(OP/NOP) ± 5°C	(OP/NOP) ± 5°C	(OP/NOP)
Pressure	≤ 5e-5 mbar			
Number of cycles	≥ 8	≥ 8	≥ 4	≥ 8
Dwell duration	≥ 2 hours	≥ 2 hours	≥ 2 hours	≥ 2 hours

9 Requirements Verification

The requirements shall be in accordance with the methods indicated in the Requirement Verification Matrix. The methods selected for verification are described below.

Inspection

Verification by inspection is a process which may be used in lieu of or in conjunction with testing to verify design features. Inspection is the process of physically measuring, examining or comparing an article to the design drawings, schematics, or other records to assure requirements compliance. This method also includes the validation of records to ascertain that correct parts, materials and processes were used.

Demonstration

Demonstration shall be the determination of properties and performance of an item involving proof-by-doing such as service and access, transportability and human engineering.

Analysis

Verification by analysis is a process used in lieu of or in addition to testing to verify compliance to specification requirements. The selected techniques may include systems engineering analysis, statistics and qualitative analysis, computer and hardware simulations, and analog modeling. Analytical techniques may be used in lieu of tests for such things as reliability assessment, life, storage, failure analysis, safety, interchangeability, and other performance requirements which are difficult or impractical to test. Analysis associated with qualification by similarity is included in this method.

Test

Test shall be the determination of properties and performance of an item by mechanical, electrical and environmental functional measurements. Tests shall be classified as follows:

Performance Testing: Comprehensive verification that the Bus meets the performance characteristics defined in Section 3 and identified in the Verification Cross Reference Matrix under both nominal conditions and environments.

Environmental Testing: Any testing performed under conditions other than the ambient environment.

Acceptance Testing: The environmental, electrical, mechanical, and other tests which all items intended for flight must pass. The tests are designed to verify proper workmanship and to demonstrate that the Bus will operate as specified when subjected to the expected worst-case environmental conditions.

Protoflight Testing: The environmental, electrical, mechanical, and other tests required to verify that the Bus components will comply with design and performance requirements under anticipated operational regimes and environments. The environment of protoflight tests shall be harsher than the predicted operational environment, but below the design safety factor level so that the components need not be refurbished prior to flight. Exposure time is based on the use cycle and/or type of flight item. When several units of the same component are

manufactured, only one shall be protoflight tested. Protoflight testing applies only to those component types identified below.

i New designs

ii. Modified designs

iii. Existing designs with qualification levels that do not meet FORMOSAT-9B requirements

9.1 Requirements Verification Cross-Reference Matrix (VCRM)

Science Payload IRD shall be flown down to Science Payload ICD (Interface Control Document) during contract implementation. The contractor shall provide the flow down traceability table. VCRM of the Science Payload ICD shall be provided by the contractor. Appendix-B contains a sample format for the "VCRM - SPL ICD".

Appendix A. Acronym

Acronym	
ACS	Attitude Control System
ADC	Analog to Digital Converter
AIT	Assembly, Integration and Test
AOCS	Attitude and Orbit Control Subsystem
APA	Attitude Pointing Accuracy
APK	Attitude Pointing Knowledge
ASR	Acquisition Schedule Report
BER	Bit Error Rate
CA	Contract Award
C&DH	Command and Data Handling
CAD	Command Allocation Document
CCB	Configuration Control Board
CDR	Critical Design Review
CLIN	Contract Line Item Numbers
CMD/TLM	Command/Telemetry
COTS	Commercial Off-The-Shelf
CPU	Central Processing Unit
CPCU	Central Processing and Control Unit
CT	Clean Tent
CSC	Computer Software Component，
CSCI	Computer Software Configuration Item
CSU	Computer Software Unit
CG	Center of Gravity
DBF	Digital Beam Forming
DC	Duty Cycle
DCM	DC Module
DEM	Deployment Mechanism
DL	Downlink
EBB	Elegant Bread Board

Acronym	
EDAC	Error Detection and Correction
EDM	Engineering Development Model
EGSE	Electrical Ground Support Equipment
EIRP	Equivalent Isotropically Radiated Power
EM	Engineering Model
EMC	Electro Magnetic Compatibility
EOL	End Of Life
EPS	Electrical Power Subsystem
EQM	Engineering Qualification Model
FCU	Flow control unit
FDF	Flight Dynamic Facility
FDIR	Failure Detection, Isolation and Recovery
FM	Flight Model
FMECA	Failure Modes, Effects and Criticality Analysis
FOH	Flight Operation Handbook
FOV	Field of View
FPGA	Field Programmable Gate Array
FR	Final Review
FSW	Flight Software
GCN	Ground Communication Network
GNSS	Global Navigation Satellite System
GNSSR	Receiver for Global Navigation Satellite System
GPSR	Global Positioning System Receiver
GUI	Graphic User Interface
HPC	High Priority Command
HW	Hardware
ICD	Interface Control Document
ICWG	Interface Control Working Group
IDR	Interface Design Review
IF	Interface
IOC	Input/Output Control

Acronym	
IP	Intellectual Property
IPC	The Institute for Interconnecting and Packaging Electronic Circuits
IPS	Image Processing System
IRD	Interface Requirements Document
IRU	Inertial Reference Unit
ISO	International Organization for Standardization
ITAR	International Traffic in Arms Regulations, ITAR
ITR	Integration and Test Readiness Review
ITU	International Telecommunication Union
LCL	Latching Current Limiter
LOS	Line of Sight
LRR	Launch Readiness Review
LV	launch vehicle
MCC	Mission Control Center
MDR	Mission Definition Review
MEMS	Microelectromechanical Systems
MEOP	Maximum expected operating pressure
MGSE	Mechanical Ground Support Equipment
MIL	Mission Timeline
MIPS	Mega (Million) Instructions Per Second
MOWG	Mission Operations Working Group
ML	Mission Life
MLI	Multi Layer Insulation
MO	Mission Orbit
MOI	Mass of Inertia
MOC	Mission Operation Center
MOP	Mission Operation Plan
MRAM	Magnetoresistive Random Access Memory
MTQ	Magnetic Torquer
NCC	National Communications Commission
OAP	Orbital Average Power

Acronym	
OASPL	Overall Sound Pressure Level
OBC	On Board Computer
OCT	Optic Communication Terminal
ORR	Operation Readiness Review
OTP	Overall Test Plan
PA	Power Amplifier
PAPP	Product Assurance Program Plan
PCM	Phase Change Material
PCU	Power Control Unit
PDHTS	Payload Data Handing and Transmission System
PDR	Preliminary Design Review
PDTS	Payload Data Transmission System
PFD	Power Flux Density
PM	Processor Module
PMP	Program Management Plan
POD	Precision Orbit Determination
PPS	Pulse Per Second
PPU	Power Processing Unit
PSR	Pre-Shipment Review
PSS	Planning and Scheduling Subsystem
P/L	Payload
RCS	Reaction Control Subsystem
RF	Radio Frequency
RFI	Radio Frequency Interference
RFP	Request For Proposal
RHCP	Right Hand Circular Polarization
RR	Radio Regulation
RTS	Remote Terminal Station
RW	Reaction Wheel
Rx	Receiver
SAPS	Solar Array Power Simulator

Acronym	
SAR	Synthetic Aperture Radar
SAT	System Acceptance Test
SCOE	System or Special Check-Out Equipment
SDC	Science Data Center
SDR	System Design Review
SEU	Single-Event Upset
SID	System Interface Document
SIT	System Integration Test
SM	Structural Model
SMS	Structure and Mechanism Subsystem
SOCC	Satellite Operation and Control Center
SOH	Status of Health
SPL	Sound Pressure Level
SP/L	Science Payload
SRR	System Requirements Review
SRS	Software Requirement Specification
SS	Sun Sensor
SSO	Sun Synchronous Orbit
SSR	Solid State Recorder
STC	Satellite Test Controller
SW	Software
TAA	Technical Assistance Agreement
TAD	Telemetry Allocation Document
TBD	To Be Defined
TBR	To Be Revised
TCS	Thermal Control Subsystem
TDM	Technology Demonstration Model
TMTC	Telemetry/Telecommand
TRM	Transmitter/Receiver Module
TRR	Test Readiness Review
TA	Technical Audit

Acronym	
TT&C	Telemetry, Tracking and Command
Tx	Transmitter
UART	Universal Asynchronous Receiver/Transmitter
UL	Uplink
VCRM	Requirements Verification Cross-Reference Matrix
V&V	Verification & Validation
WBS	Work Breakdown Structure
WSD	Work Start Date
XAS	X-Band Antenna Station
XBA	X-band Antenna
XDS	X-band Downlink Subsystem
XPAA	X-band Phased Array Antenna
XPATx	X-band Phased Array Transmitter
WDT	Watch Dog Timer

Appendix B. Sample Science Payload ICD Verification Cross- Reference Matrix (VCRM)

Reqt. Id	Requirement text	Verif. Meth.	Verif. Occ.	Verif. Doc.	Test Procedure	Status
SICD-0100	*Science payload shall be grounded in accordance with the spacecraft bus grounding scheme as specified in AD2.*	ii, tt	CDR	*FS9A-RPT-000* Section * Figure *, Page **	*FS9A-PRC-000**	ii-Close tt-Open
SICD-0110	*The science payload shall consume less than 15W orbit average power.*	ii, aa, tt	CDR	*FS9A-RPT-000* Section * Figure *, Page **	*FS9A-PRC-000**	aa-Close

國家科學及技術委員會自然科學及永續研究發展處暨國家太空中心
「福爾摩沙衛星科學酬載開發與應用」專案計畫

課題說明 A02：福衛九號第二顆衛星 (FS-9B) 科學酬載開發與應用

(一)研究目的/背景說明

福衛九號為微波遙測衛星，除了 X 頻段合成孔徑雷達主酬載外，亦安裝科學酬載等次酬載以執行科學任務。本案為福衛九號第二枚衛星 (FS-9B) 科學酬載，工作內容包含系統設計分析、軟硬體設計分析與實現、製作組裝與測試。本案規劃完成科學酬載飛行體研製與衛星整合測試，並於發射後完成早期軌道測試，確認科學酬載功能無誤。如本案執行成效良好，擬預計進行科學酬載任務操作、分析校正衛星下載之觀測資料、資料處理與儲存及服務使用者等工作，將另案處理。

(二)執行期程、審查會議時程

- 執行期程自 115 年 10 月 1 日起 54 個月內或衛星發射日起算 5 個月內完成履約 (兩者以日期較晚者為主)。
- 各階段審查會議與工作會議時程與交付項目詳表一。

(三)工作內容

受補助單位應依下列各項工作內容，提供人力、設施、測試與製造設備以及其他相關資源，配合福衛九號第二枚衛星 (FS-9B) 發射時程，規劃完成 FS-9B 之科學酬載 (Payload, P/L) 系統之開發、製造與驗證等研製工作。

- 依據附錄「**FORMOSAT-9B Science Payload to Spacecraft Interface Requirement Document**」需求，提出科學酬載發展規劃。
- 進行科學酬載發展包含設計、製造、組裝與測試。
- 於審查/工作會議報告包含工作進度、完成的工作項目、行動要項、重要問題等。
- 交付文件，清單如表二、**Committed Data Requirements List (交付文件清單)**。
- 交付實體項目包括：**科學酬載工程體 (EM, Engineering Model) 一組，及科學酬載飛行體 (Flight Model) 一組**。
- 執行在國家太空中心工程發展體 (EDM) 上及衛星系統層級的科學酬載測試。

- 支援國家太空中心的衛星系統層級有關科學酬載的整合測試。
- 支援早期軌道運轉測試。
- 於以下各研製階段應完成之相關報告及文件，應於期限內完成並交付。除另有規定外，每項報告、文件及簡報繳交紙本 1 份及電子檔各 1 份。審查會議後仍有需改正之項目，受補助單位應於會議紀錄規定時間內 (未載明者為自通知日起 15 個日曆天) 完成改正，交付國家太空中心再行審查。

1. 各階段工作項目及工作內容簡述

受補助單位應依以下各階段所列之工作項目及內容，分階段完成科學酬載之研製工作，並完成各階段之審查會議、工作/進度會議。

(1) 任務定義暨系統設計審查會議 (MDR/SDR, Mission Definition Review & System Design Review)

A. 組織、人員、工作分解內容 (WBS, Work Breakdown Structure)。

B. 時程、發展規劃。

C. 完成科學酬載系統任務定義，並確認系統需求與介面需求。

D. 完成符合科學酬載系統與介面需求之系統設計、完成品保計畫書 (Product Assurance Plan, PAP) 初稿與確認使用者需求。

(2) 初步設計審查會議 (PDR, Preliminary Design Review)

A. 完成初步科學酬載/元件與地面系統之規格定義與設計，及完成品保計畫書 (PAP)。

B. 完成測試與組裝初步規劃。

(3) 關鍵設計審查會議 (CDR, Critical Design Review)

A. 完成科學酬載系統細部設計，確認系統與介面規格符合任務需求。同時須完成科學酬載之零件選用。

B. 完成測試與組裝計畫 (初版)、初版組裝程序書及測試程序書 (包含科學酬載飛行體本身的環境、測試程序書與衛星本體介面整合測試用的程序書)。

C. 完成初版之科學酬載系統操作計畫，包括發射操作、早期軌道操作、一般軌道操作以及資料分析、處理與儲存等。同時須完成科學酬載與衛星、科學酬載與地面、地面與衛星操控中心 (SOCC) 之介面參數定義。

(4) 製造備便審查會議 (MRR, Manufacturing Readiness Review)

A. 完成製造前的準備工作，包含製造工程圖、零件材料、製造廠商、製造程序、組裝程序、品保檢驗等。

B. 確認科學酬載關鍵零組件可符合國家太空中心耐輻射需求，相關需求將於計畫啟始後提供。

(5) 測試備便審查會議 (TRR, Test Readiness Review)

A. 交付一套科學酬載工程體 (EM, Engineering Model)，並交付 EM 功能測試結果報告。

B. EM 交付後，受補助單位應配合國家太空中心時程提供人力至國家太空中心進行 EM 與衛星工程發展體之介面驗證工作；並進行與衛星工程發展體測試；於測試期間，EM 若有損害，受補助單位須配合執行修復工作。

C. 研製 EM 所發展之軟體，國家太空中心具有取得使用、修改及再製權利。

D. 確認科學酬載飛行體備便可進行環境測試。受補助單位負責科學酬載本身的性能測試與環境測試，及完成科學酬載飛行體測試程序書撰寫。科學酬載層級的測試包含功能性測試 (FPT) 及環境測試。

E. 環境測試項目可包含 Vibration、Shock、Thermal Vacuum、EMC 等測試，詳細測試規格請參照附錄「FORMOSAT-9B Science Payload to Spacecraft Interface Requirement Document」。

(6) 交付審查 (DR, Delivery Review)

A. 受補助單位須研發完成並交付科學酬載飛行體 (Flight Model) 一組，經由設計、分析與測試等方法，完成此飛行體在嚴苛發射與太空環境下仍能維持正常功能及操作之驗證，包括通過功能測試與環境測試。

B. 完成科學酬載飛行體規格符合驗證與確認 (Verification & Validation)、科學酬載飛行體 EIDP (End Item Delivery Package) 備便且通過審查。

C. 受補助單位負責科學酬載飛行體研製所需之資本設施。飛行體與衛星本體進行測試期間，若有損害，受補助單位須配合執行修復工作。受補助單位負責完成科學酬載系統操作計畫與初版科學酬載系統操作手冊之撰寫。

(7) 科學任務備便審查會議 (SMRR, Science Mission Readiness Review)

A. 受補助單位應完成科學任務備便並交付報告。

B. 受補助單位須提供資料伺服器與人員，進行科學酬載資料之分析、校正、處理與儲存工作。對於未經處理之低階資料及已處理過之高階資料、所有處理參數以及相關技術文件，均由此資料伺服器須負責儲存及管理。並適時提供給國內外有需求之單位及個人。

(8) 衛星整合測試支援服務 (ITSS, Integration & Test Support Service)

受補助單位須配合 FS-9B 衛星整測時程進行下列工作：

A. 負責科學酬載與相關地面設備的整合測試，同時支援科學酬載與衛星本體的整合測試過程中的科學酬載相關工作。

B. 完成科學酬載系統測試與組裝計畫、組裝程序書及衛星本體介面測試程序書撰寫。此階段的測試包含衛星層級功能性測試 (CPT) 及環境測試 (可包含 Vibration、Acoustic、Pyroshock、Thermal、EMC 等)、酬載儀器與地面站系統的端到端測試 (End-to-End Test)、視需要而做的 RF Compatibility Test 等。

C. 配合國家太空中心參加 FS-9B 衛星運送前審查會議 (Pre-Shipment Review, PSR)。

D. 應派員於發射場負責科學酬載之檢查作業。

(9) 早期軌道運轉測試審查會議 (IOCR, In-Orbit Checkout Review)

A. 衛星升空後，衛星系統之操控任務將由國家太空中心現有之衛星操控中心 (SOCC) 與 TT&C 地面站執行。受補助單位須配合參與發射初期 (約為發射日起算 3 個月內) 儀器之檢查操作。

B. 若發射失敗，此階段工作將不予執行。

C. 若發射延後，以單一計畫主持人計畫件數核給基準為原則或特殊情形經本會同意者，可申請計畫執行期限展延。

(10) 年度計畫審查會議及期中進度報告、研究成果報告

A. 受補助單位在各年度計畫執行期滿前 2 個月，至國科會系統線上繳交期中進度報告 (Progress Report)。

B. 受補助單位應依規定完成期末報告階段之相關工作。

C. 執行期滿後 3 個月內，必須至國科會系統繳交研究成果報告 (Achievement Report)，並辦理經費結報。

2. 計畫管理、系統工程與品質保證

(1) 計畫管理

A. 本案執行期間受補助單位須配合 FS-9B 計畫時程，與國家太空中心團隊共同舉辦及參與相關審查及介面會議；共同討論工作規劃、執行進度及成果報告與討論。

B. 各階段審查會議將邀請相關人員與會審查，受補助單位必須負責審查會議之會議紀錄、行動要項、審查報告、簡報資料，及所有將使用、參考或交付之技術或管理文件。

C. 依照規範完成各階段及各期工作/審查會議應完成並交付相關文件、定期綜整之季報與月報。

D. 依國家科學及技術委員會相關規定繳交各項報告，並配合本會施政需要提供參考資料及參加活動與展會 (如衛星科學工作坊、臺灣太空國際年會)。

(2) 系統工程

任務需求定義與系統工程由受補助單位負責，國家太空中心可提供軌道分析相關協助，視需要可召開技術會議。交付文件中之系統需求、介面需求、系統驗證、操作規劃類文件，國家太空中心可提供受補助單位參考資料。

規格與工作項目若有 TBR (To Be Revised) 、TBD (To Be Defined)，最遲於 CDR (Critical Design Review) 會議，由國家太空中心及受補助單位雙方共同確定。

(3) 品質管理

受補助單位應依據其研擬的科學酬載之品保計畫書 (Product Assurance Plan, PAP) 執行計畫；於執行期間若發現有不符合事項，應確實紀錄。

(四)實體交付項目

1. 科學酬載工程體 (EM) 一組。
2. 飛行體一組。

(五)附錄「FORMOSAT-9B Science Payload to Spacecraft Interface Requirement Document」

表一　　各階段審查會議時程

項次	會議名稱	完成時點	繳交內容
1	啟動會議 (Kick-off Meeting)	115/10/31	
2	任務定義暨系統設計審查會議 (MDR/SDR)	115/12/31	會議簡報 依據表二交付文件清單 (CDRL) 之文件
3	初步設計審查會議 (PDR)	116/4/30	會議簡報 依據表二交付文件清單 (CDRL) 之文件
4	年度計畫審查會議	116/8/31	期中進度報告 (116/7/31 前完成線上繳交) 會議簡報
5	關鍵設計審查會議 (CDR)	116/10/31	會議簡報 依據表二交付文件清單 (CDRL) 之文件
6	製造備便審查會議 (MRR)	116/12/31	會議簡報 依據表二交付文件清單 (CDRL) 之文件
7	測試備便審查會議 (TRR)	117/3/31	會議簡報 依據表二交付文件清單 (CDRL) 之文件 科學酬載工程體 (EM) 一組
8	年度計畫審查會議	117/8/31	期中進度報告 (117/7/31 前完成線上繳交 會議簡報
9	交付審查會議 (DR)	118/1/31	會議簡報 依據表二交付文件清單 (CDRL) 之文件 科學酬載飛行體 (Flight Model) 一組
10	科學任務備便審查會議 (SMRR)	118/3/31	會議簡報 依據表二交付文件清單 (CDRL) 之文件
11	年度計畫審查會議	118/8/31	期中進度報告 (118/7/31 前完成線上繳交) 會議簡報
12	衛星整合測試支援服務 (ITSS)	受補助單位應配合 FS-9B 衛星整	Test scripts 依據表二交付文件清單 (CDRL) 之文件

		測時程，於國家太空中心通知日起完成本項工作	
13	年度計畫審查會議	119/8/31	期中進度報告 (119/7/31 前完成線上繳交) 會議簡報
14	早期軌道運轉測試審查會議 (IOCR)	衛星發射日起算 3 個月內完成	會議簡報 依據表二交付文件清單 (CDRL) 之文件

表二　**Committed Data Requirements List (交付文件清單)**

Doc. No.	Title	Delivery Schedule
CDRL-01	Science Payload Specification	SDR/MDR
CDRL-02	Science Payload Product Assurance Plan	MDR, PDR
CDRL-03	Science Payload Software and Firmware Specification	PDR, CDR
CDRL-04	Science Payload to Spacecraft Interface Control Document (ICD)	PDR, CDR
CDRL-05	Science Payload Electrical Interface Control Document (EICD)	CDR, MRR, TRR
CDRL-06	Science Payload TM/TC Interface Control Document (ICD)	CDR, MRR, TRR
CDRL-07	Science Payload Mechanical Interface Control Document (MICD)	CDR, MRR, TRR
CDRL-08	Science Payload Schematic Diagram	CDR, MRR
CDRL-09	Science Payload Declared EEE Parts List	CDR, MRR
CDRL-10	Science Payload Declared Mechanical Parts, Materials, and Process List	CDR, MRR
CDRL-11	Science Payload Failure Mode Effects Analysis	CDR, MRR
CDRL-12	Science Payload Thermal Analysis	CDR, MRR
CDRL-13	Science Payload Structure Analysis	CDR, MRR
CDRL-14	Science Payload Software and Firmware Design Description Document	TRR, DR
CDRL-15	Science Payload Design Report	TRR, DR
CDRL-16	Science Payload Software and Firmware Validation Test Plan	MRR, TRR
CDRL-17	Science Payload Integration and Test Plan (integration, FPT, environmental test, etc.)	MRR, TRR
CDRL-18	Science Payload FPT Test Plan	MRR, TRR
CDRL-19	Science Payload Integration Procedure	TRR
CDRL-20	Science Payload FPT Test Procedure	TRR

CDRL-21	Science Payload LFPT Test Procedure	TRR
CDRL-22	Science Payload EMC Test Procedures	TRR
CDRL-23	Science Payload Thermal Vacuum Test Procedure	TRR
CDRL-24	Science Payload Dynamic Test Procedures	TRR
CDRL-25	As Run Test Procedures and Records	DR
CDRL-26	Science Payload Software and Firmware Validation Test Report	DR
CDRL-27	Science Payload FPT Report	DR
CDRL-28	Science Payload Radiation Test Report	TRR, DR
CDRL-29	Science Payload EMC Test Report	DR
CDRL-30	Science Payload Dynamic Test Report	DR
CDRL-31	Science Payload Thermal Vacuum Test Report	DR
CDRL-32	Science Payload EM User Manual	MRR, DR
CDRL-33	Science Payload User's Manual	DR
CDRL-34	Science Payload Requirements Compliance Matrix	DR
CDRL-35	Science Payload Test Log Book	DR
CDRL-36	Science Payload Data Processing Software Test Report	SMRR
CDRL-37	Science Payload and Spacecraft Bus Integration and Test Report	ITSS
CDRL-38	Science Payload In-Orbit Checkout Report	IOCR
CDRL-39	Quarterly Report	
CDRL-40	Monthly Repot	
CDRL-41	Progress Report	
CDRL-42	Achievement Report	