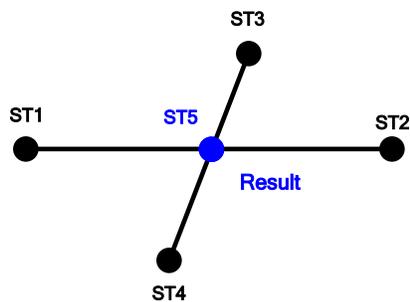


# COMPSYS 21 User Documentation

## Version 2.8/06



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Aviation System Standards (AVN)  
Information Technology Staff  
NAS/Management Systems Branch  
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# Digital Aeronautical Database System (DADS) COMPSYS 21

Version 2.8/06

The Digital Aeronautical Database System (DADS) is a graphics user interface created by the Aviation System Standard's (AVN) NAS/Management Systems Branch for the National Aeronautical Charting Office (NACO). This user-friendly interface is one part of the development designed to help automate the compilation of aeronautical data and charts. The entire system will integrate different systems and products into an advanced and flexible system of creating and maintaining charts and data.

The DADS application includes two different modes. The COMPSYS 21 mode is a graphics user interface for geodetic computations. It allows user-friendly calculations without connecting to the database or using the CAD package MicroStation. The Graphics option is currently greyed out in this standalone DADS version.

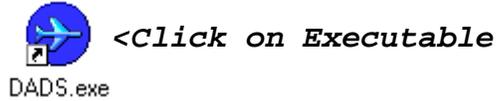
## 1.1. COMPSYS 21: (Non Graphics Mode)

All of the COMPSYS 21 calculations are available in this Windows interface. These include Forward, Inverse, Segment/Segment, Bearing/Bearing, Segment Distance, Circle Bearing, Circle/Circle and Segment Bearing. Results can be sent to a user specified printer or saved to a file. The COMPSYS 21 pull down also contains the Airport Reference Point calculation.

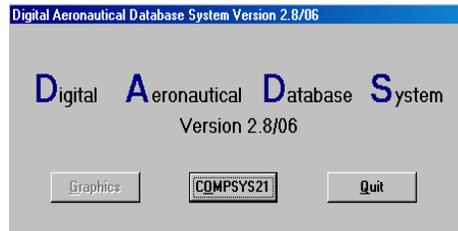
All computations are based on solutions of the geodetic forward and inverse after T. Vincenty, modified Rainford's method, with Helmert's elliptical terms. Intersection computation is also based on equations from SP-138 (NAVOCEANO, Spheroidal Geodesics Reference Systems, and local geometry by P.D. Thomas. Forward and Inverse routines are fully certified by the Department of Commerce/National Oceanic and Atmospheric Administration (NOAA)/National Geodetic Survey (NGS), the agency responsible for geodesy. The forward and inverse computations are the basis of all COMPSYS 21 calculations. Forward and Inverse computations are effective at any distance short of ANTIPODAL.

The user can create a shortcut on their desktop if desired. Just click on the DADS executable (**DADS.EXE**) and select COMPSYS 21. The initial setup will add DADS as a selection under programs from the start menu.

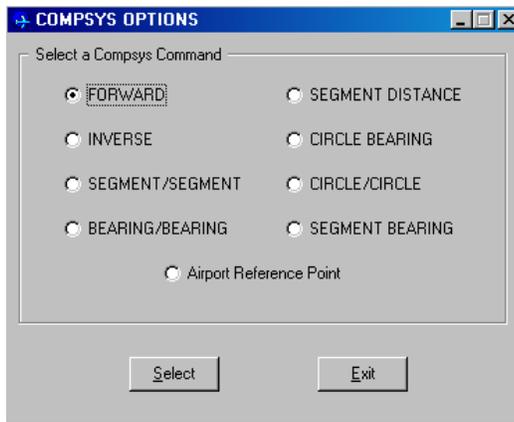
**Shortcut**



**Version 2.8/06**



**COMPSYS 21 NON GRAPHIC MODE**



Click on the desired COMPSYS 21 calculation and then click on **select** or double click on the desired routine. A blank form will appear for user inputs.

**1.2. Ellipsoids:**

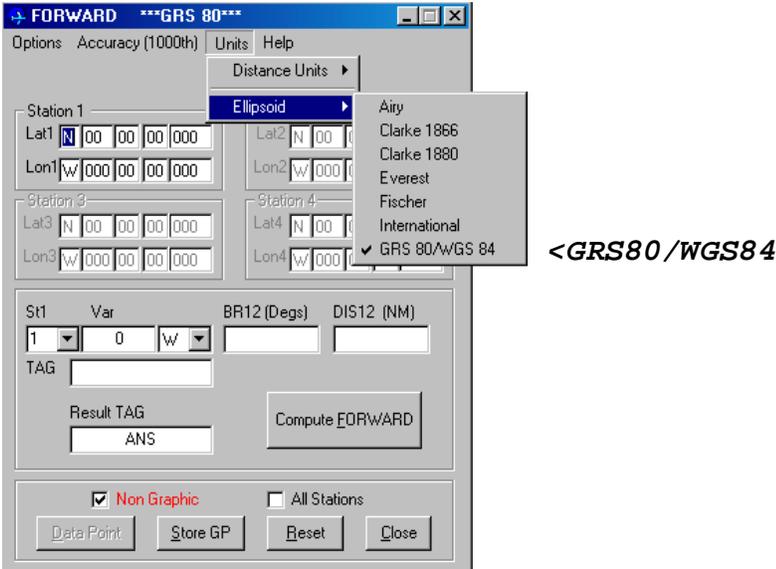
The earth is not a sphere but an ellipsoid. Due to centrifugal force generated by the rotation of the earth on its axis, the earth is flattened slightly at the poles and bulging somewhat at the equator. This shape is further influenced by the pull of gravity on different parts of the earth's surface. This shape is called a geoid. These variations in the geoid mean that a certain ellipsoid may fit different areas of the world more closely. Thus, other ellipsoids can be selected in COMPSYS 21. In 1983, the GRS80 ellipsoid was adopted for worldwide usage. NACO's computations are derived from this standard ellipsoid.

The default ellipsoid for all calculations within COMPSYS 21 is the Geodetic Reference System of 1980 (GRS80). This ellipsoid is basically identical to the World Geodetic System of 1984 (WGS84). An ellipsoid's size is defined by the semi major axis (a) and it's flattening (f). In the case of these two ellipsoids the difference in one of the constants is only a tenth of a millimeter.

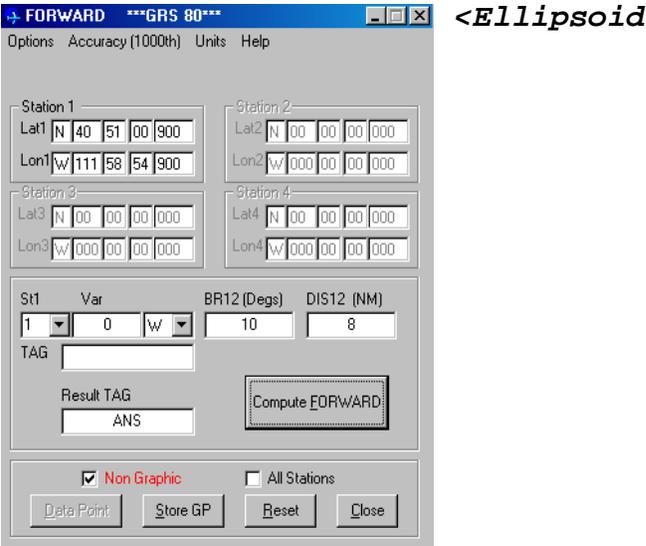
**GRS80/WGS84 Constants**

Parameter	Notation	Units	GRS80	WGS84
Semimajor Axis	a	m	6378137	6378137
Semiminor axis	b	m	6356752.3141	6356752.3142
Flattening	f		0.00335281068118	0.00335281066474

**Ellipsoids**



The ellipsoid selected will always appear on the top of the computation chosen and in any result that is saved to a file. The ellipsoid will remain active until another is picked or COMPSYS 21 is exited.

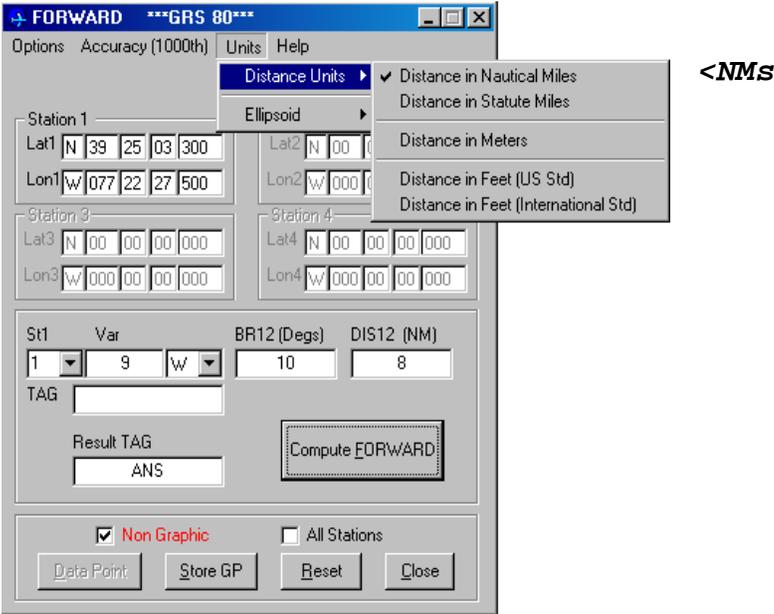


**1.3. COMPSYS 21 Units:**

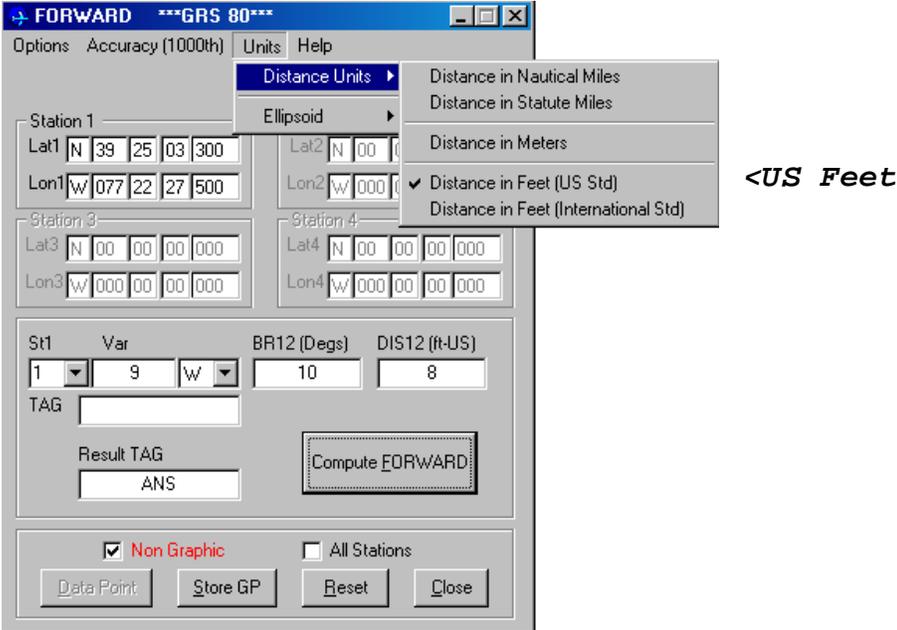
COMPSYS 21 by default uses nautical miles as the input and output distance units. COMPSYS 21 uses the international standard for a nautical mile. This standard defines one nautical mile as exactly 1852 meters. The actual distance of a nautical mile varies somewhat depending on where you are on a meridian. All computations within COMPSYS 21 are done in meters.

COMPSYS 21 has been enhanced to allow the user to enter in a distance in Statue Miles, Meters, U.S. Feet or International Feet. In 1866, the U.S. Congress defined one meter as exactly 39.37 inches. The International foot was defined in 1959 when a number of countries agreed that one inch was equal to 2.54 centimeters.

**FORWARD NAUTICAL MILES**



**FORWARD COMPUTATION in US Standard Feet**



**1.4. Store GP:**

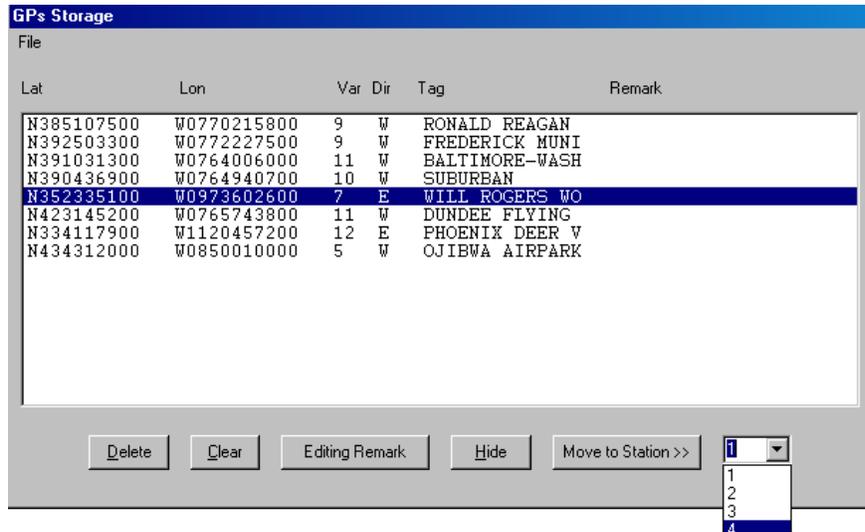
Geographic Positions can be stored for additional or future computations. Select the **Store GP** button to open the GPs Storage form. Any of the four stations can be dragged over into this form. Once stored, a position can be selected for any computation.

*Store GP>*

**GPs Storage Form**

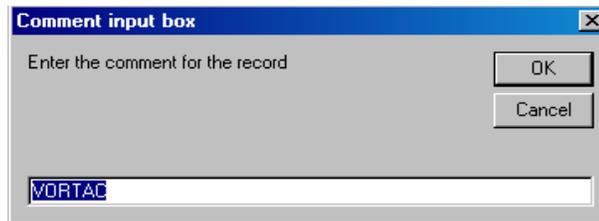
Lat	Lon	Var	Dir	Tag	Remark
N385107500	W0770215800	9	W	RONALD REAGAN	
N392503300	W0772227500	9	W	FREDERICK MUNI	
N391031300	W0764006000	11	W	BALTIMORE-WASH	
N390436900	W0764940700	10	W	SUBURBAN	
N352335100	W0973602600	7	E	WILL ROGERS WO	
N423145200	W0765743800	11	W	DUNDEE FLYING	
N334117900	W1120457200	12	E	PHOENIX DEER V	
N434312000	W0850010000	5	W	OJIBWA AIRPARK	

A stored station can be selected by clicking on the desired geographic position. Once selected, chose the station number and then the **Move to Station** button. In this example, the row highlighted will be copied into station four for a geodetic calculation.

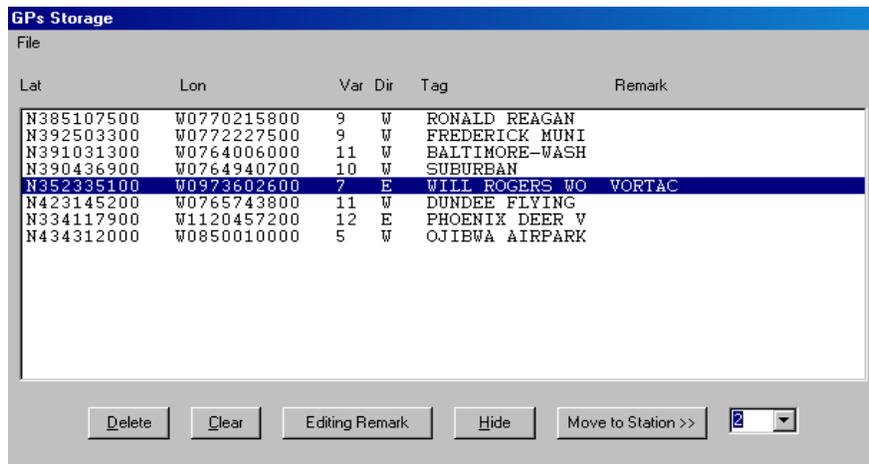


A remark can be added to aid the user. The **Editing Remark** button is used to add or edit a remark.

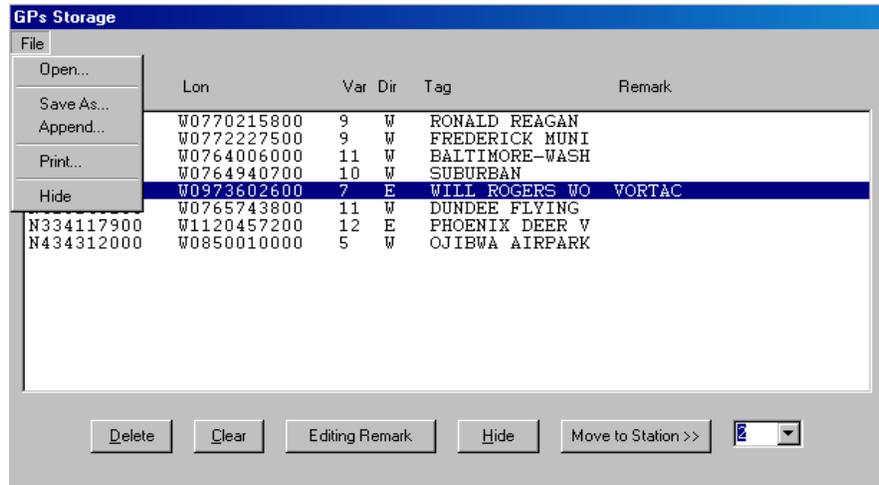
**Remark Box**



**GPs Storage with added Remark**



The GPs Storage list can be printed, saved or appended to a file. A list of geographic positions can be saved to a file and opened for future use. These options are available under the file pull down. The command button **Hide** will move the GPs Storage form to the background.



### 1.5. COMPSYS 21 Calculations:

#### 1.5.1. Forward

Given station one, plus a bearing and distance, the forward computation will return the geographic position of station two. A forward calculation is verified with the inverse calculation for accuracy. A warning message will appear if a calculation does not pass the accuracy test. The stations that are required will be black and others will be greyed out. All stations can be activated with the check box **All Stations**.

**FORWARD**

*LAT1>*

*<All Stations*

After station one has been entered, key in the bearing, distance and magnetic variation. The user can key in a tag for the result if desired. The default tag is **ANS** for answer. Once complete, select the **Compute FORWARD** button.

*<Bearing, Distance*

**FORWARD RESULTS**

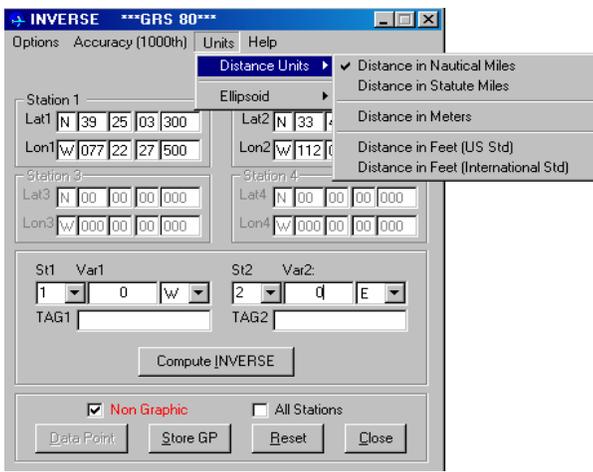
From--To	Azimuth	Magnetic	Distance (NM)
12	23.000	16.000	8.000
21	203.037	203.037	

Passed Inverse test

1.5.2. Inverse

Given station 1 and station 2, this program will calculate the bearings and distance between the two points. The user will find this very useful when validating or calculating the mileages between fixes or nav aids. The units can be defined as nautical miles, feet, or statute miles. An inverse calculation is verified with the forward calculation.

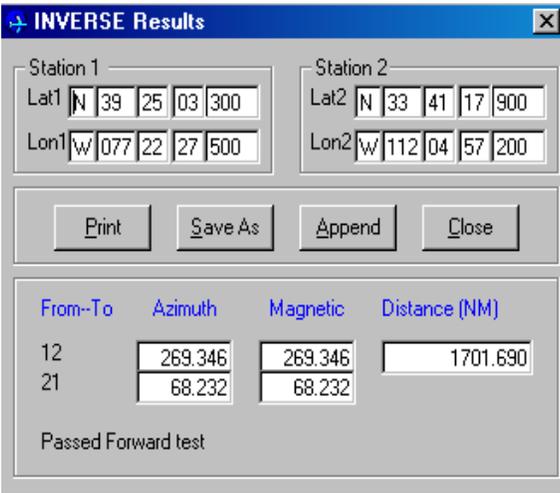
INVERSE



<Output Units



INVERSE RESULTS

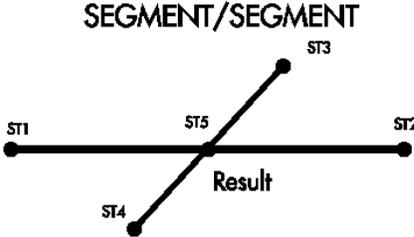


**1.5.3. Segment/Segment**

This computation is utilized when there is a line segment between station 1 and 2 and another between stations 3 and 4. It will calculate position 5 where the line segments intersect.

**SEGMENT / SEGMENT**

From-To	Azimuth	Magnetic	Distance (NM)
12	125.568	125.568	31.373
34	226.467	226.467	25.677
15	125.568	125.568	19.922
25	305.932	305.932	11.451
36	226.467	226.467	10.184
45	46.202	46.202	15.493
51	305.800	305.800	
52	125.800	125.800	
53	46.362	46.362	
54	226.362	226.362	



If the line segments do not intersect, COMPSYS 21 will extend the segments to find an intersection. It will extend the segments up to 2000 nautical miles to find an intersection. A note will appear on the results window indicating how far the segments were extended.

**No Intersection in Original Segment:**

**SEGMENT/SEGMENT**

**SEGMENT/SEGMENT Results**

Station 1		Station 2	
Lat1	N 43 59 34 900	Lat2	N 44 00 59 724
Lon1	W 112 37 51 552	Lon2	W 108 29 18 411
Station 3		Station 4	
Lat3	N 42 40 57 105	Lat4	N 43 16 50 787
Lon3	W 110 16 11 580	Lon4	W 107 48 32 991
Station 5 - Result			
Lat5	N 43 54 49 679		
Lon5	W 104 51 44 668		

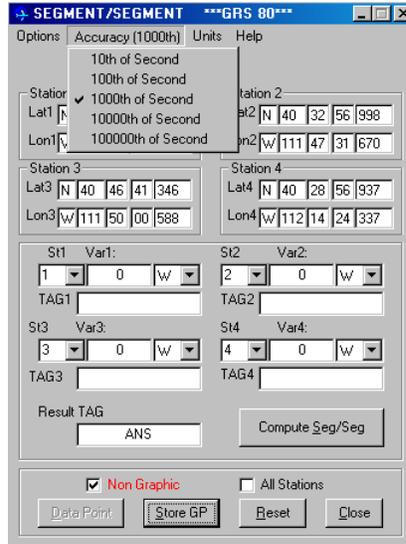
From-To	Azimuth	Magnetic	Distance (NM)
12	88.109	88.109	179.377
34	70.843	70.843	114.156
15	88.109	88.109	336.613
25	90.988	90.988	157.236
35	70.843	70.843	248.120
45	72.520	72.520	133.964
51	273.506	273.506	
52	273.506	273.506	
53	254.553	254.553	
54	254.553	254.553	

**Note**  
 No intersection in original segment 1-2  
 Intersection occurs after segment 1-2 is extended 157.236 NM  
 No intersection in original segment 3-4  
 Intersection occurs after segment 3-4 is extended 133.964 NM



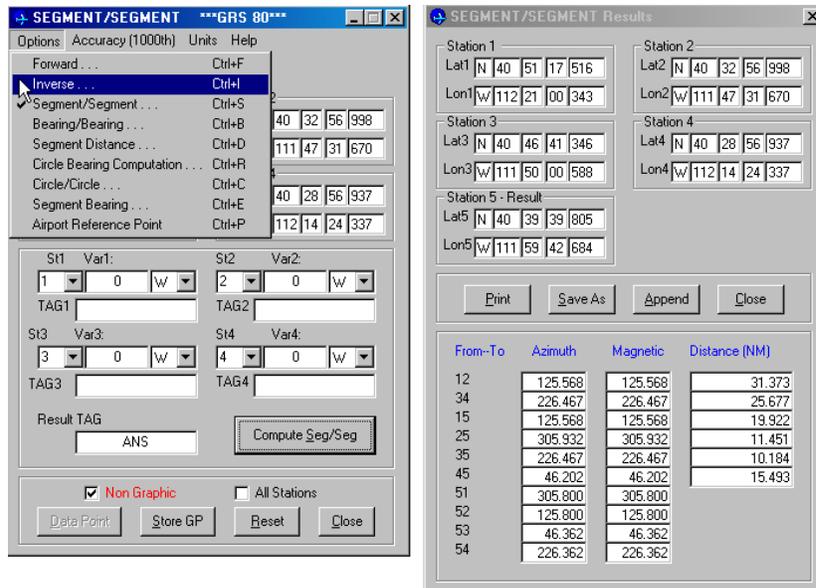
By default, the accuracy for all COMPSYS 21 calculations is 1000<sup>th</sup> of a second. The user can pick a different accuracy if desired.

**SEGMENT/SEGMENT  
Accuracy**

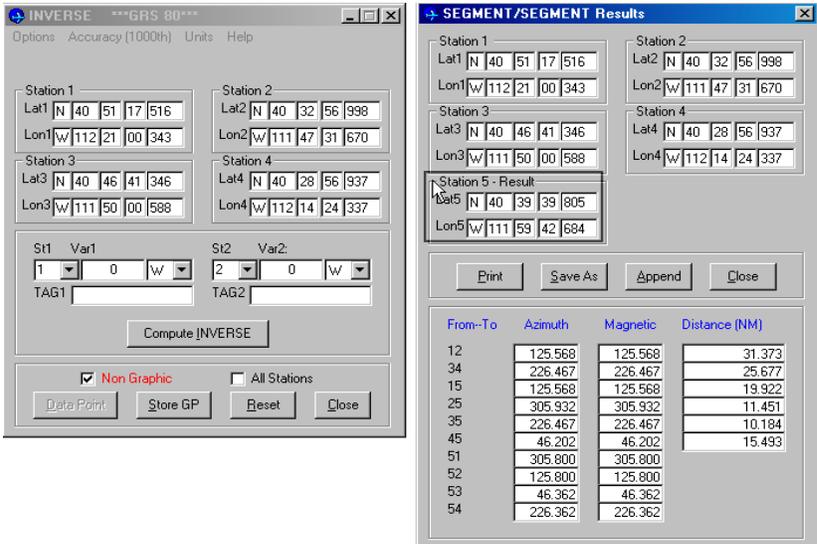


The results of a COMPSYS 21 calculation can be dragged back into the form to do another calculation. For example, the segment/segment result or Station five can be used for another calculation such as Inverse.

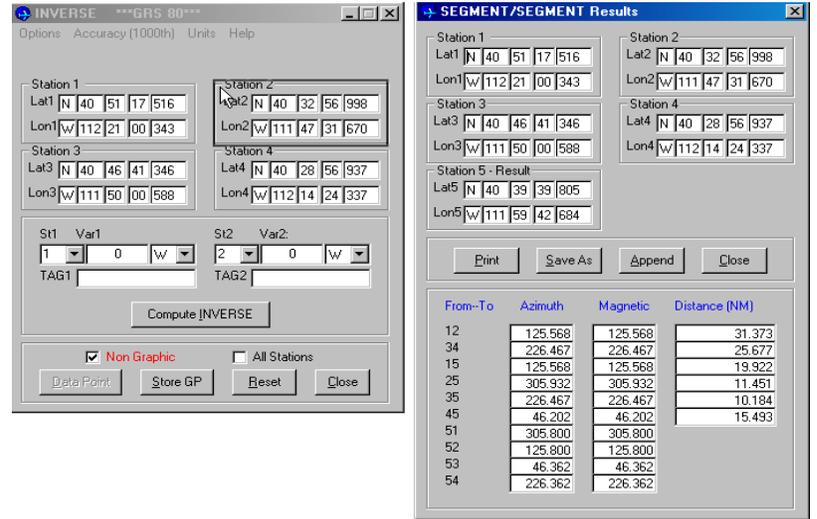
**Result Drag Back for new computation  
Choose desired calculation from Options:**



Click on Station 5-Result:

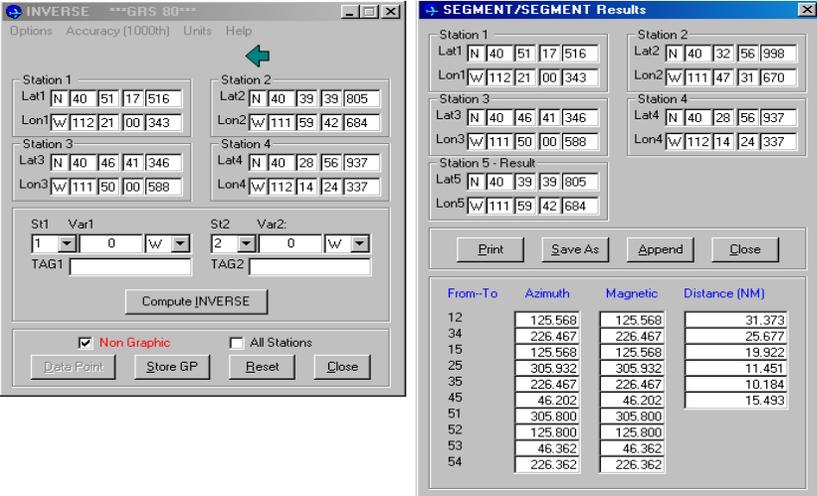


Drag and drop Station 5-Result to new calculation:



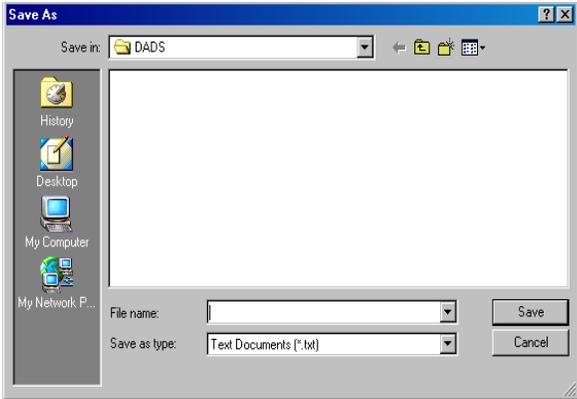
An arrow will show that a result has been dragged back:

Arrow>

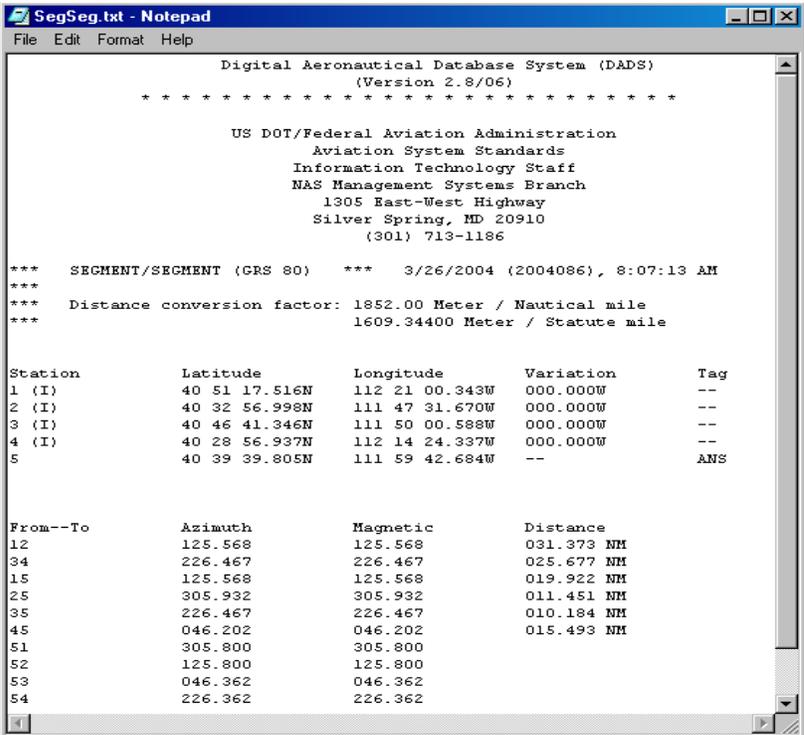


The results of any COMPSYS 21 calculation can be printed or saved into a user specified file. Just select **Save As** or **Append** for an existing file. Choose a valid directory and specify a file name. The result is a simple text file that can be viewed in a simple editor such as WordPad or NotePad. These files can be saved as a record or Emailed to others.

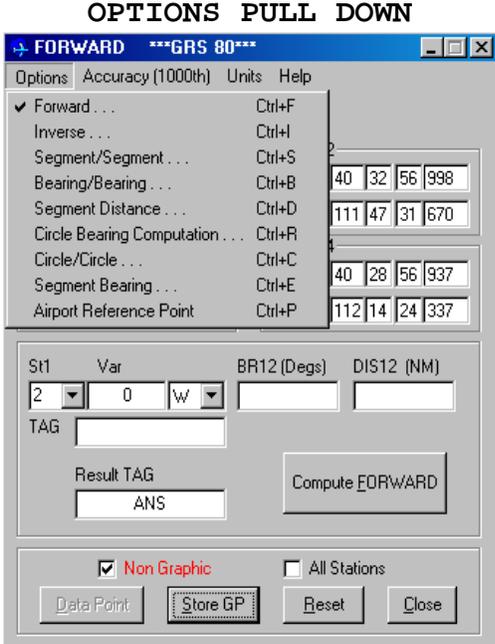
**SAVE AS**



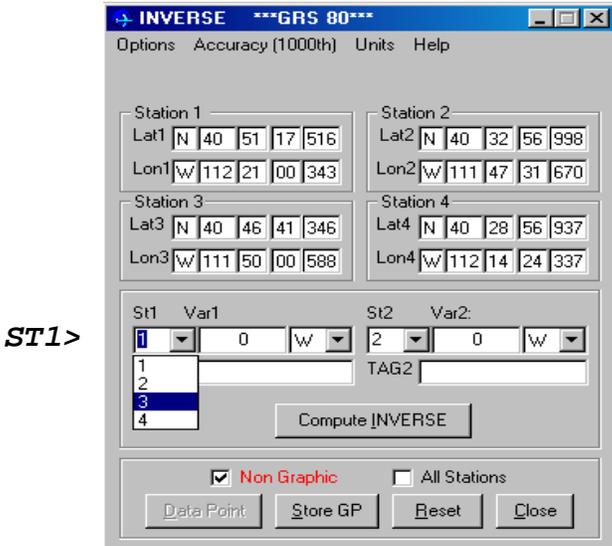
**SAVED FILE**

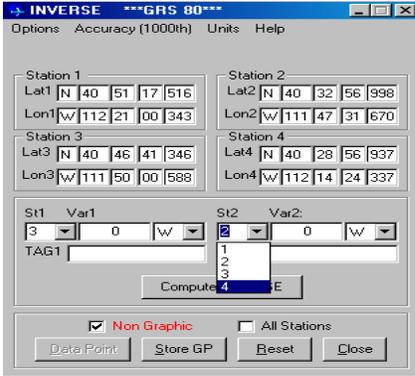


Additional COMPSYS 21 calculations can be executed with the current stations. Under options, just select the COMPSYS 21 routine desired.



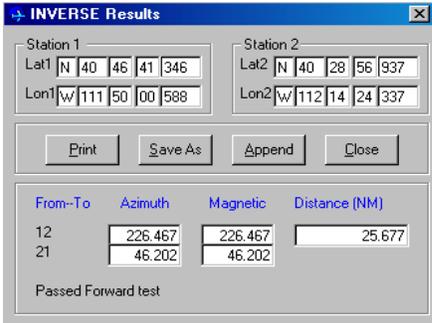
For instance, the user might want to do an inverse calculation on two of the stations that were previously used for a Segment/Segment calculation. Just select the station desired for **ST1** and the other for **ST2**.





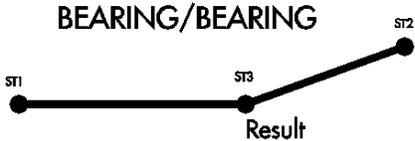
<ST2

Notice that the Inverse Results window will show only the two stations you have selected.



**1.5.4. Bearing/Bearing**

Given station 1 and station 2, with bearings, this program will calculate the geographic position of station three.



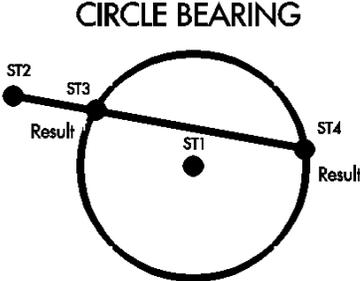
**1.5.5. Segment Distance**

Given a line segment between station 1 and station 2, and a distance from station 1 to station 3, this program will calculate the geographic position of station three on the line segment.



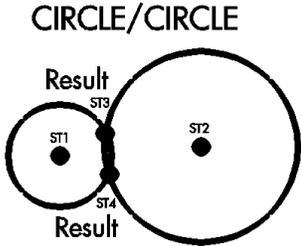
**1.5.6. Circle Bearing**

Given a position and radius for station 1, and position and bearing for station 2, this program will calculate the geographic position of stations 3 and 4 where the bearing from station 2 intersects the circle. If station two is within the circle there will be only one result.



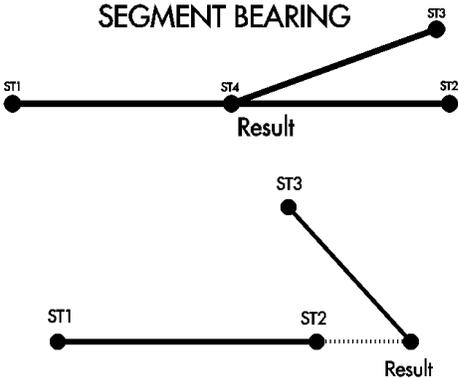
**1.5.7. Circle Circle**

Given both stations 1 and 2, and the radius for both, this program will calculate the geographic positions of stations 3 and 4 where the circles intersect. Only one result will occur when the circles are tangent.



**1.5.8. Segment Bearing**

Given a line segment between stations 1 and 2, and a bearing from station 3, this program will calculate the geographic position of station 4 where the radial intersects. If the radial does not intersect the original line segment defined by ST1 and ST2, COMPSYS 21 will extend the line to find an intersection.



**1.5.9. Airport Reference Point**

This option calculates the airport reference point based upon the runway ends and the length of the runways. Just select the **GP Entry** button and a **Data Entry** window will appear to enter in the coordinates. When the data has been entered in correctly, select **Enter in Table** button to insert onto the form.

**Airport Reference Point Form**

Runway	Latitude 1	Longitude 1	Latitude 2	Longitude 2	Entered Rwy Length (feet)	Computed Rwy Length (feet)

GP Entry >  None Graphic [GP Entry] [Reset] [Delete] [Calculate Airport Reference Point] [Close]

**Data Entry**

Enter Airport GPs

Latitude1: N 39 10 00 800      Latitude2: N 39 10 50 400  
Longitude1: W 076 40 15 900      Longitude2: W 076 39 35 100

Length: 6000 Ft      [Enter in Table]

Rwy Tag: 4/22      [Cancel]

<Enter in Table

Every time the user selects the Enter in Table button, another row will appear on the Airport Reference Point form. When all of the runways have been entered, select **Calculate Airport Reference Point**. A window will appear with the results along with the options to either print or save the results to a file.

Sample Completed Form

Runway	Latitude 1	Longitude 1	Latitude 2	Longitude 2	Entered Rwy Length (feet)	Computed Rwy Length (feet)
04/22	N391000800	W0764016900	N391050400	W0763935100	6000	6001.67

None Graphic   
    
    
    
   

<Calculate Airport Reference Point

Airport Reference Point Result

Latitude 1	Longitude 1	Latitude 2	Longitude 2	Computed Rwy Length (FT)
Runway 1: N391000800 W0764016900 N391050400 W0763935100 6001.67				

Airport Reference Point: N 39 10 25.600 W 076 39 56.000

1.6. Help Desk:

There is a help desk at the NAS/Management Systems Branch to answer questions about COMPSYS 21. The help desk is in operation from Monday thru Friday between the hours of 8:30 AM and 4:00 PM Eastern Standard Time. There is also an email address at [9-AWA-AVN-40-Helpdesk@FAA.GOV](mailto:9-AWA-AVN-40-Helpdesk@FAA.GOV).

