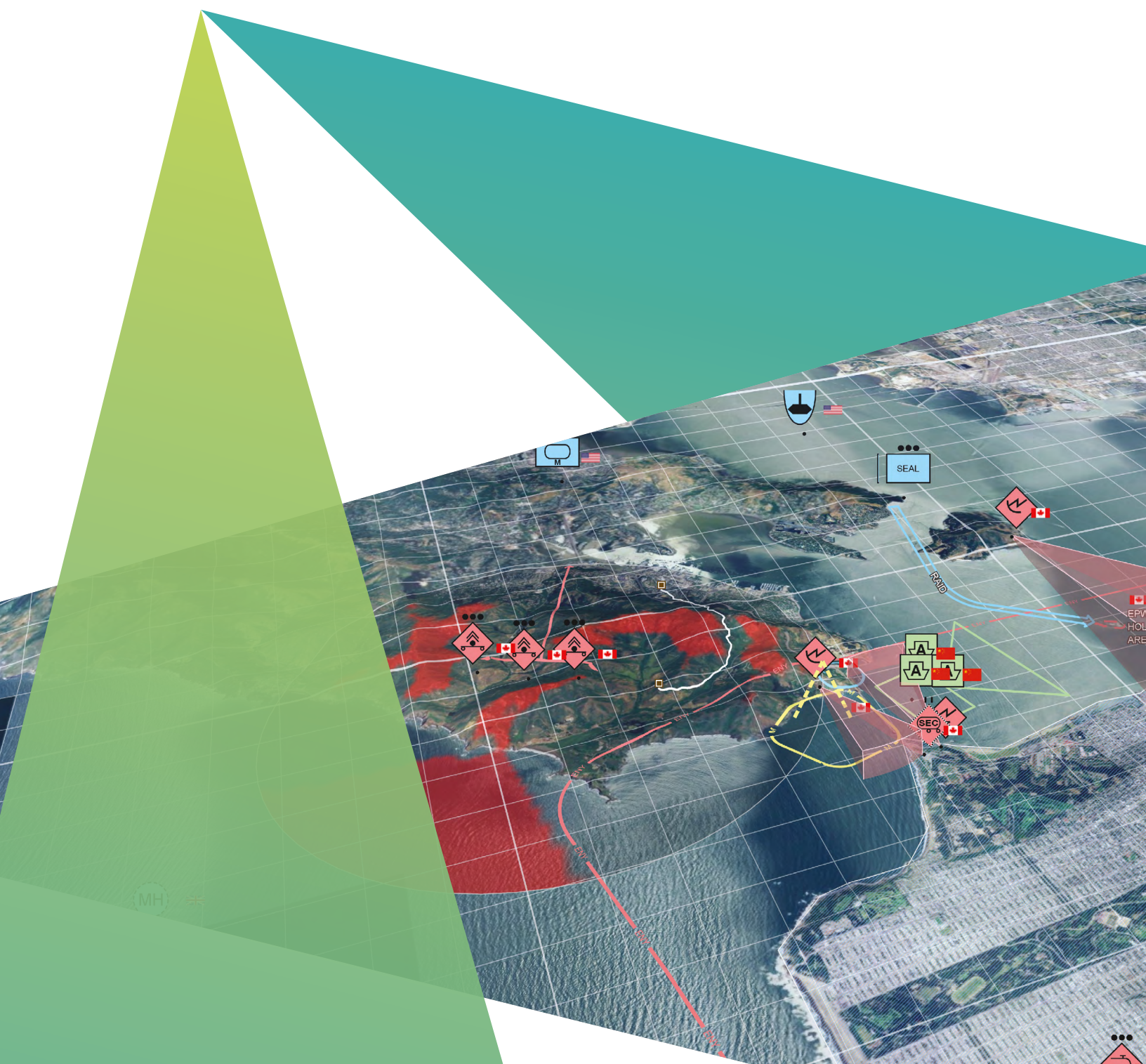HEXAGON

LuciadLightspeed

Advanced geospatial analytics 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 map.

LuciadLightspeed provides the foundations for advanced geospatial analysis applications. Developers can create high-performance C2 and location intelligence applications thanks to the clean, plug-in design, modular structure and powerful visual analytics capabilities. Using its configurable API, you can add support for custom data 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 control room staff with a common operational picture

- Stay informed via shared tactical plans in NVG format, visualized with appropriate 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 Twitter feeds for trend analysis and security at big events

- Detect patterns in traffic and be alerted of unexpected behavior

- Explore data in 4D, represented geographically, as a time series, as well as plot views

- Share vector data as a web service without rasterizing it before publishing, to offer the latest data updates to the users
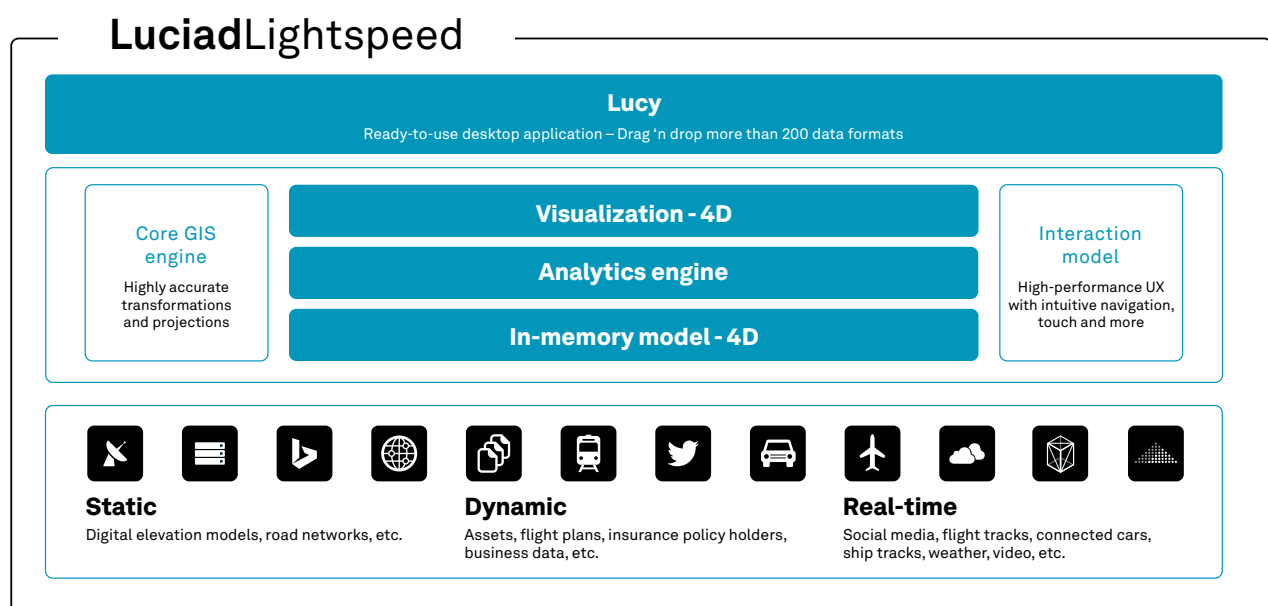

Figure 1 - Luciad's desktop and onboard solution connects to more than 200 data sources with an intuitive, drag-and-drop user interface. Its core GIS engine and visual analytics capabilities offer beautiful visualization and powerful data analysis.

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	Unprecedented user experience with hundreds of thousands of track updates per second, on-the-fly LOS calculations and real-time data access without pre-processing.
Retained geospatial positioning accuracy	Ensures precision on world 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 optimize the customizability and interoperability of your applications. Offers one single API for 2D and 3D visualization. The product allows you to meet 100% of your project requirements.
Ease of use and lowest total cost of ownership	Makes for efficient and sustainable applications by enabling 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 still extend the functionality available to you with extra options.
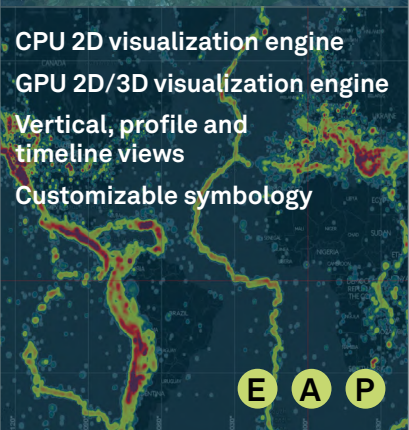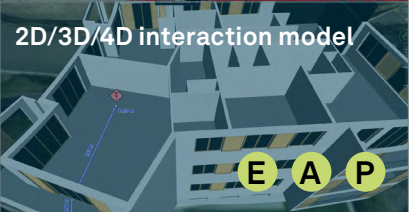
Legend

✅ Feature included

◯ Optional feature

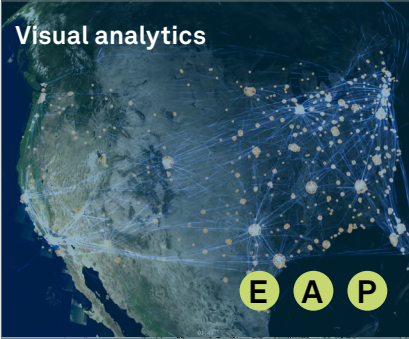| Functionality	Essential	Advanced	Pro
Core GIS engine	✅	✅	✅
Projection, datum and geoid models	✅	✅	✅
Transformation and projection engine	✅	✅	✅
4D cartesian and geodesic geometry model	✅	✅	✅
Unified data model	✅	✅	✅
CPU 2D visualization engine	✅	✅	✅
GPU 2D/3D visualization engine	✅	✅	✅
Vertical, profile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

Functional specification

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.

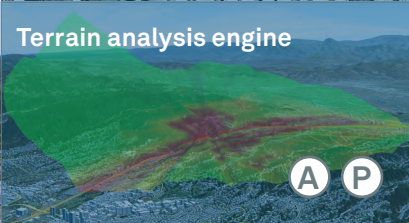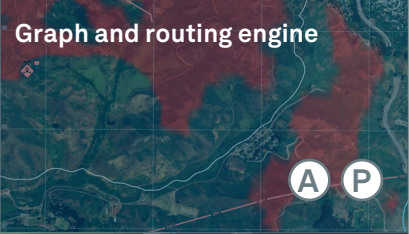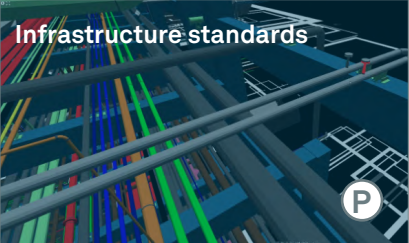|	
Core GIS engine **Projection, datum and geoid models** **Transformation and projection engine** E A P	• Access and represent data in any coordinate reference system (geodetic, geocentric, topocentric, grid) and in any projection. • Perform advanced geodetic calculations, transformations and ortho-rectification.
4D cartesian and geodesic geometry model **Unified data model** E A P	• Model any data format, represent all object geometries and their metadata and apply any data filter. • Includes support for complex geometries like geo-buffers, arcs and arc bands, radar coverage volumes, etc. • 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.
CPU 2D visualization engine **GPU 2D/3D visualization engine** **Vertical, profile and timeline views** **Customizable symbology** E A P	• 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 visualize dynamic data in a timeline view. • Apply flexible styling (layers, icons, line styles, fill styles, transparency, etc.) 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.
CPU, GPU image processingimage E A P	• Benefit from advanced, fully interactive graphical processing and visualization of raster data, including high dynamic range (HDR) and multi-spectral imagery, and multi-dimensional data.
2D/3D/4D interaction model E A P	• Benefit from many ready-to-use controllers for map interaction: standard map controls (zoom, pan, 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

Visual analytics	
E A P	• 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 similarity and change between images. • Perform density calculations and display the resulting heat maps based on static as well as dynamic data.
High-quality, large-format printing **E A P**	• 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.

Raster connectors
Vector connectors
 E A P
	• Access data in many vector and raster formats.
	• Apply multi-leveling and tiling.
	• Benefit from LuciadLightspeed's data-agnostic visualization and analysis capabilities that are complementery with any data format.
	• Out-of-the-box native support for:
	  • Raster data: BIL, Bing Maps, BMP, DTED, ESRI TFW and JGW, ETOPO, GeoTIFF and BigTIFF, GIF, JPEG, JPEG2000, MapInfo TAB, PNG, PPM, USGS DEM, MB tiles, 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, Wavefront OBJ (3-D).
	• Adding support for new, custom formats is a straightforward, well-documented process.

Point clouds and reality meshes **E A P**	• 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. • Supports OSGB, LAS, LAZ, OGC 3D tiles. • Out-of-the-box native support for: • OSGB, LAS, LAZ, OGC 3D tiles.
OGC standards **E A P**	• Connect to several OGC web services and read data in a variety of OGC formats. • Supported standards, formats and services: • 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, OGC 3D tiles.

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

Advanced raster connectors
 A **P**
	• Connect to and visualize specialized raster formats, and access a GDAL connector to add support for several other raster formats.
	 • Directly supported formats:
	     • ECW, GeoPDF, GeoSPOT, JPEG2000 (encoding), MrSID, Spot DIMAP, Swiss DHM.
	 • GDAL-supported formats, including:
	     • 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 so on.

Advanced GIS engine **A** **P**	• Calculate binary topological relations (e.g., overlaps, contains) and perform constructive geometry on shapes (e.g., union, intersection). • Benefit from support for geodetic shapes and rhumb shapes.
Real-time engine **A** **P**	• Optimally handle and visualize dynamic data, including live radar video feeds. • Play back simulations in fast or real time. Also includes playback controls and continuous label decluttering.
Tiling engine **P**	• 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.
Database connectors **A** **P**	• Adds support for connecting to spatial databases. • Supported database formats: • IBM DB2, Informix Geodetic and Spatial Datablade, OGC GeoPackage, Oracle Locator and Oracle Spatial, PostGIS (PostgreSQL spatial database extension), SAP HANA (Beta), Microsoft SQLServer, SQLite.
Terrain analysis engine **A** **P**	• Perform calculations on terrain data, such as line-of-sight (LOS) or hypsometric calculations, and get an alternative view on the terrain data. • The engine can use hardware acceleration (OpenGL and OpenCL) to reach unparalleled performance for both calculations and visualization. • Calculate shape-to-shape intervisibility based on the terrain.
Weather and environment standards **A** **P**	• Integrate environmental data, and preserve dimensional information for further visual analysis. • Supported formats: • NetCDF ISC, GRIB V1/V2 weather data (WMO/ICAO Bulletin), SIGWX (BUFR).

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

Graph and routing engine (A) (P)	• Exploit the network structure of your geospatial data, and make use of algorithms to construct graphs and solve your routing challenges. • The graph engine offers 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.
Infrastructure standards (P)	• Import and visualize your computer-aided designs into LuciadLightspeed to see your design in context. • Prepare your 3D models and cities for streaming via conversion of OBJ to OGC 3D tiles. Optimize the tiles via compresion. • Supported formats: • Autocad DWG/DXF, Microstation DGN, Hexagon Binz, OBJ.
Radar connectors (P)	• 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). • Supported formats: • Eurocontrol ASTERIX categories 1, 8, 10, 11, 21, 30, 48, 62, 240 and 244.
Aviation standards (P)	• Model and visualize aeronautical data such as airspaces, navaids, procedures and grid MORAs (minimum off route altitude) in accelerated 2D and 3D views. The visualization support includes options for custom styling. • Supported formats: • AIXM (3.3, 4.0, 4.5, 5.0 and 5.1), ARINC 424, DAFIF(T).
Defense standards (P)	• Integrate various military data formats for full situational awareness. • Supported formats: • ADRG, ASRP, BCI, CADRG, CIB, ECRG, NITF, NSIF, USRP, VPF products (VMAP0, VMAP1, VMAP2(i), DNC, DCW) including Geosym symbology, MGCP.

Defense symbology (P)	• 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.
	• Supported formats:
	   • APP-6A, APP-6B, APP-6C, APP-6D, MS2525b, MS2525c, MS2525d, NVG.
	   • Military grids: MGRS, CGRS and GARS.

Maritime standards S-63 (P)	• 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. • Supported formats: • IHO S-57, IHO S-52, UKHO AML.

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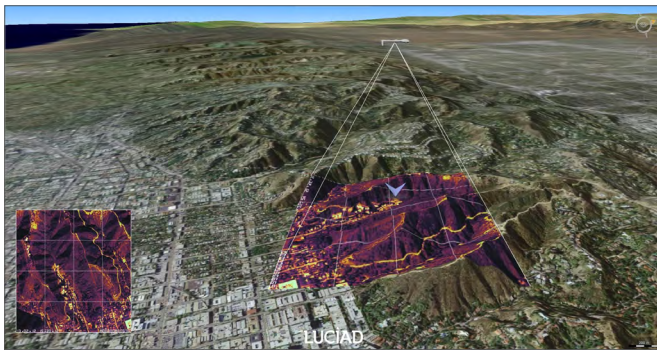
Use cases

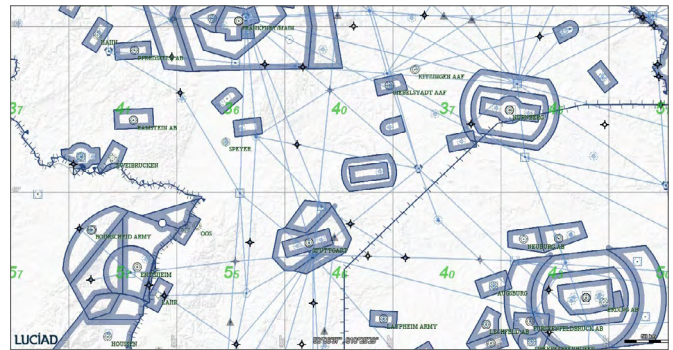Figure 3 - Real-time video draping

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 LuciadLightspeed military symbology capabilities
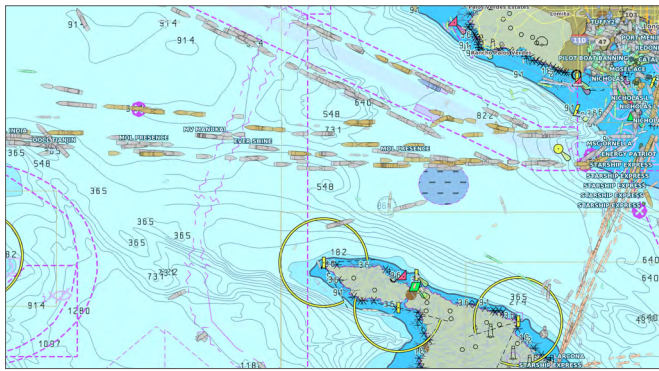
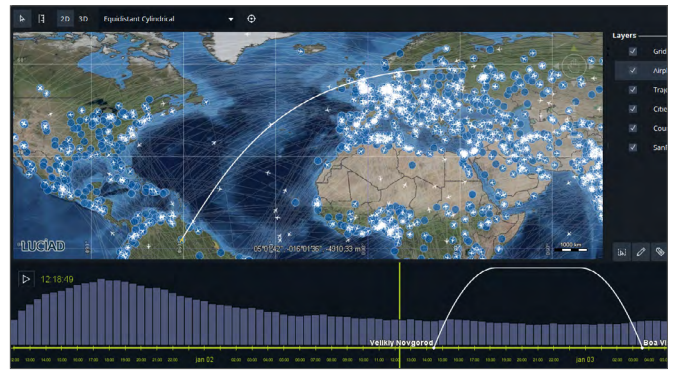Figure 7 - Vessel plots combined with electronic navigational charts

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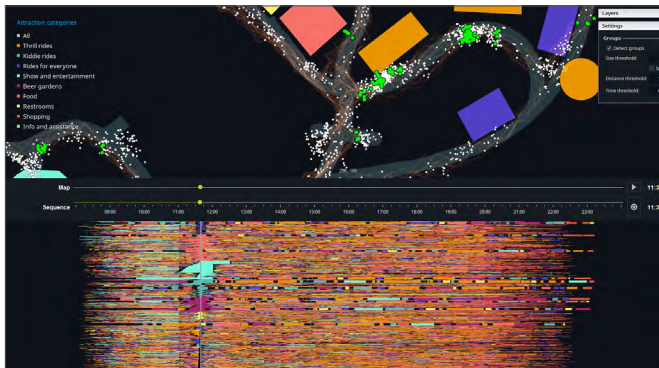

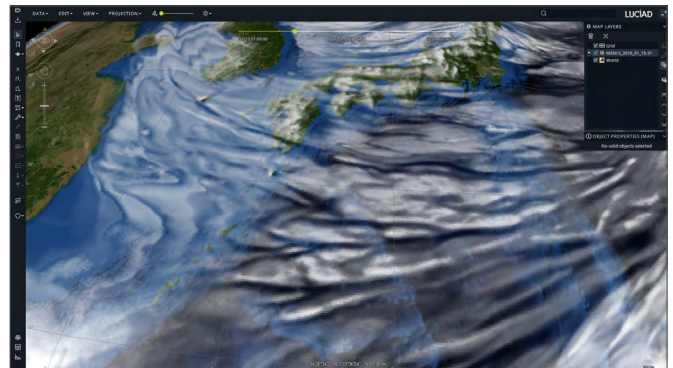Figure 9 - Visual analytics on people movement data sets using spatial and non-spatial views

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 included

- Code samples for all components

- Developer's guide with clear explanations and a description of best practices

- API reference offering detailed descriptions of all interfaces and classes

- Release notes to see what's new

- Technical notes to consult 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

Hexagon is a 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 Geospatial division creates solutions that deliver a 5D smart digital reality with insight into what was, what is, what could be, what should be, and ultimately, what will be.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 21,000 employees in 50 countries and net sales of approximately 3.8bn EUR. Learn more at **hexagon.com** and follow us @HexagonAB.