

Commercial Market for
Cargo Operations
Aviation Systems Architecture

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TOTAL CARGO MARKET

GIANT MARKET CONSISTING OF:

- **TRUCKING**
- **RAIL**
- **SEABORNE**
- **AIR CARGO**

AS THE “WORLD GETS SMALLER”, THE GROSS VOLUME OF FREIGHT HAS INCREASED DRAMATICALLY!

COMMERCIAL CARGO OPERATIONS

- . SEA
- . LAND
- . AIR
- . RIVER, LAKES, OCEAN

TYPES OF FREIGHT

- SMALL PACKAGE DELIVERY
- “LESS-THAN TRUCKLOAD” FREIGHT
- AIRLINE “BELLY FREIGHT” , e.g. AA, DL, JAL
- PALLETIZED FREIGHT
- CONTAINERIZED FREIGHT
- BULK CARGO

INTERMODAL TRANSPORTATION

ALTHOUGH THERE ARE NUMEROUS TYPES OF EQUIPMENT FOR FREIGHT, SOME STANDARDIZATION HAS BEEN ACHIEVED IN:

CONTAINERS

PALLETS

AIR FREIGHT CONTAINERS

8' X 8' X 20' CONTAINERS



8' X 8' X 40' CONTAINERS



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CONTAINERSHIPS

CAPACITY:

UP TO 9000

CONTAINERS

SIZE: 950' LENGTH

UP TO 100,000

TONS G.W.



EVERGREEN CONTAINERSHIP-TAIWAN



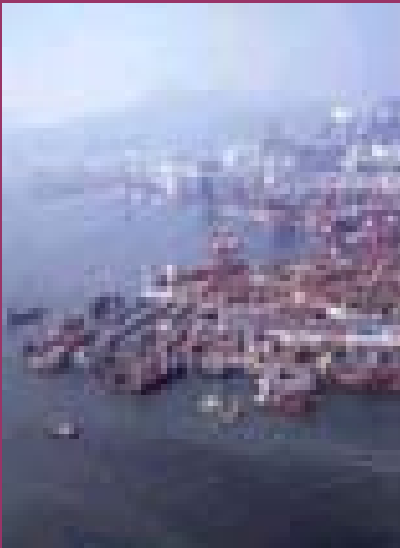
MODERN CONTAINER SHIPS

- BEAM GREATER THAN 110 ft.
- CAN'T TRANSIT PANAMA CANAL (TOO WIDE !!)
- CREW OF ONLY 13 (U.S. Destroyer is 360', 3200 tons, crew of 360 !!!)
- DIESEL POWERED , 22-23 KNOTS
- AUTOMATED SYSTEMS –low labor costs
- OPTIMIZED FOR EFFICIENCY (reduced ton-mile costs!!)

PORT FACILITIES

- HUGE LOGISTICAL INVESTMENT !!

AUTOMATION IS KEY; SPEED IN UNLOADING / MINIMIZATION OF LABOR TO REDUCE COSTS



ONE-MAN CONTAINER HANDLING



HONG KONG-PEARL RIVER DELTA- CONTAINERPORT

MILLIONS OF 20 ft. CONTAINERS
PASSING THROUGH IN 2002*

- HONG KONG 25.2*
- LONG BEACH 10.6
- NEW YORK 3.3
- OAKLAND 1.6

(PRC'S EXPORTS GREW
22% IN 2002 !!)



EXPLOSIVE GROWTH IN CONTAINER THROUGHPUT

LONG BEACH, CA

Port Container Growth In millions of twenty-foot container units



NUMBER & SIZE OF THE U.S. FLAG MERCHANT FLEET

WORLD FLEET	28,318 SHIPS
U.S. FLEET	454 (2%)
CONTAINERSHIPS	90
ROLL-ON / ROLL-OFF SHIPS	60
GENERAL CARGO SHIPS	136

SOURCE: 1960-1997 U.S. DEPT. OF TRANSPORTATION, MARITIME ADMINISTRATION, "MERCHANT FLEETS OF THE WORLD", 2001

MAERSK SHIPPING LINE INTERMODAL CONTAINER



Gross Weight :67,200 lbs. Tare : 8220 lbs. Payload : 58,980 lbs.

INTERMODAL CONTAINERS ON TRANS-CONTINENTAL RAIL SYSTEM



CARGO COMPETITION IS INTENSE!



K -LINE



EVERGREEN



TPL LINE



MAERSK SHIPPING

DOUBLE-STACKED CONTAINERS ON RAIL (TRAINS MOVE DAY AND NIGHT !!)



8' X 8' X 20' CONTAINERS AT FURNITURE FACTORY



DEMURRAGE

- AFTER A CONTAINER HAS BEEN DELIVERED TO ITS DESTINATION, THE RECEIPIENT HAS 24 HOURS TO UNLOAD
- “DEMURRAGE” CHARGES START TO ACCUMULATE AFTER 1 DAY
- CONTAINER SHIPPING COMPANIES TRACK THOUSANDS OF CONTAINERS ALL OVER THE WORLD!

BARGES-OCEAN, LAKES & RIVER

BULK CARGO: COAL, SAND, GRAVEL, ORE, OIL, ETC.



AIR FREIGHT

TYPES OF CARGO AIRCRAFT

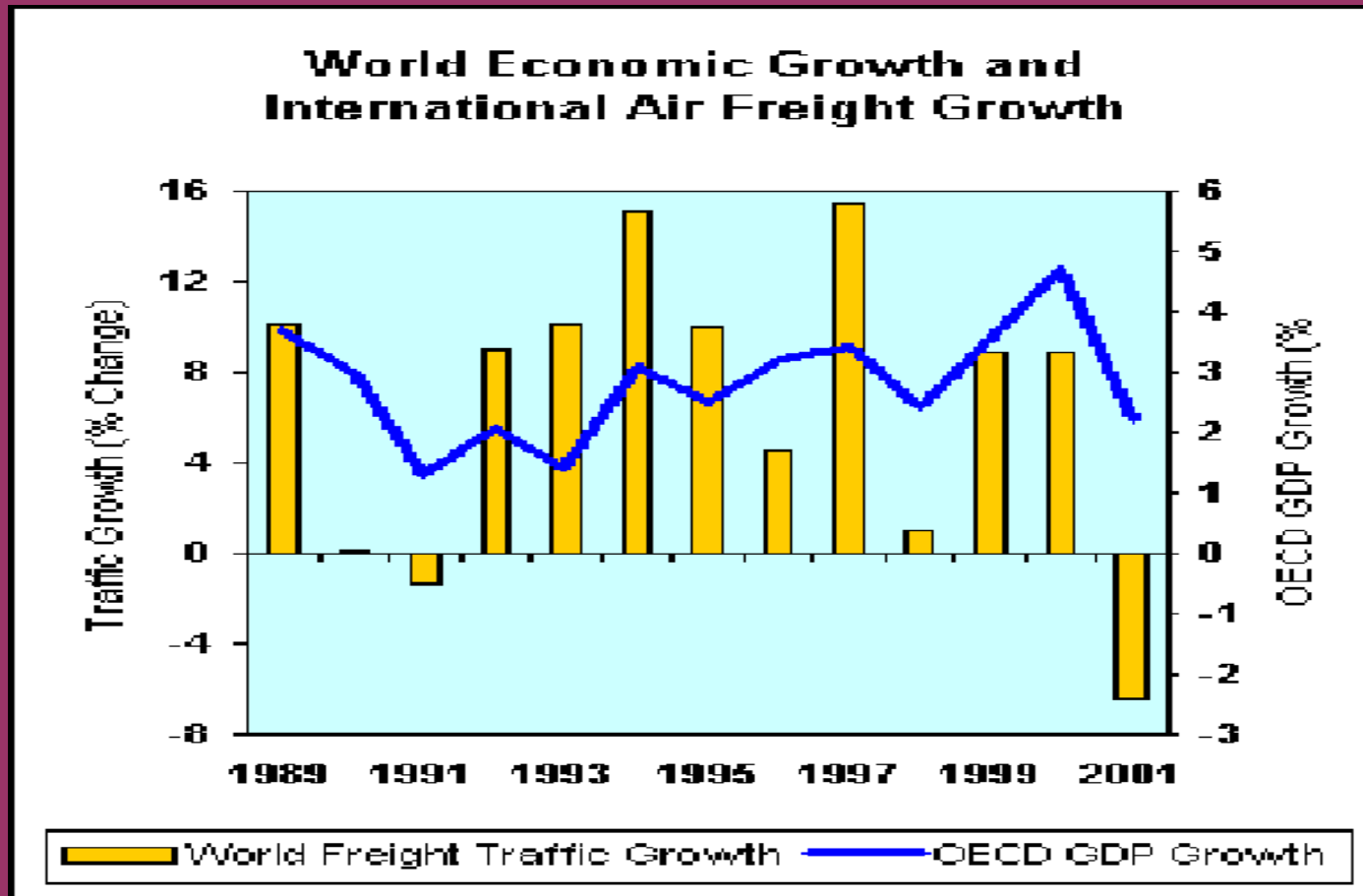
- FREIGHTERS (e.g. 747 F, MD-11F, new A-380)
- COMBI AIRCRAFT (e.g. ALITALIA

MD-11 COMBI CARRIES 200+ PAX
AND MAIN DECK CARGO AFT)

• CONVERTIBLE FREIGHTERS (e.g. MD-11CF)

**FREIGHTERS ARE MANUFACTURED NEW (747-400 ERF) OR
ARE MODS OF OLDER PAX AIRCRAFT (MD-10)**

WORLD ECONOMIC GROWTH AND INTERNATIONAL AIR FREIGHT GROWTH



GENERALLY GOOD CORRELATION BETWEEN AIR CARGO AND GDP

757 CARGO HANDLING SYSTEM (SIDE-LOADING PALLETS)



EVA 747 FREIGHTER



747 FREIGHTER-NOSE LOADING



747-400 FREIGHTER

NEW 747-400ER FREIGHTER: 910,000 lbs.

MTOGW ; APPROX. 8000 n.m. RANGE



CHINA AIR 747 LOADING CONTAINERS



757 & 767 FREIGHTERS

UPS : 767F

DHL: 757F



A-300 CARGO HANDLING SYSTEM

- . TIE-DOWN ATTACHMENTS
- . POWER-DRIVE UNITS
- . REINFORCED STRUCTURE
- . LARGE SIDE ACCESS DOOR (LOADING / UNLOADING)
- . CARGO RESTRAINT SYSTEM



EVA MD-11 CARGO FREIGHTER

630,000 lbs.MTOGW, 192,000 lbs.CARGO, 7200nm.Range



MD-11 CONVERTIBLE FREIGHTER & COMBI

CONVERTIBLE FREIGHTER

24hrs. PAX to Freighter

48 hrs. Freighter to Pax

MartinAir-HOLLAND

COMBI

Alitalia Combi

Main Deck Cargo +

219 Passengers



MD-11 COCKPIT

6 ACROSS MULTIFUNCTION FLAT PANEL DISPLAYS



**THIS COCKPIT WAS INSTALLED IN THE DC-10 MOD TO
MD-10 FREIGHTER FOR FEDEX**

DC-8F CARGOLINER

PAX AIRCRAFT CONVERTED TO CARGO ;RE-
ENGINEED WITH TURBO-FANS
(UPS FLEET)



THE BUSINESS OF AIR CARGO!

- ECONOMICS JUSTIFY **HIGH PRIORITY**
TIME CRITICAL PAYLOADS
(ELECTRONICS, FLOWERS, BERRIES)
- URGENT PACKAGES, DATA, PARTS
- AIR CARGO MARKET AIDED BY
PRESSURE TO REDUCE INVENTORIES
& CYCLE TIME
- SHORTER TIME TO MARKET

AIR CARGO CARRIERS

- POLAR AIR CARGO
- ATLAS AIR
- EVERGREEN INTERNATIONAL
- MARTINAIR
- GEMINI AIR CARGO
- AMERIJET INTERNATIONAL
- EMORY AIR FREIGHT
- DHL
- AIRBORNE EXPRESS
- LUFTHANSA CARGO
- UPS
- FEDEX

NUMEROUS FREIGHT FORWARDERS!



UNITED PARCEL SYSTEM

HEADQUARTERS: ATLANTA, GA

(WORLD'S LARGEST EXPRESS CARRIER & LARGEST
PACKAGE DELIVERY COMPANY)

- 24/7 DELIVERY
- 4 HOURS “URGENT” DELIVERY
- 180 COUNTRIES
- PICK-UP W/I 60-90 MINUTES OF
COMPUTER ORDER RECEIPT
- REAL-TIME TRACKING (BAR CODE/
WIRELESS TRANSPONDERS-PDA)
7 MIL. “ON-LINE” QUERIES PER DAY

UPS RETAIL “STORE” (INPUT TO PACKAGE / PARCEL DELIVERY SYSTEM)



UPS “FULL-SERVICE” PACKAGE / PARCEL RETAIL SYSTEM



UPS (CONTINUED)

- SYNCHRONIZED TRUCKS / PLANES/ TRAINS (FOR CROSS-COUNTRY DELIVERY)

.CHRISTMAS WEEK (19 DEC.)

.18,000,000 PACKAGES (210per sec.)

.35% SURGE (13.6 M PER DAY AVG.)

.UPS AIR: 4.5M packages 24 DEC.

.ADDED 12 A/C TO 600 A/C FLEET

LD-3 & LD-4 CONTAINERS ENROUTE UPS 747 FOR LOADING



UPS DAYLIGHT LOADING



UPS 747 FREIGHTER WITH LD3 CONTAINERS



UPS RETAIL DELIVERY



200,000 BROWN TRUCKS;
400,000 PEOPLE!*



* INCLUDES 60,000 SEASONAL WORKERS FOR CHRISTMAS RUSH



FEDEX

HEADQUARTERS: MEMPHIS, TN

.EXPRESS DELIVERY TO 211 COUNTRIES

.REGIONAL “LESS THAN TRUCKLOAD” DELIVERY OF HEAVY WEIGHT FREIGHT

. NON-STOP “DOOR-TO-DOOR” DELIVERY OF TIME-CRITICAL SHIPMENTS

. FEDEX BOUGHT AMERICAN FREIGHTWAYS , RTS AND VIKING TO COMPETE WITH UPS FOR GROUND MARKET

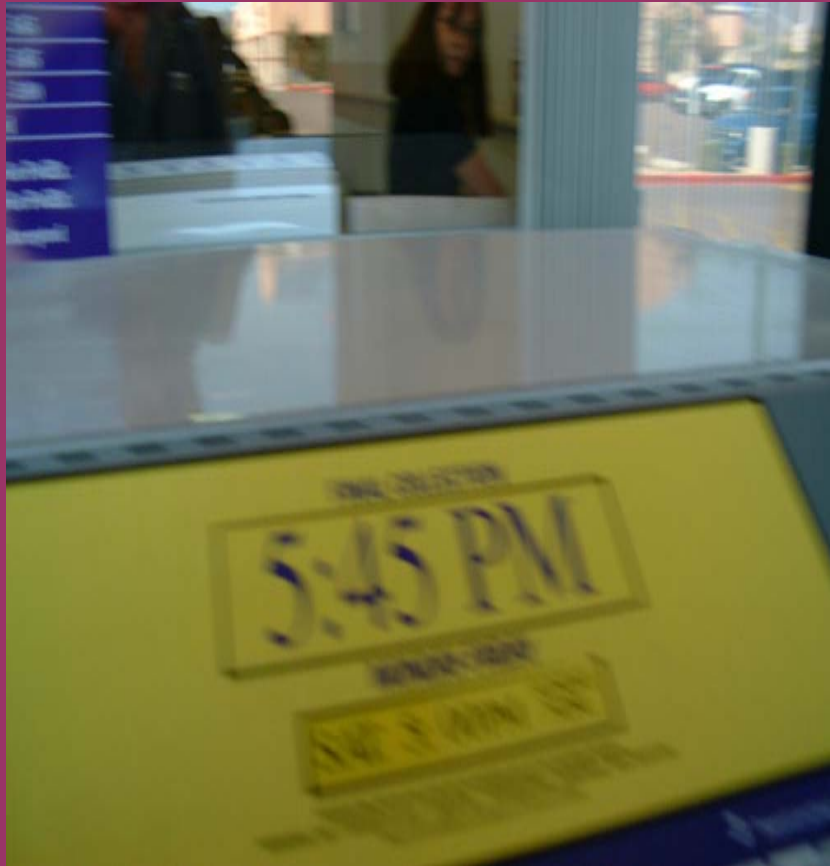
FEDEX “RETAIL” STORE



FEDEX RETAIL “DROP-BOX”



TIME-CRITICAL DROP-OFF SYSTEM



← 5:45PM CUT-OFF

FEDEX TRAILERS
UNLOADING
(SKY HARBOR AIRPORT-PHOENIX)



MARKET CONSTRAINT



MARKET AREA CONSTRAINED
BY "DRIVE TIME" FROM RETAIL
PICK-UP BOX CONSOLIDATION TO AIRPORT !!



MD-900 EXPLORER UTILITY HELICOPTER (NOTAR)

- . CARGO DELIVERY
TO OIL RIGS, REMOTE
DRILLING SITES
- . CORPORATE DELIVERY
OF HIGH PRIORITY
DATA, PACKAGES,
PARTS
- . SMALL PACKAGE
DELIVERY WAS A
DESIGN CONSIDER-
ATION



MD-900 CARGO CAPACITY



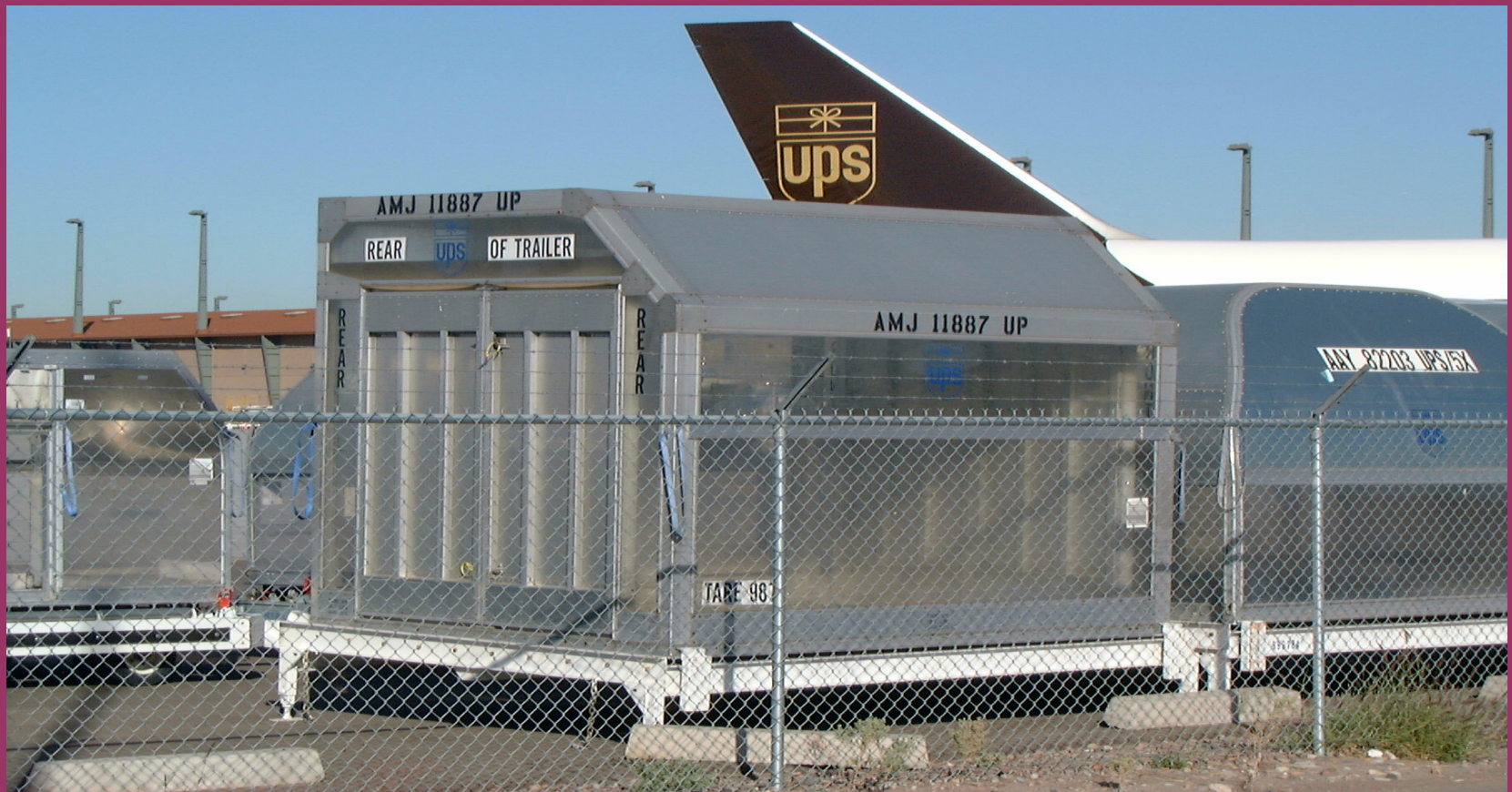
FEDEX LD-3s AWAITING LOADING



FEDEX PARETO ANALYSIS OF “DELIVERY FAILURES”

- PERCENT OF PACKAGES NOT BEING DELIVERED BY “10 AM NEXT DAY” WAS ANALYZED (e.g. 1 1/2%)
- EACH FACTOR ANALYZED (WRONG ZIPCODE, ROUTING MISTAKES, LOST PACKAGES, ETC.
- A FEDEX V.P. WAS ASSIGNED TO **ELIMINATE EACH FAILURE CAUSE**
- THE “SEE THROUGH” CONTAINER WAS THE SOLUTION TO SMALL PACKAGES “LOST” IN THE BOTTOM OF CONTAINERS!!

“SEE-THROUGH” CONTAINERS



FEDEX “VIRTUAL INVENTORY SYSTEM”

- PIONEERED SOFTWARE TO PROVIDE “SEAMLESS” INTERFACE FROM:
 - PRODUCT DESIGN
 - ORDER PLACEMENT
 - RAW MATERIAL P/U & DELIVERY
 - FINISHED PRODUCT PICK-UP &
 - DELIVERY TO END CUSTOMER

FEDEX PROVIDES ALL PICK-UPS AND DELIVERIES WORLD-WIDE

COMPANY CAN OPERATE WITH ZERO INVENTORY!!!

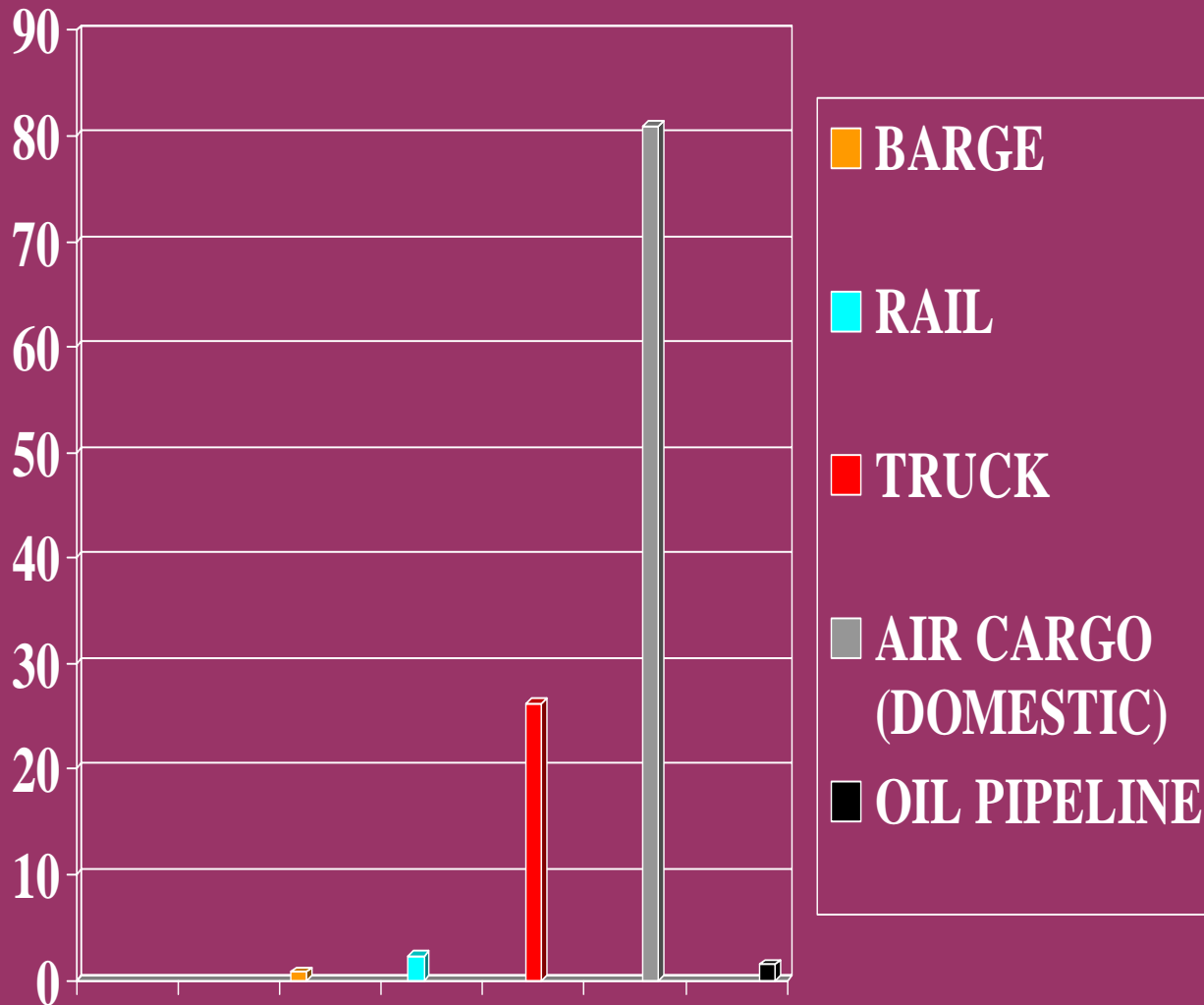
FEDEX: SUPPLY CHAIN SOLUTIONS

- PROVIDE WAREHOUSING AT MEMPHIS FOR CUSTOMERS WANTING TO OFFER 1 or 2 DAY DELIVERY OF CRITICAL ITEMS WORLD-WIDE (CATERPILLER TRACTOR)
- OFFER CUSTOMS BROKERAGE, INTERNATIONAL OCEAN FREIGHT FORWARDING, TRADE FACILITATION

WHERE IS THE MARKET
FOR AIR CARGO
EXPECTED TO GO?

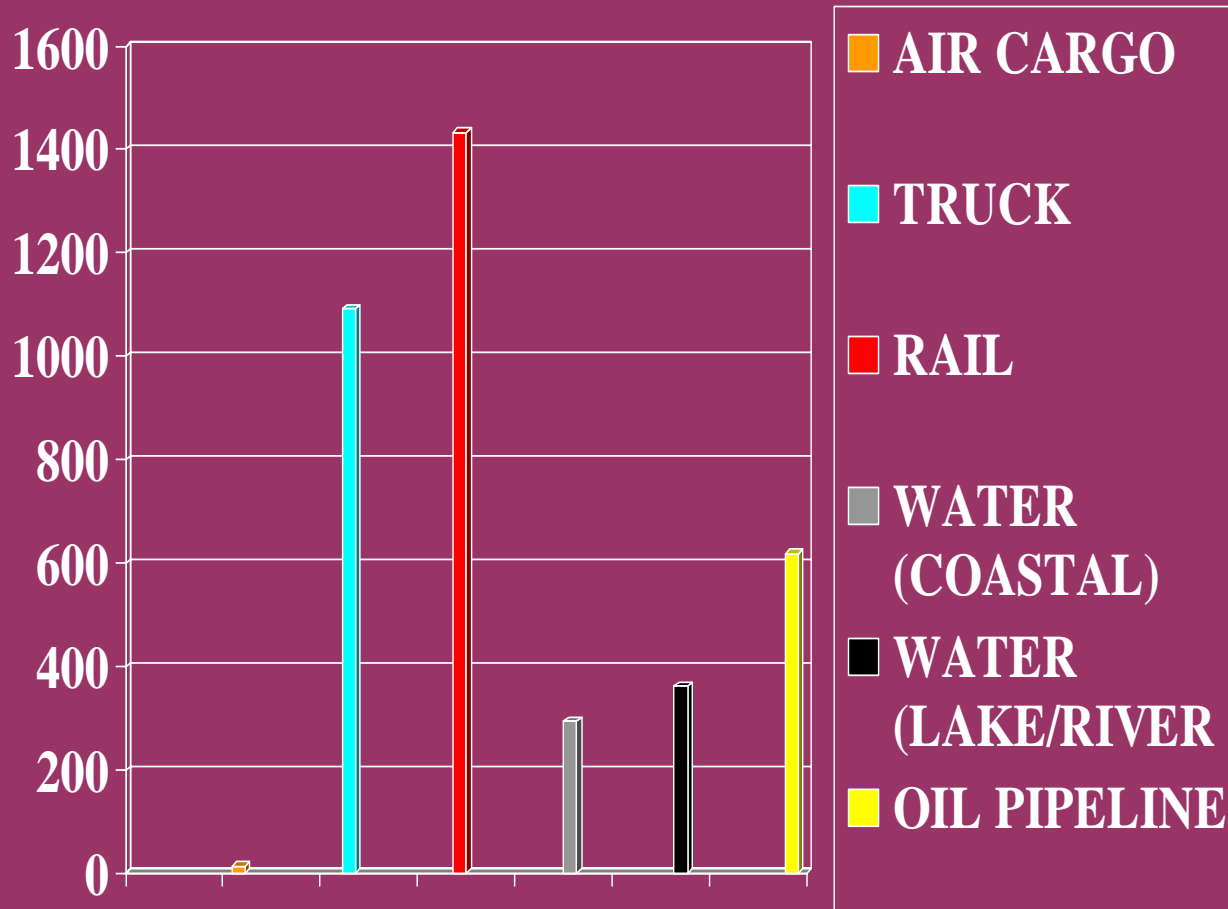
AVERAGE FREIGHT REVENUE PER TON MILE

CENTS
PER
TON-MILE

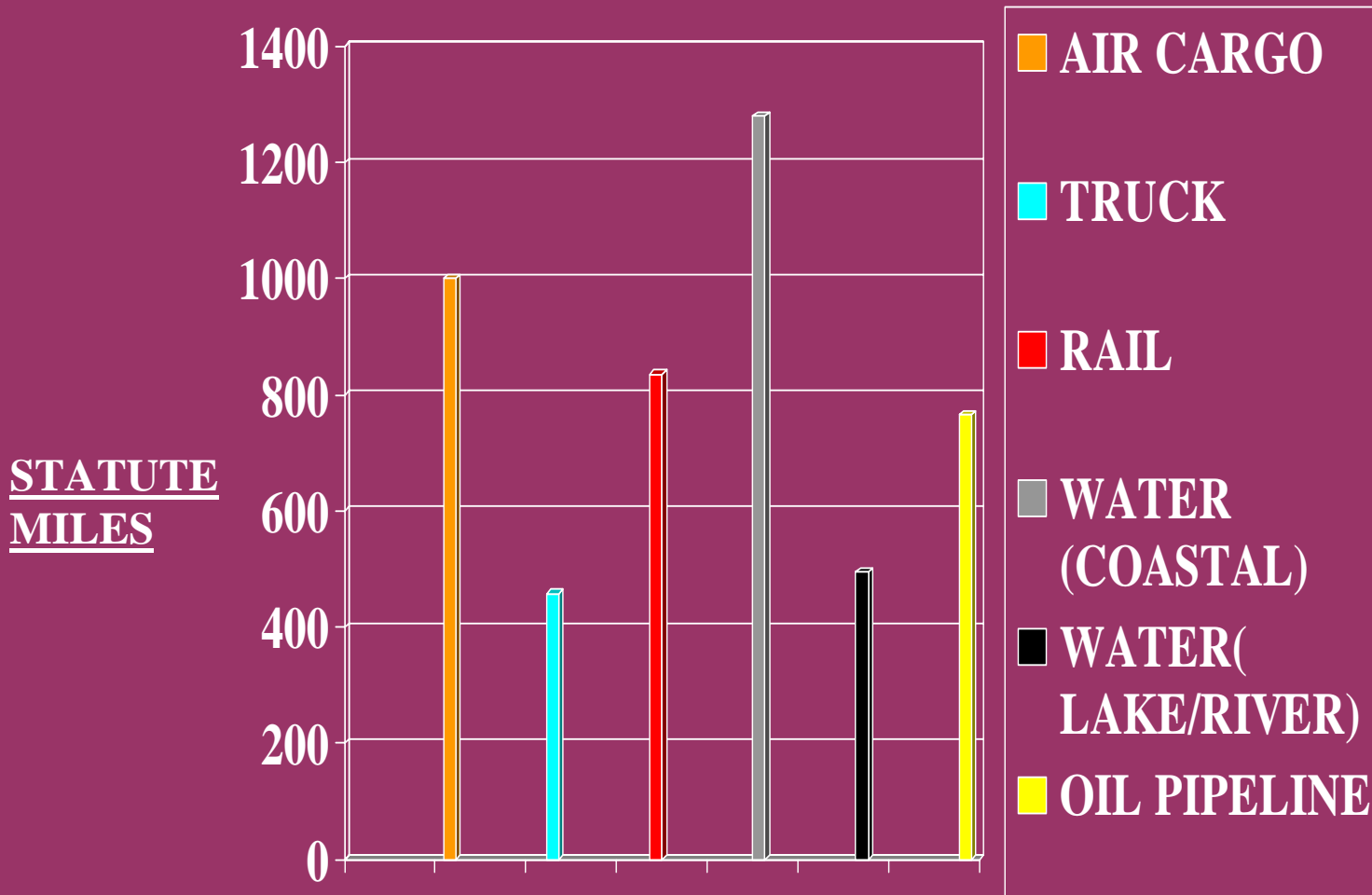


U.S. TON-MILES OF FREIGHT

**BILLIONS
OF
TON-MILES**

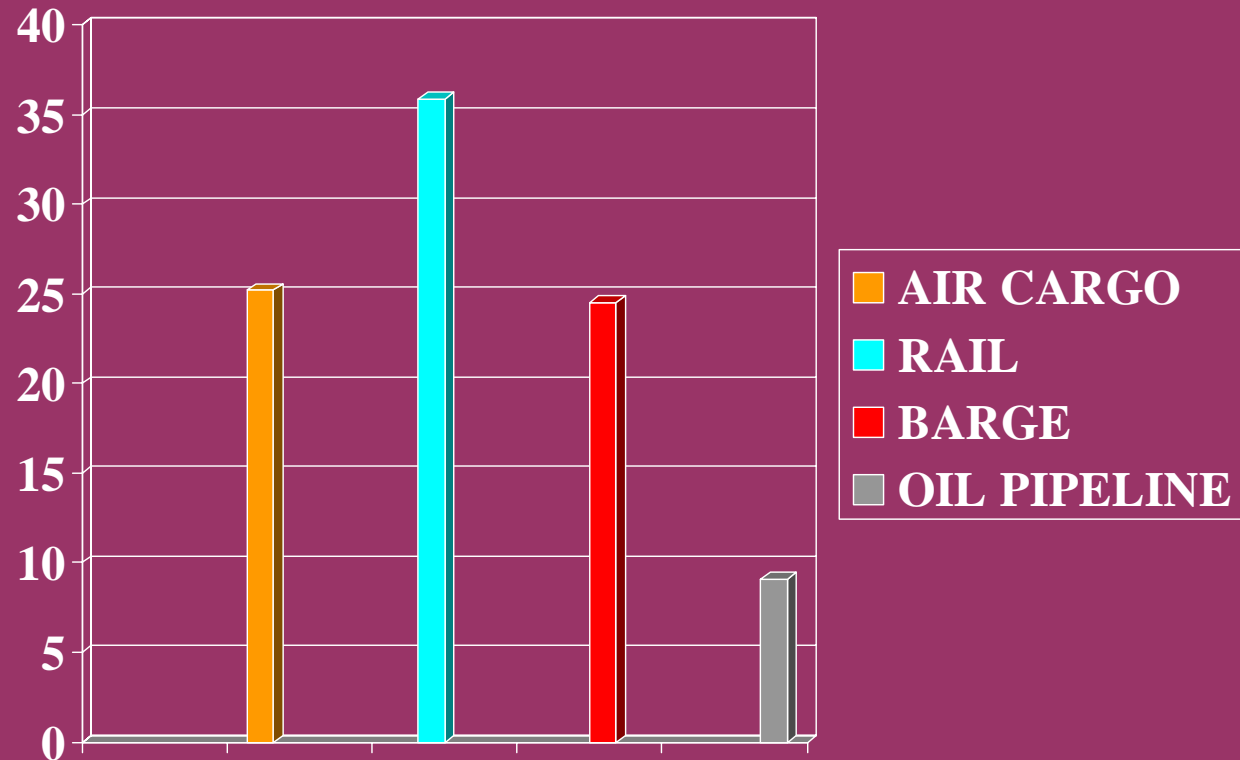


AVERAGE LENGTH OF HAUL DOMESTIC FREIGHT



TOTAL U.S. FREIGHT EXPENDITURES

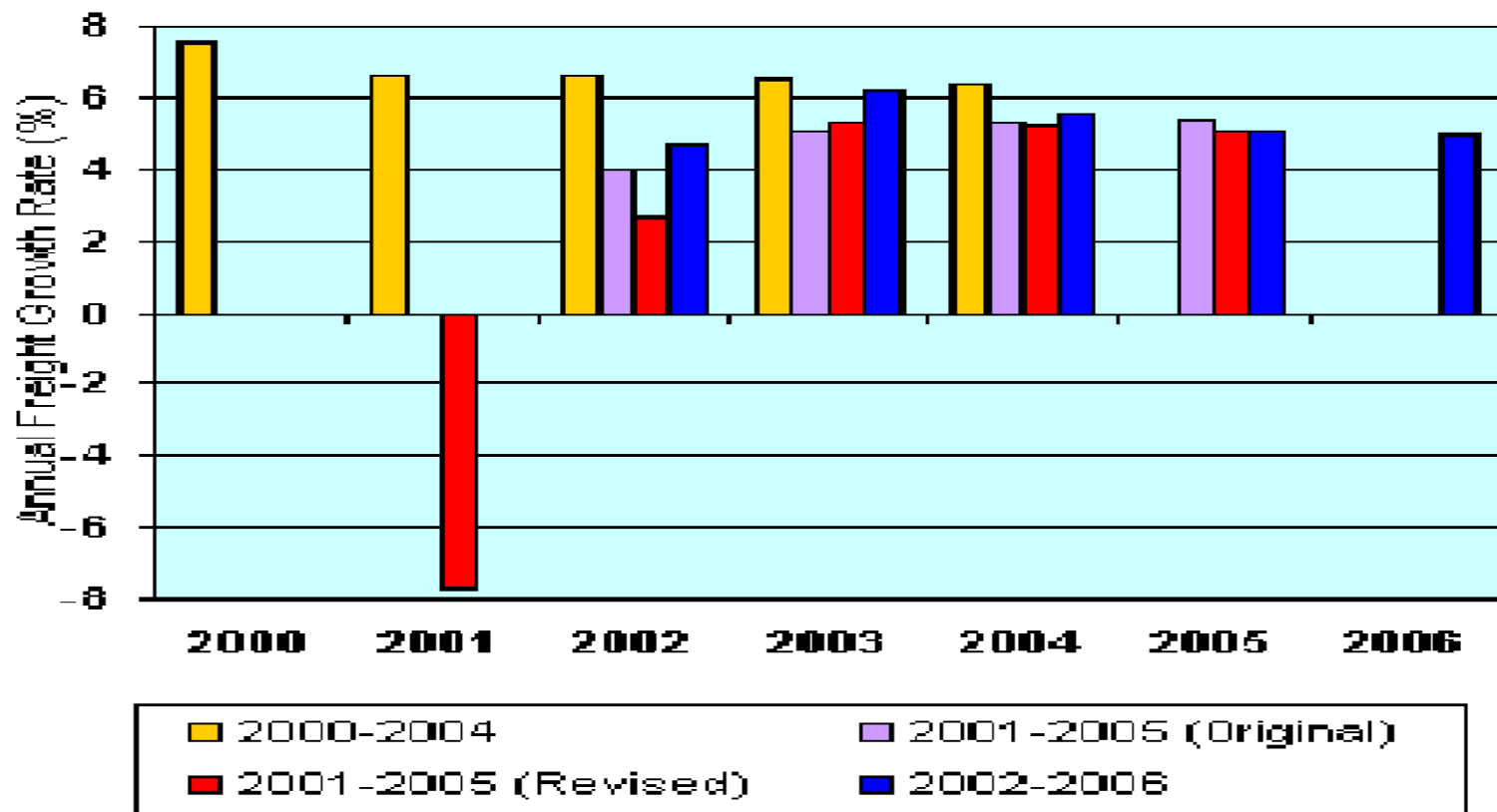
DOLLARS
(BILLIONS)



NOTES: 1. INCLUDES INFRASTRUCTURE COSTS, TAXES, SUBSIDIES, AMTRAK
SOURCE: "TRANSPORTATION IN AMERICA-2000", 2001

IATA INTERNATIONAL AIR FREIGHT FORECASTS

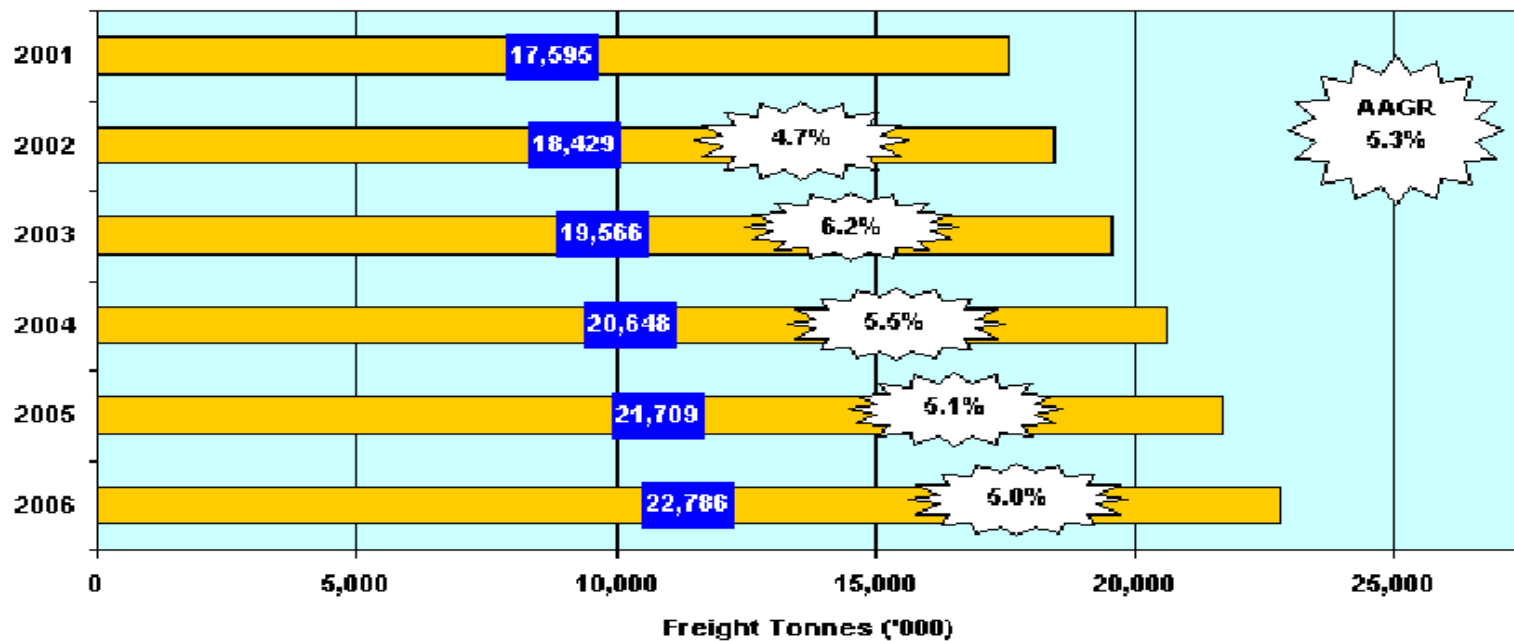
**Comparison of IATA International Air
Freight Traffic Forecasts**



INTERNATIONAL AIR CARGO FORECAST

Forecast International Air Freight Traffic

Forecast Growth Rates & Freight Tonnes



ICAO AIR CARGO FORECAST FOR THE YEAR 2010

WORLDWIDE

	<u>ACTUAL</u>	<u>ACTUAL</u>	<u>FORECAST</u>	<u>AVERAGE</u> <u>GROWTH</u> <u>RATE</u>	
	<u>1989</u>	<u>1999</u>	<u>2010</u>	<u>1989-</u> <u>1999</u>	<u>1999-</u> <u>2010</u>
<u>FREIGHT</u> <u>TONNE -</u> <u>KM -</u> <u>MILLIONS</u>	57,215	108,043	202,650	6.6%	6.0%
NOTE: EXCLUDES CIS SOURCE: ICAO FORECAST (2002)					

ICAO REGIONAL FORECAST OF AIR

CARGO FOR 2010

(FREIGHT TONNE –KILOMETRES IN MILLIONS)

	<u>1989</u>	<u>1999</u>	<u>FORECAST</u> <u>2010</u>	<u>RATE OF</u> <u>GROWTH</u> <u>1989-1999</u>	<u>RATE OF</u> <u>GROWTH</u> <u>1999-2010</u>
AFRICA	1,176	19,693	3440	5.3%	5.0%
ASIA- PACIFIC	15,634	37,564	83,000	9.2%	7.5%
EUROPE	19,246	31,193	52,120	4.9%	4.5%
LATIN AMERICA	2626	4221	6950	4.9%	4.5%
NORTH AMERICA	15,962	29,028	51,000	6.2%	5.0%

SOURCE:
ICAO 2010 FORECAST

OUTLOOK FOR AIR CARGO

- WORLD AIRLINE PAX TRAFFIC FORECAST TO GROW 1999-2010 @ 4.5%
- WORLD AIR FREIGHT GROWTH 1999-2010 FORECAST @ 6.0%
- ASIA-PACIFIC REGION EXPECTED TO DOMINATE AIR FREIGHT GROWTH MARKET
- UNIT COSTS (OPERATING COST PER AVAILABLE TONNE-KILOMETERS) (ATK) DECLINED AT AN AVERAGE ANNUAL RATE OF 3.0% FOR PERIOD 1960-1999)

LARGER, MORE EFFICIENT FREIGHTERS ARE MAKING AIR FREIGHT MORE COMPETITIVE!

CONCLUSIONS

- AIR CARGO MARKET IS TIED TO WORLD GDP; ALMOST A LEADING ECONOMIC INDICATOR
- USED PAX AIRCRAFT CONVERTED TO FREIGHTERS ARE COST-EFFECTIVE!
- CORPORATE FOCUS ON “LEAN” HAS DRIVEN INTERNATIONAL AIR CARGO GROWTH
- **AIR CARGO** IS RAPIDLY GROWING NICHE IN TOTAL CARGO MARKET!!!