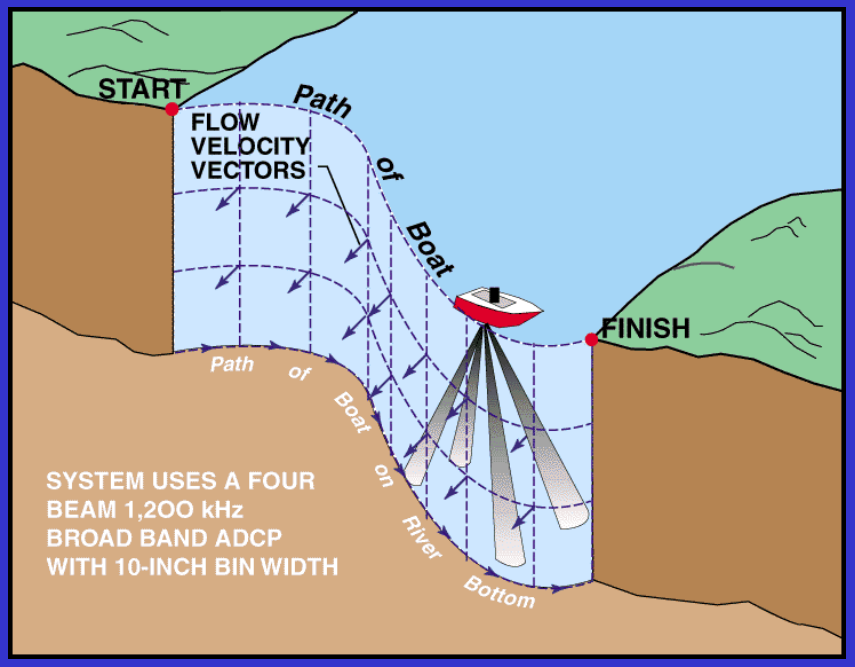
THREE-DIMENSIONAL ESTUARY FLOW MEASUREMENTS USING AN ADCP EQUIPPED WITH A DIFFERENTIAL GPS



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Outline of the Presentation

Purpose of the study
Study Area
Intro to ADCP
GPS Basics
Processing of ADCP Data
Preliminary results
Summary and Conclusions

Purpose of the Study

- Obtain 3-D velocity measurements for the purpose of calibrating and validating hydrodynamic models of the flow in the St Lucie Estuary

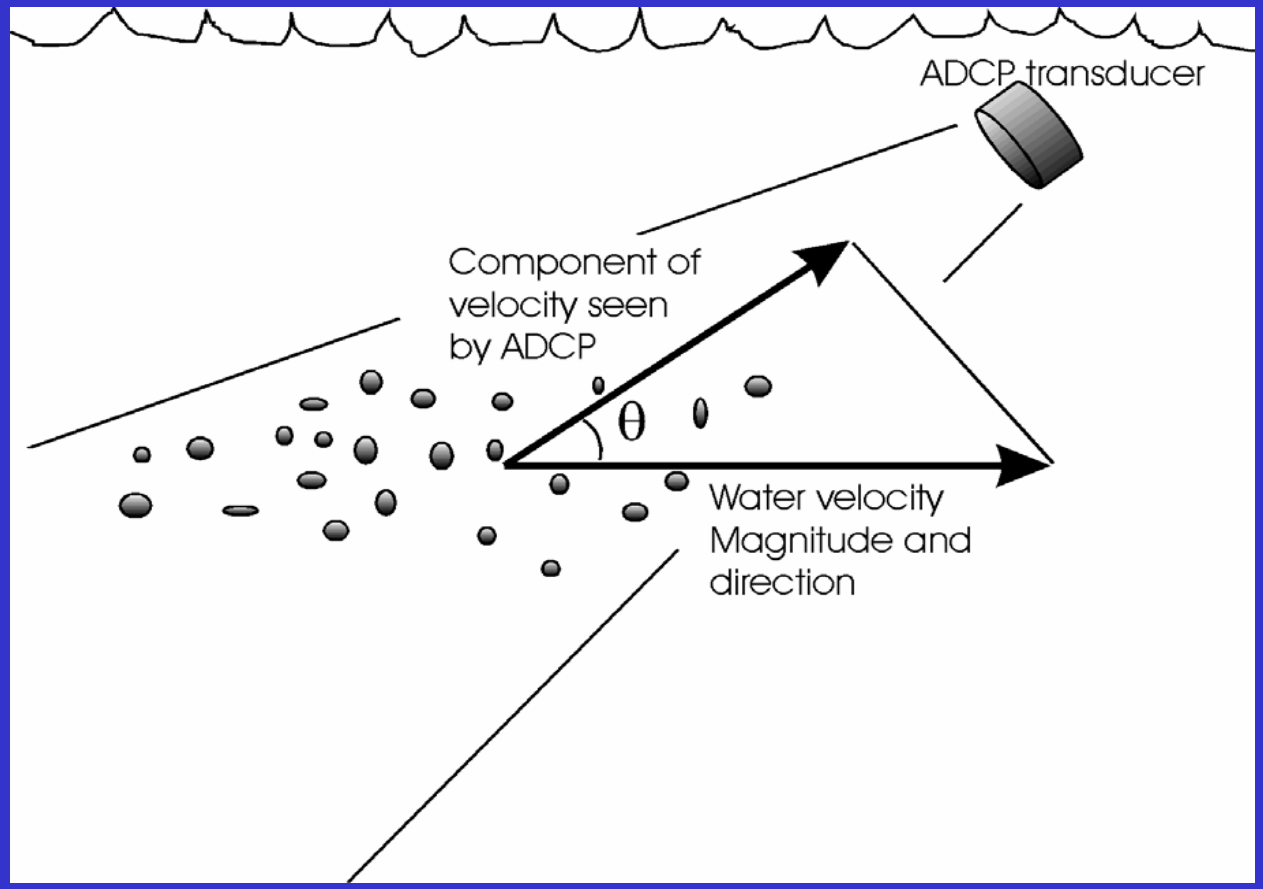
- Obtain estimate of the boat velocity at sites where bottom tracking is not possible, due to high flow (flood) or high sediment concentration conditions

Study Area

NORTH

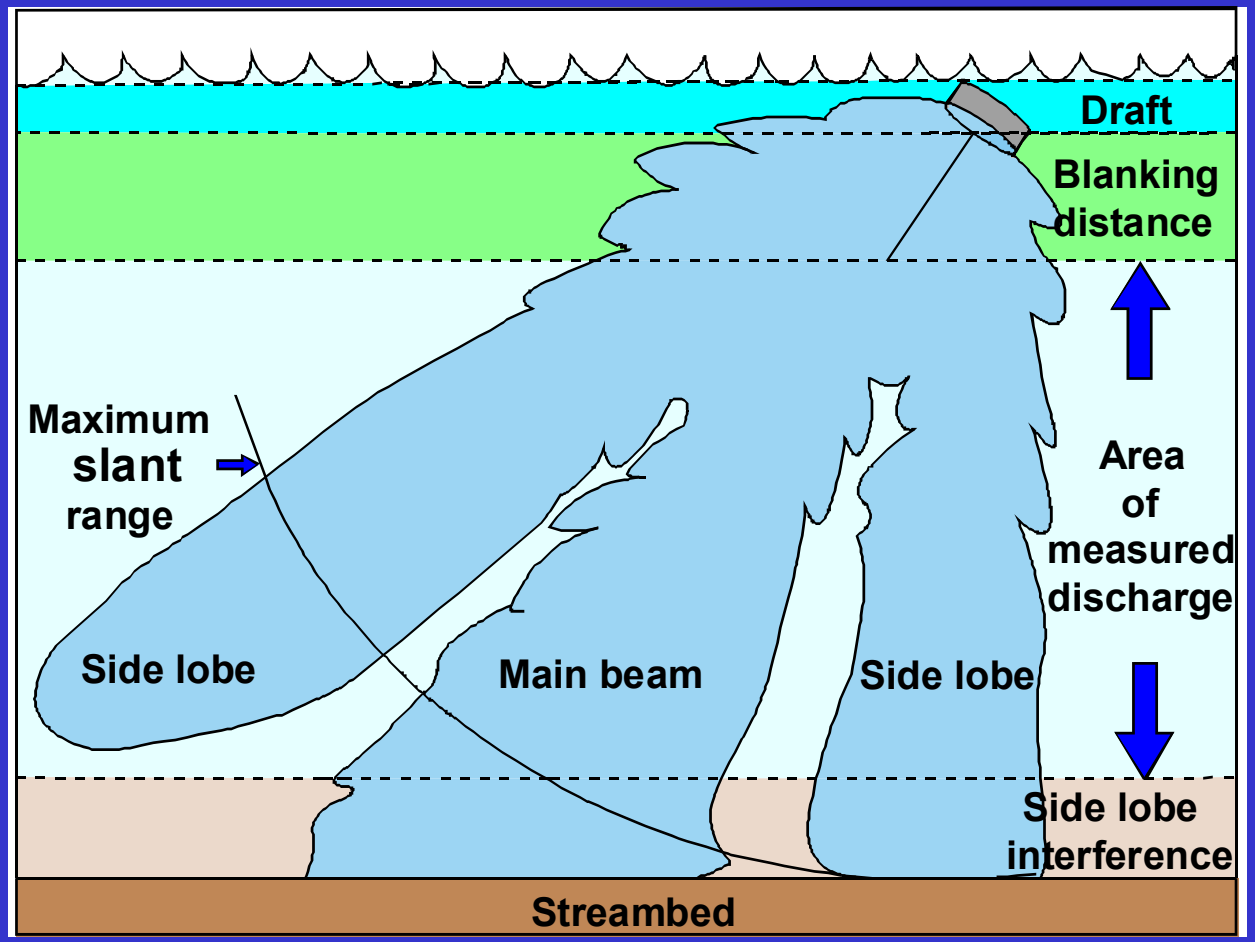
Acoustic Doppler Current Profiler

- Based on Acoustic Doppler Principle
- Measures velocities at several depth cells
- Obtains all 3 components of velocities at the same time



Profiling Termination

Depth * cos θ



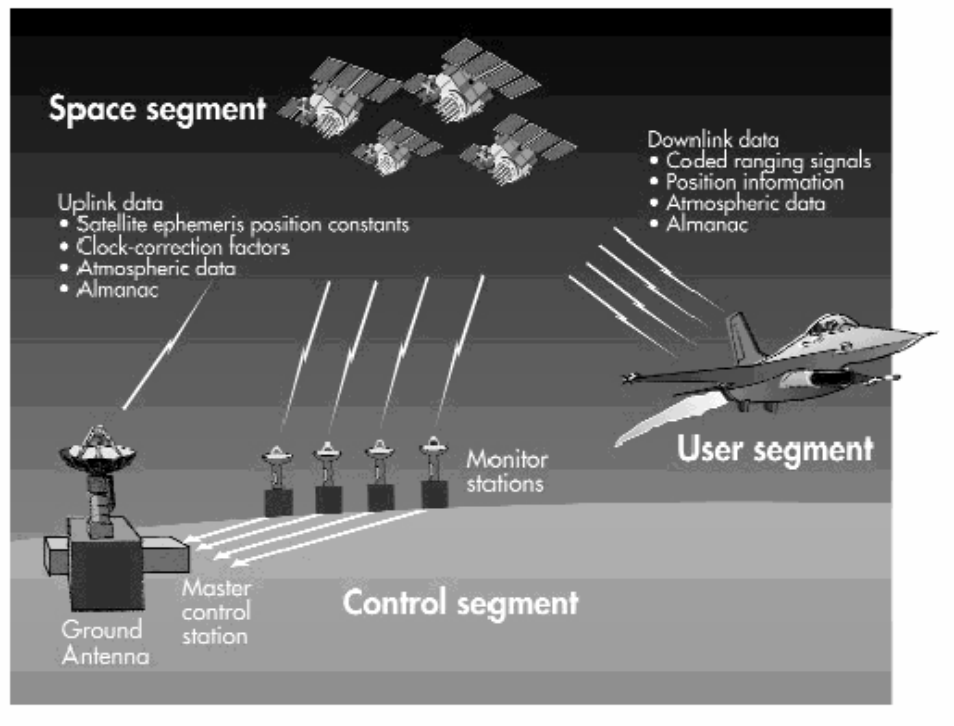
GPS - Components

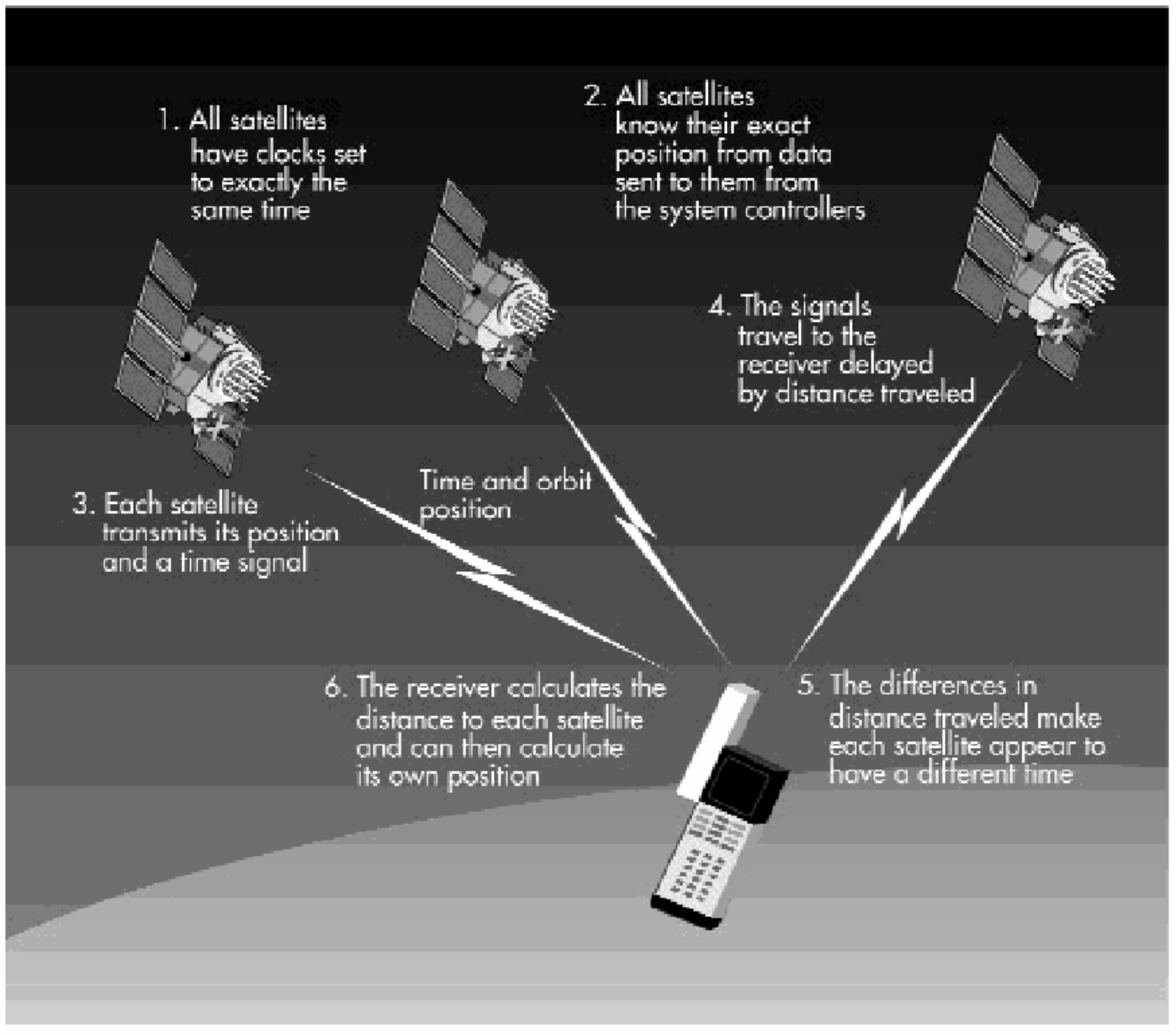
NAVSTAR GPS consists of three general components:

1) Space segment

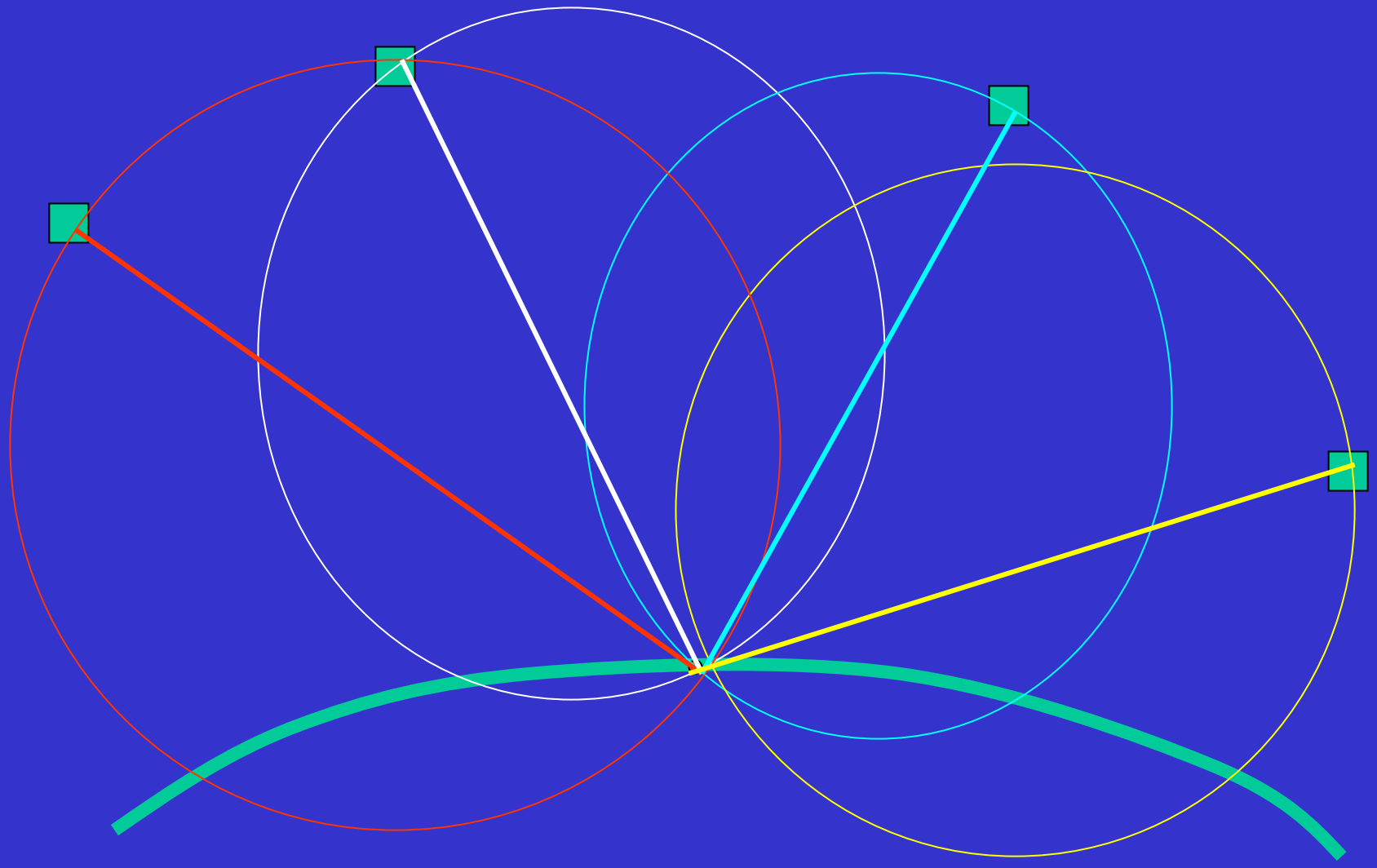
2) Ground control segment

3) GPS user segment



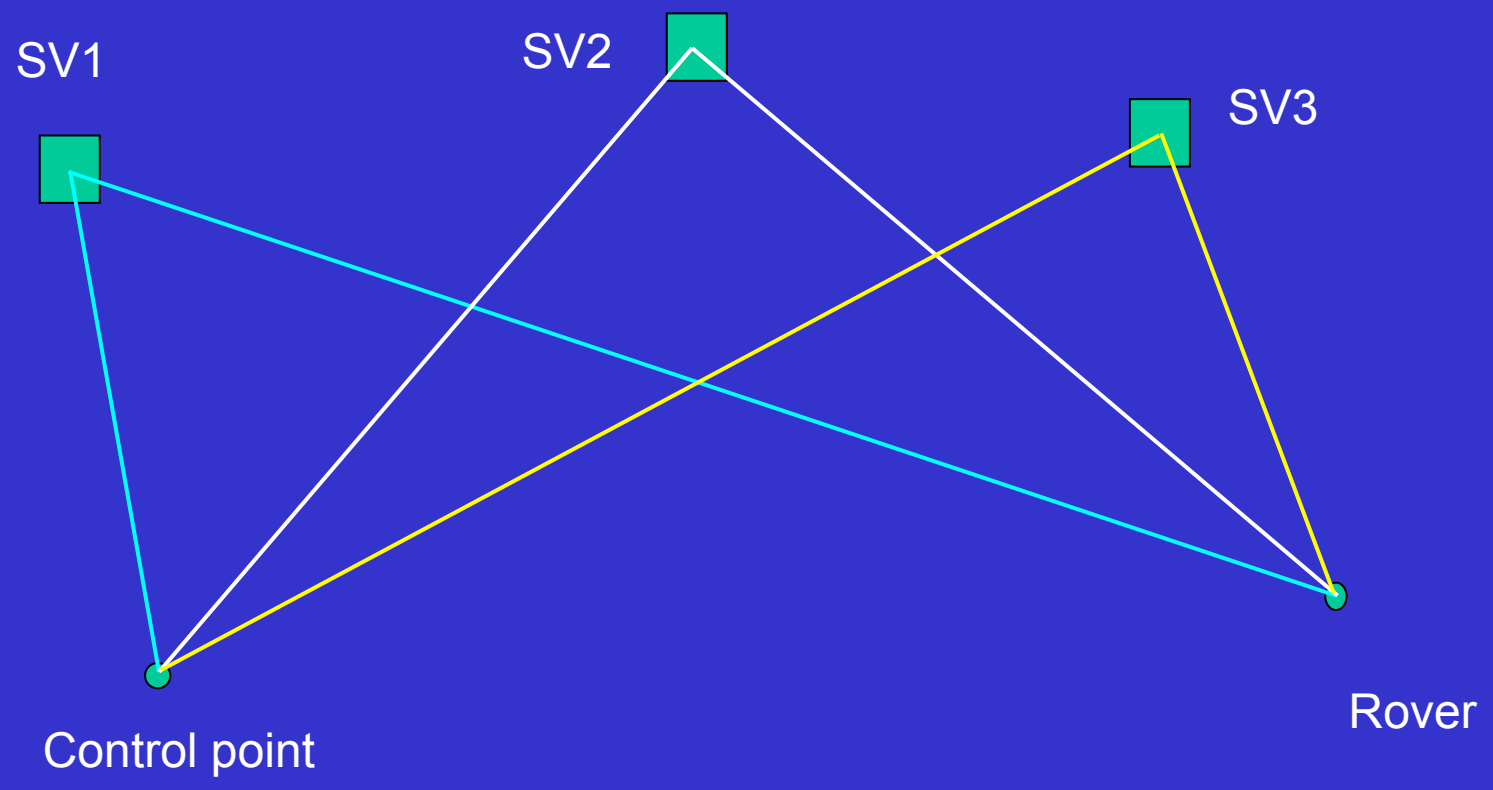

1. All satellites have clocks set to exactly the same time
2. All satellites know their exact position from data sent to them from the system controllers
3. Each satellite transmits its position and a time signal
Time and orbit position
4. The signals travel to the receiver delayed by distance traveled
5. The differences in distance traveled make each satellite appear to have a different time
6. The receiver calculates the distance to each satellite and can then calculate its own position

GPS - A Range-Range System



GPS - Differential Corrections

Differential positioning is a technique that allows the computation and removal of some GPS error and thus, increases the accuracy of the position measurement.



GPS - NMEA Output

National Marine Electronics Association

REQUIRED

GGA - Time, Position, and Fix Related Data

OPTIONAL

GSA - Position Fix Mode, SVs used, and DOP
VTG - Velocity (Speed and Course)

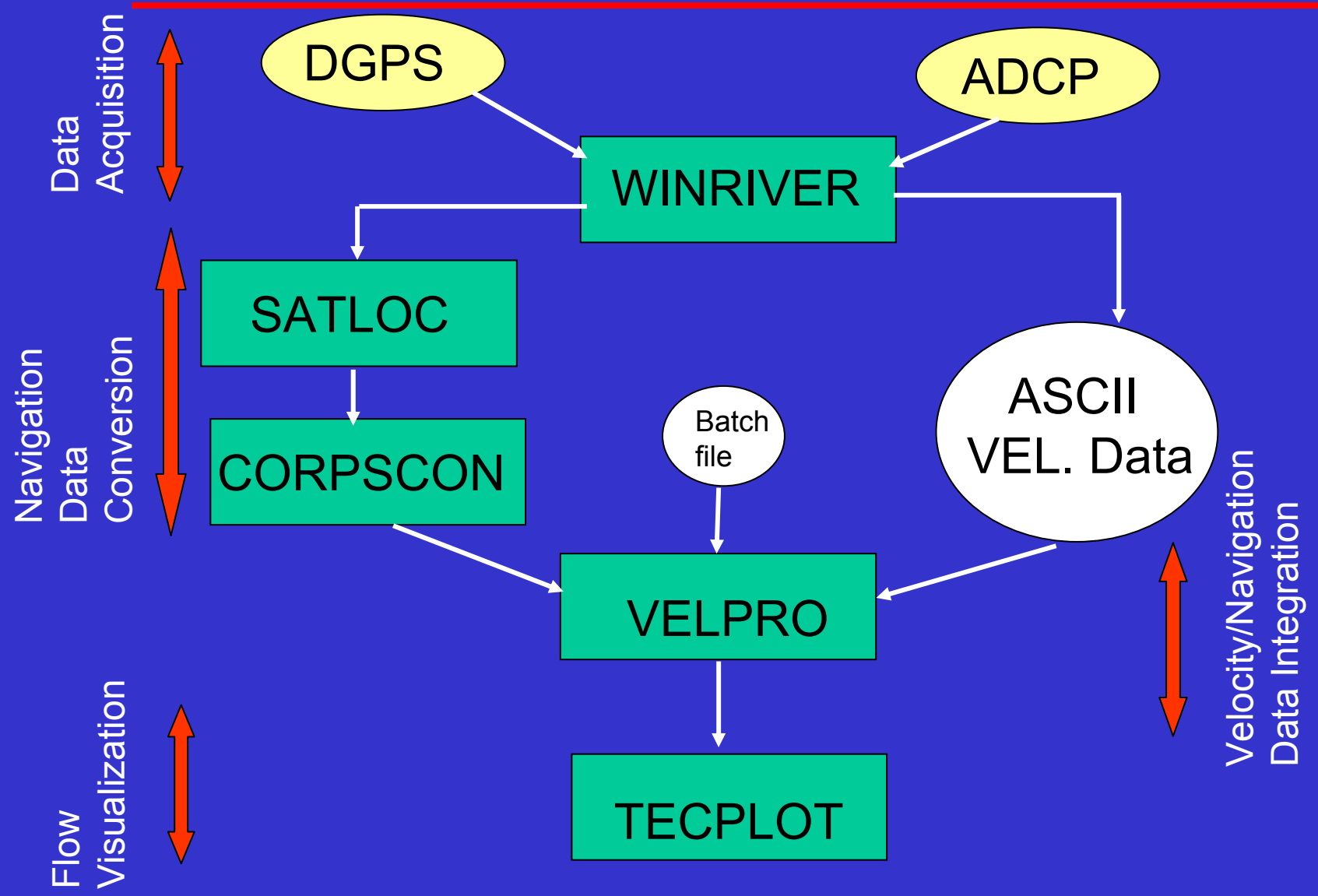
Compass Calibration

- Needed to correct differences between earth coordinate system of DGPS and the ADCP's internal magnetic compass

- Two corrections
  1. Magnetic variation
  2. One-cycle magnetic deviation errors

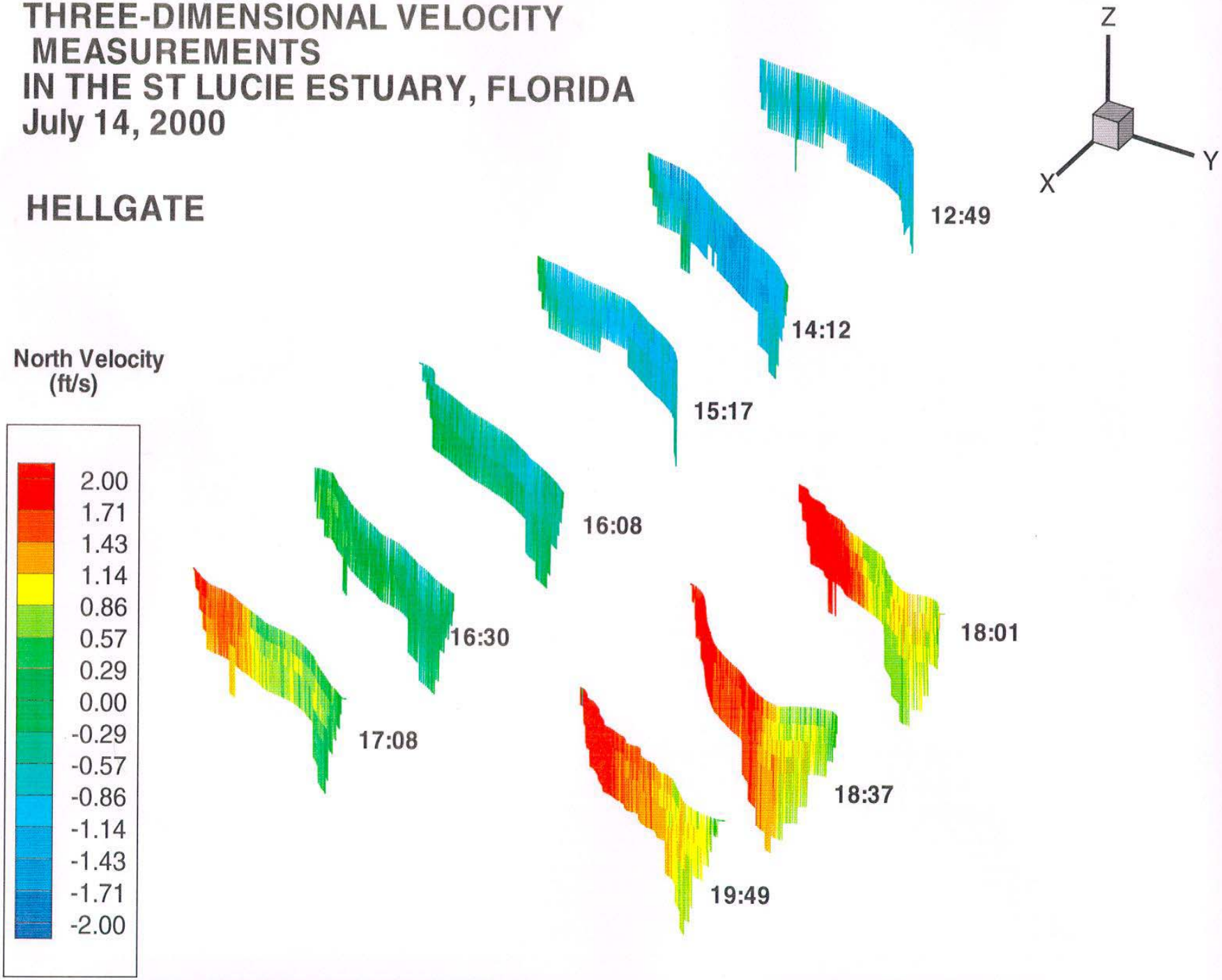
- Results
  1. Magnetic variation= 4.5 degrees W
  2. One-cycle magnetic deviation errors
     1-cycle error=0.0147
     1-cycle offset=335.53 degrees

Processing of ADCP/GPS Data



THREE-DIMENSIONAL VELOCITY MEASUREMENTS IN THE ST LUCIE ESTUARY, FLORIDA
July 14, 2000

HELLGATE



Summary and Conclusions

- ADCP is integrated with a DGPS to obtain 3-D velocity measurements in St Lucie Estuary

- 3-D velocity measurements can be used to calibrate and validate hydrodynamic models

- Calibrated and validated hydrodynamic models can be modified to develop nutrient transport models