

Advanced Paramedic Ltd. Air Ambulance

Improving Care and Patient Outcomes

with epoc Blood Analysis System

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Case
Study



Advanced Paramedic Ltd. Air Ambulance: Improving Care and Patient Outcomes with epoc Blood Analysis System



"Much of our work is hospital-to-hospital transfers, mainly for rural medical facilities that can't handle major medical events. Helping to stabilize seriously ill patients, we quickly and safely transport them to higher levels of care at trauma or stroke centers that can be hundreds of miles away."

Brad Rideout

Team Lead

Advanced Paramedic Ltd. Grand Prairie Base
Peace River, Alberta

Background

Advanced Paramedic Ltd. (APL) provides 24/7 air ambulance services for Canada's Alberta Health Service. Working aboard specially outfitted fixed-wing aircraft, experienced paramedics care for critically ill patients during inter-hospital transport and/or for emergency care. The high-acuity planes serve as compact mobile ICUs or ERs, ensuring advanced medical care while in flight.

The ability to rapidly adjust the course of therapy while in the air can be a matter of life or death. Point-of-care testing (POCT) has become a vital tool for airborne critical care transport teams such as APL, informing them of up-to-the-minute changes in the physical and mental conditions of their patients.¹ The team now conducts blood gas, electrolyte, and metabolite testing at the patient's side with the handheld, wireless epoc® Blood Analysis System. Analysis of blood gases in particular plays a significant role in changing the course of ventilator therapy in flight: approximately 30 percent of the patients APL transports are intubated.

The APL air ambulance team goes above and beyond to deliver expert critical care management and emergency medical services. Flying in all weather conditions, they travel to locations throughout Alberta, as well as the neighboring provinces of Saskatchewan and British Columbia and even the far-reaching boundaries of the Northwest Territories.

APL operates from four bases throughout Alberta. In 2017, the company upgraded its fleet, working in tandem with Can West Air who purchased five new King Air 250 planes manufactured by Beechcraft. "Our aircraft were the first ones that Beechcraft specifically designed for air ambulances," says Rideout, "so early on, we led the world in air ambulance flight." Each APL air ambulance typically covers a 200-km (124-mile) radius. Their transport times average 1–2 hours, but some flights have taken as long as 4–6 hours. From takeoff to landing, sky paramedics are responsible for delivering advanced, if not lifesaving, care.

Problem

Temperature fluctuations

Alberta winters can be brutal, especially in the coldest months of January and February. Delivering care at the bitter cold edges of medicine presents challenges. APL air ambulances may fly in temperatures ranging from -50°C to 30°C (-58°F to 86°F). While the inside temperatures of the planes are maintained at $18\text{--}20^{\circ}\text{C}$ ($64.4\text{--}68^{\circ}\text{F}$), opening the aircraft door when entering and exiting may subject the internal environment to shifts in temperature. This environmental hazard caused issues with APL's previous handheld POCT devices. They were sensitive to temperature shifts, from the cold of winter to the heat of summer. Slow to acclimate, the previous devices delayed sampling due to temperature errors that prevented them from initializing. Says Rideout, "We were always trying to warm up or cool down the devices to get them to accept samples."

Complex inventory management

Operating four in-demand air ambulance bases and five aircraft, each with a handheld blood gas and chemistry device, requires an ample supply of POCT tests. The analyzer APL previously used required ordering and managing multiple cartridge types to run the required tests. The cartridges required refrigeration and had to come to room temperature prior to use for patient-side testing. "Once they were out of the fridge, they were only good for 2 weeks and that's not a long time," says Rideout. "If we weren't busy and didn't use them all in that window of time, we had to throw out the expired ones." Operators had to label the pouch with the date it was removed from refrigeration, and manually track and verify when the cartridge should be used by, as individual cartridges do not have barcodes to track the room temperature storage period.

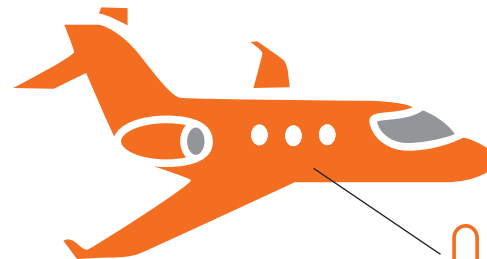
Manually identifying cartridges that had passed the 2-week window after being removed from refrigeration was critical, as the analyzer would still report results from a cartridge that had been at room temperature for too long. Discarding expired cartridges increased cost.

Time was also spent forecasting, ordering, and managing the different cartridge types based on dynamic needs and removing them from refrigeration in time for use in the field.



Outside

-50°C to 30°C
(-58°F to 86°F)



Inside

18°C to 20°C
(64.4°F to 68°F)

"With the epoc analyzer, it is rare that we can't obtain a sample due to temperature errors."

Brad Rideout



“Eliminating the need for refrigerators and the space to accommodate them has led to substantial cost savings for APL.”

Brad Rideout

Solution

In September 2017, APL made the switch to the epoc Blood Analysis System—state-of-the-art technology to match the company’s state-of-the-art aircraft. APL purchased six devices—one for each air ambulance in their fleet plus a spare. Rideout thoughtfully weighed the advantages of the epoc system and considered the benefits of each in APL’s unique clinical setting. From simplified inventory management and automated quality assurance to cost savings and ease of use, the Siemens Healthineers product was the right fit for the company’s high-volume air ambulance service. The epoc system employs a single bar-coded test card that does not require refrigeration, significantly reducing the burden of inventory management. “Looking carefully at both options, we selected the best option for our business,” says Rideout.

From the moment APL started evaluating the epoc system for inflight testing, its stability under a variety of temperatures greatly influenced the company’s decision to purchase. The epoc system is designed with a temperature sensor that can mitigate delays in sampling as the user has clear indication when the analyzer is not within the operating temperature range. The epoc system consistently remained within the appropriate operating range when used inside the air ambulance. The epoc Reader can be operated between 15°C–30°C and atmospheric pressures between 400–825 mmHg (Table 1). Internal Ambient Temperature and Barometric Pressure

Table 1. epoc System Specifications

Operating Temperature	15–30°C (59–86°F)
Charging Temperature	0–40°C (32–104°F)
Shipping/Storage Temperature	–20–45°C (–4–113°F)
Operating/Shipping/Storage Humidity	Up to 85% relative humidity, non-condensing
Barometric Pressure	400–825 mmHg (53.33–110kPa) Note: When operating between 2000m, (equivalent to 604 mmHg or 81 kPa) and 5000m (equivalent to 400 mmHg or 53.33 kPa) altitude, use only with the following component: AC Adapter Protek Power, Model PMP15M-10.

“For sure, the epoc analyzer is much more user-friendly.”

Sensor Monitors disable the Reader function if room temperature or atmospheric pressure falls outside of these ranges, and error code messages are displayed. The reliability of the handheld device allowed the team to make the best use of their time in the air to focus on their patients. “That feature was the biggest checkmark for us,” says Rideout. “With the epoc analyzer, it is rare that we can’t obtain a sample due to temperature errors.”

epoc System Advantages

The epoc system checked many boxes for APL, with benefits including:



13
critical testing
results on a single,
room temperature-
stable test card



Minimal
blood draw
(92 µl)



**Results in
less than
a minute**



Comprehensive
test menu



**Automated
quality assurance**
with bar-coded test cards
to eliminate use of
expired reagent



Streamlined
storage and
inventory management





"Eliminating the need for refrigerators and the space to accommodate them has led to substantial cost savings for APL," according to Rideout. He has also been impressed by "the short-learning curve of the epoc analyzer, with 30 to 40 minutes sufficient time to get new hires up and running after a single training session."

Other POCT users in Canada have also found the epoc system simple and easy to use.² One ambulance ground transport paramedic service recently purchased 10 units, with the purpose of using the epoc system to triage patients prior to taking them to the hospital, thereby reducing ER visits due to the COVID-19 pandemic. They also plan to use the epoc system to deliver home care by evaluating blood gases for patients recovering from surgery.

Transforming Care Delivery

More than 70% of medical decision making relies on laboratory test results.³ In prehospital settings, POCT aids in providing stabilizing care and immediately intervening to save lives and improve patient outcomes.³ From hospital pickup to receiving hospital handoff, the APL air ambulance team uses local hospital lab results when available and may perform full-panel patient-side testing using the epoc system as many as four times during a single trip.

"While we aren't with patients long enough to see reductions in mortality or days on a ventilator," says Rideout, "we have seen clinical improvements after we adjusted the ventilator settings based on epoc test results while onboard the plane." Thanks to the extensive testing capabilities of the epoc system, APL has contributed to improving patient safety and treatment as well as enhancing workflow for receiving hospitals. For example, POCT creatinine results can give hospital radiology departments a heads-up about patients' kidney function and tolerance for contrast dye prior to imaging.

"We have seen clinical improvements after we adjusted the ventilator settings based on epoc test results while onboard the plane."

Brad Rideout

"Once we hand over care at a receiving hospital, we'll let them know the creatinine is up or what the lactate levels are," says Rideout. "They are always happy to have the information to compare against their own testing. So, it's a fantastic value-add that we can pass along."

Timely testing for lactate levels has been shown to be invaluable in the care of patients with life threatening infections such as sepsis.⁴ A lactate level of ≥ 4 mmol/L is an indicator of severe sepsis or septic shock.⁴ For every hour a patient with hypotensive septic shock goes without antibiotics, the risk of mortality increases 7.6%.⁵ At Northwestern Medicine Central DuPage Hospital, a robust training program emphasizing the use of lactate testing in the context of the overall clinical picture and bedside testing improved compliance with lactate turnaround time, which improved sepsis bundle compliance.⁶ Monthly mortality rates in sepsis patients decreased from 41.7% to 8%, showing a larger reduction in mortality than results from the Surviving Sepsis Campaign (SSC) study.⁶

Conclusion

The ability to monitor patients during air ambulance transport with blood gas, electrolyte, and metabolite results available in less than a minute enables adjustment of ventilator settings and clinical improvement. Inventory management is streamlined, with 13 test results available on a single, bar-coded, room temperature-stable test card. The reliability of the easy-to-use epoc system frees the transport team to focus on patient care.

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The outcomes achieved by the Siemens Healthineers customers described here were achieved in each customer's unique setting. Since there is no typical hospital or laboratory, and many variables exist (e.g., hospital or laboratory size, case mix, level of IT adoption), there can be no guarantee that others will achieve the same results.

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