

Curriculum Vitae

Paul D. Shankland

Commander

Director, Space Acquisition, Plans, Programs, Requirements
Chief of Naval Operations N84 Chief, PNT Space Capabilities

United States Naval Observatory

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Objective: Director-Manager-Executive in Astronomical Research, Instrumentation, Observatory Operations

Employment

Present Position: Director, Space Acquisitions, Plans, Programs, Requirements: Navy Commander (since 1999)

- Oversee near-term though 15 FY strategic research, project, institutional architecture, instrument/hardware planning, based on DoD, government-wide need, development of scientific fields involving astronomy, astrometry, celestial/spaceborne/GPS navigation, Command & Control, intelligence, earth orientation, IERS/ICRS and international atomic time service
- Interface with Pentagon, DoD, National level Position-Navigation-Time (PNT), GPS, astrometric, space committees (DoD Space Experiments Review Board, National Security Space, Operationally Responsive Space, National Reconnaissance Office, AFSPACECOM, National Security Space Office. Designated Space Professional.
- Align USNO mission with DoD, astrophysics/space communities, with vision with cutting-edge growth
- Supervise classified requirements for programs: space-borne National Technical Means (NTM), space situational awareness (SSA), space object identification (SOI), Advanced Capabilities Technology Development (ACTD), sub-nanosec two-way satellite time transfer
- Defend budget in the Congressional POM: \$17.3M in FY05, 16.1M in FY06, 16.9M for PR07; currently, POM08 in defense at 20.9M
- Major program requirements oversight for Milliarsecond Astrometric Pathfinder Satellite (costed through FY12 at \$120M), USNO Robotic Astrometric Telescope (costed through FY10 at 5.1M), 6 Rb Fountain Clocks through FY10 at 5.1M, Clock vault at 11.8M
- Planning, requirements oversight for operations: 26" Great Refractor (double star speckle interferometry); 24" Cassegrain, (exoplanet photometry), 12" Clark refractor (EPO); for 29 celestial catalogs (e.g., NOMAD, UCAC, USNO-A, B, Sloan, Tycho, WDS); OBSS (Origins Billion Star Survey) concept study, SIM-Planetquest reference tie-frame studies, TPF-I spectrometer design, Flagstaff AZ dark-site (with 1.55m, 1.3m, 1m instruments; 437m-baseline Naval Prototype Optical Interferometer (NPOI)
- Precise Time requirements oversight: Precise Time/Time Interval (PTTI); the US Master Atomic Clock operations, Rb/Cs Fountain Clock implementation, GPS Oversight; and Earth Orientation - notably VLBI, VLA, ICRS and IERS (International Celestial and Earth Reference Systems), the Radio Optical Reference Frame (RORF), NEOS, and Washington Correlator (WACO) operations
- Astronomical Applications requirements oversight: ephemerides development, software implementation, the Nautical Almanac Office
- **Clearance:** current Top Secret, access to Sensitive Compartmented Information, current Single Scope Background Investigation

2001-2004: Commanding Officer (CEO Equivalent), Strike Training Squadron NINE

- Selected as deputy senior executive (COO equivalent), then Commanding Officer (CEO equivalent) in June 2003
- Navy's largest aviation squadron, Chief executive, senior pilot, educator to 550 instructor pilots, students, officers, civilians
- Responsible for training throughput: 175 US/international strike carrier pilots/year, representing \$507M in training costs annually
- Annual operating budget averaged \$45M. Directed staff of 85 seasoned Navy and Marine Corps officer instructor pilots, in addition to student carrier aviators and maintenance, administration, simulation, ground school, and ordnance staffs.
- Taught all phases: formation/tactical, all-weather, aerobatics, out-of-control flight, weapons delivery, night formation, low-level ingress, air gunnery, air combat maneuvering (dogfighting), and carrier landings
- Squadron earned Chief of Naval Operations Safety "S" Award
- 15-month transition from aging T-2C Buckeye (retiring 87 jets net valued \$217M), to the all-digital, delta-wing T-45C Super Goshawk (inducting 89 jets, representing \$2.19 Billion in assets). Required complete airframe, syllabus, logistics and support reconfiguration. Awarded Meritorious Unit Commendation for model success
- Devised novel, 'lowest-level Voice' paradigm which allowed Instructors unusual creative latitude in meeting throughput; Result: highest (>38%) rates in 2005, despite weather and transition challenges. Morale extraordinarily high; membership in squadron sought Navy-wide
- To date, accumulated over 3800 career military flight hours, 374 arrested carrier landings
- While commanding, earned/awarded Masters of Astronomy with Distinction (*summa cum laude* equivalent), through evening study

1999-2001: Strike Operations Officer, USS Theodore Roosevelt

- Director, planning/coordination for every evolution for carrier *Roosevelt* and its 16-warship battle group
- Principle coordinator: wartime target assignment, weapons/aircraft assignment, strike planning, weaponing, deconfliction
- Generated Air Tasking Orders for major strikes with his staff, using classified UNIX systems
- Head of coordination for aircraft carrier SEATRIAL and aircraft flight deck underway recertifications
- Began Masters of Astronomy program in off-time study program
- Initial deployment execution in response to "9/11"; led war planning
- Taught astronomy EPO-type classes to sailors at sea
- Arranged special EPO at-sea night sky talk on flight deck for 6000 sailors, marines and 3550 guests, 200 miles off Jacksonville FL

1996-99: DoD, Joint Interagency Liaison Head, Naval Air counter-drug operations to JIATF East: admiral's personal advisor on employment of Naval Air assets, strategy, tactics

- Acquired support for underfunded SATCOM programs, technology acquisitions for naval Aircraft (midwave FLIR, comms, IMINT, SEI)
- Educated all inbound air squadrons (incl UK, FR, AU assets) on air counternarcotics operations
- Participated in/oversaw numerous multi-ton cocaine transshipment interdictions. 550 Metric Tons interdicted during 3-year tour
- Assisted in an NRO program to determine effects of astronomical seeing on adaptive optics

1993-96: VAW-121, Aircraft Maintenance Officer (led 157 personnel), and Aerospace Safety Officer

- Lead carrier aircraft plane commander, instrument evaluator, functional check (FCF) pilot
- Flew Bosnia/Deny Flight combat Close-Air Support control missions; 7 month Deployment
- Ranked top officer/aviator in squadron by squadron Commanding Officer; Oversaw all Maintenance, \$3.4M Ops Budget
- Devised Ultraportable 8" telescope system for at-sea use, EPO-type sailor outreach classes

1986-93: Flight School, VAW-120, VAW-122, VAW-120, Staff AEW Wing Atlantic: Instructor Pilot, Instrument Evaluator & Functional Check Pilot, Carrier Aircraft Plane Commander

- Wing Manpower, Security/OPSEC Manager and Administrative Director; 5 Command inspections
- retained FRS instructor pilot status, taught 34 students
- Fabrication of 16" driven telescope, electronic drive, for several local EPO/public outreach efforts.
- Air wing strike lead, admiral's representative for anti-ship operations.
- Earned 2 Golden Top Hook Awards on both deployments for top carrier landings
- Ranked first in primary flight training

1979-86: Midshipman, U.S. Naval Academy, USS Sellers: Math major, then commissioned. Qualified Surface Warfare Officer (record 5 months), combat "Officer of the Deck", while Combat Information Center Officer aboard a Navy Guided Missile Destroyer.

- Self Defense Force Leader, Nuclear Weapons Security Officer. Led 39 personnel
- College: optics/lasers, electrical/systems engineering, astronomy, computers, in addition to majors courses in pure math
- College: Senior astrophysics research project: K-corrections of highly redshifted galaxies. Work with USNA 16" Cassegrain
- Pioneered summer internship program at the US Naval Observatory, 1982. Vice president of the USNA Astronomy Club, 1979-83

Education

- B.S. in Pure Mathematics (conc. Physics), U.S. Naval Academy, 1983.
- US Naval Aviator Flight School, Primary, Advanced Jet, 1987
- Graduate school/ASO (aerospace safety) certification, Naval Postgraduate School, Monterey, 1995
- Masters in Astronomy (with Distinction), University of West Sydney, 2003
- Completed dissertation PhD Astronomy James Cook University, to confer March 2008.

Honors and Awards

- DoD Military Outstanding Volunteer Service Medal for Educational Public Outreach (EPO) astronomy endeavors during 25-year career
- Other military decorations: 3 Meritorious Service Medals, 3 Navy Commendation Medals, 3 Navy Achievement Medals; 4 Joint Meritorious Unit Awards, 3 Meritorious Unit Commendations, a Navy Unit Commendation, a Command Battle "E", various other campaign/unit medals.
- Naval Aviator Wings, the Surface Warfare Badge, Naval Command insignia. Top Hook 1989, 1991; Hawkeye of the Year nominee 1991

Refereed Publications

- Shankland, P., et.al, 2006. On the Search For Transits of the Planets Orbiting GL 876, *ApJ*; December 2006, 653, 700.
- Shankland, P., & Orchiston, W., 2004. Lost and Found: Saga of the Historic Clark Refractor at the U.S. Naval Academy, *JATS*, 26, 17
- Shankland, P., & Orchiston, W., 2002. Nineteenth Century Astronomy at the U.S. Naval Academy, 2002. *JAHH*, 5, 165
- Shankland, P., et.al, 2008. Further Constraints on the Presence of a Debris Disk in the Multiplanet System Gliese 876, *AJ*, in press
- Shankland, P. 2007. From Jets to GEMSS: Pan-Spectral Detection, Observation & Characterization of the M-Dwarf Exoplanet System Gliese 876 -- and Beyond (PhD Thesis), Submitted 31 December 2007, James Cook University, Townsville, Australia.

Non-Refereed Publications

- Johnston, K., Shankland, P., Gaume, R. 2007, The Impact of High-Accuracy Space-Based Astrometric Survey Missions on Exoplanet Detection: J-MAPS and OBSS (White Paper to US National Science Foundation Exoplanet Task Force, April)
- Shankland, P., & Gaume, R., 2007, Astrometric Impact of the Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) (White Paper to the Department of Defense (Pentagon), July
- Shankland, P., 2004. Pan-Spectral Imaging and Analysis of M31, *Amateur Astronomy (AA)*, Issue 44.
- Shankland, P., 2002. Tidewater Observatory, *Amateur Astronomy (AA)*, Issue 35.
- Shankland, P., 2002. Visit Amateur Astronomy, *Amateur Astronomy (AA)*, Issue 36.
- Shankland, P., 1998. ATM List Help On The Internet, *Amateur Astronomy (AA)*, Issue 18

Published Abstracts, Conference Presentations and Proceedings

- Blank, D., Jayawardene, B., Shankland, P., Monard, B., White, G., Verveer, A. & Biggs, J. 2007, GEMSS Search for Transiting Exoplanets Around Proxima Centauri, in Observing Planetary Systems, ESO Workshop, Santiago, Chile, March 5-8, eds. C. Dumas (Santiago: ESO)
- Shankland, P., Blank, D., Boboltz, D., Lazio, J., White, G. 2007, Search for a Debris Disk Around GJ 876, in the 2007 NANTEN2 Millimetre Wave Astronomy Workshop (Sydney, University of New South Wales), http://www.phys.unsw.edu.au/~mgb/Meetings/mm_blank.ppt
- Pepin, J. and Shankland, P., 2006. The Continuing Search for Exoplanet Transits in GL 876, BAAS, 207, 212.08
- Shankland, P., Blank, D., Boboltz, D., & Lazio, J. 2006, in Astrobiology, VLA and ATCA Millimeter Search for Debris Rings about Multiplanet System GL 876, eds. J. Minafra & T. Okimura, (Moffett Field, CA: NASA Ames), 358
- Shankland, P. D., et.al., 2005. A Photometric Monitoring Campaign to Check for Planetary Transits of GL 876, BAAS, 206, 9.08
- Shankland, P., & Orchiston, W., 2003. in Proceedings of the 25th IAU General Assembly, in Commission 41 Working Group 3 Session 2: History of Astronomy: Historical Instruments, The Historic Clark Refractor at the US Naval Academy, ed, O. Engvold, (Provo: ASP)

Research Experience, Projects and Proposals

- Work with University New South Wales on QSO spectral shift effects on the universal Fine Structure Constant, 2001
- Designed/built *TOPHAT* system (airborne stratospheric visual/IR precision CCD ccd/GPS/intensified digital collection system) to detect transits, research astroseismology, Vulcanoids, and Kuiper Belt objects and analyze near earth and binary asteroid occultations.
- Designed/fabricated a comprehensive computerized 16" f/5 telescope/observatory system to provide robotic/computer-driven tracking/pointing capability, error-correction, active optics, stepper-motor digital-analog interface, mobile observatory--used in masters
- Built cooled CCD camera for photometric/exoplanet research. Designed/built HeNe laser from scratch as optical alignment device
- Transceiver and antenna design/fabrication experience, building, antenna theory/construction, digital techniques
- Co-I, J-MAPS, Science NASA Small Explorer (SMEX Mission MOO), in Gaume, R. Shankland, P., Johnston, K., and Dorland, B. 2008, The Joint Milli-Arcsecond Pathfinder Survey (J-MAPS) Mission: Bright Star Space Astrometry for a New Generation. (SMEX 07), <http://sunland.gsfc.nasa.gov/smex/> and <https://nspires.nasaprs.com/external/member/proposals/proposalView.do?method=init>
- Acquired US federal funding for \$120 Million (USD) Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) funding in support of 1-milliarcsecond Science & Technology development, to 1 Milliarcsecond – 2007; Satellite Launch scheduled for 2012.
- Acquired US federal funding for \$422 K (USD) for US DARPA (Defense Advanced Research Projects Agency) and MIT-Lincoln Laboratory liaison for building and initial operations of SST (Space Survey Telescope) in large etendue ($A^* \Omega$) catalog operations by DARPA
- Co-I (with J. Lazio, D. Blank, G. D. Boboltz) on VLA and in concert with (G. Laughlin, W. Danchi) Spitzer Space Telescope, observed radio-IR exoplanet periastron passage of highly eccentric system HD 80606 - 2007
- P-I (with Zachary Dugan, D. Blank, G. Laughlin) on Global Exoplanet M-dwarf Survey (GEMSS)
- Co-I (with D. Blank) for proposal to observe GL 876 for Doppler radial velocities using Gemini (2006)
- Co-I (with J. Lazio, D. Blank, G. Laughlin, AAVSO, et.al.) for proposal to observe radio-optical non-thermal/magneto-auroral studies of exoplanet systems Tau Boo, HD162020, 70 Vir, using the Giant Metre Radio Telescope (GMRT) and JCU, AU, AAVSO, USNO visual instruments. Announcement written, published with TransitSearch and AAVSO
- Paper edit/review assistance (only), for Eugenio Rivera (UCSC), G. Laughlin (UCSC) et al. 2005, ApJ, 634, 625. A ~ 7.5 Earth-Mass Planet Orbiting the Nearby Star, GL 876 (first terrestrially massed exoplanet)
- Complete overhaul of USNO Congressional Program Objective Memorandum (POM) budget at \$19 Million US in Operations (per year) and \$5 Million US Research (per year), for 2007-2016 – extensive analysis, staffing and review with USNO Scientific Director (K. Johnston), and Superintendent (J. White) – 2007
- Facilitator and coordinator for SECDEF Defense Science Board (DSB, see http://en.wikipedia.org/wiki/Defense_Science_Board) meeting and Strategic Command (STRATCOM) Senior Warfighter Forum (SWarF, see http://www.d-n-i.net/grossman/top_priority.htm), both in 2007.
- Extensive collaboration with UCSC/Lick Observatory (with G. Laughlin, E. Rivera) on differential photometry (terrestrial and stratospheric) of Exoplanet transits, with TransitSearch. Collaboration with UCSC (G. Laughlin) in radial velocity fitting (Systemic), begun Nov 2005
- P-I (with D. Blank, D. Boboltz, J. Lazio, G. White) for proposal to observe GJ-876 at 7-mm at VLA, begun May 2005
- P-I (with D. Blank) for proposal to observe GJ-876 at 3-mm at ATCA, begun August 2005
- Co-I (with D. Blank) for proposal to observe GJ-876 for exoplanet radial velocities at Gemini, begun November 2005
- Co-I (with J. Lazio, D. Blank, G. Laughlin, AAVSO, et.al.) for proposal to observe radio-optical non-thermal/magneto-auroral signatures of exoplanet systems Tau Boo, HD162020, 70 Vir, using GMRT and JCU, AU, AAVSO, USNO visual instruments, begun March 2005
- all Windows, MacOS, LINUX, TeX/LaTeX, HTML, AIPS/MIRIAD, much astronomical software hardware, Worked with C, Java, FORTRAN, Pascal, SBASIC/VBASIC

Invited Talks, Dialogues, Tours

- 2-hour talk - GL 876 transit study, doctoral review, operations & research, to USNO Staff (55 PhD attendees) – 2005
- Panel member, facilitator, senior USNO Decadal Review of all astrometry programs present and future, Flagstaff 2007
- USNO Congressional Program Objective Memorandum (POM) budget review for 2009-2016 – to 3 staffs – Oceanographer of the Navy, Chief Naval Meteorological and Operations Command, and Chief of Naval Operations (CNO) staff, after presentation to USNO Department Heads
- USNO Mission Vision: Strategic Plans, Programs and Requirements talk given to USNO department heads during reorganizing offsite seminar

- Chair/facilitator/Organizer/Speaker: 2006 Quadrennial classified DoD Astrometry Forum (558 invited attendees/speakers, 33 theses/talks [classified and unclassified], 1 VIP Keynote) – 2006. Topics: Astrometry, Fundamental Astronomy, Space Operations, ISR, Precise Time, Spacecraft Orientation, Ephemerides, Reference Frames, VLBI, OI, Earth Orientation
- One hour radio/webcast interview, “Slacker Astronomy” - 2006
- Senior National Panel: DoD Space & Technology Alliance (STA) – co-brief Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) to deputy cabinet members of government – Sept 2006, Mar 2007
- Congressional discussions – dispersed Fourier Transform Spectrometer (Senate Intelligence Oversight Committee) – 2006, 2007
- NGA (National Geospatial Intelligence Agency) / FBI discussions – dispersed Fourier Transform Spectrometer – 2007
- NSA (National Security Agency) Disruptive Technology Office (DTO) director discussions – dispersed Fourier Transform Spectrometer – 2007
- Chairman, Joint Chiefs of Staff (Resources) -- Pentagon brief on Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) mission, background and funding – 2007
- NGA (National Geospatial Intelligence Agency) / National Reconnaissance Office (NRO) – SECDEF - on Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) funding – 2007
- Presentation – Pentagon / Chief of Naval Operations (CNO) on Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) mission, astrometry, and funding – 2007
- Talks – SECDEF National Security Space Office (NSSO) on Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) funding
- Discussions and facilitator – US Space Command on Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) Mission, photometric capabilities concept of satellite operations by the USAF; also on SST (Space Survey Telescope) QPSR on large etendue ($A^* \Omega$) catalog operations by USNO – 2007
- Facilitator – Naval SPAWAR (Space Warfare) San Diego, on Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) funding
- Talks & facilitator – US Strategic Command on Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) mission and funding
- Presentation and facilitator – Pentagon / Chief of Naval Operations on Joint Milliarcsecond Astrometric Pathfinder Satellite (J-MAPS) funding
- NETWARCOM/Fleet Forces Command Intelligence-Surveillance-Reconnaissance (ISR) – Presentation on Astrometry for ISR space-borne Systems – Feb 2006, Oct 2006
- One hour interview for feature article, Editor, *Stardate* Magazine, McDonald Observatory, TX – 2006
- Coordinate support to the Jasons Defense Advisory Group, Washington, DC (en.wikipedia.org/wiki/JASON_Defense_Advisory_Group)
- Open House General Public at USNO Flagstaff 61” (1.55-meter) telescope, presenter, astronomer at eyepiece for public viewing
- Five VIP tours at USNO Washington & 12” Clark refractor - 2007. 26” Clark Great Refractor VIP Tour of Senior SECDEF staff (DSB, SWaF)
- AAS Exhibition Presenter for USNO: January 2005, January 2006
- USNO Fourier Transform Spectrometer Review Board
- SIM Science Team liaison, Events Coordinator, SIM conference 2005
- VIP Escort/Guide, telescope operator, for visiting senior governmental officials, 2004-6
- Events coordinator, Strategic Command National PNT Strategy Planning Session Oct 2005
- Advisory support to Chief of Naval Operations Navigator of the Navy (NoN), as his Deputy Navigator for Naval Aerospace Policy
- Attended 41 Colloquia/professional seminars at USNO; 17 informal talks, 2004-6
- Representative National Precise Time & Time Interval (PTTI) Conference, 2004
- Representative Annual Institute of Navigation (ION) National Technical Conference, 2005
- Representative MIT / Lincoln Labs Space Control Conference, 2005
- Representative 2005 National Reconnaissance Office (NRO) MDA Technical Conference, 2005
- Representative to 6 GPS Technical Exchange Meetings (TEM), 2004-6
- Representative Air Force Maui Optical Supercomputing (AMOS) Astronomical/SSO/Control/Optical Technical Conference, 2005
- Lead Representative 5 Strategic Command National Position-Navigation-Time (PNT) Joint Capability Review Panels, 2005
- Representative, National Space Experiments Review Board (SERB), 2005
- Representative NOAA Navigation/GPS/Tsunami Warning Conference, 2005
- Representative Geospatial Intelligence Agency (NGA) senior Steering Committee for 2 Digital Aeronautical Navigational conferences, 2005
- Hosted 2 Colloquium Lecturers at USNO – D Blank (JCU), and G Laughlin (UCSC), 2005

Miscellaneous teaching experience:

- Initiated new opportunity, became academic thesis advisor to US Naval Academy (USNA) senior, John Pepin; summer 2005 through academic year 2005-06 (3-credit course). Exoplanet /planet formation, detection, analysis, senior/graduate astronomical research project.
- Supervise a Yale astrophysics undergrad intern at USNO, Zachary Dugan, studying extrasolar planet transits and radial velocities.

Professional Organizations, Memberships

- Full Member, American Astronomical Association (AAS) (DDA, DPS, HAD)
- American Institute of Physics
- Member, International Astronomical Union (IAU) Commission 41
- Founding member, International Commission for the History of Astronomy
- International Union for the History and Philosophy of Science
- US Astronomical League
- International Dark Sky Association
- Nominee DDA Division Committee Officer 2008