MODERNIZING THE AERIAL REFUELING FLEET

Lexington Institute

EXECUTIVE SUMMARY

Aerial refueling tankers are the quiet enablers of joint air power. By allowing fighters, bombers, cargo planes and other aircraft to refuel without landing, they greatly extend the operational range of U.S. forces. The current tanker fleet consists of 520 Eisenhower-era KC-135 jets and 59 Reagan-era KC-10 jets. The KC-135s are based on the venerable Boeing 707 commercial airframe, while the KC-10s are based on the more modern McDonnell Douglas DC-10 widebody. The Air Force needs to begin replacing its KC-135s, all of which have been operating for over 40 years — making them the oldest component of the military air fleet.

The U.S. Air Force began developing aerial refueling tankers in the 1940s to support heavy bombers on nuclear-deterrence missions. Beginning with the Vietnam War, though, tankers became an integral part of conventional air campaigns. During recent air campaigns in the Balkans, Afghanistan and Iraq, Air Force tankers heavily supported coalition aircraft, enabling relatively short-range planes such as the Navy's carrier-based strike fighters to operate deep inside enemy territory. In the early months of Operation Iraqi Freedom, 149 KC-135s and 33 KC-10s conducted over 6,000 sorties in support of the joint force, delivering 376,391,000 lbs. of fuel to U.S. and allied planes.

The advanced age of KC-135s has begun to undermine their readiness and safety. The Air Force plans to competitively procure a modified commercial transport to serve as the next-generation tanker. However, selecting the best plane involves complex tradeoffs. In the air, the range and fuel-carrying capacity of planes must be balanced with the need to have enough aircraft to cover all contingencies. The biggest planes can fly further and deliver more fuel, but they also cost more to build and operate so fewer planes can be bought. Current tankers seldom offload all their fuel during air operations, but having hundreds of planes in the refueling fleet is crucial to meeting the needs of a joint force scattered across the globe.

On the ground, the amount of space a tanker takes up and the speed at which it can be filled with its fuel load are important logistical considerations. Some overseas bases lack extensive space for parking planes, or have only limited capacity to store and transfer fuel. Figuring out which aircraft are best suited to meeting future refueling needs is further complicated by the fact that long-range missions employing big aircraft generate very different refueling needs than short-range missions employing smaller, more numerous planes. These different needs have important implications for tanker performance requirements both in the air and on the ground. Whatever future missions are most pressing, though, experts generally agree that it would be useful to employ empty space on future tankers for carrying cargo so that the air fleet is as flexible and versatile as possible.

This report was designed to identify and concisely address the most important questions bearing upon selection of a next-generation aerial refueling tanker. It was written by Dr. Rebecca Grant, president of IRIS Independent Research and a research fellow at the Lexington Institute, and Dr. Loren Thompson, chief operating officer of the Lexington Institute.

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An Aging Fleet

Think of the airplane that enables the U.S. military to respond anywhere in the world on short notice. Is it a long-range bomber like the B-2? A cargo-hauling C-17? A stealthy F-22 fighter?

Think again. It's the tanker.

United States Air Force tankers are the quiet enablers of modern air power and joint warfighting. While the Navy and Marines have some refueling capabilities, the U.S. Air Force tanker fleet is the main muscle for persistent combat power and global mobility. There are 520 KC-135s and 59 KC-10s in the inventory today.

With global commitments, the joint force — Army, Navy, Marines and allies included — relies more than ever on Air Force tankers to deploy forces forward, and to sustain air operations.

The problem is that all the KC-135s — nearly 90% of the tankers in the fleet — are over 40 years old. "We are operating the oldest inventory of aircraft in our history," Air Force Chief of Staff General T. Michael Moseley has said. The fleet in use today was built for the Strategic Air Command between 1957 and 1964. About 100 of the oldest KC-135s must retire by 2010.

A plan to lease tankers to fill the gap was announced in 2002. It later died, and now the plan is to take competitive bids to buy new tankers beginning in 2007.

The recapitalization of the tanker fleet will stretch over the next 30 years and could turn out to be one of the largest procurement programs in U.S. history, rivaling the Joint Strike Fighter in terms of dollar value.

Two of the most likely contenders are Boeing's 767 and the Northrop Grumman/EADS A330.

Most experts agree the next tanker should be based on a wide-body commercial airliner with a proven track record and a world-wide maintenance network. This "KC-X" must also have enhanced cargo-carrying capacity and advanced information systems for global and net-centric operations.

After that, the choices get more complex. The recent analysis of alternatives conducted by the RAND Corporation at the direction of the Pentagon took almost two years and produced over 1,900 pages of analysis. RAND recommended a tanker of between 300,000 and 1,000,000 lbs. gross take-off weight — a broad span including everything from the KC-135 to a big wide-body like the Boeing 777.

It's important to narrow that choice down by looking at some tighter parameters in the tanker debate. This paper first looks at how tankers became such a major part of joint military operations, and what they do today. Then it poses nine questions about when and why the Air Force should buy new tankers.

What Tankers Do

Buying tankers is a top priority today because joint military operations depend on aerial refueling for combat persistence and strategic reach. Just look back at what a difference the first tankers made. Air power became a true global force only after tankers entered wide operational service in the 1950s.

Before tankers, there was no rapid global response — for combat or relief missions. Aircraft heading for missions outside the United States had to make the hop in stages across Newfoundland, Iceland and Great Britain to cross the Atlantic, for example. Experiments with air-to-air refueling started in the 1920s. But it wasn't until after World War II that Strategic Air Command (SAC) converted surplus bombers into "KB-29" tankers.

By June 1948, the Air Force had its first two tanker units: the 43rd Air Refueling Squadron at Davis-Monthan Air Force Base and the 509th at Walker Field in Roswell, New Mexico. In 1949, KB-29s helped the B-50 bomber *Lucky Lady II* complete an around-the-world mission in 94 hours. General Curtis LeMay, commander of SAC, now had bombers that could reach the Soviet Union. Tankers stood alert with bombers to form the first leg of the nuclear triad.

Tankers soon picked up new roles in conventional combat. In 1952, 60 F-84Gs flew from Georgia to California non-stop, courtesy of the fuel they got in a mass rendezvous with two dozen KB-29s over Texas. Just one year later F-84s were heading in the other direction from Georgia to French Morocco with three refuelings along the way from new KC-97 tankers.

The first combat refuelings took place during the Korean War. However, it was during the Vietnam War that refueling at the tanker became a routine part of combat air operations for fighters as well as bombers. Extra gas from the tankers let short-range fighters extend their range and endurance, and tankers integrated into a wide array of missions.

By the time of the first Gulf war of 1991, tankers were the foundation of the air campaign. More than 300 tankers deployed for Operation Desert Storm where they set up 122 separate air refueling tracks.

In 1999, tankers made it possible for NATO to spin up the intensity of the air war during the Kosovo crisis. B-2 bombers refueled by tankers flew roundtrip from the U.S. to Yugoslavia to open the air campaign. But Operation Allied Force — the Balkan air campaign — also underscored some of the constraints that make tanker operations difficult. At the peak, fully 40% of the Air Force's tankers were in use, and a staggering 80% of the tanker crews were called to action. The KC-135s and KC-10s ultimately bedded down at 12 bases from England to Eastern Europe to the Mediterranean. The Royal Air Force (RAF) base at Mildenhall took 34 tankers and Moron, in Spain, accepted 38. Each had room for only one more tanker.

Homeland defense and the global war on terrorism both put new demands on the tanker force to increase the persistence and reach of air operations.

On September 11, 2001, North American Air Defense Command launched two F-15s from Cape Cod toward New York City just as the second World Trade Center tower was attacked.

Nine out of ten tankers in the Air Force's aerial refueling fleet are KC-135s built during the late 1950s and early 1960s. These planes play a critical role in extending the range of other aircraft such as fighters, bombers and cargo planes.

The next aircraft to arrive was a KC-135 from Bangor, Maine. The tanker crew set up an orbit over John F. Kennedy International Airport at 20,000 feet. One F-15 would take on fuel while the other stayed on station or pursued unknown aircraft over New York City. More F-15s arrived shortly after noon and they, too, used the KC-135's refueling track. Later, a KC-10 from McGuire Air Force Base, New Jersey, replaced the Bangor crew.

Then came Operation Enduring Freedom. Flying into Afghanistan required a full network of aerial refueling to support long missions by everything from Navy fighters to B-2 bombers to C-17s dropping humanitarian relief supplies.

Tankers operated from locations such as Karshi Kanabad, in Uzebekistan, and Manas Air Base, Kyrgyzstan, both formerly part of the Soviet Union.

For persistence and endurance this was a new high water mark. Aided by tankers, carrier-based F-14s and F/A-18s flew strike missions far into northern Afghanistan. An Air Force F-15E set a record for the longest fighter combat mission at 15.5 hours. A B-2 crew set a record with a 44-hour combat mission. B-1s and B-52s armed with precision weapons flew high above the battlespace for hours.

Sometimes the tanker crews were very close to the action. In one case, a KC-135 was spotted by a Taliban truck armed with an anti-aircraft gun. As the truck pulled off the side of the road to take a shot, the tanker called for help. Fortunately, two Navy F/A-18s quickly arrived on scene and took out the enemy.

"In Afghanistan, Air Force tankers provided more than 80% of the 'gas in the air' for our carrier fighter pilots, many of whom refueled more than six times during combat missions routinely lasting seven to ten hours," retired Admiral Archie Clemens later wrote. "This is exactly how a joint force must operate."

In 2003 the war with Iraq showed again how joint operations depend on air refueling. The five-pronged air campaign attacked targets in the south, west and north of Iraq and in Baghdad. Getting them there and back took numerous refueling tracks at multiple locations. A total of 149 KC-135s and 33 KC-10s plus a score of coalition tankers went to war for Operation Iraqi Freedom (OIF).

U.S. Air Force tankers racked up 6,193 sorties during the main phase of Operation Iraqi Freedom and off-loaded 376,391,000 lbs. of fuel.

Tanker operations continued as coalition forces worked to stabilize Iraq. In 2005, tankers in theater flew 12,071 sorties and offloaded 755 million lbs. of fuel, just for Central Command.

Clearly, having an adequate number of aerial refueling tankers is essential to the success of joint military operations. But the present fleet is aging fast, especially the Eisenhower-era KC-135s that make up 90% of that fleet. Nine questions drive the debate about how tankers should be modernized.

What's the risk we're running with the KC-135 fleet?

On January 14, 1999, a Washington Air National Guard KC-135 tanker crashed at Geilenkirchen Air Base in Germany, killing all four crewmembers on board and destroying the aircraft. Since the cause of the crash was unknown, the KC-135 tanker force was grounded.

The A-10 Thunderbolt being refueled in this picture plays a crucial role in supporting soldiers and marines on the ground. Without aerial refueling tankers, such close air support planes would need to return to their bases to be refueled.

Analysis of the wreckage revealed that the stab-actuator, a large metal motorized nut in the aircraft's tail used to trim flight controls, had failed. Nearly 200 of the 546 KC-135 aircraft were stood down until they could be inspected and repaired; 40% of the fleet was grounded for six months.

It's risky to keep relying on the KC-135 indefinitely.

Most everyone is familiar with the age of the KC-135, and most agree we'd only like to drive a car that old on summer weekends. In a technology-driven service like the Air Force, recapitalization is a major priority. The problem is that even specialists do not know exactly how and when corrosion, fatigue, and other issues may trip up the KC-135 fleet. As Lieutenant General Michael Zettler of the U.S. Air Force testified before the House Armed Services Committee's Projection Forces Subcommittee on June 24, 2003, "Stress corrosion cracking is one of the most difficult structural failures to predict. One can only predict this type of failure by essentially 'cutting' into the actual member and performing destructive inspection. These types of failures are largely unpredictable and as the aircraft ages, the number of material failures will also be unpredictable."

The KC-135 fleet is already older than any other force element and grows older year by year. With each passing year, the risks of a grounding increase. That grounding could happen tomorrow, or next year, or in the next decade. It is inherently unpredictable, but it is inevitable.

The readiness and reliability of KC-135s are already in decline. Mission capable rates track the percentage of forward-deployed aircraft ready for combat. 100% is the goal. KC-135 mission rates dropped from over 91% on the last day of Operation Desert Storm in 1991 to an average of 78% in Operation Allied Force in 1999 before climbing back to average 86.4% in Operation Iraqi Freedom in 2003. Overall, the trend line is downward.

Skilled maintainers will do their best to keep the KC-135Rs flying. But the risk is undeniable — and hard to calculate precisely. RAND studied the problem extensively and concluded "there is considerable uncertainty about the future technical condition and sustainment cost of the KC-135." Early replacement of these 40-year old aircraft would in RAND's words be "a hedging strategy against this uncertainty."

Bottom Line: The prudent policy is to start buying replacements since future fleet lifespan can't be precisely predicted.

Will the need for tankers increase in the future?

The demand for aerial-refueling services will probably grow. "We expect aerial refueling requirements to increase after 2010 as the numbers of global missions dependent on aerial refueling assets increase," Air Mobility Command has said.

Others outside the Air Force agree. A September 2005 report from the Congressional Research Service (CRS) said "the need for aerial refueling could grow in the future" beyond the 600 tankers envisioned by the Air Force.

Joint partners depend on Air Force tankers. The same CRS report confirmed the Navy's preference for "big-wing" tankers for long-range missions. Another CRS report pointed out that using

F/A-18EFs and their highly trained crews "for aerial refueling rather than combat is seen as a sub-optimization of a scarce and valuable resource."

Coalition forces also need Air Force tankers. Tankers comprise only a tenth of the airframes in the current U.S. Air Force fleet of aircraft. There are approximately 4.2 fighters for every strategic tanker (KC-10 and KC-135) in the Air Force. In contrast, the Royal Air Force has 13 fighters per tanker. No other air force has enough tankers to create persistence over the battlespace.

Bottom Line: New tankers are essential to sustain global operations.

Why is fuel offload an important measure?

"Offload" is what the tanker does: it offloads or transfers fuel to waiting receivers. Offload capacity is important as an overall measure of how many tankers it might take to support a small operation or a major theater war or anything in between. As a metric, it helps determine whether the Air Force needs a super-large tanker or a medium-sized tanker.

Start with take-off fuel. The KC-135 typically carries 180,000 lbs. aloft while the larger KC-10 holds 327,000 lbs. according to the Air Force's standard planning factors. (Fuel is measured in pounds at about 6.7 lbs. per gallon.)

The amount of fuel available also depends on the distance the tanker flies, and other factors like the burn-rate efficiency of its engines.

The Air Force keeps track of it all in the "mobility bible" officially titled Air Force Pamphlet 10-1403. The KC-10 can fly a

2,500 nm mission radius and still provide 78,700 lbs. of fuel for offload. At that distance the KC-135 would have only 30,700 lbs. of fuel left.

If the tankers fly a mission radius of 500 nm then planners calculate the KC-10 would have 233,500 lbs. of fuel to offload while the KC-135 has 122,200 lbs.

Planners add up the tankers required based on how much fuel they expect to offload to receivers. Of course, tankers must also be at the right place at the right time when receivers show up for fuel.

Is tanker offload capacity the most important performance parameter? At first glance, it seems that bigger is better.

In reality, tanker scheduling depends on how many receivers there are and how much gas they need. A fighter topping off before a strike mission might take 6,000 lbs. of fuel. A B-2 bomber heading from the Middle East to Missouri might stay on the boom for longer and take on 50,000 lbs. or more.

Sometimes the customers are other mobility aircraft, such as a KC-10 refueling another KC-10 over Iraq. Or the receiver may be a C-17 loaded with humanitarian relief supplies, and making its way to Asia or Africa. All have different fuel requirements depending on the mission.

The best way to look at offload is on the basis of past experience. Historical averages give hard evidence on the amount of fuel the receivers take during the tanker's mission, which can last several hours.

Tankers rarely offload their entire capacity. A survey of five operations from Operation Desert Storm in 1991 to the stability operations in Iraq in 2005 showed that moderate offloads are more typical. During Operation Desert Storm, the average tanker offload (for all types, including some coalition tankers) was 47,500 lbs. per sortie. Eight years later in Operation Allied Force, the air campaign during the Kosovo crisis, the average was 48,700 lbs. per sortie. Offload rates averaged 75,400 lbs. per sortie in Operation Enduring Freedom from 2001 to early 2002, due to the long distances that receivers had to fly. Major combat operations in Iraq during the spring of 2003 saw averages of 60,800 lbs. per sortie. Stability operations in Iraq and Afghanistan saw fewer strike sorties, but similar offloads of 62,400 lbs. per sortie in 2005.

Weather, tempo and other factors vary the rates. For example, during a round of Iraqi elections in January 2005, the offload average peaked at 89,000 lbs. on one particular day as extra sorties were flown for election security.

Still, the message is clear. In most air operations, offload averages are moderate and fall well below maximum capacities. That suggests that over time there is no special advantage to a fleet of super-large tankers, because only rarely would all their fuel be needed.

Bottom Line: Medium fuel offloads are the norm in air campaigns.

How does fueling from forward bases affect tanker operations?

Basing constraints underscore another key variable in the tanker debate. Tankers are typically thought of as offloading fuel to fighters and bombers *in the air*. But what does it take to fuel up and launch the tankers themselves?

Ground handling at forward bases turns out to be a critical variable. First there is the issue of how many tankers fit on the taxi way and ramp at a base. NATO's 1999 air campaign during the Kosovo crisis maxed out allies' tanker bases. Planners use a metric called "Maximum on Ground," or MOG, to measure the capacity of bases to host tankers. Several factors affect MOG: tarmac space, refueling pits available, etc. A base can accommodate only the number of aircraft that fit the lowest MOG.

Even at a large base the fuel MOG is a serious limiting factor. Fuel MOG includes factors such as fuel-transfer hydrants available, pump rates in the refueling pits, and the fuel storage capacity available at the base. Pictures of tanker trucks lined up outside the gates of Prince Sultan Airbase in Saudi Arabia during Operation Iraqi Freedom reminded everyone that fuel must come from somewhere. Most bases keep a fuel farm for storage; Prince Sultan, now closed, had expanded its fuel storage from 2 million to 15 million gallons.

Assume a future base can pump a million gallons per day for tanker operations. Of course, commanders have to control the amount of fuel issued to ensure the base can keep operating even if fuel supplies are attacked or disrupted.

If tankers have access to one million gallons per day that yields about 6,700,000 lbs. every 24 hours. Commanders could fill up 37 KC-135s on a given day. Or, they could fill to capacity about 20 KC-10s.

Fuel MOG poses a choice in combat capability. The forward base can put more KC-135s in the air, but the KC-10s have greater range and endurance. Which does more for the joint force? How should this influence selection of a new tanker?

This is why tanker operations are an art and why the choice of a new tanker demands some truly complex trade-offs. Fuel MOG could limit the operations of large tankers to a small number of developed bases with long runways and ample ramp space.

The short answer is that the KC-135s yield slightly more hours on station when fuel is held constant. Why? The higher fuel-burn rate of the KC-10's engines somewhat erodes its take-off fuel capacity. But the main reason is that the larger number of KC-135s offsets the longer mission endurance of the KC-10 to yield more total tanker hours in the air.

There's another advantage. Like the KC-135s, multiple medium-sized tankers could be positioned at more points around the battlespace. Past experience suggests that the number of tankers available matters at least as much as the endurance of each tanker in meeting receiver requirements.

Bottom Line: Fuel and other constraints at the forward base are a crucial variable in tanker operations, and they generally favor a medium-sized tanker.

WHAT TYPE OF TANKER IS BEST FOR SUPPORTING LONG-RANGE STRIKE MISSIONS?

Aerial refueling tankers were originally developed to support the long-range bombing missions of the Strategic Air Command. SAC disappeared when the Cold War ended, but the need to accomplish long-range strikes remains. In fact, the array of long-range strike missions that the Air Force must be able to execute is increasing as threats grow more diverse. In addition to traditional nuclear-deterrence responsibilities, the service must also be able to mount conventional attacks around the world that

are prompt, precise, penetrating and persistent. It may even need to use non-lethal weapons in some long-range missions.

The Air Force is currently conducting a series of studies aimed at determining what kind of long-range strike systems it will require through 2035. Those studies will probably generate recommendations to upgrade the existing bomber fleet, begin fielding a next-generation bomber by 2018, and research more revolutionary strike concepts for implementation at mid-century. Whatever specific initiatives are embraced, though, it is clear that tankers will figure prominently in plans to execute long-range strikes. Without tanker support, even the biggest, most capable bombers would be unable to reach areas of interest in Asia and the southern hemisphere.

Long-range strikes employing heavy bombers create special aerial-refueling needs. Consider a scenario unfolding in the Western Pacific where tankers based at Guam are assigned to support bombers and escort fighters headed for the vicinity of the Taiwan Strait. A very large tanker with extended range and heavy fuel-carrying capacity would probably be the optimum support system in such a scenario, because of the imposing distances associated with Pacific operations.

Global strike missions already rely on larger tankers when they are available. In the Balkan air campaign of 1999, B-2 bombers flew non-stop from bases in Missouri to targets in former Yugoslavia. Widebody KC-10 tankers were used to support these lengthy missions, because their performance in such scenarios substantially exceeds that of the smaller KC-135s. Similar contingencies will undoubtedly arise in the future.

However, the heavy bomber fleet of today is much smaller than during the Cold War. There are only 21 B-2s in the fleet, and the entire bomber force totals less than 200 airframes. Future long-range strike concepts will probably stress the use of smaller, faster planes operating from forward locations, or unmanned systems such as intercontinental ballistic missiles armed with conventional warheads. So although big tankers are best suited to global strikes by heavy bombers — especially in the Pacific — that is not the key factor shaping future tanker requirements. Indeed, the current inventory of KC-10 tankers may be adequate to support bomber operations until new strike systems enter the force.

Bottom Line: The KC-10 is optimized to provide the heavy bomber force with aerial refueling in long-range strike missions, but it may not be the best system for supporting other kinds of air operations.

How many tankers are needed for peak receiver requirements?

Large-scale theater air operations are another matter. Peak refueling demands come when many strike aircraft are conducting attacks around the clock, spread across a wide area. It's crucial to have enough tankers (or in the vernacular, "booms") to meet peak demand.

Take the case of four fighters refueling from a single boom at a transfer rate of 2,000 lbs. per minute. (Tankers can transfer fuel faster but most current fighters can't receive above this rate.) Assume the fighters will each receive 6,000 lbs. of fuel and each will spend an extra five minutes positioning for the refueling. Those fighters need 32 minutes if they must depend on just one tanker.

The most modern tankers in the current aerial refueling fleet are KC-10s such as this one. KC-10s are well-suited to supporting a wide range of missions because they can carry large fuel loads over very long distances, but there are only 59 of them in the force.

Give them two tankers, and the time is cut to 16 minutes. Scale it up to 12 fighters and it takes four tankers to get them on their way in 24 minutes, or six to push them through in 16 minutes. Receiver demand multiplies under combat surge conditions. Multiple tankers are needed to shorten refueling time and keep strike aircraft on schedule.

The crunch comes when commanders have to position enough tankers to meet the peak wartime demand. What drives peak demand?

One driver is airstrikes on fixed and emerging targets. Another is close air support for ground forces. For example, the highest numbers of strike sorties during major combat operations for Operation Iraqi Freedom in 2003 came when the air component was working to strike deep at Republican Guards targets *and* to provide responsive close air support. Many fighters and bombers were over target areas at the same time. The Army expects to fight in a noncontiguous, distributed battlespace in the future and to rely more on air-delivered firepower.

During Operation Iraqi Freedom in 2003 strike sorties averaged 620 per day including support to two ground divisions. Future requirements could top what was needed for OIF. In Operation Desert Storm in 1991, it took 1,340 daily sorties to support *six* divisions.

Another factor is timing. Strike sorties typically double or triple in number during peak daylight hours — in part, because that is usually when enemy forces are most active.

Tankers must be able to sustain the peak requirement. Wartime surge requirements could be as high as 125 refuelings per hour. Bombers and fighters will be attacking from all angles. Ground forces will be scattered over a distributed battlespace with strike aircraft stacking to support them, and tanker tracks placed to maintain high volume in crucial time periods.

How many tankers are needed at the crunch point? If each tanker refuels seven aircraft per hour, then it takes 18 tankers to get the job done. If each tanker refuels only five aircraft per hour it would take an imposing 25 tankers per hour to support the joint campaign.

Remember, in wartime, effectiveness trumps efficiency. The tanker fleet has to be sized to accommodate first and foremost that maximum wartime surge requirement.

Bottom Line: In combat operations there is a minimum number of tankers needed for surge requirements and support of ground forces, independent of total offload capacity; a fleet with a large number of medium-sized tankers does the job best.

SHOULD A NEW TANKER CARRY CARGO, TOO?

Future tankers should be able to carry cargo too, according to General Norton Schwartz, Commander in Chief, United States Transportation Command. Schwartz is on record supporting a multi-mission tanker that can ferry essential cargo and passengers as well as fuel. He told the House Armed Services Committee in March 2006 that the combination tanker-cargo aircraft makes sense. "If I had a properly configured tanker that had doors and floors, could carry passengers, and [had] defensive systems, I could ... return the C-17 either to moving cargo or reduce the [operating] tempo," said Schwartz.

Tankers don't take the place of C-17s and other airlift but they can be a big boost early on. Both the KC-135 and the KC-10 have room for cargo as well as fuel, but buying a new tanker is a chance to invest in extra cargo capacity. Metal decks above the internal fuel tanks can be set up as a reinforced floor for pallets and passengers. New loaders have also made cargo handling much more efficient.

The new tanker candidates keep most of the "main cabin" area free for cargo and passengers with fuel tanks and lines in the belly of the widebody aircraft. According to Northrop Grumman, its KC-30 derivative of the Airbus A330 could carry up to 32 NATO standard 463L pallets. Boeing's 767 can transport 19 of those pallets. Both can split configurations — the KC-30 can carry 280 passengers, the KC-767 about 200 passengers, or a mix of pallets and passengers such as the Boeing 767 "combi" configuration of 100 passengers, 10 pallets and (of course) fuel.

Most experts agree that tanker-transported cargo would form only a small percentage of "strategic" inter-theater lift. But even if tankers brought in relatively small amounts of the total bulk airlift, their cargo could be crucial at certain times.

Expert opinion divides on how important it is for tankers to carry cargo. The question boils down to whether the tanker-transported cargo will be significant either in critical, early phases of operations, or as a fraction of the long-term sustainment and lift requirements.

Those in favor point out that tankers bringing in cargo can be very useful as a new airbase is opening. Limited ramp space and landing slots make it important to pack in everything possible as

flights land at expeditionary bases. Tankers can also bring in maintenance personnel and critical spares and supplies for a deploying squadron, for example. Tanker transports could surge to meet peak cargo demand, provide passenger movement and medevac, and act as a hedge should the Civil Reserve Aircraft Fleet degrade over time (or be unable to transit a theater under missile threat). A multi-mission tanker makes sense given the uncertainties of the future security environment.

Bottom Line: Cargo capacity can deliver valuable flexibility and a helpful strategic hedge for the future.

SHOULD THE NEXT-GENERATION TANKER BE PROCURED COMPETITIVELY?

The Air Force originally planned to lease its first 100 new tankers. By leasing, the service hoped to commence recapitalization of the aerial refueling fleet even though it lacked sufficient funding for outright purchase of the planes. However, although leasing is a common practice among airlines, the plan generated political controversy and was abandoned. The Air Force now intends to do a conventional purchase of tankers that have been derived from successful commercial-transport designs. The leading candidates are the Boeing 767 widebody and the larger Airbus A330 widebody.

Although it is being offered in tanker configuration by a U.S.-led team, the Airbus plane has generated some controversy of its own because the design is European. Such controversy is undesirable for two reasons. First, both planes were designed with extensive foreign content, which is the only cost-effective way of building planes in a globalized economy. Second, in the absence of the Airbus option, there would be no alternative to a Boeing product. Most experts agree that competition is essential to assuring that the government gets the best price and performance from whatever tanker it chooses.

As explained in the RAND Corporation's analysis of alternatives, there are numerous advantages to using a commercial-transport derivative as the next-generation tanker. Not only do both of the leading contenders have good track records for reliability in commercial operations, but they have well-established global networks of maintenance providers and spare-parts suppliers to assure efficient life-cycle support. By tapping into commercial networks and practices, the Air Force can avoid the high costs often associated with military-systems support.

However, the question of which plane is the preferred choice to meet future aerial-refueling needs is best answered through a competitive procurement. Because the 767 and A330 are both successful commercial transports, there is little doubt that either one could satisfy basic refueling needs. The virtue of competition is that it forces rival teams of prospective suppliers to think rigorously and imaginatively about future operational concepts, logistical needs, cost burdens and other factors crucial to the Air Force's final decision. Not only is the buyer educated by entertaining competing bids, but the bidders are disciplined to offer the very best package. Competitive procurement is thus the optimum approach to selecting a future tanker.

Bottom Line: Competition is a proven method of getting the best product and support package for a next-generation tanker.

Without aerial refueling from Air Force tankers, the reach of carrier-based tactical aircraft would be severely constrained. However, support of these and other military aircraft requires a force of hundreds of tankers in order to cover all likely locations and contingencies.

How many new tankers should be bought each year?

Any program to replace the Air Force's aging tanker fleet must be reconciled in the budget process with competing needs — the cost of personnel, of operations, and of other required military systems. RAND's analysis studied different start dates for buying new tankers from 2011 to 2041. The most cost-effective option is to start very soon.

Dollars will always be limited. The Air Force has a large tanker already in the KC-10, so buying a medium first would yield more "booms" for the money. Buying large tankers that will take more time to develop may just increase the risks on the medium tanker fleet without solving the problem of how to acquire a new medium tanker.

Reinvigorating the tanker fleet is a top priority for future joint warfighting. Future concepts place more reliance than ever on air-delivered fires. Deep penetrating Special-Operations Forces, ground forces conducting vertical envelopment, and naval forces supplying aircraft from sea bases all count on strategic tankers that only the Air Force possesses in large numbers.

Taking continued risk with the tanker fleet puts that all in jeopardy. Even if the Air Force elects to buy a new tanker every other week, it would take over 20 years to replace the current fleet of 520 KC-135s. Buying planes at a higher rate may prove unaffordable, but buying fewer increases the danger of age-related problems in the existing fleet at some point before recapitalization is fully completed.

Bottom Line: Tanker fleet recapitalization should begin soon to keep the buy steady and affordable and reduce risk of fleet grounding and collapse.

Conclusion

No other air force in the world possesses the vast depth of America's aerial refueling fleet. But the youngest KC-135 is 42 years old. In 2002, one KC-135 pilot, Major Les Preston, told a *St. Louis Post Dispatch* reporter about the situation in his last squadron. Preston was stationed with a KC-135 pilot whose father had also flown KC-135s. So had his *grandfather*.

Clearly, the time is long past when replacement of this aging asset should have commenced. The tanker fleet is too vital to U.S. national security to take the risk of waiting any longer.

Operational trends over the last 40 years have shown that air power today depends completely on tankers. Without a reliable fleet of them, the Air Force's expeditionary operations would be curtailed. Forward air bases would have to be near battle areas. Humanitarian relief missions would take days longer. The ability to operate in multiple theaters at the same time would wither.

"There is nothing we do … without tankers," Air Force Chief of Staff General T. Michael Moseley has said. That's the real bottom line.

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