Laser-Scan Ltd.

Software Product Specification

POLYGONS package

For LAMPS V4.3

1   *DESCRIPTION*

The Laser-Scan IFF polygon processing package (POLYGONS) operates on Digital
Equipment VAX, and Alpha AXP series computers running the VMS operating systems.
See later sections for details of hardware and software prerequisites.   It is
recommended that the reader becomes familiar with the "LAMPS Environment Guide"
which outlines in some detail the hardware and software environment required by
the LAMPS package as a whole (of which POLYGONS is but a part).   LAMPS is the
Laser-Scan **A**utomated **M**ap **P**roduction **S**ystem.

IFF stands for **I**nternal **F**eature **F**ormat and is the Laser-Scan vector file format
generated by LASERAID and other Laser-Scan mapping systems and used as the data
structure throughout the Laser-Scan LAMPS system.   IFF files are binary and
cannot be manipulated directly using a text editor.   The POLYGONS package
enables the user to create and manipulate polygon data within IFF files.

The POLYGONS package consists of independent modules which together form a
powerful polygon creation and manipulation system within an automated mapping or
GIS (Geographical Information System) environment.

The POLYGONS package is designed for use in conjunction with the STRUCTURE
package module ILINK.   ILINK is used to provide link-node data structure within
IFF files which is then used by the POLYGONS module IPOLYGON to form polygons.
(See the STRUCTURE package SPS for details of LINK and the "IFF User Guide" for
details of IFF link-node strructure).

All the POLYGONS modules have common command syntax which is decoded using the
Command Line Interpreter as used by the VMS utilities.   POLYGONS modules all
generate VMS format messages and set VMS DCL symbol $STATUS on image exit.   In
command files the success of a preceding POLYGONS module may be tested using
$STATUS before proceeding.

All POLYGONS modules are comprehensively documented in the "POLYGONS User
Reference Manual" and the documentation includes an explanation of messages
output by the modules together with suggested user action.   POLYGONS is supplied
with on-line help which is available via the VMS HELP utility.

POLYGONS is compatible with the 'new' type of IFF files produced by the
Laser-Scan IMP (IFF MAP Processing) package.   (For a detailed description of IFF
types and their component entries see the "IFF User Guide").

Within the VMS system IFF files can be treated as any other file type for file
management purposes.   To enable the user to distinguish an IFF file from a file
of another type IFF files have by default the file extension '.IFF', and
link-node structured IFF files the extension '.IFJ'.   To provide great
flexibility in the production environment IFF files are referenced by all the
POLYGONS modules using logical name LSL$IF:.   (For an explanation of logical
names see the VMS document set).   Logical name LSL$IF: is assigned to a device
and directory specification either using the VMS DEFINE command or the
Laser-Scan SI utility.

2 *FACILITIES*

The facilities offered by POLYGONS are described by module in alphabetical order
of module.

* **IPOLYGON** (Polygon creation and labelling utility)

> IPOLYGON is the Laser-Scan automatic **IFF POLYGON** creation and labelling
> utility. It forms the core of the Laser-Scan POLYGONS Package.

> IPOLYGON is designed to be run in batch mode and all options may be
> specified on the command line. No user interaction is required during
> processing.

> IPOLYGON carries out polygon formation and the determination of first
> order nesting based on the input geometry. Those segments that do not
> form part of a boundary between different polygons can be automatically
> removed.

> IPOLYGON offers two methods for labelling (and checking the consistency)
> of polygons:

> o Seed point assignment: the polygon label is extracted from the seed
>   point data.

> o Left/Right coding: each segment has a left and right AC (Ancillary
>   Code). The polygon label is extracted from the text part of the AC.

> Geometry is analysed to any required level of nesting for the
> determination of seed point placement. There are three mechanisms for
> extracting labels from seed points based on: (a) the contents of a TX
> entry within the seed point, (b) the contents of the text field of a
> specified AC type or (c) generated from the FSN of the seed point.

> If left/right coded segments are used then labels are extracted from the
> text field of the specified left and right ACs.

> In addition IPOLYGON provides a unique (internally generated) identifier
> for each polygon.

> IPOLYGON offers four methods of polygon output, any combination of which
> may be output in a single run:

> o An IFF file containing complete closed polygons as single features.

> o An IFF file containing labelled segments with left/right codes.

> o An IFF file containing a single point feature lying in each polygon.

> o An ASCII file containing lists of those segments that make up
>   polygons.

All output options allow the label and/or identifier for each polygon to be output to the IFF features through the use of user-specified AC (Ancillary Code) entries.

The calculated area of polygons can be output to the numeric field of label and/or identifier ACs of polygon boundary or point-in-polygon features.

Coded output segments can carry either left/right or left/right/contained labels and/or identifiers. Coded segments can be output to both IFF and junction-structured IFF files.

Optionally, IPOLYGON can propagate one or more partial left-right codings of input segments. This has a number of applications, including:

o extension of a consistent but incomplete segment coding,

o labelling of linear features according to their containing polygon, (line-in-polygon),

o mutual completion of multiple codings. Together with geometric processing available in the STRUCTURE package, this forms the basis of polygon overlay operations.

* ISTSEL (Segment selection and polygon aggregation utility)

       ISTSEL is the Laser-Scan **IFF ST**ring **SEL**ection utility. ISTSEL reads an
IFF file and compares text strings held as left/right AC (Ancillary
Code) entries and TX (TeXt) entries to keys given in a specified text
file.

       If a match is found between the IFF text string and any of the keys in
the text file, then the code is replaced with the matched key defined in
the text file.

       After recoding, segments with identical left/right codes are not written
to the output IFF file. The overall effect of the program is thus
segment selection and this provides a powerful polygon aggregation
facility.

       The text strings used as left/right segment labels may be numeric,
alphanumeric or alphabetic and may be up to 255 characters in length.

* **POLMERGE** (Polygon merging and elimination using multiple aggregation criteria)

> POLMERGE is the Laser-Scan automatic IFF **POL**YGON **MERG**ing and elimination utility. It forms part of the Laser-Scan POLYGONS Package.

> POLMERGE is designed to be run in batch mode and all options may be specified on the command line. No user interaction is required during processing.

> POLMERGE operates on an IFF junction structured (IFJ) file containing left/right coded links. Because output is also to a junction structured IFF file, the program may be used as a pre-processor before closed polygon creation using IPOLYGON.

> Polygons may be merged or eliminated on the basis of:

>   o area

>   o coding rules read from a user specified ASCII lookup file

>   o relative polygon sizes - large into small, small into large

>   o numeric value of polygon code

>   o ratio of perimeter/area

3   *PREREQUISITES*

3.1 *Computer Hardware Prerequisites*

The following computer hardware requirements are needed to run POLYGONS.

>   * Any DEC VAX, MicroVAX, VAXstation, or Alpha AXP computer supported by the current version of VMS.

>   * At least 4MB available disc space for software, plus sufficient for data files.

>   * Any DEC-compatible alphanumeric terminal.

>   * Memory at least 4096 page working set per process for efficient use, 10000 pages preferred.

3.2 *Software Prerequisites*

POLYGONS modules run under OpenVMS Version 5.5-2 or OpenVMS AXP V1.5 (or later versions) and assume upwards compatibility by DEC. POLYGONS modules may be run concurrently with other interactive and batch processes.

The prerequisite Laser-Scan STRUCTURE module ILINK provides the link/node data structure required by POLYGONS module IPOLYGON.

The prerequisite Laser-Scan MAPPING package provides IFF and FRT file interface libraries.

The Laser-Scan LITES2 interactive digitising and editing software is recommended for digitising vector input data. The Laser-Scan LASERAID automated digitising system is recommended for large numbers of input documents.

It is recommended that the reader becomes familiar with the LAMPS Environment Guide which outlines in greater detail the hardware and software environment required by the LAMPS package as a whole (of which POLYGONS is but a part).

3.3 *Growth Considerations*

The minimum hardware and software requirements for any future version of this product may be different from the minimum hardware requirements for the current version.

3.4 *REQUIRED POLYGONS SOFTWARE MODULE*

The POLYGONS module IPOLYGON can only be used in conjunction with the STRUCTURE package module ILINK.

ILINK enables "idealisation" of IFF geometry, and/or the creation of IFF link-node structure from unstructured IFF data. It is this latter ILINK feature which is required by IPOLYGON.

The main functions of ILINK are:

> o close feature section alignment,
>
> o the creation of ideal junctions where features almost touch or cross,
>
> o the creation of junctions where junctions are implied because existing features already cross or touch,

Each process uses working link to node and node to link pointers in the course of its operation, incorporating every junction detected. This structure can be discarded or retained in whole or in part in the IFF output. The options are as follows:

> o Ignore the link/node structure completely and do not break features into separate parts at junctions.
>
> o Ignore link/node information, but break features into separate parts at every junction and merge duplicate feature sections into single features.

o Break and merge features as above and also retain IFF link-node structure data.

Like IPOLYGON, ILINK is non-interactive and uses no graphics devices. A progress display can be activated for the more time consuming operations when the program is run in interactive mode. All warning messages and a summary of process statistics are written to SYS$OUTPUT.

For more information on ILINK please see the separate STRUCTURE Software Product Specification (SPS).

4 ***SUPPORT LEVEL***

POLYGONS is a fully supported Laser-Scan standard software product.