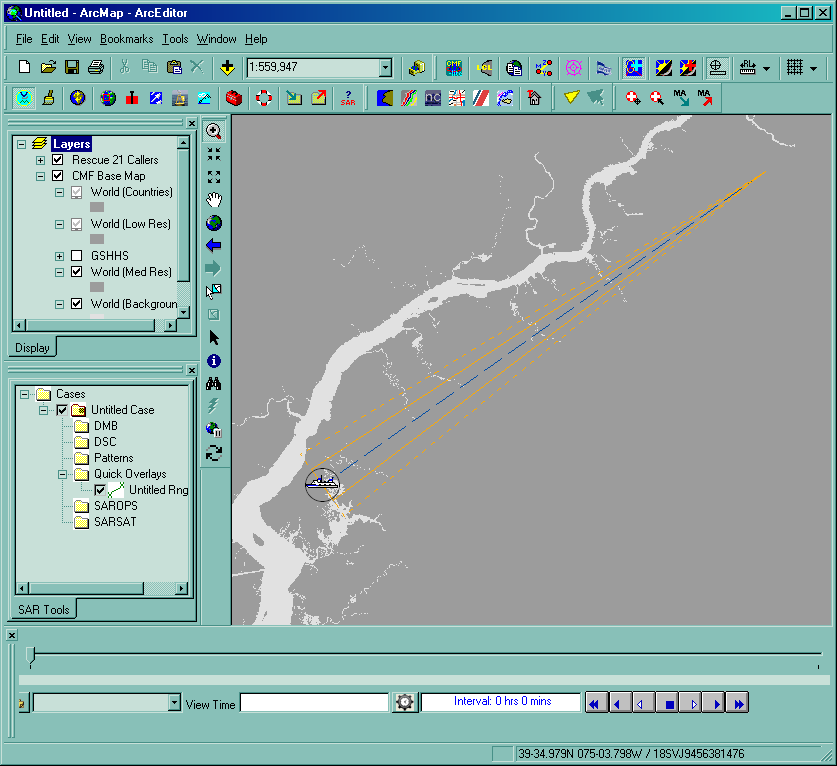
# The Question

This is going to take some explanation before I can get to the question. The requirement for this task is:

"We should plot the "Probable Bearing Error" as +/- two degrees to define the shaded area, with dashed lines at +/- four degrees (95% POC) to be consistent with other displays."

So the display should be something like this:



The problem is that the calculations are not obvious given the inputs. Look at the following diagram:



What we are given in the R21 message is the latitude/longitude of both the O (origin) and C (center) points, the distance in nautical miles from A to B (i.e the "base" of the triangle), the great circle bearing from O to C, and the GC distance from O to C.

**Question #1: How should A and B be calculated in a geodetically correct manner?**

**You mean: What are the Lat/Lon of A and B? What I would do is take half the distance from A to B and call that *r*. Find the bearing *from C to O* (which is not a simple function of the bearing from O to C), add 90 and go out from C in that direction by *r*. Note (as in your diagram) that the distance from O to A will be bigger.**

**Question #2: If the A’-O-C angle is twice the A-O-C angle, how should A’ and B’ be calculated in a geodetically correct manner?**

**I believe you want the intersection of two great circles; the one that contains O and emanates from O at a given angle (2\*alpha), and one that starts at C and heads towards A. Don’t try to use any distances; just find the intersection. I use cross products and normalize Cartesian vectors when I do this.**

**One more comment; I use a varying radius of the earth when I do this. I can supply what I do there as well.**

# Current Practice

Currently, SARTools is calculating A and B as follows:

* bearingCA = bearingOC – 90 degs
* halfBase = base/2
* A = geodesic\_coordinate(C, bearingCA, halfBase)
* bearingCB = bearingOC + 90 degs
* B = geodesic\_coordinate(C, bearingCB, halfBase)

(Where geodesic\_coordinate() is a standard geodetic function that computes the great circle lat/lng endpoint given a starting point, bearing, and distance.)

Then bearing error is calculated as follows:

* bearingOA = geodesic\_distance(O, A)
* bearingError = bearingOA - bearingOC

(Where geodesic\_distance() is a standard geodetic function that computes the great circle distance between two given points)

**Question #3: Are these calculations even correct?**

# Mapping from R21 XML

Just for documentation purposes, here is the XML message that generated the section 1 figure, annotated with source of above values:

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C

bearingOC

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