

# Waypoint Consulting Inc.

## RTKNav / RtStatic / RtDLL:

### GPS Real-Time Kinematic Software

#### RTKNav

The **RTKNav/RtStatic/RtDLL** series of modules form the basis of our Win2000/XP (not recommended for Windows 98 or NT 4.0) based Real-Time-Kinematic applications. They are designed for accuracies from the centimetre to sub-metre level. The real-time modules have a specific graphical interface like GrafNav/GrafNet, but they are principally designed so that developers can integrate these modules into their own systems. One feature of the modules is that they have the ability to process data simultaneously from up to 20 remote GPS receivers. Also, the modules can perform high precision computations whether the base station is stationary or moving. This provides additional flexibility for users who require relative range and azimuth determination from a moving base to a non-stationary target. These modules can also be configured in an attitude determination mode for computation of roll, pitch and azimuth.

**RTKNav** is a stand-alone RTK program with a full-featured Graphical Interface capable of handling code and carrier phase data from up to 20 remotes simultaneously while providing up to centimetric accuracies from single or dual frequency receivers. This module has its own built-in serial and network device driver, and it can handle real-time binary data from Ashtech, Marconi, NovAtel, and NavSymm receivers simultaneously on any combination of serial or network ports. Processed and/or raw data may also be written to the hard disk or output from a separate serial or network port to another device or computer.



dual frequency processing, Kinematic Ambiguity Resolution (KAR), accurate tropospheric and ionospheric modeling, the fixed static solution, forward and reverse processing directions for post processing and many more features.

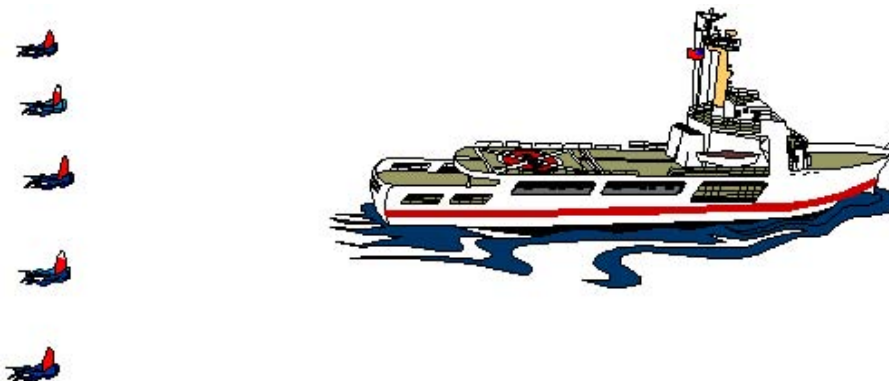
Our RTKNav Developer's kit also comes with SIOGPS.DLL. SIOGPS collects data for you from serial or network ports and decodes data for NovAtel, Ashtec, CMC, Rockwell and Parthus formats.

## Accuracy

Accuracies obtained by RTKNav and RtDLL are the same, and depend very much on the environment. Under good open conditions, accuracies of 1 cm + 2ppm can be achieved very easily. This requires a KAR initialization, which usually requires 12 minutes with dual frequency and 8-25 minutes with single frequency. Floating ambiguity modes are also available, and accuracies achieved under these conditions usually range from 10-30 cm. After a loss of lock accuracies will degrade to that of DGPS, but will improve very quickly via the carrier phase signal. Azimuth determination accuracies depend on the separation between antennae. With a 2-metre separation, 0.5 -1.0 degree accuracies are typical.

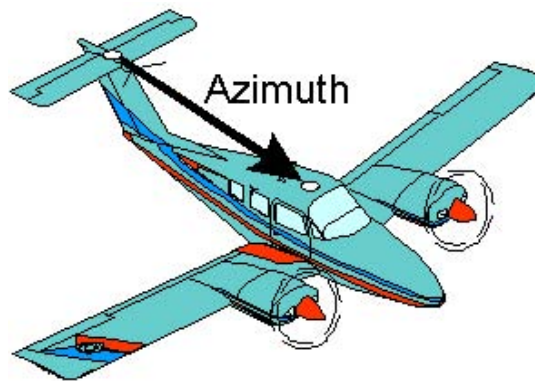
## Ship to Buoy Positioning

For many marine applications such as Seismic, Ocean Research and Military, the relative distance between the ship and one or more buoys is often required. For such an application, RTKNav/RtDLL are both proven and well suited. RTKNav/RtDLL's carrier phase processing capabilities mean that accuracies attained are much higher than more traditional code-only processing techniques. Moreover, all processing can be performed using one central processing computer on the ship.



## Azimuth Determination

GPS has been shown to be well suited for azimuth determination. Waypoint's robust and fast azimuth determination algorithm works in either static situations like tank and gun pointing or kinematic environments like aircraft or ship heading determination. Combining the software with a low cost GPS receiver, an inexpensive attitude determination system is formed.



## 3D Attitude

GPS based attitude determination techniques can be much less expensive than inertial based techniques. Moreover, they do not have the susceptibility to magnetic disturbances and vehicle dynamics that slaved attitude determination systems have. RTKNav/RtDII can compute roll, pitch and heading from 3 or more fix-mounted antennae. Included pre-calibration software ensures that the body coordinate frame is easily defined.



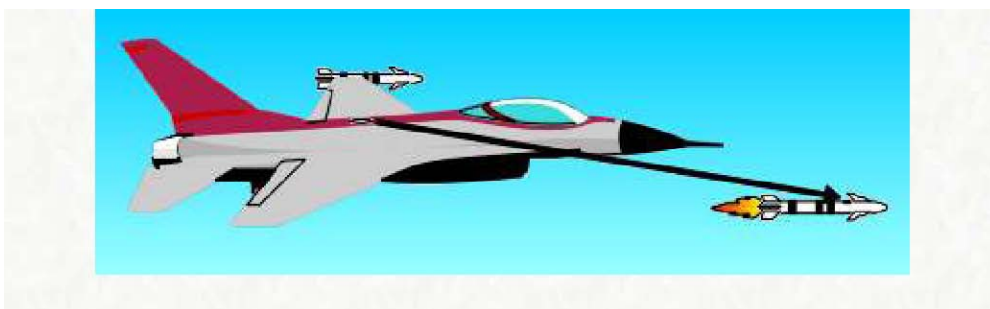
## Centimetre RTK

Using RTKNav or RtDLL combined with dual frequency GPS equipment; accuracies of a few centimetres can be obtained in a matter of minutes. This can be beneficial for applications such as construction, land surveying, marine dredging and subsidence monitoring. Waypoint's KAR algorithm facilitates such fast centimetre accuracy resolution in both static and kinematic modes. Robustness is also very important, and Waypoint Consulting Inc. has put much effort in ensuring that our algorithms are very reliable.



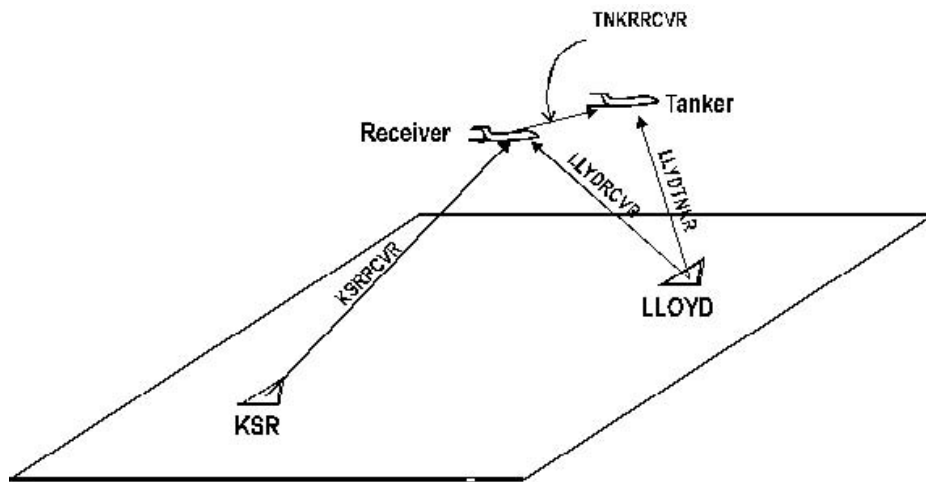
## Air to Air Position and Velocity

Some applications require the relative position and velocity vector between two aircraft. Examples of such applications are air-to-air refueling, projectile tracking, aircraft testing and helicopter-to-balloon tracking. The relatively short vector between the airborne objects makes such positioning superior to correction techniques using a fixed ground station, which is often very far away.



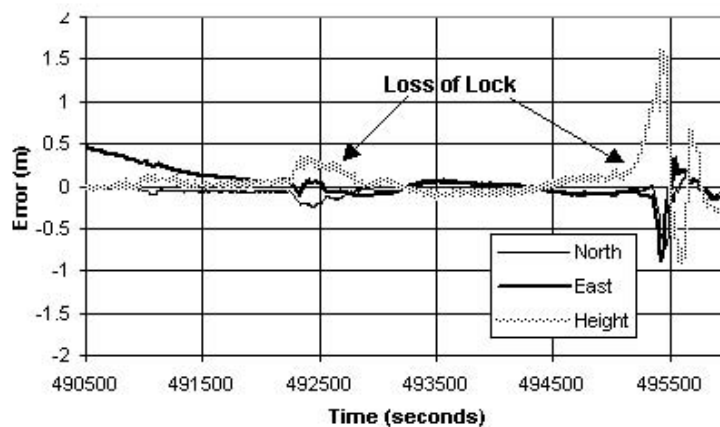
## Air to Air Refuelling

The figure below shows a real-time "moving baseline" scenario, where the tanker aircraft acts as the base station and the approaching aircraft is the remote station. Under these conditions, the item of interest is the relative vector between the tanker and approaching aircraft, providing an optimal position to complete the refuelling operation. Other similar applications exist in the marine industry.



Real-Time Moving Baseline Test Procedure

The graph below displays the absolute accuracy of the refuelling process given complete loss of lock at two places in an actual tanker-refuelling test.



Real-Time Moving Baseline Test Results

## RTKNav System Setup

RTKNav and RtDLL can be configured with as many as 20 remotes. The Figure on the right shows RTKNav configured with 4 remotes. In this configuration, each remote has its own transmission frequency and radio-modem (RM) pair. This allows for very high data rates. Other configurations are possible that use shared frequencies. The separation of remote data into individual serial streams must be performed external to RTKNav. Corrected position information is exported in a NMEA message format that can be processed or plotted.

