



High-Precision Positioning Unit 1: GNSS System Concept Sketch Student Exercise

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Concept sketches are valuable tools for assessing integrated understanding of a complex system. By illustrating and annotating multiple components and their interactions, the sketch reinforces ideas about the function of complex systems. The concept sketch is the final assessment for Unit 1.

Introduction

The understanding of the various components of a GNSS system and their contribution to determining a position is critical to continued learning. This assignment asks students to illustrate the various concepts behind a GNSS system, increasing their understanding of how individual parts (internal and external) integrate into the larger system.

Assignment

On an 8.5 x 11 sheet of paper, hand draw a collection of related images and plots to illustrate the various components and functions of a GNSS system. Remember, concept sketches are NOT just labeled diagrams, but are thoughtfully annotated with descriptive phrases that describe the *how* and *why*, not just *what*. Use symbology such as arrows and call-out boxes to describe interactions between components. It is not necessary to draw well; focus on their descriptions and interactions. It is most important to communicate ideas through the drawing.

Be sure to include:

- Satellites in orbit and the signals they send. Does data flow toward the satellites?
- Antennas and receivers on the ground
 - Explain how positioning is accomplished and the roles of GNSS components
 - Different types of GNSS receiver “grades” and their positioning accuracies
- Environmental conditions and user actions that improve or impair GNSS accuracy
- Examples of both good and poor survey design and/or practice
- Explain in drawings and words why a particular GNSS system is appropriate to the science question and how the magnitude of uncertainty supports the goals of the survey
- GNSS being used for both science and societal benefit (2 examples)

Component	Exemplary	Basic	Nonperformance
General Considerations	Exemplary work will not just include all components requested above but also answer correctly, completely, and thoughtfully. Attention to detail—as well as answers that are logical and make sense—is an important piece of this. Sketch is neat, organized, and readable.	Basic work may answer all components of the given question, but some answers are incorrect, ill-considered, or difficult to interpret given the context of the question. Basic work may also be missing components of a given question.	Nonperformance occurs when students are missing large portions of the assignment or when the answers simply do not make sense and are incorrect.
0.5 pts Concept Sketch	9–10 points: Sketch includes all parts of the GNSS station including antenna, receiver, tripod, and radio or external batteries (as discussed in the demo) Sketches includes concise descriptions of each component and its function Sketch includes directional elements (arrows) showing data communication paths from satellite to receiver Sketch includes at least one source of error, such as multipath Good articulation of GNSS applications to science and society.	5–8 points: Missing 1–2 of the listed characteristics for an exemplary sketch. AND/OR All characteristics are present but lack detail or are incorrect, showing a lack of comprehension	0–4 points: Missing 2–4 of the sketch components. AND/OR Most characteristics are present (1–2 missing) but are incorrect, showing a lack of comprehension

Rubric

*For more on concept sketches, see the References and Resources section of the Unit 1 GETSI website or see student examples from testing under Assessments: Student Examples in the appropriate unit.