

AOE 4134 Homework 7

Due: Wednesday October 11, 2000 at beginning of class

1. Do Problem 2.17 in BMW.
2. An object is observed by a radar station in Goose Bay, Labrador (you'll need to consult a map to find the coordinates of this site). The radar measures the following variables at epoch  $t_o$  (0300 UTC Sep 11, 2000):

$$\begin{aligned}\rho &= 200 \text{ km} & \dot{\rho} &= 0.1 \text{ km/s} \\ Az &= 45^\circ & \dot{Az} &= 2^\circ/\text{s} \\ El &= 60^\circ & \dot{el} &= 2^\circ/\text{s}\end{aligned}$$

- a) Determine  $\vec{r}$  and  $\vec{v}$  at epoch (km, km/s, in ECI frame).
  - b) Determine the orbital elements  $a$ ,  $e$ ,  $i$ ,  $\Omega$ ,  $\omega$ , and  $\nu_0$ .
  - c) Is it possible that this object is a ballistic missile? You must explain your reasoning in answering this question. A simple “yes” or “no” gets zero credit.
3. The following Two-Line Element set (TLE) is for the International Space Station.

ISS (ZARYA)

```
1 25544U 98067A 00275.59951216 .00109532 00000-0 12083-2 0 1349
2 25544 51.5770 317.4465 0005383 278.1771 218.9951 15.62225569106622
```

(a) Determine the following information about this satellite:

Date and time (UTC and EDT) for this TLE's epoch;

The orbital elements  $a$ ,  $e$ ,  $i$ ,  $\Omega$ ,  $\omega$ , and  $\nu$ ; and

The number of times that ISS had orbited the Earth at epoch

(b) When is the next time after epoch that ISS will be visible from Blacksburg?

You can find information about the TLE format at the following website:

<http://celestrak.com/NORAD/documentation/tle-fmt.html>