

Air Force Office of Scientific Research



Taiwan – AFOSR Nanoscience Initiative Status

Presented at the USAF/Taiwan Nanoscience Initiative Workshop, Honolulu HI

17 February 2005

*The Basic Research
Manager for the Air Force*

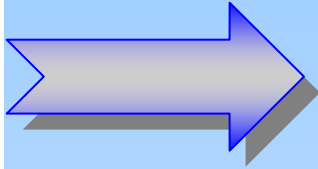
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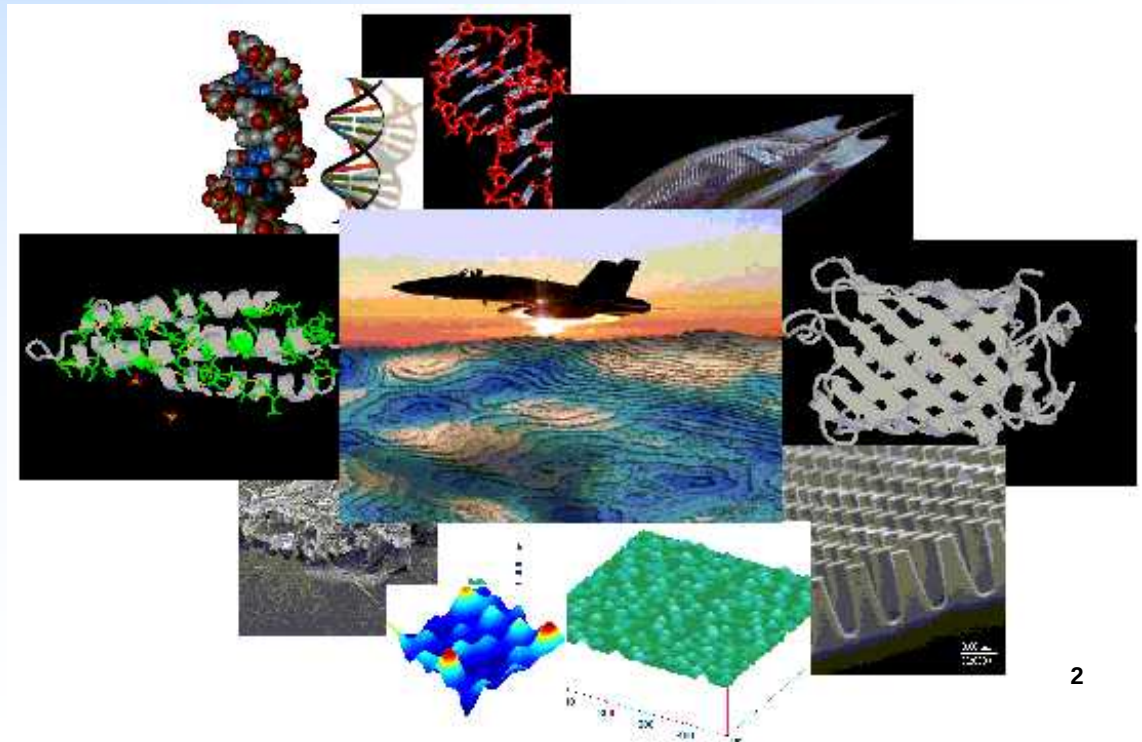
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Agenda



- **Overview**
- Research Funding
- WOS and Conference Support
- Summary





Taiwan – AFOSR Nanoscience Initiative



GOAL

Establish mutually beneficial scientific interactions between researchers in Taiwan and AFRL scientists

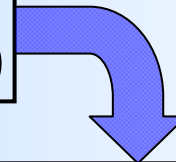
- Foster basic research innovation & interactions between scientists
- Enhance future USAF capabilities through support of Air Force fundamental nanoscience research efforts



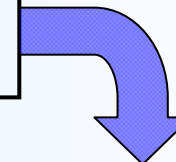
Taiwan/Air Force Program Concept



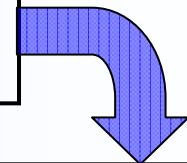
**AFOSR Requests
White Papers (2 pages)**



**AFRL & AFOSR Reviews
White Papers**



**Select / Request
Full Proposal**



**Select Proposals and
Award Contracts**

Key Program Elements

- Research Funding
- Visits and Joint Workshops
- Sponsorship of In-Country Conferences

**Hold Periodic Joint
Technical Exchange
Meetings**



USAF – TW Joint Workshop, Maui, Feb 2004



Nanoscience Initiative Chronology



- **Oct 01: AFRL Introduction to TECRO**
- **Feb 02: High Level AFOSR Delegation to Taiwan, incl. CSIST**
 - **AFOSR Commander, Chief Scientist, Dir of Phys & Electronics**
- **Apr 02: AFRL-Taiwan Nanoscience Research Opportunities Seminar (Joint Workshop)**
- **Aug 02: Visit to Researchers & NSC by AFOSR, AOARD**
- **Sep 02: High Level Delegation Visit to Taiwan**
 - **Included AFOSR Director, AFRL Chief Technologist**
- **Aug 03: AOARD Visit to Researchers**
- **Nov 03: Visit to Universities, CSIST, & NSC by AFOSR, AOARD**
- **Feb 04: Joint US Air Force/Taiwan Nanoscience Initiative Workshop, Maui HI**



Feb 2005 Nanoscience Conference



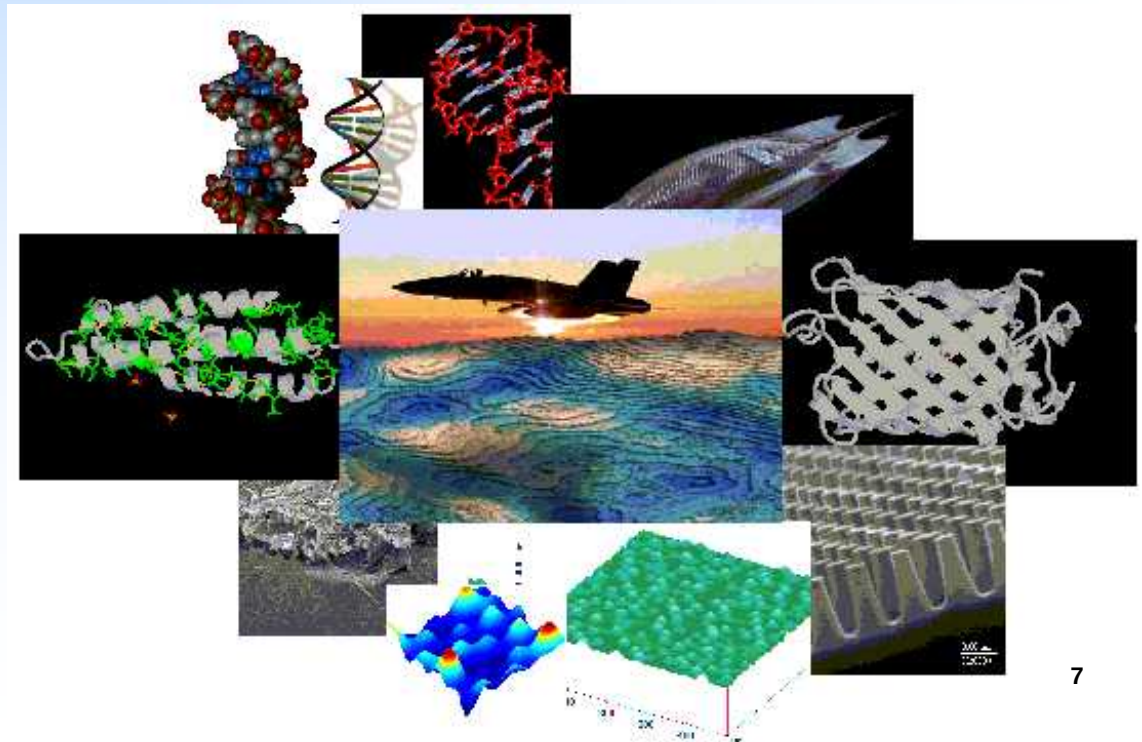
- **US Air Force/Taiwan Nanoscience Initiative Workshop, 17-18 Feb 2005, in Oahu**
 - In conjunction with 2005 Nano Materials for DoD Applications Symposium in Kona on the Big Island, Hawaii
 - Includes AFRL and Taiwan overview and technical presentations
 - Many thanks to Dr. Harold Weinstock (Workshop Organizer) and Capt Joe Tringe (AFRL/AFOSR), Dr Brett Pokines (AOARD), and Dr. Ting-Kuo Lee (Academia Sinica) for coordinating this workshop
- **Workshop is an excellent opportunity for US and Taiwan researchers to review work accomplished under proposals funded previously and discuss white papers for this cycle**
- **Travel funding**
 - AFOSR provided funding to some attending Taiwan researchers under the Windows on Science program
 - Taiwan's National Science Council (NSC) provided funding for other Taiwan researchers in attendance



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White Paper / Proposal Schedule



- **Proposed Schedule for FY05 Taiwan – AFOSR Initiative white paper / proposal cycle**
 - **7 Feb 2005** **Deadline for white papers from Taiwan researchers → extended to 25 Feb 2005**
 - **17-18 Feb 2005** **USAF-Taiwan Workshop**
 - **Mar 2005** **AFRL decision to request proposals**
 - **Mar/Apr 2005** **Proposals Due**
 - **Apr 2005** **Notify PI's of FY05 support decisions**



White Paper / Proposal Cycle



- **Cycle follows established white paper / proposal review process**
 - Establish connection with AFRL research interests
 - Request full proposals
 - Review and approve proposals for funding
 - AOARD completes contract paperwork
- **Essential for funding recommendation is complementary match with current AF research interests / niches or future targeted interests**



AFRL Nanoscience Definition



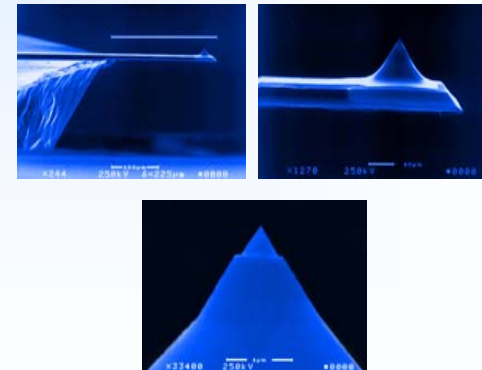
- **Work at the atomic, molecular and supramolecular levels, in the length scale of approximately 1 – 100 nm range**
- **Understand novel phenomena, properties and functions that occur on nm length scales**
- **Manipulate matter at the nanoscale to control those properties and functions**
- **Achieve macroscale functionality based on properties at the nanoscale**



Overview of AFRL NST Interest



- **Materials Area**
 1. Tailorable Dielectrics
 2. Reconfigurable Optical Response
 3. Adaptive Structural Materials
 4. Thermal Control Materials
- **Energy Area**
 5. Energetics on the Nanoscale
 6. Nano-enhanced Power Technologies
- **Devices Area**
 7. Quantum Confined Optical Sensors
 8. Nanotechnology for RF
 9. Nano Signal Processors
- **Bio-Nano Area**
 10. Bio Interactions of Nanostructures
- **Cross-Cutting (foundations)**
 11. Self-assembly of Nanostructures
 12. Nano-Micro-Macro Interfaces
 13. Modeling And Simulation



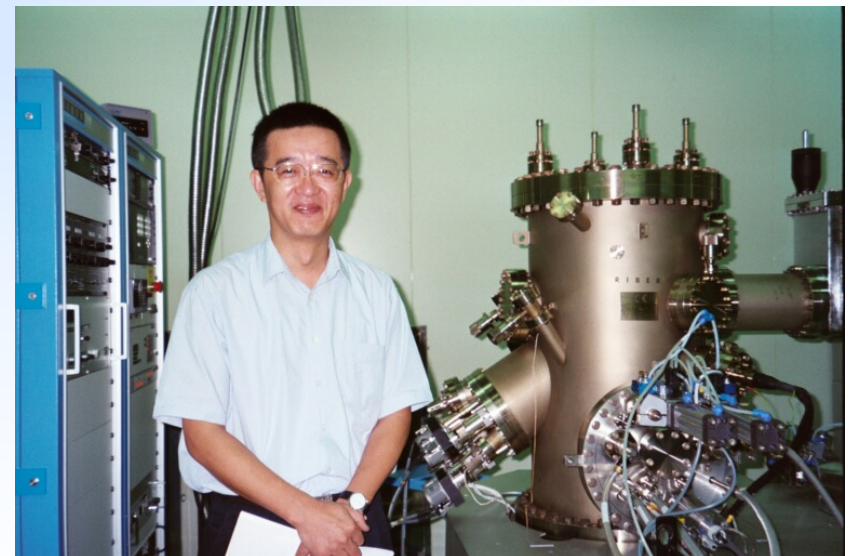


Taiwan Projects by Area



- **Materials**
 - 8 projects
- **Devices**
 - 10 projects
- **Bio-Nano**
 - 1 project
- **Energy**
 - 2 projects
- **Self-Assembly (foundation)**
 - 2 projects
- **Modeling and Simulation (foundation)**
 - 1 project

**24 Projects Total
to date**



Dr H-H Cheng, NTU



Taiwan Projects in Materials (1)



- **034017, *Investigation on Mechanical Properties of Nano-scale Thin Film*, Yeau-Ren Jeng, National Chung Cheng University**
- **034021, *Diamond-Like Carbon (DLC) Nanocomposite Film Depositions and Characterizations*, Franklin Chau-Nan Hong, National Cheng Kung University**
- **034040, *Growth and Characterization of Nanorods*, Jih-Jen Wu, National Cheng Kung University**
- **034054, *The Relationship of Microscopic Material Characteristics & Physical Behavior of Quantum Dots*, Shan Torng, Chung-Shan Institute of Science & Technology**



Taiwan Projects in Materials (2)



- **044026, *InGaN/GaN Quantum Dots --- Growth, Nano-structure Material Analysis, and Optical Characterization*, Chih-Chung Yang, National Taiwan University**
- **044073, *Study of Laser Ablation for Generating Nano-Particles*, Jehnming Lin, National Chen Kung University**
- **044074, *Dispersion and Reinforcement of Nanotubes in High Temperature Polymers for Ultrahigh Strength and Thermally Conductive Nanocomposites*, Arnold Chang-Mou Yang, National Tsing Hua University**
- **04xxxx, *Synthesis and Study of Water-soluble Two-photon Absorptive Fullerene Compounds*, Dr. Long Y. Chiang, National Taiwan University**



Taiwan Projects in Devices (1)



- **024004, *THz Laser based On Ge/Si Heterostructures*, Hung Hsiang Cheng, National Taiwan University**
- **024046, *Polymer Based Field-Effect Transistors*, Ten-Chin Wen, National Cheng Kung University**
- **024052, *Blue Laser Gain Characteristics of InGaN Quantum Dots Embedded in InGaN Quantum Well Structures*, Chih-Chung Yang, National Taiwan University**
- **034019, *Integrated Field Emission Devices Based On Carbon Nanotubes and Related Nanostructures*, Li-Chyong Chen, National Taiwan University**
- **034020, *Study on Wide-Gap Gallium-Nitride Based Films and Their Quantum-dots Devices*, Huey-Liang Hwang, National Tsing Hua University**



Taiwan Projects in Devices (2)



- **044020, THz laser based on Si, Hung Hsiang Cheng, National Taiwan University**
- **044025, Novel Organic Field Effect Transistors via Nano-Modification, Ten-Chin Wen, National Cheng Kung University**
- **044070, GaN/AlGaN Terahertz Quantum Cascade Laser, Shing-Chung Wang, National Chiao Tung University**
- **044071, Study on Wide-gap Gallium-nitride Films and Their Quantum dots Devices, Huey-Liang Hwang, National Tsing Hua University**
- **044072, Ge/SiGe Quantum Dot Detectors and Light Sources at Terahertz Frequencies, Cheewee Liu, National Taiwan University**



Taiwan Projects in Bio-Nano & Energy



- **Bio-Nano**
 - 044008, *High resolution real time phase contrast radiology study of hydrodynamic in micrometer scale*, Maw-Kuen Wu, Academia Sinica
- **Energy**
 - 044023, *High Efficiency Photovoltaic Devices Fabricated from Self-Assemble Block Insulating-Conducting Copolymer Containing Semiconducting Nanoparticles*, Wei-Fang Su, National Taiwan University
 - 024048, *High Efficiency Photovoltaic Devices Fabricated from Self-Assemble Block Insulating-Conducting Copolymer Containing Semiconducting Nanoparticles*, Wei-Fang Su, National Taiwan University



Taiwan Projects in Foundational Areas



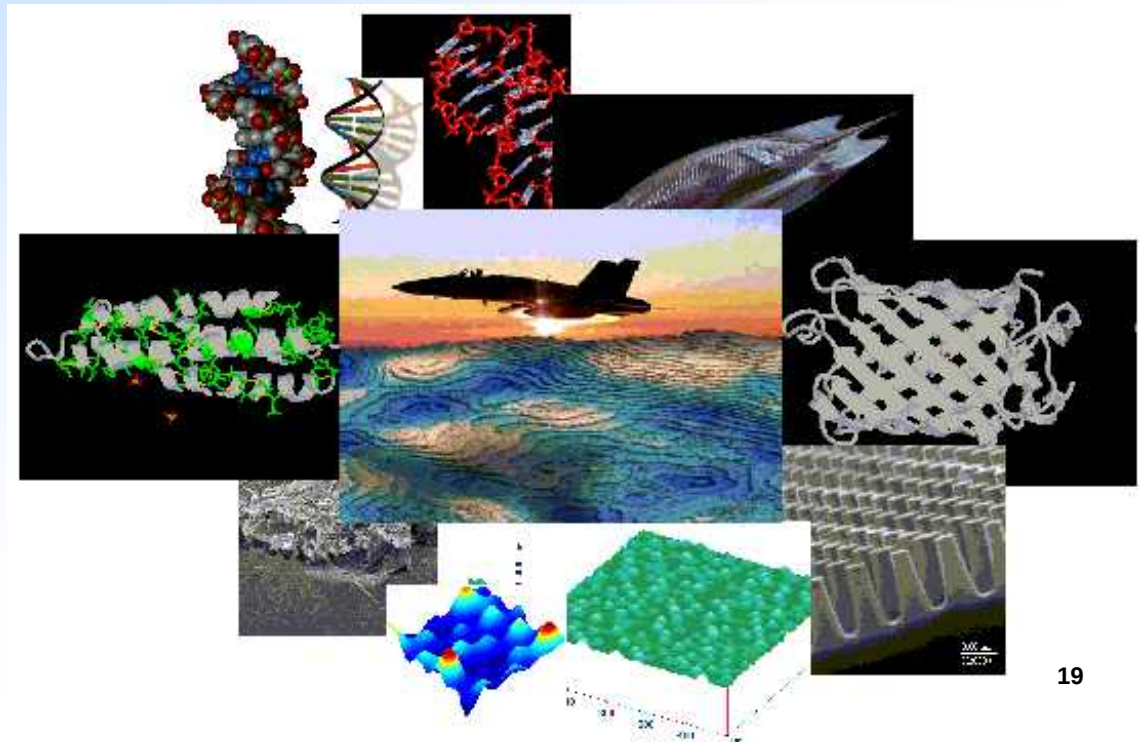
- **Self-Assembly (foundation)**
 - 034018, *Self-Assembly of Block Copolymer/Quantum Dot Nanocomposites for Optical Application*, Kung-Hwa Wei, National Chiao Tung University
 - 044069, *3D Photonic Crystals Build Up By Self-Organization Of Nanospheres*, Yu-Wen Chen, National Central University
- **Modeling and Simulation (foundation)**
 - 034039, *Fundamental study on quantum nanojets– structures, dynamics and energetic*, Huei-huang Chiu, National Cheng Kung University



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Windows on Science Activity



- **AFRL/SNHC, 12/10/2003 (AOARD Number 042025)**
 - Hung Hsiang Cheng, NTU, THz Laser based On Ge/Si Heterostructures
- **AFRL/VSSV, 1/3/2004 (AOARD Number 042015)**
 - Wei-Fang Su, NTU, High Efficiency Photovoltaic Devices
- **2004 USAF / Taiwan Nanoscience Initiative Workshop, 19-20 Feb 2004 (14 researchers)**
- **AFOSR/NL, 3/1/2004 (AOARD Number 042016)**
 - Ten-Chin Wen, NCKU, Polymer Based Field-Effect Transistors
- **AFRL/VSBXT, 10/18/2004 (AOARD Number 052006)**
 - Li-Chyong Chen, NTU, Field emission devices based on carbon nanotubes
- **2005 USAF / Taiwan Nanoscience Initiative Workshop, 17-18 Feb 2005 (20 researchers (proposed))**



Conference Support Program



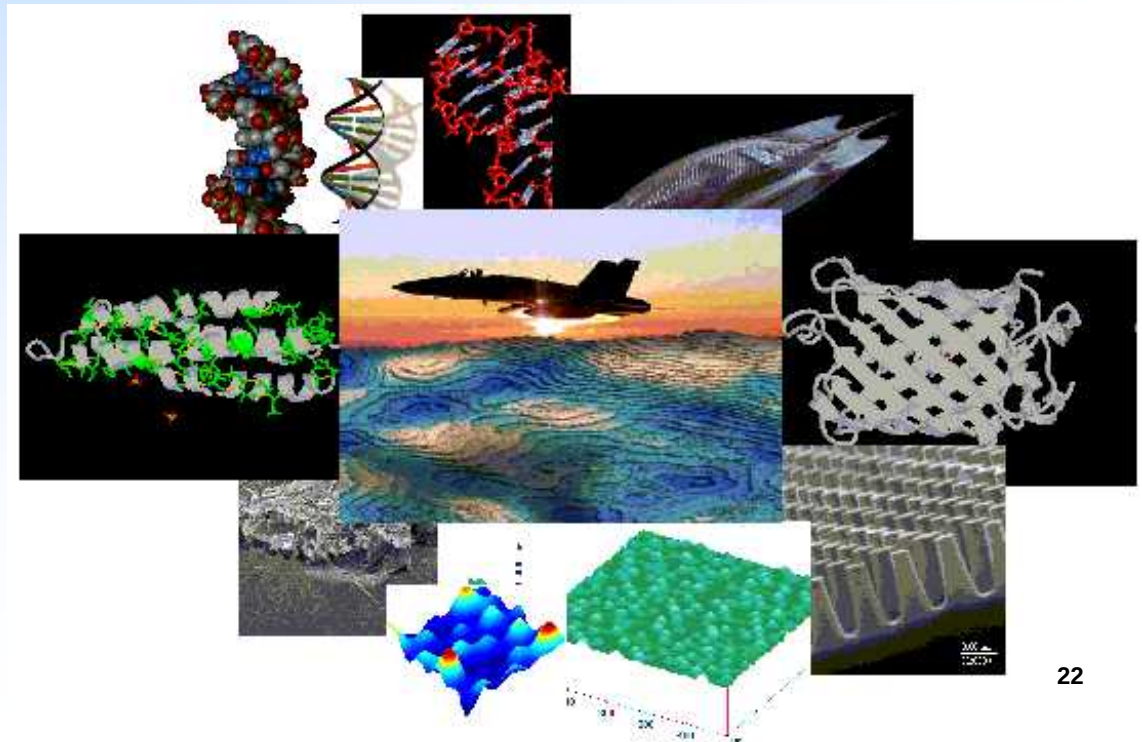
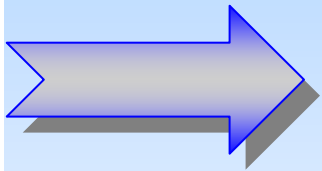
- **APAM 2002 International Conference on Collaboration and Networking**
 - Location: National Tsing Hua University, Hsin-chu, Taiwan
 - Date: 12/9/2002 (AOARD #021034)
 - Organizer: Huey-Liang Hwang, National Tsing Hua University
- **The 2nd East Asia Symposium on Superconductive Electronics (EASSE2003)**
 - Location: Taipei, Taiwan
 - Date: 11/16/2003 (AOARD #031053)
 - Organizer: Herng-Er Horng, National Taiwan Normal University
- **1st International Conference on One-Dimensional Nanomaterials**
 - Location: Center for Condensed Matter Sciences in National Taiwan University, Taipei, Taiwan
 - Date: 1/10/2005 (AOARD #051013)
 - Organizer: Li-Chyong Chen, National Taiwan University



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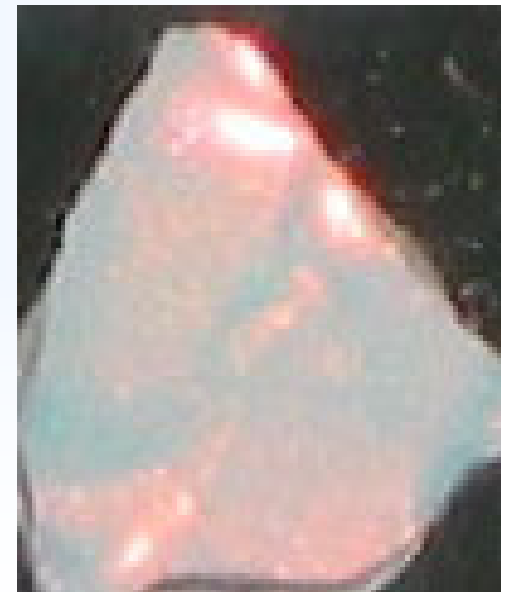




Nanoscience Initiative Summary



- More than 70 white papers received over life of the program
 - Plus 17 received so far in current white paper cycle
- 24 projects total completed / funded / approved
- 19 visits by Taiwanese researchers to AFRL scientists
 - Plus ~20 visits for current workshop
- 5 visits by AFOSR to Taiwan
- 2 joint workshops



From Prof. W.F. Su, NTU



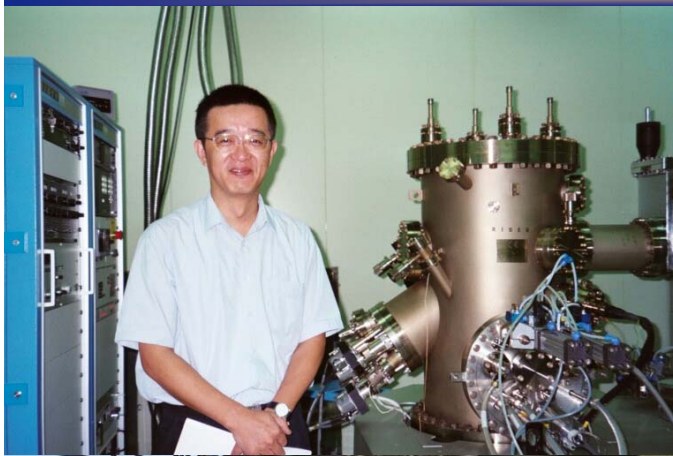
Taiwan Initiative Points of Contact



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- Dr Harold Weinstock, AFOSR/NE – Program Manager
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- Capt Joseph Tringe, AFOSR/NE – Assistant Program Manager, Taiwan – AFOSR Nanoscience Initiative
joseph.tringe@afosr.af.mil
- Dr Brett Pokines, AFOSR/AOARD – International Program Support – brett.pokines@onrasia.navy.mil



Visits Collage



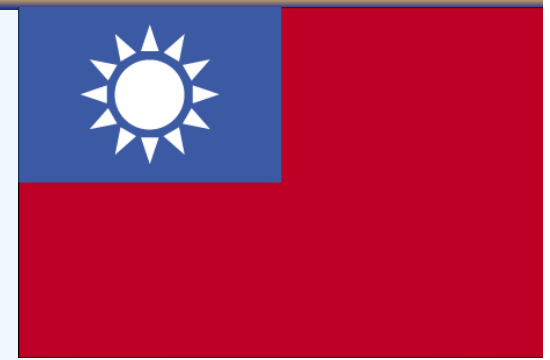


Closing Thoughts



WIN

WIN



- Nanoscience & Nanotechnology R&D is a Major Contributor to Revolutionary System Capabilities
- As the Air Force Transforms, Science and Technology Role Increasingly Important
- Globalization of R&D is Key

- Nano Science and Technology R&D is a National Priority for Taiwan
- Create New Products for Traditional Industry, New Bio-tech Industry
- Overcome Barriers and Difficulties for Information Technology Industry

Further the Scientific Goals of Taiwan and the United States



Taiwan - AFOSR Nanoscience Initiative

