



# CARGO LOADERS IN FUTURE AIR MOBILITY

## **EXECUTIVE SUMMARY**

Cargo loaders are essential to air mobility at major US aerial ports and rugged overseas bases. C-130s, C-17s, giant C-5s and a wide range of contract airlifters from 747s to Russian Antonovs all share one thing in common. Their aircrews strive to cut down time waiting on the ground for cargo and passenger loading. Time airborne means mission progress; time waiting on the ground must be held to a minimum.

Enter the cargo loaders – surely one of the most overlooked aspects of 21st Century airpower. While much bulk cargo moves by sea and land, air delivered cargo can range from units of blood to precision airdrop bundles for special forces fighting in the hills of Afghanistan. The professionals know it's impossible to project power for joint operations without rapid air mobility.

Over the past decade the Air Force acquired two new cargo loaders to beef up its expeditionary abilities. The 60K Tunner, named after the general who led the Berlin Airlift, is the mainstay of aerial ports. The agile 25K Halvorsen, named for the lieutenant who organized candy drops to children in post-war Berlin, handles lighter expeditionary cargo loading.

While the Air Force has its full complement of Tunners, it is still short about 25% of its Halvorsen loaders for expeditionary operations. Pentagon cuts led by former Secretary of Defense Donald Rumsfeld contributed to budget shortfalls and the Halvorsen procurement was never completed. Older 25K loaders remain in the inventory.

The question now is whether the two loaders create enough capacity to streamline the force structure and meet combat cargo demands for the future. Joint forces are all projecting far more dispersed, expeditionary operations. The Army wants more responsive, direct support airlift. Allies are investing in airlifters, but often depend on the US Air Force's loaders during major operations. Given future combat scenarios, the current inventory of loaders might not be enough to assure rapid air mobility.

This study was written by Dr. Rebecca Grant of the Lexington Institute.

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With a spiraling, twisting, tactical descent, the C-130J makes its first landing of the night. In less than 12 hours this crew from the Air National Guard has five stops to make before dawn and a flight “home,” perhaps to massive Al Udeid Airbase, air hub of Central Command’s far-flung operations.

What this crew wants is to get that cargo off, get the next load on board, and taxi to the end of the runway to start their next leg.

How fast they move depends on cargo handling – surely one of the most overlooked aspects of airpower.

Cargo is not an afterthought for soldiers and airmen who depend on it. The professionals know that combat cargo is what makes joint operations possible. When special forces in Afghanistan request precision airdrop bundles to remote mountain sites, it’s the K-loaders that stack it aboard.

At this rugged overseas base, it’s probably a Halvorsen 25K loader that drives up to start taking pallets off. On any given day, the K-loaders on “steel beach” may handle a contract Russian-made Antonov airlifter or transfer medevac patients to a KC-135. Pairs of loaders line up nose to tail to smoothly push pallets from C-17s. Of course, their main job is to load and unload the stream of C-130s making their regular runs through the combat theater.<sup>1</sup>

Fortunately, the Air Force managed to get new loader equipment in place in time for today’s global counter-terrorist operations. The Air Force has two new loaders, the 25K Halvorsen, in use at Bagram’s steel beach and many other expeditionary airfields, and the heavy Tunner 60K loader, specializing in aerial port work.

The Air Force did a good job selecting the two types of loaders and retiring most of the mixed fleet of several types of older equipment. Together the Halvorsen and the Tunner create a lot of flexibility for day-in, day-out operations.

The problem is that the process is not quite complete. While the Air Force has its full complement of Tunners, it is still short about 25% of its Halvorsen loaders for expeditionary operations. Older 25K loaders remain in the inventory.

The question now is whether the two loaders create enough capacity for combat cargo demands for the future. Joint forces are all projecting far more dispersed, expeditionary operations. The Army wants more responsive, direct support airlift. Allies are investing in airlifters, but often depend on the Air Force’s loaders during major operations. Given future combat scenarios, the current inventory of loaders might not be enough.

What seems like the simplest ingredient in military power can sometimes turn critical. Shakespeare said it well: for want of a nail, the shoe is lost, for want of a shoe, the horse is lost, for want of a horse, the battle is lost. That was the Battle of Bosworth in 1485, but the point is the same.

## **The Loaders**

Halvorsen and Tunner were names made famous in the Berlin Airlift of 1948-1949. The Soviet Union closed road and rail lines into Berlin in June 1948. The only way to supply war-ravaged West Berlin was by air. For 464 days, a force of 324 assigned aircraft flew 2,325,510 tons of cargo into the city, including over a million and a half tons of coal.

Those airlifters were supported by 1,600 trucks and another 500 pieces of dedicated ground equipment, known in today’s parlance as MHE or material handling equipment.

For decades, cargo handling was not all that different from the days of the Berlin airlift. By the 1970s, aircraft like the C-5 loaded primarily from doors fore and aft that opened with ramps down to ground level. A family of loaders built mainly in the 1960s was sized for fixed-base, Cold War operations.

The turn toward expeditionary operations beginning with Operation Desert Storm in 1991 quickly pointed out problems with the legacy loaders. One of the most



frustrating problems was that the ubiquitous 40K loader with its convenient five pallet capacity could not lift high enough to stock wide-body aircraft like the KC-10. The KC-10 was bought mainly to be a long-range tanker but commanders quickly grew to rely on its cargo capacity, too. However, all cargo for the KC-10 had to be loaded through a doorway high off the ground. Loaders hoisted cargo but with the 40K, there was still a four-foot gap – tough with heavy pallets. Some wide-body elevator loaders were acquired to close the gap, becoming one of the original low-density, high-demand pieces of equipment.

Air mobility experts realized how inefficient the process was. The two-step process required more equipment and more people and took more time. Still, material handling equipment was hard to get onto the budget priority list. Not until Air Mobility Command moved the new loader up to its #2 priority, behind only the C-17, did the 60K loader move into full and fast production.

**The Tunner 60K Loader.** The Tunner entered the fleet in 1997, combining trucking and lifting in one piece of equipment. Its deck was designed to crouch as low as 39

inches or rise as high as 18 and a half feet, sufficient to reach doorways on commercial wide-body aircraft. Rollers and a conveyor belt moved cargo onto the aircraft. The deck was built with pitch, roll and yaw controls to nudge heavy cargo into place.

The Tunner 60K loader is now in service at aerial ports around the world. For the Air Force, an aerial port is a primary cargo hub where people and materiel marshal from across the country for deployment overseas. Specialized aerial port squadrons operate at locations such as Charleston Air Force Base, South Carolina. C-17s and C-5s dominate the aerial port business. Together, these massive airlifters transport everything from paratroopers to tanks to folded-down helicopters. Of course, planners like to use sealift when time permits, but strategic airlift is the only way to close forces and supplies fast in a crisis.

The full planned production run of 318 Tunners was completed in 2005. Among crews the Tunner earned a reputation as a rugged system that can be worked hard in surge operations.

**The Halvorsen 25K Loader.** Pivoting off the success of the Tunner, the Air Force released a request for a next-generation small loader to work primarily with the C-130 fleet at expeditionary bases. “Small” in this case still meant the ability to tote three pallets and a weight up to 25,000 lbs.

The answer came in the form of what is now the Halvorsen 25K loader. JBT Aerotech (formerly FMC Technologies) partnered with an Australian company named Static Engineering to produce a loader that met the Air Force’s specifications. Based on Static’s “TASLU” loader already in use around the world, the new Halvorsen loader was a lighter, stronger variant. In June 2000, the Air Force awarded FMC a contract to build Halvorsen loaders at Orlando, Florida and other US locations.

The Halvorsen loader is tailor-made for expeditionary operations. “I worked with the Halvorsen in Kuwait City at the international airport, unloading 747s, C-5s, C-17s, C-130s, you name it,” said Staff Sergeant Damion Hankins of the 615th Air Mobility Squadron at Travis Air Force Base, who loaded Army and Marine Corps equipment building up for the start of Operation Iraqi Freedom in 2003. “We basically used it for small loads from C-130s, but when we had to work a 747 belly, we would use the Halvorsen because it was the only thing we had that could get in there real easy.”<sup>2</sup>

Versatility like this has made the Halvorsen loader indispensable to ongoing operations. The Halvorsen’s mission is to go into remote, rough airfields and run with very little support. It operates on dirt and gravel as well as asphalt. With a three-pallet capacity, the Halvorsen can quickly unload six pallets from a C-130. It fits easily into the C-17 and C-5 for global flights. Most important, the Halvorsen can be driven onto a C-130 for transport to other bases around the theater.

Unfortunately, the Air Force has not quite finished what it started. The initial requirement for the Halvorsen was fixed at 538 loaders. To date, 415 have been built, but production is trailing off.<sup>3</sup> According to current statistics, the Air Force is still short over 120 of the Halvorsen loaders.

It was a money crunch, not a diminished requirement for the equipment, that slowed down the acquisition of the Halvorsens and caused the Air Force not to complete its MHE overhaul. Funding for the Halvorsen loader – and other vital equipment – was interrupted in late 2004

## General Tunner and Lieutenant Halvorsen

Air Mobility Command christened its new loaders with names that made history during the Berlin Airlift, still the world’s single largest air relief operation. Like the loaders that bear their names, Halvorsen was the agile innovator while Tunner bore the heavy responsibility of command.

Lieutenant Gail S. Halvorsen of Salt Lake City, Utah, was one of hundreds of C-54 pilots landing every 90 seconds around the clock to resupply Berlin during a Russian blockade. Berlin was a city of rubble with half its prewar population gone. Berlin’s residents were mainly women, many of whom were working as manual laborers to clear the rubble of the city. Food was rationed. Halvorsen gave a few sticks of chewing gum to children watching aircraft land at Tempelhof. Their delight moved him to promise to bring more, and soon he was dropping handkerchief parachutes with candy attached from the cockpit windows. Children picked out Halvorsen’s C-54 when it wiggled its wings on final approach. By the end of the airlift, around 25 plane crews had dropped over 23 tons of chocolate, chewing gum, and other candies to children around the city of Berlin.

General William H. Tunner had organized the arduous airlift over the 20,000 foot mountains in Burma known as “the Hump” during World War II. Tunner was quickly put in command of the Berlin airlift after crashes and weather disasters threatened to make it a failure. He is credited with devising the rapid landing systems and expanding the number of airfields required to make it all work. A fierce and exacting boss, the crews responded to his iron will.

Soon after he started the candy parachute drops, young Lieutenant Halvorsen was summoned to Tunner’s office. Halvorsen expected a reprimand but instead, Tunner gave Halvorsen his full support. Word spread and candy and mini-parachutes arrived from eager donors in the United States. More than 250,000 of the tiny treats were dropped in the course of the airlift.



when the office of Secretary of Defense Donald Rumsfeld enacted deep cuts via Program Budget Directive 753. PBD 753 famously cut funding for major programs from destroyers to missile defense to the F-22, but other, less visible procurement priorities were also decremented.

In fiscal year (FY) 2004, the Air Force was still on track with a buy of 78 Halvorsen loaders. The numbers then fell to 25 per year for two years before bottoming out in FY 2007 at 12 loaders. Global War on Terror supplementals procured ten additional 25K loaders for the Air Force in FY 2008.

Some systems got back into the regular Air Force program funding, but historically-overlooked items like the loaders did not.

Beyond this, the original next-generation small loader requirement is nearly a decade old and of course, it predates the events of 9/11.

Is the Air Force about to come up short again?

The answer is not straightforward. It depends on the mix of operations joint forces should expect over the next three decades.

There's no question that those closest to the problem are concerned about current and future material handling equipment levels.

- Combined Forces Air Component Commander Lieutenant General Gary North recently expressed a need for more Halvorsen loaders in theater.
- Aerial port personnel perceive a shortfall in the number of required 60K and 25K loaders.
- Loaders (like all heavy equipment and aircraft) spend time in depot, which restricts the number available for operations.
- Allies operating the C-130 and C-17 have borrowed Halvorsen 25K loaders from US Air Force war reserve materiel stocks.

In order to get a handle on these concerns, Air Mobility Command is at work on a database capturing lessons of recent major combat operations and stability operations.

It's a complex process. Sizing material handling equipment is not a matter of just matching airlift inventory and loaders. Determining the right future mix for cargo loaders requires taking a much closer look at how airlift in theater operates for major combat operations and for ongoing stability operations and support to irregular warfare.

### Supplying Major Combat Operations

One of the best ways to understand the potential MHE requirement is to look back at major combat operations in Iraq in 1991 and 2003.

Like airlift itself, sizing material handling equipment is about meeting surges, not setting up an "airline" operation. Lift in theater is not primarily sized to be efficient. Instead, the number-one goal is to provide enough sorties to move and resupply ground forces during major combat operations. Material handling equipment must match those requirements.

The medium airlift fleet must be sized for the single most stressing case of joint operations. Most operations will (and should) fall "short" of the maximum.

In Operation Desert Storm, C-130s flew 13,961 sorties in about six weeks. Other services and Coalition partners added 2,891 sorties for a total of 16,852 sorties during the campaign. That was an average of 391 sorties per day. Sortie rates peaked well prior to the start of ground operations as commanders repositioned forces and equipment in late January and early February 1991. For all the effort, it is important to remember that ground operations lasted only four days on that occasion.

In 2003, the combined major combat operations lasted about one month. Although far fewer ground forces were involved compared to 1991, the Army's 3rd Infantry Division and the Marines' 1st Infantry Division moved rapidly on Baghdad from two directions. C-130s came right behind them, flying into newly-liberated airfields and using roads and dirt strips on some occasions.

All during this time, the C-130s were also moving air component spare parts and personnel around the theater for a high-intensity air war. In the major combat operations phase, C-130s assisted by some C-17s moved 12,444 short tons and 9,662 passengers.

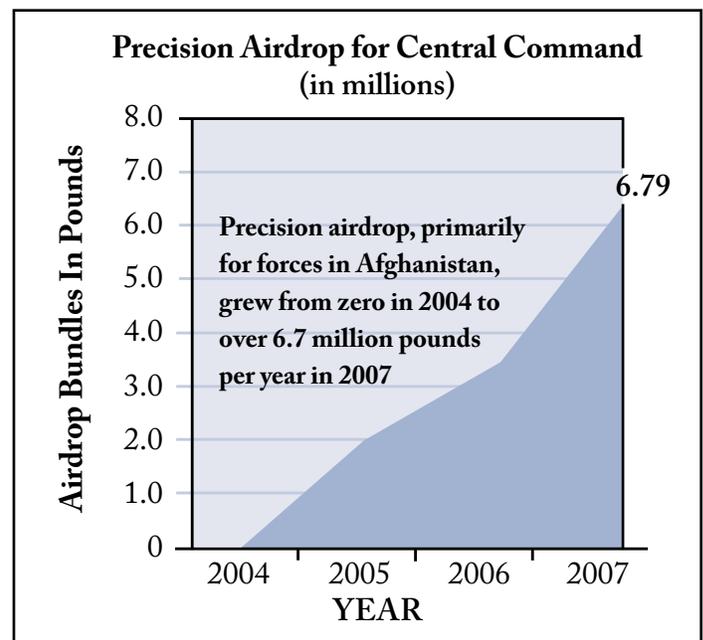
Each of these cases confirmed that demand is not flat but has somewhat unpredictable peaks. Airlift – and MHE – under the Combined Force Air Component Commander's control in theater must be sized to take care of those peaks. Beyond this, the fleet overall has to be able to handle peak operations at multiple locations, for multiple customers, and in multiple theaters of war.

### Working Through Stability Operations

This decade has shown that mobility forces must also be sized for long-duration stability operations. Stability operations are not just a lesser included case that scales down proportionally from major combat operations. Stability operations consume more intelligence, surveillance and reconnaissance (ISR), more tankers and far more lift, and add new requirements like loading for precision airdrops for special forces in remote locations.

In stability operations, C-130s conduct the bulk of passenger movement operations. US Central Command (CENTCOM) has moved upwards of 900,000 passengers around the theater every year since 2005.

In addition, as few as two but as many as 20 C-17s have been assigned to CENTCOM cargo requirements.



Stability operations have also opened up a new mission: precision airdrop. Precise airdrops use Global Positioning System guidance through descent to land right where the



bundles are needed. In the last few years, forces operating in Afghanistan have come to count on precision airdrop for resupply as an alternative to long delays on dangerous roads. The Halvorsen loaders are needed to put the specially-rigged airdrop bundles aboard the aircraft.

Sustained stability operations like these were not part of the analytic picture when Halvorsen and Tunner loader requirements were derived based on the experience of the 1990s. Conditions in Iraq and Afghanistan may change, but stability operations and support to civil authorities are now a major bulwark of joint doctrine for future operations. For the future, MHE should meet both combat surge requirements and sustained stability operations requirements.

### **Surges for Humanitarian Relief**

Finally, MHE requirements can also be driven by a different type of surge operation. Joint doctrine now officially endorses Phase 0 shaping operations including exercises and humanitarian relief. This is a new, permanent plank of US security policy. For example, the creation of Africa Command in 2008 confirmed that the US is serious

about ongoing security relationships there, and about helping partners build their own security capabilities.

One of the most high-pressure situations for theater airlift occurs when the Air Force participates in setting up relief operations alongside partner nations and non-government organizations. Questions about who is running the airfield and what gets loaded or unloaded first can quickly devolve into sub-optimal airfield operations that compromise the mission.

Setting up humanitarian relief missions at Tirana, Albania in 1999 provided many lessons about what happens when an urgent crisis demands rapid airlift at unusual locations. The goal was to deliver relief supplies to 500,000 displaced Kosovo Albanians who had been driven from their homes and into camps. The United Nations was controlling the relief operation. On the airfield, elements of two US-only and two North Atlantic Treaty Organization (NATO) airlift control elements elbowed each other. The airfield was soon saturated.

In this case, the flow at the airfield soared from an average of 5 flights per day to over 60 flights per day. Again, all of

these had to be on and off-loaded as fast as possible to get aircraft back in the air and off the congested ramp space.

Success in cases like this depends on having packaged assets ready to deploy. For MHE, that means keeping loaders in reserve, and on call, to head to a new location fast without dangerously drawing down the capacity at other busy bases. With many organizations involved, aerial port personnel may have to load a variety of aircraft at airfields with rough conditions. Ramp space always seems to be at a premium in these locations, and that will make fast action essential, and that, as always, will depend on the loaders.

## Future Operations

Operating at many locations and dispersed bases around the world could significantly increase the inventory of loaders needed to support these types of air and ground operations.

Traditional warfare with decades-old rear bases is a thing of the past. A host of non-traditional operations and fighting styles could place much heavier demands on air mobility resources. For example, October 2008 saw the stand-up of US Africa Command. For now, the command will be headquartered in Germany, but improving the air transport infrastructure in Africa has already been identified as a top priority. US Air Forces, Europe, have been routing C-130s and other cargo aircraft to Africa missions for several years. More involvement with partner nations there will almost certainly increase demands on cargo handling.

Beyond this, it's worth taking a look at new joint concepts for operating at dispersed bases.

**Nonlinear warfare.** The Army and Marine Corps have been working on doctrine and concepts for nonlinear, dispersed operations for several years. So have several allies such as Britain, the Netherlands and France.

The basic idea is that lead maneuver elements of the land component would fight in multiple spots all at once, instead of forming an unbroken forward edge of battle. Forces could then take objectives directly and overwhelm the enemy by attacking where least expected. Nonlinear operations won't use predictable ports and airfields, but seek to go "places where the enemy doesn't think you will go," said Army General William Scott Wallace, Commander, Army Training and Doctrine Command.<sup>4</sup>

Future nonlinear operations will also rely less on major aerial ports in favor of smaller hubs and resupply points for a fast-moving force. Gone are the big supply dumps and rear area lines of communication. They are even throwing out the canonical "operational pause," to rest and regroup forces while supplies caught up. For example, the 2003 drive to Baghdad featured a major, planned operational pause after four days to prepare for the final drive. Under the new operational concept, maneuver forces will keep moving without stopping to "reorganize, reposition and re-supply," in the Army's words.

Precision airdrop on a much larger scale will also be part of achieving logistics resupply for future land force operations.

The overall trend points to increased use of expeditionary and austere airfields. In the past, the land force planned for just a handful of forward operating bases, expecting to truck most of its logistics through rear areas. While the bulk of their cargo will still have to move over land, the requirements for air-delivered logistics could double or triple. MHE must be sized to handle rapid offload. In addition, bringing cargo into forward bases could increase the attrition on loaders as rough conditions or enemy action take their toll.

Demands on theater airlift to support land component nonlinear operations could increase the number of loaders needed.

- First, it will have to be responsive, meaning a big role for the Halvorsen 25K loader because it fits onto a C-130.
- Second, the inventory may have to increase because the Army will disperse its materiel over a number of unprepared or bare-base airfields. Instead of taking an airbase and building a large logistics support area near the runway, the Army could run a half dozen or more smaller logistics areas to support the same level of effort. Either way, it calls for more loaders.

**Air base dispersal.** Another scenario which could drive higher intra-theater lift requirements is base dispersal. During operations, fighter, bomber and ISR squadrons rely on regular delivery of parts and people. Ideally, air operations concentrate at several large bases to improve efficiency. However, well-targeted ballistic and cruise missiles could create new threat conditions for air forces based in theater.

Take the Pacific region. China has positioned hundreds of ballistic missile batteries along its coast in a pattern that affects many bases. However, air operations still need close-in operating locations to sustain a campaign and to help hold more of China's mainland at risk. It's possible to imagine a kind of shell game where F-22s and F-35s attack from one base and recover to another. Instead of squadron-sized deployments, a base may host just 6 or 12 aircraft in order to reduce risk and deter attack by complicating an adversary targeting decision.

How would this affect lift and loader operations? Dispersed air operations are less efficient for maintenance and sustainment, so airlift will have to be extremely responsive to make up the difference. While the aircraft could circulate on regular channel-type missions, each base would need a full allocation of Halvorsen loaders to ensure the C-130s and C-17s were turned fast. A full dispersal concept could double or triple the number of bases in use and create heavy surge requirements on the MHE.

## Options

Both trends could reshape intra-theater cargo movement and increase the numbers needed for MHE. Not only is there a need to complete the initial requirement; it's possible to imagine that requirement expanding to meet the needs of Africa operations, nonlinear warfare and dispersed airfield operations. With the Halvorsen production line still open, it's time to consider plans to reach the initial procurement threshold and to assess additional requirements. Stopping production incurs costs to restart and takes time as new agreements are put in place.<sup>5</sup>

Under any scenario, the flexibility of the Halvorsen will be essential to future operations. Most of all, the MHE needs to be there for unforeseen missions. Just a short time ago, a KC-135 landed in the middle of the night at Bagram. Its mission? Take several wounded patients back to Germany for full medical care.

Flight nurses readied the patients then lifted the stretchers aboard a Halvorsen loader. It gently extended its scissor-struts into the air, reaching the high forward door of the KC-135, where the aeromedical evacuation crew transferred the patients onto the KC-135. Sometimes the way home begins with the humblest cargo loader.



- 1 Mark Schanz, *Air Force Magazine*, September 2007.
- 2 Cynthia Greenwood, "Halvorsen Proves Reliable for Missions that support troops," *CorrDefense*, October 2005.
- 3 Even more perplexing is the origin of that requirement. The Air Force in the mid-1990s had 685 older 25K loaders of various types.
- 4 General William Scott Wallace, *Defense Writer's Group*, September 25, 2008.
- 5 For example, the quantity cut drove unit costs for the 25K loader from \$400K with a yearly production of 78 loaders to \$600K when only 12 were purchased. While some of the increase was for material costs, producing at uneconomic quantities was the major factor.





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