

ECE 6390 Radiolocation Scavenger Hunt 3

Late for Dinner

Georgia Institute of Technology

1 Introduction

You are running late for your anniversary dinner. Your significant other has called you from outside the fine restaurant where you are supposed to meet for a romantic outing. Unfortunately, your spouse's cell phone call is cut-off before you can catch the name of the restaurant. Your return calls keep dumping to voice mail. If you miss this dinner, it will be a very dangerous situation indeed.

You have one thing going for you. Your spouse's cellular phone has a trial GPS chip inside that records pseudoranges calculated from 3 received GPS signals and then calculates user position. Unfortunately, the phone must have been operating in a partially occluded location since the full 4+ pseudoranges required for 3D GPS location are not available. Since you are an electrical engineer, of course you can hack a digital cell-phone in seconds. You discover that, through some quirk of Springularizon's protocol, your handset somehow has your spouse's pseudoranges recorded in memory. You must use these pseudoranges to find the location of the restaurant.

2 Technical Data

Below are the satellite subpoint coordinates and pseudo-ranges for the 4 GPS satellites whose signals are received by a positioning radio:

	Sat 1	Sat 2	Sat 3
Lon	-62.3256°	-85.2234°	-92.8388°
Lat	7.8520°	45.1053°	29.7834°
PR/c	0.000000000 s	-0.003817986 s	-0.004077077 s

Note that all pseudo-ranges are given relative to the first satellite position (absolute time delay, of course, is unknown). Calculate the longitude, latitude, and altitude for the GPS receiver based on this data. Use 6380.00 km as the mean earth radius, 20,200.00 km as the GPS satellite altitude, and $c = 299860.00$ km/s in your calculations.

3 Deliverables

You must prepare a web-based report or presentation that documents your solution to this problem so that other engineering spouses can learn from your cleverness. The web report should be in html-format with all files submitted in-class on a CD or through e-mail¹. Your report will be graded

¹e-mail submissions must be ZIPped and are only recommended for files less than 10 MB total

completeness, **technical writing**, technical correctness, professional content, and creative use of web presentation. I will likely post a couple unique solutions and high-quality projects to the web.

Some interesting questions to address in your final web report/presentation:

- How did you solve the range equations?
- Are there any ambiguities in your technique? How did you address them?
- Can you place a confidence interval on your position estimate?
- What factors that we did not consider might affect a realistic GPS ranging estimate?

4 Final Clue

The actual longitude/latitude of the GPS receiver is a restaurant in Atlanta on the corner of two streets. The concatenated first words in the street names (e.g. “fersttechwood” or “peachtreep-eachtree”) unlocks the mystery document on the RLSH web page. The restaurant location is inside the perimeter.