

## Collecting patient samples from rural clinics in Nepal



*Droneports based at Pyuthan Regional Hospital and Bhingri Public Health Center servicing 4 remote clinics each*



*Doctor follows the flight cargo drone on a live map*

*Nurse removes cargo box containing patient samples*

OVERVIEW	
<b>Flying Labs</b>	Nepal Flying Labs
<b>Geographic area</b>	Pyuthan Province, Nepal
<b>Date</b>	June - December 2019
<b>Sector program</b>	HealthRobotics

SCOPE	
<b>Stakeholders (clients)</b>	Birat Nepal Medical Trust (BNMP), Stony Brook University (SBU)
<b>Challenge</b>	More than 80% of Nepal’s population lives in rural areas, and 50% live in remote, mountainous regions with poor access to healthcare. The majority of healthcare facilities in the country are not accessible by roads. On average, it takes 6-to-8 hours to travel between a hospital and healthcare facility in rural Nepal. This leads to shortages of essential medicines and explains why it can take so long to test patients for diseases like tuberculosis (TB) since patient samples can only be tested at diagnostic labs in major cities. Some 70% of Nepalis are carriers of TB, and many of them have full-blown versions of the disease. TB is the 4th leading cause of death in Nepal and the leading cause of death from infectious diseases.
<b>Scope</b>	Collect TB sputums from 8 remote clinics and transport them to two regional health facilities for rapid testing using affordable and locally operated cargo drones. Repurpose existing industrial mapping drones into cargo drones, and fully train local drone pilots with DR Flying Labs to operate the 100+ deliveries entirely independently.
<b>Outcome</b>	<ol style="list-style-type: none"> <li>1) This pilot project demonstrated that affordable cargo drones can be locally operated to reliably collect patient samples for rapid diagnosis over an extended period of time (6 months).</li> <li>2) This pilot is ready to be transformed into long-term delivery services.</li> <li>3) The pilot project has been extensively documented and the full report is available <a href="#">here</a>.</li> <li>4) The same project can be implemented in other countries who wish to test cargo drone operations for sample delivery and are looking for an affordable, proven alternative with a successful and fully transparent track record.</li> </ol>
<b>Next steps</b>	Nepal Flying Labs is securing local funding to continue cargo drone deliveries.

CARGO	
<b>Cargo Transported</b>	Sputum samples
<b>Cold Chain</b>	Not required

HARDWARE AND SOFTWARE	
<b>Cargo Drone</b>	DJI Matrice 600 repurposed into a cargo drone by WeRobotics
<b>Precision Landing</b>	GPS and optical image recognition using ArUco markers
<b>Flight plan software</b>	Mission planning software developed by WeRobotics (see screenshot below)



Mission planning software for cargo delivery developed by WeRobotics

FLIGHT OPERATIONS	
<b>Delivery Distance(s)</b>	Horizontal: 1-7 kilometers; Vertical: 1-1.8 kilometers (AMSL)
<b>Number of Flights</b>	106 (outbound and return)
<b>Number of Deliveries</b>	53
<b>Flight Altitude</b>	1.8km (AMSL)
<b>Total Cargo Delivered</b>	742 sputum samples (26 of which tested positive for TB)
<b>Total Distance Flown</b>	~400 kilometers
<b>Takeoff/Landing sites</b>	Flat rooftops of health facilities

COST BENEFIT ANALYSIS	
<b>Speed Savings</b>	Drone deliveries were 75% faster than ground deliveries
<b>Cost Savings</b>	<p>Cost analysis is still ongoing so the following are initial estimates:</p> <ul style="list-style-type: none"> <li>• Aerial: \$0.40 per kilometer</li> <li>• Land: \$0.62 per kilometer</li> </ul> <p>This <i>tentatively</i> represents 55% cost savings (TBC) but this figure depends significantly on the number of deliveries made per day.</p>