

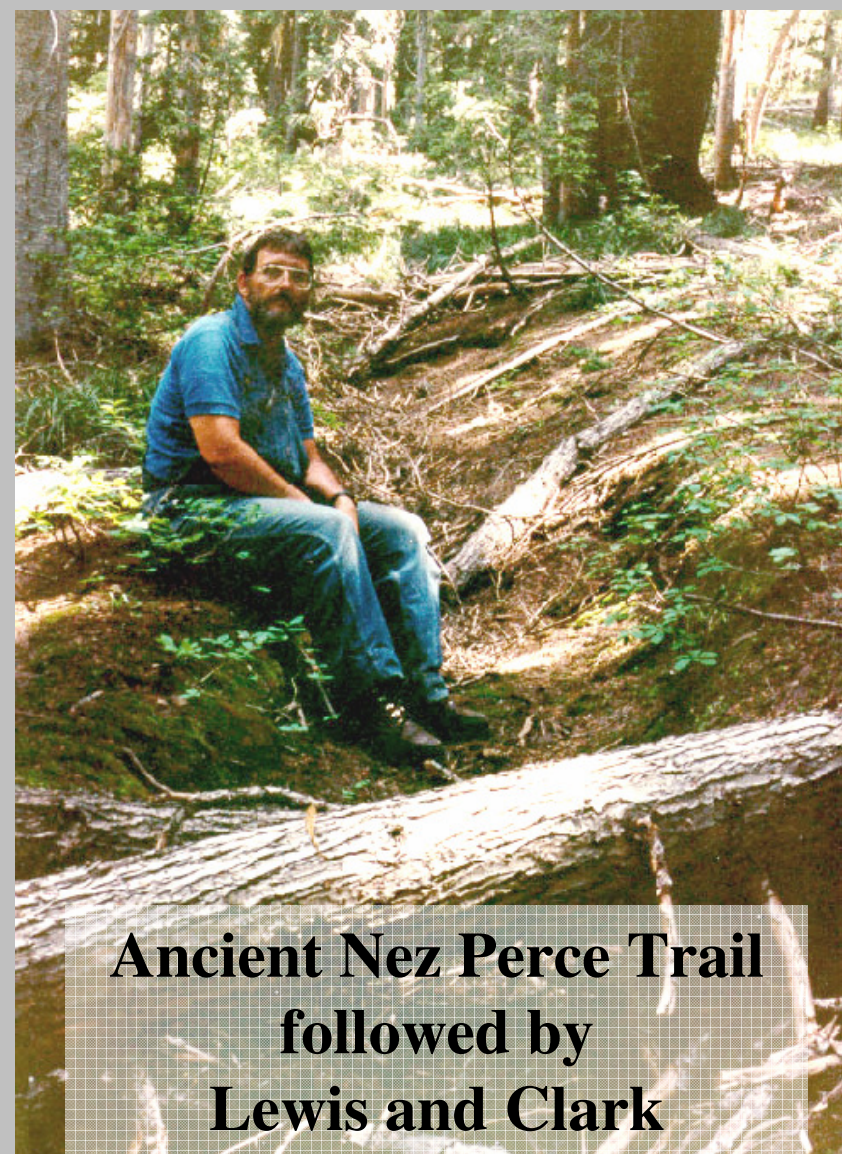
# Precision Surveying of Historic Trails

## Lewis and Clark in Idaho - 2004

Iowa State University GIS Day – Nov 15, 2006

### 1 Steve F. Russell – Interests and Goals

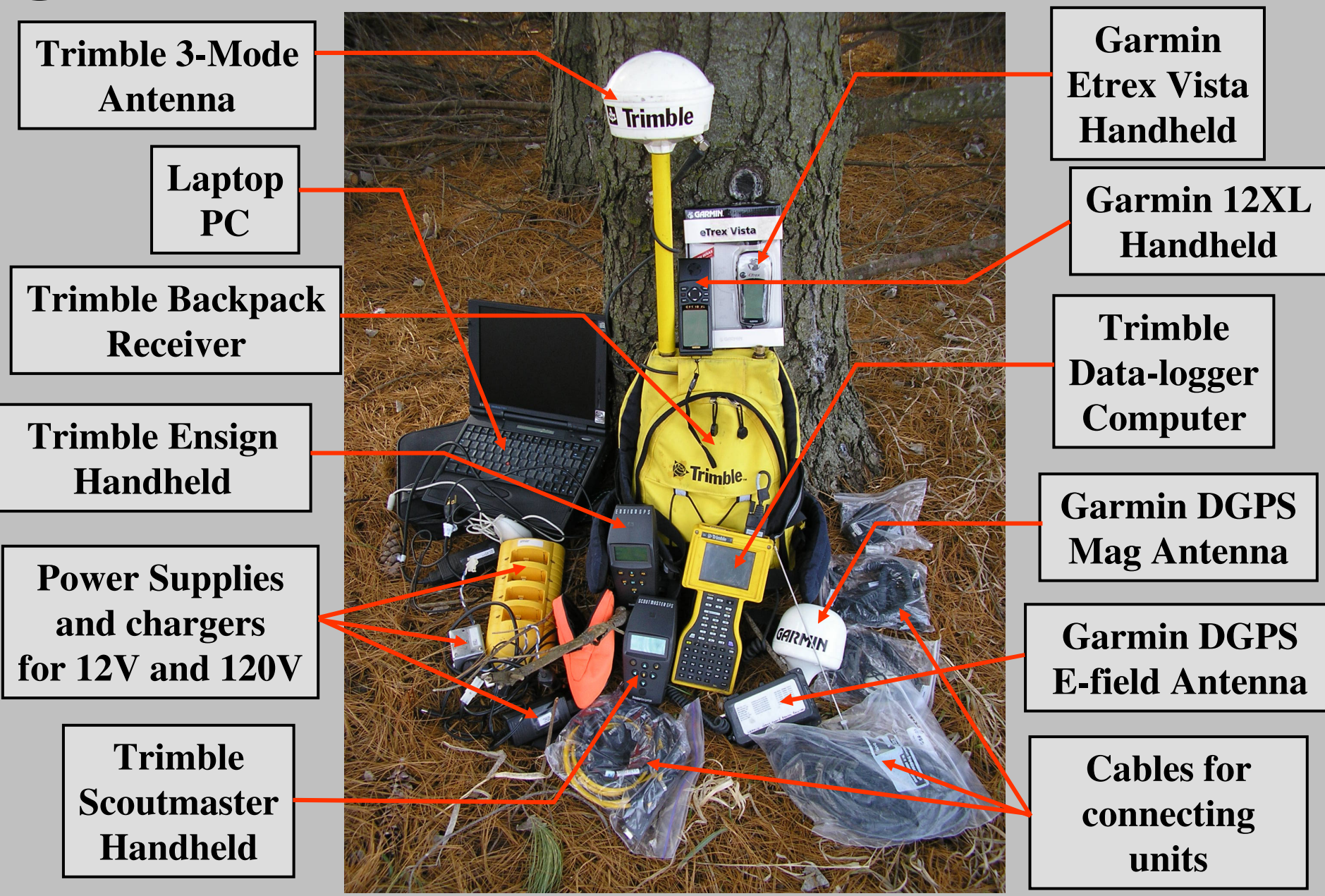
- Scholarly research on historic trails with original journals, original maps, and modern field work (camping out all summer)
- Work with state, federal, Tribal, and historic preservation agencies
- High-accuracy GIS results using ARCVIEW and precision GPS
- Natural history documentation: geology, plants, animals
- Archival results: publications and documentation in state historical society archives and journals



### 2 Technology Summary

- US Geological Survey topographic maps
- USGS digital raster graphics maps
- ARCVIEW Geographic Information System precision mapping
- Trimble Pathfinder PRO/XRS precision survey quality GPS
- Pathfinder Pro mapping software
- Laptop with support software and CD archive
- Logistics: battery chargers, inverters

### 3 GPS Menagerie

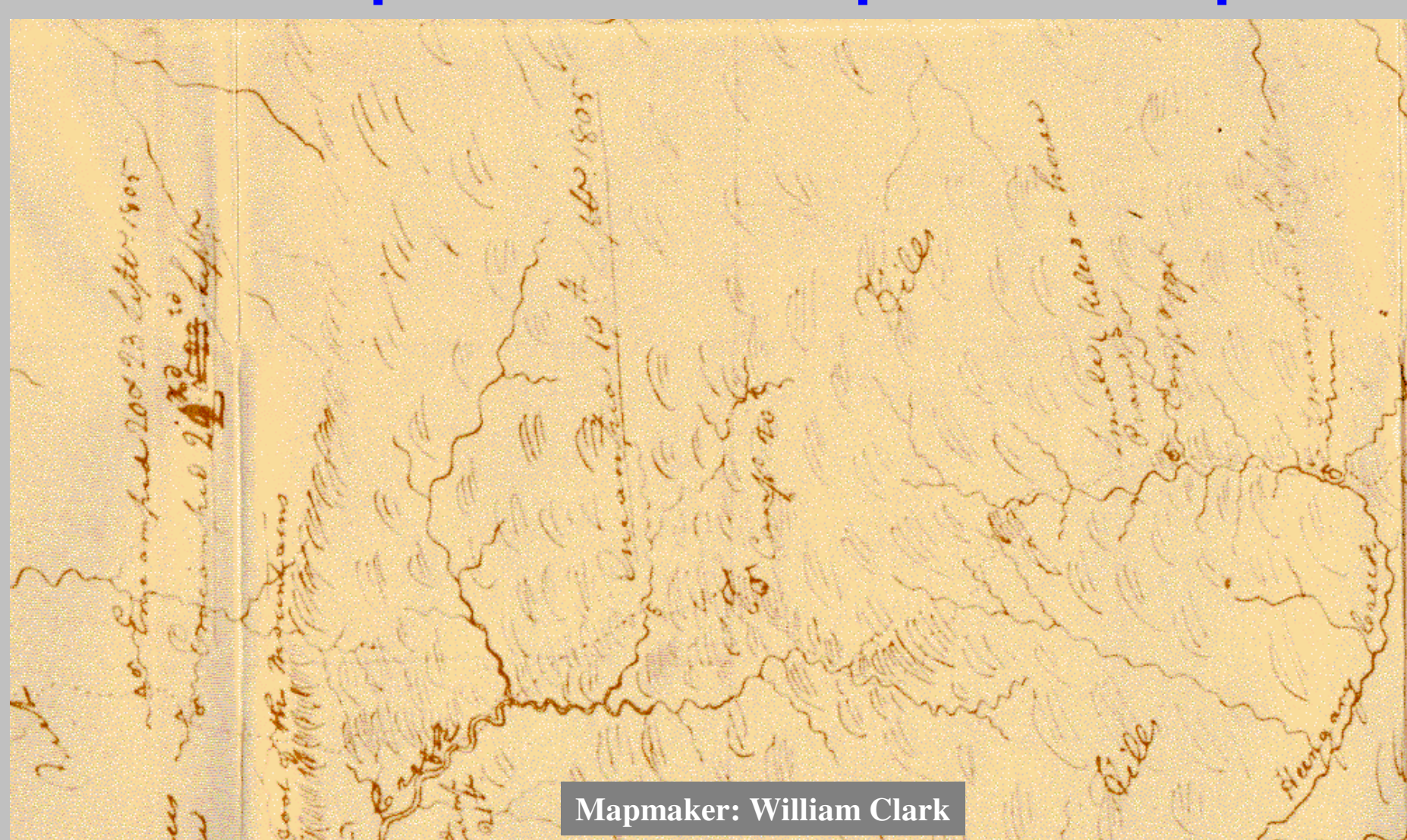


### 4 Trimble Pathfinder Pro XRS

- Precision DGPS stand-alone unit
- Satellite, WAAS, and Coast Guard beacon DGPS
- 8-10 hours of battery life in the field
- Highly flexible data logging
- Designed to minimize data errors in the field
- High performance receiver with multipath compensation
- Designed to operate in heavy forest canopy



### 5 Let's Improve on the Expedition Maps



Lolo Creek and Hungary Creek in the Bitterroot Mountains of North-Central Idaho

### 6 Zig-Zag Searching for the Trail

It takes a large amount of searching all around to find the trail tread

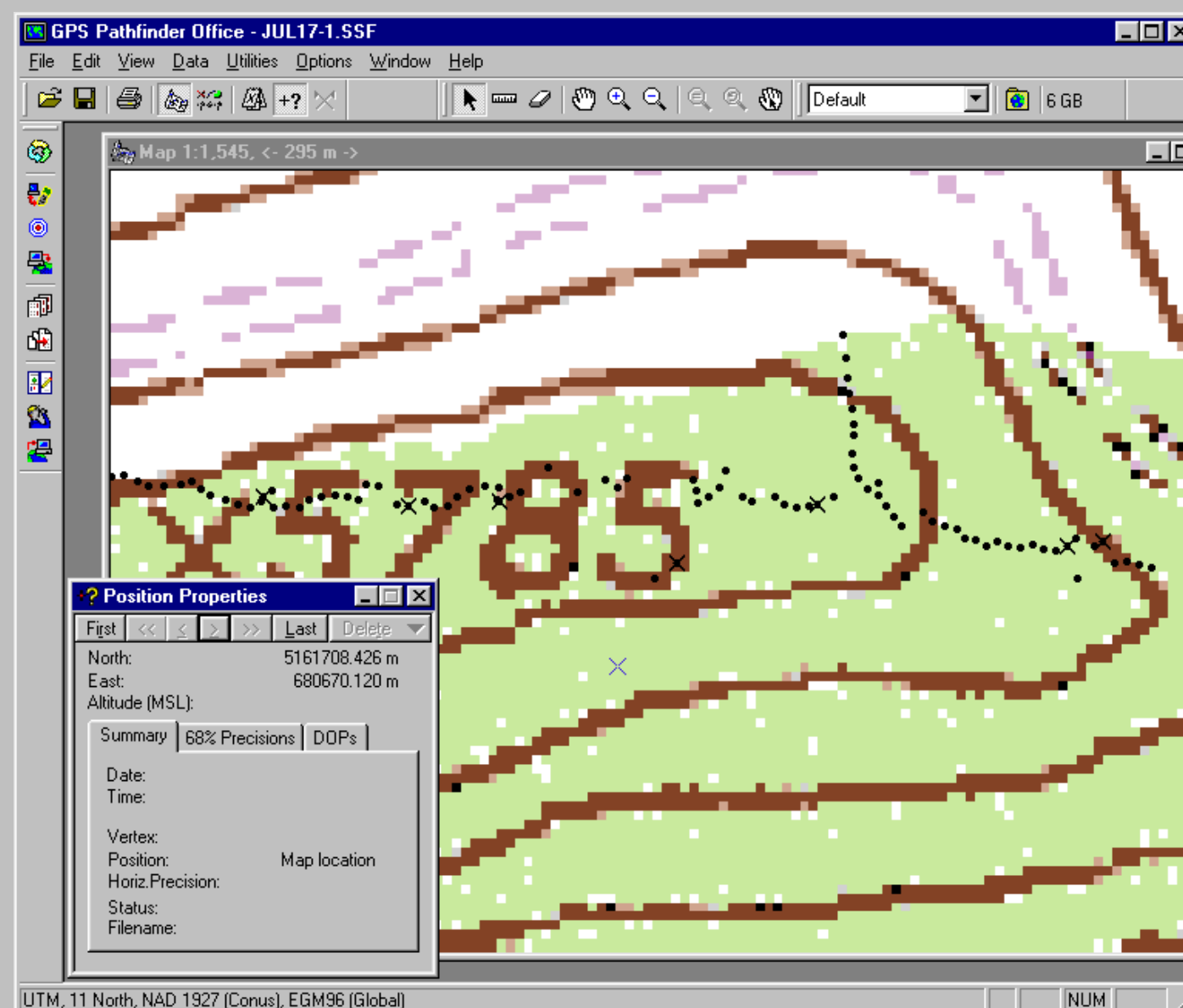
A bear has been inspecting this old log in search of insects



### 7 Screen Shot of Pathfinder Map and data

#### Initial Raw Survey Data with Topo Map

- Quad: Rocky Ridge
- Locality: Rocky Ridge Lookout
- DRG: o46114e6
- NAD 27 (conus) UTM
- ZONE: 11
- NORTH: 5161708
- EAST: 680670



### 8 Loss of Accuracy During Real-Time Tracking

- Methods of DGPS
  - Coast Guard beacon
  - Subscription satellite system
  - Wide Area Augmentation System (WAAS) satellite
  - Base-Rover differential GPS

In heavy forest canopy, only the low-frequency Coast Guard beacon is effective. DGPS satellite signals are too weak to be received.

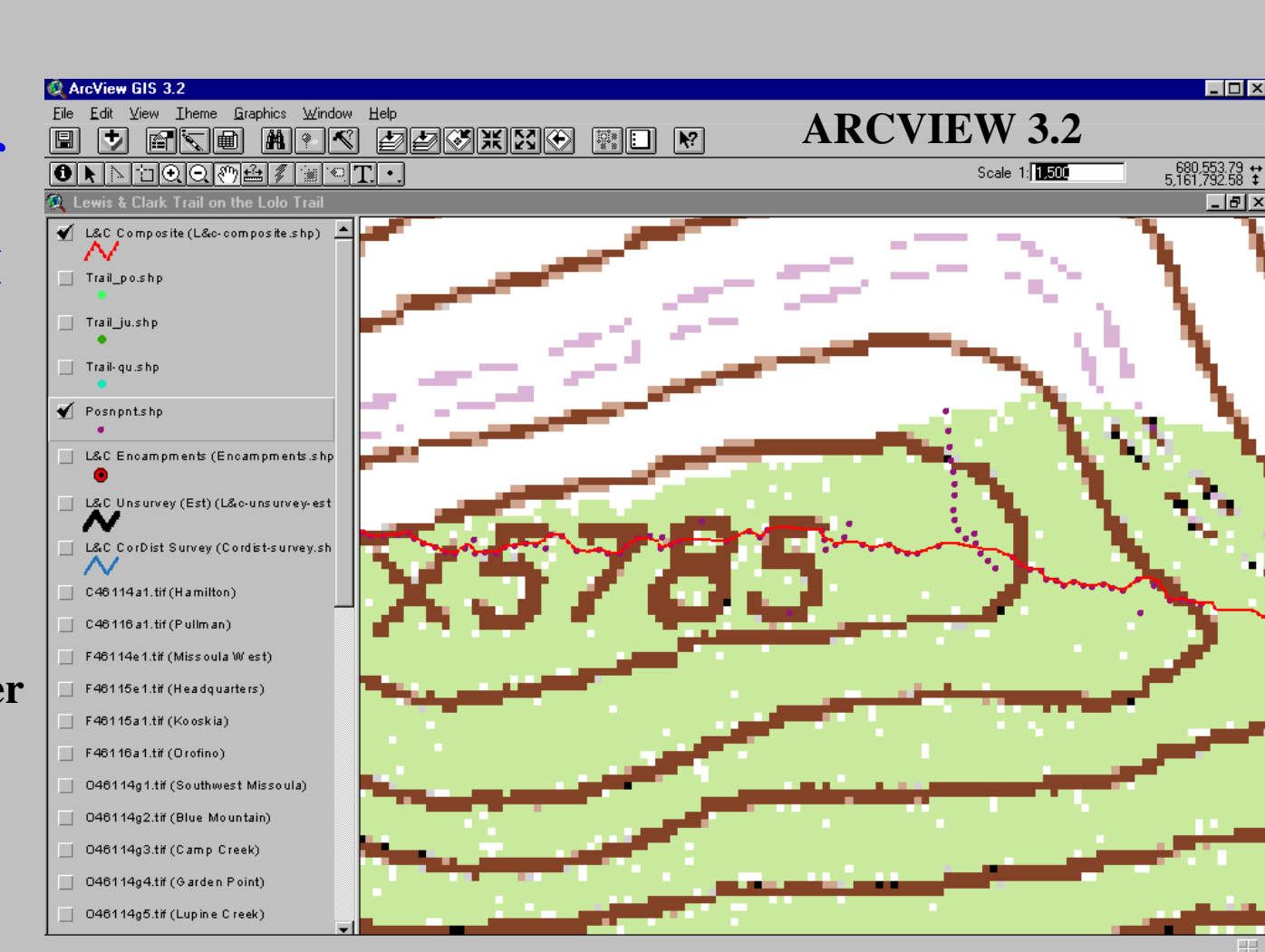
Although the Pathfinder receiver reported 3D differential GPS, its tracking loop had lost lock and gave an error almost 40 times larger than was reported

So far, the only effective solution to this problem has been to manually post-process the data

### 9 Manual Post-Processing of Data - Final Results

#### Manual post-processing of data with ARCVIEW

- Smooth line drawn between known good points
- Interpolation is used
- Scallops and other loss-of-tracking artifacts are removed
- Field notes and memorized trail features are used to assist interpolation



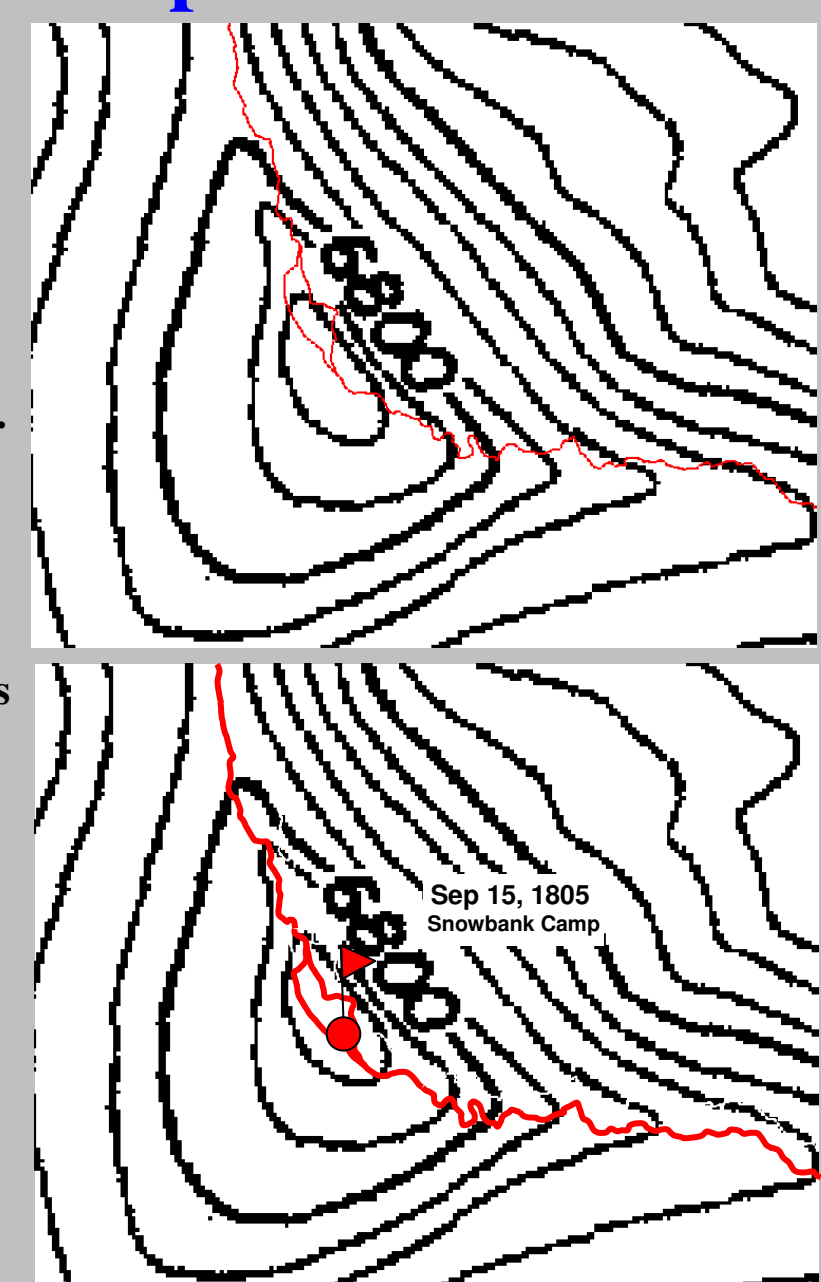
### 10 USGS Topographic Map Errors

Errors in a topographic map can make it look like the GPS plot is in error

The map to the above right has the GPS data accurately plotted on a USGS 7.5 minute DRG. The map elevation contours are distorted and too far west and south of the actual location of this ridge

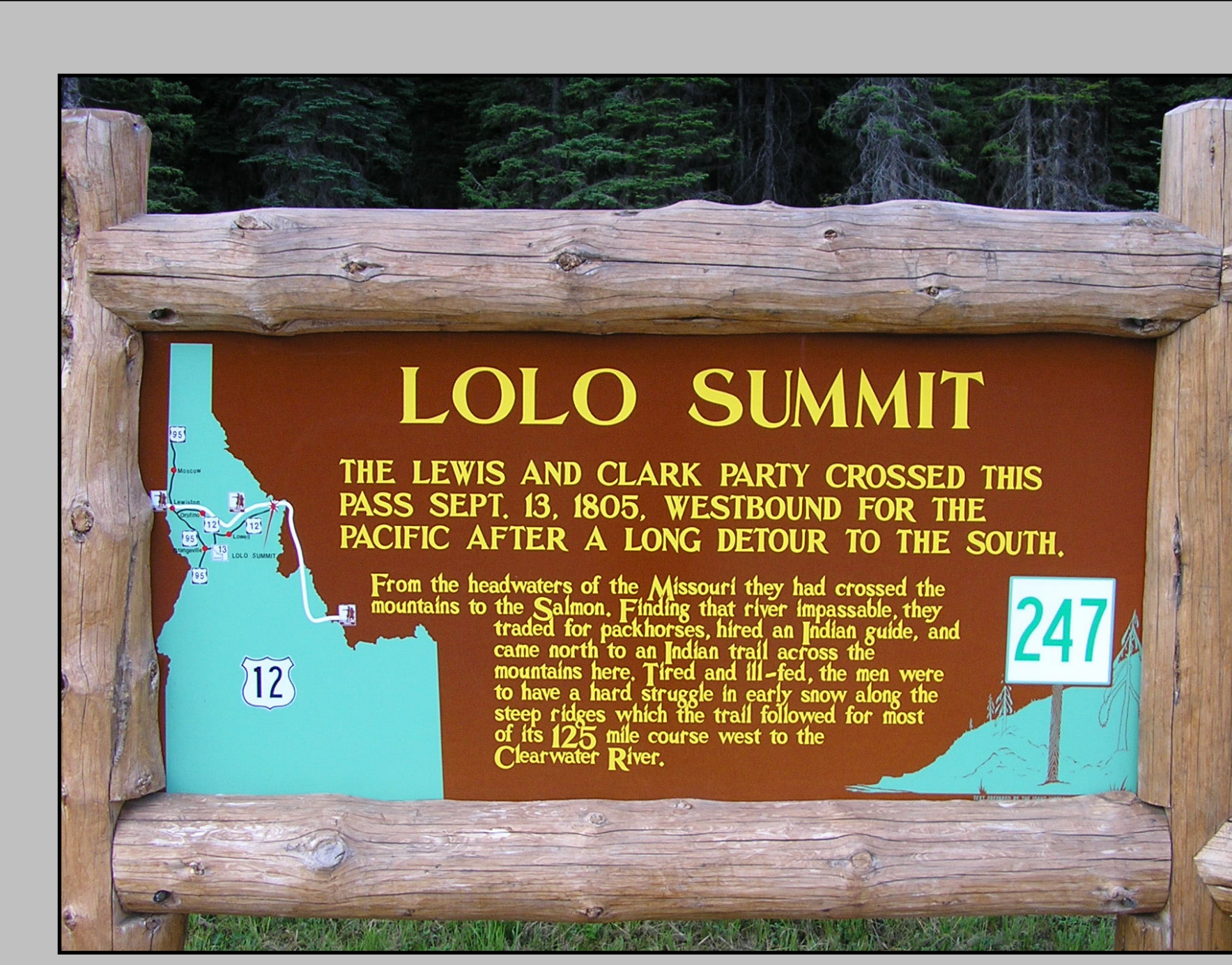
The GPS plot on the map to the below right has been distorted so that it appears to be in the correct location. This is fine for hiking and reading paper maps but any GPS readings taken from this map will be in error

Conclusion: The accuracy of USGS DRGs is not adequate for accurate portrayal of both the correct UTM location and the perceived topographic location



### Initial Processing of Data

"A different kind of tailgating"



### Last surviving plaque put along the trail by Jack Harlan, 1935



Note bullet holes!

### Salmon River Canyon in Idaho



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