

# Alcor A-3708

## Case Report



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## 1. Summary

*Information was derived from multiple sources and was all converted to Mountain Standard Time (MST). For de-identification, dates are not shown. T-0 represents the date of cardiac arrest, T-X represents occurrences before T-0, and T+X represents occurrences following T-0.*

A-3708 was a 69-year-old, post-mortem notification, third-party signup with whole-body cryopreservation arrangements. This was a cryopreservation without cryoprotection (a straight-freeze procedure). The member had been pronounced legally deceased in Thailand at 16:34 hrs on T-0 days in April of 2024.

After recovery, the patient was flown to Alcor for cryogenic cooldown. The patient arrived at Alcor on T+13 days at 12:29 hrs. The cryogenic cooldown was initiated on T+13days at 13:27 hrs and terminated on T+18 days at 21:30 hrs. The patient was transferred to long-term care at liquid nitrogen temperature immediately following termination of cooldown.

## 2. Patient Assessment

### T-0 days

This patient had passed away in a hospital in Thailand. The time of pronouncement of legal death was 16:34 hours. This would be a straight freeze procedure due to having to wait for contracts to be signed, funding arranged, and travel time. Therefore, the family was immediately advised to surround the patient with dry ice to minimize ischemic damage to the patient as much as possible. The family complied and completely surrounded the patient with 275 lbs. of dry ice.

The MRD remained in contact with the patient's family, a funeral home employee, and the funeral director to ensure the patient was maintained at dry ice temperature. Dry ice was replenished approximately every 12 hours with 10-30 lbs.

## 3. Deployment

### T+3 days

The Alcor CEO received notification at 11:05 hrs that contracts and funding had been received and authorized the deployment of the DART team to begin travel to Thailand. The DART team consisted of 4 DART team members (2 DART leads from Arizona, 2 regional DART trainees, and 1 trainee from GHT-Global Ltd. (Ground Hawk Training), the Canadian equivalent of DART in the US.

A plan was made to fabricate and ship the Alcor whole-body dry ice shipper. However, due to restraints and complications with the shipping company, it was unable to be picked up (see Discussion section) and it was necessary to have the funeral home in Thailand construct a shipper.

## 4. Patient Recovery and Transport

### T+5 days

The DART team arrived in Thailand at approximately at 01:58 hrs and went to the hospital morgue. They attempted to place internal temperature probes, but the patient, already surrounded with dry ice, was already too solid to place them (see Discussion section).

### T+6 days

The DART team returned to the morgue at 02:20 hrs to add 30 lbs. of dry ice to the patient.

### T+7 days

The funeral home obtained the death certificate from the hospital at 00:43 hrs (see the Discussion section). At 14:44 hrs, the MRD coordinated with a California funeral director to receive the patient at the cargo department when the flight was to arrive in the US.

### T+8 days

At 20:35 hrs, DART transferred the patient from the hospital morgue in Thailand to the Ziegler shipping case and used existing dry ice to completely surround the patient inside the Ziegler. At 21:58 hrs, the patient, properly replenished with dry ice, was handed over to the funeral director in order for them to transport the patient to airport cargo (see the Discussion section).

### T+9 days

The flight for the patient departed at 07:05 hours and was estimated to arrive in California the next day. The DART team's flight left approximately 10 hours later with an estimated time of arrival of 14:30 hrs the next day.

### T+10 days

The patient landed in California at 14:27 hrs. The California funeral director was at the airport and while he awaited DART's arrival, he began working on the paperwork for obtaining the patient. At 18:17 hrs, customs approved the transfer of custody from the airline to DART. At 19:07 hrs, DART obtained physical custody of the patient. DART added 20 lbs. of dry ice to the patient, though noted that the dry ice was still very well intact from transit.

### T+10 to T+13 days

DART remained in California with the patient, topping off dry ice as needed, awaiting the transit permits.

### T+13 days

DART relocated near the Arizona border in Blythe, CA at 07:34 hrs, so that as soon as the transit permits were issued, they could immediately continue on to Alcor. At 10:09 hrs, DART received the transit permits and departed Blythe for Alcor.

## 5. Cooling to Liquid Nitrogen Temperature

At 12:29 hrs, the patient arrived at Alcor. Transport temperature data was not acquired for this case due to international shipping authorities forbidding the temperature logger. This was also not necessary because the patient had been stored on dry ice upon arrival of DART. Dry ice fully surrounding the patient was constantly replenished by the field team and the patient arrived at Alcor still fully enveloped.

Computer-controlled cryogenic cooldown was initiated at 13:27 hrs on T+13 days, plunging to  $-80^{\circ}\text{C}$  and descending thereafter at  $-1^{\circ}\text{C}/\text{hour}$  to liquid nitrogen temperature.

Immediately following the start of cryogenic cooldown, the primary lid valve failed, leaking liquid nitrogen even when closed. The team replaced the valve set within three minutes and resumed the cooldown. The replacement valve set was designed for a small dewar, and the narrow sprayer tip caused issues with the PID (Proportional, Integral and Derivative, the pump control algorithm) tuning of the cooldown system. As the temperature dropped the poor tuning became noticeable. The team then adjusted the PID parameters, and the cooldown continued uneventfully.

On T+18 days at 21:30 hrs, cooldown was terminated. The patient was transferred to long-term care at liquid nitrogen temperature on T+18 days at approximately 21:35 hrs.

## 6. Timeline and Time Summaries

### Timeline

T-0	16:34	Time of Pronouncement
T-0	18:34	Notification of legal death
T-0	19:00	Family starts dry ice cooling (time estimated)
T+1	19:00	Dry ice temperature achieved (24 hours, estimated)
T+9	07:05	Patient shipped from remote location
T+13	12:29	Arrival of patient at Alcor
T+13	13:27	Start of patient cryogenic cooldown from -79°C to -196°C
T+18	21:30	End of cooldown to LN2
T+18	21:35	Transfer of patient to long-term care at LN2 temperature

### Time Summaries

Event Duration hr:min		days	time	
02:26	From: Till:	T-0 T-0	16:34 19:00	Time of Pronouncement Family starts dry ice cooling (time estimated)
26:26	From: Till:	T-0 T+1	16:34 19:00	Time of Pronouncement Dry ice temperature achieved (24 hours, estimated)
307:55	From: Till:	T-0 T+13	16:34 12:29	Time of Pronouncement Arrival of patient at Alcor
00:58	From: Till:	T+13 T+13	12:29 13:27	Arrival of patient at Alcor Start of patient cryogenic cooldown from -79°C to -196°C
308:53	From: Till:	T-0 T+13	16:34 13:27	Time of Pronouncement Start of patient cryogenic cooldown from -79°C to -196°C

## 7. Discussion

### Patient Recovery

Third party interference (non-governmental): Restraints and complications at the US shipping company used on this case prevented the transport of the dry ice shipper fabricated at Alcor, making it necessary to have one built at the funeral home in Thailand. Alcor has had past issues with this company and will no longer use them when shipment of case-related items needs to be shipped in a hurry.

The patient had been properly stored on dry ice. Due to the low temperature, the patient's nares were frozen shut, making it impossible for DART to add the temperature probes when they arrived in Thailand. DART will develop a way to instruct a family on placing temperature probes prior to adding dry ice in the future. However, even if the thermocouples could have been placed, due to Thailand shipping regulations not allowing foreign objects in the shipper, they would have needed to be removed, causing damage to the patients. For the same reason, no burr hole was made, and no burr hole thermocouple was placed.

### Patient Transport to Alcor

International Considerations (to be part of a Thailand SOP):

In Thailand, the funeral director is the only person legally allowed to transport human remains. DART cannot act as an agent of the funeral director.

In Thailand, the funeral director cannot obtain possession of a patient without first having the death certificate. The death certificate is issued by the hospital where the patient is pronounced legally deceased. This is not an issue, but a note for future consideration and knowledge.

Numerous international airlines will decline boarding with a one-way ticket and no visa. The DART personnel were able to successfully gain entry to Thailand on this case, however, in the future, confirmation with the airline should be made about refundable ticket options.

The Thailand visa requirements were not fully understood and could have led to potentially being denied entry into Thailand. Proper understanding and preparation regarding visa requirements are crucial to avoid entry issues and to ensure smooth operational execution. In the future, these issues will be discussed with the international funeral home and expatriation service contracted to assist with an international case.

The funeral home used on this case provided a dry ice shipper that was significantly smaller than required, described as a Thai version of an XL shipper, which equated to a medium size in the U.S. This discrepancy made positioning the patient challenging and compromised the amount of dry ice that could be used. Additionally, due to language barriers, it was impossible to acquire insulation foam sheets, further hindering the process. To prevent such misunderstandings in the future, a database of visual aids has been made, including detailed pictures and diagrams of all equipment and their specifications. This visual database can be used during communications with international partners to clearly convey requirements.

Despite the availability of several interpreters provided by the family, effective communication remained a challenge. Factors contributing to these difficulties included inconsistent Wi-Fi availability, which hindered real-time translation and communication

efforts. To address these communication challenges, DART will continue to refine the process of preparing typed messages for translation.

Third party interference (government of Thailand): Local regulations in Thailand prohibit the inclusion of foreign objects with patients, such as temperature probes and data loggers. This restriction posed challenges as it conflicted with established Alcor protocols. Local laws and regulations can vary significantly and may impact the execution of standard operational practices. In the future, these issues will be discussed with the international funeral home and expatriation service contracted to assist with an international case.

DART received robust support from the Alcor engineering staff to construct and prepare a dry ice shipper prior to deployment. The effective coordination and readiness significantly contributed to the smooth execution of the deployment process. The successful preparation underscored the value of teamwork and comprehensive pre-deployment checks.

The immediate availability of essential documents on Slack enabled flawless logistical operations. This thorough preparation allowed the team to execute their responsibilities without any logistical hitches, contributing directly to the success of the mission.

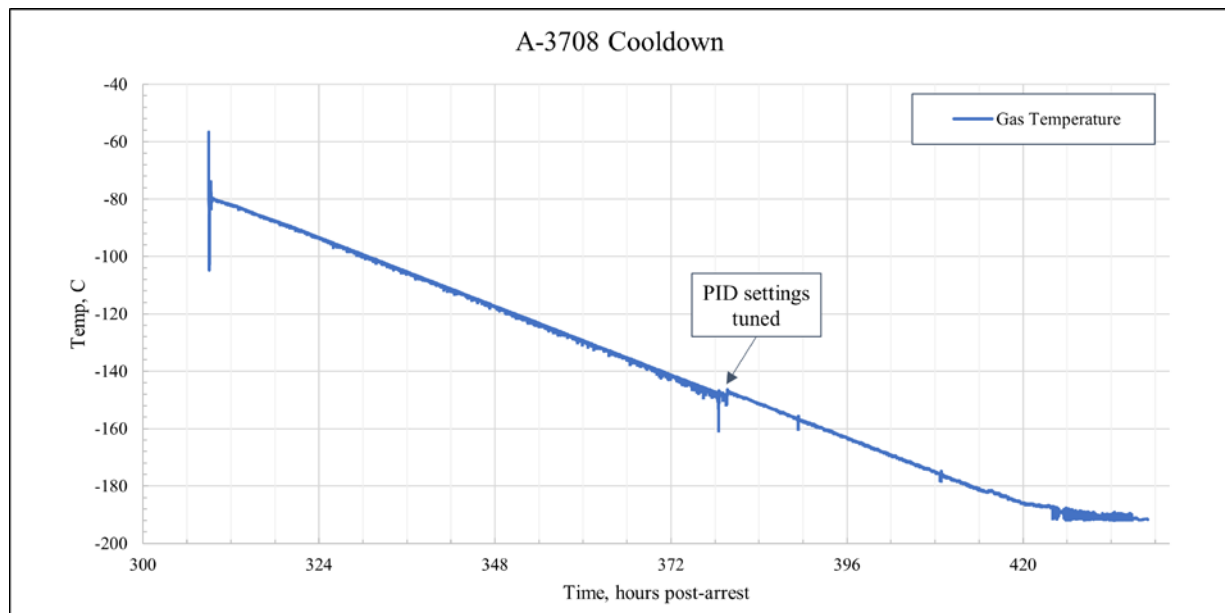
The MRD's proactive and clear communication ensured that both the funeral home and the families were well-informed about DART's operational needs and procedures. This high level of awareness and receptiveness facilitated interactions and cooperation, which were critical to the smooth execution of the mission.

The ability for GHT-Global Ltd. (Ground Hawk Training) (GHT), 's (the Canadian equivalent of DART in the US) to work seamlessly with DART highlights the potential for greater achievements through inter-team cooperation. Continuing and strengthening the partnership with GHT is crucial to expanding Alcor's international capabilities.



## 8. Cryoprotection and Temperature Graphs

Transport temperature data could not be obtained for this case due to repatriation from Thailand and their restriction that no foreign objects were allowed inside the shipper. This was unavoidable. Also, the member was placed on dry ice in Thailand prior to deployment of the DART team, so placing the temperature probes nasally was not possible without causing damage to the patient. As a result, it was not possible to create transport temperature graphs.



## 9. CT Scans

### Cryoprotectant Distribution (Post-cryopreservation CT scan)

Because this was a straight-freeze procedure, no CT scans were obtained.