

OPERATION RANCH HAND: HERBICIDES IN SOUTHEAST ASIA

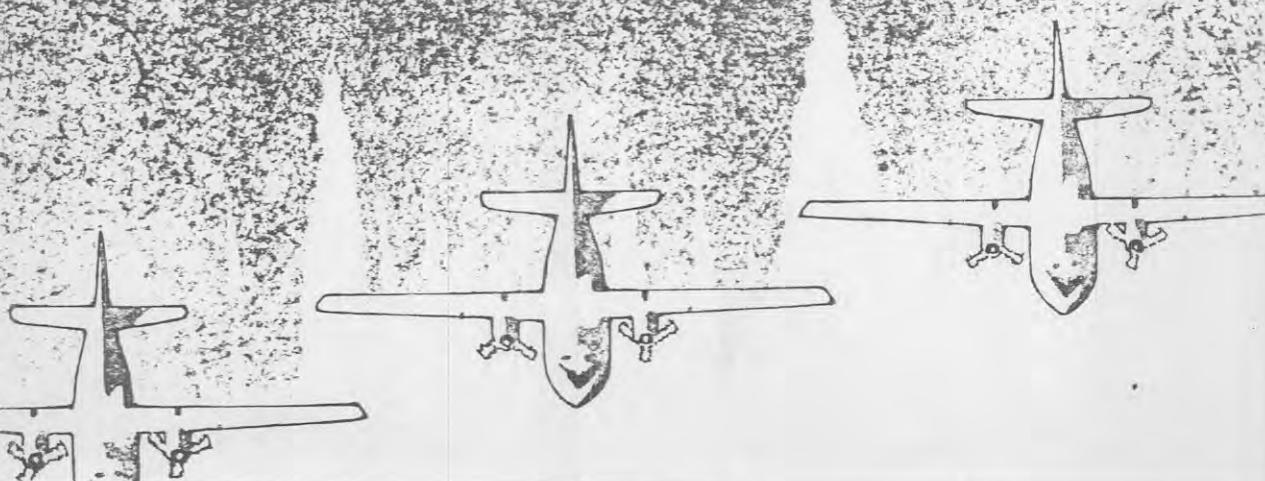
MAJOR WILLIAM A. BUCKINGHAM, JR.

IT HAS been more than twelve years since the last Ranch Hand herbicide mission in Southeast Asia. Although the controversy still continues, perhaps enough time has passed for a retrospective evaluation of this operation. The widespread use of herbicides in Southeast Asia was a unique military operation, but examining the decisions that led to the initiation, expansion, and eventual termination of Operation Ranch Hand may provide insights about the larger war of which it was a part. Its history may also be a useful pattern for anticipating the course of events that the introduction of some other unconventional tool of war in a future conflict may follow.

The term *Operation Ranch Hand* was the military code name for the spraying of herbicides from U.S. Air Force aircraft in Southeast Asia from 1962 through 1971. The term itself had no particular significance and was one of a number of similar code names such as *Farm*,

Gale and *Barn Door*, which denoted specific activities early in the Vietnam War. The aircraft employed were Fairchild C-123s, medium transports with twin piston engines that were later supplemented by two jet engines for added thrust. The Ranch Hand detachment began with six planes, dropped to two, and peaked at about 23 in 1969. It had several organizational homes over the years, but it was known during the height of its activities between 1966 and 1970 as the 12th Air Commando Squadron and 12th Special Operations Squadron. In terms of personnel and aircraft, one can see that Ranch Hand was a relatively minor part of Air Force operations in Southeast Asia.

Between 1962 and 1971, Ranch Hand sprayed about 19 million gallons of herbicide, 11 million of which consisted of Agent Orange.² The spray fell mostly on the forests of South Vietnam, but some was used in Laos, and some killed crops to deprive Viet Cong and North



Vietnamese troops of food. The military purpose for using herbicides on noncropland was to remove the vegetation cover used by Vietcong and North Vietnamese forces for concealment. Along roads, canals, railroads, and other transportation arteries, Ranch Hand cleared a swath several hundred yards wide to make ambushes more difficult. In Laos, the herbicide removed the jungle canopy from the network of roads and trails used for infiltrating men and supplies, making them more vulnerable to attack from the air. Ranch Hand also cleared large areas of forest hiding sanctuaries and bases, forcing the North Vietnamese and Vietcong to move or risk discovery and attack. In all, Ranch Hand sprayed herbicide over about six million acres, not correcting for multiple coverage.³

The chemical herbicides were common agricultural chemicals in wide use in the United States and other countries. The most common ingredients in the herbicide mixtures were 2,4-D and 2,4,5-T, phenoxy herbicides that act as growth regulators and cause destructive proliferation of tissues in plants which are in a stage of active growth. Another plant growth regulator used was picloram. Cacodylic acid, an organic arsenic compound, killed crops by causing them to dry out.⁴ These herbicides were combined in various mixtures and shipped in color-coded drums, which account for the names Agent Orange, Agent Blue, Agent White, etc. The primary continuing controversy over the human health effects of these herbicides concerns a dioxin impurity that is a byproduct of the manufacture of 2,4,5-T.

The Ranch Hand operation was not without historical precedent. U.S. aircraft conducted herbicide tests during World War II to see whether sprayed chemicals could be used to mark navigation points and defoliate jungle cover. An application considered but not employed was destroying crops grown by isolated Japanese units on Pacific islands.⁵ Later, during the Malayan Emergency of the 1950s, British aircraft sprayed herbicides on the isolated jungle plots of Communist insurgents as part of a suc-

cessful food denial program.⁶

In the decade prior to their use in Vietnam, American military pilots and aircraft in this country developed herbicide delivery techniques and equipment.⁷ One successful experiment conducted at Camp Drum, New York, in 1959 foreshadowed what was to come later in Vietnam. Sugar maple foliage was obstructing the view of an artillery impact area, and ground access was impossible because of unexploded rounds. The Army Biological Warfare Laboratories sent Dr. James W. Brown, later involved in the earliest stages of the herbicide program in Vietnam, to Camp Drum. He oversaw the helicopter spraying of the maples with a mixture of 2,4-D and 2,4,5-T, which caused their leaves to dry and drop about one month later, greatly improving visibility.⁸ This experiment at Camp Drum used the same chemicals for the same purpose for which Ranch Hand later sprayed them widely in Southeast Asia.

The Kennedy administration inherited a deteriorating situation in South Vietnam, and in its first months began to address what the United States might do to strengthen the Diem regime in its fight against a festering insurgency. One early approach was to investigate what "techniques and gadgets" from the reservoir of American technology might be useful in the counter-insurgency effort.⁹ Chemical herbicides for clearing "firebreaks" along South Vietnam's borders received specific mention as early as July 1961,¹⁰ and later that year American personnel using South Vietnamese aircraft conducted some very limited but successful tests in that country which helped to make President Diem of South Vietnam a staunch supporter of both defoliation and crop destruction.¹¹

After the development of appropriate plans, a proposal to use U.S. aircraft in a more extensive defoliation and crop destruction operation received attention in Washington during the latter part of 1961. The Department of Defense favored such an operation, while at the same time recognizing the possibility of adverse world reaction. Perhaps because of this negative potential,

the Department of Defense advocated initially only a selective defoliation program along key transportation routes, with the addition of crop destruction later, if at all.¹² The State Department did not object to a closely controlled and selective defoliation program and argued that such operations would not violate any rule of international law and could furthermore be labeled an accepted tactic of war, citing the Malayan precedent.¹³ President John F. Kennedy personally gave the approval in principle for the start of Operation Ranch Hand on 30 November 1961.¹⁴ For a year afterward, all herbicide targets to be sprayed by U.S. aircraft had to receive specific Oval Office approval, and it was not until late 1962 that President Kennedy delegated limited authority to order Ranch Hand defoliation missions to his ambassador and military commander in South Vietnam.¹⁵

The decision to begin destroying crops with herbicides was longer in coming. President Diem was an early and enthusiastic advocate of crop destruction. He maintained that he knew where the Vietcong crops were,¹⁶ and South Vietnamese officials had difficulty in understanding why the Americans would not provide them with a readily available chemical to enable them to accomplish with much less effort what they were already doing by cutting, pulling, and burning. Although the Defense Department favored crop destruction,¹⁷ several influential people in the State Department, notably Roger Hilsman and W. Averell Harriman, were opposed. The opponents argued that there was no way to ensure that only Vietcong crops would be killed, and the inevitable mistakes would alienate the rural South Vietnamese people. Hilsman also argued that the use of this technology would enable the Vietcong to argue that the United States represented "foreign imperialist barbarism,"¹⁸ and Harriman urged that crop destruction be postponed to a later stage in the counterinsurgency struggle when the Vietcong and the people would not be so closely intermingled.¹⁹

The pressure from Saigon continued, how-

ever, and on 2 October 1962, President Kennedy decided to allow restricted crop spraying to proceed.²⁰ Until 1964, crop destruction operations were rare, and South Vietnamese personnel and equipment conducted them. However, in the aftermath of the Tonkin Gulf incidents, the Ranch Hand detachment began flying crop destruction missions. Because of the continuing sensitivity of crop destruction, Ranch Hand aircraft displayed temporary South Vietnamese markings when used for this purpose.²¹

Operation Ranch Hand expanded as the U.S. commitment to Vietnam deepened. Controls and limitations on spraying gradually relaxed, and new geographic areas were added. In late 1965, Ranch Hand began spraying the Ho Chi Minh Trail complex of roads and footpaths in southern and eastern Laos.²² The following year, occasional crop destruction in Laos became part of the Ranch Hand mission.²³ In 1966 and 1967, Washington approved the spraying of herbicides in the demilitarized zone separating North and South Vietnam.²⁴ Ranch Hand's level of operations steadily increased and peaked in 1967 when the unit sprayed 1.7 million acres, 85 percent for defoliation and 15 percent for crop destruction.²⁵

THE early use of herbicides in Southeast Asia by U.S. forces did not produce the hostile international reaction that some had feared. After the first missions in early 1962, Radio Moscow, Radio Hanoi, and Radio Peking all broadcast condemnatory reports, but the reaction from foreign non-Communist capitals was light.²⁶ The first serious public relations problem over the use of herbicides did not surface until about a year later. Richard Dudman wrote a series of articles on U.S. policy in Asia which appeared in the *St. Louis Post-Dispatch* and other newspapers in February 1963. One of these articles accused the United States and its South Vietnamese allies of using "dirty war" tactics against the Vietcong, including the spraying of "poison" from Ranch Hand planes to

destroy rice fields and roadside ambush cover.²⁷ Dudman's article so disturbed Congressman Robert W. Kastenmeier of Wisconsin that he wrote President Kennedy and urged him to renounce the use of herbicides as chemical weapons in Vietnam, questioning whether the survival of the Diem regime was worth compromising America's moral principles.²⁸ The Department of Defense responded to Kastenmeier's letter, contending that the herbicides being used in Vietnam were not chemical weapons and charging that the press and Communist propaganda organs had distorted the facts about Operation Ranch Hand.²⁹

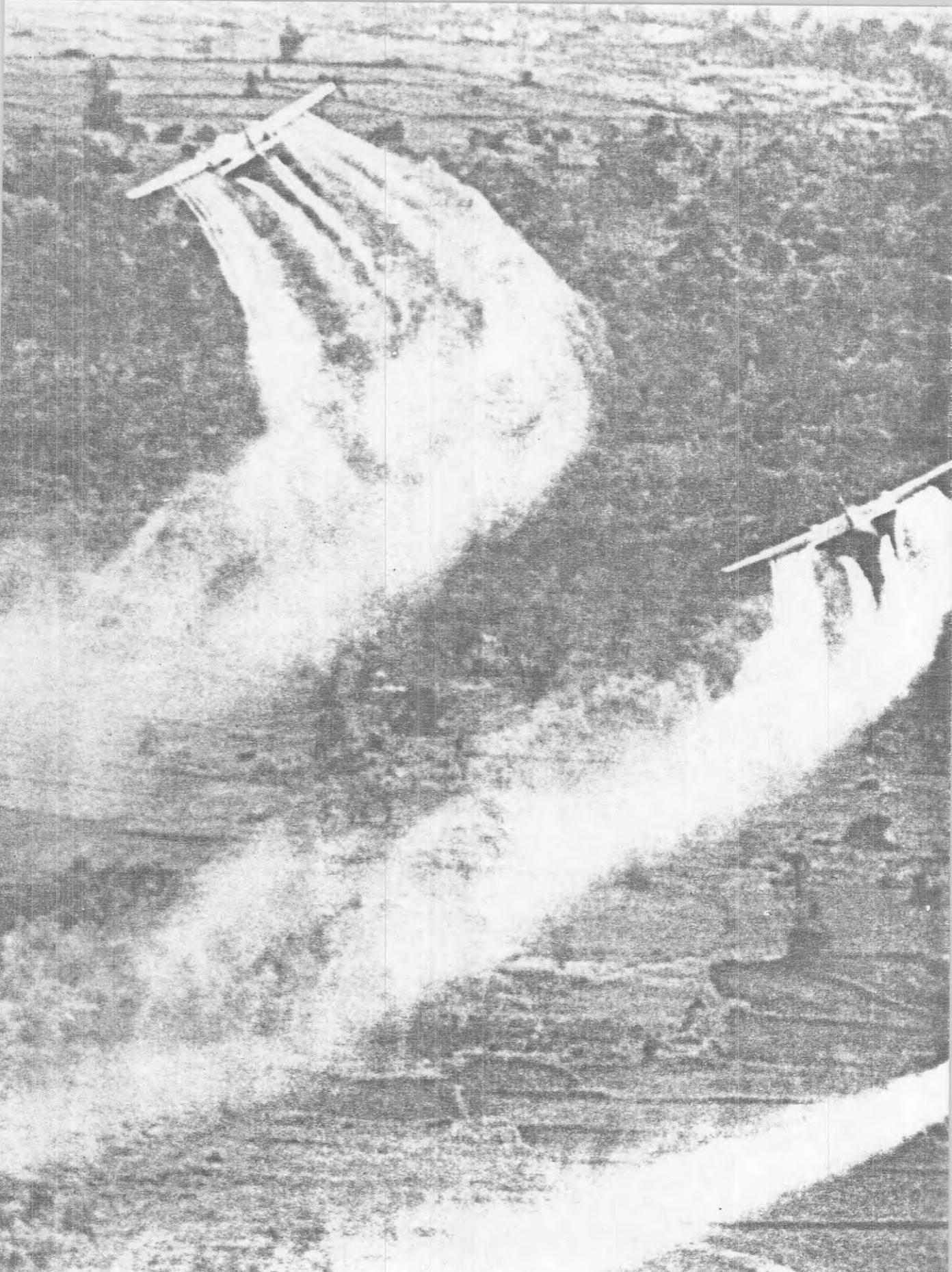
There was another relatively serious incident of press criticism of Ranch Hand in May 1964. An article by Jim G. Lucas, a Scripps-Howard staff writer, charged that a Ranch Hand plane had accidentally sprayed the friendly village of Cha La in the Mekong delta, destroying the rice and pineapples on which the people depended for their livelihood.³⁰ The *Washington Post* published the Lucas story and on the following day called editorially for an end to the use of herbicides in South Vietnam because they were totally unsuited for use against guerrilla infiltrators living among a civilian population. Herbicides, the *Post* charged, were simply too unselective and nondiscriminatory.³¹ An extensive investigation conducted in the wake of the Cha La incident failed to substantiate the charges made by Lucas.³² At this point in the war, adverse publicity was unable to stop the expansion of Ranch Hand activities, but these early stories and editorial comments were clear precursors of what was to follow a few years later.

The first official questioning at high levels of the wisdom of continuing chemical crop destruction seems to have been generated by a pair of Rand Corporation reports issued in October 1967. Based on interviews with a small sample of 206 former Vietcong and non-Vietcong civilians, Rand researchers concluded that destroying crops with herbicides had not caused any significant shortage of food among Vietcong forces. On the other hand, the spray program

had generated much hostility toward the United States and its South Vietnamese allies. Crop destruction struck at the very heart of a rural South Vietnamese farmer's existence, eliminating not only the food supply on which he and his family depended but also obliterating in one spray pass the product of many months of his family's labor. If crop destruction had to continue, these analysts concluded, much greater efforts to lessen its impact on innocent civilians would be necessary.³³

Secretary of Defense Robert S. McNamara directed the Joint Chiefs of Staff to respond to Rand's criticisms.³⁴ The JCS argued that spray missions against crops were meeting desired objectives, not only by causing enemy troops to go hungry in some areas but also by forcing them to divert men from combat and assign them to the tasks of procuring and transporting food. The Joint Chiefs played down the problem of hostility generated among civilians in the sprayed regions by arguing that almost all crop destruction had taken place in areas uninhabited by anyone other than the Vietcong, or places clearly under Vietcong domination. Anyone living there, presumably, was already alienated.³⁵ Crop destruction survived this round of criticism, and Ranch Hand continued with the task of spraying fields used to grow food.

Criticism from the civilian scientific community was also a problem for Ranch Hand. As early as 1964, the Federation of American Scientists had expressed opposition to the use of herbicides in Vietnam on the grounds that the United States was capitalizing on the war as an opportunity to experiment in biological and chemical warfare.³⁶ In January 1966, Professor John Edsall of Harvard and a group of 29 Boston scientists protested crop destruction, claiming that it was barbarous and an indiscriminate attack on both combatants and noncombatants.³⁷ About a year later, the President's Science Advisor received a petition signed by more than 5000 scientists, including 17 Nobel laureates and 129 members of the National Academy of Sciences, urging President Johnson to end the use of





antipersonnel and anticrop chemicals in Vietnam. They argued that moral restraints against chemical and biological weapons were being breached, thereby weakening the barriers against more lethal chemical weapons.³⁸

In 1967, the American Association for the Advancement of Science, prodded by Professor E. W. Pfeiffer of the University of Montana, urged the Department of Defense to study the possible long-range ecological consequences of Ranch Hand's extensive use of herbicides in Vietnam.³⁹ The Department of Defense had commissioned the Midwest Research Institute to undertake such a study based on a survey of existing literature, and the results of this survey appeared in December 1967. This study concluded that the plant-killing effects of the Ranch Hand herbicides would not last long and that revegetation would occur. On the question of toxicity to animals and people, the Midwest Research Institute researchers determined that this should not be a factor of real concern, except perhaps for cacodylic acid, which should be the subject of future investigations. A National Academy of Sciences panel, which reviewed their report, concluded that there was not yet enough research about the effects of heavy or repeated herbicide use to draw firm conclusions about damage to the ecology. Although Ranch Hand was not found guilty of causing permanent ecological damage by defense-sponsored research at this time, the unresolved questions threatened the operation's continued existence.⁴⁰

At the same time that ecological doubts and fears were developing, economic and political criticism of Ranch Hand was also helping to limit its future. A policy review committee appointed by Ambassador Ellsworth D. Bunker in Saigon in early 1968 examined the herbicide program in detail, and although this group

Operation Ranch Hand C-123s flew in three-ship formations to ensure maximum coverage with the spray. Because of these formations, crews received significant exposure to herbicides. A study is being conducted to determine if any long-term health problems may emerge.

concluded that Operation Ranch Hand had been successful militarily, they also pointed out some associated problems. The economic costs of the operation included damage to large areas of forest, one of South Vietnam's most valuable resources and a major basis of employment. Although crop destruction had contributed to enemy logistics difficulties, Bunker's analysts concluded that the civilian population of the sprayed areas had borne the main burden. The system that settled civilian claims for herbicide damage was also criticized. The review committee said that most damage occurred outside the areas of Saigon's control where the compensation machinery did not operate, and corrupt local officials were a problem where the compensation program did function.⁴¹

In September 1968, Ambassador Bunker reported the results of his herbicide policy review to President Nguyen Van Thieu of South Vietnam. Thieu responded that herbicides had had military value earlier in the war but that their future use should be limited and highly selective. He felt that with Vietnamese and American ground forces now being stronger and more capable, herbicides should only be sprayed along infiltration routes and in uninhabited regions. It would no longer be wise, Thieu felt, to use herbicides in populated and cultivated areas because of the propaganda benefits to his Communist opponents.⁴² Although American military support for Ranch Hand was still strong, Thieu's coolness at this time was an important negative factor.

As the Nixon administration began to implement its policy of reducing the American presence in Southeast Asia, Ranch Hand came under increasing pressure to cut back. In late 1969, the unit was ordered to reduce its operations by 30 percent,⁴³ and it lost 11 of its 25 aircraft.⁴⁴ Another complicating factor during the same period was the pending ratification by the U.S. Senate of the Geneva Protocol outlawing chemical and biological warfare. President Nixon favored ratification, but he maintained that the Geneva Protocol did not apply to herbicides and riot control agents. The United Nations General Assembly rejected this view in December 1969,⁴⁵ and the Senate Foreign Relations Committee was reluctant to recommend ratification so long as Ranch Hand continued.⁴⁶ The Nixon administration by late 1969 had ample political reasons to want to kill Ranch Hand entirely.⁴⁷

The demise of Ranch Hand was made virtually certain by a study released in the fall of 1969, which presented evidence that 2,4,5-T, a component of the most common herbicide, Agent Orange, could, in relatively high doses, cause malformed offspring as well as stillbirths in mice.⁴⁸ This study closely followed a spate of reports, never substantiated, in the South Vietnamese press that Agent Orange had caused human birth defects in that country. Because of doubts about the safety of 2,4,5-T, the Departments of Health, Education, and Welfare; Interior; and Agriculture on 15 April 1970, ordered the immediate banning of this chemical in the United States, except for carefully controlled use on noncropland such as ranges and pastures.

Military authorities favored the continued spraying of Agent Orange in Southeast Asia under restrictions applicable in the United States.⁴⁹ The Defense Department nevertheless temporarily halted all spraying of Agent Orange in April 1970, a ban that was never lifted in spite of intense and repeated protests from the military.⁵⁰ With Agent Orange no longer available, Ranch Hand sprayed all existing stocks of the substitute defoliant Agent White in a matter of days, flying its last defoliation mission of the war on 9 May 1970.⁵¹ Crop destruction sorties continued for a few months, but they, too, ended on 7 January 1971, putting Ranch Hand permanently out of business almost nine years to the day after it had begun.⁵²

THE end of the Ranch Hand flights, of course, did not terminate the controversies over what the extensive spraying of herbicides in Southeast Asia had done to the ecology of the land and the health of the people there. Under a

congressional mandate, the Department of Defense contracted with the National Academy of Sciences in 1970 to study the effects of herbicides in Vietnam, a study which civilian scientists had long wanted.⁵³ The National Academy of Sciences took about three years to complete its research, releasing its report to the public in 1974.⁵⁴ Its researchers found no direct evidence of human health damage from herbicides, although they did uncover a pattern of largely secondhand reports, which they could not confirm, that herbicides had occasionally caused acute or fatal respiratory problems in children. Even after considerable effort, the researchers found no evidence substantiating a link between herbicides and human birth defects.

As was the case with humans, the National Academy of Sciences researchers found that Ranch Hand damage to the land and vegetation had been less than some had feared. The main effect of the herbicides was that they killed the leaves on the trees, and there was usually little lasting damage in future growing seasons unless the trees had been sprayed three or more times. Only about twelve percent of the total area covered by Ranch Hand had received triple coverage. The mangrove areas in the southern part of South Vietnam were an exception, however, having been devastated by just one spraying due to their high sensitivity to herbicides. About thirty-six percent of the mangrove forest area in South Vietnam had been destroyed and would not return to its natural state for perhaps a century without extensive reseeding. Nevertheless, these researchers concluded that herbicides had not had any lasting effects on the nutrients in the soil, with the possible exception of potassium. They also pointed out that the more conventional wartime bombing and shelling had had a worse effect on inland forests than had the herbicides. Besides killing trees, shrapnel imbedded in wood made it both costly and hazardous to saw logs into lumber.⁵⁵

Concern over the long-term effects on human health of exposure to herbicides lingered and reappeared. A Chicago television station aired a

report on 22 March 1978, which alleged that 41 Vietnam veterans living in the Midwest were suffering from Agent Orange exposure. A Veterans Administration benefits counselor suggested this causal link because of the similarities in the backgrounds of veterans voicing medical complaints that she had seen. The complaints of this group included diminished sex drives, psychological problems, numbness, and skin rashes.⁵⁶

During the month following this news story, the Air Force Surgeon General directed the USAF Occupational and Environmental Health Laboratory to update previous assessments of human health effects from exposure to herbicides, particularly Agent Orange and its associated dioxin contaminant. The dioxin produced in the manufacture of 2,4,5-T had been identified as the main source of concern over possible adverse effects on humans. This chemical had been present in the parts-per-million range in Agent Orange and was known by this time to be extremely toxic, some would say the most toxic man-made chemical in existence. Researchers at this Air Force laboratory reviewed published scientific literature and concluded that the minimal reports of adverse effects from their worldwide use since the middle 1940s indicated that 2,4-D and 2,4,5-T, the active ingredients of Agent Orange, were generally safe chemicals if used properly. Any adverse effects from these herbicides, they said, should manifest themselves shortly after exposure, and symptoms arising for the first time months or years later were probably not caused by herbicides. They could find no research to confirm cancer, fetal deformities, or mutations in humans caused by exposure to phenoxy herbicides or dioxin.⁵⁷

Media interest and political pressure for further research into this subject continued, and on 4 June 1979 the Air Force announced that it would conduct a lengthy study of the health of 1200 Ranch Hand veterans. This study would compare the health of these men with a control group to determine whether Ranch Hand veterans had suffered any detrimental health effects

from Agent Orange and other herbicides. They were a logical group to study, having been exposed repeatedly to these chemicals during their service in Southeast Asia. Ranch Hand planes had often flown in trail formations, covering the following aircraft with herbicide spray and drawing vapors into their ventilation systems. Of any Americans who had served in Southeast Asia, then, Ranch Hand veterans were among the groups having most potential for exposure. Ranch Hand veterans also represent a distinct, identifiable group whose potentially extensive occupational exposure to Agent Orange can be quantified much more precisely than that of any other group of military personnel assigned in Vietnam.⁵⁸

On 15 September 1982, the Air Force Deputy Surgeon General, Major General Murphy A. Chesney, presented an update on the progress of this study of Ranch Hand personnel to the Subcommittee on Oversight and Investigations of the House Committee on Veterans' Affairs. General Chesney reported that preliminary findings showed that Ranch Hand veterans had had a death rate equivalent to that of an occupationally similar comparison group and a significantly lower mortality than the general population of white American males of the same age. He said that morbidity studies (disease and birth defects in offspring) and a program of follow-up examinations to stretch over 20 years were also under way. General Chesney indicated that more information from this study would be released in 1983, including a mortality report and preliminary reports of data obtained from questionnaires and physical examinations.⁵⁹

The examination of health effects of herbicides on Vietnam veterans is under way in at least two other forums at present. A potentially major product liability suit is scheduled to go to trial this year in New York. A group of veterans is suing the chemical companies which sold the herbicides to the Air Force, charging that they manufactured defective products and should therefore pay damages for the health problems alleged by the veterans to have been caused by

herbicides. Also, the Center for Disease Control has taken over from the Veterans Administration a study that is wider than the Air Force research on Ranch Hand veterans. This more extensive project will compare the health of several thousand servicemen who may have been exposed to Agent Orange with another group that was not exposed but was in the military at the same time. This study is scheduled for completion by 1987 and will be a major factor in determining whether the government will award disability payments to veterans who claim to be suffering from aftereffects of Ranch Hand spraying.⁶⁰

THE military use of herbicides in Southeast Asia should be placed in comparative perspective. One illustrative statistic is that in the United States alone, between the years 1966 and 1969, 7,939,000 acres were treated with 2,4,5-T, the herbicide whose dioxin contaminant is causing such current health concern.⁶¹ This figure compares with the 6,000,000 acres sprayed with all herbicides by Ranch Hand during the period 1962-71. This domestic use of 2,4,5-T was for agricultural purposes, on lawns and turf, along rights-of-way, on private forests, to kill aquatic plants, and for other purposes. Probably few people who lived in the United States or other developed countries during the 1960s escaped exposure to 2,4,5-T and its associated dioxin.

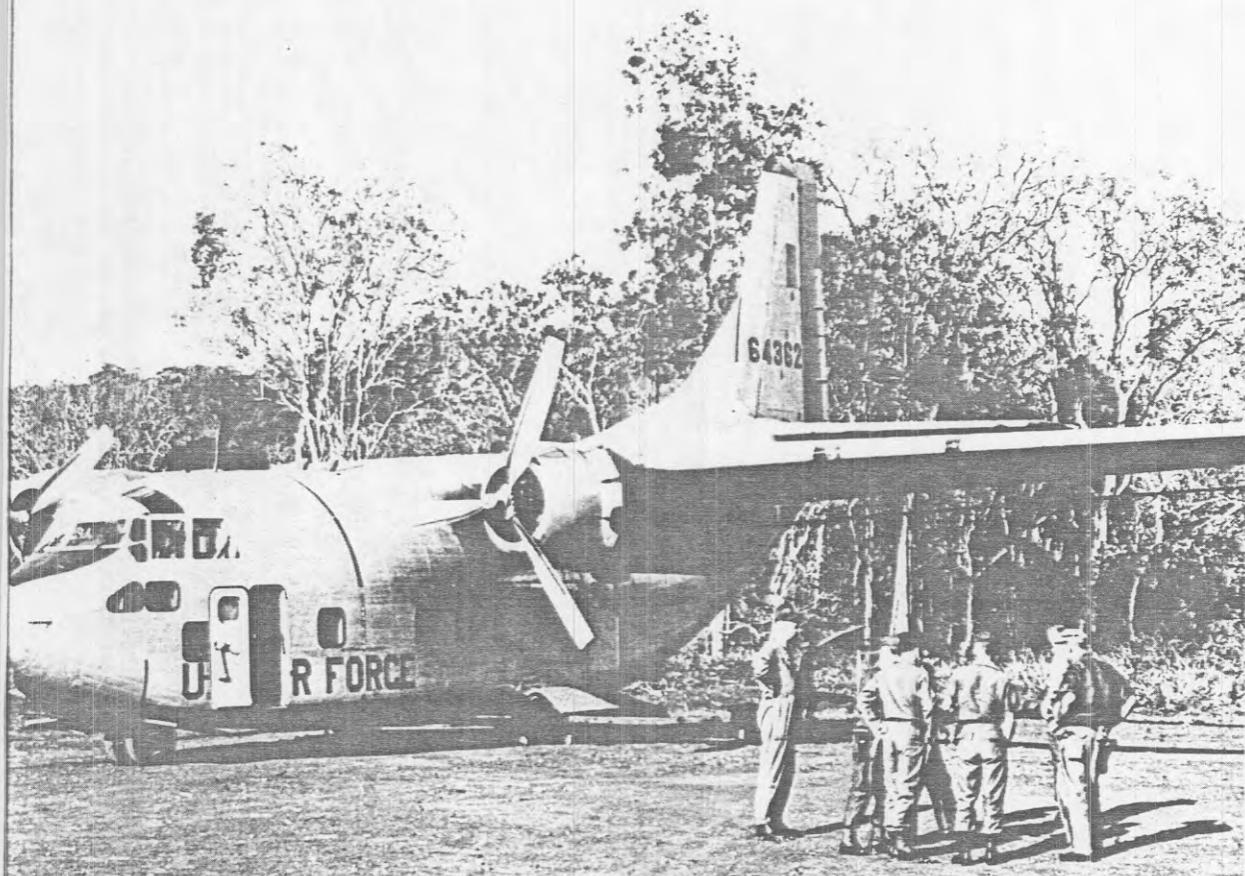
A personal example may help to illustrate this point. My family lived on a small farm in Tennessee, and honeysuckle vines were a constant problem on our woven wire fences. Before the general availability of herbicides, the only way to remove these vines and keep them from weighing down and destroying fences within a few years was to hack them away laboriously. In the early 1960s, my father discovered a herbicide that he could use to kill these vines using a simple hand sprayer. I recently asked him what he had been spraying all these years on the fences, and he directed me to a bottle which he

had saved from the stock he had when the product was removed from the market. The label listed its active ingredients as an approximately equal mixture of 2,4-D and 2,4,5-T, the same as Agent Orange. I think I can conclude that my family had more exposure to Agent Orange at home in Tennessee than most veterans had in Vietnam, and I doubt that our situation was unusual. Of course, none of this is relevant to the determination of the adverse health effects, if any, of phenoxy herbicides such

as those sprayed by Ranch Hand. However, we should recognize that Vietnam veterans are probably not significantly different from the rest of the population in terms of their exposure to 2,4,5-T and its dioxin contaminant.

The collateral consequences of Ranch Hand have received and continue to receive wide attention, but anyone studying this operation must, of course, also look at the military value of herbicides. Except for the very earliest evaluations,⁶² assessments of their military usefulness have been consistently positive. The Army's Engineer Strategic Study Group surveyed U.S. military officers who had served in Vietnam and released a report in 1972 which concluded that

Ranch Hand crews were the first to deploy to Southeast Asia, reaching Vietnam in January 1962. Initial missions were along highways, waterways, and railroads near Saigon.



combat operations would have been considerably more difficult without herbicides. The main military benefits had been increased visibility from both the air and the ground and assistance in the defense of fixed bases. The main impact of the crop destruction had been to force the Vietcong and North Vietnamese to modify their operations.⁶⁵ In short, the military with few exceptions viewed the results of Ranch Hand as very valuable.

Perhaps the best way to understand Ranch Hand's role in the war is to view it as part of an American effort to bring technology to bear on the solution of a problem. Herbicides were part of a war effort that, whenever possible, substituted firepower and other manifestations of wealth and applied science for manpower, especially American manpower. Denying the enemy the use of certain areas could also have been accomplished by placing combat troops on the ground in those places. More soldiers could have secured roads and other lines of communications against ambushes and interdiction. More numerous patrols and additional outposts to extend control in contested areas would have burdened the Vietcong at least as much as did crop destruction. However, any of these substitutes, at least while Americans were heavily involved in ground operations, would have cost

more in American lives, the most precious and politically costly resource available to U.S. military commanders. Herbicides were an important part of the American approach to the war which emphasized a remote, technological means of fighting.

Finally, we must acknowledge the changing nature of the times from 1962 when Ranch Hand began operations to the present. Rachel Carson is now honored with her portrait on the 17¢ stamp, but the ideas she enunciated in *Silent Spring* were not widespread when the decisions were made to initiate and expand the herbicide program. Then, America was in an era of "better living through chemistry." Later, it became common to question the safety and environmental impact of almost every substance, from aspirin to rainwater. This changing perception in American society of the products of technology made it much easier to perceive herbicides as dangerous and somehow immoral. Opponents of the Vietnam War were then able to use this issue in their attack on broader American policy in Southeast Asia. Perhaps the lesson to be drawn is that unconventional weapons can have unanticipated and unconventional effects, in both the physical sense as well as in the policy area.

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Notes

1. Most of this article is derived from the author's book, *Operation Ranch Hand: The Air Force and Herbicides in Southeast Asia, 1961-1971* (Washington: U.S. Government Printing Office, 1982). Where appropriate, specific source documents are cited.

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3. Ibid., p. I-12.

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System Installation for Aircraft, 3 June 1952.

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9. Memo, Walt W. Rostow to the President, April 12, 1961.

10. JCS 2343/3, Status Report on the Presidential Program for Vietnam as of 10 July 1961, 21 July 1961.

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12. Memo, Deputy Secretary of Defense to the President, subj: Defoliation Operations in Vietnam, 21 November 1961.

13. Memo, Secretary of State (SECSTATE) to the President, subj: Defoliant Operations in Vietnam, 24 November 1961.

14. NSAM 115, subj: Defoliant Operations in Vietnam, 30 November 1961.

15. Message, Department of State to AMEMBASSY Saigon, Joint State-Defense Message No. 561, 30 November 1962.

16. Record, Fourth Secretary of Defense Conference, Hq CINC-

PAC, 21 March 1962.

17. Memo, Secretary of Defense (SECDEF) to the President, subj: Chemical Crop Destruction, South Vietnam, 8 August 1962.

18. Letter, Roger Hilsman to W. Averell Harriman, subj: Crop Destruction in South Vietnam, 24 August 1962.

19. Letter, W. Averell Harriman to Roswell L. Gilpatrick, 6 September 1962.

20. Memo, Michael V. Forrestal to W. Averell Harriman, 3 October 1962.

21. Report, MACJ325 to Asst CSAF, J-3, subj: Herbicide Program in RVN, 18 December 1964; info brief, Lt Col Paul C. Callan, CBR/N Ops, 6 April 1965, cited in Lazlo Hadik et al., *Constraints on the Uses of Weapons and Tactics in Counterinsurgency*, Institute for Defense Analyses, Report R-117, June 1966, p. 41.

22. Message, SECSTATE to AMEMBASSY Vientiane, Joint State-Defense Message, 250130Z Nov 65, cited in Project CHECO Southeast Asia Report, *Tiger Hound*, 6 September 1966, pp. 7-8.

23. Message, JCS to CINCPAC, subj: Crop Destruction, 261640Z Jul 66.

24. DJSR-196-67, Defoliation Operations in the DMZ and NVN, 18 January 1967; Project CHECO Southeast Asia Report, *Herbicide Operations in Southeast Asia, July 1961-June 1967*, 11 October 1967, pp. 28-29; Message, SECSTATE to AMEMBASSY Saigon, subj: Defoliation Operations, 121808Z Jun 67; Message, State #22808, 172309Z Aug 67.

25. Memo, Department of State Legal Adviser, subj: Proposed Q&A's for Hearings on the Geneva Protocol, 21 January 1971.

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27. *St. Louis Post-Dispatch*, February 6, 1968, as reprinted in *Congressional Record-Senate*, March 4, 1968, p. 3458.

28. Letter, Robert W. Kastenmeier to President John F. Kennedy, 7 March 1963.

29. Letter, William P. Bundy to Robert W. Kastenmeier, 6 March 1963.

30. Fact Sheet, subj: *Washington Post* report of Defoliation Damage at Cha La Outpost An Xuyen Province, Hq MACV, 31 May 1964, Annex B.

31. *Washington Post*, May 27, 1964.

32. Messages, COMUSMACV to JCS, subj: Jim Lucas Story on Defoliation of Friendly Area, 280421Z May 64 and 031238Z Jun 64.

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