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The Evolution of the Air Force Aerial Spray Capability

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The Air Force, first under the Army Air Corps, and later as a separate service, has engaged in aerial spraying since the inception of the technique. Aircraft were used as early as 1919 for making surveys of potential mosquito breeding habitats. Aerial dusting was undertaken at Mound, Louisiana, and in 1927 at Quantico, Virginia (Lumpkin & Konopnicki, 1962). However, it was not until 1931 that the first successful liquid spray by means of aircraft for mosquito control occurred (Ginsburg 1931). The variety and modifications of military aircraft used in both experimental and operational aerial spraying have been extensive. One example is a wind-driven propeller assembly that was modified for the Piper cub (L-4). This assembly produced approximately 50 pounds per square inch of pressure that forced the liquid pesticide through six spray nozzles mounted on the lower trailing edge of a hopper clamped to the lower longerons of the fuselage. In 1946 the Army Air Forces Board modified this same equipment for use in the L-5 aircraft (Nowell 1954).

The original concept of aerial spraying in the military service was primarily for the control of mosquito populations and mosquito-transmitted diseases. DDT powders and sprays proved to be excellent control agents when used to combat fly populations and, after a period of time, aerial spraying was utilized to control both fly and mosquito populations in all combat theaters. Consequently, these repeated DDT applications resulted in some

insecticide resistance in local pestiferous fly populations.

Experience gained in 1945 indicated that successful aerial spraying required technical supervision in the preparation of projects as well as the selection of planes and spray equipment (Nowell 1954). Therefore, the War Department updated policy for aerial spraying, which included a review of all projects by entomologists and a single agency of the Army Air Forces to conduct spray operations. Subsequently, the Special DDT Flight was created at Greenville AAB, South Carolina, in 1946 but was soon transformed to the Special Aerial Spray Flight (SASF) in 1947 and moved to Langley AFB, Virginia, when the Air Force separated from the Army to be a distinct service (Dowell 1965).

The Korean War catalyzed the establishment of the Air Force Medical Entomology career field as the public health threat to troops was quickly realized. A program for aerial spraying in the Korean War was proposed early in 1951 by the 5th Air Force after 355 cases of Japanese B encephalitis and 429 cases of malaria were diagnosed during the last half of 1950 in United Nations Forces. By June, C-46 aircraft began flying operational spray missions over a series of targets on a 21-day treatment interval. These missions were considered highly successful and helped to firmly establish the entomology program in the Air Force. Stateside, the SASF continued the use of the C-47 to spray military installations, such as

Dover AFB in Delaware, to control mosquitoes.

Following the Korean War and continuing through 1973, the Air Force was extremely active in aerial spray operations. The C-123 had been selected as the most versatile aircraft to continue the Air Force spray mission, and methods of dispensing ULV, low volume, and granular sprays were developed (Dowell, 1965). Aerial sprays were conducted in the continental United States, Alaska, Labrador, the Bahamas, Iran, Afghanistan, and several other locations.

By the time of the Vietnam War, the aerial spray mission had developed a sufficient level of importance that the requirement for multiple spray missions was considered justified, and mosquito control and herbicide applications were carried out to protect and aid troops in combat zones. The 'mosquito war' required over 1,300 individual missions and dispensed approximately 1.76 million liters of malathion concentrate (500,000 gallons). This mission, Operation FLYSWATTER (1962-1971), was a significant part of the overall United States preventative medicine program to reduce the number of man-days lost to ground forces due to malaria. Ironically, although the program was widely publicized through both military and civilian in-country channels, the memories of many veterans of the Vietnam War would later confuse exposure to the mosquito insecticide spray missions with the spraying of Agent Orange defoliants. During the Vietnam War, approximately 11 million gallons of Agent Orange were applied by the SASF and several other groups using various aircraft (Cecil and Young 2007). The negative publicity that followed the use of defoliants

tarnished the image of aerial spray operations and began a contraction of the program by the military and the State Department. Executive Order 11850 was signed in 1975, renouncing the use of herbicides during war.

In 1966, an outbreak of St. Louis encephalitis occurred in and around Dallas, Texas. During the course of the epidemic, most of Dallas County was sprayed aerially with an ultra-low-volume, high-concentration malathion mist. Hopkins et al. (1975) stated that "the effects of this treatment cannot be adequately assessed from the human epidemiologic aspect alone, but the spraying clearly reduced the number and infection rate of the vector mosquitoes." Some members of the Public Health Service were apparently so impressed with the results that it was suggested that mosquito densities be only cursorily monitored and aerial sprays used whenever vector mosquitoes threatened public health. These ideas would later be refined to include the principles of integrated pest management (IPM), which dictate ongoing surveillance to track pest and vector levels. This was the first domestic use of military aircraft to interrupt disease transmission by mosquitoes in a civilian population and would serve as a model for future responses following natural disasters.

Following Vietnam, the Air Force aerial spray mission was transferred from active duty to the Air Force Reserve Command (AFRC) on 1 April 1973 and was relocated to Lockbourne AFB, Ohio, later renamed Rickenbacker AFB. The 355th Tactical Airlift Squadron (AFRC) gained the mission using UC-123K spray aircraft and an active-duty Air Force entomologist. The Aerial Spray Group's first spray mission took place at Langley Air Force Base on

22 May 1973 to control mosquitoes. The mission remained at Rickenbacker using C-123K's until 1985 when airframes were replaced with C-130E models. The Modular Aerial Spray System (MASS) was developed in 1988 to provide easy configuration changes, making the spray-modified C-130's capable of normal C-130 tactical air/land missions in addition to aerial spray. While the MASS was capable of delivering an impressive spread of application rates, between 0.25 ounces per acre and 25 gallons per acre, the Spray Group lost the ability to dispense granules at this time. The Air Force Aerial Spray Unit was moved to the Unit's current base of operations at Youngstown Air Reserve Station, Ohio, in 1992. Youngstown currently is using C-130H2 model aircraft to conduct aerial spray operations.

In order to train for the wartime tasking of protecting troops from vector-borne illness, the Aerial Spray Unit is involved in a number of pest management programs at military installations around the United States. The majority of these missions focus on mosquito and biting midge control using ULV adulticides and low-volume liquid larvicide sprays in locations from North Dakota, Virginia, and South Carolina to southern Florida. The Unit has also been successful at using herbicides to combat invasive plant species in the United States. Using IPM methods, herbicide sprays have helped reduce the incidence of musk thistle on the Smoky Hill Air National Guard Range, Kansas, and improved native prairie plant species by

reducing competition with cheatgrass on the Saylor Creek Range near Mountain Home AFB, Idaho.

Looking toward the future, the Spray Unit has embraced predictive computer modeling of droplet fate to reduce the risk of off-target pesticide drift. Aircraft are equipped with navigational GPS systems and an integrated droplet fate model. The Unit is also exploring new aerial spray techniques, such as rotary nozzles and high pressure sprays.

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