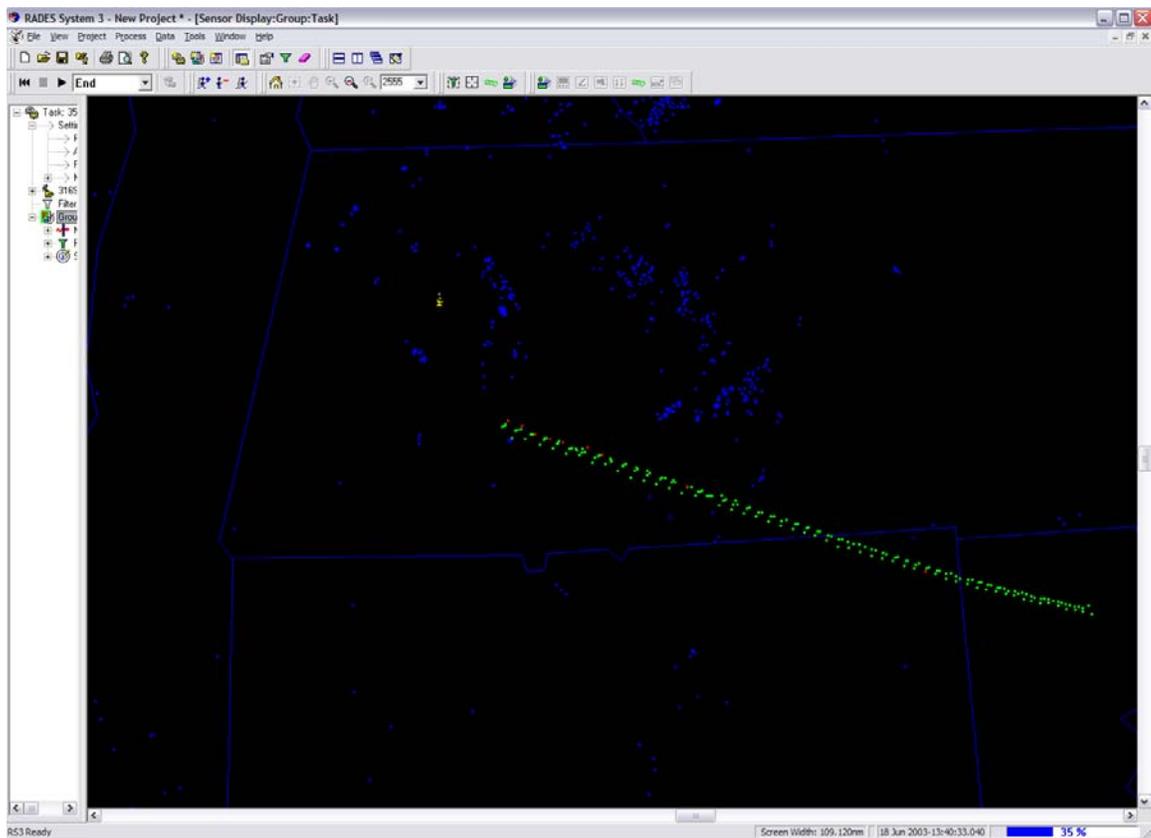


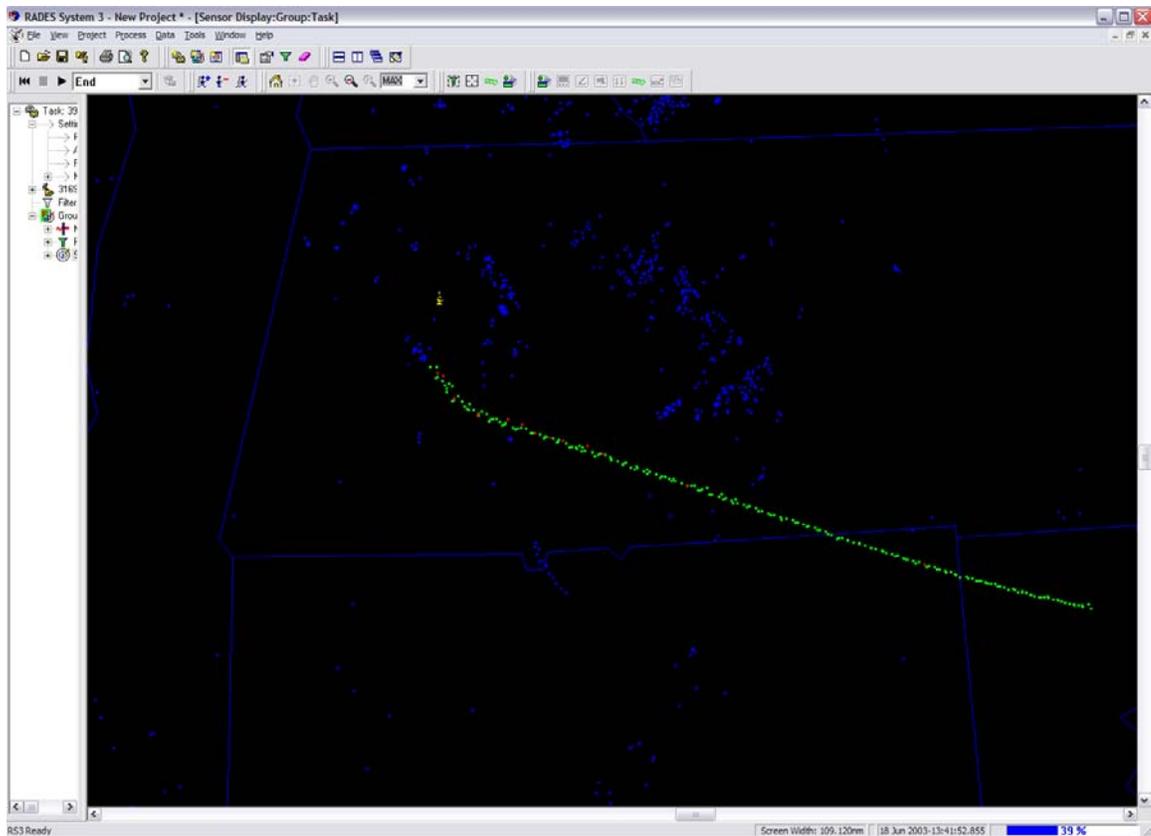
ZBW ZNY ARTCC registration errors 07/30/2003

Boston ARTCC requested AOS-270 to help with a constant -3 plus ACP NAS registration error with the QEA No Truro ARSR-4 LRR. Before traveling to the Boston Center area A extensive analysis of the QEA radar data was performed. For example, here is one RS-3 data recording that clearly show the problem, and possibly the solution. Here are two RS3 screen captures. Second one has a $+5$ ACP correction added to the same QEA data file. You can clearly see the (in this data file) $+5$ ACP adjustment makes a difference.

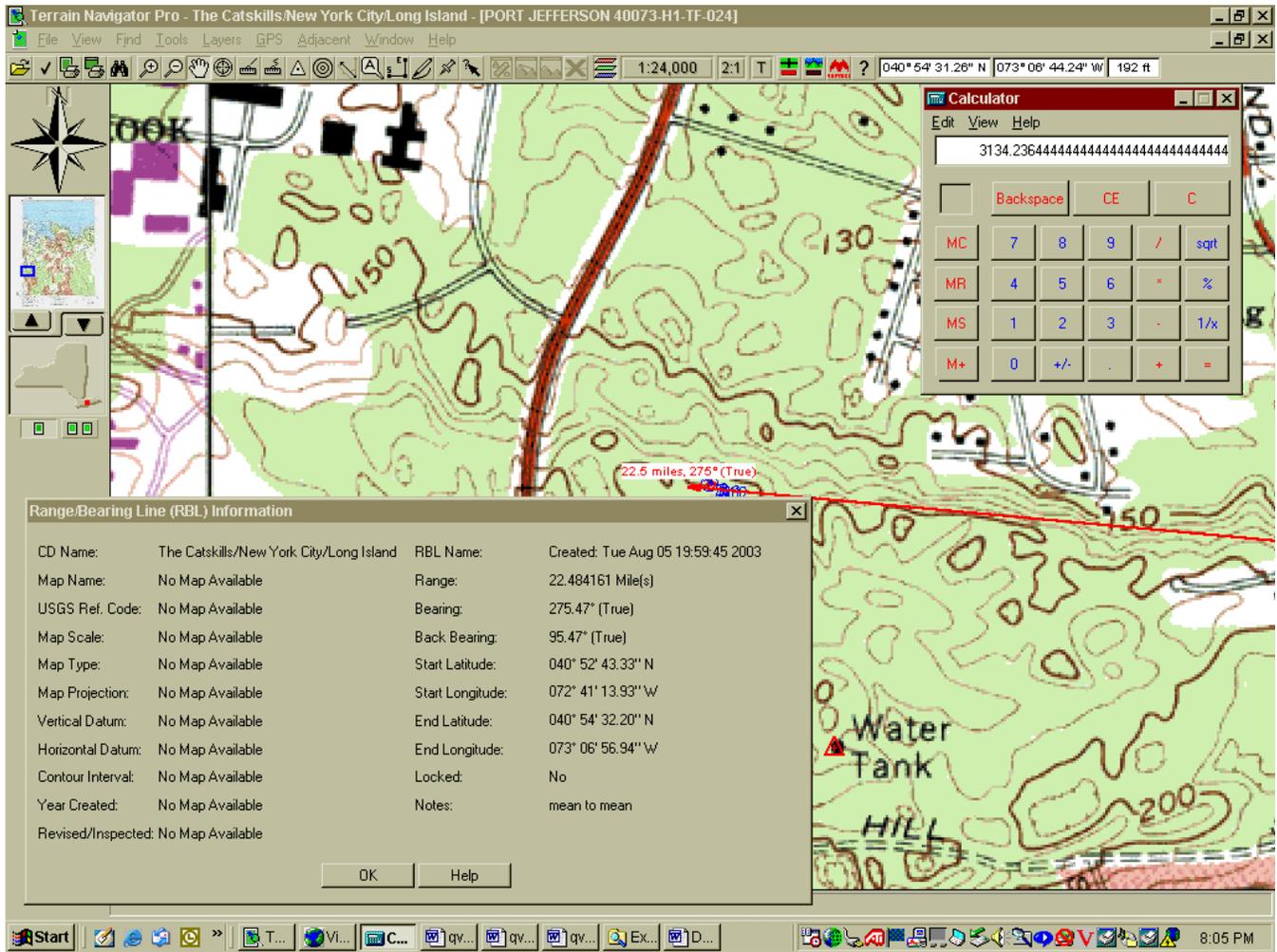
QVH, QHA, and QEA Track with no correction.



$+5$ ACP correction to QEA.....



Jeff Griffin was requested by New York Center to help analyze a problem with the Riverhead NY LRR site. As the 3 ACP error at Riverhead NY LRR seemed to be part of the North Truro, MA problem, it was decided to travel to ZNY ARTCC first to look at the QVH radar. A survey conducted on the week of July 14, 2003 of the site's beacon parrot and radar location revealed a 400 foot error in the parrot's location. The 400-foot error works out to 3 ACP error in the parrot's location. ZNY ARTCC's NAS operational program's subroutine ZR, the registration program agreed that there was indeed a -3 ACP error in the Riverhead ARSR-4's data. The following data was collected...



Mean average data

Jeff Griffin went to Gibbsboro New Jersey ARSR-4 LRR to investigate a problem with the ARSR-4's Azimuth Pulse Generators, A and B. After much discussion with the site personnel and AOS-230 it was determined that the site personal should perform the ARSR-4 IACP differential count measurement procedure. Here are the results of that test.

ARSR-4 Rotary Joint Common Mode Test at QIE

Map/Sync A Online

Seconds	1st Scan	2nd Scan	3rd Scan	Average	Expected	Error
1	1366	1366	1366	1366.00	1365.33	0.67
2	2732	2731	2731	2731.33	2730.67	0.67
3	4097	4097	4097	4097.00	4096.00	1.00
4	5462	5462	5462	5462.00	5461.33	0.67
5	6826	6826	6826	6826.00	6826.67	-0.67
6	8194	8194	8193	8193.33	8192.00	1.33
7	9558	9558	9558	9558.00	9557.33	0.67
8	10923	10923	10924	10923.67	10922.67	1.00
9	12289	12288	12288	12288.33	12288.00	0.33
10	13654	13654	13654	13654.00	13653.33	0.67
11	15019	15019	15019	15019.00	15018.67	0.33
12	16384	16384	16384	16384.00	16384.00	0.00

Map/Sync B Online

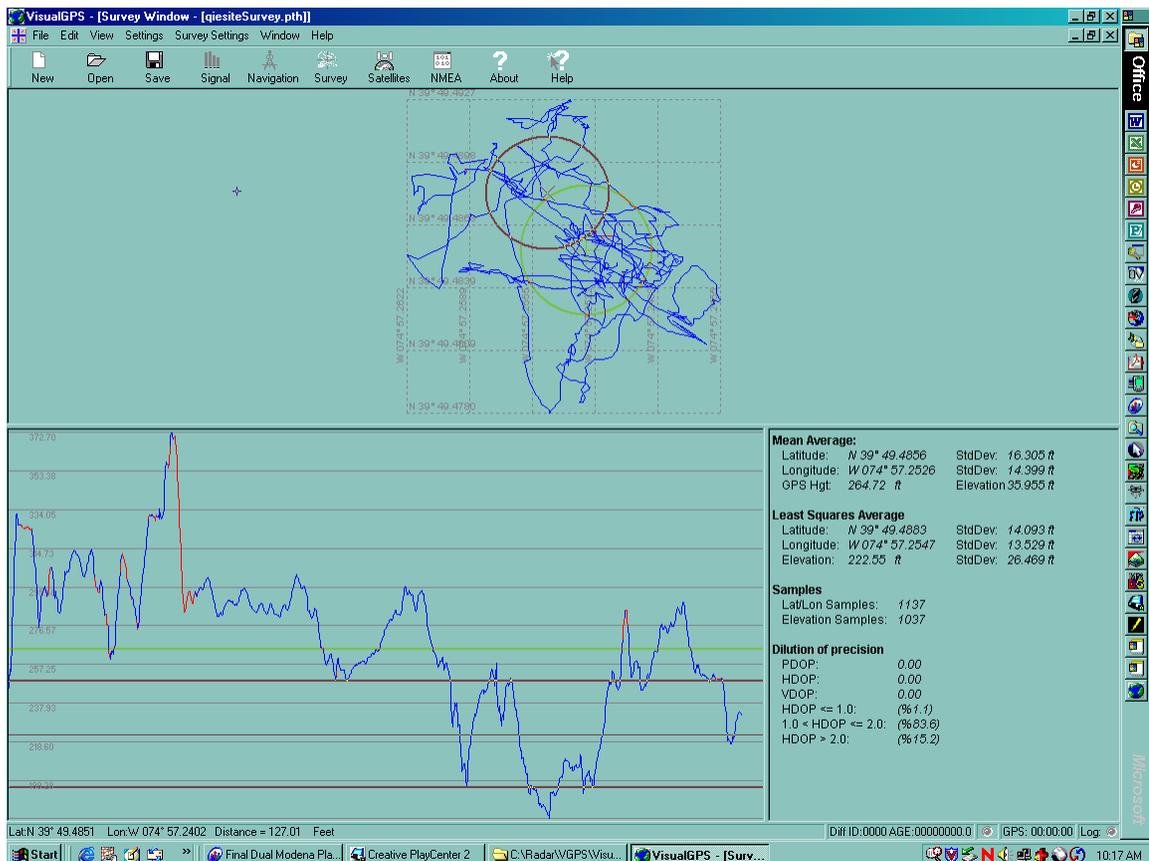
Seconds	1st Scan	2nd Scan	3rd Scan	Average	Expected	Error
1	1367	1367	1367	1367.00	1365.33	1.67
2	2735	2735	2735	2735.00	2730.67	4.33
3	4103	4103	4102	4102.33	4096.00	6.33
4	5475	5474	5474	5474.33	5461.33	13.00
5	6842	6843	6842	6842.00	6826.67	15.33
6	8207	8207	8206	8206.33	8192.00	14.33
7	9566	9568	9569	9568.00	9557.33	10.67
8	10931	10938	10931	10931.00	10922.67	8.33
9	12304	12312	12292	12296.00	12288.00	8.00
10	13654	13654	13655	13654.67	13653.33	1.33
11	15015	15020	15016	15015.67	15018.67	-3.00
12	16382	16382	16385	16384.00	16384.00	0.00

The results of this test clearly show that at 140 degrees there is a 16 IACP difference between the two APG's. It becomes apparent that there is a problem with the alignment between the two APG's. AOS-230 was contacted.

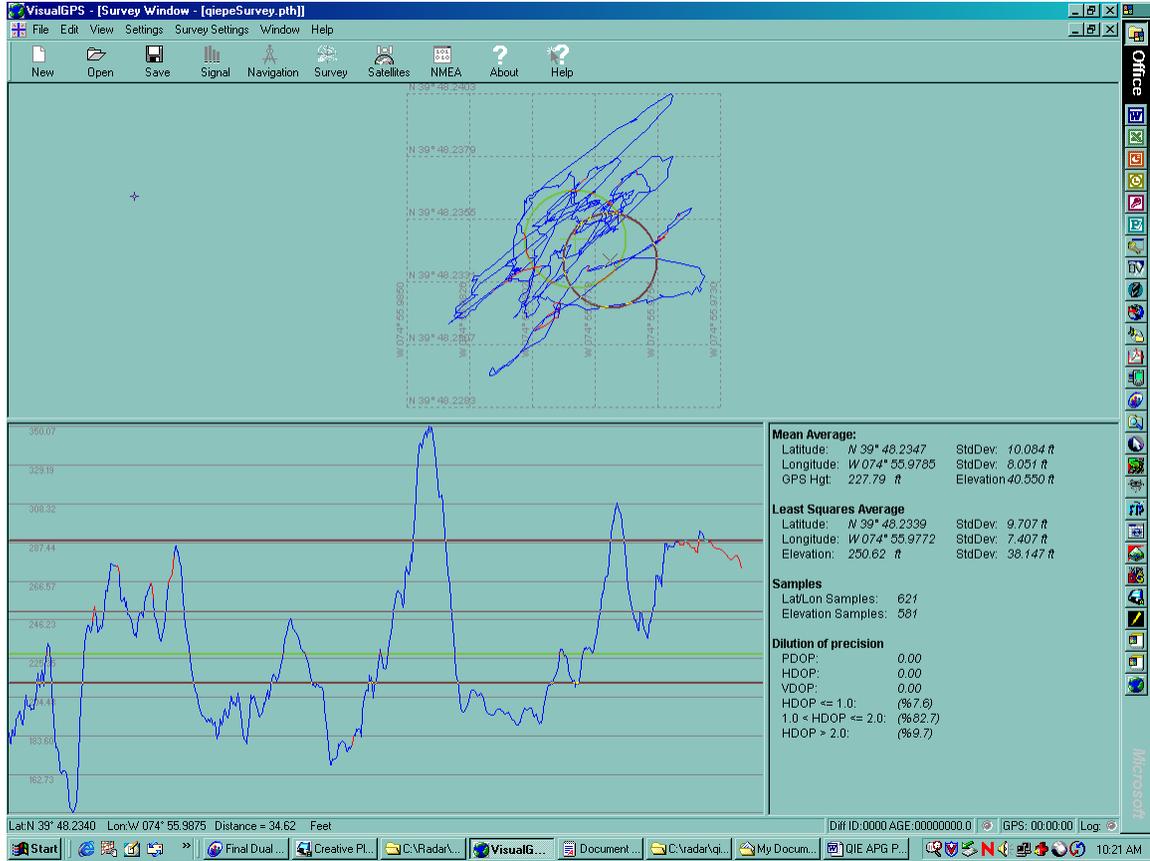
While involved with the Gibbsboro LRR an evaluation of QIE's site and beacon parrot location was performed on July third 2003. Jeff Griffin, AOS-270, traveled to Gibbsboro NJ to do a site survey on the QIE ARSR4 LLR , and the QIE Beacon parrot.

The same procedure used at the Riverhead LINY LRR site was used. We concluded that to get a correct angle (ACP) value to use with the system we may need to verify actual location of the P.E. in reference to the QIE site. We used a program "VisualGPS" that allowed us to record over a period of time GPS data. These readings are averaged and logged and saved on a laptop using a connected GPS receiver. A single WAAS GPS unit, and the VisualGPS software suite were used to do the survey. Over 30 minutes of data were collected at the radar, and beacon parrot site. The measurement at the radar site was accomplished during scheduled downtime. So the readings could be taken from the focal point of the radar. Here are the results of that survey.

Here are the (averaged over 30 minutes) GPS reading's taken at the two locations. Stature miles was selected, and NAD83 as the datum.



QIE SITE SURVEY



QIE PE SURVEY

QIE Site location data

Site *N 39 49.4856* *W 074 57.2526* *HGT 264.72 feet*
Adjusted to seconds *28.8* *15*

PE *N 39 48.2347* *W 074 55.9785* *HGT 227.79 feet*
Adjusted to seconds *13.8* *58.2*

This set of readings is within 7 feet of the NOAA survey for the site and beacon parrot.

The site location is reported in the OCI as....

Site *N 39 49 29* *W 74 57 15*
PE *N 39 48 14* *W 74 55 58*

The NOAA survey result's are....

ARSR (QIE) | 394929.0216| -745714.9498| 189.2| | | | 2022002|

PARROT (QIE) | 394814.1220| -745558.5720| | | | 2022002|

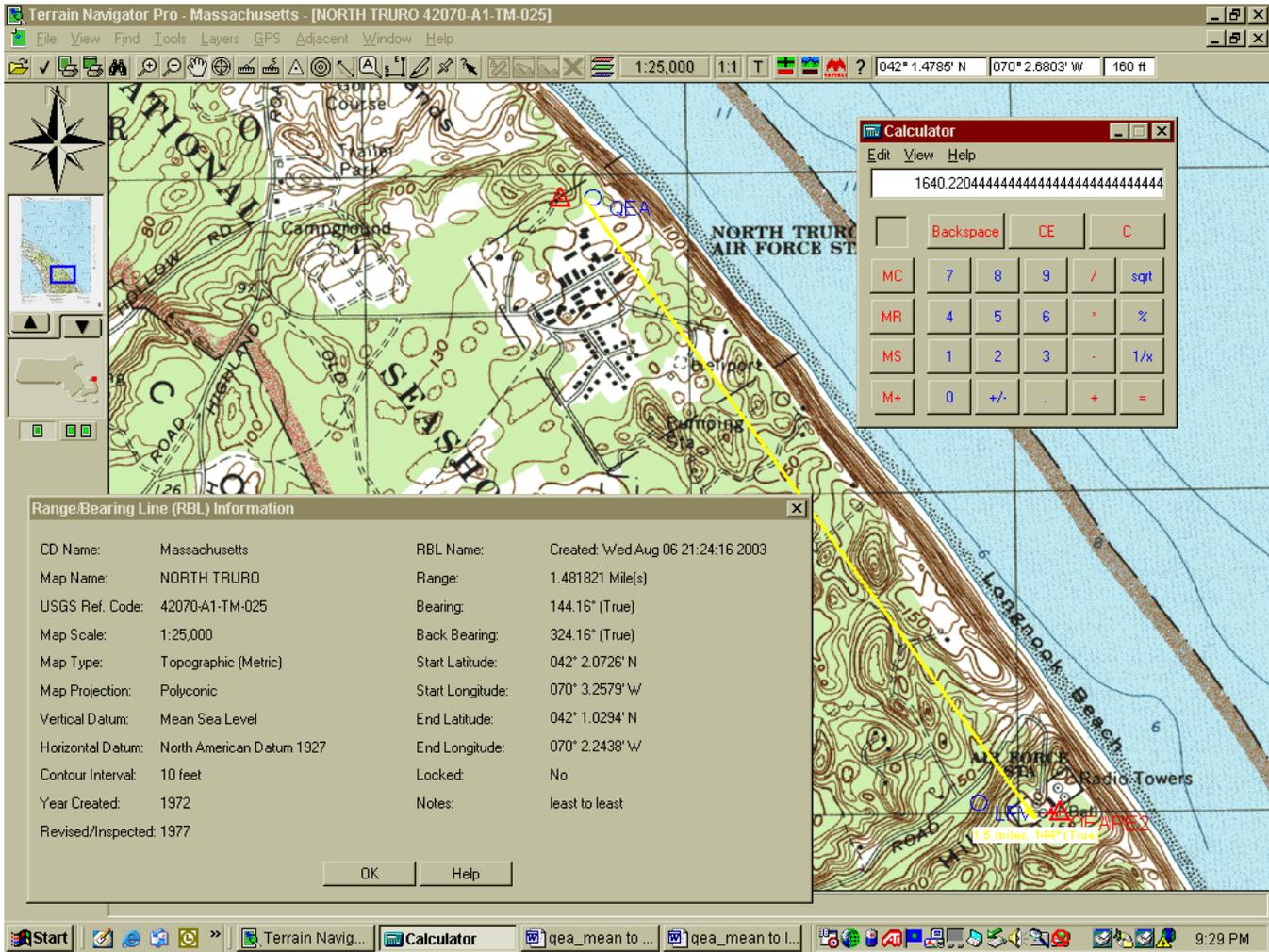
Additional Information:

ARSR (QIE) BASE OF DOME = 266.9 FEET NAVD

In conclusion it appears that the QIE LRR, and the QIE parrot are properly located. But. I did a quick calculation on the reported site to parrot azimuth, and come up with a 3 ACP error? I see the parrot at 141.9 degrees, the reported position is 141.6? Or 1614 ACP's, not 1611. From this data AOS-270 recommends that the QIE Beacon parrot be located at 1614 ACP's. AOS-270 also asks all centers involved to adapt QIE's beacon parrot in NAS to 1614 ACP's. This is to done after the repair to the rotary joint , and APG alignment.

During the week of July 28 2003, Jeff Griffin AOS-270, Juan Soto ZNY ARTCC, Tony Coelho ZBW ARTCC traveled to North Truro, MA to collect some GPS data to verify the QEA site, and Beacon parrot's location's. While in the North Truro area, a search permanent echo site was also surveyed. Upon return to the Boston ARTCC we spent the day going over all the GPS data for the site, and beacon parrot. Once again, we found that a beacon parrot in very close, 1.58 NMI. This makes it very difficult to make positional decisions based on the in close data we collected. It looks like most of the data says we should make an azimuth adjustment in the QEA radar. To verify this, we spent the day trying to get a search PE we surveyed to show up in the centers data from the QEA radar. The site could see the data on their rappi display, we both had it at 154.9 degrees from the site, but we needed ACP level resolution. Rich McCoy, AOS-230 was called to assist the site in putting in the PE zone, to allow the search PE area to mapped lower in the geocensor map. FYI the smallest geocensor area allowed by the ARSR-4 is .7 degrees, 1/8 NMI range cell. The Beacon PE survey provided the following Data.

*Here is the result of the survey data collected at No Truro MA LRR.
And the recommended changes needed*



Least squares data

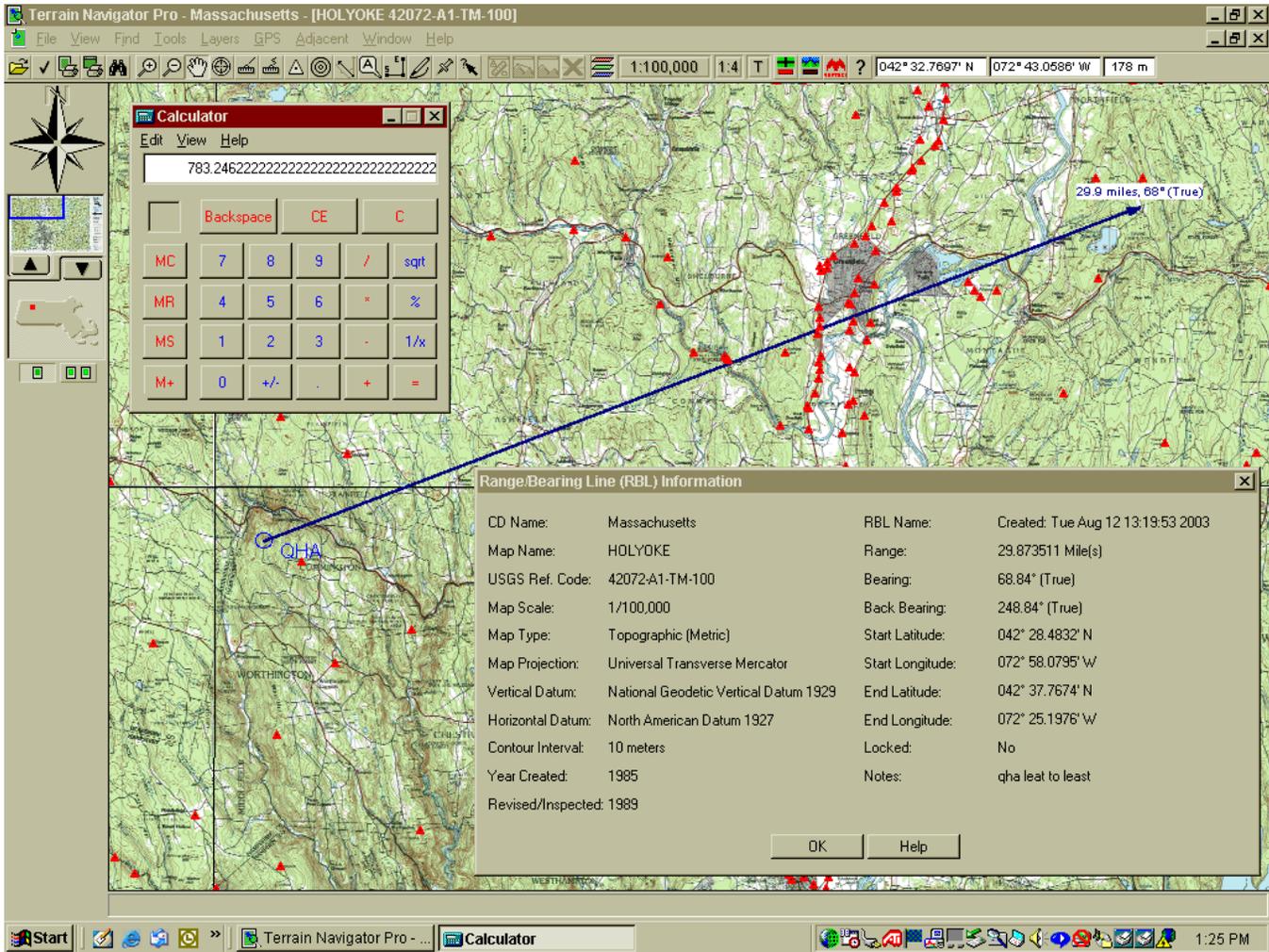
The least squares computation of GPS data computes a 144.16 degree and a 1640.22 ACP location. To verify the beacon results, we spent the day evaluating a search PE. A search PE was located at 154.9 degrees from the site or 1762.4 ACP's. The site ZBW ARTCC could see the search PE on their rappi display at 154.6 degrees or 1759 ACP's. NAS is reporting a -3 ACP registration error.

So, the beacon PE surveyed at 1640 ACP's azimuth, ZBW has the beacon PE adapted at 1637 ACP's. The search PE data survey of 1762 and reported azimuth of 1759 support's the need for -3 ACP change in the azimuth reporting of all targets from the North Truro, MA LRR.

Also while onsite Jeff Griffin AOS-270 assisted the site personal with the ARSR-4 IACP differential count measurement procedure. The results

of this test show that the APG's are well within spec. Maximum difference between APG A, and APG B was 4 IACP's. So there is no apparent problem with APG alignment between the two APG's. The counter output was observed for 30 minutes . It was decided not to perform the second part of the test procedure that would document the location of the maximum error, as there appeared to be no significant error to make note of.

As the Air force, Boston ARTCC, and New York ARTCC each had a different lat long listed for QHA , it was decided to travel to Cummington MA to survey the QHA radar. Jeff Griffin will travel to the Cummington area on Thursday, as the QHA site personnel will be at the Erving MA beacon parrot site. Early Friday morning QHA has scheduled downtime. He will collect GPS data at the Cummington radar, Then proceed to New York center on Monday August 4 , to continue working on the problem.



Least squares data

Here is the result of the survey data collected at Cummmington, MA LRR. AOS-270, Boston Center, and New York center all recommend no azimuth reporting changes are needed at the Cummmington, MA LRR.

Some radar downtime was acquired at the Riverhead LRR site the morning of August 6th. Upon arrival at New York Center Tuesday afternoon August 5, 2003 we discussed the problem and made some final verification's on the previously collected data on July 23, 2003.

It was agreed an 11 IACP change in the Riverhead radar's data would be applied at the radar site. The test was performed on both APG A and APG B at the site. The procedure used is attached.. Here is the result of that test. AOS-270 noting that APG B, showed slightly less values than APG A, suggested that the Riverhead site personnel perform the iAPG offset count test, and pass the results on the ZNY, ZBW, ZDC, and AOS-270. This will determine final IACP changes at the site for both APG's to be implemented in the next available NAS adaptation build, this of course will have to be coordinated with all users of the radar as this is a change in the actual positional information that the radar outputs.

Some half mile offset data was collected at New York Center on Tuesday, August 12. Four recordings were made. Then MDM QARS was run on all four files. Here are the results of the QARS runs. Listed is the Collimation total azimuth error, as calculated by MDM QARS.

*APG A beacon channel A TOT AZ ERROR -1.31 ACP's
APG A beacon channel B TOT AZ ERROR -1.03 ACP's
APG B beacon channel A TOT AZ ERROR -1.27 ACP's
APG B beacon channel B TOT AZ ERROR -1.03 ACP's*

There is a -1.03 to a 1.31 beacon to search collimation error in the Riverhead ARSR-4 LRR system. Jeff Griffin Talked to Sholin Wright AOS230. Sholin checked the Riverhead ARSR-4's configuration, and stated that QVH centroid's on the beacon Message. So AOS-270 recognizes the collimation error, but(as it has no bearing on the registration problem) recommends that it be addressed after the permanent -3 ACP change in the radar system's target reporting, to be implemented on September 04, 2003

PHL ASR-9

Another registration problem at New York center is PHL. The Philadelphia international Airport's ASR-9 data has an 11 ACP error. AOS-270 has collected the following data to resolve the problem.

Mode-s survey data

ASIS-II converter box

The ASIS converter box has an -11.9 degree or 135 ACP magnetic declamation change to the azimuth of the raw data being reported to ZNY. Here is the magnetic declamation for PHL calculated from 1992 to 2003, in one-year increments. Source of data is the NOAA site....

<http://www.ngdc.noaa.gov/cgi-bin/seg/gmag/flsnt1.pl>

Latitude: 39.52 deg
Longitude: -75.14 deg
Elevation: 20.00 ft
Range of Interest: 9/3/1992 - 9/3/2003, step 1.00

Date (yr)	<u>D</u> (+ East) (deg)	<u>I</u> (+ Down) (deg)	<u>H</u> (nt)	<u>X</u> (+ N) (nt)	<u>Y</u> (+ E) (nt)	<u>Z</u> (+ D) (nt)	<u>F</u> (nt)
1992.67	-11d 43m	68d 11m	20183	19763	-4098	50408	54298
1993.67	-11d 47m	68d 7m	20210	19783	-4128	50301	54209
1994.67	-11d 52m	68d 3m	20236	19804	-4159	50194	54120
1995.67	-11d 55m	67d 57m	20267	19830	-4186	50056	54003
1996.67	-11d 58m	67d 52m	20299	19858	-4211	49903	53873
1997.67	-12d 2m	67d 46m	20332	19886	-4236	49749	53744
1998.67	-12d 5m	67d 41m	20365	19914	-4262	49596	53615
1999.67	-12d 8m	67d 35m	20398	19942	-4287	49443	53485
2000.67	-12d 10m	67d 30m	20430	19971	-4307	49304	53369
2001.67	-12d 12m	67d 24m	20461	19999	-4324	49173	53260
2002.67	-12d 14m	67d 19m	20493	20028	-4341	49041	53151
2003.67	-12d 15m	67d 14m	20525	20057	-4358	48909	53041
2003.67	-12d 15m	67d 14m	20525	20057	-4358	48909	53041
	<u>dD</u> (min/yr)	<u>dI</u> (min/yr)	<u>dH</u> (nT/yr)	<u>dX</u> (nT/yr)	<u>dY</u> (nT/yr)	<u>dZ</u> (nT/yr)	<u>dF</u> (nT/yr)
2003.67	-2	-5	32	29	-17	-132	-109

Since 12 degrees equals 136.53 ACP's, it appears that (from the NOAA mag dec data) the ASIS box has the correct offset applied to the PHL data being sent to ZNY ARTCC. The problem is that the ASR-9 and the ARTS system are running with a -11 degree Magnetic declamation correction. The ARTS handbook states that a change to the correction factor won't be done until there is a 2 degree change. So the ASIS box magnetic declamation settings will have to reflect the -11 degrees setting, used at the ASR-9 radar site.

AOS-270 suggests Philadelphia ASR-9 site personnel to coordinate a change in the ASIS mag dec offset from 135 ACP's to 125 ACP's. This will solve ZNY ARTCC's 10 ACP registration error with PHL's data.

Several TELCON's were held over a period of several weeks. It was decided to follow AOS-270's recommendation to change the offset in the ASIS boxes supplying data to New York, and Washington ARTCC's. This change was done incrementally starting at 1900z on September 23, 2003. Leesburg's ASIS Magnetic Declamation data was first changed from -135 ACP's to -125 ACP's. New York center then observed the data on their DARC system, and noted a big difference, to the good on the glass. ZR registration checks were then run at ZNY ARTCC. A 1 to -1 registration with QVH QPL were noted, a 10 ACP improvement. Then the ZNY ASIS box was then changed to 125 ACP's. Both boxes were showing the same good results. At 2000z ZNY ARTCC and ZDC both switched over to the new ASIS magnetic declamation offset of -125 ACP's. The 11 ACP error from the PHL radar data is now fixed.

Implementation of the 3 ACP change at QVH LRR site.

Jeff Griffin traveled to Washington Air Traffic Control Center the week of September 01 2003 to help site personnel , and also to observe any registration problems that might develop to the west, when the 3 ACP change is made to QVH. A TELCON was held on September 04 at 0000z. Present at the TELCON were Washington ARTCC, New York ARTCC, and Jeff Griffin AOS-270. Prior to the TELCON, several NAS ZR registration checks were done at ZDC to verify positions of several radars. Here is a typical sample of the registration errors observed in the present NAS system.

*QVH QVR -3 ACP error
QIE QBN -2 ACP error
QVH QIE -3 ACP error
QVH QVR -3 ACP error
QVH QVR -2 ACP error*

It appears that the+ 3 ACP change To Riverhead's data will fix the registration errors in the NAS system's at ZDC, ZNY, and ZBW. After ZNY released QVH LRR , onsite technicians applied a -11 IACP change

in APG A, and a -12 IACP change in APG B. At 0600z, ZNY, and ZDC booted their latest NAS build that had the updated positional information for the QVH parrot in the rsite table. For several hours both center's monitored QVH's registration in the NAS system. The 3 ACP adjustment made to the QVH radar was successful. QVH is now registered properly in the NAS, or less than plus or minus 2 ACP's, as defined in the Maintenance of NAS En Route stage A order 6100.1E page 230 paragraph 508 c.3.b. The Riverhead LRR was returned to service at 0920z on September 04, 2003.