FORTY-THIRD WINGS CLUB
GENERAL HAROLD R. HARRIS
‘SIGHT’ LECTURE

AIR CARGO: BACK TO THE FUTURE

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CHAIRMAN, PRESIDENT & CEO
FEDEX CORPORATION

Presented at
The Wings Club on May 24, 2012
New York City
Good afternoon. Thank you for inviting me to participate in the Wings Club’s 70th anniversary celebration. This organization has always been at the crossroads of the aviation industry, and I am honored to join the ranks of so many distinguished past speakers, from Jimmy Doolittle to my friend Herb Kelleher.

I’m also proud to represent our 300,000 FedEx team members around the world, not only those on our team today but also the thousands who have served our company in decades past. I am able to stand here before you because of their hard work and their commitment to our famous Purple Promise, which states simply, “I will make every FedEx experience outstanding.”

Finally, I feel I’m among old friends, some of whom I’ve known from 1984, when I was president of the Wings Club. Our industry has been through so many changes that it’s good to be among those who really understand the significance of all we’ve accomplished.
While I was president, a movie came out called, “Back to the Future” in which the main character, Marty McFly, alternates between the past, present, and future via Doc Brown’s plutonium-powered DeLorean time machine. The movie is a great framework for a “Sight” speech, which focuses on events taking place over a broad time span. The movie is also a good metaphor for the history and evolution of air cargo. Certainly, the future of air cargo is built on its past. And, like Marty, we must use the past to ensure our own successful future.

Before I get started, I want to cover a few notes about FedEx and our broad portfolio of shipping solutions. As you know, we began as Federal Express and created the modern air-express industry almost four decades ago. Our history spans the most important era of the modern air cargo industry, and today we have nearly 690 aircraft, the largest all-cargo fleet in the world. Our growth has been spurred by several macro-economic trends: the increase of high-tech and high value-added goods, the wider access of world markets to each other, just-in-time delivery, and the rise of the Internet.

But besides FedEx Express, we also have other major operating companies: FedEx Ground, FedEx Freight and FedEx Services, which contains our technology and retail units, the latter being FedEx Office. We have
several smaller companies, one of which is FedEx Trade Networks, dealing in freight forwarding and ocean services, among other things. Because we transport by air, land and sea, FedEx bears witness to the global trends affecting those areas.

As sophisticated and widespread as travel has become in the 20th and 21st centuries, we should remember that man has pursued travel and trade since before recorded history. The evidence of wheels and boats has been found in the earth’s strata dated thousands of years BC. And the wide use of these inventions gave rise to great civilizations. Greece, Rome, China, the Middle East and the British Empire grew prosperous on the rolling wheels and navigable vessels that connected them to their trading partners. Even to the present day, ships and wheeled vehicles of all sizes remain key purveyors of trade and culture.

But truly, nothing has connected the world like aviation. It’s astounding how much the airplane has done for trade and travel in only the past 100 years.

Let’s take a closer look at aviation history as it pertains to cargo.

In the beginning, from the invention of flying through World War I, planes were used to carry very expensive, very urgent items which were small or lightweight. With its limited passenger and payload capabilities, a Curtiss Condor, let’s say, could only carry important people or very important things—such as the U.S. mail. After all, unlike earthbound ships and vehicles, it costs a lot of money and technology to get a heavy plane to break the bonds of gravity and stay in the air over longer distances. So it was primarily the U.S. government, beginning in 1911, that funded the air cargo industry to get the mail delivered. Small cargo planes were also used for passenger travel.
important goods such as medical supplies, military goods during World War I, or newspaper delivery. In short, cargo aviation was a government-subsidized industry in the early days.

It was not until the mid-1930s that Douglas came out with their DC-3, a plane that could support itself from commercial revenues rather than government subsidy. People began placing more value on their time and on access to the marketplace. As a result, the DC-3 came into more general use for passengers and light cargo.

Still, the cost of moving goods by airplane as compared to boat or vehicle was just not competitive. And the payload of a DC-3 was about 6,000 lbs. or 24 passengers. So the plane was still limited mainly to carrying high-value and smaller shipments.

Then World War II came along, and the DC-3 became workhorse to the war. About 10,000 of them were built during World War II. Money was poured into its derivatives, the DC-4 and DC-6, and all the big prop airplanes were used worldwide during the early post-war years. More than 100 airlines flew them, often using ex-military aircraft. Some people had
grandiose visions of cargo planes becoming the “ships of the sky,” but the truth was that boats and wheels still remained the prime instruments of trade. Most cargo shipments from the end of the war until the 1970s were moved by either the U.S. government or the military. One problem with the military cargo planes so prevalent after the war was that they could not be adapted to commercial use. Delta tried with the Lockheed C-130, a derivative of the L-100 Hercules, but experienced only limited success. So, in the 50s and 60s, passenger airlines went to other planes, and the cargo industry loped along.

That’s not to say there wasn’t a growing need for fast, reliable, long-haul cargo transportation. I ran across an article from the March, 1946 issue of Flying magazine that discussed the birth of The Flying Tiger Line, which began as a non-scheduled operation. Their motto was “We haul anything anywhere.” They used stainless steel Conestogas designed for use with the short runways of the tropics. The Flying Tiger Line was able to fly coast-to-coast such varied cargo as penicillin, fruit, furniture, dresses, wine, and 8,000 baby chicks. One enthusiastic farm-implement company told Bob Prescott, the founder of Flying Tigers, “If we could slash our inventories by using airplanes to assure one-day service on replacement parts from the factory, we could pass on important savings to our customers.”

In fact, it would take a confluence of three factors in the 1970s to make Flying Tigers a truly viable company as the air cargo industry matured and became a major force in the world’s economy:

- The rise of the four “Asian Tigers” and Japan;
- The increased manufacture of electronic products in these countries; and
- The introduction of the Boeing 747.
Beginning in the 1960s, Japan, Hong Kong, Singapore, Taiwan and South Korea, evolved into major manufacturing locations. This was particularly driven by the purchase of electronics and automobiles by American and European consumers. Significant investment in these Asian countries, including modern infrastructure and hi-tech factories, produced high growth rates that continued into the 90s. The world economy was booming so much in the 1960s that travel and transport demand had outgrown the airliners then in service.

But in January 1970, Boeing introduced its 747, which revolutionized aviation. Its operating costs were an attention-getting 30% lower per passenger seat or unit of payload than any other commercial aircraft. It was two-and-a-half times bigger than the largest jet airliners in service at that time—the Boeing 707 and the McDonald Douglas DC-8. The freighter version of these four-engine aircraft and a few cargo and convertible versions of even smaller 727s, DC-9s, 737s, and BAC-111s were put in service in niche markets. However, none of these all-cargo aircraft produced profits for their operators. There simply wasn’t enough high-yield, point-to-point freight to justify flying an all-cargo aircraft in general service.

Now, if any of you attended Joe Sutter’s Sight Lecture five years ago, you know how the 747 became a great cargo airplane. In that speech, Joe tells the story of how, in the 1960s, Boeing was competing for a contract to develop a jumbo freighter for the U.S. Air Force. The SST or Supersonic Transport was viewed as the passenger plane of the future. However, after they lost the Air Force competition to the Lockheed C5-A, Boeing focused
on the passenger version of its 747 design but viewed it only as an interim passenger aircraft to be shortly replaced by the SST.

To make sure the 747 remained viable after the passenger business went supersonic, it was decided to also make the 747 an excellent commercial freighter in its “afterlife.” Of course, no American SST was ever built, and the European Concorde proved to be uneconomical. As a consequence, the 747’s compelling costs as both passenger liner and freighter created significant increases in demand for travel and shipping by air. In the latter regard, the 747 air freighter, for the first time, gave air cargo a starring role in the air transportation system, instead of its being an after-thought in the underbellies of passenger planes. Now, finally, you had the plane to carry computers, electronics and other high-value perishables such as flowers across vast distances. The international air cargo market came to resemble the sea freight and surface freight markets with large point-to-point freight consolidations.

As the 747 began to dominate long-haul services, an upstart network called Federal Express began flying from Memphis in spring 1973 with less than 200 packages rattling around in 14 small Dassault Falcons going to 25 cities on its first day.

Our hub-and-spoke distribution system was one uniquely developed to deliver overnight express packages from one point to any other on the network. This capability was unprecedented. Also, we created an integrated air-ground express network that was a first in the air cargo industry. And we understood at FedEx that information about the package is as important as the package itself, so we also originated the first tracking system to enable people to keep tabs on their shipments.

Federal Express’ creation was driven by the automation of society and the increasing use of computers and electronic devices for many different applications. There was a growing need to move small, important shipments randomly throughout the U.S., “absolutely, positively overnight” as our iconic advertising touted in those days.
So, combined with deregulation in the 1970s, you had all the elements in place for air express and air cargo to materially change modern logistics. In the long-distance international marketplace, the right plane—the 747F—and the proliferation of hi-tech, high-value-added goods around the world built unprecedented prosperity throughout Asia and connected North America and Europe to all parts of the world with almost unbelievable economics compared to the past. At the same time, the new U.S. air express delivery model for the first time made domestic all-cargo operations profitable. These two developments came together in the 1990s as FedEx began to meet customers’ needs for international air express shipments by expanding abroad and by purchasing Flying Tigers for its extensive route authorizations and facilities, particularly in the burgeoning Asian market. Subsequently, with the growing importance of air commerce, most international bilateral aviation treaties were liberalized to allow freighter operations to align with global trade flows. All of these factors combined to usher in the golden age of air cargo.

**World Trade Summary by Major Sectors & Modes**

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<td>Air</td>
<td>Ocean</td>
<td>Air</td>
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<td>High-tech</td>
<td>17.8%</td>
<td>82.2%</td>
<td>18.3%</td>
<td>81.7%</td>
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<tr>
<td>Others</td>
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<td>0.7%</td>
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<td>1.9%</td>
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<td>Chemicals and Allied Products Products</td>
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<td>0.4%</td>
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<td>$30.86</td>
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<td>4.0%</td>
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<td>$38.88</td>
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<tr>
<td>Machinery except Electrical</td>
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<td>91.2%</td>
<td>6.3%</td>
<td>93.7%</td>
<td>$35.81</td>
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<td>Electrical and Electronic Machinery/Apparatus</td>
<td>6.0%</td>
<td>93.2%</td>
<td>5.3%</td>
<td>94.7%</td>
<td>$23.36</td>
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<td>Apparel and Related Products</td>
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<td>90.5%</td>
<td>7.9%</td>
<td>92.5%</td>
<td>$10.84</td>
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<td>3.7%</td>
<td>96.3%</td>
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<td>Furniture and Fixtures</td>
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<td>0.8%</td>
<td>99.2%</td>
<td>$6.36</td>
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<tr>
<td>Papier and Allied Products</td>
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<td>0.8%</td>
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<td>Perishables, Agricultural, and Livestock Products</td>
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<td>1.0%</td>
<td>99.0%</td>
<td>$2.06</td>
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<td>0.3%</td>
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<tr>
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<td>88.0%</td>
<td>8.8%</td>
<td>91.2%</td>
<td>$36.59</td>
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- **High-Tech, Others, and Chemicals (includes pharma) are the sectors that have shown increased usage by air vs. ocean.**

**Notes:**
1. Containerized ocean cargo, excluding bulk commodities such as oil

Source: Global Insight Trade Data & FedEx Analysis

- Today international air cargo/air express is a $78-billion business that transports 35% of the value of goods traded internationally, worth some $10 trillion, but only 2% of the tons moved.
- In 2010, the value of goods transported by air was $32.78 a pound as compared to $1.87 a pound by ocean.
- Air cargo is a critical part of the airline business, which is part of a value chain that supports 32 million jobs and $3.5 trillion of economic activity.
At the same time the air cargo industry was transforming into a major worldwide business, the shipping business was also undergoing big changes. This story can be told through the life of one man, Malcolm McLean, a friend of mine who passed away 11 years ago. Malcolm invented the shipping container, “a contribution to maritime trade so phenomenal that he has been compared to the father of the steam engine, Robert Fulton,” according to a Harvard Business School article.

McLean began as a truck driver during the Depression, who saw all the time being wasted as he waited at port for stevedores to unload truck cargo and put it onto ships. By the 1950s, states began adopting new trucking weight restrictions and levying fees. McLean saw a way around this through the use of coastal shipping vessels, which could handle most of the transport but also work in tandem with trucks, which could then make shorter, lighter-weight hauls to final destination. This eventually led to his invention of “the box,” or the cargo shipping container, constructed of heavy steel to protect contents and withstand rough seas. These standardized containers were stacked in the hulls of ships. Eventually, ports redesigned their dockyards to accommodate the lifting and storage of these containers. The labor savings and efficiencies, in addition to the ability to transport more cargo across oceans to Asia and Europe, gave a much needed reinvigoration to the shipping industry that continues today.

Over the years, these ships, unlike aircraft, have gotten bigger, better and quantumly more efficient. Today they run more than 3.5 times the size
of a football field and have capacities up to almost 15,000 TEUs (twenty-foot equivalent units). On the other hand, the 777F, today’s most efficient air freighter, while more cost-efficient and longer-ranged than the 747F, is not materially larger than the early 747s from 40 years ago! As you can see from this slide, one of the largest container ships today has 138 times the capacity of the Boeing 777’s payload capability of 112 tons. With the massive growth of the sea container market, customer service has improved significantly as well, with daily sailings between most major ports, better schedule reliability, and enhanced shipment-information capability.

Why do I share this information about the evolution of maritime shipping with you? Because ocean cargo shipping is inextricably tied to the air cargo industry and accounts for many of the changes we’re seeing in the future of air cargo.

Some of those trends actually hark back to those that emerged post World War II. Now, instead of the Asian Tigers, you have the rise of the BRIC
countries—Brazil, Russia, India and China. These countries, along with other developing nations, account for the majority of world growth. The rise of China into an economic superpower has been astounding. Over the last decade, manufacturing in China has produced consumer goods at lower prices than could have been imagined just a few years ago. In addition, it has become the world manufacturing center for high-tech and high-value-added goods like electronics that are small but produced in great numbers. And in this age of instant-technology-gratification, the world is hungry for these products, all on display at our fingertips over the Internet. Of course, that’s great for express air cargo. We take care of all the details such as customs clearance and provide, in essence, a clipper ship service for the computer age.

**Air Cargo Traffic And Semiconductor Billings**

- Semiconductors are a vital component of complex electronics like PCs and cellular phones — products often carried by air cargo
- Goldman Sachs forecasts global semiconductor shipments (computing units, cellular handsets) to increase 8% - 10% in 2012, but forecasts weakness in the 1st quarter of 2012 due to weak demand
- Semiconductor manufacturers are expected to grow capacity at 10% - 15% through 2013.

*Strong correlation between air cargo traffic and semiconductor billings*

You can see from this chart the strong correlation between the air cargo business and billings for semiconductors, those parts so crucial to computers, smart phones and other hi-tech gadgets.

But, as we all know, there’s a cloud hanging over today’s industrial horizon—the high price of oil. It’s a villain we didn’t have to deal with in the mid-century world of cheap gas and fin-tailed cars. We’ve certainly had our challenges in the last four decades with the price of oil. I’ll never forget the effect of 1973’s oil embargo on a fledgling FedEx. We almost went under before we’d barely begun. But for the most part, during the late 70s through the 90s, we enjoyed cheap petroleum. In
1999, oil was $16 a barrel—in 2008, $147 a barrel—a 900% increase. It is important to note that global oil prices in recent years reflect the increase in demand of emerging economies versus temporary supply disruptions that caused price spikes—and economic slowdowns—in the 1980s and '90s. In this regard, I strongly recommend the May 8th report of Securing America’s Future Energy, which gives an excellent comprehensive analysis of petroleum markets.

Given these trends, FedEx Express began a major fleet modernization program several years ago that will substantially reduce the amount of fuel required to move our airborne traffic. We are also researching biofuels and using more electric power and natural gas in our vehicle operations to reduce costs and petroleum consumption.

With high fuel prices, it is increasingly expensive to fuel all kinds of transportation, but it’s been hardest on aviation because planes consume vast quantities of jet fuel. Let’s compare a 747 and a large container ship, both going from Los Angeles to Hong Kong. For the ship, it takes one ton of fuel to move 330 tons of cargo. For the plane, it takes about 330 tons of fuel to move the same amount of cargo.

The result of such high fuel costs is a muted profit outlook near-term for air cargo as a whole. In short, traditional air cargo profitability is being squeezed by spiking fuel prices, lower volumes of electronic shipments and falling yields. According to IATA’s most recent report, growth will be
anemic in the U.S. and Europe, but positive worldwide due to the strength of emerging markets. Des Vertannes, IATA’s Global Head of Cargo, says “Despite a positive outlook for world trade, the mix of freight and increasing costs is favoring maritime over air (cargo).”

All those big ships I mentioned earlier are nibbling away at the air cargo business, and those bites will become bigger when the Panama Canal expansion is completed in 2014. The expansion will permit large ships from Asia to travel directly to our East Coast instead of offloading on the West Coast and shipping them across country by air, rail or road. With 15% of the world’s maritime fleet unable to use the Canal because the ships are too large, the expansion project will have a major impact on world trade.

![Panama Canal](image)

This chart demonstrates more clearly what’s happening between air and sea cargo. As fuel prices have increased over the first decade of the 21st century, air express has been growing, but commodity air freight has been stagnant. These trends are expected to continue unless there is a substantial reversal in energy costs.
Now, at a certain value per kilo, air freight can be a cheaper means of transport than ocean, as you can see from this chart. If the value of the cargo is high, it’s actually cheaper to move by air rather than sea and avoid high carrying costs for a lengthy ocean voyage. But as fuel costs rise, the more valuable the cargo must be per pound to justify shipping by air.

But less expensive shipments are more often going by sea. To give you a real-life example of air-to-sea mode shift, let’s look at a perishable, high-value retail product—cut flowers. The cut-flower business has long been mostly the preserve of the air freight industry. But, like everyone else, flower shippers are looking to cut costs. A recent article in Air Cargo Management magazine described a joint venture between FloraHolland, operator of the largest flower auction in Europe and TransFresh, a subsidiary of fruit producer Chiquita. TransFresh specializes in controlled-atmosphere shipping containers, which can better handle fragile cargos such as cut flowers, which not only need a certain temperature, but also reduced air in the container to curb blossom degradation. Combine that with the much lower costs of sea shipping compared to air, and you can understand why the flower industry is keen to shift more of its supply
chain to ocean transport. One industry consultant, discussing Kenya’s rose-growing industry, estimated that in five years’ time, you’ll see about 20% of Kenya’s flower volumes transferred from air to sea.

In the largest air cargo lanes, high fuel prices make it difficult to fly freighters profitably with 3:1 and 2:1 traffic imbalances between Asia and Europe and Asia and the U.S. respectively. Moreover, international air cargo is becoming more volatile with both the frequency and amplitude of business cycles increasing and electronic product introductions becoming more episodial. This makes it very difficult for many operators to effectively utilize all-cargo aircraft over longer periods of time. Despite these factors, air freight yields have been declining in real terms for many years, while new main-deck all-cargo capacity has been increasing. So, in general, freighter flying has truly gone back to the future where most operations are marginally profitable at best!

The takeaway from this evolution of the air cargo industry is that the air express sector will continue to grow long-term as the integration of the world’s economies generate more small shipments moving directly from point of production to the end user. Another major factor undermining the future market for main-deck commodity air freight services has been the significant additional underbelly capacity produced as a byproduct of long-range passenger services. These relatively small compartments and the containers and the Unit Load Devices that fit in them lend themselves to the movement of smaller shipments being pulsed out around the world. In short, the bigger commodity consignments are increasingly moving by sea, and dedicated express networks and underbellies are capturing more urgent, lighter shipments. So in many ways, the future of air cargo is akin to the early days of the industry, when planes carried the mail or some other small, valuable product as opposed to larger shipments.

For example, one of our customers is Medtronic, which manufactures heart valves and surgical kits. They use FedEx Express to get those valves out for next-day surgery in the U.S., using our first overnight or priority service. But on the international side, they’ve used FedEx Supply Chain to set up distribution centers, which we manage in
China India, and other Asian locations. Shipments of medical equipment to these centers move as bulk freight, either by deferred air delivery or by ocean, and then are moved by air express to their ultimate destination.

Other examples, these from the tech sector: our customers Apple, Dell and HP do much of their manufacturing in Asia. When the companies get orders, those are sent directly to the Asian plants and manufactured. Then the products are sent around the world by FedEx Express and injected directly into our express distribution systems, bypassing warehouses. However, low-value peripheral products such as screen covers, charging stations, or cases can take their time by truck, ocean or deferred air.

At FedEx, (Slide 26 – FedEx 777) we will continue to work hard to take

FedEx Today

advantage of that express air cargo sweet spot and bundle it with our ground, freight and ocean capabilities to remain a key player in the evolving air cargo industry. It’s been part of our strategy for quite awhile to make sure we can offer our customers every major shipment option possible.

It’s been said many times that the only certainty in life is change. That’s been true in my life and the life of FedEx. No matter what’s happening in our industry now, it won’t be the same 10 years from now. But that’s what makes the journey so exhilarating. In “Back to the Future,” Marty is berated by his principal as being a slacker like his old man. The principal says, “No McFly has ever amounted to anything in the history of Hill Valley. To which Marty retorts, “Yea, well, history is gonna change.” It always does, Marty, and at FedEx we look forward to it. I hope all of you do too.

Thank you.