Steven P. Hotaling, Ph.D.
Curriculum Vitae

Senior consultant to the U.S. Government and industry. Advanced Science & Technology, Big Data Analytics, Machine Learning and Artificial Intelligence. Focus: Large, Complex Systems including those exhibiting multidimensional, stochastic, nonlinear behaviors.   Effective communicator of complex mathematics, physics, engineering and data science to the c-suite. Leads interdisciplinary/multinational teams as well as performing in-depth analysis. Deep background in Data Analysis, Mathematical Physics, Aerospace, and Strategic Planning. Program Design, Implementation and Operational Support.

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Photonics and Optics
Materials Growth, Characterization, and Applications
Physical Chemistry
Organic Photochemistry
Surface Science
Nanocellular materials
Semiconductors and Nano-technology
Quantum, Nuclear, and Kinetic Effects in Critical Materials and Devices (optics,
Photonics, Microelectronics, and Structural materials)
Atmospheric Propagation and Scattering
Plasma Enhanced Chemical Vapor Deposition (PECVD)

Significant Engineering Science, S&T, and Strategic Planning Contributions
AI Strategic Leadership: From AI Foundations to Advanced Enterprise Applications
Core Team Member - Proteus Project
Technical lead/program manager and analytical lead Multiple Satellite ISR system
Mission Analysis: Special Communications
SOF/SOLIC Science Advisor
non-Traditional Avionics Project Manager
NSC Briefer
National Security Policy Board Consultancy
Congressional Staff Briefs and Congressional SME Witness
Chief, Intelligence Data Fusion
Field Consultant to Special Operations Forces
Millimeter Wave Principal Investigator
RF Signal Propagation
Re-Entry Vehicle ISR Code Developer
Large Optics in Space
G&CS R&D Engineer
CEO/CFO AM&SSC

Undergraduate Work
Control Systems Engineer
Parallel and Distributed Processing
Microwave Systems Technology (12-90 GHz)
Forensic Engineering Analysis

Education

Teaching

Publications – 9 US Patents Issued, Over 500 Open Literature publications and Citations

White House Briefings, Publications and Submissions

Congressionally Directed Actions (CDA)

Journal Articles

Editorials

Conference Papers and Selected Technical Reports

Books

Chapters in Books

US Patents (9 issued)

Course Notebooks and Teaching Aids

Internet Publications and Citations

General Publications
   Written by other researchers, newspaper reporters and magazine editors

Career Related Professional Activities

Community Interaction

Languages

Awards and Honors

Erdős Number citation:
http://www.ams.org/mathscinet/collaborationDistance.html?group_source=622928

Einstein Number Citation:
http://www.ams.org/mathscinet/collaborationDistance.html?group_source=622928

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Clearances: TS//SCI//NATO;   Information available upon request
   Past: DOE/Q with Gammas and Sigmas

Core Competencies

- Strategic Leadership
- Sensor Network Architectures
- Automated Threat Resilience
- Financial Analytics

- Automata: Complex Emergent Systems
- Systems Engineering: Requirements & Risks
- Theoretical & Applied Physics
- Socio-political Economy/Intelligence Analysis

- Futures Analysis
- Data Quality
- c-Suite Consulting
- Leadership/Mentoring

Professional Experience

1. **Current: President.** *Polymath*N LLC (2013-Present): Big Data Analytics, Machine Learning and Artificial Intelligence. AI Strategic Theory; Investigatin of AI for several market segments and intersegment relationships including: large sensor/communications networks (legacy and IoT) feeding cloud-based data lakes, cyber security, market analysis, text/language processing. Graph theoretic modeling of machine-machine and machine-human automata in complex ecosystems for DoD, IC, and commercial enterprises. *Polymath*N is a multidisciplinary research and consultancy firm working with senior leaders in government, NGOs, and industry to improve U.S. competitiveness, national security, and regional securitization. Integrates the perspectives of policy makers, intelligence providers, industry, global market forces, technology disruption, and envisions alternative futures possible through science, technology, and econometric modeling.
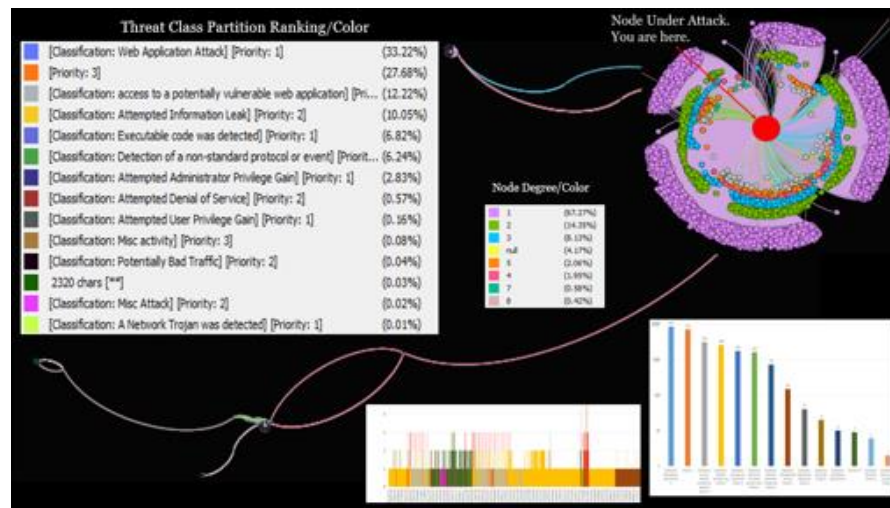
- **2017-2019: Program:** Theoretical Physics Derivation of unconventional and "impossible" antennas. Design, Prototype, and Operational Filed Test (classified)—exceeded all customer expectations, very stressing operational environment.
- **2020** – present: consulting to DoD, IC and commercial industry

2. **Areté Associates (April 2019-Present):** Senior Principal Scientist. Support to DoD and Intelligence programs from seafloor to space.

3.   **Noblis, Senior Data Scientist-Machine Learning (December 2015-April 2018):** Big Data Analytics, Machine Learning, and Artificial Intelligence applied to **Cyber Security** -Network Analysis, NetFlow Analysis, Log Analytics, fraud detection/analysis. Detection and mitigation of cyber security threats. Cyber Threat Intelligence Analysis, Cyber Hunting. Support to IR&D projects- Interdepartmental consulting for commercial applications to health care, market segmentation and finance. Government: DHS and Treasury.

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4.   **Stellar Solutions, Senior Scientist (July 2013-August 2015)**
Supported intelligence programs and business development, creating new opportunities by envisioning new dimensions of possibility space. Machine Learning/AI- Big Data use cases for several industrial sectors including: Financial, Insurance, Health Care, DNA genomics (phylogenetics), geospatial /temporal analytics, quantum mechanics, cyber security, predictive analytics, fraud detection, statistical data quality, and other scenarios of interest. Senior consultant to the US Government for Science & Technology, National Security, Denial and Deception, Crisis Support, Strategic Planning, Futures Forecasting, Political Economy, and Operational Analysis.
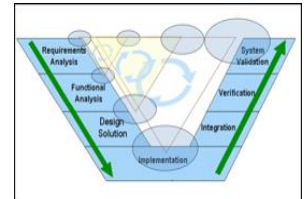
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5. **National Intelligence Community Support through DOD and NRO (TASC 1995-2009 and Aerospace Corp. 2009-2015, other organizations – through present)**
Defense and Intelligence Community senior level consulting (NIC/ODNI, DoD, U.S. Congress (HPSCI, SSCI, HASC, and SASC,), White House, and United Nations. Advanced AI and statistical data modeling and analysis involving Information-Geometric multi-dimensional manifolds with non-Euclidean geometries/metrics, Informatics, Algebraic Topology, Physics, Engineering, Econometrics, and GIS. Satellite Systems and Data Wrangling/Data Engineering. Econometric models of major Wall Street technology sectors – market segmentation and penetration analytics, statistical modeling, logistic and predator prey (survival) modeling and analysis. Neural networks – multi-attribute decision analysis (decision trees and dynamic tree branching based upon both Bayesian and non-Bayesian statistics). Process metrics derivation, human centered Big Data study, biologically accurate mind-brain modeling and simulation. Modeled the 2014 Ebola crisis. Big Data Analytics for requirements analysis. Regional Studies: Cultural anthropology, political economy and international security for Asia Pacific, Eurasia, South West Asia, Middle East North Africa, Sub-Saharan Africa, Levant, and Latin America.

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Selected Intelligence Community Senior Leadership Consultation

- Core Team Member, by name acknowledgement- Proteus: Insights form 2020, with Deloite & Touche; Integrated psycho-neurolinguistics, analytical history-political economy, psychology, security and international geo-cultural/regional factors throughout past and abstracted *future-histories*. Published a trade book – unclassified, available on Amazon. This work -to the present day, stimulates Proteus Projects World-wide and dynamic analytics for the U.S. Government and several Fortune 400 company Alternative Futures studies.

- Northrop Grumman Senior Technical Fellow- c-suite support to CEO, CTO and division VPs;

- Consulting to Venture Capital firms – Silicon Valley technology sector, semiconductors, nanotechnology, software, Machine Learning/AI, and data analytics;

- Originator of *"Base Hit"* Strategic Communication Instrument (one-pagers) 20 out of 20 were highlighted in OD&E weekly highlights;

- Nrothrop Grumman/TASC Senior Technical Fellow – Support to corporate CEO, CTO, business Dev, Corporate Strategy, M&A, division directors, and project teams (technical and operational: IC and DOD);

- ODNI and NIC: Foreign Denial and Deception Committee;

- US Congress (SSCI): Econometric modeling across various technology sectors;

- US Gov: Modeling of 2014 Ebola Crisis statistics;

- US Gov: Cyber Security, Big Data Analytics - Discovery of Anomalies;

- US Govt: Big Data Analytics for Large, Globally deployed Systems Engineering Requirements analysis;

- Support to Bomber Branch Chief/ HQ USAF Combat Forces Requirements Support: Special Programs;

- Support to SAF Executive Agent to the National Security Policy Board: Special Programs Consultant on issues related to: SIGINT, SIGCOM, White House, OUSD, State Department, AND AF SPECIAL PROJECTS see also NSPB2 link and mission coin received.

- Support to the Administrative Assistant to the Secretary of the Air Force SAF/AA: Special Programs, mission coin received;

- DNRO/Under Secretary USAF Peter Teets: Lead-Radiation Hard High Power Team;

- DCI Staff Support (classified);

- Community Management Staff support (classified);

- ODNI D&D Support (classified);

- NCS/CIA Support (classified);

- ADCI/C: Collection Concepts Development and facilitation of an analytical surge operation;

- Support to Dr. Pete Rustan (NRO, AS&T, MSD): RDT&E and Support to Military Operations;

- Support to Secretary of the Air Force Hon. James Roche: a system deployed to Iraq;

- Support to NRO AS&T Group Chief – Innovation, Analysis and Outreach to the IC;

Left: Operational Prototype deployed to OIF. So successful that a new R&D program was started to create the new system shown on the right.

War Game SME, scenario design conventional and WMD, AI data analysis and inference derivation from human behaviors

  - Analyst: UNREAL GAMING ENVIRONMENT
  - WMD BlackHat SME: Thor's Hammer.
  - SME: Space War Games
  - HDBT War Games, THUNDER, EADSIM
  - USIP Peace Games – International
  - Counterterrorism War Games;

- White House: Presidential Daily Brief contributor for Presidents G.W. Bush and B. Obama,PFIAB Support (classified), NSC: Briefer on an EUCOM -NSC: Prepared briefing on national support to PRI-1 Missions and Crisis Support;

- State Department: INR Support (classified), DS Support (classified), US Institute for Peace, Carnegie Endowment for International Peace, Woodrow Wilson oodrow Wilson International Center for Scholars

  - Lead teams supporting international 5 EYE interagency working groups consisting of SMEs, lawyers, and task forces;

- Congress: personally briefed HPSCI, SSCI, HASC and SASC staffers and members- giving formal testimony and once as a witness in an HPSCI hearing;

- Briefed NATO and UN senior executives and Combined Joint Stafs in EUCOM, CENTCOM, PACOM, and represented senior government officials in crises in Asia and the Middle East;

- OIF Support: D-day thru D+5 Scenario Team Facilitator by name appointed by ADCI/C;

- Counterterrorism (DHS and other agencies): Airport security: fused IR and THz wave spectroscopic imager design – defense in depth concept, analysis of terrorist interrogation reports. Support to the Counter Terrorism Center (CTC/CIA classified);

- Support to SIGCOM: (classified).

Satellite Systems Engineering: Physics, Mathematics, AI and Big Data Analytics

- Development of engineering roadmaps, functional requirements, system-level designs, system analysis and modeling, and operational support, early orbit and operations and ground support systems (mission payloads and ops). Technical support to prelaunch and early orbit testing including resolution of

anomalies.

- Managed system-level and component-level requirements and ensured traceability to design documentation, test cases, and operational training material;

- TASC Technical lead/program manager for a multiple sensor (ground-space) ISR constellation; an advanced multi-mission, multi-sensor, multi-platform system. Community-wide coordination across many discipline areas and organizations. Requirements definition and analysis including coverage, links, orbital dynamics analysis, multi-INT Big Data Fusion; and led international team on COPOPs IAW international law

- TECH-SIGINT (1999- 2015) - Signal Propagation Principal Investigator- Radio wave propagation modeling of- and collection over a curved earth in the diffraction region. Smooth and knife-edge diffraction. Antenna Design/Test/Analysis, Calibrated Indoor Antenna Range and tested foreign and domestic antennae. Analysis of outdoor antenna range data. Multistatic and monostatic coverage mapping (space, air, and ground systems). Fused data from over 35 national signals databases and over 10 IMINT data bases. ELINT, MASINT, and COMINT signal processing and exploitation (Internals and Externals). SIGDEV. Operational (Ground, Air, Naval, Space) SIGINT Support – RF and Cyber, Ground stations – other RF sites. Designed collection plans and receiver tasking parameters against various emitter targets subject to varied operational environments and constraints. Performed statistical signal processing of raw signals data, link budget calculations, diverse world-wide technology target analysis and SIGDEV for mission support, signal geolocation SME. SIGCOM support. Analysis of world-wide overhead SIGINT collection system. SIGINT systems engineering: collection, processing, international SIGINT data governance. SIGINT Counter D&D. Foundations of automata and sentience for signal processing.

- Image and Signal Geolocation, Fusion and Big data Machine Learning/AI analysis – diverse set of targets ground and other. 2-D and 3-D SAR and ISAR multistatic imaging. Co-creator of precursor to operational multi-INT AI-based data fusion engine.

- R&D advanced technology insertion into the baseline programs. Direct Support to Field tests (world wide) and data analytics associated therewith;
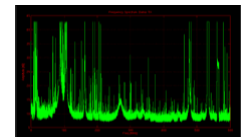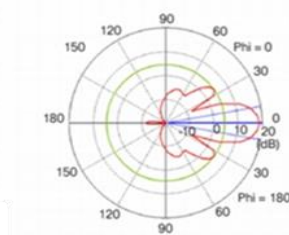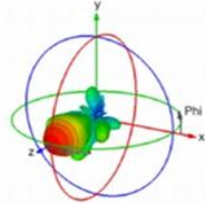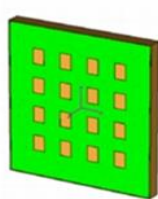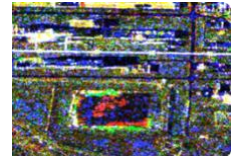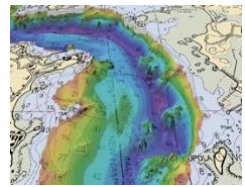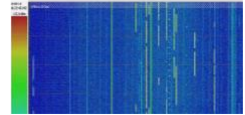
- Space Science: Orbital dynamics, guidance and control, bus systems, active on-orbit contamination control, synergistic effects of the space environment on spacecraft, launch threat analysis, nuclear, laser and RF weapon radiation effects. Space weather analysis.

- Interdisciplinary Leadership to include: scientific and engineering, human capital management, finance, strategic management, decision analysis and operational intelligence;

- Ground Processor Deployment (world-wide);

- SME ICBM launch ISR (launch, midcourse, end-game, detection, tracking, RV and MIRV mitigation);

- MASINT SME (classified);
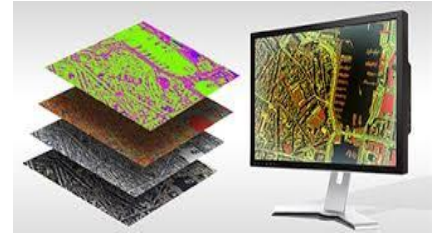
- Computed orbital elements, ground tracks, access and coverage for any satellite, aircraft, ground sensor in the space catalogue and Orders Of Battle. Thousands of objects modeled and associated AI-based analytics thereof;

- Space Counter D&D analysis (offensive and Defensive);

- Big Data Fusion, Machine Learning/AI, and analysis across platforms and systems (Theater, National and Special- ground/air/space/underground/undersea);

- Satellite and Ground Systems Performance Modeling and COOP;

- SME – Satellite Geolocation – Machine Learning/AI for automated scheduling and human site machine-assistant systems, virtualization systems engineering;
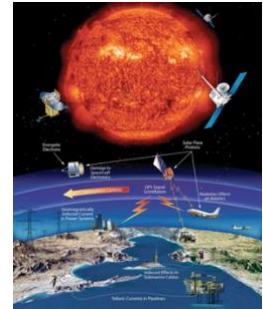
- SME Quantum ISR concepts, Originator of a Quantum ISR concept (1993-1995), and created a nationally funded quantum ISR program. This project related to Quantum computation (2 patents and several internationally published peer-reviewed journal articles as well as quantum cryptographical programs, this work is still cited in the literature today);

- Computed EO/IR/Comms/Radar access and link budgets from space-to-ground, space-to-space, space-to-aircraft, space-to-naval asset;

- Design of orbital maneuvers for survivability against all existing and many postulated man-made and natural threat scenarios- what is called space protection – Principal initiator of the DRNO's High Power Team on Satellite Survivability (2007);

- Foreign Space Surveillance system studies- Machine Learning/AI-based studies – work briefed to White house (NSC), senior IC leadership;

- COOP strategy team- ground/satellite systems resilience team member, inc. space protection (2002-2013).

- By-name consultant to MIT Aerospace faculty for space orbital design course and lab origination;

- Co-orbital small-sats and major platform studies – cube sat data analytics analysis of anomaly data;
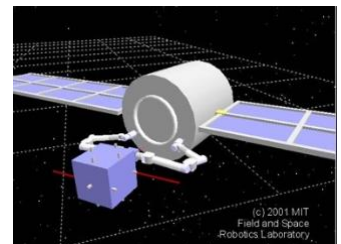
43947 Cheltenham Circle, Ashburn VA 20147   703-220-4605   polylmathn@gmail.com

- Design of special mission payloads, platforms, and orbits for U3 (unwarned, unexpected, unconventional) collection, processing, and action;

- Study of impacts of the earth-ionosphere-magnetosphere upon satellite survivability to include the effects of nuclear weapons in space and design of countermeasure technologies for platforms and payloads against man-made and natural threats (Space Weather modeling);

- Satellite Systems Engineering SME: analysis of requirements and capabilities, orbitology, warning, threat scenarios, for all aspects of existing and planned National systems- DOD, civil and commercial, foreign, and associated ground support infrastructures;

- Special mission space support to DOD and IC operations;

- Mission Analysis: Special Communications (2000-2001) Systems and CONOPS design and analysis for a national level office. Requirements definition and analysis. Deployed special communications equipment, mission scenarios, and performed field testing. Support to State Dept, DOD, field deployments.

- New U3 collection tasking pushing payloads beyond design specs;

- Offensive and Defensive Denial and Deception for space and other assets – direct support to ODNI/FDDC (presented with three U3 awards and an ODNI coin for this work);

- Design of space collection against top 20 NIPF missions, as well as contribution to mission assessment for the NIPF process;

- Support to NASIC for space system survivability issues – including kinetic events;

- SME consultant to CI and their support to Law Enforcement (FBI) on two cases and major issues requiring physics and national systems capabilities;

- Evaluation of DOD, DOE, and NASA programs with National system touch points;

- National Office consultant to LM Skunk Works (Palmdale);

- National Office Consultant to BOEING Phantom Works;

- SME by-name special consultant to Northrop Grumman for space and air collection against IEDs – personally assigned by SECAF to assist Northrop Grumman CEO with OIF counter-IED mission planning and analysis;

- Space/air collections SME supporting J2 commanders at: CENTCOM CJ2 (Afghanistan), EUCOM, PACOM; STRATCOM;

- National Office consultant to DOE labs for space systems and WMD, part of design and analysis teams for physics packages and unconventional delivery vehicles;

- National Office Consultant for underground facilities UGF (DOD, UFAC, DOE, NSA, CIA, ODNI) contributed to UGF intelligence assessments (Mulit-INT Collection, S&T analysis , physical chemistry, biophysics, and AI machine learning-and Big Data analytics);

- Space SME on Foreign Space-Related facilities, operations, assets and capabilities;

- SME for space collection against WMD targets and HDBTs – 5D's Science and Technology;

- SME for space collection against new uncharacterized HAL airborne assets;

- SME for: SIGINT, MASINT; COMMS; IMINT; GEOINT space Big Data collection and fusion;

- AI Machine learning for space asset scheduling;

- AI Machine Learning for space asset tasking, operations; analysis and dissemination;

- Ground station consultant for Calibration, COOP, deployed forces, and other ground issues;

- Space Systems Resilience and Survivability;

- SME Countering KKV and Space Debris effects;

- SME: countering threats to spacecraft launch and on-orbit;

- SME Integrated Special Mission Analysis (special communications) support to: State Dept., DOD, and IC;

- SME and R&D on Ring Laser Guidance and Control Systems for varied platform types: Space, Air, Ocean, rail guns, particle beam and RF weapons

- ICBM deployment analysis and characterizationof various MIRV targets illuminated by phased arrays, and radar image studies. Existence and uniqueness conditions for wide-band radar image analysis. Analysis of RCS (Radar Cross-Section) for diverse target sets and spectra. 3-D Radar Imaging, COBRA DANE/COBRA JUDY, Optical and other sensors. Radar coverage and system sensitivity analysis for a variety of fixed and mobile radar systems against a diverse of RCS target set. Fire control and targeting analysis. Code developer for reentry vehicle impact and damage scenario maps – thermonuclear war scenario end-game analysis. LO RCS derivation. Missile Technology and Launch Analysis (AI systems- analysis tools).

- Optimal parameter estimation- system identification and optimal control: developed new technique for the analysis of ring laser gyro error modeling. Modified Maximum Likelihood Estimation (MMLE) laser noise statistical analysis. Figure of Merit (FOM) studies, parametric effects of environmental features upon G&CS system performance. Nuclear hardness issues (underground test design and analysis). Experiment design and data analysis for quantum noise in RLGs. SICBM, MK-48 torpedo, cruise missiles, GPS correlation analysis, G&CS for space-based kinetic kill vehicles. Analysis of laser plasma dynamics in high electromagnetic field intensities.

- SME for Large Optics in space, "4 Miracles project" and Large Optics –Laser Weapon, X-ray Laser, Neutral Particle Beam Weapons;

- SME for High Energy Particles and Fields- impacts on space assets;

- SME for Missiles and Space signals analysis;

- SME for WMD ISR;

- Short Listed for crisis support (DOD, IC offices);

- Spacecraft thermodynamics and heat transport modeling and analysis;

- Spacecraft Bus: Power, Thermal, Attitude Control Systems;

- Spacecraft RF antennas and propagation: design, analysis, fabrication, anechoic chamber tests: near-field and far-field studies; link budget analysis – operational assessment for space-ground antenna and receiver performance: Comms/Radar/Signal Processing-Detection.
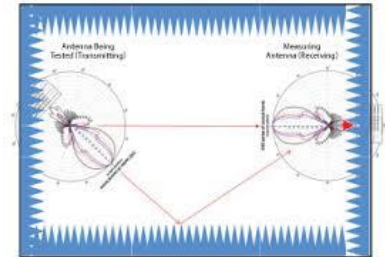
Interdisciplinary Science and Technology Programs
- Formulation of S&T long range alternative futures and conceptual roadmaps for long term investment strategy for large ($bn programs). Advanced statistics and financial modeling;

- Ocean Vessel TT&L (ISR support for counterterrorism, counter WMD, anti-Piracy);

- Management Consulting for nanotechnology start-up firms, venture capital valuation, forecasting and strategy development;

- Econometric analysis of US Semiconductor Industrial Competitiveness: coauthor of CDA Report for Congress. Political economy and comparative politics analysis – Cross Cultural communications. Analytical history of regional commands for DOD;

- Consultant to DOD and IC Legal offices for ITAR, CCB,   Patent/Trademarks for Advanced Semiconductor Technology.

- Coordination and management of advanced field testing for deployed forces. This activity takes new concepts to ground stations and to the battlefield, and it has been a major success for the war fighter and the national interest;

- Lead USAF Quantum Computation, Cryptography, Communications and ISR (QC3I);

- High Density ASIC multicore processor heterostructures – hybrid Analog/Digital Chips;

- Millimeter Wave Microelectronics: MMW Integrated Circuit packaging, physics - thermophoresis and electrophoretic mass transport, thermodynamics, whisker analysis, millimeter wave detector and payload systems design/analysis, High Power GaN semiconductor systems on chip;

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- Nonequiliberium Green's function and self-consistent multi-physics mesoscopic (atomic and nano-scale to bulk multi-phase (solid/liquid)) modeling of quantum mechanical excitations and transport of charge and phonons/plasmons;

- Machine Learning/AI Neurolinguistics and video behavior analytics: Developed new generalized Bayesian net-based analytical engines. Analysis for new advanced programs in speech analysis, neurolinguistics, combinatorial neurogenetics, cognitive modeling, mind/brain modeling and sentient computational machines. Ontological derivation and "Blink" analysis for system behaviors: lexical semantics, logical semantics based machine learning – vision and speech AI fusion
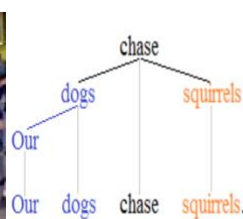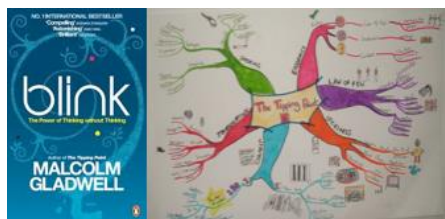
Performed this work with major research institutions (Stanford University, University of California Berkley, Scripps Institute, DARPA, Northrop Grumman, Lockheed Skunk Works). Incorporation of doxastic and epistemological modal logic into AI decision processes for human-machine interaction and machine-machine interaction. This work is still being pursued under other community programs;

- Graph-baed applications to national operational missions – derivation of ontological and dynamic hyperdigrph model-based behaviors of targets;

- Advancements to on-going programs supporting customer transition capabilities to: PACOM, EUCOM and CENTCOM. Program was critical in supporting EUCOM's operations in West Asia, Southern Europe, Africa & the Levant, the CENTCOM-EUCOM interfacial region, and the SWA operations;

- Direct support to overseas operations: counterproliferation mission; received IC recognition;

- Principal SETA for NRO Denial and Deception Team (2011-2013). Consulted for ODNI/FDDC, SIGCOM, CTC, and special programs;

- Spacecraft Payload Programs: Precision timing, solar cells, batteries, electro optical sensors, antennas and satellite RF systems

- Millimeter Wave Collection payload design, and collection Analysis. See also Millimeter Wave Microelectronics and TECH SIGINT;

- Science and technology development supporting counterproliferation analysis;

- Strategic Analysis, long-range alternative futures and conceptual roadmaps to include technology valuation, futures forecasting and associated science and technology investment strategy;

- SOF/SOLIC Support: Special Operations and Low Intensity Conflict, MOOTWA – Military Operations Other than War, Flew in AFSOC Aircraft, deployed with ground troops: US, UK, NATO see also SOF Science Adviser;

- Political economy analysis of the worldwide emerging semiconductor market. Competitor analysis, Econometric analytics – Technology Futures Valuation and Forecasting;

- PROTEUS -alternative futures program, (Core-team, contributor to a book published on the project, *Proteus: Insights from 2020*, pub. Copernicus Press, ISBN: 0-9706885-0-4, 2000)
- Future World Environment Creation and Shaping
- Game Scenario Design
- Actor Attributes
- Planes of Influence – Drivers and Reactions
- Complex discrete Relationships
- Uncertainty, Risk, Surprise Modeling;
- Big Data Mining, Modeling and Analysis
- Excel, Alteryx, Ayasdi, SPSS, SAS, Python, R, SPARK, JULIA, SCALA, analytics: Machine Learning, regression, hypothesis testing, econometric models of major Wall Street technology sectors – market segmentation and penetration analytics;
- Statistical modeling, segmentation, logistic and, predator prey (survival) modeling and analysis;
- AI/Machine Learning/Neural Networks – self modifying, multi-attribute decision analysis (decision trees and dynamic tree branching based upon data, both Bayesian and non-Bayesian statistics)
- Process metrics derivation – all systems studied;
- Human Centered Big Data Study – neuron spike modeling in humans, insects, and emergent systems – such as swarms of AI-based systems;
- Modeling the 2014 Ebola Crisis;
- Big Data Analytics for Large, Globally deployed systems requirements;
- Mind-Brain Modeling and Simulation- biologically accurate.

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Regional Studies: Analysis, and Operational Support: Cultural anthropology, political economy and international security studies and analysis

- **Asia Pacific**: Cultural anthropology, political economy and international security. US-Asian policy (S&T) including study of the history of science and civilization in China, Japan and impacts/interactions with the West. Study of cross cultural interactions and national interests in the Asia Pacific region.   Consulted USFK in a peninsula crisis – received mission coin.

- **Eurasia, including South West Asia (SWA)**: Cultural anthropology, political economy and international security. Counter terrorism and development. Peace and justice studies. Russian Federation and former Soviet Republics' emerging transnational issues and impact on the US strategic interests. International securitization issues concerning Eurasia and SWA.

- **Middle East-North Africa (MENA), Sub-Saharan Africa and the Levant:** Cultural anthropology, political economy and international security. Studies of counter terrorism, gray arms, energy and strategic materials, as well as and peace and justice studies. Study of poverty, health and human diasporas and transnational impact on US national interests in the region. Received mission coin.

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USAF Chief, Nontraditional Sciences– Special Projects Group, Civilian Scientist (1990 -1998), some work overlapped with above Intelligence Community support

There were over 150 technology projects in my portfolio and separate projects pertaining to international security policy for various world regions.   Details of the programs are highly classified, but highlights of programs include:

- Technical and policy consultation to new Research Development Test and Engineering (RDT&E) programs;

- Direct Support to SECAF on special programs;

- Direct Support to SAF/AA;

- Direct Support to Exec Assistant/AFSAB;

- Direct Support to ADCI/C;

- S&T support to chief, SAF/AAZ. Support to director, Science and Technology Integration, Office of Security, Counter-Intelligence and Special Program Oversight. Support to director, AF Science Advisory board. Support to director, Plans, Programs, and Budget, office of SAF/AA.

- Underground imaging and materials detection/analysis;

- Counterproliferation;

- Counterterrorism;

- Weapons of Mass Destruction (WMD) effects modeling, Black Hat SME to war games;

- ISR analysis of foreign UGT events – national and DOD assets, patents flew on DOD aircraft supporting these missions;

- Electromagnetic wave and particle propagation (free space and through dense media, exo- and endo-atmospheric). Includes: communications, radar, jamming, Low Observables (LO)/counter LO, 3D UHF/VHF monostatic and multi-static volumetric SAR imaging, and EW-ECM;

- Team lead for design, test, and deployment of 3D UHF/VHF volumetric SAR to detect and locate UGFs, buried IEDs, and contraband caches in Iraq and Afghanistan, included FOPEN and BPEN;

- Hypervelocity aircraft, projectiles and endo-exo atmospheric vehicles;

- S&T support to Bomber Branch Chief, HQ-USAF Combat Forces Requirements division;

- National Telecommunications and Power system infrastructure analysis and protection;

- Water Supply analysis and Protection;

- Middle East Water analysis – Future Wars will be fought over water as well as oil;

- Jungle operations analysis – SOCOM and PACOM CT support

- Historical and cultural study and analysis of Chinese technology and innovation over 6000 years- and how we must understand it: briefed Pentagon;

- Historical and cultural study of Middle East North Africa (MENA) over past 300 years – briefed to Pentagon;

- Weapons Effects Studies (Theory and Experiment): rail gun, gas gun, GBU, nuclear, bio, chem, radiological, laser, maser, and acoustic sources. Field tests- ballistics of small arms against personnel transport vehicles and designed countermeasures. Briefed Army for USAF.

- Performed QRC field experiments, built ISR sensors and proofs of principle experiments – for a wide variety of scenarios – RDT&E and deployment to troops in OIF and OEF in faster than normal acquisition could imagine;

- Consultant to the National Security Policy Board, White House, and Department of State for:
    a. Regional statecraft strategies regarding diplomatic instrument trade-off studies
    b. Chemical, Biological, Radiological, Nuclear (CBRN) weapons effects
    c. Underground/underwater C3I communications concepts
    d. Technological investment strategy
    e. Long- and medium range strategic planning team involvement: global political and economic technological studies including deeper analysis of several major technology thrusts featured by Gartner, CD-NET and Economist
    f. Nontraditional communications concepts
    g. Psychological Operations (PSYOPS)
    h. SOF Science Adviser-   A variety of advanced complex warfare systems analyzed as potential means and alternatives to implement Strategic (WMD), Facility Denial, and LIC/MOOTW (SOF-Low Intensity Conflict and Military Operations Other Than War, including plans and policy. Joint operational theater concepts and treaty implications considered, and advice/council given to national level commanders in areas regarding scientific and technological means to implement policy. Contributor to long- and medium range-Strategic Planning Process. Deployed to the field with troops (in BDUs). Flew on special collections A/C. Pentagon office adviser. Chief, Intelligence Data Fusion- Global Military Exercise;

- Senior OUSD level S&T programs, and "Black Hat" counterterrorism and counterproliferation studies;

- Non-Traditional Avionics Manager- Consultant team for the integration of a new nontraditional avionics sensor package onto several aircraft systems; fixed and rotary wing. QRC-RDT&E and deployed to field within one year – to include Acquisition Control Board and Flight Safety certification board interaction;

- Nuclear weapons design concepts and stockpile stewardship mesoscale physics analysis;
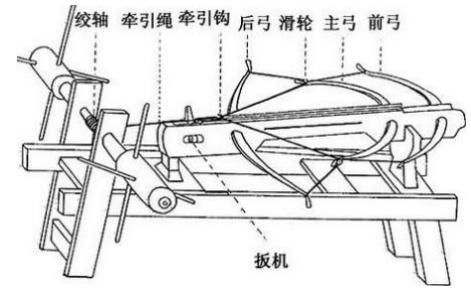
- Various roles in Data fusion: programmer, tool developer, program manager, data fusion lead for deployed field test (EFX and CFX). Rapidly brought laboratory photonics experiments to the battlefield with troops---QRC rapid experiment –to-field … faster than acquisition cycles could allow;

- Technical support to the GBU-28, and the B-61-11earth penetrating nuclear weapon, Hard and Deeply Buried Target HDBT AOA (advanced hydro-codes, mesoscale nuclear effects analysis for DOD, DOE, and DTRA);

- Nuclear Weapon detonation modeling (mesoscale effects- quantum –to-classical waves and residual nuclear effects);

- Studies of advanced materials quantum/nanotechnology based systems for various DOD and IC applications;

- Supported Marine-1 testing and other highly sensitive programs;

- CEO/CFO -Applied Mathematics and Systems Science Corporation: Consultant for at-Sea Hazardous Waste Incinerator Control system analysis (blast furnace thermodynamics). Liquid Level Control system and Venturi control system analysis. Environmental Science, supported U.S. EPA for statistical analysis. Business development.
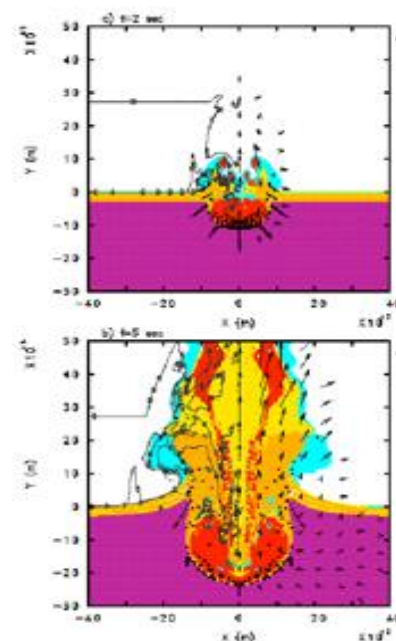
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Nuclear and Condensed Matter Physics (1983 - Present - various organizations, overlapping timeframes)

1. Nuclear, Chemical, Biological, Radiological, RF, Laser and WMD Studies (ongoing)

2. Counter Proliferation Analysis, CBRN+missiles (2000-present) – Crisis Leadership and geopolitical consequence analysis for various national target teams

3. Mesoscale Nuclear Weapons Design and Effects Analysis (1999-2009) Picoseconds to years

4. Radiation Hard Microelectronics, both academic studies and support to DoD/National level offices (1983-2008) Theoretical and experimental work including: micro- and nanomaterials, devices and systems. Physiochemical materials and device synthesis, defect dynamics, crystalline and noncrystalline materials growth characterization. Mico- and nanocellular cellular aerogels and polymers, (synthesis, analysis, technology applications development), optical and e-beam lithography, and device-level studies, to include contact-device (metal and semimetals – to-semiconductors and organic material heterostructures) and study of the synergistic effects of the space radiation environment upon materials, devices, circuits and major systems. Support to DoD (Air Staff pentagon) and industrial consulting to Silicon Valley and university spin off firms. SETA to PC-750 design team.

5. Nuclear Testing (1983-1993)- Principal Investigator- Solid State Materials (organic and inorganic materials and devices), Electronic Devices (SEU), SGEMP, Ultra-low density materials effects (aerogels in simultaneous thermal and ionizing radiation events), prompt and latent event effects. Synergistic space radiation environmental effects upon satellite systems. Space based beam weapons/survivability. Patents on radiation hard opto-electronics for nuclear weapon guidance and control systems.

Apparatus: ^{60}Co, symmetrical cylindrical gamma-ray source, Dose Rate: 2.5 Mrad/hr, Linear Accelerator (electron and positron pulse and CW beams (Dynamatron, electron gun and Ion Beam sources)), and X-ray Irradiation. Plasmas, Dosimeter studies (various types). Performed nuclear spectroscopy and radiation induced defect dynamics modeling. Ring Laser Gyro radiation test analysis. Electromagnetic pulse and rail-gun effects on gaseous and solid state lasers. Nuclear weapons Testing UGT.

6. Nuclear Physical Scenario Analysis (1983-1985, 1990-2013, 2022-present)

6.1 Weapons & Systems Survivability (1983-1985, 1990-2013) Offensive and Defensive MIRV reentry models. High Energy Particle and wave beam systems (neutrals, ions, photonic, electromagnetic). Major systems (manned /unmanned) survivability in radiation and complex electromagnetic environments (exo-endo atmospheric). Hypervelocity impact experimentation. High energy density laser damage/secondary radiation experiments. Pulsed power damage to electronics and optics. Strategic missile and bomber survivability. G&CS survivability and targeting accuracy studies.

6.2 Environmental and Biological Nuclear Event effects (1983-1985, 1990-2003) - Underground Test design and analysis. Foreign Counterproliferation analysis for the S&T engineering lifecycle: R&D→production→retirement. U.S. and foreign ground system survivability (electronics, communications, force structure: counter-value and counter-force). *Target Team* member- WMD Counter Denial and Deception and crisis team member (received award – classified). Contributor to WMD/Missile/UGF ODNI policy documents.
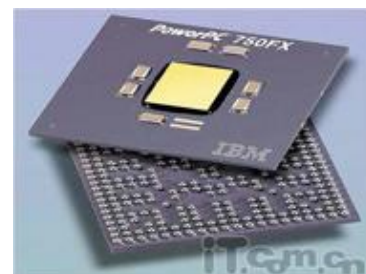
7. Non-nuclear EMP and DEW (Directed Energy Weapons) – DoD/IC joint program office (1995-2002) - Chemical and electromagnetic processes for unique weapons effects, semiconductors and systems (classified)

8. Chemical Explosive detection, forensics and analysis: DOD, Counterterrorism, DHS, CTC (1995-2010) Analyzed chemical explosive photochemistry, spectroscopic imaging, molecular dynamics and detonation forensics using advanced hydro-codes and test center samples. Performed field testing. Assessed proposed threat scenarios and countermeasures.

9. IC/MDA/DTRA/DNA/BMDO/SDIO Missile Studies- Team member and individual contributor. Provided technical support on satellite ISR, processing, target detection/tracking and fire control for KKVs, high energy lasers, and particle beam weapons programs. Radiation effects (natural and man-made) upon electronics and optics in endo- and exo-atmospheric environments. ICBM/Mobile Missile/SLBM analysis (technical capabilities and deployment analysis, ISR, and countermeasures).   WMD analysis (CBRN) and Black hat SME for war games and tiger teams. Signals analysis of Missile events, Signals mission collection planning and analysis, Fused Imagery-Signals MASINT collection planning and analysis, multiple platform missile launch detection and analysis. Foreign missile technology assessments. Missile plume and chemical plume detection and analysis (active and passive).
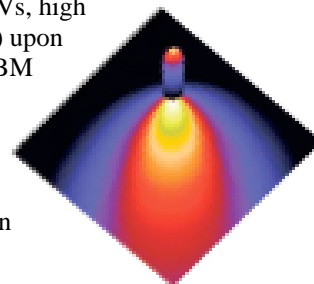
10. Atmospheric and Ionospheric Modeling of Solar-driven Space Plasma Dynamics and impacts on Radar, Communications, Electrical Power Grids (satellite and Terrestrial systems).   Nuclear Weapon energetics: mesoscale modeling from picoseconds to hours, days, and years.

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Quantum and Condensed Matter Physics (1983-Present)

1. Quantum Information Sciences (1993-1998) Program Manager, team member and independent researcher. Derivation of quantum mechanical Hamiltonians for two- and three-spin interactions yielding quantum mechanical realizations of the NOT, XOR, and other Boolean (and non-Boolean) logic gates. Derived new Radix-R > 2 quantum algebras and logics derived for candidate quantum chains and lattices. Quantum Information Theory investigated. Quantum wavelet algorithms investigated for data encryption and information representation. Dr. Hotaling served as the science advisor to a national level office for its Quantum Information Science program. Dr. Hotaling designed a quantum cryptographic system experiment, which was successfully transitioned to another national level organization (device set world record for quantum cryptographic key distribution). Well published and cited by community as the originator, listed by name in community compendia on the foundations of quantum mechanics. Quantum mechanical gravity gradiometers and gradiometric applications, to include tests of PPN models of Einstein's General Theory of Relativity and DoD applications thereof. Slow Light physics and quantum mechanical applications to communications, cryptography, EW and other areas. Phase transitions and critical phenomena – statistical physics, scaling effects and applications.
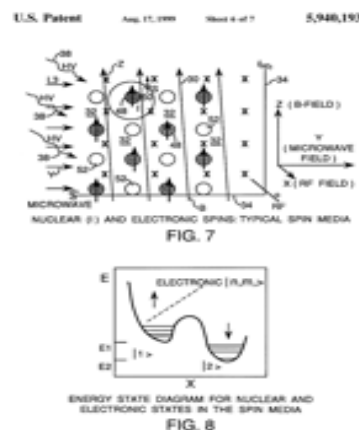

2. Photonics and Optics (1992-1998) Nonlinear Optical Materials (crystals, polymers and microcellular materials), Spacecraft electro-optics survivability (synergistic effects of low earth orbital environment). Quantum mechanical modeling of photonic excitations in photorefractive crystals, semiconductors, photovoltaic materials, devices, and systems (e.g. solar cells and optical modulators, waveguides, filters and quantum wells). Defect creation, annihilation dynamics modeling, photo-carrier trapping dynamics. Dr. Hotaling served on international photonic technology assessment committees. Investigation of the quantum implications for nanotechnology. Originator, SPIE Quantum Computing Working Group, Chair: first and second SPIE Photonic Quantum Computation Conferences. Designed interface between operational KG-228 and Free Space Quantum Key Distribution (QKD) system.
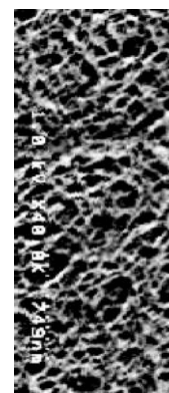

3. Materials Growth and Characterization (1985-1994)

3.1. Physical Chemistry (1993-1994) Principal Investigator- Determined the influence of transition metal dopants on the physico-chemical properties of Bismuth Metal Oxide Sillenites (BMO, M = Si, Ge, or Ti). Intrinsic and doped single crystal samples of BMO were grown using the Czochralski and hydrothermal techniques. Proved that similarly doped Czochralski- and hydrothermally- grown BMO materials had identical properties. Samples were optically characterized using: infrared, ultraviolet and visible absorption and UV- photoluminescence spectroscopy. Microstructure was characterized using the reverse-Laue x-ray diffraction technique. Impurity analysis included: Energy Dispersive X-ray (EDX), X-ray Photoemission (XPS), and Auger Electron Spectroscopy (AES), and Photoluminescence (PLS) and SPARK-Source mass (SMS) spectroscopy. Electron Nuclear Double Resonance Spectroscopy (ENDOR) was used to characterize defect dynamics (**LINAC** –linear accelerator and other radiation sources used in defect dynamics studies). Work Performed at: Naval Research Laboratory (Washington, DC), MIT/Hanscom AFB, Clarkson University (Potsdam, NY), collaborated with Smithsonian Institute (Washington, DC), and U.S. National Archives (Adelphi MD).
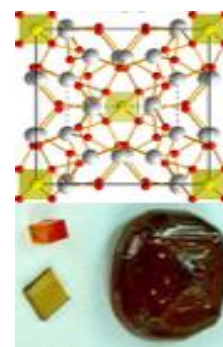
3.2. Organic and Inorganic Photochemistry (1992-1993) Principal Investigator - Synthesized and characterized dichromated polyvinyl alcohol (DCPVA) photopolymer. Organic materials may be alternatives to bulk crystalline photorefractives - for example in applications in which thin film photorefractives are desired. Thin film dichromated poly (vinyl alcohol) or DCPVA, was investigated as a holographic storage medium. Sample survivability in ionizing radiation environments (gamma, x-ray, neutron, neutral particles, electrons and positrons) which were tested in a space environmental chamber at various temperatures. Work cited by NASA and ESA satellite programs.
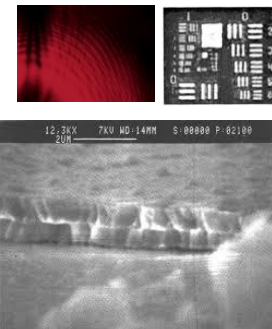
3.4. **Surface Science** (1990-1993) Principal Investigator- Jet Spray, electron beam, neutral particle beam, and ion beam contamination removal. Spectroscopic studies included: EO, FTIR, Auger, XPS, EDX,

SMS, UV, Quartz microbalance, surface renormalization studies, Crystallography, Reverse Laue X-ray backscatter, VUV photopolymerization, LN2 and LHe surface science studies—Three semesters of surface science course work.

3.5. **Nanocellular Materials** (1991-1993) Principal Investigator- Synthesized and characterized microcellular gels, foams and emulsions. Characterized samples for thermal and ionizing radiation survivability in a cryogenic vacuum environment. Hold several patents for this technology. These materials were applied to deployed counter proliferation (WMD) systems, contamination control, and ultra-lightweight optical component applications. Applications extended to spacecraft contamination control, AFSOC missions, counterproliferation platforms, and counterterrorism deployed technologies. **This patented invention received the Air Force Materiel Command Science and Technology Achievement Award, presented by Dr. G. Abrahamson, AFMC Chief Scientist.** The patent has been applied in several areas of the military and civilian sectors. Dr. Abrahamson later became a mentor to Dr. Hotaling.

3.6. Semiconductors and Nano-Technology (1991-1993) Principal Investigator -Nanofabrication techniques at Cornell University National Nanofabrication Facility. Developed contamination control concepts for nanofabrication. Patents held in micro- and nanocontamination control and nanocrystalline semiconductor structures. Discovered and patented the process of depositing passivation layers on micro- and nano-cellular foams. Studied low dimensional elementary excitations and transport physics, and nanotechnology applications. Atomic scale device models, e.g. how many atoms does it take to constitute a transistor? Nano-scale RF tuners and meta-materials. Cornell NNF Visiting Scientist.
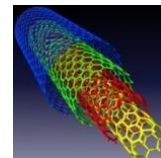
3.7 Quantum, Nuclear, and Kinetic Effects in Critical Materials and Devices (optics, photonics, microelectronics, and energetic, and structural materials)- Guest Researcher (1994), Naval Research Laboratory, Washington, DC. Chemistry and Materials Science Department, spectroscopic studies of photonic materials, high energy beam weapons effects studies, nuclear radiation effects, KKV impacts upon materials.
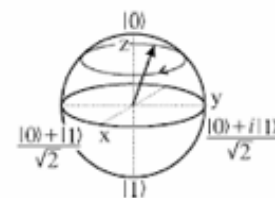
a. **Atmospheric Propagation and Scattering (1990, 1992-1993, 2001-2004, 2009-2010)**: RF, EO, IR, MMW, THz, single photon, and quantum-entangled photon: propagation, absorption, scattering, target cross section, including refraction, diffraction, reflection, ducting, scatter, speckle, light squeezing, slow light, physical optics, NLO, quantum optics, adaptive optics, advanced mirrors and telescopes, IR scene projection, hyperspectral imaging, radar imaging, multistatic non-traditional signals imaging. Low Light near-IR system RDT&E, and deployment. Indoor/outdoor antenna range target characterization
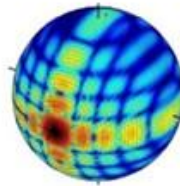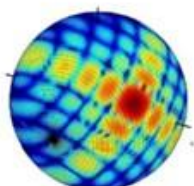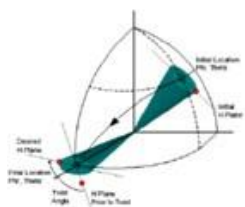
. An example of spherical rotations to illustrate moving a pattern feature in the Phi, Theta coordinate frame
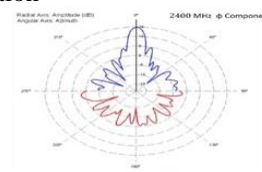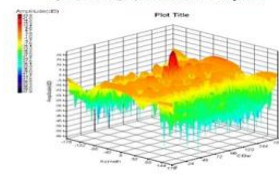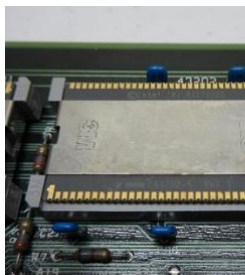
3.9 Plasma Enhanced Chemical Vapor Deposition (PECVD, remote PECVD) of amorphous silicon (a-Si:H, a-Si$_x$Ge$_{1-x}$) thin films; Plasma reactor design and fabrication. Electron Paramagnetic Resonance (EPR) and transient Time of Flight (TOF) material characterization experiments designed and performed. Photolithographic electrode mask and device fabrication performed. Metal semiconductor contact study. Characterization of laser and high intensity IR radiation induced degradation of a-Si:H materials -modeling of radiation induced degradation. EPR characterization of material parameters: fabrication- and radiation- induced defects. Gauge theory of topological defects. Modeled the effects of growth parameters upon electron and hole μτ-products (1985-1988). Contact materials studies.   Application area – Solar Cells, flat screen transistors, and semiconductor research.
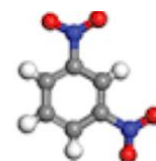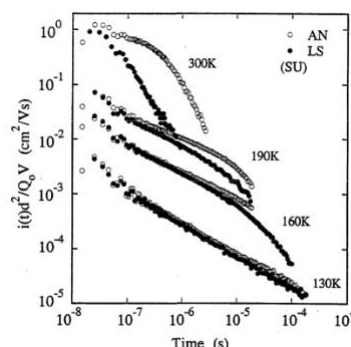
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CEO/CFO AM&SSC (Applied mathematics & Systems Science Corporation): Stochastic systems analysis (1983-1985), see also Control Systems Engineering work.

Undergraduate Work

- **Control Systems Engineer** -Student team member: design and engineering of stable platform test and measurement facility for fusion of FLIR and SAR/ISAR radar sensors (ARMY Helicopter and NAVY (A6-E) systems). Analog feedback and control system design using PID controllers. Digital control system design using Intel 2920 digital filter microprocessor (1981-1983). Nonlinear Control System design/analysis. Avionics weapons fire control systems analysis. Stochastic systems analysis. Thermodynamics of Blast Furnace Venturi design for complete burning of Organic VOCs and remote sensing thereof– at sea incineration of Hazardous waste, laser altimeter RDT&E. Built a scaled-down NASA aircraft wing (inverted for drag racing) and performed wind tunnel testing: hydrodynamics, Navier-Stokes analysis.

- **Parallel and Distributed Processing-** Student Team Member- Analysis of Precedence Maps for: the Red, Green, Blue, Dianna, early versions of the Ada object oriented, concurrent programming language. iAPX432, 80286, and 2920 system analysis. Studied early Ada compilers in a 432 environment. Independent study and course work in parallel processors and multiple microprocessor systems (1981-1983). Software testing for multiple distributed processors used on CONUS radar coverage. Derivation of group theoretic behaviors for parallel processing and precedence mapping. Parallel computer instruction set architecture design and analysis. Ph.D. level course work as an undergraduate.

- **Consulting to earn my way through school**: Aero/hydro dynamics: Airfoil design, build, WindTunnel test and modeling (Navier-Stokes eqns. etc.). Modified NASA airplane wing design (pub. NASA Tech. Briefs) for application as a drag racer airfoil. Venturi Analysis – Thermal Jet and Blast furnace system (At Sea Incinerator combustion analysis). Microwave communications system consulting.
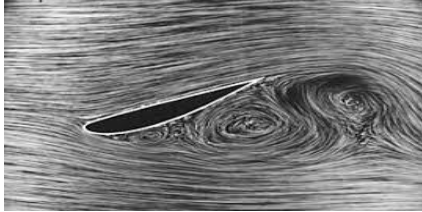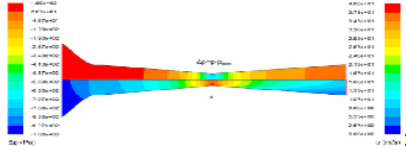
$$\rho \frac{d}{dt}(\mathbf{u}(x,y,z,t)) = \mathbf{s} \quad \Rightarrow \quad \rho\left(\frac{\partial \mathbf{u}}{\partial t} + \frac{\partial \mathbf{u}}{\partial x}\frac{dx}{dt} + \frac{\partial \mathbf{u}}{\partial y}\frac{dy}{dt} + \frac{\partial \mathbf{u}}{\partial z}\frac{dz}{dt}\right) = \mathbf{s}$$

$$\Rightarrow \quad \rho\left(\frac{\partial \mathbf{u}}{\partial t} + u\frac{\partial \mathbf{u}}{\partial x} + v\frac{\partial \mathbf{u}}{\partial y} + w\frac{\partial \mathbf{u}}{\partial z}\right) = \mathbf{s}$$

$$\Rightarrow \quad \rho\left(\frac{\partial \mathbf{u}}{\partial t} + \mathbf{u}\cdot\nabla\mathbf{u}\right) = \mathbf{s}$$

- Finite Element Modeling/System Test: Mechanical vibration testing using hydrodynamic and electrodynamic shakers, control system design/test of Gimbaled G&CS systems; Thermal and electrodynamic modeling of glass structures, electromagnetic field modeling and measurements inc. antennas
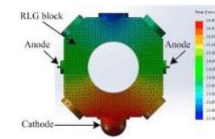
- **Microwave Systems Corp.** Technician: Microwave technology (1 to 60 GHz): Design, Build and Repair microwave Phase-Lock Loop frequency stabilization equipment used for stabilization of klystrons, Traveling Wave Tubes, Backward Wave Oscillators and plasmas. Microwave circuit (strip line) design, build, and test. Build test microwave comb generators. These systems were used in magnetic resonance spectroscopy, atomic clock frequency standards, and Communication and RADAR systems. Built and tested high precision crystal oscillators and frequency standards. Digital ECL Phase Locked Loops. Experiments in digital signal receivers. Managed subcontract proposal bids for spare parts contracts. (1979-1982)
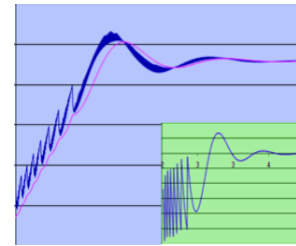
- **Forensic Engineering Analysis-** Student Team Member: Engineering analysis of industrial accidents and fires. Effects upon electrical systems of lightning, severe weather, and vehicle fires. Materials analysis of post fire explosion in buildings, determination of heats of fires. Analysis of power distribution system faults which caused fatalities (took theoretical electrodynamics and explained in practical terms for lawyers). Customer base consisted of insurance companies (1982-1983).

Education

Ph.D. (Engineering Science, Interdisciplinary-Physics), Clarkson University

M.Sc. (Condensed Matter Physics), Syracuse University

BS (Electrical Engineering), Syracuse University

Diploma Air Command and Staff College (ACSC), Air Force University

Teaching

1986-1990 Syracuse University (Instructor) Physics 101/102 and Physics 201/202, Astronomy 101, Physics Labs
1991-1993 Utica College of Syracuse University (Adjunct Professor of Physics) Astronomy 101
Currently: Private teaching – Big Data Analytics (1 student); Physics (1 student), mentoring graduates
Nuclear and Radiological Weapons Design and Effects on Biological and Inorganic materials, ACSC
Chemical and Biological Weapons, ACSC
World-Wide Nucler ForcesStructures, ACSC

Publications

9 US Patents Issued, Hundreds of publications and citations

White House Briefings, Publications and Submissions

Microelectronics work presented to President Obama at MIT (2009), part of a technology brief, name not mentioned. Two separate classified operational support topics prepared to support the President Bush Daily Brief (2007). On one topic, Dr. Hotaling received a by name reference by briefer- original charts used, and he received a thank you note from the briefer's agency. Prepared data/presentations for NSC on national systems response and timeliness for PRI-1 missions.   Briefer to national- level office and White House (NSC) for European regional political issue (1997-1998). Prepared response to NSC for National Level Office on PRI-1 mission responsiveness (2008).

Congressionally Directed Actions (CDA)

R. Ridgley and S.P. Hotaling, Competitiveness of the US Semiconductor Industry, Prepared as a response to CDA from Senator J. Liberman to DNRO (2003)

Electronics and Semiconductor Roadmap support to R. Ridgley, presented to S&T congressional staffers and the Intelligence Community (2004)

Satellite Systems: Future concepts, support to Mr. Ridgley, presented to S&T congressional staffers, and the Intelligence Community (2004)

Briefings to the US Congress (HPSCI, SSCI staff, and SASC staff), and served as witness giving formal testimony to a HPSCI hearing (2013).

Journal Articles

1. D. Mozyrsky, V. Privman, S.P. Hotaling, Design of Gates for Quantum Computation: the XOR gate based upon two-spin Interactions, International Journal of Modern Physics B (1998)

2. D. Mozyrsky, V. Privman, S.P. Hotaling, Design of Gates for Quantum Computation: Extended Quantum XOR Gate in Terms of Three-Spin Interactions, International Journal of Modern Physics B (1998)

3. S.P. Hotaling, Radix R> 2 Quantum Computation, International Journal of Theoretical Physics, January, (1998)

4. D. Mozyrsky, V. Privman, S.P. Hotaling, Design of Gates for Quantum Computation: the Not gate, International Journal of Modern Physics B, (1997)

5. S.P. Hotaling, Photon-Spin Interactions in Condensed Matter Systems: A Potential Foundation for Photonic Quantum Computation, Proc. SPIE, vol. 2749, (1996)

6. S.P. Hotaling, Photonic Excitations in $B_{12}SiO_{20}$, Proc. SPIE vol. 2487, (1995)

7. S.P. Hotaling, The Influence of Transition Metal Oxide Dopants on the Properties of Bismuth Metal Oxide Sillenites Grown By the Czochralski and Hydrothermal Techniques, Ph.D. Dissertation, Clarkson University, Potsdam, New York (1995)

8. S.P. Hotaling, et al, An Advanced Particle Removal & Collection and Control System, in Particles On Surfaces , ed. K.L. Mittal, pp. 1-140, Marcel Dekker Press, December (1994)

9. S.P. Hotaling, Adapting Military Technology for Civilian Use: Contamination Removal and Collection Techniques, Microcontamination, (1 May 1993)

10. S.P. Hotaling, G. Manavannian, R. Changkakoti, R.A. Lessard, The Performance and Survivability of Dichromated poly(vinyl alcohol) Holograms for Photonic Applications, USAF   Laboratory, RL-TR-93-131 (1993)

11. S.P. Hotaling, Aerogel Optical Substrates, Journal of Materials Research, vol. 8, p.352, (February 1993)

12. S.P. Hotaling et al, Amorphous Hydrogenated Silicon Photovoltaic Thin Films Deposited Onto Ultra-Low Density Aerogels, in Amorphous Silicon-1991 , ed. A. Madan, Materials Research Society Press, (September 1991)

13. S.P. Hotaling, H. Antoniadis, and E. Schiff, Electron Mobility-Lifetime Product and Dangling Bond Defect Density in a-Si:H, Journal of Noncrystalline Solids, vol. 114, p420 (1989)

14. S.P. Hotaling, H. Antoniadis, and E. Schiff, Electron Trapping and Paramagnetic Defect Density in a-Si:H, Solar Cells, vol. 27, (1989)

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Editorials

1. S.P. Hotaling, Ebola's Economic Impacts, Global Health NOW, Johns Hopkins University Bloomberg School of Public Health, Issue 159 (2014).

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Conference Papers and Selected Technical Reports

i.   Thoughts on Big Data Analytics and Machine Learning for Cyber Security (presentation January 2017- considering for book).

ii. On Measurement, Computation, and Automata (presentation March 2017- considering for book).

iii. Automata: Minds, Brains, Consciousness, Computation, Machine Learning and Artificial Intelligence, Science and Technology Research Lecture, Noblis (presentation January 2018- considering for book).

0.1 Big Data Analytical Detection and Modeling of watering hole cyber attacks (submitted, IEEE 2017).

0.2 Dynamic reconfigurable network topologies in hypergeometric manifolds (in preparation).

1. Colloquium Presentation: Quantum Measurement and Computation, George Washington University, Department of Electrical and Computer Engineering ECE COLLOQUIUM SERIES Wednesday (April 3, 2013)

2. International Security and Evolution, Northrop Grumman Technical Fellow Presentation (2006)

3. S.P. Hotaling, Quantum Mechanical Implications for Nanoscale Devices 2000, NASA **Nanospace** Conference, Galveston TX (2000)

4. S.P. Hotaling, Quantum Computing, AFRL-SN-RS-TR-1998-49, available through NTIS (1998)

5. C.M. Bowden, J. P. Dowling, S.P. Hotaling, Quantum Computing ENDOR, first NASA Conference on Quantum computing and Communications (1998)

6. S.P. Hotaling, Radix R>2 Quantum Computation, SPIE conference on Quantum Computing, April 1996, published in: Photonic Quantum Computing 1, S.P. Hotaling and A.R. Pirich, editors, SPIE Press, (1997)

7. C.M. Bowden, J. Dowling and S.P. Hotaling, ENDOR-based Quantum Computation, SPIE conference on Quantum Computing, April 1996, published in: Photonic Quantum Computing 1, S.P. Hotaling and A.R. Pirich, editors, SPIE Press, (1997)

8. D. Mozyrsky, V. Privman, S.P. Hotaling, Hamiltonians for Quantum Computation in: Photonic Quantum Computing 1, S.P. Hotaling and A.R. Pirich, editors, SPIE Press, (1997)

9. C. Bowden, J. Dowling and S.P. Hotaling, Magnetic Resonance in Quantum Computation, Optical Society of America General meeting, (August 1997)

10. S.P. Hotaling, Introductory Comments on Quantum Computation, Faculty Colloquium, Clarkson University, (October 1996)

11. S.P. Hotaling, Higher Radix Quantum Computation, International Quantum Structures Conference, Berlin, Germany (August 1996)

12. S.P. Hotaling, Quantum Computing, AFOSR (1996) -- same presentation given at NSA, Ft. Meade (1996).

13. S.P. Hotaling, Photonic Excitations in Condensed Matter Systems, International Society for Photonic Engineers, Orlando, FL, (April, 1996)

14. S.P. Hotaling, The Role of The Scientist in Society, Presented to the 44th New York State Science Congress, (June, 1996)

15. S.P. Hotaling, New World Vistas, Air Force. Wrote a private distribution volume entitled *On Power*, which was used for *Proteus: Insights from 2020*. (Sept. 1995)

16. S.P. Hotaling, Abstract: Photo-Excited Processes in doped Bismuth Metal Oxide Sillenites: $B_{12}SiO_{20}$, Intl.Conf. Photo Excited Processes and Applications, Jerusalem (Sept., 1995)

17. S.P. Hotaling, Abstract: Luminescence Characterization of Czochralski and Hydrothermally Grown Bismuth Metal Oxide Sillenites: $Bi_{12}SiO_{20}$, sub. Intl. Conf. on Crystal Growth, The Hague, The Netherlands (July, 1995)

18. S.P. Hotaling, Abstract: EPR and ENDOR Characterization of ^{57}Fe-and ^{51}V- Doped Bismuth Metal Oxide Sillenites: $B_{12}SiO_{20}$, USAF   Laboratory, sub. Intl. Conf. on Crystal Growth, The Hague, Netherlands (July, 1995)

19. S.P. Hotaling, Growth and Physico-Chemical Characterization of Bismuth-Metal-Oxide Sillenites, Clarkson University Faculty Seminar, (February 1995)

20. S.P. Hotaling, Growth of Bismuth-Metal-Oxide Sillenites for Photonic Device Applications, International Workshop on Materials Processing in a Microgravity Environment, Clarkson University (March 1994)

21. S.P. Hotaling, Application of Air Force Satellite Technology to Commercial Microcircuit Fabrication, Clarkson University Mechanical and Aeronautical Engineering Department Seminar, 31 January (1994)

22. G. Brost, K. Magde, S.P. Hotaling, Enhanced Photorefractive Effects in Bismuth Silicon Oxide with Low Frequency Square Wave AC Electric Fields, 1994 Annual meeting of the Optical Society of America, (1994)

23. S.P. Hotaling, Contamination Control Techniques, 1992 Biannual Space Technology Interdependency Group Meeting, (18 November1992)

24. S.P. Hotaling, Microcontamination Detection Identification Removal & Collection System, 1992 Government Microcircuit Applications Conference, Proceedings (1992)

25. S.P. Hotaling, Advanced Silicon &Metal Surface Contamination Removal Using jet Spray and Ion beam Techniques, 1992 International Microcontamination Conference, Silicon Valley CA (1992)

26. S.P. Hotaling, Microcontamination Control Techniques, ASYST Corp., CA, (1992)

27. S.P. Hotaling, Aerogel Contamination Control Invention in Spacecraft Environments, Hughes Aircraft Corp. (1992)

28. S.P. Hotaling, An Analysis of LDEF Leading Edge and Trailing Edge Optical Samples Before and After Treatment with Advanced Contamination Control Techniques, presented at NASA LDEF Materials Results for Spacecraft Applications Conference, (28 October 1992)

29. S.P. Hotaling, Aerogel Reflective Optics, presented at High Power Optical Components Conference, (26 October 1992)

30. S.P. Hotaling, Aerogel-Photopolymer Photonics, Faculty Colloquium, Universite´ Laval, Quebec, Canada,(Sept.1991), in Rapport Annuel de Centre d´ Optique et Photonique et Laser, Laval (1991-1992)

31. S.P. Hotaling, The Application of Advanced Contamination Control Techniques to Spacecraft, presented at DoD High Power Optical Components Conference, (October 1991)

32. S.P. Hotaling, Aerogel Solar Cell Substrates, presented at Materials Research Society Symposium, (5 May 1991)

33. S.P. Hotaling, The Multiple Trapping Model, RL-TM-91-28, (Dec. 1991)

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34. S.P. Hotaling, Materials Challenges for the 21st Century, ASME mtg. on 21st Century, Materials, (Chicago, IL 1994)

35. S.P. Hotaling, An Analysis of LDEF Leading Edge and Trailing Edge Optical Samples Before and After Treatment with Advanced Contamination Control Techniques, in NASA TR-LDEF-MATI (Oct.1993)

36. S.P. Hotaling, Aerogel Reflective Optics, published in Naval Air Warfare Center Tech Report (Oct. 1993)

37. S.P. Hotaling, The Application of Advanced Contamination Control Techniques to Spacecraft, published in Naval Air Warfare Center Tech. Report (Oct. 1993)

38. S.P. Hotaling, et al, An Introduction to Laboratory Contamination Control Technology, published inRL-TM-92-18(May1992)

39. S.P. Hotaling, Ultra-Light Aerogels For Optical Applications, RL-TM-92-27, (May 1992)

40. S.P. Hotaling, Aerogel Optical Applications, published in Cornell National Nanofabrication Facility Research Accomplishments, (1992)

41. S.P. Hotaling, G. Manivannan, R. Changkakoti, and R.A. Lessard, The Performance and Stability of Dichromated Poly(Vinyl Alcohol) Holograms for Space Based Photonic Applications, RL-TR-93-131 (1993)

42. S.P. Hotaling, Analysis of Leading Edge and Trailing Edge Cover glass Samples Before and After Treatment With Advanced Satellite Contamination Removal Techniques, RL-TR-93-51 (1993)

43. S.P.Hotaling, The Application of Jet Spray and Ion Beam Contamination Removal Techniques to Samples from the LDEF Spacecraft, RL-TR-93-109 (1993)

44. S.P. Hotaling, Ultra-Low Density Aerogels for Advanced Optical Applications, published in Cornell NNF Accomplishments, (1991)

45. S.P. Hotaling, Ultra-Low Density Aerogel Mirror Substrates, RL-TR-93-42 (1993)

46. S.P. Hotaling, The Aerogel Mesh Contamination Collector, RL-TR-93-148, Final ILIR Report for LDFP12H2 (1993)

47. S.P. Hotaling, D. Norton, D. Williamson,   Laboratory Cooperative Sabbatical Program, IEEE Dual Use Technology Applications Conference, IEEE Press, May 1993,

48. S.P. Hotaling, The Laboratory Teacher Mentor Program, City School District (1993)

49. S.P. Hotaling, C.R. Norwood, Likelihood Ratio Tests for Random Walks in Ring Laser Gyros, Litton Industries IRD report, (1984)

50. C.R. Norwood, S.P. Hotaling, Sensitivity Analysis of High Accuracy Ring Laser Gyro, Litton Industries IRD report (1984)

51. S.P. Hotaling, Testing Parameterized Post Newtonian Theories of Gravitation Using the Sagnac effect, SRC (1986); work revisited again in 2000 in collaboration with Yale University using atomic fountain and quantum optical techniques.

52. S.P. Hotaling, Multistatic Radar Coverage of CONUS, SRC-TR (1986)

53. S.P. Hotaling, Diffractive Radio Wave Propagation Over a Curved Earth, SRC-TR (1985)

54. S.P. Hotaling, Existence and Uniqueness Conditions for 3-D Wideband Radar Imaging, (Phased Arrays) SRC-TR (1985)

55. S.P. Hotaling, Advanced Materials for Optical Applications, Rome Academy of Science, (17 Oct. 1992)

Books

1. Quantum Computing, Author: Steven P. Hotaling, ISBN: 1423561414 Publisher: Storming Media Date published: 1998 Format: Spiral-bound, All Editions Similar Books

2. Quantum Computing, Author: Steven P Hotaling, ISBN: B0006QWL8W, Publisher: Air Force Research Laboratory, Sensors Directorate, Date published: 1998-01-01, Format: Unknown Binding

3. Photonic Quantum Computing II, V.3385, Author: Steven P. Hotaling (editor) Andrew R. Pirich (editor) ISBN: 0819428345, Publisher: SPIE-International Society for Optical Engine Date published: 1998-07
Format: Paperback, Number of pages: 142

4. Photonic Quantum Computing: 23-24 April 1997, Orlando, Florida (Proceedings / Spie--The
International Society for Optical Engineers), Steven P. Hotaling (editor) Andrew R. Pirich (editor)
ISBN: 0819424919, Publisher: SPIE-International Society for Optical Engine, Date published: 1997-O1
Format: Hardcover, Number of pages: 240

5. P. Krause, et. al., *Proteus: Insights from 2020*, Copernicus Institute Press, 2000, Contributor.

Chapters in Books

1. C.P. Williams, Quantum Computing and Quantum Communications, Springer Lecture Notes in Computer Science no: 1509, Springer Verlag (1999).

2. K. Mittal, ed., Particles on Surfaces: Detection, Adhesion and Removal: Developments in Surface Science, Chapter 7, Marcel Dekker Press (1995).

3. A. Madden, Y. Hamakawa, M.J. Thompson, P.C. Taylor and P.G. Lecomber, eds., Amorphous Silicon Technology-1991, MRS Press (1991).

4. M. Paesler, S.C. Agarwall and R. Zallen, eds., Amorphous and Liquid Semiconductors, North Holland Press (1989).

US Patents (9 issued)

1. S.P. Hotaling, A.R. Pirich, General Purpose Quantum Computation, Patent 5, 940,193 (1999)

2. S.P. Hotaling, A.R. Pirich, Multi-Purpose Quantum Computation, Patent no. 5,838,436, (1998)

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3. S.P. Hotaling, Compact Lightweight ring laser gyro, Patent no. 5,260,962 (1993)

4. S.P. Hotaling, et al, Aerogel Mesh Getter, Patent no. 5,308,533 (1993)

5. S.P. Hotaling, Lightweight Solar Cell, Patent no. 5,221,364 (1993)

6. S.P. Hotaling, Lightweight Aerogel Reflector, Patent no. 5,358,776 (1994)

7. S.P. Hotaling, et al, Contamination Control System, Patent no. 5,360,572, (1994)

8. S.P. Hotaling, Radiation Resistant Ring Laser Gyro Detector Systems, US Patent no. 5,404,007 (1994)

9. S.P. Hotaling, Aerogel Mesh Contamination Collector, Patent no. 5,470,612 (1994)

Course Notebooks and Teaching Aids

1.   S.P. Hotaling, Base Hit Project Summary Linguistics (U), US Government (2010)

2.   S.P. Hotaling, Satellite Remote Sensing 201, National Level Office Lecture (2005)

3.   S.P. Hotaling, Problem Book in Undergraduate Electromagnetics (1989)

4.   S.P. Hotaling, Parameterized Post Newtonian Theories of Relativity (1988)

5.   S.P. Hotaling, Course Notes in Astronomy, Utica College (1991)

Internet Publications and Citations

Almost all of the above journal articles and conference papers were posted on the internet by Journal Editors.
In addition, Dr. Hotaling's work has been included in chapters in books by other authors and notably, in a web listing on a web page entitled "Foundations of Quantum Mechanics." Despite not publishing and conferencing in the open community since 1998 due to governmental restrictions, Dr. Hotaling's open source papers and books continue to be cited by the scientific community in key areas of quantum physics, mathematics, chemistry, and engineering.
Dr. Hotaling's citations can be found on Google searches as "S.P. Hotaling."

General Publications
Written by other researchers, newspaper reporters and magazine editors

0.0 Interview w/ trade journal, Artificial Intelligence (ongoing interviews – publication in preparation)

1. NRO Trailblazer Article with B. Talbot (2004) (classified)

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2. Adan Cabello, Bibliographic guide to the Foundations of Quantum Mechanics and Quantum Information, Departamento de Fisica Aplicada II, Universidad de Sevilla, 41012 Sevilla, Spain (May 16, 2001)

3. Spic and Span Optics, AVIATION WEEK & SPACE TECHNOLOGY, p13 (August 3 1992).

4. Cosmic Glass Cleaning Is A Far Reaching Problem, OBSERVER, p3 (July 23, 1992).

5. Astronomy Professor to Give Lecture, OBSERVER (October 15, 1992).

6. Lab Offers Scientists for Teacher Education, OBSERVER, (1993), byline: Chip Haley.

7. Microcontamination Wins Award, MICROCONTAMINATION, (May 1994).

8. Photonics and Optics Demonstration, MOHAWK FLYER, byline J. Lawson (1993).

9. Classroom Visitor, HERKIMER HERALD (1993).

Career Related Professional Activities

1. Automata: Minds, Brains, Consciousness, Computation, Machine Learning and Artificial Intelligence, Science and Technology Research Lecture, Noblis January 2018.

2. Cyber Texas conference (2016)

3. Cyber Maryland (2016)

4. Alamo Ace AFCEA Cyber conference (2016)

5. USIP/FP PEACEGAME 2014: Peacemaking in an era of violent extremism, US Institute of Peace, State Dept., and Foreign Policy Journal (5 December 2014).

2. Dupont Summit, Policy Studies Organization, Carnegie Institution for Science, Washington, DC (2012)

3. Woodrow Wilson Institute for Scholars, VIP Pannelist: US, Japan, China Working Group (2014)
     Eurasia-Middle East Lecture Series (2012)

4. Thought Leader, Economist Intelligence Unit (2010-2019, 2023); interviewed by the Economist on Technology Futures (2012) Conference Committee Member, 2012 Economist Future Technology Conference, Berkeley

5. Former Member: American Political Sciences Society (2006-2010)

6. Former Member: International Econometrics Society, (2003-2007)

7. Invitee, Defense Sciences Research Council (DSRC, hosted by DARPA, 2005)

8. Consultant to the Radiation Hard Oversight Committee, RHOC, OUSD (2003-2006)

9. Conference Chairman: Photonic Quantum Computing, International Society for Optical Engineering (1997-1999)

10. Conference Display Coordinator: Mohawk Valley Engineers Executive Council (1995-1998)

11. Journal Referee for: Fine Particle Society (1992-1994)

12. Adjunct Professor of Physics; Utica College of Syracuse University (1990-1993)

13. Co-Chairman: Space Technology Interdependency Group (1993-1994). Contamination Committee; Congressionally Mandated Joint NASA/DoD Committee

14. Committee Member: Materials Development in Space (1993-1995)

15. Committee Member: DoD JDL Electronic Warfare Committee IRSP: Infrared Scene Projection (1992-1993)

16. Committee Member: International Working Group, NASA Crystal Growth Consortium Technical Advisory Committee (1993-1995)

17. Committee Member: AFRL Materials Committee (1993-1998)

18. Program Committee Member: IEEE Dual Use Technologies and Applications Conference (1994)

19. Visiting Scientist: Lawrence Livermore National Laboratory (1992)

20. Visiting Scientist: MIT and AFMC Materials Laboratory (Bedford, MA), Crystal Growth work (1993)

21. Visiting Scientist: ASYST Corp., Silicon Valley hard drive manufacturer. Taught microcontamination mitigation techniques to technical staff. (1992)

22. Visiting Scientist: CORNING GLASS Corp., Corning NY, Taught microcontamination mitigation techniques to technical staff (1992)

23. Visiting Scientist: Cornell University National Nanofabrication Facility (1991-1993)

24. Visiting Scientist: Universite' Laval (Quebec, Canada) (1991-1993)

25. Former Member: New York Academy of Science, Science and Technology Policy and Economics Groups, (1995)

26. Former Member: American Association for the Advancement of Science, (1993 to 1996)

27. Former Member: American Association of Mechanical Engineers, (1994 to 1996)

28. Former Member: IEEE Societies on Information Theory, Automatic Control, Nuclear and Plasma Sciences,

29. Former Member: Association of Atomic Scientists

30. Former Member: American Association of Physics Teachers.

BACK to Table of Contents

Community Interaction

1. Mentor, Ph.D. and M.S. students from various universities, Mathematics, Physics, Electrical Engineering, Commercial Telecoms, GPS, other areas 1998-present. Also private teaching to hand-selected gifted/talented young STEM student (2015-2020).

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2. Consulted for the Federal Business Council on Cyber Security (2016-2017).

3. Interviewed as Artificial Intelligence Expert by *Government Executive* (2017).

4. Served as Expert Artificial Intelligence panelist for the University Of Maryland Francis King Law School Symposium on Medical Automation and Robotics (2017).

5. Advisor, NRO Technical Fellows program (1999- 2010).

6. Conference Attendee, Policy Studies Organization, Carnegie Institution for Science, Dupont Summit 2012.

7. Attendee, and VIP Pannelist, Lectures at the Woodrow Wilson International Center for Scholars.

8. Member, contributor, and reader- standing committees on International Security and Regional Securitization.

9. Lion's Club fund raisers (2004-2009, 2016)

10. Conference Committee, NRO Technology Forum, 2006.

11. Boy Scout Space Exploration merit badge councilor, NRO sponsored program (2003 and 2004).

12. Space Exploration Merit badge lecturer, NRO-Sponsored course, 2003.

13. Boy Scout Citizenship in the World merit badge councilor (2000-2003)

14. Boy Scout Troop Committee Member, Troop 1577, Herndon VA (1998-2004)

15. Cub Scout Troop 1488, Webelo activity badge leader (1999-2000)

16. Keynote Speaker: 44thNew York State Science Congress, State University of New York, at Syracuse University (1 June 1996)

17. Committee Member: North Syracuse (NY) School District Science Planning Team (1995-1998)
18. HOTALING LECTURE SERIES- To the general public (1991-1996)

        I. Photonics and Electromagnetics for high school students

        II. What is Light? For elementary school students

        III. What is Science? -for elementary school Students

        IV. The Near Earth Orbital Environment - for grades 4-12

        V. Contamination Control Science and Technology- general audience

19. Program Originator and Manager: Laboratory Cooperative Sabbatical Program, which brings high school teachers into government laboratories. This entailed working with teacher's union and district administration politics; which went from local to national levels, to include congressional interaction.

20. Contributor- NY School district Math/Science Planning Committee (1992-1993).

21. Judge for International Science and Engineering Fair, Birmingham AL, (May 1994)

22. Co-Chairperson, Keynote Speaker: "Space Day," Higby Rd. Elementary School and New Hartford Elementary School, New Hartford NY, 1993

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23. Guest Speaker: Elementary Schools, New York High Schools, College and University Colloquia, Parent-Teacher Groups, Scouting Groups, Church Groups,   NY Academy of Science, Corporations (191-1993).

24. Mentor and Judge: Local and Regional Science Fairs (Upstate New York).

25. Boy Scouts of America, Explorer Post Mentor, (NY) (1992-1993)

26. Volunteer Teaching Consultant, North Syracuse School District, - Wrote successfully funded grant proposals and taught 4th and 5th grade classes science, math, an interdisciplinary course on: global warming and environmental change, and an experimental course in which selected 5th grade students were taught College Physics 101 – the identical course taught by Dr. Hotaling at Syracuse University (1986-1989).

Languages

Spoken proficiency for all is elementary: French, German, Japanese, Spanish, and just started Mandarin. Translation only (of technical papers) with dictionary: French, German, Japanese, Spanish, and Russian, started looking at Mandarin- but that is OBE

AWARDS AND HONORS

1. Noblis Technology Leadership Award, Significant Software Development (October 2016)
2. Office of the Director National Intelligence (ODNI), National Intelligence Council's Foreign Denial and Deception Committee (FDDC), Certificate of Appreciation for Support to the 2014 Symposium: Foreign Denial and Deception in the 21st Century: An Evolution of Technology and Surprise.
3. US Govt. letter of appreciation for support to a series of European Community (EC) meetings – classified (dk), 2011.
4. DoD letter of appreciation, for significant support to the War on Terror–classified (de), October 2010
5. Office of the Director National Intelligence (ODNI), National Intelligence Council's Foreign Denial and Deception Committee, two awards for superior performance supporting two different Counter Denial and Deception U3 Target Teams (U), April 2010
6. United Nations Combined Forces Command PACOM/USFK Combined Intelligence Coin for "Excellence in support to the Combined Intelligence Community (2008)."
7. TASC Performance Award for Significant and Extraordinary Performance, 2008
8. Northrop Grumman Sr. Technical Fellow, 2002-2007
9. Air Force Coin, (SECAF-AA) for Multi-Int Support to Special Operations, 2005
10. TASC Vice President's Coin, (Stu Shea, TASC VP, Space Intelligence, TASC Inc.) for fielding a unique new ISR system in Iraq, in support of OIF, 2004
11. National Reconnaissance Office- Letter of Appreciation for Outstanding Performance (rr), January 2003.
12. TASC Inc Certificate of Appreciation- Integrated System Engineering, February 2000.
13. TASC Inc. Above and Beyond the call of Duty Team Award, Contract Winning Proposal, 1999.
14. National Reconnaissance Office- Letter of Appreciation for Outstanding AS&T support (em), January 1999.
15. US Air Force LTFT Doctoral Fellowship-Clarkson University, 1993-1995
16. US Air Force Excellent Performance Award,1994
17. US Air Force Material Command Scientific and Technology Achievement Award,1993
18. US Air Force Certificate of Merit for Significant Contributions to the Mission of the US Air Force, Laboratory,1993

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19. US Air Force Excellent Performance Award,1993
20. US Air Force Certificate of Merit for Significant Contributions to The Mission of the US Air Force, Laboratory,1992
21. US Air Force Superior Performance Award,1992