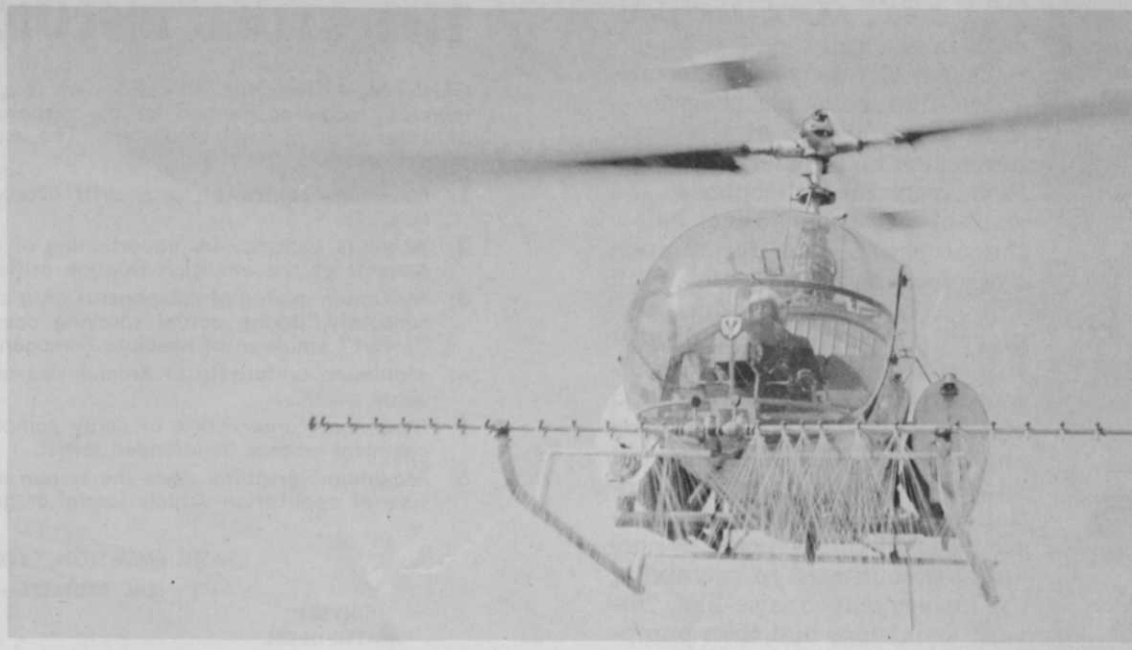
Bifluid Spray System



Helps Place Herbicides On Target

By DAVID P. PETERSEN
Vice-President, Stull Chemical Company, San Antonio, Texas

A common problem in many endeavors is our human tendency to get "the cart before the horse". This old cliche is most certainly true in the chemical industry, specifically in the case of chemical pesticides, where a really fantastic array of new insecticides, herbicides, fungicides, etc., have reached the user market in a single score of years since World War II.

A vast majority of these new pesticides work—if—you put them where they belong and keep them there. It is at this point that the post-war cart got before the pre-war horse. Application techniques did not keep pace with product development, and the whole nation heard about some of the consequences through books, magazines, television, congressional investigations, and the courts.

Our own activities in the area of right-of-way brush control contracting brought these facts home very pointedly. We were applying hormone herbicides from helicopters to narrow strips of brush stretching over thousands of miles of agricultural lands. The exposure rate to susceptible crops was obviously alarming, and we bought a few bales of premium cotton, some of the world's most productive vegetable gardens, and a number of priceless shade trees before we came to the full realization that there had to be a better way to

Central Power & Light Company utilizes bifluid spray equipment to apply invert herbicide spray for right-of-way brush control inside city limits at Laredo, Tex.

U.S. Army installation at Fort Bliss, Tex., uses bifluid system for weed control around quarters areas. System is adaptable for industrial uses such as rights-of-way, fence lines, plant yards, sub-stations.

apply 2,4-D, 2,4,5-T, and pesticides in general.

Thus motivated, we undertook a two-fold research program—safer formulations of the basic herbicides, and a safer way to get them from the helicopter to the right-of-way some 75 feet below the aircraft. Our formulation work focused on the water-in-oil ("invert") emulsions which displayed good qualities of droplet size and drift control. Simultaneously, we developed a bifluid method of proportioning, mixing and spraying the water and oil phases of the emulsion in a continuous process. This was necessary due to the difficulties normally encountered in premixing the heavy, mayonnaise-like, "invert" emulsions and then pumping them into a sprayer for use.

The first commercial applications with the new Stull Bifluid System were made by helicopters on utility rights-of-way in 1959. Almost immediately, it became apparent that the same demands for improved application techniques were common to aerial and ground equipment alike, so the system was translated to all kinds of ground power sprayers for boom, air-blast, or handgun applications as well as to a much larger number of individual herbicide chemicals. In the latter case, a series of neutral spray adjuvants are used to produce "invert" emulsions in combination with the ever increasing number of water soluble, oil soluble, or conventionally emulsifiable herbicides available for selective weed control (See Figure No. 1). These spray adjuvants provide the means to apply one, two, or

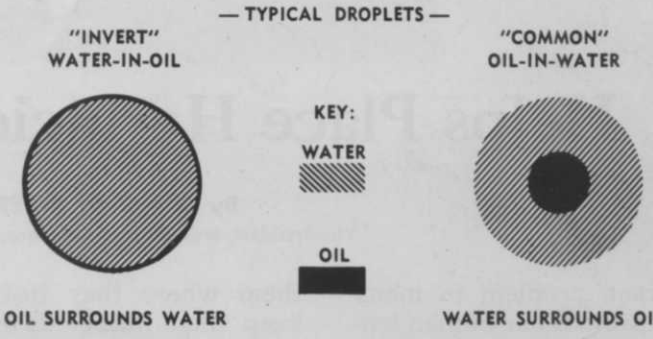
THE STULL BIFLUID SYSTEM

GENERAL — The Stull Bifluid System is a scientifically and commercially accepted method for the preparation and dissemination of water-in-oil (invert) emulsions. The major advantages of the system are:

1. Maximum control of spray drift approaching virtual elimination.
2. Absolute accuracy in proportioning of the oil and water components of the emulsion through orifices of known diameter.
3. Maximum mixing of components on a continuous basis, instantaneously, during actual spraying operations, to produce an "invert" emulsion of absolute homogenious composition.
4. Maximum uniformity of droplet size over the entire effective spray swath.
5. Maximum conservation of spray components since all of the chemical reaches its intended target.
6. Maximum versatility since the system may be installed on any type of application vehicle (aerial or ground).

BASIC EMULSION TYPES

— TYPICAL DROPLETS —



Both droplets contain one part of Oil to 10 parts of Water

PRINCIPLE OF OPERATION — The Stull Bifluid System is basically a process for the simultaneous proportioning, mixing and spraying of an oil-base pesticide chemical formulation and water. These components form an emulsion of water-in-oil, commonly referred to by agriculturists as an "invert" emulsion, rather than the "common" oil-in-water emulsion normally used in agriculture.

Water-in-oil emulsions characteristically have a thick "mayonnaise-like" consistency which in part accounts for their resistance to wind drift. In addition, the water part of the droplet is surrounded by an oil film which nearly eliminates the evaporation rate of droplets as they move through the air. Common oil-in-water emulsion droplets reduce in size rapidly as the outer water film evaporates. This resistance to evaporation by invert emulsions accounts for a part of the drift resistance and for the uniformity of spray pattern since the droplets remain essentially the same size from their point of discharge to their intended target.

Helicopter applies invert emulsion of 2,4-D to alligatorweed infestation in Texas irrigation canal.

Results of early season control shown at the left are still apparent four months following treatment.

Figure No. 1. Herbicide Chemicals Now Being Applied Through the Bifluid Spray System

Basic Herbicide	Formulation	"Inverting" Agent	Remarks
2,4-D and 2,4,5-T	Oil Soluable Amines	Self Emulsifying	Other herbicides may be added to the water phase.
2,4-D and 2,4,5-T	Water Soluable Amines	Spray Adjuvant	
2,4-D, 2,4,5-T and 2,4,5-TP	LV Ester Concentrates	Use with Oil Soluble Amine or spray adjuvant	Emulsify LV Ester concentrate in the water phase.
Ammonium Sulfamate	Salt	Spray Adjuvant	Dissolve Ammonium Sulfamate in water phase.
Dalapon	Sodium Salt	Spray Adjuvant	Dissolve Dalapon in water phase.
Dicamba	Amine Salt	Oil Soluble Amine of 2,4-D or 2,4,5-T, or spray adjuvant	Dissolve Dicamba in water phase.
Diquat	Salt	Oil Soluble Amine of 2,4-D or 2,4,5-T, or spray adjuvant	Dissolve Diquat in water phase.
MSMA	Salt	Oil Soluble Amine of 2,4-D or 2,4,5-T, or spray adjuvant	Dissolve MSMA in water phase.
Picloram	Potassium Salt	Oil Soluble Amine of 2,4-D or 2,4,5-T, or spray adjuvant	Dissolve Picloram in water phase.
Propanil	Emulsifiable Concentrate	Spray Adjuvant	Emulsify Propanil in water phase.

more herbicides at the same time.

Existing Pumps Used In New System

Simplification of equipment has been a constant goal with the bifluid system since its inception. From a rather complex dual storage, dual pumping, dual discharge, dual mixing nozzle has evolved the simple installation of a mixing device into the suction side of an existing sprayer pump. The discharge of the pump proceeds through existing equipment. There is, of course, a need for an additional storage tank to hold the oil phase of the emulsion, but this is only about one-tenth the size of the regular spray tank, since the mixing ratios involved average one part oil to nine parts water by volume.

Although the bifulid system was designed principally as a safety control in pesticide applications, other advantages presented themselves over a number of years usage (Figure No. 2). Foremost of these advantages appear to be the great reduction in evaporation losses as experienced with conventional emulsions and straight solutions, as well as the greater size uniformity and spreading characteristics available with "invert" emulsion droplets in comparison to other liquid systems.

Bifluid System Use Is Expanding

The bifluid sytsem is now finding expanding use throughout the world—from Africa to Australia to Europe to South America, as well as in the United States and Canada. Federal agencies have used the bifluid system in this country over the past several years on increasingly larger acreages for selective brush control programs in forests, rangelands, reservoirs and flood control projects.

Industrial usage has increased rapidly from the initial helicopter applications. Rights-of-way, fence lines, plant yards, and substations are representative of the many industrial non-crop lands which require routine vegetation control maintenance—and more often than not, in close proximity to individual property-owner neighbors whose goodwill would be lost quickly if damages were allowed to occur.

Landscaped areas such as parks and golf courses can now be safely maintained free of broadleafed weeds and many undesirable grasses through the application of combination sprays such as 2,4-D, and MSMA without endangering ornamental plants close by.

We like to feel that the bifluid spray system was a major step forward in getting the horse back in front of the cart. Certainly, it has spurred a lot of worthwhile research and development in other, safer, application techniques since 1959. Agricultural and industrial losses due to undesirable vegetation are one thing —damages paid to a neighbor for perfectly unintentional drift or misplacement are something else—but the two losses come from the same pocket. Proper application with the bifluid spray system can do a very commendable job of eliminating both losses at one time.

Figure No. 2. Advantages of the Bifluid Spray System Compared to Straight Solutions or Conventional Emulsions

Reduction in evaporation losses.
Reduction in run-off waste.
Reduction in spray drift.
Reduction in application labor.
Reduction in equipment corrosion.
Reduction in rain washoff.
Increase in foliage and stem penetration.
Increase in droplet spreading characteristics..
Increase in droplet size uniformity.
Increase in spray unit capability.