CSci363 User Interface Design

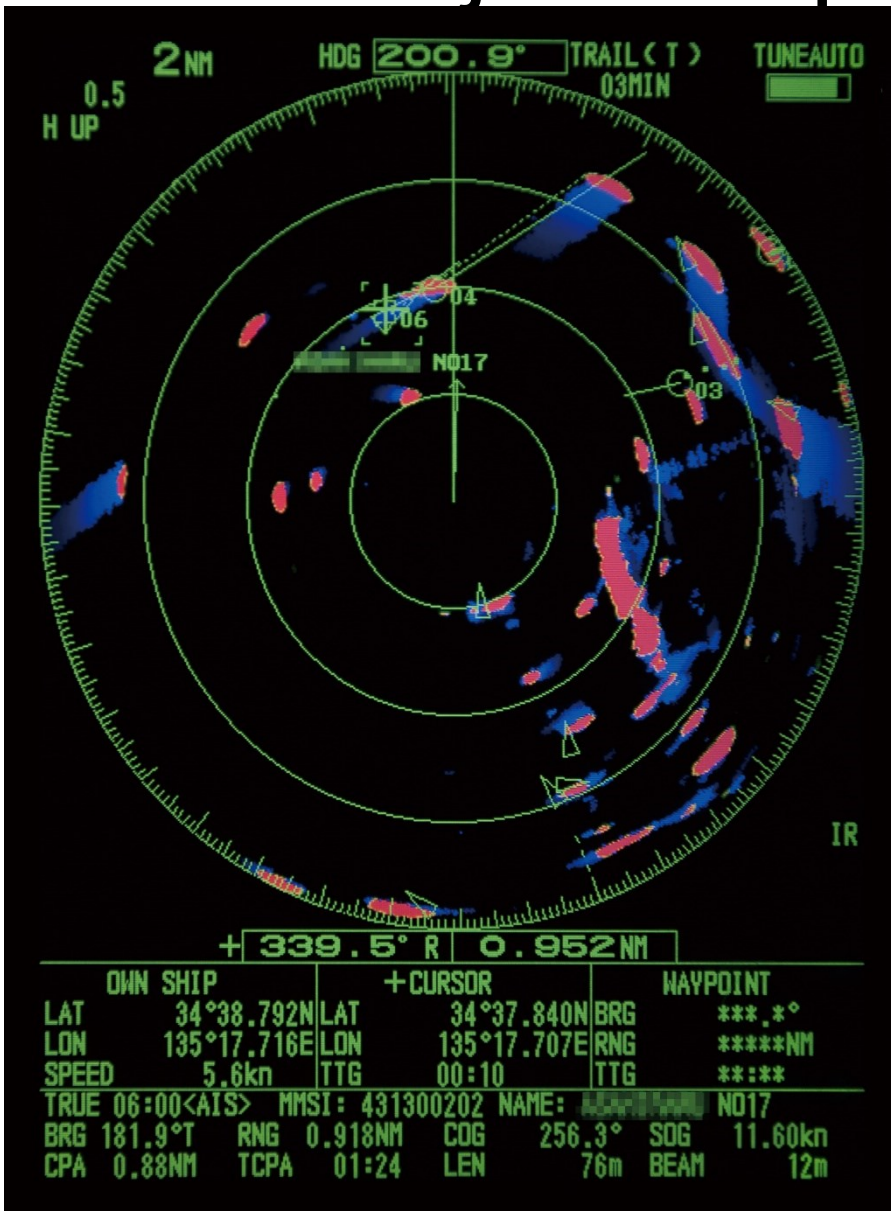
Friday, September 27, 2017

Today's session:

1. Project Support Material

Current Display System

Possible Project Display

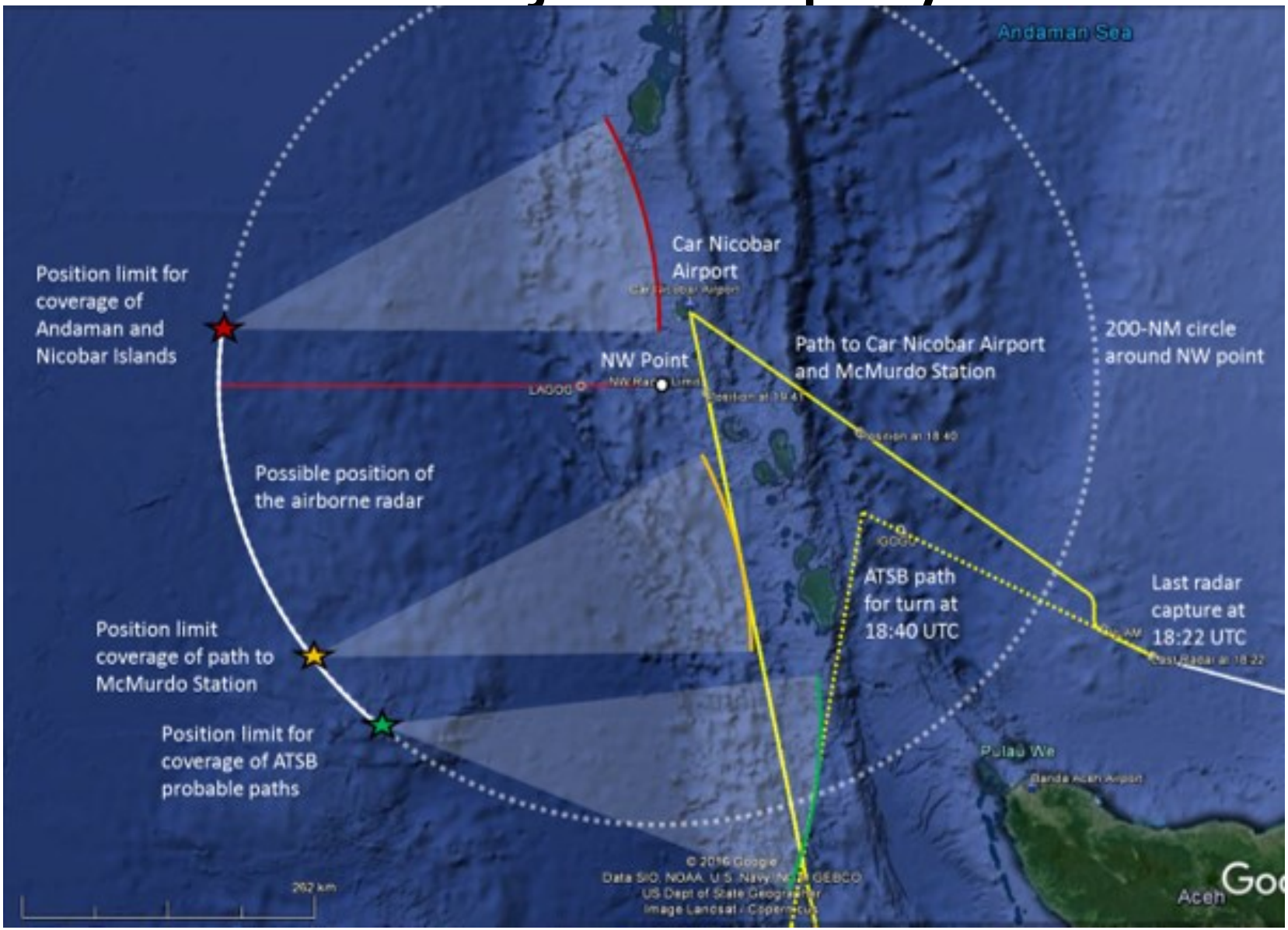


Possible Project Display cont'd

Possible Project Display cont'd

Possible Project Display cont'd

Possible Project Display cont'd

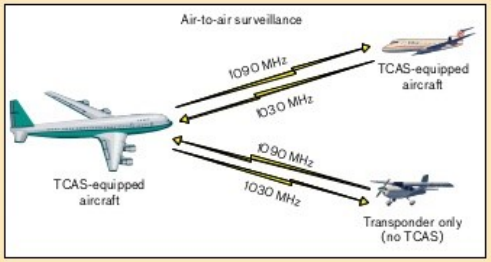


Project Support Material

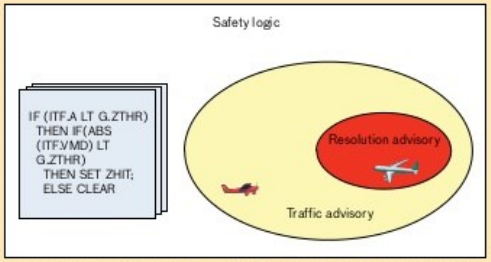
How TCAS Works

There are four main components of TCAS: airborne surveillance, safety logic, vertical advisories, and a pilot interface. If another airborne aircraft is a potential threat, TCAS issues a traffic advisory (TA), which gives the pilots an audio announcement "Traffic, Traffic" and highlights the intruder on a traffic display. The TA is intended to help pilots achieve visual acquisition of other aircraft and prepare the pilots for a potential avoidance maneuver. If a maneuver becomes necessary, the system will issue a resolution advisory (RA), instructing the pilots to climb or descend to maintain a safe distance. There is an audio announcement of the required vertical maneuver, and the range of acceptable vertical rates is shown on the vertical speed indicator. On some aircraft, additional pitch guidance is provided to pilots.

TCAS may issue a variety of different advisories, including do not climb or descend, limit climb or descend to 500, 1,000, or 2,000 ft/min, level-off, climb or descend at 1,500 ft/min, increase climb or descend to 2,500 ft/min, or maintain current vertical rate. Depending on how the encounter evolves, TCAS may strengthen, weaken, or reverse the direction of the advisory. Note that an RA provides vertical guidance only; TCAS does not issue



The TCAS surveillance unit interrogates nearby transponder-equipped aircraft. Traffic range, bearing, and altitude estimates are calculated based on the received time, location, and content of the reply. If the tracked aircraft is declared a threat and is also TCAS-equipped, the two TCAS units coordinate complementary advisories through discrete messages.

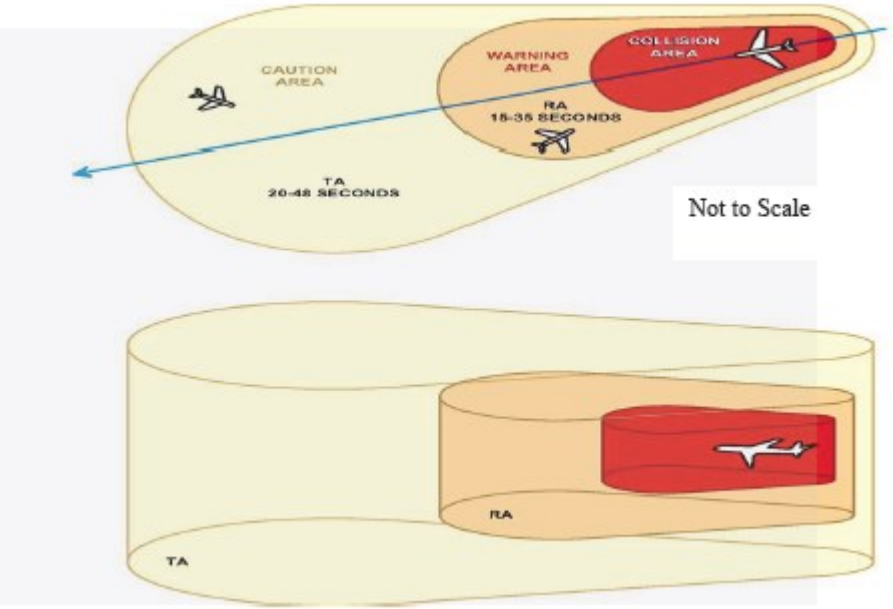


Advisory logic uses deterministic and heuristic rules to issue alerts against a potential threat on the basis of time of closest approach and projected miss distance.

Logic Optimization

The logic optimization process takes as input a probabilistic dynamic model and a multi-objective utility model. The probabilistic dynamic model is a statistical representation of where the aircraft will be in the future, and the multi-objective utility model represents the safety and operational objectives of the system. We then use an optimization process called dynamic programming to produce a numeric lookup table [7]. This optimization requires about 10 minutes on a single thread on a modern desktop computer. The resulting table occupies about 300 MB of memory, uncompressed. Although the processing and memory requirements are quite modest according to today's standards, this kind of approach was not feasible when TCAS was originally developed.

A numeric table is a major departure from how



https://www.faa.gov/nextgen/
https://aerosavvy.com/tcas/

Project Support Material