Community Standard Justification: 16-139

TITLE: LAS Specification Version 1.4 – R13 (15 July 2013)

CONTRIBUTOR

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# Introduction

This document provides a justification to the OGC Technical Committee (TC) for consideration of LAS Specification Version 1.4 – R13 (15 July 2013) as a Community standard. This justification, along with the submitted candidate Community standard, will form the basis for TC review and vote to approve the start of the Community standard process for this standard.

The submitters agree to abide by the TC Policies and Procedures and OGC Intellectual Property Rights Policy (<http://www.opengeospatial.org/ogc/policies)> during the processing of this submission.

# Overview of proposed submission

LAS is a specification for a point cloud file format. It is primarily used for transmitting laser point cloud data (Lidar) but can be used for any general 2D or 3D point oriented encoding.

The original lidar binary file specification grew out of work done by EnerQuest Systems (whose software development work is now owned by Virtual Geomatics) in the late 1990s. EnerQuest had developed a proprietary point cloud binary format for laser scanned data (LASer) to make dealing with the generally unorganized data associated with lidar more efficient. Don Wicks, then president of EnerQuest, generously agreed to contribute the EnerQuest LAS work to the public domain. Leica Geosystems, Optech and Z/I Imaging joined the effort and the LAS 1.0 specification was born (the bulk of the implementation work was done by John Nipper, a software developer then at EnerQuest). About a year after this industry group defined the initial specification, the ASPRS agreed to take over ownership.

The LAS specification is a relatively compact binary encoding of point location and point attribute data. Rather than store attributes in referenced records, the light-weight attribute data of LAS is stored in the same record as the point data.

This proposal is specifically referring to the document that reflects the fourth revision of the LAS format specification since its initial version 1.0 release. Some of the highlights of LAS 1.4 include:

* Backward compatibility with LAS 1.1 – LAS 1.3 when payloads consist of only legacy content
* LAS 1.4 Mode which supports
  + Extension of offsets and field sizes to support full 64 bit
  + Support for up to 15 returns per outgoing pulse
  + Extension of the Point Class field to support 256 classes
  + Definition of several new ASPRS standard classes
  + Extension of the Scan Angle field to 2 bytes to support finer angle resolution
  + Addition of a Sensor Channel bit field to support mobile mapping systems
  + Addition of Well Known Text (WKT) definitions for Coordinate Reference Systems
  + Addition of an Overlap bit to allow indicating pulses in the overlap region while maintaining the class definition
  + Addition of an (optional) Extra Byte Variable Length Record to describe "extra bytes" stored with each point
* Other minor changes
  + Added definitions for “LAS Domain Profile” and “LAS Domain Profile Description”

Within the standard itself, it says: “The intention of the data format is to provide an open format that allows different LIDAR hardware and software tools to output data in a common format.” This sounds a lot like many of the goals supported within OGC. Based on this and the overwhelming evidence of support in the geospatial community, the submitters of this proposal feel strongly that the LAS 1.4 Specification should be put forward as a Community Standard within the OGC.

\*Thanks to Lewis Graham for providing information regarding the history of LAS within this section of the submission.

# Relationship to other OGC standards

During the March 2014 meetings in Washington, DC, someone asked a question regarding where did point clouds fit into the OGC. After some short discussions, it became obvious that point clouds represented a big gap in our activities. So an ad-hoc meeting was scheduled to gauge interest and it was heavily attended with a decision that we should begin a Point Cloud Domain Working Group. This submission represents the first major activity for this group and was based on input from the Point Cloud Survey conducted by the Working Group.

So currently there are no dependencies from other standards within OGC.

# Alignment with OGC Standards Baseline

Although this proposal may share some relationships with work currently happening within OGC such as the HDF SWG and the many 3D streaming activities, we do not see it competing with any other OGC standards. In fact, most members working with point clouds already support this specification. As to how it fits within the existing standards baseline, it will begin to fill the large gap within OGC where point clouds have been ignored. As part of the recent Point Cloud survey, three areas were identified as potential work areas:

1. Making the LAS standard a Community Standard
2. Investigate streaming protocols that can handle large amounts of point cloud data
3. Look at emerging technologies (HDF5) that might help to resolved some of the issues found point cloud formats.

This clearly shows the need to bring the ASPRS version of LAS into OGC and distinguish it as the recommended LAS encoding.

We need to be clear in saying that we do not expect this to be the only format for storing/transferring point clouds. In fact, we expect other formats that specialize in various domain interests to have the need for more advanced formats. However, this is not unusual for OGC to support multiple formats when it comes to encodings.

# Evidence of implementation

One of the first activities of the Point Cloud DWG was to conduct a survey to determine who was interested and using point clouds and how those organizations were using them. The results of that survey detailed how almost 80% of the 188 responses said they use LAS formats to store their point clouds and 70% use LAS to transfer their point clouds. You can see this in question #2 and #3 of the questionnaire located here:

[*https://docs.google.com/forms/d/19eQVHYaylKwBHOQTlVrlitxk8AXm1xbzmfCWyeHKICs/viewanalytics*](https://docs.google.com/forms/d/19eQVHYaylKwBHOQTlVrlitxk8AXm1xbzmfCWyeHKICs/viewanalytics)

As though that is not enough evidence to prove the large number of implementations in the community, the following represent organization that have specifically implemented it in their software:

The following implementations use the proposed Community standard.

**Implementation name**:  ArcGIS

**Date of most recent version**:  May 2016

**Implementation description**: ArcGIS is a comprehensive platform for geospatial data. Support for LAS (V1.0 to V1.4) is included in both ArcMap and ArcGIS Pro. These applications enable the point clouds to be viewed directly along with all other geospatial data in both 2D and 3D. The points can be filter based on return and classification codes. Profiles views are also available and the coding of the point can be edited. The point clouds can also be used as input for a range of analysis tasks or used as input to create different surfaces.

**Implementation URL**: <http://www.esri.com/software/arcgis/arcgis-for-desktop>

**Is implementation complete**?  [**Yes]**      **No**

**If not, what portions of the proposed Community standard are implemented?**

**Implementation name**:  Leica Cyclone

**Date of most recent version**:  Nov 15 2016

**Implementation description**: Leica Cyclone provides 3D point cloud and imaging system users with the widest set of work process options for end-to-end project delivery. Support for LAS format (up-to version 1.4) is included in the "IMPORT" and other licensed modules of the Leica Cyclone software. Web-based viewing, 2D drawings and 3D CAD models can be produced and fused with other reality capture content.

**Implementation URL**: <http://hds.leica-geosystems.com/en/Leica-Cyclone_6515.htm>

**Is implementation complete**?  [**Yes]**      **No**

**If not, what portions of the proposed Community standard are implemented?**

**Implementation name**:  USGS Lidar Base Specification

**Date of most recent version**:  November 2014

**Implementation description**: The USGS Lidar Base Specification is intended to be used to create consistency across the USGS National Geospatial Program and even partner-funded lidar collections, especially those that are collected in support of the 3D Elevation Program, or 3DEP. In the USGS Lidar Base Specification Version 1.2, released November 2014, lidar point data delivery is required in LAS v1.4, Point Data Record Format 6, 7, 8, 9, or 10; and proper use of the Overlap and Withheld bit flags is required.

**Implementation URL**: <https://pubs.usgs.gov/tm/11b4/pdf/tm11-B4.pdf>

**Is implementation complete**?  [**Yes]**      **No**

**If not, what portions of the proposed Community standard are implemented?**

# Public availability

Is the proposed Community standard currently publicly available?  **Yes**  **No**

URL: [http://www.asprs.org/LAS\_Specification](http://www.asprs.org/wp-content/uploads/2010/12/LAS_1_4_r13.pdf)

# Submitting member(s)

|  |  |
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# Intellectual property rights

Will the submitter retain intellectual property rights?  **Yes**  **No**

If yes, the submitter will be required to work with OGC staff to properly attribute the submitter’s intellectual property rights.

If no, the submitter will assign intellectual property rights to the OGC.