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# LST CGM Generator and Viewer Final Report CRADA No. TSB-1558-98

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# LST CGM Generator and Viewer

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Project Accomplishments Summary  
CRADA No. TSB-1558-98  
Technical Work Ended: 1999

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Date: March 26, 2001

Revision: 4

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## A. Parties

The project is a relationship between the Lawrence Livermore National Laboratory (LLNL) and Larson Software Technology.

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## B. Background

At the time of the CRADA, DOE Defense Programs and Defense Nuclear Technologies faced a technical problem with the exchange of digital drawing files within the Nuclear Weapons Complex (NWC). The existing exchange format was a popular but non-standard format known as Hewlett-Packard Graphics Language (HPGL). The use of HPGL resulted in occasional unreadable and even erroneous files that needed to be hand-modified to be viewed or printed. This process was very disruptive, labor-intensive, and could leave some doubt about the validity of the modified file.

There was a digital drawing file format known as Computer Graphics Metafile (CGM) that was an international standard designed expressly for exchanging, archiving, viewing, and printing 2-D images, including CAD drawings. It is owned and maintained by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Because of its consistency and longevity, CGM (ISO /IEC 8632) was adopted by the U.S. airline, automobile, petroleum, and railroad industries for storage of their on-line maintenance and repair manual CAD illustrations. U.S. and international corporations such as Boeing, United Airlines, Shell, and Exxon also adopted it for internal use.

LLNL's had two workhorse CAD systems, Pro/ENGINEER and AutoCAD. Only Pro/ENGINEER would produce CGM-formatted files. However, the file quality of Pro/ENGINEER CGM was less than desirable for the exchange of nuclear weapons data.

Larson Software Technology (LST), a small business established in the early 1980s, was a supplier of trusted and certified CGM generating, viewing, and printing software. They developed:

- (1) Software tools for generating ISO/IEC 8632- compatible CGM files
- (2) NIST-certified CGM viewing and printing software

Their CGM tools converted internal (native) formats used by a CAD vendor into high-quality CGM files suitable for unambiguous exchange and long-term storage. They wrote graphics data conversion tools for HPGL and Raster formats. LST's CGM viewers allowed remote users to read CGM files stored in an archive, such as the LLNL ERC, and displayed the resulting image on remote workstations. Their client software ran on many platforms, including UNIX and Windows.

At the time of the CRADA, LST was active in standards committees in both the petroleum and air transport industries. As founding members of the CGM Open Consortium, they helped to develop a cross-industry Web profile for CGM.

### **C. Description**

The purpose of this project was to jointly develop and test a software plug-in that would convert native Pro /ENGINEER digital engineering drawings to Computer Graphics Metafile (CGM) format. If it was not feasible to convert the Pro/ENGINEER files, we planned to develop and test a similar conversion of native AutoCAD engineering drawings to CGM. CGM viewer plug-ins were developed as needed.

There were four main tasks in this project:

1. Requirements for CGM Plug-in
2. Product Evaluation
3. Product Development Feasibility Study
4. Developing a "Plug-In" Application

### **Task 1: Requirements for CGM Plug-in**

During this task, we developed and prioritized four (4) requirements for software for generation of Computer Graphics Metafiles and CGM, from CAD systems. The requirements applied equally to Parametric Technology Corporation's Pro/ENGINEER and to Autodesk Corporation's AutoCAD.

The four requirements were:

- (1) Visual accuracy of a display of the generated CGM
- (2) Adherence to the ISO/IEC standard and to industry profiles
- (3) Efficiency of storage of geometric information
- (4) Integration with work flow software

These requirements were in terms of the produced CGMs, except when the application would be a "plug-in" to the CAD system or to work flow management software.

### **Task 2: Product Evaluation**

We tested and evaluated the functionality for eight (8) Larson Software Technology applications. We evaluated two of them for actual performance:

1. Larson Plot Shop(R), an Interactive CGM Graphics Editing and Presentation Tool
2. Larson, CGMview, a CGM viewer for the Windows environment

Both applications were generally satisfactory for their intended applications, but had features that limited their usability for LLNL. Modification of these features would bring these products to a satisfactory level of performance.

### **Task 3: Product Development Feasibility Study**

Development of an improved CGM module for Pro/ENGINEER was abandoned or postponed because of a lack of information on the internal format. A feasible alternative application was developed for generation of CGMs from the AutoCAD DWG format.

#### Task 4: Developing a "Plug-In" Application

Larson Software Technology had developed an application, *dwg2cgm*, for conversion from the AutoCAD DWG format to CGM.

Evaluation of *dwg2cgm* revealed that, with some exceptions, CGMs produced from AutoCAD DWG files appeared to be visually accurate representations of the AutoCAD drawings and that they were syntactically correct and conformed to industry profiles for CGM. However, the produced CGMs were of less than desired efficiency, using only low level representation of geometric elements. The failure to translate all solids into 2-D representations for display or printing was a serious defect and the incompatibility with workflow software was an additional limitation.

#### **D. Expected Economic Impact**

##### Industrial Partner

This project helped LST improve their product line and competitiveness in the CGM market. These capabilities were becoming increasingly utilized within the U. S. airline, automobile, petroleum, and railroad industries.

##### The U.S. Economy

CGM is used worldwide and is a key element in the future of all technical data exchange and storage. This project will help the U. S. maintain a competitive edge in the field.

#### **E. Benefits to DOE**

##### Laboratory Program(s) core competencies

This project laid the foundation for the future exchange and long-term storage of 2-D CAD files at LLNL and across the DOE complex. The project leveraged LLNL's expertise in technical data exchange and standards conformance testing.

##### DOE Programs

Storage and exchange of technical data in standard formats is of paramount concern throughout DOE, and especially within the Nuclear Weapons Complex.

#### **F. Industry Area**

Airline, automobile, petroleum, and railroad industries

#### **G. Project Status**

This project was completed in 1999.

**H. LLNL Point of Contact for Project Information**

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**I. Company Size and Point(s) of Contact**

Larson Software Technology has annual sales of less than \$10 million. The company employs less than 50 people.

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**J. Project Examples**

There are no project examples.

**K. Subject Inventions and Copyrights**

This small value contractual mechanism did not anticipate any generation of Intellectual Property (IP) including subject inventions. The LLNL contributors and the company participants both indicate that no new intellectual property was generated.

**Documents/Reference List**

**Reports**

"Functional Requirements for Software for Conversion of Pro/Engineer and/or AutoCad Drawing Files to CCGM;" CRADA TSB-1558-98; Task 1; Garner, Bruce L.; CRADA Technical Report

"An Evaluation of CGM Tools from Larson Software Technology for Possible Application to LLNL Engineering Design and Archive;" CRADA TSB-1558-98; Task 2; Garner, Bruce L. and Dickson, Terri; CRADA Technical Report

"Feasibility of Developing Software for Conversion of Pro/Engineer and/or AutoCAD Drawing Files to CGM;" CRADA TSB-1558-98; Task 3; Garner, Bruce L. and Larson, Don; CRADA Technical Report

"Evaluation of Larson Software Technology's dwg2cgm, an Application for Conversion of Auto CAD DWG Files to Computer Graphics Metafiles, CGM;" CRADA TSB-1558-98; Task 4; Garner, Bruce L., CRADA Technical Report

### **Patent/Copyright Activity**

The AutoCad to CGM converter (dwg2cgm) was copyrighted by Larson Software Technology in June 1999.

### **Generated Information**

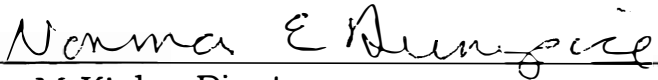
None

### **Background Intellectual Property**

No rights to Background Intellectual Property were acquired. There was no licensing of BIP.

**L. Release of Information**

I certify that all information contained in this report is accurate and releasable to the best of my knowledge.

  
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Karen McKinley, Director  
Industrial Partnerships and Commercialization  
Date May 15, 2001

**Release of Information**

I have reviewed the attached Project Accomplishment Summary prepared by Lawrence Livermore National Laboratory and agree that the information about our CRADA may be released for external distribution.

  
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Don Larson, President  
Larson Software Technology  
Date \_\_\_\_\_