

Appendix F: Implementation Journal

12/15/98

Using Labview Professional

DegToRad - converts degrees to radians

ArcLengthTwoPts - calculates arcLength for two pts

DegToDecimalDeg - converts degrees to decimal degrees

12/16/98

Implemented RadsBetTwoPts

Implemented NMBetTwoPts - used Aviation Formulary V1.22

Discarded ArcLengthTwoPts

12/18/98

CourseBetTwoPts

Works in only one direction for LAX-JFK.

Works in both directions for East-West

Works okay for short distance < 180? But accuracy is within
36 deg.

Verify accuracy

Magnetic variation - East = -, West = +

VORStatus

Set maximum value for VOR to be on/off in this subVi.

AddRadians/SubRadians - fix modulation problem so that range is only 0-360-

VORStatus was correctly implemented and works correctly

VORStatus

Verify Correct Operation

12/19/98

Created TestUsingData to use data in text file: testdata.txt

Noted 16-17 Deg Magnetic variation in Bay Area

12/20/98

VORStatus - Problem in comparing OBS and CourseDirection in order to determine TO. The problem was that a modulus radian addition/subtraction was being used, but this caused more problems. Instead, a non-modulus radian addition/subtraction was used.

Created control for compass/ADF.

Simulation -

Used 1-second timer to delay. Increase if more time desired.

Implemented bank effects on course.

Make sure switch is on.

Speed fluctuates occasionally for set speed.

12/21/98

Implemented SimAcceleration

Simulation

Check Latitude calculations

Check longitude calculations

12/23/98

Fixed simulation problems with latitude and longitude calculations by using ModRadians.vi

Chose not to use pictures imported for displays in order to preserve portability among various platforms and not degrade appearance.

Created VOR display as a VI. Was unable to create as a control.

Added all highlighted VORs which have Lat/Long info to database.

Tested DME NM=293 and TestDisplay worked okay.

VOR Testing Files

VORTestUsingData.vi - acts as interface for VOR and for main testing.

VORStatus - main file

VORTest.vi - calculation for VOR module

Fixed Problem with OBS in VORStatus.vi

Fix problem with needle deflection - check for smaller value.

12/24/98

VOR Deflection and Status fail for 0=360.
Corrected VOR status problem.

VOR deflection works for TO only, not for FROM.

12/27/98

Fixed VOR deflection.

12/28/98

Created XYGraph.vi - a scatter graph which displays an X-Y Scatter graph

Connected Simulation and VOR into SimVORTestUsingData.vi

Problem: Simulator is constantly running - affects data. Fix so that simulator does not run when switch is off. Data is constantly changing and leads to erroneous results.

However, data is being transferred properly. Possible Solution: Review Case statement

Possible Solution: Move timer to outside while loop

Possible Solution: Replace simulation structure with Case statement

12/29/98

Fixed Simulation continuously running problem by using Cases instead of loop.

New Problem: Simulator values oscillate, and do not change as required. Also, simulator values reset when Simulator/File switch is changed.

Note New File: SimVORTestUsingData2.vi

Fixed Simulator Oscillation Problem.

Added ability to import data from file. Could not import data from file with constant.

Was able to import data from file but path must be set as a constant. Created InputFileIO.vi for input information.

Working on TestArray.vi, which will take elements and append them to an array.

Created PosGraphDataArray.vi which will store all necessary information for creating a graph, by appending necessary information.

12/30/98

Embedded Track Record into SimVORTestUsingData2.vi

Track Record and Simulation work in SimVORTestUsingData2.vi.

1/3/99

Fixed TrackRecord so that array resets once on run.
Implemented VOR Display into SimVORTestUsingData3.vi
Implemented 2 VOR Displays.

1/5/99

Attempted to implement instruments that use dynamic calculations. Airspeed failed...could be problem in DistanceAlongRadial.

1/6/99

Fixed airspeed problem....distance(rads)input of DistanceAlongRadials was accidentally connected to distance(NM). Also fixed constants for ms in hour to 3600,000 ms/hr

1/7/99

Implemented heading indicator calculations. Tested and verified.

1/10/99

Implemented heading and speed indicator calculations as separate from Simulation module...to allow easy implementation/non repetitive implementation for GPS unit.
Saved as SimVORTestUsingData5.vi

1/12/99

Converted all station id info to GetStationInfo.vi
Implemented storing output data using switch into file output.dat
Saved as SimVORTestUsingData6.vi

1/13/99

Tested various flight routes/distances/courses. Used Excel to determine percent errors - saved in file: output 1-13-99 spreadsheet.
Original data in file 1-13-99

Errors could be accounted to accuracy and revisions of map.

1/19/99

Retested for errors for positions from 1/13/99 (see Excel file).
Noted that %error for heading was incorrectly calculated in Excel file.
All heading problems corrected.

Verified OAK-LIN and LIN-OAK distance error is in both directions. Verified map-determined that map reading was at fault - did not see a multiple segment between LIN and OAK. Okay.

Updated GetStationInfo so that it will work in any hemisphere.

Simulation did not track to VOR station. Implemented magnetic deviation for simulation.

All new information saved in file SimVORTestUsingData8.vi

Implemented necessary conversions for all hemispheres. Not tested.

1/20/99

Tested and created file for searching database for VORs - SearchDatabase.vi.

Implemented searchDatabase and VOR. Saved as SimVORTestUsingData10.vi

Also created test file for data...VORDummyData.txt

Data file must have a delimiter: 999 XXX 999.9 N000 00.0 W000 00.0

Used Excel to clean up original data file and sort. New data file is LRF VOR Data.txt.

VOR 1 completely implemented.

Implemented ADF. Saved as SimVORTestUsingData11.vi

2/25/99

To download from GPS (on Desktop – set Com2, on laptop – set Com1). Screen should be on acquiring satellites.

2/26/99

Created SerialIO.vi to handle reading and writing to serial ports.

2/28/99

Used HyperTerminal and NMEA setting on GPS unit to retrieve data from unit.

Connected SerialIO.vi to Garmin. Saved test data in Garmin NMEA Test Data. Used Peter Bennett's and other NMEA data contained in NMEA Information.doc

Saved as NMEAToPos.vi

SimVORTestUsing..11.vi has File Position implemented
SimVORTestUsing...20.vi has GPS unit serial i/o implemented. This is a working version.

Number of bytes read is set by trial and error from GPS unit.
NMEA was chosen since it is the standard.

3/1/99

Consolidated registers in SimVORTestUsing..21.vi

3/3/99

SimVor..21.vi is good.

SimVor..23.vi has a few problems – combined simulation mode.

3/4/99

SimVor...24.vi

NMEA vs Garmin protocol (specialized)

3/6/99

Fixed database search error when value > Max Frequency is set and error when value not in database but > freq1 and < freq2. This was fixed by setting a boolean value if database search found at least one match.

GPSProject.vi implemented as overall project control

Implemented Station Index in 26.vi

Current is ...28.vi

Set all filenames to be user selected.

Set up defaults for inputs.

Fixed problems with selecting invalid stations.

3/8/99

Current is ..29.vi with reading lat/long data from input file set up, but not implemented.

3/9/99

Created SaveDebugData to store data during testing. Not yet implemented. Stores data in hardcoded filename: output.txt

ADF Corrected by adding appropriate calculation. However, constantly goes to NAN. Implemented shift register correction to prevent fluctuating needle.

4/1/99

Created ReadGPSData.vi for Strasilla and terrain avoidance team.

1. Plug in GPS to serial port and make sure GPS is on
2. Set GPS setup Input/Output to NMEA output.
3. Determine Serial port (usually Com2 on PCs and Com1 on laptops)
4. Run Labview
5. Open ReadGPSData.vi (do not run, just open file)
6. Set serial port number
 - Com 1 = 0
 - Com 2 = 1
 - Com 3 = 2
 - Com 4 = 3
7. Run ReadGPSData.vi – requires NMEAToAltitude.vi, NMEAToPos.vi
8. Once GPS unit has located satellites, position, time, and altitude will be displayed.
9. Adjust number of bytes read depending on GPS unit being used. For GPSMAP195, use 1000. For all others, experiment to determine. If too low number is set, then GPS data will flicker. Correct data will be provided for high number, but will cost speed. Begin with high number initially until correct number is experimentally determined.

See NMEA FAQ by Peter Bennett

<http://vancouver-webpages.com/pub/peter/index.html>

4/3/99

Documenting files. Saved as SimVor...32.vi

4/24/99

Fixed reading from data file problems. Saved as SimVOR34.vi

5/1/99

Oriented to look better – Saved as GPSProject37.vi