

EarthSat NaturalVue®

NaturalVue-Rev2:

A Global Landsat Image Dataset

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Executive Summary

This document describes MDA Federal Inc's EarthSat NaturalVue-Rev2 product consisting of complete global coverage of natural color-enhanced Landsat digital data (acquired circa year 2000), which has been precision orthorectified and seamlessly mosaiced.

Under a series of NASA contracts, extending between 1997 and 2004, MDA Federal Inc. (MDAF) has produced three epochs of global Orthorectified Landsat data coverages, referred to as GeoCover-Ortho products. These GeoCover-Ortho products, along with a number of derivative products, are available from both MDAF and the USGS EROS Data Center in Sioux Falls, SD.

The suite of NaturalVue products has been produced by MDAF from the circa year 2000 (Landsat-7 based) GeoCover-Ortho products. The NaturalVue products are only available directly from MDAF and MDAF authorized distributors.

Background

The GeoCover-Ortho program began in 1998 with a contract between MDAF (then known as Earth Satellite Corporation) and NASA to generate precision orthorectified image products of circa 1990 Landsat TM data along with a spatially coregistered set of orthorectified circa mid-1970s Landsat MSS data. This program was completed in December of 2002. In February of 2002, MDAF was awarded a follow-on NASA contract to create a circa 2000 coverage of orthorectified Landsat-7 ETM+ data which was produced to be systematically coregistered with the earlier Landsat TM and MSS GeoCover-Ortho products.

The circa 1990 TM and circa mid-70's MSS coverage consisted of approximately 7,600 and 8,000 Landsat scenes, respectively. The circa 2000 Landsat ETM+ GeoCover-Ortho product was expanded to 8,500 scenes to include the vast majority of the ocean islands. Figure #1 shows the coverage of the circa 2000 GeoCover-Ortho product in green. Given these were the inputs data to the NaturalVue product, the green color also shows the coverage of the NaturalVue-Rev2 product.

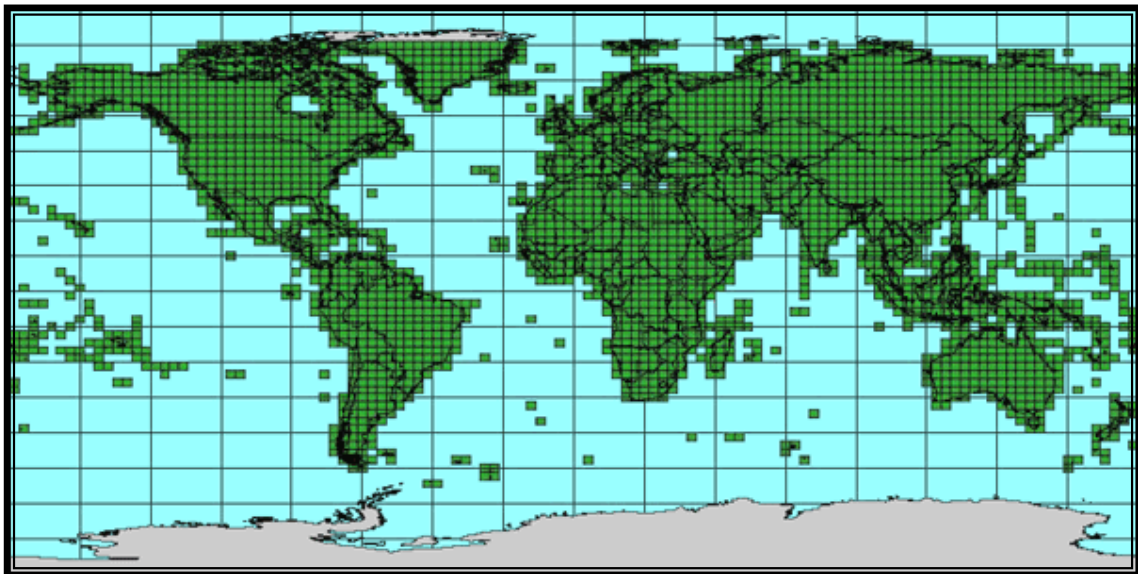


Figure #1 - Coverage of MDAF's EarthSat NaturalVue-Rev2 product (derived from the circa year 2000 GeoCover-Ortho dataset)

The NASA accuracy specification for the GeoCover-Ortho products was 50m RMSEr, everywhere in the world. The best available US Government vertical and horizontal control was provided to MDAF by NGA in support of the GeoCover-Ortho production. The GeoCover-Ortho products, using a patented orthorectification technique developed by MDAF, have achieved independently validated horizontal errors under 25 meters RMSEr or 53.7 meters at 90% CE. Table 1 illustrates NASA’s validation of the geometric accuracy of the GeoCover-Ortho data.

Area	RMSE (m)	90% CE (m)
Northeastern Africa	25	53.7
Middle East	22	47.2
United States	19	40.8

Table 1. Horizontal Accuracy of GeoCover-Ortho

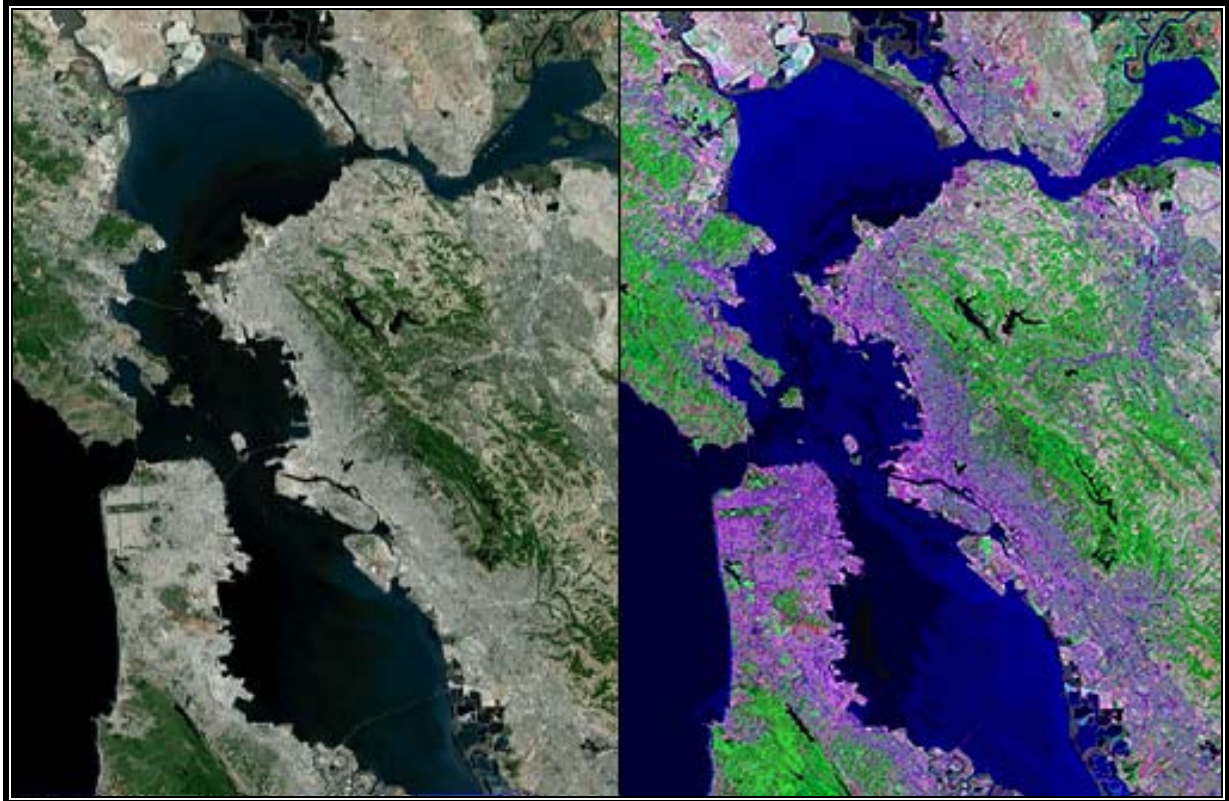
NASA invested over 20 million dollars for the 1975 and 1990 datasets. For the year 2000 dataset, NASA and USGS together invested a total of over 6 million dollars.

MDAF’s NaturalVue 2000 Landsat Mosaic Product

Using the visible red, green, and blue spectral bands of the Landsat ETM+ sensor, it is possible to create a straight forward “true color” image by simply color compositing ETM+ bands 3,2, and 1 as R,G, and B, respectively. However, the generation of true natural color Landsat imagery by such an approach is consistently plagued by the strong attenuation affect of haze in the higher frequency bands (ETM 1 and 2) and is further challenged by the low reflectance of vegetation in each of these three spectral bands. To counteract this effect, several image processing techniques have been developed over the course of the past 20 years. Each has advantages and disadvantages. Over the past few years, MDAF has been actively engaged in research aimed at establishing a systematic processing technique that will consistently produce a high quality natural color image while, as the same time avoiding the issues of atmospheric distortion and low vegetation response. The first revision of the NaturalVue product (NaturalVue 2000) used an MDAF proprietary technique (MDAF SNAC) which used a uniquely weighted linear band combination of the six reflective ETM+ spectral bands (Bands 2,3,4,5, and 7) to produce the final simulated natural color image. The SNAC approach had the disadvantage of leaving a residual bluish-purple colorization within the urban areas.

The EarthSat NaturalVue-Rev2 product is created using a proprietary colorization technique that transforms specially enhanced color composite of ETM+ 7,4,2 (as R,G,B) into an “out-the-window” realistic image of the earth’s surface. The colorization process is the result of over 10 man/months of effort in determining subtle manipulations of color space dimensions to map the false color 742 into a natural color gambit.

Figures 2, 3 and 4 show side-by-side comparisons of the San Francisco, CA area as the original 742 color composite and the NaturalVue-Rev2 product.



NaturalVue-Rev2

742 composite

Figure 2: San Francisco Metropolitan Area, NaturalVue-Rev2 vs. 742



NaturalVue-Rev2

742 composite

Figure 3: San Francisco Airport at 15-meters, NaturalVue-Rev2 vs. 742



Figure 4: Downtown San Francisco (Showing Golden Gate & Bay Bridges) showing NaturalVue-Rev2 (Top) vs. 742 composite (Bottom)

Projection and Pixel Size

The NaturalVue-Rev2 product is delivered as Geographic (Lat/Long) on the WGS84 datum/spheroid with pixel sizes of 0.5 arc seconds (approximately 15 meters at the equator).

MDAF's NaturalVue Product – The world as it has never been seen before.