Explanation of Navigational Database

Surprisingly, there has been no significant updating of navigational information of ships involved in the Earhart Search since July, 1937, when the officers of the various ships provided charts to Admiral Orrin Murfin the Commandant of the Fourteenth Naval District in Hawaii, who then submitted the Earhart Search Report to the Chief of Naval Operations. These charts were compiled during the time of the various cruises, and were not recomputed for current drift and sets, nor for bad navigational fixes. By comparing the dead-reckoned navigation to actual navigational fixes, the current speed (drift) and direction (set) can be determined, and then used to verify notional guesses of currents in the search area. Since the advent of computers and satellite navigation (even before GPS), oceanographic ships routinely recomputed their positions based upon a smoothed, interpolated course constrained by these satellite navigational fixes. These computer programs typically utilize the estimated errors in the navigational fixes to help smooth the true ship positions over time, and do not constrain the ship to be precisely at the point determined by the fix at the time of the fix. I have taken the programs used to calculate smoothed navigation of ships at sea, and modified it for the Earhart search vessels. The major modification was in fixing the ship at the navigational fix point, since there are no error estimates with these positions. A series of manual iterations are needed to eliminate poor fixes; this is usually done by examining the current drift and sets. In particular, if the drift seems overly high, it is usually due to a bad navigational fix. That fix is then removed as a constraint, and the program re-run. A fair amount of subjectivity enters into the process, and there is no one "true" solution.

The program was applied to all eight ships involved in the Earhart mission, including the Ontario, which did not actually participate in the search. In addition, careful examination of Earhart's crossing of the Pacific from Oakland to Hawaii was quite instructive, and provided a good test of the program output. That output, HONOLULU, agrees well with the operating parameters of the plane and with weather charts compiled years after the crossing for routine weather purposes. In addition, the program was also applied to the PBY plane sent by the Fleet Air Base in Honolulu to Howland, but the plane had to return back due to inclement weather at altitude. Good navigational control was available due to the copious radio messages sent by the PBY, along with sightings by the SWAN. By careful manipulation of wind speed directions and speeds, I was able to estimate the time when the PBY plane turned around, which was not available.

A couple of comments regarding the various ship navigational data. The Swan's information was fairly coarse, and I estimate its accuracy to no better than 5 nautical miles, and more probably 10 nautical miles. All other ships appear to be good to within 3 nautical miles, and consistency checked when various ships rendezvoused. Many reported navigational fixes had to be discarded in the process of running the computer program, but I estimate no more than about ten percent of all the fixes. Most of the navigational fixes came from the bridge logs, when notations were made at 0800, 1200, and 2000 local time. In most cases, the first two values are somewhat poorer in quality than the 2000 time, since only the sun could be used reliably for celestial navigation. Noon fixes, if done correctly, can be fairly precise. The best, however, would be star fixes at night.

The navigational database is organized by ship, and a separate file for each ship or plane is included. The various entries are:

GMT DA	The Greenwich Mean Time day of the position
GMT MO	The Greenwich Mean Time month of the position
GMT YR	The Greenwich Mean Time year of the position
GMT TIME	The Greenwich Mean Time time of the position
LATITUDE	The degrees and decimal minutes of latitude of the position. Positive values are north; negative values are south.
LONGITUDE	The degrees and decimal minutes of longitude of the position. Negative values are west; positive values are east.

ACTUAL DIST	The distance, in nautical miles, traveled from the beginning time of the navigational sequence for that vessel.
SPEED	The actual speed of the vessel, in nautical miles per hour (knots). This value remains constant between each set of navigational fixes. The speed incorporates any contribution by the current speed.
COURSE	The actual direction of the vessel, measured in degrees relative to true North. The course includes any contribution by the currents.
DRIFT SPEED	The speed of the current drift, in knots. This value remains constant between navigational fix pairs.
DRIFT HED	The direction of the current set, measured in degrees relative to true north. This is the direction the ship would take if it was absolutely dead in the water. Both the drift speed and heading likely have contributions from the wind, since ships act as sails in wind.
DR SPEED	This is the dead-reckoned speed in knots, or the speed intended by the ship if there were no currents or winds affecting motion.
DR CSE	The dead-reckoned direction of the ship, or the direction intended by the ship if there were no currents or winds affection motion.
CMT	An internal code for determining the type of fix or changes in direction and/or speed. The various codes are: c/c change of course c/cs change of course and speed c/s change of speed c/x getting underway fdr Colorado fix in bridge log without notation of observed, assumed to be dead-reckoned fixx bridge log notation of position fobs Colorado fix with notation that it was observed, not dead-reckoned logg report in comment section of position of Equator crossing map Colorado fix, from letter to Hydrographic Office met Lexington fix, obtained from their aerological reports radi fix from radio message radm fix from radio message swan Colorado refueling Swan
LOCAL DA	The local day of the month, as recorded by the vessel.
LOCAL MO	The local month of the year, as recorded by the vessel
LOCAL TIME	The local time of the day, as recorded by the vessel. Using the Time Zone, as denoted in the ship's Comment section in the bridge logs, this time was converted to GMT time.
DRIFT DIST	The distance of drift the vessel would make if it was absolutely still, calculated from the previous navigational fix to the current navigational fix.
DRIFT TIME	The time in decimal hours between navigational fixes.
NO.	The line number of the navigational output.