**GPS Triangle-Strain Project**

Refer to the grading rubric as you prepare your project. <http://CroninProjects.org/Vince/Geodesy/Rubric13.doc> Identify a set of three adjacent PBO GPS sites that are located in an area of active crustal strain. The sites should form a triangle whose interior angles are all greater than ~30°. An efficient way to identify an area where there is active crustal strain is to consult the *Quaternary Fault and Fold Database of the United States* online via <http://earthquake.usgs.gov/hazards/qfaults/>

Given three suitable PBO GPS sites, you are to do the following, at a minimum.

(1) Compile the location and velocity data required for the GPS triangle-strain analysis. For example, consult <http://CroninProjects.org/Vince/Geodesy/PBOWorksheet14.doc>

(2) Create an accurate map showing the relative locations of the three GPS sites and their component velocity vectors (N-S and E-W)

(3) Create an accurate map showing the relative locations of the three GPS sites and their total velocity vectors

(4) Input the location and velocity data into the Excel strain calculator that was distributed in class and that is available online via <http://www.unavco.org/education/resources/educational-resources/lesson/majors-gps-strain/module-materials/gps-triangle-strain-calculator.xlsx>

***RENAME*** the spreadsheet that has your data, using your last name in the new title.

(5) Create an accurate map showing the relative locations of the three GPS sites, a circle that is concentric with (has the same center as) the triangle between the sites, and an exaggerated-but-proportionate strain ellipse concentric with the circle that accurately indicates the nature of the instantaneous horizontal strain in the area between the GPS sites.

(6) Create an accurate map showing the relative locations of the three GPS sites, the strain ellipse and the trace of all active faults in the map area, along with appropriate map indicators of the type and sense of motion of the faults.

(7) Create and deliver a PowerPoint presentation of 5 minutes duration that describes where your study area is, why this area is of geologic interest, which PBO GPS sites were used, includes the maps you created, presents the results (output of the Excel triangle-strain calculator), and explains/interprets the results with reference to active faulting in the area. The text of your presentation should be in the “notes” part of the PowerPoint file that you will turn in.

*Your presentation will be recorded with a digital video camera.*

**Digital documents to be turned-in the day of the presentation:**

• gps-triangle-strain-calculator.xlsx with your sites' data, ***RENAMED*** using your last name, and

• your PowerPoint file including the presentation slides and the associated text, ***USING YOUR LAST NAME*** in the name of the file.

**Files/sites you might want to use as you prepare your project (version of 6/2014)**

**PowerPoint files**

Introduction to GPS <http://CroninProjects.org/Vince/Geodesy/GPS_Intro.ppt>

Introduction to the GPS triangle-strain problem <http://CroninProjects.org/Vince/Geodesy/GPS_Triangle_Strain.ppt>

**Word files**

Primer on instantaneous <http://CroninProjects.org/Vince/Geodesy/GPS_Strain_Primer.doc>

Algorithm for triangle strain <http://CroninProjects.org/Vince/Geodesy/TriangleStrainAlgorithm.doc>

How to find PBO GPS data <http://CroninProjects.org/Vince/Geodesy/FindingGPSdata.doc>

Worksheet for Tahoe PBO GPS data <http://CroninProjects.org/Vince/Geodesy/TahoePBOWorksheet13.doc>

Blank worksheet for an arbitrary triplet of GPS data <http://CroninProjects.org/Vince/Geodesy/PBOWorksheet14.doc>

Tahoe map for depicting total site velocities <http://CroninProjects.org/Vince/Geodesy/TahoeVelocityMap.doc>

Library of triangle-strain images <http://CroninProjects.org/Vince/Geodesy/TriangleStrainPics.doc>

Description of GPS triangle strain project (this document):

<http://CroninProjects.org/Vince/Geodesy/GPS_ProjDescr_2014.docx>

Grading rubric for GPS strain project <http://CroninProjects.org/Vince/Geodesy/Rubric13.doc>

Vectors and simple vector math summary sheet <http://CroninProjects.org/Vince/Geodesy/VectorSummary30Aug2012.docx>

Matrices and simple matrix math summary sheet <http://CroninProjects.org/Vince/Geodesy/Matrices.doc>

How to find the eigenvectors of a symmetric 2x2 matrix <http://CroninProjects.org/Vince/Geodesy/FindingEigenvectors.doc>

**Excel file**

GPS triangle strain calculator in *Excel* <http://CroninProjects.org/Vince/Geodesy/GPS_Triangle_Strain.xls>

**Mathematica file**

GPS triangle strain calculator in *Mathematica* <http://CroninProjects.org/Vince/Geodesy/TriangleStrainCalculator.nb>

**MatLab file**

GPS triangle strain calculator in *MatLab* <http://www.unavco.org/edu_outreach/resources/gps-strain/majors-gps-strain/module-materials/current-version/calcstrain.m>

**Web**

Plate Boundary Observatory, GPS network map, maintained by UNAVCO <http://www.unavco.org/instrumentation/networks/status/pbo> (better) or <http://pbo.unavco.org/network/soh_map>

Quaternary Fault and Fold Database of the United States, maintained by the USGS with help from numerous state agencies <http://earthquake.usgs.gov/hazards/qfaults/>