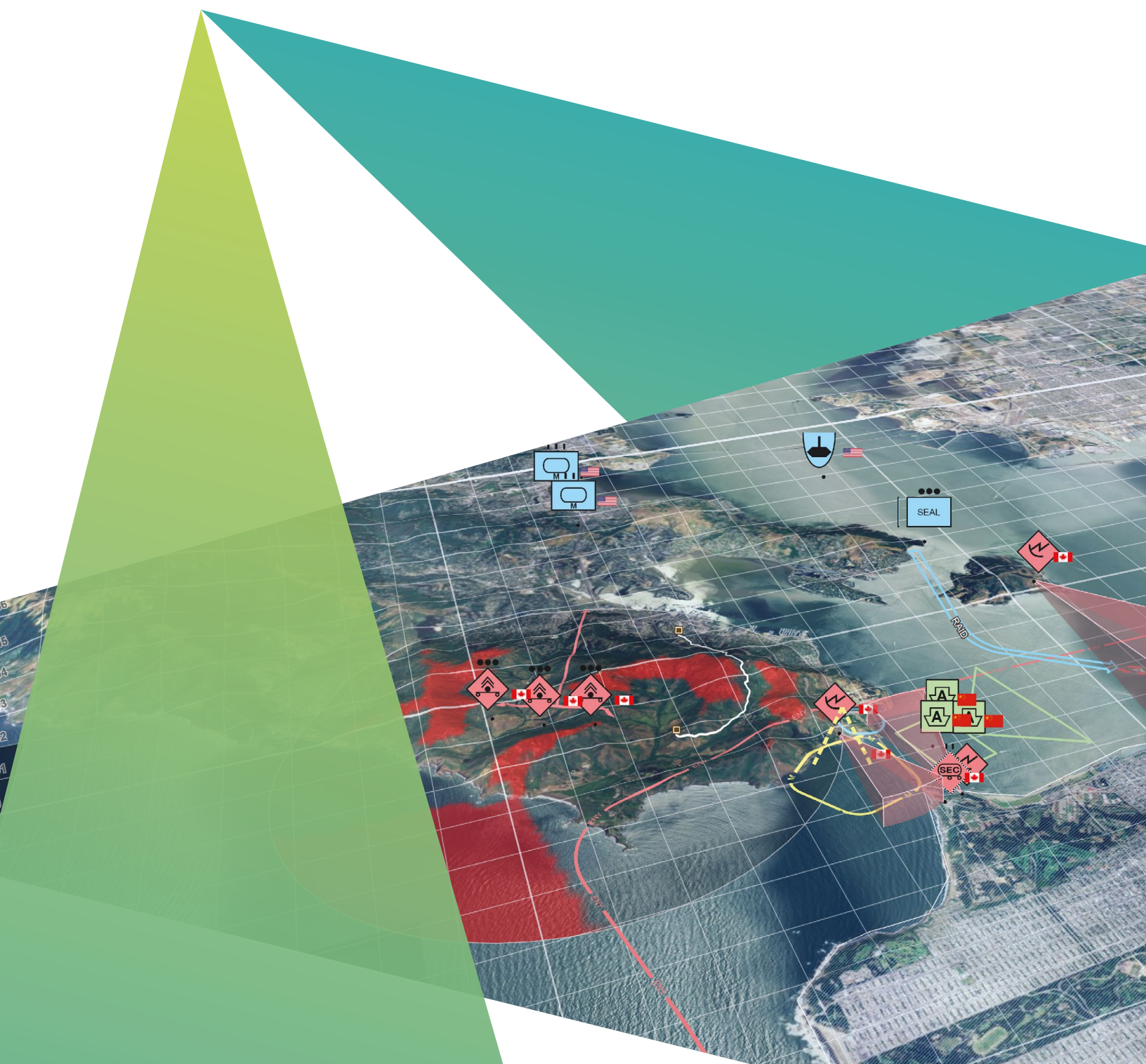


Advanced geospatial analytics for desktop and onboard applications



LuciadLightspeed is a modular and extensible desktop and onboard solution for geospatial situational awareness. Users can bring in a multitude of data sources together in a common operational picture (COP).

LuciadLightspeed provides the foundations for advanced geospatial analysis applications. Developers can create high-performance C2 and location intelligence applications thanks to the clean, modular structure and powerful visual analytics capabilities. Using its configurable SDK, you can add support for custom data sources or databases, add your own symbology or match user interaction and look and feel to your company's unique needs and style.

Luciad's desktop and onboard solution comes with Lucy, a ready-to-use application framework. Lucy allows users to drag and drop or connect to more than 200 data formats and databases with unparalleled performance, all while preserving data precision. Data can be explored in a 2D or 3D map view, table view or vertical intersection view. Annotate maps and print or export the result to report your findings.

Who needs the LuciadLightspeed desktop and onboard solution?

These are just a few examples of why users turn to LuciadLightspeed for their geospatial data challenges:

- Provide your operational staff with a COP
- Stay informed via shared tactical plans in NVG format, visualized with military symbology
- Analyze complex airspaces delivered as AIXM data using 3D visualization
- Create a certified recognized air picture
- Correctly represent data for the polar region
- Explore X (formerly Twitter) feeds for trend analysis and security at big events
- Detect patterns in traffic and get alerts about unexpected behavior
- Explore data in 4D, represented geographically as time series as well as plot views
- Share vector data as a web service without rasterizing it before publishing

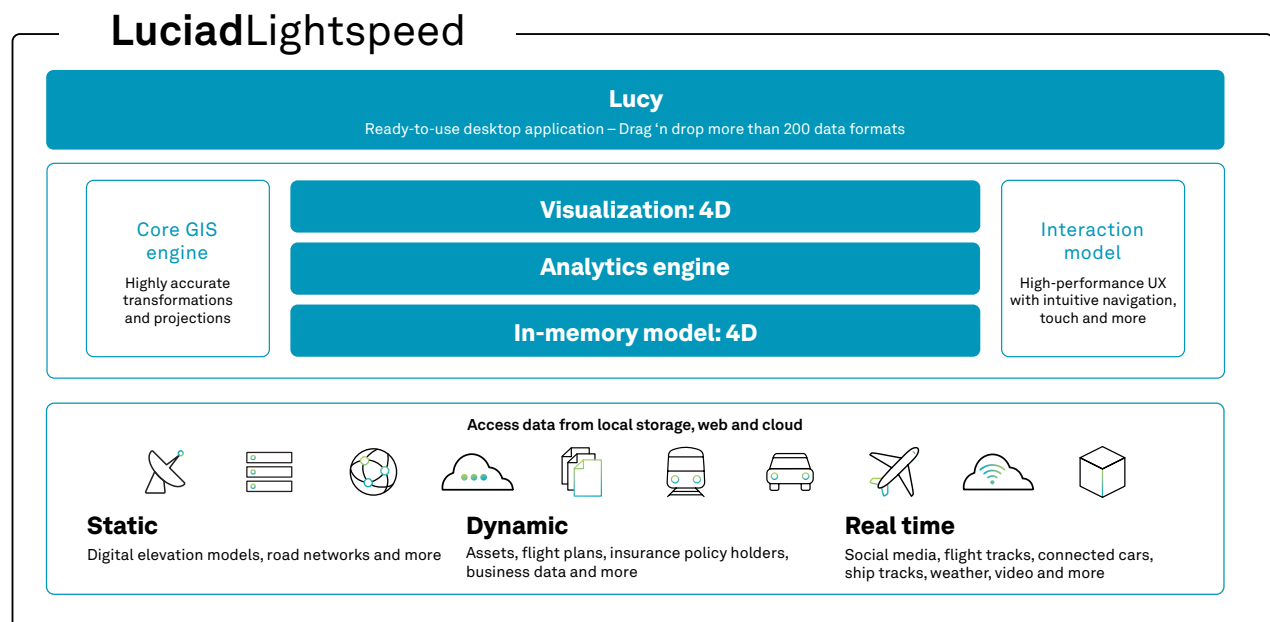


Figure 1: Luciad's desktop and onboard solution connects to more than 200 data sources with an intuitive, drag-and-drop user interface. Its core GIS engine and visual analytics capabilities offer beautiful visualization and powerful data analysis.



Figure 2: Starting in LuciadLightspeed's application template Lucy, you can drag and drop your geospatial data, visualize it, add additional data layers and run analyses.

Key benefits

Best-in-class performance	Allows an unprecedented user experience with hundreds of thousands of track updates per second, on-the-fly line of sight (LOS) calculations and real-time data access without pre-processing
Retained geospatial positioning accuracy	Ensures precision on a worldwide scale for visualization, transformation and calculation of any data
Platform independence	Runs on all platforms (with or without GPU — desktop, tablet, embedded, high-end or low-end) that support Java, including Windows, Mac and Linux
Flexibility	Designed to integrate into any architecture and has fine-grained customization options
Ease of use and lowest total cost of ownership	Enables rapid development and customization, ensuring source code and backward binary compatibility and eliminating the need for data pre-processing

Overview

The LuciadLightspeed components have been organized into product tiers. Depending on the needs of your organization, you can opt for LuciadLightspeed Essential, Advanced or Pro. From the Advanced and Pro tiers, you can extend the functionality available to you with extra options.

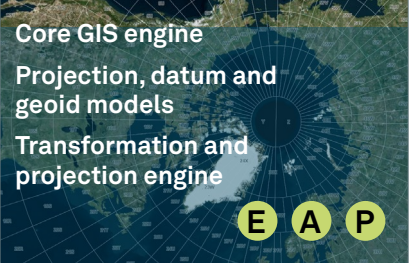
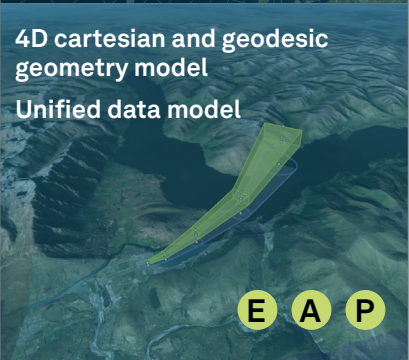
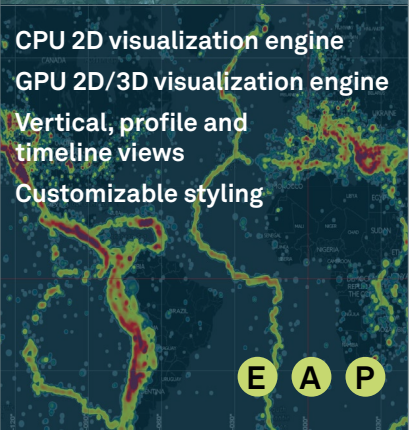

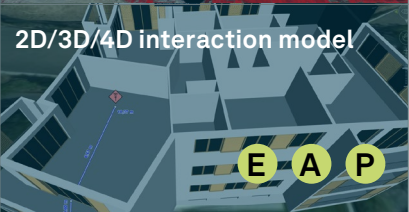
Legend

- ☒ Feature included
- ☐ Optional feature

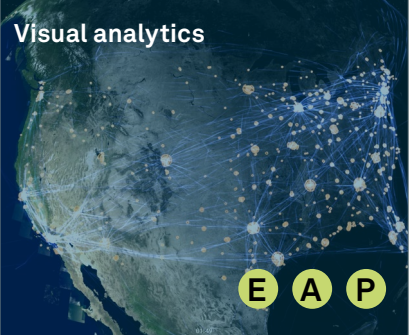

Functionality	Essential	Advanced	Pro
Core GIS engine	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Projection, datum and geoid models	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Transformation and projection engine	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4D cartesian and geodesic geometry model	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Unified data model	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
CPU 2D visualization engine	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
GPU 2D/3D visualization engine	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Vertical, profile and timeline views	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Customizable symbology	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
CPU, GPU image processing image	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2D/3D/4D interaction model	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Visual analytics	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
High-quality, large-format printing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Raster connectors	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Vector connectors	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Point clouds and reality meshes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
OGC standards	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Advanced raster connectors		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Advanced GIS engine		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Real-time engine		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Tiling engine			<input checked="" type="checkbox"/>
Database connectors		<input type="checkbox"/>	<input checked="" type="checkbox"/>
Terrain analysis engine		<input type="checkbox"/>	<input type="checkbox"/>
Weather and environment standards		<input type="checkbox"/>	<input type="checkbox"/>
Graph and routing engine		<input type="checkbox"/>	<input type="checkbox"/>
Infrastructure standards			<input type="checkbox"/>
Radar connectors			<input type="checkbox"/>
Aviation standards			<input type="checkbox"/>
Defense standards			<input type="checkbox"/>
Defense symbology			<input type="checkbox"/>
Maritime standards			<input type="checkbox"/>
S-63			<input type="checkbox"/>

Functional specifications

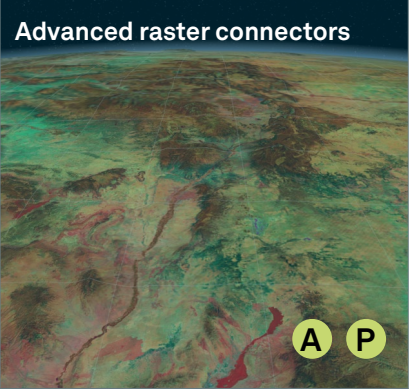
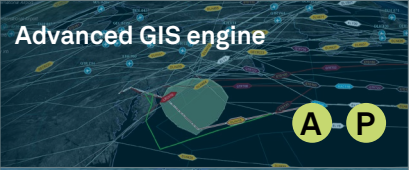

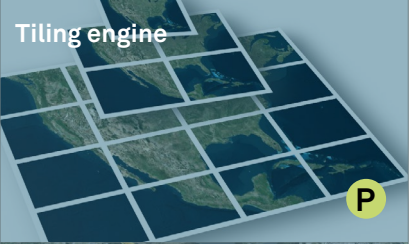

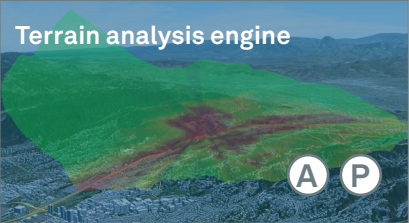
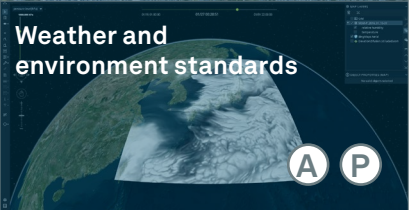
Below is a high-level, non-exhaustive overview of the functionality available in LuciadLightspeed. You can use the functionality it offers out of the box or extend it to meet user-specific requirements.

 <p>Core GIS engine Projection, datum and geoid models Transformation and projection engine</p> <p>E A P</p>	<ul style="list-style-type: none"> • Access and represent data in any coordinate reference system (geodetic, geocentric, topocentric and grid) and in any projection • Get support for vertical datums • Perform advanced geodetic calculations, transformations and ortho-rectification
 <p>4D cartesian and geodesic geometry model Unified data model</p> <p>E A P</p>	<ul style="list-style-type: none"> • Model any data format, represent all object geometries and their metadata (standard or specific for your application domain) and apply any data filter • Integrates with all calculations from the GIS Engine • Get support for complex geometries like geo-buffers, arcs and arc bands, radar coverage volumes and more • Accurately represent radar coverage beams and other sensor detection ranges as 3D volumes and set up geo-fencing for those volumes • Boost performance with support for concurrent data access and asynchronous loading • Retrieve data from local, network attached or cloud storage
 <p>CPU 2D visualization engine GPU 2D/3D visualization engine Vertical, profile and timeline views Customizable styling</p> <p>E A P</p>	<ul style="list-style-type: none"> • Visualize data in an accelerated 2D/3D view or a non-accelerated 2D view • Visualize data with height information in a vertical view or a profile view and dynamic data in a timeline view • Apply flexible styling (layers, icons, line styles, fill styles, transparency and more) to your data and customize it using OGC-defined styled layer descriptor/ symbology encoding (SLD/SE) standards; use hardware-accelerated styling expressions to update your dynamic data at runtime • Use high-performance terrain rendering that is integrated in the view; if elevation data is present, all data can be draped automatically over the terrain • Benefit from advanced labeling and decluttering of vector data • Integrate with the UI toolkit of your choice; a dedicated view implementation is available for JavaFX/OpenJFX
 <p>CPU, GPU image processing</p> <p>E A P</p>	<ul style="list-style-type: none"> • Benefit from advanced, fully interactive graphical processing and visualization of raster data, including high dynamic range (HDR) and multispectral imagery and multi-dimensional data
 <p>2D/3D/4D interaction model</p> <p>E A P</p>	<ul style="list-style-type: none"> • Benefit from many ready-to-use controllers for map interaction: standard map controls (zoom, pan and select), editing/creating geometries, rotating, distance measurements, multi-touch and more • Easily create other controllers for custom interaction • Fine-tune navigation using the configurable 3D camera


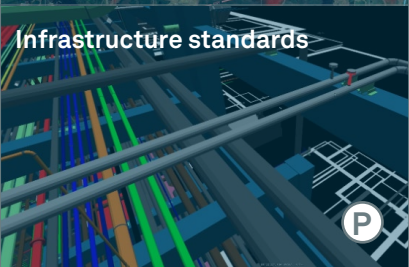





E Included in Essential **A** Included in Advanced **P** Included in Pro

 <p>Visual analytics</p> <p>E A P</p>	<ul style="list-style-type: none"> • Rapidly gain a thorough understanding of your geospatial data using advanced visual analytics tools • Configure clustering algorithms to aggregate a multitude of data objects into easily distinguishable clusters based on their properties • Slice and filter data dimensions for analysis • Use swipe, flicker and porthole controllers to uncover similarities and change between images • Perform density calculations and display the resulting heat maps based on static, as well as dynamic data
 <p>High-quality, large-format printing</p> <p>E A P</p>	<ul style="list-style-type: none"> • Configure, preview and print snapshots of LuciadLightspeed views in high quality, including custom layers • Print in large formats or use multi-page support to stitch together a large print
 <p>Raster connectors Vector connectors</p> <p>E A P</p>	<ul style="list-style-type: none"> • Access data in many vector and raster formats • Exploits multi-leveling and tiling • Benefit from LuciadLightspeed's data-agnostic visualization and analysis capabilities, which are complementary with any data format • Get out-of-the-box native support for: <ul style="list-style-type: none"> • Raster data: BIL, Bing Maps, BMP, DTED, ESRI TFW and JGW, ETOPO, GeoTIFF and BigTIFF, GIF, JPEG, JPEG2000, MapInfo TAB, PNG, PPM, USGS DEM, MBTiles and Open Street Map • Vector data: CGM, Collada, ESRI Shape, GeoJSON, MapInfo MIF and MAP, LiDAR LASer and LASZip (LAZ), OpenFlight (3-D), OSGB 3D meshes, SVG, MB tiles and Wavefront OBJ (3-D) • Add support for new, custom formats through a straightforward, well-documented process
 <p>Point clouds and reality meshes</p> <p>E A P</p>	<ul style="list-style-type: none"> • Connect to and visualize unlimited point clouds and reality meshes • Load 3D tiles smartly • Style and filter point clouds and reality meshes based on expressions • Combine 3D data with terrain, other geodata, annotations and measurements • Gain support for OSGB, LAS, LAZ, OGC 3D Tiles, supporting Draco compression • Get out-of-the-box native support for: <ul style="list-style-type: none"> • OSGB, LAS, LAZ, E57 and OGC 3D Tiles
 <p>OGC standards</p> <p>E A P</p>	<ul style="list-style-type: none"> • Connect to several OGC web services and read data in a variety of OGC formats • Get support for these standards: <ul style="list-style-type: none"> • OGC GeoPackage, GML, KML, WCS, WFS(-T), WMS, WMTS, OGC Filter 2.0 (spatial filter capabilities can be enabled from the Advanced GIS engine listed under Advanced and Pro options), OGC Symbology Encoding (SE), ISO 19115 metadata and OGC 3D Tiles

E Included in Essential **A** Included in Advanced **P** Included in Pro

 <p>Advanced raster connectors</p> <p>A P</p>	<ul style="list-style-type: none"> • Connect to and visualize specialized raster formats, and access a GDAL connector for several other raster formats • Gain direct support for these formats: <ul style="list-style-type: none"> • ECW, GeoPDF, GeoSPOT, JPEG2000 (encoding), MrSID, Spot DIMAP and Swiss DHM • Get GDAL support for these formats: <ul style="list-style-type: none"> • ARC/Info Binary Grid (AIG), BSB Nautical Chart Format, ARC/Info Export E00 GRID, ENVI HDR Labelled Raster, ERDAS Imagine, ERDAS Imagine Raw, ILWIS Raster Map, Intergraph Raster, PCI Geomatics database File, PCRaster, Sentinel 1 SAR SAFE, Sentinel 2, SAR CEOS, SRTM HGT, GDAL Virtual, ASCII Gridded XYZ and more
 <p>Advanced GIS engine</p> <p>A P</p>	<ul style="list-style-type: none"> • Calculate binary topological relations (for example, overlaps and contains) and perform constructive geometry on shapes (for example, union or intersection) • Benefit from support for geodetic shapes and rhumb shapes
 <p>Real-time engine</p> <p>A P</p>	<ul style="list-style-type: none"> • Optimally handle and visualize dynamic data, including live radar video feeds • Play back simulations in fast or real time; take advantage of playback controls and continuous label decluttering
 <p>Tiling engine</p> <p>P</p>	<ul style="list-style-type: none"> • Fuse, tile and multi-level large amounts of raster and imagery data using the tiling engine • Build globes with detailed and accurate point-sampled terrain data, centimeter-accurate, area-sampled (multispectral) imagery and multi-dimensional weather data and imagery • Optimize point cloud data for direct access or streaming as OGC 3D Tiles
 <p>Database connectors</p> <p>A P</p>	<ul style="list-style-type: none"> • Gain support for spatial databases • Get support for these database formats: <ul style="list-style-type: none"> • IBM DB2, Informix Geodetic and Spatial Datablade, OGC GeoPackage, Oracle Locator and Oracle Spatial, PostGIS (PostgreSQL spatial database extension), SAP HANA (Beta), Microsoft SQLServer and SQLite
 <p>Terrain analysis engine</p> <p>A P</p>	<ul style="list-style-type: none"> • Perform calculations on terrain data, such as LOS or hypsometric calculations, and get an alternative view on the terrain data • Reach unparalleled calculation and visualization performance with hardware acceleration (OpenGL and OpenCL) • Calculate shape-to-shape intervisibility based on terrain
 <p>Weather and environment standards</p> <p>A P</p>	<ul style="list-style-type: none"> • Integrate environmental data, and preserve dimensional information for further visual analysis • Get support for these formats: <ul style="list-style-type: none"> • NetCDF ISC, GRIB V1/V2 weather data (WMO/ICAO Bulletin) and SIGWX (BUFR)

A Included in Advanced **P** Included in Pro **A** Optional in Advanced **P** Optional in Pro

 <p>Graph and routing engine</p> <p>(A) (P)</p>	<ul style="list-style-type: none"> • Exploit the network structure of your geospatial data and make use of algorithms to construct graphs and solve your routing challenges • Leverage the graph engine and get support for all kinds of network-related processing, such as shortest path or cross-country movement calculation; also enables the creation of flexible cost functions
 <p>Infrastructure standards</p> <p>(P)</p>	<ul style="list-style-type: none"> • Import and visualize your computer-aided designs to see them in context • Prepare your 3D models and cities for streaming via conversion of OBJ, Binz and IFC to OGC 3D Tiles; optimize the tiles via compression and preserve material properties • Get support for these formats: <ul style="list-style-type: none"> • Autocad DWG/DXF, Microstation DGN, Hexagon Binz, OBJ, IFC, Revit and Navisworks
 <p>Radar connectors</p> <p>(P)</p>	<ul style="list-style-type: none"> • Visualize radar data captured in the ASTERIX format; combined with the real-time engine, the radar connector offers fast and flexible handling of ASTERIX data, including radar video (ASTERIX Cat 240) • Get support for these formats: <ul style="list-style-type: none"> • Eurocontrol ASTERIX categories 1, 8, 10, 11, 21, 30, 34, 48, 62, 240 and 244
 <p>Aviation standards</p> <p>(P)</p>	<ul style="list-style-type: none"> • Model and visualize aeronautical data such as airspaces, navaids, procedures and minimum off route altitudes (MORAs) in accelerated 2D and 3D views; integrate with operations from the Advanced GIS Engine • Gain visualization support, including options for custom styling • Get support for these formats: <ul style="list-style-type: none"> • AIXM (3.3, 4.0, 4.5, 5.0 and 5.1), ARINC 424 and DAFIF(T)
 <p>Defense standards</p> <p>(P)</p>	<ul style="list-style-type: none"> • Integrate various military data formats for full situational awareness • Get support for these formats: <ul style="list-style-type: none"> • ADRG, ASRP, BCI, CADRG, CIB, ECRG, NITF, NSIF, USRP, VPF products (VMAPO, VMAP1, VMAP2(i), DNC, DCW) including Geosym symbology and MGCP
 <p>Defense symbology</p> <p>(P)</p>	<ul style="list-style-type: none"> • Full support for symbols and tactical graphics of the latest military symbology standards in 2D and 3D; NATO Vector Graphics support increases interoperability; this support encompasses the lookup, creation, visualization and editing of military symbols and tactical graphics • Get support for these formats: <ul style="list-style-type: none"> • APP-6A, APP-6B, APP-6C, APP-6D, MS2525b, MS2525c, MS2525d and NVG • Military grids: MGRS, CGRS and GARS
 <p>Maritime standards S-63</p> <p>(P)</p>	<ul style="list-style-type: none"> • Accurately visualize electronic navigational charts in 2D and 3D; complies with standards defined by the International Maritime Organization (IMO) and the International Hydrographic Organization (IHO) • Decode data in the IHO S-57 format and visualize charts in compliance with the IHO S-52 visualization standard • Decode and visualize electronic navigational charts in the encrypted IHO S-63 format • Get support for these formats: <ul style="list-style-type: none"> • IHO S-57, IHO S-52 and UKHO AML (STANAG 7170)

(A) Optional in Advanced (P) Optional in Pro

Use cases

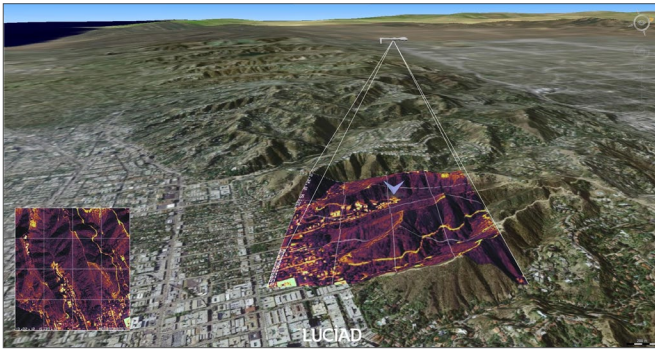


Figure 3: Real-time video draping

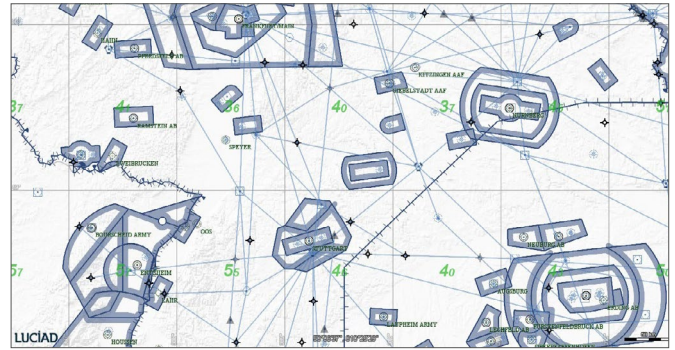


Figure 4: 2D aeronautical chart data



Figure 5: LOS analysis and dynamic routing on 3D terrain



Figure 6: A tactical scenario visualized using APP6 symbology shows LuciadLightspeed's military symbology capabilities.

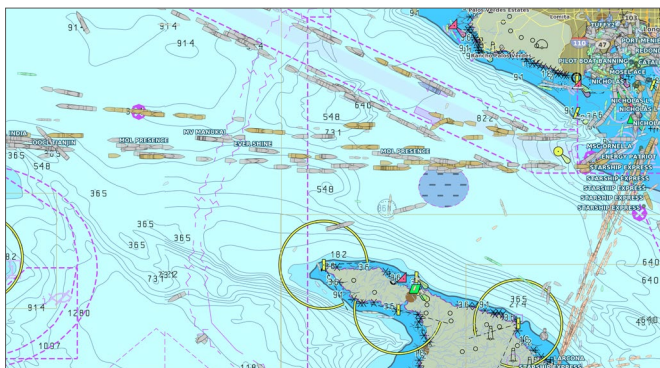


Figure 7: Vessel plots combined with electronic navigational charts

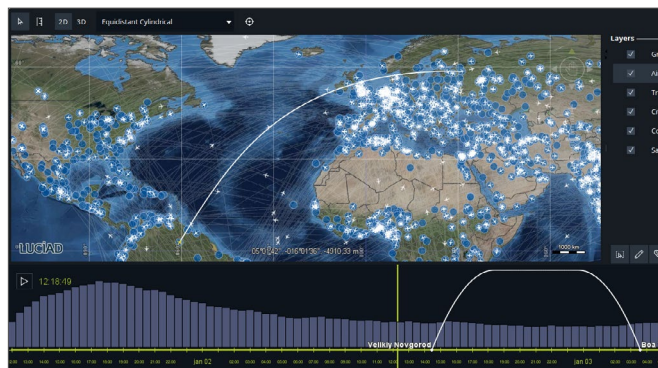


Figure 8: Dynamic aircraft tracks and trajectories combined with a timeline view LuciadLightspeed map

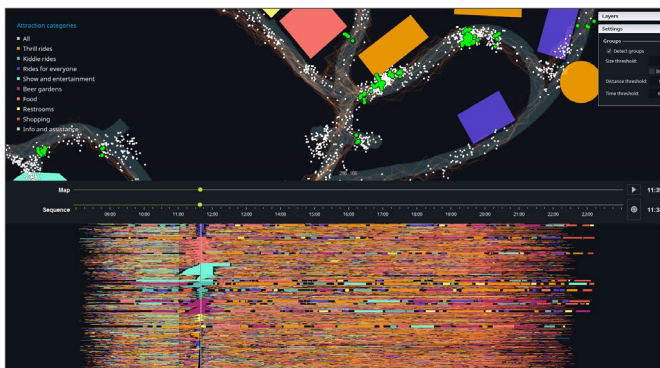


Figure 9: Visual analytics on people movement data sets using spatial and non-spatial views

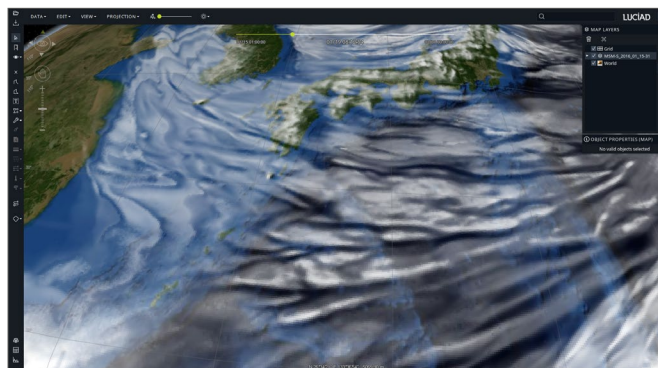


Figure 10: 4D analysis of a NetCDF weather cube

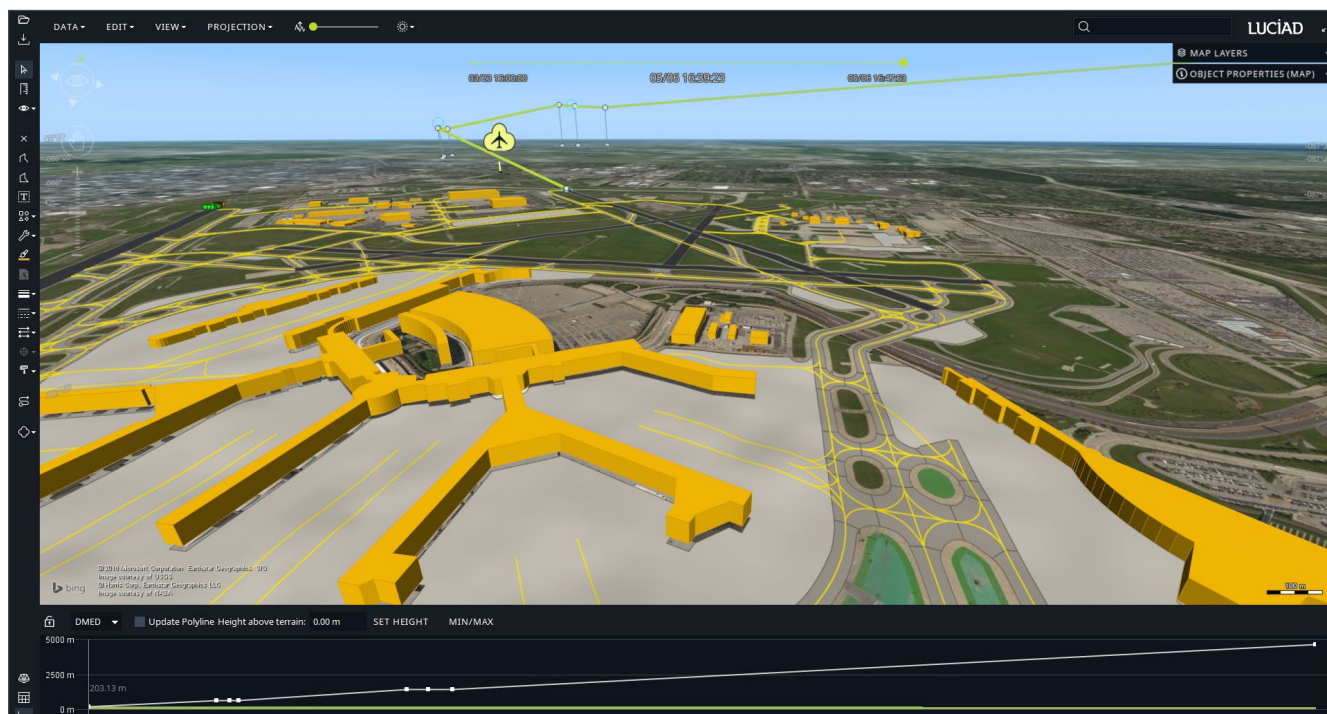


Figure 11: AIXM 5 data and flight plan preview in 3D and a vertical view

More information

LuciadLightspeed comes with:

- An automated installer and a launcher for applications, samples and documentation
- Build scripts and Maven POM files for all libraries
- Code samples for all components
- Developer's guide with clear explanations and an overview of best practices
- API reference offering detailed descriptions of all interfaces and classes
- Release notes to see what's new
- Technical notes to support technical requirements

To learn more or schedule a demo, contact us at info.luciad.gsp@hexagon.com.

For developer guides, code snippets, technical articles, videos and more, visit the [Luciad Developer Platform](#).



Hexagon is the global leader in digital reality solutions, combining sensor, software and autonomous technologies. We are putting data to work to boost efficiency, productivity, quality and safety across industrial, manufacturing, infrastructure, public sector, and mobility applications. Our technologies are shaping production and people-related ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

Hexagon's Safety, Infrastructure & Geospatial division improves the resilience and sustainability of the world's critical services and infrastructure. Our solutions turn complex data about people, places and assets into meaningful information and capabilities for better, faster decision-making in public safety, utilities, defense, transportation and government. Learn more at hexagon.com and follow us [@HexagonAB](https://twitter.com/HexagonAB).