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A REPORT ON THE LOCUST CAMPAIGN

USAID/MAURITANIA 1988

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LOCUST CAMPAIGN USAID/MAURITANIA 1988

The Sahel-wide locust invasion of 1988 has been characterized as the largest and most damaging in some 35 years. But the underlying conditions which produced it began the previous year.

Abundant rains blessed Mauritania during the summer and fall of 1987, as well as neighboring countries of Mali, Algeria, Senegal. This rainfall created favorable conditions for breeding and survival of the Desert Locust, Schistocerca Gregaria. Added to the often sighted and therefore known threat from developing locust populations in Mauritania was the unknown threat from the Western Sahara, whence desert nomads sometimes reported sighting locusts in various stages of development.

By November of 1987, confirmed reports of isolated locust individuals had been noted in northern Mauritania. The Mauritanian Crop Protection Service said that swarms had been sighted in Mauritania near the Algerian border, and a UNDP aerial team was sent to investigate. The USAID Mission reminded CPS that the northern part of Mauritania was possibly hazardous for air reconnaissance because of conflicts with Western Sahara.

The Mauritanian Director of Agriculture at the time, Adama Sy, asked if the USAID spray planes then in use in Senegal could be brought by the AID Mission to Mauritania to survey and control operations in central regions.

Also by November, rainfall data from AGHRYMET had proved to be unreliable, making locust control decisions as well as famine warning systems very difficult.

The locust activity continued through November and accompanying heavy rains into December led Mission Entomologist William Thomas to conclude that those conditions would continue to favor the Desert Locust hatch and development into a large population. He predicted in a situation report to Washington on Dec. 23 that "eggs laid this season by locusts in the north will hatch to be part of next season's invasion. Northern hatches of locusts could move southwest, presenting a crisis to the Sahel next year."

The Mission in the same cable requested spray aircraft and support from USAID/Morocco as well as funds from Washington to mount an extensive control program at that time. Both aerial control for adult swarms and ground control for hopper bands were thought to be necessary.

By January 1988, the Mauritania Mission was predicting, in a Situation Report to Washington, that if locusts were not controlled that spring in northern Mauritania, there was a good chance swarming locusts would threaten agriculture in Morocco as

well as southern Mauritania, Senegal, Mali and other Sahelian countries later in 1988. Entomologist Thomas further predicted that a locust invasion could be a crisis for both East and West Africa.

The Mauritanian CPS continued to ask donors for pesticides, other materials and funds, and continued the familiar litany of difficulty in controlling locust development in the north due to lack of resources, vastness of the area, danger from military mines, and potential for attacks from across the border with Western Sahara.

Another controversy complaint from both CPS and OCLALAV related to USAID restrictions against using Dieldrin in any operation even partially funded by U.S. funds (in most cases, AID-provided fuel). Both agencies claimed that if stores of Dieldrin could be used, less chemical would need to be applied, with less frequency. But CPS conceded that use of Dieldrin was not recommended in the presence of numerous nomads and their herds taking advantage of the seasonal changes in pasturage.

Locusts were not the only beneficiaries of the lush pasturage in the north, as the Jan. 12 edition of the newspaper, "Chaab", reported that some 300,000 camels and other livestock were in the region, with more en route. Locusts were having a definite negative effect on grazing of the first greenery in northern Mauritania since 1968. CPS had expected these grazing lands to remain green for the next several years, accommodating a large number of animals. Although there are no croplands in the northern regions, animal herds are historically important to Mauritania's survival and economic livelihood.

After field trips in early January by Mauritanian government officials, the Minister of Rural Development was impressed by sightings of larval bands, and became very concerned about potential for pasture and cropland damage.

A two-phase plan was proposed by CPS: Phase 1 (Jan.-March) would involve aggressive control of larval bands. Phase 2 (March-June) would aim at controlling swarms and missed larvae. Mission Entomologist Bill Thomas agreed with the basic strategy of the plan, but felt CPS estimates of needed resources were too costly. He concurred that additional grant aid was necessary to upgrade present resources in order to achieve control in the next months. Phase 1 of the CPS plan called for five 3-ton trucks, two 10-ton trucks, 100,000 liters of Fenetrothion, a helicopter for surveying, and \$378,000 for operational costs, among other resources. Phase 2 would call for additional materials and \$314,000.

By the end of January, the Mission asked AID/Washington to give serious consideration to a request for \$500,000 for locust surveying operations, additional training of local personnel, satellite greenness maps, and technical assistance. The Mission strongly recommended the continuation of the satellite greenness

pilot program of 1987 because use of the maps by the government of Mauritania allowed the conservation of scarce resources in narrowing down areas to be inspected visually. The Mission also strongly supported training individuals to more efficiently use existing resources as a move toward self-sufficiency.

Nomads continued to report adult swarms and larval bands in Western Sahara, leading Bill Thomas to predict that swarms would move south into the Sahel in coming months. Although 62,000 hectares in northern Mauritania had been treated by Jan. 26, new hatchings seen required re-surveying and re-treatment there.

Unusual off-season rains continued through January, contributing to perfect conditions for the proliferation of the Desert Locust -- moist soil for egg laying and hatching, and substantial vegetative growth for food sources. The Mission warned of a worsening situation, predicting that ecological factors would remain very favorable in the north, with additional rains expected to expand infested territory. By March, the Mission believed the situation to be very serious and beyond the point of gaining control. A Maghreb Mission (North African investigative team) reported extensive pastureland damage and potential threat of very numerous swarms migrating to other countries. Because of both locust damage and dessicating conditions, 300,000 camels and other animals would probably move south, creating problems in agricultural regions of Mali, Mauritania, and Senegal.

Late in March, Bill Thomas and Carl Castleton of AID/Washington traveled to northern Mauritania and reported a calmer situation. Lack of rainfall, early high temperatures and dessicating winds eradicated the favorable ecological conditions necessary for locust reproduction. Thomas and Castleton felt that the little information available from Western Sahara indicated that it was also drying out.

On March 24, the Mission advised Washington that although the immediate locust crisis was over, AID/Mauritania's allotment of \$468,000 was still vitally needed to reinforce CPS response capability for prevention of further outbreaks.

By late June of 1988, swarms of gregarious locusts were reported to be moving through Mauritania in a southerly direction, seen especially in the southeastern regions near the Mali border.

The June and July rains in the south and southeast regions of Mauritania created an ideal moisture level for locust egg laying. Annual grasses fed by the rains would provide lush locust feeding grounds after hatching. Invasions of locusts from the north were expected in August, in regions long untouched by this insect.

In mid-July CPS began transporting pesticides from storage in Nouakchott to prepositioning sites at regional capitals, financed by a USAID pledge of \$50,000 toward transportation costs. Pesticides on hand at that time included 1,100 tons of powder,

250,000 liters of liquid. CPS estimated a requirement of some 1500 tons of powder and 2 million liters of liquid, as well as funds to maintain vehicles.

The Mission was concerned that CPS might want to use stores of Dieldrin left over from OCLALAV activities of the early 60's. Some 280 55-gallon barrels stored just above a water source at Aioun, had possibly already contaminated that water. As France and Morocco extolled the virtues of this chemical, the Mission insisted that U.S. funds could not be used in any connection with the application of Dieldrin. CPS replied that they had no intention of using the chemical for locust control, and would consider relocating the Dieldrin, but would require funding.

France donated Lindane to the CPS locust control campaign, and the Mission reminded CPS that Lindane also could not be used in any connection with U.S. grants. The French criticized that the U.S. was sabotaging the only real tools available to fight the locust. Ironically, French and CPS treatment teams later stopped using Lindane because of its corrosive effects on application equipment! The French switched to U.S.-approved Fenitrothion.

Mauritania by mid-August was still experiencing good rains in the south and southeast. Vegetative biomass accumulated, with dense pockets of locust hoppers. Mature adult swarms mated and laid eggs in the southwest due to excellent ecological conditions in the area. Around the country, warm temperatures, frequent rains, early development of vegetation and perfect soil conditions for locust development were reported. Locust larval bands, extensive locust damage to rainfed crops, swarms, dispersed individuals all were reported. Replanting due to locust damage had begun in some areas, Hodh Chargi, for example.

AERIAL CONTROL OPERATIONS BEGIN

By August it was obvious to all concerned that CPS treatment efforts were overwhelmed by both the vastness of the infested regions and the rapidly increasing numbers of locusts. The Mission reported an urgent request by the CPS for 13000 liters of diesel for pesticide distribution, and \$94,900 for control operations. USAID donated fuel for treatment and survey vehicles, funds for pesticide transport, and funds to repair CPS vehicles. France donated 100 hours of helicopter time and 10,000 liters of fuel, and FAO brought in a Cessna spray plane. Although CPS was using available resources to the best of its ability, it was now recommended that sparse resources be concentrated on crop protection rather than eradication of the Desert Locust.

By early September, rainfall in the south and southeast had exceeded the heavy levels of the previous year, promoting waist-high, verdant growth of crops and annual grasses. The entire southeast part of Mauritania was ecologically perfect for locust proliferation.

With donor assistance, some 20 CPS ground units and one aircraft treated a total of 713,736 hectares in southeast, central and

southwest Mauritania by mid-September. A \$50,000 USAID grant to purchase fuel restarted ground treatment operations which had been halted for lack of fuel. The Mission reported to Washington that CPS would not be able to control the breeding and invading populations of locust without considerable assistance.

THE GOVERNMENT OF MAURITANIA GROWS CONCERNED

Locust Invasion Takes on Emergency Status

The eastern skies darkened as a cloud of whirling, spinning locusts approached Nouakchott on Oct. 5. The pink and yellow insects settled in for a few days, munching tree tops, and inspiring the Mauritanian government to send out a few trucks to spray pesticide into the air. The tardy spraying had little effect on the adult locusts, but needlessly contaminated homes and inhabitants of the city. Indeed, spray trucks lumbered through the streets and sandy lanes of Nouakchott spraying indiscriminately, with no warning, frequently catching passers-by in the direct dust vapor.

With the locust problem literally camped out on the government's doorstep, the stage was set for further pressure by donors upon the government, to act decisively.

USAID Representative Glenn Slocum and newly arrived Ambassador William Twaddell called on the Minister for Rural Development, the Secretary General and Director of Agriculture. The Ambassador explained that he was breaking the protocol order of his initial formal calls upon Ministers in order to reiterate USG concern about the worsening Desert Locust crisis, as expressed frequently over the previous months.

The Ambassador emphasized that in the frequent informal discussions among donors, contributing countries and agencies had asked that the Mauritanian government convene meetings to assess available resources and determine needs to mount an effective control operation. The Mission cited the results of the FAO-SKAF Mission, to which the Director of Agriculture replied that he was aware of the findings, and endorsed its suggestion of the use of medium-sized planes for spraying.

The Mission stressed the preliminary need to equip ground crew survey teams, lest the aerial operations be ineffectual. Ambassador Twaddell and Mr. Slocum informed the group that OFDA Director Julia Taft likely would visit Mauritania. The Director of Agriculture estimated that 960,000 liters of pesticides would be needed to continue control operations.

In a subsequent telephone conversation with Julia Taft, USG conditions were delineated under which consideration would be given to supplying two DC-3's: Government of Mauritania and other donor resource commitment to aerial operations, including fuel, pesticides and equipment for 20 CPS ground survey teams.

An October 11 communique issued by the Government of Mauritania spurred concern in the Mission regarding implications that the

the government had been willing but the donors weak. "In spite of indications and the warnings to world opinion, and although some countries and organizations have responded, albeit often with delay, to our appeals, the joint international and regional efforts have been neither prompt nor sufficient."

Donors concurred with AID that despite their awareness of impending gravity of infestation and pressure on the Government of Mauritania to mobilize a campaign, the government had reacted at best at a snail's pace. Slocum reported Oct.13 to Washington by cable that "Given recent Government of Mauritania support for the medium plane operations, we can expect them to push donors to contribute support costs. But for an effective control operation to succeed, we donors are going to have to do the lion's share of the work for them, even to making operational their (CPS) 20 ground survey teams."

The FAO-coordinated Donor Committee met Oct.18, the first time since Aug. 30. There CPS presented a lengthy "needs" list, which most donors considered to be excessive, especially since many items had been donated the previous year. The U.S. discussed the need to inventory fully the CPS materials in preparation for future locust campaigns. CPS reported locust activity all over the country, but also stated that grasshopper activity was becoming very destructive, giving them a strong desire to concentrate resources on that insect. The general feeling of donors, however, was to concentrate resources on control of larval locusts.

Two USAID field trips in October reported stunning sightings of all phases of the Desert Locust. Bill Thomas visited the Kiffa and Aioun areas Oct 10-11, where he found Canadian and FAO teams extremely dissatisfied with CPS survey teams. Planes had not sprayed for a week because of a lack of targets, despite the presence of larval bands in the area. Thomas observed 2nd- and 3rd-larval bands in most interdunal areas. He further found that since southeast pastureland was drying out, grasshoppers were moving to crops. Only small rainfed millet and sorghum subsistence fields were left, with some resultant complete crop loss. Thus the CPS faced the dilemma, with their limited resources, of the impossibility of control of both grasshoppers in the southeast and locusts in southwest and central Mauritania.

Both the Canadian base at Aioun and the FAO two-plane operation suffered from inadequate CPS ground survey assistance. CPS complained that most survey vehicles were either broken down or needed fuel, despite generous U.S. donations of fuel and spare parts earmarked for survey operations.

U.S. AERIAL OPERATIONS T.A. TEAM ARRIVES

In mid-October, the AID/Washington Aerial Operations Technical Assistance team of Dick Jackson, Andrew Stancioff, and Pat McCroy arrived to investigate the possibility of a U.S.-funded aerial operation in Mauritania. On a survey trip between Nouakchott and Akjoujt Oct. 20-21, the team saw massive numbers of pink adults

consuming all vegetation (village gardens, crops, date palms). They reported large swarms forming in the air (which soon moved northward, out of the area).

The general feeling of donor agencies and countries through early fall, 1988, was that it was better to concentrate existing limited resources on the larval locust, rather than adult swarms. Although the southeast was drying out, the southwest, from Kaedi to the Atlantic offered many enticing sites to support breeding and survival of the Desert Locust. Eggs laid by passing swarms were expected to reach maturity 3-4 weeks later in central and western regions. Rosso, R'Kiz and Boghe in the south were likely to be the next infested areas. This zone comprises not only rainfed and recessional agriculture, but much irrigated cropland along the Senegal River.

JULIA TAFT VISIT RESULTS IN TARGETING CAMPAIGN GOALS

The Oct. 23 - 26 visit to Mauritania of OFDA Director Julia Taft was the catalyst for the Government of Mauritania, the AID Mission and the donor community, and produced agreement on targeting the most vulnerable agricultural and agro-pastoral regions for aggressive locust control. Mrs. Taft's energy and ability to focus Government of Mauritania and donor attention on problems, combined with OFDA willingness to increase contributions, advanced the control effort even as the first massive swarms of locusts blanketed Nouakchott.

Mrs. Taft was received by President Taya for one hour, during which he described the locust threat and affirmed his government's commitment to combat it, including the mobilization of all army units to work with CPS field personnel. President Taya told Mrs. Taft, Ambassador Twaddell, and Mr. Slocum, that only two months previously, some 300,000 hectares of crops had been infested, but now four million hectares were predicted to harbor the locust. He blamed regional committees' failure to work on a concerted approach for slow action in the control effort.

Mrs. Taft told President Taya that the U.S. was ready to provide greater levels of assistance, but she emphasized that the Government of Mauritania must decide on a strategy with a descending order of needs.

She pointed out that if four million hectares were infested, there wouldn't be enough pesticides in the world to treat such surface area, even if massive aerial operations could be organized in time. President Taya stated that Mauritania was concerned about crops but equally worried about rangeland.

Throughout her visit, Mrs. Taft reiterated the need for the Government of Mauritania to rank-order needs and assess existing resources. She pointed out to CPS officials that donors could not identify the most urgent program needs for an emergency campaign.

Ambassador Twaddell characterized the Taft visit as "a stroke of good luck. We knew the government and the donors and we together had been incapable of coming to grips with the crisis situation. She came through Mauritania at a critical time. Her solutions were global, but very responsive to local needs. She really discussed strategy. Crop protection as first priority crystallized."

The Ambassador continued. "We knew we were talking politics when we talked of protecting crops in southern Mauritania. We never excluded completely the idea of doing something in the north. Many of the top officials are from there. I thought of Atar -- of the huge infestations seen by our own experts in the Inchiri - Akjoujt region.

Although various Ministers insisted that field reporting was extensive and accurate, they could not give precise answers as to numbers of operational radios, vehicles, etc. Gross inaccuracy characterized some reporting: i.e. a total of 13 planes reported in country, when only six (later five, when one crashed) actually were available to a locust control program.

Mauritanian officials were unequivocal in their rejection of any suggestion of a joint operation with Senegal along the Senegal River. They maintained that Mauritania would get less than its fair share in any such cooperative effort.

At R'kiz, during a survey flight, Mrs. Taft proposed to Mauritanian officials that U.S. funds be used to protect the green belt along the Senegal River. She reiterated the need to give priority to the protection of agricultural crops, given the limitations of OFDA's budget. A member of the OFDA team observed that the Director of Agriculture appeared uncomfortable, but kept his own counsel.

Asked later whether there was a problem, the Director of Agriculture replied, "You cannot protect only crops. When the pasture is gone, cattle will move onto croplands."

As discussions progressed during the Taft visit, consensus emerged on identifying 190,000 hectares of cropland in the southwest to be treated along with contiguous rangeland. Based on the team's assessment, it was decided to establish an OFDA-funded spray operation there.

Extensive hopper-phase populations on the ground were observed by the Taft party in the Lake R'Kiz region, with similar sightings between Rosso and Nouakchott. The Mission aircraft encountered a small swarm of flying adults on the way back to Nouakchott, confirming the need for action.

Ambassador Twaddell hosted lunch for Mrs. Taft, the Minister of Rural Development, Director of Agriculture, and donor agency

heads. The UNDP representative suggested that the government use the 60 Land Rovers provided for the national census in the ground surveying. Helpful discussion ensued from all sides.

The U.S. proposed the following program:

A. The primary emphasis would be to protect irrigated crops, recessional farmlands, village agriculture and contiguous pasturelands. USAID management would allot four Turbo-thrush spray aircraft at strategic airports, backed up by one Alouette II survey helicopter and one supply aircraft.

B. Locust control would be achieved by survey teams comprising Mauritanian agriculture personnel, trained military personnel, and Peace Corps agricultural Volunteers surveying crop and pasture areas. Criteria to treat include presence of five locusts per square meter. Teams would relay information by radio to a control center. As treatment concludes in each sector, survey teams, aircraft and equipment would move to the area of next priority, expecting to finish in the Adrar area.

The plan was to field eight survey teams, i.e. two per spray aircraft. The teams would function for an estimated five to six weeks.

The AID technical assistance team, after their late-October trips to the north, east, and south of Nouakchott, reported cloud-like swarms of the Desert Locust greater than anything any one of them had ever seen.

"Mauritania's locust problems are just beginning." (Situation report cabled to AID/Washington on October 25, 1988.)

By November 1, the Mission had honed its control operation plan to the following approach: 1. Survey the area 2. Delimit and aerially treat a limited number of infested hectares. The proposed management area included Rosso, the Aleg Triangle, and north to Nouakchott. The Mission intended eventually to field three operational bases, each with one or two planes, teams, and crews. Operations were to commence at R'kiz, then move to Boutilimit, Akjoujt and Aleg as needed. R'Kiz was chosen as the first base rather than Nouakchott because of the possibility of spray overlap with a French operation then based at Nouakchott, and inadequate maps available for Nouakchott.

During the course of the Taft visit the US Mission concluded that they would conduct an integrated program of control, relying as little as possible on the Government of Mauritania or other donors, except for the Food Security Office under the Ministry of Rural Development, who could provide some survey people, and military personnel for vehicle use.

TWO LOCUST DISEASES NOTED

Around this time, AID entomologists noted the presence of the fungal disease, Entomophaga grylli, in many specimens collected around Nouakchott. Mature locusts at Nouakchott, Boutilimit and Rosso manifested dark mottling on their abdomens, with a white coating in advanced stages on abdomen and pronotum.

A second locust disease, the bacterium, Coccobacillus acridorum, was later observed by the Mission entomologists. It was suggested that the two diseases should be tracked for biology control benefits. In a Nov. 7 situation report to Washington, Bill Thomas asked whether the two diseases had been noted elsewhere in the Sahel. Later reports indicated, however, no other AID Mission had seen the disease in locust populations.

The two locust diseases were felt to be of incidental interest at that point in the invasion, with little immediate impact on the population. With favorable weather, such diseases eventually could be a real asset in controlling the locust. Nature's ancient controls had been known for hundreds of years. For the layman, it is enough to know that predators and parasites always lag behind the plague which feeds them. The virulent plague (locust) outruns them for some time. But after a while, food supplies decrease as the population increases. The locust population weakens, and the predators and the parasites have a chance to catch up.

In late October, the OFDA team reported that in the R'Kiz area and to the south and east of Nouakchott, most young adults and mature adult locusts had migrated from the area, with 3rd, 4th and 5th instar larvae remaining. Various-sized bands were covering hundreds of square kilometers, sometimes with an individual band more than ten kilometers in length.

Pasture in the southwest, like most of Mauritania, was drying out quickly, a factor which doubtless contributed to the westward migration. Although there had been no rain in Mauritania since early October, soils in scattered areas still retained adequate moisture for egg survival.

In early November, AID Entomologist Dick Jackson and PCV Entomologist John Przybyszewski surveyed the Akjoujt region -- two weeks after Jackson's previous visit there. Jackson found dramatic changes, as vast quantities of locusts had migrated out in a northerly direction. Remaining locusts were diseased and moribund. Damage was most noticeable in traditional recessional agriculture and oases. Traditional farmers in Domane had replanted 4000 hectares of sorghum for the fourth time this season, due to incessant locust attacks. Obviously the maturity of the crops for the season was questionable.

The Jackson team could only speculate about the source of infestation for the surveyed region, since surveying the

suspected source, the interdunal region to the south and southeast, was precluded by impassable dunes, to any means save camel or helicopter. Once again, our experts relied on the time-honored communications source, passing nomads, who reported heavy infestations of locust larvae. The qualitative aspects of such information, however, were questionable.

Migrating adults had overwhelmed control and crop protection efforts by CPS and Mauritanian army spraying between Damane and El Nidenne. Jackson and company told CPS that Akjoujt was a priority area for aerial control by the U.S. aircraft. Although this would provide some relief for farmers, continued potential for additional swarm movement from other locations or out of interdunal regions was likely.

By early November locust infestations were reported virtually all over Mauritania, in all stages from new larval, to stage-5 larval bands as well as adult. CPS field reports revealed dry conditions below the 17th parallel. Although some traditional agricultural crops such as millet and sorghum had matured, other crops had been replanted due to locust and grasshopper damage. The CPS attributed crop loss due to locust damage to be 30 - 60%.

The Mission reported to Washington the continued need for some 300,000 liters of pesticide, and reported that 50,000 liters of Fenitrothion had been moved to the USAID base at R'kiz. Ironically, the U.S. financed transport of some pesticide back from sites to which it had financed transport for pre-positioning.

U.S.-FUNDED CONTROL OPERATION COMMENCES

The OFDA team shifted gears and began to prepare all logistics necessary for the spray operation. They moved into a just-vacated AID-leased house, and the Mission moved in a set of office furniture to complement the household set already in place. This location, around the corner from AID headquarters, became the Locust Command Center.

LOCUST COMMAND CENTER IS ESTABLISHED

The Center housed an administrative office, with a busy, hefty petty cash operation controlled by a locally-hired Belgian, Geza Strammer. As project accountant, Strammer said that a large petty cash was necessary because purchases had to be made quickly to get operational both in Nouakchott and at R'kiz. "I started Nov. 5, and the project was already spending money since Nov. 1" "We had to buy bedding, pay laborer salaries, purchase enormous amounts of food and supplies, all in cash. These vendors (most in the local markets) cannot deal in checks, or vouchers."

To get trucks loaded and rolling, Geza and other personnel all would be out at the airport until 9 or 10 p.m. filling barrels with gasoline. By 7 a.m. daily huge green trucks lumbered away from the locust headquarters, loaded almost to overflowing.

Other personnel at the locust headquarters included Andrew

Stancioff, logistician, who canvassed the markets of Nouakchott for barrels, and bargained for transport trucks. He did not try to hide his frustration with the need to follow USAID regulations for contracting and procurement. Fuel to get trucks moving to R'kiz was an immediate need. Local-currency PL-480 counterpart funds (\$190,000) were released with the help of the Mission Food for Peace Officer Jim Bednar, for local purchases. AID Executive Officer Joe Varley arranged for cash advances, and both moves enabled Stancioff to boost the Mauritanian economy for November.

Although all parties understand the need to follow carefully the established USG procedures for contracting, funding and purchasing overseas, the need for immediate access to funds in order to get the emergency assistance into operation for this campaign could have been frustrated by normal USAID procedures. OAR/M's situation is aggravated by the lack of an on-site USAID controller, with the consequent need at the time of the locust emergency to go through REDSO/WCA in Abidjan for approvals of dollar purchase orders.

Specifically, funds for the locust emergency campaign came from three sources. OFDA dollars were allotted in part directly to maintain the projects of William Thomas. The rest was to be expended by normal process of PIO/T and PIO/C. When the Jackson-Stancioff team started out, they wrote individual Project Implementation orders (PIO/T, PIO/C), of a very specific nature each time they had to spend money.

RECOMMENDATIONS FOR FUTURE EMERGENCY FUNDING PROCEDURES

Mission Executive Officer Joe Varley recommends that the Mission should have general project implementation orders rather than individual ones, which say "implement project..." thus making funds available to the post as needed.

The purchase order process since has been streamlined, so that the Mission can write purchase orders up to the value of the total PIO at post. (This saves the Mission, in theory, at least five days, and in practice, one to two weeks.) Thus the problem of availability of dollar funds allotted to projects (such as the OFDA emergency funds) is now solved.

Another source of funding for the locust emergency was the OFDA contracts written in Washington, specifically the Ruhe contract, and the PSCs of the OFDA team who came out from the U.S. All personnel who came out from the U.S. should have brought with them a copy of their contract and their travel orders; and arrangements for keeping them liquid should have been made before they left the U.S. and agreed upon by post. (Upon arrival, they were unable to cash checks, pay for accommodations, meals, etc.)

Trust Funds were used to finance local purchases such as fuel and materials to establish the spray operations base camp. The Mission set up an account at a bank, where the project cashed checks and thus used cash for all purchases, but there was no

reporting system in the early days.

Large amounts of cash payments were made. Such a system should be set up in a formal way in the future. A check would be issued to the project accountant. The accountant would have to liquidate the cash advance and then replenish it as needed (much as a petty cash account is maintained). Thus we would account for all funds at any given moment. A regular report to the AID office and CSA of purchases, etc. should be required.

For the 1988 locust emergency, AID gave CSA the budget for the spray camp at R'kiz. Jim Bednar, Food for Peace Officer, and Joe Varley, Executive Officer, co-signed checks and \$43,000 in local currency was spent to get the camp operational. Because so much spending was done hastily, unusual procurement procedures took place. Joe Varley recommends written guidelines on how procurement should be done under this system in the future. He further recommends that AID and CSA set up a management team to decide procedures to follow for use of Trust Funds at the hint of any future emergency need.

U.S. SPRAYING OPERATIONS COMMENCE

Team leader Dick Jackson, entomologist with many years of experience in control operations, divided his time between the Nouakchott and R'kiz headquarters. PCVs at Nouakchott worked the radio and helped with procurement.

The radio was the lifeline between R'kiz camp and Nouakchott HQ. Requests and status reports were transmitted all day: "We just sent 19 empty barrels up to you. We need jet fuel, yellow legal pads, pencils, another receipt book...we are spending money LIKE CRAZY."

R'kiz Camp opened on Nov. 5, and Turbothrush aircraft arrived that week. Spray operations commenced Nov. 10. The Heli-Ouest helicopter started surveying operations Nov. 16. USAID experienced a series of problems bringing in the helicopter from Chad due to problems with the Government of Mauritania over an indemnity clause in the contract. Problems with lack of spare parts or non-arrival of spare parts also delayed its arrival.

Another snafu involved the arrival of the spray aircraft with pilots and maintenance teams to Nouakchott. The personnel were frustrated at being routed through Dakar by their contractor, Bob Ruhe, where they spent a week doing nothing, followed by several days at St. Louis, Senegal, before they could enter Mauritania. This treatment, with its lack of foresight and clear instructions about visas and other international entry procedures, was to be repeated at the end of the spray contract work for OFDA, when the pilots, planes and mechanics were stuck at Nouakchott for weeks, not knowing where they next would be sent.

Mission Executive Officer Joe Varley recommends that any such contracting in future be done in a manner whereby the planes and pilots be provided to the Mission, along with a budget for local

support. The Mission should be consulted before the contracting is concluded, about possible logistical needs for the personnel, and available support the Mission could provide.

The Mission foresaw a need for 150,000 liters of pesticide for the USAID control operation, and would be able to get half of that from existing supplies. But there was concern that lack of pesticides might well limit the extent of the USG operation. In a Nov. 1 cable to Washington, the Mission requested information concerning future funding availability.

The R'kiz base camp was fully operational by mid-November, when two days of spraying by two planes treated 7,800 hectares with 3,900 liters of Fenitrothion. Estimated kill rate was 70 - 80% of 5th instar larva and adults. Four Turbo-thrush spray aircraft and one support aircraft had arrived from the U.S. and Senegal. There were now 32,000 liters of Fenetriophion at R'kiz, and an additional 20,000 liters was accessible at Rosso. CPS had agreed to release 30,000 liters for transport from Zourate, but rainfall had made transportation difficult.

The Mission therefore was concerned that only a couple of weeks' supply of pesticides remained, creating a major problem in control schemes. Ambassador Twaddell agreed to pursue the acquisition of more pesticide with other donors.

At this early period of the spray operation, there was general feeling that despite some problems with the military assistance in surveying, it worked as smoothly as could be expected. The Peace Corps Volunteers functioned very well at base operations, survey assistance and flagging. The two PCV's at Nouakchott staffed the radio communications center and assisted with local procurement. Their help with the helicopter became more valuable than anyone had been able to anticipate.

PEACE CORPS VOLUNTEERS PROVE INVALUABLE

Peace Corps Volunteers had been released from their regular assignments to assist with the emergency surveying effort. USAID locust control team anticipated assigning 3 PCVs to each aircraft, for a total of 12 PCVs at R'kiz and Akjoujt, and two PCVs at Nouakchott to act as CPS liaisons and communications center personnel.

Like many other aspects of the locust emergency campaign, the use of PCVs did not work out exactly as planned, especially since only one base camp was established, with all four aircraft, at R'kiz. Some six PCV's were returned to their regular sites and jobs. But personnel connected in any way with the locust campaign were nearly unanimous in their praise and admiration for the work of the Peace Corps Volunteers.

Despite assurances from the government, the R'kiz operation initially had no cooperation from the Mauritanian military personnel assigned to assist in the survey operation. The 15 military units at

R'kiz refused to cooperate without written permission from the Nouakchott commander. They also insisted that they be paid per diem separately from their usual salaries. Ambassador Twaddell and Director Slocum presented these problems Nov 14 to the Minister of Rural Development.

Dick Jackson, team leader for the OFDA-funded operation at the R'kiz camp, echoed U.S. Mission sentiment about the frustratingly slow beginnings to the locust control campaign: "The biggest thorn in our side is the lack of cooperation from the Mauritanian government."

On the first day of R'kiz camp operations, the Government of Mauritania promised that six military vehicles would be placed at the disposal of the U.S. operation for surveying. On day two, two vehicles were brought to the camp, gassed up, whereupon one disappeared and the other broke down after a few days. Thus of the six military vehicles promised for surveying, the camp had access to only one, and that was non-functional.

The lack of vehicles was even more frustrating to the camp crew as they could see fourteen "beautiful, all-terrain, Toyota Land Cruiser pick-ups" parked, tanks empty, at R'kiz. The U.S. four-plane operation couldn't get its hands on even one vehicle, despite Ministry of Agriculture promises of support from the Military.

Dick Jackson observed, "We don't want to go out and spray without survey vehicles. We can't do it." Indeed, the French were doing this, with questionable effectiveness.

Added to the difficulties in ground surveying without vehicles was the necessity to check the daily "kill." A Mauritanian entomologist, Ali Sy, was commended by all of the R'kiz team for his tremendous cooperation. When there was no other way to do it, he walked 20 km. to check the kill.

At this time, three Peace Corps Volunteers were sent back to Nouakchott, leaving three at R'kiz to survey, since the lack of vehicles obviated the original plan to field two survey teams.

Even more ludicrous was the fact that Camp R'kiz had on hand all the diesel fuel possibly needed for all surveying. "No vehicles and we have all this fuel. Now THAT'S frustrating!" asserted Jackson.

Since early November, huge green trucks daily left the Locust Command Center at Nouakchott, around the corner from USAID. These supply trucks hauled beds, boards, diesel generators, tools, mattresses, building materials and food as well as barrels of pesticides, diesel and aviation fuel from the capital down the paved road to Rosso, and then overland to Camp R'kiz. Those who traveled to R'kiz experienced first hand evidence of the huge burdens carried to establish and maintain the camp. The two-track roads over the sand were chewed and churned up enough to force

lighter 4WD vehicles off the usual route.

Pesticide supply continued to be the main concern among the USAID team as the Mission reported to Washington that the usage rate by CPS and donor aircraft was so high that accessible pesticides would soon run short. There were 673 tons of pesticide powder and 275,000 liters of liquid pesticide in Mauritania in mid-November, most of which was prepositioned in the interior, making transport to a central area difficult and therefore expensive.

At R'kiz, by Nov. 17 three days' worth of pesticides remained. A plea went out to other donors. In fact, the pesticides then in use were EEC donated. 30,000 hectares had been sprayed with 15,000 - 16,000 liters of Fenethiothion. Dick Jackson said that despite obstacles, "I feel very comfortable with what we have accomplished."

Spraying on the 13th and 14th, for example, had resulted in a 70 - 90% kill, of fledgeling adults. From Nov. 15 - 17, a 90% kill rate was accomplished as locusts were caught as larvae. "We're really after them at that stage," explained Jackson. "They are much easier to kill. Once they get a hard skeleton, it's very difficult to kill them."

Unseasonable rains in northern Mauritania in early November alerted entomologists to watch the area warily, as near-surface bedrock assured moist soil conditions for locust reproduction and survival. It appeared likely that any mature swarm moving out of increasingly dry areas would stop and lay eggs there.

The southern regions presented a different picture. South of the 18th parallel, pasturelands were 100% dry. Cereals were being harvested, except for the crops replanted due to locust and grasshopper damage. Prospects for the replanted crops were not good in view of the lack of moisture. Locusts in that area were mostly pink swarms and larval bands in ecologically favorable pockets.

The USAID locust control team had expected to set up the second base camp at Akjoujt or Nouakchott by about Nov. 21. But by then, the crop protection mandate priorities resulted in a decision to stay in southwest Mauritania.

R'KIZ OPERATION CONTINUES IN HIGH GEAR

The R'kiz camp operation by Nov. 22 had treated 56,000 hectares with 28,300 liters of Fenitrothion. At that rate, the U.S. operation had enough pesticide on hand to treat through Dec. 3. The Mission again sought more pesticides from CPS and other donors.

The total treated area by combined CPS, donor aircraft, Army and farmer operations was 119,100 hectares in recent weeks, for a campaign total of 606,600 by Nov. 22.

Donor pressure on CPS for release of pesticides stocks continued,

to no avail. The USAID team foresaw shortages looming even if all in-country stocks were to be liberated, and in turn that would produce a logistical nightmare.

France pledged to deliver 30,000 liters on 12/15 for its operations, and Germany would formulate 100,000 liters of Fenitrothion at its Nouakchott plant. The Mission held some reservations about the quality of such locally produced pesticides, and informed Washington that it would test for possible use in USAID operations, as other options were pending or unsuitable.

The tide of resistance by the military began to ebb after USAID flew the Director of Agriculture and the responsible military commander to R'kiz on 11/21. Bill Thomas and other team members reported that the Mauritanian officials were very cooperative, appropriate orders were issued to local responsible parties, and a new era of cooperation ensued at R'Kiz.

Four military vehicles and drivers were assigned to the camp on 11/22 and there they remained, on call as needed, until the camp closed. The camp absorbed the drivers and their sergeant, who bedded down and took their meals at the camp and became true members of the campaign team. Once working, the cooperative survey operations became very valuable to the control effort.

One Peace Corps Volunteer rode with each army vehicle, surveying in cropping areas and along the river. With the helicopter, the ground survey operations formed the core of spray operations by providing the four Turbo-Thrush spray planes with daily targets.

The Director of Agriculture was very impressed with the camp operation, especially the safety components in place for disposal of emptied pesticide containers. Neutralizing and rendering unusable all pesticide containers is necessary as the barrels are the ideal size to drape over the side of a camel's hump. Indeed, earlier in the locust invasion, a regional official had been accused and convicted of reselling used pesticide barrels -- despite obvious danger from toxicity to unsuspecting rural folk who need water containers. Bill Thomas followed the case and was satisfied that the culprit was arrested.

The Camp R'kiz solution was to punch holes in the containers, crush them and follow up with burial in a pit.

Ambassador Twaddell was pleased that "The Mauritanian government learned a lot from the way we did things. The CPS had initial reservations, but they are learning things they would not have without us."

At this time, it was felt that the locust population in the R'kiz region was dwindling due to maturation and control activity. It was proposed that the camp move to Keur Massene for the remainder of the December locust control operations. The plan was to finish spray operations around 12/17, and resume after

Jan. 1 in a new location to the north. Mission Entomologist Thomas feared the effects of the Christmas holiday shutdown, observing that the majority of desert locusts in this part of the world were Moslem...

CAMP R'KIZ DAILY LIFE

Some five kilometers or so before reaching R'kiz, the odor of pesticide, now so familiar in the Sahel, announced the proximity of the Camp. A huge banner flapping in the breeze sported a locust, drawn by a pilot to mark the airstrip.

The camp at R'kiz was the logistical center for surveying, spraying and kill checking. From the early days, the operations at the camp projected a military air, as maps were marked with sectors and quadrants indicating battle plans; radios crackled with statistics on kill rates; even the informal meetings after spray pilots, mechanics and surveyors returned each day looked military, held as they were under a canvas canopy.

The locust crew rented a roughly finished new small house near the town of R'kiz, and further boosted the economy by hiring laborers and laundresses, as well as commissioning a gunny sack full of baguettes to be delivered just before dawn each day.

Twisted branches delineated the camp, giving it the look of an East African "boma," set as it is in lightly treed savannah. Several camp-dwellers felt that a mistake had been made when the logistician had ordered all of the grass to be pulled out within the camp enclosure. The result was sand and dust flying all over. In retrospect, all agreed it would have been better to leave the dry prickly grass, and merely make paths.

A cook imported from Nouakchott prepared food at first for 40, and when the camp was cut to about half that many, had some difficulty adjusting his measurements! Staggering amounts of food were brought from the capital on any transport heading that way ... the huge trucks, light pick-ups, the small shuttle plane, and any personnel who traveled for a visit were loaded down with eggs, vegetables, perhaps a side of beef or a fleet of coolers loaded with shrimp, and always, always a few cases of chocolate. Alcohol was notably absent from the camp, but the fridge was stocked with plenty of colas. All visitors were struck by the air of military professionalism and precision in the camp, set anachronistically in the midst of a rather remote area of one of the least developed countries in the world.

Camp routine ran something like this: At about 4 or 4:30 a.m., some crew members awoke to drink instant coffee and tea, and perhaps nibble some crackers and cheese. As they left for the airstrip, Peace Corps Volunteers and a couple of the laborers, the mechanics and then pilots would arise and do the same. The Peace Corps Volunteer crew perfected the loading of pesticide to an elegant operation of about one hour, wherein they could load 1000 liters of pesticide per plane, directly from the huge barrels via hoses. This crew wore special suits, masks, gloves,

etc. When offered a ride back to camp in an enclosed vehicle once, one PCV considerably declined because of his pesticide aura.

By the time the sky started to lighten slightly, another vehicle would wind its way to the airstrip in the cold morning air and deliver the pilots. The mechanics would give a last once-over, the pilots would review their own planes, and the planes would line up to taxi away. Even before dawn, the survey helicopter would take off to check on the locusts spotted the previous evening, and radio back the location of the swarms.

At dawn, the four spray aircraft took off in formation, returning in an hour or so. The color of mature locusts, they looked like giant yellow wasps. The Turbo-thrush is a favorite of spray pilots, for its ability to take off on a short bit of runway, with a very heavy load. The OFDA team repeatedly declared that the Turbo-thrush is the best agricultural plane made. It was first developed some 20 years ago, and later modified. The planes use jet fuel, all of which was trucked down from Nouakchott.

Two other planes supported the group at first: a Cherokee and a Cessna were used for observation, commuting and supply transport. The best survey vehicle was felt to be the helicopter, especially for operations in remote areas such as most of Mauritania. Surveying in the interdunal area would have been impossible by any other method.

On their return, the mechanics would begin to go over the planes, and gradually everyone headed back to camp for a lumberjack breakfast. Good food and a well-supported operation were felt to be of paramount importance at Camp R'kiz, for maintaining morale of the entire crew under difficult conditions.

When spray operations could cease for a couple of days, (because of a lack of targets), the pilots and staff were ferried to Nouakchott and back for a few days of R and R. Sometimes this afforded a few days for more pesticides to reach the camp. The locust operation included the camp manager, Earl Springer, a couple of locally-hired Filipino mechanics, French helicopter team of pilots and mechanics; three Peace Corps Volunteers, (Pulaar speaking, second-year) who were able to communicate with local officials and villagers and thus facilitate many operations; the Team leader, entomologist Dick Jackson, later replaced by Paul Joseph and Nathaniel Perry, and the OFDA-contracted pilots and mechanics.

The camp building housed a dorm room, two pilot bedrooms with several beds each, kitchen, radio closet, and dining room which opened out into the outdoor dining area. With the first truckloads of equipment from Nouakchott, the PCVs and the Filipino mechanics built a partially enclosed outdoor latrine and shower area with washstand at the rear of the house. Water was shuttled constantly from town to fill barrels for bathing and washing up, and heating elements were added eventually to the

water tanks for showers in the cold outdoor mornings (even more necessary than normal given the pesticide handling of many of the camp crew).

After the initial, emergency phase of operations had leveled off to a more routine, albeit still high-pressure situation, some leisure time activities included darts, and volleyball. The camp crews joked about their "country club", and many of those who visited from Nouakchott were struck by the beauty of the area.

A few cassette tapes played over and over, per diem payments were used to provide as good quality food as could be found in Nouakchott. One pilot made an extensive insect collection with local spiders, scorpions and, naturally, locusts for his nephews.

Around the camp building a nomad village atmosphere prevailed, replete with traditional Mauritanian desert tents as well as the latest in pup tents and family tents. Diesel generators and barrels of fuel dominated one side of the camp. The huge green transport trucks drove in and out of camp at all hours of the day and night, as demand and profit-making dictated. One wily transporter, Abdoulaye, put a couple of the USAID "handshake" stickers on his truck doors. Thus looking like the numerous USAID-donated project vehicles which contribute to the sparse traffic, he flew by the Customs booths!

The transport costs for the camp were deemed high, (by the end of November, \$40,000) but given the emergency circumstances, the only practical suggestions for cost-cutting seem to be to set up the base for spray control operations at the Nouakchott airport. Much trucking is eliminated...food, building materials, jet-A fuel, diesel fuel, personnel, furniture and household appliances, generator, and pesticides would not have to be transported overland if operations were based at Nouakchott.

But, since small Turbo-thrush planes were used, with their relatively smaller range when fully loaded with pesticide and fuel, all of the experts agreed that the R'kiz location, despite somewhat more expensive logistical support, was ideal for the targeted operation. To operate efficiently out of Nouakchott, larger, DC-3 type spray planes would be necessary, in order to have the range when loaded.

The use of larger planes was absolutely not to be considered by donors ranging from Mrs. Taft for OFDA, to the Algerian FAO Rep, and the French Embassy, which in a cable to France maintained that spraying from large planes would "damage the environment."

The camp at R'kiz was fairly self-sufficient in aviation maintenance, thanks to the constant contact over radio with the command center at Nouakchott. Pilots and mechanics needed to repair a windshield broken by a hapless hawk. "There's more birdlife here than I've ever seen anywhere," declared one pilot. "Flocks of herons, storks, buzzards, veering in and out, wherever there are locusts." Birds hit the leading edge of the aircraft

wings, and pilots and mechanics would then pound out the dents.

They ordered up a piece of Plexiglass, which they cut in half, installed, and were back up in the air in no time. "How do you make such repairs in a place like this?"

"Oh, we use 100 mile-an-hour-tape. In the hangar, that's what it's called. Outside the hangar, it's duct tape. If your plane flies 150 miles an hour, it's 150-mile-an-hour tape!"

Afternoons at the camp were spent making such repairs, going over the planes, planning out strategy for the next day's operation, writing in logs and diaries, speaking on the radio, and holding briefing sessions as needed, or when land survey teams reported in.

The helicopter made afternoon forays to track locusts as they settled down for the evening, and the next day's attack sectors would be plotted on the map. Always, the disciplined, military ambiance prevailed, with the occasional need for a camp commander to assert control when another member of the locust team might attempt to usurp his authority.

In one instance, some rather vociferous discussion was going on among different groups at the camp about a certain issue. A Nouakchott team member was questioning the wisdom of an unforeseen use of the helicopter, arguing against the potential expense. The camp chief finally intervened.

"Look, I am in charge of this operation right now. I am here to run an efficient, U.S. style operation. In the U.S., we always know the whereabouts of our personnel. If we don't, we find out. I don't care what the motives are for this person not to have followed instructions on checking in; I am not here to speculate. It's my decision to follow through on the steps to take when something is amiss. That's all."

MAURITANIA MISSION CONTROL OPERATION LAUDED

Such efficiency and discipline led to the operation being praised and congratulated by AID/Washington for the overall effectiveness of the control program. The U.S.-funded control operations were conducted from Nov. 10 to mid-December, with a total of 156,150 hectares treated and 19,650 liters of pesticide used. Although the primary aim of the U.S. locust control program in Mauritania was crop protection, swarms moving north out of Senegal were also treated.

Ambassador Twaddell characterized the successful operation as "elegant...the beauty of it is that we are doing it all ourselves. The Washington response has been helpful. Bill Thomas has been terrific; the Peace Corps Volunteers, with their experience and languages, willingness to live in primitive conditions, have been invaluable. Without the AID Mission and the help of Peace Corps, this operation couldn't have worked. When we got the help of the Mauritanian military, we had it all

together."

The Ambassador further stated that Bill Thomas' idea of training Peace Corps Volunteers to work first in observation and warning, then in surveying, counting kill, etc. was a great success, and should form the basis of the next phase of locust control.

Helicopter surveys at mid-Nov. showed dense swarms of late larval bands and pink fledglings along the southern coast. Nouakchott was invaded by a small, mixed color swarm on the evening of 11/17. The locusts nested in trees and consumed existing vegetation. Nearly 100% of collected individuals manifested signs of the fungal disease Entomophaga gryllii.

More frustrating was another small swarm invasion of very young pink locusts arriving three days later, among whom few if any showed signs of disease.

Interestingly, CPS crop loss estimates of 40 - 60% did not tally with those of voluntary agencies, which put crop loss totals much lower.

LOCUSTS AGAIN INVADE NOUAKCHOTT

Government asks AID to Spray Capital

On the day after Thanksgiving, government officials paid a Sabbath visit to USAID offices, appealing to us to bring our R'kiz crew up to Nouakchott to spray a swarm threatening the hard-won greenery of the capital. This huge swarm of adult locusts stretched some 100 km along the coast north of Nouakchott.

The Mauritanian representatives, including the Director of Agriculture, the Minister of Rural Development Secretary General, and an FAO technical assistant, insisted that Nouakchott must be protected. The Mission countered that, given our dwindling stock of pesticides, we were committed to protecting crops. (...Not city trees.) Furthermore, Mission feeling was that we had been telling them we were about to run out of pesticide for some three weeks, but they wouldn't go to donors and appeal for relief.

As Mission Entomologist Bill Thomas pointed out, "Nouakchott is right in the flight path ... we're in the middle of a locust plague, unfortunately, and I don't think they realize this."

During the three hour meeting, USAID found that a Hercules C-130 aircraft was available for lease in Morocco, including fuel, pesticide, logistical support, for four days at \$500,000. The delegation was willing to go ahead with that spray method, but only if USAID would pick up the tab! The Mauritanian officials claimed they would lose their jobs if locusts invaded Nouakchott once again, but Mission representatives held firm. Spraying continued around R'kiz, until a few days later when there was time and enough pesticide to spray a swarm of rather mature locusts near Nouakchott.

Living with locusts had become a routine in Nouakchott, and even

in Bill Thomas' office, flying, crawling locusts seemed to have taken over. As he catches and preserves two, Thomas relates a dream that two specimens came to seek revenge.

PLANE DOWN IN SOUTH

Tragedy was averted Nov. 26 when at 4 p.m. the pilot of the Cherokee heard a metallic "pop" as his engine stopped. With about 40 seconds to choose a landing spot, he was able to put the plane down on the road. He later explained that had he not been flying over the highway at the time, he would have had at most a 50-50 chance of coming out of a forced landing into soft sand. The plane was towed from the site by a truck and awaited a new engine from the U.S., leaving the R'kiz operation with only one plane.

Although Mission personnel and the Reader's Digest writer who traveled with him that day were alarmed by the accident, the pilot retained the pragmatic, cool attitude thought to be characteristic of those who fly for a living. "It's happened to me once before, in the (U.S.) Midwest. It happens, that's all. Sooner or later, machines have problems no matter how well they are maintained." He was up in the air again soon thereafter.

Because of low stocks of pesticide, the R'kiz team in late November was treating new swarms moving into the R'kiz area, but not foraging into untreated areas. Bill Thomas, Glenn Slocum and Andrew Stancioff all were still trying to get more pesticides from other donors, with little success. Diminishing stocks stored at R'kiz would continue to be used for spray operations, however.

Dick Jackson reported on Nov. 30 that the pesticide crisis had abated. "It was nip and tuck for awhile, but with 30,000 liters arriving tonight from Zouerate, we have enough to last until we shut down for the holidays."

Jackson continued, "By now our work is to protect the area we have already treated." Indeed, on Nov. 29, the team sprayed a previously treated area over which new swarms were passing.

Spraying from Nov. 26-30 concentrated on the border area along the Senegal River, where the team engaged huge swarms. The large map covering one wall at locust headquarters showed that the spraying had nearly encircled Lake R'kiz. Jackson predicted they would spray closer to the Atlantic coast, where large swarms still were being sighted.

By this time, more than 107,000 hectares had been treated. Locusts encountered were mostly adults by then, with very few 5th instar stage left.

DICK JACKSON MUSES, DEPARTS DEC. 6

As team leader Dick Jackson prepared for his Dec. 6 departure, he declared that the U.S. control operation in Mauritania had gone extraordinarily well, after it got going. He, like all personnel involved in the control effort, ruefully ascribed the Government

of Mauritania's reluctance to mobilize to fight the Desert Locust as a major contributor to the severity of the control fight.

"If we could have sprayed back in October when it should have been done, it would not have had to be done over and over again, because the larvae wouldn't have grown to adulthood."

He recommended starting the new year with set-up work, ensuring that systems would be in place for meeting the next locust crisis. "Decide whether you are going to continue crop protection. Where? Primarily in the southeast sector. Pick out a camp site. Find somewhere in that area to store pesticide and fuel. Do all the pre-planning and training. Get John Przybyszewski (PCV entomologist) to be the trainer."

Jackson stated that any locust control effort for 1989 should start slowly after the new year, building slowly to the control point, perhaps in July. "I see no break in the Desert Locust breeding cycle. There are probably enough spots affected by egg-laying that there will be a problem."

Jackson recommended setting up contacts with cropdusters willing to go overseas, so that bids could be solicited in May for a July start. "Crop protection could be done with 6 to 8 Turbo-Thrush aircraft. They could spray all that's needed."

GOVERNMENT OF MAURITANIA APPEALS TO USAID FOR NORTHERN OPERATION

As the R'kiz locust control camp smoothly operated in the south, attention focused on the northern Mauritania - Western Sahara region as a likely locust breeding area.

Greening vegetation in that area indicated by USGS/EROS greenness maps confirmed fears of the development of favorable environmental conditions for Desert Locust breeding. Northerly movement of great numbers of swarms to those lush grounds would indicate locust infestations at least similar to those of the last year, perhaps by late February or March.

The Director of Agriculture and Chief of CPS requested on Dec. 3 that the U.S.-funded survey helicopter move from R'kiz to the Zouerate region to commence survey operations in northern Mauritania. CPS hoped, additionally, that USAID then would move its locust control operation to that region.

The Mission held grave reservations about sending a surveying team to this region of Mauritania because of the tenuous status of the airspace, and the implication and expectation that we then would follow up with the complete control operation.

AID Representative Slocum and Charge d'Affaires John Vincent temporized that the CPS request would be taken under consideration upon Ambassador Twaddell's return to the capital Dec. 6. Many considerations, both negative and positive, colored the Mission attitude toward fielding a locust control operation in this militarily sensitive region.

Because the eastern area of Western Sahara is a militarily contested zone, The Polisario maintain surface-to-air missiles which pose threats to our Turbothrush aircraft and helicopter, and the land on both sides of the Mauritania/Western Sahara border is littered with anti-tank and anti-personnel mines which effectively rule out ground survey or treatment operations. Relations between Morocco and Algeria, and Mauritania and its northern neighbors preclude the feasibility of a quick negotiation for safe operations in the hot zone.

Indeed, although Mauritania has been represented at meetings concerning a proposed international green force, government officials have ignored the subject with donors. Neither do Moroccan nor Algerian representatives appear willing to cultivate the cooperative attitude with the Government of Mauritania implicit in this locust control strategy.

If the U.S. mounted an effective control operation in the north, the U.S. Mission here feared that the fledgling international green force pilot project could be undermined. There might then be no need for Mauritania and Morocco and even Algeria and the Polisario, to coordinate and devise a common plan.

Many factors tempted the U.S. to consider the CPS appeal to move operations to the north. Fuel, pesticides and supplies could be shipped easily to the airport or the port at Nouadhibou, and then by train to Zouerate. It was thought that the four Turbothrush aircraft and the helicopter, ideal for larval control operations in the north, would be finished at R'kiz by mid-December.

But the \$2 million cost could be eaten up by swarms breeding uninterrupted in Western Sahara, ready to travel into Northern Mauritania and Morocco.

Further, the Mission recommended an FAO-coordinated multinational operation, or especially the international green force, using aircraft and resources already in-country through other donor nations. The Mission advised CPS that the helicopter survey request was under advisement, but that we would not send aircraft into the region without an agreement among all parties involved in the area. Encouraging CPS to work with FAO toward a solution, AID Rep. Slocum told the Minister of Rural Development that current USG plans called for termination of Mauritanian operations by mid-December, when aircraft would move to Sudan.

Most important, it was the ultimately prescient consensus of top U.S. Mission officials and locust control TA team members that "We're not going to send any Americans up where they could be shot at."

On Dec. 8, two DC-7s chartered by USAID/Senegal were on their way to Morocco, carrying personnel and pesticide to continue the fight against the Desert Locust in North Africa. Polisario missiles hit both planes as they flew into Western Saharan territory, downing one plane and killing all five aboard.

The second plane saw the first hit as it smoked and exploded in a huge fireball. Although hit, the second plane made a safe landing some 250 miles further on into Morocco. Mission personnel in Mauritania gathered over the weekend at the Locust Control Center and in the Embassy as word was awaited in the possible involvement of the U.S. Mission to Mauritania in the delicate negotiations over recovery of bodies. Information was sketchy, due to the remoteness of the crash site, and the war zone characteristic of that no-man's land.

U.S. Mission officers compiled lists of vehicles which could be used, and aircraft which could be rented, if they would be called upon to go up to the crash site. The grim lists, including available caskets, highlighted the difficulties in effecting even a post-tragedy mission in such inhospitable disputed territory.

Before culpability was established, diplomats quietly sought means of investigating the accident and recovering bodies, given the delicate state of relations among Morocco, Mauritania and Western Sahara. One AID officer was approached by a national of a third country with close ties in Mauritania, who said a Polisario-connected Mauritanian offered to put the Embassy in contact with the Polisario, who privately admitted the accident. This avenue was not needed as the guerillas finally acknowledged their error and offered to retrieve bodies.

Joe Varley, Mission Executive Officer, arranged for a memorial service at the Catholic Mission in Nouakchott, which was attended by all who had taken part in the locust control operation. The service elicited deep emotion in the cohort of locust fighters, and seemed to focus a dramatic final effort by the spray team to continue the fight.

Pilots and crew members in the multinational spray team buttonholed Ambassador Twaddell, DCM Vincent, and any AID officers outside the church, voicing their desire to continue the fight against the locust in the parlance of warriors. Sharing an aperitif in the Varley home later on, the R'Kiz crew appealed even to this writer to lobby for extension of their contract. They had grown attached to the quadrant of land they were protecting, and they owned almost a patriotic belief in their work. They feared that the occasional traveling swarms of adult locusts still passing over their area would "undo" their efforts to protect crops.

Their energetic arguments failed to win over AID/Washington, as orders came through that very evening to Bill Thomas to proceed with planned break-up of the camp and wrap-up of the operation.

By that time, the protected area's crops were mature enough to be harvested or to withstand the occasional passing swarms of locusts with minimal effect, since millet and sorghum stalks were hardy enough to survive stripping of foliage by them.

The camp broke up quickly, with some borrowed items such as generators and appliances being returned to USAID warehouses, and emergency purchases such as tents, bedding, tools etc. being stored there as well. By Dec. 14, the last of the green trucks had lumbered away from R'kiz.

Geza Strammer and Paul Bernard were retained through January to clean up the last details of the accounts and the logistics of the camp.

Bob Ruhe's pilots remained at Nouakchott, awaiting orders which did not materialize to fly on to Sudan, or elsewhere in Africa. The Heli-Ouest helicopter and crew flew the Mission personnel on a last foray or two to survey for locusts, before the contract and the locusts swarms ran out concurrently by Dec. 18. The spray planes and helicopters remained at Nouakchott well into March, as both contractors appeared befuddled as to a next move upon completing the USAID commitment.

Bill Thomas made a 15-day field trip in March, with Mauritanian military escort, accompanied by an unusual Mahgrebine cohort of Mauritians, Algerians, Tunisians and Moroccans. They traveled north to Bir Moghreïn and Ain Bentili, and southeast toward the Mali border. They saw little indication of any Desert Locust activity, and few indications of rain.

For 1989, no one can predict the level of locust activity as yet. Nature sets too many conditions on the proper breeding of this insect for predictions.

LOCUST VETERAN VISITS NOUAKCHOTT

Dr. George Cavin, entomologist and Desert Locust veteran from 1940's and 50's control operations, has been contracted by OFDA to advise them, USAID, and the Desert Locust Task Force in making decisions on their actions. He is also to keep the Africa Bureau informed of the actual Desert Locust situation, to project and assess what has been done, and to make recommendations.

By December 8, in a trip up the beach from Nouakchott, Dr. Cavin observed a few scattered but inactive swarms of locusts. He observed, "They are severely lacking in body fat. They are slowly starving to death for lack of forage."

He stressed the necessity to "get younger people out here" to

monitor the Desert Locust, because "the locust will be back". (Dr. Cavin is one of the few veterans of the days of strong regional control efforts who remains active in his field.) He laments that there has been little concentrated monitoring of the Desert Locust by younger scientists since the late 1950's.

Dr. Cavin stated that control of the locust depends on a cooperative attitude among governments not only just in Africa, but other nations which could be affected. "The locust can fly 2,000 miles. The result is that, once they spread over a wide area, drought conditions in one region won't stop them, because they can perpetuate in other areas and move on from there." He observed that the Sahel is an extremely difficult area to control, because of the wide range of rainfall. Desert Locusts spread and do not concentrate in large numbers. Density is minimal, but the area is wide-ranging.

In fact, Mauritania is not normally considered a major breeding and reproductive center, but rather a passage area for the Desert Locust. With significant rainfall, this country becomes more important as a host to the locust.

Whether the summer rains will bring swarms and hatchings of the locust in huge numbers to the Sahel is anyone's guess. Entomologists can't even be sure of exactly where some huge swarms ended up. The uncountable swarms in west Sudan could have gone into Chad, Mali, Niger...

Most involved countries will claim 100% control of the locust situation, according to Dr. Cavin. After Morocco declared the situation to be completely calm, major groups of escapees moved out, as they did from Algeria, Senegal and western Sudan.

Dr. Cavin further stated that if we don't see a major population suppression as a result of last year's efforts concentrating on crop protection and attacking the locust in well-known breeding areas, the only weapon to fight the locust is through a central, multi-national group.

"You could set up a central organization in Rome, through FAO and various nations, to oversee the logistics, financing, administration, etc. It wouldn't get off the ground immediately, and it would depend on the involved nations and their will to cooperate."

For now, in Mauritania, we watch and wait.