This page is intentionally left blank.

Appendices

Appendix A: Background

Aerial sketchmapping is the geo-locating of features observed on the ground from an aerial platform and the subsequent recording of these features on maps or photographs. Aerial sketchmapping for forest health protection has been conducted since the 1940's. Typically, sketchmapping surveyors fly the area to be surveyed in a high-winged, high performance mono-plane, such as a Cessna 206, at elevations of 1000 – 3000 feet above the ground. The surveyor tracks the plane's location on a hardcopy map (typically several maps that are trimmed, edge-joined and taped together) or aerial photographs, then sketches areas of the forest that have been damaged by insects, diseases, weather, fire, and other natural and abiotic disturbances. The sketched features (points and polygons) are then registered and digitized into a Geographic Information System (GIS). Finally, the resulting GIS data are used to create maps and reports at the forest, regional and national levels.

Although skilled surveyors have successfully employed manual sketchmapping techniques for years, there is potential for error in the process. Some examples of the sources of error are:

- Not knowing the aircraft's location on the map, particularly in unfamiliar or flat terrain,
- The 're-inking' of map data upon completion of the day's flying, and
- Inaccurate registration, line following and attribute capture when digitizing data into the GIS.

In addition to the potential for error, some of the processes used in manual sketchmapping require additional time to complete. Some of those processes that would be eliminated with a digital system are:

- The 're-inking' of map data upon completion of the day's flying,
- The management of numerous taped and folded maps in the cockpit, and
- The taping and folding of maps prior to the mission, the cutting apart of those maps prior to digitizing, and the re-taping of the maps after digitizing, but prior to proof-checking the digitizing results.

System Capabilities

To be favorably compared against manual sketchmapping, a competent D-ASM system should address the problems listed above and should meet the following list of requirements which we developed for this project:

1. The map display must be linked to a GPS receiver so that an icon on the display represents the current position of the aircraft on the movable digital map.
2. The map display must update quickly at ground speeds of 130 mph and re-orient when turning, if desired by the surveyor, based on the GPS position and heading of the aircraft.
3. The screen must be viewable under a variety of lighting conditions including full sunlight, and must also display, at minimum, full (256) color.
4. The viewable screen size must be at least 10" measured diagonally.
5. The software must have the capability to:

    - Digitize points, lines, and polygons – including nested and overlapping polygons.
    - Attribute digitized features (points, lines, and polygons) quickly and easily.
    - Allow editing of feature attributes quickly and easily.
    - Allow the user to pre-define the feature attributes to be collected during that day's mission.

- Collect the GPS log file of the flight.
- Allow the user to zoom quickly to different map scales.
- Retrieve and display common raster and vector data types as background maps quickly and seamlessly (including the USGS 1:100,000-scale DRGs that aerial surveyors currently use in hardcopy form).
- Export files in a format that is easily imported into ESRI Arc/Info software, thus eliminating the intermediate digitizing step.
- Save data automatically to the computer's disk.

6. The hardware should be operational in moderately harsh conditions (32 – 120 degrees F, high humidity, dusty conditions).
7. The primary input device must be a touchscreen with stylus.

Appendix B: Hardware Technical Specifications

B.1 Laptop PC

B.1.1 Panasonic Toughbook, Model CF-47 (Fig. B.1.1a)

Key Specifications:

- Operating System: Windows 98
- Processor: Intel Mobile Pentium III 450 MHz
- RAM: 256 MB
- Hard Drive: 12 GB with 4 GB partitioned as C: drive by default
- RS232 Dsub 9-pin serial port connector
- Dsub 15-pin external video connector
- Video Adaptor: NeoMagic Magic Media 256 AV w/ 2.5 MB Video RAM
  Typical Display Settings: High (16-bit) Color at 1024 x 768 pixel resolution
- PCMCIA Slot for two Type I or Type II or one Type III
  Configured for Intel PRO/100 CardBus II Network Adaptor
- USB port
- 24x Max CD-ROM Drive
- 3-1/2" Floppy disk drive
- AC Adaptor w/ Input: 100 – 240v AC, 50 Hz / 60 Hz, Output: 15.5v DC, 3.85 A
- Dimensions: 12.1" wide x 1.8" high x 10" deep
- Weight: 6.8 lb.

Ports and Controls (Figs. B.1.1b, B.1.1c, & B.1.1d)

- Power Switch (A). Turns the laptop computer on or off. The laptop should be the last component turned on when starting up the D-ASM system, and the first shut down when turning the system off
- PC Card Slots (B). Used for network adaptor. Do not connect or disconnect network connection cable unless the computer has been powered off.
- Floppy Disk Drive (C)
- CD-ROM Drive (D)
- Touch Pad (E)
- DC-IN Jack (F). Connects Panasonic AC Adaptor from 120v AC house current or Lind Model PA1540-228A from Gator Photo Breadboard Power Distribution Board's 12v DC output.
- External Keyboard / Mouse Port (G). For external mouse in lieu of ToughBook's Touch Pad (E).
- Parallel Port, Dsub 25-pin female Port (H). Mounts GeoLink Software Key to the ToughBook.
- USB Port (I). 4-pin, Type A female. Connects to USB-RS232 Converter Cable or Edgeport/2 Serial Port Adaptor, which is mounted atop the laptop's top lid with Velcro. With either serial port replicator, COM2 is typically assigned to the GPS signal.
- Serial Port, Dsub 9-pin male (J). Configured as COM 1, is connected to the TouchScreen monitor, and used to receive signals from the TouchScreen's stylus.
- External Display Port, Mini Dsub 15-pin female port (K). Sends the video signal to the external TouchScreen monitor.

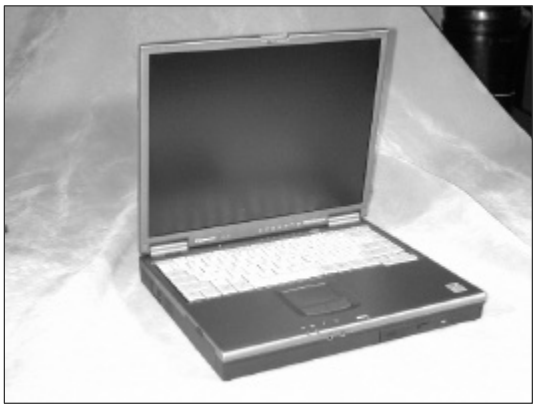


Fig. B.1.1a. Panasonic Toughbook

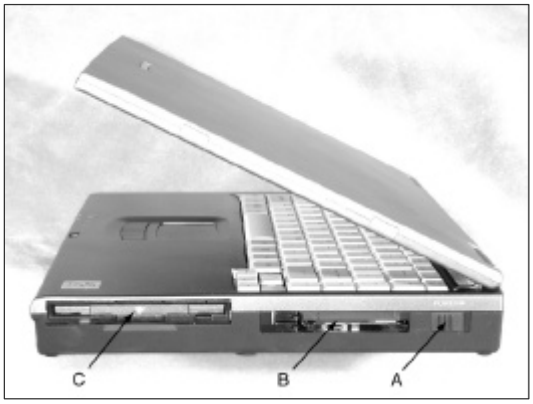


Fig. B.1.1b. Panasonic Toughbook, Right-side View

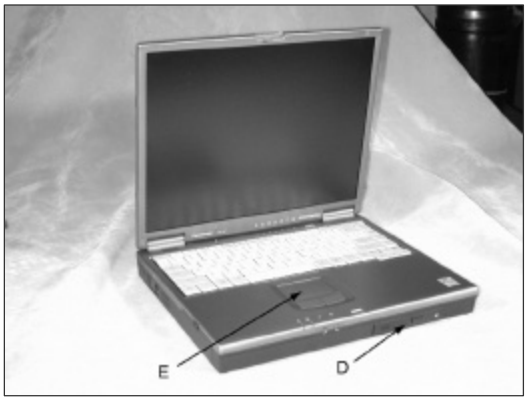


Fig. B.1.1c. Panasonic Toughbook, ¾View

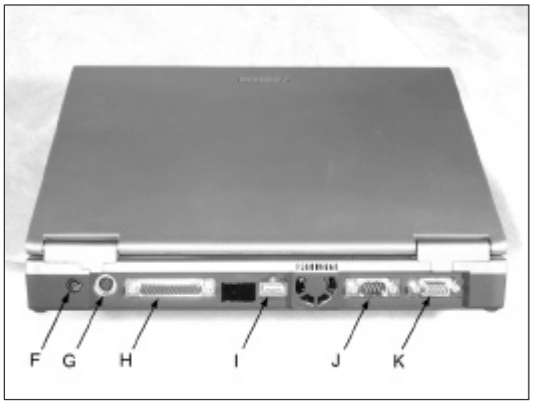


Fig. B.1.1d. Panasonic Toughbook, Rear View

B.1.2 Dell Inspiron 8000e (Fig. B.1.2a)

Key Specifications:

- Operating System: Windows 2000 Professional v. 5.00
- Processor: Intel Mobile Pentium III 850 MHz
- RAM: 512 MB
- Hard Drive: 20 GB
- RS232 Dsub 9-pin serial port connector
- Dsub 15-pin external video connector
- Video Adaptor: ATI Mobility M4 w/ 32 MB Video RAM
  Typical Display Settings: High (16-bit) Color at 1024 x 768 pixel resolution
- PCMCIA Slot for two Type I or Type II or one Type III
  Configured for Xircon Cardbus Ethernet 100 Network Adaptor
- 2 USB ports
- 8x Sony CD-RW CDRX700E CD-ROM Drive
- 3-1/2" Floppy disk drive
- AC Adaptor w/ Input: 90 – 135v AC, 50 Hz / 40 - 63 Hz, Output: 20v DC, 3.5 A
- Dimensions: 12.8" wide x 1.7" high x 10.8" deep
- Weight: 7.2 lb.

Ports and Controls (Figs. B.1.2b, B.1.2c, B.1.2d, & B.1.2e)

- Power Button (A). Turns the laptop computer on or off. The laptop should be the last component turned on when starting up the D-ASM system, and the first shut down when turning the system off.
- Track Stick (B)
- Media Bay containing Floppy Disk Drive (C)
- Touch Pad (D)
- Touch Pad Buttons (E), below Touch Pad.
- Track Stick Buttons (F), above Touch Pad.
- Battery Bay (G)
- CD-RW Drive (H)
- PC Card Slots (I). Used for network adaptor. Do not connect or disconnect network connection cable unless the computer has been powered off.
- AC Adaptor Connector (J). Connects Dell AC Adaptor from 120v AC house current or Lind Model DE2035A-259a from Gator Photo Breadboard Power Distribution Board's 12v DC output.
- PS/2 Connector (K). For external PS/2 keyboard or PS/2 mouse in lieu of Inspiron's Touch Pad/Track Stick.
- Video Connector, Mini Dsub 15-pin female port (L). Sends the video signal to the external TouchScreen monitor.
- Docking Station Connector (M).
- Parallel Connector, Dsub 25-pin female Port (N). Mounts GeoLink Software Key to the Inspiron.
- Serial Connector, Dsub 9-pin male (O). Configured as COM 1, is connected to the TouchScreen monitor, and used to receive signals from the TouchScreen's stylus.
- 2 USB Connectors (P), 4-pin, Type A female. Top Type A connector connects to USB-RS232 Converter Cable or Edgeport/2 Serial Port Adaptor, which is mounted atop the laptop's top lid with Velcro. With either serial port replicator, COM4 is typically assigned to the GPS signal.

Fig. B.1.2a. Dell Inspiron 8000

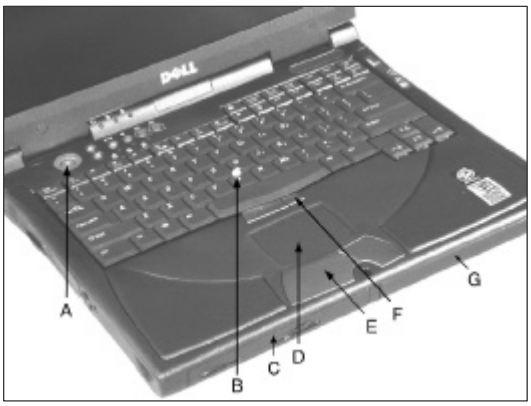


Fig. B.1.2b. Dell Inspiron 8000 Keyboard View

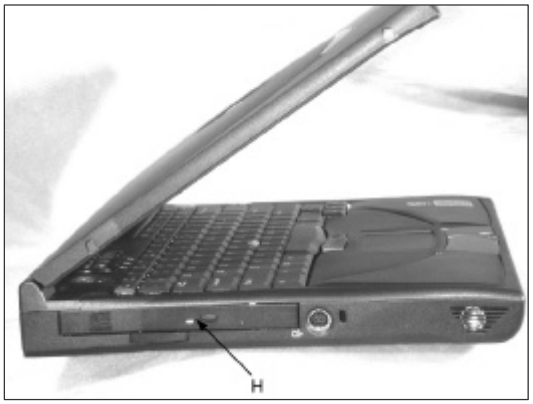


Fig. B.1.2c. Dell Inspiron 8000 Left-side View

Fig. B.1.2d. Dell Inspiron 8000 Right-side View

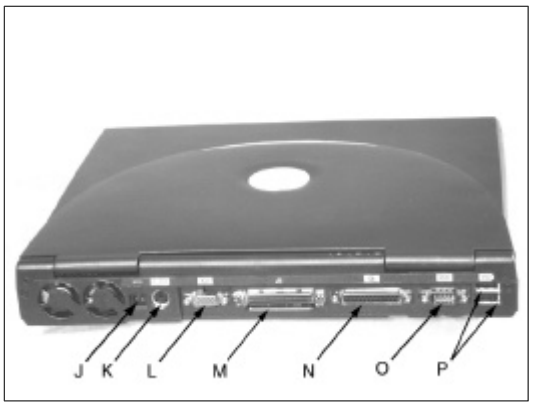


Fig. B.1.2e. Dell Inspiron 8000

B.1.3 IBM ThinkPad, Model 390e (Fig. B.1.3a)

Key Specifications:

- Operating System: Windows 95
- Processor: Pentium III, 300 MHz or better
- RAM: 256 MB
- Hard Drive: 4 GB
- RS232 D-sub 9-pin serial port connector
- D-sub 15-pin external video connector
- Video Adaptor: unknown
- PCMCIA Slot for two Type I or Type II or one Type III USB port
- CD-ROM Drive: unknown
- 3-1/2" Floppy disk drive
- AC Adaptor w/ Input: unknown
- Dimensions: " wide x " high x " deep
- Weight: lb. (with batteries)

Ports and Controls (Figs. B.1.3b, B.1.3c, & B.1.3d)

- Touch Pad (A)
- TrackPoint (B)
- PC Card Slots (C)
- Floppy Disk Drive (D)
- CD-ROM Drive (E)
- External Input Device Connector Port (F). For external mouse in lieu of the ThinkPad's TouchPad (A) or TrackPoint (B).
- Parallel Connector, D-sub 25-pin female Port (G). Mounts the GeoLink Software Key to the ThinkPad.
- Serial Connector, D-sub 9-pin male Port (H). Configured as COM 1, connects to the TouchScreen monitor, and receives signals from the TouchScreen's stylus.
- External Monitor Connector, Mini Dsub 15-pin female Port (I). Sends the video signal to the external TouchScreen monitor.
- Power Jack (J). Connects IBM AC Adaptor from 120v AC house current or Lind Model IB1635-209 from Gator Photo Breadboard Power Distribution Board's 12vDC output.
- USB Connector Port (K), 4-pin, Type A female. Connects to USB-RS232 Converter Cable or Edgeport/2 Serial Port Adaptor, which is mounted atop the laptop's top lid with Velcro. With either serial port replicator, COM4 is typically assigned to the GPS signal..
- Power Switch (L). Turns the laptop computer on or off. The laptop should be the last component to be turned on when starting up the D-ASM system and the first to be turned off when turning off the system.

Fig. B.1.3a. IBM ThinkPad Model 390e

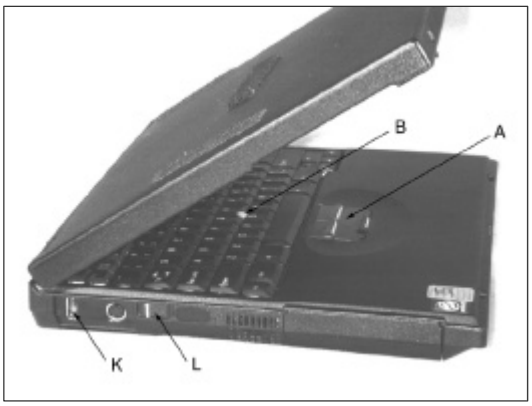


Fig. B.1.3b. IBM ThinkPad Model 390e Left-side View

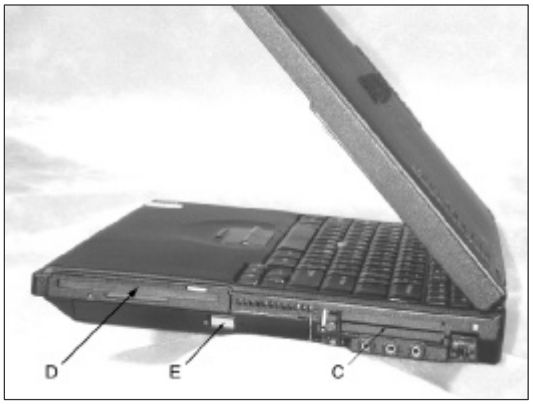


Fig. B.1.3c. IBM ThinkPad Model 390e Right-side View

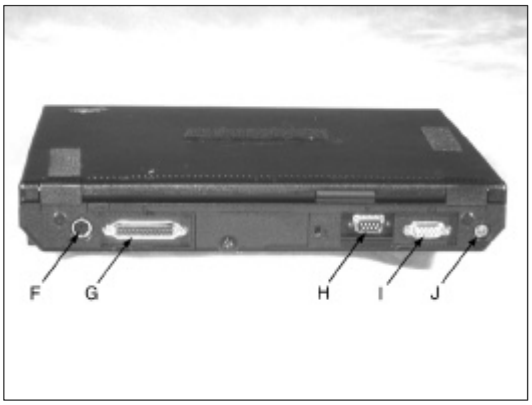


Fig. B.1.3d. IBM ThinkPad Model 390e Rear View

B.2 Touchscreen Monitor:

B.2.1 KDS, Model PB12MAPB (Fig. B.2.1a)

*(**NOTE**:* These Touchscreen models have serial numbers 16000xx and SAM150MP10xx. They have five buttons on their controller cards which can be accessed through holes in the rear cover.

Key Specifications:

- Maximum 1024 x 768 resolution
- 1500 nits brightness
- 12.1” diagonal Capacitive (sensitive to stylus, not hand) screen
- Equipped with detachable tethered stylus on 24” cord
- Dimensions: 13” wide x 12-1/2” high x 3-1/2” deep
- Weight = 7 lb.
- Equipped with AC Adaptor w/ Input: 100 – 240v AC, 50 Hz / 60 Hz, Output: 12v DC, 4.58 A
- Requires 12v DC Input

Ports (B.2.1b)

- External Stylus Port (A). Female phone jack connects to tethered stylus (Fig. B.2.1c)
- Serial Connector Port (B). Dsub 9-pin female connects to COM 1 on the laptop computer via Cable #2 (Fig. B.2.1d), and is used to transmit signals from the TouchScreen’s stylus to the PC.
- DC-IN Connector Port (C). Male 4-pin XLR connects to 120v AC house current via AC Adaptor (Fig. B.2.1e) or to Gator Photo Breadboard Power Distribution Board’s 12v DC output via Cable #1K (Fig. B.2.1f).
- External Display Port (D). Mini Dsub 15-pin female, receives the video signal from the laptop computer via Cable #3 (Fig. B.2.1g).

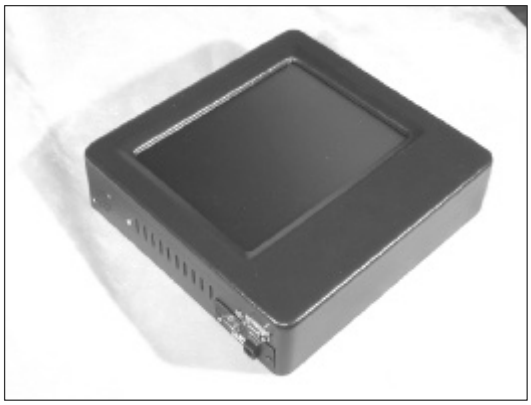


Fig. B.2.1a. KDS Touchscreen

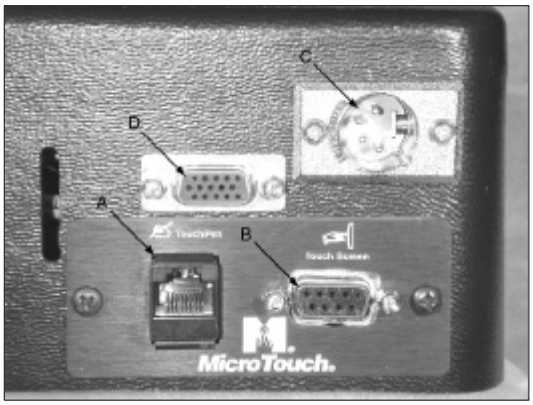


Fig. B.2.1b. KDS Touchscreen Ports

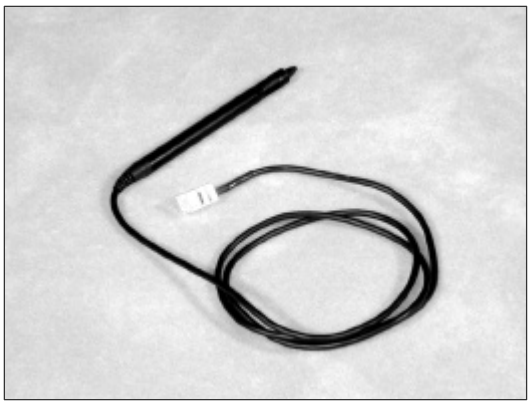


Fig. B.2.1c. Tethered Touchscreen Stylus

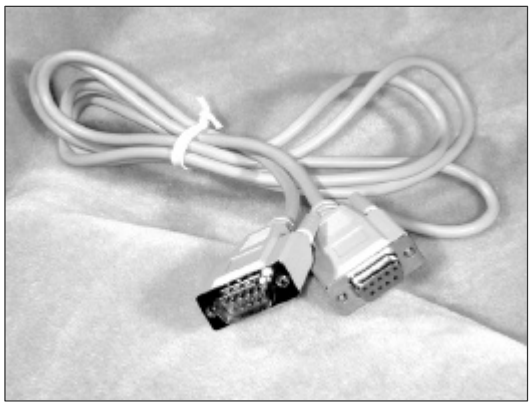


Fig. B.2.1d. Cable 2

Photo Not Yet Available

Fig. B.2.1e. Touchscreen AC Adaptor

Fig. B.2.1f. Cable 1K

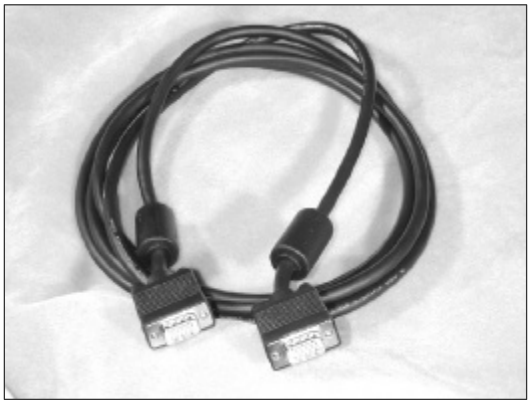


Fig. B.2.1g. Cable #3

B.2.2 Touchscreen Monitor: Preston Peavey, No Model Name (Photos not yet available)

Key Specifications:

- Maximum 1024 x 768 resolution
- 1500 nits brightness
- 15” diagonal Capacitive screen
- Equipped with detachable tethered stylus
- Dimensions: 16-3/4” wide x 12-1/2” high x 3-1/2” deep
- weight = 14-1/2 lb.
- Requires 28v DC Input

Ports (Photos not yet available)

This page is intentionally left blank.

B.3 GPS Receiver

B.3.1 Garmin Model GPS 12XL (B.3.1a) w/ Antenna (Fig.B.3.1b)

Key Specifications:

- 12-channel Receiver, differential-ready
- Displays positions in Geographic (Lat/Long) or UTM projection, among many others
- Default map datum is WGS 84; many others available
- Powered by any 10 - 32v DC source or four AA batteries (up to 24 hours)
- Dimensions: 2.1” wide x 5.8” high x 1.2” deep
- Weight: 9.5 oz. (with batteries)
- Provided with PC Interface Cable for 12v DC Input, and serial cable for data transmission to PC’s additional COM port
- Provided with low-profile external antenna with suction cup base for mounting to aircraft windshield (or magnetic base for attachment to auto roof) and cable with MCX connector to GPS receiver
- Backlit screen with variable contrast
- Outputs include NMEA 0183 Version 2.0 signal with GPGGA sentence
- Equipped with durable carrying case

Ports (Fig. B.3.1c):

- MCX male port (A) for data connection to antenna cable
- 4-pin male port (B) for data connection to PC and power connection to 10 – 32v DC power source via PC Interface Cable 6 (Fig. B.3.1d)
- Two chambers at bottom of Receiver case (C) for four AA batteries. Access is gained by a counter-clockwise quarter-turn of the thumb-loop on base.

Fig. B.3.1a. Garmin GPS Receiver

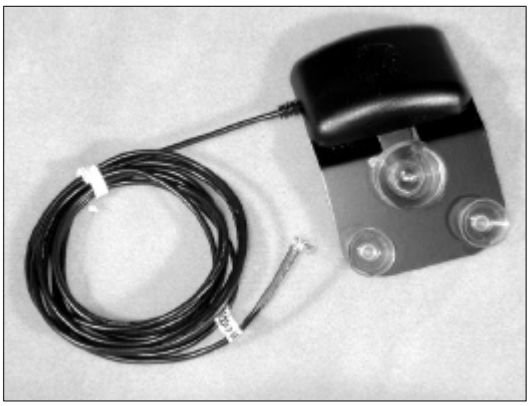


Fig. B.3.1b. Garmin GPS Antenna w/Cable

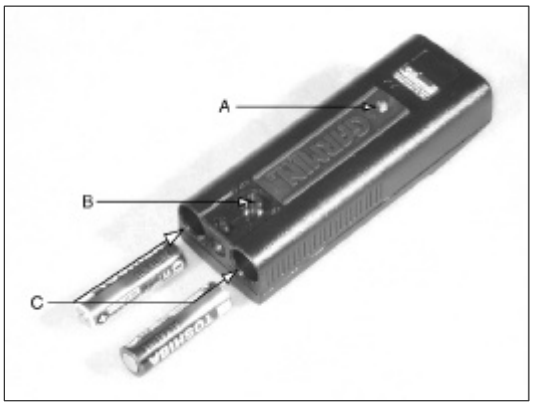


Fig. B.3.1c Rear View Garmin GPS Receiver

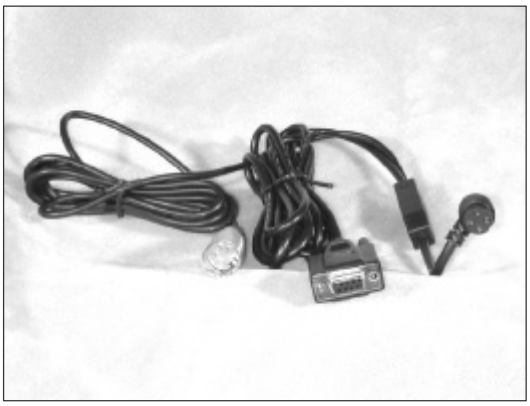


Fig. B.3.1d. Cable 6, Garmin pc Interface Cable

B.3.2 Trimble Centurion Model (Fig. B.3.2a) w/ Antenna (Fig. B.3.2b)

Key Specifications:
6-channel PPS P(Y) code Military Receiver

- Geographic (Lat/Long), UTM and other coordinate systems
- 123 selectable map datums including WGS 84
- Powered by any 9 - 32v DC source or eight AA batteries (5 hours)
- Dimensions: 8.3” wide x 2.5” high x 7.4” deep
- Weight = 3.16 lb. (with batteries)
- Provided with 6 ft. Interface Cable 7 (Fig. B.3.2c) for 12v DC Input with U229/G3 (5-pin audio) connector x male 4-pin XLR connector to Breadboard power
- Provided with 6 ft. serial Cable 8 (Fig. B.3.2d) for data transmission with 329/G2 (6-pin audio) connector x DB-9-pin female adaptor to Edgeport/2 USB serial port adaptor
- Provided with L1/L2 external antenna adapted with suction cup base for mounting to aircraft windshield and 25 ft. Cable 9 (Fig. B.3.2e) with SMA-type female coaxial connectors (Fig. B.3.2f)
- Backlit screen
- Outputs include NMEA 0183 signal with GPGGA sentence

(NOTE: Transfer and use of the Centurion GPS Receiver is restricted by the Department of Defense. It must be returned to MTDC, Missoula, MT, every 240 days to be re-keyed.)

Ports and Controls (Figs. B.3.2g & B.3.2h)

- PowerPort (A). Connects Centurion to breadboard for DC power via Cable 7 (Fig. B.3.2c).
- Data Port: (B). Carries time and GPS position data to laptop PC via Cable 8 (Fig B.3.2d).
- Remote Antenna Port (C). Connects the receiver to Trimble L1/L2 external antenna via Cable 9 (Fig. B.3.2e).
- LCD Display Screen (D). Displays settings and monitors GPS position data. The contents of the screen are determined by the location of the rotary knob and the user-selected options.
- Rotary Knob (E). 8-position switch selects the type of operation to perform.
- CMD/SEL Switch (F). 2-way switch selects the commands available for each rotary knob position.
- (+/-) Increment/Decrement Switch (G). A 2-position switch step through numbers, letters or options. Pressing the switch upward or downward changes the value of the selected item on the screen.
- The Centurion Receiver has a built-in antenna. It works fine for open field use, but an external antenna is required in flight. Other Trimble antennas may work, but may require different cable configurations than those listed here.

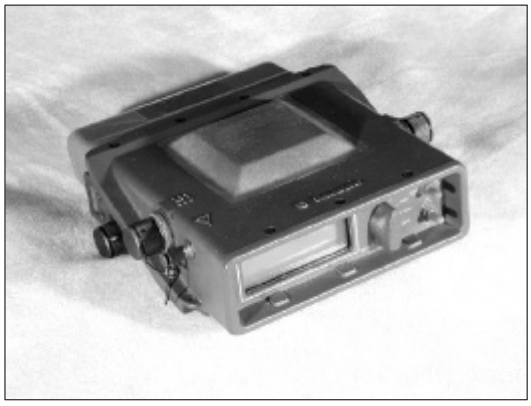


Fig. B.3.2a. Trimble Centurion GPS Receiver

Fig. B.3.2b. Trimble Centurion L1/L2 Antenna

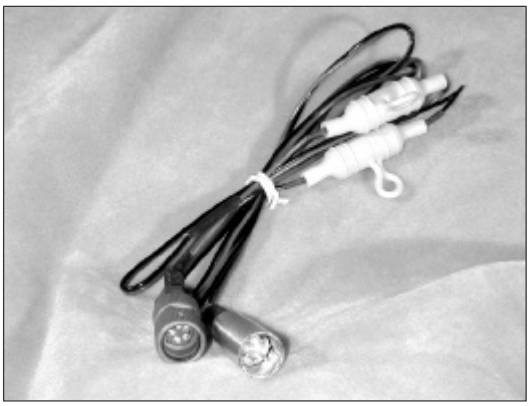


Fig. B.3.2c. Cable 7

Fig. B.3.2d. Cable 8

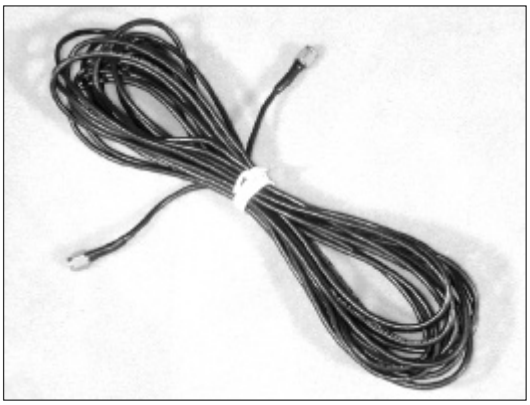


Fig. B.3.2e. Cable 9

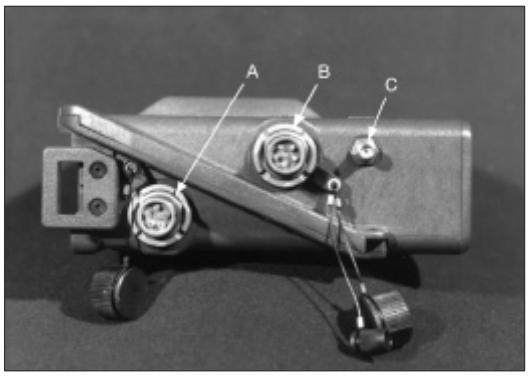


Fig. B.3.2f. Trimble Centurion Side View Ports

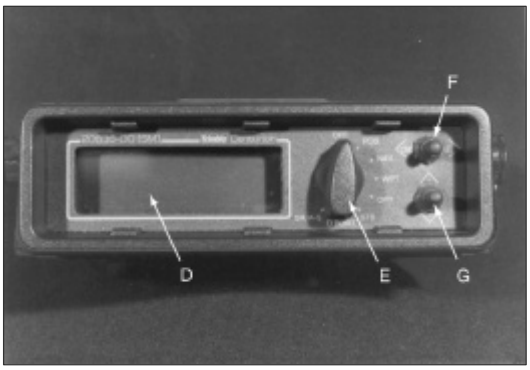


Fig. B.3.2g. Trimble Centurion Front View Controls

B.4 USB Serial Port Adaptor:

B.4.1 Edgeport/2, P/N 301-1000-02 (Figs B.4.1a and B.4.1b)

Key Specifications:
USB to 2 port RS-232 serial connection
Dimensions: 7-1/4” wide x 1” high x 4-1/2” deep
Weight = 9 oz.
Connects to any PC’s USB port by a standard USB-A (PC end) x USB-B (adaptor end) connector Cable 4 (Fig. B.4.1c)

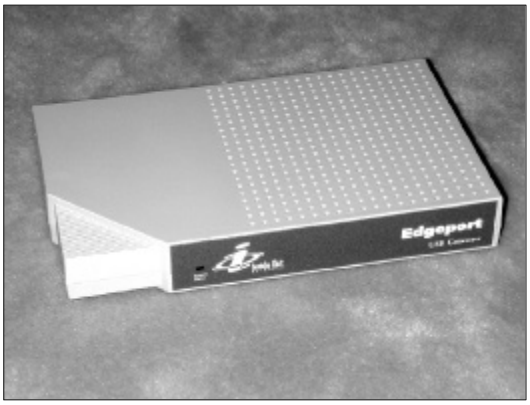


Fig. B.4.1a. Edgeport/2 USB Serial Port Adapter, Front View

Fig. B.4.1b. Edgeport/2 USB Serial Port Adapter, Front View, Ports A & B

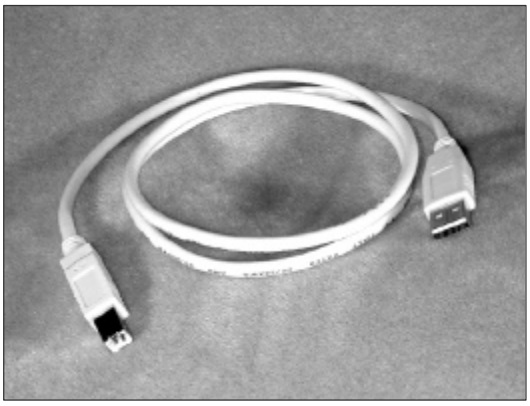


Fig. B.4.1c. Cable 4

B.4.2 USB to RS232 Converter Cable, Model U232-P9 (Fig. B.4.2a)

Key Specifications:
USB to single port RS-232 serial connection
Supports baud rates of 1200 to 115.2k
Operates under Windows 98 and Windows 2000
Length = 6 ft.

Ports:
USB Type A port x RS232 D-sub 9-pin serial port

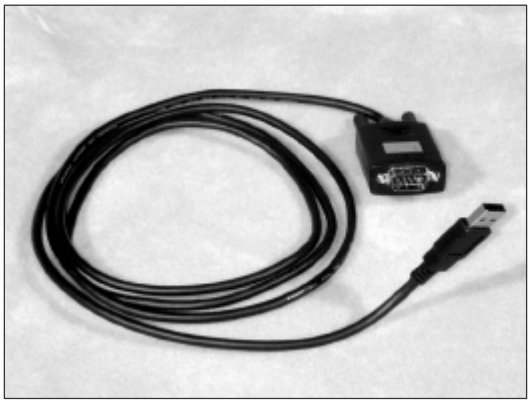


Fig. B.4.2a. USB to RS232 Converter Cable

B.5 Power Distribution Board:

B.5.1 Gator Photo 28 / 12 "Breadboard" (Fig. B.5.1a)

The Breadboard's purpose is to distribute proper voltage to as many as four components when connected to aircraft power. It has a step-down DC converter (A) to convert 24-28v DC to 12v DC and junction box (B) for the four output connectors: three 12v DC four-pin female XLR connectors and one 28v DC three-pin female XLR connector. All output lines are controlled by a circuit-breaker/switch and can be powered off by pulling up on the appropriate breaker/switch.

Key Specifications:
Dimensions: 11-3/4" wide x 4-1/4" high x 15-3/2" deep
Weight = 8 lb. 10 oz.

There are three possible input power connections for the "Breadboard" (Fig. B.5.1b):

- Connects to 28v DC aircraft power w/ attached 10-ft. Power Cable and M 3-pin "Air-Attack" connector (A). In this configuration, power input = 22 – 32v DC and power output = 28v DC (B, 1 port: female 3-pin XLR) and 12v DC (C, 3 ports: female 4-pin XLR).
- Connects to 12v DC aircraft power with 10-ft. Power Cable, M 3-pin Air Attack connector x M 4-pin XLR connector Cable 5 (Fig. B.5.1c). See instructions below. In this configuration, power input = 12v DC and power output = 12v DC (C; 3 ports: female 4-pin XLR)
- Connects to 120v AC power via connection to Regulated DC Power Supply w/attached 10-ft. Power Cable (A) with M 3-pin Air Attack connector. This configuration simulates 28v DC aircraft power, but is used in an office environment.

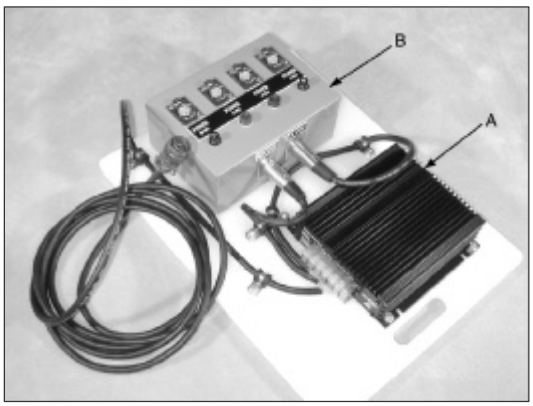


Fig. B.5.1a. Gator Photo “Breadboard” Power Distribution Board

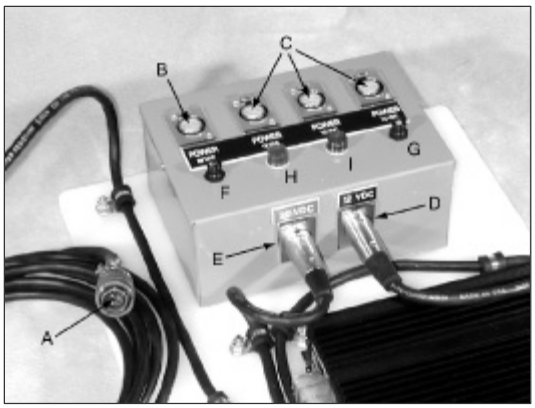


Fig. B.5.1b. “Breadboard” Connectors, Lights, and Switches

Fig. B.5.1c. Cable 5

B.6 Regulated DC Power Supply:

IPC Model RPS-1224 (Fig. B.6a)

Key Specifications:

Input power = 120v AC, 60 Hz, output power = 28v DC, 10 A.
Connectors = 2-prong plug for 120v AC wall current input and F 3-pin “Air-Attack” connector for 28v DC output power.
Dimensions: 8” wide x 5” high x 10-1/2” deep
Weight = 14 lb.

This unit is to be used in an office, AC environment to perform lab tests on all components. We have modified it to output 28v DC power through a standard MS3112E12-3S female 3-pin “Air-Attack” connector.

Fig. B.6a. IPC Model RPS-1224 Regulated DC Power Supply

Appendix C: DRG Bingo v2.2a

This utility is designed to help locate digital raster data that is organized using the USGS Standardized Data Set Naming (DSN) structure, otherwise known as the Bingo or Ohio code. For most digital raster data products from the USGS, this structure is defined as follows:

DSN Convention Applied to DRG Products:

Category + Lat/Lon of Secondary Cell + Map Index Number + Period Operand + File Type

One Alpha	Five Numeric	One Alpha + One Numeric		.	Three Alpha
(A)	(YYXXX)	(A)	(N)	.	(TIF)

```
AYYXXXAN.TIF

Where:

  A = Category (Series, Scale, and Class)
 YY = Degrees Latitude (Secondary Cell)
XXX = Degrees Longitude (Secondary Cell)
 AN = Map Index Number (Primary Cell)
TIF = Tagged Image File Format
```

EXAMPLE: O37091H7.TIF = Rolla, Missouri, 7.5-minute, 1:24,000-scale Topographic Quadrangle

```
Where:

  O = 7.5-minute, 1:24,000-scale Topographic Quadrangle
 37 = Degrees Latitude
091 = Degrees Longitude
 H7 = Map Index Number for the Rolla Quadrangle
TIF = Tagged Image File Format
```

DEFINITIONS:

CATEGORY - One alpha character identifying the series, scale, and class of the DRG.

CATEGORY	SERIES	SCALE	CLASS
R	7.5'	1:20,000	Topographic
O	7.5'	1:24,000	Topographic
P	7.5'	1:24,000	Orthophoto
L	7.5'	1:25,000	Topographic
J	7.5'	1:30,000	Topographic
K	7.5'X15'	1:25,000	Topographic
I	Alaska	1:63,360	Topographic
G	30'x60'	1:100,000	Planimetric
F	30'x60'	1:100,000	Topographic
C	1 x 2 Degree	1:250,000	Topographic

LAT/LONG OF SECONDARY CELL - Expressed in degrees of latitude (2 characters) and degrees of longitude (3 characters), defining the southeast corner (integer grid corner), of the secondary cell.

To maintain unique DSNs throughout this series, the longitude of secondary cells falling in the eastern hemisphere, west of 180-degrees, are incremented upward from 180. As an example, the southeast corner of a
1-degree secondary cell located at 52-degrees north latitude and 175-degrees east longitude (5 degrees west of 180) converts to the following five-character code describing the cell's location: 52185.

SECONDARY CELL - 1-degree by 1-degree cell (except Alaska) defined by integer latitude and longitude. Cells in Alaska vary in size, but are always identified by integer latitude and longitude.

MAP INDEX NUMBER - Two-character alphanumeric code locating the primary cell (quadrangle) within the secondary cell.

TIF - Tagged Image File Format (TIFF) - A tag based file format that is designed to promote the interchange of digital image data.

Naming Structure for DRG Products Prepared by LandInfo International:

LandInfo data are named using a modified DSN code, with the category alpha character dropped and a tiling subdivision added to the end:

Lat/Lon of Secondary Cell + Map Index Number+ LandInfo Tile ID + Period Operand + File Type

Five Numeric	One Alpha +	One Numeric	One Alpha	.	Three Alpha
(YYXXX)	(A)	(N)	(Z)	.	(TIF)

```
YYXXXANZ.TIF

Where:

 YY = Degrees Latitude (Secondary Cell)
XXX = Degrees Longitude (Secondary Cell)
 AN = Map Index Number (Primary Cell)
  Z = LandInfo tile identifier*
TIF = Tagged Image File Format
```

* Each Primary Cell is divided into 25 cells (5 x 5). Each of these cells is named with an alpha character. See the documentation that came with your LandInfo data for a graphic of this schematic.

INSTALLING DRG BINGO

DRG Bingo v2.2a is an Arcview extension; this is advantageous because once the extension is installed on a PC, DRG Bingo v2.2a can be used from any ArcView project on that PC. The DRG Bingo v2.2a extension accesses shapefile data sets that come bundled with ArcView; be sure that these files are installed with ArcView on your PC. They should be located in C:\ESRI\ESRIDATA\USA. The path to these datasets is defined in the extension and it is assumed that ArcView is installed on the PC's C:\ drive.

INSTALLATION FROM THE CD

To install DRG Bingo v2.2a from the CD, simply drag the <yourCD>:\Bingo folder to your C:\ drive. Next, move the extensions (*.avx) to the extensions folder for ArcView C:\ESRI\AV_GIS30\ARCVIEW\EXT32).

INSTALLATION FROM A .ZIP FILE

To install DRG Bingo v2.2a, first you need to define a couple of folders. Make a folder called 'Bingo' at the root of your C:\ drive (C:\Bingo). Next, make a folder called DRGs within the C:\Bingo folder (C:\Bingo\DRGs).

Now open the Bingo2.2a.zip archive file using Winzip and extract all files to the C:\Bingo directory. If you do not have WinZip, it can be down loaded from www.winzip.com. Alternatively, you could unzip the files on another computer and transfer the files via floppies. After unzipping, the C:\Bingo folder should contain shapefiles called 75quad, L48_County, utmzonepts_lines and Lower48. The Alaska version will contain the shapefiles ak_ohio and alaska. Also included is the extension Bingo_v2.2a.avx (For Alaska, Ak_Bingo_v2.1.1.avx), and this Readme file (ReadMev2.2.txt).

Next, move the extension (*.avx) to the extensions folder for ArcView (C:\ESRI\AV_GIS30\ARCVIEW\EXT32).

In the event that you do not have ArcView installed on your C:\ drive, locate the drive where it is installed and place the extension in the extensions folder using the same path (i.e <drive>:\ESRI\AV_GIS30\ARCVIEW\EXT32).

RUNNING DRG BINGO

1.) Launch ArcView and either open an exisiting project or create a new one.

2.) Make the Project (*.apr) window active and select "Extensions" from the "File" pull down menu.

3.) Scroll through the list of available extensions and click the check box next to "USGS DRG Utility, v2.2a". Click the "OK" button. The Alaska DRG Utility will appear in this list as "USGS DRG Utility, v2.1.1-AK"

4.) Turning on the extension loads a view called "Project/Survey Area" into your project. Open this view and you will see a map of state and county boundaries, general water features, and major highways. The Alaska utility will display a map of state and borough boundaries. You will also see a new menu called DRG Tools .

2.) The view "Project/Survey Area" displays, when zoomed in, a grid of 7.5' quad boundaries. On this view, zoom in to your area of interest (AOI). If your data are organized by county, make the 'Western US' theme active and use the identify tool to see which counties your AOI is in.

3.) After you have zoomed the view to your AOI, the theme '7.5' quads' should be visible. Make this theme active and select the 7.5 min quads that cover your AOI by holding the shift key down and using the 'Select feature' tool. Also visible is a theme (30'x 60' Quads) that displays the 1:100,00, 30 x 60 mapsheet boundaries; this theme may help you select the right 7.5' quad tiles for your AOI.

4.) Alternatively, you may select your AOI by typing in the coordinates of the upper left and lower right corners of the rectangular AOI. Make sure that no other AOI is selected by making the '7.5' quads' theme active and clearing all selected features (theme - clear selected features). Now run the DRG Bingo script by selecting the DRG Bingo v2.2 from the DRG Tools menu and you will see a window where the coordinates
can be entered in decimal degrees.

5.) Run the DRG Bingo script by selecting the DRG Bingo v2.2 from the DRG Tools menu. Follow the on-screen prompts. You will first be asked to locate the .tif files on the CD. Navigate through the directory structure on the CD and pick one .tif file in the source location subdirectory. This tells the script where to look for tiles that cover your AOI.

6.) Next, you will be prompted to identify the subdirectory on your hard drive where the .tif files should be written. The default is C:\Bingo\DRGs, which you established in the installation above. You may specify any subdirectory that exists and you have write access for.

7). Five other tools are available in the DRG Tools menu. These tools will help you in organizing image themes in the view. They include tools to turn image themes on and off, making image themes active, and moving image themes from the top to the bottom of the view's table of contents.

HELPFUL HINTS

LOCAL DIRECTORY - You may create a subdirectory anywhere that you have write permission on your machine and write the image files to that folder. The C:\bingo\DRGs directory is created and used as a default for your convenience. If you choose, the script will add all the files present in the specified local directory as themes in the view "Project/Survey Area", so if there are files in this directory that you do not wish to display you should move or delete them.

SELECTING TILES - You may want to clear the selected tiles before running the script. To do this, make sure that '7.5 Min quads' is the active theme and go to 'View/Clear Selected Features'.

WORKING WITH 1:100,000 OR SMALLER SCALE DATA- Each of these tiles may cover 4 or more of the 7.5 min bingo tiles. These larger tiles are named after the bingo cell where their center (or sometimes SE corner) falls, even though they may cover the majority of surrounding bingo cells. So if you are using the utility to assemble these image tiles for a specific area, you may need to select an area that is somewhat larger than your AOI. This is especially true with USGS full 30x60 scanned maps.

Polite suggestions/comments can be directed to:

Charlie Schrader-Patton
Remote Sensing/GIS Analyst
RedCastle Resources, Inc.
USFS Remote Sensing Applications Center
665 NW Sean CT
Bend, OR 97701
541.312.4291
email: cschrader@oregontrail.net

This page is intentionally left blank.

Appendix D: GeoLink default file structure

A GeoLink project is comprised of a series of files and folders, which are created when you establish a project, and log and translate data from within that project (Fig. D.1).

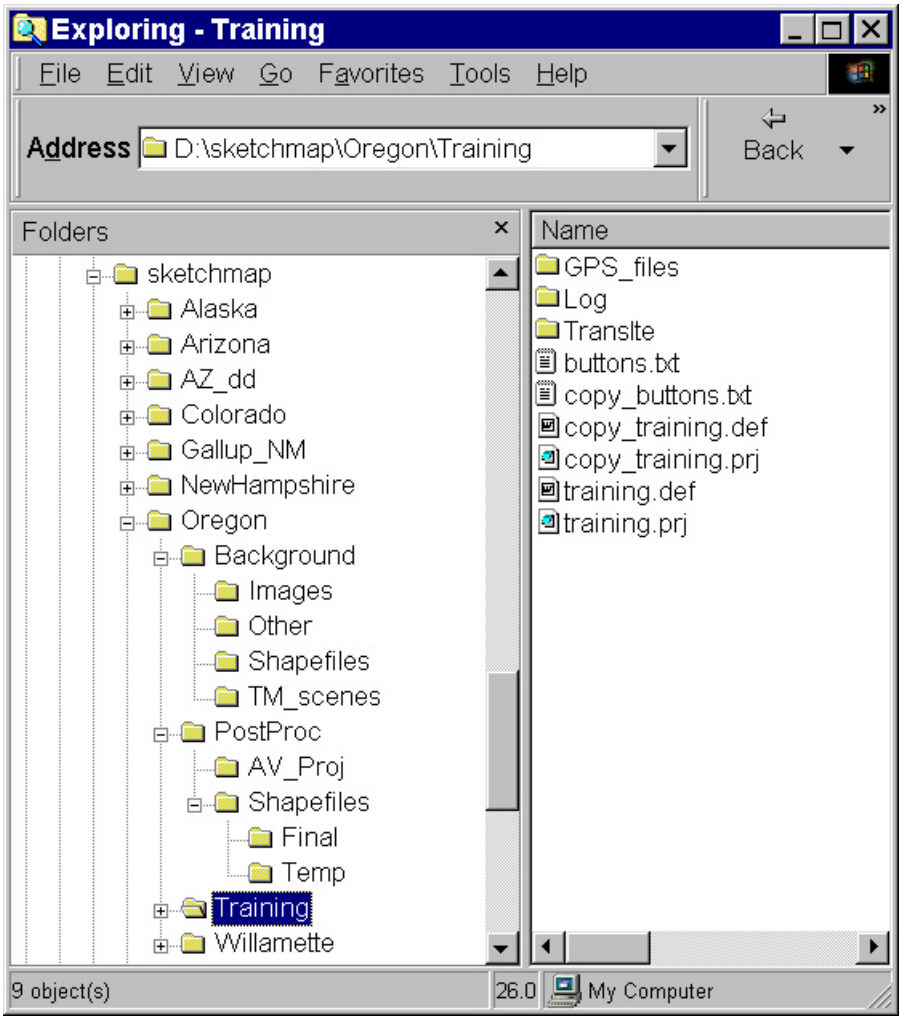


Fig. D.1. The core project files are *.prj, *.def and Buttons.txt.

Using Fig. D.1 as an example, we can see that the project called 'Training' contains three files: Training.prj, Training.def, and Buttons.txt. The .prj and .def files contain path and other parameters for the project; the Buttons.txt file contains the definitions for the virtual keypad keys. When you log data with this project, a folder called Log is created in the same directory as the project. Likewise, when you translate data, a folder called Translte is created. Data are organized in these folders by date and time.

Lets take a closer look at the Log folder in our example (Fig. D.2)

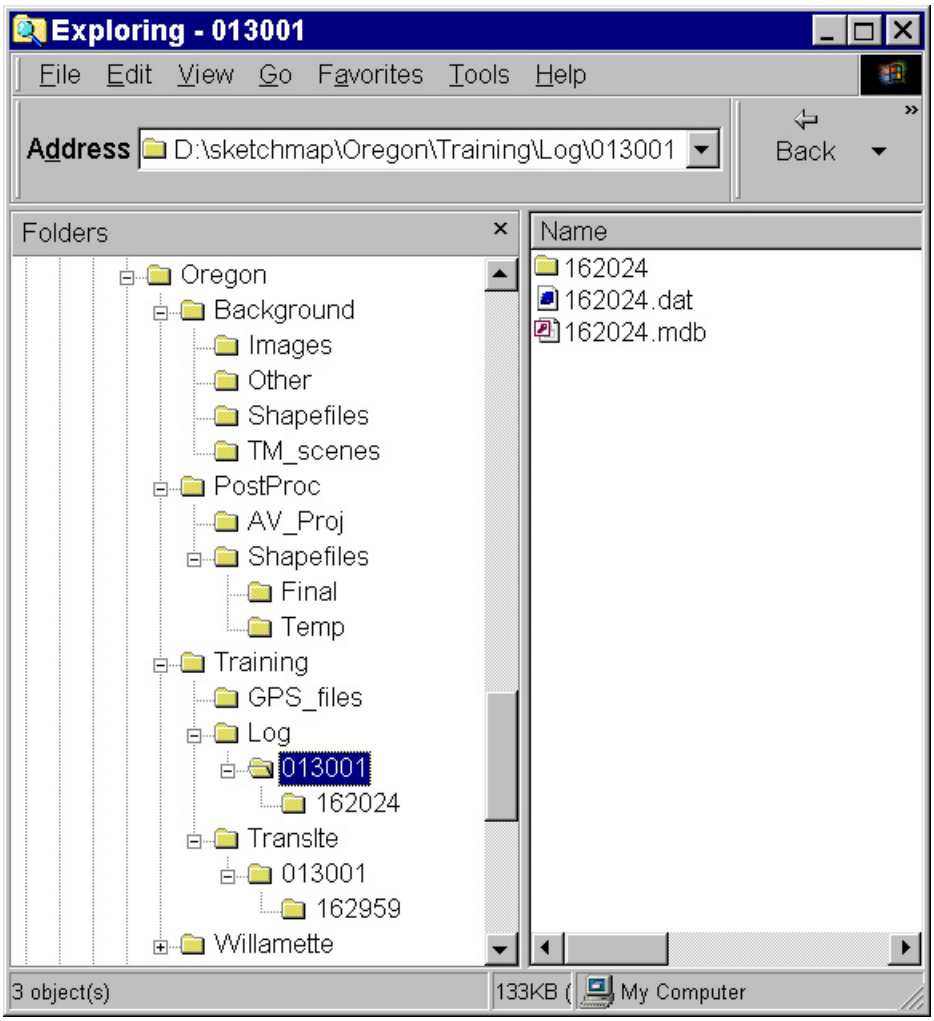


Fig. D.2. In the 'Log' and 'Translate' folders, data are organized by date and time of data collection or translation.

IMPORTANT: Be sure the correct date and time properties set on your PC before you begin to collect or translate data.

When you collect data, a folder is created in the project's Log folder. GeoLink names the folder according to the date on which the data was collected (mmddyy). The date folder for each log session you start on that date will contain two files and a folder; GeoLink will use the time that the log file was started (hhmmss) to name these files and folder. Collectively, these two files and folder are called proto-shapefiles.

In the example above (Fig. D.2), a log file was started at 4:20 pm (162024). The file named 162024.dat is the GPS file collected during the log session; the file named 162024.mdb is the Microsoft Access file that contains the attribute information.

The Translate folder is organized along the same date and time structure as the Log folder. In this example, the data were translated on the same day (013001) at 4:29 pm (162959). (For more information on data management, see section 5.20 of the *GeoLink for Windows User Manual.*)

Appendix E: Post-Processing D-ASM Data

Processing Complex Polygon Coverages

The Digital Aerial SketchMapping (D-ASM) system allows aerial surveyors to collect data directly into a digital format. This changes how these data are post-processed; traditionally, hardcopy products were delivered to GIS personnel and features were digitized and attributed manually. The resulting GIS coverages were then placed into the appropriate projection and format to meet reporting requirements or for further spatial analysis. Instead of receiving hardcopy maps, GIS personnel will now receive digital files from the aerial survey crew. In addition to producing digital files, the D-ASM system also changes how surveyors can collect data in special situations, such as island and overlapping polygons, areas of no-data within polygons, and oversize polygons.

In this document, we will describe some methods of post-processing complex polygon data from the D-ASM system; "complex" polygon data are those datasets that contain overlapping areas, islands within other polygons, and no-data areas within polygons.

The software used in the D-ASM system, GeoLink PowerMap (GeoResearch) outputs geospatial data in ESRI shapefile format. This non-topological format is advantageous because surveyors can perform basic QA/QC editing and other functions in ESRI ArcView software. Additionally, it allows for overlapping polygons; a situation frequently encountered during aerial survey.

We assume that you have received shapefiles that have been processed using the steps described in "D-ASM: Data Post-Processing for Aerial Surveyors". These steps include QA/QC of attribute data, merging of shapefiles, and calculation of original acres. The shapefile feature attribute table should contain a field called 'Acres_1'. The acreage figure in this field was calculated before the various polygon fields were merged; this is the field to use when calculating trees per acre (TPA). Be sure that you know the projection and coordinate system of the shapefile; the aerial survey crew should provide this.

The methods described use both ArcView and Arc/Info GIS software. The target audience for these instructions are GIS Personnel with proficiency in ESRI Arc/Info and ArcView software.

NOTE: The focus of this document is on compiling data to meet the National Forest Health Monitoring GIS (FHM GIS) Standards. However, the methods described here can be modified to create data products to meet other reporting requirements.

Creating a polygon coverage from a shapefile containing overlapping and island polygons

In this example, we will step through the methods used to create a polygon coverage in the FHM GIS format We are assuming that you will receive polygon shapefiles that were either digitized directly as polygons, or were converted from line features. Large polygons may also have been created by dissolving the boundaries between overlapping polygons.

This method describes a process that takes a polygon shapefile with island and overlap features and creates an Arc/Info polygon coverage where the islands and overlaps contain both sets of feature attributes. Islands and overlap polygons will have two, or perhaps three attributes of interest; we will refer to these attributes as the primary, secondary, and tertiary attributes (Fig E.1).

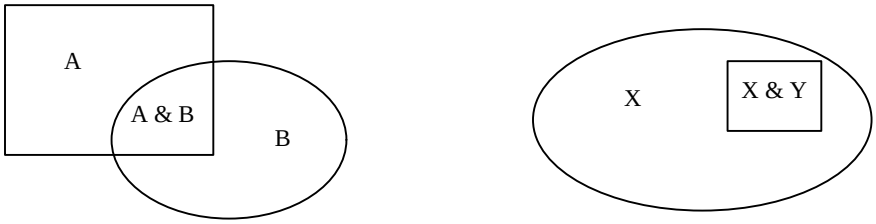


Figure E.1. Overlap and island areas have primary and secondary attributes.

The islands and overlaps may be the result of direct digitization, or from the union of two shapefiles that overlap. Some of the island areas maybe ‘no-data’ exclusion areas surrounded by damage.

The following example shows how to process a polygon shapefile that was collected in the GeoLink software; this process results in a Arc/Info polygon coverage where overlaps and islands are distinct polygons with both primary, secondary, and (if present) tertiary attributes. To deal with the overlapping and island polygons, we will use the REGIONS subclass data model in Arc/Info.

A.) Converting polygon shapefile to an Arc Coverage

Consider the following polygon shapefile. The file is called 'polygons.shp'. The first step is to convert the file to an arc coverage using the SHAPEARC command. The following command creates the arc cover ‘pest’ with the region subclass ‘bugz’:

```
Arc:
Arc:
Arc: shapearc polygons pest bugz
13 Type 5 (POLYGON) shape records in /WSA1/CHARLIE/SKETCHTEST/POLYGONS.
22 unique nodes built for pest
13 preliminary region(s) appended to subclass bugz.
Arc:
```

Now, force the fuzzy tolerance to its lowest setting and clean the coverage:

```
Arc:
Arc: tolerance pest fuzzy .001
Arc: clean pest
Cleaning /WSA1/CHARLIE/SKETCHTEST/PEST
 Checking regions...
 Sorting...
 Intersecting...
The specified tolerance 0.00100000 is below the minimum resolution for
this
data - intersections will be detected with a tolerance of 0.75026557
instead.
 Assembling polygons...
```

```
 Re-building AAT...
Arc:
```

At this point, it would be wise to look at the coverage and determine how many overlap/island polygons it contains. If there are few, you may want to just run ‘REGIONPOLY’ which will create polygons from the regions; then manually add the secondary and (if present) tertiary attributes to the overlap/island polygons. If this is the case, skip down to B below.

If there are more than a few overlaps/islands, continue with the following sequence of commands.

Next, make a copy of the bugz region subclass within the coverage that was cleaned above (pest):

```
Arc:
Arc: copyfeatures
Usage: COPYFEATURES <from_cover> <from_feature_class> {to_cover}
                    {to_feature_class} {ATTRIBUTES | GEOMETRY}
Arc: copyfeatures pest region.bugz # region.cpbugz
Created RXPCPBUGZ,PALCPBUGZ,PATCPBUGZ in cover pest
Arc:
Arc:
```

Use the ‘REGIONQUERY’ command to select the overlap/island areas, which will be placed into a new region subclass called ‘BUGZ2’ in the ‘PEST’ cover:

```
Arc:
Arc: regionquery
Usage: REGIONQUERY <in_cover> {out_cover} <out_subclass>
{selection_file}
                   {NONCONTIGUOUS | CONTIGUOUS} {out_item...out_item}
Arc: regionquery pest # bugz2 # # bugz.* cpbugz.*
Region query with
input cover: /WSA1/CHARLIE/SKETCHTEST/PEST
output cover: /WSA1/CHARLIE/SKETCHTEST/PEST
output subclass: BUGZ2
output items: BUGZ.* CPBUGZ.*
Enter a logical expression. (Enter a blank line when finished)
>: resel bugz.bugz-id <> cpbugz.cpbugz-id
>:
Do you wish to re-enter expression (Y/N)? n
Do you wish to enter another expression (Y/N)? n
Number of Regions for Subclass BUGZ2 (Input,Output) =          0
4
Arc:
Arc:
```

Next, use ‘REGIONPOLY’ to create a polygon cover from the ‘BUGS2’ subclass:

```
Arc:
Arc: regionpoly
Usage: regionpoly <in_cover> <out_cover> <in_subclass> <out_table>
Arc: regionpoly pest pest3 bugz2 bgtab
```

Now, you have a polygon cover (pest3) of the overlap/island polygons with code values from both parent polygons.

The next step is to build a polygon cover from the ‘BUGZ’ subclass. This cover will contain the rest of the polygons in the original shapefile.

```
Arc: regionpoly
Usage: regionpoly <in_cover> <out_cover> <in_subclass> <out_table>
Arc: regionpoly pest pest4 bugz table
```

Combine the two covers (PEST3 and PEST4) into one cover using the ‘UNION’ command:

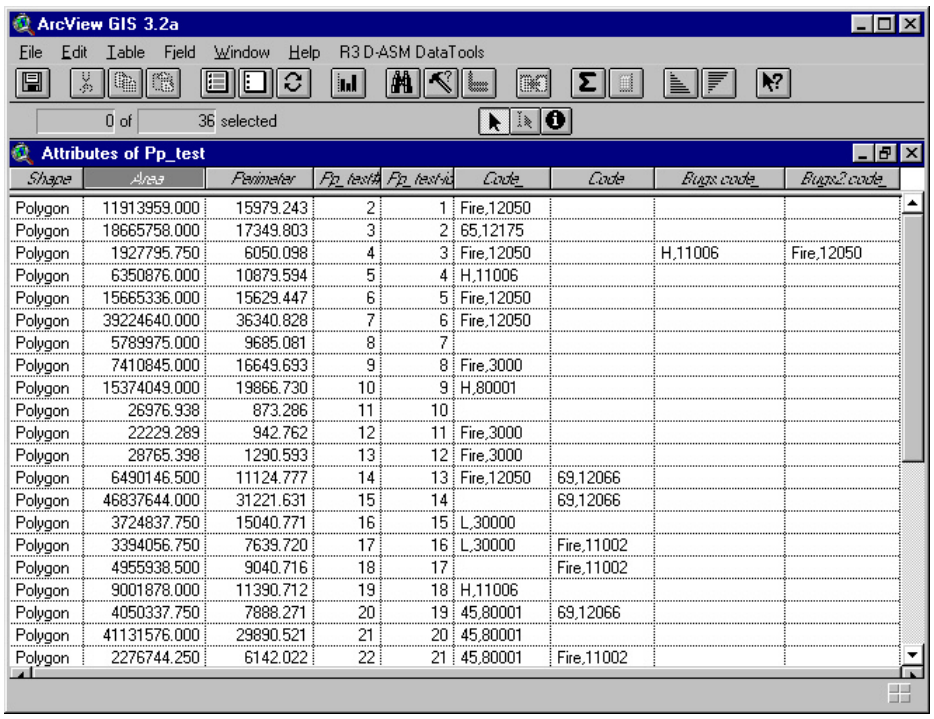
```
Arc: union
Usage: UNION <in_cover> <union_cover> <out_cover> {fuzzy_tolerance}
             {JOIN | NOJOIN}
Arc: union pest4 pest3 pest5
 Unioning pest4 with pest3 to create pest5
 Sorting...
 Intersecting...
 Assembling polygons...
 Creating new labels...
 Creating pest5.PAT...
** Item "AREA" duplicated, Join File version dropped **

** Item "PERIMETER" duplicated, Join File version dropped **

** Item "AREA" duplicated, Join File version dropped **

** Item "PERIMETER" duplicated, Join File version dropped **

** Item "POLY#" duplicated, Join File version dropped **

** Item "SUBCLASS" duplicated, Join File version dropped **

** Item "SUBCLASS#" duplicated, Join File version dropped **

Arc:
```

B.) Convert the feature attribute table to FHM GIS format

Now you have a complete polygon coverage that contains all attributes. The next step is to clean up the .pat table by breaking down the four ‘code’ columns into the three (primary, secondary, and tertiary) code attributes of interest. Open this coverage in an ArcView project and view the attribute table. The feature attribute table may look something like Figure E.2.

The table in figure 2 represents an example polygon dataset that was processed using the method described above. The ‘code’ values contain two comma-delimited attributes; the first attribute is a combined damage type/severity code, the second, a pest code.

Notice also that are four ‘code’ attributes; our next task is to sort out these codes into primary (Code1), secondary (Code2) and tertiary (Code3) attributes.



Shape	Area	Perimeter	Pp_test#	Pp_test-id	Code_	Code	Bugs code_	Bugs2 code_
Polygon	11913959.000	15979.243	2	1	Fire,12050			
Polygon	18665758.000	17349.803	3	2	65,12175			
Polygon	1927795.750	6050.098	4	3	Fire,12050		H,11006	Fire,12050
Polygon	6350876.000	10879.594	5	4	H,11006			
Polygon	15665336.000	15629.447	6	5	Fire,12050			
Polygon	39224640.000	36340.828	7	6	Fire,12050			
Polygon	5789975.000	9685.081	8	7				
Polygon	7410845.000	16649.693	9	8	Fire,3000			
Polygon	15374049.000	19866.730	10	9	H,80001			
Polygon	26976.938	873.286	11	10				
Polygon	22229.289	942.762	12	11	Fire,3000			
Polygon	28765.398	1290.593	13	12	Fire,3000			
Polygon	6490146.500	11124.777	14	13	Fire,12050	69,12066		
Polygon	46837644.000	31221.631	15	14		69,12066		
Polygon	3724837.750	15040.771	16	15	L,30000			
Polygon	3394056.750	7639.720	17	16	L,30000	Fire,11002		
Polygon	4955938.500	9040.716	18	17		Fire,11002		
Polygon	9001878.000	11390.712	19	18	H,11006			
Polygon	4050337.750	7888.271	20	19	45,80001	69,12066		
Polygon	41131576.000	29890.521	21	20	45,80001			
Polygon	2276744.250	6142.022	22	21	45,80001	Fire,11002		

Figure E.2. Feature attribute table with four ‘code’ attributes.

Examine the dataset in detail by opening a view and table window simultaneously in ArcView. Select on various features and notice that the overlap/island features two ‘code’ values (Fig E.3).

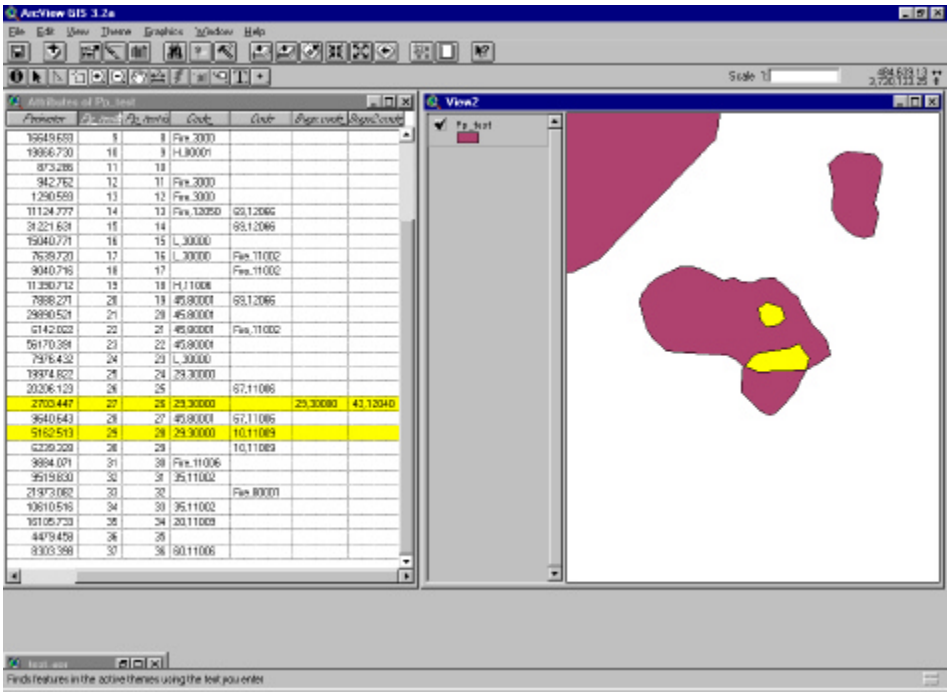


Figure E.3. Islands and overlap features have at least two ‘code’ values.

Some islands will have no ‘code’ values; these are excluded areas within a polygon.

It appears from our table that most of the primary attributes are in ‘Code_’, but there are some features that have their only attribute in ‘Code’. Using the query builder, select those features and copy the values into the ‘Code_’ field. The resulting table (Figure E.4) has a ‘Code_’ field that is entirely populated, with the exception of ‘no-data’ polygons.

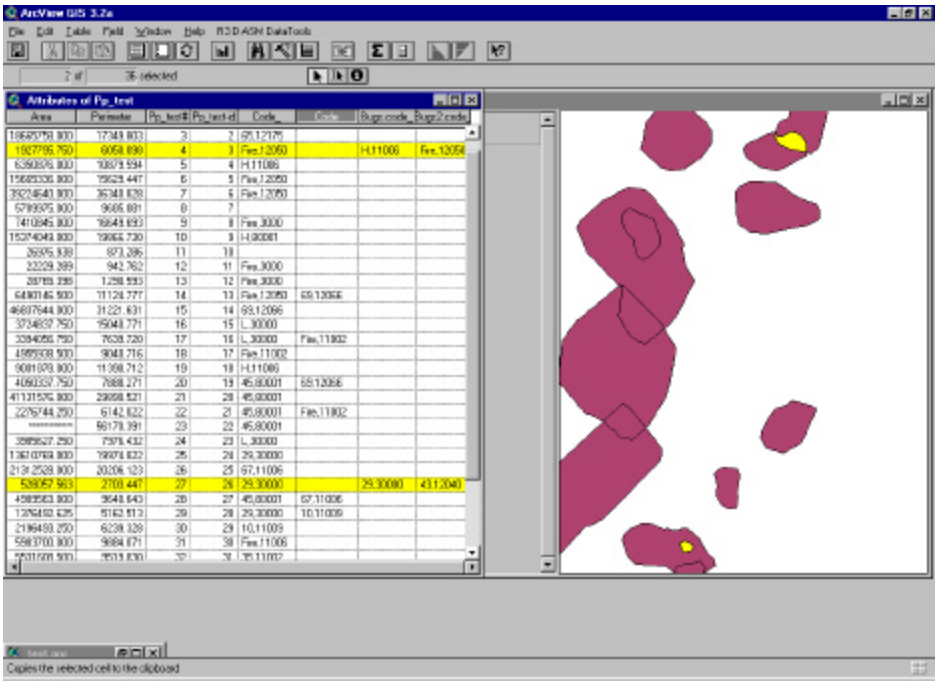


Figure E.4. Some polygons will have redundant ‘code’ values.

Next, examine the dataset and identify those features with redundant ‘code’ values (Figure 4). Populate the field containing the secondary attributes with the non-redundant attribute value (Figure E.5).

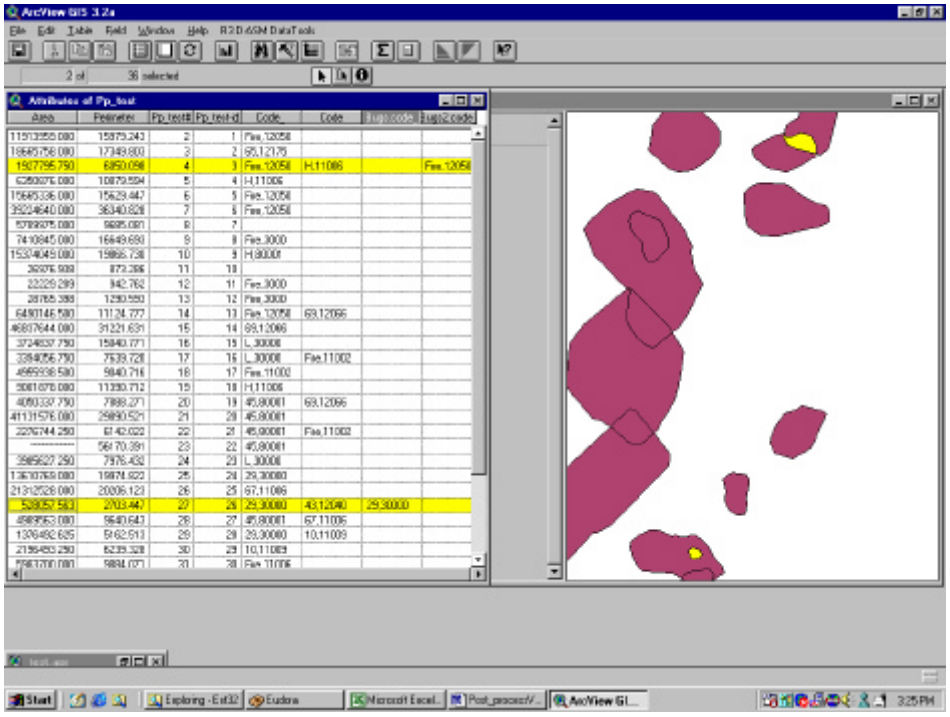


Figure E.5. Secondary attributes now occupy ‘Code’ column.

The data in the ‘Bugs.code_’ and ‘Bugs2.code’ fields is redundant and can be deleted. Examining the dataset, we now see that there are no double overlapping polygons and therefore no tertiary attributes. So the next step is to create ‘Code1’ and ‘Code2’ fields (String, Width 16) and populate them with ‘Code_’ and ‘Code’, respectively (Figure E.6). The table is now in the proper format to use the FHM Data Tools.

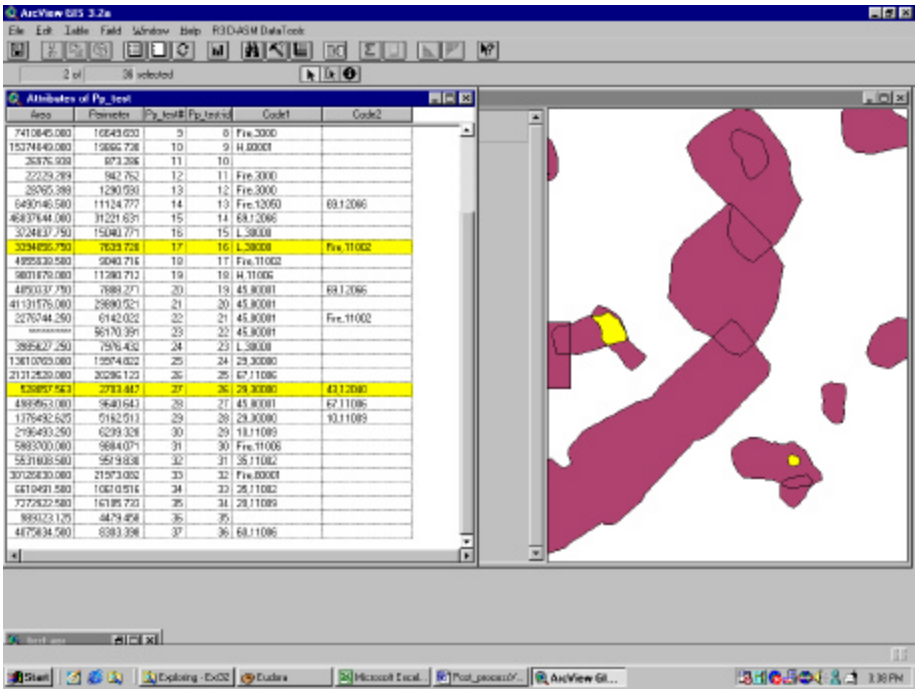


Figure E.6. The ‘Code1’ and ‘Code2’ fields are now populated.

Now we need to add the fields required in the Aerial Survey GIS Handbook for national reporting to FHM. Then we need to populate those fields. To accomplish this, we have built a series of three tools packaged as an ArcView extension. These tools are engineered specifically for US Forest Service Region 3 aerial survey data, however the basic framework can be modified to suit other datasets. The extension will operate in the UNIX or PC environments.

To load the extension for use on the PC, copy the ‘R3_PP_Tools.avx’ file into your ArcView extensions directory (usually C:\ESRI\AV_GIS30\ARCVIEW\EXT32). You should now be able to turn on the extension from within any ArcView project.

To load the extension for use on a UNIX-based workstation, you must first create a directory where you will place the extension, then modify your .kshrc file with a line pointing to this directory. For example, lets say we have created the directory ‘/wsa1/charlie/avext’ for our ArcView extensions. From your home directory, open your .kshrc file in a text editor. Add this line:

export USEREXT=/wsa1/Charlie/avext

Save the .kshrc file. Open ArcView and you should be able to load the extension in any ArcView project.

Using the R3 Data Tools, our first step is to parse the ‘Code1’ and ‘Code2’ fields into their constituent attributes. Recall that our example dataset contains two comma-delimited code attributes, damage type/severity code and a pest code. Using the ‘R3 D-ASM DataTools’ we will parse the ‘Code’ fields, placing each attribute into its own field (Fig E.7).

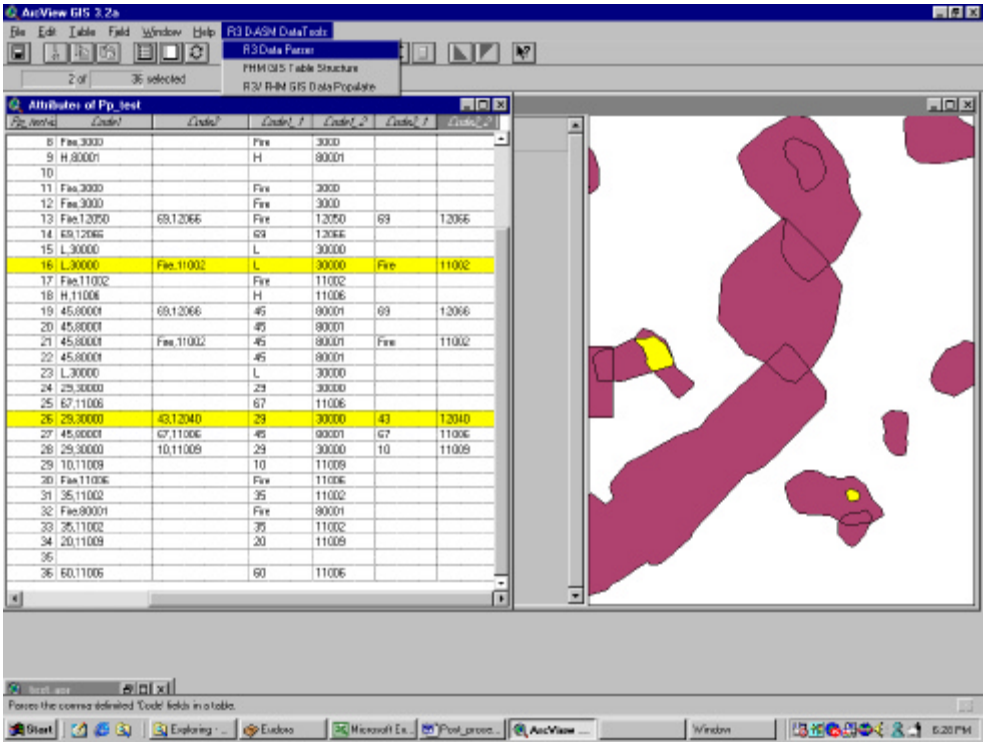


Figure E.7. The Data Parse tool adds and populates fields for each ‘Code’ attribute.

Next, we will add the FHM GIS attributes as specified on page 13 of the Aerial Survey GIS Handbook (Oct 99). Use the FHM GIS Table Structure tool (Fig E.8).

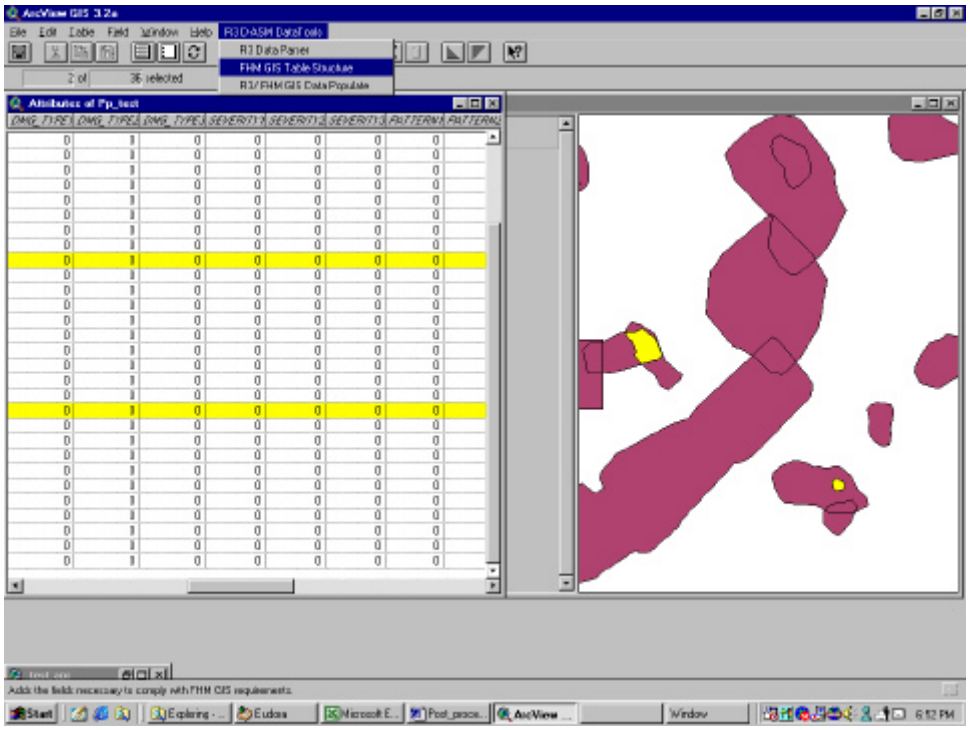


Figure E.8. The 'FHM GIS Table Structure' tool adds FHM GIS fields.

Finally, populate the fields using the 'R3/FHM GIS Data Populate' tool (Fig E.9). This application populates the FHM GIS fields using a series of look-up statements applied towards the parsed 'Code' attributes.

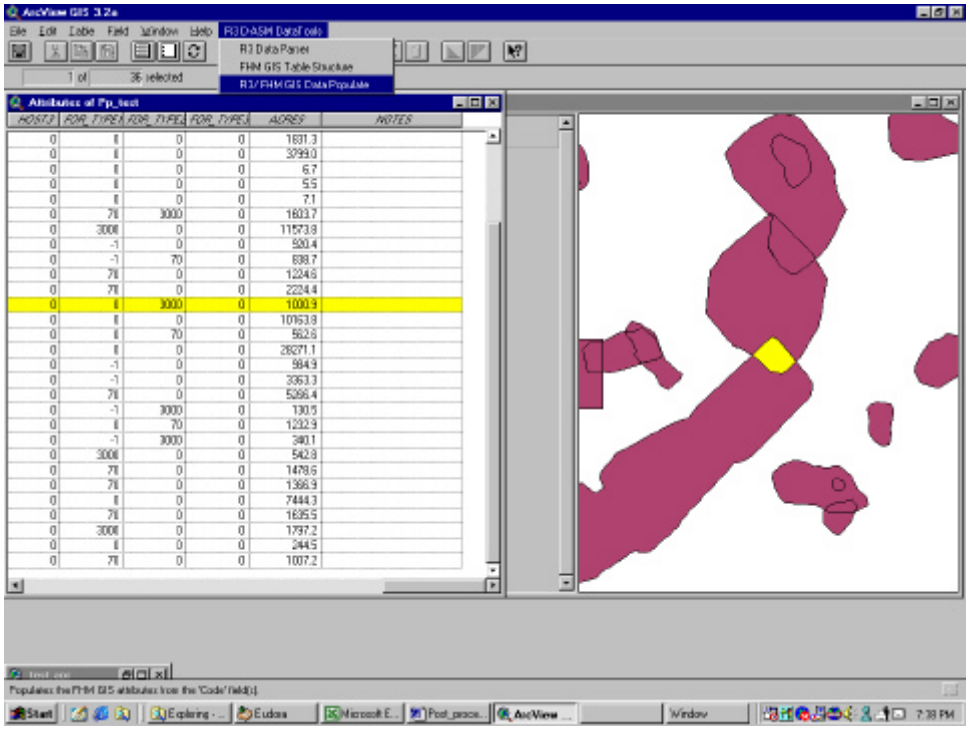


Figure E.9. The 'R3/FHM GIS Data Populate' tool populates the FHM GIS attributes according to Region 3 decision rules.

Review the feature attribute table and calculate/populate any fields where possible, such as TPA, Survey_ID, No_Trees, etc.

When calculating TPA, be sure to use the 'Acres_1' field, which was calculated prior to merging the files in ArcView.

Conduct a thorough QA/QC of the dataset, making sure that a representative sample of the features are attributed correctly. The table may be cleaned up by removing extraneous fields used during processing.

The above method is but one way to achieve the desired goal of a Arc/Info GIS coverage suitable for submission to FHP/FHM. We encourage you to use these methods as a starting point to develop your own scripts/techniques that address your specific aerial survey data.

Charlie Schrader-Patton
FHTET/RSAC Digital Aerial SketchMap Support Team