

Benjamin T. Tuttle, PhD



Summary

Experienced R&D, geospatial, engineering, product, IT, security, and AI leader with over 20 years of experience developing product strategies and turning that strategic vision into day-to-day execution by motivating and organizing teams around shared goals and strategies. Strong communication skills with experience working across stakeholders to ensure vision, strategy, and tactics are coordinated. Strong understanding of imagery constellations, data, and analysis. A timely decision maker with the ability to balance robust strategic vision with tactical execution.

Education

University of Denver

PhD Geography — 2007 - 2012

Dissertation Title: Aladdin's Magic Lamp: Developing Methods For Calibration And Geolocation Accuracy Of The DMSP-OLS

MS GIS — 2005 - 2007

Thesis Title: Virtual Globes: An Overview of Their History, Uses, and Future Challenges

University of Colorado, Boulder

BA Geography & BA Environmental Studies — 1996 - 2001

Emphasis on Remote Sensing, GIS, Cartography, Environmental Analysis

University College Dublin, Ireland

One Year Study Abroad Program — 1998 - 1999

One year of coursework with an emphasis on Zoology and Botany

Experience

Chief Technology Officer, EOI Space

Denver, CO — July 2022 - Present

Responsible for the entire EOI technology and product roadmaps, including the responsibilities of Chief Product Officer and Chief Information Officer. Leading a team of engineers and product specialists to build out a 60 satellite constellation of Very Low Earth Orbit (VLEO) satellites delivering the highest available commercial resolution, revisit, and on-orbit compute to generate and deliver high-level products directly from the satellite to users. This constellation will be driven by a dynamic tasking and collection system with options for on-orbit and ground data processing and analysis. The engineering and product teams are responsible for all efforts starting with design through build, test, integration and launch of the satellites and ground system.

VP Product & Software (July 2022 - February 2023)

Lead the development of EOIs product and software roadmap. This involved working with stakeholders across the company to ensure engineering, product, sales, and business needs were aligned. This position also worked closely with the USG sales team to ensure a product line with unique value to United States Government (USG) Department of Defense (DoD) and Intelligence Community (IC) users as well as capturing contract opportunities with multiple agencies.

Principal, GeoOutlook

Denver, CO — May 2022 - Present

Principal at GeoOutlook, consulting on geospatial data, technology, analytics, and strategy. Focus on remote sensing, AI/ML/DL and Predictive Analytics, mobile and web applications, and fusing new technology and data to deliver enhanced decision/policy making and tactical solutions across multiple markets.

Chief Technology Officer, Arturo.ai

Denver, CO — February 2019 - April 2022

Joined the company as CTO, including the duties of CIO, prior to its spinout from American Family Insurance. Responsible for leading the development of all engineering, IT, and cybersecurity into a standalone company in preparation for taking the product public and raising a series A fundraising round. Started with an engineering team of nine people and built it into a 54-person team over three years. The department included an AI/ML team, a Platform/Infrastructure/IT team, an Apps/Analytics team, and a Customer Operations team. Lead the development of solutions that allowed the company to expand into international markets and raise a successful Series B fundraising round at 6x valuation from Series A. Responsible for working collaboratively with the Chief Executive Officer, Chief Strategy Officer, Chief Financial Officer, Chief Marketing Officer, and Director of Sales to ensure all engineering efforts align with and deliver on company goals and objectives. Developed and implemented the technology roadmap to deliver on product needs for customers. This included labeling and model training, model tuning and enhancements, a real time platform for ingesting multiple data sources on-demand and executing models against them, an API for on-demand access (typically 5s-10s) to return 60+ (AI/ML/CV derived) attributes about a residential property, and frontend apps and analytics to further enhance the value of these attributes for an array of use cases.

R&D Technologist, National Geospatial-Intelligence Agency

Aurora, CO — 2010 - 2019

Director of Outposts (2016-2019)

Developed the plan/strategy and opened the NGA Outpost Valley, an innovation office based in Silicon Valley, to tap into new commercial geospatial technology and data companies, enhance the relationships with academia on the west coast, and to provide access to the west coast talent pool of scientists, engineers, and developers. This involved gaining leadership support from across the agency and coordinating a strategy that represented all facets of the agency. Built a new team to open the office and worked the management issues of moving the team and opening a physical office presence in San Francisco. Lead partnership engagements with industry, academic, and other government partners and work strategy to ensure successful integration of new technology, talent, and capabilities into the enterprise. Also worked on strategy and implementation of a second outpost in Austin, TX. Responsibilities included defining strategy, daily leadership/supervision, budget development and management, and ensuring coordination with other agency offices around the country.

Head of Product & Engineering GEOINT Services; Chief of Development & Operations Division (2015 - 2017)

Served as Head of Product & Engineering for GEOINT Services, an initiative to rapidly modernize the agency's data and analytic services, setting overall product strategy and working with product managers to implement projects across the IT platform, data services, and analytic services. Introduced the concept of product teams to the agency and built multiple product teams to deliver new capabilities. This effort involved ensuring alignment between NGA strategy and Office of the Director of National Intelligence (ODNI) strategic guidance. As a division chief, managed projects and oversaw development efforts of a geographically dispersed team and led the strategic planning efforts to develop IT infrastructure, a DevOps pipeline, backend services, and mobile and web applications for accessing data and analytics. Designed and deployed a modernized cloud information technology environment with a suite of scalable cloud based data and analysis services to improve service to NGA customers. These efforts involve managing costs and schedules, defining requirements, and architecting/guiding mobile and web app development as well as backend services. Interacted with customers to define resource requirements, develop project schedules, and set deliverables for the team. Represented the organization by presenting at meetings and conferences as well as organizing meetings and events to foster collaboration. Provided technical oversight including analysis, evaluation, and adaptation of government and commercial software applications and data services.

Mobile Apps Team Lead (2012 - 2015)

Served as the mobile apps team lead, managing projects and overseeing development efforts of a geographically dispersed team and leading the strategic planning efforts to develop mobile and web applications, location-based technologies, and researching mobile future technologies. Represented the organization by presenting at meetings and conferences as well as organizing meetings and events to foster collaboration.

Project Scientist (2010-2012)

Research and Development in the Geospatial Intelligence Advancement Testbed (GIAT). Focused on scientific problem solving, research and development, Multi-INT fusion, integrating user contributed data, and future technologies that lead to state of the art advances in capabilities for NGA and its customers. Responsibilities included research and information gathering, data analysis, applied scientific analysis, and developing prototype web and mobile GEOINT Applications.

GIS/RS Scientist, Cooperative Institute for Research in Environmental Sciences Boulder, CO — 2001 - 2010

Carried out Research and Development efforts at the National Geophysical Data Center including processing and analysis of data and scientific problem solving to produce imagery products including nighttime lights, forest fires, and impervious surface area. Worked on prototyping processes in preparation for new projects, including using MODIS data with nighttime lights for identification of gas flares, and using MODIS data to analyze the impacts of snow cover on brightness of nighttime lights. Worked on projects to predict impervious surface area and to estimate gas flaring volumes globally. Executed technical design and development for a near real-time system for distributing DMSP-OLS data via Open Geospatial Consortium (OGC) web services, which covered the entire process from ingesting raw orbits to

providing data products as online services. Developed web applications for outreach and collaborative mapping. Designed the Nighttime Lights of the World posters. Redesigned the DMSP website to improve customer service. Served as project manager for the DMSP film scanning project and provided technical guidance and oversight. Used IDL for information visualization and analytics. Built web applications to assist in access and interaction with data products using PHP, Ruby, Javascript, Mapscript, and MySQL. Assisted in technology evaluation for projects including defining hardware and software requirements. Presented research at conferences and meetings as a representative of the organization.

Geospatial Developer, Waterstone, Inc

Boulder, CO — 2007 - 2008

Part-time position developing geospatial web solutions on a team focused on rapid solution development. Projects included prototyping web services and applications with ArcGIS Server and MapServer, and building modules for security, analytics, and advanced visualization in virtual globes. Worked on an application to automate the conversion of ArcMap documents to MapServer documents to simplify the process of publishing desktop maps to the web. Worked on a web application using a virtual globe as an interface to explore Olympic athletes and events during the 2008 Olympics.

Teaching Assistant, University of Denver, Department of Geography

Denver, CO — 2007 - 2010

Teaching assistant for Application Design and Production, Geographic Information Analysis, GIS Modeling, Human Population, Introduction to Cartography, Introduction to GIS, Introduction to Statistics, and Our Dynamic Earth.

Research Assistant, University of Denver, Department of Geography

Denver, CO — 2005 - 2007

Internship at Esri Denver Regional Office performing map design, supporting ArcGIS Server application development using VB .NET and ASP .NET, and database design/implementation.

Research Assistant, Cooperative Institute for Research in Environmental Sciences

Boulder, CO — 1998 - 2001

Supported Research & Development efforts at the National Geophysical Data Center including archiving, retrieval, processing, and analyzing data to produce images including nighttime lights and forest fires and delivery to customers.

Fellowships and Awards

Constellation Research Business Transformation 150

2018 - 2019

NASA Earth & Space Science Fellowship

2008 - 2011

ASPRS Rocky Mountain Region Scholarship

2007 - 2008

Professional Memberships & Service

- **Association of American Geographers**
 - Chair - Cyber-Infrastructure Specialty Group (2011-2012)
 - Vice-Chair - Cyber-Infrastructure Specialty Group (2010-2011)
 - Chair - Application Visualization Committee' Cyber-Infrastructure Specialty Group (2009-2011)
 - Student Director - Remote Sensing Specialty Group (2008-2010)
- **American Geophysical Union**
- **American Society for Photogrammetry and Remote Sensing**
 - President - University of Denver Student Chapter (2008-2010)
- **FOSS4G 2011 Organizing Committee**
 - Chair - Workshop Committee

References

Available upon request.

Selected Publications

Holmes, C., Tucker, C., Tuttle, B.. 2018, GEOINT at Platform Scale, The State and Future of GEOINT 2018, United States Geospatial Intelligence Foundation

Tuttle, B.T., Anderson, S., Elvidge, C., Ghosh, T., Baugh, K.E., Sutton, P. C., 2014, Aladdin's Magic Lamp: Active Target Calibration of the DMSP OLS, Remote Sensing, 6(12):12708-12722

Tuttle, B.T., Anderson, S., Elvidge, C., Baugh, K.E., 2013, It Used To Be Dark Here: Geolocation Calibration of the Defense Meteorological Satellite Program Operational Linescan System, Photogrammetric Engineering & Remote Sensing, 79(3):287-297

Sutton, P. C., Anderson, S. J., Tuttle, B. T., Morse, L, 2012, The Real Wealth of Nations: Mapping and Monetizing the Human Ecological Footprint, Ecological Indicators, 16:11-22

Ziskin, D., Aubrecht, C., Elvidge, C., Tuttle, B, Eakin, C. M., Strong A. E., Guild, L. S., 2011, Describing coral reef bleaching using very high spatial resolution satellite imagery: experimental methodology. Journal of Applied Remote Sensing, 5

Elvidge, C.D., Baugh, K.E., Sutton, P.C., Bhaduri, B., Tuttle, B.T., Ghosh, T., Ziskin, D., Erwin, E.H., 2011, "Who's In The Dark: Satellite Based Estimates Of Electrification Rates", Urban Remote Sensing: Monitoring, Synthesis and Modeling In the Urban Environment, Ed. Xiaojun Yang, Wiley-Blackwell, Chichester, UK

Anderson, S.J. and Tuttle, B.T., 2010, Client/Server Architectures in Encyclopedia of Geography, (Warf, B. editor). Thousands Oaks, CA: SAGE Publications, Inc.

Anderson, S. J., Tuttle, B. T., Powell, R. L., Sutton, P. C., 2010, Characterizing Relationships Between Population Density and Nighttime Imagery for Denver, CO: Issues of Scale and Representation, International Journal of Remote Sensing, 31(21):5733-5746

Elvidge C.D., Keith D.M., Tuttle B.T., Baugh K.E., 2010, "Spectral Identification of Lighting Type and Character", Sensors, 10{4}, 3961-3988

Ghosh, T., Elvidge, C. E., Sutton, P. C., Baugh, K. E., Ziskin, D., Tuttle, B.T., 2010, Creating a Global Grid of Distributed Fossil Fuel C02 Emissions from Nighttime Satellite Imagery, Energies, 3(12):1895-1913

Elvidge, C.E., Tuttle, B.T., Sutton, P., 2009, Collaborative tool for collecting reference data on the density of constructed surfaces worldwide. 6th International Symposium on Digital Earth, Beijing, China

Elvidge, C.D.; Erwin, E.H.; Baugh, K.E.; Ziskin, D.; Tuttle, B.T.; Ghosh, T.; Sutton, P.C., 2009, Overview of DMSP nighttime lights and future possibilities. IEEE Proceedings of the 7th International Urban Remote Sensing Conference, Shanghai, China

Elvidge, C. D., P. C. Sutton, T. Ghosh, B. T. Tuttle, K. E. Baugh, B. Bhaduri, and E. Bright, 2009, A Global Poverty Map Derived from Satellite Data. *Computers and Geosciences*, 35,1652-1660

Elvidge, C. D., Ziskin, D., Baugh, K. E., Tuttle, B. T., Ghosh, T., Pack, D. W., Erwin, E. H., Zhizhin, M., 2009, A Fifteen Year Record of Global Natural Gas Flaring Derived from Satellite Data. *Energies*, 2 (3), 595-622

Elvidge, C.D., Sutton, P.C., Tuttle, B.T., Ghosh, T., Baugh, K.E, 2009, Global Urban Mapping Based on Nighttime Lights, Chapter 6 in *Global Mapping of Human Settlement*, (Gamba, P. and Herold, M. editors), CRC Press, p. 129-144

Kiran Chand, T.R., Badarinath, K.V.S., Elvidge, C.D., Tuttle, B.T., 2009, Spatial characterization of electrical power consumption patterns over India using temporal DMSP-OLS night-time satellite data. *International Journal of Remote Sensing*, 30{3}, 647-661

Aubrecht, C, Elvidge, C. D., Longcore, T., Rich, C., Safran, J., Strong, A. E., Eakin, C. M., Baugh, K. E., Tuttle, B. T., Howard, A. T., Erwin, E. H., 2008, A global inventory of coral reef stressors based on satellite observed nighttime lights. *Geocarto International*, 23(6), 467-479

Elvidge, C.E., Tuttle, B.T., 2008, How virtual globes are revolutionizing earth observation data access and integration. ISPRS Congress Beijing, Proceedings of Commission VI, Volume XXXVII, Part B6a, WGVI/4: Internet Resources and Datasets, ISSN 1682-1750

Tuttle, B.T., Anderson, S., Huff, R., 2008, Virtual globes: An overview of their history, uses, and future challenges. *Geography Compass*, 2(5), 1478-1505

Chand, T.R.K., Badarinath, K.V.S., Murthy, M.S.R., Rajshekhar, G., Elvidge, C.D., Tuttle, B.T., 2007, Active forest fire monitoring in Uttaranchal State, India using multi-temporal DMSP-OLS and MODIS data. *International Journal of Remote Sensing*, 28(10), 2123-2132

Elvidge, C.D., Safran, J., Tuttle, B.T., Sutton, P., Cinzano, P., Petit, D., Arvesen, J., Small, C., 2007, Potential for global mapping of development via a Nightsat mission. *GeoJournal*, 69,45-53.

Elvidge, C.D., Tuttle, B.T., Sutton, P.C., Baugh, K.E., Howard, A.T., Milesi, C., Bhaduri, B., Nemani R., 2007, Global distribution and density of constructed impervious surfaces. *Sensors*, 7,1962-1979

Elvidge, C.D., Milesi, C., Dietz, J.B., Tuttle, B.T., Sutton, P.C., Nemani, R., Vogelmann, J.E., 2004, U.S. constructed area approaches the size of Ohio. *EOS Transactions, American Geophysical Union*, 85, 233.

Elvidge, C.D., Milesi, C., Dietz, J.B., Tuttle, B.T., Sutton, P.C., Nemani, R. Vogelman, J.E. 2004, Paving Paradise. *GeoSpatial Solutions* 14(9), 58

Elvidge, C.D., Safran, J., Nelson, I.L, Tuttle, B.T., Hobson, V.R., Baugh, K.E., Dietz, J.B., Erwin, E.H., 2004, Area and position accuracy of DMSP nighttime lights data. Chapter 20 In *Remote Sensing and GIS Accuracy Assessment* (Lunetta R.S. and Lyon, J.G. editors), CRC Press, 281-292

**Selected
Panels,
Presentations
, & Posters**

Elvidge, C.D., Hobson, V.R., Nelson, I.L, Safran, J.M., Tuttle, B.T., Dietz, J.B., Baugh, K.E.,, 2003, "Overview of DMSP-OLS and scope of applications - Chapter 13", Remotely Sensed Cities, 281-299

Elvidge, C.D., Imhoff, M.L., Baugh, K.E., Hobson, V.R., Nelson, I., Safran, J., Dietz, J.B., Tuttle, B.T., 2001, Nighttime lights of the world: 1994-95. ISPRS Journal of Photogrammetry and Remote Sensing, 56,81-99

Courtois, J., Galic, C., Haddad, T., Perrot, B., Tuttle, B., Zevenbergen, A., 2023-09-14: Defense and Security Requirements: Challenges Taken Up By Commercial Players, World Satellite Business Week, Paris, France -Panel Participant

Fischer, L., Sucha, G., Thomason, J., Tuttle, B., 2023-05-12: Riding the Big Data Wave: How Geospatial Companies Are Creating Value, North 51, Banff, Alberta, Canada -Panel Participant

Budideti, J., Cadell, W., Gorman, S., Tuttle, B., Winters, A., 2022-09-28: Founders Forum, Sat Summit, Washington, D.C., USA -Panel Participant

Tuttle, B., Wise, D., Yoong, J., 2021-05-18: GeoConvergence Across Fields of Application, GeoConvergence Workshop, Virtual - Panel Participant

Hamann, H., Jasper, R., Maskey, M., Tombs, V., Tuttle, B., Wilson, S., 2021-04-21: Trustworthiness of GeoAI Systems, The Trillion-Pixel Challenge, Virtual -Panel Participant

Garcia, S., McCune, J., Sams, B., Tuttle, B., Whelen, T., 2021-04-08: Geographers in Business/Private Sector Careers, American Association of Geographers Annual Meeting, Virtual - Panel Participant

Cadell, W., Gorman, S., Tuttle B., 2020-02-06: Geospatial Analytics Will Eat The World, And You Won't Even Know It, North51: Off The Map, Banff, Alberta, Canada -Panel Participant

Tuttle, B. T., 2019-06-04: Turning Your Data Into Real Time Actionable Insights, USGS Community Data Workshop: From Big Data To Smart Data, Boulder, CO., USA -Invited Speaker

Brown, M., Gumtow, K., Klimavicz, J., Kutner, E., Tuttle, B., 2019-04-11: Looking At Innovation In Acquisition: 2020 And Beyond. Security Innovation Network (SINET) IT Security Entrepreneurs Forum (ITSEF), Mountain View, CA., USA -Panel Participant

Stroup, T., Merrit, J., Tuttle, B., Sears, K., Vandermeulen, R., 2018-2-7: Market for Defense Applications, Smallsat Symposium, Mountain View, CA., USA -Panel Participant

Tuttle, B. T., 2017-5-24: Delivering GEOINT in the Open. CalGIS/LocationCon 2017, Oakland, CA., USA -Keynote Presentation

Tuttle, B. Christopher, C., Hess, J., 2017-4-13: Modern Technology Infrastructure for Analysis. Powering GEOINT Analytics: Big Data From Small Sats, Springfield, VA., USA -Panel Participant

Tuttle, B.T., 2015-10-15: Embracing Open Source for Real -- Deploying, Enhancing, and Developing OSS in the Federal Government. Fed Geo Day, Washington, D.C., USA -Oral Presentation

Frantz, N., Tuttle, B.T., Lander, S., Lee, M., 2015-9-16: GeoPackage and how open source is

changing the way governments think about standards. FOSS4G, Seoul, Korea

Fleming, S., Tuttle, B., Oxendine, C., Mayfield, C., Kutner, E., Har-Noy, S. .2014-4-14: Chaos Management in a Disconnected World, GEOINT Symposium, Tampa, FL, USA -Panel Participant

Pickle, E., Tuttle, B.T., Campbell, J., Lyon, L., 2013-02-28: Tearing Down The Wall: Procuring and Deploying Open Source GeoTools. Fed Geo Day, Washington, D.C., USA -Panel Participant

Tuttle, B.T., King, W. S., 2012-09-16: Leveraging Open Source Tools in Support of Disconnected Mobile Map Caches. Workshop on "The Internet and Geospatial Technologies" at AutoCarto 2012, Columbus, OH, USA -Workshop Lead

Tuttle, B. T., Anderson, S., Sutton, P., Elvidge, C., Powell, R., 2012-2-28: Aladdin's Magic Lamp: Calibrating the DMSP-OLS with an Active Target. Association of American Geographers Annual Meeting, New York, NY, USA -Oral Presentation

Tuttle, B. T., Jenkins, A., Crossler, J., White, A. Demmy, G., Hendricks, M., 2011-10-16: People and Technology: New Sensing Paradigm for Geospatial Data Collection and Integration, GEOINT Symposium, San Antonio, TX, USA -Panel Participant

Craun, K., Tuttle, B. T., Ball, M., 2011-10-16: Mobile GEOINT Applications, GEOINT Symposium, San Antonio, TX, USA -Panel Participant

Tuttle, B. T., 2011-5-2: Nighttime Lights Research & Applications. American Society of Photogrammetry and Remote Sensing Annual Meeting, ENVI User Group, Milwaukee, WI, USA -Oral Presentation

Tuttle, B. T., Anderson, S., Sutton, P., Elvidge, C, Baugh, K., Powell, R., 2011-4-13: Aladdin's Magic Lamp: A methodology for improving nighttime lights time series analysis. Association of American Geographers Annual Meeting, Seattle, WA, USA -Poster

Tuttle, B. T., Anderson, S., Sutton, P., Elvidge, C., Powell, R., Baugh, K., 2010-4-16: Aladdin's Magic Lamp: Building an Active Calibration Target for the Defense Meteorological Satellite Program Operational Linescan System (DMSP OLS). Association of American Geographers Annual Meeting, Washinton D.C., USA -Oral Presentation

Tuttle, B.T., Sutton, P., Anderson, S., Elvidge, C.D., 2009-3-22: Developing a web-based collaborative mapping tool to map impervious surface globally. Association of American Geographers Annual Meeting, Las Vegas, NV, USA -Oral Presentation

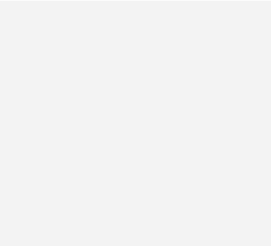
Edsall, R., Tuttle, B., Moskal, M., Dunbar, M., 2008-4-28: The interface between cartography and remote sensing. The American Society for Photogrammetry and Remote Sensing Annual Conference, Portland, OR, USA -Panel Participant

Tuttle, B.T., Anderson, S., Elvidge, C., Sutton, P., Baugh, K., 2008-4-15: Validating DMSP-OLS and MODIS fire detections with nighttime Landsat. Association of American Geographers Annual Meeting, Boston, MA, USA -Poster

Tuttle, B.T., Elvidge, C. E., 2008-10-22: Gas flaring as observed within Google Earth. Scientific Applications With Google Earth Conference, Ann Arbor, MI, USA -Poster

Tuttle, B.T., C. Elvidge, 2007-8-27: Web Mapping Service development for DMSP satellite data. 24th Asia Pacific Advanced Network (APAN) Meeting, Beijing, China -Oral Presentation

Tuttle, B.T., C. Elvidge, K. Baugh, A. Howard, 2007-1-9: DMSP detection of active fires.



Global Estimation of Biomass using the Next Generation Sensor Workshop - Hosted by the University of Tokyo, Tokyo, Japan -Oral Presentation

Tuttle, B.T., C. Elvidge, K. Baugh, R. Nemani, C. Milesi, P. Sutton, 2007-4-17: Global mapping of impervious surface area. American Geographers Annual Meeting, San Francisco, CA, USA -Oral Presentation