Boris R. **Fernandez Astro**

HD Map Engineer · LiDAR & Photogrammetry Specialist
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Education

M.Sc. in Higher Education — Scientific Research Methodology CEPIES, Universidad Mayor de San Andrés
Thesis: "A Software-as-a-Service didactic strategy for strengthening teaching and learning in Geographic Engineering, EMI" · Summa Cum Laude 2021

Postgraduate Diploma in Research Methodology for Higher Education CEPIES, Universidad Mayor de San Andrés
2019

Postgraduate Diploma in Higher Education Escuela Militar de Ingeniería (EMI)
Planning and development of professional competences 2018

Postgraduate Diploma in Higher Education — University Teaching CEPIES, Universidad Mayor de San Andrés
2015

Postgraduate Diploma in Water Management Universidad de la Cordillera
Planning for climate change adaptation 2015

B.Sc. in Geographic Engineering (Geomatics) Escuela Militar de Ingeniería (EMI)
Thesis: "Proposal for the implementation of the LTM-PTL projection with standardized parameters for Bolivia" · defended with honors, 9.80 / 10 2014

Academic Appointments

- Jul 2025–present: GIS Specialist — HD Mapping for Autonomous Vehicles, U.S. based company. (remote; USA)
- Nov 2021–present: Founder and Principal Geospatial Engineer, Astro Geomática, La Paz, Bolivia
- 2016–2026: Faculty, Geographic Engineering, Escuela Militar de Ingeniería (EMI)
- 2022–2024: Specialist Consultant — LiDAR and Photogrammetry, Servicio Nacional de Aerofotogrametría (Bolivia's national aerial survey agency)
- 2019–2021: Spatial Information Lead / Cartography Lead, Wildlife Conservation Society Bolivia
- Dec 2015–Dec 2018: Head, Project Evaluation Section, Servicio Nacional de Aerofotogrametría
- 2014–2015: GIS and Remote Sensing Consultant — FAO, OTCA, Instituto Geográfico Militar, NetDesign-IT

Research Areas

Research Focus

HD mapping for autonomous vehicles (Lanelet2 / OSM lane networks), Airborne and mobile LiDAR: classification, strip adjustment, DTM/DSM, Photogrammetry: aerial triangulation, stereo-satellite DEM, SfM and UAV/RPAS, Geodesy, map projections and local topographic planes, GIS, remote sensing and artificial intelligence applied to point clouds and imagery, 3D geospatial modeling, virtual reality and 3D printing from geospatial data

Awards & Honors

- 2026: **'Julio Sanjinés Goytia' Career Achievement Award for contributing to the prestige of the Military School of Engineering (EMI)** Escuela Militar de Ingeniería
- 2018–2021: Teaching Merit Diploma (four consecutive years), Universidad Loyola
- 2016: Letter of commendation, Servicio Nacional de Aerofotogrametría
- 2015: **1st place, Francisco Coello International Award, 16th edition** — Escuela Politécnica Superior, Universidad de Jaén, Spain
- 2014: Thesis defense approved with honors, Escuela Militar de Ingeniería
- 2012: Academic excellence scholarship, Escuela Militar de Ingeniería

Books

- **B. R. Fernandez Astro** (2015). *Topographic surveys using local topographic coordinates and their applications in cadastre*. Universidad Mayor de San Andrés. ISBN 978-99974-54-92-8.

Publications

Published: 1 book · 5 papers and technical reports · 2 field manuals

2019

- **B. R. Fernandez Astro** (2019). "Research projects in aerial and close-range photogrammetry." Escuela Militar de Ingeniería "Mcal. Antonio José de Sucre".

2018

- **B. R. Fernandez Astro** (2018). "Methodology and applications of close-range photogrammetry (case study: Cnl. Julio Sanjinez Goitia monument)." Escuela Militar de Ingeniería "Mcal. Antonio José de Sucre".

2017

- **B. R. Fernandez Astro** (2017). "Application of the ALS70-HP system integrated with the RCD30 aerial camera for urban cadastre purposes." XVI Meeting of Latin American Geographers (EGAL 2017), Universidad Mayor de San Andrés.

2016

- **B. R. Fernandez Astro** (2016). "Proposal for the implementation of the Local Transverse Mercator – Local Topographic Plane (LTM-PTL) projection with standardized parameters for Bolivia." Escuela Militar de Ingeniería; published in *InfoGEO* (Colegio de Ingenieros de Bolivia), Vol. 4.
- **B. R. Fernandez Astro** (2016). "Technical criteria for the quantification of forest surfaces as a contribution to Bolivia's Joint Forest Mechanism policies." Universidad de la Cordillera / Escuela Militar de Ingeniería. Finding: UTM underestimates area by about 0.132 % at 2,000–2,500 m a.s.l., against about 0.077 % in the lowlands.

2015

- **B. R. Fernandez Astro** (2015). *Leica FlexLine TS06 PLUS 5" manual, version 1.0*. Escuela Militar de Ingeniería.
- **B. R. Fernandez Astro** (2015). *Trimble Juno 3B manual, version 1.0*. Escuela Militar de Ingeniería.

Software & Tools

Software

- HD mapping / AV: **Lanelet2 (OSM)**, JOSM, lane-level network assembly, lane boundaries, virtual and turning lines, intersection cut lines, slicing at condition changes, regulatory associations, GeoJSON layer interchange, QA/QC against automated validation checks, corridor handoff and connectivity, route-stationing tiling specifications
- Point clouds: **Terrasolid suite** (TerraScan, TerraMatch, TerraModeler, TerraPhoto) on MicroStation and Spatix, TopoDOT, LiDAR360, LAStools, Leica Cyclone 3DR, Trimble RealWorks, strip adjustment, trajectory management, classification and ground filtering, breaklines, DTM/DSM
- Photogrammetry: **Trimble Inpho** (ApplicationsMaster, UASMaster), ERDAS IMAGINE 16.7 with ORIMA-LPS, Catalyst Professional (PCI Geomatica), Agisoft Metashape, RealityCapture, aerial triangulation, stereo-satellite block adjustment, orthomosaics, SfM, UAV/RPAS
- Geodesy and GNSS: RTK / PPK / **PPP** (CSRS-PPP, MARGEN, ITRF2020), Trimble Business Center, Leica Infinity, Inertial Explorer, Helmert transformations, site calibration, least-squares network adjustment, geoid QC, CRS/EPSG and datum management, author of the LTM-PTL local projection
- GIS and remote sensing: **ArcGIS Pro**, QGIS, Global Mapper, Google Earth Engine, eCognition Developer (OBIA and deep learning), NV5 ENVI, PostGIS, GeoServer, spatial databases and SDI, CAD thematic cartography
- Programming: **Python** (ArcPy, PyQGIS, GDAL/OGR, geospatial libraries), JavaScript (Google Earth Engine), Excel VBA, SQL, PHP, HTML/CSS, AWS EC2 GPU virtual workstations, cloud processing pipelines
- 3D and visualization: Blender and BlenderGIS, ESRI CityEngine, Unreal Engine (geospatial applications, in progress), geospatial VR/XR, 3D-printing model preparation from DTM/DSM and point clouds, animation rendering

Own Development

- **QGIS plugin** (in-house): Bundles the geoprocessing tools and Python scripts I use most in production into a single QGIS plugin
- **Inpho ⇄ Metashape project converter**: Translates photogrammetric project definitions between Trimble Inpho and Agisoft Metashape in both directions, so a block can move between the two without rebuilding it

Sensors & Field Equipment

- **Leica ALS70-HP / ALS80-HP** with RCD30 metric camera: Airborne sensor operator on 18 campaigns, including the ALS80-HP calibration flight
- Leica CloudPro, IPAS CO+, FramePro, Inertial Explorer: Airborne LiDAR mission control, trajectory and camera data processing
- DJI Matrice 300 RTK, Phantom 4 RTK: UAV/RPAS photogrammetric acquisition and training

- Leica FlexLine TS06 total station, differential GNSS: Ground control, checkpoints and topographic survey

Teaching

Courses at Escuela Militar de Ingeniería (EMI)

- Applied Photogrammetry: Geographic Engineering, undergraduate (2021–2026)
- Photogrammetry: Geographic Engineering, undergraduate (2017–2025)
- Geostatistics: Geographic Engineering, undergraduate (2024)
- Mathematical Cartography: Geographic Engineering, undergraduate (2022)
- Surveying: Civil Engineering, undergraduate (2022)
- Introduction to LiDAR: Geographic Engineering, short course (2018)
- Geoinformatics: Geographic Engineering, interim lecturer (2016)
- Leica FlexLine TS06 total station: Geographic Engineering, refresher course (2015)

Courses at Universidad Loyola

- Photogrammetry: Undergraduate (2016–2023)
- Surveying: Undergraduate (2019)
- Introduction to LiDAR: Short course (2018)

Courses at Graduate Programs

- LiDAR in Road Infrastructure Surveying: Road Infrastructure Works Supervision diploma, EMI Graduate School (La Paz and Santa Cruz) (2022, 2023, 2024)
- GIS-Oriented Programming: M.Sc. in Remote Sensing and GIS applied to Earth Sciences, UMSA (2022, 2023)
- Geographic Databases and Spatial Data Infrastructure: M.Sc. in Remote Sensing and GIS applied to Earth Sciences, UMSA (2022, 2023)
- Python for geospatial technologies and methodologies: Graduate Unit of Geographic Engineering, UMSA (2025)
- Technologies Applied to Cadastre: M.Sc. in Territorial Cadastre and Geodesy, UAGRM (2023)
- Theory of Errors: M.Sc. in Territorial Cadastre and Geodesy, UAGRM (2024)
- Drone handling, photogrammetry and geospatial data processing: Diploma in Territorial Planning and Cadastre with GIS and UAV technologies, Universidad Nacional Siglo XX (2024)

Courses at Other Institutions

- Spatial Network Analysis: Escuela Militar de Topografía del Ejército, NCO advanced training school (2015)

Mentoring

Undergraduate Research Supervision, EMI

- Geoinformatic technologies with artificial intelligence for segmentation and classification to optimize orthomosaics (Las Nieves, La Paz): AI and remote sensing
- Methodological proposal for adapting virtual reality environments from photogrammetric products (Bajo Pampahasi, La Paz): VR and photogrammetry
- Methodology for cadastral zonification through drone (RPAS) photogrammetry in the urban area of Palca: UAV cadastre
- Orthophoto, digital terrain model and digital surface model with LiDAR methodology for the 230 kV Mizque–Sucre transmission line study: Airborne LiDAR
- Methodology for generating 3D cartography from drone (RPAS) photogrammetry (Pampahasi Bajo, La Paz): 3D cartography
- Optimization of the LiDAR data workflow for the cartographic projects of the Servicio Nacional de Aerofotogrametría: LiDAR production
- Determination of the relative and absolute accuracy of photogrammetric restitution using Structure from Motion (SfM) software: SfM accuracy
- Systematized cloud workflow for the generation and evaluation of aerial photogrammetric products: Cloud processing
- Technical methodology for generating a 3D cadastre through aerial photogrammetry with a Matrice 300 RTK drone (urban area of Viacha): 3D cadastre and UAV
- Methodological development with artificial intelligence for updating the physical cadastre of the municipality of La Paz (Irpavi zone): AI and cadastre

Workshops

2025

- Point cloud classification with LiDAR and photogrammetry, plus artificial intelligence applications. Specialization course, *Educare Internacional S.A.C.* Peru. August–September 2025
- Introduction to LiDAR360 and environment setup. *Arturo Rauda Ingeniería Geomática*. Mexico. July 2025

2023
- Interpretation and processing of satellite imagery with QGIS. *Drones y Tecnología SRL (DRONTEC)*. La Paz, Bolivia. August 2023

2022
- Advanced Photogrammetry Program: use and processing of P4RTK drone (RPAS) data. *EPSAS*. La Paz, Bolivia. November–December 2022
- Satellite Photogrammetry. *Colegio de Ingenieros Geógrafos de Bolivia (CIGEO)*. March–April 2022

2021
- Geographic Information Systems (GIS). *Educational Training Center*. La Paz, Bolivia. November–December 2021

Invited Talks

(7 talks given at Bolivian universities and at Latin American conferences)

2018
- "Proposal for a Local Transverse Mercator (LTM) projection with Local Topographic Planes (PTL) for large-scale projects." *Universidad Loyola*. La Paz, Bolivia. October 25, 2018
- "Application of geomatics in the formation and maintenance of rural cadastre in Bolivia." *Universidad San Francisco Xavier de Chuquisaca, Faculty of Technology — Geodesy and Surveying*. Sucre, Bolivia. April 21, 2018

2017
- "Application of the ALS70-HP system integrated with the RCD30 aerial camera for urban cadastre purposes." *XVI Meeting of Latin American Geographers (EGAL 2017)*, Universidad Mayor de San Andrés. La Paz, Bolivia. April 29, 2017
- "Digital photogrammetry and LiDAR imagery applications in urban cadastre." *Universidad San Francisco Xavier de Chuquisaca, Faculty of Technology*. Sucre, Bolivia. March 30, 2017

2016
- "Remote sensing in disasters, change and climate adaptation." *Universidad Mayor de San Andrés, Faculty of Geological Sciences*. La Paz, Bolivia. October 5, 2016
- "Photogrammetric flight planning and the applications of aerial photographs." *Universidad San Francisco Xavier de Chuquisaca, Faculty of Technology — Surveying*. Sucre, Bolivia. April 4, 2016

2014
- Speaker, *GeoEMI 2014 Earth Sciences Conference Cycle*. Escuela Militar de Ingeniería, La Paz, Bolivia. November 28, 2014

Institutional Services

Escuela Militar de Ingeniería (EMI), Geographic Engineering
- Program Operational Lead: Geographic Engineering undergraduate program
- Curriculum redesign committee member: Undergraduate curriculum
- Career council member: Program governance
- Reviewer on undergraduate thesis defense boards: Grade-work defenses

Universidad Mayor de San Andrés (UMSA), Graduate Unit of Geographic Engineering
- Examining board member: M.Sc. thesis proposal defenses