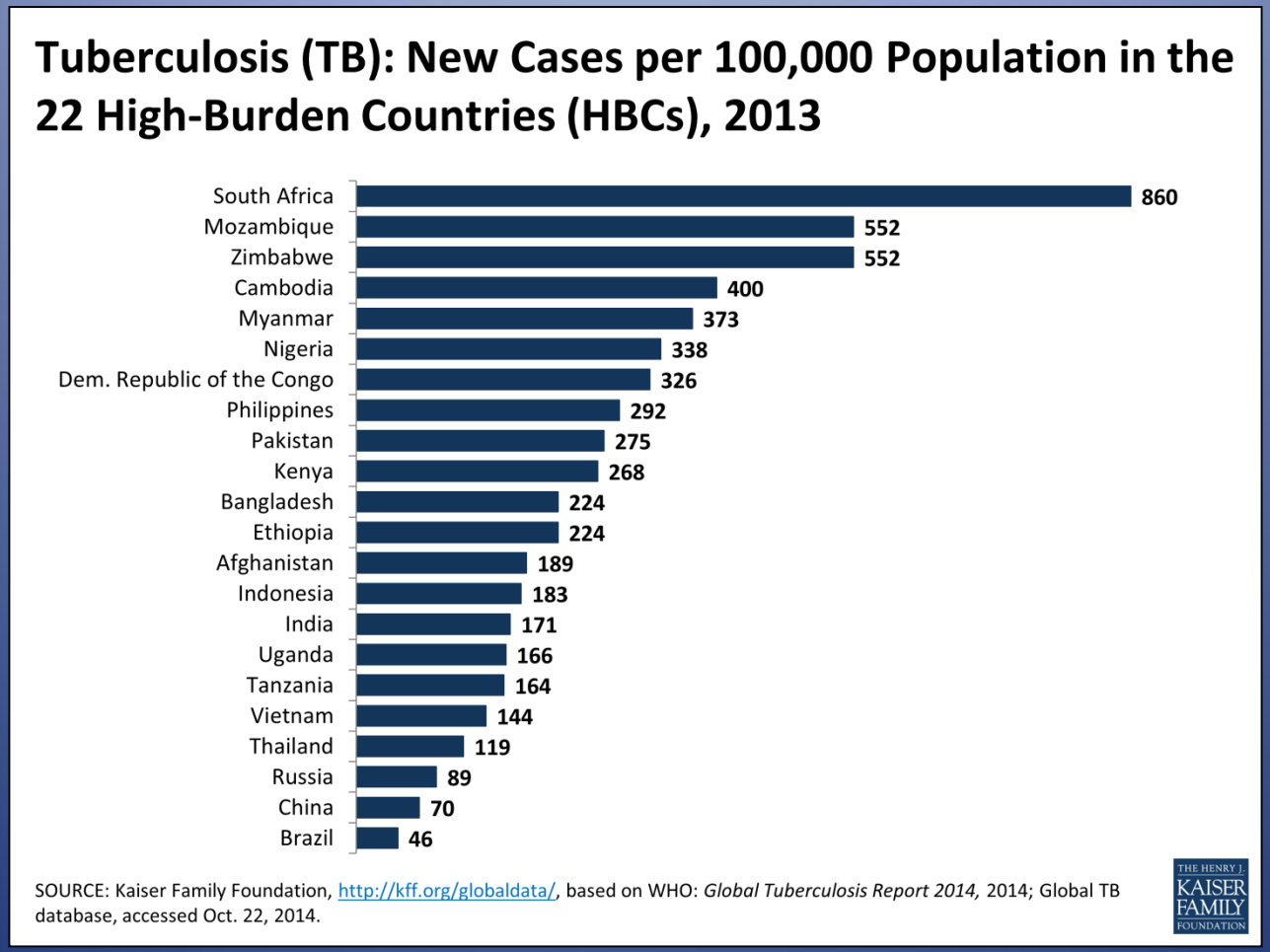
Drones in Health Care

Tuberculosis High Burden Countries



NHLS Sites


NATIONAL HEALTH LABORATORY SERVICE
Namibia
LIMPOPO
NORTHWEST
MPUMALANGA
FREE STATE
KWAZULU NATAL
NORTHERN CAPE
EASTERN CAPE
WESTERN CAPE
Swaziland
Lesotho
Orange
Springbok
Upington
Kimberley
De Aar
Vredendal
Vredenburg
Beaufort West
Worcester
Oudtshoorn
George
Knysna
Welkom
Kroonstad
Bethlehem
Bloemfontein
Botshabelo
Grahamstown
Port Alfred
Port Elizabeth
East London
King Williamstown
Bisho
Somerset East
Cradock
Graaff-Reinet
Mthatha
Tabankulu
Middelburg
Barberton
Shongwe
Piet Retief
Standerton
Phalaborwa
Tzaneen
Ellisras
Mokopane
Tembisa
Rustenburg
Potchefstroom
Klerksdorp
Carletonville
Johannesburg Hospital
Mt Ayliff
Butterworth
Cecilia Makiwane
Duncan Village
Greenville
Uitenhage
Livingstone
Mossel Bay
Paarl
Tygerberg
Somerset West

The Laboratory Logistic Loop (LLL)

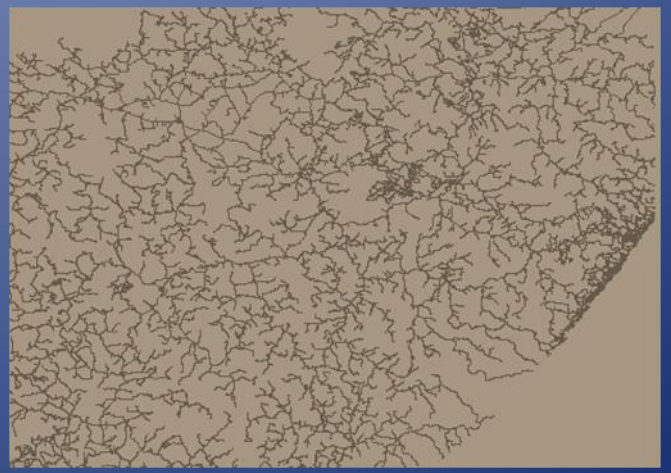
- Afferent limb

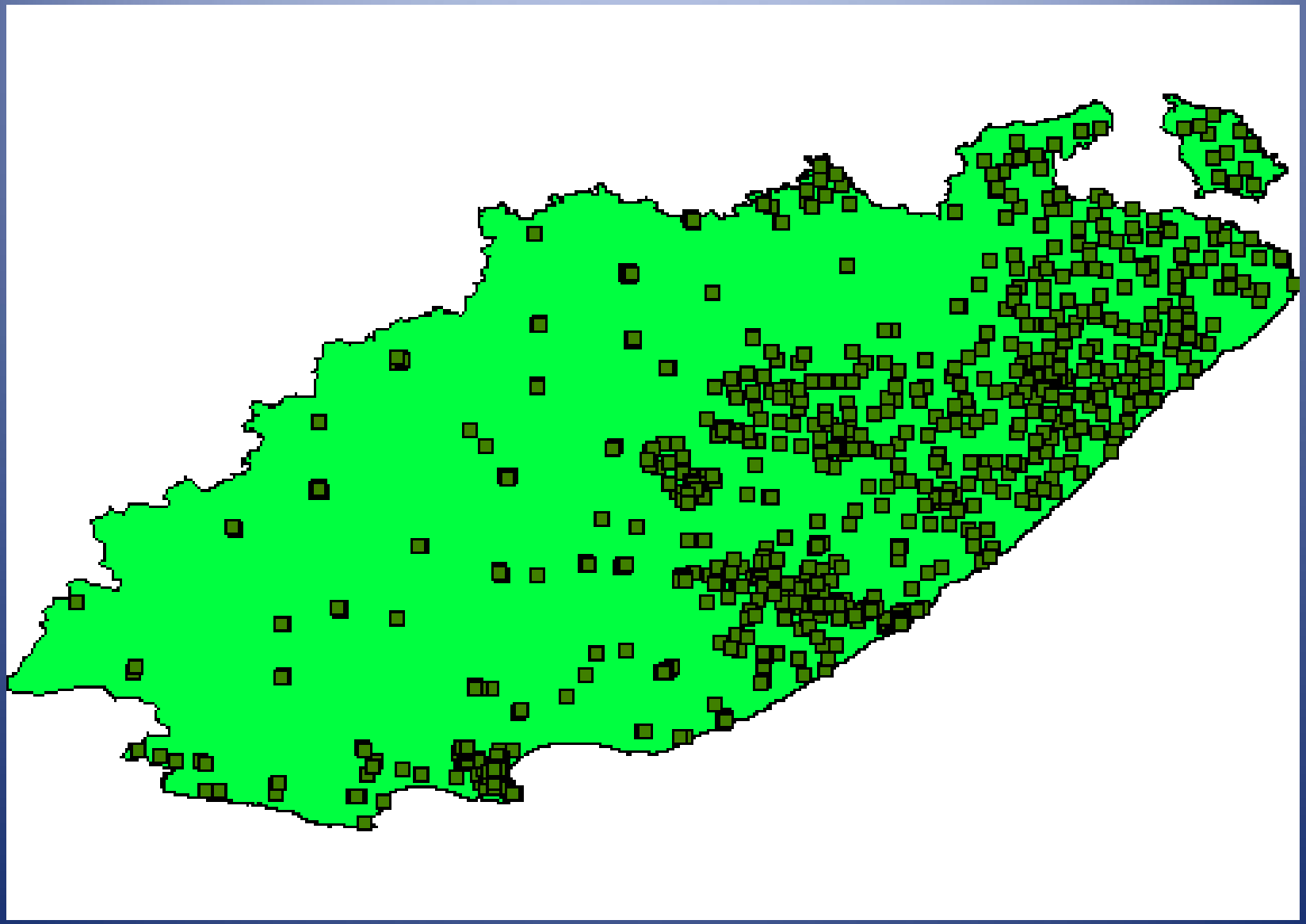
  Specimen from Clinic to Lab

- Efferent limb

  Result from Lab to Clinic

DHIS



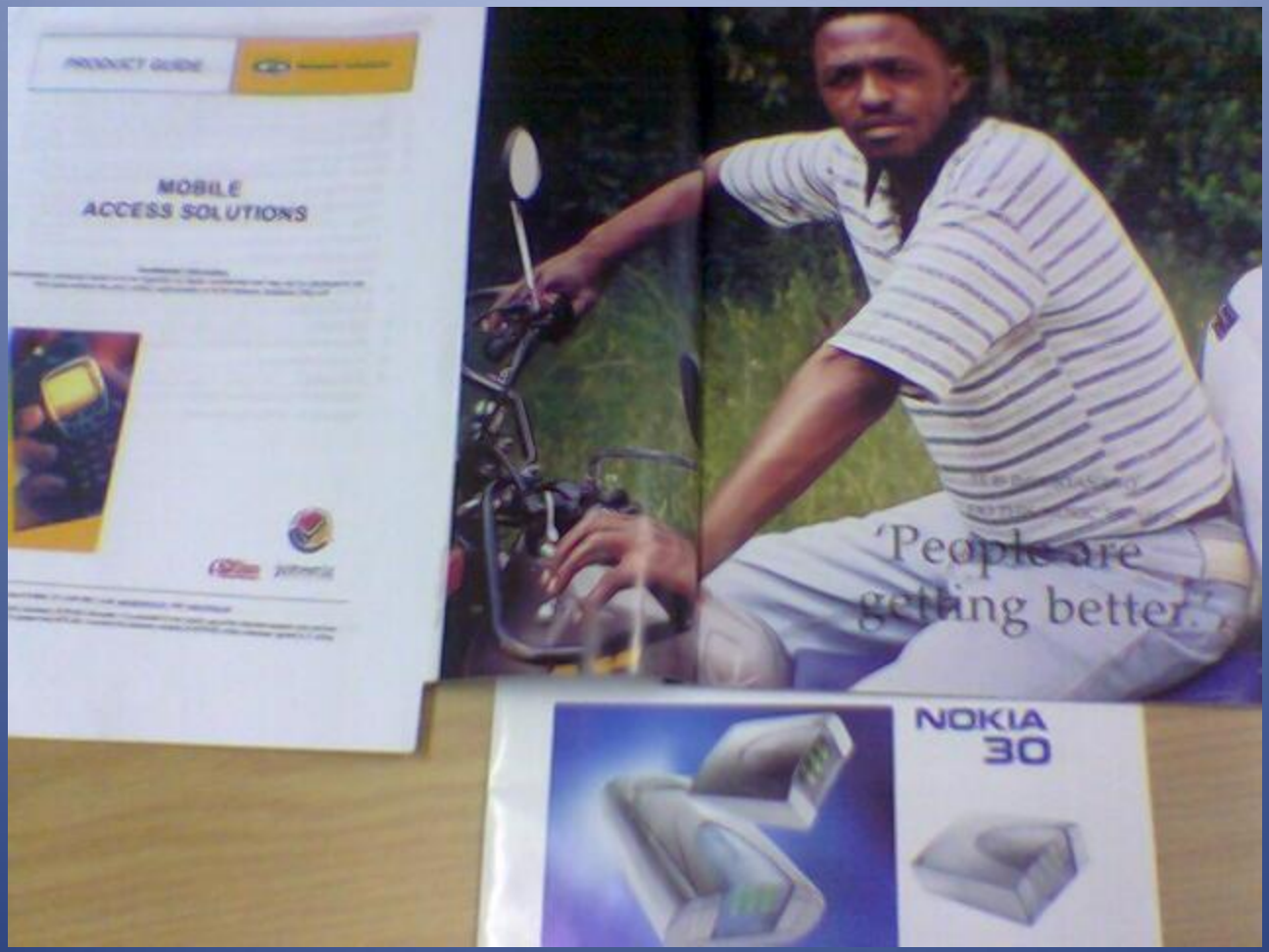


The Efferent Limb

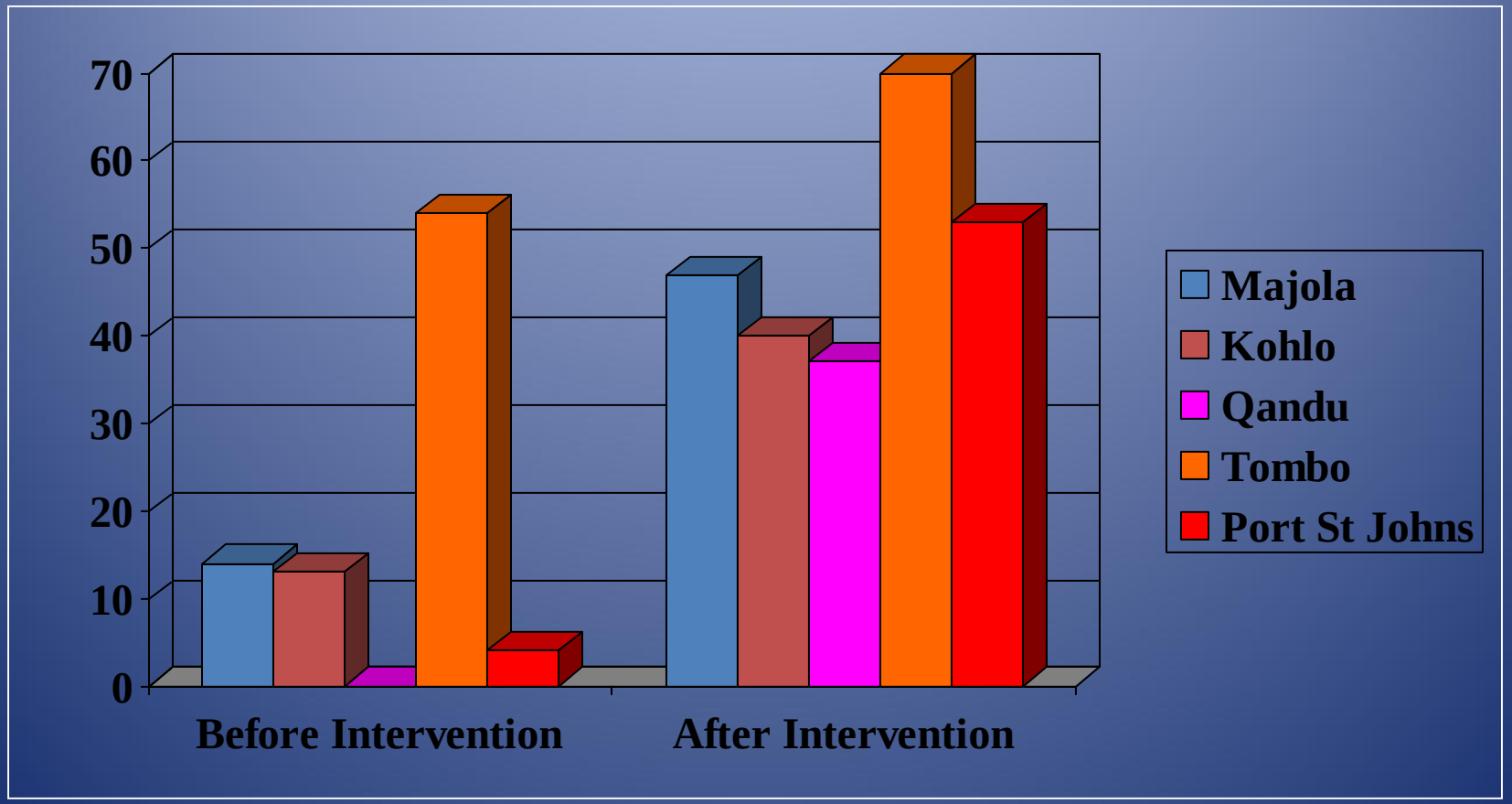
- Hardcopy
- Telephone
- Fax
- Email
- GSM
- GPRS
- 3G
- HSPA
- LTE


Cashbuild
Cashb

Impumelelo Award Winner 2001



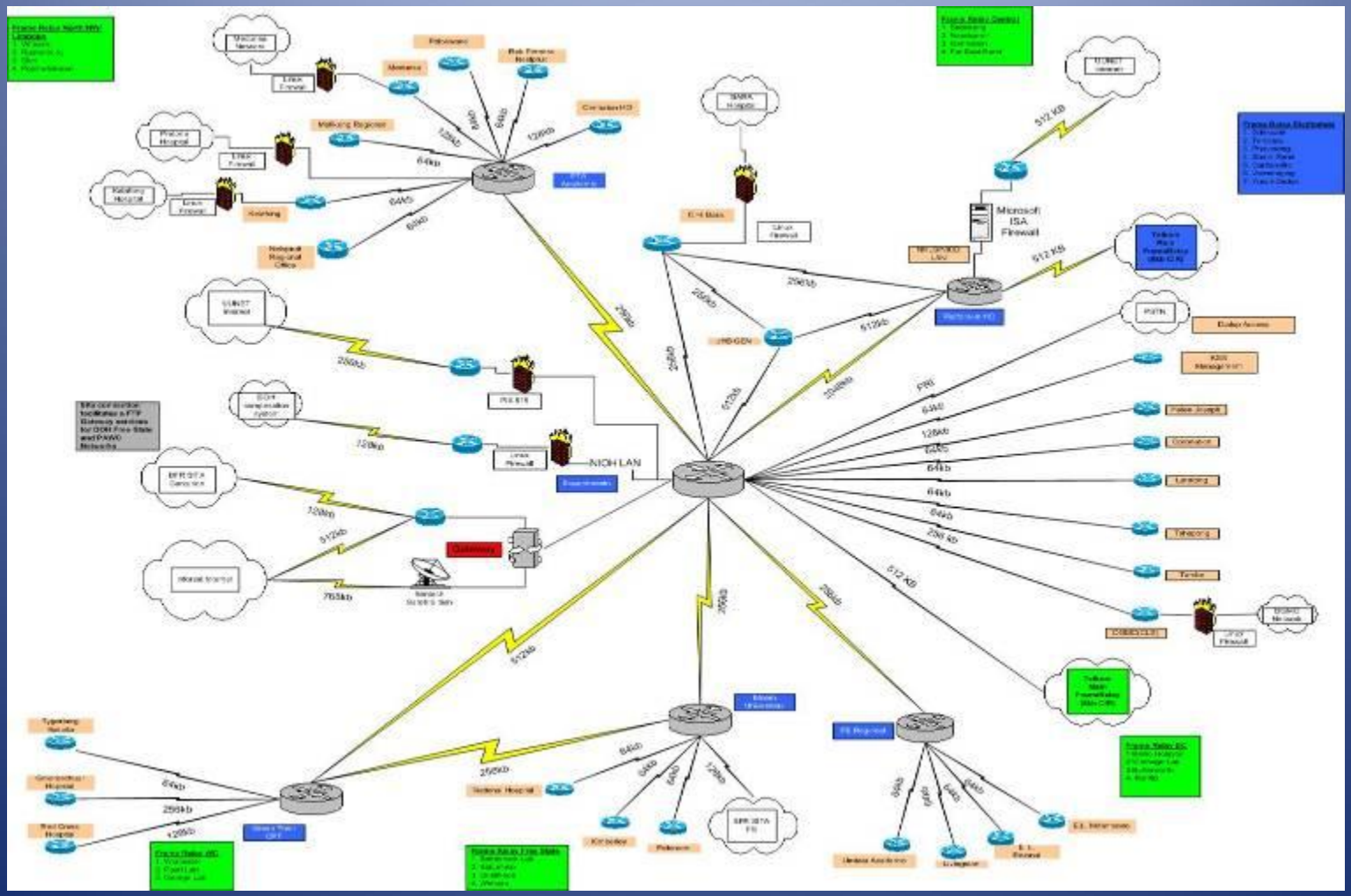
% Patients Successfully Treated



Data Dr Rudi Thetard

Slides Tumi Tlahle

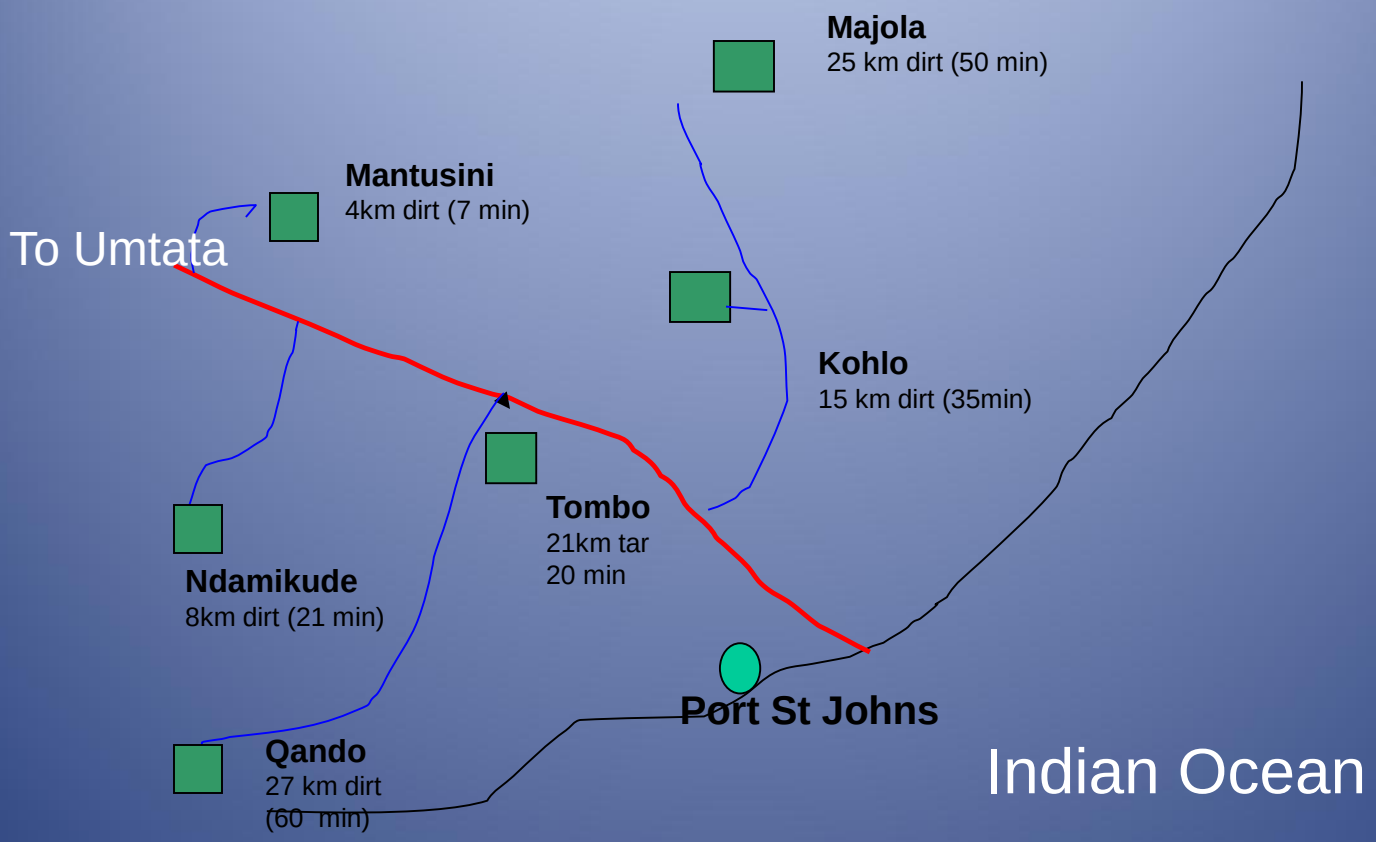
NHLS IT Network



The Afferent Limb

- Couriers
- Motorcycles
- Taxi’s
- Ambulances
- Ad hoc
- Helicopters

Robinson R22


Majola
25 km dirt (50 min)
Mantusini
4km dirt (7 min)
To Umtata
Kohlo
15 km dirt (35min)
Tombo
21km tar
20 min
Ndamikude
8km dirt (21 min)
Port St Johns
Qando
27 km dirt
(60 min)
Indian Ocean

NHLS/DENEL e-Juba (electronic pigeon)

- GPS navigated UAV
- Electric powered (Lithium Polymer batteries)
- Brushless outrunner motor
- Comprehensive autonomous flight avionics
  - 3D gyros and accelerometers
  - Barometric pressure and pitot sensors
  - Differential GPS
  - 1000 waypoints
  - Autonomous launch/recovery with ultrasonic AGL
  - Electronic compass board
- Comprehensive on board telemetry

Development of e-Juba, a preliminary proof of concept unmanned aerial vehicle designed to facilitate the transportation of microbiological test samples from remote rural clinics to National Health Laboratory Service Laboratories

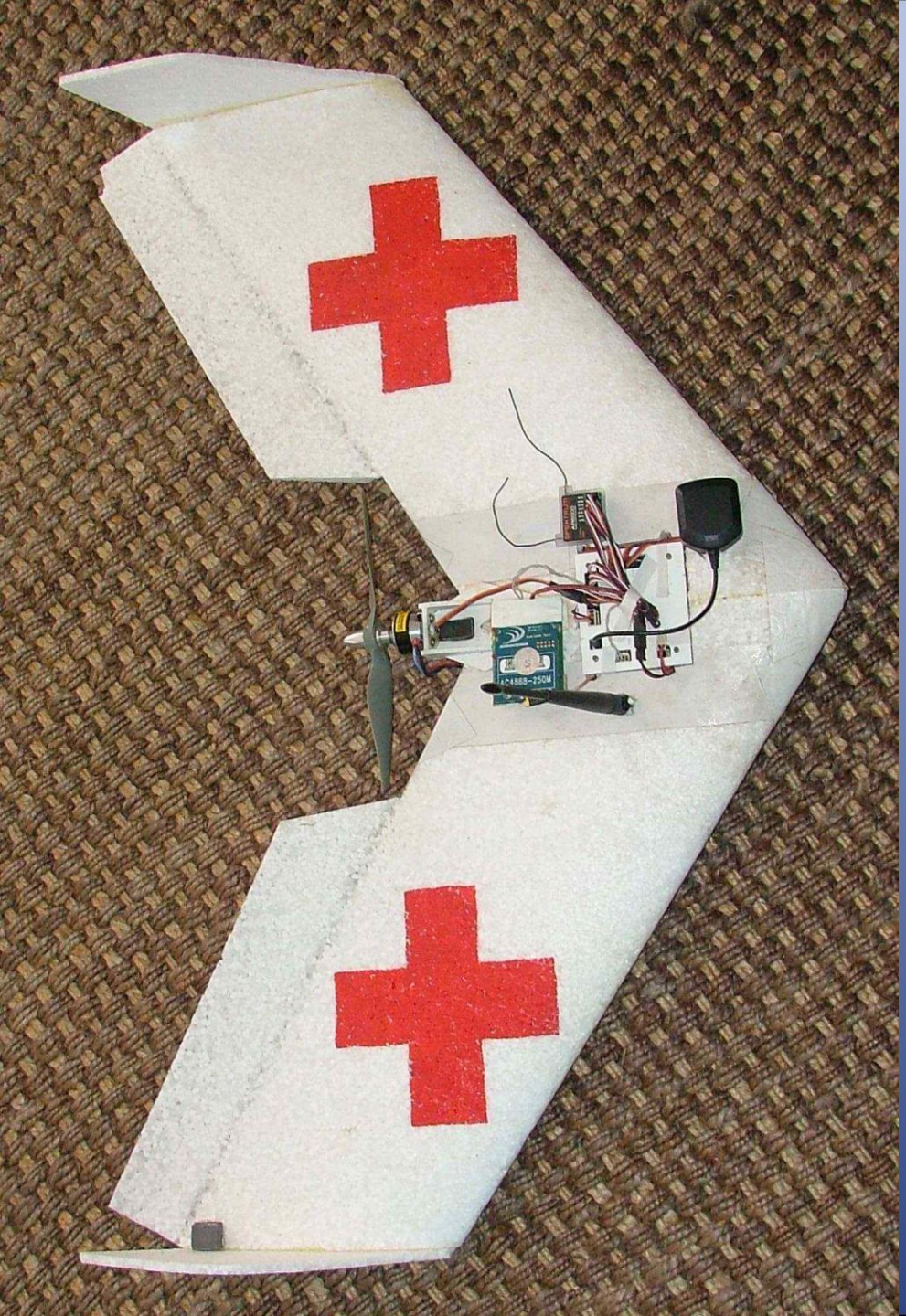
B Mendelow, P Muir, B T Boshielo, J Robertson

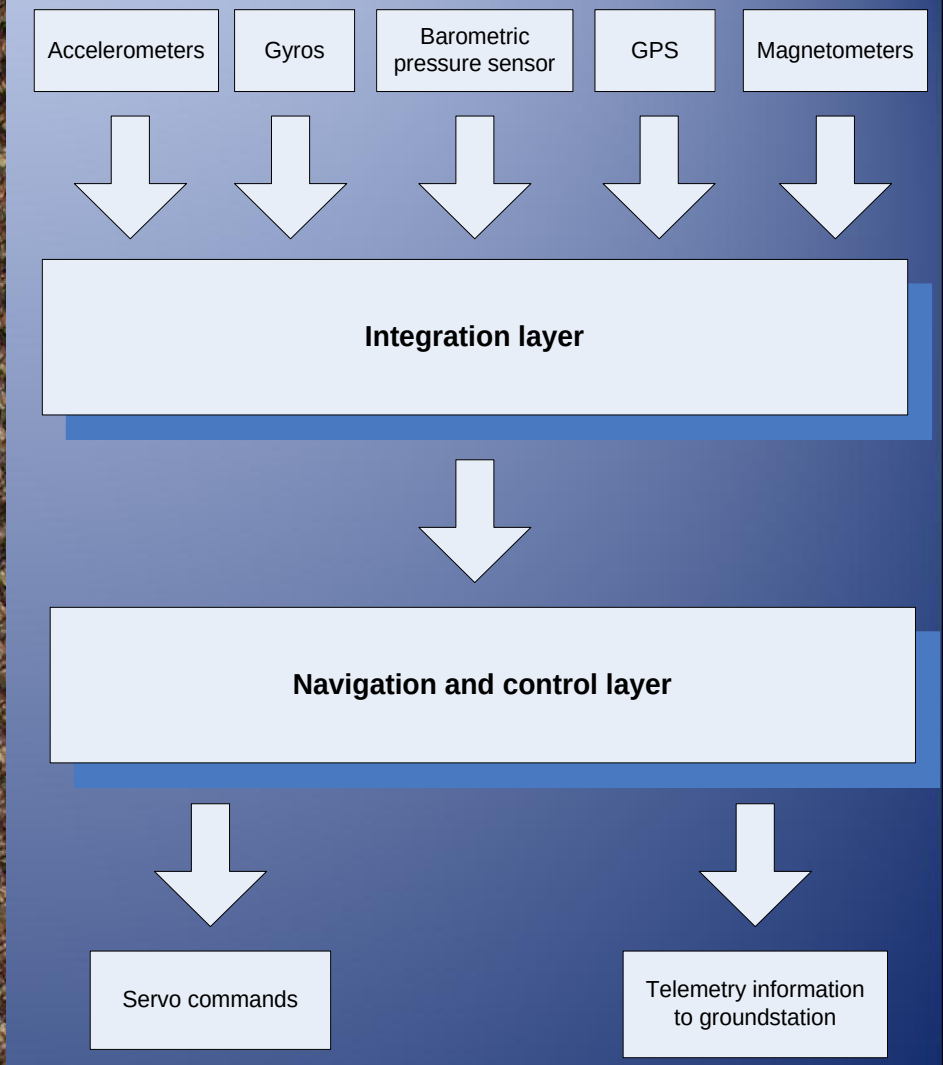
November 2007, Vol. 97, No. 11 **SAMJ**

"The payload is specified to accommodate medical diagnostic samples, but could also be applicable to carrying urgently required medications such as rabies immune globulin, anti-snakebite serum or packed red cells (the current e-Juba airframe could be modified to carry a maximum of two units, whose weight would not exceed the payload design specification)."

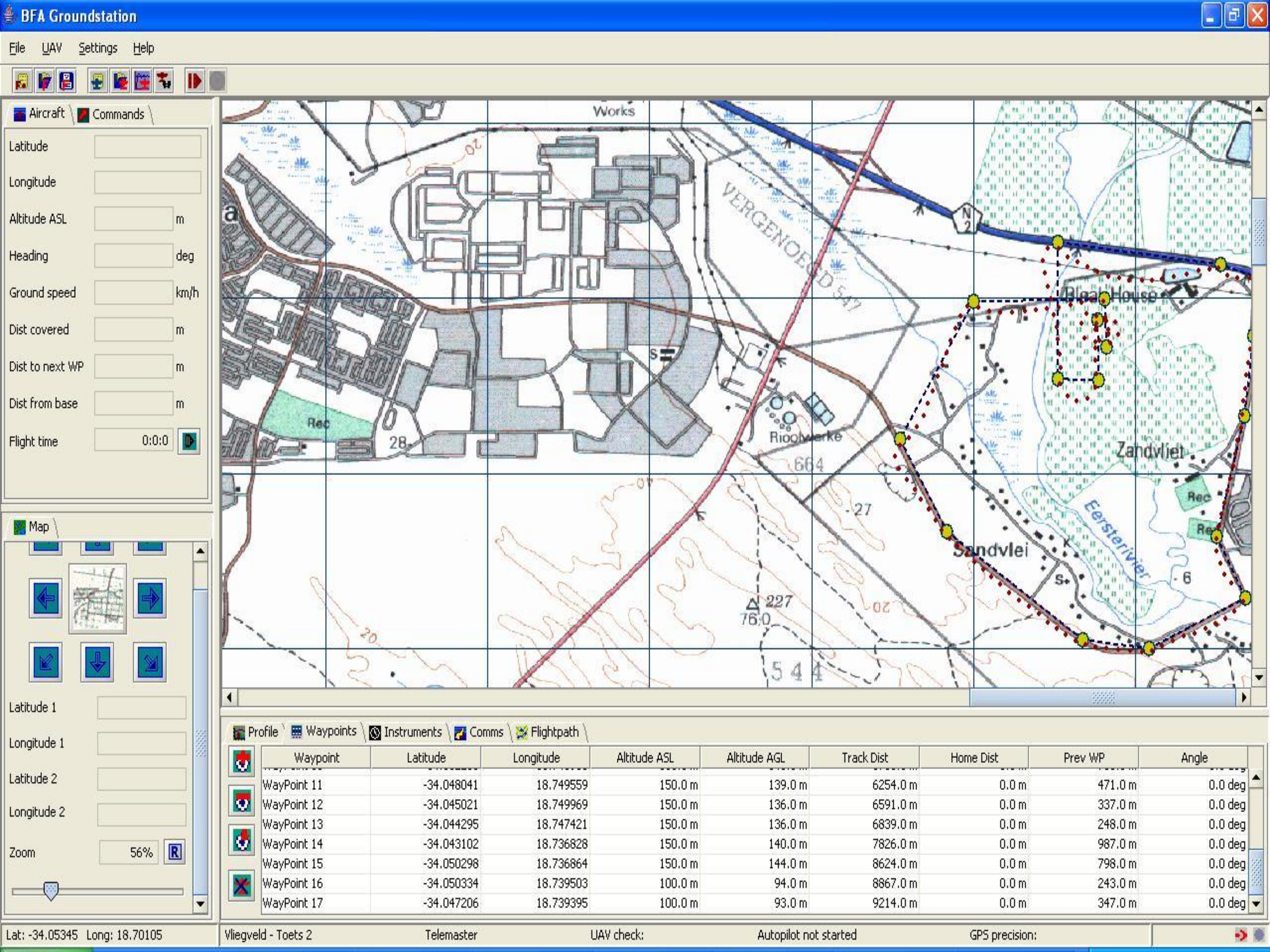
MedicAir Courier

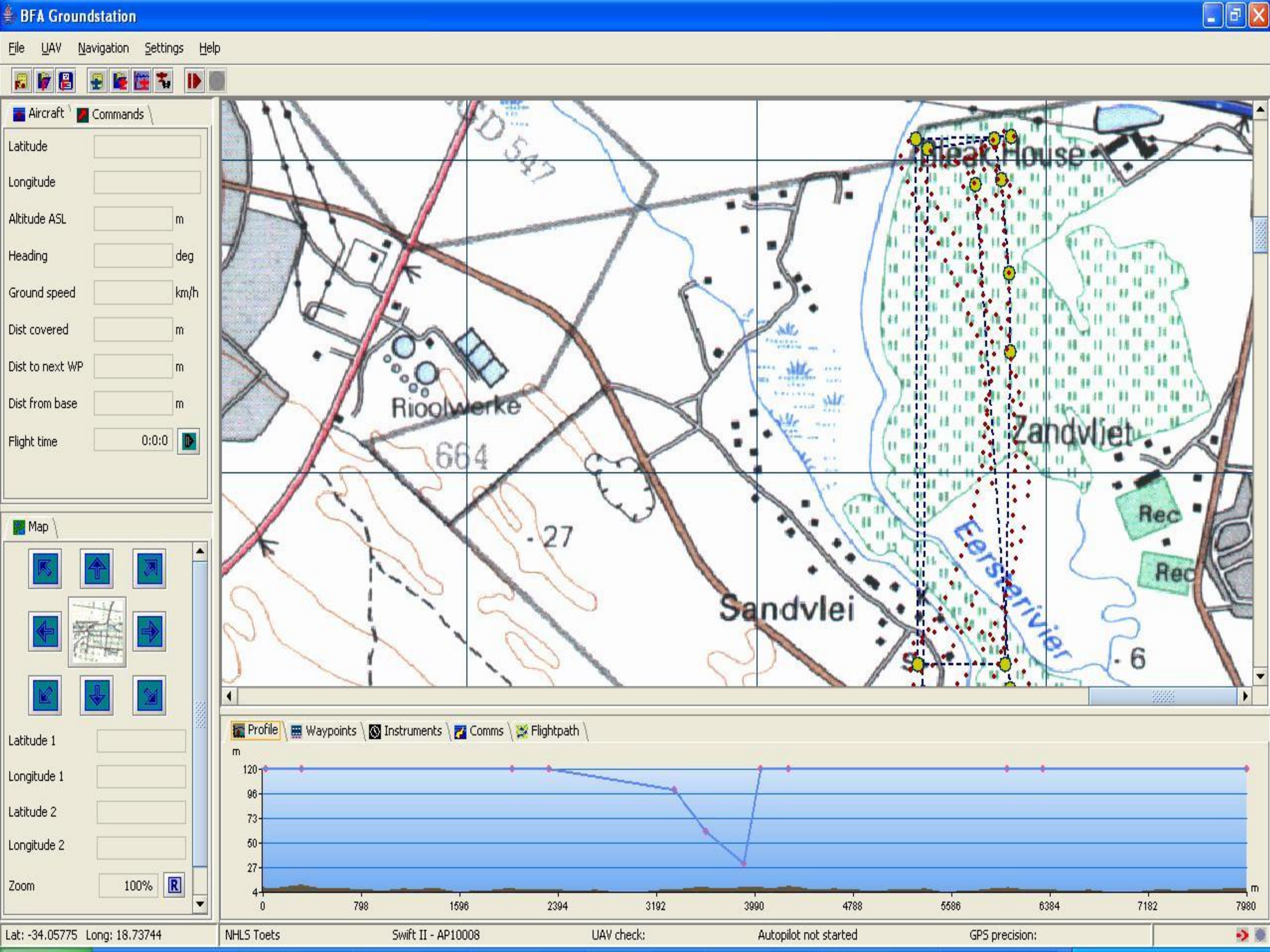
• Mass	800g
• Endurance	+/- 40km
• Service ceiling	>1000m AGL (>3000m ASL)
• Cruising speed	50km/hr
• Payload	Sufficient for 10-20 paper spot samples
• Propulsion	Brushless electric motor powered by Lithium Polymer batteries




Accelerometers
Gyros
Barometric pressure sensor
GPS
Magnetometers
Integration layer
Navigation and control layer
Servo commands
Telemetry information to groundstation


11.0592
16100
552166
TWD812
AutoPilot
V1.0
JSTAMP.COM
A040601

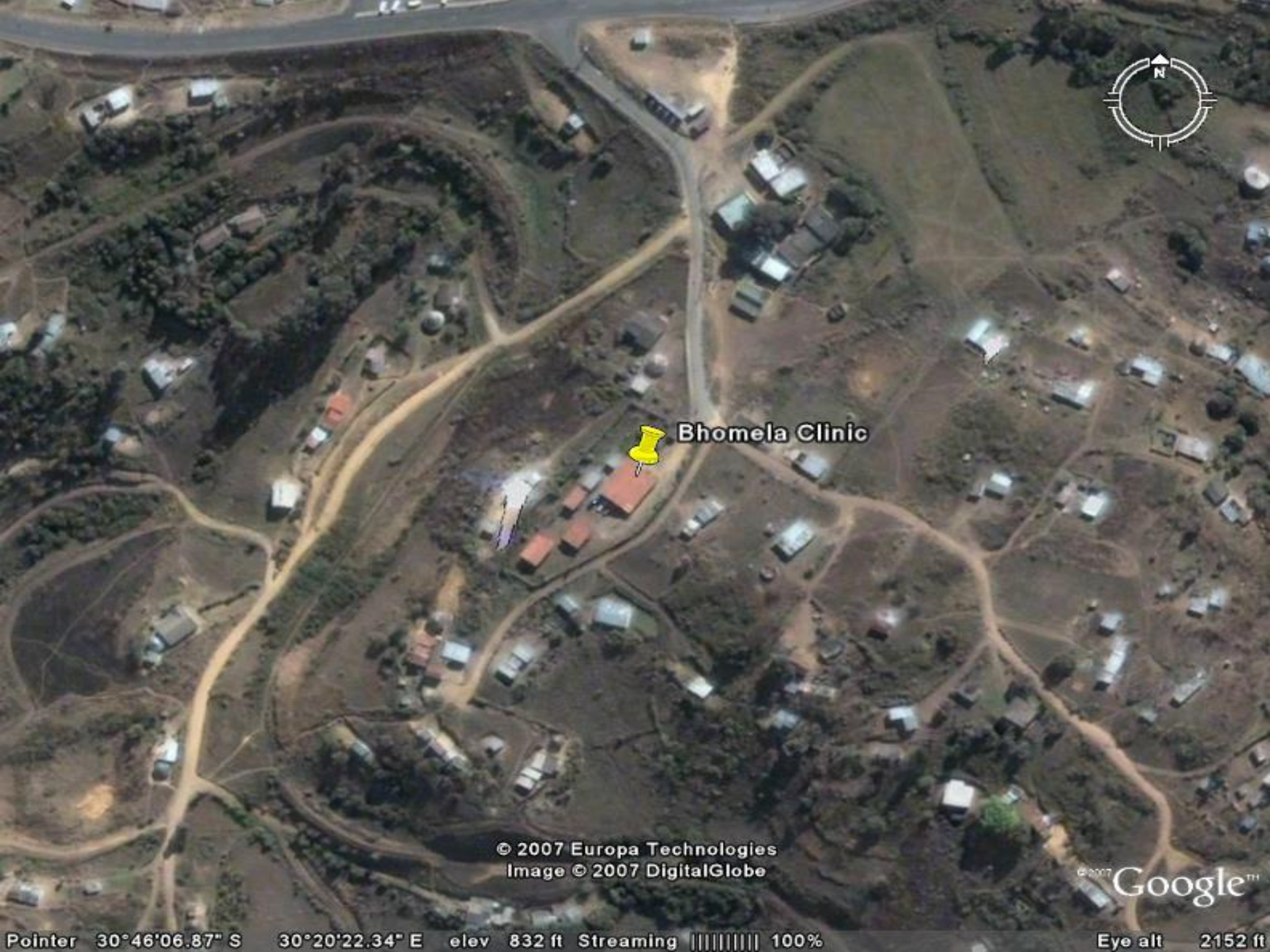

BFA Groundstation
File UAV Settings Help
Aircraft
Commands
Latitude
Longitude
Altitude ASL m
Heading deg
Ground speed km/h
Dist covered m
Dist to next WP m
Dist from base m
Flight time 0:0:0
Map
Latitude 1
Longitude 1
Latitude 2
Longitude 2
Zoom 56%
Works
VERGENOEGD 547
Bleak House
Rec
28
Rioolwerke
664
Zandvliet
Sandvlei
Eersterivier
227
544
Profile
Waypoints
Instruments
Comms
Flightpath
Waypoint Latitude Longitude Altitude ASL Altitude AGL Track Dist Home Dist Prev WP Angle
WayPoint 11 -34.048041 18.749559 150.0 m 139.0 m 6254.0 m 0.0 m 471.0 m 0.0 deg
WayPoint 12 -34.045021 18.749969 150.0 m 136.0 m 6591.0 m 0.0 m 337.0 m 0.0 deg
WayPoint 13 -34.044295 18.747421 150.0 m 136.0 m 6839.0 m 0.0 m 248.0 m 0.0 deg
WayPoint 14 -34.043102 18.736828 150.0 m 140.0 m 7826.0 m 0.0 m 987.0 m 0.0 deg
WayPoint 15 -34.050298 18.736864 150.0 m 144.0 m 8624.0 m 0.0 m 798.0 m 0.0 deg
WayPoint 16 -34.050334 18.739503 100.0 m 94.0 m 8867.0 m 0.0 m 243.0 m 0.0 deg
WayPoint 17 -34.047206 18.739395 100.0 m 93.0 m 9214.0 m 0.0 m 347.0 m 0.0 deg
Lat: -34.05345 Long: 18.70105
Vliegveld - Toets 2
Telemaster
UAV check:
Autopilot not started
GPS precision:

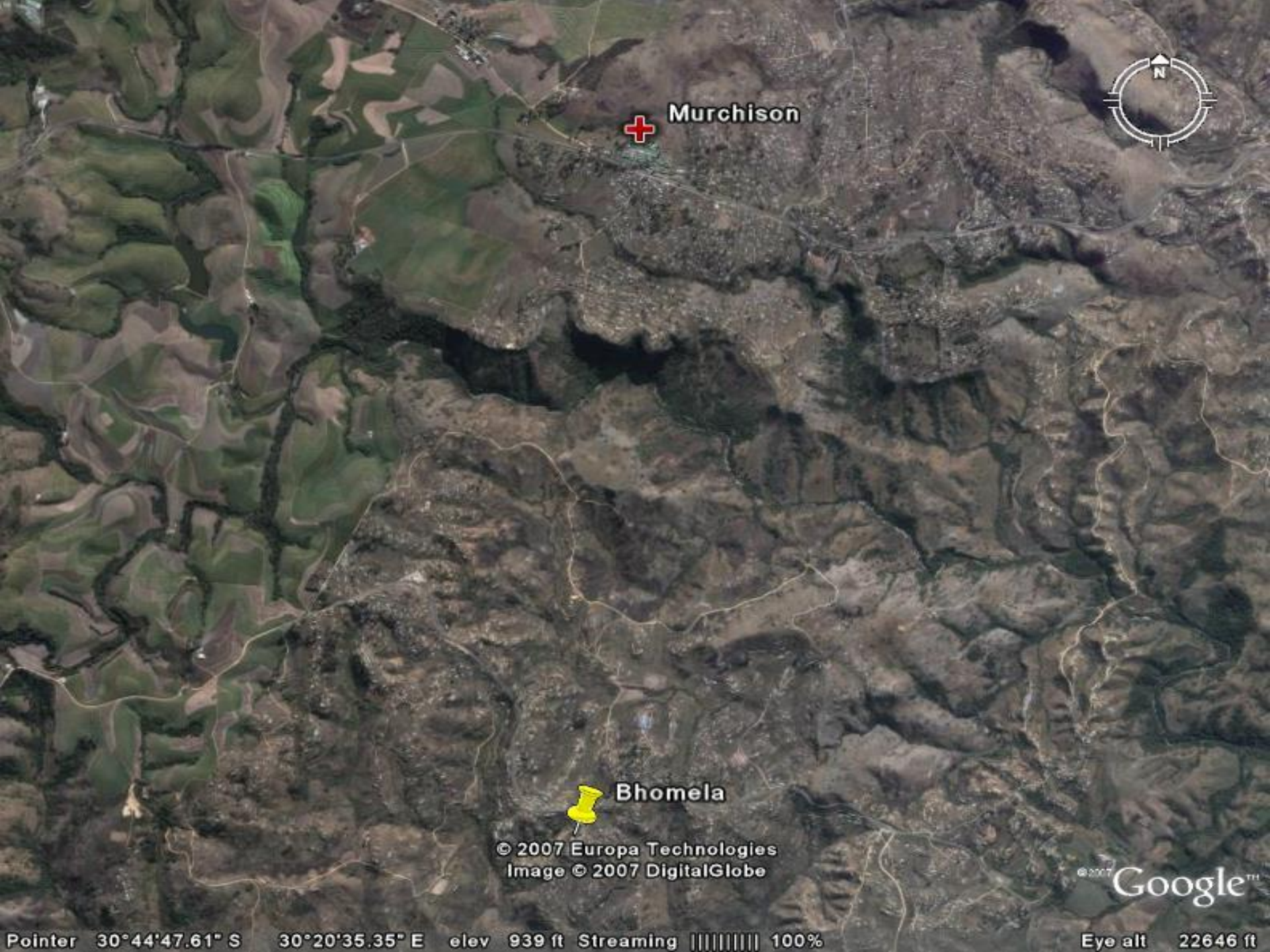


BFA Groundstation
File UAV Navigation Settings Help
Aircraft Commands
Latitude
Longitude
Altitude ASL m
Heading deg
Ground speed km/h
Dist covered m
Dist to next WP m
Dist from base m
Flight time 0:0:0
Map
Latitude 1
Longitude 1
Latitude 2
Longitude 2
Zoom 100% R
Rioolwerke
664
27
Sandvlei
Zandvliet
Eersterivier
Rec
Rec
6
Profile Waypoints Instruments Comms Flightpath
m
120
96
73
50
27
4
0 798 1596 2394 3192 3990 4788 5586 6384 7182 7980
Lat: -34.05775 Long: 18.73744
NHLS Toets
Swift II - AP10008
UAV check:
Autopilot not started
GPS precision:


Eedeswold
Murchison
Port Shepstone
Bhomela Clinic
Izotsha
© 2007 Europa Technologies
Image © 2007 DigitalGlobe
Image © 2007 TerraMetrics
©2007 Google™
Pointer 30°44'30.85" S 30°25'05.66" E elev 262 ft Streaming 100%
Eye alt 45159 ft


Murchison
N
© 2007 Europa Technologies
Image © 2007 DigitalGlobe
© 2007 Google™
Pointer 30°43'37.54" S 30°20'36.83" E elev 1152 ft Streaming 100%
Eye alt 2478 ft

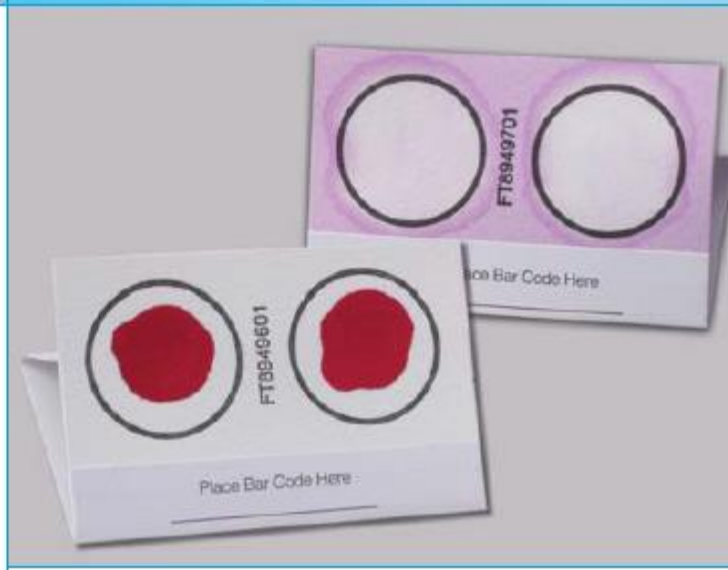

N
Bhomela Clinic
© 2007 Europa Technologies
Image © 2007 DigitalGlobe
© 2007 Google™
Pointer 30°46'06.87" S 30°20'22.34" E elev 832 ft Streaming 100%
Eye alt 2152 ft


Murchison
N
Bhomela
© 2007 Europa Technologies
Image © 2007 DigitalGlobe
©2007 Google™
Pointer 30°44'47.61" S 30°20'35.35" E elev 939 ft Streaming 100%
Eye alt 22646 ft

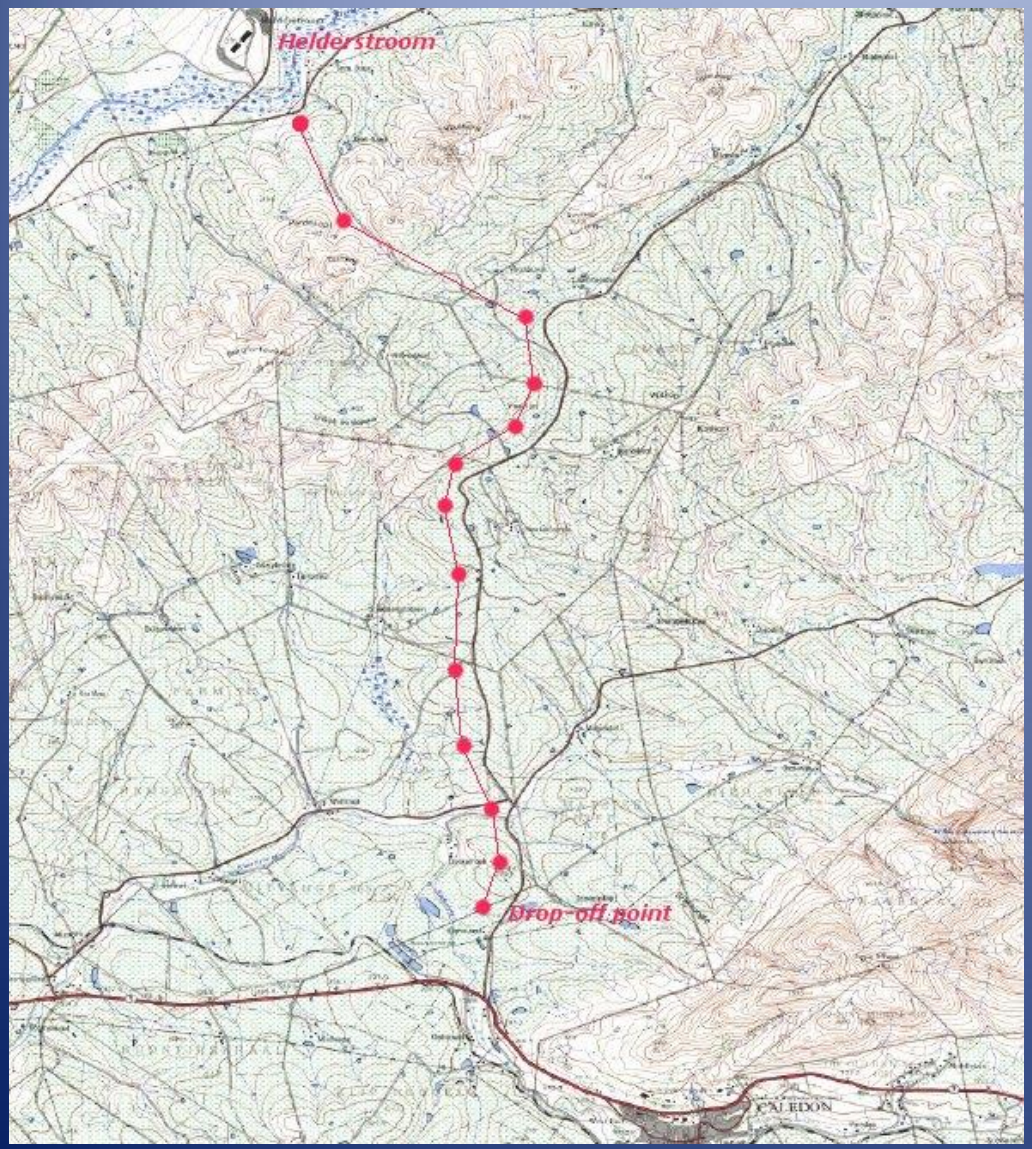
Whatman FTA® for Bacterial DNA

Collect, transport, store and purify bacterial DNA.

Whatman FTA® provides a remarkably easy way to purify genomic DNA from bacteria for genetic analysis. Simply apply cultures or clinical samples to the FTA matrix and the DNA is captured and stabilized. Pathogens are inactivated. Store samples at room temperature indefinitely, so you can analyze whenever you're ready. Ship safely. And purify in 30 minutes. Try FTA, and you'll soon find it's an indispensable part of your DNA toolbox.



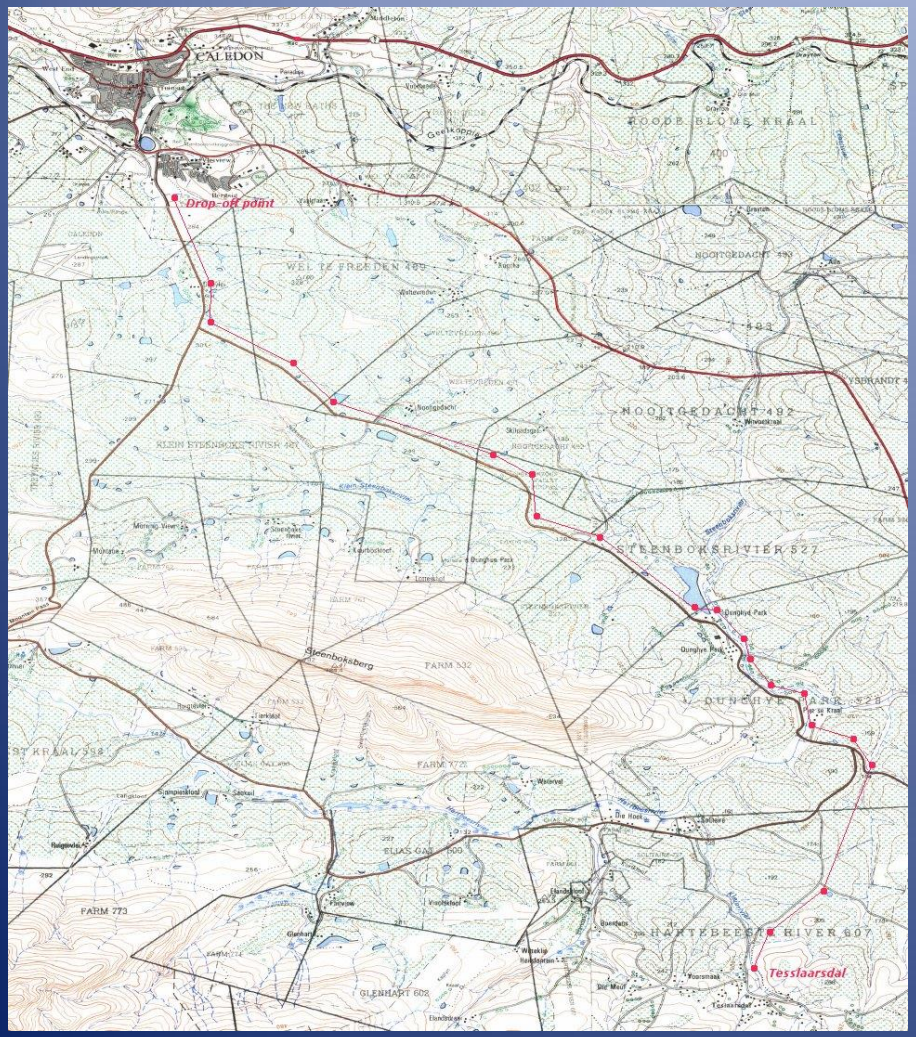
Helderstroom-Caledon-Helderstroom

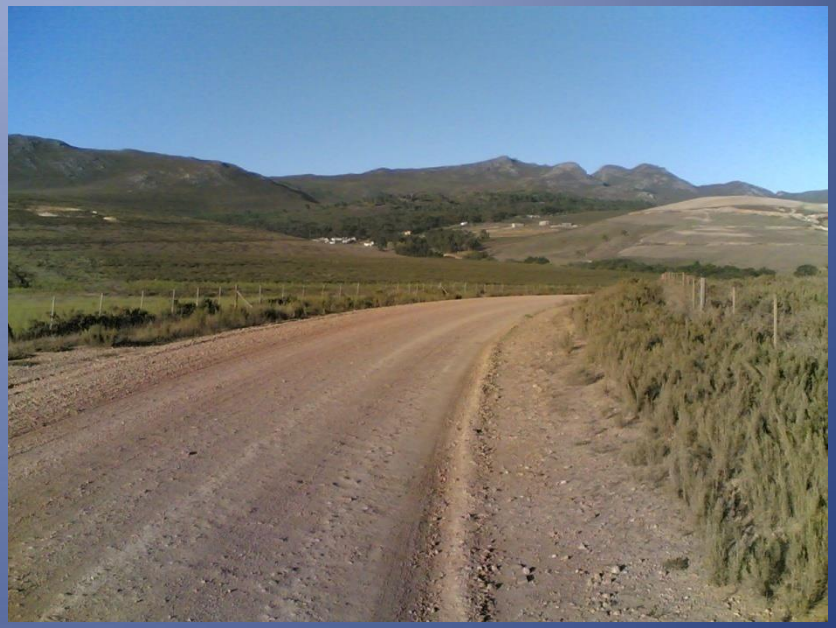


Helderstroom

Genadendal-Caledon

Tesselaarsdal-Caledon-Tesselaarsdal





Tesselaarsdal

Reliability and Cost

- 3 suppliers responded to NHLS Tender
    - ATE (Ex Mirage SA) “Kiwit”
    - S Plane Automation (Stell Univ) “Nightingale”
    - J Davel – “Miggie”
- Trials conducted in Limpopo and West Coast
- 306 flights up to 30km
- >99% completely successful
- 100% recovery of aircraft and cargo
- Running costs 4c per km

Nightingale

The National Health Laboratory Service (NHLS) of South Africa approached S-Plane Automation to create a small, inexpensive unmanned aircraft system to transport sterile medical samples between more than 1 500 rural clinics and laboratories. The resulting system, aptly named Nightingale, is an incredibly reliable aircraft, capable of enduring extreme punishment in remote parts of South Africa. Nightingale is a resounding success. It recently completed a 2-month-equivalent operational field trial between a clinic and a laboratory on the West Coast of South Africa with a 100% success rate under extreme environmental conditions.

Human Resource

- Essential to draw from local communities
- Youth Development Plan
- Employment Opportunities for
  - Pilots
  - Manufacturing
  - Service and Maintenance
- Rural Teaching and Learning Opportunities in Science, Engineering and Technology

Bhomela Light Anti-Aircraft Brigade

Legislative issues

- SACAA UAS committee constituted June 2008
- Interim verification sought for NHLS
  - Aircraft
  - Cargo
  - Routes
  - Pilots
- Legislation anticipated 2015

Delivery Drones 2015 (Wikipedia)

- Matternet is a Silicon Valley startup developing small UAVs for the delivery of lightweight goods. It had its origins in 2011 at Singularity University, based at the NASA Ames Research Center in Moffett Field, CA. Their transportation solution comprises small UAVs able to carry up to 1 kg goods over distances of up to 20 km on a battery charge.
- Amazon founder Jeff Bezos announced Dec 2013 that Amazon was planning rapid delivery of lightweight commercial products using UAvs.
- Google revealed in August 2014 it had been testing UAVs in Australia for two years.
- USPS has been testing delivery systems with HorseFly Drones. FedEx is reported to be testing integration of drone delivery with their existing logistics model.
- In December 2013, in a research project of Deutsche Post AG subsidiary DHL, a sub-kg quantity of medicine was delivered via a prototype Microdrones “parcelcopter”
- DHL Parcelcopter was already in use in Germany.
- In February 2014, the prime minister and cabinet affairs minister of the UAE announced plans to launch a fleet of UAVs for civilian purposes.
- UK based FPS Distribution and Switzerland's Swiss Post are both developing drone delivery services for wide scale use.
- In December 2014 French mail services company La Poste unveiled experimental delivery drone project.
- In February 2015 Hangzhou based e-commerce provider Ali Baba started delivery drone services around select cities in China.
- In March 2015 Shenzhen based SF Express started providing delivery services with XAircraft drones in China.
- In May 2015 CJ Express initiates delivery with drone services in South Korea.
- In July 2015 FAA endorses Let’s fly wisely, by Flirtey an Australian startup to deliver medicines via drones in USA.

Medical drones poised to take off

Amazon's Prime Air drones probably won't be dropping packages on American doorsteps anytime soon. But in some remote parts of the world, unmanned aerial vehicles (UAVs) are already being field-tested for medical uses. Drones successfully delivered small aid packages after the Haitian earthquake in 2012, and in Papua New Guinea, Doctors Without Borders used them to transport dummy TB test samples from a remote village to the large coastal city of Kerema.

PLOS ONE

RESEARCH ARTICLE

Can Unmanned Aerial Systems (Drones) Be Used for the Routine Transport of Chemistry, Hematology, and Coagulation Laboratory Specimens?

Timothy K. Amukele[1,2¤a]*, Lori J. Sokoll[1¤a], Daniel Pepper[3¤b], Dana P. Howard[4¤c], Jeff Street[4¤d]

1 Department of Pathology, Johns Hopkins University School of Medicine, Baltimore, Maryland, United States of America, **2** Clinical Core Laboratory at Infectious Diseases Institute, Makerere University-Johns Hopkins University, Kampala, Uganda, **3** University of Michigan Medical School, Ann Arbor, Michigan, United States of America, **4** NextGen Aeronautics, Torrance, California, United States of America

¤a Current Address: Department of Pathology, Johns Hopkins University School of Medicine, 600 N. Wolfe


© EPA

Drones for Development

www.dronesfordevelopment.com

Apps Bookmarks JR's website on Deep ... Outlook Web App IS Online - Login Google Models CV TV Guide | DStv | Movi... Aquaria Sailing Photographic musictheory.net

DRONES FOR DEVELOPMENT

At Drones for Development we truly believe that small drones can significantly improve life in developing countries, especially when it concerns access to healthcare.

Acknowledgements

- SAIMR/NHLS
- Wits Molecular Medicine and Haematology
- Denel Dynamics
- MedicAir Couriers
- ATE
- S-Plane Automation
- CAA

Videos

- New Scientist
- Kiwit
- E-Juba