Desert Locust Control Organization for Eastern Africa
(DLCO-EA)

REPORT ON DGPS DEMONSTRATION AND TRAINING ON GROUND SUPPORT FOR AERIAL OPERATIONS ZEWAY, ETHIOPIA 20 – 23 APRIL, 2004

DGPS Demonstration participants group photo at Zeway

Desert Locust Control Organization for Eastern Africa (DLCO – EA)
April 2004
Addis Ababa, Ethiopia

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1. Introduction

A demonstration on the functions of Differential Global Positioning System (DGPS) and a one – day training on ground support for aerial operations were held at Zeway, Ethiopia from 20 – 23 April, 2004. The Desert Locust Control Organization for Eastern Africa (DLCO – EA), the FAO Emergency Prevention System (FAO/EMPRES) Programme and the Commission for Controlling the Desert Locust in the Central Region (CRC) jointly organized the demonstration and the training programme. DLCO – EA provided the operational resource persons (Experts) and the aircraft while FAO/EMPRES provided financial assistance and the DGPS equipment installed on DLCO – EA aircraft (5Y – BCK) that was used for the demonstration. Fourteen participants drawn from five EMPRES Central Region countries, namely Yemen, Sudan, Saudi Arabia, Oman and Ethiopia participated in the demonstration and the one – day training programme. The participants were Managers of Spray Air Services, Spray Pilots, Heads of Locust Control Units, Locust Control Information Officers, etc. (Annex 1:List of participants). The diverse nature of the participants created favourable conditions for extensive discussions to be held and also to look at the new technology from various perspectives. The trainers or demonstrators were senior staff from DLCO – EA and OPTRON Pty Ltd of South Africa, the agent of Trimble AgGPS for sub – Saharan Africa.

1. DGPS Demonstration

2.1 Objectives

The main objectives of the DGPS demonstration were as follows:

a) To facilitate the introduction of DGPS technology for Desert Locust control operations as recommended by FAO Desert Locust Control Committee (DLCC) in its 36th Session.

b) To demonstrate the advantages of the DGPS technology to the Managers of Spray Air Services, Spray Pilots and to the Locust Control Officers in the Central Region. This technology is also considered useful for the control of non – migratory pests.

2.2 Class Room Presentations

a) Presentation by Mr. B.K. Matemu

The presentation by Mr. Matemu, the Chief Engineer of DLCO – EA focused on the activities of DLCO – EA Air Unit and the advantage of DGPS technology for improving aerial pest control operations. Mr. Matemu highlighted the rich experience the organization has in aerial control operations and its development of spray system that is suitable for

the control of its mandated migrant pests, namely Desert Locusts, African armyworms, grain eating Quelea birds and Tsetse flies. His presentation also covered the benefits of DGPS technology for safer and more cost efficient application of pesticides. Furthermore, the presentation covered the advantage of DGPS technology where all the components are installed on the aircraft and no ground station is required as compared to SATLOC.

b) Presentation by Mr. Jochem Erasmus

Mr. Erasmus, Manager of Consumer Service of OPTRON Pty Ltd of South Africa, covered the following topics in detail with the help of power point:

- The components of AgGPS: field computer, DGPS receiver and light bar;
- The operation of the different components of AgGPS for aerial application of agricultural chemicals;
- Configuration of AgGPS system

The AgGPS 170 Field Computer was presented as a major component of AgGPS Trimflight 3 System, a precision agricultural system that helps to carry out a range of agricultural activities, including field mapping and field guidance. Mr. Erasmus highlighted the main functions of AgGPS Field Computer as follows:

- Field definition and mapping
- Guidance to predefined field patterns
- Navigation to specific field points
- Logging of application coverage information
- Output of information for analysis in office – based Geographic Information System (GIS) software

The presentation also covered the role of lightbar, which is standard component provided with the AgGPS TrimFlight 3 System. The lightbar was reported to provide guidance along straight or curved swath lines using a row of 35 colored LEDs (Light Emitting Diodes). Three LEDs are illuminated at any one time to indicate aircraft position with respect to the current swath.

c) Presentation by Mr. Mehari Tesfayohannes

Mr. Mehari, the Information and Forecasting Officer of DLCO – EA, demonstrated the mechanisms of DGPS technology with the help of the Training Mode of AgGPS 170 Field Computer. This mode was designed as a training or system demonstration tool. The presentation familiarized the participants in the operation of AgGPS.

Mr. Mehari also explained the possibilities and advantages of real – time data collections during the field demonstration at Meki Airstrip. These data could be used for reporting and for evaluating the spray operation. The *Plan View Map* showed graphically the areas in the field that have been missed (or skipped) and where overlaps have occurred (See Pages11-13). Also data such as the amount of chemical sprayed, the area sprayed, the swath size, etc., can be viewed.

2.3 Field Demonstration

Mr. Erasmus demonstrated the functions of AgGPS to the participants by practical field exercises on a DLCO – EA Beaver Aircraft (5Y – BCK) and a vehicle at Meki Airstrip, in the Central Rift Valley of Ethiopia. The participants were instructed on how the DGPS is being used for marking spray areas; swath widths and spraying of marked areas. After the aircraft demonstration, the field computer, the lightbar and the GPS were mounted on a vehicle for ground demonstration.

These exercises familiarized the participants with the application of the DGPS equipment and the benefits of more precise aerial application of agricultural chemicals by more accurate track spacing. It was demonstrated that better track spacing is reducing significantly the amount of pesticides used for aerial control operations, and thus costs and the damage to the environment. Furthermore, the equipment was providing computer print out of the exact tracks followed by a spray aircraft (See Pages 11 –13), plus the amount of pesticide sprayed thus enabling the operators to better evaluate and check the control operation.

2.4 Evaluation and Conclusion

At the end of the field workshop, the participants were requested to provide the organizers with their views and opinions of the demonstration. The results of the rating are shown as follows:

Participant	Accom.	Presentation	F/Demo.	Organization
1	V/G	E	V/G	E
2	V/G	V/G	E	V/G
3	G	G	E	V/G
4	V/G	G	E	E
5	V/G	V/G	V/G	V/G
6	G	V/G	V/G	V/G
7	V/G	E	E	E
8	G	G	V/G	E
9	G	G	V/G	V/G
10	V/G	V/G	V/G	V/G
11	E	E	E	E
12	V/G	V/G	E	V/G
13	V/G	E	V/G	V/G
14	V/G	E	V/G	V/G

Note: Accom. = Accommodation; F/demo = Field demonstration; E = Excellent; V/G = Very Good; G = Good

From the feedback provided by the participants, the demonstration was considered as very successful. The participants felt that the functions of the DGPS equipment had comprehensively been demonstrated. They were satisfied on the way the demonstration had been conducted by the organizers and believed that they gained sufficient background information on the advantages of the DGPS technology for aerial application of agricultural chemicals. In addition, the participants appreciated that they were given enough and instructive reference materials for further information.

The participants from SCIDCO AG AVIATION of Saudi Arabia and Spray Service Division of the *Ethiopian Airlines* expressed their wish to recommend the DGPS also to their respective organizations for further testing and introduction.

The participants also valued the economic and environmental benefits of this equipment by thus improving aerial pest control operations as a whole. However, some considered the cost of the equipment and the annual subscription fees for the GPS signal of US$ 2000.00 as too expensive and felt that the relatively high investments at the beginning might not facilitate the introduction of the DGPS technology for pest control. It was therefore suggested that the price of the equipment and the annual subscription fees should be reduced.

At the outset, the first investment and the subscription fees seem to be fairly high, but the economic and ecological returns by saving thousands of liters of pesticides can be considered as significantly higher. The cost for one DGPS equipment of roughly US$ 20,000 is equal to approximately 1,000 Liters of pesticides, which might be sufficient for around 2,000 ha. During Desert Locust upsurge or even plague campaigns, several millions of hectares have normally been sprayed with pesticides. By this simple calculation it becomes obvious that the investment in DGPS technology will rapidly pay off.

3. Training on Ground Support for Aerial Operations

3.1 Objective

The main objective of this training programme was to train the locust control officers on the principle support operations required from the ground teams both at the airstrip and at the target site in order to support aerial control operations.

3.2 Lecture Presentations

a) Presentation by Mr. B.K. Matemu

Mr. Matemu presented the essential features of migratory pest control spraying aircraft as follows:

- The aircraft engine must be bird proofed so that the aircraft can safely fly through a swarm of locusts or a flock of birds without endangering the pilot;
- The cooling system of the engines should enable air to flow freely through the cooling fins of the cylinders and oil cooler during spraying to maintain engine cooling when flying through swarms of locusts or flocks of birds;
- Pilot's visibility throughout spraying should be maintained by the pilot reaching and wiping the screen, while "slide sleeping" is required to locate landing strips;
- The leading edges of the aircraft wings and other sensitive structure should be protected by fiberglass covers while maintaining smooth airflow over the air frame.

He also described the spray pod system developed by DLCO – EA in collaboration with the Micronair in the 1980's and its advantages in terms of safety to the pilot and creating additional space in the cabin for the crew to carry essential tools, first aids and other safety devices.

He also demonstrated how spray aircraft could be calibrated for the correct application of pesticides.

b) Presentation by Mr. Mehari

The presentation by Mr. Mehari covered two topics: droplet collection and assessment, and locust mortality assessment. In droplet collection and assessment session, he discussed various droplet-sampling techniques that

are currently used and the method of droplet sample analysis. In the locust mortality assessment session, he discussed the importance of mortality assessment and the techniques that are used at present. The techniques he described included field mortality assessment and cage assessment.

c) Presentation by Captain Ahmed Y. Bashir

Captain Bashir pointed the needs for effective and well-organized ground supports such as flagging, smoking, and location of high-tension power lines as prerequisite of successful aerial control operations. He stated that the flags should either be orange or yellow and should be big enough i.e. 2x1m and put in two poles. He also emphasized the importance of smoking to guide the pilot from far away to the target site. The pilot should also be shown the location of high-tension power lines in order to prevent accidents. He also stressed the need to equip ground team with walky talky equipment to communicate with the pilot and provide the technical support and guidance during aerial control operations.

4. Certificate of Attendance

At the end of the workshop, a certificate of attendance was given to all participants.

Annex 1: List of Participants

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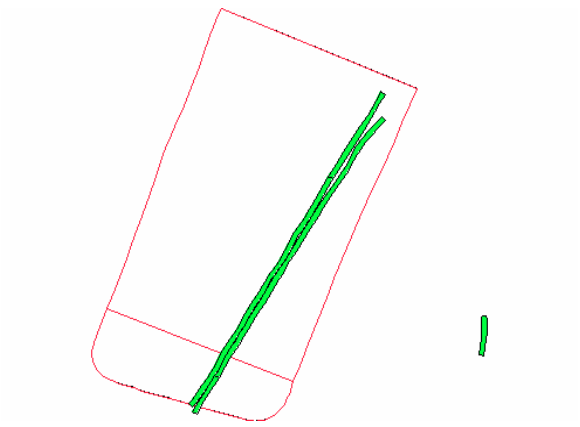
AgGPS TrimFlight 3 V3.00 Application Report

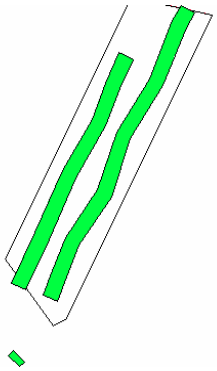
Client Name,	eth
Farm Name,	zeway
Field Name,	default23
Event Name,	training1
Operator,	beshir
Material,	
Crop,	
Weather,	
Notes,	
Start Date,	21-Apr-2004
Start Time,	11:52:47
Last Date,	21-Apr-2004
Last Time,	14:52:29
Field Area,	3171.4212
Productive Area,	3171.4212
Area Units,	ha
Perimeter,	22228.3200
A-B Length,	1479.7380
Distance Units,	m
Speed Units,	knt
Serial Number,	4149B11251
Pattern,	Straight
Number of Headlands,	0002
Swath Width,	100.0000
Application Width,	95.0000
Average Offline,	-6.2061
Standard Dev. Offline,	16.0560
Total Time,	000:01:15.78
Total Distance,	13681.2515
Total Area,	129.9719
Area Remaining,	3041.4493
Percent Complete,	4.0982
Area/Hour,	6174.1112
Completed,	No
Logging Start Date,	21Apr-2004
Logging Start Time,	12:07:47
Total Quantity Applied,	0.0000
Default Rate,	0.0000
Average Rate,	0.0000
Last Swath,	0008
Swath Direction,	Right
Work Towards,	Point C

Generate Access Paths,	No
Number of Skips,	0002
Access Path Width,	0.0000
Swaths in First Group,	0001
Swaths in Subsequent Groups,	0002
Guide to,	Swaths



AgGPS TrimFlight 3
V3.00ApplicationReport

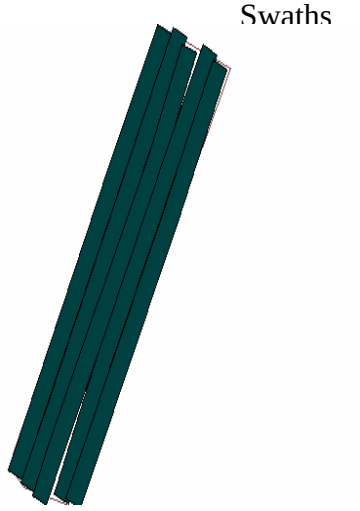
Client Name,	eth
Farm Name,	zewa4
Field Name,	default28
Event Name,	training2
Operator,	bashir
Material,	dursban
Crop,	sorghum
Weather,	clear skies
Notes,	nil
Start Date,	23-Apr-2004
Start Time,	11:02:18
Last Date,	23-Apr-2004
Last Time,	11:32:49
Field Area,	1.0376
Productive Area,	1.0376
Area Units,	ha
Perimeter,	507.0408
A-B Length,	182.0364
Distance Units,	m
Speed Units,	knt
SerialNumber,	4149B11251
Pattern,	Straight
Number of Headlands,	0002
Swath Width,	10.0000
Application Width,	10.0000
Average Offline,	0.6541
Standard Dev. Offline,	1.8188
Total Time,	000:25:35.81
Total Distance	366.4363
Total Area,	0.3664Area
Remaining,	0.6712
Percent Complete,	35.3158
Area/Hour,	0.8589
Completed,	Yes
Logging Start Date,	23-Apr-2004
Logging Start Time,	11:13:33
Total Quantity Applied,	0.0000
Default Rate,	0.0000
Average Rate,	0.0000
Last Swath,	0000
Swath Direction,	Right
Work Towards,	Point C
Generate Access Paths,	No
Number of Skips,	0002
Access Path Width,	0.0000
Swaths in First Group,	0001
Swaths in Subsequent Groups,	0002
Guide to,	Swaths



AgGPS TrimFlight 3 V3.00 Application Report

Client Name,	eth
Farm Name,	zewa4
Field Name,	default31
Event Name,	training2
Operator,	bashir
Material,	dursban
Crop,	none
Weather,	fine
Notes,	
Start Date,	23-Apr-2004
Start Time,	13:41:59
Last Date,	23-Apr-2004
Last Time,	14:03:14
Field Area,	1.0656
Productive Area,	1.0656
Area Units,	ha
Perimeter,	530.9101
A-B Length,	212.4367
Distance Units,	m
Speed Units,	knt
Serial Number,	4149B11251
Pattern,	Straight

Number of Headlands,	0002
Swath Width,	10.0000
Application Width,	10.0000
Average Offline,	0.4130
Standard Dev. Offline,	0.5745
Total Time,	000:21:13.89
Total Distance,	1106.5282
Total Area,	1.1065
Area Remaining,	0.0000
Percent Complete,	103.8409
Area/Hour,	3.1270
Completed,	Yes
Logging Start Date,	23-Apr-2004
Logging Start Time,	13:49:29
Total Quantity Applied,	0.0000
Default Rate,	0.0000
Average Rate,	0.0000
Last Swath,	0000
Swath Direction,	Right
Work Towards,	Point C
Generate Access Paths,	No
Number of Skips,	0002
Access Path Width,	0.0000
Swaths in First Group,	0001
Swaths in Subsequent Groups,	0002
Guide to,	Swaths



DLCO – EA Beaver Aircraft 5Y – BCK used for DGPS Demonstration

DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS)
DEMONSTRATIONS AND TRAINING ON GROUND SUPPORT
FOR AERIAL OPERATIONS
BY DLCO-EA
ZEWAY, ETHIOPIA, 20 - 23 APRIL, 2004

Chairman : Dr. Tessema Megenasa, (CRO)
Rapporteur : Dr. Abdurahman Abdulahi, (RO)

Day	Time	Activity	Remarks
Monday: 19/04/04		Arrival of participants via Addis Ababa	Coordinated by RO/AO/TS
Day 1 Tuesday 20/04/04	09:00 - 09:30	Registration	Dr. Abdurahman Abdulahi
	09:30 - 10:00	Welcome & Opening Address	Mr. Peter O. Odiyo, DLCO-EA Director
	10:00 - 10:30	**Coffee/Tea Break/Snacks**	
	10:30 - 12:30	1. Introduction: 1.1 System Description 1.2 System functions • Field Mapping • Guidance • Logging • Data Management 1.3 AgGPS Trimflight 3 system components • 1.3.1 DGPS signals	B.K. Matemu /Jochem Erasmus Jochem Erasmus /Mehari Tesfayohannes/ B.K. Matemu
	12:30 - 14:00	**Lunch Break**	
	14:00 - 15:30	2. Getting Started: 2.1 AgGPS Trimflight 3 system requirements 2.2 Switching on the Ag.GPS 170 field computer	Mehari Tesfayohannes/Jochem Erasmus / B.K. Matemu
	15:30 - 16:00	**Coffee/Tea Break/Snacks**	

Day	Time	Activity	Remarks
	16:00 - 18:30	2.3 Training mode 2.4 Exercise 1-Familiarisation 2.5 Exercise 2 - Define a field using the front panel	Mehari Tesfayohannes/Jochem Erasmus/ B.K. Matemu " "
Day 2 Wednesday 21/04/04	09:00 - 10:30	2.6 Working with the front panel	Mehari Tesfayohannes/Jochem Erasmus
	10:30 - 11:00	**Coffee/Tea Break/Snacks**	
	11:00 - 12:30	Cont. Working with the front panel	Mehari Tesfayohannes/Jochem Erasmus
	12:30 - 14:00	**Lunch Break**	
	14:00 - 15:30	3. Operating the AgGPS 170 field computer: 3.1 Configuring the system 3.2 Defining a new field 3.3 Working with existing field 3.4 Using the AgGPS 170 field computer for guidance	Jochem Erasmus /Mehari Tesfayohannes " " " "
	15:30 - 16:00	**Coffee/Tea Break/Snacks**	
	16:00 - 18:30	3.5 Way points 3.6 Using the AgGPS 170 field computer logging 3.7 Warning message 3.8 Setting the swath parameters 3.9 Getting help	Capt. Bashir/Mehari Tesfayohannes/ Jochem Erasmus Mehari Tesfayohannes/Capt. Bashir " " Mehari Tesfayohannes
Day 3 Thursday 22/04/04	09:00 - 12:30	4. Field Demonstration with aircraft, Meki Airstrip	Dr. Abdurahman Abdulahi /Capt. Bashir/OTHERS
	12:30 - 14:00	**Lunch Break**	
	14:00 - 15:30	5. Viewing data in Office: 5.1 Office computer requirements 5.2 Data formats	Mehari Tesfayohannes/Capt. Bashir Mehari Tesfayohannes "
	15:30 - 16:00	**Coffee/Tea Break/Snacks**	
	16:00 - 18:30	5.3 Data Organization 5.4 Transferring data to the office computer 5.5 Using Arc Explorer Software	Mehari Tesfayohannes/Capt. Bashir Mehari Tesfayohannes "

Day	Time	Activity	Remarks
Day 4 Friday 23/04/04	08:00 - 10:00	1. Introduction to Aerial Spraying 1.1 Features of Spray Aircraft 1.2 Aircraft type 1.3 Spray equipment 2. Calibration	B.K. Matemu B.K. Matemu/Mehari Tesfayohannes
	10:30 - 11:00	**Coffee/Tea Break/Snacks**	
	11:00 - 11:30	3. Discussion on item 1 and 2	B.K. Matemu/Mehari Tesfayohannes
	11:30 - 12:30	4. Delimiting and marking spray targets 5. Weather conditions for Aerial Spraying	Capt. Bashir
	12:30 - 14:00	**Lunch Break**	
	14:00 - 15:30	6. Ground Support 6.1 Airstrip 6.2 At target site	 B.K. Matemu Capt. Bashir
	15:30 - 16:00	**Coffee/Tea break/Snacks**	
	16:00 - 16:30	7. Mortality assessment	Mehari Tesfayohannes
	16:30 - 17:00	Closing Remarks	Representative of DLCO – EA Director

Abbreviations:

CRO = Chief Research Officer;
CE = Chief Engineer;
RO = Research Officer
IFO = Information and Forecasting Officer
AO = Administrative Officer
TS = Transport Supervisor

~~INFORMER~~
ETHIOPIAN HERALD
April 14, 20

Opinions, Views, Facts

P.O.Box 30701

DLCO-EA and FAO EMPRES to demonstrate new airborne pest control technology

The Desert Locust Control Organization for Eastern Africa (DLCO-EA) supported by the Emergency Prevention System (EMPRES) of the FAO, will conduct field demonstrations and lectures in Lake Zeway area of Ethiopia, between 20-23 April, 2004.

The field demonstrations and lectures will be on the workings and advantages of a new satellite-based navigational pest control technology, called the Differential Global Positioning System or DGPS.

The DGPS equipment, which has been fitted into one of DLCO-EA's Spray Aircraft, has the capacities to enhance aerial control operations against upsurges of the Desert Locusts, African Armyworm caterpillars and Tsetse flies through precise application of chemical pesticides or bio-control agents per unit area of land or crop farm.

This modern Agricultural Management System equipment, also called AgGPS Trimble Trimflight3 170 Field Computer, is designed to improve the accuracy of Global Navigation Satellite Systems (GNSS) for ships, aircraft, etc by measuring very small changes in variables to provide satellite-positioning corrections.

For aerial pest control operations, the system has the advantages of facilitating:

a) A more targeted and more precise application of chemical pesticides - thus reducing the amounts required to treat a given area.

b) The application of more accurate track spacing—thus enabling the Spray Pilot to avoid unwanted contamination of uninfested areas with chemical pesticides.

c) Accurate spacing of swaths for barrier spraying, e.g. against Desert Locust hopper bands or discreet populations of Tsetse flies–thus reducing costs and environmental contamination.

d) The production of a computer printout of images of the exact tracks followed by a spray aircraft, plus the amount of pesticide sprayed—thus enabling Management to exercise controls, and to keep records of field operations.

The objectives of the field demonstrations are as follows:

a) To implement the decision of the 36th Session of the Desert Locust Control Committee (DLCC) of the FAO, which recommended the introduction of the DGPS technology for all Desert Locust control operations;

b) To enable Pilots and aerial application Managers of companies with the necessary technical backgrounds and experience, to observe the workings of the DGPS, which can also be used for the control of other pests, including migratory or transboundary pests, such as the African Armyworm caterpillars, Tsetse flies, etc.

c) To enable Donors and Environmental Protection Agencies based in Addis Ababa, to observe the operations for information and necessary action.

The field demonstrations will be conducted on a test basis using simulated runs because Lake Zeway represents an ideal location for testing the system under operational conditions.

The DGPS equipment was donated to DLCO-EA by the FAO through its Emergency Prevention System (EMPRES) Programme, with funding by the USAID. After several tests under operational field conditions, e.g. against outbreaks of the Red Locusts in Tanzania, the system has proved useful and easy to manage.

The target audience will include Spray Pilots and Managers of Spray Air Services in the Eastern Africa side of the Central Region, such as from Sudan, Eritrea, Ethiopia, Somalia and Djibouti, as well as from neighbouring countries of the Arabian Peninsular, such as Egypt, Saudi Arabia, Yemen and Oman.

Background lectures will be conducted at a Hotel in Zeway town by DLCO-EA staff and by an Expert from South Africa's Option Company which supplied and titted the DGPS, while the DLCO-EA Aircraft (5Y-BCK) will be based at Meki Airstrip from where the spray demonstrations will be carried out.

(Source: Desert Locust Control Organization for East Africa)