UNITED STATES ARMY MEDICAL MATERIEL AGENCY PARTICIPATION IN INTEGRATED LOGISTICS AERIAL RE-SUPPLY (ILAR) EVENT 4
13-18 FEBRUARY 2005

YUMA PROVING GROUNDS, ARIZONA

AFTER ACTION REPORT

TRIP DATES: 13-18 February 2005
DESTINATION: Yuma Proving Grounds, Arizona

PURPOSE: To attend the Integrated Logistics Aerial Re-supply test of the SnowGoose unmanned aerial vehicle (UAV) and evaluate its use for delivering class VIII medical supplies.

MAJOR COMMANDS/AGENCIES INVOLVED:
United States Special Operations Command (USSOCOM), Yuma Air Delivery and Soldier Systems Division, 4th Psychological Operations Group (Airborne), Logistics Transformation Agency (Ft Belvoir), US Army Soldier Systems Center (Natick), United States Army Medical Materiel Agency (USAMMA), Army Medical Department.

SNOWGOOSE OVERVIEW:
The SnowGoose (CQ-10A) has been developed for a primary mission of delivering leaflets and Psychological Operations (PSYOP). The SnowGoose is an autonomously guided, powered parafoil system that can be ground launched from a HMMWV or air launched from a cargo aircraft. Deployment. operations, and recovery require a 4 man team that can be completely trained to standard on the system in 3 weeks.

The SnowGoose has 6 bays that can hold up to 100 pounds of fuel or cargo in each bay. The cargo and parachute must fit within the bays that are 29.8" tall x 17.75" wide x 10.3" deep. The cargo bays have a gravity feed trap door on the bottom that releases the cargo at pre-determined coordinates.

MEDICAL LOAD RESULTS:

MONDAY, 14 FEBRUARY 2005

Test drops to determine the proper size parachutes and rigging methods were conducted on Monday morning. During these test an M-5 bag containing a trauma kit, VaxiPak, and Gamow bag were each dropped from 1000 feet AGL using a static line deployment of the parachute. All loads landed successfully within the drop zone and showed no signs of damage. All items were opened and inspected for damage after the drops and no damage could be found.

M-5 Trauma Kit

VaxiPak

Inventory of M-5 Trauma Kit

Quan	Description
2ea	IV Start Kit
4ea	Large Kerlix – 4.5” x 4.1 yd
2ea	First Aid Dressing (7.5” x 8”) 6510-00-201-7430
1ea	First Aid Dressing (11.75”) 6510-00-201-7425
2ea	Instant Cold Compress
4ea	500ml Lactated Ringer
6ea	Muslin Bandage, Compress 6510-00-201-1755
1ea	Small Sharps Container
2ea	SAM Splint
1ea	Suction Apparatus 6515-01-516-2554
4ea	Compressed Gauze Bandage 6510-01-503-2117
1ea	12”x16” Abdominal Trauma Dressing
2ea	Sterile Compressed Bandage – 8”x10” Abdominal
2ea	Eye Dressing 6545-00-853-6309
4ea	Orange Chem Lights
10pr	Exam Gloves
6ea	1ml vial Diphenhydramine 50mg/ml
2ea	25ml vial 2% Xylocaine
1ea	30ml vial Epi 1:1000

While the test drops were taking place, Kevin Lintereur and Major Tavella picked up the rest of the medical equipment that had been shipped in for the test. VaxiPac’s were taken to the Yuma Troop Medical Clinic to be stored in their refrigerator in order to obtain proper temperature. A mission planning briefing was held Monday afternoon for the test drops that would occur on Tuesday.

TUESDAY, 15 FEBRUARY 2005

Mostly Sunny
Wind 5-10 mph
High 72 degrees

Mission Plan:

Pass # / Time	Load Type / Recovery System	Deployment Technique	Wt (lb)	Altitude AGL (Ft)
1 1000-1045	SnowGoose 8 – Takeoff (C-17 Runway)	HMMVV	-	-
2 1030-1145	SnowGoose 9 – Takeoff (C-17 Runway)	HMMVV	-	-
3 1320-1300	SnowGoose 9 – Drop One Case of MREs	HALO	30	1164
4 1230-1300	SnowGoose 9 – Drop M-5 Bag - Trauma	Static	22	1000
5 1300-1330	SnowGoose 9 –Drop 40 lbs - Leaflets	-	40	TBD
6 1300-1330	SnowGoose 9 – Landing (C-17 Runway)	-	-	-
7 1330-1400	SnowGoose 8 – Drop 5 Gallon Water Container	HALO	45	1540
8 1330-1400	SnowGoose 8 – Drop GHC w/Blood 2 ea.	Static	20	1000
9 1400-1430	SnowGoose 8 – Drop 80 lbs. Leaflets	-	80	TBD
10 1400-1430	SnowGoose 8 – Landing (C-17 Runway)	-	-	-

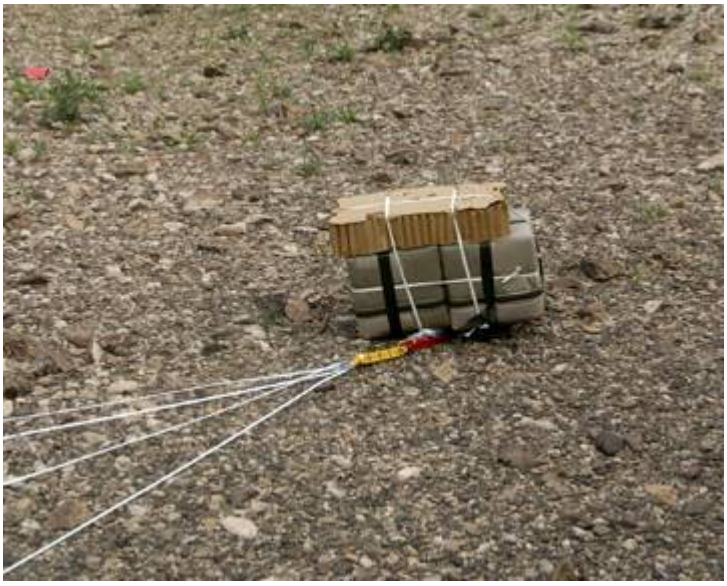
Note: SnowGoose 9 also carried 2 Golden Hour Containers w/blood during it's entire mission and landed with the blood on board.

GHC Being Released

GHC Landing

GHC as Landed

GHC as Landed



Initial Inspection at Drop Zone

GHC Landed With SnowGoose

Results:

All drops were successful with no damage noted to any of the loads.

Golden Hour Containers & Blood:

The four Golden Hour Containers (GHC) each contained 4 units of blood. Two of the GHC's were provided by the Special Operations Command Surgeons office and the other two GHC's were on loan from the manufacturer (Minnesota Thermal Science). Blood was provided by Walter Reed Army Institute of Research, Blood Storage Branch. Dr. Victor Macdonald is the chief of the blood storage branch and is the POC at WRAIR for the blood.

The blood needed to be packed into the SnowGoose Monday afternoon for the Tuesday morning drop. Because of this time frame we were unable to ship the blood Fed-Ex to Yuma because Fed-Ex does not offer Sunday service. Arrangements were made with United Airlines to check the blood with our luggage on the flight from Dulles to Yuma. Two GHC were placed inside a Collins box (without the Styrofoam cooler) and bubble wrap was added for protection during shipment. Two Collins boxes were used to transport the 4 GHC's and blood.

Attachment 1 contains the report from Walter Reed Army Institute of Research and all the test data that was collected on the blood. The following is an explanation of the ambient temperatures shown in the graphs:

Hour 10 – Flight from Dulles to Yuma, AZ
Hours 15-25 Collins boxes containing GHC kept at room temperature
Hours 25-35 Collins boxes transported in vehicle to staging area where the GHC's were removed and rigged
Hours 35-50 GHC sat in the warehouse overnight at room temperature.
Hour 53 GHC on SnowGoose. GHC's retrieved and packed back into Collins boxes with bubble wrap. Blood was shipped back to WRAIR via Fed-Ex overnight delivery.

GHC Rigged for Test

Two GHC's were loaded into each of the two cargo bays for the test. It was confirmed during packing that it is possible to fit 4 GHC's and parachute into a single SnowGoose cargo bay. Each GHC holds 4 units of blood making it possible to drop up to 16 units of blood per cargo bay.

The M-5 trauma bag had a second successful drop. Once back at the hangar the contents were inspected and no damage could be found.

WEDNESDAY, 16 FEBRUARY 2005

Partly Cloudy
Scattered morning showers
Wind 5-10 mph
High 73 degrees

Pass # / Time	Load Type / Recovery System	Deployment Technique	Wt (lb)	Altitude AGL (Ft)
1 0930-1000	SnowGoose 8 – Takeoff (C-17 Runway)	HMMVV	-	-
2 1030-1100	SnowGoose 9 – Takeoff (C-17 Runway)	HMMVV	-	-
3 1130-1200	SnowGoose 8 – Drop Package of Repair Parts	Static	50	2250
4 1130-1200	SnowGoose 8 – Drop M-5 Bag – IV's	Static	15	1000
5 1200-1230	SnowGoose 9 –Drop 40 lbs - Leaflets	-	40	TBD
6 1200-1230	SnowGoose 8 – Landing (C-17 Runway)	-	-	-
7 1230-1300	SnowGoose 9 – Drop Medical Equipment	HALO	70	3100
8 1230-1300	SnowGoose9 – Drop VaxiPak	Static	12	1000
9 1300-1330	SnowGoose 9 – Drop 40 lbs. Leaflets	-	40	TBD
10 1330	SnowGoose 9 – Landing (C-17 Runway)	-	-	-
*NOTE: SnowGoose 8 missions canceled and landed early due to mechanical problems.				

SnowGoose 8 & 9 were launched on schedule. After SnowGoose 8 reached the drop zone mechanical problems with steering arose and SnowGoose 8 was programmed to return to the airfield and land without dropping any loads.

VaxiPak – The VaxiPak was dropped from 1000 feet using a static line to open a 12” parachute. The VaxiPak had a slow rate of decent and landed within the drop zone. Internal temperature sensors did not detect any temperature variations at altitude in either the VaxiPak that was dropped or the VaxiPak that remained on the UAV. Inspection of the VaxiPak after the drop did not show any damage to the containers.

Medical Equipment – The Surgeons office at the Special Operations Command provided the medical equipment for the drops at Yuma. The first piece of equipment was a new mini Propaq that has not yet been approved by the FDA for patient use. The second piece of equipment was a small Automatic External Defibrillator (AED). Both items were individually packed in a pelican cases. The AED was then wrapped in cellulose packing material and put inside a wooden ammunition crate. The ammunition crate was placed on 3” corrugated cardboard and then wrapped in bubble wrap for additional protection. The Propaq was attached to the top of the crate the AED was contained in.

The plan for the medical equipment was for it to be dropped from 3100’ AGL under a drogue chute for 12 seconds. After the 12 seconds pyrotechnic cutters release the main 16” parachute at about 1000’ AGL. The main chute did not open as planned and the medical equipment landed using only the drogue chute. The rate of decent under the drogue chute was much higher than wanted but on initial inspection no damage was observed. The equipment was taken back to the hanger and further inspections and functions checks were done on the two pieces of equipment. No deficiencies with the medical equipment could be found.

The reason for the failure of the main chute to open was attributed to the way the load was rigged. Ticket 3 cord is a type of string that is used to keep the parachute wrapper closed until it is time for the parachute to deploy. Ticket 3 has a tensile strength of 2 pounds, when the pyrotechnic cutters fired the drag from the drogue chute should have been more than 2 pounds allowing the main chute to open. Even though accepted rigging methods were used in preparing this load the main chute did not open. Test data collected during this trip showed that on loads under 30 pounds the ticket 3 cord has a high probability of not releasing the wrapper and allowing the parachute to deploy. Recommendation is not to use ticket 3 cord to secure the parachute wrapper for loads under 30 pounds. Further testing is needed to confirm this finding and validate possible solutions.

AED & Propaq as Landed

VaxiPak as Landed

VaxiPac rigged for test

VaxiPac Being Inspected After Test

AED & Propaq Before Drop

AED Inspection After Test

Propaq Inspection After Drop

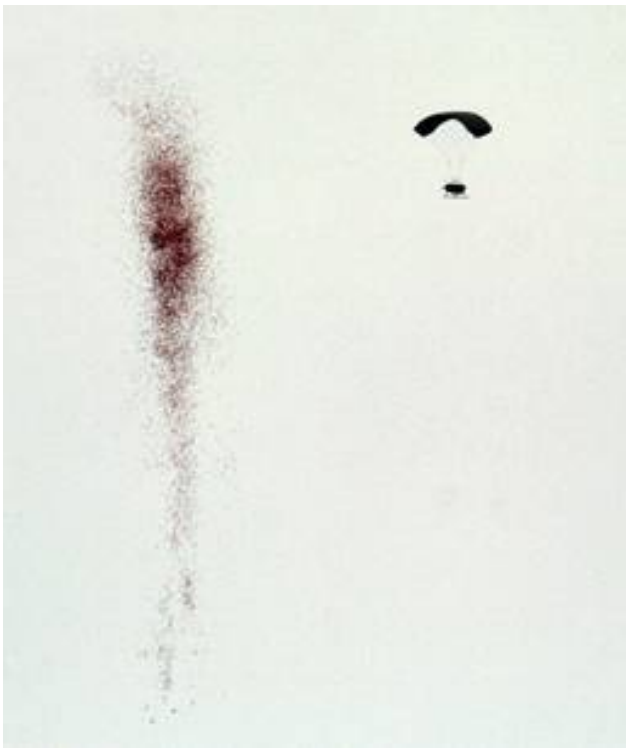
Gamow Bag After Drop

Leaflet Drops:

The soldiers that were responsible for the SnowGoose during the tests were from the 4th Psychological Operations Group (Airborne) out of Fort Bragg. The four soldiers have completed the 3 week training course and attended the Yuma tests for more practice as their unit is the first to be fielded a SnowGoose system. Since their use of the SnowGoose will be primarily PSYOP and leaflet drops, on each day a leaflet drop was included in the missions for them to practice their skills.

The SnowGoose calculates wind speeds based on flight performance and in turn calculates the optimum release point for leaflets to land within a designated area.

100 Pounds of Leaflets Dropped From SnowGoose



Thursday 17 February, 2005

The loads from Wednesdays test were inspected Thursday morning and equipment was packed for shipment. The three VaxiPac's that were used during testing were sent back to USAMMA where temperature data was downloaded from the sensors.

Major Tavella and Kevin Lintereur departed Yuma on Friday morning and returned to Ft. Detrick.

NOTE: At the time of this report data had not yet been released on the Yuma tests detailing rigging methods used, landing distance from IP, and landing velocities of loads.

ATTATCHMENT 1: The following report was provided by Dr. Victor Macdonald of Walter Reed Army Institute of Research (WRAIR), Blood Storage Branch.

The attached file contains photographs of the Golden Hour Containers (GHCs) and their contents (PRBC load) after they returned to WRAIR. As you can see, nothing was amiss. The only deformations in the Vacuum Insulation Panels (VIPs) came from the ties used to lash the boxes together in paired sets. The inner black Thermal Isolation Chambers (TICs) and their packed red blood cell (PRBC) loads appeared as they were before being shipped to Yuma.

All four GHCs functioned according to specifications during the entire four day period, ultimately maintaining a steady 3.5-3.7 Deg C temperature (see graphs). The GHCs were pre-conditioned to maintain their PRBC loads within the required temperature range in the face of warm ambient temperatures (i.e., above freezing). Each box contained four 250 ml PRBC units along with a two-channel ESCORT iLog temperature recorder set to record and store temperature readings at 35 second intervals for the entire time that they were away from WRAIR. In each box, a thermister temperature probe was inserted into the middle of the load and one was attached to the outside of an end PRBC unit (against the inner wall of the frozen TIC). A single channel iLog unit was attached to the strap of each GHC to record corresponding individual ambient temperatures.

Four PRBC units were drawn three days prior to being sent to Yuma (WRAIR1 AS-5). Four PRBC units were drawn 29 days earlier (WRAIR2 AS-5), and eight twelve day old PRBC units were purchased from the American Red Cross (Red Cross AS-1). This provided for a range of red cell ages that could be tested for viability in the Yuma drop. A full range of in vitro red blood cell viability assays were carried out just before the units were sent to Yuma and immediately upon their return to WRAIR.

GHC 1 and 2 were each loaded with two PRBC units from WRAIR1 and two PRBC units from WRAIR2. This ensured that fresh and old WRAIR cells would experience identical stresses throughout the exercise. These are the units that were subjected to a static line drop from the Snowgoose vehicle. All eight of the Red Cross units were packed into GHC 3 and 4, which were subjected to a Snowgoose flight and air landing.

The results of the in vitro assays were grouped and analyzed by age and origin. This meant that the four PRBC units of WRAIR1 were grouped together, as were the four units from WRAIR2 and the eight Red Cross units. Since week to week storage-related changes occur in all parameters measured it seemed reasonable to view the data by plotting the means of each measured parameter for each group versus their storage age. In most cases we could then include identical historical data from red cell storage studies carried out in this laboratory to determine if the changes observed before and after the ILAR drops demonstrated an abnormal trend.

The graphs demonstrate an overall conformance to normal storage trends. That is, there is no evidence that any of the groups of red cell units were adversely affected by the ILAR exercise. The extremely low levels of hemolysis upon return to WRAIR and the high levels of ATP indicate that the units remained safe for transfusion, just as if they were left under normal blood bank storage conditions over the same period of time. The decrease in pH and increase in lactate production indicate normal metabolism. The observed drop in 2,3-DPG, while precipitous, is consistent with a time-dependent process that is normally seen in red blood cells stored for a similar period.

The bottom line is that our evidence supports the conclusion that transfusable units of packed red blood cells can be delivered by the Snowgoose system.

GHC Shipping Containers After ILAR Test

View 1

View 2

GHC 1 & 2 After Static Line Drop

1 Front

2 Front

1 Back

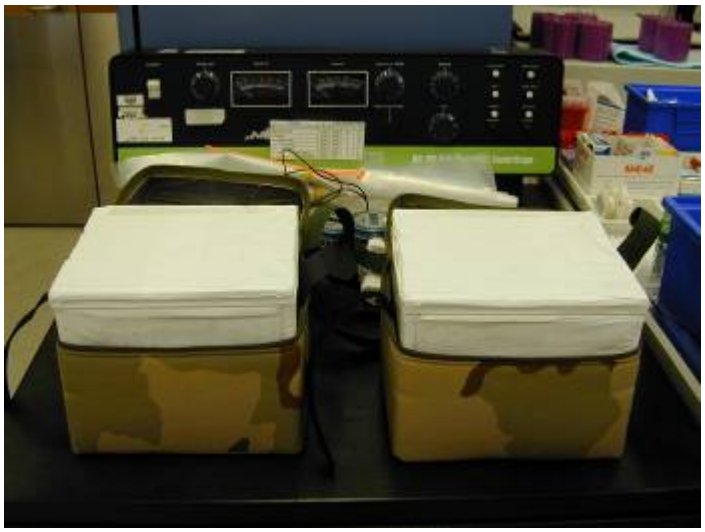
2 Back

GHC 3 & 4 After Air Landing

3 Back 4 Front

3 Front 4 Back

GHC 1, 2, 3, & 4 VIP Tops



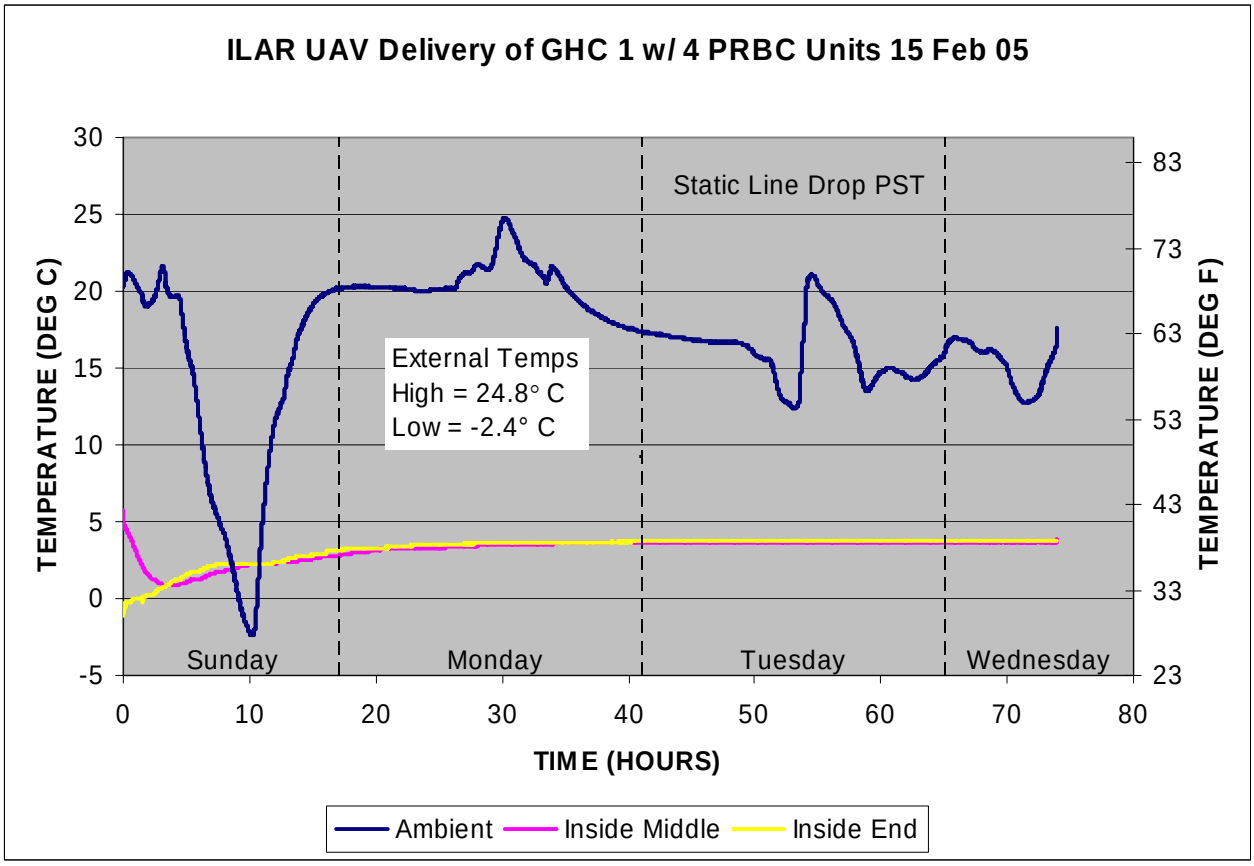
1 & 2 After Static Line Drop

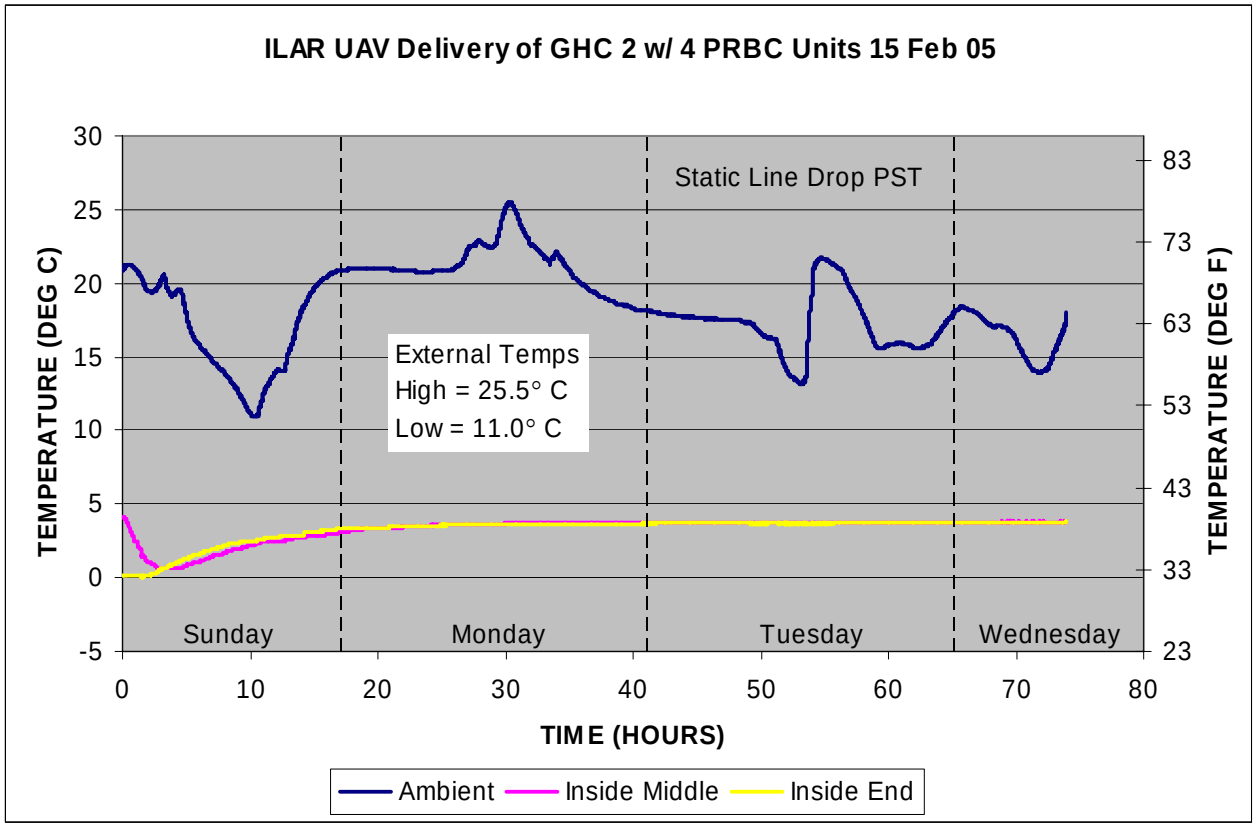
3 & 4 After Air Landing

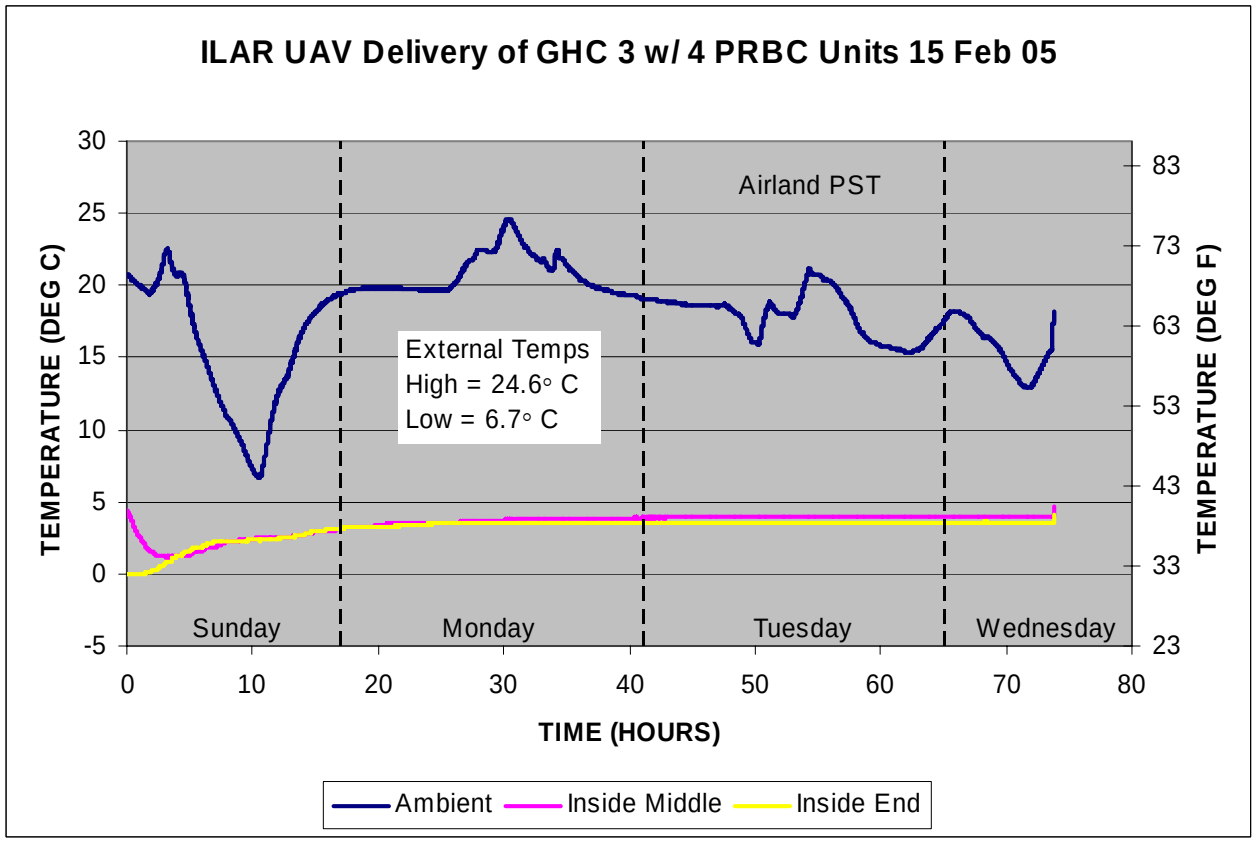
GHC 1, 2, 3, & 4 TICs & PRBC Loads

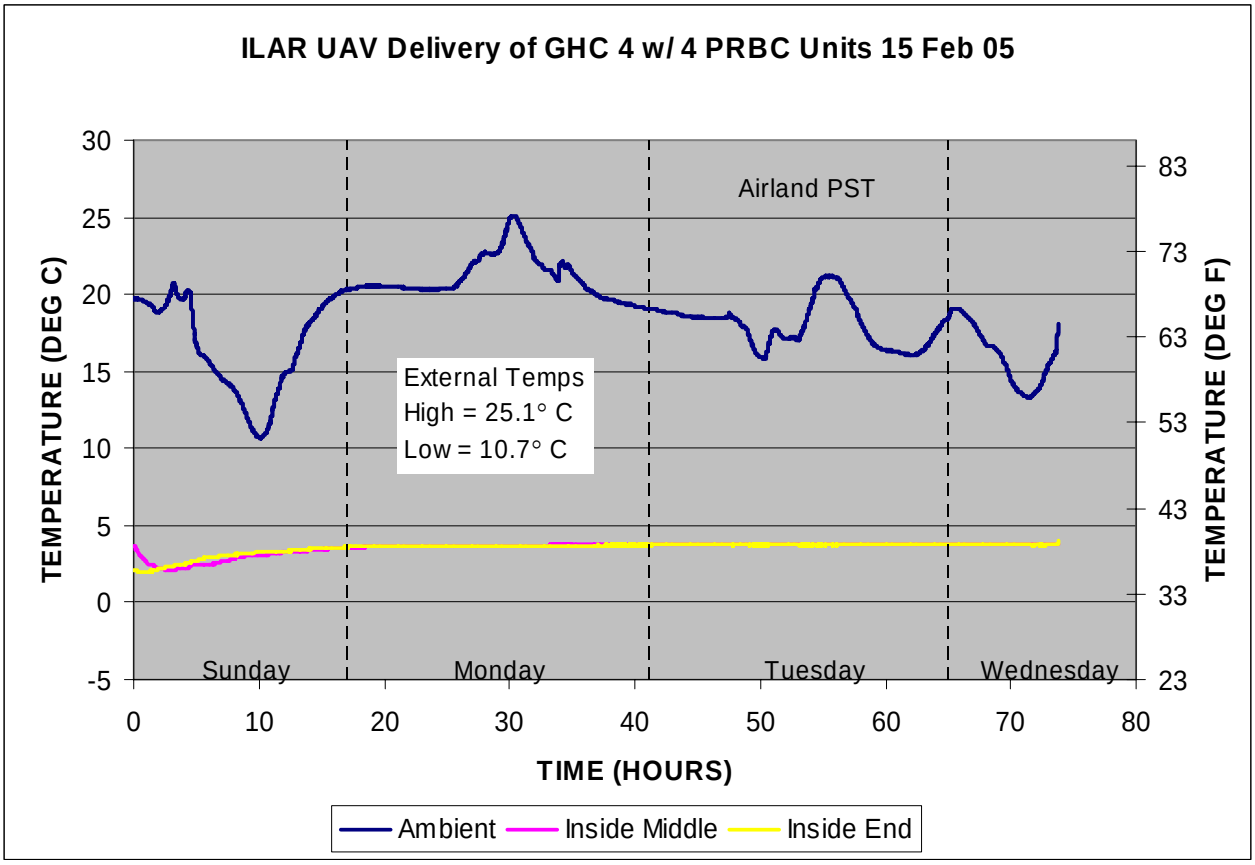
1 & 2 After Static Line Drop

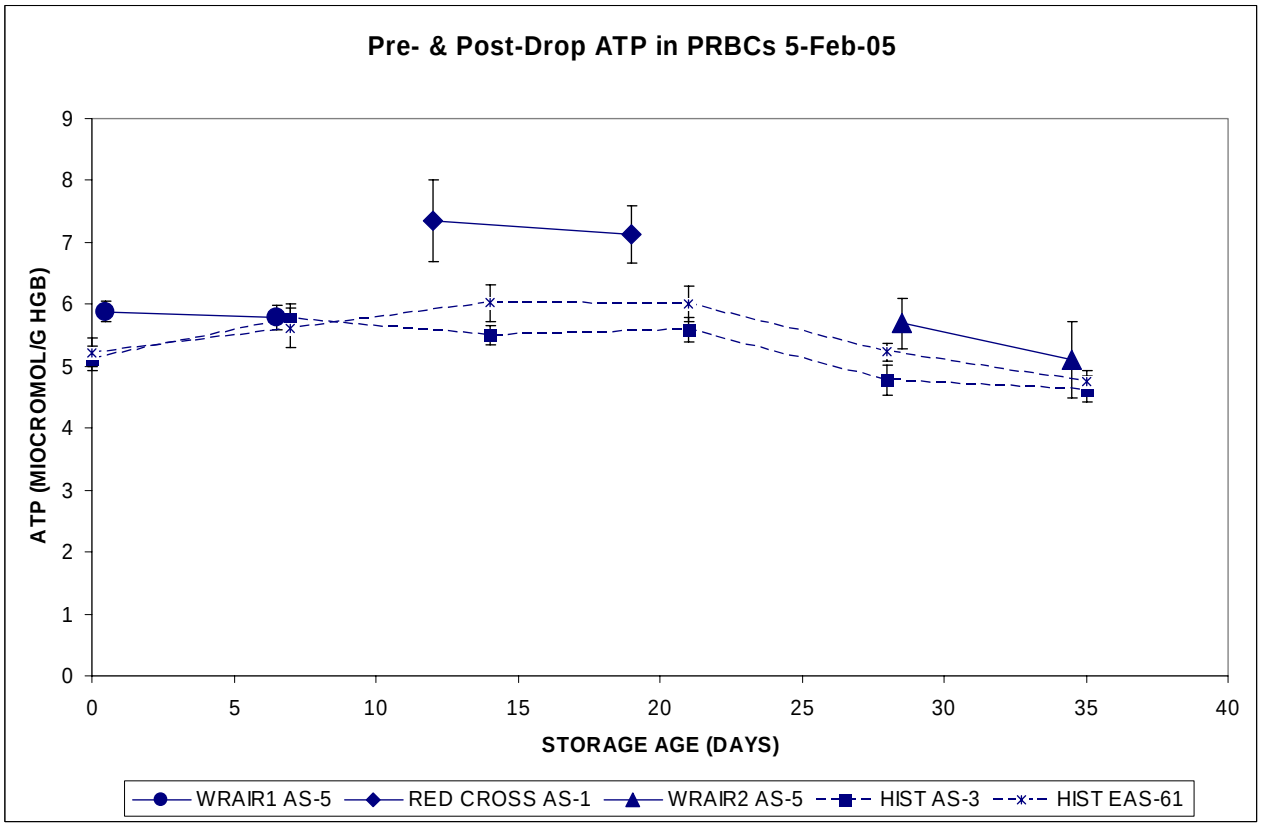
3 & 4 After Air Landing

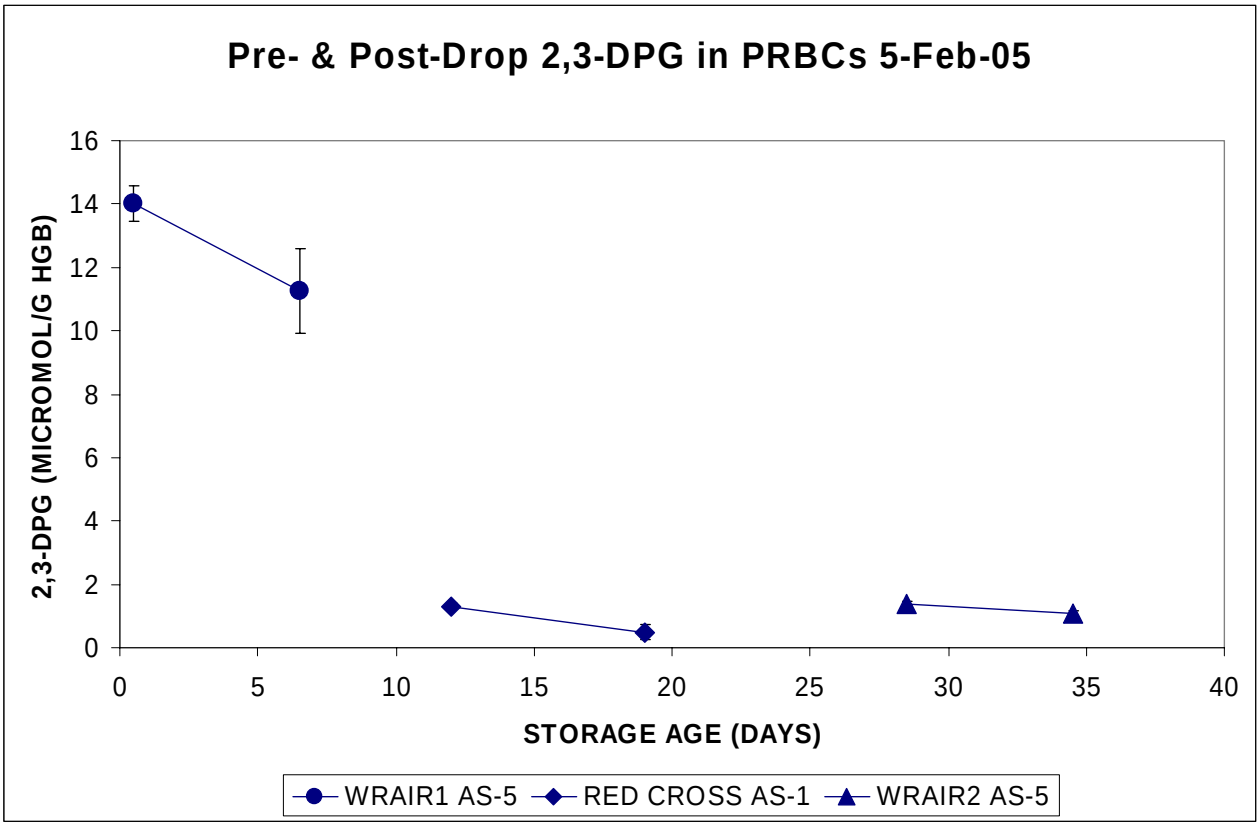


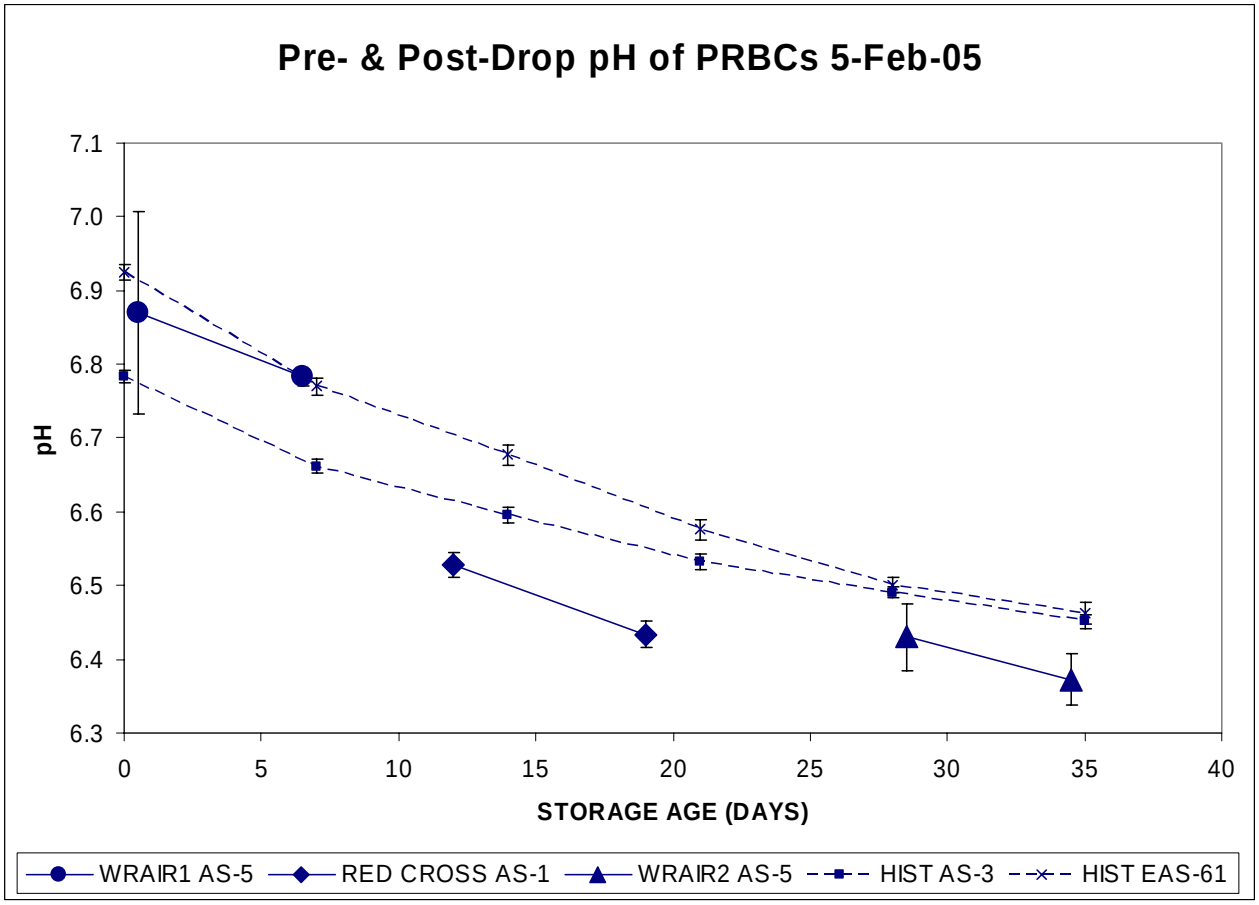

ILAR UAV Delivery of GHC 2 w/ 4 PRBC Units 15 Feb 05
Static Line Drop PST
External Temps
High = 25.5° C
Low = 11.0° C
Sunday
Monday
Tuesday
Wednesday
TEMPERATURE (DEG C)
TEMPERATURE (DEG F)
TIME (HOURS)
Ambient
Inside Middle
Inside End

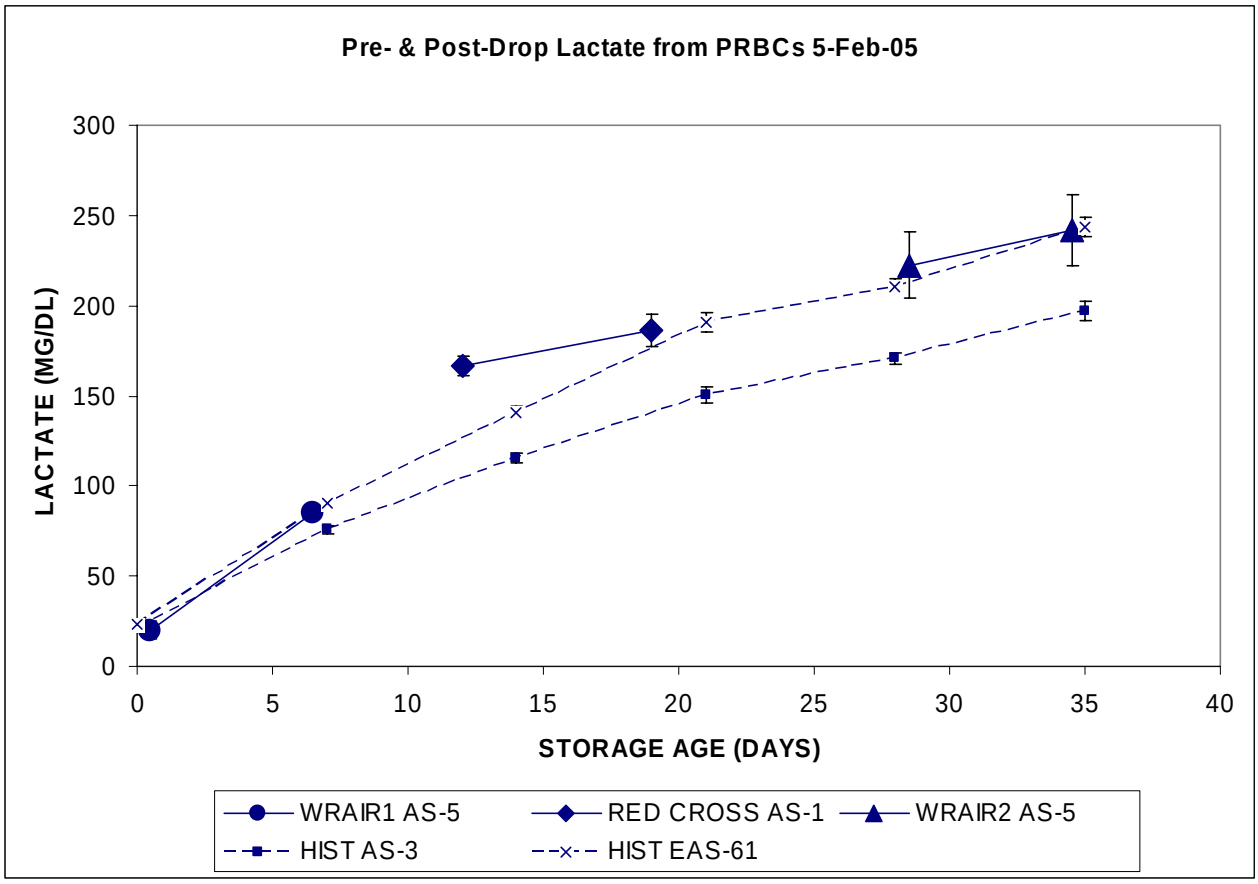

ILAR UAV Delivery of GHC 3 w/ 4 PRBC Units 15 Feb 05
Airland PST
External Temps
High = 24.6° C
Low = 6.7° C
Sunday
Monday
Tuesday
Wednesday
TEMPERATURE (DEG C)
TEMPERATURE (DEG F)
TIME (HOURS)
Ambient
Inside Middle
Inside End

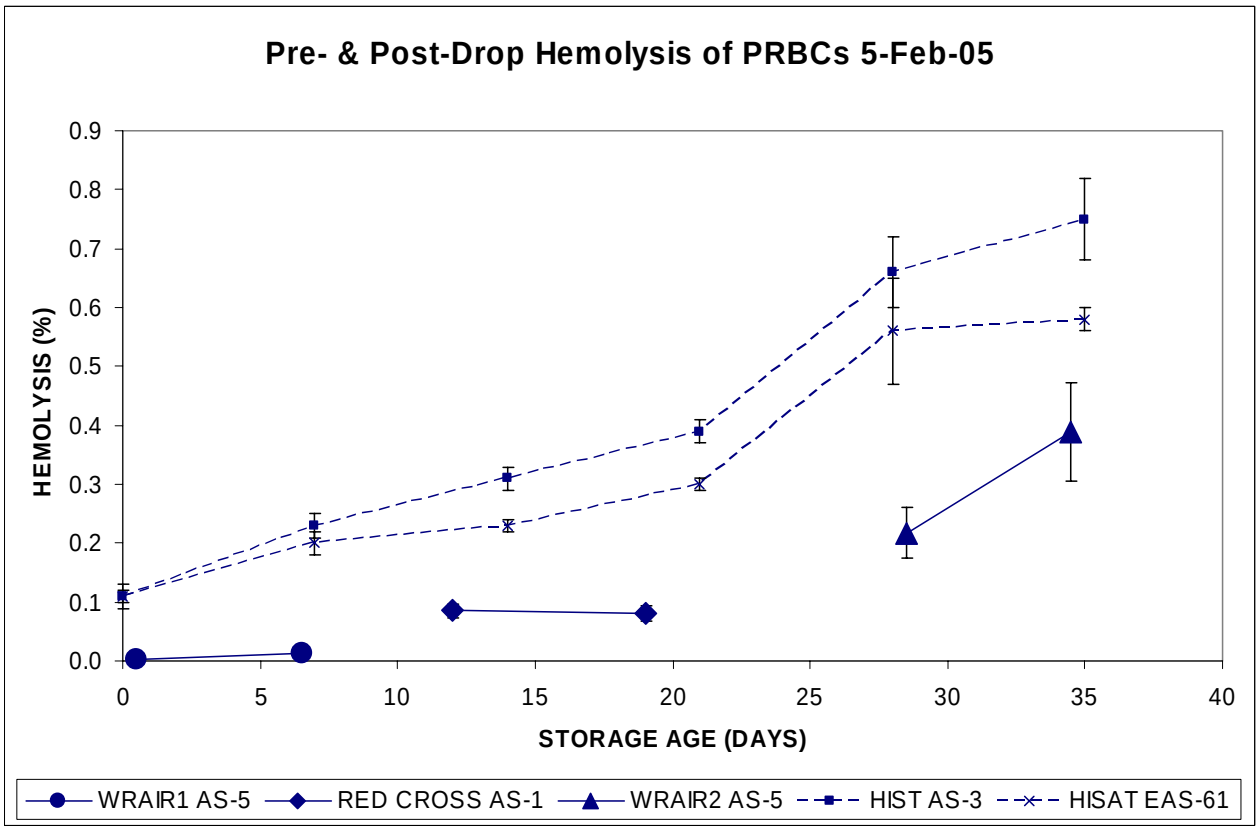

ILAR UAV Delivery of GHC 4 w/ 4 PRBC Units 15 Feb 05
TEMPERATURE (DEG C)
TEMPERATURE (DEG F)
TIME (HOURS)
Airland PST
External Temps
High = 25.1° C
Low = 10.7° C
Sunday
Monday
Tuesday
Wednesday
Ambient
Inside Middle
Inside End


Pre- & Post-Drop ATP in PRBCs 5-Feb-05
ATP (MIOCROMOL/G HGB)
STORAGE AGE (DAYS)
WRAIR1 AS-5
RED CROSS AS-1
WRAIR2 AS-5
HIST AS-3
HIST EAS-61


Pre- & Post-Drop 2,3-DPG in PRBCs 5-Feb-05
2,3-DPG (MICROMOL/G HGB)
16
14
12
10
8
6
4
2
0
0
5
10
15
20
25
30
35
40
STORAGE AGE (DAYS)
WRAIR1 AS-5
RED CROSS AS-1
WRAIR2 AS-5


Pre- & Post-Drop pH of PRBCs 5-Feb-05
pH
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
0
5
10
15
20
25
30
35
40
STORAGE AGE (DAYS)
WRAIR1 AS-5
RED CROSS AS-1
WRAIR2 AS-5
HIST AS-3
HIST EAS-61


Pre- & Post-Drop Lactate from PRBCs 5-Feb-05
LACTATE (MG/DL)
300
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
STORAGE AGE (DAYS)
WRAIR1 AS-5
RED CROSS AS-1
WRAIR2 AS-5
HIST AS-3
HIST EAS-61


Pre- & Post-Drop Hemolysis of PRBCs 5-Feb-05
HEMOLYSIS (%)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
5
10
15
20
25
30
35
40
STORAGE AGE (DAYS)
WRAIR1 AS-5
RED CROSS AS-1
WRAIR2 AS-5
HIST AS-3
HISAT EAS-61