行政院教育部

國立成功大學出國報告

（出國類別：參加國際合作會議）

「參加國際太空反物質探索計畫 2003年7月份技術交流會議」

服務機關：成功大學
出國人職稱：教授
姓名：林清一

出國地區：瑞士、義大利
出國期間：7月28日至8月7日
報告日期：92年 8月 25日

系統識別號:C09202884

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頁數: 5　含附件: 否

報告名稱:　參加國際太空反物質探索計畫 2003 年 7 月份技術交流會議

主辦機關: 國立成功大學

聯絡人／電話:

出國人員: 林清一　國立成功大學　航太系　教授

出國類別:　考察

出國地區:　瑞士　義大利

出國期間:　民國 92 年 07 月 26 日 -民國 92 年 08 月 07 日

報告日期:　民國 92 年 08 月 23 日

分類號/目:　G0／綜合（各類工程）　G0／綜合（各類工程）

關鍵詞:　國際太空反物質計畫，超導磁質譜儀（AMS）、磁場量測技術、電力供配系統

內容摘要:　本校於 91 年 9 月 29 日與美國麻省理工學院丁肇中院士簽訂參與「國際太空反物質探索計畫」參與執行 AMS-02 計畫，支援超導磁鐵建置經費一百萬美元，爲此本校成立研究團隊積極參與。AMS-02 計畫定期舉行技術交流會議，AMS 全體各主要小組團隊必須提出工作進度報告，互相交換技術意見，提出各小組之問題，共同解決問題。今年 3 月 7 日丁院士指派本校主持「電力供配系統（PDS）建置」小組，並直接協助計畫主持人獲得國科會主委之承諾提供建置經費（1.6 M Euro）及參與團隊需求支各項支助。本校 PDS 團隊於月份成立，提出國際合作計畫書，正由國科會審查中。依據 AMS 整體團隊之要求，本校 PDS 團隊將於本次技術交流會議（TIM）中完成基本規劃報告，並與 AMS 整體團隊所選定的承包商 CGS 公司達成基本協議，建立國際分工合作基本規章。因受國科會經費核定程序之影響，參加此次會議尚無經費，僅由本校已獲得教育部專案補助之旅費支應，由計畫主持人參與此會，完成團隊及技術規劃報告，並與 CGS 公司進行第一階段計畫合約談判。

本文電子檔已上傳至出國報告資訊網

一、摘要

本校於 91 年 9 月 29 日與美國麻省理工學院丁肇中院士簽訂參與「國際太空反物質探索計畫」參與執行 AMS-02 計畫，支援超導磁鐵建置經費一百萬美元，為此本校成立研究團隊積極參與。AMS-02 計畫定期舉行技術交流會議，AMS 全體各主要小組團隊必須提出工作進度報告，互相交換技術意見，提出各小組之問題，共同解決問題。今年 3 月 7 日丁院士指派本校主持「電力供配系統（PDS）建置」小組，並直接協助計畫主持人獲得國科會主委之承諾提供建置經費（1.6 M Euro）及參與團隊需求支各項支助。本校 PDS 團隊於月份成立，提出國際合作計畫書，正由國科會審查中。

依據 AMS 整體團隊之要求，本校 PDS 團隊將於本次技術交流會議（TIM）中完成基本規劃報告，並與 AMS 整體團隊所選定的承包商 CGS 公司達成基本協議，建立國際分工合作基本規章。

因受國科會經費核定程序之影響，參加此次會議尚無經費，僅由本校已獲得教育部專案補助之旅費支應，由計畫主持人參與此會，完成團隊及技術規劃報告，並與 CGS 公司進行第一階段計畫合約談判。

二、目的

國立成功大學為參與丁肇中院士所主持的「空反物質探索」國際合作研發超導磁場質譜儀 AMS-02 計畫，成立研究小組，積極推動參與計畫。為了解 AMS-02 整體計畫之進行狀況、報告我方計畫之工作進度，計畫主持人或主要成員參與定期的 AMS-02 團隊技術交流會議 (Technical Interchange Meeting, TIM)。

本校計畫原於 92 年 7 月 13 日經丁肇中院士及 Prof. Hofer 核准支援超導磁鐵團隊執行「AMS-02 超導磁鐵 3D 磁場分佈量測」計畫，於本年 5 月 7 日奉丁院士命，增加「AMS-02 電力供配系統(Power Distribution System, PDS)之建置發展」計畫。與其他國外團隊整合成立 PDS 團隊，獨立運作，滿足 AMS-02 所有電源供應的需求。

本計畫所需經費已經提出國際合作計畫書申請國科會補助。

三、議經過

國際太空反物質探索計畫 2003 年 7 月份技術交流會議於瑞士日內瓦 CERN 舉行。議程安排如過去的方式，先從 NASA 計畫支援的整體規劃與進度開始，接著是各團隊工作進度的簡單報告，以及各團隊的內部會議後，在安排各團隊詳細的工作狀況與技術問題檢討報告。除了各團隊的內部會議外，全部採用全體出席的大會方式，讓每個出席的成員都能有機會瞭解其他團隊的工作狀況與技術內容。

本次會議 NASA 帶來極為不好的訊息，由於 STS-107 失事，經過半年的調查，咸認為太空梭都已經太過老舊，任務的負擔必須減輕，以降低機會風險。在技術上，太空梭必須減重，因此減少太空梭燃料是一項重要的考量，其次則是各任務承載重量(Payload)也必須適度的降低或分散至後續的任務上。減少太空梭液態燃料的相對解決方案則是降低國際太空站的軌道高度，此點在操作上並不困難，也對太空站其他任務的影響最小。降低任務承載重量將影響各任務的需求，對 AMS 計畫而言，在 AMS 就位前所需的工程任務將拖長工程時間及任務次數。NASA 的結論暫時將 AMS 發射計畫從原來的 2005 年 10 月 28 日推遲一年至 2006 年 11 月。

本次會議，我方計畫必須完成兩項任務，第一是報告磁場量測部分的工作進度，第二是啟動 PDS 團隊的工作。丁肇中院士在會中也正式宣佈 PDS 團隊開始啟動的訊息。報告資料如附件一、二。

本次會議由國家科學研究院李羅權院長報告該院規劃以及太空計畫室的研究成果，其中高空放電的觀測成果，稱為紅色精靈，受到極大的讚賞。

本次會議的第一天為丁院士及 NASA 的報告，提出 AMS-02 計畫之核心工作，以及 NASA 配合的工作。第二天起為各主要團隊的工作報告，以及各主要團隊的內部會議。關於 PDS 團隊之工作，與 7 月 29 日下午的分組會議中討論計畫工作的細節。第四天及第五天為 NASA 與 LMSO 兩主要團隊討論與發射有關之任務規劃，本次會議因 NASA 延後 AMS-02 之發射，將引起 AMS-02 計畫的一些重大變更與調整。。

四、重要工作紀錄

為執行我方計畫的部分，AMS 超導磁場量測技術研發與測試的進度與成果，在超導磁鐵團隊中提出進度報告。超導磁鐵之進度再度落後，本計畫量測部分將再度推延。我方計畫之量測機構完成製造及模型演練。下一階段預計於八月份至九月份至中山科學研究院利用 AMS01 進行實體量測與分析。

關於 PDS(電源供配系統)計畫團隊的啟動，主要是本校申請國科會參與 AMS02 之 PDS 計畫可望於七月份核准，AMS 團隊評估整理技術能力，將採用義大利 CGS 公司的計畫書，以 CGS 的設計與 NASA 認證為基礎，設計 AMS 所需的 PDS。7 月 29 日第一次 PDS 團隊會議，討論我方計畫所負擔的責任、CGS 公司承擔的責任，以及 MIT、ETHZ 支援我方計畫之分工大綱，完成 PDS 團隊應有的組織架構與任務分派。

關於 PDS 計畫工作，將有部分製造的工作在台灣執行，計畫進行方式的討論將於 TIM 會後赴義大利米蘭 CGS 公司討論。

五、計畫工作訪問

8 月 4 日赴米蘭 CGS 公司訪問，討論 PDS 計畫分工與合約。國科會計畫下，我方計畫均以零組件方式採購以確實支援 PDS 之整體建置，並降低後續的財產歸屬與管理問題。CGS 公司所提出之計畫分為兩部分，第一為初步設計報告，依據 NASA 規範、參考該公司提供 AMS01 之技術規格，設計符合 AMS02 整體需求之電源供配系統，此部分已經於月初完成，報告業經 MIT 及 ETHZ 審核，達到預期效益。所需經費，於我方計畫下支付。本項計畫部分之合約經討論後帶回學校討論，並於簽訂合約後付款。會議紀錄及合約如附件三、四。

第二部分計畫包含 PDS 之細部設計、QM、EM 與 FM 之製造、各階段技術認證、系統組裝、測試、整體驗證等工作，已經討論依據我方所核准之經費的細目來制訂合約，並依據採購法規範執行。關於國內採購與製造之部分，也將依據採購法公告徵詢又意願之廠商，並以最有利標之方式進行廠商之資格審查、工廠訪視最後評定適當的公司參與本項計畫。第二部份之合約內容、經費細節將於 11 月底以前討論確定，並簽約執行。依據 AMS 總計畫之規劃，PDS 團隊時程計畫已經初步確定，如附件五，本團隊之總計畫工作時程計約 12 個月。

六、心得

參與 AMS-02 計畫之技術交流會議，學習到許多團隊整合、分工、合作的運作，對於我方計畫所應負責的部分，必須依規劃時程及技術規範，配合各方資源，努力達成。

國內參與 AMS 計畫之團隊越來越多，對 AMS 計畫的投入也越來越積極，本校「太空科技中心」所推動的工作應可以夠更積極的爭取到 AMS 團隊委派的工作任務，以達到本校提昇國際能見度的期望。

附件1

3D Magnetic Field Distribution Measurement for AMS02 Superconducting Magnet

Status Report on July 28, 2003

Prof. Chin E. Lin

National Changhua University of Education

National Cheng Kung University

Objective

- Support AMS02 project for measurement and identification on Superconducting Magnetic Field Distribution
- Field distribution data acquisition for variations under different excitation current controls, and identify sensitive locations for remote monitor and control.
- Establish Bending Power Calculation Database

Method

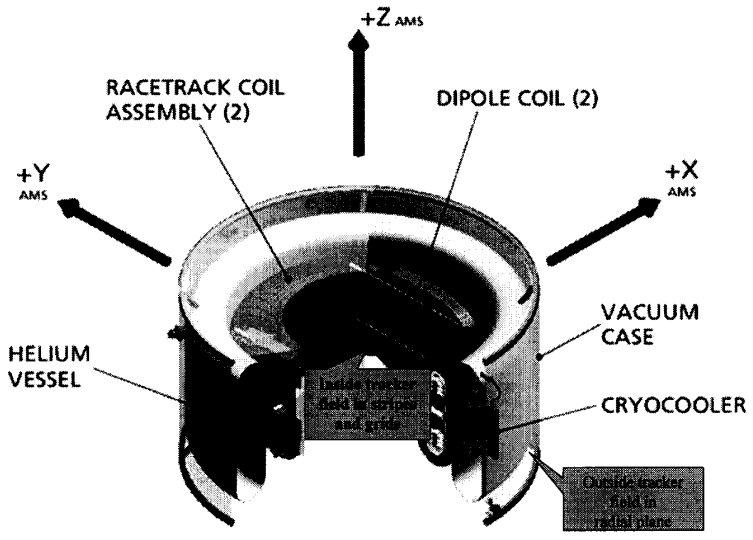
- Use Hall sensor array to scan magnetic field in X-Y-Z dimensions inside and outside tracker.
- Establish field distribution database.
- Determine bending power calculation database, setup computing program.
- Change magnet currents by 10%, 15% to analyze possible sensitive locations.
- Select sensors and design control loop for remote monitor and operation.

Work Plan

- Phase 1: design and produce measurement structure before 1Q, 2003, Practice with AMS01 at CSIST 2-3Q, 2003.
- Phase 2: identification measurement at SCL,1Q, 2004.
- Phase 3: At CERN, establish magnetic field distribution data and bending power calculation database in 2-3Q, 2004.
- Phase 4: Magnetic field monitor 4Q, 2004.

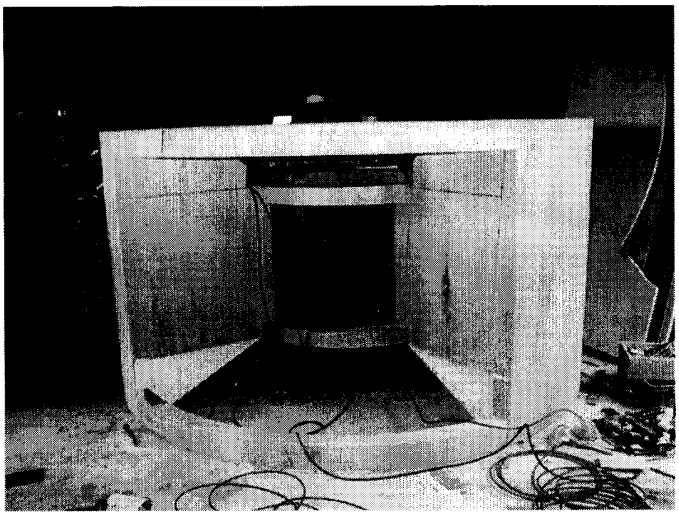
Construction of a Mock-up

- For measurement fixture training, full scale mock-up is constructed
- Mockup Completed March 2003
- Require exact match to all corner posts on AMS02 superconducting magnet with a open window for observation
- Install CCD to monitor inside operation

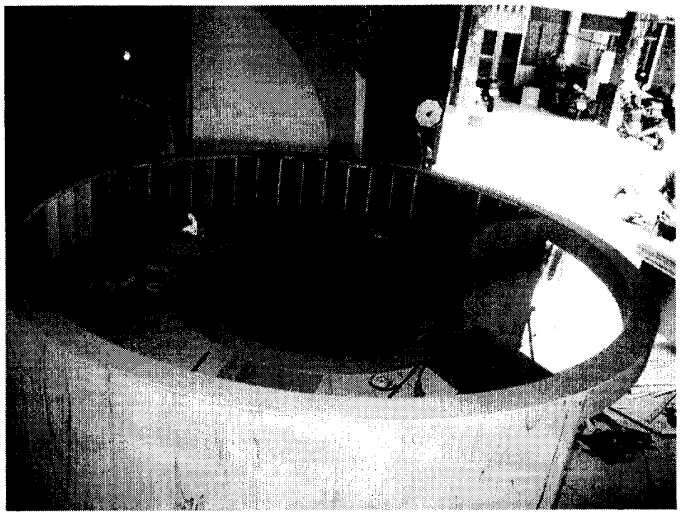


AMS-02 SUPERCONDUCTING MAGNET LAYOUT

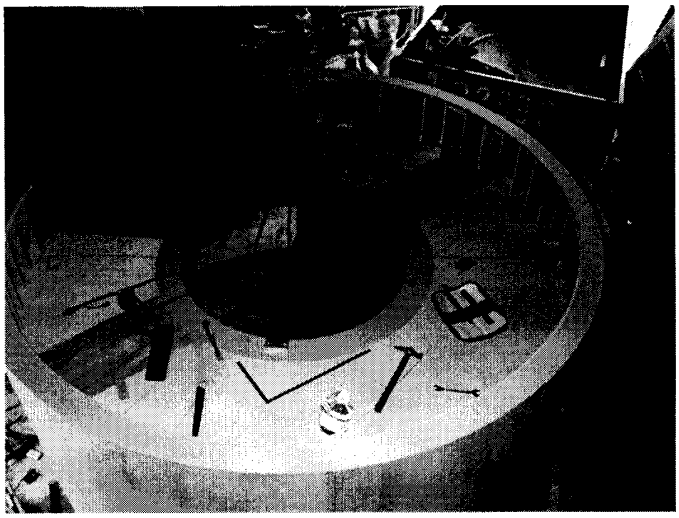
AMS02 Mock-up at Work



AMS02 Mock-up at Work



AMS02 Mock-up at Work

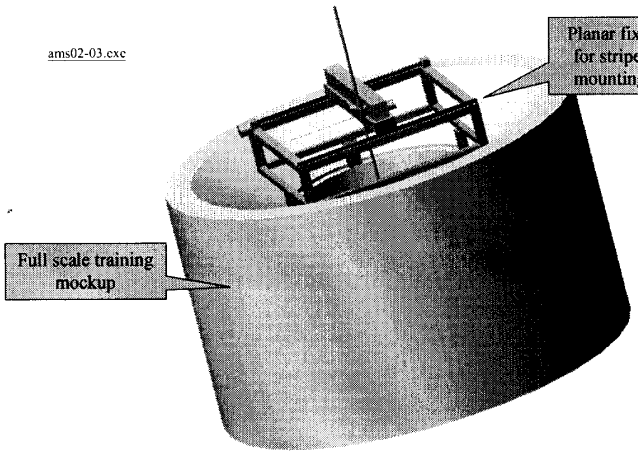


System Requirements

- Magnetic measurement system design
  - Auto field intensity range change
  - Determine field sensitivity
- Fixture system design
  - Servo mechanics
  - 3D accurate motion

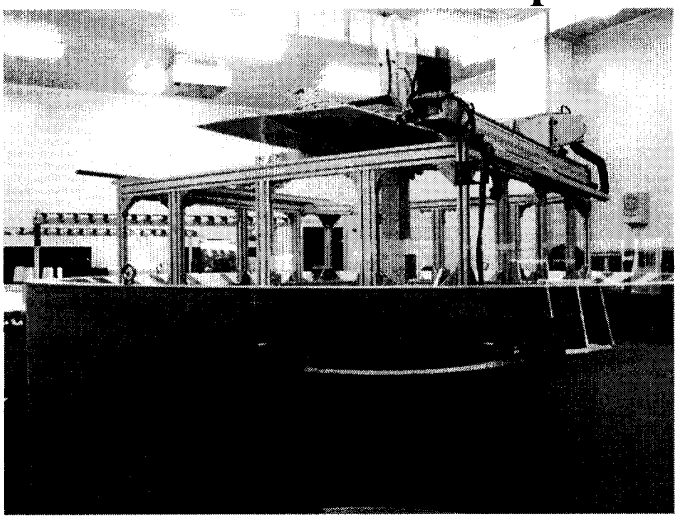
Inside Tracker Measurement

ams02-03.exe



ams02-4.exe

Fixture on Mock-up

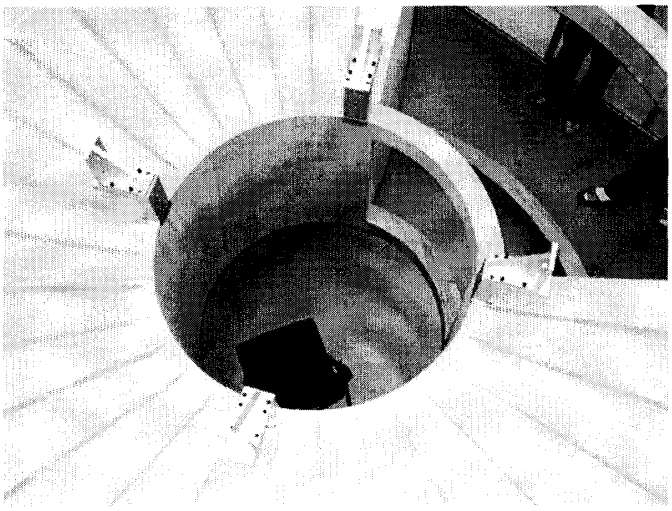


Fixture on Mock-up

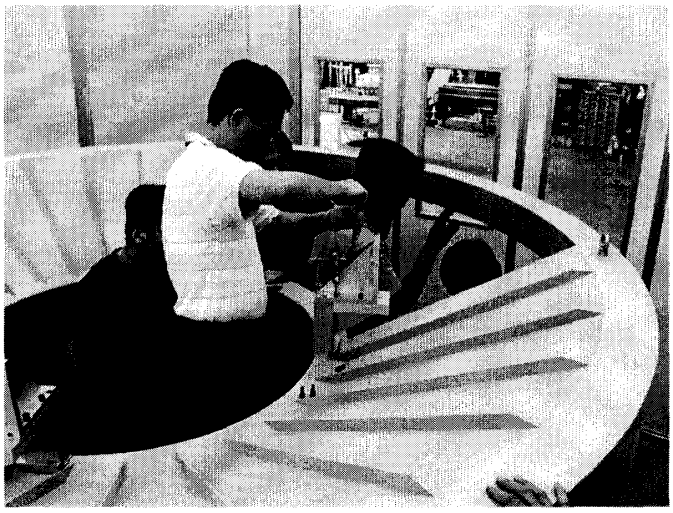
Fix Post calibration

- Fix Posts for Measurement Calibration
  - Establish an AMS02 mockup in Taiwan.
  - Use four posts to locate the planar fixture
  - Calibration process to reference posts in the mockup.
  - Training with this mockup.

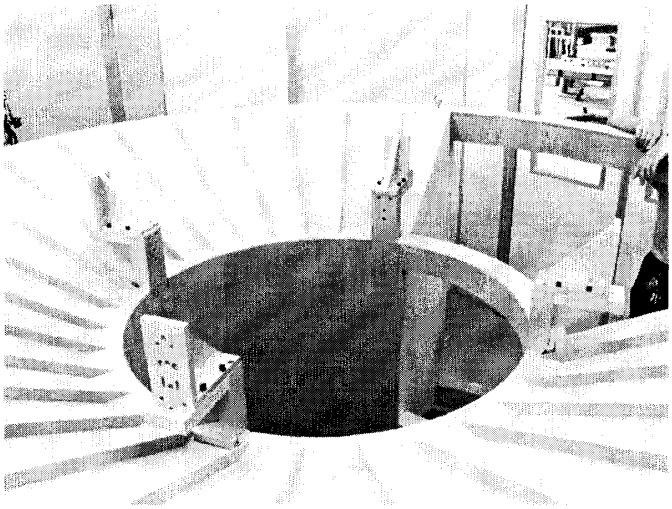
Fix Post Calibration

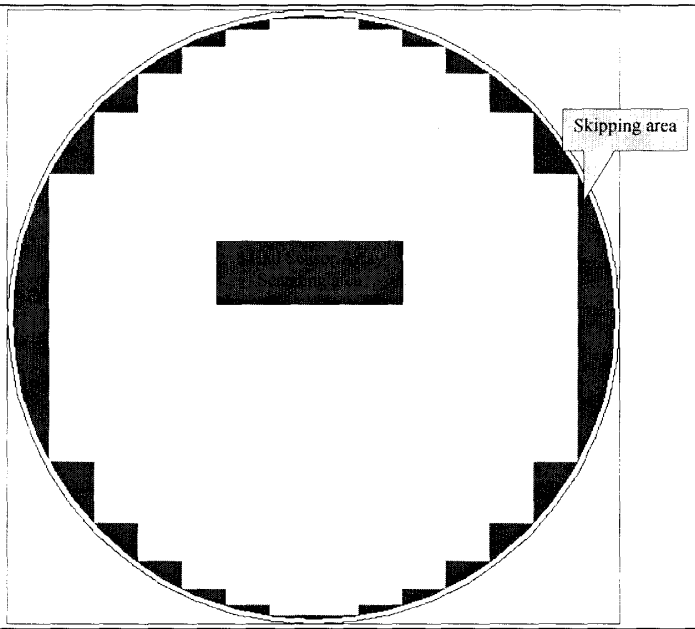


Fix Post Calibration

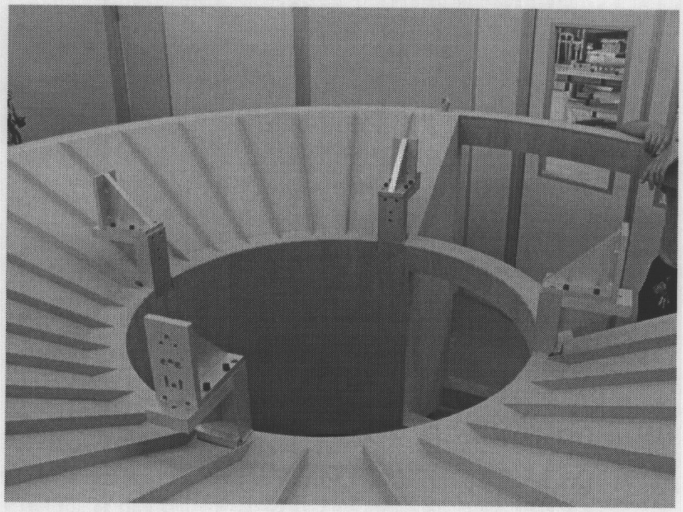


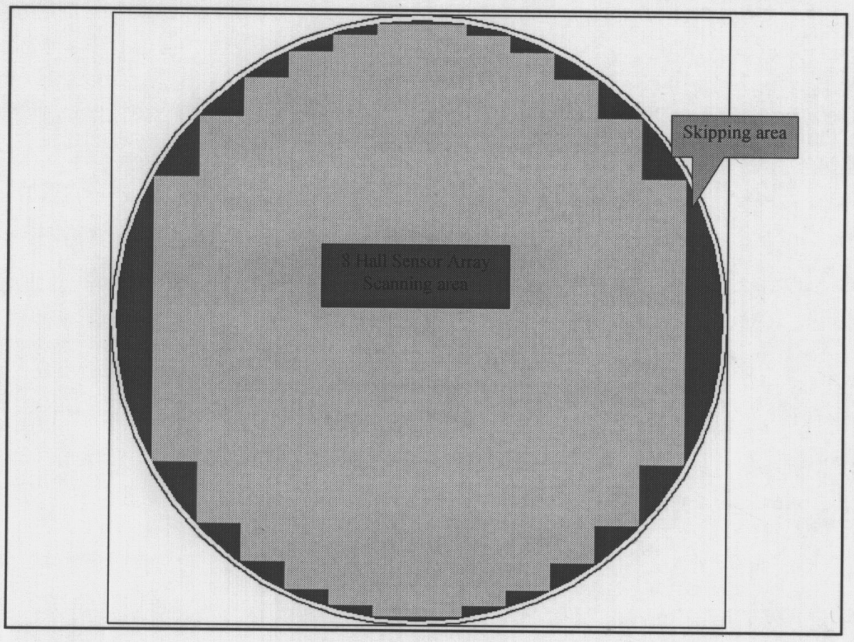
Fix Post Calibration

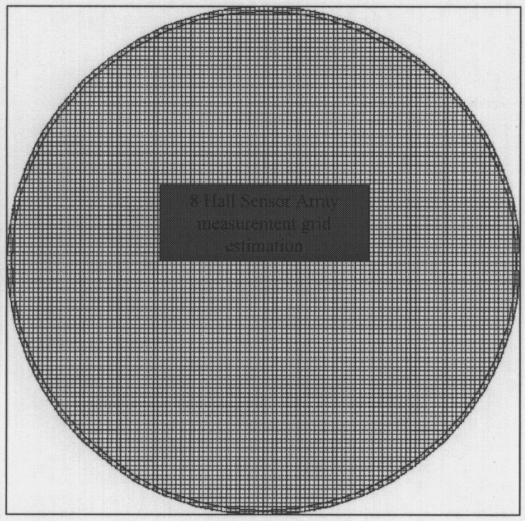




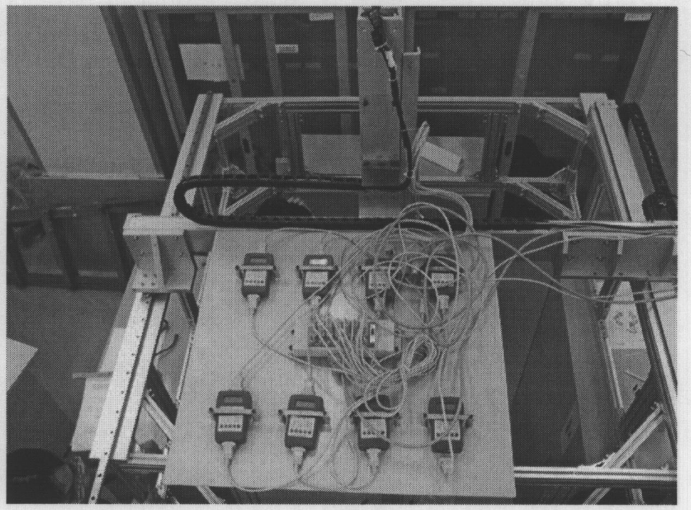
Fix Post Calibration



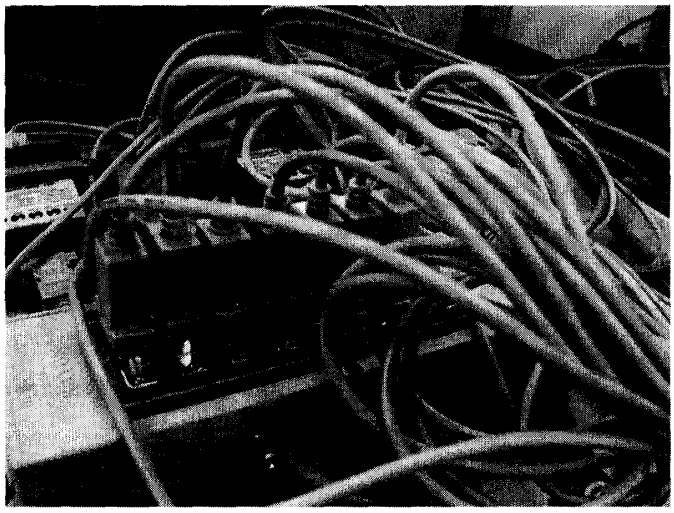




Sensor Amplifier



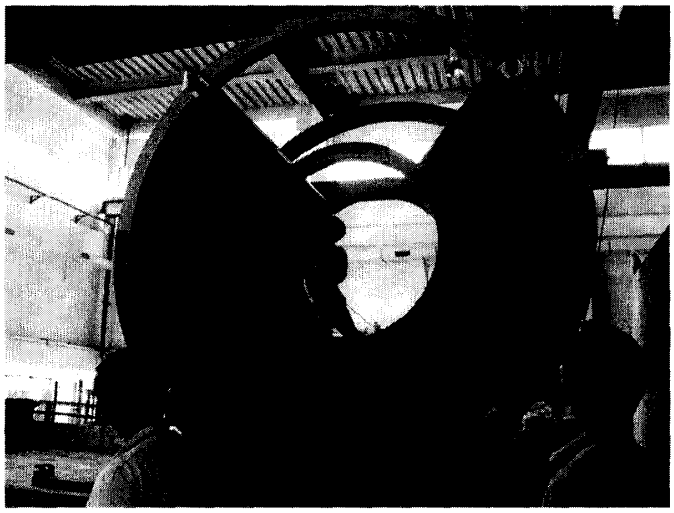
Cabling in Mock-up



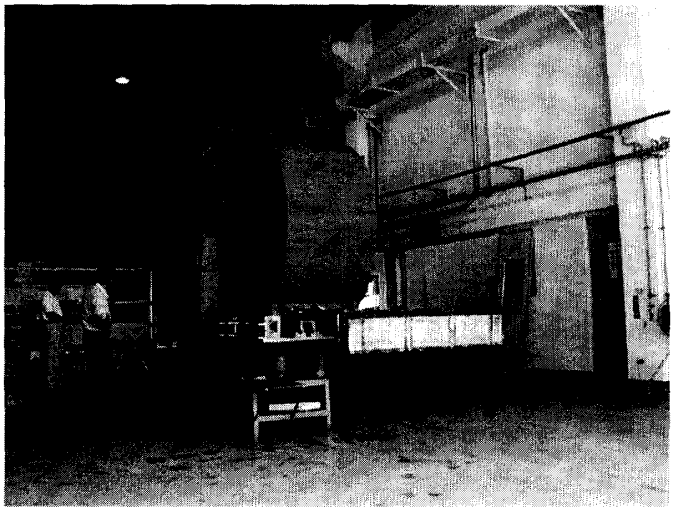
Mock-up in Position

- Mockup for Measurement Practice.
  - Precision calibration to planar fixture (PLF)
- Mockup set-up March 2003
- Mechanical limits tuning
- Use AMS01 at CSIST in August 2003
  - for magnetic field data measurement training
  - measurement calibration and verification test

Mock-up in Position



Mock-up in Position



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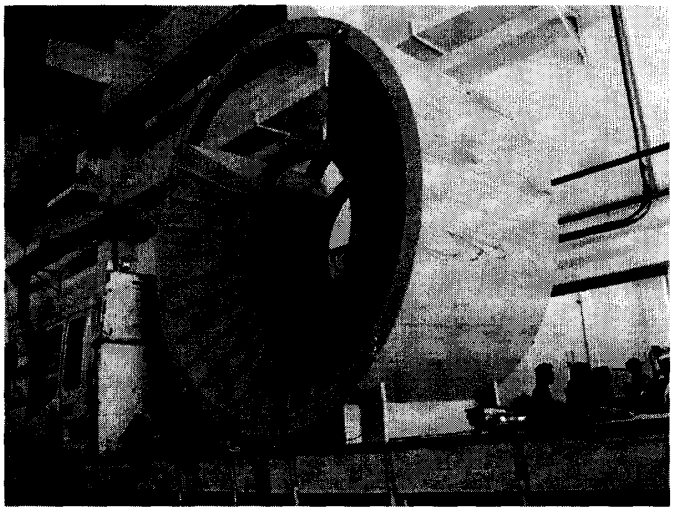

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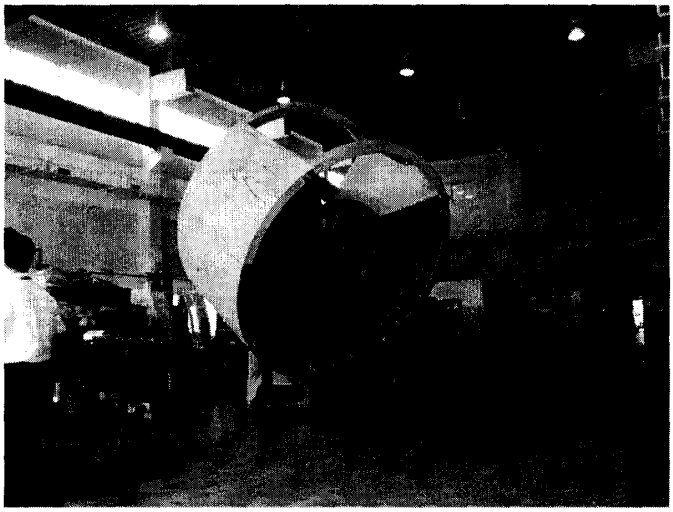
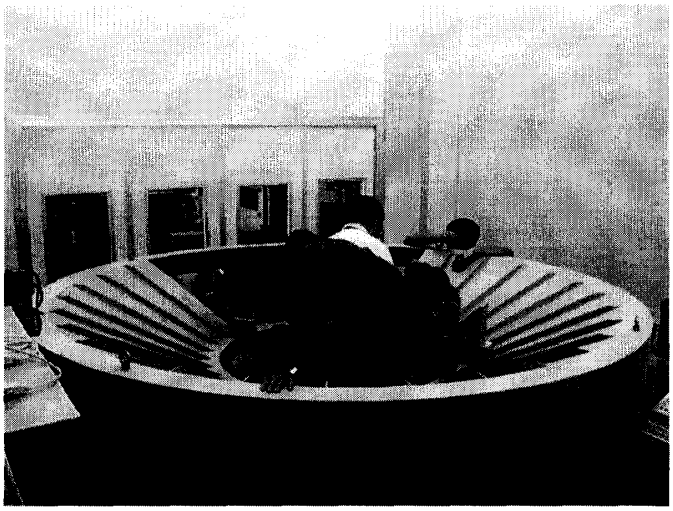
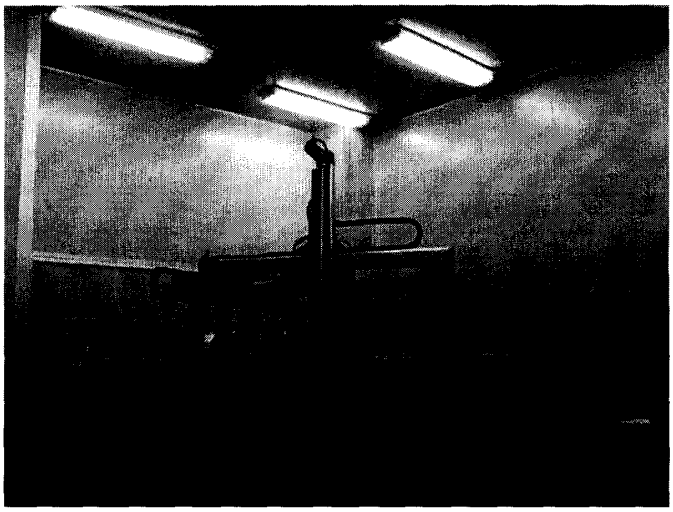


Mock-up in Position



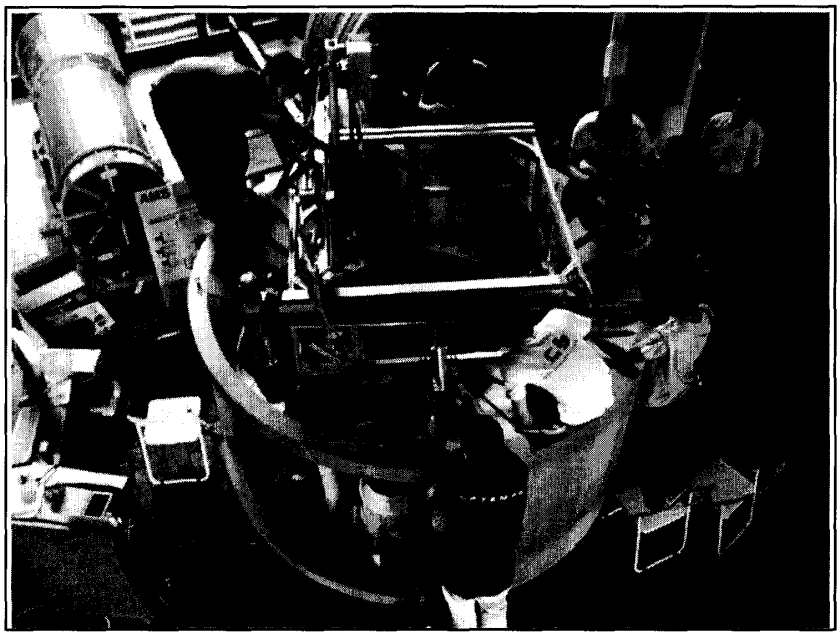
Mock-up in Position

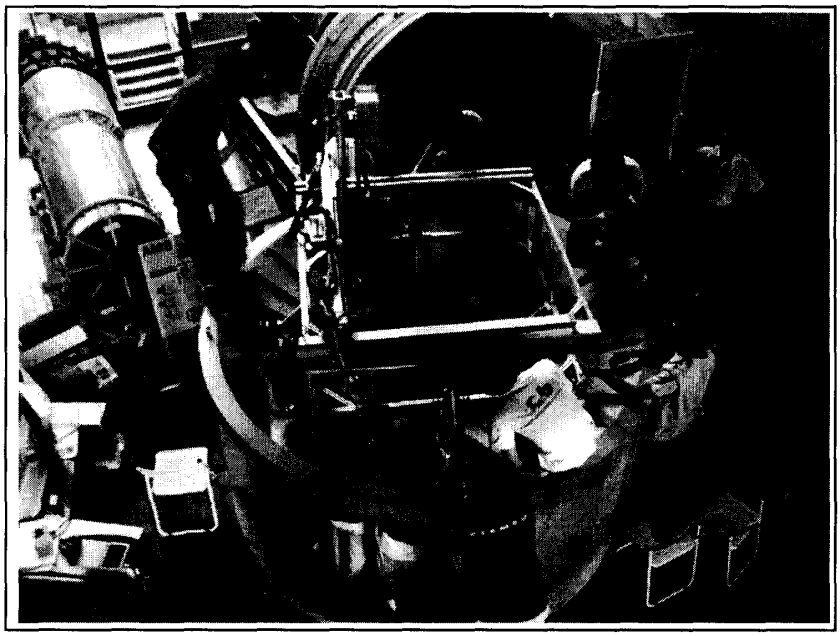
Mock-up in Position



Calibration using Mock-up

- Use Mockup for Measurement Calibration
  - Moving test
  - Accuracy test
  - Sensor mounting test
  - Data recording test
  - Monitor test
  - Establish SOP





Mock-up in Position

- Mockup for Measurement Practice.
  - Precision calibration to planar fixture (PLF)
- Mockup set-up March 2003
- Mechanical limits tuning
- Use AMS01 at CSIST in August 2003
  - for magnetic field data measurement training
  - measurement calibration and verification test

We are working hard

附件2

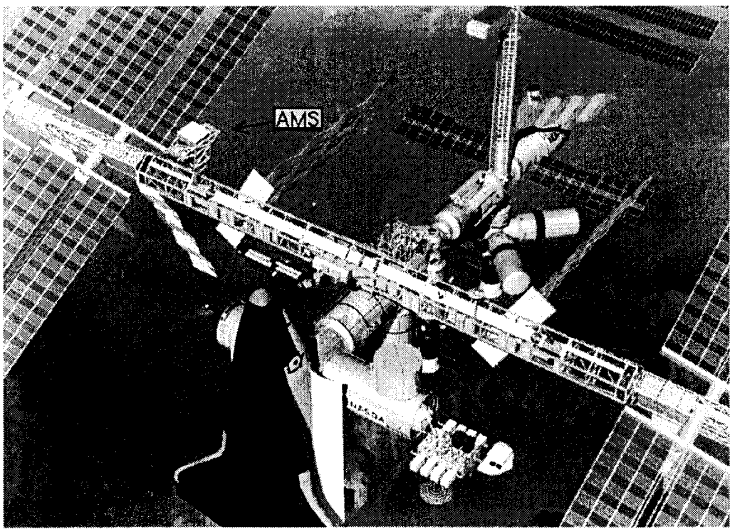
PDS+MF for AMS-02

林清一教授

Project Title and Terms

- AMS電力供配系統之研發與建置以及AMS超導磁場3D分佈之量測
- Development and Implementation of the Power Distribution System from ISS to AMS and Measurement of the AMS02 Superconducting 3D Magnetic Field Map
- June 1, 2003 to May 31, 2006 for 3 years

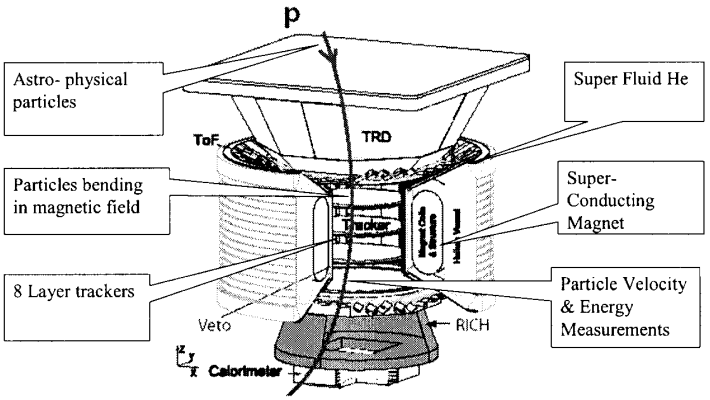
AMS-02 on ISS



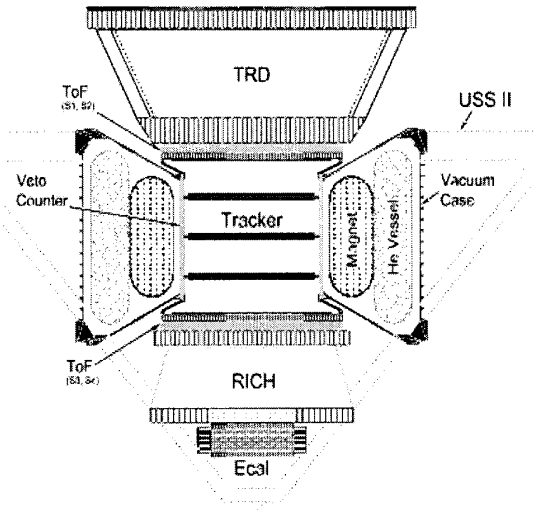
AMS-02 Concept

$p = mv$

$\Delta V/V = 0.1\%$ to determine the mass



AMS-02



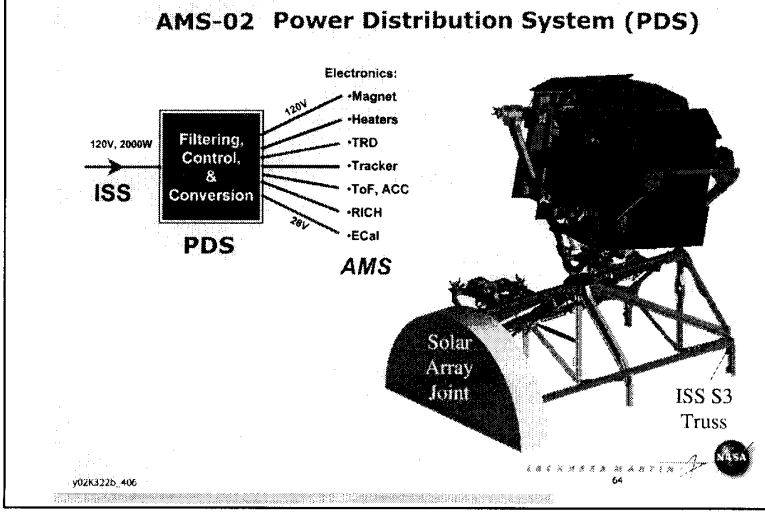
Project Goals

- Support AMS-02 main project
- Carry out system design, implementation and verification for power distribution system (PDS)
- Superconducting magnetic field measurement for AMS-02.

Specifications for PDS

- Feed power from ISS or STS
- Converting 120~128 V, 2 kW DC into AMS-02
- Supply 120 V DC and 28 V DC power in two-bus configuration
- Redundancy configuration

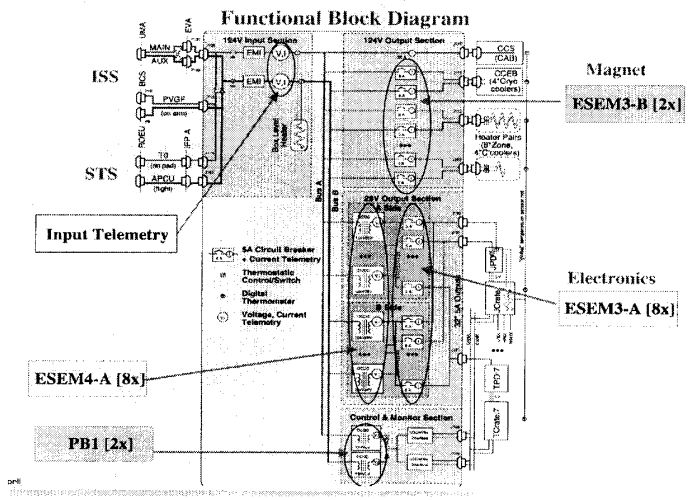
Power Distribution Syste



PDS Hardware Profile

- 4 sets of 120V DC/DC Converters
- 3 sets of 28 V DC/DC converters
- Including Engineering Model (EM) and Flight Model (FM)
- NASA approved 90~92 % efficiency
- Bus configuration + switching + remote control

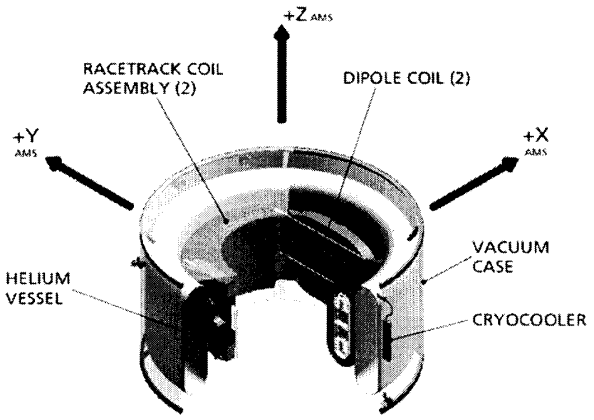
PDS Circuitry



Project Goals

- For PDS objective, we are organizing NCKU team to participate CGS for space qualification system design, test and verification. Among all different aspects of PDS specifications, NCKU team will complete subsystem manufacturing and quality assurance test in Taiwan. Through this project, the NCKU team will establish and promote industrial capability in space qualification system design, manufacturing and verification skills.

AMS Superconducting Magnet



AMS-02 SUPERCONDUCTING MAGNET LAYOUT

Project Goals

- For superconducting magnetic field measurement, the NCKU team will contribute magnetic technology expertise to establish accurate magnetic field distribution data for further data analysis. The magnetic field measurement work includes measurement fixture design, manufacturing and execution of real measurement at SCL and CERN.

Sub-Projects

- Subproject 1:系統分析及規格訂定 Characteristic Analysis and System Specifications 陳建富教授
- Subproject 2:直流轉換器之製造與測試 DC/DC Converter Manufacturing and Test 黃裕煒教授
- Subproject 3:直流轉換器特性驗證 Characteristics Verification for DC/DC Converters 趙怡欽教授
- Subproject 4:系統整合、驗證與技術轉移 Integration, Verification and Technical Transfer 陳介力教授
- Subproject 5: AMS超導磁場3D分佈之量測 Measurement of the AMS02 Superconducting 3D Magnetic Field Map 林清一教授

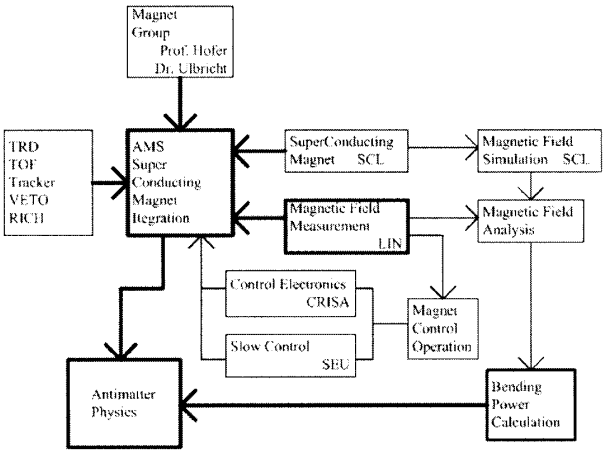
Team Members

- Prof. Chin E. Lin 林清一
- Prof. J. F. Chen 陳建富、Prof. Y. W. Huang 黃裕煒
- Prof. Y. C. Chao 趙怡欽、Prof. C. L. Chen 陳介力
- Prof. H. H. Chiu 邱輝煌、Prof. S. T. Jenq 鄭泗滄
- Prof. T. J. Liang 梁從主、 Prof. T. C. Chen 陳添智
- Prof. T. F. Wu 吳財福、Prof. T. R. Chen 陳財榮
- Prof. A. S. Hou 侯安桑、Dr. Edwin S. Wang 王信雄
- Section Head Steven S. Tsai 蔡深浩組長
- Prof. Y. Y. Zhou 鄒應嶼

Team Members

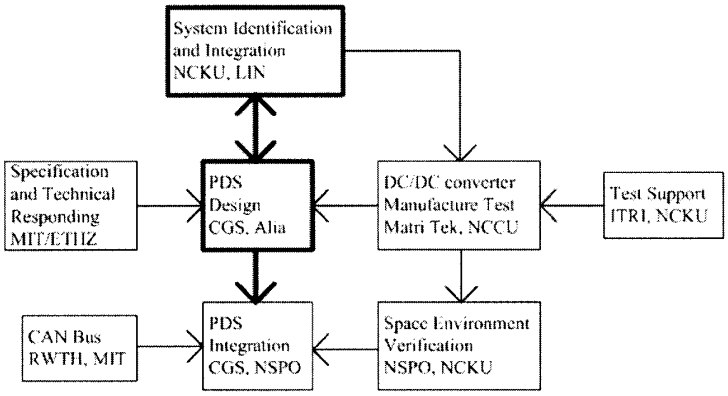
- International Team Member
- Pror. Hans Hofer, ETHZ, Magnet Leader
- Dr. Juergen Ulbircht, ETHZ, MF
- Dr. Mike Capell, MIT, MF+PDS
- Dr. Gert Viertel, ETHZ, PDS
- Mr. Steven Harrison, SCL, MF
- CGS Member, PDS
- Crisa Member, Spain, MF

Magnet Team



AMS02 Superconducting Magnet Group Work Flow Chart

PDS Team



Man Power in Project

- One Full Time Post Doctoral for 3 years
- 2 Two Full Time Masters for 3 years
- 1 Part time Administration Assistant
- 5+2, 5+2, 4+1 Part Time Master and Ph D. Students to support project work loads.

Project Budget

- Probably NT$ 78 M for three years
- CGS asks for Euro 1.65 M for design, manufacturing and mission.
- Negotiation is required to bargain for 22% to 40 % job return to Taiwan team.
- MF part needs NT$ 5 M
- 8% Overhead to NCKU

Proceedings

- Team members may have chance to join the Technical Interchange meeting at CERN, or NASA JSC/KSC
- MF subproject carries experiment to SCL, UK, and CERN, CH, Madrid, SP, under schedules.
- PDS subproject carries verification test to CGS, IT.
- PDS verification test in NSPO, TW.

Proceedings

- MF measurement requires 4-6 weeks at CER, CH, in July 2004.
- PDS Mission preparation requires 6-12 weeks at NASA KSC, USA, in August 2005.
- AMS-02 launch schedule on October 28, 2005.

Sub-Project 1

- Sub-project 1 is lead by Prof. Jien-Fu Chen, EE, NCKU, to join CGS in PDS characteristics analysis and system specifications.
- This work has to get started immediately with CGS and other cooperation partners to determine detail specifications for converters and controllers in PDS.
- This work has also responsible in sourcing a qualified Taiwanese manufacturer to handle some productions in Taiwan. This process should fulfill Government Procurement Regulations and NASA requirements.

Sub-Project 2

- Sub-project 2 is lead by Prof. Yue-Wei Huang, EE, NCUE, to manipulate PDS manufacturing control both from Taiwan and Italy.
- This work is to set-up contract with CGS and Taiwanese manufacture, to monitor manufacturing process and to carry out tests to meet the specifications both in CGS and in Taiwan.
- This process should fulfill Government Procurement Regulations and NASA requirements.

Sub-Project 3

- Sub-project 3 is lead by Prof. Yie-Chin Chao, AA, NCKU, to carry out converter test and characteristics verification in Taiwan, and in Italy.

Sub-Project 4

- Sub-project 4 is lead by Prof. Chieh-Li Chen, AA, NCKU, to work with CGS for PDS integration in Italy and space qualified system verification in NSPO, Taiwan.

Sub-Project 5

- Sub-project 5 is lead by Prof. Chin E. Lin, AA, NCKU, to support the magnetic field measurement of the superconducting magnet.
- The required mechanical fixtures, magnetic field sensors, system integration and data acquisition software will be developed in Taiwan.
- Preliminary measurement work will be carried out at SCL, UK, after the magnet is first assembled, and at CERN, Switzerland, after the complete magnet assembly but before other parts of AMS are installed.
- Schedule is dependent on Magnet Team.

Project Management

Organization

- Organization: This project is executed through Project Control Office (PCO) at Room 5859, AA Building, NCKU. Tel. 06-274-1820, NCKU 63693
- Prof. Chin E. Lin, Cell Phone: 0932-983979, 0929-071071, Assistant: Chih-Ching Li李志清, Cell Phone 0935-179101
- E-mail: AMS_NCKU@seed.net.com

Project Management

Team Meetings

- Team Meeting will be called on regular basis before and after AMS-02 TIM.
- Consulting meeting will be called on each occasion of technical specialist.
- Project report meeting will be called on preparation and finish to Prof. Ting.

Project Management

Responsibility Control

- Responsibility will be identified after negotiation with CGS.
- Responsibility is monitored according to schedule and tasks by PCO.
- All project data feed back to PCO instantly.

Project Management

Financial Control

- Financial control is executed through PCO following the approved budget.
- PCO handles team member travels and expense applications.
- Request man power quota through PCO, depending actual demands.

Project Management

Documentation

- All sub-projects require to handle related documentation control from CGS, CERN and NASA.
- All documentations merge to PCO instantly.

Project Management

Schedule Control

- PDS progress milestone and check points should meet overall schedule requirements with 4 weeks tolerance to due date.
- Prior to AMS-02 assembly at CERN, Sub-project 5 should finish magnetic field measurement and data analysis before October 2004. Magnet test at SCL, UK, should be carried out before January 2004, in advance.

Project Management

Schedule Control

- Prior to PDS integration and assembly at CGS, Sub-project 1 and 2 should finish all PCB parts, such as DC/DC converters and control circuit boards, by NASA requirement tests, EM by December 2003, and FM by August 2004.
- Prior to AMS-02 assembly at CERN, Sub-project 3 and 4 should finish PDS integration verification before March 2005.

Project Management

Schedule Control

- NCKU team may need to support AMS-02 integration work at CERN and at KSC before launch, from May to October 2005.
- Schedules are subject to change following AMS-02 overall schedule.
- AMS-02 launch is scheduled on October 28, 2005.

CARLO GAVAZZI SPACE SpA	**RELAZIONE DI RIUNIONE / VISITA** ***MINUTES OF MEETING / VISIT***	N° **AMS-02-MOM-057** FOGLIO *SHEET* **1** DI OF **2** ANNEX

DATA – *DATE*	LOCALITA' – *LOCATION*	COMMESSA – *JOB*	RIF. - *REF.*
04 – August - 2003	**MILAN**	**AMS-02**	

IMPIANTO *PROJECT*	DESCRIZIONE *DESCRIPTION* AMS-02 PDS CGS AND NCKU COLLABORATION	CLIENTE - *CUSTOMER*
	LOCALITA' *LOCATION* Carlo Gavazzi Space (Milan)	ORDINE - CONTRACT

SCOPO RIUNIONE *PURPOSE OF MEETING*	**CGS & NCKU COLLABORATION FOR POWER DISTRIBUTION SYSTEM (PDS) OF AMS-02 EXPERIMENT**	REDATTO – *WRITTEN BY* S. Alia
		LISTA DI DISTRIBUZIONE *DISTRIBUTION LIST* G. Viertel (ETH) M. Capell (MIT) G. Borghi (CGS) G. Mazzoni (CGS) R. Grossi (CGS) P. Apollonio (CGS) F. Facchin (CGS)

PRESENTI - *ATTENDED BY*	**NOMI - *NAMES***	**POSIZIONE - *POSITION***
	Prof. Chin E. Lin (NCKU)	
	R. Aceti (CGS)	
	S. Alia (CGS)	
	M. Molina (CGS)	

PUNTI *ITEMS*	**ARGOMENTI DISCUSSI – DESCRIPTION OF DISCUSSION**	**AZIONE A CURA** [1] *ACTION BY* [1]
1.	AMS-02 PDS Preliminary Design Phase CGS presents the following documentation to NCKU: • Proposal S3-054 Power Distribution System – Preliminary Electrical Design • Draft Contract between NCKU and CGS for the PDS Preliminary Electrical Design Both document are handed over to Prof. Lin for further review and comments. Pending authorization from Prof. Ting and finalization of funding for AMS PDS, NCKU will proceed to place a contract to CGS for the activities associated with the Preliminary Design of PDS for an amount of 142400 Euro	NCKU comments to draft contract by 8 August 2003 NCKU PDS Preliminary Design contract signed before the end of September 2003
2.	CGS presents the AMS-02 PDS proposal S3-057 Issue 1 Revision 1 to NCKU describing the activities associated with the development of the PDS engineering model and flight model. The share of responsibilities between CGS and NCKU will reflect the need to keep the full responsibility of the PDS performance at CGS while sharing the work with NCKU. It is proposed that CGS will develop and integrate at its premises the engineering model with the participation of NCKU engineers to familiarize with the design while NCKU will manufacture the PCBs and the mechanical parts, assemble the boards, perform the full functional test and the full environmental test. CGS will support these NCKU manufacturing and integration activities. The proposal S3-057 Issue 1 Rev. 1 will be updated to specify better the	

1) INDICARE IL NOMINATIVO RESPONSABILE DELL'AZIONE E DATA DI COMPLETAMENTO
1) ACTUAL PERSON RESPONSIBLE FOR THE ACTION AND COMPLETION DATE SHALL BE SHOWN

CARLO GAVAZZI SPACE SpA	**RELAZIONE DI RIUNIONE / VISITA** ***MINUTES OF MEETING / VISIT***	N° **AMS-02-MOM-057** FOGLIO *SHEET* **2** DI OF **2** ANNEX

DATA – *DATE*	LOCALITA' – *LOCATION*	COMMESSA – *JOB*	RIF. - *REF.*
04 – August - 2003	**MILAN**	**AMS-02**	

PUNTI ***ITEMS***	**ARGOMENTI DISCUSSI – DESCRIPTION OF DISCUSSION**	**AZIONE A CURA** [1] ***ACTION BY*** [1]
	technical involvement of NCKU engineers coming to CGS during the PDS engineering model development phase. A further update will be associated with a more detailed planning for CGS support during the Flight Model production The schedule discussed at the TIM meeting of July 29 2003 has been confirmed in its main parts and will be updated to include additional milestones in the flight model manufacturing and integration phase.	CGS update the proposal by 8 August CGS to draft a contract and send it to NCKU for the PDS development by mid. August 2003 NCKU to place a contract to CGS for the PDS full development by end of October

1) INDICARE IL NOMINATIVO RESPONSABILE DELL'AZIONE E DATA DI COMPLETAMENTO
1) ACTUAL PERSON RESPONSIBLE FOR THE ACTION AND COMPLETION DATE SHALL BE SHOWN

Contract

between

National Cheng Kung University
N° 1, University Rd
Tainan, Taiwan 701

hereinafter called NCKU

and

Carlo Gavazzi Space SpA
Via Gallarate 150, I-20151 Milano

hereinafter called CGS

for the AMS-02 Power Distribution System
Preliminary Electrical Design

Table of Contents

1. Scope of the Work....3
2. Deliverables and Schedule....3
3. Subcontracts....3
4. Shipment of Documents....3
5. Cooperation and Exchange of Information....3
6. Price and Invoicing....3
7. Confidentiality....4
8. Language....4
9. Governing Provisions....4
10. Contract Changes....5
11. NCKU Representatives....5
12. CGS Representatives....5
13. Technical Specifications....5
14. Transfer Account Details....5

1. Scope of the Work

CGS shall perform the preliminary electrical design of the AMS-02 Power Distribution System (PDS). This preliminary phase was part of the PDS proposal S1-043 Is2 Rev.2 dated July 2002 issued to ETH institute and now extracted and detailed in the proposal S3-054 Is1 Rev1 dated July 2003 issued to the NCKU institute. The proposed Power Distribution System is based on the development of the Remote Power Distribution Assembly (RPDA) carried out by CGS for the International Space Station, with the necessary upgrades for AMS-02 as described in the CGS proposal.

2. Deliverables and Schedule

The design activity will last one month, from the date of signature of the contract and in any case not later than 31 August 2003. The following deliverable document are foreseen:

- Electrical Design Report: **AMS02-RP-CGS-001 Is.2 dated July 2003**

3. Subcontracts

No subcontract are foreseen for this activity

4. Shipment of Documents

CGS is responsible for all administrative and customs formalities required to ship the deliverable documents. CGS is not responsible for any custom taxes and similar fees in Switzerland.

5. Cooperation and Exchange of Information

In case it is deemed necessary or advisable the contracting parties shall meet to discuss problems relative to the project.

6. Price and Invoicing

The Firm Fixed Price of the AMS-02 PDS Preliminary Electrical Design is:

142400 Euro

A single invoice shall be submitted for payment at the delivery of all technical documentation.

Payment shall be effected, upon invoicing, within 30 days.

The invoices shall bear the contract number. They shall be sent to NCKU in two copies and shall not carry any additional information.

7. Confidentiality

Any data and information supplied by either Party to the other, identified as "restricted use", company confidential" or "proprietary" and belonging to the disclosing Party or any third party, shall be governed by the following terms and conditions:

The receiving Party agrees to protect such data and information with the same degree of care which the receiving Party uses to protect its own like data and information.

The receiving Party shall not disclose or have disclosed to third parties, in any manner or form, or otherwise publish such data and information so long as it remains confidential without the explicit authorisation of the disclosing Party.

The receiving Party agrees that it shall use such data and information solely in connection with the performance of the Work, unless otherwise explicitly authorised by disclosing Party with the designation of specific data and information and use.

Nothing herein shall require the receiving Party to protect from disclosure information which was in the receiving Party's custody prior to the inception of the Contract, information which comes into custody of the receiving Party without restriction and without breach of obligation, information which is independently generated by the receiving Party, or information otherwise in the public domain without breach of the Contract by the receiving Party.

Nothing shall restrict the use of any information which

a) is established by CGS to be otherwise available in the public domain otherwise than by breach of the Contract; or,

b) is established by CGS to be without restriction in the lawful possession of the person or entity using the same; or,

c) was obtained by such person or entity from a third party who was free to supply the same without restriction.

8. Language

The language used in the Contract, correspondence and any relevant documentation appertaining thereto shall be the English language.

9. Governing Provisions

This contract and technical specification constitute the entire agreement between the parties with respect to its subject matter. Swiss Law shall govern this contract.

10. Contract Changes

Alterations of this contract shall be valid only if they are recorded in the form of an annex signed by both parties hereto.

11. NCKU Representatives

The overall responsibility is with Prof. Chin E. Lin
Ph: +886-6-274 1820
Fax: +886-6-236 1835

The technical responsibility is with G. Viertel (ETH Zurich)
Ph: +41-1-633 2015
Fax: +41-1-633 1104

12. CGS Representatives

For technical matters: Sergio Alia,
Ph: +39 02 38048 236
Fax: +39 02 3086458

For contractual and administrative matters: Flavio Facchin
Ph: +39 02 38048 227
Fax:: +39 02 38048 207

13. Technical Specifications

The CGS proposal S3-054 Is1 Rev1 dated July 2003 is an integral part of this contract and shall be signed by the contract parties.

14. Transfer Account Details

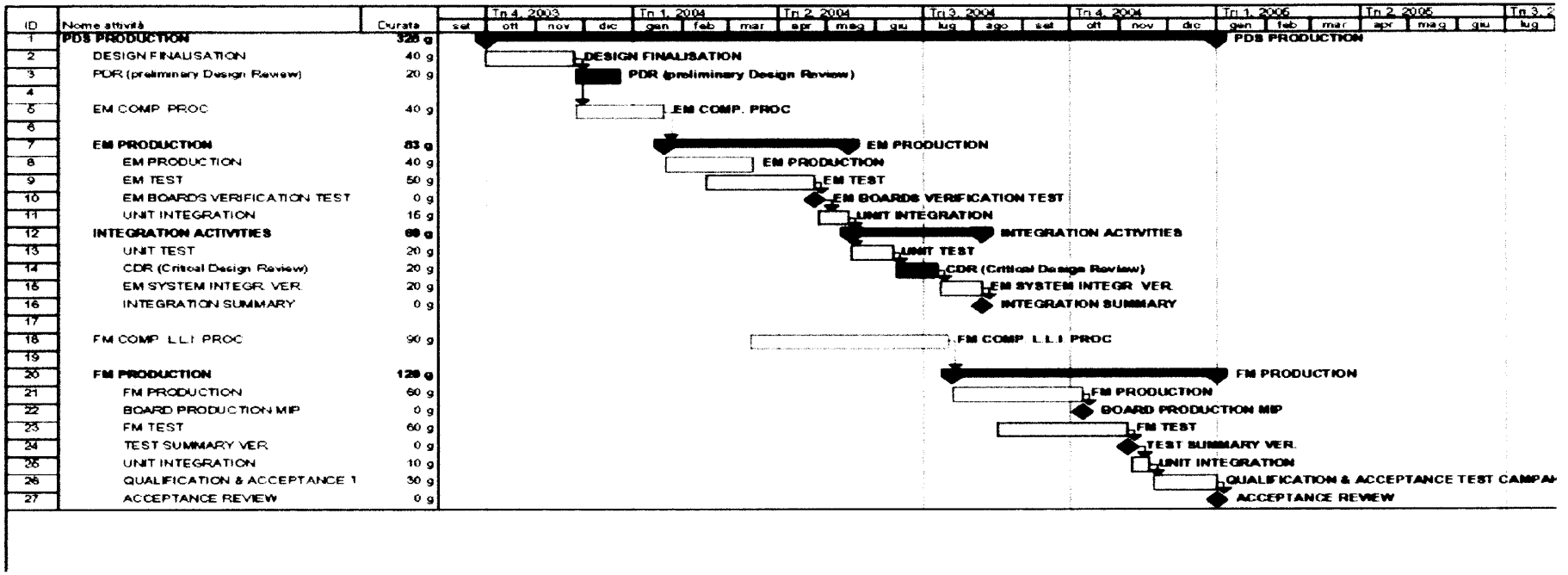
Name:	BANCA INTESA RETE COMIT MILANO
IBAN CODE:	IT68 R030 6909 5490 5069 8000 110
BIC:	BCITITMM384

Signed on behalf of Carlo Gavazzi Space SpA

. . . . . .

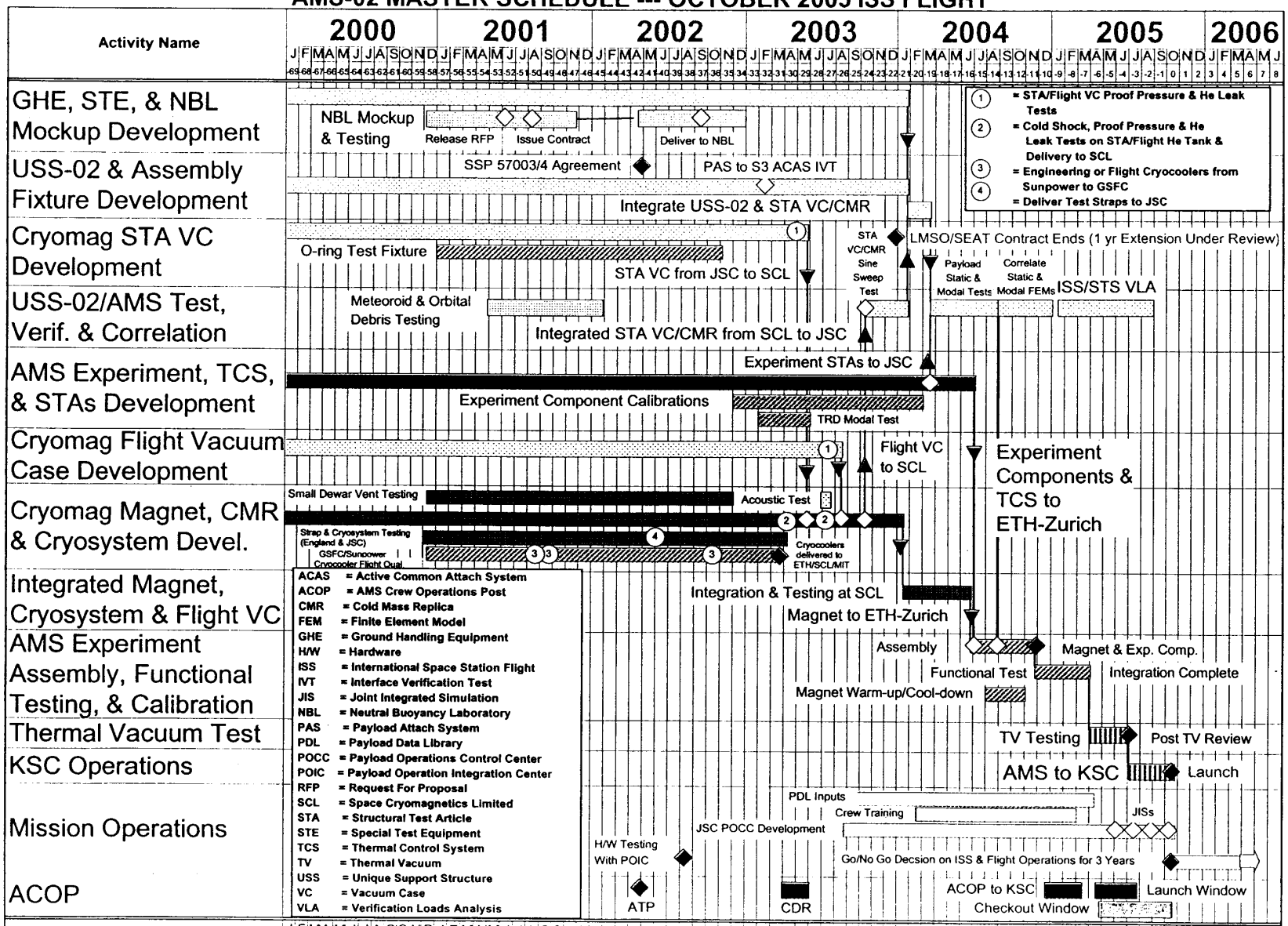
Signed on behalf of NCKU

. . . . . .



ID	Nome attività	Durata
1	**PDS PRODUCTION**	**325 g**
2	DESIGN FINALISATION	40 g
3	PDR (preliminary Design Review)	20 g
4		
5	EM COMP. PROC	40 g
6		
7	**EM PRODUCTION**	**83 g**
8	EM PRODUCTION	40 g
9	EM TEST	50 g
10	EM BOARDS VERIFICATION TEST	0 g
11	UNIT INTEGRATION	15 g
12	**INTEGRATION ACTIVITIES**	**60 g**
13	UNIT TEST	20 g
14	CDR (Critical Design Review)	20 g
15	EM SYSTEM INTEGR. VER.	20 g
16	INTEGRATION SUMMARY	0 g
17		
18	FM COMP. L.L.I. PROC	90 g
19		
20	**FM PRODUCTION**	**120 g**
21	FM PRODUCTION	60 g
22	BOARD PRODUCTION MIP	0 g
23	FM TEST	60 g
24	TEST SUMMARY VER.	0 g
25	UNIT INTEGRATION	10 g
26	QUALIFICATION & ACCEPTANCE T	30 g
27	ACCEPTANCE REVIEW	0 g

AMS-02 MASTER SCHEDULE --- OCTOBER 2005 ISS FLIGHT



Jim Bates / Trent Martin / Ken Bollweg (281) 483-0657 / (281) 335-2139 / 2714

September 16, 2002

Rev. 19

Project Budget Plan PDS &MF for AMS

2003 to 2004

Item	Function/Assignment	fare basis	quantity	duration	sub-total	Item-SUM	Remark
1 **Personnel**		basis	person	month		2284500	
	Full Time Assistant	34000	2	13.5	918000		project coordinator, MS /PDS
	Part time assistant	6000	1	12	72000		part time assistant tat NCUE
	Full Time Postdoctor	55000	1	13.5	742500		technical coordinator /PDS
	Part Time Student-MS	6000	5	12	360000		experiment support / MF
	Part Time Student-PhD	8000	2	12	192000		experiment support /PDS
					2284500		
2 Equipment		unit price	quantity	phase		780000	
	Tilt Area MF 3D Fixture	420000	1	1	420000		measurement demand/ MF
	3D Hall Sensor	180000	2	1	360000		measurement demand/ MF
					780000		
3 Material		estimate	quantity	phase		536000	
	Electronics Devices/Parts	1,000	20	10	200000		for lab support/ MF
	Local Trip	4000	10	1	40000		staff support
	Office stationary	5000	1	12	60000		staff support
	Phone and postage	5000	1	12	60000		staff support
	Computer peripherials	5000	1	12	60000		staff support
	Team meeting supplement	4000	1	4	16000		group meeting
	Equipment shipment	100000	1	1	100000		Equipment ship to SCL /MF
					536000		

4 Travel		unit price	trips	persons		2374600	
	TIM trip to CERN	112,000	2	5	1120000		Attend TIM at Swiss
	TIM trip to NASA	85,280	2	5	852800		Attend TIM at USA
	SCL Test PI	155,500	1	1	155500		Carry out test at SCL, UK
	SCL Test Students and Asst	123,150	1	2	246300		Carry out test at SCL, UK
					2374600		
	Year Sum					5975100	
	overhead					288040	
	Year One Total					6263140	

Project Budget Plan PDS &MF for AMS

2004-2005

Item	Function/Assignment	fare basis	quantity	duration	sub-total	Item-SUM	Remark
1 **Personnel**		basis	person	month		2333100	
	Full Time Assistant	34800	2	13.5	939600		project coordinator, MS /PDS
	Part time assistant	6000	1	12	72000		part time assistant in NCUE
	Full Time Postdoctor	57000	1	13.5	769500		technical coordinator /PDS
	Part Time Student-MS	6000	5	12	360000		experiment support/ MF
	Part Time Student-PhD	8000	2	12	192000		experiment support /PDS
					2333100		
3 Material		estimate	quantity	phase		596000	
	Fixture Metal Supplements	2,000	5	4	40000		for lab support/ MF
	Magnetic Sensor Supplemen	20,000	2	4	160000		for lab support/ MF
	CCD Sensor	10,000	4	1	40000		MF support
	CCD Amplifier IC Board	5,000	4	1	20000		MF support
	Local Trip	4000	10	1	40000		staff support
	Office stationary	5000	1	12	60000		staff support
	Phone and postage	5000	1	12	60000		staff support
	Computer peripherials	5000	1	12	60000		staff support
	Team meeting supplement	4000	1	4	16000		group meeting
	Equipment shipment	100000	1	1	100000		Equipment ship to SCL /MF
					596000		

4 Travel		unit price trip		persons		3352825	
	TIM trip to CERN	112,000	2	4	896000		Attend TIM at Swiss
	TIM trip to NASA	85,280	2	4	682240		Attend TIM at USA
	PI&CoPI EM test to Italy	115,000	2	4	920000		Carry out verification test at CGS
	PI Dr. Lin to CRISA, Spain	115,000	1	1	115000		MF Control Verification
	CERN Test PI&CoPI	147,917	1	2	295834		Carry out test at CERN, Swiss
	CERN Test Students & Asst	147,917	1	3	443751		Carry out test at CERN, Swiss
					3352825		
	Year Sum					6281925	
	Overhead					234328	
	Year Two total					6516253	

Project Budget Plan PDS &MF for AMS

2005-2006

Item	Function/Assignment	fare basis	quantity	duration	sub-total	Item-SUM	Remark
1 **Personnel**		basis	person	month		2216400	
	Part time assistant	6000	1	12	72000		Part time assistant in NCUE
	Full Time Assistant	35700	2	13.5	963900		project coordinator, MS /PDS
	Full Time Postdoctor	59000	1	13.5	796500		technical coordinator /PDS
	Part Time Student-MS	6000	4	12	288000		experiment support /PDS
	Part Time Student-PhD	8000	1	12	96000		experiment support /MF
					2216400		
2 Material		estimate	quantity	phase		396000	
	Test circuit Board	5,000	12	1	60000		for lab support / MF
	Local Trip	4000	10	1	40000		staff support
	Office stationary	5000	1	12	60000		staff support
	Phone and postage	5000	1	12	60000		staff support
	Computer peripherials	5000	1	12	60000		staff support
	Team meeting supplement	4000	1	4	16000		group meeting
	Equipment shipment	100000	1	1	100000		Equipment ship to SCL /MF
					396000		

3 Travel		unit price trip		persons		2427180	
	TIM trip to CERN	112,000	2	5	1120000		**Attend TIM at Swiss**
	TIM trip to NASA	85,280	2	3	511680		Attend TIM at USA
	PI&CoPI EM test to Italy	115,000	1	4	460000		Carry out verification test at CGS
	AMS Fly Preparation PI	102,500	1	1	102500		AMS Pre-fly verification at NASA KSC
	AMS Fly Preparation Studer	116,500	1	2	233000		AMS Pre-fly verification at NASA KSC
					2427180		
	Year Sum					5039580	
	Overhead					403166.4	
	Year Three total					5442746.4	
	Total 2003-2006					18222139.4	
	將CGS部分挑出						
	CGS cost	1585600	1	39.4		**62472640**	
	overhead					**4997811.2**	
	total for CGS					**67470451.2**	
	Revision Add up					85692590.6	
	Previous Budget					86929265	
	Difference					-1236674.4	