

## Operating Systems

Windows XP (32-bit and 64-bit)  
Windows Vista (32-bit and 64-bit)  
Linux Kernel 2.6.x (32-bit and 64-bit)  
Mac OS X (10.4/10.5) Intel 32-bit, PPC 32-bit  
Mac OS X (10.5) Intel 64-bit  
Sun Solaris 10 (32-bit and 64-bit)

## Data Import

ADS  
ASAR Data  
AATSR Data  
ALOS Data:  
• PRISM / PRISM RPC  
• AVNIR-2  
• PALSAR  
ArcGIS Layer File (.lyr)  
ArcGIS® File Geodatabase  
ArcGIS® Personal Geodatabase  
ArcGIS® Enterprise (SDE) Geodatabase  
ASTER Data  
ATSR Data  
AVHRR Data  
AVIRIS Data  
CARTOSAT-1 Data  
DMSP Data  
ECW Format  
Elevation Data:  
• USGS DEM  
• USGS SDTS DEM  
• DTED  
• FORMOSAT-2  
• GEOTIFF & RPC  
• SRTM  
ENVISAT level 1b and level 2 Data  
• MERIS  
• AATSR  
• ASAR  
EOS Data (HDF-EOS format):  
• ASTER  
• MISR  
• MODIS  
EROS A level 1a and 1b Data  
ESRI GRID Format  
ESRI Layers  
FORMOSAT-2  
Generic Image Formats:  
• ASCII (x,y,z columns, grids)  
• BMP  
• ECW  
• Flat binary files  
• GeoJ2K  
• HDF, HDF-EOS  
• JPEG  
• JPEG 2000  
• MrSID  
• PDS  
• PICT  
• PNG  
• SRF  
• TIFF, GeoTIFF  
• XWD  
GeoEye-1:  
• GeoTIFF/RPC  
• NITF/RPC  
Gzip Compressed Files

Hymap Data  
Image Processing Software Formats:  
• ArcView (.bil)  
• ECW  
• ENVI (raster and classification)  
• ERDAS (.lan, .img, .ige)  
• ER Mapper  
• MrSID (up to and including 3.0)  
• RemoteView RSET (with NITF license)  
• PCI (.pix)  
IRS Data in EOSAT Fast Format & Superstructural  
JPEG 2000 Format  
KOMPSAT - 2  
Landsat MSS, TM, ETM Data:  
• EOSAT FAST  
• GeoTIFF  
• GeoTIFF with Metadata  
• HDF  
• NLAPS  
• ACRES CCRS  
• MRLS  
• ESA CEOS  
LAS Lidar Format  
Military Formats:  
• NITF 2.0, 2.1 (with license)  
• NSIF 1.0  
• ADRG, CADRG  
• CIB  
• TFRD  
MERIS Data  
MIVIS Data  
MODIS Data  
MODIS Simulator (MAS-50 HDF) Data  
MrSID Format  
OrbView:  
• GEOTIFF / RPC  
• NITF / RPC  
• Mosaic Tiled  
QuickBird:  
• GEOTIFF / RPC  
• NITF / RPC  
• Mosaic Tiled  
Radar Data:  
• RADARSAT  
• ASAR  
• PALSAR  
• AIRSAR  
• SIR-C/X-SAR  
• TOPSAR  
• ERS  
• JERS  
SeaWiFS (OrbView-2) Data:  
• CEOS  
• HDF  
RapidEYE:  
• GEOTIFF  
• NITF  
SPOT Data:  
• SPOT 5 (DIMAP) and level 1 metadata  
• 1A, 1B, 2A, CAP  
• ACRES  
• HDF Vegetation  
• GeoSPOT  
Thermal Data:  
• TIMS  
• MASTER (MODIS/ASTER Simulator)  
• ASTER

• AATSR  
User-Definable Data Formats  
USGS DOQ Files  
Vector Formats:  
• ARC Interchange Format (Uncompressed)  
• ESRI Shape (.shp) with attributes  
• ENVI (.evf)  
• AutoCAD DXF  
• USGS DLG  
• USGS SDTS  
• MapInfo  
• Microstation .DGN  
WorldView-1 Data:  
• GeoTIFF/RPC  
• NITF/RPC  
• Mosaic Tiled

## Output Formats

ArcGIS Geodatabase  
Microsoft PowerPoint  
PDF  
Encapsulated Postscript (EPS)  
Google Earth:  
• KML Creation  
• Footprints  
• Image Overlay  
Raster Formats:  
• ArcView (.bil)  
• ASCII  
• BMP  
• ENVI  
• ERDAS (.lan, .img)  
• ER Mapper (.ers)  
• ESRI GRID  
• GeoTIFF  
• Gzip Compressed  
• HDF  
• JPEG  
• NITF 1.1, 2.0, 2.1 (with license)  
• PCI (.pix)  
• PICT  
• PNG  
• SRF  
• TIFF  
• XWD  
Vector Formats:  
• ESRI Shapefiles (with attributes)  
• DXF  
• ENVI Vector Format  
Chip from Display to:  
• File  
• PowerPoint  
• Print  
• ArcMap  
Direct Output to Printer  
MPEG  
PostScript  
VRML  
Output to Tape  
Export To:  
• PDF  
• EMF  
• AI  
• EPS  
• SRG  
• BMP  
• JPEG

- PNG
- TIFF
- GIF

## **Display Functions**

Chip To:

- File
- PowerPoint
- Print
- ArcMap

Drag/Drop from:

- ArcGIS
- File System
- Windows Explorer

• Data Manager

Drag/Drop to the:

- Display
- Process
- Workflows

GeoLink with ArcMap

Color Mapping

Color Tables:

- Pre-built Tables
- Interactive Color Table Editor
- Cursor Query for Data/Screen Value, Elevation, Map Coordinates

Dynamic Overlays (unlimited displays)

Histogram Matching Between Displays

Image Flickering and "Movies"

Image Overlays:

- Annotation
- Classification Results
- Contour Lines
- Density (gray level) Color Slicing
- Grid Lines
- Regions of Interest
- Vector Layers

Interactive 2-D Scatter Plotting

Interactive Histograms & Stretching:

- Arbitrary Stretching
- Auto Apply Stretches
- Gaussian Stretching
- Histogram Equalization Stretching
- Histogram Matching Between Displays
- Linear, Piecewise Linear Stretching
- Square Root Stretching
- Import/Export ASCII Look Up Tables
- User-Defined Look Up Tables

Interactive Pixel Editor

Line-of-Sight (Viewshed) Analysis

Link Unlimited Displays

Measurement Tool

Output Displays PowerPoint:

- Create New Presentation
- Append to Existing Presentation

Output Displays to File or Printer

Output Displays of Zoom Window

Quick Filters:

- Sharpen
- Smooth
- Median

Quick Color-Infrared, True-Color Displays

Save and/or Restore Display Group

Select Display Bands from Spectral Plots

Set Default Display Bands

Spatial and Spectral Pixel Editing

Spatial and Spectral Profiles

Sub-Pixel Cursor Location

Unlimited Number of Displays

Virtual Mosaic

Vector Overlays & GIS Capabilities

## **Regions of Interest**

Buffer Zones Around ROIs

Classification Images from ROIs

Export ROIs to Vectors

Input ROIs from ASCII

Interactive, Easy-to-use ROI Definition:

- Draw Polygons, Polylines, Pixels
- Draw ROIs with Interior Spaces (Donuts)
- ROIs from Intersection of Other ROIs
- Multiple Objects Within One ROI
- ROI Definition via Scatter Plots
- Threshold Images to ROI
- Merge ROIs
- Import ROIs from Vectors

Output ROIs to ASCII

ROI Save & Restore

Reconcile ROIs between Images via

Map Coordinates

ROI Growing Based on Statistics

ROI Statistics

## **Data Preparation**

Create New Standard or Virtual Image File from

Existing Bands

Generate Test Image

Mask Generation From:

- Annotation
- Image Data Values
- ROIs
- Intersection of ROIs
- Vectors
- NaN

Mosaic Functions:

- Color Mosaic Preview
- Cutline & Edge Feathering
- Interactively Mosaic Multiple Bands, Files
- Mosaic by Pixel (Line, Sample) or Map Coordinates

• Automatic Color Balancing

• Standard Image or Virtual Mosaic Output

Define Spatial Subset by:

- Drawing on Display
- File, Map Coordinates
- Region of Interest
- Other Image Extent
- Meta Scroll Extent

NITF Metadata Browser

Rotate/Flip Data

Spatial and Spectral Subsets

Storage Order (Interleave) Conversions:

- BSQ, BIL, BIP
- New File or Replace Original

Stretch Data

Subsample Images

## **Pre-processing & Calibration**

Apply Gain & Offset

Bad Band Identification

Bad Line Replacement

Bad Pixel Replacement

Cross-Track Illumination Correction

Dark Subtraction

Destripe Data

Empirical Line Calibration

ERS and Radarsat Data Calibration

Flat Field Calibration

Ignore Pixel Value

Internal Average Relative Reflectance

Calibration

Log Residuals

MODIS Bowtie Correction

Radiometric Calibrations:

- AVHRR
- Landsat MSS, TM, ETM

- TIMS

- QuickBird

Sea Surface Temperature From AVHRR

Thermal Atmospheric Correction

## **Registration & Rectification**

Associate DEM With Image

Automatic Georeferencing of ASTER, AVHRR,

AATSR, ASAR, MERIS, MODIS, Radarsat,

SeaWiFS, SPOT

Subpixel Ground Control Point Locations

Georectify SPOT Using Information From Leader File

Ground Control Points Prediction

Image-to-Map Registration

Image-to-Image Registration

Interactive Ground Control Point Collection

Import Ground Control Points from File

Orthorectification:

- Aerial Photographs (Digital and Frame)

- ASTER

- CARTOSAT-1

- Generic RPC

- Generic Pushbroom Sensors

- IKONOS

- OrbView-3

GeoEye-1

WorldView

FORMOSAT-2

Kompsat-2

QuickBird

SPOT 1-5

Radial Resampling

Rational Polynomial Coefficients

(RPCs) Support

Replacement Sensor Model (RSM)

Real-time GPS Link

Rotated Projections

Save Transformation Matrix to ASCII

Warp Resampling Methods:

- Bilinear

- Cubic Convolution

- Nearest Neighbor

Warping Methods:

- Delaunay Triangulation

- Polynomial

- Rotation, Scaling, Translation (RST)

## **Map Projection Support**

Convert Coordinates Among Projections

Contours From Any Registered Image

Convert Map Projection

Datum Support (>100)

Dozens of Prebuilt Map Projections (Examples Include):

- Universal Transverse Mercator (UTM)

- State Plane

- Gauss-Kruger

- Map Grid of Australia

- Mississippi Standard Transverse Mercator

Ellipsoid Support (>35)

French RGF projection

Pseudo-Projections from RPCs and RSM

User-Defined Map Projections

User-Defined Projection Units

USGS GCTP Projections, Including:

- Albers Conical Equal Area

- Azimuthal Equal Area

- Lambert Conformal Conic

- Space Oblique Mercator (A & B)

- Stereographic

- Transverse Mercator

## **Vector GIS Functions**

Drag/Drop ArcGIS Layers  
ArcGIS Layer Attribute Viewing  
Add Nodes to Vectors  
Annotate Vector Windows  
Attributes:

- Create New Vector Attributes
- Edit Query Vector Attributes
- Import from ArcView Shapefiles, ASCII
- Query to Create New Vector Layer

Burn-in Vectors on Raster Image  
Convert Vector Layer Projection  
Create Contour Vectors from Raster Data  
Create New Vector Layers  
Create Vector Boundaries:

- Countries, States, Coasts, Rivers
- For Whole World
- For Lat/Long Boundaries

Direct Printing of GIS Layers  
Display Vectors with Different Projections in the Same Window  
Drag/Drop to Arrange Layer Order  
Edit Layer Characteristics  
Export Vector Data to Common GIS Formats  
Export Vector Attributes  
GPS Input  
Heads-up (On-screen) Digitizing  
Intelligent Digitizer  
Import Common GIS Formats:

- ESRI Shapefiles
- Arc Interchange
- AutoCAD DXF
- MapInfo
- Microstation DGN
- USGS DLG
- USGS SDTS
- ENVI Native Vector Format

Import from ArcGIS GeoDatabase  
Interactive Vector Layer Querying  
Join Vectors  
Multiple Vector Selection  
On-the-fly Vector Projection Conversion  
Raster to Vector Conversions  
Save Vectors to ArcGIS GeoDatabase  
Split Vectors  
Vector Cursor Query  
Vector Display Zooming  
Vector Editing  
Vector to Raster Conversion

## **Spectral Analysis Tools**

Adaptive Coherence Estimator (ACE)  
Anomaly Detection  
Automated Corner Clustering in N-D Scatter Plot  
BandMax Band Optimization  
Constrained Energy Minimization (CEM)  
Continuum Removal of Images, Spectra  
Decision Tree Classifier  
Extraction of Endmember Spectra  
Integrated Spectral Viewing & Analysis  
Linear Spectral Unmixing  
Least Squares (LS) Fit  
Matched Filtering  
Mixture Tuned Matched Filtering  
Mixture Tuned Target - Constrained Interference  
- Minimized Filter (MTTCIMF)  
N-Dimensional Visualizer (Scatter Plot)  
Orthogonal Subspace Projection (OSP)  
Pixel Editing  
Pixel Purity Index (PPI)  
SAM Target Finder With BandMax  
SMACC Endmember Extraction & Sub-pixel Analysis

SPEAR Tools:

- Change Detection - Two Color Multi - View
- Change Detection - PCA
- Change Detection - Subtractive
- Pan-Sharpener
- Lines of Communication - Water
- Lines of Communication - Roads
- Watercraft Finder
- Relative Water Depth
- Vegetation Delineation and Stress Detection
- Spectral Analogues
- TERCAT (Terrain Categorizations)

Spectral Resampling:

- Predefined Sensor Band Filters
- User Defined Filters
- Spectral Libraries and Images

Spectral Analyst for Material Identification  
Spectral Angle Mapper (SAM)  
Spectral Feature Fitting (SFF)  
Spectral Hourglass Wizard  
Spectral Information Divergence (SID)  
Spectral Libraries Included:

- Minerals, Vegetation, Rocks, Water, Soils, Snow, Manmade
- VNIR, SWIR, MWIR, LWIR

Spectral Library Builder/Importer  
Spectral Library Viewer  
Spectral Math  
Spectral Plots:

- Boxcar Average of Pixel Spectra
- Continuum Removal
- Cursor Query of X,Y Plot Values
- Drag and Drop Spectra Among Plot
- From 3D SurfaceView
- From Image Pixels (Z Profile)
- From Spectral Libraries
- From ROI Averages
- Link Spectral Plots from Multiple Images
- Plot Stacked Spectra
- User-Defined Plot Functions
- Wavenumber or Wavelength

Subspace Background Suppression  
Spectral Slices  
Target - Constrained Interference - Minimized  
Filter (TCIMF)  
Target Detection Wizard  
Vegetation Guided Workflows:

- Fire Fuel Load
- Agricultural Stress
- Forest Health

Vegetation Indices:

- Greenness
- Light-use Efficiency
- Canopy Nitrogen
- Senescent Carbon
- Canopy Water
- Leaf Pigment

Vegetation Suppression Algorithm

## **SPEAR Tools**

Anomaly Detection  
Change Detection - 2 Color Multi-view (2CMV)  
Change Detection - PCA  
Change Detection - Subtractive  
Google Earth Bridge  
Image-to-Map Registration  
Independent Component Analysis  
LOC - Lines of Communication - Roads  
LOC - Lines of Communication - Water  
Metadata Browser  
Orthorectification  
Pan Sharpening  
Relative Water Depth  
Spectral Analogues

Terrain Categorization (TERCAT)

Vegetation Delineation  
Vertical Stripe Removal  
Watercraft Finder

## **Transforms**

Adaptive Coherence Estimator (ACE)  
Band Ratios  
Color Transforms:

- RGB to HSV, HSL, or Munsell HSV
- HSV, HSL, or Munsell HSV to RGB

Decorrelation Stretch  
Independent Components Analysis  
Image Sharpening:

- Color Normalized Spectral
- Gram-Schmidt Spectral
- HSV and Brovey
- PC Spectral
- Preserving Spectral Integrity

Minimum Noise Fraction (MNF)  
Normalized Difference Vegetation Index (NDVI)  
Pan Sharpening (see Image Sharpening)  
Principal Components Rotation  
Saturation Stretch  
Synthetic Color Image  
Tasseled Cap

## **Filters**

Adaptive Filters:

- Frost, Enhanced Frost Gamma, Kuan, Lee, Enhanced Lee, Local Sigma, Bit Error

Convolution Filters:

- High & Low Pass, Laplacian, Directional, Gaussian, Median, Sobel, Roberts

Filtering Preview  
Interactive Fourier Filtering:

- Forward Transform
- Interactive Frequency Domain Masking
- Inverse Transform

Morphology Filters:

- Dilate, Erode, Opening, Closing

Texture Filters:

- Data Range, Mean, Variance, Entropy, Skewness, Homogeneity, Contrast, Dissimilarity, Second Moment, Correlation

User-Defined Filter Kernels

## **Mathematics & Statistics**

Autocorrelation  
Band Histograms  
Band Math and Spectral Math:

- Boolean Operators
- Trigonometric Functions
- Data Type Conversion Functions
- Relational Operators
- Many Other Mathematical Expressions

Correlograms  
Display Statistics:

- Minimum, Maximum, Mean, Standard Deviation

Image Statistics:

- Band Minimum, Maximum, Mean, Standard Deviation, Eigenvalues, Eigenvectors, Covariance, Correlation Matrices

Output Matrix Stats to Image Files:

- Covariance Matrix
- Correlation Matrix
- Eigenvectors

Semivariograms

## **Image Classification**

Adaptive Coherence Estimator (ACE)  
Accuracy Assessment  
AIRSAR Scattering Mechanism Classifier

Automatic Legends for Classified Images  
 Change Detection - PCA  
 Change Detection - 2CMV (2 Color Multi-view)  
 Change Detection - Subtractive  
 Change Detection, Thematic and Grayscale Images  
 Classification Preview  
 Class Statistics  
 Classification Image from ROIs  
 Constrained Energy Minimization (CEM)  
 Decision Trees  
 Density Slicing  
 Interactive User-Defined Rule Classifier  
 Independent Components Analysis  
 Orthogonal Subspace Projection (OSP)  
 Mixture Tuned Target-Constrained Interference-Minimized Filter (MTTCIMF)  
 Receiver Operating Characteristic (ROC) Curves:
 

- Find Optimal Classification Thresholds
- Decrease False Classifications

 Separate Classification Thresholds for Each Class  
 Supervised Classifications:
 

- Binary Encoding
- Parallelepiped
- Mahalanobis Distance
- Minimum Distance
- Maximum Likelihood
- Neural Network
- Spectral Angle Mapper (SAM)
- Spectral Information Divergence (SID)
- Support Vector Machine (SVM)
- TERCAT (Terrain Categorization)

 Target-Constrained Interference-Minimized Filter (TCIMF)  
 Training Data From:
 

- Regions of Interest
- Pixel Spectra
- Library Spectra

 Unsupervised Classifications:
 

- K-Means
- ISODATA

 Vegetation Guided Workflows:
 

- Fire Fuel Load
- Agricultural Stress
- Forest Health

## **Post Classification Tools**

Accuracy Assessment:
 

- Kappa Coefficient
- Confusion Matrix

 Classification to Vector  
 Class Statistics  
 Interactive Class Overlay Tool  
 Reassign Class Colors, Names  
 Spatial Functions:
 

- Buffer Zones Around Classes
- Clump, Sieve, Combine
- Majority & Minority Analysis
- Segmentation Image

 Stratified Random Point Generation

## **Topographic Analysis**

Associate DEM with Image  
 Calculate Slope and Aspect Images  
 Calculate Shaded Relief Image  
 Create DEM From Vector Elevation Contours  
 Hillshade (Shaded Relief Combined with RGB Image)  
 Line-of-Sight (Viewshed) Analysis  
 Rasterize Point Data  
 Topographic Measures:
 

- Convexity
- Plan Convexity

- Longitudinal Convexity
  - Cross Sectional convexity
  - Minimum Curvature
  - Maximum Curvature
- Three-Dimensional Visualization
- 
- Topographic Feature Extraction (Classification):
- Ridge, Channel, Plane, Peak, Pit

## **3-D SurfaceView**

Animated 360° Visualization  
 Associate DEM With Image  
 Change View Interactively Using Mouse  
 Create Fly-Through Sequence:
 

- Interpolate Between User Selected Views
- Follow Annotation Line

 Custom Background Color  
 Drape Image Over 3-D Surface  
 Output Fly-Through Sequence:
 

- MPEG, VRML 2.0

 Overlay Vectors, Regions Of Interest  
 Set Vertical Exaggeration  
 Smooth Image, DEM

## **Annotation and Map Composition**

Map/Print Layout utilizing ArcGIS Templates  
 Utilize ArcGIS Layout Templates  
 Automatic Contour Labeling  
 Automatic Legends for Classified Images, Scale Bars, and Color Ramps Text, Polygons, Polylines, Points, Symbols  
 Burn-in or Overlay Annotations  
 Cartographic Symbols  
 Contour Lines from DEM, Other Images  
 Counting Tool  
 Create Reusable Map Templates  
 Grid Lines: Pixel, Lat/Long &/or Map Grids  
 Inset Images (e.g., Logos) or Vector Plots  
 Interactive Map Composition Using Image Displays  
 Interactively Reposition Annotation and Map Elements  
 Interactive Plot Scaling  
 Rotated Map Projections  
 Save & Restore All Parameters  
 TrueType® Fonts (Plus Add Your Own)  
 User Definable Arrows, Declination Diagrams (True, Grid and Magnetic North)  
 Vector Overlays

## **Radar Functionality**

Adaptive (Speckle Reduction) Filters:
 

- Frost
- Enhanced Frost
- Gamma
- Kuan
- Lee
- Enhanced Lee
- Local Sigma
- Bit Error

 Antenna Pattern Correction  
 AIRSAR Scattering Mechanism Classifier  
 CEOS Tape Reading  
 Convert integrated TOPSAR to:
 

- C-band VV data
- Correlation image
- Digital Elevation Model (DEM)
- Incident Angle image
- L- and P-band polarimetric AIRSAR Data

 Display and Analyze Radar Data Using Standard ENVI tools  
 Edge Enhancement Filters  
 Import ASAR, ERS, JERS, RADARSAT, AIRSAR, TOPSAR, SIR-C/X-SAR, ALOS  
 Incident Angle Images

Multi-Look SIR-C Data  
 Pedestal Height Images  
 Phase Difference Images  
 Polarization Signatures from ROIs & Single Pixels  
 RADARSAT - 2 Endorsement  
 Sigma nought and Beta nought from ERS, Radarsat  
 Slant-to-Ground Range Conversion  
 Synthetic Color Image  
 Synthesize Images from Compressed, Complex Scattering Matrix Data  
 Texture Measures  
 View CEOS Headers

## **General Interface & Operation**

8- and 24-Bit Color, Multiple Displays  
 Access to IDL Functions\*  
 Add Custom Routines to Menu  
 Batch Recording, Queuing, and Playback  
 Build Scripts for Common Functions\*  
 Command Line Use of ENVI Routines \*  
 Context-Sensitive Mouse Descriptions  
 Cursor Coordinates (Pixel & Map) , Data Values, and Elevations  
 Direct Link to GPS Devices (Real-time Input)  
 Edit ENVI Header Information  
 Efficient Memory Management  
 Extensive Preferences Settings  
 Geo-Browser Image Selection from Graphical Index Map  
 Logical Menu-Based GUI (Graphical User Interface)  
 Multi-Processor Aware Algorithms  
 Platform-Independent Operation  
 Recursive Directory Scanning for Files  
 Support for Files Greater than 2GB  
 User-Configurable Menus & Buttons

## **Modules**

ENVI Atmospheric Correction Module  
 ENVI Certified NITF Module:
 

- ENVI Certified NITF Module with TFRD

 ENVI DEM Extraction Module for Stereo Images  
 ENVI Feature Extraction Module  
 ENVI Orthorectification Module  
 SARscape Family of Modules for ENVI

## **Documentation**

Context-Sensitive Help  
 Module Documentation  
 On-line, Hyperlinked Documentation  
 Printed Documentation  
 Programmer's Guide (with Examples)  
 Training Manuals  
 Tutorials & Sample Data  
 User's Guide

\* Only available in ENVI+IDL.

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