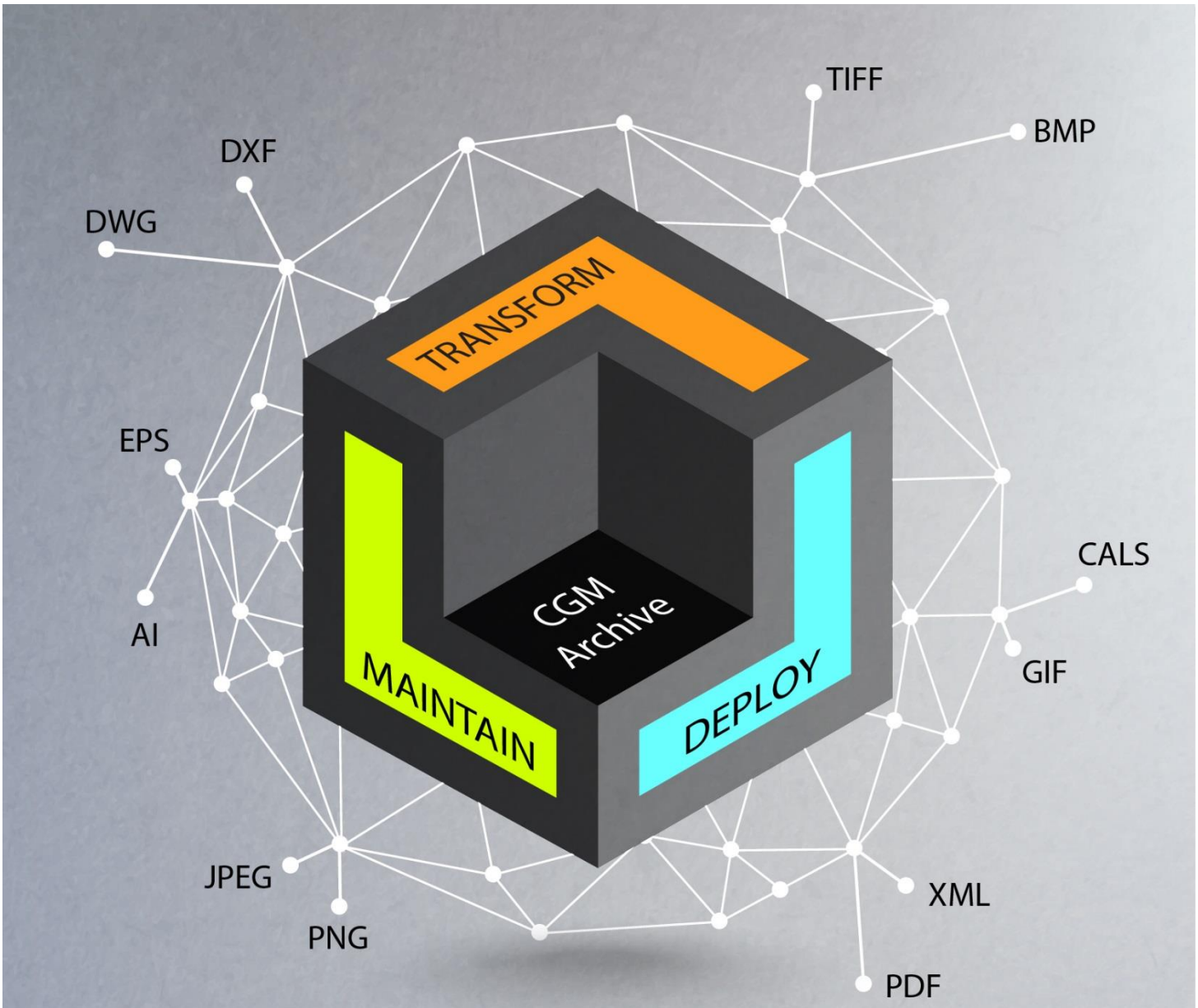

EFFECTIVELY CREATE, EDIT AND DEPLOY YOUR CGM ARCHIVE WITH

Larson CGM Products

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Background

To be competitive in today's fast-paced global economy, organizations need to publish digital information quickly and reliably. Technical illustrations, schematics, and graphical diagrams are key information assets of any organization. An open standard for storing and transmitting graphics up and down the supply chain is essential.

CGM[1] (Computer Graphics Metafile) is that open standard, a high performance 2D graphics format. This document will describe how companies and organizations will benefit from the use of CGM and the methodology and technology required to achieve the goal of a CGM Archive.

When the CGM format first appeared in the 1980's it was common to find support for the format in many graphics and CAD applications. However many of these applications did not update their capabilities as the CGM standard evolved. This began to change in the early 1990's as standards groups formed in various industries like the ATA (Air Transport Association) to work on digital standards. This resulted in CGM profiles that defined industry requirements and drove developers to update their software so their products would be compliant and used by those industries. Then in 1999 CGM Open[1], an alliance of major Aerospace and Defense companies and Developers was formed to create a single unified CGM profile, the WebCGM profile along with conformance test data. This enabled developers to test their software effectively and resulted in better quality and reliable CGM products. CGM had found its place, where graphics reuse, interoperability and consistency is important.

In 2014 the CGM format still persists but is it right for your company to adopt the format and base an archive on it? At Larson we've been involved with CGM since 1984, in fact 30 years ago we founded our business based on the format. We consider Larson to be the global leader in CGM technology so you can trust and rely on the products and information we provide.

While we firmly believe the CGM format will be a good solution for many industries, there are some simple questions you could ask yourselves which should assist in determining if CGM is the appropriate format for your graphics archive.

- Do we need to maintain our technical graphics for over 10-20 years?
- Do we need to comply with industry standards?
- Do we need to exchange graphics up and down the information supply chain?

[1] CGM Open www.cgmopen.org

- Do we want to edit and manage one instance of our technical graphics?
- Do you use the XML format to author and manage your textual data?

We now invite you to continue reading and exploring the reasons why a CGM archive will benefit your technical graphics process.

The Case for a CGM Archive

This document will describe the business benefits you can experience by adopting the CGM file format as your 2D technical graphics archive.

So what is a technical graphic? The production of a technical manual will require graphical elements that can be found resident in different areas of the organization. The graphics required to produce the technical manual could consist of engineering drawings, schematic and technical illustrations, and also wiring diagrams. The file formats of these graphical elements will probably be different so having one instance from a business perspective makes sense, much easier for the department to manage, edit and publish. CGM offers the best opportunity to consolidate the graphics into one single archive.

So why choose CGM? Firstly it is an open and structured graphics file format, it can contain both vector and raster data, and in version 4.0 of the format the capability to include metadata enabling intelligent graphics. CGM also supports industry profiles providing the ability to validate for conformance, and additionally validate against illustration business rules. The format also supports very efficient file sizes an important factor when managing a substantial archive.

The major benefit of the CGM format is it can be both edited and published without the need of an intermediary file format therefore one instance of the file to edit, manage and publish, an exact match for the characteristics we are looking for, next we will examine in more detail the advantages of adopting CGM.

OPEN STANDARD

"Open Standards" are made available to the general public and are developed, approved maintained via a collaborative and consensus driven process.

The alternative is to use a proprietary format to populate your archive. The risk of choosing the proprietary route is generally the format can only be used in the software it is was saved in. Another limiting factor is certain graphic effects can only be performed and output in the originating software and therefore cannot be transferred and used effectively into alternative software solutions.

The choice of CGM negates the reliance on one software solution as a consequence protecting investment and providing the ability to maintain a consistent graphics archive.

STANDARDS BASED

Since 1987 CGM has been an ISO standard for vector and composite vector/raster picture definition. The standard is published and details can be found on the ISO website, please see Reference Section for further information. The CGM format is also referenced as profiles

in the S1000D[2] and iSpec2200[3] International Military and Commercial Aerospace Specifications. It is also referenced in the Commercial Marine and Rail Industries via the ShipDex[4] and RailDex[5] initiatives both of which reference the S1000D standard.

INTEROPERABILITY

Interoperability provides the ability to make systems and organizations work together. The interoperability of XML provides the textual data with this ability and results in major benefits. The opportunity for CGM to derive the same benefit is possible through good business processes and technology. The use of CGM will protect the investment of companies and government organizations from both operational and IT infrastructure perspectives.

INTELLIGENT GRAPHICS

The concept of "Intelligent Graphics" defines standardized structured graphics, which could be used by applications in an interactive way. The CGM format has the capability to be intelligent, using meta-data, a region of the graphic can be defined as a trigger for an action to be performed when clicked. This clickable area is also known as a graphic hotspot the functionality is commonly see in IETM's (Interactive Electronic Technical Manual's) for example when identifying spare parts information.

SINGLE SOURCE PUBLISHING

The CGM format provides the capability to base the graphics publishing process on a single source archive. The management of graphical data is crucial in the production of technical publications. The CGM format provides a single source capability enabling the streamlining this process. A single instance of a CGM file can be easily, edited, managed and published either to traditional printed output or delivered electronically with interactive capabilities.

[2] www.s1000d.org
[3] Airlines for America
[4] www.shipdex.com
[5] www.raildex.com

Challenges when creating a CGM Archive

SOURCES OF GRAPHICAL INFORMATION

We have already determined that sources of technical graphics within an organization are varied and can be situated in different business areas. The physical location of data is an immediate and real challenge for some organizations. A good example would be gaining access to engineering data from the CAD department. It is possible that business processes inhibit the exchange of information but the benefits of data transformation should drive the business case to change business practices. This is just one example of the challenges that might present themselves when executing the strategy of a CGM archive.

QUANTITY OF DATA

There could be a business challenge with respect to the quantity of files and their differing formats. Typical questions that could be asked by the organization are:

- How long will it take to convert the files and at what cost?
- Is technology available to cost effectively convert the files?
- What will be the return on our investment?
- What benefits will be experienced when the conversion is complete?

The quantity of data to be converted will always be a major concern as it could be a time consuming process. However the technology is available to cost effectively convert the files and the return on investment will be enabled by only managing one instance of the file in the CGM format.

GRAPHICS QUALITY

The quality of technical graphics is of paramount importance to any organization and a common perception is that converting data will result in the loss of quality. The facts however do not support this thinking and it is possible to improve the quality of some data types.

The scanning of legacy illustrations provides the opportunity to save the raster file as part of the CGM file. The raster image retains its properties it can still be edited and vectors added if the graphic requires amending.

The transformation of CAD data to CGM can improve the graphical quality and reduce the file size. CADS files are composed of geometric elements such as arcs, ellipses, splines and simple lines, it is important the conversion process retains a high degree of graphics quality and scalability.

TECHNOLOGY

The introduction of new technology into any business is almost always challenging. The management of data presents its own particular challenges. Many organizations have chosen XML to create, maintain, manage and deliver their textual data. The graphics community also have has an option to adopt a similar strategy by selecting CGM as the file format of choice.

The task of transforming this data into a single graphics archive can seem technically daunting and time consuming. However software solutions are available which enable batch data processing and support of the major formats.

COST AND RETURN ON INVESTMENT

There will be costs involved when implementing this strategy, in both technology and resources. However the return on investment will multiply with the management, maintenance and publishing of a single CGM archive.

Optimize the technical graphics process using Larson CGM Products

The document so far has presented the case for establishing a CGM Archive and the challenges faced by organizations implementing the strategy. The paper will now offer solutions to enable this strategy based on Larson CGM Products.

The Larson CGM family of product provide the capability to transform common file formats to quality CGM files with VizEx Transform, edit files using VizEx Edit, and deploy graphics using the VizEx View.

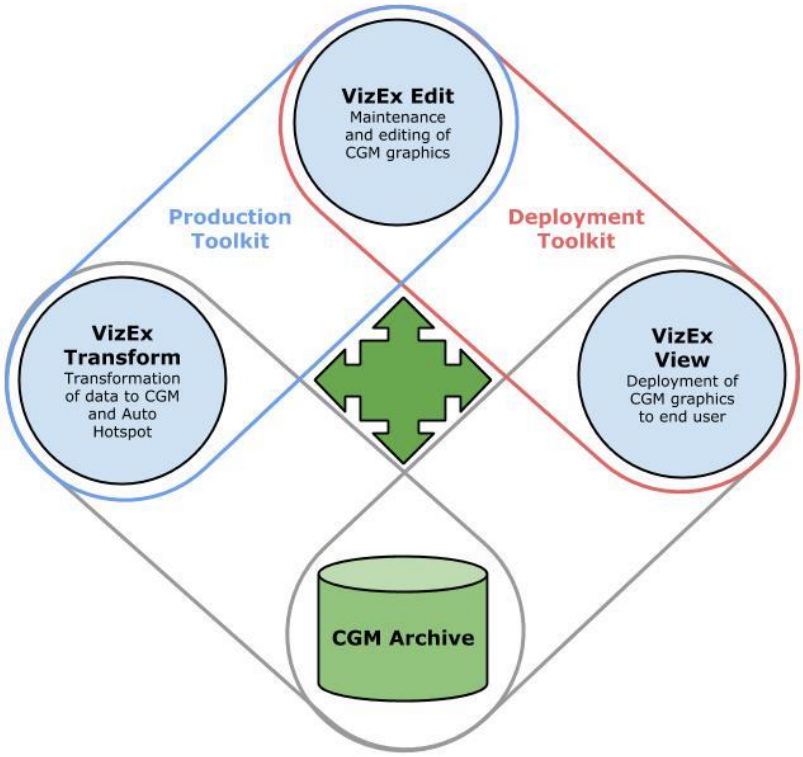

Figure 1 The Larson CGM family of products enable the CGM Ecosystem

CORE BENEFITS

The benefits provided by Larson Products are visible both in technical graphics production and deployment phases, Figure 1 provides the vision of a CGM Ecosystem, simple, productive and excellent quality.

The Benefits of the Larson CGM Products

- The Larson VizEx Transform has the ability to convert files of differing formats to CGM and add value with an automatic hot spotting capability.
    - The transformation of files is cost effective by utilizing the batch processing functionality.
    - CAD files can be transformed utilizing the DWG format enabling the reuse of engineering data within the organization.
    - The reuse of vector graphics embedded inside PDF files and graphics created in popular graphics programs e.g. Adobe Illustrator, CorelDraw etc.
    - A fast and highly configurable automatic hot spotting capability, downstream end users will benefit from interactive intelligent graphics.

- The Larson VizEx Edit products provide sophisticated tools to edit graphics and create and maintain hotspot information.
    - Provides a simple to use interface and powerful graphics editing options to maintain your CGM graphics. An intuitive interface to add and maintain hotspot information.
    - A cost effective way of performing graphics editing tasks in comparison to expensive vertical technical illustration tools.

- The Larson VizEx View products provide a whole range of different options for deploying your CGM graphics, from plugins for web browsers through to Software Development Kits for embedding a CGM viewer into an IETM (Interactive Electronic Technical Manual).
    - VizEx View products can also be used to display CGM files in popular browsers such as Internet Explorer, Chrome and Firefox on Windows and Linux.
    - Larson also provides viewing technology for iOS to enable CGM graphics on the iPad.

Our customers receive many benefits by both implementing Larson VizEx products and adopting CGM as their preferred graphics file format.

Features of the Larson CGM Products

In the previous section we outlined the benefits of the Larson CGM Products in this section we focus on some of the major features. The product datasheets are also available on request providing additional information on the individual products.

VizEx Transform

This is a truly unique application enabling the transformation of multiple graphical data formats into CGM in one simple to use interface. The application also has the ability to add hotspot information to the CGM graphics during the transformation process. This is all done using a batch process saving time and money.

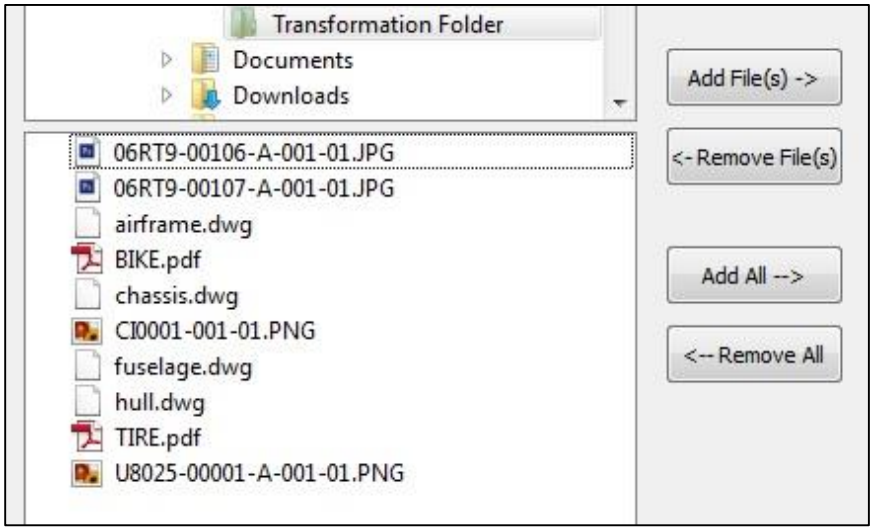

Figure 2 Transform multiple file formats

Transform DWG and DXF files

Transform CAD files from the engineering department and successfully reuse of existing data without the loss of graphics quality.

- Supports "Model" and "Paper" space options.
- The pen weight values are supported and mapped to the CGM file.
- The option for arcs, ellipses, polylines, and scaling control.
- Control individual layers by turning off selected layers. For example turn off title block, extract desired text for specific languages.
- Convert colors to monochrome

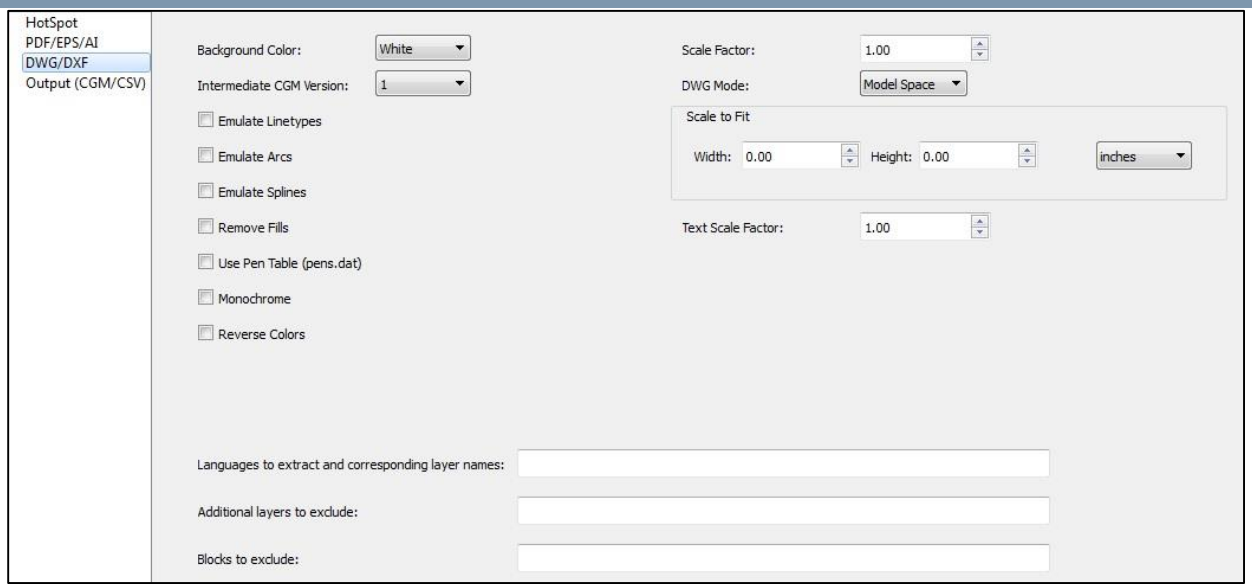

Figure 3 DWG & DXF settings

Transform PDF files

This graphics transformation eliminates the requirement to re-author or redraw existing illustrations in the PDF format. The same technology can also be used to convert from popular graphics software that do not support CGM, for example Adobe Illustrator, but do output in PDF or EPS.

- The ability to convert a multiple page PDF document into separate CGM files.
- The option of scaling line widths.
- The ability to choose individual pages of a PDF document to be converted.
- Scale line widths

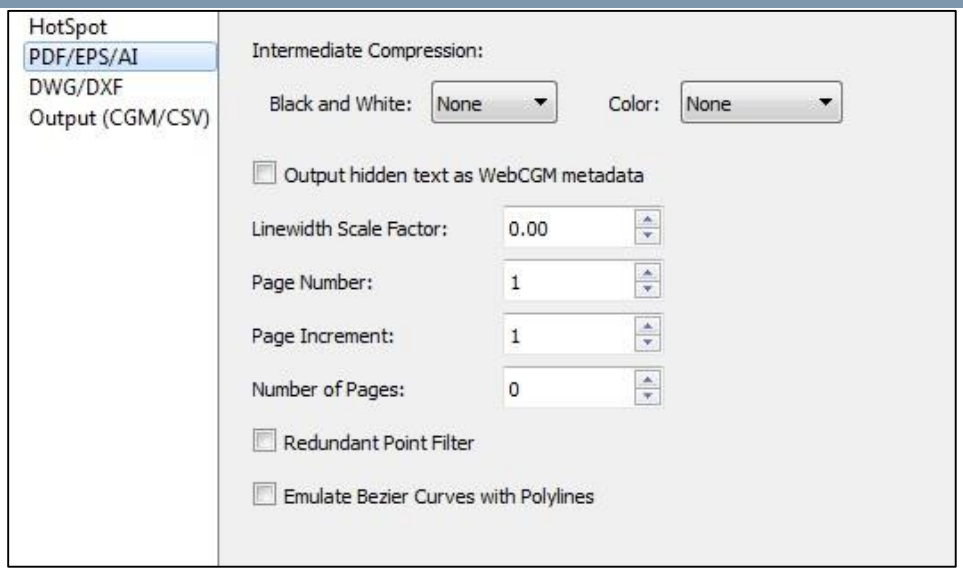

Figure 4 PDF transformation settings

Transform Image files

Common image formats such JPEG, PNG, TIFF and BMP are transformed into the CGM format. CGM is commonly thought of as a vector format, but CGM V3 onwards includes the support for raster files.

- Supports Raster to Raster conversion.
- Advanced features include color swapping, compression for monochrome images.
- The DPI (dots per inch) resolution can be controlled.
- Options for file compressions, image quality, grayscale, size (pixels, inches, metric), Aspect Ratio, Gamma, and Rotation.

Automatically create intelligent CGM graphics

Larson's VizEx Transform also automates the creation of hotspot information in CGM files during the conversion process.

- The ability to identify text based on characteristics including minimum and maximum digits, minimum and maximum height. For more powerful text filtering specify characteristics with regular expression (regex).
- The tool also provides option to output hotspot information to a file in CSV format so you can add or replace developed applications, which refer to databases, or add screen tips text and actual URL links.
- The Raster option allows you to take TIFF, JPEG, PNG, and CALS raster files and automatically recognize callouts and then convert them to CGM Version 4 with hotspots.

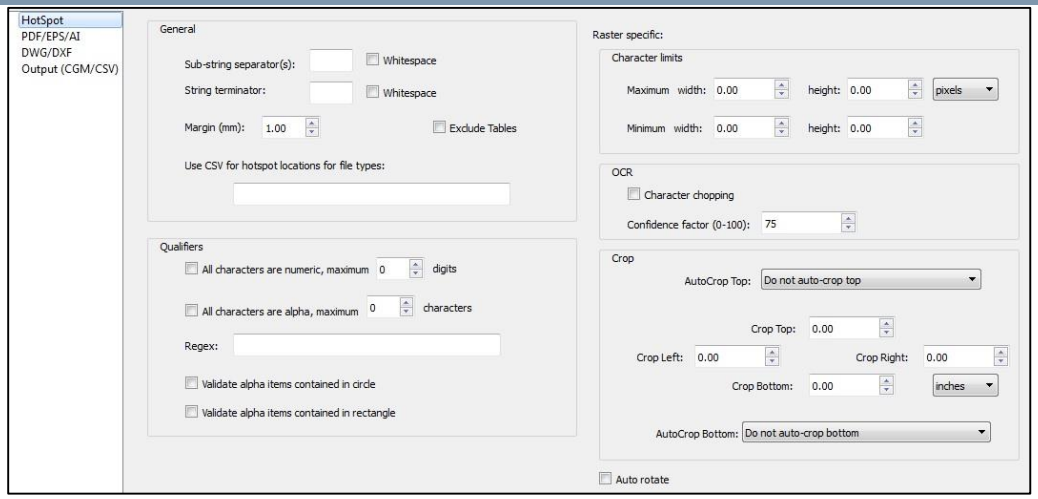

Figure 5 Hotspot settings

VizEx Edit

Provides a cost effective solution to edit and maintain your CGM archive. Create overlay hotspots, embed hyperlinks, and link all your drawings together with this standards based graphics technology.

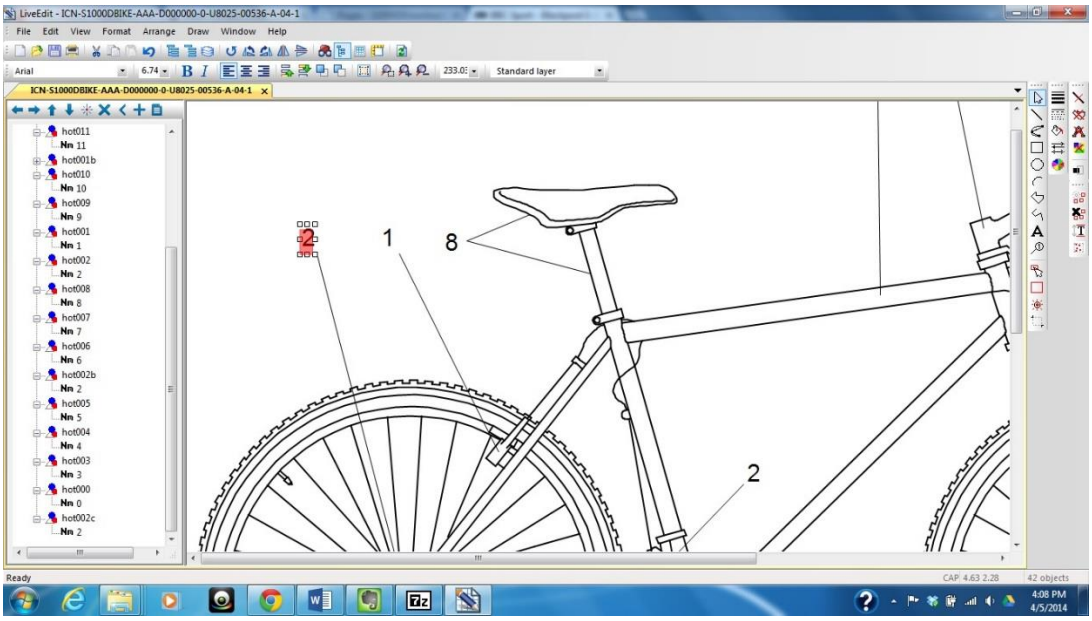

Figure 6 Maintain CGM files in VizEx Edit

Product Features

- Enables the revision CGM's, edit lines, fill colors, change fonts, reposition objects and delete them.

- Allows the import of Adobe Illustrator, PDF, DWG, TIFF and other graphics formats, additionally all versions of CGM.
- Quickly and easily add hotspots and enter the associated metadata. Simply click and drag a rectangle to indicate hotspot location, or select group of objects to create a hotspot for the entire group.
- The metadata "Tree View", see Figure 5, enables the intuitive modification of hotspot attributes like object id, name(s), embedded links. The clicking of the hotspot while pressing Control-key also allows individual hotspot attributes to be very quickly edited.
- The document tabs feature permits several files to be opened in a single session enabling quick and easy navigation between CGM files.
- The split views feature enables multiple files to be viewed side by side for quick comparison and revision.
- The Auto Hotspot technology is also available as a fully integrated option for Live Edit.
    - Select the Auto Hotspot function and the file is scanned for all vector and raster text.
    - The text to be hot-spotted can be identified by the setting of parameters, for example, alpha, numeric only, or a regex text filter.
    - The CGM file is hot-spotted on screen, the attributes will be automatically generated and be edited if required to obtain the required result.
- Layout Tools: Align, Crop, Group, Un-Group, Flip, Rotate, Arrange, Crop, Copy/Paste, Snap to Grid, Zoom
- Mark-up Tools: Text, Bezier Curves, Circles, Ellipses, Rectangles, Polygons, Transparency, Lines, Hotspot, True Type Fonts, Line and Fill Attributes

VizEx View

Distribute your CGM graphics easily to your co-workers, customers, partners and suppliers with Larson's world leading CGM viewing technology. VizEx View comprises of various products each designed to deliver quality CGM files the customer can rely on.

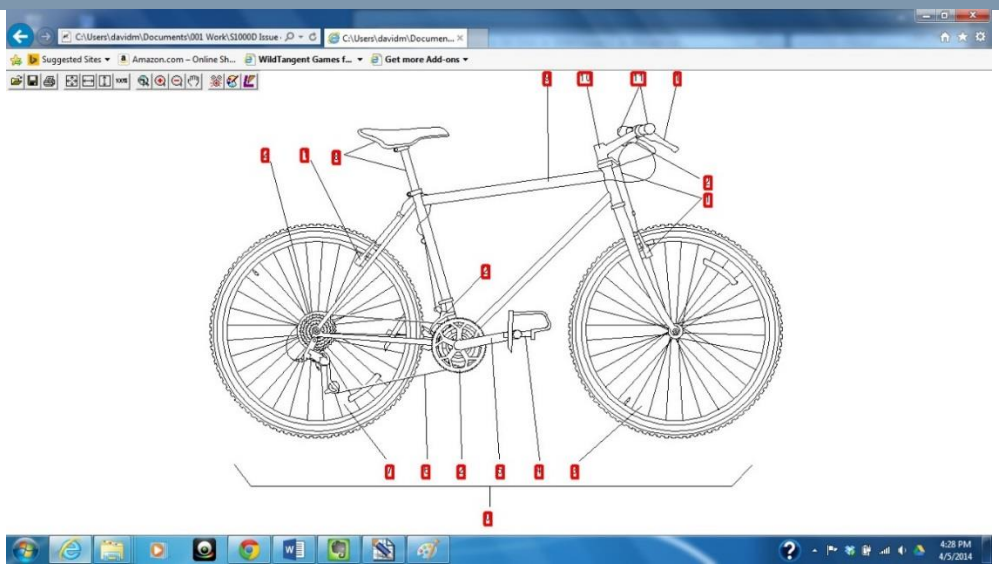

Figure 7 Deploy CGM files in VizEx View

VizEx View Plugin for Chrome, Internet Explorer and Firefox browsers

Larson provides technology for the support of CGM in all major internet browsers. The support of CGM is comprehensive and easy to implement.

- Full support for the WebCGM 2.0 DOM, a JavaScript API and event model for programmatically interacting with graphical and non-graphical picture elements. E.g. identifying a user click on a hotspot then changing the color of a line or text element.
- Supports hyperlinking and document navigation, picture structuring and layering, and enabling of search and query of WebCGM content.
- Support XML Companion File for externalization of non-graphical metadata for easier metadata management e.g. link, screen tips.
- Toolbar for added user interaction: scale, zoom, pan, show hotspots.
- Menu right-click menu provides text search in addition to scale, zoom, pan, show hotspots functions.
- Supports Open-Type and True-Type fonts
- OpenGL is utilized on Linux for fast and accurate graphics rendering.
- Embed CGMs in HTML document, with either an OBJECT tag or via the JavaScript API.

VizEx View C++

This product includes an easy to use C++ library for Windows and Linux developers looking to support CGM in their application(s). The VizEx View C++ Library Software Development Kit includes sample code, documentation and the object code library (.DLL or .SO on Linux), both which you can utilize with your C++ applications.

VizEx View iOS

The distribution of technical documentation on tablet devices is becoming very important. The ability deploy CGM files on iOS is now possible with this Larson product. VizEx View iOS enables delivery of quality native CGM graphics including all the functionality you would expect on other platforms.

VizEx Office

The View Office product (an add-in for Microsoft Office 2010 and later) that seamlessly inserts CGM Files into Microsoft PowerPoint and Word documents utilizing Larson's unique technology. This will improve your slides and documentation by inserting high resolution CGM files. Insert all types of CGM technical graphics and easily reuse your single instance archive.

Summary

The objective of the document was to present a compelling explanation of the advantages of using the CGM format as a technical graphics archive. As a world leading supplier of CGM technology Larson has the credentials, experience and products to enable the vision.

Larson Software Technology is the ideal partner to assist achieving and delivering your technical graphics goals. The technical graphic assets have comparative importance with their textual counterpart and need to be treated as a valuable component of the technical documentation lifecycle. The result will be a configured, validated, maintainable and reusable high performance CGM technical graphics archive working in unison with XML textual information.

The Larson organization was founded on its belief in the CGM format and has successfully built a business around the technology. The next step is to experience the benefits and discuss with our experts the implementation of your company’s CGM Archive.

Glossary

API	Application Programming Interface
BMP	Bitmap image file
C++	A general purpose computer programming language
CAD	Computer Aided Design
CGM	Computer Graphics Metafile
CSV	Comma-Separated Values
DOM	Document Object Model
DWG	A binary file format developed by AutoDesk, used by many CAD systems including AutoCAD as native file format.
Hotspot	A graphical hotspot is a region where information about an associated action is contained
HTML	Hyper Text Markup Language
IETM	Interactive Electronic Technical Manual
JavaScript	A computer programming language, most commonly used as part of web browsers
JPEG	Joint Photographic Experts Group
PDF	Portable Document Format
PNG	Portable Network Graphic
Raster Graphics	A dot based data structure representing an image made up of pixels and viewable via a monitor, paper, or other display medium.
RIP	Raster Image Processor
SDK	Software Development Kit
TIFF	Tagged Image File Format
Vector Graphics	Points, lines, curves, shapes and polygons based on mathematical expressions representing images in computer graphics.
XML	Extensible Markup Language

References

- S1000D is an international specification for the production of technical publications. www.s1000d.org
- Aerospace Industries Association (AIA), played a key role in developing S1000D specification.along with Aerospace and Defence Industries Association of Europe (ASD) www.aia-aerospace.org/
- The ATA e-Business Program, where the global commercial aviation industry collaborates to create standards for information exchange to support engineering, maintenance, materiel management and flight operations. www.ataebiz.org/specifications/
- Airlines for America (A4A), formerly known as Air Transport Association of America, Inc. (ATA), was the first and remains the only trade organization of the principal U.S. airlines. https://publications.airlines.org/
- The World Wide Web Consortium (W3C) is an international community that develops open standards to ensure the long-term growth of the Web. www.w3.org/Graphics/WebCGM/
- Part of the U.S. Department of Commerce, NIST (National Institute of Standards and Technology's) is one of the nation's oldest physical science laboratories. www.itl.nist.gov/div897/ctg/graphics/cgm_std.htm
- CGM Open Foundation is non-profit international foundation, made up of developers and users dedicated to open and interoperable standards for the exchange of graphical information. www.cgmopen.org/

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