出國報告（出國類別：其他）

# 出席 2006 年台灣希臘學術研討會及福爾摩沙衛星三號發射作業

服務機關：行政院國家科學委員會
姓名職稱：謝清志 副主任委員
派赴國家：希臘、美國
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# 摘要

赴希臘出席 2006 年台灣希臘學術研討會，就「科技」議題發表專題演講。結束後隨即飛往美國參加「福爾摩沙衛星三號星系計畫」發射作業。「福爾摩沙衛星三號星系計畫」爲一大型台美合作計畫，主要參與機構包括我國國科會、國家太空中心、中央氣象局以及美國國家科學基金會（NSF）、美國太空總署（NASA）、美國大學大氣研究聯盟（UCAR）等。福爾摩沙衛星三號於 95 年 4 月 14 日(美國時間)在美國加州范登堡空軍基地發射場順利發射升空，本會國會聯絡組並邀請立法委員赴美觀覽衛星發射實況。此外，鑑於矽谷爲全球科技重鎮，爲使媒體了解矽谷發展的策略與現況以作爲我國科技發展的參考，本會舊金山科技組亦安排前往參訪研發機構 SRI，並拜會矽谷最大的印裔社團 TiE。

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## 一、目的

爲介紹台灣的科技發展經驗與拓展合作空間，應外交部邀請一同前往希臘出席2006年台灣希臘學術研討會，該研討會訂有「經濟」、「科技」、「安全」以及「民主政治」等4項議題，此行係就「科技」議題發表專題演講，並於會後參與相關參訪暨拜會行程。結束後隨即飛往美國加州范登堡空軍基地參加「福爾摩沙衛星三號計畫」發射作業。「福爾摩沙衛星三號星系計畫」爲一大型台美國際合作計畫，主要參與機構包括我國國科會、國家太空中心、中央氣象局以及美國國家科學基金會（NSF）、美國太空總署（NASA）、美國大學大氣研究聯盟（UCAR）等，其任務爲發射6顆衛星，收集全球定位衛星的折射訊號以作天氣預測、全球氣象變遷以及電離層和重力研究，將建立全球首創由6顆衛星組成的大氣觀測網，深受全球科技界及氣象界的重視。福爾摩沙衛星三號於95年4月14日(美國時間)在美國加州范登堡空軍基地發射場順利發射升空，本會國會聯絡組亦邀請陳明真、郭俊銘以及莊和子等3名立法委員由台灣飛往美國共同觀覽衛星發射實況。此外，爲宣導我國太空計畫此一突破性成就，也規劃國內媒體赴美實地採訪發射活動，同時鑑於矽谷爲全球科技重鎮，爲使媒體了解矽谷發展的策略與現況，以作爲我國科技發展的參考，本會舊金山科技組亦安排赴矽谷參訪研發機構SRI，並拜訪矽谷最大的印裔社團TiE，計有國內媒體13名赴美採訪。

## 二、過程

（一）行程

| 日期 | 地點 | 工作紀要 |
|---|---|---|
| 4 月 7 日 | 希臘雅典 | 出席台灣高科技研討會 |
| 4 月 8 日 | 希臘雅典 | 出席台灣高科技研討會 |
| 4 月 9 日 | 希臘雅典 | 本日爲週日，自由活動 |
| 4 月 10 日 | 希臘雅典 | 出席台灣高科技研討會 |
| 4 月 11 日 | 希臘雅典 | 出席台灣高科技研討會 |
| 4 月 12 日 | 希臘雅典 | 出席台灣高科技研討會 |
| 4 月 13 日 | 美國洛杉磯 | 訪加州范登堡空軍基地發射場工作人員 |
| 4 月 14 日 | 美國洛杉磯 | 出席福衛三號發射活動 |
| 4 月 15 日 | 美國洛杉磯 | 觀察衛星入軌運作，啓程前往舊金山 |
| 4 月 16 日 | 美國舊金山 | 本日爲週日，自由活動 |
| 4 月 17 日 | 美國舊金山 | 上午參訪 SRI International（Stanford Research Institute），中午聽取舊金山科技組楊啓航組長簡報「矽谷－世界的科技首府」，下午拜訪印裔科技社團 TiE。 |
| 4 月 18 日 | 美國舊金山 | 凌晨搭機返台 |

※ 美國行程國科會參與人員：謝清志副主任委員、王永壯（秘書室）主任、王儷珍（秘書室公關科）科長

（二）紀要

4 月 7 日至 4 月 12 日期間赴希臘雅典出席 2006 年台灣希臘學術研討會，該研討會訂有「經濟」、「科技」、「安全」以及「民主政治」等 4 項議題，並就「科技」議題以 “Taiwan's S&T Development and International Collaboration” 爲題發表英語專題演講，會後亦參與相關參訪暨拜會行程。

4 月 13 日至 4 月 18 日期間飛往美國加州范登堡空軍基地參加「福爾摩沙衛星三號計畫」發射作業及參訪舊金山矽谷科技重鎮，摘要如后：

4 月 13 日美國空軍原安排舉行發射前記者會，卻臨時取消，爲使媒體了解衛星發射前之準備工作及發射當日天候預測及發射工作之應變情形，於是安排由我方國家太空中心福衛三號總主持人陳正一博士與美國大氣聯盟（UCAR）主席瑞克安薩斯於 Santa Maria Inn 主持發射前說明會。

4 月 14 日爲衛星發射日，媒體於 Radision Inn 接受美國空軍核對身份後乘坐專車前往發射場。媒體與僑胞均至 Shooting Range 觀看發射，本人與立委、駐美代表及多位科技組組長則進入控制室觀看發射實況。預訂於美國時間下午 5:10 發射，後在倒數 1 分 31 秒因第一節火箭壓力計電源器電流指數異常，可能危及發射安全，故中止倒數計時作業。經過一個多小時檢查，評估後認爲仍在安全範圍內而重新展開倒數，終於在美國時間下午 6:40 順利發射升空。

4 月 15 日媒體續觀察衛星發射之後續，美國阿拉斯加費爾班克斯（Fairbanks）接收站收到 6 顆衛星訊號均正常，福衛三號並於發射後 8 小時飛越台灣上空，依所攜帶之燃料推升至 475 公里到 600 公里的暫駐軌道，預計 13 個月後將會進入 700-800 公里高的任務軌道，以形成涵蓋全球的低軌道微衛星星系，進而接收全美 24 顆全球定位衛星的訊號，每天提供全球 2500 個觀測點的大氣層資料，能提升全球天氣預測準確度。

4 月 17 日上午媒體參訪 SRI International（Stanford Research Institute）。SRI 成立已有 60 多年，原本隸屬美國史丹福大學，後來獨立發展爲非營利之研發機構，並有矽谷的靈魂之稱，足見 SRI 在矽谷的科技研發的重要角色。SRI 之策略在於結合研發能量與市場趨勢，在資訊、工程科技、生化製藥、物理、化學、教育、國民健康與經濟發展方面提供高附加價值的創新產品與策略。SRI 研發出全球第一台電腦滑鼠以及支票數字辨識碼等傑出產品，亦曾參與台灣十大建設之規劃，和台灣工研院與相關企業有合作計畫。近來 SRI 在佈局全球上，看中亞洲的發展，同時看好台灣製造能力的優勢－Faster、Better、Cheaper，因此選擇台灣作爲前進亞洲的研發基地，將與台灣的相關機構有密切的合作與交流。中午由舊金山科技組楊啓航組長對媒體

分析矽谷作爲世界科技首府的策略與發展。2005 年全球知識競爭力指標中，美國 San Jose 排名第一，台灣排名第 99。在矽谷 1500 平方英哩中，有 250 萬人口，約 100 萬個工作機會，在矽谷創立許多知名的科技公司如 HP、Apple、Greentech、Yahoo、Google 等，矽谷不但擁有史丹福大學、柏克萊大學、SRI 等單位的創新人才及頂尖技術，並掌握全美約 40% 的創投基金，擁有完整的法律與金融服務業和充沛的國際化管理人才，因而產生了不斷創新的動能，成爲美國創新經濟的心臟。台灣應把握科技經由矽谷聯結世界的管道，大幅加強在矽谷的投資，以建立”創新據點”，並學習正確風險認知與風險管理，發展科技的創新價值與國際接軌。下午拜訪矽谷最大的印度國際組織 TiE，由 TiE 執行長 Raj Jaswa 及會長 Sridar Iyengar 接見。TiE 1992 年於矽谷成立，是一個非常團結的國際組織，在全世界有 50 幾個分會，分佈在 10 個國家，會員超過 1 萬人，矽谷則是 TiE 的總部。TiE 認爲政治與宗教會造成世界分裂，創造財富與利潤才能使人民受惠。TiE 提供平台作爲企業者與科技業者的諮詢、交流與傳承經驗，致力於創造企業的利潤與進步。自 1992 年起與 TiE 直接或間接接觸的企業所創造的產業價值超過 2000 億美元。楊組長表示，在矽谷的華人社團很多，但力量分散，TiE 是印度在矽谷最大且唯一的組織，他們的年會動輒數千人參加，講員就有 100 多人，TiE 的矽谷分會有 1000 多名會員，分佈在近百家成功的企業，是具有凝聚力的組織。台灣未來欲加強與印度的科技合作與交流，國內亦有台印協會的成立，但台灣與印度最短的距離是經由矽谷，我們可以透過 TiE 作爲台印合作的平台，應該能爲科技合作創造更多的價值。

## 三、心得

2006 年 2 月，我爲福爾摩沙三號衛星的發射專程到美西范登堡空軍基地視察，最主要的目的當然是要確保發射成功，但另一項同樣重要的事是去看看這 20 多位離鄉背景、夜以繼日爲國家尊嚴奮戰的太空中心同仁。想像他們白天在不甚理想的測試廠房內工作，整天與儀器、電線、電腦等爲伍，如果遇到所測得的數字與預期的不符，便必須夜以繼日找出原因，是儀器錯？電線接觸不良？電腦有問題或是衛星本身出問題？許多造成不符的可能加上發射時程的壓力，足够令他們抓狂！深夜，拖著疲憊的身軀回去，迎接他們的不是溫暖的家而是旅社內的一間空蕩蕩的卧室。鄰近衛星發射場旁邊的小鎮除了沉靜就是空谷傳音的曠野山丘、沒有消遣的地方，更看不到熟悉的景象如新竹或台北的熱鬧情景。一連三、四個月待在不能下廚的旅社內，即使天天在外吃牛排也會索然無味，而寂寞更是令人發狂，而這一切都是爲了圓自已的太空夢，企望爲自己國家的科技提昇而付出的代價。他們沒有怨言、反而因有此服務、奉獻的機會而甘之如貽！

謝博士非常感謝這群年輕的工程師們為了福衛三號衛星的發射，離開台灣在加州待了四個月，因此特別請工程師們吃晚餐。

福衛三號發射計畫是台灣自 1990 年決定發展太空科技以來的第 3 次衛星發射。前兩次均成功地把衛星射入預定軌道，衛星經校正、調整使之在太空中正常運作並執行預設的研發任務，其中第 1 顆衛星已於 2004 年因太陽能電池老化而功成身退、圓滿除役。福衛二號目前運作正常，每天攝得並送回無數張世界各地的高精度珍貴照片，預計可運行至 2010 年。不同於一、二號衛星，三號是由 6 顆小衛星組成，發射時是疊在一起置放在火箭頂端升空，上太空後再利用 1 年的時間調整至固定位置，待形成一星系後開始同步執行氣候量測任務。由於台灣在國民黨時代，國科會已答應與美國國家科學發展基金會(NSF)合作並同意出百分之 80 的費用（約美金 8 千萬元），且所得氣象資料供全世界科學家們免費自由使用，因此氣象學界都很注意福衛三號的發射。衛星是台灣所有，但發射服務（火箭）

則購自美國空軍新研發的發射載具(Minotaur)。

按慣例，即將升空的火箭外表都塗上各種圖案，想當然爾，代表國家的國旗當然不能少。參與的台灣國內外廠商也都希望把他們的標誌漆上去，除了商業目的最主要的是他們皆有「與有榮焉」的感覺！一、二號發射時都是如此，大家歡歡喜喜如辦喜事、過嘉年華會般，緊張中並帶著深深的期許與盼望迎接成功的喜悅。然而，不清楚是弱國無外交或是小國沒尊嚴，於基地巡視途中，我們的任務團隊負責人告訴我，美方不准在我方於火箭上漆上我國國旗。並且，可塗漆的面積僅限爲 250 公分見方。當時，我並沒在意，心想只要衛星能順利發射且成功進入太空，其餘都是次要。當晚，我回到旅社卻越想越不對勁，覺得美方有點欺人太甚，思量當初決定執行這計劃並不全爲國家利益，而是基於美方要求。再者，我國所答應的百分之 80 經費乃是以現款（hot cash）支付，而美方負責之百分之 20 部份還是以實物及設備抵價而成。經我初步客觀思考，最壞的打算是：如果到時取消發射，我方的損失其實是有限的金錢而已，因爲此計畫是純學術研究，而氣象在台灣並非顯學，有沒有這組衛星其實影響甚小。反之，對美方的衝擊將會很大，因爲美國科學發展基金會對全世界的承諾、宣傳造勢將泡湯！甚至，美國海、空軍也有兩顆小測試衛星一起掛在火箭上待升空，同時世界上也很難找到像台灣這樣，願意不計成本、花這麼大筆錢在這個雖有成果卻毫無回收的計畫上。考慮清楚之後，我馬上請團隊負責人向基地空軍指揮官協調,但不得要領。他們表示，有關國家代表性乃由美國國務院或外交部負責。於是我駐華府科技組受命就近向國務院溝通，但所得到的答案都是不准，而且還更進一步設限：連我國國花及台灣圖樣都不行了！

三月間，我到科羅拉多大學與科學基金會人員見面時，當面表明台灣相當重視國旗塗於火箭上之問題。尤其是前兩次發射並沒有此問題，然而爲何此次特別？並且表示，在國旗之問題未獲圓滿解決之前將停止一切衛星與火箭間硬體介面銜接的工作，並已作好延後發射之心理準備。同時，如有必要，台灣方面並不惜考慮取消發射計畫！本來未將這當一回事的科學基金會開始感到事態嚴重，並表示要向上反應。但由於國務院的決定，基金會並沒有置喙之餘地，因此成效可能有限。主其事者此時表示願意配合台灣方面需求，向台灣人民說明台灣此舉對學界的巨

大貢獻，並願意親自來台當面向當局及各界說明。美國在台協會也開始關切。華府方面，我國外交部也積極地頻頻出面協商，希望能挽回頹勢讓衛星能在國旗下升空！幾經折騰，美方堅不讓步，最後同意在沒有國旗的條件下作一些調整：

(一) 張貼面積可擴大；

(二) 創作藝術品內的台灣圖可以，但不能有國旗，不論多小都不可以；

(三) 允許漆上中、英文字，不論大小均可接受。


奉層峰『務必準時發射』的指示，爲了不影響外交及顧全大局，也爲了不延誤發射，更爲了不爲難友邦，我們只好根據上述之 3 原則著手進行備案計畫。但我們仍然堅持國旗一定要上太空，不達目的絕不罷休！唯美方一再強調火箭發射計畫雖由台灣負擔大部份費用，但依『台灣關係法』，屬美國財產之火箭本身不能漆有象徵台灣爲一國家的任何標誌。

4 月 14 日倒數計時啓動，開始一切都很順利按發射步驟進行，發射前兩分鐘自動計時亦順利啓動，但當倒數至發射前 1 分 50 秒時，電腦偵測出異常而發出停止進行及取消發射的訊號。此時指揮官劍及履及地下了回歸到「發射準備」時間點的指示！要知道把已啓動的發射步驟回歸至「發射準備」的時間點是個艱難而令人窒息的動作，因爲一步走錯、全盤皆輸！此時連衛星內的電池都已開始運作放電，此刻必須鎖住、停止放電且再回復充電到滿載。所幸，發射團隊臨危不亂，指揮官氣定神閒。一個小時後，重新最後倒數計時(final countdown)再度向發射邁進。晚上 8 時左右，福衛三號帶着國人的祝福，稍微發了一頓上述的小脾氣後，以超乎尋常的準確度，成功地抵達距地面 400 公里高的太空預定軌道。那一刻，『TAIWAN』與『台灣』清晰地隨火箭直冲雲霄，緊扣住每位台灣人的心弦！

福衛三號在不甚理想的氣候下終於成功發射，爲本次任務劃下超乎完美的句點。

同時爲台灣及全世界氣象專家們點燃另一個希望、塑造另一個美夢！到目前爲止，台灣的太空任務是百分之百地成功，此成績是舉世少見的。而此次的成功，實應歸功於這群爲太空工程著迷的工作同仁。他們的成功，不僅讓我們與有榮焉，也激勵了更多台灣人勇於挑戰夢想。也慶幸近年來立法院的鮮少干預、讓計畫執行人員有較大的揮灑空間。這真是國家之福！全體國人應珍惜且引以爲傲。

美國范登堡基地衛星發射室。左起為SF台灣代表處長、立委陳明真、郭俊銘、莊和子。

福爾摩沙衛星三號發射成功後，謝博士與太空人Ronald Grable，即美國Orbital Science Corporation (OSC)副總裁在慶祝餐會中握手。

## 四、建議事項

本次出訪行程無論是台希雙方的科技交流或是福衛三號發射過程中與美方就我旗圖的外交折衝都是跨部會的團隊合作成果。尤其我國的科技發展與民主成長經驗在國際間備受矚目與肯定，在面對中國全面的封鎖與打壓下，如何善用我方的優勢走出外交的困境不僅是政府的責任也是全體國人要一同努力的課題。此外，鑒於矽谷科技發展、印度在矽谷科技實力的崛起以及台印科技交流的趨勢，南亞大國印度的迅速發展也值得政府及國人進一步觀察與重視。

## 五、附錄

“Taiwan's S&T Development and International Collaboration”（2006 年台灣希臘學術研討會專題演講簡報資料）

行政院國家科學委員會
NATIONAL SCIENCE COUNCIL

# Taiwan's S&T Development and International Collaboration

*Dr. Ching-Jyh Shieh*

Deputy Minister
National Science Council, Taiwan

April 2006

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行政院國家科學委員會
NATIONAL SCIENCE COUNCIL

## Contents

- Development System
- Resources for Development
- Major Activities
- Science Parks
- Achievements
- International Collaboration

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NATIONAL SCIENCE COUNCIL

# Development System

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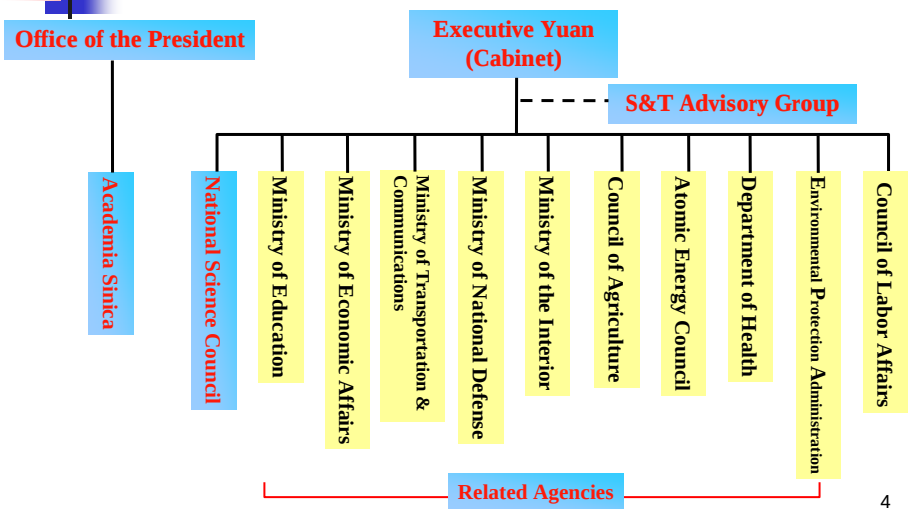
## Organizational Framework for S&T Development

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# RDT&E* Classification

6.1 Basic Research
6.2 Applied Research
6.3 Advanced Technology Development
6.4 Demonstration and Validation
6.5 Engineering and Manufacturing Development
6.6 Management Support
6.7 Operational Systems Development

Basic Research

Science & Technology

* U.S. DoD RDT&E (Research, Development, Test and Evaluation) Classification

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# System for Implementing S&T Development

| Relevant Organizations / Research Levels | Promotion | Implementation | | | |
|---|---|---|---|---|---|
| | Government Agencies | Universities and Research Organizations | | Non-Profit Organizations | Industry |
| Basic Research | Academia Sinica<br>S&T Advisory Group<br>National Science Council<br>Ministry of Education<br>Ministry of Economic Affairs<br>Ministry of National Defense<br>Ministry of Transportation and Communications<br>Council of Agriculture<br>Atomic Energy Council<br>Department of Health<br>Environmental Protection Administration<br>Council for Cultural Affairs<br>Others | Academia Sinica Divisions | Universities and College Department | Synchrotron Radiation Research Center (*SRRC*)<br>National Applied Research Laboratories (*NARL*)<br>National Health Research Institutes (*NHRI*)<br>Institute for Information Industry<br>Department Center for Biotechnology<br>Industrial Technology Research Institute (*ITRI*)<br>Others | |
| Applied Research | | Chunghwa Telecommunication Laboratories<br>Institute of Transportation<br>Agriculture Research Institute<br>Others | | | National Corporations<br>Private Enterprises |
| Technological Development | | | | | |
| Commercialization | | | | | |

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# Resources for Development

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## R&D Expenditures - **TAIWAN**

(Million current PPP$)

| Item | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|
| R&D expenditures | 8600.3 | 9616.8 | 10326.0 | 10901.9 | 12240.0 | 13668.4 | 15372.6 |
| Growth Rate(%) | 12.9 | 8.0 | 3.7 | 3.7 | 9.5 | 7.3 | 8.3 |
| As percentage of GDP(%) (93SNA) | 1.91 | 1.98 | 1.97 | 2.08 | 2.20 | 2.33 | 2.42 |
| Public / Private funds | 2811.8/ 5788.5 | 3129.0/ 6487.9 | 3447.4/ 6878.7 | 3634.7/ 7267.0 | 4308.8/ 7931.2 | 4857.3/ 8811.0 | 5213.7/ 10159.0 |
| Percentage (%) | 32.7/67.2 | 32.5/67.5 | 33.4/66.6 | 33.3/66.7 | 35.2/64.8 | 35.5/64.5 | 33.9/66.1 |
| Basic research / R&D expenditures | 10.1 | 10.6 | 10.4 | 10.8 | 11.0 | 11.8 | 11.4 |

Source: Indicators of Science and Technology, Taiwan, 2005.
Notes: Data are million current PPP$ and FTE with person-year as unit, respectively.
Excluding defense from 1997 to 2001, including defense since 2002.

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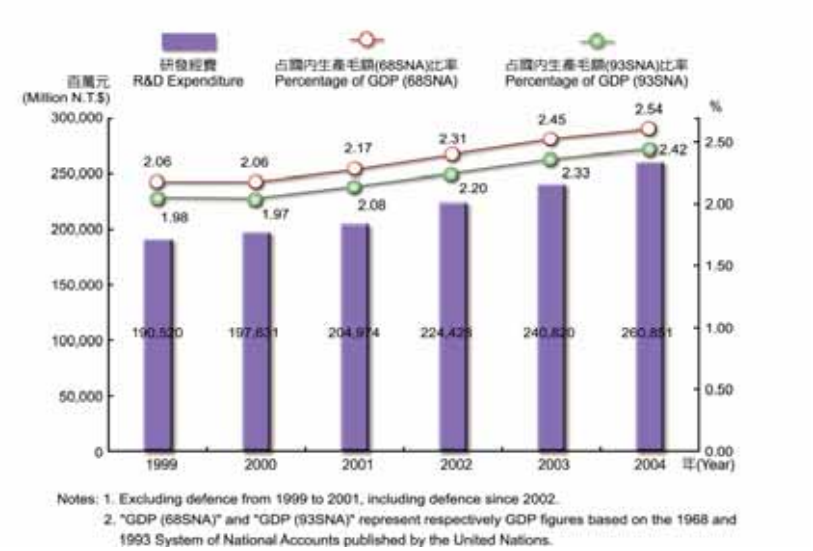
行政院國家科學委員會
NATIONAL SCIENCE COUNCIL

## R&D Expenditure as a Percentage of GDP




Notes: 1. Excluding defence from 1999 to 2001, including defence since 2002.
2. "GDP (68SNA)" and "GDP (93SNA)" represent respectively GDP figures based on the 1968 and 1993 System of National Accounts published by the United Nations.

Source: Indicators of Science and Technology, Taiwan, 2005.

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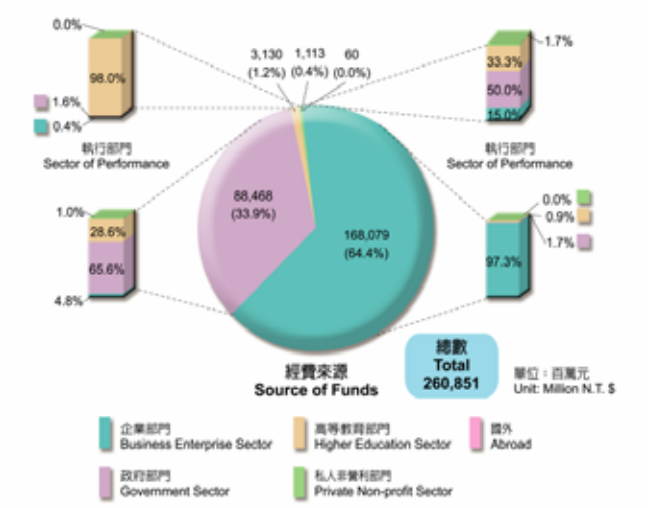
## R&D Expenditure by Source of Funds and Sector of Performance, 2004




Source: Indicators of Science and Technology, Taiwan, 2005.

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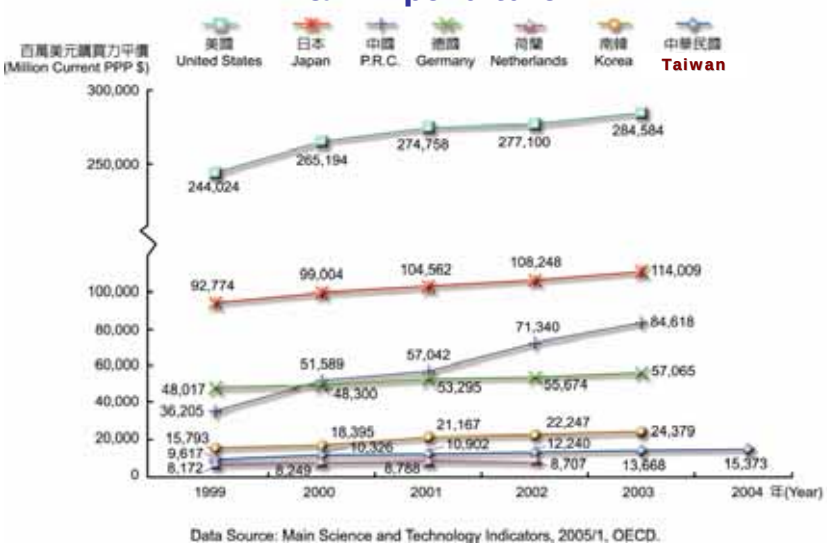
## R&D Expenditure




Data Source: Main Science and Technology Indicators, 2005/1, OECD.

Source: Indicators of Science and Technology, Taiwan, 2005.

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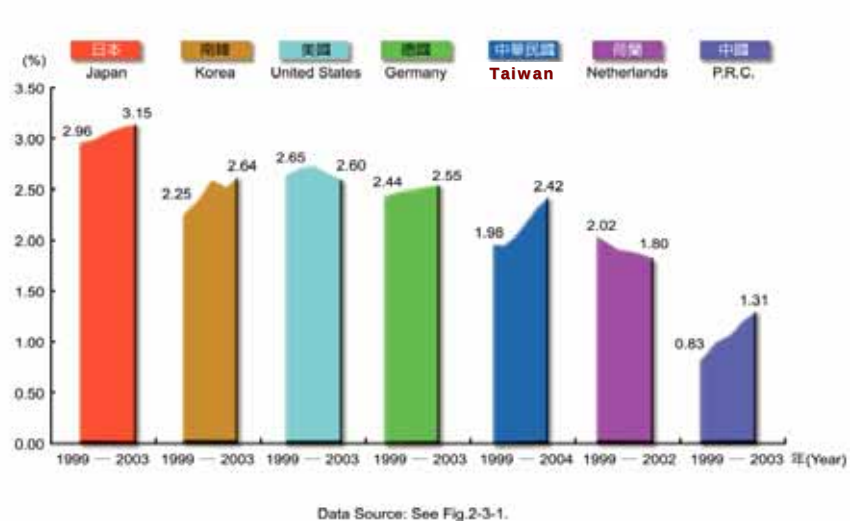
## R&D Expenditure as a Percentage of GDP




Data Source: See Fig.2-3-1.

Source: Indicators of Science and Technology, Taiwan, 2005.

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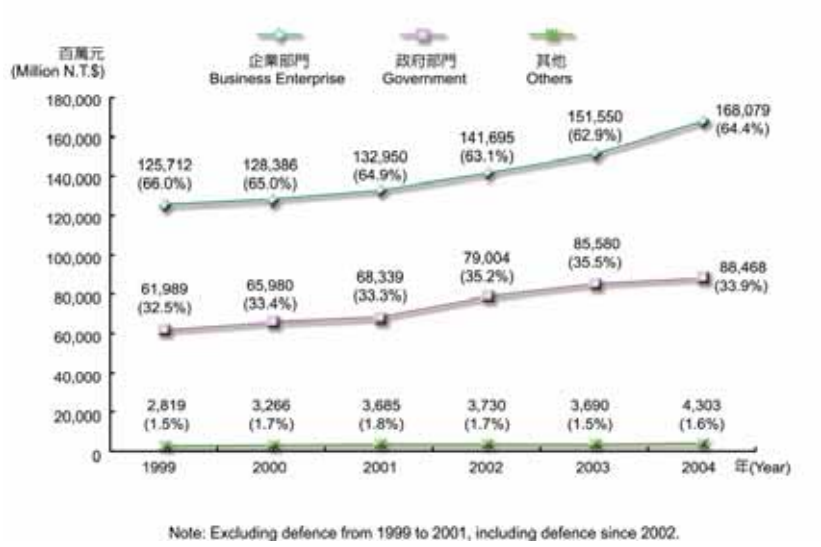
## R&D Expenditure by Source of Funds




Note: Excluding defence from 1999 to 2001, including defence since 2002.

Source: Indicators of Science and Technology, Taiwan, 2005.

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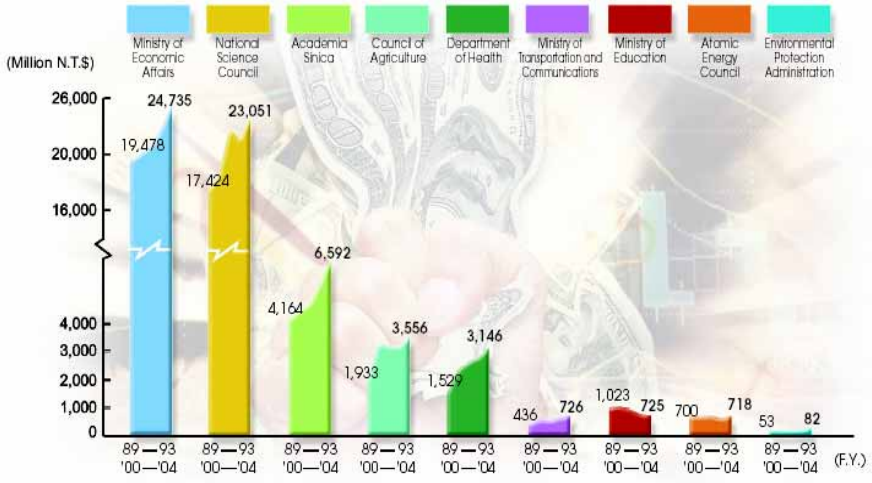
NATIONAL SCIENCE COUNCIL

## Central Government S&T Budget (Defense Excluded) by Department

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NATIONAL SCIENCE COUNCIL

# R&D Manpower Indicators - **TAIWAN**

| Item | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|
| Researchers | 53,492 | 54,844 | 55,460 | 59,656 | 64,171 | 67,599 | 72,720 |
| Researchers per 1,000 population | 2.4 | 2.5 | 2.5 | 2.7 | 2.9 | 3.0 | 3.2 |
| Researchers per 1,000 labor force | 5.6 | 5.7 | 5.7 | 6.1 | 6.4 | 6.7 | 7.1 |
| Percentage of advanced degree holders among researchers with university degree or higher | 61.7 | 61.3 | 63.0 | 64.7 | 66.2 | 67.3 | 68.0 |

Source: Indicators of Science and Technology, Taiwan, 2005.
Notes: Data are FTE with person-year as unit..
Excluding defense from 1997 to 2001, including defense since 2002.

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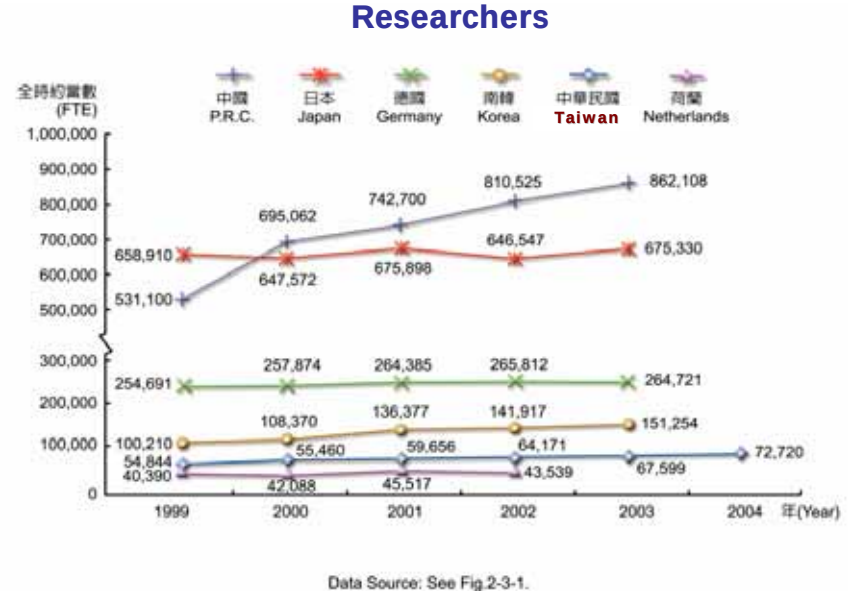
## Researchers




Data Source: See Fig.2-3-1.

Source: Indicators of Science and Technology, Taiwan, 2005.

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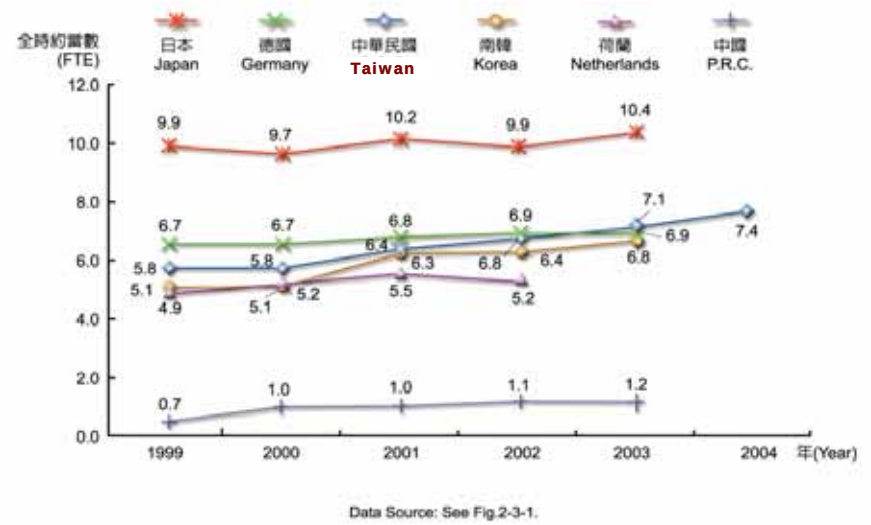
## Researchers per 1,000 Employed Population




Data Source: See Fig.2-3-1.

Source: Indicators of Science and Technology, Taiwan, 2005.

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# Major Activities

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行政院國家科學委員會
NATIONAL SCIENCE COUNCIL

# Missions

- Planning and implementing the nation's S&T development
  - ** Coordinating of National Sci-tech Programs, Mid- and Long-term Plans*
  - ** Program Review, Control, and Evaluation*
  - ** R & D Activity Surveys*
- Supporting academic research
  - ** Funding Research Projects*
  - ** Training, Recruiting, and Rewarding Sci-tech Personnel*
  - ** Promoting Interchange and Cooperation; Domestic/International*
- Developing science parks
  - ** Green Silicon Island – National Dream*

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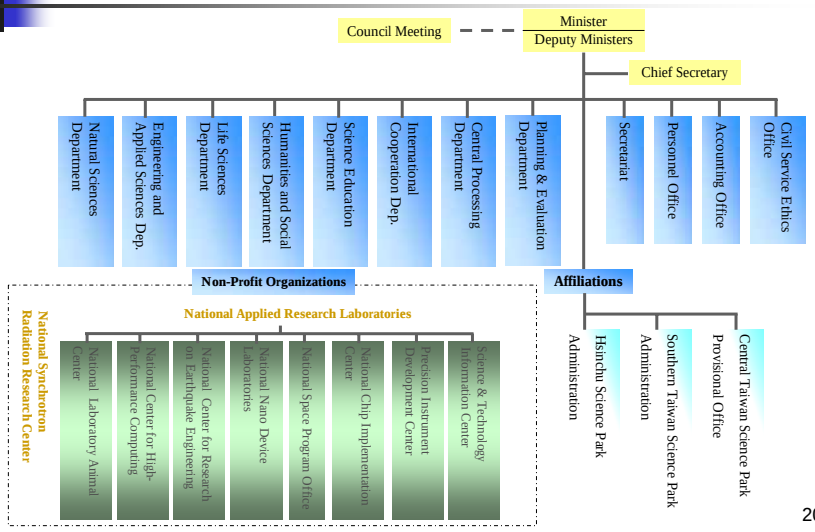
行政院國家科學委員會
NATIONAL SCIENCE COUNCIL

# Organizational Chart

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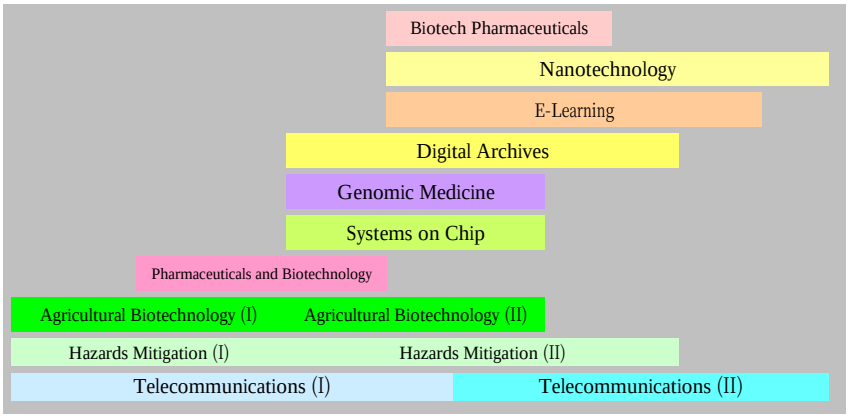
行政院國家科學委員會
NATIONAL SCIENCE COUNCIL

# National-level Sci-Tech Programs

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NATIONAL SCIENCE COUNCIL

# National-level Sci-Tech Programs

Budget (Million NT$)

| Program Office | 2004 | 2005 | Growth rate(%) |
|---|---|---|---|
| 1. Telecommunications | 2,024 | 1,611 | -20.4 |
| 2. Nanoscience and Nanotechnology | 3,008 | 2,696 | -10.4 |
| 3. System-on-Chip | 1,966 | 1,963 | -0.2 |
| 4. Genomic Medicine | 1,661 | 1,649 | -0.7 |
| 5. Agricultural Biotechnology | 711 | 573 | -19.4 |
| 6. Biotechnology and Pharmaceuticals | 1,544 | 1,458 | -5.6 |
| 7. Hazards Mitigation | 605 | 519 | -14.2 |
| 8. National Digital Archives | 453 | 549 | 21.2 |
| 9. e-Learning | 607 | 565 | -6.9 |
| Program Office | 172 | 174 | 1.2 |
| **Total** | **12,751** | **11,757** | **-7.8** |

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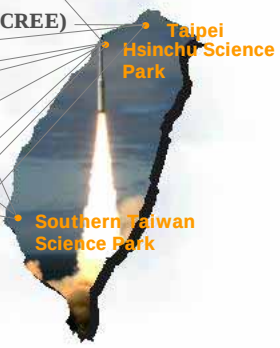
# National Laboratories

**National Synchrotron Radiation Research Center (NSRRC)**

**National Applied Research Laboratories (NARL)**

National Center for Research on Earthquake Engineering (NCREE)
National Laboratory Animal Center (NLAC)
National Nano Device Laboratories (NNDL)
National Space Organization (NSPO)
National Center for High-Performance Computing (NCHC)
National Chip Implementation Center (CIC)

Instrument Technology Research Center (ITRC)
S&T Policy and Research Information Center (STPI)

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NATIONAL SCIENCE COUNCIL

# Taiwan Space Programs

- Formosat-1:
  - Launched January 1999, decommissioned May 2004
  - Scientific missions – Ionosphere, Ocean Color, Space Communications
- Formosat-2:
  - Launched May 2004, mission life 5 years (through 2009)
  - High-resolution remote sensing satellite
- Formosat-3:
  - To be launched April 14, 2006
  - Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC)
  - A Taiwan-US cooperation project

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## Successful Launch of FORMOSAT-2

FORMOSAT-2 Launched from Vandenberg AFB
On 21 May 2004

- FORMOSAT-2 has been successfully launched at 01:47:03 (Taiwan Time) on 21 May 2004 by Taurus XL from Vandenberg AFB.
- FORMOSAT-2 was injected into a circular parking orbit of 737 km altitude and 99.01° inclination.
- On 2 June 2004, FORMOSAT-2 was successfully maneuvered into tis mission orbit of 891 km altitude and 99.14° inclination.
- On 4 June 2004, FORMOSAT-2 has acquired its first images with performance as expected.
- FORMOSAT-2 data will be distributed to worldwide image users very soon.

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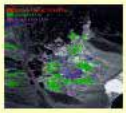
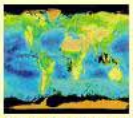
## FORMOSAT-2 Mission



Agriculture & Forestry  Land Use  Natural Disaster

Environment Monitoring  Research & Education

- Remote Sensing Mission
  - Acquire and monitor the terrestrial & marine environment and resource of Taiwan in near real time
  - Applications are mainly focused on agriculture and forestry, land use, natural disaster assessment, environmental monitoring, as well as academic researches and public education

- Science Mission
  - ISUAL (Imager of Sprite Upper Atmospheric Lightning)
  - ISUAL is to observe the natural upward lightning discharge phenomenon toward the ionosphere on the top of the tropopause
  - ISUAL is a joint research program by NSPO, University of California, Berkeley, National Cheng Kung University, and Tohoku University

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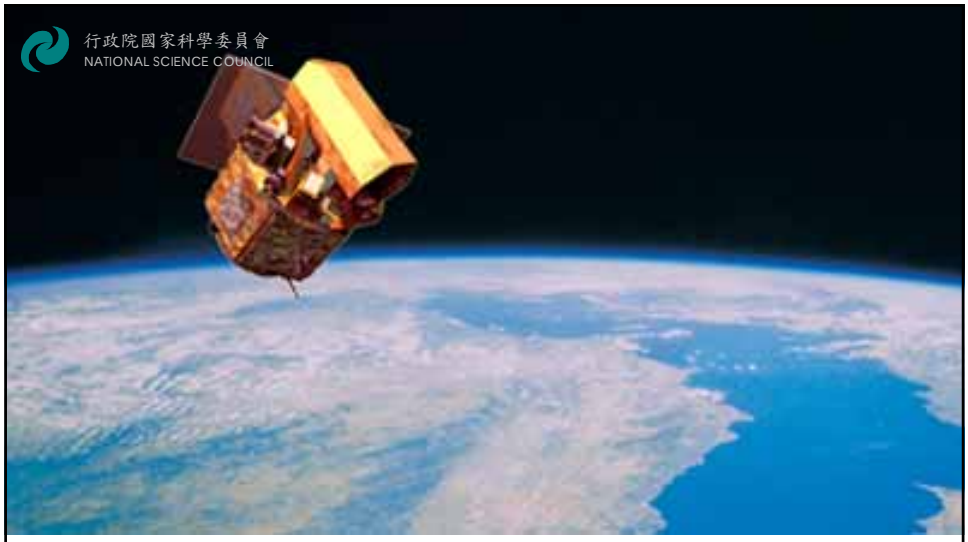


- *Weight: **742** kg (with payload and fuel)*
- *Shape: Hexahedron, height **2.4** m, outer diameter about **1.6** m*
- *Orbit: **891** km, Sun-synchronous, **2** Passes over Taiwan Strait each day*
- *Ground Sampling Distance (GSD)**2** m for black and white images ; **8** m for color images*
- *Mission Life: **5** years*
- *Launch Date: **May 21**, **2004** (Taipei Time)*

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NARL
Athens, Greece
NSPO
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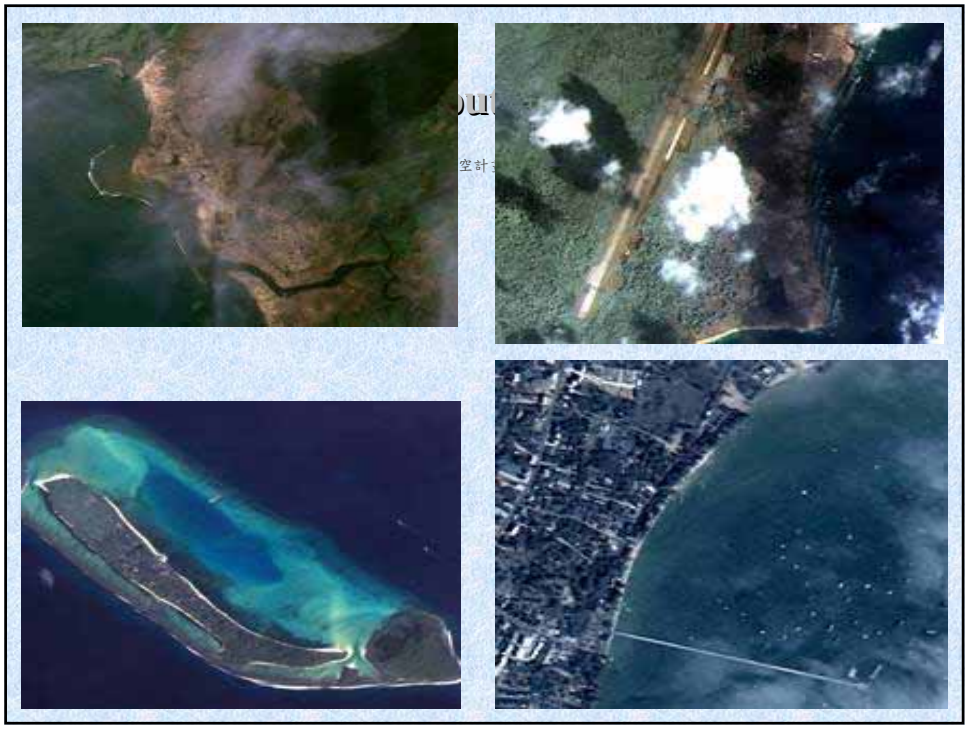
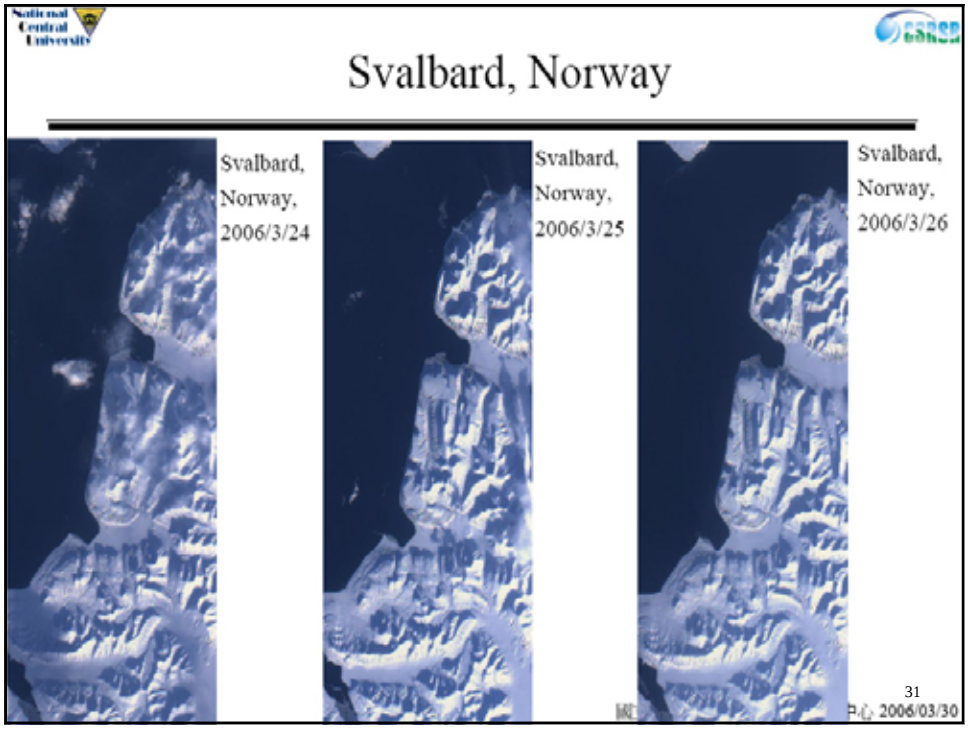
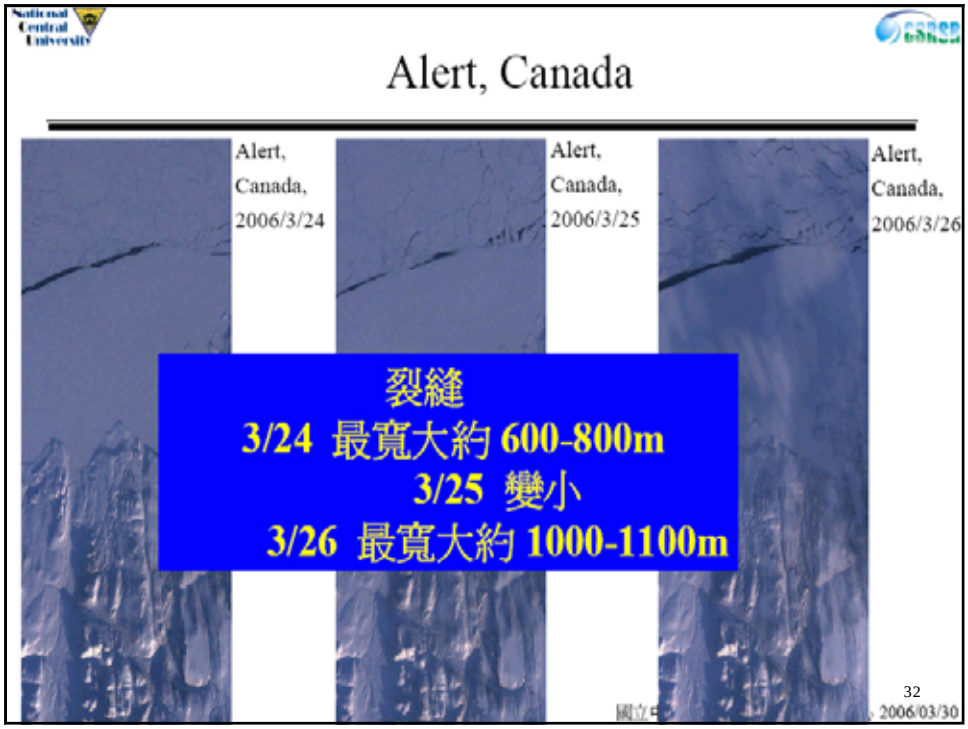
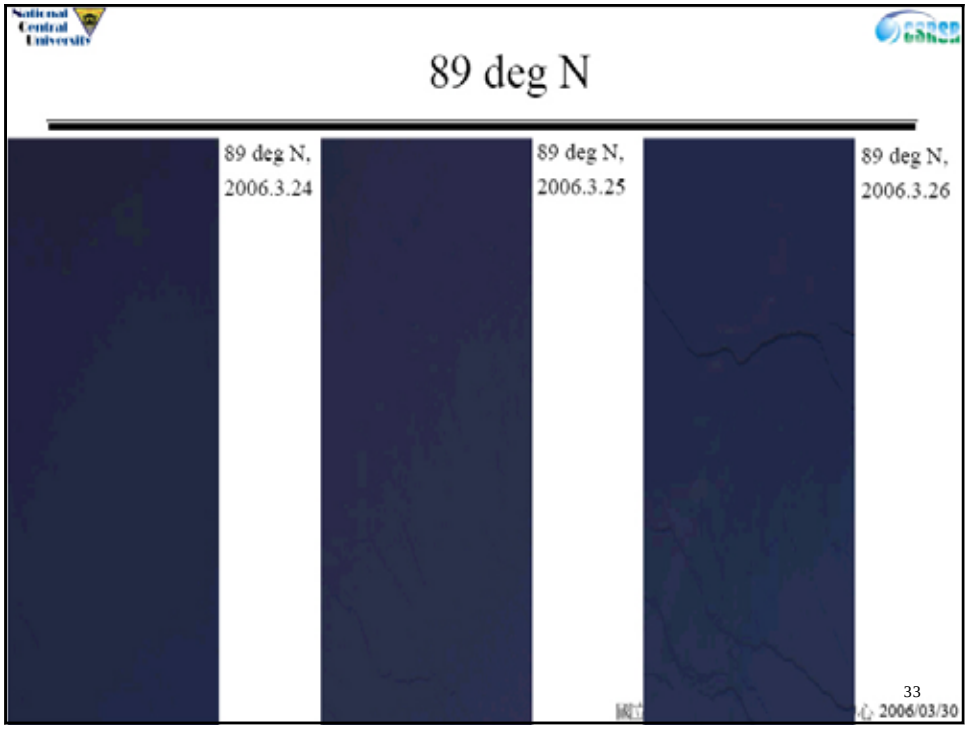
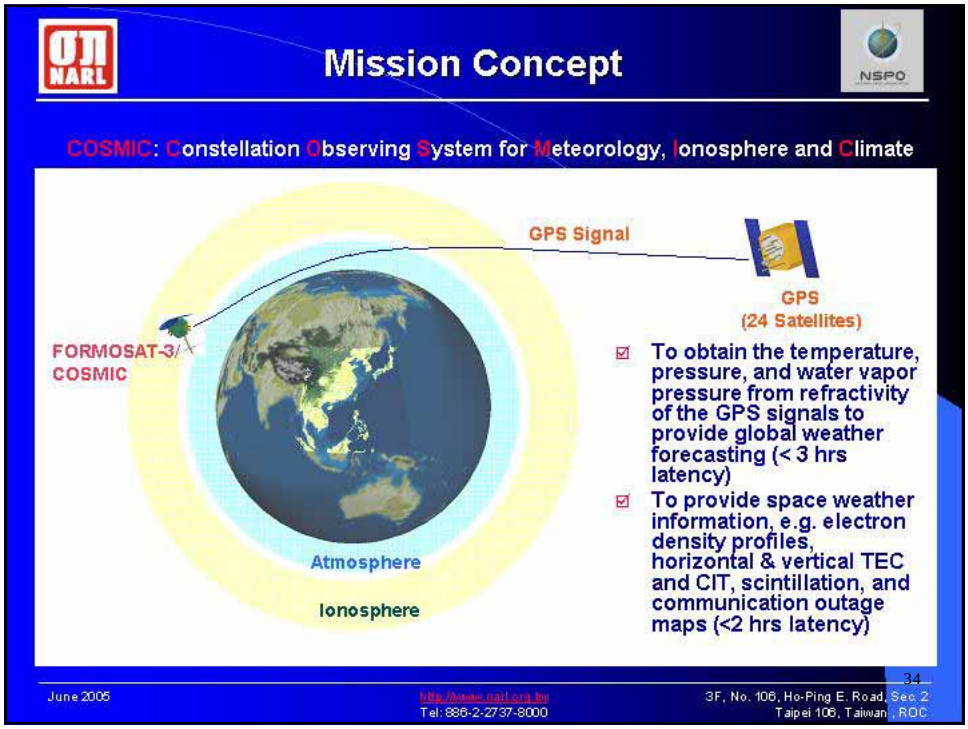



Svalbard, Norway
Svalbard, Norway, 2006/3/24
Svalbard, Norway, 2006/3/25
Svalbard, Norway, 2006/3/26
31
2006/03/30


Alert, Canada
Alert, Canada, 2006/3/24
Alert, Canada, 2006/3/25
Alert, Canada, 2006/3/26
裂縫
3/24 最寬大約 600-800m
3/25 變小
3/26 最寬大約 1000-1100m
32
2006/03/30


89 deg N
89 deg N, 2006.3.24
89 deg N, 2006.3.25
89 deg N, 2006.3.26
33
2006/03/30


Mission Concept
NSPO
COSMIC: Constellation Observing System for Meteorology, Ionosphere and Climate
GPS Signal
GPS
(24 Satellites)
FORMOSAT-3/
COSMIC
Atmosphere
Ionosphere
To obtain the temperature, pressure, and water vapor pressure from refractivity of the GPS signals to provide global weather forecasting (< 3 hrs latency)
To provide space weather information, e.g. electron density profiles, horizontal & vertical TEC and CIT, scintillation, and communication outage maps (<2 hrs latency)
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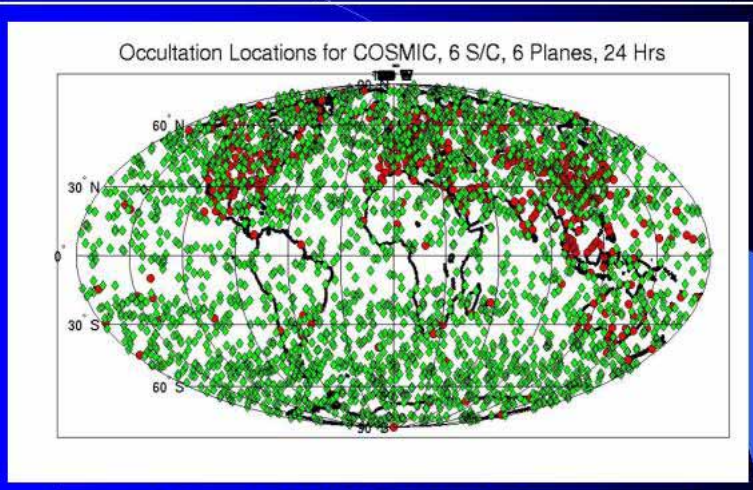
June 2005
Tel: 886-2-2737-8000
3F, No. 106, Ho-Ping E. Road, Sec. 2
Taipei 106, Taiwan, ROC

## COSMIC Soundings in a Day




The constellation of six FORMOSAT-3/COSMIC satellites monitors as many as 2,500 profiles of the atmosphere each day. In comparison, ground sounding stations provide only 900 profiles of measurements.



June 2005
Tel: 886-2-2737-8000
3F, No. 106, Ho-Ping E. Road, Sec. 2
Taipei 106, Taiwan, ROC

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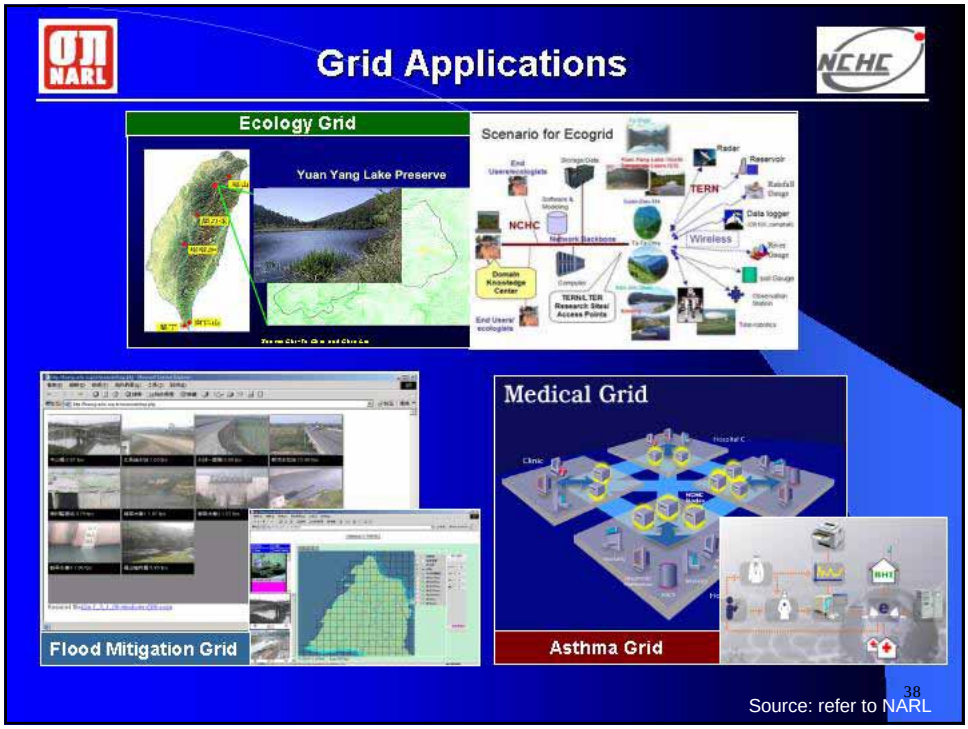
## e-Taiwan toward u-Taiwan

- Knowledge Innovation National Grid (KING)
  - Ecology, Health, Hazard Mitigation, Distant Learning
- Taiwan Advanced Research and Education Network (TWAREN)
  - Bandwidth 40 GBS, light path network design, 10 GBS link to outside, ranked top worldwide


The Gateway to Global Research and Education Networks in the Asia Pacific
Knowledge Innovation National Grid
TaiWan Advanced Research and Education Network
KING
Knowledge Innovation National Grid
Ecology Grid
Telescience Grid
Access Grid
Grid Operation Center
Taipei
Hsinchu
Taichung
Tainan
Biology Grid
e-Learning Grid
Nano Science Net
Healthcare Grid
Chronic Illness Grid
Hazard Mitigation & Emergency Response Grid
TWAREN
TaiWan Advanced Research & Education Network
e-Learning
Multimedia
Multicast
IPv6
MPLS/VPN
Measurement
Network management
Penghu
Backbone : 40Gbps
Regional : 10Gbps
Campus : 1Gbps
37
Source: refer to NARL


Grid Applications
Ecology Grid
Yuan Yang Lake Preserve
Scenario for Ecogrid
NCHC
TERN
Wireless
Flood Mitigation Grid
Medical Grid
Asthma Grid
38
Source: refer to NARL

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# Science Parks

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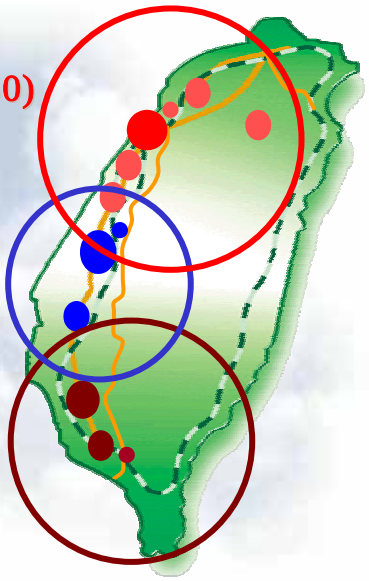
National Science Council

**Hsinchu Science Park (1980)**
**1,868 hectares**

**Central Taiwan Science Park (2003)**
**756 hectares**

**Southern Taiwan Science Park (1996)**
**1,617 hectares**



**Total: 4,241 hectares**

1 hectare = 100m X 100m

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# Incentives

- 5-year corporate income-tax holiday
- Import tax exemption
- No commodity or business tax on exported products
- Low interest loans
- R&D grants

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# I. Northern Taiwan

- Established in 1980
- Overview of resident firms:
  - Number of companies (2005.12) 382
  - Number of new companies approved (2005.12) 30
    Approved capital US$ 0.44 billion
  - Number of employees (2005.12) 114,836
  - Sales (2005.12) US$ 30.3 billion

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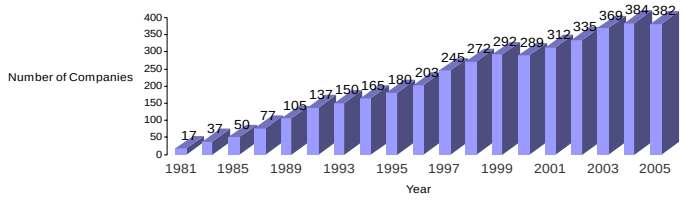
# I. Northern Taiwan (Contd.)

| Type of Industry | No. of Companies | No. of Employees | Sales(US$Billions) |
|---|---|---|---|
| Integrated Circuits | 169 | 67,893 | 21.1 |
| Computers and Peripherals | 56 | 12,550 | 3.1 |
| Telecommunications | 47 | 5,811 | 1.5 |
| Optoelectronics | 65 | 26,142 | 4.2 |
| Precision Machinery and Materials | 21 | 1,426 | 0.3 |
| Biotechnology | 24 | 1,014 | 0.1 |
| Total | 382 | 114,836 | 30.3 |

Companies in the Hsinchu Science Park

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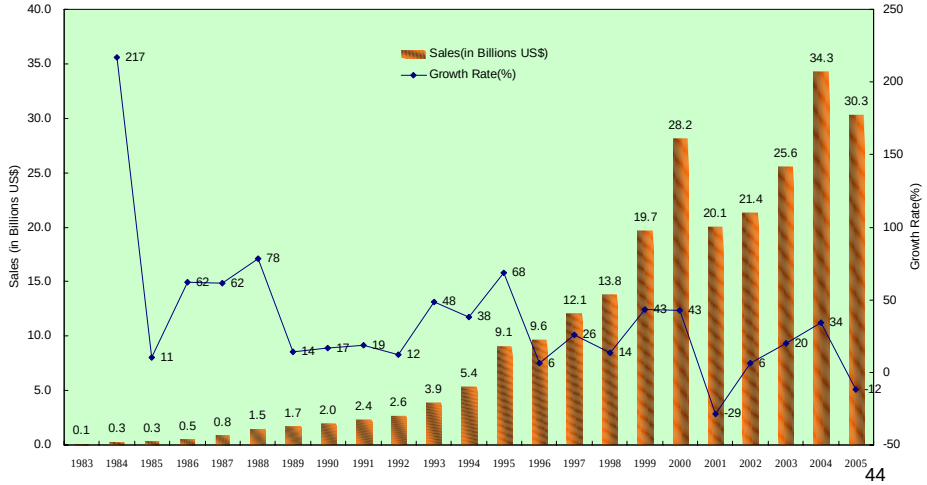
# I. Northern Taiwan (Contd.)

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# II. Southern Taiwan

- Operations began in July 1997
- Overview of resident firms:
  - Number of companies (2005.12) 178
  - Number of new companies approved (2005.12) 21
    Approved capital US$ 0.2 billion
  - Number of employees (2005.12) 42,170
  - Sales (2002) US$ 3 billion
    (2003) US$ 4.6 billion
    (2004) US$ 7.6 billion
    (2005) US$ 10.4 billion

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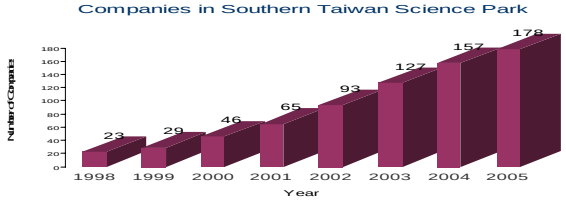
# II. Southern Taiwan (Contd.)

Overview of Industries in Southern Taiwan Science Park, 2005

| Type of Industry | No. of Companies | No. of Employees | Sales(US$Millions)* |
|---|---|---|---|
| Integrated Circuits | 23 | 8,745 | 244.6 |
| Computers and Peripherals | 3 | 176 | 3.3 |
| Telecommunications | 16 | 724 | 3.1 |
| Optoelectronics | 48 | 27,880 | 766.1 |
| Precision Machinery and Materials | 48 | 1,745 | 14.9 |
| Biotechnology | 30 | 790 | 4.5 |
| Others | 10 | 1,210 | 1.0 |
| Total | 178 | 41,270 | 1,038 |

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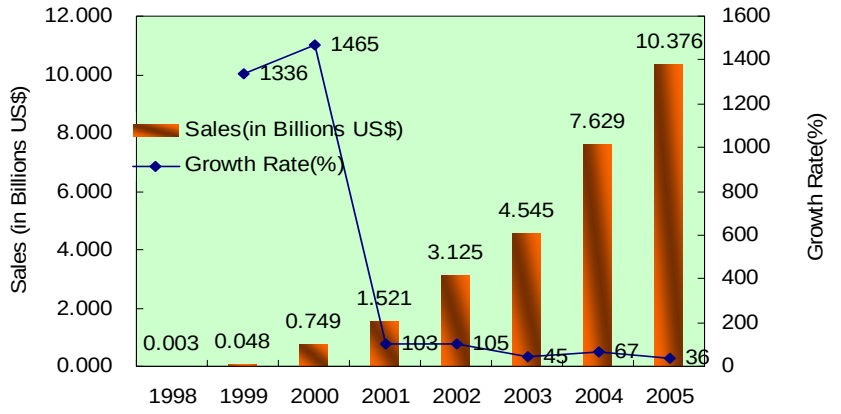
## II. Southern Taiwan (Contd.)

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## III. Central Taiwan

- Established in 2003
- Overview of resident firms:
  - Number of companies (2005.12) 77
  - Number of new companies approved (2005.12) 20
    Approved capital US$ 18.2 billion
  - Number of employees (2005.12) 10,682
  - Sales (2005.12) US$ 1.9 billion

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## Parks in Perspective

2005 Statistics:

- Accommodated 637 firms
- Employed 167,688 personnel
- Generated US$43 billion revenue, accounting for 13% of GDP

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## Deregulation

This regulation will be lifted in the near future:

'*The transportation between the Park and seaports or airports shall be handled by the warehouse and transportation units established by the Park Administration or handled by common carriers approved by the Park Administration, by means of transportation tools equipped with bonding facilities.*'

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# Achievements

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## Where Taiwan Stands

- **Area: *35 980 km² (137th place)***
- **Population: *22.8 millions (47th place 2004)***
- **GDP per capita (Purchasing Power Parity): *PPP US$ 24,676 (28th place 2004)***

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# GDP and GDP(PPP) per Capita

| GDP PER CAPITA | | | GDP(PPP) PER CAPITA | | |
|---|---|---|---|---|---|
| Ranking | Economies | US$ | Ranking | Economies | US$ |
| 1 | LUXEMBOURG | 70,744 | 1 | LUXEMBOURG | 64,626 |
| 2 | NORWAY | 54,433 | 2 | ILE-DE-FRANCE | 42,156 |
| 3 | ILE-DE-FRANCE | 50,400 | 3 | IRELAND | 39,397 |
| 4 | SWITZERLAND | 48,389 | 4 | NORWAY | 38,484 |
| 5 | IRELAND | 44,923 | 5 | USA | 38,360 |
| 6 | DENMARK | 44,725 | 6 | BAVARIA | 33,138 |
| 7 | ICELAND | 41,765 | 7 | LOMBARDY | 33,087 |
| 8 | USA | 39,468 | 8 | ICELAND | 32,419 |
| 9 | BAVARIA | 38,501 | 9 | DENMARK | 32,135 |
| 10 | SWEDEN | 38,063 | 10 | CANADA | 31,260 |
| 11 | JAPAN | 36,559 | 17 | JAPAN | 28,670 |
| 34 | KOREA | 14,105 | 28 | TAIWAN | 24,676 |
| 35 | TAIWAN | 13,459 | 34 | KOREA | 18,686 |

*SOURCE: IMD WORLD COMPETITIVENESS YEARBOOK 2005.*

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# WEF's Competitiveness Rankings

| Country | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|
| Finland | 1 | 2 | 1 | 1 | 1 |
| United States | 2 | 1 | 2 | 2 | 2 |
| Sweden | 9 | 5 | 3 | 3 | 3 |
| Denmark | 14 | 10 | 4 | 5 | 4 |
| **Taiwan** | **7** | **3** | **5** | **4** | **5** |
| Singapore | 4 | 4 | 6 | 7 | 6 |
| Iceland | 16 | 12 | 8 | 10 | 7 |
| Switzerland | 15 | 6 | 7 | 8 | 8 |
| Norway | 6 | 9 | 9 | 6 | 9 |
| Australia | 5 | 7 | 10 | 14 | 10 |
| Japan | 21 | 13 | 11 | 9 | 12 |
| China | 39 | 33 | 44 | 46 | 49 |

* The Report 2005-2006 examines the growth prospects of 117 economies.

*Source: Global Competitiveness Report 2005-2006, WEF, September 2005.*

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# WEF's Competitiveness Rankings

| Item | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|
| Growth Competitiveness Index Rank | 7 | 3 | 5 | 4 | 5 |
| Macroeconomic Environment Index Rank | 15 | 6 | 18 | 9 | 17 |
| Public Institutions Index Rank | 24 | 27 | 21 | 27 | 26 |
| Technology Index Rank | 4 | 2 | 3 | 2 | 3 |
| Innovation Subindex Rank | 3 | 2 | 2 | 2 | 3 |
| ICT Subindex Rank | 16 | 10 | 7 | 9 | 6 |
| Business Competitiveness Index Rank | 21 | 16 | 16 | 17 | 14 |

* The Report 2005-2006 examines the growth prospects of 117 economies.

*Source: Global Competitiveness Report 2005-2006, WEF, September 2005.*

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# IMD's Competitiveness Rankings

| Countries | Items | | | | |
|---|---|---|---|---|---|
| | Overall Performance | 1. Economic Performance | 2. Government Efficiency | 3. Business Efficiency | 4. Infrastructure |
| USA | 1 | 1 | 16 | 3 | 1 |
| Hongkong | 2 | 4 | 1 | 1 | 20 |
| Singapore | 3 | 5 | 2 | 5 | 6 |
| Iceland | 4 | 17 | 6 | 2 | 12 |
| Canada | 5 | 11 | 9 | 11 | 9 |
| Finland | 6 | 32 | 3 | 9 | 4 |
| Denmark | 7 | 31 | 4 | 7 | 5 |
| Switzerland | 8 | 19 | 7 | 14 | 2 |
| Australia | 9 | 22 | 5 | 4 | 15 |
| Luxembourg | 10 | 2 | 12 | 19 | 24 |
| **Taiwan** | **11** | **18** | **19** | **6** | **18** |
| Japan | 21 | 21 | 40 | 35 | 3 |
| Korea | 29 | 43 | 31 | 30 | 23 |
| China | 31 | 3 | 21 | 50 | 42 |

*Source：International Institute for Management Development, 60 economies, IMD, 2005;*

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# IMD's Competitiveness Rankings

| Item | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|
| Overall Performance | 16 | 20 | 17 | 12 | 11 |
| Economic Performance | 26 | 38 | 33 | 24 | 18 |
| Government Efficiency | 17 | 24 | 20 | 18 | 19 |
| Business Efficiency | 9 | 16 | 11 | 7 | 6 |
| Infrastructure | 20 | 20 | 23 | 20 | 18 |

*Source：International Institute for Management Development, 60 economies, IMD, 2005;*

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# Bill Gates' Comments on Taiwan's IT Industry


- *Each time I visit Taiwan, I'm impressed with the innovative work that is being done here.*
- *There's no doubt that Taiwan's IT industry contributes a great deal to making the PC more attractive and more affordable!*

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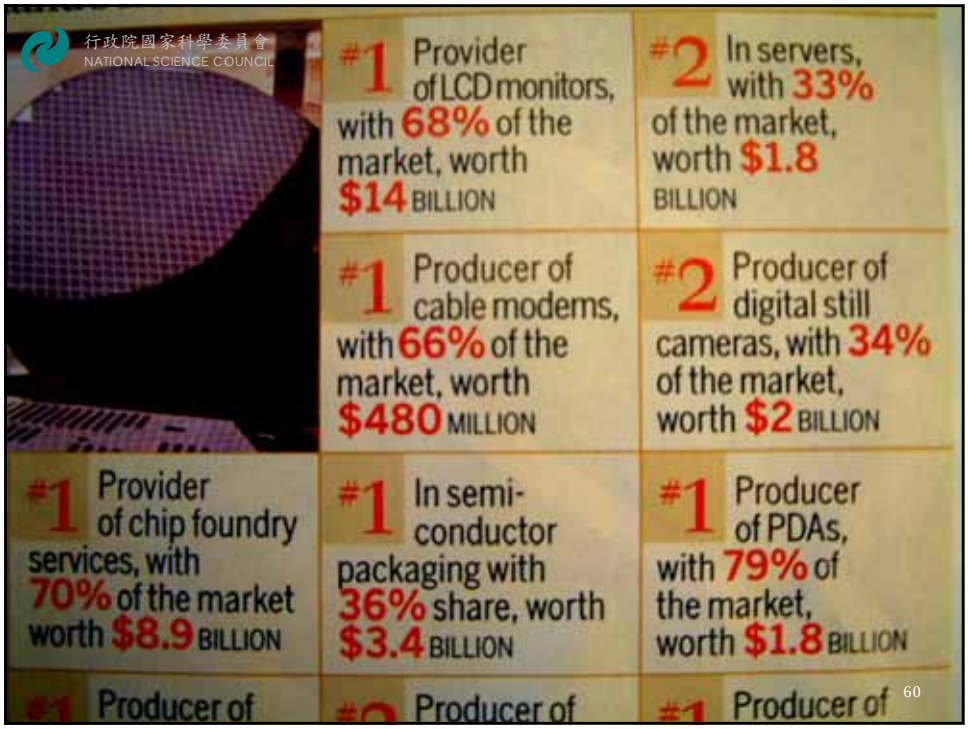
INDIA'S MEDIA EXPLOSION (P. 26) | OUR PERSONAL TECH GUIDE (P. 62)
BusinessWeek
WHY TAIWAN MATTERS
The global economy couldn't function without it. That's why peace with China is so crucial.
BY BRUCE EINHORN (P. 26)
59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#1 Provider of LCD monitors, with 68% of the market, worth $14 BILLION
#2 In servers, with 33% of the market, worth $1.8 BILLION
#1 Producer of cable modems, with 66% of the market, worth $480 MILLION
#2 Producer of digital still cameras, with 34% of the market, worth $2 BILLION
#1 Provider of chip foundry services, with 70% of the market worth $8.9 BILLION
#1 In semi-conductor packaging with 36% share, worth $3.4 BILLION
#1 Producer of PDAs, with 79% of the market, worth $1.8 BILLION
Producer of
Producer of
Producer of
60


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# Taiwan's Capabilities (2004)

| Ranking No. 1 | | Ranking No.2 | | Ranking No.3 | |
|---|---|---|---|---|---|
| Item | Production Value World Share % | Item | Production Value World Share % | Item | Production Value World Share % |
| Foundry | 67.6% | DSL CPE | 52% | Ethernet LAN Switch | 6% |
| IC Package | 41.0% | Cable Modem | 38% | DRAM | 21.6% |
| Mask ROM | 91.1% | IC Design | 28.2% | LED | 12% |
| WLAN | 44% | Large TFT-LCD | 37% | NB | 8.5%* |
| SOHO Router | 44% | Small TFT-LCD | 12% | Polyester Staple Fiber | 8.7%* |
| Network Card | 7% | TN/STN LCD | 16.8% | Nylon Fiber | 12.2%* |
| Hub | 4% | MB | 11%* | | |
| CD-R Disc | 48% | Polyester Filament | 11.2%* | | |
| CD-RW Disc | 88% | PTA | 14.4%* | | |
| DVD R Disc | 73% | TPE | 13.8%* | | |
| DVD RW Disc | 70% | PU Leather | 9.5%* | | |
| Glass Fiber | 48% | | | | |
| ED Copper Foil | 36% | | | | |
| ABS | 24.3%* | | | | |

**Source:** Industrial Technology Intelligence Services (ITIS) project of the Ministry of Economic Affairs. (18 April 2005)
The above products are manufactured within Taiwan and does not include overseas production by Taiwanese firms.
*: World share % of Production Volume

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# Multinational Corporations Setting up R&D Centers in TAIWAN (30 Cases)


SOURCE: Ministry of Economic Affairs, 2005.11.

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| Company | R&D Center |
|---|---|
| HP (US) | HP Product Development Center |
| SONY (Japan) | SONY DECT（Design & Engineering Center Taiwan） |
| SONY (Japan) | System in Module Center Taiwan (SMCT) |
| AIXTRON (Germany) | Manufacturing Oriented Research Lab. |
| Becker Avionics (Germany) | Avionics Certification Skill And Key Technology Development Center |
| Dell (US) | Dell Taiwan Design Center |
| Microsoft (US) | Microsoft Technology Center |
| IBM (US) | Mobile e-business R&D Center |
| PERICOM (US) | Advanced Mixed-Signal IC R&D Center |
| INTEL (US) | Intel Innovation Center |
| IBM (US) | Life Sciences Center of Excellence |
| ERICSSON (Sweden) | ERICSSON Innovation Center |
| Broadcom (US) | Network SoC R&D Center |
| Motorola (US) | Motorola Taiwan Product DevelopmentCenter (MTPDC) |
| IBM (US) | IBM xSeries Taiwan R&D Center |
| GSK (UK) | GSK Taiwan R&D Operation Center |
| Atotech (US) | Advanced TechnologyCenter |
| DuPont (US) | DuPont Taiwan Technical Center |
| Alcatel (France) | Alcatel ICT Application Research Center |
| AKT (US) | Asia Research & Development Center |
| NEC (Japan) | NEC Innovative Product Joint Development Center for Engineering |
| Synopsys Taiwan Ltd. (US) | VDSM EDA R&D CENTER |
| Telcordia Technologies (US) | Telcordia Applied Research Center in Taiwan (TARC-TW) |
| FESTO (Germany) | FESTO CEC R&D Center Taiwan |
| General Instrument (US) | Motorola Connected Home Solutions Taiwan Technology Center (TTC) |
| SRI International (US) | SRI Taiwan R&D Center |
| UL (US) | Green Electronic Materials and Energy Device Safety Testing and Inspection Technology Research and Development Center |
| Fujitsu (Japan) | Fujitsu Taiwan Dev elopement Center |
| Dow Chemicals (US) | Dow Chemical Taiwan Plastics Application Development Center |
| Ulvac (Japan) | Ulvac Advanced Technology Center |

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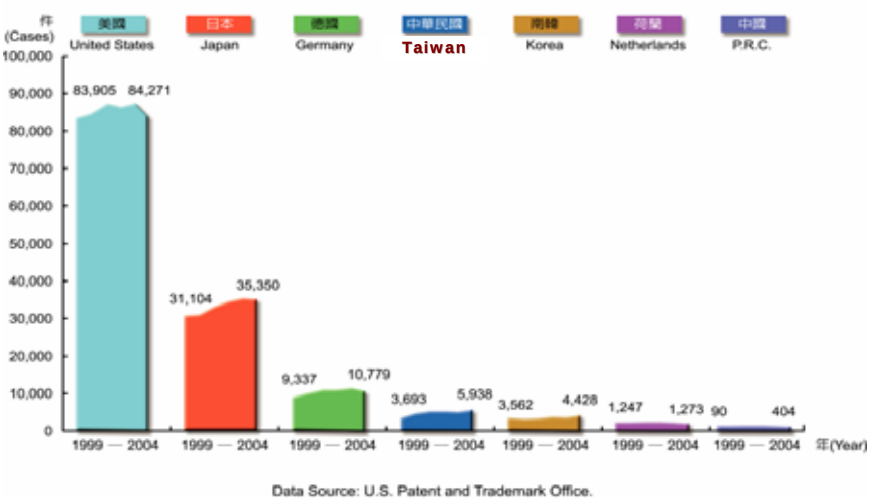
## Number of U.S. Patents (Excluding New Design) Granted by Nationality




Source: Indicators of Science and Technology, Taiwan, 2005.

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## Made in Taiwan → Made by Taiwan (I)

| Changes of percentage of production of communication product in and by Taiwan | | | |
|---|---|---|---|
| | | 2003 | 2004 |
| NB | Made by Taiwan | 67% | 72% |
| | Made in Taiwan | 21% | 9% |
| | Made outside Taiwan | 46% | 63% |
| Ethernet Switch | Made by Taiwan | 43% | 38% |
| | Made in Taiwan | 26% | 16% |
| | Made outside Taiwan | 17% | 22% |
| CD/DVD Drive | Made by Taiwan | 41% | 37% |
| | Made in Taiwan | 0% | 0% |
| | Made outside Taiwan | 41% | 37% |
| CD/DVD Disc | Made by Taiwan | 69% | 61% |
| | Made in Taiwan | 67% | 50% |
| | Made outside Taiwan | 2% | 11% |
| Cell Phone | Made by Taiwan | 9% | 8% |
| | Made in Taiwan | 6% | 5% |
| | Made outside Taiwan | 3% | 3% |
| WLAN | Made by Taiwan | 91% | 95% |
| | Made in Taiwan | 78% | 53% |
| | Made outside Taiwan | 13% | 42% |
| Cable Modem | Made by Taiwan | 53% | 53% |
| | Made in Taiwan | 41% | 26% |
| | Made outside Taiwan | 12% | 27% |
| Ref: ITRI IEK, May 2005 | | | |

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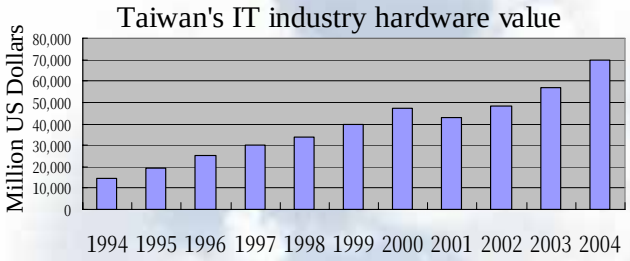
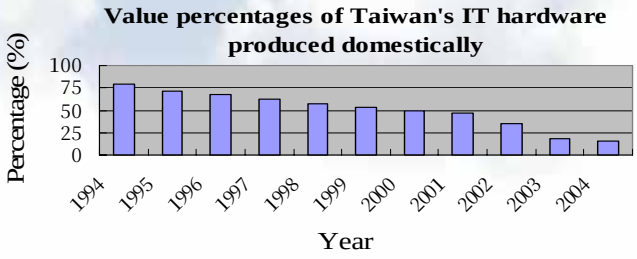
## Made in Taiwan → Made by Taiwan (II)

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## TAIWAN - from MIT to IIT

Innovated In Taiwan Product Development Center

Made In Taiwan Original Design Manufacturing

Original Equipment Manufacturing

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# Room for Improvement

## We're not perfect, let's face it!

- Promotion of National Sci-tech Development
  - ***S***trategies: unfocused, rigid, and inflexible
  - ***F***unding policy for research
    - * proportional distribution of funding for existing programs hinders flexibility and innovation
  - ***Z***ero-base budgeting system
  - ***N***ational programs
- Support for Academic Research
  - ***P***apers indexed in SCI:
    - * ranked 18th, high in quantity
    - * impact factor 2.45(108th), low in quality
  - ***T***echnology Balance of Payments (ratio=export/import)
  - ***I***nternational cooperation
  - ***E***xtend funding research life cycle to 3 years
- Development of Science Parks
  - ***S***hortage of talent
  - ***I***nfrastructure (living conditions for international families, health, education, etc.)
  - ***O***ver-expansion: demands from local elected officials for new Park establishments may cause over-building and thwart the established success
  - ***T***alent search (domestic and international)
  - ***I***mprovement of infrastructure

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# Room for Improvement

Contd.

- Rigid Civil Service System
  - *- Salaries are not level with world standards*
  - *- Rigid employment rules, personnel rotation is difficult*
  - *- Workers are passive, lack initiative to resolve problems*
- Inflexible Accounting Systems
  - *- Budgeting process is overly complicated, and funds cannot be flexibly used*
  - *-Too much emphasis on uniformity in resource allocations, cannot meet needs of research style: knowledge-based, innovative, these are short life-cycles, high altruism rate*

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# Room for Improvement

Contd.

- Public policy
  - *Bribery and corruption – Low quality in public constructions*
  - *Legislation: private property protection, organized crimes*
  - *Judicial system independence*
  - *Social welfare and benefit system*
- Globalization
  - *Culture/language assimilation*
  - *Inadequate internationalization*
- Political sensitivity - Intimidation from China

We'll work harder, that's for sure!

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# International Collaboration

*Way to Go!*

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# Why Go International?

*Numbers that Speak!*

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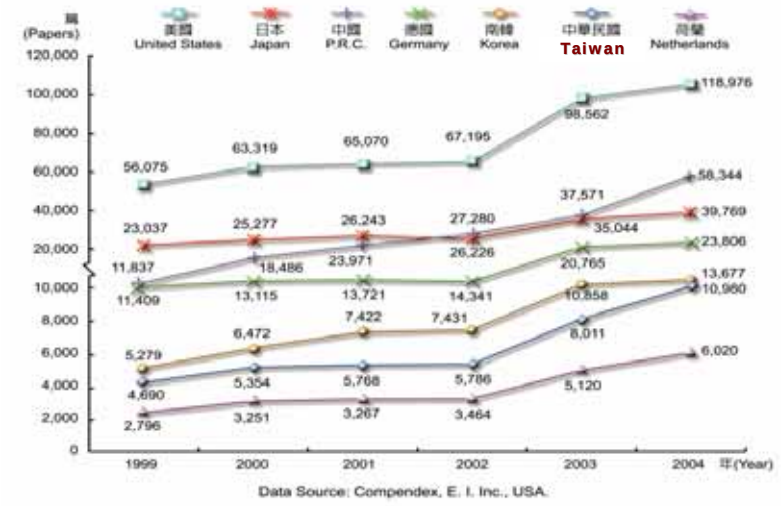
## Papers in EI by Nationality




Source: Indicators of Science and Technology, Taiwan, 2005.

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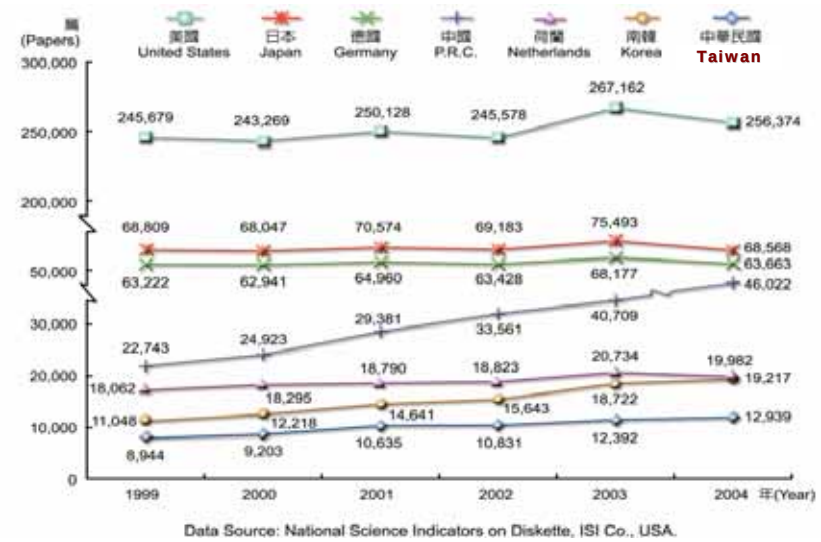
## Papers in SCI by Nationality




Data Source: National Science Indicators on Diskette, ISI Co., USA.

Source: Indicators of Science and Technology, Taiwan, 2005.

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## Annual Papers and Rank in SCI

| Country | Impact | Citations | Papers | sorted by impact | sorted by papers |
|---|---|---|---|---|---|
| USA | 6.62 | 8,412,365 | 1,270,832 | 5 | 1 |
| JAPAN | 4.14 | 1,467,863 | 354,933 | 32 | 2 |
| UK | 5.72 | 1,955,181 | 342,018 | 11 | 3 |
| GERMANY | 5.37 | 1,748,743 | 325,858 | 16 | 4 |
| FRANCE | 4.96 | 1,164,214 | 234,697 | 22 | 5 |
| CANADA | 5.39 | 899,106 | 166,891 | 15 | 6 |
| ITALY | 4.80 | 760,329 | 158,550 | 24 | 7 |
| CHINA | 2.17 | 330,713 | 152,226 | 119 | 8 |
| RUSSIA | 1.92 | 238,571 | 124,553 | 129 | 9 |
| SPAIN | 4.16 | 466,166 | 112,035 | 31 | 10 |
| AUSTRALIA | 4.69 | 501,636 | 106,945 | 27 | 11 |
| NETHERLANDS | 6.07 | 579,332 | 95,436 | 6 | 12 |
| INDIA | 1.89 | 162,923 | 86,144 | 131 | 13 |
| SWEDEN | 5.64 | 427,406 | 75,811 | 12 | 14 |
| SOUTH KOREA | 2.67 | 194,694 | 72,931 | 90 | 15 |
| SWITZERLAND | 7.30 | 507,631 | 69,491 | 1 | 16 |
| BRAZIL | 2.59 | 137,864 | 53,219 | 98 | 17 |
| **TAIWAN** | **2.45** | **128,393** | **52,301** | **108** | **18** |
| BELGIUM | 5.26 | 267,552 | 50,844 | 18 | 19 |
| POLAND | 2.76 | 137,761 | 49,944 | 82 | 20 |

* *1999-2003, 173 countries.*

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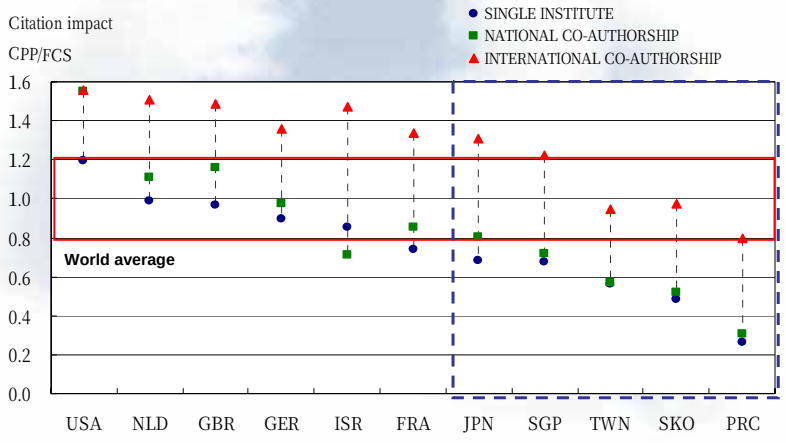
## Breakthroughs in International Co-authorship




Source：CWTS/Thomson-ISI (1995-2001), NARL.

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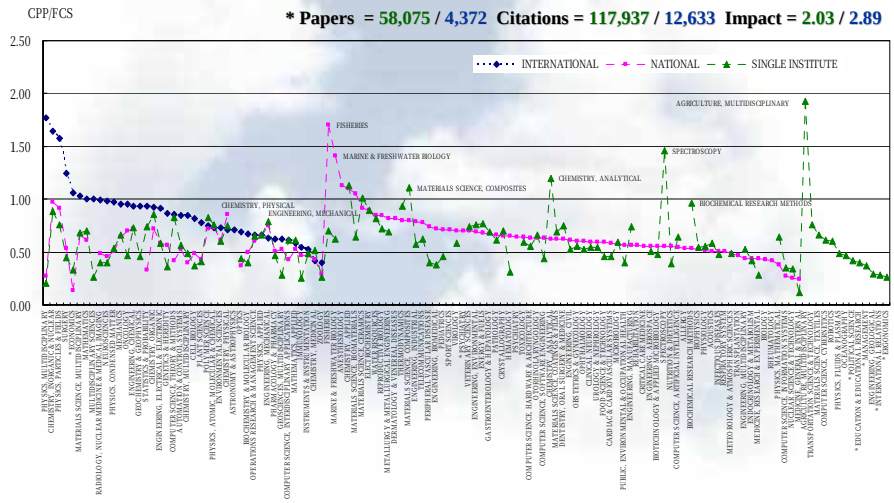
## Taiwan's Co-Authorship by Field




Source：CWTS/Thomson-ISI (1995-2001), NARL.

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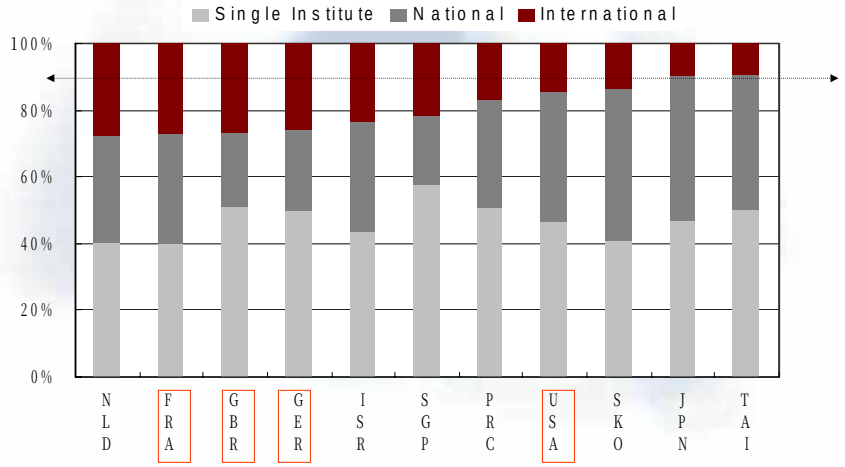
## Co-authorship by Countries




Source : CWTS/Thomson-ISI (1995-2001), NARL.

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## How Do We Do It?

- Reaching Out – S&T Divisions around the world
- Following Global Trends
- Strategic Planning
- Examples

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# NSC's S&T Divisions

11 Nations / 15 Divisions†

1970 - 2000 : 7 nations / 11 divisions

2000 - : 4 nations / 4 divisions


† 16th division scheduled for 2006: Prague (Czech Republic)

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# Trends: Global Teaming

- *Collaborative efforts* among different disciplines
- *Closer coordination* among funding agencies
- *Effective partnerships* involving universities, industry, and national laboratories

- ***Partnerships*** ameliorate academic standing
- International collaboration! The way to go!

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## NSC Strategies for International Collaboration Programs

I. **International Research Programs**
Project oriented, cross border research teams

II. **International Conferences/Scholar Exchanges**
to/from Taiwan for academic meetings

III. **Research Fellowships for Trainees**
Scholarships for international students studying in Taiwan

Summer internship programs for college students, graduates and young scientists from USA, Canada, Japan, France, and Germany.

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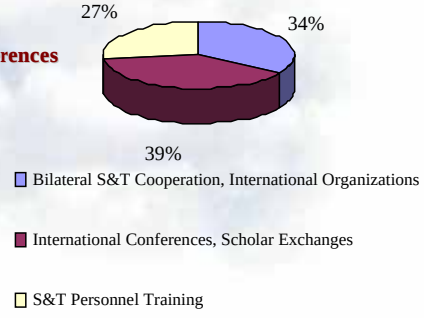
## International Cooperation - Policy and Methodology

**1. International Sci-Tech Cooperative Research Projects**
- **50/50 research team funded**
- **Funded by cases**
- **Air Force Office of Scientific Research (AFOSR)**

**2. International Conferences/Scholar Exchanges**
- **Organizing or traveling to international conferences**
- **Inviting foreign scientists to Taiwan**

**3. S&T Personnel Training**
- **Graduate Students Study Abroad Program**
- **Taiwan Merit Scholarships**
- **Taiwan Tech Trek**

2005 Budget US$ 18,000,000.

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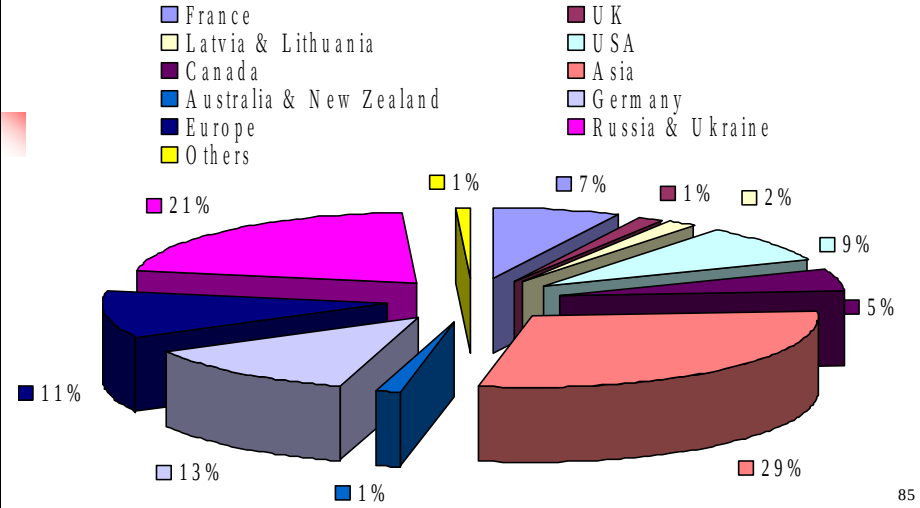
# International Cooperation

NSC Funding by Country (2006)

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# Examples of Collaboration (EU)

## Information Society Directorate - EC :

- EU-Taiwan Financial Agreement (October 2003)
  - ❖ NSC and DG (Directorate-General) - Information Society
- Promotional Activities
  - ❖ 2005 Euro-Taiwan IT Cooperation Event (April 2005)
- Framework Programme
  - ❖ Taiwanese research teams participated in more than 10 FP6 multi-national research projects
  - ❖ Proposals involving Taiwanese teams achieved 40% success rate (in IST, compared to 18.5% of average FPs)

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## Taiwan-Canada S&T Collaboration Model 1

- Bottom-up, free research projects –
  NSC & NRC jointly call for proposals and conduct international peer review
  Up to Can$100K/yr for three years on each side
- 10 research projects per year, Can$3 million/yr since 1999
- Top-down, mission-oriented approach –
  Began focus on nano and bio science programs in 2005

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## Taiwan-Latvia-Lithuania Mutual Fund Model 2

- Taiwan contributes ¾ of the fund together with matching funds from Latvia and Lithuania totaling $360,000
- Starting from 2002, two research projects are selected each year and financed for three years, for $60,000 per project per year

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## Taiwan-Russia S&T Fund
## Model 3

- Russia Foundation for Basic Research (RFBR) and NSC signed agreement to form Taiwan-Russia S&T Development Fund in November 2004
- Since 2005, 20 research projects and 3 S&T conferences have been funded
- Expect to finish 60 projects annually with project life of three years or longer

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# BE CREATIVE !

# A GREECE-TAIWAN COLLABORATION?

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# THANK YOU FOR YOUR ATTENTION

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