NARLabs

2021
Annual Report

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董事長的話

經過前兩年瀰漫全球的疫情，2021 年的臺灣，不僅僅以防疫能力驚豔全球，也掌握了成長及轉型的機會，展現臺灣科技產業扎實的基礎。近幾年雲端、5G、物聯網及各種智慧科技讓我們的生活越來越便利，也幫助許多店家度過 COVID-19 疫情難關，加上近來正夯的元宇宙議題，在在顯示數位轉型及社會生活型態轉變已勢不可擋。

面對轉型，行政院布局先進網路建設，由科技部國研院國網中心負責建置公共服務網路交換中心，整合政府 TANet、TWAREN、ASNet 及 GSN 等四大網路，提升政府公共服務及教育研究所需的網路順暢度；另建置聯網中心，希望讓國際海纜從臺灣北部上岸，經過陸路高速頻寬網路連接到臺灣南端，銜接南下到東南亞的海纜，再繼續連接到歐洲地區的網路高速公路，以吸引國際業者來臺設立雲端資料中心或內容傳遞網路(CDN)，讓臺灣成為亞太地區數據資料的重要樞紐。

面對此波疫情，國研院動物中心全力支援 COVID-19 的疫苗開發與檢測，儀科中心輔導廠

商開發出世界首創新冠病毒快速檢測晶片，皆是以科技協助防疫的重要作為。另外，海洋中心積極發展水下技術，國震中心建立離岸風機支撐結構與關鍵零組件測試平台，對於臺灣正積極發展的離岸風電亟為關鍵；半導體中心持續培育臺灣的關鍵科技人才，科政中心協助新國科會擘畫前瞻科技政策，都是臺灣邁向 2030 不可或缺的。雖然太空中心將在 2022 年進行組織變更，成為行政法人，但也會繼續與國研院保持密切合作，共同協助國內太空產業發展。

科技部即將在 2022 年改制為「國家科學及技術委員會」，將以國家整體科技發展的高度，協調臺灣數位發展與產業創新，攜手數位發展部、經濟部、衛福部、農委會、文化部等，以跨部會、跨產學研之型態，引領臺灣軟體、硬體整合創新。

國家實驗研究院是科技部以及未來的國科會轄下的法人，期許國研院持續扮演學界與產業界的橋梁，一方面支援學術界將原創性研究落實到下游的產業，一方面鼓勵新創業者來與國研院合作，鏈結跨域創新價值，促進科研產業化，秉持「創新科技，守護臺灣」的營運目標，成為學研界的堅強後盾，並協助新國科會建立未來整體國家的長期發展能力與競爭力。

董事長 吳政忠

Despite the pandemic that has ravaged the globe over the past two years, Taiwan in 2021 not only impressed the world with its ability to control the spread of the virus, but also seized opportunities for growth and transformation and showcased the strong foundation of its technology industry. In recent years, cloud technology, 5G, the Internet of Things, and various smart technologies have made our lives increasingly more convenient and helped many businesses get through the COVID-19 pandemic. Moreover, the high interest in metaverses shows that digital transformation and social lifestyle changes are unstoppable.

In light of this transformation, the Executive Yuan has laid out plans for the construction of advanced networks, with our National Center for High-performance Computing responsible for building an internet exchange center integrating the four major government networks, TANet, TWAREN, ASNet, and GSN, to better support public services and educational institutions. In addition, a network center will be built to allow international submarine cables to reach the northern Taiwan shore, connect to the southern tip of Taiwan over land-based high-speed bandwidth networks, join up with submarine cables going to Southeast Asia, and go on to connect to network highways in Europe. This will encourage international companies to set up cloud data centers or content delivery networks (CDN) in Taiwan, making our nation an important data hub in the Asia-Pacific region.

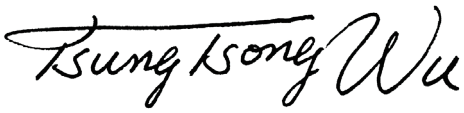
As for facing this wave of the pandemic, the National Laboratory Animal Center has assisted greatly in the development and testing of the COVID-19 vaccine, and the Taiwan Instrument Research Institute has provided guidance to manufacturers to develop the world's first COVID-19 rapid detection chip, both of which are important accomplishments in fighting the pandemic with technology. In addition, the Taiwan Ocean Research Institute has been actively developing underwater technology, and the National Center for Research on Earthquake Engineering has established a testing platform for offshore wind turbine support structures and key components, which are crucial to Taiwan's active development of offshore wind power. The Taiwan Semiconductor Research Institute has continued to foster the talent of Taiwan's technology experts,

and the Science & Technology Policy Research and Information Center will assist the new National Science and Technology Council in formulating forward-looking policies. The accomplishments of NARLabs' research centers are all indispensable towards Taiwan's progress as we approach 2030. Although the National Space Organization will become an independent administrative agency in 2022, it will also continue to work closely with NARLabs to assist in the development of Taiwan's space industry.

The Ministry of Science and Technology will soon be transformed into the National Science and Technology Council in 2022, and will coordinate Taiwan's digital development and industrial innovation from the angle of overall national science and technology development. It will also collaborate with the Ministry of Digital Development, the Ministry of Economic Affairs, the Ministry of Health and Welfare, the Council of Agriculture, and the Ministry of Culture to lead Taiwan's software and hardware integration and innovation by working across ministries, industries, universities, and research institutes.

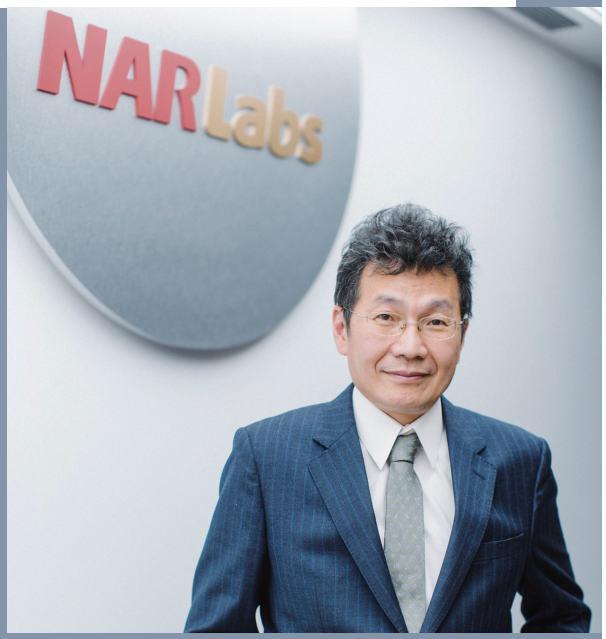
As an agency under the Ministry of Science and Technology and the future National Science and Technology Council, NARLabs hopes to continue to serve as a bridge between academia and industry, supporting the academic community in implementing original research into down-stream industries while also encouraging new entrepreneurs to collaborate with us. We aim to link the values of cross-disciplinary innovation and promote the industrialization of scientific research, upholding the goal of innovating technology and safeguarding Taiwan. NARLabs will strive to be a strong backing force for academic and research communities and assist the new National Science and Technology Council in building up the long-term developmental capabilities and competitiveness of the country as a whole in the future.

Chairperson



MESSAGE FROM THE PRESIDENT

院長的話



國家實驗研究院是科技部轄下的財團法人，未來將持續積極配合國家科技政策，包括蔡英文總統提出的「六大核心戰略產業」，以及科技部吳政忠部長提出的「台灣 2030 科技願景六大加強發展主軸」，積極整合轄下各中心的研發能量，支援學術研究，推動前瞻科技。

國研院扮演國內科技人才與創新經濟所需之科技研發平台的提供者，除了建置國內大學無法單獨建置的大型儀器設施如超級電腦、大型地震振動台、勵進海研船提供學研界使用外，也建立了許多結合軟硬體並由專業人員提供服務的科研平台，協助學研界進行尖端科技研發。國研院 2021 年首度徵選「研發服務平台亮點成果獎」，選出 6 組傑出團隊（1 組特優獎、2 組優等獎、3 組佳作獎）給予獎勵，希望能鼓勵產官學研各界更踴躍使用這些以國家力量建構的研發服務平台，做出具有全球競爭力的研發成果。

國研院也不斷提升研發能力，在 2021 年獲得了幾個重要獎項，包括國網中心與陽明交通大學、東海大學合作研發的「智能點雲技術」獲得有科技界奧斯卡獎之稱的全球百大科技研發獎（R&D 100 Awards）；國網中心建構基於雲端原生架構的「教育雲」，獲得紅帽亞太區創新獎（Red Hat APAC Innovation Award）；國震中心建置於臺南

沙崙智慧綠能科學城 C 區進行實證應用的「沙崙 C 區 5D 智慧維運管理系統」獲得智慧化居住空間創意競賽「巢向未來組」金獎，同時獲獎的場域單位為國研院沙崙 C 區維運組；儀科中心與臺灣大學醫學院合作開發「免萃取式農藥殘留快速偵測系統」，只要 30 秒就能偵測農藥超標之農產品，獲得第 18 屆國家新創獎—學研新創獎；儀科中心另與花蓮慈濟醫院合作開發「智慧藥箱」，解決偏遠地區病患取藥不易、取藥後忘記用藥等問題，獲得第 18 屆國家新創獎—臨床新創獎。

其他如半導體中心和清華大學、臺灣大學及工研院共同研發出新型態的「自旋軌道力矩式磁性記憶體」（SOT-MRAM），是全世界第二個開發出具備垂直異向性 SOT-MRAM 元件的團隊，可協助產學研界將相關研發成果接軌至記憶體晶片或新一代人工智慧晶片等應用驗證；動物中心為因應 COVID-19 疫苗與藥物開發需求，提供 3 種疾病模式動物，支援相關基礎研究及治療方法開發；海洋中心與中山大學合作研發能於小型船舶作業的輕型工作級水下遙控無人載具（ROV）；科政中心建構科研資訊觀測平台，統整專利、國際論文、博碩士人才及政府委託研究計畫，提供以往無法綜觀掃描及分析之各類資訊。這些都是國研院在擔任國內重要科研平台這一角色上，非常傑出的表現。

國研院的另一項重要工作是人才培育，除持續提供大學生或研究生實習或參與研究計畫的機會，縮短學用落差，也加強推動向下扎根的科普工作，如與東臺傳播公司合作拍攝「下一步，AI。NEXT，愛」科普影片，幫助民眾認識臺灣的 AI 研究成果；以及和中興大學共同參加「亞洲種子送上太空計畫」（Asia Herb in Space, AHiS），選定臺灣藜、姬蝴蝶蘭、甜椒及向日葵等 4 種作物在國際太空站停留 7 個月後，交給學生栽種並作觀察報告。國研院期能藉由這些科普活動激起年輕學子對科學的興趣，導引他們進一步探索並追尋科學知識，進而成為國家未來重要的科技人才。

代理院長

林博文

Under the jurisdiction of the Ministry of Science and Technology (MOST), NARLabs will continue to play an active role in implementing national scientific and technological policies. Among these include President Tsai Ing-wen's "Six Core Strategic Industries" and the "Taiwan 2030 Science & Technology Vision" as proposed by MOST Minister Wu Tsung-tsong. NARLabs will also continue to establish and maintain R&D platforms to support academic research and promote industrial technology.

NARLabs serves as a provider of technological R&D platforms needed by Taiwan's science and technology experts in the innovation economy. In addition to building large-scale research apparatuses and facilities which local universities are unable to install on their own, such as supercomputers, large seismic stations, and the ocean research vessel Legend, NARLabs has also established many innovative research platforms. These platforms integrate software and hardware and also feature service by professional staff to assist research communities in conducting R&D for cutting-edge technologies. In 2021, NARLabs held the inaugural R&D Service Platform Achievement Awards, selecting six outstanding teams to receive awards (one High Distinction, two Excellences, and three Honorable Mentions), with the goal of encouraging industry, government, academia, and research sectors to use these Taiwan-made R&D service platforms even more readily and conduct globally competitive R&D.

In 2021, NARLabs continued to improve its R&D capabilities and won several major awards, including an R&D 100 Award, which is regarded as an Oscar of the tech industry, for "Cloud-based Smart Point Cloud Processing" technology developed by the National Center for High-Performance Computing (NCHC) in collaboration with National Yang Ming Chiao Tung University and Tunghai University. The NCHC was also granted a Red Hat APAC Innovation Award for its "Edu-Cloud", which is based on cloud-native architecture. In addition, the "Shalun Zone C 5D Smart Maintenance and Management System", built and run by the National Center for Research on Earthquake Engineering (NCREE) in Zone C of the Shalun Smart Green Energy Science City in Tainan, won gold in the "Toward Future Homes" category of the Intelligent Green Building Design Competition, with the prize granted to NARLabs' Shalun Zone C Maintenance Team. At the 18th National Innovation Awards, the "Extraction-Free Rapid Pesticide Residue Detection System", developed by the Taiwan Instrument Research Institute (TIRI) and National Taiwan University College of Medicine, which can detect excessive levels of pesticide residue in just 30 seconds, won the Research Innovation prize. TIRI also collaborated with Hualien's Tzu-Chi Hospital to develop a "Smart Medicine Kit" to help patients in remote areas who have difficulty getting and remembering to take their medicine, winning the Clinical Innovation prize at the 18th National Innovation Awards.

The Taiwan Semiconductor Research Institute (TSRI), together with National Tsing Hua University, National Taiwan University, and the Industrial Technology Research Institute, developed a new type of spin orbit torque magnetoresistive RAM (SOT-MRAM), being the second team in the world to develop a SOT-MRAM device with perpendicular magnetic anisotropy. This device will be able to help industrial, academic, and research sectors connect their research results to memory chips or next-generation AI chips, among other applications. In response to the demand for COVID-19 vaccine and drug development, the National Laboratory Animal Center (NLAC) provided three types of animal models to support foundational research and treatment developments. Meanwhile, the Taiwan Ocean Research Institute (TORI) collaborated with National Sun Yat-sen University to develop a light work class remotely operated underwater vehicle (ROV) that can operate on small vessels. And lastly, the Science & Technology Policy Research and Information Center (STPI) built a research platform integrating content related to patents, international papers, doctoral and master's degree scholars, and government-commissioned research projects to provide many types of information that could not previously be scanned and analyzed comprehensively. These are all outstanding achievements by NARLabs, which has embraced its role as a major platform for scientific research in Taiwan.

Another important task that NARLabs values is talent training. In addition to continuing to provide opportunities for university or graduate students to participate in internships or research projects to narrow the gap between academic study and professional work, NARLabs has also stepped up its efforts to promote science from the ground up, such as collaborating with Dong Tai Communication to produce the series "Next, AI" to help the public learn more about AI research in Taiwan. NARLabs also participated in the Asia Herb in Space (AHiS) project with National Chung Hsing University, in which four types of seeds, including Taiwan red quinoa, moth orchid, bell pepper, and sunflower seeds, were selected to complete a seven-month stay on the International Space Station, after which students planted the seeds and reported on their observations. Through these activities, NARLabs hopes to spark young students' interest in science and guide them to further explore and pursue scientific studies so they can one day become Taiwan's science and technology experts.

President (Acting)

R&D Service Platform Achievement Awards

研發服務平台亮點成果獎

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財團法人國家實驗研究院
研發服務平台亮點成果獎

國研院係以「追求全球頂尖、開創在地價值」為願景，在科技部的支持與指導下，建立各種研發服務平台，以協助學研界開發出頂尖的科研成果，期能創造新興產業，貢獻民生福祉。2021 年首度徵選「研發服務平台亮點成果獎」，頒發給 6 組優秀團隊，希望能鼓勵國內學研界更踴躍與國研院合作，來使用以國家力量建構的研發服務平台，做出具有全球競爭力的研發成果。

NARLabs R&D Service Platform Achievement Awards

"Global Excellence, Local Impact". Such is the vision of NARLabs. Under the auspices of MOST, NARLabs has established various R&D service platforms to support and help research and academic communities in achieving top-notch results in scientific research. we aim to foster the creation of new industries and contribute to the well-being of our citizens. NARLabs inaugurated the R&D Service Platform Achievement Awards in 2021, in which six outstanding research teams received honors. we encourage researchers from domestic academic and research institutions to collaborate with NARLabs by conducting globally competitive research with our R&D service platforms, which have been put together with the government's complete support and the country's most advanced resources.

▲ 國研院「研發服務平台亮點成果獎」頒獎典禮
NARLabs' R&D Service Platform Achievement Awards ceremony

特優 High Distinction

亮點成果 Achievement

次埃解析度 (sub-Å) 原子結構研究與應用
Sub-Å Atomic Structure Research and Applications

使用平台 Platform

儀科中心「次埃解析度 (sub-Å) 原子結構研究與應用研發服務平台」
TIRI's Sub-Å Atomic Structure Research and Applications R&D Service Platform

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優等 Excellence

亮點成果 Achievement

利用深度蛋白基因體技術解析國人不吸菸肺癌之成因及進展
Deep Proteogenomic Technology to Explain the Causes of Lung Cancer and Its Progression in Patients Who Are Non-smokers

使用平台 Platform

國網中心「LIONS 生醫平台」
NCHC's LIONS Biomedical Platform

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優等 Excellence

亮點成果 Achievement

次世代定序識別基因變體系統晶片
Genetic Variant Discovery SoC for Next-Generation Sequencing

使用平台 Platform

半導體中心「人工智慧系統晶片 (AI SoC) 設計平台」
TSRI's AI SoC Design Platform

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佳作 Honorable Mention

亮點成果 Achievement

新穎類神經網路架構研發、應用與新創產業化

From Neural Network-based HarDNet to Start-up Neuchips Corp

使用平台 Platform

國網中心「臺灣 AI 雲 (TWCC) 平台」

NCHC's Taiwan Computing Cloud (TWCC) Platform

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王廷基 Ting-Chi Wang
清華大學 National Tsing Hua University

佳作 Honorable Mention

亮點成果 Achievement

超低溫金氧半場效電晶體由於直接穿隧電流所造成之臨界擺幅飽和

Ultra-low Temperature MOS-FET Threshold Swing Saturation Caused by Direct Tunneling Currents

使用平台 Platform

國網中心「simPlatform 平台」

NCHC's simPlatform

團隊成員 Team Members

高國興 Kuo-Hsing Kao
成功大學 National Cheng Kung University

佳作 Honorable Mention

亮點成果 Achievement

口腔癌 / 胰臟癌檢測方法與免疫檢測試劑

Oral and Pancreatic Cancer Detection Methods and Immunoassay Reagents

使用平台 Platform

儀科中心「鏈結產學技術加值服務平台」

TIRI's Value-Added Service Platform for Industry-Academia Technology Linkage

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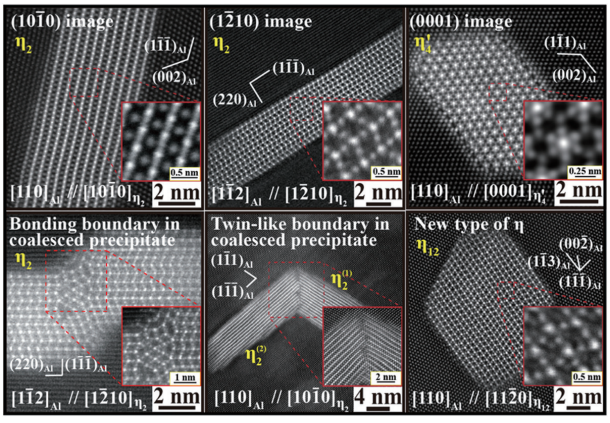
世延生醫股份有限公司 S&T BIOMED CO., LTD.

次埃解析度 (sub-Å) 原子結構研究與應用

臺灣大學楊哲人特聘教授及鍾采甫博士整合臺灣大學、清華大學、陽明交通大學、中山大學、中興大學、日本京都工業大學、宜特科技股份有限公司及美商 EA Fischione Instruments 共同組成的研究團隊，使用儀科中心「次埃解析度 (sub-Å) 原子結構研究與應用」研發服務平台所配備之「原子解析度像差修正掃描穿透式電子顯微鏡」，點解析度為目前臺灣研究單位最高的 0.78 Å。團隊從材料最原始組成點 (即原子) 拓展至點和點之間的二維與三維空間結構，深度探索前瞻性金屬材料相變態、先進半導體元件與二維材料之學理及應用，建構出全球最完整的航太級鋁合金之原子級析出物相變態顯微結構演化機制，完成下世代二維材料與量子點半導體元件原子結構與成分分析，並建立全臺首創的「原子解析度三維顯微結構」分析技術量能，提供國際學術界與產業界全新的研發視野，可以進一步了解先進材料之結構與性質之間的連結。團隊表示，儀科中心的「次埃解析度 (sub-Å) 原子結構研究與應用」研發服務平台，可說真正幫助了海內外產、官、學界充分發揮研發量能。



▲ 航太級鋁合金之原子級析出物相變態顯微結構演化機制

Microstructure evolution of atomic-level precipitates in aerospace-grade aluminum alloys

Sub-Å Atomic Structure Research and Applications

National Taiwan University (NTU) Distinguished Professor Jer-Ren Yang and Dr. Tsai-Fu Chung, together with a research team with members from NTU, National Tsing Hua University, National Yang Ming Chiao Tung University, National Sun Yat-sen University, National Chung Hsing University, Kyoto Institute of Technology (Japan), Integrated Service Technology Inc. (iST), and EA Fischione Instruments (U.S.), conducted research on TIRI's "Sub-Å Atomic Structure Research and Applications" R&D service platform, which is equipped with the "Atomic Resolution Aberration-Corrected Scanning Transmission Electron Microscope" with a resolution of 0.78 Å, the highest in Taiwan. Starting with the material's most fundamental composition points (i.e., the atoms), the research team extended them to 2D and 3D spatial structures between points and thoroughly explored the phase transformation of forward-looking metallic materials as well as the scientific theory and applications of advanced semiconductor devices and 2D materials. They then proceeded to establish the world's most complete atomic microstructure evolution mechanism of the precipitation phase transformation in aerospace-grade aluminum alloys, completed the analysis of the atomic structure and composition of next-generation 2D materials and quantum-dot semiconductor devices, and pioneered Taiwan's "atomic-resolution 3D electron tomography" analysis technology, which has opened new R&D horizons in academia and industry across the world for investigating the connections between the structure and properties of advanced materials. The team indicates TIRI's "Sub-Å Atomic Structure Research and Applications" R&D service platform has indeed provided excellent support to industries, government institutions, and academia, from both home and abroad, to help them fully utilize their R&D capabilities.

利用深度蛋白基因體技術解析國人不吸菸肺癌之成因及進展

臺灣團隊受邀加入美國「癌症登月計畫」(National Cancer Moonshot)，運用嶄新的蛋白基因體學 (Proteogenomics) 策略進行大規模癌症病人分析，探討疾病發生機制、檢測及治療的線索，希望能提供國人精準醫療的新方針。

第一期「臺灣癌症登月計畫」聚焦於肺癌及乳癌，由中央研究院、臺灣大學、臺北醫學大學、臺大醫院、中山醫學大學附設醫院、三軍總醫院等跨領域團隊參與。目前已建立數百例病人大數據，建構東亞第一套結合深度多體學及完整臨床資料之早期肺癌大數據，解析國人不吸菸肺癌之成因及進展，並榮登國際知名期刊《Cell》封面故事。此成果有數項突破：首先是發現臺灣與西方族群有顯著不同及具性別與年齡獨特體細胞突變，包括年輕女性病人具有 APOBEC 特徵突變好發率與環境致癌物誘導突變印記；並發現新型早期肺癌高風險之「類晚期」亞型，篩選高風險病人積極治療及探索藥物標的；蛋白體分群亞型揭露早期肺腺癌腫瘤進展的候選標記。這是美國臨床蛋白基因體腫瘤分析聯盟 (CPTAC) 首次和國際聯盟團隊 (臺灣) 攜手合作，揭開臺灣及美國病人肺癌生物學的面紗。

團隊特別感謝國網中心「LIONS 生醫平台」協助他們建置系統，從軟硬體安裝到巨量資料之轉移，讓團隊的多體學數據分析順利完成。未來將持續和國網中心合作建置「臺灣癌症多體學智識庫」。

Deep Proteogenomic Technology to Explain the Causes of Lung Cancer and Its Progression in Patients Who Are Non-smokers

The Taiwan Cancer Moonshot Project was organized by invitation to join the International Cancer Proteogenomics Project under the Cancer Moonshot project in the U.S. By conducting a large-scale cancer patient analysis using novel proteogenomics-based strategies, the project aims to reveal the new insight for cancer mechanisms and pave the pathways to facilitate the discovery of new strategies in detection and treatment towards cancer precision medicine.

The first phase of the Taiwan Cancer Moonshot Project focused on lung cancer and breast cancer, with the participation of cross-disciplinary teams from Academia Sinica, National Taiwan University, Taipei Medical University, National Taiwan University Hospital, Chung Shan Medical University Hospital, and Tri-Service General Hospital. Currently, the team has established big data collected from hundreds of patients in lung and breast cancer. By integrated analysis of multi-omics datasets and comprehensive clinical data, the team establishing the first deep proteogenomics landscape of lung cancer in East Asia, which delineated the pathogenesis of lung cancer and its progression in non-smoker patients. The findings were published and chosen to be the cover story of the internationally renowned journal *Cell*, and it delivered several breakthroughs in discovery of the demographically distinct molecular attributes and hallmarks of tumor progression. The Taiwan patients have demographically distinct molecular mutational signature and age- and gender-related mutagenesis mechanisms, characterized by high prevalence of APOBEC mutational signature in younger females and over-representation of environmental carcinogen-like mutational signatures in older females. In addition, the proteomics classification reveals the progression of early-stage lung adenocarcinoma and lead to the discovery of a novel "late-like" subtype of early-stage lung cancer, which allows for the screening of high-risk patients for active treatment. This is the first time that the Clinical Proteomic Tumor Analysis Consortium (CPTAC) and an international consortium (Taiwan) have collaborated to unveil the biology of lung cancer cohorts in Taiwan and the U.S.

The team sincerely acknowledges the “LIONS Biomedical Platform” at NCHC for assisting the research team in setting up the system, from hardware and software installation to transferring the big data, thus enabling the team to complete the multi-omics data analysis successfully. In the future, the team will continue to work with NCHC to build the Taiwan Cancer Multi-omics Knowledge Base.

次世代定序識別基因變體系統晶片

次世代基因定序是近年來被廣泛使用於基因資料分析的定序技術，透過大量平行定序方式，大幅降低定序成本與時間；但後續基因分析與基因變體之識別，透過電腦的中央處理器 (CPU) 或圖形處理器 (GPU) 仍需花費數天運算。為滿足不斷增加的早期癌症偵測與新生兒遺傳疾病篩檢等需求，並邁向精準醫療，醫療院所需要運算速度更快、更有效率且更經濟的硬體運算設備，以加速取得檢測報告與結果。臺灣大學楊家驤教授協同陽明交通大學洪瑞鴻副教授的團隊，使用半導體中心開發之「人工智慧系統晶片 (AI SoC) 設計平台」，透過協作式的技術服務，共同完成次世代基因定序識別基因變體系統晶片設計。該晶片可進行完整次世代基因定序資料分析與識別，可在 37 分鐘內完成完整人類基因 (高達數百 GB 之基因資料) 分析。由於不需將病患的大量基因資料上傳至雲端，除節省網路傳輸及雲端運算成本並兼顧資訊安全及隱私外，即時性亦大幅提升。相較於一般電腦，此專用晶片之基因定序資料分析運算速度提升 60 倍以上，能耗則只有 1/200。此研究成果發表於素有積體電路界「晶片奧林匹克」美稱之頂尖國際會議 ISSCC，並榮獲 ISSCC 2020 Takuo Sugano Award for Outstanding Far-East Paper (ISSCC 所設之遠東區最佳論文獎)。

Genetic Variant Discovery SoC for Next-Generation Sequencing

Next-generation sequencing (NGS) has been widely employed for genetic data analysis. The cost and time of sequencing have been greatly reduced by massively-parallel sequencing, but the subsequent genetic analysis and discovery of variants still require days of computation with either central processing units (CPUs) or graphics processing units (GPUs). To meet the increasing demand for early cancer detection and neonatal genetic diseases screening, as well as to advance toward precision medicine, hospitals require faster, more efficient, and more cost-effective computing devices to expedite test reports and results. Professor Chia-Hsiang Yang of National Taiwan University and Associate Professor Jui-Hung Hung of National Yang Ming Chiao Tong University teamed up to design an genetic variant discovery system-on-chip (SoC) for NGS using the "AI SoC Design Platform" developed by TSRI. The chip is capable of analyzing the complete human genome (with up to several hundreds of gigabytes) in just 37 minutes. By eliminating the need to upload large amounts of genetic data from users to the cloud, it not only provides timely access to the data but also saves network bandwidth and cloud computing costs while maintaining security and privacy. This dedicated chip achieves over 60 times faster analysis speed than ordinary computers with 200 times lower energy consumption. Their research was presented at the International Solid-State Circuits Conference (ISSCC), known as the "IC Olympics", and won the ISSCC 2020 Takuo Sugano Award for Outstanding Far-East Paper.

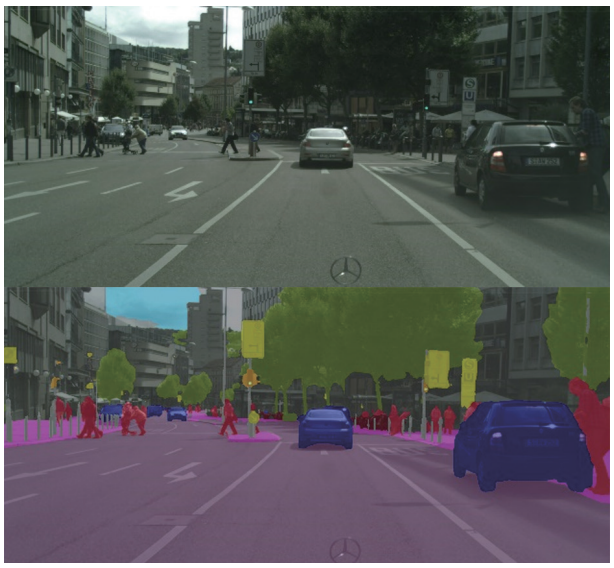
◀ AI SoC 設計平台記者會
AI SoC Design Platform press conference

新穎類神經網路架構研發、應用與新創產業化

清華大學林永隆講座教授帶領陽明交大及中原大學團隊執行科技部半導體射月計畫，使用國網中心「臺灣 AI 雲 (TWCC) 平台」，成功研發出準確、快速、省電、安全之新穎類神經網路結構 HarDNet，成果已被國際研發社群大量引用，並獲得 4 項美國專利與 11 項中華民國專利。學生團隊參加多項國際競賽獲得優異成績，在醫學影像分割與自動駕駛用視訊分割兩項重要應用上皆獲得世界第一。所促成的新創公司創鑫智慧股份有限公司(Neuchips Corp.)已獲准進駐新竹科學園區，為全球唯一提供推薦系統專用硬體加速器解決方案之公司，已成功募得新臺幣 10 億元資金，正在開發全球最高能源效率之資料中心用 AI 加速系統，是國內極少數開發 7 奈米晶片的公司之一，為破紀錄的學界新創實例。團隊表示，智慧計算需求幾無止盡，因為有了國網中心完善的服務與高效的運算平台，讓團隊可以心無旁騖把精力專注於開發人工智慧技術，是團隊能將研究結果不斷往前推進的最大助力。

From Neural Network-based HarDNet to Start-up Neuchips Corp

Professor Youn-Long Lin, Chair Professor of National Tsing Hua University, led a team from National Yang Ming Chiao Tung University and Chung Yuan Christian University to implement MOST's Semiconductor Moonshot Project and conducted research with NCHC's Taiwan Computing Cloud (TWCC) platform. They successfully developed an accurate, fast, energy-efficient, and secure neural network-based system called HarDNet, and their published results have not only been widely cited by research communities around the world but have also been granted 4 U.S. patents and another 11 patents from Taiwan. The student team also participated in several international competitions and won first place in two important applications: medical image segmentation and video segmentation for autonomous driving. Neuchips Corp., a start-up that grew out of these efforts, has been permitted to set up operations in Hsinchu Science Park. It is currently the only company in the world that provides hardware accelerator solutions for recommender systems and has successfully raised NT$1 billion in capital to develop the world's most energy-efficient AI accelerator system for data centers. It is also one of the few companies in Taiwan developing 7nm chips, a new record-breaking endeavor for academia. The team said that the demand for AI computing is limitless, and with NCHC's comprehensive service and highly efficient computing platform as their solid support, the team was able to focus on developing AI technology and continue to push ahead with their research efforts.



◀ HarDNet 應用於自駕車影像語義分割

Application of HarDNet to semantic segmentation of self-driving car images

超低溫金氧半場效電晶體由於直接穿隧電流所造成之臨界擺幅飽和

在量子電腦領域裡，矽基互補式金氧半導體 (Si CMOS) 電子元件已被公認為操作量子位元的最佳候選者之一，其在低溫的量子系統與室溫的古典系統間，提供了一個連接的介面，進而提高量子位元的密度，可大幅提升量子電腦的計算力。

以理想的半導體元件而言，元件的漏電流會隨著溫度降低而下降。然而，隨著 CMOS 元件通道長度的縮小，導致電子在低溫下能經由量子穿隧效應從元件的源極到達汲極，因此產生漏電流。這種漏電流的出現，將大幅影響 CMOS 在低溫下的電性，並導致不必要的能量耗散。

目前量子位元較有競爭力的候選者，大都需要在極低溫的情況下操作，上述的穿隧電流所形成的漏電機制，亦會產生不必要的電流熱效應，導致元件的溫度升高，因而破壞量子電腦中最重要的量子糾纏態，讓糾纏態的可作用時間大幅減短，限制了量子位元的可操作性與穩定性，降低了此類量子電腦的可用性。

成功大學高國興副教授使用國網中心「simPlatform 平台」研究發現，當矽通道的長度短於 25 奈米時，電子元件就無法藉由降溫至低於 50 K 來降低漏電流，此量子效應將會大幅影響 Si CMOS 在量子電腦中的發展。若要降低電子的穿隧機率，改善漏電流的大小，可藉由增加對閘極的控制能力來消弭兩電極間的穿隧電流，或是使用二維材料增加材料中電子的有效質量來改善。

Ultra-low Temperature MOS-FET Threshold Swing Saturation Caused by Direct Tunneling Currents

In quantum computing, electronic devices based on complementary silicon metal-oxide-semiconductors (Si CMOS) have been recognized as one of the best candidates for manipulating quantum bits. Si CMOS provides an interface between low-temperature quantum systems and room-temperature classical systems, thereby increasing the density of quantum bits and significantly improving the power of quantum computers.

For an ideal semiconductor device, its leakage current decreases as the temperature decreases. However, as the channel length of a CMOS device shrinks, electrons can migrate from its source to the drain terminal via quantum tunneling effects at low temperatures, resulting in leakage currents. This resulting leakage current will significantly affect the electrical properties of the CMOS device at low temperatures and lead to unnecessary energy dissipation.

Currently, most of the competing candidates for quantum bit manipulation need to operate at extremely low temperatures. The leakage mechanism caused by the tunneling currents mentioned above will also generate unnecessary current thermal effects, causing the device's temperature to rise, and the result is the destruction of the quantum entanglement state, the most important feature in quantum computers. This will drastically decrease the action time of the entangled state and limit the manipulability and stability of the quantum bits, eventually reducing the quantum computers' usability.

Associate Professor Kuo-Hsing Kao of National Cheng Kung University, using NCHC's simPlatform in his research, found that when the length of the silicon channel is less than 25 nm, an electronic device's leakage currents cannot be reduced by cooling down to below 50 K, and this quantum effect will significantly limit the use of Si CMOS in quantum computers. To reduce the tunneling rate of electrons and improve upon the extent of leakage currents, one can increase the ability to control the gate terminal to eliminate the tunneling currents between the two electrodes, or else employ a two-dimensional material to increase the effective mass of electrons in that material.

口腔癌 / 胰臟癌檢測方法與免疫檢測試劑

口腔癌為國人好發癌症，男性發生率世界第一（主因為龐大嚼食檳榔人口），已成為臺灣重大健康議題與醫療負擔。然而在過去 20 年間，口腔癌的早期偵測與精準標靶治療進展非常有限，缺乏有效的生物標記可應用於提高早期口腔癌檢出率及輔助術後追蹤。長庚大學分子醫學研究中心與林口 / 高雄長庚醫院及奇美醫院組成團隊，利用先進「蛋白質標靶定量質譜術」，針對過去 20 年間已被報導具有應用潛力的超過 300 個口腔癌生物標記群，於數百例口腔癌篩檢受試者唾液中，進行系統性的比較驗證，成功驗證出最佳唾液標記分子 MMP-1 及標記組合，研究成果已於 2016 年發表於《美國國家科學院院刊》，領先其他國際團隊，並獲得多國專利。

研究團隊使用儀科中心的「鏈結產學技術加值服務平台」，將技術移轉給本土新創生技公司世延生醫，進行後續免疫檢測試劑 ELISA 及快篩試紙的開發與臨床試驗。其中 ELISA 試劑已經成功開發，進一步經過 1,160 例口腔癌篩檢受試者唾液嚴格驗證，於 2020 年 12 月完成歐盟註冊，已可進入歐盟銷售。此為國人自行成功開發的第一個口腔癌生物標記免疫檢測商品化試劑組，可成為後續一系列衍生或相關檢測產品的重要參考品，具指標性意義，對提升國人口腔癌的檢測能力預期將有重大影響。

Oral and Pancreatic Cancer Detection Methods and Immunoassay Reagents

Oral cancer is one of the most prevalent forms of cancer that have plagued the people of Taiwan, with the male population experiencing the highest occurrence rates in the world given its large betel nut-chewing population. Indeed, oral cancer has become a major health issue and a great burden to the health care system in Taiwan. Over the past two decades, however, early detection and precisely targeted treatment of oral cancer have not seen much advancement, and there is a lack of effective biomarkers that can be applied to improve the detection rate of early oral cancer and to assist in postoperative follow-up. A team from the Molecular Medicine Research Center of Chang Gung University, together with the Linkou and Kaohsiung branches of Chang Gung Memorial Hospital and also Chi Mei Medical Center, employed advanced "mass spectrometry-based protein quantification" techniques to systematically compare more than 300 oral cancer biomarker candidates reported to have potential applications over the past 20 years in the saliva of hundreds of oral cancer screening subjects. The team successfully validated the optimal saliva marker molecule MMP-1 and the marker combination. The team is leading many other research efforts around the world and has been awarded patents in a number of countries. Their research was published in the *Proceedings of the National Academy of Sciences of the United States of America* (PNAS USA) in 2016.

Using TIRI's "Value-Added Service Platform for Industry-Academia Technology Linkage", the research team was able to transfer the technology to a Taiwanese biotech start-up, S&T Biomed, which conducted the subsequent development and trials of ELISA, an immunoassay reagent, and rapid test filter papers. In particular, the ELISA detection reagent has been successfully developed and further validated via the saliva of 1,160 subjects for oral cancer screening, and it was approved by the European Union for sale in that market in December 2020. This is the first commercialized oral cancer biomarker immunoassay reagent developed entirely in Taiwan, which has a crucial significance and represents an important reference product for subsequent derivatives or other related cancer detection products, and it is expected to have a significant impact on enhancing the country's ability to detect oral cancer.

Highlights

年度亮點

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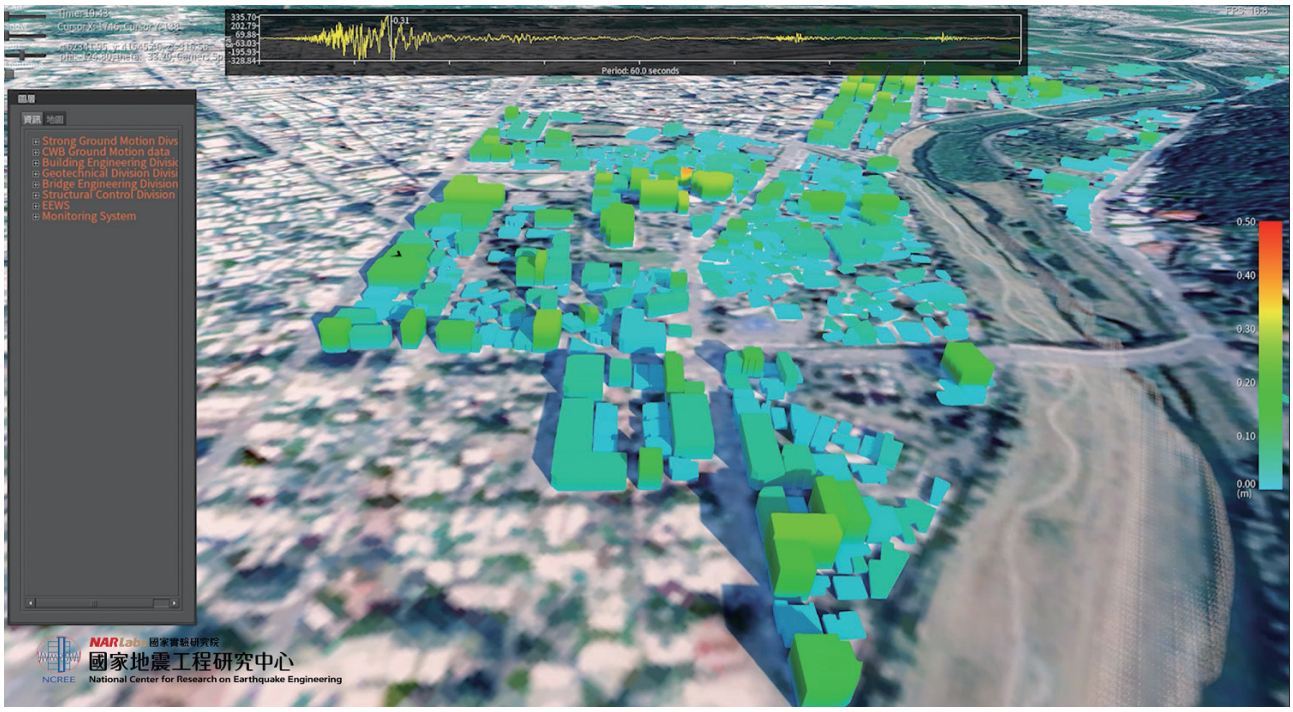
守護臺灣的「5D 智慧城市防救災平台」

國震中心打造「5D 智慧城市防救災平台」，建構真實城市的數位分身，地震時城市建築會隨地震搖晃而逐漸變色來呈現受損情形，顏色越深代表受損機率越高。此技術可應用於震前推估災害潛勢、震後規劃救災路線與避難地圖，亦可派遣無人機至受災現場回傳即時災損影像以利擬定救援計畫，使防減災更加智慧化，是實現智慧城市的一大利器。

Guardian Angel: 5D Smart City Disaster Prevention & Relief Platform

NCREE's 5D Smart City Disaster Prevention & Relief Platform creates a virtual city based on the physical features of a real urban center and is capable of simulating the effects of seismic events on buildings and displaying the degrees of damage with color contours. The darker the color, the higher the probability a building will suffer damage in an earthquake. This technology can be utilized to estimate disaster potential before an earthquake strikes as well as to help plan escape routes afterward. UAVs can also be dispatched to the disaster areas to record and send back real-time images of the affected locations, which can be useful in planning rescue and relief efforts. The platform is an excellent tool for intelligent disaster prevention and mitigation, and it contributes to the realization of the Smart City.



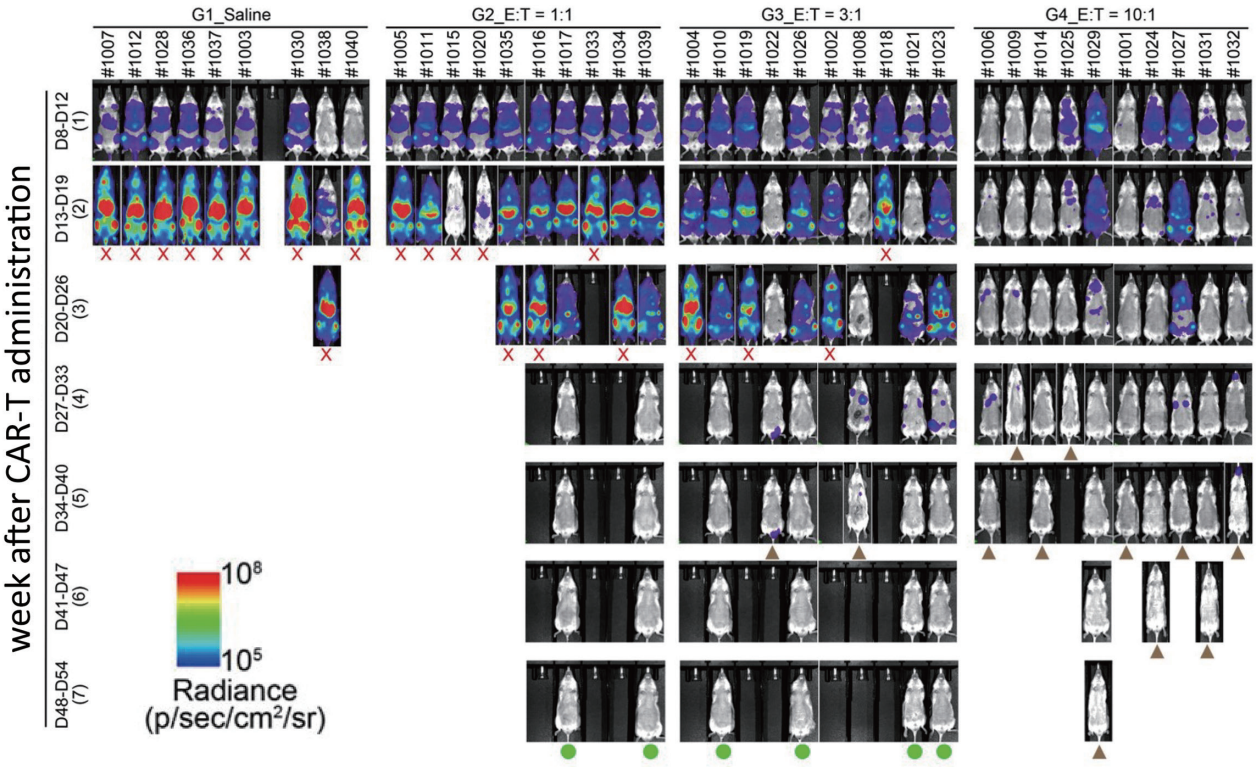
▲「5D 智慧城市防救災平台」模擬受損程度
"5D Smart City Disaster Prevention and Relief Platform" simulates damage levels

血癌藥物功效性測試

動物中心與沛爾生醫合作，結合實驗鼠資源、生醫影像服務及動物試驗技術，使用中心自行開發之高度免疫不全小鼠 (ASID) 進行腫瘤異種移植，建立 Raji/Luc 血癌模式動物，再施打 CAR-T 細胞進行治療。試驗期間執行腫瘤生長監測、臨床觀察及病理分析，提供完整的功效性試驗報告，扶植產品進入 TFDA 臨床試驗審查，榮獲第 17 屆國家新創獎—企業新創獎。

The pre-clinical CAR-T efficacy animal study

In collaboration with Pell Biomedical Technology, NLAC leverages its laboratory mouse resources-advanced severe immunodeficiency (ASID) mice, biomedical imaging service and animal experimental techniques to establish Raji leukemia xenografted ASID models for CAR-T efficacy evaluation. To provide the comprehensive efficacy study report, NLAC executed and analyzed the combined data from tumor growth monitoring, clinical observations and pathological evaluation. Now, this pre-clinical animal study facilitates the product to initiate the application for Taiwan FDA approval of cell therapy clinical trial. The technology also won the 17th National Innovation Award in the Enterprise Innovation category.



▲ CAR-T 細胞可有效治療異種移植 ASID 小鼠模型中的淋巴瘤
CAR-T cells can effectively treat lymphoma in xenograft ASID mouse models

NSPO 國家太空中心

「太空發展法」三讀通過

「太空發展法」於 5 月 31 日在立法院三讀通過，6 月 16 日由總統公布，是奠定我國太空發展法制基礎的重要一步。太空發展法共計 6 章 22 條，建立臺灣太空發展的法源依據，提供公部門與民間企業法律依循，同時揭示了尊重國際公約及相關規範等基本原則。在政府政策引導、資源投入，以及完備相關法制與支援體系下，臺灣將可順利發展更具前瞻性的技術，提升太空相關產業的競爭力。

▲ 立法院三讀通過太空發展法
The Space Development Act passes its third reading in the Legislative Yuan

Space Development Act Enacted by Taiwanese Legislature

The enactment of the Space Development Act was completed on May 31 and was promulgated by the President on June 16. It represents an important step toward establishing country's legal foundation for space development. Comprising 22 articles in six chapters, the Act provides the legal basis for space-related activities for both the public and private sectors and sets basic principles of honoring international conventions and other relevant regulations. Under the guidance of government policies, allocation of resources, and a comprehensive legal and support system, Taiwan will be in a leading position to develop further forward-thinking technologies and enhance the country's competitiveness in space-related industries.

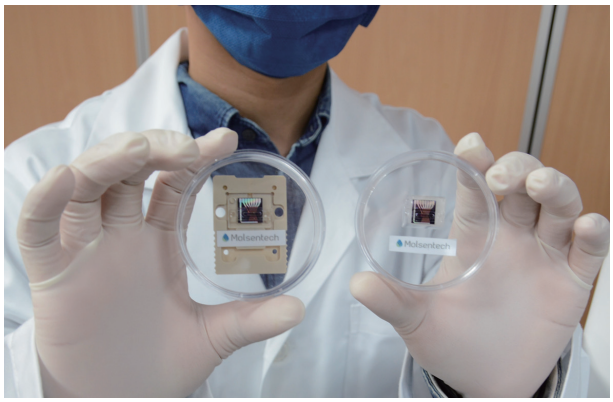
TIRI 台灣儀器科技研究中心

輔導廠商開發全球首套新冠病毒快速檢測晶片

儀科中心協助矽基分子電測科技公司開發全球首套新冠病毒快速檢測晶片，此檢測晶片擁有不需要經過 PCR 放大的超高靈敏度，僅需 3 分鐘即可完成判讀，比現行核酸檢測至少 90 分鐘加快許多，且準確度與核酸檢測相同，即使感染初期或是無症狀患者，皆能提供準確的檢驗結果，可作為早期快速檢測的第一道防線。

TIRI Assists Tech Company in Developing World's First COVID-19 Rapid Test Chip

TIRI provided assistance to Molsentech to verify the effectiveness of the world's first COVID-19 rapid test chip. It has ultra-high sensitivity that does not require amplification via PCR, and analysis can be completed in only three minutes, significantly faster than the current nucleic acid tests (NATs), which require at least 90 minutes. The chip also produces results that are equally accurate to those of NATs, even for asymptomatic patients and those in their early stages of infection, and it is, therefore, suitable as a first line of defense for early-stage rapid detection.



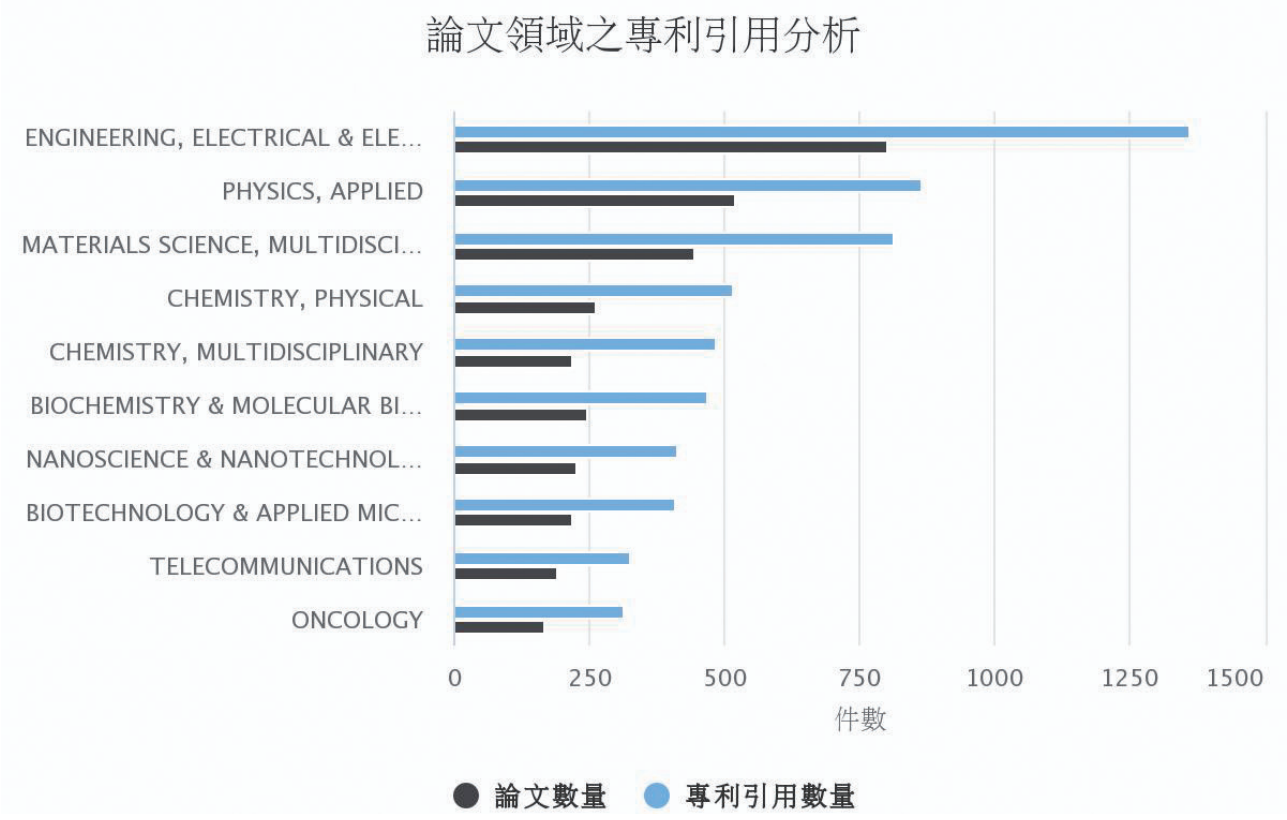
▲ 世界首創新冠病毒快速檢測晶片
World's first COVID-19 rapid test chip

建構科研資訊觀測平台 綜觀掃描評估我國科研能量

科政中心統整專利、國際論文、博碩士人才及政府委託研究計畫，建構完整的科研資訊觀測平台，提供以往無法綜觀掃描及分析之各類資訊。透過此平台之鏈結，將由國家層級細緻至個人層級，提供大範圍且廣泛之評估基準，供決策者、執行者、監督者以多方面角度，針對我國重點科研與產業能量進行完善之評估。

Creating a Scientific Research Observation Platform

STPI is responsible for compiling and consolidating information on patents, international research papers, experts with advanced graduate degrees, and research projects commissioned by the government to create a comprehensive scientific research observation platform, providing access to previously unavailable synoptic and cursory views of the data. This platform's versatile features allow decision-makers, project implementers, and overseers to view the information from multiple angles and vantage points, ranging from national to individual levels, thus facilitating the comprehensive evaluations of Taiwan's key scientific research and industrial capabilities via wide-ranging evaluation standards with a broad scope.



▲ 科政中心科研資訊觀測平台資料
Data on STPI's Scientific Research Observation Platform

科技部資安暨智慧科技研發大樓啟用典禮

由國研院負責維運的科技部資安暨智慧科技研發大樓，於 12 月 24 日舉辦「資安‧智慧‧大南方」聯合啟用典禮，呈現政府推動「從六大核心戰略產業來鏈結大南方計畫」的實績，期望藉由此研發大樓匯聚各法人、南部各大學、周邊科學園區、工業區，以及產官學研的完整能量，加速資安及智慧科技發展，將臺灣建設成亞太地區重要的資安暨智慧科技發展基地，推動產業數位轉型及南北均衡發展。

Cybersecurity & Smart Technology R&D Building Inaugurated

The Cybersecurity and Smart Technology R&D Building, operated by NARLabs, officially opened on December 24 with a joint ceremony entitled "Cybersecurity, Intelligence, Great South". This brand-new building is one of the achievements of the government's policy of promoting the "Six Core Strategic Industries to Connect Northern and Southern Taiwan" initiative. The objective of creating this building is to bring together R&D capabilities from non-profit organizations, universities in southern Taiwan, neighboring science and industrial parks, and government-sponsored and private research institutions in order to accelerate Taiwan's cybersecurity and smart technologies and to propel the country into becoming a crucial technology hub in the Asia-Pacific region, while at the same time helping industries to complete their digital transformation and addressing the need for a more balanced development between the north and the south.

▲ 蔡英文總統於啟用典禮致詞
President Tsai Ing-wen gives a speech at the opening ceremony

智能點雲技術榮獲 2021 年全球百大科技研發獎

國網中心與陽明交大、東海大學共同開發之「智能點雲技術」（CSPCP），可以自動校正建築物或物品 3D 模型的錯誤色彩，並能精細到毫米等級，做出無顆粒感的效果。此技術可運用於古蹟維護、戲劇場景典藏、建築工程、自動駕駛、數位城市等廣泛領域，於 2021 年榮獲有科技界奧斯卡獎之稱的全球百大科技研發獎（R&D 100 Awards），是電機 / 資訊類別唯一入圍及得獎的臺灣團隊。

Cloud-based Smart Point Cloud Processing (CSPCP) Technology Wins 2021 R&D 100 Award

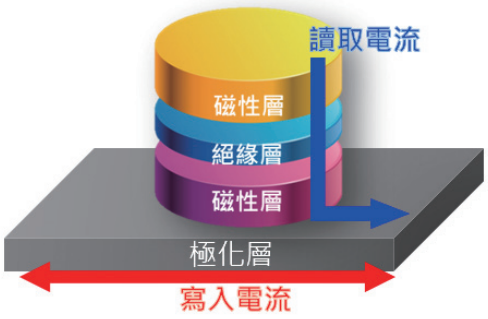
The Cloud-based Smart Point Cloud Processing (CSPCP) technology, jointly developed by the NCHC, National Yang Ming Chiao Tung University, and Tunghai University, is capable of automatically correcting color errors in 3D models of buildings or objects, reaching levels as fine as millimeters to deliver a grain-free effect. This technology has found applications in a wide range of areas, such as historical site maintenance, theater scene collection, construction engineering, autonomous driving, and digital cities. CSPCP won a 2021 R&D 100 Award, dubbed an Oscar of technology, and its developers were the only Taiwanese team to have advanced and gone on to win in the IT/ Electrical category.

左半邊：有異常紋路與顆粒；右半邊：CSPCP消除異常紋路與顆粒 (建物取樣：國研院國網中心)

▲ 智能點雲技術處理前後之差異比較
Before and after processing using the Cloud-based Smart Point Cloud Processing technology

新世代全能記憶體 MRAM

配合科技部「埃世代半導體計畫」的推動，半導體中心透過累積多年的技術能量，和清華大學、臺灣大學及工研院共同研發出新型態的「自旋軌道力矩式磁性記憶體」(SOT-MRAM)，是繼英特爾之後，全世界第二個開發出具備垂直異向性 SOT-MRAM 元件的團隊，而且電性和尺寸都能達到與英特爾同等級，現並將相關技術陸續轉為平台服務。



Next-generation Super Memory Device: MRAM

In support of MOST's Angstrom Semiconductor Initiative, TSRI has leveraged its extensive technical expertise to co-develop spin-orbit-torque magnetoresistive RAM (SOT-MRAM) technology with National Tsing Hua University, National Taiwan University, and ITRI, making them the second R&D team after Intel Corp. to have developed SOT-MRAM components with perpendicular magnetic anisotropy, with both the electrical properties and dimensions matching Intel's specifications. The technology is currently being made available as a platform service.

◀「自旋軌道力矩式磁性記憶體」SOT-MRAM 架構
SOT-MRAM architecture

自主研發輕型工作級 ROV

海洋中心重型工作級水下遙控無人載具 (ROV) 受限於作業時的空間需求，目前僅能於勵進研究船執行任務，因此海洋中心與中山大學合作研發能於小型船舶作業的輕型工作級 ROV，現已完成加工製作、組裝、港內配重及控制等測試，也順利於小琉球海域完成作業演練。

Independently Developed Light Work Class ROV

Operations of TORI's heavy work-class remotely operated underwater vehicle (ROV) are constrained by its space requirements and can currently be deployed only with R/V LEGEND. To solve this problem, TORI and National Sun Yat-sen University joined forces to develop a light work class ROV that can operate with smaller ships. Currently, these lighter ROVs have been constructed and assembled and have gone through counterweight and control tests at the port, and operational drills have also been conducted successfully in the waters near Liuqiu Island.

◀ 海洋中心與中山大學合作研發之輕型工作級 ROV
Light Work-Class ROV developed by TORI and National Sun Yat-sen University

R&D and Service Accomplishments

研發與服務成果

4

焦點疊合自動顯微拍照(TORI FOCUS)科研服務

科學影像是溝通研究議題的視覺語言，也是拓展科學知識的素材。海洋中心自主研發的焦點疊合自動顯微拍照系統 (TORI FOCUS)，能自動拍照並組合多張不同焦距的顯微圖像，合成產出清晰的影像。2021 年新增中部科研據點，協助高雄及臺中地區累計 168 人次、拍攝 2,329 件標本的清晰圖像，部分高解析照片已成為科普教育推廣之素材。

Scientific Research Support Services via TORI FOCUS

Scientific images are a visual language that facilitates communication between researchers, and they are also the raw materials upon which our scientific knowledge can be expanded. TORI FOCUS, a focus-stacking automatic micrograph system developed by TORI, combines images taken automatically at varying focal points via image overlay techniques to synthesize clear images. In 2021, TORI established a new scientific research location in central Taiwan and provided assistance to researchers in Kaohsiung and Taichung 168 times by acquiring high-clarity images of 2,329 specimens, part of which have been used in promoting science education for the general public.

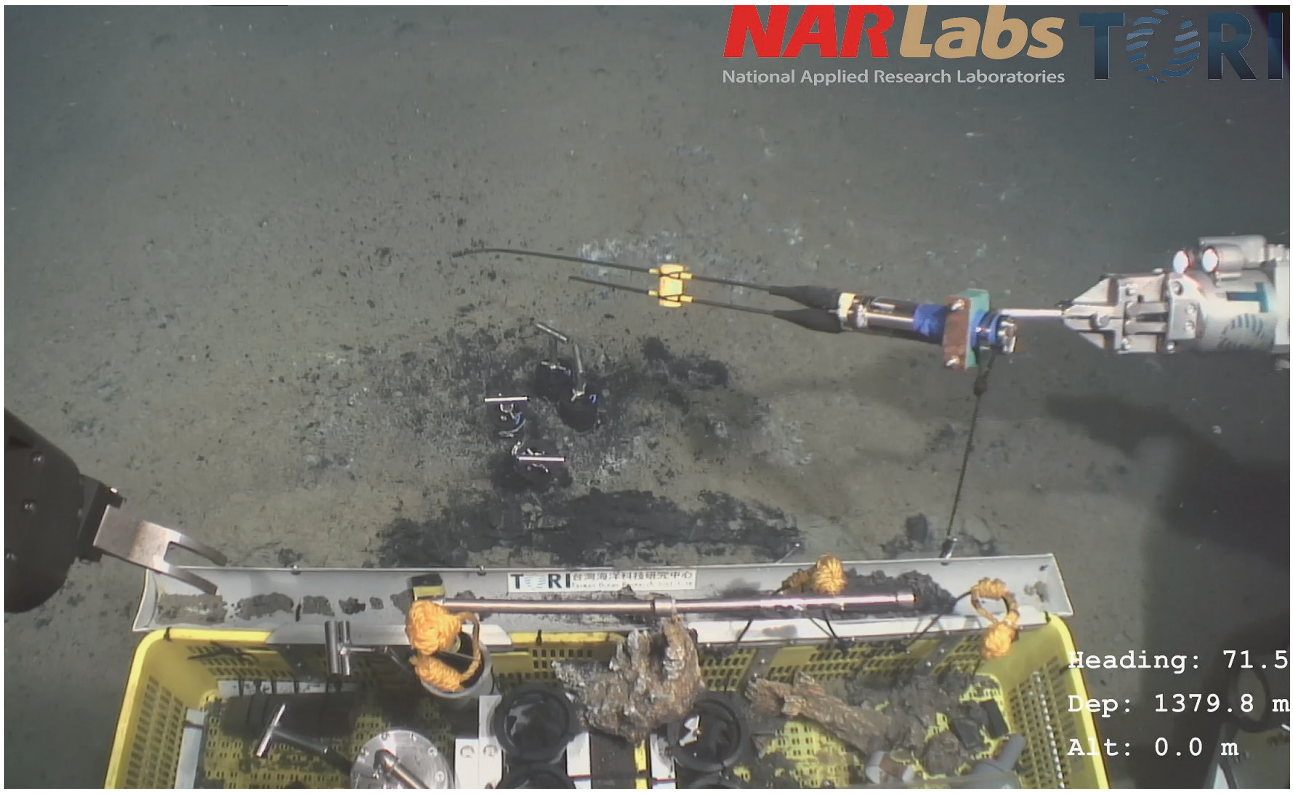
▲ TORI FOCUS 的顯微拍照成果
TORI FOCUS micrograph results

臺灣東北海域—南沖繩海槽探索

勵進研究船搭載重型工作級水下遙控無人載具 (ROV)，於 5 月前往臺灣東北部的南沖繩海槽棉花火山場址，進行地質與礦產調查。ROV 兩次下潛到 1,392 公尺與 1,380 公尺深處，水下作業時間平均達 8 小時，機組人員熟練地操控 ROV 避開水下多變流場與炙熱干擾，順利完成海底熱液探勘、礦石與沉積物樣本採集。

Exploring Taiwan's Northeast Waters and Southern Okinawa Trough

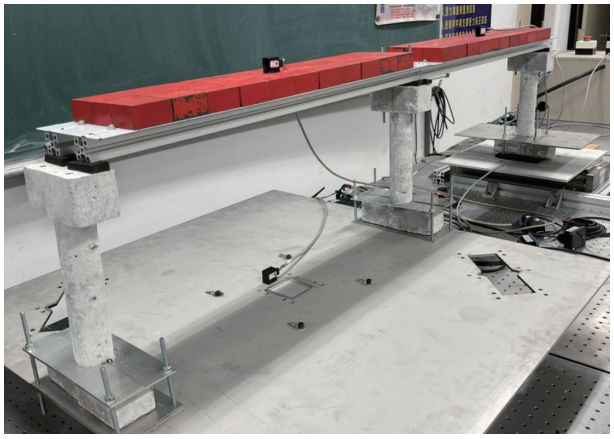
Equipped with a remotely operated underwater vehicle (ROV), R/V LEGEND traveled to the southern Okinawa Trough, located in an area northeast of Taiwan, in May and conducted geological and mineral deposit surveys at the Mien-hua Volcano site. The ROV was lowered to the depths of 1,392m and 1,380m on two separate occasions and conducted operations lasting 8 hours on average. The crew maneuvered the vehicle skillfully to avoid variable flow fields and incandescent interference to successfully complete the survey of undersea hydrothermal fluids and the collection of mineral deposits and sediment samples.



▲ ROV 執行地熱測量
ROV performs geothermal measurements

跨斷層橋梁耐震性能分析研究

國震中心與中原大學合作，透過案例參數研究，以多支承輸入之非線性動力歷時分析方法，探討動態斷層錯動對不同橋梁結構系統耐震性能的影響，並配合小型振動台試驗來驗證分析結果。另外也透過分析研究，評估各種橋梁的耐震因應對策對跨斷層地震之減災效益，包括將多跨簡支橋梁之主梁連續化，以改良為連續橋梁等。



▲ 跨斷層橋梁耐震性能研究試驗模型
Research model for earthquake resistance of cross-fault bridges

Earthquake Resistance Analysis of Cross-Fault Bridges

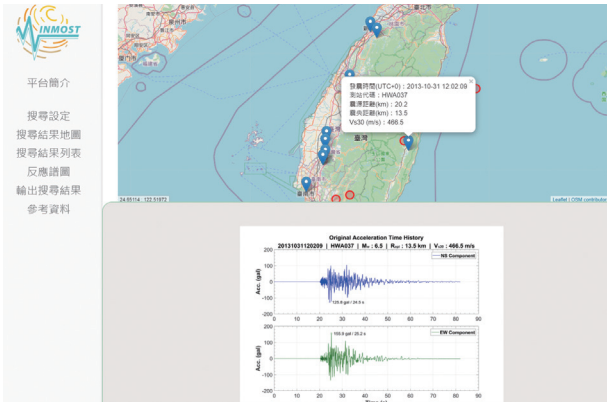
In collaboration with Chung Yuan Christian University, NCREE investigated the impact of dynamic fault movement on the earthquake resistance of different structural systems of bridges through parameter study using nonlinear dynamic time-history analysis with multi-support input, validating the results of a small-scale shaking table test. In addition, through analytical studies, the disaster mitigation benefit of various bridges' seismic countermeasures for cross-fault earthquakes were evaluated, including the continuation of the main beams of multi-span simply supported bridges to allow them to become continuous bridges.

臺灣工址輸入地震查選平台(INMOST)服務上線

為解決實務上執行非線性歷時分析時，常遭遇如何挑選與調整實測輸入地震的瓶頸，國震中心開發「臺灣工址輸入地震查選」(INMOST) 平台(http://seaport.ncree.org/inmost)，可對應我國現行規範要求、適用全臺一般工址、具備視覺化查詢及多功性圖表展示功能，且能提供優選地震紀錄與完整地震資訊，將有助於提升我國耐震設計與檢核的水準。

Input Motion Selection for Taiwan (INMOST) Service Goes Online

In order to address the bottleneck of how to select and modify recorded motion when performing nonlinear time-history analysis, NCREE has developed the Input Motion Selection for Taiwan (INMOST) platform (http://seaport.ncree.org/inmost). INMOST follows Taiwan's current regulations, is applicable to all general sites in Taiwan, has visual query and versatile graphical display functions, and can provide suitable seismic records and complete seismic information. INMOST will help to improve the practical application of seismic analysis and design in Taiwan.



▲ 臺灣工址輸入地震查選平台 (INMOST)
Input Motion Selection for Taiwan (INMOST)

抗疫2.0專案與疫情地圖服務 挹注創新與防疫治理

國網中心推動科技抗疫2.0專案，供應算力、儲存、資料分析工具、病毒基因定序分析等國家級科技資源，加速疫情資訊整合技術之開發，執行至9月共通過120件專案；於3月建置「COVID-19全球即時疫情地圖」（https://covid-19.nchc.org.tw），串接美國約翰霍普金斯大學與臺灣衛福部數據，例如疫苗覆蓋率、全球解封指數等，以動態視覺化介面呈現，提供快速便利之疫情分析。

▲ 科技抗疫 2.0 專案
Tech v Virus 2.0 project

Tech v Virus 2.0 and COVID-19 Dashboard Contribute to Innovation and Governance

The Tech v Virus 2.0 project offers computational power, storage, data analysis tools, virus genomic sequencing analysis, and other technological resources available only to topic researchers, enabling the development of integrated pandemic information technologies. There were a total of 120 approved projects as of September. The COVID-19 Dashboard (https://covid-19.nchc.org.tw/?language=en), completed in March, brings together data compiled by John Hopkins University and Taiwan's Ministry of Health and Welfare and provides up-to-date analysis, such as vaccination coverage and a "world unblocking index" via a user interface with dynamic visualization capabilities.

最新一代超級電腦— 台灣杉三號開放服務

全新超級電腦—台灣杉三號於2021年第二季開放服務，共50,400個計算核心，總記憶體為172.8 TB，浮點計算能力為2.7 PFlops，為目前世界排名第181名、國內第1名的純CPU高效能計算主機，效能為台灣杉一號2倍左右，為服務國內廣大學研界之科學研究增添動能。

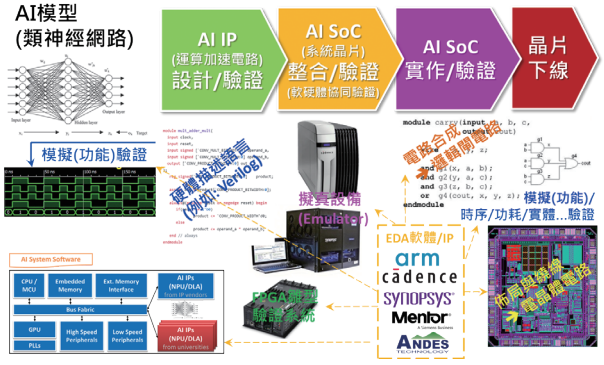
Next-gen Supercomputer Taiwania 3 Now Open to Researchers

First made available in the second quarter, the all-new supercomputer Taiwania 3 features 50,400 computing cores, 172.8 TB of memory, and an overall performance of 2.7 peta floating point operations per second (PFLOPS). Taiwania 3, an exclusively CPU-based powerhouse, is currently the country's top-performing supercomputer and ranks 181st overall in the world. Its outstanding performance, about twice that of Taiwania 1, is expected to reduce program runtime significantly.

▲ 台灣杉三號
Taiwania 3

打造臺灣學界 AI 晶片設計與關鍵技術開發之生態環境

半導體中心在既有數位晶片設計環境基礎上，建立人工智慧 (AI) 系統晶片設計平台及實作驗證環境，打造臺灣學界多樣化應用之 AI 晶片設計與關鍵技術開發的生態環境。AI 晶片設計技術門檻高，半導體中心提供的生態環境讓學界只要將創新想法加入平台，就能設計出完整 AI 晶片，以達成頂尖論文發表、高階人才培育或衍生新創的研發目標。



▲ AI 系統晶片設計平台及實作驗證環境
AI chip design platform and validation environment

Creating an Ecosystem for Taiwan's AI Chips and Key Technologies

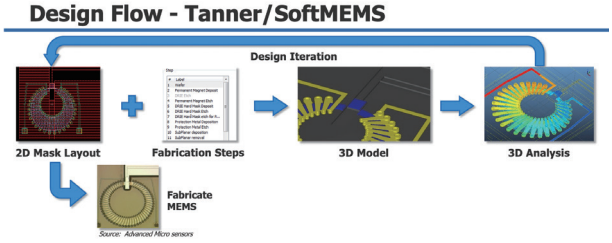
Based on existing semiconductor design environments, TSRI has established an AI SoC (System on a Chip) design platform as well as an implementation and verification environment to provide researchers in academia with an ecosystem for developing key technologies in AI chip design aimed at diverse applications. As designing AI-based chips requires a very high level of technical know-how, TSRI's ecosystem enables researchers to realize their chip designs in their entirety by simply implementing their innovative ideas on the platform. This helps to fulfill R&D objectives, including the production of high-impact research papers, cultivation of high-end talents, and creation of start-up enterprises.

引進微機電軟體開發平台

引進全球三大 EDA 廠之一西門子公司市值超過 500 萬美元的「微機電開發平台」，此平台廣泛應用在全球最先進的 5G 濾波器及各種高階微機電傳感器的開發，接軌國際標準，可協助國內學界優秀的研究成果在模擬推演下，轉譯為業界的生產技術，提供業界商品化參考；更重要的是，此平台讓國內碩博士生在論文研究階段即可使用與業界相同的軟體環境，降低學用落差。

New MEMS Software Development Platform

TSRI acquired the US$5-million MEMS Design solution from Siemens EDA, one of the three largest EDA vendors in the world. The global standards-compliant platform, widely deployed in the development of the most advanced 5G filters and high-end MEMS transducers, will help translate the excellent research of Taiwan's academia into industrial production technologies via simulation modeling, and it also will provide guidance on product commercialization. Most importantly, with this system, graduate students will have access to the same advanced software environment used in the industry while working on their dissertations, which will help bridge the academia-industry research gap.



▲「微機電開發平台」設計流程
"MEMS Development Platform" design process

COVID-19 小鼠模式

因應 COVID-19 疫苗與藥物開發需求，動物中心提供 3 種疾病模式動物 (ACE2 humanized mouse models)，包含模擬輕症、重症的基因改造鼠及研究細胞激素釋放症候群的免疫擬人鼠。病毒感染後誘發激烈免疫反應，或是肥胖、糖尿病及高血壓等慢性疾病造成的加成影響，是 COVID-19 從輕症到重症死亡的關鍵轉折。透過提供不同階段動物模式及分析方法輔助驗證，支援相關基礎研究及治療方法開發。

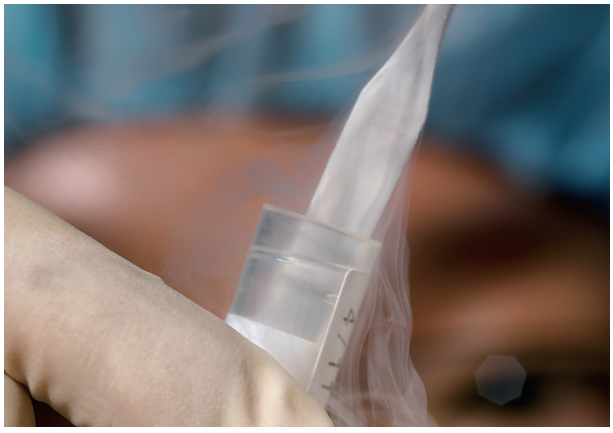
COVID-19 Mouse Models

To address the need for developing COVID-19 vaccines and drugs to treat infections, NLAC provides three types of animal models for disease testing (ACE2 humanized mouse models), including genetically modified mice which mimic mild and severe conditions and humanized mice for investigating cytokine release syndrome. Viral infection often triggers a violent immune response, meanwhile, obesity, diabetes, hypertension, and other chronic diseases could exacerbate the conditions that lead to severe conditions or death, even if the initial infection was mild. NLAC is now able to support relevant basic research and the development of treatment procedures by verification of animal models at different stages with various analysis tools and methods.

▲ 動物中心提供 3 種 COVID-19 疾病模式小鼠
NLAC provides 3 types of mouse models for COVID-19

方舟專案—實驗鼠資源緊急保種

為避免國內 COVID-19 疫情升溫導致實驗動物設施緊急關閉，於三級警戒期間，動物中心輔助生殖實驗室協助國內 10 個科研單位緊急保存 54 個品系的冷凍精子種原，解除面臨斷種的危機。期間亦持續保存寄存於動物中心的 3,173 個品系，作為國內產學研界的備援後盾，為珍貴的生醫研發成果提供保障。



▲ 利用冷凍保存技術凍存重要研究成果
Freezing important research results with cryopreservation techniques

Emergency “Noah’s Ark” Program Helps to Preserve Rodent Resources

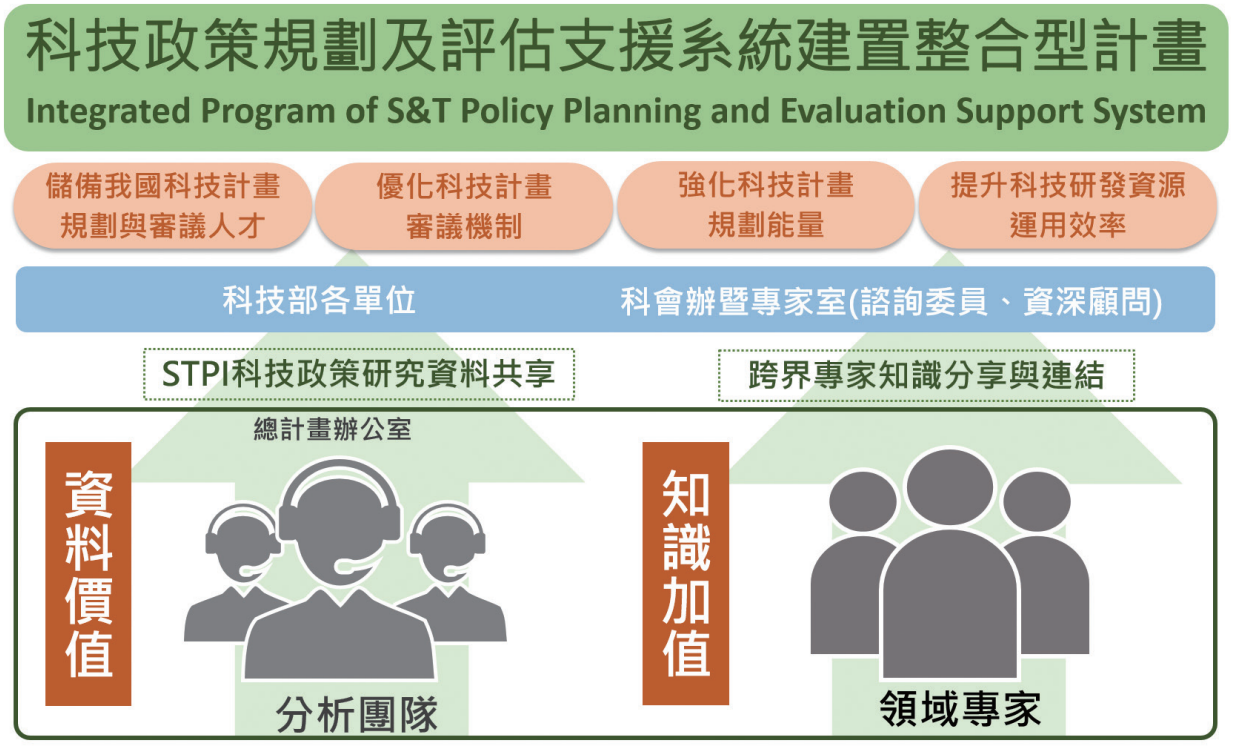
The domestic outbreak of COVID-19 caused the emergency closure of laboratory animal facilities under the Level 3 epidemic alert. To avoid many precious rodent strains being cut off, the Assisted Reproduction Laboratory of NLAC urgently helped 10 domestic research institutes to cryopreserve the sperm from 54 strains. A total of 3,173 strains of laboratory rodents continued to be preserved in the rodent model resource center (RMRC) of NLAC during this crisis period. RMRC serves as a crucial safeguard of rodent repository resource for the biomedical industry and research community in Taiwan.

整合跨域專家運作科技政策規劃及評估支援系統

科政中心為協助科技部優化科技計畫規劃、執行及評估效益，就審議、執行、結構等三個面向提出具體之科技計畫規劃與審查機制優化的建議。在提升科技研發資源運用效率上，針對科技綱要計畫書與法人執行科技計畫之概況進行盤點與分析，以瞭解科技計畫資源分配狀況，並進一步提出優化資源運用的建議，同時建立群組專家常態性的研討平台，培育我國科技計畫規劃與審議人才。

Integrating Interdisciplinary Experts to Enable Support System for Planning and Evaluating S&T Policies

To assist in MOST's plan to improve the planning, execution, and performance evaluation of S&T programs, STPI has proposed specific recommendations to improve the mechanisms for planning and evaluating S&T programs based on the following three aspects: review, implementation, and structure. On the issue of improving the efficiency of utilizing R&D resources in S&T programs, surveys and analyses have been conducted on technological outline plans and the general status of S&T projects implemented by non-profit institutions for the purpose of understanding the allocation of resources for S&T programs. STPI aims to propose recommendations for improving their utilization, establish a permanent forum for group experts, and train talent in the planning and evaluation of S&T programs on behalf of the country.



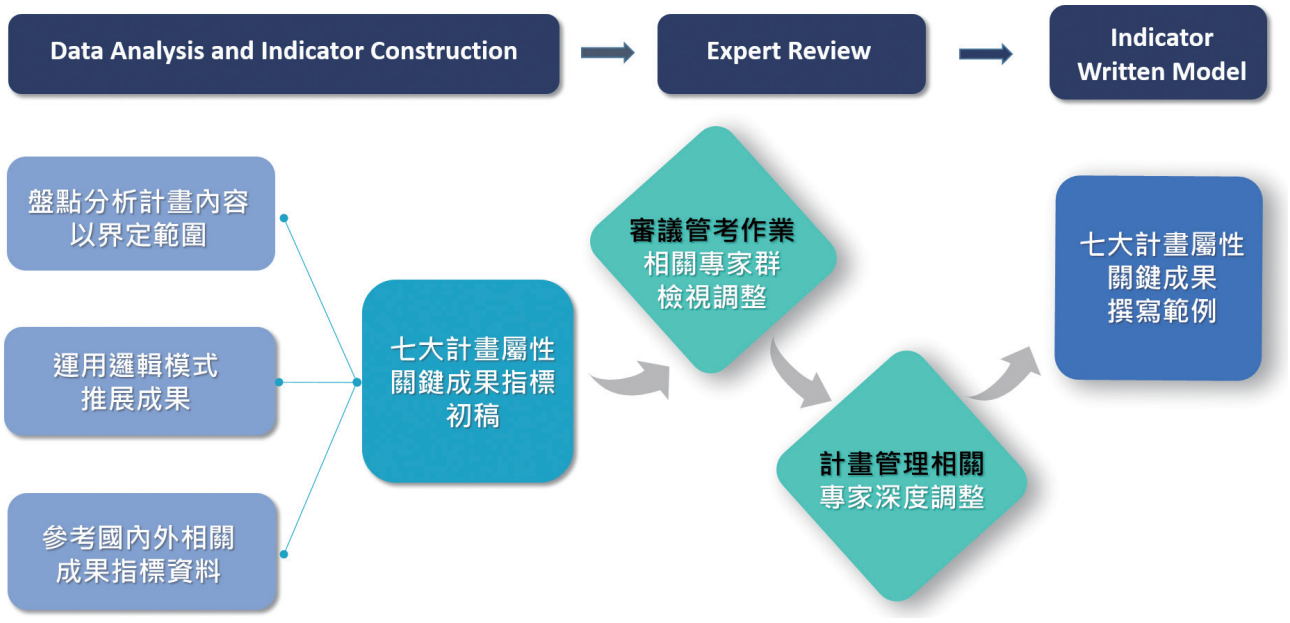
▲ 科技部跨部會協調平台架構
MOST's Inter-Ministerial Coordination Platform framework

完成「七大屬性科技計畫關鍵成果指標」範例

為使科技計畫的關鍵成果與社會經濟效益產生直接關聯，並協助各部會強化科技計畫審議與評估效益，科政中心針對七大屬性科技計畫進行關鍵成果指標撰寫範例研究，透過計畫內容盤點分析，並借鏡國內外成果指標，利用邏輯模式推導出重要關鍵成果及指標，完成一份各部會及領域專家皆認同之指標範例。此範例將直接影響 2023 年科技計畫審議評估機制，協助強化部會設定之關鍵成果品質，進而優化科技計畫管理效能。

Key Achievement Indicators for Seven Categories of S&T Programs

In order for society to benefit economically from the key achievements of national S&T programs in a direct manner, as well as to help government ministries and councils to become more effective in evaluating such S&T programs, STPI has conducted research on the authoring of templates for key achievement indicators for the seven major S&T program categories. Having surveyed and analyzed each program's details and having learned from the experience of other organizations, both at home and abroad, in their developments of achievement indicators, STPI successfully completed the design of an indicators template, later approved by all ministries and domain experts, by employing a logical model to deduce important key achievements and their associated indicators. This new template will have a direct impact on how S&T programs are evaluated in 2023, and it will also help to strengthen the quality of key results set by each ministry or council, ultimately improving the efficiency of managing S&T programs.

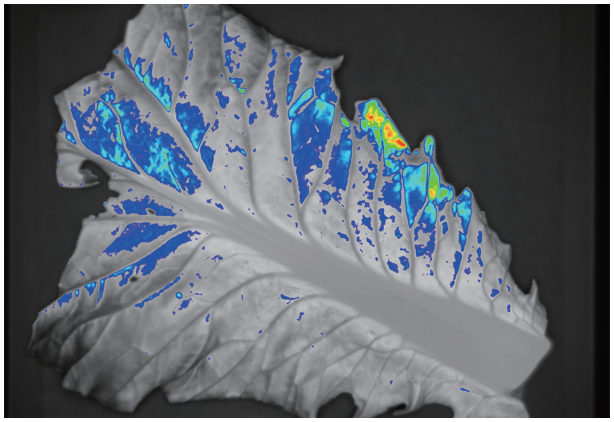


▲ 七大計畫屬性關鍵成果撰寫範例研究流程

Key achievements for 7 categories of science and technology programs: written model research process

聯手臺灣大學與清華大學提升農藥殘留篩檢效率

儀科中心利用長期累積的影像光譜技術，與臺灣大學及清華大學合作，開發「免萃取式農藥殘留快速偵測系統」，只要 30 秒就能偵測農藥超標之農產品，且不需專業人員執行繁瑣的萃取步驟，可有效避免取樣偏差，大幅提升農作物的農藥殘留篩檢效率，因此榮獲第 18 屆國家新創獎—學研新創獎。



▲ 葉菜農藥殘留超標示意圖
Diagram showing excessive pesticide residue in leafy vegetables

Collaboration with NTU Hospital on New and Efficient Method to Detect and Screen Agricultural Pesticide Residues

Leveraging its extensive expertise on image spectrum technology, TIRI joined forces with National Taiwan University College of Medicine to develop the Extraction-free Rapid Detection System for Pesticide Residue, which is capable of detecting excessive levels of pesticide residues in agricultural products in just 30 seconds without the need for professionals to perform complicated extraction procedures, thus effectively avoiding sampling deviation and greatly improving the efficiency of screening pesticide residues in crops. For its innovative technology, the system won the Academic Research Innovation Award at the 18th National Innovation Awards.

與慈濟醫院合作開發「智慧藥箱」解決偏鄉用藥問題

儀科中心與花蓮慈濟醫院合作開發「智慧藥箱」，解決偏遠地區病患取藥不易、且藥品配給後常發生病患忘記用藥或弄錯藥物服用間隔、數量與方式等問題，因此榮獲第 18 屆國家新創獎—臨床新創獎。

"Smart Medicine Kit" Developed with Tzu Chi Hospital Aims to Improve Administration of Medication in Remote Areas

TIRI partnered with Hualien Tzu Chi Hospital to develop the Smart Medicine Kit, which is aimed at helping patients living in remote areas of the country to access the correct medication as well as to take the right dosage at the right time and in a manner prescribed by physicians. The device won an award at the 18th National Innovation Awards in the Clinical Innovation category.

▲「智慧藥箱」解決偏鄉用藥問題
"Smart Medicine Kit" solves the problem of medication dispensing in remote areas

福爾摩沙衛星五號協助乾旱監測

由於 2020 年罕見地沒有颱風登陸臺灣，加上全年降雨量偏少，造成本島 2021 年初陷入自 1947 年以來最嚴重的乾旱，西部地區許多水庫的蓄水量不到 20%，有些水位甚至低於 10%，導致各地區進入不同程度的減壓供水、限水、停耕、歇業等情況。太空中心提供福衛五號遙測影像，與聯合新聞網、極現科技公司三方合作，製作水庫地區於乾旱前後期的新聞報導 (https://topic.udn.com/event/droughtreservoir) 。

FORMOSAT-5 Monitors Drought Conditions

The year 2020 was a very dry year for Taiwan, as not a single typhoon landed in the country. At the beginning of 2021, the resulting drought became the most serious on the main island since 1947. The storage capacities of many reservoirs in the western region fell below 20%, with several even reaching levels as low as 10% or lower, causing reduced water supply, restrictions, cessation of farming, and even closure of businesses in various regions and to different extents. NSPO provided remote sensing images from FORMOSAT-5 and collaborated with UDN News and Earthbook to illustrate the patterns before and after on areas around the country's reservoirs (URL: https://topic.udn.com/event/droughtreservoir).

◀ 新竹寶山水庫滿水位與乾旱期之衛星影像比對
Satellite images of the Hsinchu Baoshan Reservoir at full level and during drought

福爾摩沙衛星七號星系部署完成

太空中心衛星操控團隊於 2 月 3 日成功將福衛七號的 6 枚衛星全部佈署在高度 540-550 公里之任務軌道。福衛七號於 2019 年發射升空，在佈署完成之前即已開始執行觀測任務，佈署完成後可提供 24 小時均勻分佈的全球大氣層與電離層觀測資料，供氣象預報和太空天氣監測使用，可降低整體天氣預報誤差 11% 以上。

▲ 福衛七號 6 枚衛星任務軌道
Position and orbit of the six satellites in the FORMOSAT-7 constellation

FORMOSAT-7's Constellation of Satellites Deployed Successfully

All six satellites of FORMOSAT-7's constellation were successfully deployed on their mission orbits at altitudes between 540 and 550 km on February 3 by the control team. Launched in 2019, FORMOSAT-7 began to carry out its observation tasks even before the completion of its satellites' deployment. Currently, the constellation provides round-the-clock evenly distributed observation data on the atmosphere and ionosphere for weather forecasting and space weather monitoring, which reduces overall forecast error by at least 11%.

智慧化居住空間創意競賽「巢向未來組」金獎

國震中心團隊開發出「5D 智慧維運管理系統」，建置於臺南沙崙智慧綠能科學城 C 區進行實證應用，於第 14 屆「創意狂想巢向未來」智慧化居住空間創意競賽奪得金獎。此平台建立科技部資安暨智慧科技研發大樓及臺灣智駕測試實驗室兩棟建築物的 BIM 建築資訊模型，並整合沙崙科學城 C 區「用電資訊」、「AI 預測供電」、「環境監測及照明控制」等資訊，透過結合感測器資訊與位置，改善 2D 圖面空間限制，達到可視化維運管理新高度。

Gold Award in Intelligent Living Space Design Competition

The Shalun Zone C 5D Smart Operations & Management System, created by a team from NCREE, won the Gold Award at the 14th Intelligent Living Space Design Competition. This platform implemented the BIM models for the Cybersecurity & Smart Technology R&D Building and Taiwan CAR Lab, which is integrated with Shalun Smart Green Energy Science City Zone C's "power usage information", "AI power supply forecasts", "environmental monitoring and lighting control", and other relevant data. By combining the system with data collected by sensors and their positions, spatial limitations imposed by 2D images are no longer an issue, allowing visualization for operations and maintenance to reach new heights.

▲ 沙崙 C 區 5D 智慧維運管理系統
Shalun Zone C 5D Smart Maintenance and Management System

Development Plans

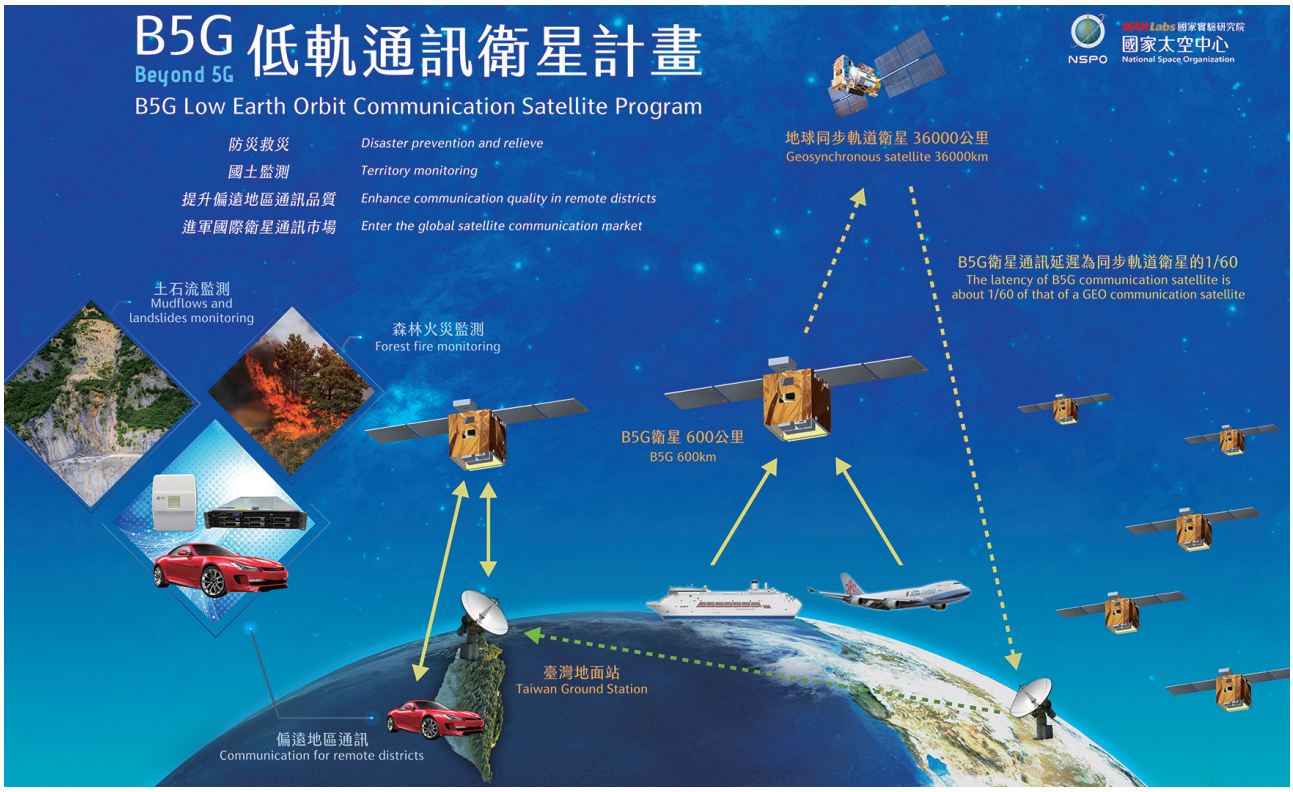
重點推動計畫

Beyond 5G 低軌衛星—通訊衛星計畫

為建立臺灣自主發展低軌通訊衛星的能量，包含衛星本體與酬載、地面設備技術以及相關產業的推動，未來期望達成臺灣偏鄉、高山與離島的寬頻服務，滿足國家需求且帶動通訊衛星產業，太空中心與工研院將合作發展兩顆高效能低軌通訊衛星，太空中心負責衛星本體，酬載由工研院負責，預計部署在 600 公里的低軌道上，進行在軌衛星到地面站的通訊測試與驗證。

Beyond 5G: The Low Earth Orbit (LEO) Communications Satellite Project

NSPO has set out to build up Taiwan's domestic capabilities in developing a low earth orbit (LEO) satellite communications system, which will range from developing satellites, payloads, and ground systems to promoting the development of space-relevant industries. Such undertakings are meant to serve the bigger picture of providing a nationwide broadband service network, which will cover even remote and mountainous areas as well as offshore islands, to satisfy domestic demand and propel the development of the communication satellite industry. NSPO and ITRI will collaborate to develop two high-efficiency LEO communications satellites. NSPO is responsible for the satellite while ITRI is responsible for the payload. It is expected to be deployed into a 600 km-high orbit for testing and verifying the communications between the satellite in orbit and the ground station.



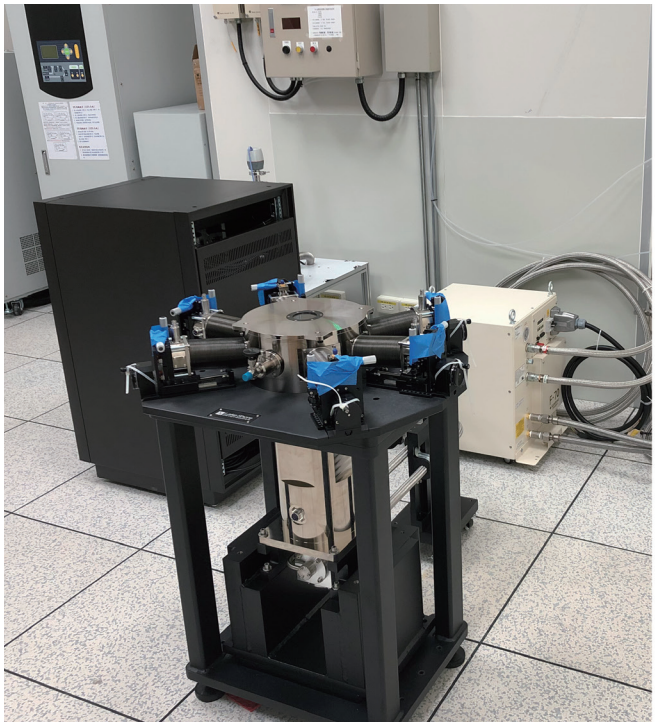
▲ B5G 低軌衛星計畫示意圖
Illustration of B5G low earth orbit satellite program

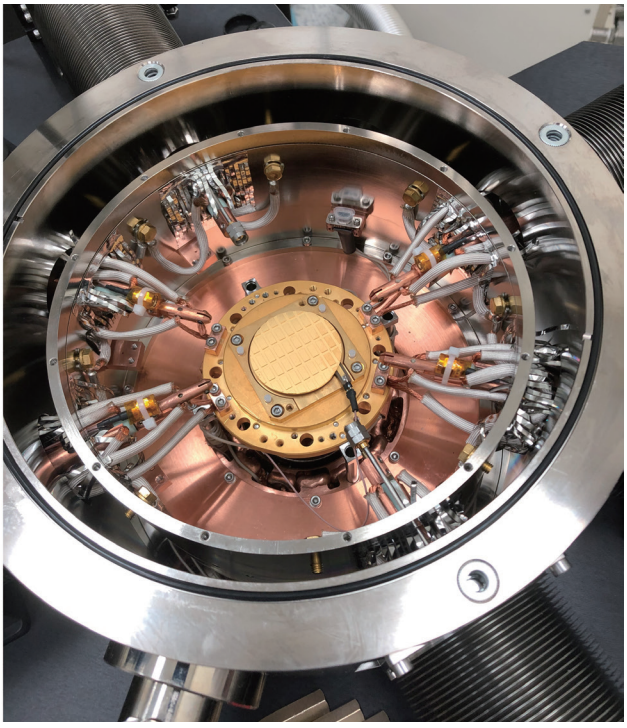
協助國內量子電腦計畫推動

半導體中心規劃建置超低溫 (4K) 數位 / 類比混合訊號及射頻電路晶片之低溫量測系統，進行量子位元 4K 控制電路設計及驗證，已利用不包含雙極性電晶體之電路架構，設計並製作出於 4K 下正常運作之線性穩壓器晶片，於連續測試 12 小時之內提供穩定的輸出電壓 (~0.95 V)。此外，並建置超低溫探針工作台，進行低溫電晶體 SPICE 模型所需之量測，已初步建立 4K CMOS SPICE 模型，透過半導體中心 cryo-CMOS 模型的建立，協助國內相關領域進行驗證工作。

The Driving Force behind Taiwan's Quantum Computer Project

TSRI plans to build a cryogenic (4K) measurement system comprising digital and analog/mixed signals and radio frequency (RF) chips that enable qubit-control circuit design and verification at a 4K temperature. In fact, TSRI has successfully designed and developed a linear voltage regulator integrated circuit (IC) capable of operating at 4K without a bipolar junction transistor (BJT) in its circuit architecture. The IC demonstrated stable output voltage (~0.95 V) throughout a 12-hour test. Moreover, TSRI will build a cryogenic probe station that allows for low-temperature measurements required by Simulation Program with Integrated Circuit Emphasis (SPICE) models. Currently, TSRI has set up a preliminary SPICE model, which, together with the cryo-CMOS (Complementary Metal Oxide Semiconductor) in the pipeline, is envisioned to facilitate the verification work of relevant sectors in Taiwan.





▲ 超低溫探針工作台
Cryogenic probe station

TIRI 台灣儀器科技研究中心

國內首創大面積二維材料製程與關鍵設備

儀科中心將開發大面積二維材料製程與關鍵設備，協助本土設備商切入二維材料製程設備並導入次奈米製程，領導國內半導體產業邁入新世代半導體元件開發，並進入高附加價值之半導體製程設備供應鏈，使國內廠商能佈局下世代半導體製程與設備產業。

▲ 大面積二維材料製程設備
Large-area 2D material processing equipment

Developing Taiwan's First Key Equipment for Large-scale Fabrication of 2D Materials

TIRI has set out to pursue the development of the key equipment for large-scale fabrication of 2D materials to help domestic equipment manufacturers break into the 2D material manufacturing and equipment market and move beyond the 1nm process. The manufacturers will then lead Taiwan's semiconductor industry to develop next-generation semiconductor devices and enter the supply chain of high value-added semiconductor manufacturing equipment. This is expected to assist domestic companies to establish their roadmaps for venturing into the next-generation semiconductor manufacturing equipment industry.

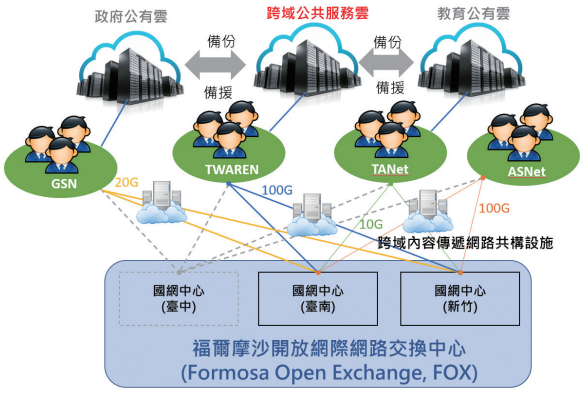
NCHC 國家高速網路與計算中心

建置公部門網路交換中心與混合雲 提升數位治理成效

國網中心將建置公共服務網路交換中心，導入先進網路傳輸技術與人工智慧網路維運管理系統，串聯政府四大網路 GSN、TWAREN、TANet、ASNet，提升國內跨網傳輸效率及備援能力；並建構跨域公共服務雲，以系統備援備份協助政府關鍵服務不中斷，整備智慧國家所需之數位網路基礎設施。

Enhancing Digital Governance Effectiveness by Developing the Public Service Internet Exchange and Hybrid Cloud

NCHC aims to establish the Public Service Internet Exchange with a management system maintained and operated with advanced transmission technology and Artificial Intelligence (AI). By integrating Taiwan's four major networks, namely GSN, TWAREN, TANet, and ASNet, it is envisioned to increase the efficiency of transmission over networks and enhance backup solutions. NCHC also aims to develop a cross-field public cloud service, which will help ensure the continuity of the government's key services through its system backup and recovery and get an all-digital network infrastructure ready for a Smart Taiwan future.



▲ 福爾摩沙開放網際網路交換中心
Formosa Open Exchange

海洋探測設備自主研發能量展現

科學研究議題之開展受限於儀器設備，而國內海洋科儀設備長期仰賴國外進口，不但購置成本高昂，且面臨後續維修困難之困境。考量海洋研究探測之永續發展，海洋中心規劃未來 10 年之自主研發項目，目前已完成海底地震儀、海底電磁儀、輕型工作級 ROV、海氣象資料浮標觀測系統、水下滑翔機原型機等設備，將逐步建立海洋探測設備自主研發與維運之作業能量。

Harnessing Taiwan's Independent R&D Capabilities with Home-Built Marine Exploration Equipment

The limits of scientific research are largely defined by the instruments and equipment available. In the case of Taiwan, scientific equipment for marine exploration has been mostly imported over the years, which translates into not just expensive costs but also the challenges of repair and maintenance. To ensure the sustainable development of marine research and exploration, TORI has laid out a series of independent R&D projects for the next ten years. To date, projects that have been completed include the development of an ocean-bottom seismometer, the Ocean Bottom Electro-Magnetometer (OBEM), a light-duty work-class ROV, an ocean data buoy system, and the Underwater Glider prototype. Building upon such a foundation of work, TORI will progressively expand its independent capabilities in the R&D and maintenance of home-built marine exploration equipment.

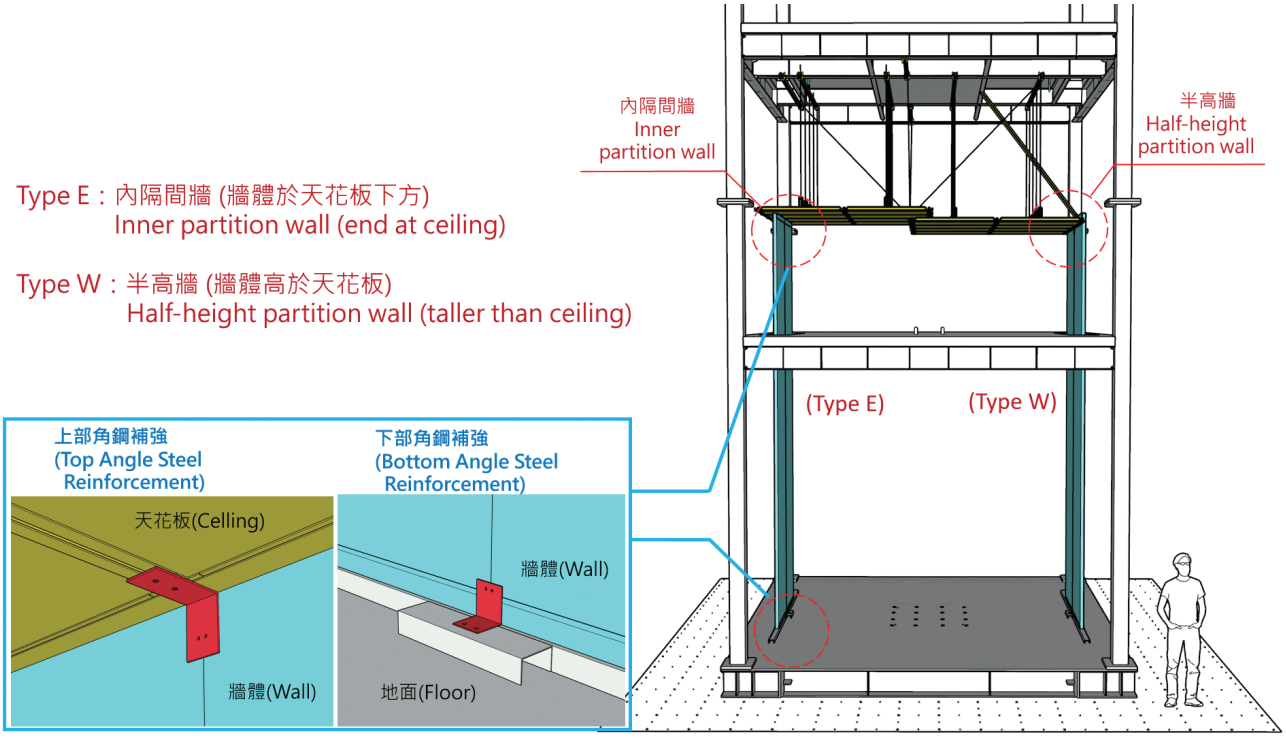
▲ 海洋中心自主研發之海洋科學儀器
TORI's self-developed marine science instruments

能源與民生關鍵設施之耐震能力提升

有別於一般建築中震可修、大震不倒的性能要求，關鍵設施如醫院、科技廠、發電廠等，於震後必須力求正常運作。國震中心長期著墨於提升關鍵設施非結構耐震性能，2021 年起與日本名古屋大學、成功大學合作，模擬神戶大地震、九二一大地震下，建築內部非結構系統受震情境，以研發建築隔震、非結構補強等耐震性能提升之有效策略。

Upgrading the Seismic Performance of Energy and Critical Infrastructure

Most buildings are generally designed to achieve the seismic performance of being repairable under moderate earthquakes and exempted from collapse under strong earthquakes. However, critical infrastructure, such as hospitals, high-tech plants, and power plants, require the continuity of normal operation after an earthquake. To this end, NCREE has long been devoted to improving the seismic performance of non-structural components in critical infrastructure. For instance, it has joined hands with Nagoya University in Japan and National Cheng Kung University since 2021 to perform earthquake simulations of the Great Hanshin earthquake and the Chi-Chi earthquake, studying their seismic scenarios with a focus on non-structural systems in buildings. The goal is to develop effective strategies for upgrading seismic performance, such as developing seismic isolation system for building structures and seismic-strengthening techniques for non-structural systems.



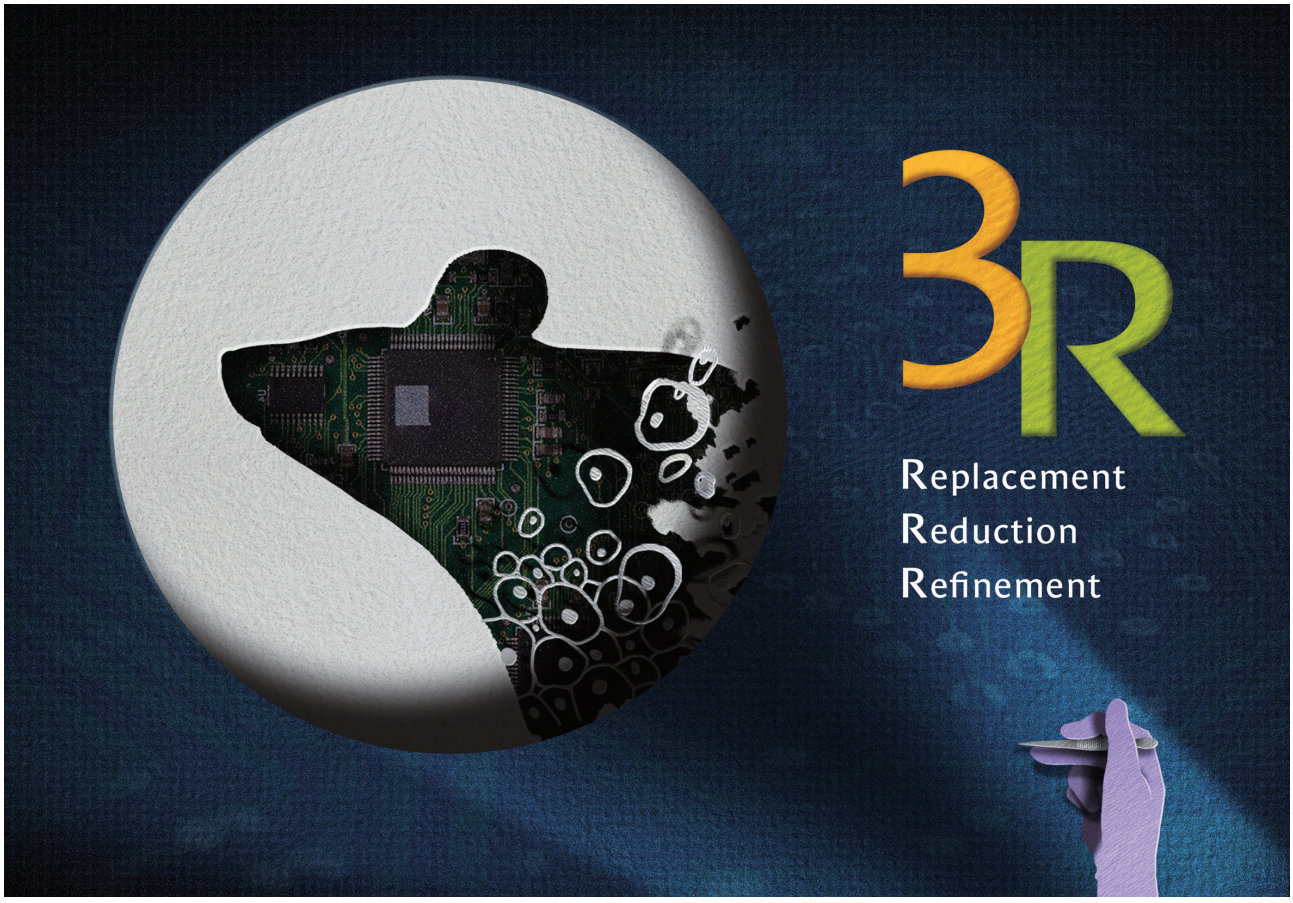
▲ 兩個獨立的系統同時試驗的耐震研究
Simultaneous testing of two systems for seismic studies

推動動物實驗 3R 替代

實驗動物議題一直受到各界關注，但在醫藥及醫材開發之臨床前試驗可完全被替代前，動物試驗仍是把關安全性及功效性的重要環節。動物中心經科技部指導，於 2021 年第四季成立 3R 辦公室，建立國內產學研界及民間團體的對話管道，增進國內外技術交流，並成立替代測試方案的研究平台及工作小組，推動替代方案發展。

Supporting 3Rs

Preclinical test using animals have long been a concern for many. However, it is currently irreplaceable as a guardian of safety and efficacy of new drug and medical device development. Therefore, the top priority is to ensure the quality of animal testing and in the meanwhile develop replacement system. Supervised by the MOST, NLAC has set up an office dedicated to 3R principles for animal research. The office will engage industry, academia, research institutes, and the society in conversations and boost technical exchanges. It has also establish a research platform and a task force to lead the efforts of promoting alternatives to animal testing.



▲ 動物實驗 3R—「替代」(Replacement)、「減量」(Reduction) 及「精緻化」(Refinement)
The 3R's of animal experimentation: Replacement, Reduction, and Refinement

Collaboration Connecting Industry-Academia-Research

鏈結產學研合作

06

愛延續健康永續—跨域合作 精準健康大數據平台啟航

國網中心與中研院臺灣人體生物資料庫、國衛院人體生物資料庫整合平台攜手 (https://event.nchc.org.tw/2021/love)，以國家級高速網路與雲端運算設施，提供資料庫所需之龐大計算分析及釋出服務，協助基因數據資料串接、釋出、管理、應用，並同時確保安全與可用性，為精準健康的工作奠基。

Sustaining Health with the Love that Goes On: Taiwan Launches the Health Big Data Platform

In collaboration with the Taiwan Biobank of Academia Sinica and the National Health Research Institutes Biobank integration platform (https://event.nchc.org.tw/2021/love), NCHC provides powerful computational services required to operate the Taiwan Biobank. Using its national-level high-speed network and cloud computing facilities, NCHC assists in the concatenation, release, management, and application of genetic data, while also ensuring security and availability to lay the foundation for precision health work.

◀「愛延續健康永續」網站
Website of the health big data platform

世界首創 8 吋矽基氮化鎵 晶圓技術

儀科中心與中央大學及進化光學公司合作，共同研發第三代半導體核心材料的矽基氮化鎵晶圓磊晶技術，成功應用於大面積 8 吋矽晶圓，技術領先全球，帶領臺灣半導體供應鏈邁向一個新的里程碑，目前為世界第一。

Developing the World's First 8-inch GaN-on-Si Epitaxy

TIRI, together with National Central University and Microluce, Ltd., has successfully developed the epitaxial technology of gallium nitride on silicon (GaN-on-Si), one of the key "third-generation semiconductor" materials. It is compatible with 8-inch wafers. This world-leading technology marks a new milestone of bringing Taiwan to the number one position in the global semiconductor supply chain.

◀ 世界首創 8 吋矽基氮化鎵晶圓技術
World's first 8-in. GaN-on-Si wafer technology

臺灣首艘自製「第一代雙載水下載具 MUV」實海測試

海洋中心與其他 6 個產學單位合作完成臺灣首艘自製「第一代雙載水下載具 MUV」之實海測試，海洋中心除了參與載體流體動力分析之外，大洋探測團隊與勵進研究船操船團隊負責系統佈放與回收，並提供寬廣甲板整備空間以及高機動性的整備支援。透過海洋中心的支援，MUV 順利執行上浮下潛、垂直航行、水面航行及水下潛航等功能。

Taiwan's Home-Built "First-Generation Two-pilot Manned Underwater Vehicle (MUV)" Completes Sea Trials

TORI, together with six other industry-academia collaborative partners, successfully completed the sea trials of their first-generation two-pilot manned underwater vehicle (MUV), which is also the first home-built MUV in Taiwan. In addition to analyzing the hydrodynamic forces acting on the vehicle, the ocean exploration team and the crew responsible for maneuvering the R/V Legend were in charge of the deployment and recovery of the vehicle. TORI also provided a spacious deck and high-mobility assistance to facilitate the preparation work. With TORI's support, the MUV successfully executed a wide range of movements, such as ascending and descending, vertical movement, surface navigation, and submerging.

▲ 勵進研究船佈放雙載水下載具完成實海測試
Legend research vessel deploys underwater vehicle, completing on-sea trial

無噪表面振動麥克風

半導體中心與中正大學合作，開發振動式麥克風 vMic，直接貼近於聲帶附近的皮膚表面，就可以感測講話時所產生的振動，進而轉換成正常的聲音而不受周遭環境雜音的影響。搭配先進的 AI 補償演算法，可以讓聲音更清楚且真實。透過黏貼式及夾式兩種機構外觀設計，可以讓 vMic 輕鬆地貼在皮膚上或夾在衣服或帽帶上。概念成品於 1 月 11 日至 14 日 CES 線上展出。

vMic, the Noise-free Surface Vibration Microphone

TSRI and National Chung Cheng University have jointly developed the vMic, a surface vibration microphone that senses the vibrations of speaking when it comes into contact with the skin near the throat. The vibration is then converted into the sound we would normally hear, but without the interference of background noise. Utilizing an advanced AI compensation algorithm, the vMic is also able to deliver a clearer and more authentic sound. It is available in two designs, adhesive and clip-on, which allow the vMic to be easily adhered to a person's skin or clipped on their clothes or a chinstrap. The finished product was showcased at the online Consumer Electronics Show (CES) from January 11 to 14.

◀ 無噪表面振動麥克風 vMic 產品照
Noise-free surface vibration microphone vMic

新興傳染病研究核心設施平台

動物中心與國防醫學院預防醫學研究所 P3 實驗室合作，透過新興傳染病研究核心設施平台提供聯合服務，除了供應倉鼠進行臨床前試驗外，並提供 COVID-19 檢測分析，協助研究團隊進行攻毒後動物感染模式之病理分析及檢測報告，包含免疫組織染色、病理診斷、血液生化分析及全景玻片掃描等，支援疫苗及藥物開發之功效評估。

Emerging Infectious Diseases Core Facility Platform

NLAC has collaborated with the P3 laboratory at the Institute of Preventive Medicine at National Defense Medical Center to provide services jointly via the Emerging Infectious Diseases Core Facility Platform. Apart from supplying hamsters for pre-clinical tests, this platform also supports the COVID-19-related analyses, helping research teams to perform pathological analysis for the infected animals and provide pathological reports. These analyses include immunohistochemistry (IHC) staining, pathological diagnosis, blood biochemistry analysis, and whole slide imaging, which in turn facilitates the efficacy evaluation of vaccine and drug.

◀ 新興傳染病核心設施平台
Core facilities for emerging infectious diseases platform

Fostering of Scientific and Technological Manpower

科技人才培育

太空產業專班課程

為促進國內業者多了解太空產業應用，太空中心規劃太空環境驗測與低軌道衛星通訊兩大課程，內容包含：太空軌道概論、太空環境介紹、太空規格規範、通訊酬載與地面通訊設備、太空驗測及測試設備，並藉此課程讓國內相關產學研界彼此交流與學習。太空環境驗測課程於 11 月 25 日展開，低軌道衛星通訊課程於 12 月 16 日開班，共 40 位產研界人士報名參加。

Education Programs for the Space Industry

To help domestic businesses gain a better understanding of the space industry and its applications, NSPO offered two major courses: one on the verification and testing of the space environment and another on low earth orbit (LEO) satellite communications. Topics covered include the introduction to orbits, introduction to the space environment, specifications and standards applied to the space industry, communication payloads and ground systems, space environment verification, and space equipment testing. These courses boosted the exchanges between relevant industries, academia, and research institutes in Taiwan. The course on space environment verification and testing was launched on November 25, while the LEO communications satellite course started on December 16. Altogether, the courses welcomed 40 students from relevant industries and research institutes.

▲ 太空產業專班課程資料
Space industry course information

創新創業激勵計畫（FITI）鼓動學研創新旋風

科政中心自 2013 年起執行科技部「創新創業激勵計畫」（From IP to IPO, FITI），以鼓勵國內學研機構運用創新技術開辦新創企業，擴散研發成果。計畫執行至今共激發近 3,000 件創業構想，協助成立 342 家新創公司，願意公開之對外累積總募資金額約新臺幣 50 億元，不僅成功鏈結科技部所屬相關機構的創業資源，帶起學研界新一波的創新創業風潮，更為臺灣經濟發展注入一劑強心針。

Driving Young Minds Towards Innovation Through the FITI Program

The From IP to IPO (FITI) Program has been implemented by STPI under the commission of the MOST since 2013. It aims to encourage academic and research institutions in Taiwan to utilize innovative technologies and pursue startup entrepreneurship as a means to spread their research. To date, the program has cultivated over 3,000 entrepreneurship ideas, helped established 342 startups, and solicited nearly NT$ 5 billion of voluntarily disclosed funding. The FITI Program not only helped consolidate entrepreneurship resources across various institutes under the MOST, but has also set off a trend towards innovation and entrepreneurship, giving Taiwan's economic development a shot in the arm.

▲ 2021 年第二梯次頒獎典禮獲獎新創團隊合照
The 2021 2nd-round award-winning teams

以資安專業與攻防平台培育資安領域專業人才

跨部會籌辦之第一屆資安女婕思競賽，由國網中心與學界合作規劃整合賽制、場域、關卡題型之競賽平台，開啟培育我國女性資安專業青年人才契機；此外，以資安攻防平台 CDX 提供資安課程與實戰模擬情境，持續培育產學資安人才，提升企業防禦能力。

Cultivating Cybersecurity Talent with Expert Training and the Cyber Defense Exercise (CDX) Platform

With the hope of bringing more talented young women to the scene of cybersecurity, various ministries have come together to launch Taiwan's first Girls in CyberSecurity contest. In particular, NCHC collaborated with academic institutions in establishing the platform for competition with well-prepared rules, venues, and cases at different levels of difficulty. NCHC also launched the Cyber Defense Exercise (CDX) platform, which provides cybersecurity courses and simulated scenarios of real-life events as resources for industry-academia partnerships to cultivate cybersecurity talent, which will help strengthen corporate defense against cyber-attacks as a whole.

◀ 資安女婕思之資安闖天關及創意發想賽頒獎
Conferring awards for the Girls in CyberSecurity competition

TORI 台灣海洋科技研究中心

海洋中心虛擬實境平台「TORI VR」走進海洋

為讓民眾更接近海洋，海洋中心推出線上虛擬實境平台「TORI VR」(https://walkinto.in/tour/WkgjxB8gWPWJlgilr8eWP)，將各個科研實驗室虛擬實境化，民眾只需透過網路，即可自由參觀海洋中心各科研實驗室，並觀賞精選的海洋探測設備與海洋研究工作場域介紹。

Exploring the Ocean with TORI VR

To bring people closer to the ocean, TORI launched a virtual reality (VR) platform, known as TORI VR (https://walkinto.in/tour/WkgjxB8gWPWJlgilr8eWP), that offers simulated environments of all divisions' laboratories for exploration. People can now go online and tour the laboratories of their choice, checking out the different marine exploration facilities and equipment.

◀ TORI VR 網站
TORI VR website

臨床醫師訓練課程

動物中心與醫療器材廠商合辦臨床醫師訓練課程，提供實驗動物專用之手術室與心導管室，並配合手術團隊協助動物麻醉、照護與提供手術協助。臨床醫師透過實驗動物進行手術練習，以熟悉心血管醫療器材及儀器操作、訓練手感及精進技術，銜接第一線醫療所需之實務練習。2021 年共辦理 9 場次訓練活動，共 143 位臨床醫師參與。

Training Courses for Clinicians

NLAC joined hands with medical device manufacturers in providing training courses for clinicians, through which the trainees could have the hands-on experience of working in the operating rooms and cardiac catheterization rooms specialized for laboratory animals. They could also learn surgical team works while anesthetizing and animal caring. The clinicians can practice surgical operation on laboratory animals, familiarize themselves with the equipment for cardiovascular surgery and others. In total, nine sessions of training courses were held in 2021, which saw the attendance of 143 clinicians.

▲ 臨床醫師練習心血管醫療器材及儀器操作
Clinicians practice operating cardiovascular medical devices and equipment

VTD & CARMAKER 系統課程培育自駕人才

由科技部委託維運的臺灣智駕測試實驗室，為推廣虛擬模擬研發平台及 DiVE (Drive in Virtual Environment) 擬真模擬環境，以培養國內產學研界之自駕相關研究人才，2021 年辦理 5 場 Hexagon-VTD 及 IPG CarMaker 虛擬模擬軟體推廣課程，參與學員合計達 298 人次。未來將持續規劃 DiVE 系統、車輛軟硬體實作、圖資應用、車聯網資安等系列課程，打造臺南沙崙智慧交通研發聚落，建立我國自駕相關研發基地。

Nurturing Autonomous Vehicle Talent with VTD and CARMAKER Training Courses

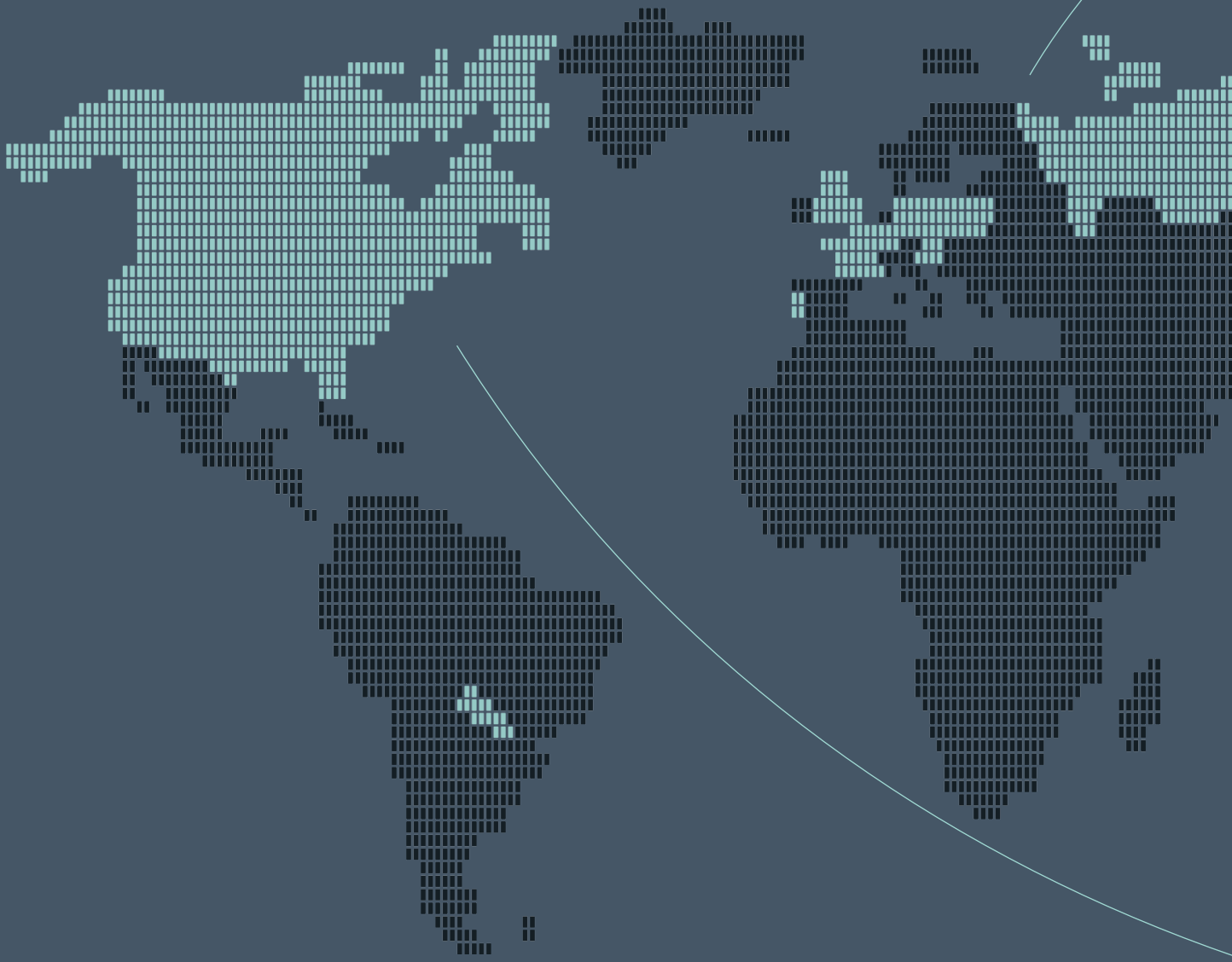
Taiwan CAR Lab is a platform with its operations overseen by NARLabs as commissioned by MOST. To promote the use of the virtual simulation R&D services and the Drive in Virtual Environment (DiVE) simulation system on its platform—as a means to nurture domestic R&D talent across industry, academia, and research institutes for autonomous driving— Taiwan CAR Lab held five sessions of training courses in 2021 on two types of virtual simulation software, the Hexagon-VTD and IPG CarMaker, which were attended by 298 participants in total. Looking forward, Taiwan CAR Lab will offer courses on the DiVE system, autonomous vehicle software and hardware, cartographic information applications, and information security management on the Internet of Vehicles. Moreover, it also aims to establish an R&D cluster of smart transportation in Shalun, Tainan, as a foundation for cultivating Taiwan's R&D talent pool in the field of autonomous driving.

▲ VTD (Virtual Test Drive) 系統課程
VTD (Virtual Test Drive) course

International Collaboration

國際合作

創新應用科技 Innovative Applied Technology
支援全球永續 Supporting Global Sustainability
培育國際人才 Developing International Talent



國研院以「追求國際頂尖、開創在地價值」為願景，藉由多元機制與國際頂尖機構鏈結，以推動前瞻科技發展並培育具國際觀科技人才。希冀經由以人為本的科技交流與合作，回應新興問題與挑戰，共創全球永續發展。

With the vision of "Global Excellence, Local Impact", NARLabs is committed to promoting the development of frontier technologies and nurturing science and technology professionals with international perspectives by linking up with top international institutions through a wide range of creative channels. By adopting a people-focused approach, NARLabs can achieve sustainable global development, and utilize technological exchange and collaboration to tackle emerging issues and challenges.

歐洲 EUROPE

半導體、生醫科技、海洋探索、太空產業

Semiconductors
Medical Technology
Ocean Exploration
Space Industry

東北亞 NORTHEAST ASIA

人工智慧、科技政策、海洋探索

Artificial Intelligence
Technology Policies
Ocean Exploration

東南亞 SOUTHEAST AISA

災防科技、生醫科技

Disaster Prevention Technology
Biomedical Technology

大洋洲 OCEANIA

資通訊科技、地球觀測

Information & Communication Technology
Earth Observation

美洲 AMERICA

半導體、生醫科技、太空科技、智慧城市

Semiconductors
Medical Technology
Space Technology
Smart Cities

國際合作夥伴 International Partners

美洲 America

半導體、生醫科技、太空科技、智慧城市

Semiconductors, Medical Technology, Space Technology, Smart Cities

美國 UNITED STATES

- Argonne National Laboratory
- BROAD Institute
- Duke University
- iCAIR, International Center for Advanced Internet Research, Northwestern University
- MIT, Massachusetts Institute of Technology
- NCSA, National Center for Supercomputing Applications
- NOAA, National Oceanic and Atmospheric Administration
- Stanford University
- UCB, University of California, Berkley
- UCF, University of Central Florida
- UCLA, University of California, Los Angeles
- UCSD, University of California, San Diego
- University of Hawaii System
- University of Houston
- University of Texas MD Anderson Cancer Center
- UW, University of Washington
- WHOI, Woods Hole Oceanographic Institution

加拿大 CANADA

- NRC, National Research Council Canada
- University of Toronto
- WATERLOO. AI, Waterloo Artificial Intelligence Institute

巴拉圭 PARAGUAY

- AEP, Paraguayan Space Agency

歐洲 Europe

半導體、生醫科技、海洋探索、太空產業

Semiconductors, Space Industry, Medical Technology, Ocean Exploration

奧地利 AUSTRIA

- AIT, Austrian Institute of Technology

比利時 BELGIUM

- imec, Interuniversity Microelectronic Centre

捷克 CZECH REPUBLIC

- CAS, Czech Academy of Sciences

法國 FRANCE

- CEA-Leti, Laboratoire d'électronique des technologies de l'information
- CNES, Centre national d'études spatiales
- Ifremer, Institut français de recherche pour l'exploitation de la mer; R/V Marion Dufresne
- Inserm, Institut national de la santé et de la recherche médicale

德國 GERMANY

- GEOMAR, Helmholtz Centre for Ocean Research Kiel; R/V Sonne
- HLRS, High-Performance Computing Center Stuttgart
- MARUM, Zentrum für Marine Umweltwissenschaften

匈牙利 HUNGARY

- ZalaZone

立陶宛 LITHUANIA

- NanoAvionics

葡萄牙 PORTUGAL

- INESC TEC, Institute for Systems and Computer Engineering, Technology and Science

俄羅斯 RUSSIA

- RAS, Russian Academy of Sciences

土耳其 TURKEY

- TÜBİTAK, Scientific and Technological Research Council of Turkey

英國 UK

- MRC, Medical Research Council

東北亞 Northeast Asia

人工智慧、科技政策、海洋探索

Artificial Intelligence, Technology Policies, Ocean Exploration

日本 JAPAN

- AIST, National Institute of Advanced Industrial Science and Technology
- CIEA, Central Institute for Experimental Animals
- ERI, Earthquake Research Institute, University of Tokyo
- JAMSTEC, Japan Agency for Marine-Earth Science and Technology
- JAXA, Japan Aerospace Exploration Agency
- Kumamoto University
- NICT, National Institute of Information and Communications Technology
- RIKEN, The RIKEN Center for Computational Science
- Tohoku University
- Tokyo Institute of Technology
- Tokyo University

韓國 KOREA

- KISTEP, Korea Institute of S&T Evaluation and Planning
- KISTI, Korea Institute of Science and Technology Information
- NST, National Research Council of Science and Technology
- SESTEC, Seismic Research and Test Center

大洋洲 Oceania

資通訊科技、地球觀測

Information & Communication Technology, Earth Observation

澳洲 AUSTRALIA

- ANFF, Australian National Fabrication Facility
- ANU, Australian National University
- CSIRO, Commonwealth Scientific and Industrial Research Organization
- University of Technology Sydney

紐西蘭 NEW ZEALAND

- QuakeCoRE, The NZ Centre for Earthquake Resilience

東南亞 Southeast Asia

災防科技、生醫科技

Disaster Prevention Technology, Biomedical Technology

印度 INDIA

- IIT, Indian Institute of Technology, Roorkee
- ISR, Institute of Seismological Research

菲律賓 PHILIPPINES

- De La Salle University
- DOST, Department of Science and Technology
- University of the Philippines

新加坡 SINGAPORE

- NAMIC, National Additive Manufacturing Innovation Cluster

泰國 THAILAND

- AIT, Asian Institute of Technology
- EECi, Eastern Economic Corridor of Innovation
- GISTDA, Geo-Informatics and Space Technology Development Agency
- KUMTT, King Mongkut's University of Technology Thonburi
- NARLabs Bangkok Office
- NSTDA, National Science and Technology Development Agency
- Thai-BISPA, Thai Business Incubators and Science Parks Association

越南 VIETNAM

- MONRE, Ministry of Natural Resources and Environment
- VNU, Vietnam National University, Hanoi

增進跨國實習，培育科技人才

國研院自 2020 年啟動國際實習生計畫，提供獎學金補助國外大學、碩士、博士生，以及在臺灣的國際學生，至國研院的研究中心實習。2021 年來自歐、美、亞洲的申請案多達 53 件，其中以法國 14 件、土耳其 8 件、捷克和印度各 6 件為多，經審查後共計推薦 13 件。受疫情影響，除兩位在臺的國際學生順利在國網中心完成實習，其餘獲推薦之外籍學生將延至 2022 年執行。

Promoting International Internships & Cultivating Science and Technology Talent

The NARLabs International Internship Program was launched in 2020 to grant scholarships to foreign undergraduate, master's, doctoral students, and international students in Taiwan to intern at our research centers. In 2021, 53 applications were received from Europe, the Americas, and Asia, including 14 from France, 8 from Turkey, and 6 each from the Czech Republic and India. A total of 13 applications were recommended after review. However, due to the pandemic, except for two international students in Taiwan who successfully completed their internships at NCHC, the rest of the recommended students' internships will be delayed until 2022.

佈局全球，深耕合作夥伴關係

與國際頂尖科研機構建立長期合作夥伴關係為國研院國際鏈結之重要環節。2021 年締結的夥伴有：捷克科學院 (CAS)、匈牙利車輛測試場域 (ZalaZone)、比利時微電子研究中心 (imec)、泰國育成中心與科學園區協會 (Thai-BISPA)、韓國科學暨技術研究委員會 (NST)、日本國立研究開發法人海洋研究開發機構 (JAMSTEC) 等。為落實相互交流，在疫情下舉辦多場線上學術研討會：臺澳 NARLabs-ANFF 量子技術研討會、臺日 NARLabs-NICT 雙邊研究計畫啟始會議、臺捷 NARLabs-CAS 合作啟動會議暨雙邊研討會等。

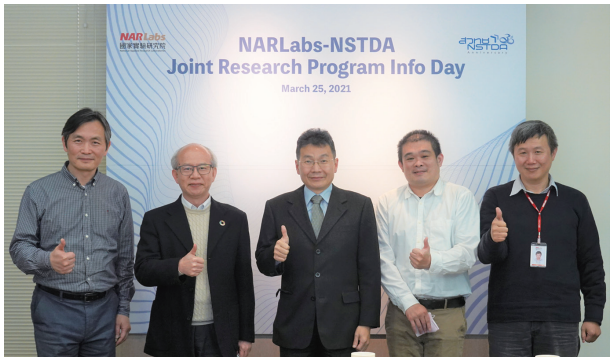
Global Outlook Deepening Partnerships

The establishment of long-term partnerships with leading international research institutions is an important part of the international connections made at NARLabs. Our 2021 partners include: the Czech Academy of Sciences (CAS), ZalaZONE in Hungary, the Interuniversity Microelectronics Centre (imec) in Belgium, the Thai Business Incubators and Science Parks Association (THAI-BISPA), the National Research Council of Science & Technology (NST) in South Korea, and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC). Several academic seminars were held online in order to facilitate communication in face of the pandemic, such as the NARLabs-ANFF Quantum Workshop, the NARLabs-NICT Joint Research Project Kick-Off Meeting, and the NARLabs-CAS Collaboration Kick-Off Meeting and Joint Workshop.

◀ 與捷克科學院簽署合作協議書
MOU with Czech Academy of Sciences

推動尖端跨域研究，接軌國際

藉由共同研究計畫、大型研究設施共用、人員交流及資料共享等，提升科技研發實力，與國際夥伴共享科研成果：半導體中心主導並支援前瞻學術研究，多項成果發表於國際旗艦型會議，例如 IEDM、ISSCC 及 VLSI，與日本產業技術總合研究所 (AIST) 合作開發之新型電晶體結構獲國際媒體報導；儀科中心與比利時微電子研究中心 (imec) 合作，成功建置可見光暨近紅外光寬頻測試平台，完成高光譜顯微影像校正測試實驗架構及驗證方法，結合反射式干涉與高光譜技術為國內首創；海洋中心與美國伍茲霍爾海洋研究所 (WHOI)、葡萄牙系統與計算機工程、技術及科學研究所 (INESC TEC) 與波爾圖大學 (University of Porto) 成功開發「水下滑翔機載具」原型機。國研院為進一步深化與國際科研單位之合作，更與泰國國家科學院 (NSTDA)、日本情報通信研究機構 (NICT)、韓國科學暨技術研究委員會 (NST) 啟動雙邊研究共同徵求計畫機制，目前已有 7 件計畫執行中。



▲ 與泰國國家科學院 (NSTDA) 雙邊研究共同徵求計畫
Joint Research Program with the NSTDA of Thailand

Promoting Cutting-Edge Interdisciplinary Research & Making International Connections

Through joint research projects, sharing of large-scale research facilities, personnel exchange, and data sharing, NARLabs have been able to enhance our science and technology R&D capabilities and share research achievements with international partners. TSRI leads and supports frontier academic research, and many of its achievements have been presented at international flagship conferences such as IEDM, ISSCC, and VLSI. In addition, new transistor architecture developed in collaboration with Japan's National Institute of Advanced Industrial Science and Technology (AIST) received international media attention. TIRI and Interuniversity Microelectronics Centre (imec) have successfully built a broadband test platform for visible and near-infrared light, as well as completed an experimental framework and validation method for hyperspectral microscopic imaging calibration combining reflection interference and hyperspectral technology, which is the first of its kind in Taiwan. TORI successfully developed an underwater glider prototype with Woods Hole Oceanographic Institution (WHOI) in the United States, the University of Porto, and the Institute for Systems and Computer Engineering, Technology and Science (INESC TEC) in Portugal. To further deepen collaboration with international research institutions, NARLabs has launched a mechanism for Joint Research Program with the National Science and Technology Development Agency (NSTDA) of Thailand, the National Institute of Information and Communications Technology (NICT) of Japan, and the National Research Council of Science & Technology (NST) of Korea, and seven projects are currently being carried out.

催生產學創新，促成國際鏈結

藉由技術交流與整合，加速國內產學成果轉譯新創，促成國外先進技術公司來臺與國內團隊合作，共同開拓國際市場。2021 年主要成果有：(1) 由國研院負責維運的科技部臺灣智駕測試實驗室與科技部資安暨智慧科技研發大樓攜手，與匈牙利車輛測試場域 ZalaZONE 合作，未來將協助我國車輛零組件、車用電子傳統產業升級，建構未來智慧交通 / 車聯網環境之技術與資安要求，以提升整體產業動能。(2) 太空中心與斯洛伐克太空公司 3IPK 及 Decent、捷克太空產業聯盟 Czech Space Alliance、立陶宛衛星公司 NanoAvionics 合作，未來將協助國內業者前進歐陸，並共同開發亞洲市場。

Accelerating Innovation in Industry and Academia & Facilitating International Linkage

Through technological exchange and integrating the acceleration of domestic industrial and academic achievements, NARLabs conveys innovation, facilitates the arrival of foreign advanced technology companies in Taiwan, and helps new domestic startup teams expand to international markets. The year's major achievements include the following: (1) Taiwan CAR LAB has integrated the R&D capabilities of the Ministry of Science and Technology's Cybersecurity and Smart Technology R&D Building and collaborated with ZalaZONE, a Hungarian vehicle test site, to help upgrade the traditional vehicle components and automotive electronics industries in Taiwan. This will help to build what is required for technological and information security in the future smart transportation/V2X environment so as to enhance overall industrial dynamics. (2) NSPO has collaborated with Slovak space companies 3IPK and Decent, the Czech Space Alliance, and Lithuanian satellite company NanoAvionics to assist the Taiwanese space industries in entering Europe in the future and jointly develop the Asian market.

▲ 與匈牙利車輛測試場域 ZalaZONE 簽約
MOU with ZalaZONE

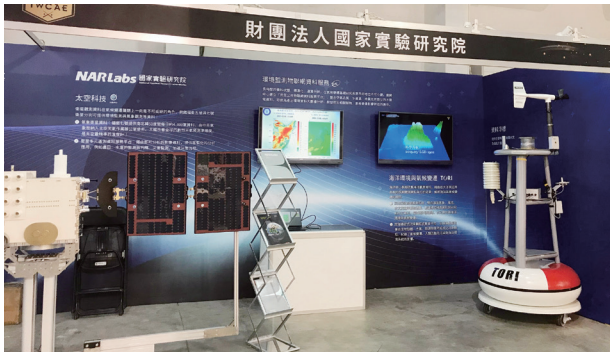
▲ 與泰國育成中心與科學園區協會簽約
MOU with Thai BISPA, linking the capabilities of Taiwan and Thailand's industries

落實區域協作，共創永續社會

為協助政府推動新南向政策，國研院於 2019 年設立泰國曼谷辦公室，以促進與東協、南亞及紐澳等國的交流，並開創互利共贏的合作模式。目前成果有:(1) 以國研院地球環境領域之科技成果，強化亞太區域災害韌性，如國震中心在印度、紐西蘭等國建置地震預警系統、在泰國示範校舍耐震補強作業；太空中心提供福衛遙測影像，與日本、印度、泰國、越南、新加坡、阿拉伯聯合大公國等國在守望亞洲 (Sentinel Asia) 協作，貢獻災害防救；(2) 參與泰國智慧醫療展 (Health Tech Thailand 2021)，彙集儀科、國網、半導體及動物中心分別與我國產業界以及泰方合作之技術，以醫療、防疫相關主題參展，展現國研院前瞻生技醫療研發成果與醫材價創平台服務效益。

Implementing Regional Coordination & Creating a Sustainable Society

In response to the New Southbound Policy, NARLabs established an office in Bangkok, Thailand in 2019 to integrate collaboration among industry, academic, and research institutions, promote exchanges with ASEAN, South Asia, Australia, and New Zealand, and create a mutually beneficial, win-win collaboration model. (1) NARLabs' technological achievements in the field of earth and environmental science have helped strengthen the resilience of the Asia-Pacific region to disasters. For instance, NCREE set up earthquake warning systems in India and New Zealand and reinforced the earthquake resistance of school buildings in Thailand. NSPO coordinated with countries which have joined Sentinel Asia including Japan, India, Thailand, Vietnam, Singapore, and the United Arab Emirates to provide FORMOSAT remote sensing images to contribute to disaster prevention and relief. (2) NARLabs' TIRI, NCHC, TSRI, and NLAC research centers participated in the Health Tech Thailand 2021 exhibition, working together with domestic industries and Thai partners on technology to showcase our frontier biotech medical R&D achievements and the benefits of our medical appliance value creation platform.



▲ 參與臺灣氣候行動博覽會
Participation in Taiwan Climate Action Expo

▲ 參與泰國智慧醫療展
Health Tech Thailand 2021 exhibition

Social Engagement

社會參與

9

教育雲平台獲 Red Hat 紅帽亞太區創新獎

教育雲服務平台參與全球頂尖雲端技術賽事 Red Hat Summit，以「Hybrid Cloud for Education in Pandemic」，獲臺灣地區 Cloud-native 之優勝獎。未來將持續精進服務規格並拓展功能，輔助教育界推展高效能運算與智慧化應用技術，育成我國高階資訊人才，以成為我國雲端運算與智慧技術首選訓練平台。

NCHC's Edu-Cloud Platform Wins Red Hat APAC Innovation Award

Red Hat Summit, the world's leading cloud technology event, announced NCHC's Edu-Cloud platform as the winner of the Red Hat APAC Innovation Awards 2021 for Taiwan. In particular, NCHC was named the winner for the Cloud-Native Development category with its "Hybrid Cloud for Education in Pandemic" solution. Building upon the achievement, NCHC will continue to upscale its cloud solutions and widen its scope of functions to help educational institutions tap into more applications of high-performance computing and smart technologies. The platform is envisioned to become Taiwan's top training platform for cloud computing and smart technologies, fostering more high-level local IT talent for the future.

◀ 教育雲平台獲 Red Hat 紅帽亞太區創新獎
Edu-Cloud Platform wins Red Hat APAC Innovation Award

製播《下一步，AI。Next，愛》科普影片

國研院和東臺傳播公司共同製作的《下一步，AI。Next，愛》，是臺灣罕見將科學界與影藝界同框處理的紀實 / 劇情科普影片，全系列三集共三小時，放進了 1 個愛情故事和 18 個不同面向的 AI 研究，藉由愛情故事引出臺灣 AI 人工智慧發展的歷程。

▲《下一步，AI。Next，愛》影片與相關產品
"Next, AI" series and related products

"Next, AI", a Popular Science Series Produced by NARLabs

"Next, AI", a project jointly created by NARLabs and Dong Tai Communication, is a popular science production that blends drama with reality by putting together a rarely-seen combination of science and film art. A three-episode series totaling three hours, "Next, AI" follows a love story and 18 distinct research trends in AI. Through the lens of the love story, viewers are led on a journey of Taiwan's AI progress.

NSPO 國家太空中心

臺灣種子上太空

太空中心與中興大學共同促成國內學子參與「亞洲種子送上太空計畫」，選定臺灣藜、姬蝴蝶蘭、甜椒及向日葵等 4 種作物，於 2020 年 12 月 7 日運送至國際太空站，經過 7 個月的停留後，種子於 2021 年 7 月 9 日返抵地球，9 月 16 日抵臺後，交由全臺 85 所國小、國中及高中參與栽種及實驗。栽種結果於 2022 年 1 月 25 日在中興大學舉辦決賽暨成果展。

Seeds from Taiwan Launched into Space

The NSPO and National Chung Hsing University worked together to facilitate the participation of local students in the "Asia Herb in Space" project. Four types of seeds, including Taiwan quinoa, moth orchid, bell pepper, and sunflower seeds, were sent to the International Space Station on December 7, 2020 and returned to Earth on July 9, 2021 after a seven-month stay. The seeds were then planted by middle and high school students, who composed written reports on their observations. It is hoped that the project will inspire students to learn more about outer space.

▲ 送上太空的 4 種臺灣種子
The 4 types of Taiwan seeds sent to outer space

NCREE 國家地震工程研究中心

私有建物耐震階段性補強

臺灣近年大地震中，建築物倒塌常見的主因之一為軟弱底層問題，俗稱「軟腳蝦建築」。為降低此風險，國震中心自 2017 年起協助內政部營建署，研擬單棟大樓耐震階段性補強技術手冊，於 2019 年成立專案辦公室，輔導全國私有建物申請階段性補強經費，協助民眾改善住宅結構安全，並於 2021 年完成「建築物耐震設計規範及解說」修訂條文草案（現正審議中）。

▲ 採用新增剪力牆、翼牆等工法進行耐震補強
Seismic retrofit by shear walls, wing walls, etc.

Interim Seismic Retrofit Program for Private Buildings

Taiwan was attacked by several massive earthquakes in recent years, and most of these earthquakes caused buildings to collapse. These events have, in fact, exposed the major vulnerability of buildings in Taiwan, that is, having a soft and weak lower story, commonly being described as resembling "soft-footed shrimps". To reduce such collapse risk, NCREE has been assisting the Construction and Planning Agency of the Ministry of the Interior since 2017 in developing a technical manual of interim seismic retrofit for residential buildings. They completed the draft amendment of the Seismic Design Specifications and Commentary of Buildings in 2021 (which is currently under review). Moreover, a project office has also been established to assist private building owners in applying for the subsidies of the interim seismic retrofit project. The goal is to improve the safety of residential buildings in Taiwan.

Milestones

大事紀

10

Jan. & Feb.

01.07 - 08

海洋中心辦理水深資料處理工作坊，邀請學者進行經驗交流與分享。

TORI holds a workshop on bathymetric data processing and invites scholars to share their experiences.

01.29

儀科中心攜手中央大學協助進化光學有限公司發表 8 吋矽基氮化鎵晶圓技術。

TIRI and National Central University assist Microluce, Ltd. in launching 8-in. GaN-on-Si wafer technology.

02.03

福爾摩沙衛星七號 6 枚衛星佈署完成。

The six satellites of the FORMOSAT-7 constellation are successfully deployed.

Mar.

03.06

儀科中心連續七年協同美國機械工程師學會臺灣分會舉辦「國研盃智慧機械競賽」學生競賽，2021 年由清華大學團隊奪冠。

For the seventh year in a row, TIRI and the American Society of Mechanical Engineers (ASME)-Taiwan Section organize the NARLabs Smart Machinery Competition for students, with a team from National Tsing Hua University winning first place.

03.09 - 11

海洋中心研發之輕型工作級 ROV 首次於 2021 亞太國際風力發電展公開亮相。

TORI's Light Work-Class ROV debuts at the 2021 Wind Energy Asia exhibition.

May & Jun.

05.30

動物中心舉辦亞洲突變鼠資源聯盟會議。

NLAC hosts the Asian Mouse Mutagenesis Resource Association (AMMRA) conference.

05.30

動物中心成立 3R 辦公室。

NLAC establishes its 3R promotion office.

05.31

太空發展法於立法院三讀通過，並由總統於 6 月 16 日公布。

The Space Development Act passes its third reading in the Legislative Yuan and is announced by the President on June 16.

06.08

國網中心啟動科技抗疫 2.0 暨台灣杉三號正式開放服務，以科技抗擊疫情。

NCHC launches the Tech v Virus 2.0 project and Taiwania 3 services to fight the pandemic with technology.

Aug. & Sep .

08.04

科技部、衛福部、經濟部正式啟動「健康大數據永續平台」，運用國網中心的高效運算環境，跨域合作精準健康大數據平台。

MOST, MOHW, and MOEA officially launch the "Health Big Data Platform", which utilizes the high-efficiency computing environment of the NCHC for cross-domain collaboration on big data in precision health.

08.30

國研院舉辦「研發服務平台亮點成果獎」頒獎典禮。

NARLabs holds the R&D Service Platform Achievement Awards Ceremony.

09.16

太空種子返回臺灣。

Seeds launched into space return to Taiwan.

Oct.

10.02

儀科中心舉辦第 13 屆「國研盃 *i*-ONE 儀器科技創新獎」，由清華大學及揚子高中獲得首獎。

TIRI holds the 13th NARLabs *i*-ONE Instrument Technology Innovation Competition, with National Tsing Hua University and Yang-Tze High School receiving first place in their divisions.

10.03

太空中心成立 30 年。

NSPO celebrates its 30th anniversary.

10.22

太空中心前往歐洲，與斯洛伐克、捷克、立陶宛簽署 MOU。

NSPO signs MOUs with Slovakia, the Czech Republic, and Lithuania.

10.26

國網中心與陽明交通大學、東海大學合作之智能點雲技術，榮獲全球百大科技研發獎。

NCHC, National Yang Ming Chiao Tung University, and Tunghai University's "Cloud-based Smart Point Cloud Processing" technology receives an R&D 100 Award.

Nov.

11.04

國網中心開發之教育雲平台獲多所學校青睞，更榮獲紅帽亞太區創新獎。

NCHC's Edu-Cloud Platform wins a Red Hat APAC Innovation Award.

11.05

臺灣智駕測試實驗室與匈牙利 ZalaZONE 簽署合作備忘錄。

Taiwan CAR Lab and Hungary's ZalaZONE sign an MOU.

11.09

半導體中心發表「新世代磁性記憶體」，是全世界第二個開發出具備垂直異向性 SOT-MRAM 元件的團隊。

TSRI becomes the second team in the world to develop a SOT-MRAM device with perpendicular magnetic anisotropy.

Dec.

11.16

國震中心發表守護臺灣的「5D 智慧城市防救災平台」。

NCREE announces its "5D Smart City Disaster Prevention & Relief Platform" to protect Taiwan from earthquakes.

11.25

國震中心「沙崙 C 區 5D 智慧維運管理系統」榮獲智慧化居住空間創意競賽「巢向未來組」金獎。

NCREE's "Shalun Zone C 5D Smart Maintenance and Management System" wins gold in the "Toward Future Homes" category of the Intelligent Green Building Design Competition.

11.25

半導體中心與新思科技合作，引進該公司 Sentaurus TCAD 與 Quantum ATK 模擬工具，合作打造下世代半導體製程研發環境。

TSRI introduces Synopsys's Sentaurus TCAD and Quantum ATK simulation tools to create an R&D environment for next-generation semiconductors.

12.04 - 05

科政中心辦理 CONCERT 國際研討會，主題為「學術服務在疫常中的重生與創新」。

STPI holds the CONCERT international seminar on "Crisis, Resilience and Inspiration: Scholarly Communication Services in the Next Normal."

12.11

科政中心舉辦 XFail 失敗者年會，透過失敗經驗分享，鼓勵創業者勇敢挑戰自我。

STPI holds the X Fail conference to encourage entrepreneurs to challenge themselves by sharing their experiences of failure.

12.22

儀科中心與各大學合作開發「智慧藥箱」、「免萃取式農藥殘留快速偵測系統」、「人工下顎與植體骨仿生結構」等，榮獲三項國家新創獎。

TIRI collaborates with several universities to developed the "Smart Medicine Kit", "Extraction-free Rapid Detection System for Pesticide Residue", and "Artificial Mandible and Implant Bone Bionic Structure", winning three prizes at the National Innovation Awards.

12.24

科技部委託國研院維運的資安暨智慧科技研發大樓舉行「資安‧智慧‧大南方」聯合啟用典禮。

NARLabs, commissioned by MOST, holds a joint opening ceremony for the Cybersecurity & Smart Technology R&D Building.

Annual Profile

年度概況

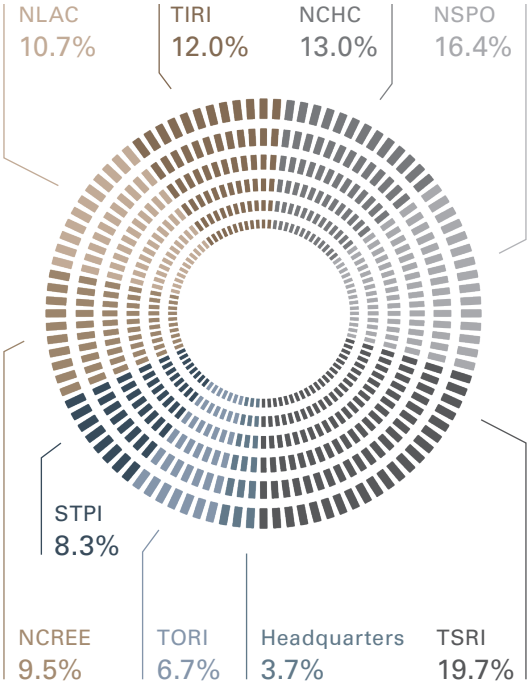
01

人力配置 Human Resources

總人數 1,393 人

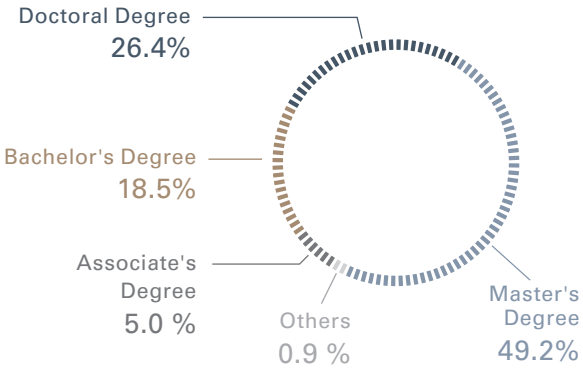
單位分佈
Number of Employees in Laboratories

院本部	Headquarters	52 人
台灣海洋科技研究中心	TORI	94 人
科技政策研究與資訊中心	STPI	116 人
國家地震工程研究中心	NCREE	132 人
國家實驗動物中心	NLAC	149 人
台灣儀器科技研究中心	TIRI	167 人
國家高速網路與計算中心	NCHC	181 人
國家太空中心	NSPO	228 人
台灣半導體研究中心	TSRI	274 人

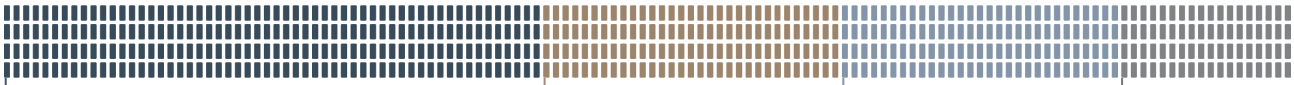


學歷分佈 Education Level

其他 Others	12 人
專科 Associate's Degree	70 人
學士 Bachelor's Degree	258 人
碩士 Master's Degree	685 人
博士 Doctoral Degree	368 人



職務分佈 Human Resources Profile



研究人員 Researchers	技術人員 Technicians	工程人員 Engineers	行政人員 Administrators
41.6% (579 人)	22.9% (319 人)	19.5% (271 人)	16.1% (224 人)

財務資訊 Financial Information

民間單位自籌款
Funds Raised from the Private Sector **10%**

政府單位自籌款
Funds Raised from Government Agencies **17%**

政府補助款
Grants **73%**

Revenue (FY 2021) (Rate: 1 USD = 27.73 NTD)

院本部 Headquarters
273 百萬元 / USD $10 Million

台灣海洋科技研究中心 TORI
357 百萬元 / USD $13 Million

國家實驗動物中心 NLAC
522 百萬元 / USD $19 Million

國家地震工程研究中心 NCREE
708 百萬元 / USD $25 Million

科技政策研究與資訊中心 STPI
709 百萬元 / USD $26 Million

台灣儀器科技研究中心 TIRI
728 百萬元 / USD $26 Million

台灣半導體研究中心 TSRI
1,359 百萬元 / USD $49 Million

國家太空中心 NSPO
1,499 百萬元 / USD $54 Million

國家高速網路與計算中心 NCHC
1,721 百萬元 / USD $62 Million

組織架構 Organization

董監事會
Board of Directors & Supervisors

董事長	吳政忠
Chairperson	Tsung-Tsong Wu
常務董事	陳東升、賀陳弘、謝達斌、蘇慧貞
Managing Director	Dung-Sheng Chen, Hong Hocheng, Dar-Bin Shieh, Huey-Jen Su
董事	吳益群、周美吟、周景揚、林一平、林建煌
Directors	孫元成、徐清祥、馬國鳳、郭耀煌、劉佩玲 (依中文姓氏筆劃排序) Yi-Chun Wu, Mei-Yin Chou, Jing-yang Jou, Yi-Bing Lin, Chien-Huang Lin, Yuan-Chen Sun, Charles Hsu, Kuo-Fong Ma, Yau-Hwang Kuo, Pei-Ling Liu (In order according to Chinese surnames)
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Executive Supervisor	Yu-Yen Liao
監事	林嬋娟、吳正己
Supervisors	Chan-Jane Lin, Cheng-Chih Wu
稽核室 / 主任	王泰享
Auditing Office / Director	Tai-Hsiang Wang

院長室
President's Office

院長	林博文 (代理)
President	Bou-Wen Lin (Acting)
副院長	林博文、葉文冠 (代理)
Vice President	Bou-Wen Lin, Wen-Kuan Yeh (Acting)
營運長	徐玉學
Chief Operating Officer	Yu-Hsueh Hsu

院本部 / 主任
Headquarters / Directors

策略企劃室	陳維鈞
Strategy & Planning Office	Way-Jin Chen

營運推廣室 Operation & Promotion Office	陸璟萍 Ching-Ping Lu
國際事務室 International Affairs Office	陳明智 Franz Ming-Chih Cheng
行政服務室 Administration Office	陳穎萱 Ying-Hsuan Chen
財務會計室 Finance & Accounting Office	林淑貞 Shu-Chen Lin
人力資源室 Human Resources Office	洪茵茵 Yin-Yin Hung
資訊服務室 Information Technology Services Office	蔡俊輝 Jyun-Hwei Tsai

實驗研究單位 / 主任
Laboratories / Director Generals

國家實驗動物中心 National Laboratory Animal Center (NLAC)	秦咸靜 Hsian-Jean Chin
國家地震工程研究中心 National Center for Research on Earthquake Engineering (NCREE)	周中哲 Chung-Che Chou
國家太空中心 National Space Organization (NSPO)	吳宗信 Jong-Shinn Wu
國家高速網路與計算中心 National Center for High-performance Computing (NCHC)	張朝亮 Chau-Lyan Chang
台灣半導體研究中心 Taiwan Semiconductor Research Institute (TSRI)	葉文冠 Wen-Kuan Yeh
台灣儀器科技研究中心 Taiwan Instrument Research Institute (TIRI)	楊燿州 Yao-Joe Joseph Yang
科技政策研究與資訊中心 Science & Technology Policy Research and Information Center (STPI)	林博文 Bou-Wen Lin
台灣海洋科技研究中心 Taiwan Ocean Research Institute (TORI)	王兆璋 Chau-Chang Wang

設置地點 Location

總部 Headquarters

臺北 Taipei

國家實驗研究院院本部
NARLabs Headquarters

國家實驗動物中心
National Laboratory Animal Center

國家地震工程研究中心
National Center for Research on Earthquake Engineering

科技政策研究與資訊中心
Science & Technology Policy Research and Information Center

新竹 Hsinchu

國家太空中心
National Space Organization

國家高速網路與計算中心
National Center for High-performance Computing

台灣半導體研究中心
Taiwan Semiconductor Research Institute

台灣儀器科技研究中心
Taiwan Instrument Research Institute

高雄 Kaohsiung

台灣海洋科技研究中心
Taiwan Ocean Research Institute

分部 Branches

新竹 Hsinchu

國家實驗動物中心
National Laboratory Animal Center

臺中 Taichung

國家高速網路與計算中心
National Center for High-performance Computing

臺南 Tainan

國家實驗動物中心
National Laboratory Animal Center

國家地震工程研究中心
National Center for Research on Earthquake Engineering

國家高速網路與計算中心
National Center for High-performance Computing

台灣半導體研究中心
Taiwan Semiconductor Research Institute

Our Laboratories

中心簡介

12

沿革 Evolution

2003

國研院正式成立，6 個國家實驗室改制納入

- 國家晶片系統設計中心
- 國家高速網路與計算中心
- 國家地震工程研究中心
- 國家奈米元件實驗室
- 國家實驗動物中心
- 國家太空中心

National Applied Research Laboratories (NARLabs) was established with six founding labs:

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

2005

2 個國家實驗室納入國研院

- 儀器科技研究中心
- 科技政策研究與資訊中心

Two more labs joined NARLabs:

· Instrument Technology Research Center (ITRC)
· Science & Technology Policy Research and Information Center (STPI)

2008

台灣海洋科技研究中心成立

Taiwan Ocean Research Institute (TORI) was established.

2011

台灣颱風洪水研究中心成立

Taiwan Typhoon and Flood Research Institute (TTFRI) was established.

2019

- 台灣颱風洪水研究中心併入行政法人國家災害防救科技中心
- 國家晶片系統設計中心與國家奈米元件實驗室整併為台灣半導體研究中心
- 儀器科技研究中心更名為台灣儀器科技研究中心

· Taiwan Typhoon and Flood Research Institute (TTFRI) was merged into National Science and Technology Center for Disaster Reduction (NCDR).
· National Chip Implementation Center (CIC) and National Nano Device Laboratories (NDL) were merged into Taiwan Semiconductor Research Institute (TSRI).
· Instrument Technology Research Center (ITRC) was renamed Taiwan Instrument Research Institute (TIRI).

科政中心以成為具有學術基礎和實證研究特色、完備快速回應議題能力的國家級科技政策智庫為定位與願景，掌握全球科技發展趨勢，提供及時、專業、客觀的分析與建議，擔負支援政府科技政策規劃、協助科技計畫審評與管理、創新創業人才培育及提供學術資源服務等四大任務。科政中心自 2005 年改制以來，持續支援科技部草擬我國科技發展策略藍圖與科技白皮書，亦負責協助辦理全國科學技術會議，同時也致力完備政策知識平台、產業資料庫及人才與指標的連結，以政策研究及創新服務雙軌並進，全方位協助政府科技部會加速推動國家科技發展與研發成果創新，提升國家總體競爭力。

With an academic foundation and an expertise in empirical research, the Science & Technology Policy Research and Information Center (STPI) has a vision to become a national science and technology policy think tank, providing complete and rapid responses to issues and grasping global technology development trends with timely, professional, and objective analyses and advice. STPI's missions include supporting the government on S&T policy planning, facilitating the evaluation and management of national S&T programs, cultivating innovative and entrepreneurship talents and providing integrated information services. Since its restructuring in 2005, STPI has continued to support the Ministry of Science and Technology (MOST) in drafting blueprints and white papers for Taiwan's scientific and technological advancement. It is also responsible for assisting in staffing for state policy events such as the National Science and Technology Conference, and also commits to linking these policies' knowledge platforms together with industry databases, talents, and indicators. Through dual-track policy research and innovative services, these tasks will assist MOST in accelerating the national development of science and technology and the innovation of R&D achievements, enhancing the country's overall competitiveness.

TIRI 台灣儀器科技研究中心

儀科中心為深耕基礎研究，聚焦於前瞻光學、先進真空與智慧生醫關鍵技術開發，建構跨領域整合的儀器科技研發服務平台，為學術團隊在尖端研究之關鍵合夥人，是國內唯一可針對學術界各領域進行前瞻研究與實驗之需求，開發特規客製儀器設備的單位。同時積極研發「臺灣第一、國際領先」的下世代半導體製程與設備、尖端國防與太空酬載系統及防疫相關儀器，培育高階跨域儀器技術人才，提升科研資源運用效能。

To deepen foundational research, Taiwan Instrument Research Institute (TIRI) has its sights set on the development of advanced optics, advanced vacuum technology, and smart biomedicine. Meanwhile, it has constructed a cross-field R&D service platform for instrument technology, backing research teams by being their key partner in cutting-edge research. Moreover, it is the only institute in Taiwan that helps develop customized instruments and equipment to fulfill academic needs for prospective research and experimentation in various fields. TIRI also actively pursues the R&D of "No. 1 in Taiwan" & "world-leading" next-generation semiconductor manufacturing processes and equipment, as well as cutting-edge national defense, spaceborne remote sensing systems, and anti-epidemic related instruments. At the same time, it is devoted to cultivating high-level instrument technology talent with cross-disciplinary capabilities in order to optimize the utilization of scientific research resources.

NLAC 國家實驗動物中心

動物中心以多元實驗動物資源及符合國際認證之設施為基礎，支援國內研究人員進行醫藥開發、醫材功效驗證及 COVID-19 等疾病研究，並針對國內臨床前動物試驗缺口，串聯三地四據點，以基因改造鼠產製、隔離操作箱、腫瘤精準醫療測試等技術，建立新興動物試驗平台，並提供動物飼育及試驗空間，供產業界進駐使用，亦可協助進行一站式試驗服務。此外，為彌補醫材業界中大動物安全試驗缺口，配搭手術團隊及 GLP 生物相容性實驗室，協助執行安全性驗證。

With the foundation of diverse laboratory animal resources and international accreditation facilities, National Laboratory Animal Center (NLAC) strives to support Taiwan's pharmaceutical development, medical device validation, and research on diseases, such as COVID-19. To meet Taiwan's pre-clinical animal testing needs, NLAC has also established a new animal testing platform through the synergy of all four of its bases in three major industry parks, offering technologies such as rodent genetic editing, rodent microbiome research, and precision medicine for tumor testing. Moreover, NLAC also serves as a one-stop solution for preclinical research, providing laboratory spaces and animal care services. To assist the medical device industry in addressing the need for compatibility and safety test, NLAC further offers medical device safety validation services by collaborating with surgical teams and its Good Laboratory Practice (GLP) accredited biocompatibility testing laboratory.

NCHC 國家高速網路與計算中心

國網中心以高速計算、100G 學研網路及國家級 AI 雲端服務設施等核心能量，提供大規模共用、共享的基礎設施 (IaaS)，並持續提升總體服務效能與關鍵技術，藉鏈結產學研界用戶之經營策略，致力發展服務、研發、育才三大面向，且打造可彈性應用之平台 (PaaS) 與資料分析平台 (DaaS)，帶動資通訊之創新研發與價值創造。

The National Center for High-performance Computing (NCHC) provides a high-speed computing environment of large-scale sharing, with core capabilities such as high-speed computing, a 100G academic research network, national AI research and development and cloud service facilities and resources. This lays the foundation for Taiwan's technological capabilities, serving industry, government, and academia in the research and development of AI applications. NCHC's mission includes the continuous improvement of its core technologies, such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Data as a Service (DaaS). It also strives for the rapid creation of cloud resources and R&D environments required for production, education and research, and the integration of cross-domain resource cooperation. Such endeavors promote innovative developments in Taiwanese academic research regarding computing, data, and smart software.

NSPO 國家太空中心

太空中心是我國唯一負責太空科技政策執行及太空科技研發的機構，已成功執行多項衛星計畫，並完備衛星整合測試、多枚衛星操控及衛星影像處理能力。太空中心目前執行第三期國家太空計畫，正發展更高解析度的光學遙測衛星、B5G 低軌通訊衛星、合成孔徑雷達衛星，並挑戰外太空探索任務，以期達到帶動國內太空產業發展、邁入國際市場，同時深耕太空教育、培養太空科技人才的目標。

National Space Organization (NSPO) is the only organization in Taiwan responsible for space technology R&D and the implementation of space technology policy, and it has successfully carried out multiple satellite programs as well as satellite assembly, intergration and testing, multiple satellite operation and control, and satellite image processing. NSPO is currently implementing the third phase of the National Space Program by taking on outer space exploration missions and developing higher resolution optical remote sensing satellites, B5G low Earth orbit communication satellites, and synthetic aperture radar satellites. As part of its vision, NSPO aims to promote Taiwan's space industry, enter the international market, and strengthen space education to inspire future leaders in the field.

TORI 台灣海洋科技研究中心

海洋中心根據產官學研界之研究需求，積極進行海洋探測科儀設備自主設計研發，建立自主創新技術，輔佐科學研究、海洋工程及國土調查等任務，並促進海洋產業發展。藉由海洋探測設備研發，掌握關鍵技術，改善海洋探測設備過度仰賴國外進口之現狀，擴展研究議題，亦可不受商業規格之限制。以自主研發之探測機具，培植研究船作業之精準探測技術，實現以科技支援科學的策略，建構並維運海洋研究探測所需之核心基礎設施及作業技術團隊。

Taiwan Ocean Research Institute (TORI) actively engages in the independent design and R&D of marine exploration equipment and innovative technologies that serve the research needs of government, academia, and research institutes. By facilitating scientific research, marine engineering, and land investigation missions, TORI strives to propel the development of the marine industry. Moreover, TORI aims to reduce Taiwan's dependency on imported marine exploration equipment by acquiring core development technologies through independent R&D processes, which will also allow for more diverse research that goes beyond the constraints of commercial tools. This self-developed exploration equipment can contribute to research vessel exploration with greater precision. By realizing the "backing science with technology" strategy, TORI is devoted to developing and maintaining core facilities as well as managing the exploration teams essential for marine research and exploration.

TSRI 台灣半導體研究中心

半導體中心南部基地於 2021 年 10 月啟動試營運工作，設置與業界生產研究環境接軌的 200 坪半導體無塵室，另外還有 35 坪生醫光電核心設施檢測實驗室，提供南部地區研發前瞻性科技的技術服務；並與新竹本部同步前進、南北分工，齊力開發物聯網、生醫、感測等未來性產業所需之半導體製程與應用研究服務。同時亦將協助南部地區師生執行產業界計畫，以人才培育為目標，增加學生的實作經驗，以便其未來能更快進入產業，藉由與新竹本部南北串連，為產學界吸引和栽培出更多高階人才。

The Tainan Base of Taiwan Semiconductor Research Institute (TSRI) officially went into trial operation in October. The base consists of a 200-ping (about 661 ㎡) cleanroom that is up to par with industry manufacturing and R&D standards and a 35-ping (about 116 ㎡) testing laboratory for biophotonic equipment. These facilities will provide technology services to researchers in southern Taiwan to support them in their R&D of forward-looking technologies. The Tainan Base will also join forces with the Hsinchu headquarters, through work specialization, to develop semiconductor manufacturing processes and applications for future-oriented sectors, including the Internet of Things (IoT), biomedicine, and sensor industries. To cultivate talent, it also aims to support schools in southern Taiwan to undertake industrial projects that will help students accumulate more hands-on experiences conducive to entering relevant industries. The joint effort between the TSRI bases in both the north and the south will certainly cultivate more high-level talent for industry and academia.

國震中心配合震前準備、震時應變、震後復建之需要，發展「結構耐震實驗及數值模擬」、「結構耐震設計及評估補強」、「地震災損評估」三大核心技術，運用大型實驗設施、實驗技術及地震資料庫，結合國內產官學研，並強化國際合作。近年積極開發智能科技防救災技術，如人工智慧、5D數位科技等，均有具體成果並落實應用，未來期能逐步將臺灣打造成為耐震永續家園。

National Center for Research on Earthquake Engineering (NCREE) has developed three core technologies in the areas of “Structural Seismic Testing and Numerical Simulation", "Structural Seismic Design, Evaluations and Reinforcement Retrofitting", and "Earthquake Damage Assessments Loss Estimation". These technologies enhance pre-earthquake preparation, earthquake strain emergency response, and post-earthquake reconstruction by taking advantage of large-scale experimentation facilities, technology, and seismic databases, connecting Taiwan's industry, government, and academic research, and strengthening international cooperation. In recent years, NCREE has also been actively developing smart technologies for disaster prevention and relief, such as artificial intelligence and 5D digital technology, and has made concrete achievements as well as implemented applications to bring Taiwan closer to becoming a hub for earthquake resistance.

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Honorable Publisher

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林博文
Bou-Wen Lin

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