Lecture

Introduction to Navigation

EE 570: Location and Navigation

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1 Overview

What is Location and/or Navigation?

- The process of determining a vehicle's "course" by geometry, astronomy, radio signal, or other means. *Often described by Position, Velocity, and Attitude (PVA)*
- This can be accomplished via "position fixing" or "dead reckoning"
  - Position fixing: Directly measuring location
  - Dead Reckoning: measures changes in position and/or attitude
    - need to initialized and then "integrate" the Δ's
    - Inertial sensors measure the Δ's without requiring an external reference

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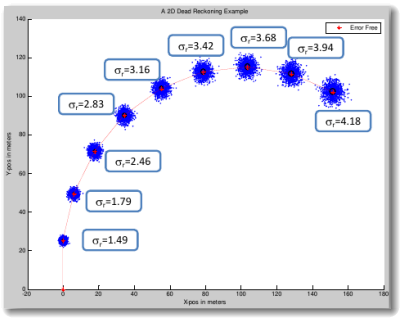
2 Dead Reckoning

Dead Reckoning: An Example 1

- At each epoch we measure Δx and Δy with noise ($\sigma = 1m$)
- Then add to the prior location



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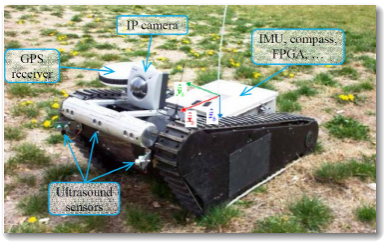
Dead Reckoning: UGV Examples

PVA needed in terms of local datum DARPA grand challenge

SOCOM Robot (EE NMT project)



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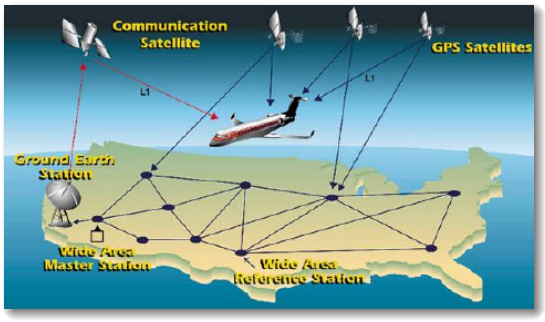
Dead Reckoning: Aircraft or UAV Examples

Earth Centered Earth Fixed Coordinate System



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Dead Reckoning: Spacecraft Examples

Earth Centered Inertial Coordinate System

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3 Navigation Concept

Navigation Concept

1. There exists a wide variety of information sources (i.e., sensors)
   - Inertial, Doppler, GPS, radar, compass, camera, odometry, barometric, ...
2. How should I describe my location?
   - Position, velocity, and attitude?
     - attitude can be a bit tricky!!
3. When answering the question "where am I?" the *wrt* must be very clearly defined!!
   - Lead in to the notion of coordinate systems

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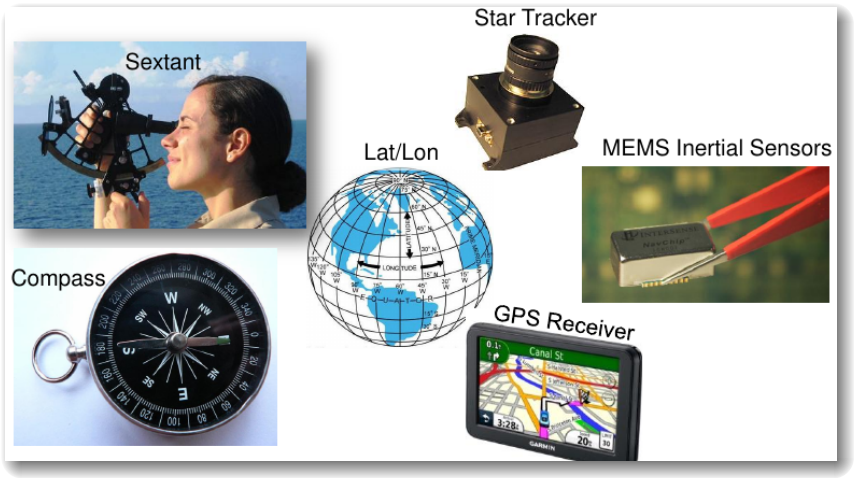
4 Sensors

Navigation Sensors: Past, Current, and Future



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