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CASE STUDY · MARLUC SYNOPSIS

Rwanda national drone blood delivery network

IMPLEMENTED 2016 ONWARDS · HEALTH AND LIFE SCIENCES · RWANDA · BAND C · PARTLY PROVED

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Rwanda's government and Zipline run drone ports that deliver blood products to public hospitals by order from the hospital. A peer-reviewed Lancet Global Health study found faster deliveries and fewer expired units, and a 2026 study by Penn and Rwandan researchers reports lower hospital stock, less waste and lower in-hospital deaths. The drones are automated flight systems; the sources do not describe them as using generative AI or machine learning.

ABOUT THIS SYNOPSIS

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Facts and figures are as reported by the sources listed below, which may be incomplete, self-reported or out of date. Check the original source before relying on any figure.

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NOTICE WORDING LAST UPDATED 16 NOVEMBER 2026

AT A GLANCE

AI and automation used: Autonomous fixed-wing delivery drones flying set routes from drone ports; the sources describe the drones as automated and do not describe any machine learning or generative AI.

Implemented: 2016 onwards. Grade: band C, Process change, Partly proved.

Headline result, as reported: Hospitals served by Zipline drones cut red blood cell stock by 63% and blood wastage by 40%, and in-hospital deaths fell 51% for postpartum haemorrhage and 30% for trauma, per a Penn study reported in 2026

1 · The case

The facts, as reported by the 5 sources listed at the end. Where a source is silent, the field says "Not reported".

Organisation

Government of Rwanda (Ministry of Health), with Zipline International. Rwanda's national drone blood delivery network, run in a public-private partnership between the Government of Rwanda and Zipline International, a fixed-wing drone delivery company. In June 2020 two drone

Business challenge

The challenge. Per Wharton Magazine, hilly terrain made it hard for Rwandan hospitals to manage stocks of valuable blood products, and delivery by road over unpaved routes took several hours. Blood products are scarce and perishable, so unused units can expire.

How it was addressed. The first drone port opened in Muhanga in 2016 and a second in Kayonza in 2019. Hospitals order by phone or text. Port staff prepare the consignment in under 10 minutes, load it into the drone and launch. The package is air-dropped at a collection point and the drone returns to base automatically. Platelets, fresh frozen plasma and cryoprecipitate are held at the drone ports and dispatched within minutes, per HospiMedica. [1] [2] [3] [4] [5]

Who implemented it

Zipline International (Equipment or robot maker): Operates the drone ports and fixed-wing delivery drones under a public-private partnership with the Rwandan government..
In-house (In-house): Government of Rwanda: Formed the partnership and supplies the hospitals and blood services served by the network..
University of Pennsylvania and University of Global Health Equity (University or research lab): Co-authored the 2026 outcome study with the Rwanda Ministry of Health..
The Lancet Global Health 2022 study is by Rwandan and Canadian-funded researchers; funding was from the Canadian Institutes for Health Research.

Technology (SEAM pillar E)

SEAM types: T9 AI in physical systems. Deployment: Not reported. Vendors and products: Zipline International, Zipline fixed-wing delivery drones.

Where it was built in: Hospitals order by phone or text to a drone port, where staff prepare consignments in under 10 minutes and load them into the drone. Packages are air-dropped at designated collection points and the drone returns automatically to base.

What changed

Before: deliveries took several hours by road and hospitals held their own stocks. After: deliveries take 15 minutes to an hour depending on distance, and hospitals hold less red blood cell stock. By the Penn study as reported, in-hospital deaths fell 51% for postpartum haemorrhage and 30% for trauma patients at facilities served by drones. [1] [2] [3] [4] [5]

What it cost

Not reported

What it saved

Red blood cell stock down 63% and blood product wastage down 40% at hospitals served by drones (HospiMedica reporting the Penn study). Lancet Global Health 2022: mean drone delivery 49.6 minutes, 79 minutes faster than estimated road delivery, and 7.1 fewer blood unit expirations per month. Cost saving: Not reported; the 2022 authors say future studies should investigate cost-effectiveness. [1] [2] [3] [4] [5]

Governance and control

The network operates under a government partnership with Zipline. Hospital staff place the orders. Delivery performance has been studied by independent academics. Flight safety regime, contract terms and an accountable owner: Not reported in the sources opened.

S2 · Accountable owner · Evidenced
Wharton Magazine says Rwanda's government formed the partnership with Zipline, and the Rwanda Ministry of Health is a co-author of the outcome study. A named accountable owner is not reported. [2] [1]

A1 · Safe use · Not reported
Not reported.

A2 · Human in the loop · Evidenced
Hospital staff place each order and drone port staff prepare each consignment; the drone itself flies and returns automatically. [1]

A3 · Monitoring and assurance · Evidenced
Peer-reviewed analysis of delivery times and expirations (Lancet Global Health 2022) and an outcome study by Penn with Rwandan researchers (2026), including robustness checks by the authors' account. [4] [1] [2]

A4 · Vendor AI · Not reported
Not reported.

A5 · Agent controls · Not reported
No agents described.

A6 · Standards and regulation · Not reported
Not reported.

What worked, what did not, what is unproven

WORKED

– Mean drone delivery time was 49.6 minutes, 79 minutes faster than estimated road delivery (Lancet Global Health 2022).

– Blood unit expirations fell by 7.1 per month after drone delivery began, a 67% reduction at 12 months (Lancet Global Health 2022).

– Hospitals served by drones cut red blood cell stock by 63% and wastage by 40%, and in-hospital deaths fell 51% for postpartum haemorrhage and 30% for trauma patients (Penn study as reported by HospiMedica).

– Per Think Global Health, Zipline drones deliver 75% of the national blood supply outside Kigali.

DID NOT

– The mortality benefit was uneven: facilities closest to the drone ports saw the greatest reductions, per HospiMedica.

– Delivery-time savings varied widely by facility, from 3 to 211 minutes (Lancet Global Health 2022).

– In 2024, Think Global Health described the Wharton mortality study as not peer reviewed at that date; the 2026 coverage says it is now published in Manufacturing & Service Operations Management.

UNPROVEN

– How much of the fall in in-hospital deaths is due to the drones rather than other changes in the health system; the sources opened give no study design detail.

– Whether results from this single national programme transfer to other countries; Wharton Magazine suggests the model could be adopted elsewhere.

Timeline

2016 First drone port begins operations in Muhanga under a government partnership with Zipline [1]

Mar 2017 Start of the delivery-time data later analysed in the Lancet Global Health study [4]

2019 Second drone port begins operations in Kayonza [1]

Jun 2020 Two ports serve 29 public hospitals [1]

2022 Lancet Global Health study: drone delivery faster than road and blood unit expirations lower [4]

Jun 2024 Think Global Health reports Zipline drones deliver 75% of Rwanda's blood supply outside Kigali, and describes the Wharton study as not peer reviewed at that date [3]

2026 Study by Penn and Rwandan researchers on inventory and mortality published in Manufacturing & Service Operations Management and covered by Wharton Magazine and HospiMedica [2]

2 · Grade and SEAM assessment

MarLuc's opinion, made on the evidence above. How cases are graded: marluc.co.uk/case-studies/how-we-rate

Level of change and impact

Claimed: A. Grade: C, Process change. Proof: Partly proved. Level of change: Process change.

Process change (Level 2, band C), claimed as transformational (band A). The blood supply process was rebuilt around drone ports and shows faster delivery and less waste in a peer-reviewed study. Whether the wider health system is transformed is not shown.

Graded C, claimed A. Blood supply to hospitals was redesigned around drone ports and the effect on delivery time and waste is independently documented. Sources call the technology transformative; the sources opened do not show how much of the mortality change is due to the drones, so any wider transformation is potential and unproven.

The SEAM view and lessons learnt

This is a supply-chain redesign with unusually rich outcome evidence for a logistics technology. The technology is automated flight rather than generative AI, so lessons about AI adoption apply only in part: the transferable ideas are measuring delivery time and waste against the road baseline, holding scarce stock centrally, and having independent researchers publish the results. The gap is attribution of the mortality figures, which rests on a study the sources opened only describe.

1. Measure delivery time and waste against the previous route before scaling.
2. Hold scarce, perishable stock centrally and release it on demand.
3. Commission independent evaluation and say which results are peer reviewed.

Evidence

Score 3 of 4. Independent: a peer-reviewed Lancet Global Health paper (2022) plus a 2026 academic study reported by Penn, Wharton and HospiMedica. Limit: the 2026 paper was not opened; its figures are taken from secondary reports.

Evaluation method. Peer-reviewed retrospective analysis of delivery times and monthly expirations at 20 facilities (2022); outcome study of hospital inventory and mortality by Penn with Rwandan researchers (2026), method not reported in the sources opened.

Sources disagree. HospiMedica reports 40% lower blood product wastage from the Penn study; the Penn Today release does not state a wastage percentage. Think Global Health (2024) describes the Wharton study as not peer reviewed; 2026 coverage says it is published in a peer-reviewed journal.

Status. Ongoing: Think Global Health says the service delivers 75% of the national blood supply outside Kigali; 2026 reports say officials have expanded ports and products.

3 · Original sources

Read these in full. To challenge a fact or a grade, use the contact form at marluc.co.uk or the link on https://marluc.co.uk/case-studies/rwanda-zipline-drone-blood-delivery

[1] HospiMedica: Medical Drone Program Improves Blood Access and Patient Survival
https://www.hospimedica.com/critical-care/articles/294811654/medical-drone-program-improves-blood-access-and-patient-survival.html

[2] Wharton Magazine: How Rwanda Is Using Drones to Improve Health Care
https://magazine.wharton.upenn.edu/issues/fall-winter-2026/how-rwanda-is-using-drones-to-improve-health-care/

[3] Think Global Health: Drones Deliver Humanitarian Aid in Africa
https://www.thinkglobalhealth.org/article/drones-deliver-humanitarian-aid-africa

[4] The Lancet Global Health (2022) via Europe PMC: Effect of unmanned aerial vehicle (drone) delivery on blood product delivery time and wastage in Rwanda
https://europepmc.org/article/MED/35303465

[5] IEEE Spectrum: Zipline emphasizes safety with its delivery drones in preparation for U.S. operations (March 2019)
https://spectrum.ieee.org/zipline-emphasizes-safety-with-its-delivery-drones-in-preparation-for-us-operations

Government of Rwanda (Ministry of Health), with Zipline International website: https://www.moh.gov.rw

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VERSION HISTORY

v1.1 25 November 2026 Method update: technology type set to T9 (AI in physical systems) and controls re-checked against sources; the drones' parachute landing system recorded as a structural control.
v1.0 15 November 2026 First published