

Symposium on the Economic and Social Value of Air Transportation

**Do we have the right air transportation
infrastructure and technology?**

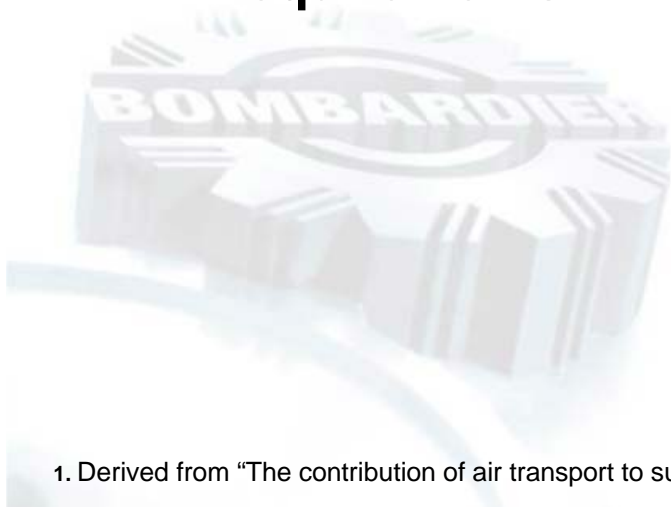
Presented by Chuck Evans
Director, Airline Industry Analysis
Bombardier Aerospace



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The Importance of Technology and Infrastructure Applied to Economic and Social Development

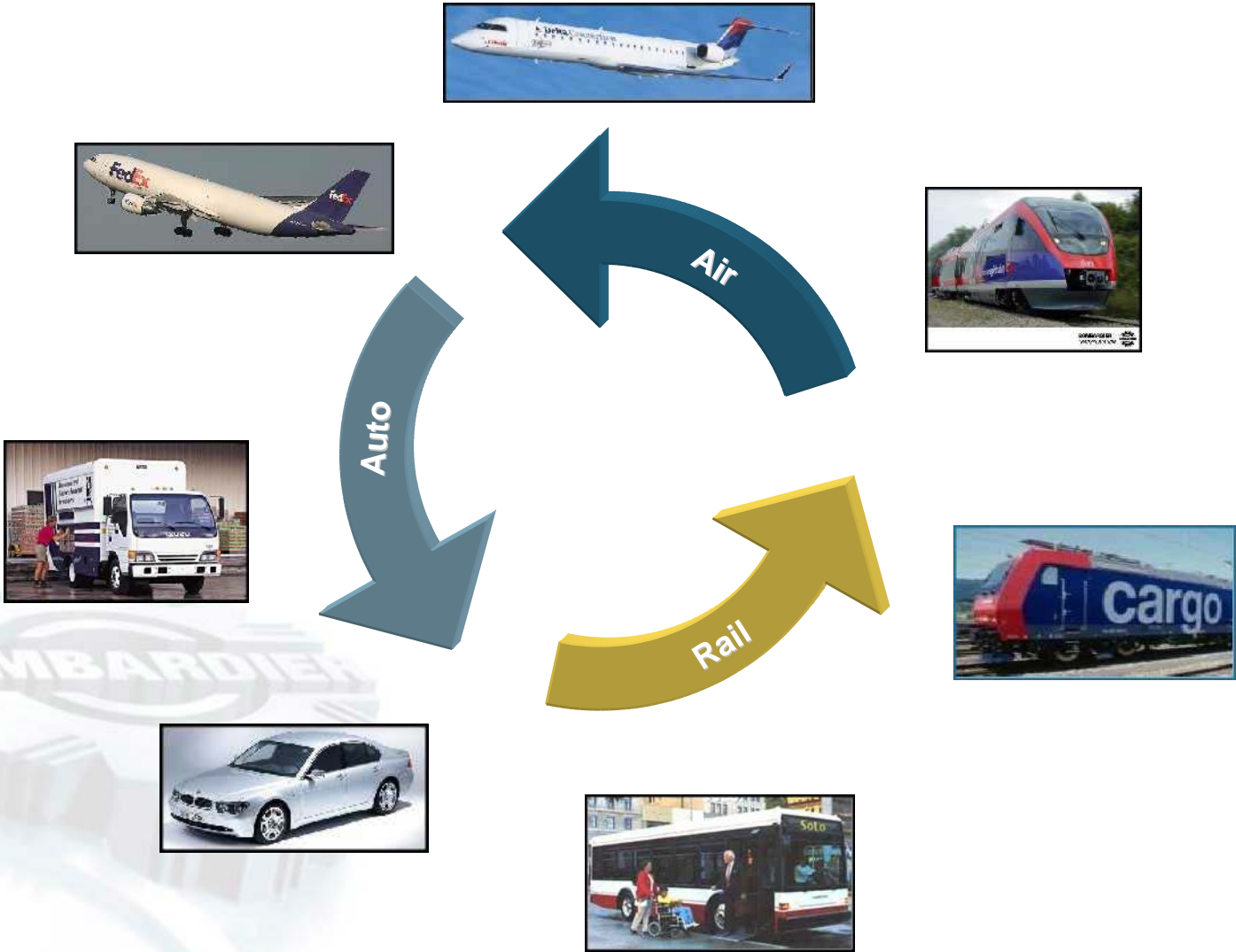
- **Transport infrastructure is a necessary condition for economic growth and it has a key role to play as a facilitator of and complement to policies that aim to improve living standards¹.**
- **Current transportation technology and infrastructure, though more developed in some regions than others, is well designed to meet economic and social development requirements**



1. Derived from “The contribution of air transport to sustainable development in Africa” study by Air Transport Action Group



Over-land Transportation Is Fundamental to the Facilitation of Commerce



The Infrastructure Requirements for Overland Transportation Require Time and Investment

■ Roads

- Low initial cost though very maintenance intensive
- Primarily focused on city commerce (urban and inter/intra city)

■ Rail

- Higher initial cost with higher capabilities (passenger and cargo capacity)
- Specifically targeted toward inter/intra city business

■ Air

- Moderate initial cost with no 'in-between' infrastructure requirements
- Serves regional and international commerce



As Transportation Infrastructure, Aviation Itself Represents a Technology Advancement

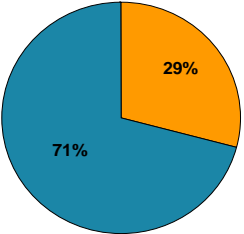
- **Air transportation is very flexible as services can be changed from day to day**
 - Airlines can add and delete cities within their networks regularly
 - Aircraft can be sized to meet the capacity requirements
- **Aircraft require less infrastructure than auto's and rail**
 - Aircraft only need runways (1-2 miles) to provide service
 - Aircraft navigation aids vary from expensive and complex to cheap and simple
- **Aircraft vary widely in capacity and price**
 - New aircraft offer the latest technology with varying capacities and prices
 - Used aircraft can be acquired with little capital investment in many sizes



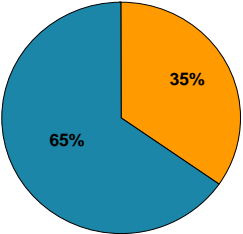
Regional Aircraft, Key Components of Airline Networks, Link Smaller Population Areas to Larger Ones

Commercial Aircraft Fleets by Carrier

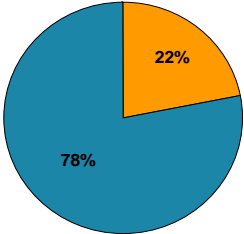
American Airlines



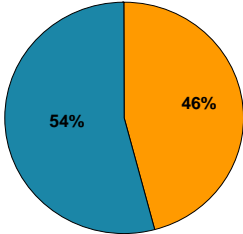
United Airlines



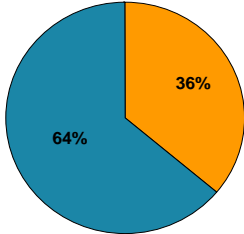
British Airways



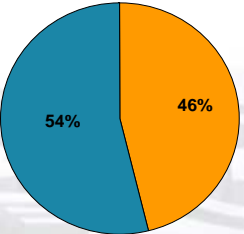
Lufthansa



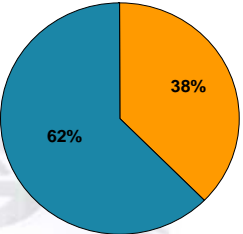
Air Canada



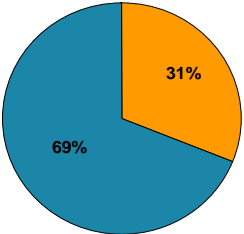
Delta Air Lines



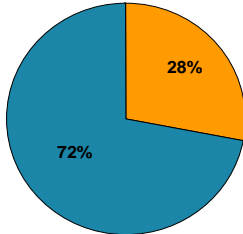
Continental Airlines



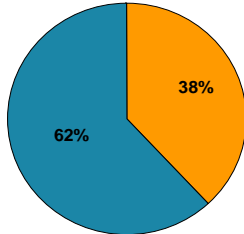
Air France



Northwest Airlines



USAirways



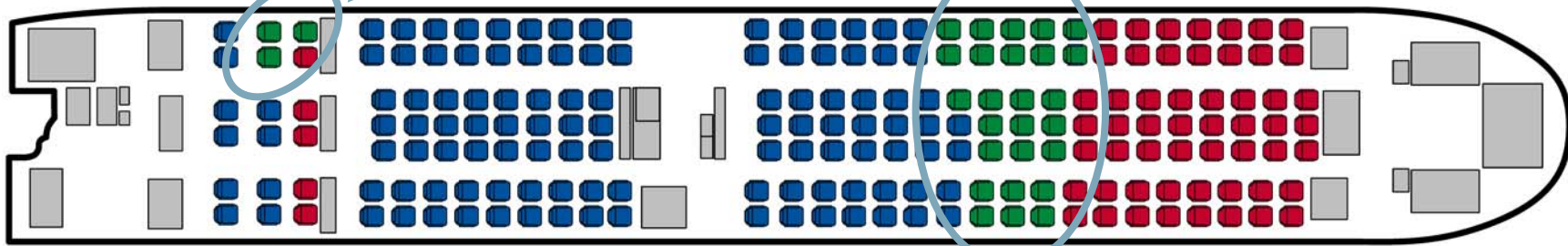
Regional Aircraft
 Mainline Aircraft

* Source: ACAS Fleet Database April 2003



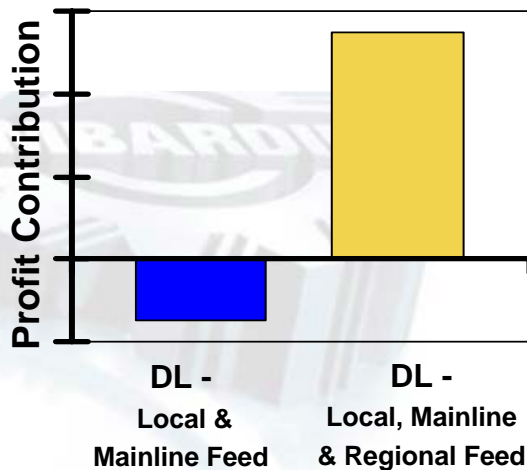
Regional Jet Feed is Critical to Long Haul Profits at Delta Airlines

20% of Passengers Come from Regional Connections



AW212

Average Flight Traffic Composition from Cincinnati Hub (CVG)



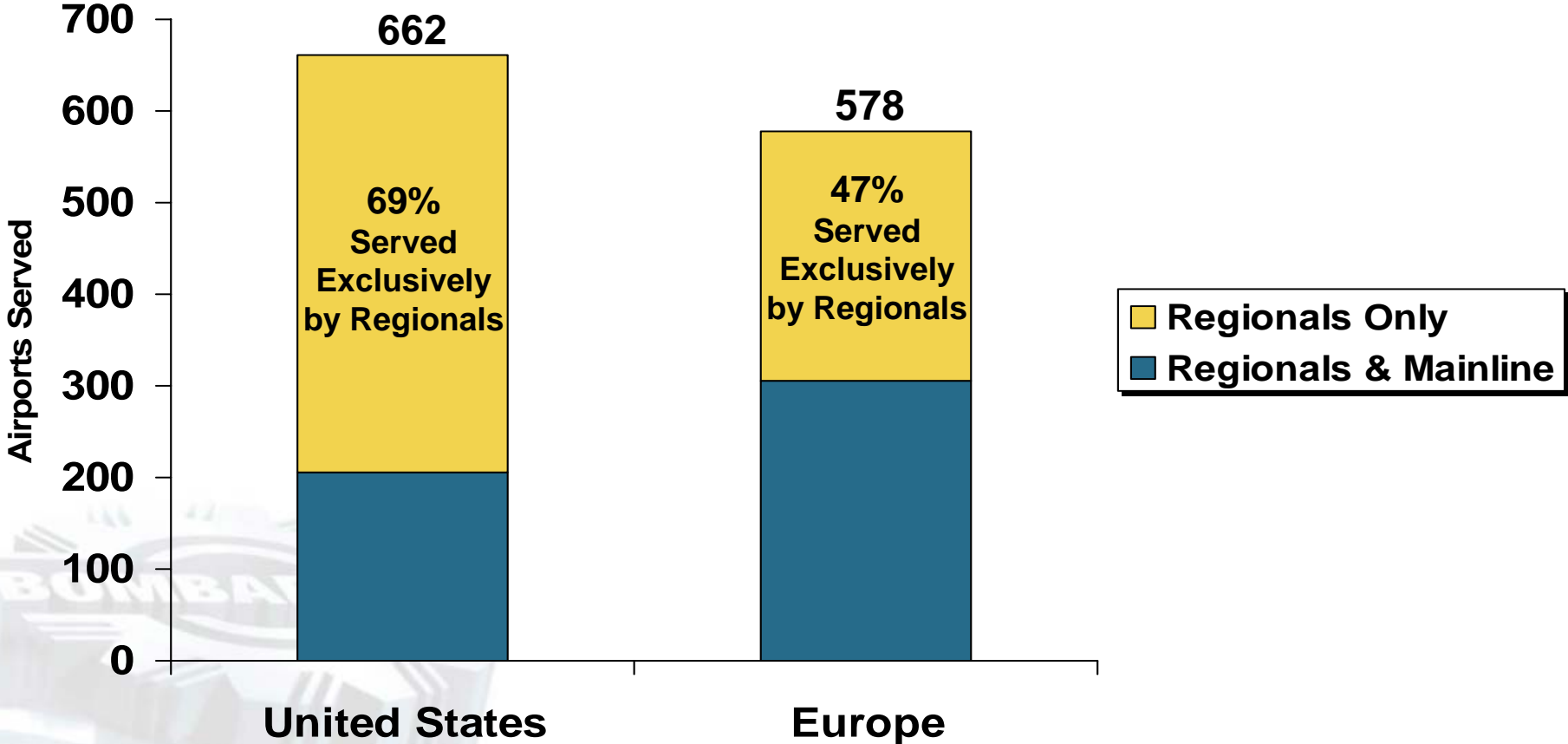
- Local Traffic & Mainline Feed
- Regional Connecting Feed
- Empty Seats

Without Regional Feed Mainline Flights at CVG Would not be Profitable



Source: Delta Air Lines Report

Half of the European and U.S. Communities Are Exclusively Served by Regional Airlines



Sources: OAG, RAA



The First Regional Revolution: Enter the Now Ubiquitous Turboprop



**In The Last 20 Years, Dash 8 Has Carried
over 400 Million Passengers**



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Dawn of the Regional Jet Revolution

Canadair Regional Jet (CRJ) First Delivery – October 1992

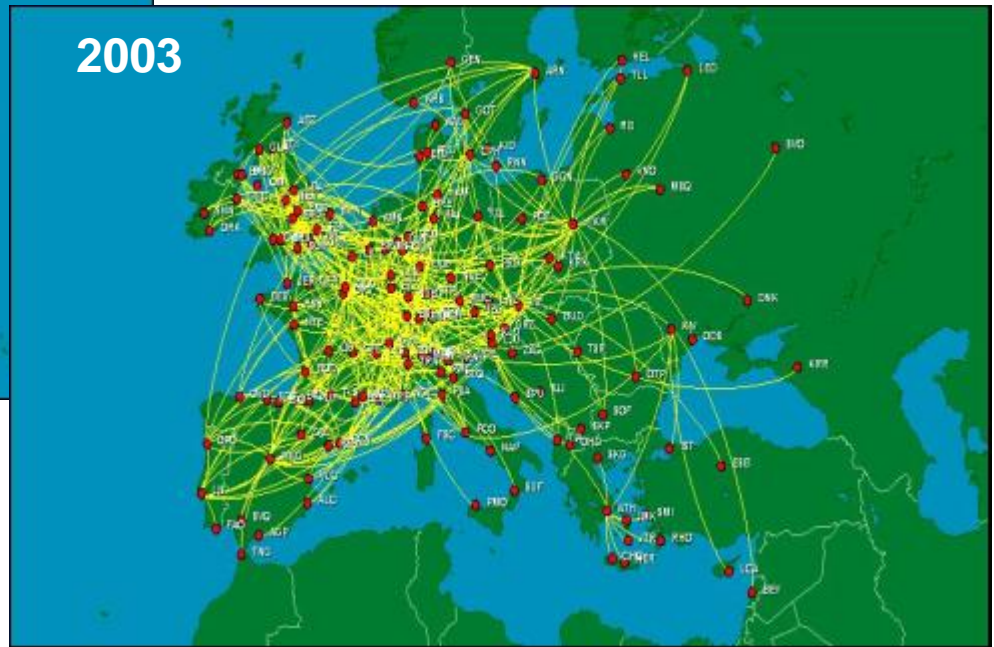


Today: Over 2,600 Orders & Options for the CRJ Series



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The regional jet continues to change the airline industry



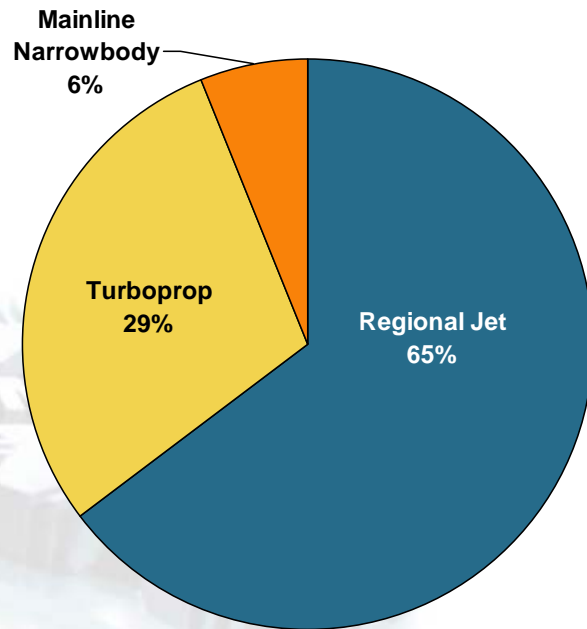
Over 1,800 City-Pair Markets Served



Regional Jets Represent a Recent Technology Enhancement Furthering Economic Development

- Regional airlines provide 94% of the departures from Knoxville

Departures by Equipment Type



Example: Knoxville, TN
Regional Jet Destinations from Knoxville

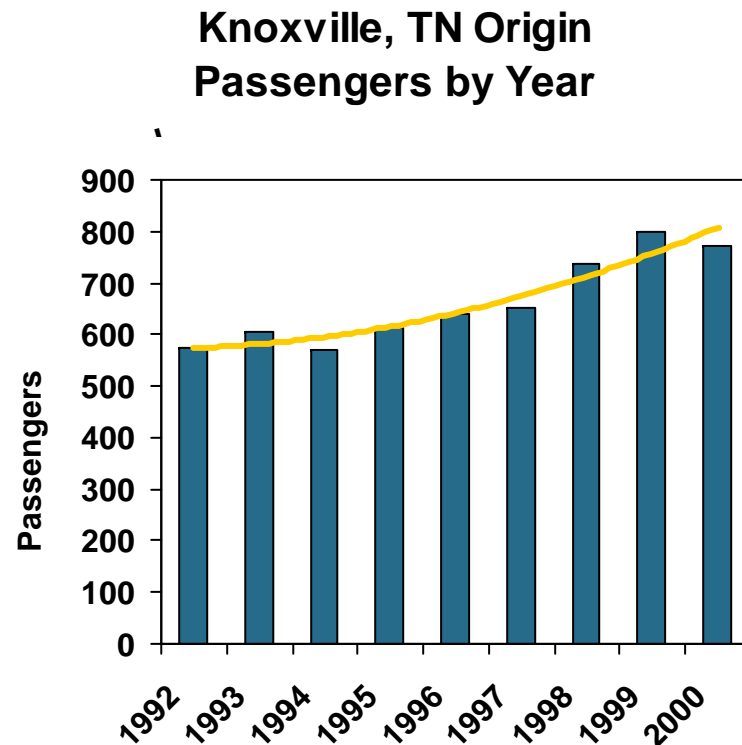


* Source: OAG Schedules 2004



The Introduction of the Regional Jet Caused Substantial Increases Traffic Volumes

- Regional jet services began in 1995
- The increased range of the regional jets allowed airlines to serve Knoxville from their far away hubs (Minneapolis, Dallas, Chicago and Houston)
- Nonstop service to New York became reality due to the regional jet
- This increased service caused traffic to grow by 41% over a five year period (1994-1999)



* Source: USDOT O&D Data

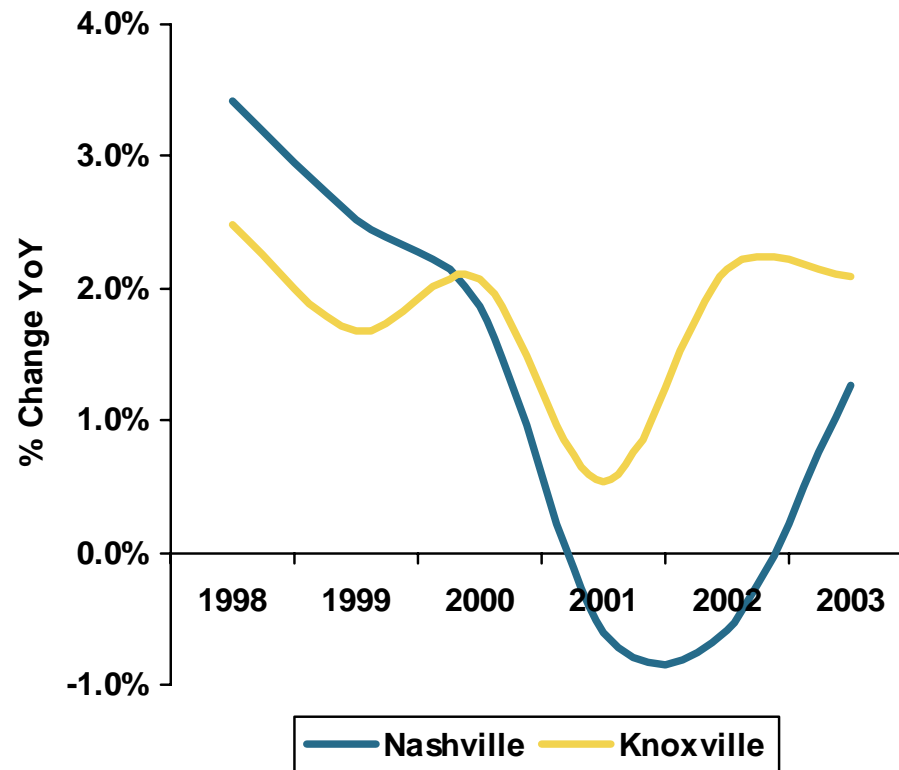


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A Tale of Two Cities Influenced by Aviation

- Nashville was decommissioned as an American Airlines hub in the late 1990's
- Knoxville has seen consistent airline service growth, including nonstops to NYC
- Employment reductions were evident in Nashville as transportation options were reduced

Total Employment
Non Farm 1998-2003



Knoxville's employment continued to grow through the recession



Transportation Infrastructure in Developing Countries

- **Road improvement investment provides necessary short haul travel within and around urban areas**
- **Rail links provide low cost commodity transportation**
 - Upgrading existing rail links can increase line capacity without massive investment
 - Creating rail links is a long term investment as the initial costs are high, though the return is a modern cost effective network
- **Air transport infrastructure requires airports, navigation and runways and is very flexible**
 - No physical infrastructure between airports is required
 - Service patterns can easily be matched to accommodate commercial requirements (seasonal travel markets, peak accommodation, etc.)

Air Transportation infrastructure is quick to develop



Similar to Mobile Phone Technology, Aviation Can Provide Necessary Links With Less Infrastructure

■ Mobile Phone Technology

- Developing countries can increase communication infrastructure without adding hard lines
- Countries like South Korea, Philippines, UAE, Cameroon, etc. have more mobile phones than land lines

■ Aviation

- Other than navigation aids, air transportation requires only 1-2 miles of paved surface on either end
- Airlines can be established in short periods of time versus years to create roads and rail services

Orange™ Mobile Phone Coverage in the Dominican Republic



Aviation As a Technology Advancement Allows Faster Development of Emerging Economies

- Singapore, a country of 4.6 million people, has built itself as a transportation hub for the Asian region
- Powered by a shipping port and one of the worlds most successful airlines, Singapore's GDP per capita is in the top 25
- Singapore Airlines provides service to most of the worlds major business centers creating easy connections for commerce

Singapore Airlines Route Map



Singapore is an example of development through transportation



Air Transportation Is a Vital Consideration in Economic Planning

Ghana Transportation Infrastructure Projects

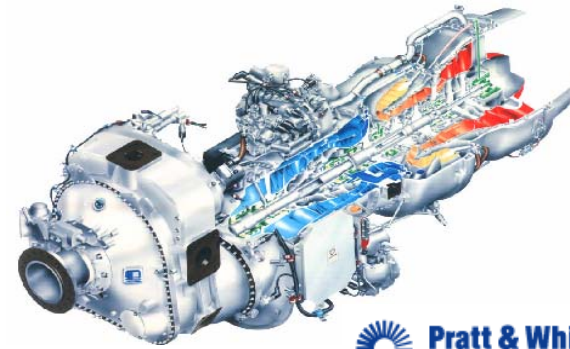
- **With assistance from the World Bank** (Ghana Investment Promotion Center)
- **Development of scheduled bus system.**
- **Rail System**
 - Rail upgrades and passenger rail transport on chosen corridors e.g. Accra-Tema; Accra-Nsawam
- **Lake Transport**
 - Lake (Volta) transport system to be developed to attract cargo (imports/exports) to and from land locked neighbours of Burkina Faso, Mali and Niger.
- **Air Transport**
 - **Private Air operators to operate domestic and sub-regional services.**
 - **Domestic Airports**
 - **Rehabilitation and development of domestic airports (ie. At Kumasi, Tamale, Sunyani, Ho, Wa and Bolgatanga**
 - **Taking up concessions for commercial activities at the airports.**



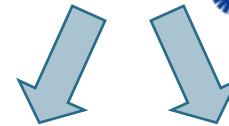
Bombardier Continues the Technology Advancement in Multi-modal Transportation Systems

- Powerplant technology advancements have provided more power and increasing lower fuel consumption
- Bombardier uses the advanced engine technology to power aircraft and locomotives making transportation more cost effective
- Increasingly efficient transportation vehicles allow for lower cost growth of infrastructure

Pratt & Whitney PW150 Turbine Engine



 **Pratt & Whitney Canada**
A United Technologies Company



Transport infrastructure is more affordable and feasible than ever



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In Summary, Transportation Infrastructure's Evolution Supports Economic/social Development

- **Transportation and the required infrastructure have proven to be a necessity for economic and social development from the most advanced nations to those that are developing**
- **The technology behind transportation continues to evolve into more efficient and more economical standards**
- **As a result of transportation technology advances, transformations of developing countries and/or areas can be more rapid than ever before**

