WENDY M. MORGENSTERN | Senior Systems Engineer | Space Systems | TS/SCI

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PROFILE

Distinguished leader with 35+ years at NASA Goddard Space Flight Center (GSFC, retired), specializing in Mission Systems Engineering (MSE), Chief Engineer, and Guidance, Navigation, and Control (GNC). Directed full life cycles for Solar, Earth, Astrophysics, and Technology Development missions from concept to on-orbit operations. Senior technical authority | Chair | subject matter expert for anomaly investigations, independent assessments, and Agency-level Standing Review Boards (SRBs).

Key Recognitions:
• 3× NASA Outstanding Leadership Medal | 1x NASA Exceptional Service Medal
• Robert H. Goddard Awards: Mentoring, Leadership, Engineering Excellence

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REVIEW BOARD & AGENCY SERVICE

- **Standing Review Board (SRB) Chair, HelioSwarm** (2024-2025)
- **Deputy SRB Chair**, **PACE** (Plankton, Aerosol, Cloud, ocean Ecosystem) (2018 – 2023)
- **SRB Member**, **ICESat-2** (Ice, Cloud, and Land Elevation) (2011 – 2018)
- **Anomaly Investigation Lead**, Roman Space Telescope (RST), Canada's RadarSat
- **NASA-wide Systems Engineering Workforce Development, Member Systems Engineering Agency Leadership Team** & **Cross-Agency Mentor**
- **Independent Review Team Member** for mission, element, subsystem or peer reviews. Recent examples: **RST**, **GOES-U** (Geostationary Operational Environmental Satellite), **LRO** (Lunar Reconnaissance Orbiter), **GPM** (Global Precipitation Mission), **DaVINCI** (Deep Atmosphere Venus Investigation of Noble gases, Chemistry, and Imaging), **Lucy**, and **CCRS** (Capture Containment and Return System)

WORK EXPERIENCE

Morgenstern Engineering, LLC | Founder | Systems Engineer (2025 – Present)
- Senior Systems Engineer & Space Systems Subject Matter Expert (SME), offering consulting services in all areas of expertise.

NASA | Systems Engineering Technical Discipline Deputy, **NASA Engineering and Safety Center (NESC)** (2024-2025).
Directly support the Agency's Systems Engineering (SE) Technical Fellow's collaboration with leadership to improve systems engineering across NASA and its commercial partners.
- Focus areas include: SE workforce development (workshop, mentoring) and retention. Identify systemic risk(s) across programs and recommend the right balance between programmatic resources and technical rigor. Update NASA SE standards to remove pain points and increase efficiency.
Lead independent technical assessments on complex engineering challenges.
- Example: Led independent assessment of 20W 20K Cryocooler, key technology development for propellant storage and long range space flight. After ten years of repeated prototype failures, independent review provided root cause analysis and recommendations to reduce risk and field a successful flight unit.

NASA | Division Chief Engineer, Instrument Systems and Technology Division (2023 – 2024)
Oversight / technical authority for a $300M+ portfolio spanning optics, cryogenics, detectors, electro-optical systems, radar, lasers, microwave, and quantum technologies.

- Lead monthly technical review for all on instrument technology and flight implementation activities ensuring all project/research milestones are met.
- Champion top technical issues. Provide mentoring, technical direction and coordinate stakeholders / resources across organizations to resolve.
- Chair independent reviews of engineering work and associated best practice waivers.
- Division troubleshooter. Examples include:
  - In-depth surge support for a struggling subsystem, mentoring the new leadership and bringing the effort on schedule despite lack of requirement maturity.
  - Coaching an inexperienced and understaffed CubeSat team through their preparations for launch and advising NASA authorities on the realized Risks.

NASA | Lead Systems Engineer & Technical Authority, OSAM-1 (On-Orbit Servicing Assembly and Manufacturing) Mission (2019 – 2023)
Directed 40+ SEs and over 400 engineers for NASA's flagship ($2B) technology development mission through critical design, integration and test, and development of flight operations.

- OSAM-1 design is driven by series of unique operational phases – launch, transit, autonomous rendezvous & docking, robotic servicing of the Landsat 7 vehicle, robotic assembly and functional demonstration of a reflector antenna, and manufacturing of a boom in space before deorbit and disposal of the OSAM-1 vehicle. This required focusing my team on high risk pain points, such as:
  - Challenging design and delivery schedule of two different 6DOF robotic arms systems for two separate payloads.
  - Operations and ground system design for on-orbit operation, requiring fitting robotic operations into limited real-time contacts with high rate telemetry.
  - Autonomous operations for rendezvous, docking, departure and safing.
  - Flying Maxar (SSL) GEO heritage bus for LEO polar orbital environment. Provide systems engineering expertise to our commercial partners struggling to adapt their production line mentality to the unique mission requirements which forced architecture, hardware and software changes and upscaled their typical verification program.

NASA | Deputy Lead MSE, OSAM-1 (formerly Restore-L) Mission (2017 – 2019).
Recruited as the Deputy MSE to provide additional experienced and decisive technical leadership. In addition to day-to-day duties, led specific efforts to address key pain points. Examples include:

- The long lead development of simulators / emulators necessary for verification testing were ill-defined in Phase A. Led effort to define the architecture and necessary engineering and test hardware to be developed, capture specific fidelity requirements, and coordinate the schedule across multiple mission stakeholders (subsystem testing, software development, V&V, operations) facing the perennial problem of limited hardware testbeds.
- Expert risk evaluation and recommendations concerning following or waiving best practices and arbitrated the independent review of these decisions with agency authorities.
- Took command of the faltering Fault Management Working Group effort and completed the fault management architecture, requirements definition, and peer reviews required to deliver a successful preliminary design.

NASA | Mission and Spacecraft Systems Engineer & Technical Authority, HELIX (Heliospheric and Interstellar Explorer)– Step I Proposal (2016 –2017)

Technical authority for development of an NASA GSFC built spacecraft and mission architecture, proposed for the Interstellar Mapping and Acceleration Probe (IMAP)
- Designed the mission architecture, derived detailed requirements.
- Maintained key systems budgets: Data volume, mass, power and master equipment list
- Authored the Mission Systems Engineering section for the proposal

NASA | Lead Systems Engineer & Technical Authority, PRAXyS (Polarimetery of Relativistic Astrophysical X-ray Sources)– Astrophysics SMEX Step II Proposal. (2015- 2016). Class D Mission, 50+ person team.
- Lead system engineer for a creating a low-cost telescope concept fitting within a small launch vehicle envelope by use of a deployable wire boom, delivering a beyond PDR maturity in the Concept Study Report.

NASA | Mission Systems Engineering | GNC Systems Engineer, **MMS** (Magnetospheric Multiscale Mission) (2010 – 2015)
- GNC Systems Engineer, responsible for technical oversight and coordination between GNC elements Propulsion, Propulsion Avionics (EVD), Navigator hardware, on-orbit Navigation, Attitude Control System (ACS) and Attitude Ground System (AGS).
  - Led these GNC subsystems through build, test, launch, and commissioning
  - Responsible for GNC pointing and alignment requirements and verification.
  - Delivered record setting design and tight fleet formation for the constellation meta-science observations.
- Burn Operations Group (BOG), Deputy Lead: Provided technical leadership to successfully transition of new formation flying technologies into flight maneuver requirements and ground operational products, coordinating efforts across multiple disciplines (ACS, AGS, Navigation, Propulsion, Flight Dynamics, Operations)
- Test Director, Fleet I&T:
  - A primary test director for the fleet I&T campaign, Comprehensive Performance Test (CPT) plan and execution.
  - Directed shifts through four Observatories environmental test (vibration, thermal vacuum, vibration of stacked observatories, and expanded magnetic and EMI/EMC testing for mission unique magnetic cleanliness requirements.
  - Participated in the resolution of 150+ formal failures, leading 15.
- Systems engineering oversight, Propulsion subsystem for:
  - Testing four Propulsion modules, integrating with the vehicle and performing end-to-end GNC verification
  - Fueling four observatories simultaneously. Operations were unprecedented in scope and complexity, requiring unique attention to personnel, hardware and facility safety.
- Mission Launch Director | Launch site Technical Authority:
  - Led the development of launch day operations and emergency procedures
  - Completed five MMS launch rehearsals and three integrated simulations with the launch vehicle and range at the launch site
  - In conjunction with Safety, trained the launch team for preservation of evidence in the event of launch mishap.
- Mission Readiness (Flight operations simulation) Test Director:
  - Developed nominal and contingency operations for GNC flight operations; led mission rehearsals appropriate for training personnel. Examples include rehearsals for the month long campaign to deploy the science booms and rehearsals for Collision Avoidance Emergency maneuvers.

- Deputy Commissioning Lead. MMS five month commissioning campaign is a complex series of joint spacecraft / instrument activities for four observatories / over 100 instruments
  - Directed teams in planning and executing on-orbit checkout
  - Key part of the commissioning team, coordinating five months / over 1000 instrument tests across the fleet.
- Flight Director and Maneuver Lead:
  - Led on-orbit Flight shifts, directing daily activities of the multi-disciplinary team through the five month commissioning operations; required detailed knowledge of the end-to-end interfaces of flight (Observatory spacecraft and science suite avionics and software) and ground elements (FEDS, ASIST, various ground networks - SN, DSN, TDRS, data trending, Flight Operations procedures and processes)
  - Responsibility for the design, planning and execution of on-orbit maneuvers - required development and review of operational product interfaces across multiple disciplines

NASA | GNC Systems Engineer, SDO (Solar Dynamics Observatory) (2008-2010)

- Lead Systems engineer responsible for oversight of all flight and ground segments of the GNC subsystem.
  - Led technical activities of senior systems and sub-system engineers for GNC test and verification
- GNC Systems / Maneuver Lead:
  - Led development of all operational requirements, products, procedures and activities necessary to execute the series of orbital maneuvers that took spacecraft from launch vehicle separation through safe arrival at geosynchronous orbit
  - Verified all Observatory and GNC pointing and alignment requirements
  - Managed GN&C ground elements definition and development; formulation of operational constraints; developed concepts for launch and mission operations; planning and directing mission simulations to train personnel.
- Test Director:
  - Led multi-disciplinary team during daily test activities throughout integration and environmental test, responsible for Safety of personnel and hardware and for verification of flight and ground segments performance.
  - Oversaw ~400 formal problem resolutions and ~60 failure investigations.
- Flight Director / GNC Systems:
  - Led the multi-disciplinary team in execution of daily on-orbit operations
  - Led HGA Handover testing, verifying end-to-end system interface and performance.
  - Led one of the most extensive on-orbit GNC jitter testing efforts ever done on a GSFC mission. Included characterizing all mechanism jitter and the end-to-end system effect on line-of-sight jitter at the instrument CCD.
  - Led a follow-on test for the image quality jitter, characterizing 'worst' to 'typical' jitter disturbances and identifying risk mitigation options for long-term maintenance.
  - On-Orbit Propellant Slosh Anomaly Team Lead:
    - Diagnosed and resolved a fuel slosh issue that triggered maneuver aborts due to excessive attitude motion during main engine firing.
    - Led alternate operations team in executing a contingency plan, maintaining orbital progress using backup thrusters during anomaly investigation.
    - Restored main engine operations within one week by co-leading ACS controller and operational redesign efforts, successfully passing two peer reviews and a flight project management review

NASA | Attitude Control Subsystem (ACS) Lead & Deputy GNC Systems Engineer, SDO (2002

– 2008)

Responsibilities spanned the mission life cycle from mission concept and requirements development, through design, build integration, and launch and continued into on-orbit operations and long-term maintenance of the flight vehicle. Throughout the seven year life cycle:

- Lead mission systems trade studies to select the flight system architecture, trading technical risk against cost, schedule and mission requirements.
- Directed a 40-person multidisciplinary team in the design, development, testing, and integration of the Attitude Control System (ACS).
- Defined end-to-end interfaces with the science payload, leveraging its fine guidance sensor for ACS pointing.
- Oversaw ACS hardware development: defined avionics requirements, evaluated international vendors, managed contracts, and ensured certification of commercial components.
- Led design and verification of closed-loop attitude controllers across six operational modes, including full flight software lifecycle.
- Directed development and certification of advanced Ground Support Equipment (GSE) for dynamic simulation and end-to-end system testing.
- Defined operational requirements and risk mitigations for command/telemetry interfaces and sensor failure modes. Mitigations were implemented as fault management and contingency procedures.
- Coordinated the use of new technologies and analysis concepts for jitter analysis and risk mitigation.
- Collaborated on jitter risk mitigation, co-developing novel ground tests with the Lead Jitter Analyst to characterize sources and impacts on science data.
- Authored on-orbit jitter test requirements and oversaw implementation.
- Managed ACS subsystem cost, schedule, and technical risk throughout the mission lifecycle.

NASA EARLY CAREER ROLES (1994-2002) include:

- **Mission Systems Engineering** | **Spacecraft Systems** for **VISAx**, a Discovery Venus proposal.
- **Systems Engineer** for GSFC's first in-house CubeSat, **Dellingr**
- **GEMS** (Gravity and Extreme Magnetism Small Explorer) **GNC Systems Engineer**.
- Dual lead for **Triana ACS Analysis & ACS Flight Software**;
- **GNC and ACS development roles for TRMM** (Tropical Rainfall Measuring Mission)**, XTE** (X-ray Timing Explorer), **STEREO (**Solar Terrestrial Relations Observatory) and **James Webb Space Telescope**.

EDUCATION:

MS, Aerospace Engineering (Controls Focus), University of Maryland | Magna Cum Laude | 1999
BS, Aerospace Engineering, Virginia Polytechnic Institute & State University | Summa Cum Laude | 1994

SELECTED PROFESSIONAL AWARDS:

- NASA Honor Award: Outstanding Leadership Medal for Exceptional Leadership as the Mission Systems Engineer for the OSAM-1 Project, 2022.
- NASA Honor Award: Outstanding Leadership Medal for professional and outstanding leadership as the MMS Guidance, Navigation and Control Systems Engineer, 2016.
- Robert H. Goddard Award for Exceptional Achievement for Leadership for Exceptional Leadership as a Guidance, Navigation and Control Systems Engineer and Standing Review

Board Member, 2014.

- NASA Honor Award: Exceptional Service Medal for exceptional service to the Agency in support of many NASA missions, 2013.
- NASA Honor Award: Outstanding Leadership Medal for outstanding leadership as the Solar Dynamics Observatory Attitude Control System Product Development Lead and Guidance, Navigation and Control Systems Engineer, 2009.
- NASA Honor Award, Silver Achievement Medal for significant contributions to success of ICESat-2, 2018.
- NASA Office of Chief Engineer Engineering Excellence award for the SDO Systems Team, 2011.
- Special Act Awards for Outstanding Performance: 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2013, 2014, 2015, 2021, 2022
- NASA Honor Group Achievement Awards for Outstanding support of the following flight projects: MMS, SDO, JWST, Triana, TRMM, and REXTE. 1996 to 2009.

PUBLICATIONS & PRESENTATIONS

- Morgenstern, W.M., Morgenstern, R.M., "MBSE: Convince Me: Debating the future of systems engineering tools," presented at *NASA Systems Engineering Workshop*, Cleveland, OH, May 2024.
- Hughes, D.W., et al., "Lessons Learned in Designing a Proposed Ultraviolet Sterilization System for Space." *Aerospace* 2024, 11(7), 538. https://doi.org/10.3390/aerospace11070538
- Morgenstern, W.M., "OSAM-1: Building on the Bleeding Edge of Technology," presented at *NASA GSFC Systems Engineering Symposium*, Greenbelt, MD, Oct 2022.
- Morgenstern, W.M., "OSAM-1" [Audio podcast episode] *Small Steps, Giant Leaps.* August 24, 2022. https://www.nasa.gov/podcasts/small-steps-giant-leaps/small-steps-giant-leaps-episode-91-osam-1/
- Morgenstern, W.M., Bourkland, K.L., Hsu, O.C., Liu, K.C., Mason, P.A.C., O'Donnell, J.R., Russo, A.M., Starin, S.R., Vess, M.F., "Solar Dynamics Observatory Guidance, Navigation, and Control System Overview." *AIAA Guidance, Navigation, and Control Conference*, AIAA Paper 2011-6726, Portland, OR, August 2011. https://arc.aiaa.org/doi/epdf/10.2514/6.2011-6726
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- O'Donnell Jr., J.R., Bourkland, K.L., Hsu, O.C., Liu, K.C., Mason, P.A.C., Morgenstern, W.M., Russo, A.M, Starin, S.R., Vess, M.F., "Solar Dynamics Observatory Launch and Commissioning." *33rd Annual AAS Guidance and Control Conference.* AAS Paper 11-081, Breckenridge, CO, February 2011.
- Starin, S.R., Vess, M.F., Kenney, T.K., Maldonado, M.D., Morgenstern, W.M., "Fault Detection and Correction for the Solar Dynamics Observatory Attitude Control System." *31st Annual AAS Guidance and Control Conference.* AAS Paper 08-037, Breckenridge, CO, February 2008.
- Vess, M.F., Starin, S.R., Morgenstern, W.M., "Use of the SDO Pointing Controllers for Instrument Calibration Maneuvers." *NASA GSFC Flight Mechanics Symposium*, Greenbelt, MD, October 2005.
- Starin, S.R., Bourkland, K.L., Liu, K.C., Mason, P.A.C, Vess, M.F., Andrews, S.F., Morgenstern, W.M., "Attitude Control System Design for the Solar Dynamics Observatory" *NASA GSFC Flight Mechanics Symposium*, Greenbelt, MD, October 2005.

- Morgenstern, W.M.,"Control of the Triana Spacecraft in the Presence of Fuel Slosh Dynamics." *Unpublished Master's capstone paper*. Department of Aerospace Engineering, University of Maryland, College Park, MD, May 1999.
- Chen, J.R., Morgenstern, W.M., Garrick, J., "Triana Safehold: A Gyroless, Sun-Pointing Attitude Controller." *NASA GSFC Flight Mechanics Symposium*, Greenbelt, MD, June 2001.
- O'Donnell, Jr., J.R., Andrews, S.F., Morgenstern, W.M., Bartholomew, M.O., McComas, D.C., "Using Automation to Improve the Flight Software Testing Process." *NASA GSFC Flight Mechanics Symposium*, Greenbelt, MD, June 2001.
- Robertson, B.R., Placanica, S., Morgenstern, W.M.,"TRMM On-Orbit Attitude Control Performance," *22nd Annual AAS Guidance and Control Conference.* AAS Paper 99-073, Breckenridge, CO, February 1999.
- Andrews, S.F., Morgenstern, W.M., "Initial Flight Results of the TRMM Kalman Filter." *AAS/GSFC 13th International Symposium on Space Flight Dynamics.* AAS Paper 98-4509, Greenbelt, MD, May 1998.
- Crouse, P.L., Flatley, T.W., Morgenstern, W.M.,"Polar Spin Axis Anomaly." *NASA GSFC Flight Mechanics Symposium*, Greenbelt, MD, May 1997.
- Flatley, T.W., Morgenstern, W.M., Reth, A., Bauer, F. "A B-Dot Acquisition Controller for the RADARSAT Spacecraft," *NASA GSFC Flight Mechanics Symposium*, Greenbelt, MD, May 1997.
- Flatley, T.W., Morgenstern, W.M., (nee Moore, W.A.) "An Earth Albedo Model," NASA Technical Memorandum 104596 (NASA-TM-104596), 1994. https://ntrs.nasa.gov/citations/19940020024

References available upon request