

PAOLO E. COLETTA*
U.S. Naval Academy

THE NAVY'S AIR NAVIGATION CHARTS

In preparing for a flight today, the naval pilot goes to the Operations Officer of his squadron or station for a kit that contains all the flight information he will need. He usually gets a brief case jammed full of charts, publications, and perhaps a graphic aid to navigation. Does he consider how the materials were prepared, who compiled and published the books, constructed the charts, devised the aids? Generally not, but when he is asked about the quality of each of these items, he almost invariably says it is good. There may be an error here and there, as in the printing of the letters VLI when the radio beacon signal is actually VLF, or he may complain either that there is too much or too little topographical detail on a chart, or that a chart will tear along its folds after prolonged use, as in training flights, or that arrows should mark both the bearing and reciprocal of radio station signals. But he cheerfully admits that flight would be impossible without these aids and that with minor exceptions they are adequate and kept up to date.

The story of air chart preparation goes back one long generation, when the history of naval aviation in the United States was itself very short. It was on 25 March 1898 that Theodore Roosevelt, the Assistant Secretary of the Navy, proposed to Secretary John Long that the Navy investigate Professor Langley's flying machine, saying in part:

The machine has worked. It seems to me worth while for this government to try whether it will not work on a large scale to be of use in the event of war. For this purpose I recommend that you appoint two officers of scientific attainments and practical ability, who in conjunction with two officers appointed by the Secretary of War, shall meet and examine into this flying machine, to inform us

*Dr. Paolo E. Coletta is an Associate Professor in the Department of English, History and Government at the U. S. Naval Academy. He has published widely both in American political history and in the field of naval history. He is a contributing author to the Naval Academy's geography textbook. Dr. Coletta wishes to express his appreciation to the U. S. Navy Hydrographic Office for the assistance given him in the preparation of this article.

whether or not they think it could be duplicated on a large scale, to make recommendations as to its practicability and prepare estimates as to the cost. I think this is well worth doing.

The first joint Army-Navy board on aeronautics ever appointed reported on 29 April that Langley's machine was too small--it had only a 12-foot wing-span--but suggested further experiments, and on 2 December the Chief of the Bureau of Equipment wrote the Secretary of the Navy that a number of "aero-planes" be purchased and that naval personnel be directed to develop features adapted to naval use. A decade later, in January 1911, Glenn Curtiss made the first successful flight with a "hydro-aeroplane" in San Diego harbor, and in May the Navy ordered the Triad--an eight cylinder amphibian biplane with double controls.

While the need for air charts and other navigational aids for balloonists had been voiced as early as 1888, it was seven years after the Navy purchased its first plane that heavier-than-air flight became so extended as to require them. Even so, chart production was stimulated by the exigencies of the first World War, the first "Naval Operating Charts" issued by the United States Navy Hydrographic Office, in 1918, being designed for the use of pilots on antisubmarine patrol in the approaches to the important Atlantic and Gulf coasts. During the beginning of the Zeppelin era, the Hydrographic Office issued a seven color 34 x 50" sectional chart of the New York-Washington-Pittsburgh area for the U. S. S. Shenandoah (ZR-1), but the air patrol and lighter-than-air charts were the only two air navigation charts available as late as 1923.

One may well question what the increasing number of pilots did use. Most popular during these years for local, low-level, low-speed flights were the maps issued by the Post Office Department on a 1": 1 mile scale. As flights slowly extended, Rand McNally State Maps were favored because they covered larger areas and showed the railroads which most pilots followed on long hops. Nautical charts of coastal areas with aeronautical overprint and Geological Survey Maps were used less frequently, and although the first strip charts designed specifically for air navigation were provided in 1923 by the Airways Section of the United States Army Signal Corps, Rand McNally Air Trail State Maps proved favorites until the early 1930's. The Army's air navigation charts, drawn to a scale of 1:500,000, showed magnetic headings, lines of magnetic variation, and airfield locations in red. The Rand McNally maps, which superimposed on their state maps, in red, air routes, isogonic lines, airport and seaplane anchorages, and radio range beacons, were preferably by pilots not confined, as the military were, to fixed routes. Meantime the first marked seaplane airway was established, between Washington, D. C., and Norfolk, Virginia, by painting the roofs of lighthouses with distinguishing markers. The first naval strip chart, H. O. No. V-234, of 1925, covered the seaplane route between Baltimore, Washington, Annapolis, Norfolk, and various Chesapeake Bay points. Along its margins were photographs of lighthouses and landing fields.

In 1920 the Hydrographic Office marked another "first" with its monthly,

now biweekly, issue of the Notice to Aviators, a means of giving pilots the latest information on available airports, seaplane anchorages, routes, and changes in facilities. The next year radio despatches, NOTAMS (Notice to Airmen), were used to disseminate non-meteorological information involving safety and efficiency in flight; and in 1925 appeared the Memorandum to Aviators, which disseminates temporary information on seaplane anchorages and airports and is issued whenever needed. The year 1926 brought the first Naval Air Pilot, in this case chartlets and textual material dealing with the seaplane anchorages of the Atlantic and Gulf coasts of the United States. The year 1928 brought the Aircraft Plotter (VP-10), an 8 x 8" plastic device adapted from the Mooring and Maneuvering Board, and 1933 saw two experimental models of aircraft dead reckoning computers as well as improved aircraft plotting boards. Thus graphic and textual information kept up with the rapid pace in the development of aircraft and of radio and other aids to air navigation. In addition, for naval aircraft, the Hydrographic Office has been responsible for furnishing graphic air target materials and evaluated intelligence on air facilities. Moreover, as our planes began to fly all over the world and were shore-based, mobile-based, and land-based, the Office has had to provide information on a global scale. As early as 1934 the increasing speed of aircraft led to a reduction in the number of charts carried by the provision of strip charts covering larger areas, one new one in some cases replacing as many as five older charts. In 1938 appeared the Aircraft Navigation Manual (revised 1940), used for the teaching of air navigation, and in 1943 came the Air Navigation Notebook, which illustrated for aviation cadets all the basic navigation problems. The first astrograph plotting sheet, for plotting star altitude curves, was issued in 1941.

To describe all the efforts of the Hydrographic Office's Air Navigation Division would fill a large book, and to merely list the titles of its charts, publications, and aids to air navigation would fill many more. Therefore, a brief account of the origin and development of the Division and of its collection, evaluation, production, and distribution system must suffice.

The collection of material on airports, seaplane anchorages, maps and charts, electronic aids to navigation, and airspace restrictions for each point of interest to naval aviation was begun in 1920. From pilots, ships, consuls, military attaches, American tourists abroad, air navigation officers, and other sources came a mountain of information to be evaluated and disseminated in the form of NOTAMS, publications, or charts.

The Hydrographic Office in 1925 established the Section of Aerial Navigation in the Division of Maritime Security (now Maritime Safety) and in 1929 the Section of Aviation Chart Construction was established in the Division of Chart Construction. Bursting from their confines, these two sections were combined in 1931, to form the Air Navigation Division, which has since spawned new sections upon need.

Today the Air Navigation Division has a formidable task. For carrier-

based and land-based aircraft and for seaplanes, in those areas of strategic interest to the Navy, it constructs and maintains aeronautical charts, mosaics, graphics, and related publications for operational and intelligence requirements; disseminates flight advisories and information on facilities; approves United States Naval Air Station Instrument Approach Procedures; advises on military air mapping and seeks to standardize specifications and symbols for air charts and publications at meetings of the International Civil Air Organization; and investigates and evaluates the naval requirements for air charts, publications, and special studies.

Most important among the charts issued by the Air Navigation Division are those of the V30 series. They were developed during World War II to provide world coverage in long-range navigational charts useful for patrol, reconnaissance, escort, and transportation. This series has been revised for use by high-speed transport type planes and high flying jets. On a 35 x 54" mercator projection with a scale of 1:2,188,800, or 1 inch: 30 nautical miles, it provides the requirements for visual pilotage, dead reckoning, radio electronic navigation, radar navigation, celestial navigation, and plotting accuracy of one nautical mile. In addition these charts include topographic features (metropolitan areas, large cities, major transportation systems, drainage, and relief,); 10 and 100 fathom curves; and stable aeronautical information (electronic aids to navigation, selected airfields and seaplane areas, restricted areas, air corridors, oceanic control areas, and air defense identification areas). Relief is indicated by contours, spot elevations, and gradient tints; the fathom curves and bomb jettison lines in bathymetric tints of blue. Furthermore, the compass roses and isogonic values are so positioned that the charts may be split in about 18" widths and made into route charts--all of which is saying a good deal for just one chart!

The V70 series is quite similar to the V30, and it has a special (SP) series which illustrates the Arctic and Antarctic. These charts contain special information of vital importance to pilots who transit the polar regions. In addition, the Air Navigation Division issues various pilot charts, such as those for Pacific Airways (VR series); USN/USAF Aircraft Plotting Sheets; and Loran Charts (one series uses the V30, V70, and VR series charts with Loran overprint, another, the VS series, puts the Loran rates on the reverse side of the chart).

These basic chart series have been and are supplemented by additional charts developed and produced by the Hydrographic Office to fulfill many specialized and unique requirements of naval aviation. World War II brought the Target Chart and Naval Air Combat Information Aviation Chart to maturity. The first, dealing with Japan in many volumes, indicated specific forward area bombing objectives by charts, photographs, and associated text; the second joined Kardex to navigation plotting boards in an 8 x 8" Target Chart Series of the Pacific that could be handled readily by the pilot of a single-seater aircraft. Of great value to the downed airman and other friendly forces were the "Evasion and Escape Charts of Korea, 1953." These pre-

sented terrain with complete transportation networks and information on concealment and survival so detailed as to be of aid to a man on foot in a hostile area.

Since their beginning in 1926, the Naval Air Pilots have gone through a period of evolution which has involved changes in both format and name. The present publications are identified as "Flight Information Publications - Terminal - Seaplane," and are one of a family of joint U.S. Navy - U.S. Air Force Flight Information Publications which provide information on the planning, en route, and terminal phases of flight. Of special interest are TACAN (Instrument Approach Procedures) Charts and the Radar Navigation Charts.

In 1921 an item in Notice to Aviators No. 4 called the attention of pilots to a new railroad map of Ohio and urged them to obtain it because it contained useful features not generally shown on government charts, and in the next Notice detailed instructions for the use of pigeons were provided. The pigeons could be used to verify important radio messages and to deliver notice of forced landings or accidents; they should not be released except during daylight nor in heavy fog, rain, or snow. Of course all information must be written on the form contained in the Pigeon Service Book and in accordance with the peculiar instructions enclosed.

It is difficult to recall that nonstop flights between New York and Washington excited great public interest only a generation ago and that at the time aviators had justifiable complaints. In 1926 an aviator wrote:

With the present equipment and the way it is used, aerial navigation is about as far advanced in our Navy as the South Sea islanders of the past century were in surface navigation. We cruise along the coast, make short hops to land which is just below the horizon, which, if we hit on the nose, causes us to congratulate ourselves on our excellent "navigation." Aside from the trans-Atlantic Flight of the NC-4 and the attempted flight to Hawaii of the PN's, which were in reality, not under service or war conditions at all, the longest over-water flight that has been made by naval aviators was the flight of Scouting Squadron ONE in the winter of 1919-1920 when they flew from Jamaica to Old Providence Island, a distance of about 360 miles. However, even this flight was made only once and the next longest over-water flight after that is the Cozumel Island to Cape Antonio flight over the Strait of Yucatan. This flight of about 110 miles has been accomplished exactly three times. If it is not the fault of the pilots--we are like baby seals who must learn to handle themselves along the shore before they can withstand the open sea.

As soon as aviators come to the realization that their pinions are now fairly strong, and it is time that we were learning the rest, there will be a sudden demand for aids to aerial navigation. The following must be developed or produced:

1. Special Aviation Charts of a size suitable to be used in the limited space of an airplane cockpit and embracing special information of primary importance to the pilot but of little use to surface craft.

2. The Naval Air Pilot to cover all the world.

3. Methods of Aerial Navigation which reduce the time of solution without decreasing the accuracy or requiring the use of any special skill are the prime necessity.

4. Coastal airways should be developed including special flights, beacons, etc.

The suggestions of this pilot have been fulfilled beyond measure. Charles Lindbergh consulted and later advised the Hydrographic Office on long-distance flight charts. The Office prepared the charts and routes for the Wiley Post World Flight of 1933, the 1934 MacRobertson International Air Race from London to Melbourne, the United States Navy record-breaking long-distance non-stop flight from Perth, Australia, to Columbus, Ohio in 1946, and for many others. Today, when naval jets streak across our continent in about four hours and across the oceans in record time, we should recall that the charts, aids, and other information they use stem in great part from a generation of effort by a small but devoted group of men in the Air Navigation Division of the Hydrographic Office.
