

Bridging the Present and Future

Global Excellence, Local Impact



NAR Labs
National Applied Research Laboratories

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National Applied Research Laboratories

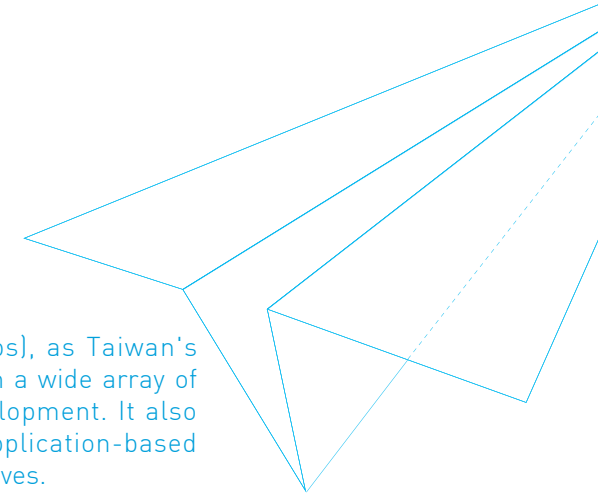
The National Applied Research Laboratories (NARLabs), as Taiwan's premier interdisciplinary research institution, engages in a wide array of topics that concern the country's socio-economic development. It also serves as the bridge and integrator of the country's application-based research efforts to achieving the nation's S&T policy objectives.

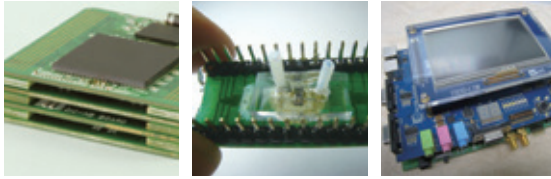
The NARLabs was established in June 2003 by officially incorporating then six separate national laboratories into an integrated research conglomerate. The NARLabs as a public juristic body of research is affiliated with the Ministry of Science and Technology. It is charged to develop cutting-edge technologies and to provide advanced service platforms that enable the transformation of the scientific endeavors of the government, academia, industry and research bodies into high-value products and/or services for the society at large.

At present the NARLabs focuses on the development of information and communications technologies, biomedical technologies, and integrated disaster prediction and warning systems. The research tasks are carried out by the affiliated centers:

- National Chip Implementation Center (CIC)
- Instrument Technology Research Center (ITRC)
- 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)
- Science & Technology Policy Research and Information Center (STPI)
- Taiwan Ocean Research Institute (TORI)
- Taiwan Typhoon and Flood Research Institute (TTFRI)

The NARLabs organizational structure motivates cross-disciplinary and cross-functional research and development to address issues crucial to the country. In addition, the NARLabs is undertaking the effort to become both a key player and a valuable collaborator in the international scientific community.





CIC

National Chip Implementation Center

The National Chip Implementation Center (CIC), established in 1992, aims to focus on developing human resources and advanced technologies in IC/System design, chip fab and system measurement. Since CIC has adopted the operating model of a non-profit institution, the main objectives thus focus not only on service but also on research. By continuing developing our services on IC/System design and measurement environment, embedded system design and measurement environment, RF and mix-signal design environment, and heterogeneous system design environment, CIC will operate in coordination with the demands of National Programs for Intelligent Electronics (NPIE) to develop MG+4C (medical electronics, green electronics, car electronics, and 3C electronics) related technologies. Currently CIC has initiated various service-oriented researches include CMOS Sensor Implementation Platform, Wireless Sensing System Platform, and Heterogeneous System Integration and Prototyping Platform (MorPACK Platform).

By applying these platform technology, CIC will operate in coordination with the demands of national programs and aims to become a world-class laboratory for IC/System design research and service in Taiwan.

Missions

- To integrate and develop the IC/System design environment
- To provide chip fabrication and measurement services
- To promote technology interchange and cooperation
- To develop and establish integration platform on intelligent electronics system

Core Technologies

- IC/SoC Design
- SoC/SiP Integration Technology
- Heterogeneous Integration Technology Platform
- Integration Technology for Intelligent Electronic Systems

Core Facilities

- Electronic design automation (EDA) tools
- Laser Doppler vibrometer
- Accelerometer measurement system
- MEMS measurement system
- SoC Automated Test Equipment (ATE)

Achievements

- Heterogeneous System Integration and Prototyping Platform (MorPACK Platform)
- Configurable SoC and Embedded System Prototyping Platform (CONCORD Platform)
- Modularized FPGA Development Platform for IC Contest and Education (MorFPGA Platform)
- Heterogeneous sensor chip technology
- System in package modulation technology



ITRC

Instrument Technology Research Center

Founded in 1974, Instrument Technology Research Center (ITRC) has been known as a pioneer in vacuum and optics technologies and is now dedicated to the development of frontier instrument technology platform for fulfilling goals of national technology policy and needs of industrial economic development. With a sophisticated service platform for advanced instrument applications, ITRC aims to bridge the academia and industry, providing innovative engineering prototyping and customization. ITRC's long-term prospect is to encourage and commercialize pioneering scientific ideas for the emerging industry as well as to promote academic research for the country and industry economic benefits.

Missions

- To promote the R&D of instrument technology and its applications in compliance with national S&T policies
- To participate in national S&T program and support the R&D of national laboratories
- To promote instrumentation engineering, maintenance of instrument resource banks, and talent cultivation

Core Technologies and Facilities

- Instrument System Integration
- Large Aperture Optical Polishing and Metrology
- Precision Optical/ Mechanical Machining and Inspection
- Remote Sensing Instrumentation
- Electro-optics Inspection and Measurement
- Advanced Thin Film Coating
- Micro Fabrication & Characterization

Achievements

- Remote sensing instrument (RSI): accomplishing its primary mirror, secondary mirror, correct lens and multispectral band-pass filter array for FORMOSAT-5.
- Precision optics and mechanic components: accomplishing micro lens array mold insert, illumination lens of pico-projector, laser beam shaping module, large aperture reflection mirror, etc as well as investing in semiconductor device fabrication and automatic optical inspection equipment exploitation.
- Advanced thin film technologies and nanofabrications: developments of atomic layer deposition (ALD) systems and in-situ monitoring modules as well as technology transfer to assist domestic companies to develop next-generation equipment.
- Opto-electro remote sensing system: accomplishing multispectral imager and hyperspectral imager as well as assisting the government doing environmental monitoring, precision agriculture research and disaster forecast and promulgate instrument exploitation.
- Graphical human-machine interfaces and instrument integration: providing customization and various innovative instruments exploitation as well as assisting the academia industrializing its innovation and creating economic value added.



NCHC

National Center for High-performance Computing

The National Center for High-performance Computing (NCHC) is the only national laboratory that provides integrated high-performance computing (HPC), networking, and storage services in Taiwan. From its inception in 1991, the NCHC has played a leading role in Taiwan's HPC, networking, and platform integration. NCHC continues improving the infrastructure, information security, and technology of cloud computing to provide a secure, efficient, and uninterrupted service platform and a cloud data center with multiple data backup facility. Based on its current foundations in HPC, cloud computing, and networking, NCHC contributes to improve the academic environment, foster domestic cloud industry, and promote scientific discoveries as well as technology innovation.

Missions

- To provide research environments and professional services in HPC and network applications
- To implement R&D of HPC, network applications and platform integrations
- To enable technology exchange and achievement of HPC and network applications

Core Technologies

- High-performance Computing
- Cloud Computing
- Big Data Computing
- Network and Information Security

Core Facilities

- High-performance Computers
- Advanced research and education network, TWAREN
- National level off-site storage, replication, and archive facilities
- Large-scale engineering and scientific software and databases

Achievements

- Provided computational power up to 200TFlops to meet the needs of more than 710 research projects in areas of high-performance computing, science and engineering researches in Taiwan.
- Organized new-generation network systems with 100G backbone connected with 13 GigaPOP nodes, and maintained high-quality TaiWan Advanced Research and Education Network (TWAREN) to provide services for various applications and researches.
- Established Taiwan's first Total Information Platform to effectively resist malware threats on education and research networks.
- Built Taiwan's cluster computing systems, the Formosa series, and related service environments to serve cloud-computing environments for 3D Drosophila brain neural images, 3D geographic information systems of Taiwan, and the render farm.
- Developed various middleware for cloud computing environments using the high-performance computing technology to advance Taiwan's cloud computing software technology.



NCREE

National Center for Research on Earthquake Engineering

The National Center for Research on Earthquake Engineering (NCREE) was established in October 1990. Its laboratory, equipped with a tri-axial shaking table, an L-shape reaction wall system, and a large strong floor test bed allows earthquake engineering simulations of structural components or systems in full-scale. NCREE links researchers and practicing professionals to build interdisciplinary knowledge and expertise using a variety of computational and experimental facilities in earthquake-related fields. Thus, NCREE engages in basic and applied researches that resolve critical seismic engineering issues. Due to the needs on pre-earthquake preparedness, emergency response, and post-earthquake recovery, the center brings together national academic resources, implements integrated research projects and develops enabling technologies for earthquake hazard mitigation.

Missions

- To advance experimental and numerical simulation technologies: Construct and maintain the world-class experimental facilities. Provide hardware, software and technical support to national and international researchers and practitioners on earthquake engineering simulations.
- To develop and apply earthquake loss estimation technologies: Develop and enhance the Taiwan Earthquake Loss Estimation System (TELES) software for advancement of seismic disaster scenario simulation technologies.
- To develop seismic design, evaluation and retrofit technologies: Advance seismic design, evaluation and retrofit technologies and code provisions for buildings and bridges to ensure structural resilience, and mitigate life and property losses during earthquakes.
- To develop state-of-the-art seismic technologies: Conduct researches on innovative, environment-friendly, and intelligent construction materials, technologies, and systems.
- To promote educational outreach and consolidation of earthquake knowledge: Consolidate earthquake research findings, disseminate earthquake engineering and hazard mitigation knowledge to enhance earthquake awareness and public capability of emergency responses.

Core Technologies

- Seismic Testing and Numerical Simulation Technologies
- Seismic Resistant Design, Evaluation and Retrofit Technologies
- Earthquake Loss Estimation Technologies

Core Facilities

- 5mx5m Tri-axial Earthquake Simulator
- L-shaped Reaction Wall and Strong Floor Testbed
- Multi-Axial Testing System (MATS)

Achievements

- Ensuring seismic resilience of new buildings and bridges through design code revisions.
- Upgrading seismic capacity of existing buildings and bridges through assessment and retrofit.
- Developing resilient structural systems through innovative design schemes and new construction materials.
- Developing TELES in accordance with governmental needs for quick response and risk management.
- Promoting integration of engineering and science to advance research innovation and engineering applications.
- Enhancing earthquake awareness and preparedness through educational outreach.



NDL

National Nano Device Laboratories

The National Nano Device Laboratories (NDL), established in 1988, has been dedicated to supporting the academia for its research to develop advanced semiconductor processing technologies and cultivating semiconductor talents needed by the industries. As the semiconductor process is continually progressing from sub-micron to nanometer technology, in accordance with national science and technology policies and industrial developments, the NDL has been exploring in superior processing technologies and applications such as functional nano CMOS Device, nano energy and optoelectronic device, NEMS / Bio-MEMS, and High-Frequency. By adding functional nanotechnologies, the NDL will keep providing advanced solid service required by the industries, academia and research institutes.

Missions

- Construct R&D platforms: to integrate domestic resources in nano fabrication equipment and tools, and establish an open environment for research of world-class nano device fabrication and electronic system research.
- Support academic research: to collaborate with academia on research projects and facilitate full use of all resources available at the NDL by all universities and academic research institutes around Taiwan and generate research results with superior quality.
- Promote futuristic science and technology: to conduct collaborative research with the industry, academia, and research institutes, both domestic and overseas, to enhance the technical service quality in areas of nano CMOS device platform, nano energy and optoelectronics device platform, and NEMS/MEMS technology platform.
- Cultivate science and technology talents: to offer various categories of training courses to cultivate domestic talents for leading-edge technologies such as nano optoelectronics, nano energy and NEMS/MEMS related fields.

Core Technologies

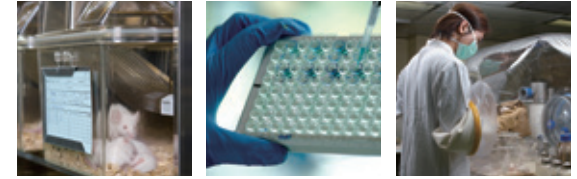
- Nano CMOS Device Technology
- Nano Energy and Optoelectronic Device Technology
- Nano Bio-MEMS Technology

Core Facilities

- Nano Device Fabrication Factory
- Nano Metrology Laboratory (Nano Device Materials Characterization)
- High-Frequency Technology Center
- Tainan Device Fabrication Factory (Photovoltaic and MEMS Processing)

Achievements

- Developed the 9nm functional resistive random access memory (RRAM) array cell.
- Developed the world's first 16nm functional static random access memory (SRAM) prototype.
- The bottom-up silver contact technology and triangular germanium FinFET surpass the limits of conventional materials and achieved nearly 3-fold of improvement in transistor speed
- Developed nano-technology chip for fast bacteria detection.
- Developed the "Accumulator-type 3D Stacked CMOS/Memory Hybrid Chip".



NLAC

National Laboratory Animal Center

The National Laboratory Animal Center (NLAC) was founded in 1994. It is the first specific pathogen free (SPF) laboratory rodent supply unit in Taiwan that reached the international standard. In 2003, the local demand turned the goal of NLAC to become a "world class" laboratory animal resource center, which provides international standard rodent resource, technical service and miscellaneous training to the academic field. Currently, NLAC cooperates with Executive Yuan on the "Promotion Plan for the Biotechnology Industry" activity and with National Science Council on the "Genetic Engineered Murine Model Services" project, which are both based on the laboratory animal service. Gradually, NLAC is transforming to a platform that is able to test new drug and medical device preclinically; it makes up the gap of the value chain, speeds up the development of the biotechnology and translational medicine in Taiwan and strengthens the international competence of the country.

Missions

- Establish an international laboratory rodent resource center to fulfill the local research and industrial demand.
- Provide animal test service, which meets the international animal welfare management standard and support the national biotechnology development.
- Promote alternative educational and experimental methods to implement the core human spirit of the animal science.
- Establish talent cultivation mechanism to reduce the gap among the biotechnology talents.

Core Technologies

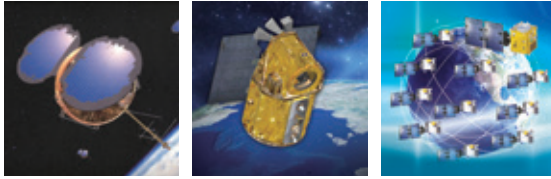
- Quality Control of Laboratory Animal
- Reproduction and Breeding Management
- Isolator Techniques
- Genetic Modification Techniques

Core Facilities

- AAALAC International accredited facility for SPF laboratory rodents
- TAF accredited diagnostic laboratory for the quality control service
- Rodent Model Resource Center (RMRC)
- Genetic Engineered Murine Model Services (GEMMS)

Achievements

- Provide the best quality laboratory rodents to more than 70% of the local biomedical field. Supply more than 140 strains including SPF rodents, genetically modified (GM) rodents and gnotobiotic rodents.
- Based on the breeding technique, provide one-stop Animal Hotel service with various animal experiment techniques; 234 strains served so far.
- Provide laboratory rodent quality control and diagnostic service and monitoring the health of animals in the local academic field and biomedical industry; more than 22,000 items served per year.
- Rodent Model Resource Center (RMRC) keeps more than 50% of the laboratory rodent repository and research outcomes in Taiwan; since 2010, RMRC has been registered in International Mouse Strain Resource (IMSR) – 19th repository database worldwide, 3rd in Asia.
- Establish the first inducible GM rat production platform and develop inducible red/green dual fluorescence GM rats.
- Passed ISO 9001, ISO 17025, ISO 27001 and AAALAC accreditation to prove the good quality control.



NSPO

National Space Organization

National Space Organization (NSPO) was established in 1991 and is the sole institute that takes charge of the execution of the national space program and the development of space technology in Taiwan. NSPO have actively implemented to become the center of innovation and excellence for the space technology through the development of satellite programs. In the near term, NSPO's mission goal is to build up the self-reliant space technology through the execution of FORMOSAT-5 and FORMOSAT-7 programs with the missions related to remote sensing and meteorology, respectively.

Missions

- Establish indigenous space technology
- Fulfill pronounced societal impacts
- Promote frontier space science research

Core Technologies

- Satellite Systems Engineering
- Spacecraft Bus Development
- Electro-Optical Remote Sensing Instrument
- Satellite Control & Operation
- Remote Sensing Image Processing

Core Facilities

- Satellite I&T Facility
- Ground Control & Operation Systems
- Image Processing Center
- Spacecraft R&D Laboratories

Achievements

- NSPO has established the space technology development infrastructure platform, and has successfully executed three satellite programs, FORMOSAT-1, -2, and -3, which launched in October 1999, May 2004 and April 2006, respectively.
- FORMOSAT-2, the first remote sensing satellite of NSPO, is providing valuable daily-revisit images which are used for disaster rescue, land usages, environmental monitoring, and academic resources researches etc. FORMOSAT-2 is honorably decommissioning after 12-year services on August 19, 2016.
- FORMOSAT-3, an international collaboration project for meteorology, ionosphere, and climate, is recognized as "the world's most accurate, precise, and stable atmospheric thermometer in space".
- FORMOSAT-5 is the first indigenous satellite built by NSPO with the in-house development of the high-resolution remote sensing payload.
- FORMOSAT-7/COSMIC-2, a constellation of 12 satellites, is a major collaboration space program between Taiwan and US. FORMOSAT-7 will provide 8,000 atmospheric profiles per day, which will greatly enhance the capabilities of the weather forecast, climate change, and space weather monitoring.



STPI

Science & Technology Policy Research and Information Center

The Science & Technology Policy Research and Information Center (STPI), established in 1974, was transformed as a non-profit organization under the National Applied Research Laboratories in 2005. STPI aims to support the government's technology policy-making and address social needs for globalization and the coming era of knowledge economy. Functioning as the main government think-tank for science and technology policy and the major platform for incorporating Taiwan's research communities, STPI has focused in collecting, collating and disseminating science & technology information for the purposes of innovation, competitiveness, sustainable development and social well-being and has integrated and provided with several nationwide technology related information services in improving the efficiency of scientific research. The future vision of STPI is to continue advancing the level in support of science & technology policy and information services and improving the nation's science & technology competitiveness by creating a sound S&T policy research infrastructure and setting up academic and policy databases, methodology, tools and core competencies with authoritative and international standard.

Missions

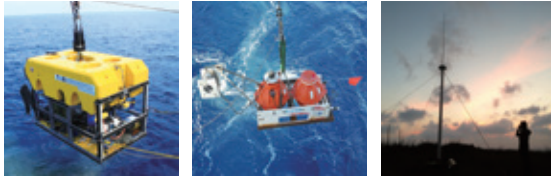
- Collect and establish nationwide S&T information and provide integrated services
- Perform study of technology foresight and development trend research, and assist planning and establishment of S&T policy
- Support and improve positive S&T policy decision-making system
- Assist national technology plan review, implementation, and performance evaluation

Core Technologies

- Technology Foresight and Forecasting Methodologies
- National Innovation System Research
- Performance Evaluation
- Sci-tech Projects Management
- Integrated Sci-tech Information Service Platform

Achievements

- Served as the main government think-tank for science and technology policy and maintained close and collaborative working relationship with government in supporting for National Science and Technology Conference and the STAG Board Meeting, and planning The White Paper on Science and Technology. Developing foresight research methods and the establishing foresight database, creating S&T policy research infrastructure and formulate the visions and strategies for Taiwan's S&T development.
- Provide S&T policy management information system, to assist government for S&T Program Performance Evaluating, and update Government Research Bulletin (GRB) database and providing services, and effectively support government S&T policy planning and project management.
- Provide CONsortium on Core Electronic Resources in Taiwan (CONCERT) and Nationwide Document Deliver Service (NDDS) services, to introduce global electronic information resources and to enhance resource sharing among major academic and research institutes, to strengthen infrastructure of S&T research and development.



TORI

Taiwan Ocean Research Institute

Founded in 2008, The Taiwan Ocean Research Institute (TORI) is a federally funded research and development agency devoted to research and education in oceanology and related sciences. TORI's mission is to enhance and extend the capabilities of the institutions in community, both nationally and internationally, by fostering research vessels and facilitating major oceanographic equipments (*i.e.*, ROV, LOMCS, OBS, CODAR, *etc.*), databank and post-processing productions.

Missions

- Instigate Marine Technology and Ocean Science Research Platforms
- Operation and Maintenance of Ocean Research Vessel
- Support and Enhance National Marine Technology and Ocean Science Researches
- Promote and Motivate Cutting-edge Ocean Researches
- Developing and Training of Ocean Research Personnel

Core Technologies

- Physical Oceanographic Moored Observations and Modelling
- Marine Geoscience Observations
- Marine Biogeochemistry Observations
- Deep sea Exploration Technology
- Ocean Information Database and Network

Core Facilities

- Taiwan Ocean Radar Observing System (TOROS)
- Ocean Bottom Seismometers (OBS)
- Near real-time Data Buoys
- Sediment Traps
- Remotely Operated Vehicle (ROV)
- Marine Core Repository and Laboratory (MCRL)
- Long offset Multichannel Seismic System (LOMCS)
- Marine Biogeochemical Laboratory

Achievements

- TOROS: Seventeen sets of the operational Coastal Ocean Dynamics Application Radars (CODAR) HF ocean radar systems are in operation around the island for long-term ocean surface current mapping. The grid resolution is at 10 km within 120 to 150 km distance away from the coastline.
- Data Buoys: Two data buoys have been maintained separately in the South China Sea (Taiping Island, aka Itu Aba Island) and the West Pacific Ocean southeast of Taiwan. Sea surface meteorological parameters, including SST, were transmitted back in every 6 hours through Iridium satellite network.
- OBS: A series of specialized Sub-Broadband Ocean Bottom Seismometers with 5000 m depth capability are now available and deployed. A teamwork achieved by efforts contributed from TORI, Academia Sinica, and National Sun Yat-Sen University.
- MCRL: The MCRL supports field, lab, and curatorial logistics for Taiwanese oceanographic community and some international co-operations. Meanwhile, the MCRL installs up-to-date analytical equipments such as automatic, non-destructive imaging, color reflectance and multi-sensor core logger to provide infrastructure support for marine core research in Taiwan.
- TOPS: Taiwan Ocean Prediction System (TOPS) is composed of the operational wave and ocean numerical models to provide a 72-hour high-resolution marine forecast around Taiwan.



TTFRI

Taiwan Typhoon and Flood Research Institute

The Taiwan Typhoon and Flood Research Institute (TTFRI) was established in 2011. Besides serving as an information-sharing platform to support academic research, TTFRI develops advanced prediction techniques of typhoon and flood to assist government agencies in disaster prevention, to mitigate the social and economic impacts of typhoon/flood-related disasters. Meanwhile, TTFRI focuses on typhoon and flood-related researches with regional characteristics and also devotes itself to nurturing talents for future world-leading researchers.

Missions

- Construct atmospheric and hydrologic information-sharing platforms to support academic research
- Conduct mission-orientated research to develop advanced techniques for disaster prevention and mitigation of typhoon and flood
- Nurture talents for future researchers

Core Technologies

- Numerical weather modeling techniques
- Quantitative precipitation forecast techniques
- Hydrologic modeling techniques
- Advanced atmospheric and hydrologic observation and measurement techniques

Core Facilities

- The Taiwan Cooperative Precipitation Ensemble forecast Experiment (TAPEX) platform
- An efficient system for urban inundation evaluation
- Atmospheric-hydrological database
- Observation and measurement instruments - flux tower, disdrometer, atmospheric sounding system, Ground Penetrating Radar (GPR), acoustic Doppler current profiler (ADCP), water level gauge, inundation sensor, etc.

Achievements

- Hydro-meteorological integrated observation and measurement networks: TTFRI worked with Water Resources Agency (WRA) and universities to develop two experimental watersheds. In addition to hydrologic measurements, TTFRI also successfully conducted onboard atmospheric sounding observations on Taiwan Ocean Research Institute's Ocean Researcher V.
- Atmospheric and hydrological Database: The database has been ISO 9001 and ISO 27001 certified. It is utilized by more than 500 people and in 200 research projects, and achieves a 94 percent customer satisfaction rate.
- Development of GPS-RO data assimilation technologies for FORMOSAT satellite data: TTFRI cooperates with research institutes in Taiwan and in the U.S. to develop the GPS-RO data assimilation techniques. A systematic evaluation using 11 landfall typhoons shows that assimilating GPS-RO data helps to reduce the typhoon track forecast error by about 5 to 10%.
- Quantitative precipitation ensemble forecast technique and its applications: TTFRI cooperates with CWB, WRA, NCDR, and universities to conduct the Taiwan Cooperative Precipitation Ensemble forecast Experiment (TAPEX). The typhoon track forecast of TAPEX has reached international standards. There are more than 40 disaster prevention operational entities using the TAPEX platform.
- To meet the demands of water resources management, TTFRI has worked out a plan to estimate the watershed rainfall and its inflow to a reservoir.

Location

TAIPEI

National Applied Research Laboratories (NARLabs)
National Center for Research on Earthquake Engineering (NCREE)
National Laboratory Animal Center (NLAC)
Science & Technology Policy Research and Information Center (STPI)
Taiwan Typhoon and Flood Research Institute (TTFRI)*

HSINCHU

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TAICHUNG

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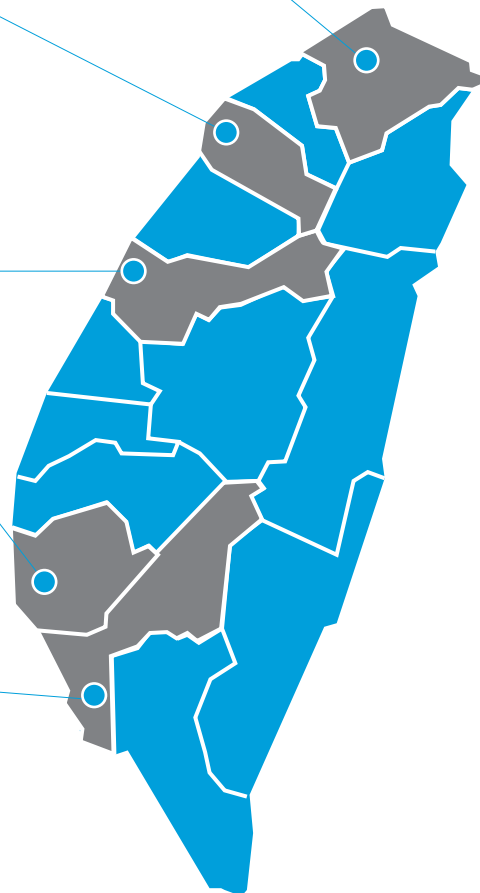
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