Drones in Health Care
Tuberculosis High Burden Countries

Tuberculosis (TB): New Cases per 100,000 Population in the 22 High-Burden Countries (HBCs), 2013

South Africa: 860
Mozambique: 552
Zimbabwe: 552
Cambodia: 400
Myanmar: 373
Nigeria: 338
Dem. Republic of the Congo: 326
Philippines: 292
Pakistan: 275
Kenya: 268
Bangladesh: 224
Ethiopia: 224
Afghanistan: 189
Indonesia: 183
India: 171
Uganda: 166
Tanzania: 164
Vietnam: 144
Thailand: 119
Russia: 89
China: 70
Brazil: 46

NHLS Sites
The Laboratory Logistic Loop (LLL)

• Afferent limb
  Specimen from Clinic to Lab

• Efferent limb
  Result from Lab to Clinic
The Efferent Limb

- Hardcopy
- Telephone
- Fax
- Email
- GSM
- GPRS
- 3G
- HSPA
- LTE
Impumelelo Award Winner 2001
% Patients Successfully Treated

Before Intervention | After Intervention

Majola | Kohlo | Qandu | Tombo | Port St Johns

Data Dr Rudi Thetard
Slides Tumi Tlahle
NHLS IT Network
The Afferent Limb

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

Mantusini
4 km dirt (7 min)

Ndakide
8 km dirt (21 min)

Qando
27 km dirt (60 min)

Tombo
21 km tar
20 min

Majola
25 km dirt (50 min)

Kohlo
15 km dirt (35 min)

Port St Johns

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

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“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
Magnetometers
GPS

Integration layer

Navigation and control layer

Servo commands
Telemetry information to groundstation
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
Tesselaarsdal-Caledon-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
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.
RESEARCH ARTICLE

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

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