

GeoTIFF Format Specification

GeoTIFF Revision 1.0

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Acknowledgments:

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Mike Ruth, Niles Ritter, Ed Grissom, Brett Borup, George Galang,
John Haller, Gary Stephenson, Steve Covington, Tim Nagy,
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Additional advice from discussions with Tom Lane, Sam Leffler regarding
TIFF implementations.

Roger Lott, Fredrik Lundh, and Jarle Land provided valuable information
regarding projections, projection code databases and geodetics.

GeoTIFF Mailing list:

Posting: geotiff@tazboy.jpl.nasa.gov
Subscription: geotiff-request@tazboy.jpl.nasa.gov
(send message "subscribe geotiff your-name-here").

Disclaimers and Notes for This Version:

This proposal has not been approved by SPOT, JPL, or any other organization. This represents a proposal, which derives from many discussions between an international body of TIFF users and developers.

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Concurrence

The following members of the GeoTIFF working group have reviewed and approved of this revision.

Name	Organization	Representing
Niles Ritter	Jet Propulsion Labs	JPL Carto Group
Mike Ruth	SPOT Image Corp. (USA)	SPOT Image Corp. (USA)

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Table of Contents

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1 Introduction

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1.1 About this Specification

This is a description of a proposal to specify the content and structure of a group of industry-standard tag sets for the management of georeference or geocoded raster imagery using Aldus-Adobe's public domain Tagged-Image File Format (TIFF).

This specification closely follows the organization and structure of the TIFF specification document.

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1.1.1 Background

TIFF has emerged as one of the world's most popular raster file formats. But TIFF remains limited in cartographic applications, since no publicly available, stable structure for conveying geographic information presently exists in the public domain.

Several private solutions exist for recording cartographic information in TIFF tags. Intergraph has a mature and sophisticated geotie tag implementation, but this remains within the private TIFF tagset registered exclusively to Intergraph. Other companies (such as ESRI, and Island Graphics) have geographic solutions which are also proprietary or limited by specific application to their software's architecture.

Many GIS companies, raster data providers, and their clients have requested that the companies concerned with delivery and exploitation of raster geographic imagery develop a publicly available, platform interoperable standard for the support of geographic TIFF imagery. Such TIFF imagery would originate from satellite imaging platforms, aerial platforms, scans of aerial photography or paper maps, or as a result of geographic analysis. TIFF images which were supported by the public "geotie" tagset would be able to be read and positioned correctly in any GIS or digital mapping system which supports the "GeoTIFF" standard, as proposed in this document.

The savings to the users and providers of raster data and exploitation softwares are potentially significant. With a platform interoperable GeoTIFF file, companies could stop spending excessive development resource in support of any and all proprietary formats which are invented. Data providers may be able to produce off-the-shelf imagery products which can be delivered in the "generic" TIFF format quickly and possibly at lower cost. End-users will have the advantage of developed software that exploits the GeoTIFF tags transparently. Most importantly, the same raster TIFF image which can be read and modified in one GIS environment may be equally exploitable in another GIS environment without requiring any file duplication or import/export operation.

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1.1.2 History

The initial efforts to define a TIFF "geotie" specification began under the leadership of Ed Grissom at Intergraph, and others in the early 1990's. In 1994 a formal GeoTIFF mailing-list was created and maintained by Niles Ritter at JPL, which quickly grew to over 140 subscribers from government and industry. The purpose of the list is to discuss common goals and interests in developing an industry-wide GeoTIFF standard, and culminated in a conference in March of 1995 hosted by SPOT Image, with representatives from USGS, Intergraph, ESRI, ERDAS, SoftDesk, MapInfo, NASA/JPL, and others, in which the current working proposal for GeoTIFF was outlined. The outline was condensed into a prerelease GeoTIFF specification document by Niles Ritter, and Mike Ruth of SPOT Image.

Following discussions with Dr. Roger Lott of the European Petroleum Survey Group (EPSG), the GeoTIFF projection parametrization method was extensively modified, and brought into compatibility with both the POSC Epicentre model, and the Federal Geographic Data Committee (FGDC) metadata approaches.

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1.1.3 Scope

The GeoTIFF spec defines a set of TIFF tags provided to describe all "Cartographic" information associated with TIFF imagery that originates from satellite imaging systems, scanned aerial photography, scanned maps, digital elevation models, or as a result of geographic analyses. Its aim is to allow means for tying a raster image to a known model space or map projection, and for describing those projections.

GeoTIFF does not intend to become a replacement for existing geographic data interchange standards, such as the USGS SDTS standard or the FGDC metadata standard. Rather, it aims to augment an existing popular raster-data format to support georeferencing and geocoding information.

The tags documented in this spec are to be considered completely orthogonal to the raster-data descriptions of the TIFF spec, and impose no restrictions on how the standard TIFF tags are to be interpreted, which color spaces or compression types are to be used, etc.

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1.1.4 Features

GeoTIFF fully complies with the TIFF 6.0 specifications, and its extensions do not in any way go against the TIFF recommendations, nor do they limit the scope of raster data supported by TIFF.

GeoTIFF uses a small set of reserved TIFF tags to store a broad range of georeferencing information, catering to geographic as well as projected coordinate systems needs. Projections include UTM, US State Plane and National Grids, as well as the underlying projection types such as Transverse Mercator, Lambert Conformal Conic, etc. No information is stored in private structures, IFD's or other mechanisms which would hide information from naive TIFF reading software.

GeoTIFF uses a "MetaTag" (GeoKey) approach to encode dozens of information elements into just 6 tags, taking advantage of TIFF platform-independent data format representation to avoid cross-platform interchange difficulties. These keys are designed in a manner parallel to standard TIFF tags, and closely follow the TIFF discipline in their structure and layout. New keys may be defined as needs arise, within the current framework, and without requiring the allocation of new tags from Aldus/Adobe.

GeoTIFF uses numerical codes to describe projection types, coordinate systems, datums, ellipsoids, etc. The projection, datums and ellipsoid codes are derived from the EPSG list compiled by the Petrotechnical Open Software Corporation (POSC), and mechanisms for adding further international projections, datums and ellipsoids has been established. The GeoTIFF information content is designed to be compatible with the data decomposition approach used by the National Spatial Data Infrastructure (NSDI) of the U.S. Federal Geographic Data Committee (FGDC).

While GeoTIFF provides a robust framework for specifying a broad class of existing Projected coordinate systems, it is also fully extensible, permitting internal, private or proprietary information storage. However, since this standard arose from the need to avoid multiple proprietary encoding systems, use of private implementations is to be discouraged.

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