AE4580 Introduction to Avionics Integration
Spring 2004 Homework #5
Due: Monday March 29, 2004 at 2:05pm (beginning of class) or before

1. Problem 7.2 in Kayton & Fried, parts (a) and (b) only.

2. Develop a Kalman filter design that utilizes three range measurements (from distinct DME transponders), that each become available at the same fixed time interval, to estimate the 2-D (North/East) velocity and position of a vehicle in approximately steady/level atmospheric flight.
   (a) In tabular form, list all parameters that must be selected in order to utilize your filter, including any required initial conditions – and describe how they might be obtained.
   (b) Write down all equations necessary to implement the filter, and indicate the order of operation, and how to start the algorithm. (Hint: Section 3.13.1 may be helpful)
   (c) In MATLAB, implement and test your filter for the first 60 seconds after the initial condition. Provide plots of the position, estimated position, north and east velocity estimate error (as a function of time), north and east position estimate error (as a function of time). Use the following: (and use your answer to part (a) for any parameters missing here)
      (i) Aircraft starts at (0,0) and moves with velocity (300,400), units are *ft* and *ft/sec* respectively
      (ii) Initial guess for aircraft position and velocity estimates are (1000,0) and (300,450) respectively
      (iii) DME transponders are located at (-30000,0), (10000,30000), and (-10000,20000), update rate is once per second

      Note: be sure to add appropriate zero-mean noise to your simulated DME measurements.

3. Extra Research: Select a Flight Management System (FMS) used on a current commercial aircraft (e.g. G-5, B-737NG,747-400,757,767,777, MD-11, A-319,320,321,330,340, etc.). Summarize what it can do in about 500 words. As always, indicate your sources of information.