

## Curriculum Vitæ

### MATTHEW D. HEJDUK

#### EDUCATION

Ph.D., University of Dallas, Philosophy, 2006

Thesis: *Hegel, Kierkegaard, and the Limits of Rationality*

M.A., University of Dallas, Philosophy, 1998

M.T.S., Southern Methodist University, 1995, *magna cum laude*

B.S.E., Princeton University, Mechanical Engineering, 1989, *cum laude*

#### PROFESSIONAL EXPERIENCE

Senior Project Leader, The Aerospace Corporation (2021-present)

*Current position: Chief Engineer, NASA Satellite Conjunction Analysis Risk Assessment Program*

President, Astrorum Consulting LLC ([www.astrorum.us](http://www.astrorum.us)), 2014 – present

Adjunct Scientist, a.i. solutions Inc., 2010 – 2014

Adjunct Scientist, SRA Inc., 2006 – 2010

Senior Systems Engineer, L3 Technologies, 2002 – 2006

Systems Engineer, SenCom Corporation, 1993 – 2002

Acquisition Officer, USAF, 1989 – 1993

#### RESEARCH INTERESTS

Satellite conjunction assessment techniques

Satellite radar and optical signature modeling and analysis

Estimation theory

Space Surveillance Network modeling and simulation

#### ARTICLES/PAPERS – LEAD AUTHOR

Hejduk, M.D., and Snow, D.E. “Satellite Conjunction ‘Probability,’ ‘Possibility,’ and ‘Plausibility’: A Categorization of Competing Conjunction Assessment Risk Analysis Paradigms.” 2019 AAS/AIAA Astrodynamics Specialist Conference (Paper #19-652), Portland ME, August 2019.

Hejduk, M.D., Snow, D.E., and Newman, L.K. “Satellite Conjunction Assessment Risk Analysis for “Dilution Region” Events: Issues and Operational Approaches.” Fifth Annual Space Traffic Management Conference “Progress through Collaboration, Austin TX, February 2019.

- Hejduk, M.D. and Snow, D.E. “The Effect of Neutral Density Estimation Errors on Satellite Conjunction Serious Event Rates.” *Space Weather* Vol. 16 No. 7 (July 2018), pp. 849-869.
- Hejduk, M.D. and Pachura, D.A. “Conjunction Assessment Screening Volume Sizing and Event Filtering in Light of Natural Conjunction Event Development Behaviors.” 2017 AAS/AIAA Astrodynamics Specialists Conference, Stevenson WA, August 2017.
- Hejduk, M.D., Laporte, F., Moury, M., Kelso, T.S., Newman, L.K., and Shepperd, R. “Consideration of Collision ‘Consequence’ in Satellite Conjunction Assessment and Risk Analysis.” 26th International Symposium on Space Flight Dynamics, Matsuyama, Japan, June 2017.
- Hejduk, M.D. “Covariance Manipulation for Conjunction Assessment.” 2016 AAS/AIAA Astrodynamics Specialist Conference, Long Beach CA, September 2016.
- Hejduk, M.D. and Johnson, L.C. “Approaches to Evaluating Probability of Collision Uncertainty.” 2015 AAS/AIAA Space Flight Mechanics Meeting, Napa CA, February 2015.
- Hejduk, M.D., Newman, L.K., Besser, R.L. and Pachura, D.A. “Predicting Space Weather Effects on Close Approach Events.” 2015AMOS Technical Conference, Kihei HI, September 2015.
- Hejduk, M.D., Plakalovic, D., Newman, L.K., Ollivierre, J.C., Hametz, M.E., Beaver, B.A., and Thompson, R.C. “Recommended Risk Assessment Techniques and Thresholds for Launch COLA Operations.” 2013 AAS/AIAA Space Flight Mechanics Meeting, Hilton Head, SC. August 2013.
- Hejduk, M.D., Casali, S.J., Cappellucci, D.A., Ericson, N.L., and Snow, D.E. “A Catalogue-Wide Implementation of General Perturbations Orbit Determination Extrapolated from Higher-Order Theory Solutions.” 2013 AAS/AIAA Space Flight Mechanics Meeting, Kauai, HI. February 2013.
- Hejduk, M.D., Plakalovic, D., Newman, L.K., Ollivierre, J.C., Hametz, M.E., Beaver, B.A., and Thompson, R.C. “Trajectory Error and Covariance Realism for Launch COLA Operations.” 2013 AAS/AIAA Space Flight Mechanics Meeting, Kauai, HI. February 2013.
- Hejduk, M.D., Cowardin, H.M., and Stansbery, E.G. “Satellite Material Type and Phase Function Determination in Support of Orbital Debris Size Estimation.” 2012 AMOS Technical Conference, Kihei, HI. September 2012.
- Hejduk, M.D. “Specular and Diffuse Components in Spherical Satellite Photometric Modeling.” 2011 AMOS Technical Conference, Kihei, HI. September 2011.
- Hejduk, M.D. and Ghrist, R.W. “Solar Radiation Pressure Binning for the Geosynchronous Orbit.” 2011 AAS Astrodynamics Specialists Conference, Girdwood, AK. August 2011.
- Hejduk, M.D. and DePalma, D. “Comprehensive Radar Cross-Section ‘Target Typing’ Investigation for Spacecraft.” 2010 AAS Astrodynamics Specialists Conference, Toronto, CA. August 2010.
- Hejduk, M.D. “Improved Radar Cross-Section ‘Target Typing’ for Spacecraft.” *Advances in the Astronautical Sciences*, Vol. 135 (August 2009), pp. 3-17.

- Hejduk, M.D. "Space Catalogue Accuracy Modeling Simplifications." 2008 AAS Astrodynamics Specialists Conference, Honolulu, HI, August 2008.
- Hejduk, M.D. "Phase Functions of Deep-Space Orbital Debris." 2007 AMOS Technical Conference, Kihei, HI. September 2007.
- Hejduk, M.D., Ericson, N.L., and Casali, S.J. "Beyond Covariance: A New Accuracy Assessment Approach for the 1SPCS Precision Satellite Catalogue." 2006 MIT / Lincoln Laboratory Space Control Conference, Bedford, MA. May 2006
- Hejduk, M.D. "RCS Calculation Improvements at the Eglin FPS-85 Radar." 2005 MIT / Lincoln Laboratory Space Control Conference, Bedford, MA. April 2005.
- Hejduk, M.D., Lambert, J.V., Williams, C.M, and Lambour, R.L. "Satellite Detectability Modeling for Optical Sensors." 2004 AMOS Technical Conference, Kihei, HI. September 2004.
- Hejduk, M.D. "Statistical Distributions of SP DC Residuals." 2004 MIT / Lincoln Laboratory Space Control Conference, Bedford, MA. April 2004.
- Hejduk, M.D., Lambert, J.V., Williams, C.M, and Lambour, R.L. "Improved Satellite Brightness Estimation Techniques." 2003 AMOS Technical Conference, Kihei, HI. September 2003.
- Hejduk, M.D. and Lambert, J.V. "Statistical Distributions of Object RCS Histories." 2003 MIT / Lincoln Laboratory Space Control Conference, Bedford, MA. April 2003.
- Hejduk, M.D. "Composite RCS Catalogue". 2002 MIT / Lincoln Laboratory Space Control Conference, Bedford, MA. April 2002.
- Hejduk, M.D., Kervin, P.W., Lambert, J.V., Stansbery, E.G., Africano, J.L., and Pearce, E.C. "Visual Magnitude Satellite Catalogue Release 1.0." 2001 AMOS Technical Conference, Kihei, HI. September 2001.
- Hejduk, M.D., Sousa, M.W., Snow, D.E., and Daw, R.S. "SP/GP Catalogue Accuracy: Technical Approach and Initial Results." 2001 MIT / Lincoln Laboratory Space Control Conference, Bedford, MA. April 2001.
- Hejduk, M.D. "Region-specific Space Catalogue Growth." 15ème Symposium International: Mecanique Spatiale; Centre National d'Études Spatiales, Biarritz, France. July 2000
- Hejduk, M.D. and Daw, R.S. "Space Catalogue Growth Model for Simulations." 2000 MIT / Lincoln Laboratory Space Control Conference; Bedford, MA. April 2000.
- Hejduk, M.D. "SPADOC IV Unassociated Observation Flow." 1993 MIT / Lincoln Laboratory Space Control Conference; Bedford, MA. April 1993. (unclassified typescript available)

## ARTICLES/PAPERS – SUPPORTING AUTHOR

- Mashiku, A.K. and Hejduk, M.D. “Recommended Methods for Setting Mission Conjunction Analysis Hard Body Radii.” 2019 AAS Astrodynamics Specialist Conference (Paper #19-702), Portland ME, August 2019.
- Lechtenberg, T. F., and Hejduk, M. D. “Assessment and Validation of Collision ‘Consequence’ Method of Assessing Orbital Regime Risk Posed by Potential Satellite Conjunctions.” 2019 Hypervelocity Impact Symposium, Destin FL, March 2019, HVIS2019-061.
- Casali, S., Hall, D., Snow, D., Hejduk, M., Johnson, L., Skrehart, B., and Baars, L. “Effect of Cross-Correlation of Orbital Error on Probability of Collision Determination.” 2018 AIAA/AAS Astrodynamics Specialist Conference (Paper # AAS 18-272), Snowbird UT, August 2018.
- Hall, D.T., Hejduk, M.D., and Johnson, L.C. “Remediating Non-Positive-Definite State Covariances for Collision Probability Estimation.” 2017 AAS/AIAA Astrodynamics Specialist Conference, Stevenson WA, August 2017.
- Carpenter, J.R., Alfano, S., Hall, D.T., Hejduk, M.D., Gaebler, J.A., Jah, M.K., Hasan, S.O., Besser, R.L., DeHart, R.R., Duncan, M.G., Herron, M.S., and Guit, W.J. “Relevance of the American Statistical Society’s Warning on p-Values for Conjunction Assessment.” 2017 AAS/AIAA Astrodynamics Specialists Conference (paper # 17-614), Stevenson WA, August 2017.
- Hall, D.T., Hejduk, M.D., and Johnson, L.C. “Time Dependence of Collision Probabilities during Satellite Conjunctions.” 2017 AAS Space Flight Mechanics Meeting, San Antonio TX, February 2017.
- Newman, L.K., Hejduk, M.D., and Johnson, L.C. “Operational Implementation of a Pc Uncertainty Construct for Conjunction Assessment Risk Analysis.” 2016 AMOS Technical Conference, Kihei HI, September 2016.
- Zaidi, W.H. and Hejduk, M.D. “EOS System Covariance Realism.” 2016 AAS/AIAA Astrodynamics Specialist Conference, Long Beach CA, September 2016.
- Vallejo, J.J., Hejduk, M.D., and Stamey, J.D. “Trending in Probability of Collision Measurements via a Bayesian Zero-Inflated Beta Mixed Model.” 25th International Symposium on Space Flight Dynamics, Munich Germany, October 2015.
- Frigm, R.C., Hejduk, M.D., Johnson, L.C. and Plakalovic, D. “Total Probability of Collision as a Metric for Finite Conjunction Assessment and Collision Risk Management.” 2015 AMOS Technical Conference, Kihei HI, September 2015.
- Vallejo, J.J., Hejduk, M.D., and Stamey, J.D. “CA Risk Trending Using a Simple Functional Model in a Bayesian Framework.” 2014 AAS Astrodynamics Specialist Conference, Vail CO, August 2015.
- Newman, L.K., Frigm, R.C., Duncan, M.G., and Hejduk, M.D. “Evolution and Implementation of the NASA Robotic conjunction Assessment Risk Analysis Concept of Operations.” 2014 AMOS Technical Conference, Kihei HI, September 2014.

- Horwood, J.T., Aristoff, J.M., Singh, N., Poore, A.B., and Hejduk, M.D. “Beyond Covariance Realism: a New Metric for Uncertainty Realism.” *SPIE Proceedings: Signal and Data Processing of Small Targets* 2014, vol. 9092, 2014.
- Yocom, M.R. and Hejduk, M.D. “Satellite Persistent Monitoring Assessment Metrics.” 2013 MIT Lincoln Laboratory Space Control Conference, Bedford, MA. April 2013.
- Plakalovic, D., Hejduk, M.D., and Frigm, R.C. “A Tuned Single Parameter for Representing Conjunction Risk.” 2011 AAS Astrodynamics Specialists Conference, Girdwood, AK. August 2011.
- Narvet, S., Frigm, R.C., and Hejduk, M.D. “Assessment of Uncertainty-based Screening Volumes for NASA Robotic Leo and GEO Conjunction Risk Assessment.” 2011 AAS Astrodynamics Specialists Conference, Girdwood, AK. August 2011.
- Mulrooney, M.K., Matney, M.J., Hejduk, M.D., and Barker, E.S. “An Investigation of Global Albedo Values.” 2008 AMOS Technical Conference, Kihei, HI. September 2008.
- Gow, C.E., Eaves, S., and Hejduk, M.D. “The Visual Magnitude Distribution and Optical Variability of LEO Space Objects.” 2005 AMOS Technical Conference, Kihei, HI. September 2005.
- Okada, J.M. and Hejduk, M.D. “Satellite Brightness Estimation using Kriging Optimized Interpolation.” 2005 AMOS Technical Conference, Kihei, HI. September 2005
- Lambert, J.V. and Hejduk, M.D. “Observed Optical Brightness Distributions of Deep Space Satellites”. 2002 AMOS Technical Conference, Kihei, HI. September 2002.
- Daw, R.S. and Hejduk, M.D. “Determining SSN Operational System Capability (SYSCAP).” 1999 MIT / Lincoln Laboratory Space Control Conference; Bedford, MA. April 1999.

## **INVITED LECTURES**

- Hejduk, M.D. “Effects of Atmospheric Neutral Density Mismodeling on Satellite Conjunction Assessment.” NOAA 2017 Space Weather Workshop, Broomfield CO, May 2017.
- Hejduk, M.D. “Approaches to Defining Uncertainty Bounds for Probability of Collision Calculations.” Department of Aerospace Engineering, University of Texas at Austin. April 2016.
- Hejduk, M.D. “Spacecraft Collision Probability: Problems in Uncertainty Modeling.” Department of Statistics, Baylor University. September 2013.
- Hejduk, M.D. and Snow, D.E. “Deterministic/Stochastic Satellite Brightness Modeling.” Center for Astrophysics, Space Physics, and Engineering Research, Baylor University. February 2008.
- Hejduk, M.D. “Approaches to Satellite Characterization: the Deterministic/Stochastic Divide.” American Statistical Association Conference on Quantitative Methods and Statistical Applications in Defense and National Security, Santa Monica, CA. February 2006.

## **TEACHING EXPERIENCE**

ENG 2v97: Innovation in Engineering (Baylor University), 2016  
PHI 4341/5341: Continental Philosophy (Baylor University), 2008 – 2009  
GTX 2302: Medieval Intellectual Tradition (Baylor University), 2008  
PHI 2300: Introduction to Philosophy (University of Texas at Arlington), 2001 – 2002  
PHI 1301: Philosophy and the Ethical Life (University of Dallas), 2000

## **PROFESSIONAL SERVICE AND ASSOCIATIONS**

Technical submission evaluator, *Acta Astronautica*  
Technical submission evaluator, *Advances in Space Research*  
Technical submission evaluator, *Journal of the Astronautical Sciences*  
Technical submission evaluator, *Journal of Guidance, Control, and Dynamics*  
Technical submission evaluator, *Journal of Space Safety Engineering*  
Technical submission evaluator, *Journal of Spacecraft and Rockets*  
Technical submission evaluator, *Proceedings of the Royal Society A (Mathematical, Physical, and Engineering Sciences)*  
Technical submission evaluator, *Space Weather: A Journal of the American Geophysical Union*  
Grant application evaluator, National Sciences and Engineering Research Council of Canada  
Grant application evaluator, Air Force Office of Scientific Research

Senior Member, American Institute of Aeronautics and Astronautics  
Senior Member, American Astronautical Society

## **SENIOR COMMITTEES AND EXPERT PANELS**

International Astronautical Federation Space Traffic Management Committee (2020-21)  
NASA “Living with a Star” (LWS) expert panel on neutral atmospheric density modeling (2016)  
Air Force Space Command Astrodynamics Innovation Committee; scientific peer review panel (2014 – 2019)  
Air Force Space Command Astrodynamics Innovation Committee; working group on covariance realism (2014 – 2019)

## **COMMUNITY INVOLVEMENT**

Undergraduate applicant interviewer, Princeton University, 2010 – present  
Board of Directors member and Chairman, YMCA of Central Texas, 2011 – 2018  
Volunteer of the Year, Habitat for Humanity Waco, 2016  
Music Director, St. Gregory Society, Waco TX, 2007 – present