There We Were at 18,000 Feet

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"There we were at 18,000 feet…" That introduction is usually followed by moving hands and an embellished story of a fighter pilot's air-to-air engagement. While not as dramatic, there was an interesting chance encounter at the US Army Yuma Proving Ground (YPG) the last week in October 2004. The encounter had historical as well as current significance and dealt with another important aspect of warfare – the airdrop of combat and humanitarian supplies from high altitude, out of and above harms way.

A very busy week of precision airdrop testing had been scheduled over the desert ranges of the proving ground. This included high-altitude drops of a variety of advanced Global Positioning System (GPS) self-guided parafoil systems and the Precision Airdrop System (PADS) for real-time accurate wind estimates, all under development by the US Army Natick Soldier Systems Center. The Air National Guard deployed a C-130H to the proving ground to drop test payloads up to near 25,000 feet Mean Sea Level (MSL). To meet the demanding test requirements, YPG leased a C-130A from International Air Response (IAR) in Chandler, Arizona, flown by an IAR aircrew. IAR also owns and operates another C-130A, as well as DC-7 aircraft, each modified for a various airlift and airdrop operations, including aerial fire fighting.

I was scheduled to fly and test drop the latest version of a hand-launched GPS wind dropsonde from the C-130A. Walking in for the "O-Dark Thirty" mission briefing, I saw John Limbach, CMSgt USAF (Ret), sitting at the briefing table wearing a baseball cap embroidered with "Vietnam Veteran – I Served With Pride". After a brief introduction and hand-shake, I asked, "Were you involved in the re-supply of An Loc?" "You bet!" was the proud reply. So after 32 years, fate conspired to place me, a retired weather officer and the contract program manger for PADS, with a combat veteran involved in the An Loc airdrop operation. An Loc is arguably the birthplace of the requirement for high-altitude precision airdrop and where these operations were first executed on a large scale. John, as a certified loadmaster, joined the IAR team that week at YPG from Big Sky Aviation International, Billings Montana, where he serves as the Executive Director.

The siege of An Loc and other cities and villages in South Vietnam during the 1972 Nguyen Hue Easter Offensive by the North Vietnamese Army and Viet Cong is well documented in US Air Force and Army histories. The following is a brief summary of the historical information about the An Loc operation extracted from The Army Historical Foundation, *The Siege at An Loc: How Air Resupply Helped Save the City*, by Lt Col Len Funk, US Army (Ret); the Combat Airlift Review Volume 6, Issue October 2000, *An Loc*, by Sam McGowan; and from a now-declassified HQ PACAF Project Contemporary Historical Examination of Current Operations (CHECO) Report, *Airlift to Besieged Areas*, 7 Apr – 31 Aug 72.

The enemy surrounded An Loc, the capital of Binh Long Province about 50 miles northwest of Saigon, and interdicted roads and ground supply routes into the city, using strangulation and starvation tactics akin to Medieval sieges of castles. The Republic of Vietnam Armed Forces, and their American advisors defending the city and the civilian population soon required ammunition, fuel, water, food and medical supplies. In early April 1972 Vietnamese Air Force (VNAF) and US Army CH-47 Chinook and OH-13 Sioux helicopters began air-land re-supply. During the same period, the VNAF also conducted low-altitude daylight C-123 Provider and C-119 Flying Boxcar airdrop operations. Some

VNAF pilots dropped from around 5,000 feet Above Ground Level (AGL) but inaccurate wind information put most of the bundles in enemy territory. Air land and airdrop operations were exposed to enemy mortar, .51-caliber, 37MM and 57MM Anti-Aircraft Artillery and small arms fire with lethal effect. Helicopters were damaged or destroyed on the Drop Zone (DZ) and C-123s were damaged or shot down with the loss of aircrews. All these operations were cancelled by mid-April 1972.

The US Air Force 374th Tactical Airlift Wing began C-130E Hercules low-altitude and high-altitude airdrop operations for An Loc 14 April 1972 from Tan Son Nhut Air Base, South Vietnam. The small size of the DZ, a 200 meter by 200 meter soccer field, and other small DZs near An Loc, added to the airdrop problem. The first high-altitude airdrop was conducted from 8,500 feet AGL with over 65% of the bundles lost to the enemy. To offset the effects of inaccurate winds, High-Altitude Low-Opening (HALO) systems, using timed cutters, and high-velocity delivery systems were used. However, some parachutes opened at high altitude because of rigging problems, resulting in low accuracy due to wind errors. Parachutes also failed to open in time, which destroyed payloads. When available, AC-130 Specter gunships were used to estimate the mean effective wind based on expected versus actual impact points of 25mm GAU-12 Gatling gun rounds. The only other available observed wind sounding information was that from Bien Hoa Air Base some distance away, and that information was normally more than six hours old. Improper use of honeycomb cushioning on the payloads for high velocity ring-slot parachute delivery systems also resulted in unacceptable payload damage. In addition, the enemy had recently deployed the SA-7 Strella shoulder-fired, heat-seeking, surface-to-air missile system in South Vietnam. On 11 May 1972 the first SA-7 firings were reported at An Loc. The SA-7 threat forced the safe airdrop altitude to 10,000 feet AGL, making precise airdrop even more challenging. Assistance was needed, and it was requested from the Tactical Air Warfare Center (TAWC) in Florida.

TSgt John Limbach, then assigned to the TAWC, had over 1,400 C-123 combat sorties in South Vietnam under his belt. The photographs below show John in front of the venerable C-123 at Bien Hoa Air Base in 1967 and at work in the cargo bay of a C-123 in 1968. John arrived back in-country 5 May 1972 and immediately set about correcting the HALO rigging and payload packing problems. John recalls, “Due to the extremely low inventory of de-reefing cutters and the high demand for resupply, I worked with US and Army of the Republic of Vietnam riggers and rapidly developed an ad-hoc high velocity delivery method using two clustered 15-foot extraction parachutes, all that were available in quantity, married to a 2,000 pound Container Delivery System bundle rigged with extra honeycomb.” John flew on the early test airdrop missions and confirmed that his solutions worked.

John’s efforts, together with improved navigation and high-altitude release procedures, markedly improved the airdrop re-supply of An Loc. High velocity airdrops from 10,000 feet AGL approached a 90% effectiveness rate, and 97% of the high-velocity drops from the same altitude were reported on the DZ during the 11-16 May 1972 enemy direct attack of An Loc. That attack was repelled by the re-supplied defenders of An Loc and by tactical air power. People from the US Army Natick Laboratories (forerunner of the US Army Natick Soldier Systems Center), arrived at Tan Son Nhut Air Base 21 May 1972 with a new two-stage HALO system using cutters activated by barometric pressure. This new system was used for later An Loc re-supply operations. High-altitude C-130E airdrop resupply operations for An Loc continued through December 1972. High-altitude airdrop operations were also used to resupply other locations in Southeast Asia during the Nguyen Hue Offensive, but they had their beginning at An Loc. Before the modified high-altitude airdrop operations were employed at An Loc, the enemy received the majority of the goods delivered. John remembers that, “There were no further battle damage reports once the drops moved to high altitude.” Before that, the results of An Loc air land and low-altitude airdrop operations were 37 aircraft damaged, aircrew members wounded, 2 C-123s and 3 C-130Es shot down – and 15 fatalities.

Airman First Class John Limbach, C-123, Bien Hoa Air Base, Republic of Vietnam, 1967 and In Action Onboard a C-123, 1968

Since An Loc, navigation accuracy, payload rigging, delivery procedures and wind forecasting accuracy have all improved significantly. However, little has changed in the basic way high-altitude airdrop operations are planned and conducted. This is about to change. The US Army Natick Soldier Systems Center and the Air Mobility Command have been working together to develop and field the latest technologies applied to precision airdrop. This was fueled by the results of high-altitude humanitarian airdrop over Sarajevo, Bosnia-Herzegovina, 1992-1996, and later, airdrop operations in Afghanistan during Operation Enduring Freedom. The resulting new system, PADS, has been operationally tested and has demonstrated, in the hands of operational aircrews, that it significantly improves the accuracy of high-altitude high-opening (HAHO) ballistic airdrop from altitudes up to 25,000 feet MSL.

Wind measurements from GPS-based dropsondes deployed from the airdrop aircraft, or an advance aircraft, have replaced the AC-130 gunship mean effective wind and distant, aged ground-based wind sounding information. High-resolution four-dimensional forecast fields produced by the supercomputers at the Air Force Weather Agency, Offutt Air Force Base, Nebraska have replaced the single forecast ballistic wind. The procedures to determine the Computed Air Release Point for HAHO ballistic loads have been improved from a time-of-fall offset based on a forecast ballistic wind, to a full-dynamics payload release, parachute opening and descent trajectory model applied to a final three-dimensional wind and density field as modified by the underlying topography. This is all produced by PADS software on a pressure-ruggedized laptop computer operated aboard the airdrop aircraft using near real-time winds from the hand-launched wind dropsonde and other available wind data sources such as Pilot Reports. This integrated technology has resulted in demonstrated high-velocity HAHO ballistic Circular Error Average accuracies of less than 400 meters from altitudes between 18,000 feet and 25,000 feet AGL from C-130 and C-17 airdrop aircraft.

The US Army Natick Soldier Systems Center, as with its predecessor during operations in Vietnam in 1972, remains at the forefront of solving the high-altitude airdrop accuracy problem, first with PADS and now with guided systems. For very precise airdrop delivery requirements, on the order of 100 meters or less, a family of GPS self-guided systems are in development under the Joint

Precision Airdrop System (JPADS) program managed by the Natick Soldier Systems Center. The development of these systems is directly parallel to the development of laser and GPS-guided bombs and munitions that provide accuracy much better than that possible with so-called "dumb bombs" that can not correct for wind and other delivery errors after release.

The JPADS program addresses four categories of total payload weight. JPADS-XL (Extra-Light) is focused on 500 to 2,200 pound payloads. JPADS-L (Light), aimed at payloads in the 2201 to 10,000-pound category, is part of an Office of the Secretary of Defense Advanced Concept Technology Demonstration program. Delivery of heavier single payloads is being addressed by JPADS-M (Medium), 10,001 to 30,000 pounds, and when funded, by JPADS-H (Heavy), 30,001 pounds to 60,000 pounds. JPADS-XL systems are the most mature – a small number of systems have been rapidly fielded to current Area of Responsibility (AOR). Systems range from completely parafoil-based designs to a parafoil-round canopy hybrid where round ballistic parachutes are opened for the terminal phase to ground impact. A controllable round parachute system is in development, in the JPADS-XL category, which has an inserted guidance and control unit that applies riser pulls to the G-12D canopy to slip to the PADS wind-predicted ballistic trajectory to the Point-of-Impact. PADS will also be used to wirelessly update onboard guided systems with the planned PI and latest PADS wind estimate before release. PADS and selected guided systems are earmarked for fielding to the AOR this coming summer.

The significant advances in precision airdrop to date are the result of a strong Government-Laboratory-Industry team headed by the Natick Soldier Systems Center. The team includes the Air Mobility Command, guided airdrop system developers, the Charles Stark Draper Laboratory, the National Oceanic and Atmospheric Administration Forecast Systems Laboratory, and Planning Systems Incorporated. More information on current precision airdrop programs can be obtained from the US Army Natick Soldier Systems Center (Richard Benney, 508-233-5835, Richard.Benney@natick.army.mil). Specific information on PADS also can be obtained from the author (Bob Wright, 703-788-7746, rwright@plansys.com).

Now back to "There we were, at 18,000 feet…" An unplanned link with history was made during the C-130A October 2004 test drop missions at YPG, with John Limbach as loadmaster. Onboard the aircraft before engine start, I further explained to John how the GPS dropsonde and PADS work together to solve the high-altitude airdrop accuracy problem. John nodded and said, "It's about time we did something about that." He then prepared me to hand-launch the test dropsondes. From just under 18,000 feet MSL I released PADS GPS wind dropsondes to measure winds below the aircraft. Guided parafoil systems, with up to 10,000 pounds total weight, were dropped. Even though wearing a safety harness that could hold an elephant, I still felt much better with John close-at-hand watching out for my well-being as I stood in the paratroop door and deployed the dropsondes – soon to be a loadmaster task. After one of the missions, we took the photo below by the IAR C-130A.

Though this C-130A did not see service in South Vietnam, IAR's other C-130A (S/N 54-1631) did. From records provided by IAR, "54-1631" was assigned to various US Air Force and US Air Force Reserve units from 1964 through 1975, some having served in South Vietnam. It was assigned to the 924th Tactical Airlift Group, 446th Tactical Airlift Wing, Ellington AFB Texas, March 1968 to October 1972. While "54-1631" probably was not flow in support the 1972 An Loc airdrop operation, IAR physically confirmed that the aircraft did indeed see action in South Vietnam. IAR acquired the aircraft October 1989 from the US Forest Service. During an inspection, IAR found an enemy .51-caliber round lodged between the floor and skin aft of the troop door, fuselage station 737, right side, by the ramp hinge – a reminder of the need to drop from high-altitude.

John Limbach, Bob Wright, C-130A, Yuma Proving Ground, October 2004