Overview

Lucy is a LuciadLightspeed application component that offers a framework for high-level, faster development. As a full-fledged geospatial application, it provides easy access to the capabilities of LuciadLightspeed. At its most basic level, Lucy assists you with the visualization of geospatial data by giving the LuciadLightspeed development environment a graphical user interface. Lucy realizes its full potential, however, by serving as a springboard for your own application: simply plug into Lucy’s modular framework, and build an instantly functional geospatial application that integrates all of LuciadLightspeed’s powerful features while meeting all your development project requirements.

The Lucy component consists of a wide range of add-ons, organized in an application framework. The Lucy API is built on top of the LuciadLightspeed API. The entire Lucy component framework is focused on smooth data connection, instant visualization, and result-driven analysis of geospatial data with impeccable performance and accuracy.

You can build anything from a lightweight geospatial data viewer to a robust, high-end professional application on top of Lucy. To meet all of your application requirements, you can customize the Lucy add-ons, add on your own, make optimal use of the functionality offered by the back-end, and tweak the front end to suit the needs of your users.

With Lucy, Luciad focuses on the same, demanding domains as it does with LuciadLightspeed. You can use Lucy for the rapid development of C4ISR applications, mission planning systems, common operational picture (COP) applications for defense, air traffic control (ATC), air traffic management (ATM), aeronautical information services (AIS) and management (AIM) applications for aviation, as well as vehicle traffic control, urban planning, infrastructure asset management applications, and more.

Practical Information

Lucy is a development framework for LuciadLightspeed that integrates all capabilities of LuciadLightspeed and other LuciadLightspeed additional components in a customizable and extendable application. An add-on-based mechanism enables easy integration of custom capabilities to adjust to any project requirement.

You can purchase Lucy as an additional LuciadLightspeed component, and integrate it into your LuciadLightspeed configuration. Other optional LuciadLightspeed components instantly plug into Lucy through dedicated Lucy add-ons, without any additional effort on your part. One of those additional components allows you to connect with our data management product, LuciadFusion.
### Key Benefits

**Visualize & analyze any data in a 2D/3D hardware-accelerated view**

- Instantly visualize data in one of the many supported formats on a fast 2D/3D view and integrate it with other data to create a full situational picture in its geospatial context. Then proceed with visual data analysis. Plug in your own custom format with limited effort.

**Flexible & configurable**

- Customize each aspect and make it your own.
- Plug in your own application components and your own front end. The product is designed to optimize customizability and interoperability, allowing you to meet all your project requirements.
- The Lucy back-end has been designed for maximum flexibility and integration with commonly used development environments.

**Clean design through Model-View-Controller separation**

- Lucy has been designed according to Model-View-Controller separation principles, and separates functionality from the graphical user interface. It offers maximum GUI flexibility as a result, while guaranteeing permanent and complete access to its functionality. The Lucy application framework has also been designed to achieve high development speed and sustainable applications.

### Functional Specification

Lucy offers the following application capabilities out of the box:

- **Visualization of vector, imagery and sensor data on a hardware-accelerated 2D/3D hybrid view, and in vertical, profile and table views**
- **3 GUI varieties:**
  - 2D/3D hybrid views in a tabbed or dockable GUI
  - 2D/3D hybrid views in a map-centric GUI
  - 2D views in a tabbed or dockable GUI
- **Easy application debugging and optimizing with a dedicated debug application**
- **Selection and instant application of projections and coordinate systems**
- **Visual data styling**
- **Lighting control**
- **Elevation support: application-wide color mapping, exaggeration and lighting**
- **Shape drawing and storage of drawing layers to aid with mission design**
- **Support for Drag and Drop, Copy and Paste, Undo and Redo functionality**
- **Search objects and placemarks**
- **Multi-page printing, image export and PDF document generation**
- **User preference and workspace support**
**Seamless API interaction**
The Lucy API is built on top of the LuciadLightspeed API, and Lucy add-ons are built on top of the Lucy API. As a result, the LuciadLightspeed API remains accessible up to the level of custom add-ons, and the integration of existing and newly developed functionality becomes effortless.

**Data consistency in various view types**
Consistently display data in a 2D and 3D map view, or in a table view, profile view, or vertical view. Select and edit the data with automatic synchronization across all views.

**Add-on management**
Lucy offers a number of standard add-ons, each of which provides a specific piece of functionality: read and process a data format, create a map, perform an analysis, and so on. You can also configure add-ons yourself.

**Support for own add-ons & data formats**
Lucy’s modular design allows you to quickly write your own add-ons. Several helper classes assist you with the creation of add-ons. You can add custom user interface components, or you can plug in a dedicated format add-on by implementing convenient format add-on base classes.

**Service sharing**
The Lucy back-end provides a service mechanism that prevents hard dependencies between objects, and allows for easy sharing of functionality.

**Flexible UI & front end customization**
Lucy has a pluggable user interface which offers several graphical interface styles out of the box. All interfaces allow for customization, and allow you complete control over menus, toolbars, panels, and positions.

You can also replace the Lucy front-end application entirely with a custom implementation. You can customize the application startup, the add-on loading sequence, and the user interface.

**Central map management**
The Lucy map managers keep track of all active and inactive map components in the Lucy application, and distribute change notifications.

**Preferences & workspace management support**
Support for storing preferences and preferred workspace configurations, so that these are immediately accessible when Lucy is restarted.

**User assistance & Localization**
Localization of the UI is possible for any language.

**Others**
Print view snapshots and generate PDF documents in high quality. Visualize data in a vertical/altitude view. Perform density calculations. Slice and filter data dimensions for analysis.

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**Key Benefits**
Below is a high-level, non-exhaustive overview of the development functionality available in Lucy. You can use the Lucy development components out-of-the-box or extend them to meet your specific requirements.
On top of this, Lucy provides add-ons for plugging in LuciadLightspeed optional components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aeronautical information system (AIS)</strong></td>
<td>Adds support for modeling and visualizing aeronautical data such as airspaces, navaids, procedures, and grid MOPAs in accelerated 2D/3D views. The visualization support includes options for custom styling.</td>
</tr>
<tr>
<td><strong>Database connector components</strong></td>
<td>These are multiple components that add support for connecting to a specific spatial database. See the 'Formats &amp; Standards' section.</td>
</tr>
<tr>
<td><strong>Data format components</strong></td>
<td>These are multiple components that add support for reading data in a specific data format, and writing data to common open standard formats. See below in 'Formats &amp; Standards' for a list of supported data formats.</td>
</tr>
<tr>
<td><strong>Geometry</strong></td>
<td>Enables you to calculate binary topological relations (e.g. overlaps, contains) and perform constructive Boolean operations on shapes (e.g. union, intersection).</td>
</tr>
<tr>
<td><strong>LuciadFusion data connector</strong></td>
<td>Enables you to connect to the LuciadFusion data management product to retrieve data, using a LuciadFusion specific protocol.</td>
</tr>
<tr>
<td><strong>Military symbology &amp; NATO Vector Graphics (NVG)</strong></td>
<td>Add full support for symbols and tactical graphics of the latest military symbology standards, in 2D and 3D. NATO Vector Graphics (NVG) support increases interoperability. This support encompasses the lookup, creation, visualization, and editing of military symbols and graphics. See below in 'Formats &amp; Standards' for a list of supported standards.</td>
</tr>
<tr>
<td><strong>User assistance &amp; Localization</strong></td>
<td>Localization of the UI is possible for any language.</td>
</tr>
<tr>
<td><strong>OGC Formats</strong></td>
<td>Enables you to decode, visualize and encode vector and raster data in the GeoPackage format, a SpatiaLite format specifically designed by OGC for the distribution of vector and raster data across platforms with varying capabilities.</td>
</tr>
<tr>
<td><strong>OGC Web services</strong></td>
<td>There is a web client and a web server suite, which you can use to, respectively, connect to an OGC web service to retrieve data or to build an OGC web service and serve data to clients. See the 'Formats &amp; Standards' section.</td>
</tr>
<tr>
<td><strong>Real-time</strong></td>
<td>Offers optimizations for handling and visualizing dynamic data. Enables you to play back simulations in fast or real time. Also includes playback controls and continuous label decluttering.</td>
</tr>
<tr>
<td><strong>Terrain elevation analysis (TEA)</strong></td>
<td>This component adds the ability to perform calculations, such as line-of-sight (LOS) or hypsometric calculations, on terrain data, and provides alternative views on the terrain data.</td>
</tr>
<tr>
<td><strong>Maritime Electronic Chart Display &amp; Information System (ECDIS)</strong></td>
<td>Allows for the rapid visualization of electronic navigational charts in 2D and 3D. Compiles with standards defined by the International Maritime Organization (IMO) and the International Hydrographic Organization (IHO). Decodes data in the IHO S-57 and encrypted S-63 formats, and visualizes the charts in compliance with the IHO S-52 visualization standard.</td>
</tr>
</tbody>
</table>
## Formats & Standards

The Lucy visualization and analysis capabilities are data-agnostic, so it is complementary with any data format. Adding support for new, custom formats is a straightforward, well-documented process, but of course most common data formats are already supported. Native support for specialized formats is optionally available per format, as listed in the ‘Optionally Available’ section. For the following common data formats, out-of-the-box native support is included:

### Raster data
- BIL, BMP, CADRG, CIB, DTED, ESRI TFW and .JGW, ETOPO, GeoTIFF and BigTIFF, GIF, JPEG, JPEG2000, MapInfo TAB, PNG, PPM, USGS DEM

### Vector data
- CGM, Collada, Esri shapefile, GeoJSON, MapInfo MIF & MAP, OGC GML, OpenFlight (3D), SVG, Wavefront OBJ (3D)

## Common, open standards supported in Lucy:
- OGC Filter
- OGC Symbology Encoding (SE)
- ISO 19115 metadata

## Optionally Available

<table>
<thead>
<tr>
<th>Database connectors</th>
<th>DB2, Informix, Oracle, PostGIS, PostgreSQL, SQL Server, SQLite</th>
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</thead>
<tbody>
<tr>
<td>Additional raster data formats</td>
<td>ADRG, ASRF, BCI, Bing Maps, ECW, ECRG, GeoPDF, GeoSPOT, GRB, JPEG2000 (encoding), MrSID, NetCDF, NITF, NSIF, Spot DMAP; Swiss DHM; USIR</td>
</tr>
<tr>
<td>GDAL-supported formats including ARC/INFO Binary Grid (AIG), BSB Nautical Chart Format, ARC/INFO Export E00 GRID, ENVI HDR Labeled Raster, ERDAS Imagine, Raw Format, IWI Raster Map, Intergraph Raster, PCI Geomatics database file, PCIRaster, Sentinel 1 SAR SAFE, Sentinel 2, SAR CIESB, SRTM HGT, GDAL, Virtual, ASCII Gridded XYZ, and so on.</td>
<td></td>
</tr>
<tr>
<td>Additional vector data formats</td>
<td>AIXM, AHMS, ARINC424, ASDI, Asterix, AutoCAD DWG/DXF, DAFIF(T), KML, Lidar, LASer, MicroStation DGN, S-57 &amp; S-63, VPF</td>
</tr>
<tr>
<td>OGC formats &amp; web services</td>
<td>GeoPackage, WMS, WMTS, WFS(T), WCS</td>
</tr>
</tbody>
</table>
Application Features

High-quality styling and visualization of maritime charts in Lucy

Comparing flight track objects in map-centric Lucy
Comparing flight track objects in map-centric Lucy

Flight profile preview integrated with AIXM airport infrastructure objects in map-centric Lucy
Flight profile preview integrated with AIXM airport infrastructure objects in map-centric Lucy

3D Collada buildings integrated with Bing Maps road data in map-centric Lucy

A Lidar point cloud visualized in Lucy, with the color attribute selected for visualization on the left, and the height attribute selected on the right
NetCDF scientific data about relative humidity integrated in map-centric Lucy to analyze humidity at various flight levels.

Integration of San Francisco aerial imagery and Collada data in map-centric Lucy.
More Information

Lucy comes with:

- An automated installer and a launcher for applications, samples and documentation
- Code samples for all components
- Developer guide with clear explanations and description of best practices
- API reference offering detailed description of all interfaces and classes
- User guide with a detailed description of the graphical user interface

Stay Connected

The Luciad Developer Platform offers code samples, tips and much more for developers and architects at dev.luciad.com
To learn more or schedule a demo, contact us at info.luciad.gsp@hexagon.com.
Hexagon is a global leader in sensor, software and autonomous solutions, providing technologies that are shaping urban and production 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 20,000 employees in 50 countries and net sales of approximately 4.3bn EUR. Learn more at hexagon.com and follow us @HexagonAB.

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