Scenario-Based Traffic Demand Modeling

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PROJECT BACKGROUND AND OBJECTIVE

Background

- The NASA Aeronautics research program has increased its emphasis on air traffic management (ATM) technologies in response to heightened national needs.

- NASA is considering programs to develop technologies for an advanced national airspace system (NAS).

- However, it is necessary to have a solid understanding of the broader economic environment in which those technologies will operate.

Objective

- A more complete understanding of the potential environments in which NASA research will operate enables solutions that are robust under a wide variety of conditions.

BRIEFING OUTLINE

- ✈Research Activity 1: Describe economic impacts of air transportation
- ✈Research Activity 2: Generate operational scenarios for the year 2022
- ✈Research Activity 3: Translate operational scenarios into airport-level demands

RESEARCH ACTIVITY ONE

- Describe the current state of knowledge on the relationship between transportation and the economy and how that affects the NASA air transportation research program:
  - T1: Articulate what air transportation means within the nation's economy and why its continued vitality should be a national priority
  - T2: Survey prior efforts to capture the incremental value of aviation in the economy
  - T3: Develop performance measures for policy makers, consumers of aviation, and associated industries (e.g., service providers) that track development of air transportation technologies

FRAMEWORK FOR ANALYSIS – PRINCIPAL HYPOTHESES

- **H1: Air transportation is an enabler of economic activity**
  - People and goods rely on aviation to realize economic benefits
  - Aerospace and associated industries generate significant economic output

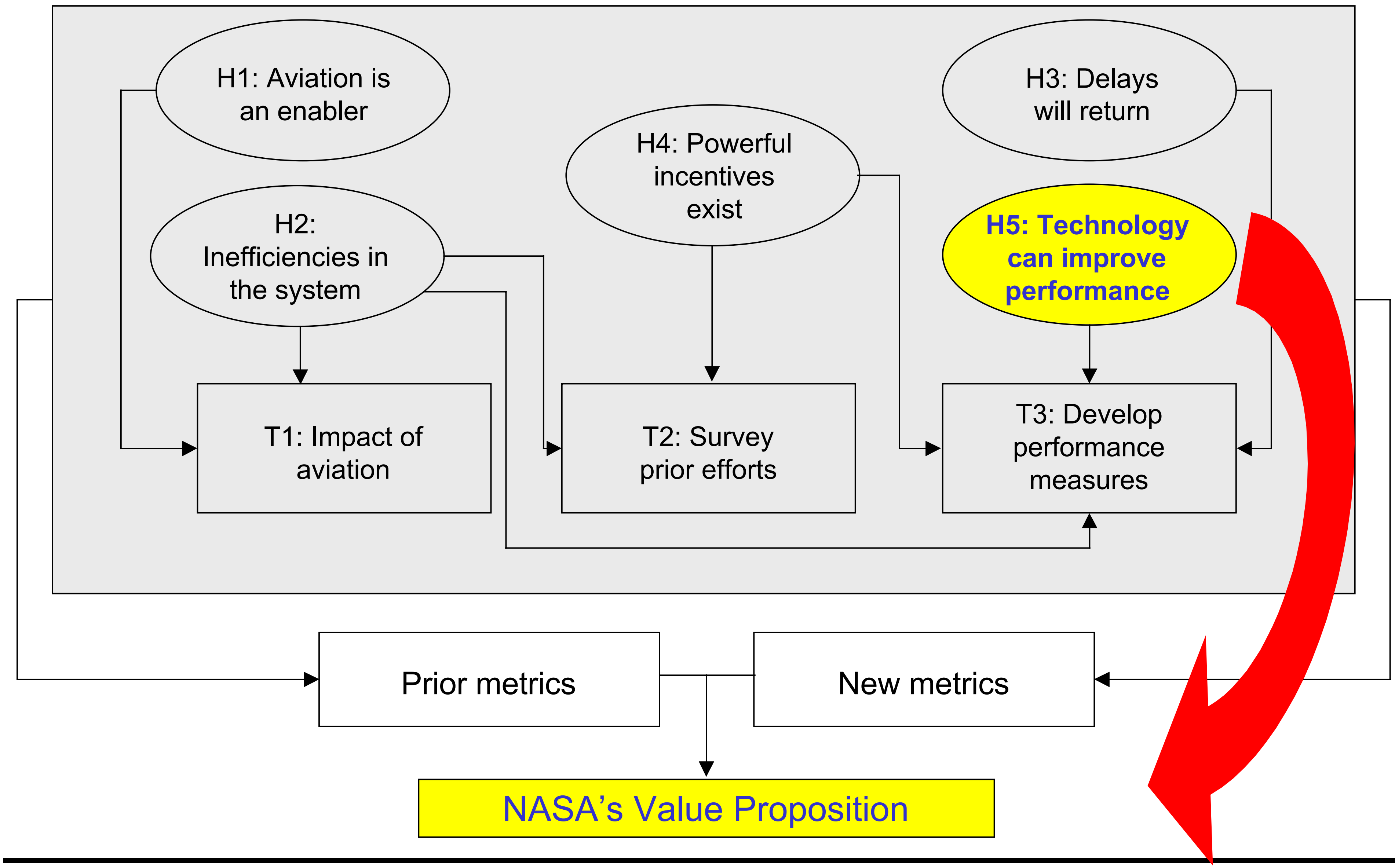
- **H2: The aviation system is marked by implicit/explicit inefficiency**
  - ATC, security, other delays are costly
  - Hubs dominate as a proportion of overall enplanements

- **H3: In spite of current doldrums, delays will return**
  - Passenger and cargo growth will rebound
  - Existing technology will again be stretched
  - Competition, particularly from low-cost carriers, will intensify
  - Impact of new security measures on operations remains largely unknown

- **H4: New solutions must be consistent with incentives that govern**
  - Producers (controllers, pilots, airports, technology providers [NASA, Boeing, Lockheed, Raytheon, etc.])
  - Consumers (passengers, shippers, air carriers, policy makers)
  - “Perfect” solutions are not achievable – there are always trade-offs

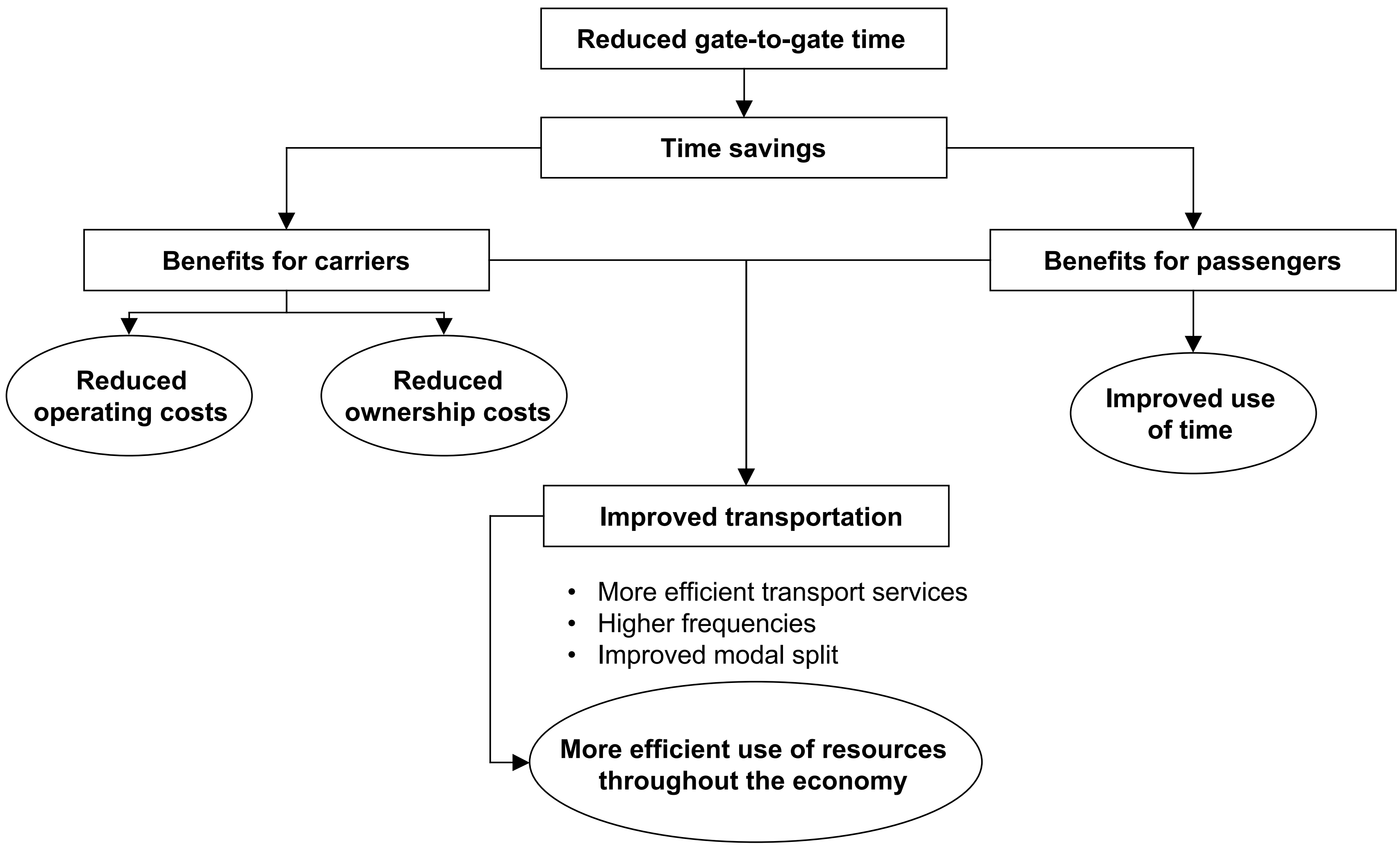
- **H5: Technology can improve system performance**
  - NASA produces technology
  - To identify and measure improvement, there must be consensus on metrics

CONCEPTUAL LINKAGES IN RESEARCH ACTIVITY ONE



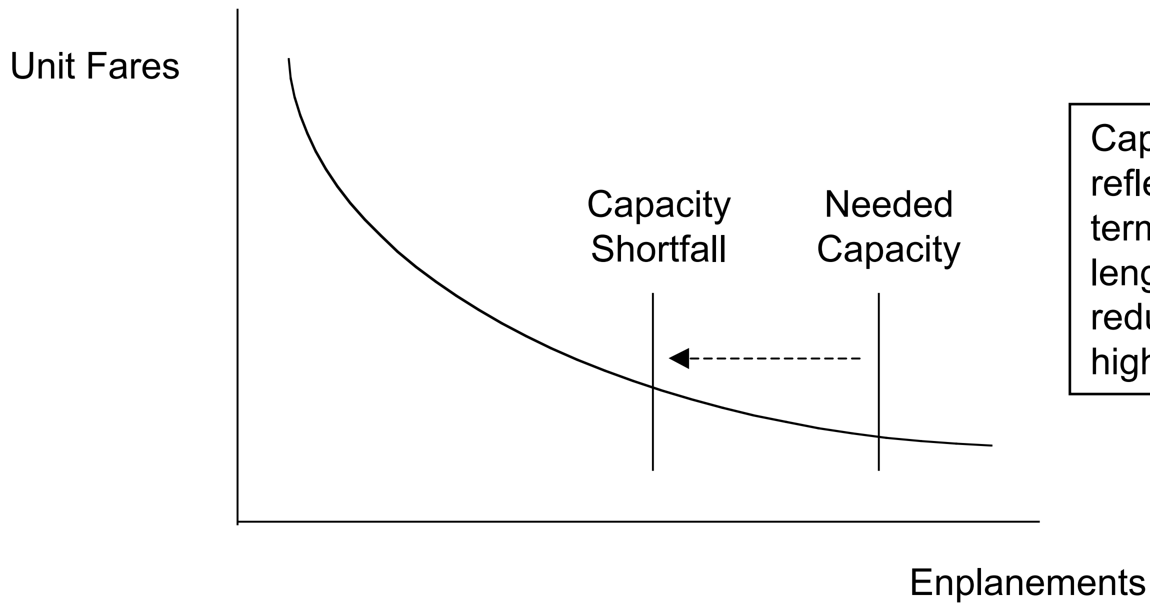
TECHNOLOGY CAN IMPROVE PERFORMANCE

- Increased capacity in the NAS is a common aim of key system stakeholders that will benefit passengers and operators.



NASA'S VALUE PROPOSITION

- NASA will confirm its value proposition by demonstrating that its technologies add value for key industry stakeholders.
- For example, air carriers, airports, and passengers want to avoid the following scenario, which may be caused by a shortfall in NAS capacity.



Capacity shortfalls could be reflected in increased terminal area congestion, lengthened block times, reduced daily segments, higher ticket prices, etc.

- Inadequate capacity and rising fares would constrict demand, lowering enplanements and reducing gross revenues.
- A 2002 DRI-WEFA study of the economic impacts of US civil aviation estimates delay costs for year 2000 commercial passenger operations at $9.4 billion.

METRICS ARE KEY

- While NASA's products, once implemented, will affect numerous stakeholder groups, FAA is the principal customer.
- Therefore, the impacts of NASA products should be gauged by FAA's metrics for improved NAS performance.
- Three broad areas of NAS performance can be improved by NASA's tools and techniques:
  - Supply/Demand – availability/efficiency of airspace in terminal and en route areas
  - Operational – efficiency/optimization of airline and general aviation movements
  - Fiscal – asset utilization/cost performance for key NAS stakeholders

RESEARCH ACTIVITY TWO

- Review the previous scenarios developed for NASA by the National Research Council ("Scenario-Based Strategic Planning for NASA's Aeronautics Enterprise"), and revise, update, and expand them as required to reflect current and future conditions. In particular, emphasis will be placed on developing operational scenarios against which future NASA technologies can be evaluated.

WHY SCENARIO-BASED PLANNING?

- The future is not simply a point estimate for a small set of variables, especially for longer-term assessments
- Want plans and planning tools that are “robust” to plausible variability in operating environments
- Even firm micro linkages between drivers of future become weaker with longer forecast horizons
- For longer-term planning (forecast horizon is 2022)
- Contingency planning
- Handling and characterizing complexity

FUNDAMENTAL ELEMENTS

- Define scenario space
  - Select drivers/constraints

- Determine base or starting values (not necessarily drivers)
  - GDP and traffic response
  - Pricing and traffic response
  - Input prices

- Determine constraints on future opportunities
  - Infrastructure
  - Substitutes

- Combinations/Number of scenarios
  - Number of drivers/constraints (N)
  - Number of values for each (M)
  - Number of scenarios (M^N)

- Drivers of scenarios need not be parameters of greatest analytic interest

THE FOUR SCENARIO DRIVERS

Four parameters used to develop scenarios:

- **GDP Growth**—High or low: Recognizes that economic growth drives air travel; driven by population and productivity

- **Airline Yields**—High or low: Yields are fare per mile; high fares mean industry is profitable and can attract investment for modernization; low fares stimulate consumer demand, all other factors equal; driven by demand/capacity balance, industry structure and government regulation

- **Limits to Aviation System Growth**—Many or few: Barriers limit ability to expand at moderate costs; driven by noise and emissions rules, ATC and airport capacity, airport access, security requirements, etc.

- **Substitutes to Commercial Air Travel**—Good or poor: More attractive substitutes serve to discipline prices and reduce demand for commercial air travel, while poorer substitutes provide pricing power to carriers, other things equal; includes aviation and non-aviation substitutes

SCENARIO MATRIX

Scenario	GDP Growth	Airline Yields	Limits to Aviation System Growth	Substitutes to Commercial Air Travel	Probability
Economic growth/ Airlines recover	***high***	***high***	***many***	***poor***	***20%***
Economic growth/ Consumer rules	high	low	few	poor	10%
Substitutes take share	high	low	many	good	15%
Growth limits prevail	low	high	many	poor	15%
Low Cost Carriers dominate	***low***	***low***	***few***	***good***	***20%***
Three other plausible scenarios	N/A	N/A	N/A	N/A	20%

Note: Probabilities represent LMI/GRA consensus. While a total of 16 scenarios are possible, eight of them were regarded as implausible. Of the remainder, five scenarios were regarded as likely and were analyzed further.

FORECAST BASELINES

Recovery reaches year 2000 levels:

- Domestic passenger 2004
- International passenger 2003
- Domestic cargo 2004
- International cargo 2004
- GA passenger miles 2005

Short-haul impacted more:

- Longer average stage lengths
- More RPMs/Op (fewer SH operations)

Parameter	Base Value
Domestic passenger RPMs	513 B
Type of domestic network	Hub-Spoke
International passenger RPMs	181 B
Domestic cargo RTMs*	14.7 B
International cargo RTMs*	14.5 B
Belly vs. all cargo split	
Domestic cargo	30/70
International cargo	50/50
GA passenger miles** (@ 65% LF)	13.9 B
Single-engine	2.9 B
Multi-engine	4.4 B
Jet-engine	6.6 B

* Includes freight/express and mail
**Includes fractionals

ESTIMATING GROWTH IN AVIATION TRANSPORT SERVICES

Principal drivers of commercial aviation activity are:

- Real GDP annual growth (between 2.3% and 6.3% over 18-year periods)
- Fares/yields, which have been at historically low levels for a year

Aviation activity responds:

- Positively to increases in the GDP growth rate (income elasticity of 1.25)
- Negatively to increases in yields (price elasticity of –0.75)

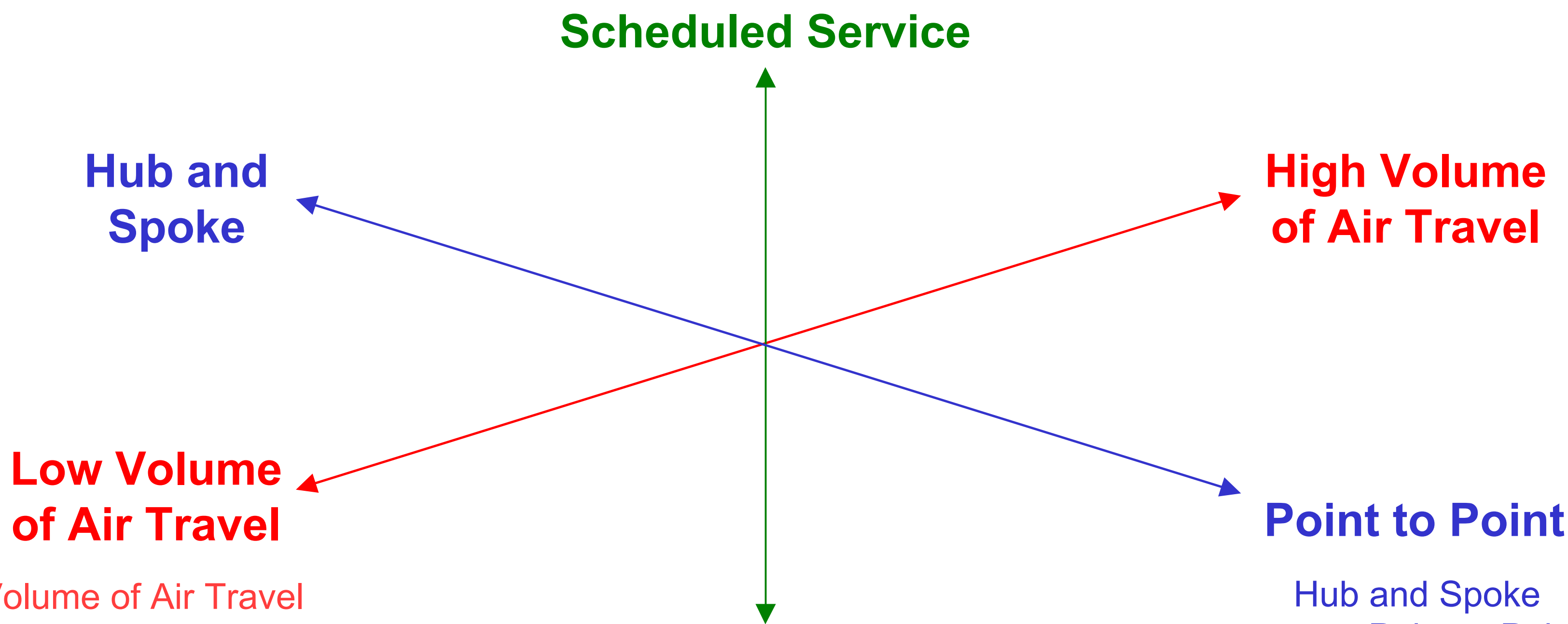
Other factors – limits to system growth and quality of substitutes – may constrain growth

To estimate domestic passenger growth rates in each scenario:

- GDP growth set at “high” value of 4.0% or “low” value of 2.5%
- Yield changes set at “high” value of 0.5% annual growth or “low” value of –0.1%
- Include growth-retarding effects of system growth limits or effective substitutes if present in scenario (subtract 0.5% for each constraint)
- Other market sectors have grown more rapidly than domestic passenger sector

To estimate GA activity, extrapolate from past flight hour and load factor data, using trends in vehicle size and engine type, plus GA share of domestic passenger miles

COMPONENTS OF FUTURE COMMERCIAL AVIATION INDUSTRY STRUCTURE



On-Demand Modes

Volume of Air Travel attribute is a function of overall health of economy, demographic trends, security issues, and relative attractiveness of competing surface modes

Scheduled versus On-Demand attribute measures the degree to which scheduled air carriers satisfy air travel demand relative to personal and corporate GA aircraft

Hub and Spoke versus Point to Point attribute measures the degree to which passengers travel directly from their true origin to their true destination

"ECONOMIC GROWTH/AIRLINES RECOVER"

Description

- High GDP growth, coupled with many limits to aviation system growth and poor substitutes for commercial services, implies that airlines will be able to raise fares (yields). This scenario, although not the one with the highest level of traffic growth, is perhaps the most favorable for the major network carriers.

Level of Growth in Traffic

- Tracks GDP growth closely

Locus of Growth:

- Further growth in hub and spoke system
- Growth by LCCs and others serving low yield sectors at secondary airports

New Systems:

- On-demand modes do not improve relative to scheduled service

SCENARIO GROWTH RATES FOR "ECONOMIC GROWTH/AIRLINES RECOVER"

Parameter	Average Annual Growth Rate	2022 Value
Domestic passenger RPMs	4.1%	1,056 B
Type of domestic network		Hub-Spoke continues
International passenger RPMs	5.5%	500 B
Domestic cargo RTMs	5.5%	38.5 B
International cargo RTMs	6.0%	41.4 B
Belly vs. all cargo split		
Domestic cargo		25/75
International cargo		50/50
Total GA passenger miles*	4.2%	28.2 B
Single-engine	2.6%	4.5 B
Multi-engine	2.6%	6.8 B
Jet-engine	5.7%	16.9 B

*Includes fractionals and SATS

"LOW COST CARRIERS DOMINATE"

Description

- A weak economy, coupled with few limits to growth and attractive substitutes, bodes poorly for the growth of traditional airlines. Fares are low and demand is price-sensitive; the shift of travel to LCCs continues.

Level of Growth in Traffic

- In the airline sector, LCCs grow relative to network carriers
- Network carriers stagnate and try to shift parts of their networks to RJs

Locus of Growth

- Secondary carrier airports

New Systems

- On-demand modes maintain share because there are few limits on aviation system growth

SCENARIO GROWTH RATES FOR "LOW COST CARRIERS DOMINATE"

Parameter	Average Annual Growth Rate	2022 Value
Domestic passenger RPMs	2.7%	828 B
Type of domestic network		Point-to-Point
International passenger RPMs	3.5%	348 B
Domestic cargo RTMs	3.5%	27.3 B
International cargo RTMs	4.0%	32.0 B
Belly vs. all cargo split		
Domestic cargo		27/73
International cargo		50/50
Total GA passenger miles*	2.8%	22.1 B
Single-engine	1.2%	3.5 B
Multi-engine	1.1%	5.3 B
Jet-engine	4.2%	13.3 B

*Includes fractionals and SATS

OUTPUTS FROM RESEARCH ACTIVITY 2

For each specified future aviation industry environment/scenario:

2022 U.S. commercial passenger demand:

- Domestic passenger demand in terms of RPMs
- Degree to which domestic scheduled passenger service is provided via hub-and-spoke vs. point-to-point network
- International passenger demand in terms of RPMs
- All assumptions used in commercial passenger demand forecasting

2022 U.S. air cargo demand:

- Domestic air cargo in terms of RTMs (U.S. internal RTMs only)
- International air cargo (between one of the U.S. airports and one of the foreign airports) in terms of RTMs
- Belly vs. all cargo split
- All assumptions used in air cargo demand forecasting

2022 U.S. GA passenger demand:

- Transported passenger miles (TPM) in GA aircraft
- Disaggregation by aircraft type
- All assumptions used in GA passenger demand forecasting

RESEARCH ACTIVITY THREE

- Develop a set of demand forecasts, incorporating both aggregate travel volumes and the distribution among airport-pairs and air vehicles, for each of the scenarios defined under research activity two:
  - Passenger flights
  - All cargo flights
  - GA itinerant flights

METHODOLOGY – PASSENGER FLIGHTS

- Assumptions Applied to All Scenarios:

- Two market segments have different growth rates:
  - Domestic
  - International

- Within each scenario, all domestic airports have the same passenger demand growth rate from 1997 to 2022

- Within each scenario, international travel demands at the 102 airports have the same growth rate from 1997 to 2022

- International passenger flights at the 102 airports include departures by both U.S. and foreign flag airliners

METHODOLOGY – PASSENGER (CONT.)

- Methodology for Developing 2022 Passenger Flight Demand:
  - Created three baseline matrices for in-network domestic flights; out-of-network domestic flights represented by a 102-by-1 vector
  - Created a 102-by-1 vector for international flights using the data from DOT’s U.S. international air passenger and freight statistics
  - Used operational parameters to link travel demand with flight demand
  - Applied flight growth multipliers from the five scenarios to the appropriate baseline matrix and the domestic and international vectors

METHODOLOGY – PASSENGER (CONT.)

Three Baseline Matrices for Domestic Flights:

- Baseline One:
  - Reflects current Hub-and-Spoke system
  - Constructed a 102-by-102 airport-pair matrix using 1997 OAG data
- Baseline Two:
  - Assumes a hypothetical Point-to-Point system
  - Constructed a 102-by-102 airport-pair matrix using 1997 Origin and Destination (O&D) data
- Baseline Three:
  - Assumes a 50/50 split between current Hub-and-Spoke and pure Point-to-Point systems

A SAMPLE OF IN-NETWORK SCHEDULED PASSENGER FLIGHT DEPARTURES

Airport	Hub-and-spoke	Point-to-point	50/50 Split
ATL	672 (3.49%)	420 (3.04%)	546 (3.30%)
ORD	904 (4.70%)	499 (3.62%)	702 (4.25%)
SFO	443 (2.30%)	329 (2.38%)	386 (2.34%)
IND	164 (0.85%)	166 (1.20%)	165 (1.00%)
PVD	100 (0.52%)	94 (0.68%)	97 (0.59%)
SAT	113 (0.59%)	127 (0.92%)	120 (0.73%)
DAY	79 (0.41%)	60 (0.43%)	70 (0.42%)
LIT	63 (0.33%)	69 (0.50%)	66 (0.40%)
MSN	39 (0.20%)	37 (0.27%)	38 (0.23%)
…			
102 Airports Total	19,240 (100%)	13,801 (100%)	16,521 (100%)

METHODOLOGY – PASSENGER (CONT.)

Passenger Flight Growth Multiplier: G

$$G_i = \frac{2022RPMs}{1997RPMs} * \frac{1997size}{2022size} * \frac{1997L.F.}{2022L.F.} * \frac{1997length}{2022length}$$

Where:
G is a flight growth multiplier;
size is average aircraft size (number of seats);
L.F. is load factor; and
length is average stage length.

Since domestic and international market segments have their own operational parameters, the multipliers for the two market segments are calculated separately.

METHODOLOGY – PASSENGER (CONT.)

Convert Domestic RPM Growth Multipliers to Flight Growth Multipliers

Scenario	Domestic Scheduled RPMs in 2022 (billion)	RPM Growth Multiplier 2022/1997	Convert to Flight Growth Multiplier 2022/1997	Domestic Load Factor	Domestic Average Aircraft Size	Domestic Average Stage Length
4. Airlines recover	1,056	2.35	1.97	0.72	150	880
6. Consumer rules	1,232	2.74	2.32	0.74	145	880
7. Substitutes take share	1,056	2.35	1.92	0.74	150	880
12. Growth limits prevail	772	1.72	1.40	0.74	150	880
13. LCCs dominate	828	1.84	1.57	0.76	140	880
1997 baseline	449			0.69	143	812

METHODOLOGY – PASSENGER (CONT.)

Convert International RPM Growth Multipliers to Flight Growth Multipliers

Scenario	International Scheduled RPMs in 2022 (billion)	RPM Growth Multiplier 2022/1997	Convert to Flight Growth Multiplier 2022/1997	Int'l Load Factor	Int'l Average Aircraft Size	Int'l Average Stage Length
4. Airlines recover	500	3.15	2.97	0.76	230	3,350
6. Consumer rules	599	3.77	3.47	0.78	230	3,350
7. Substitutes take share	599	3.77	3.47	0.78	230	3,350
12. Growth limits prevail	348	2.19	2.07	0.76	230	3,350
13. LCCs dominate	348	2.19	2.07	0.76	230	3,350
1997 baseline	159			0.74	245	3,036

DAILY PASSENGER FLIGHT DEPARTURES AT SFO

Calculation 1: Domestic Scheduled Passenger Flights

Scenario	Operation System	**Baseline 1997**: Daily Domestic Departures	Flight Growth Multiplier	**2022 Daily Domestic Departures**
4. Airlines recover	H&S	508	1.97	1,001
6. Consumer rules	50/50 Split	451	2.32	1,047
7. Substitutes take share	50/50 Split	451	1.92	866
12. Growth limits prevail	50/50 Split	451	1.40	631
13. LCCs dominate	P2P	394	1.57	619

DAILY PASSENGER FLIGHT DEPARTURES AT SFO

Calculation 2: International Scheduled Passenger Flights

Scenario	Operation System	**Baseline 1997**: Daily International Departures	Flight Growth Multiplier	**2022 Daily International Departures**
4. Airlines recover	P2P	55	2.97	164
6. Consumer rules	P2P	55	3.47	192
7. Substitutes take share	P2P	55	3.47	192
12. Growth limits prevail	P2P	55	2.07	114
13. LCCs dominate	P2P	55	2.07	114

DAILY PASSENGER FLIGHT DEPARTURES AT SFO

Calculation 3: Total Scheduled Passenger Flights

Scenario	**Baseline 1997**: Total Daily Passenger Departures	**2022 Total Daily Passenger Departures**
4. Airlines recover	563	1,165
6. Consumer rules	506	1,238
7. Substitutes take share	506	1,058
12. Growth limits prevail	506	746
13. LCCs dominate	449	733

OUTPUTS FROM RESEARCH ACTIVITY 3

- Operational Demand at the Airport Level:
  - 2022 commercial passenger flights at 102 airports for each of the five scenarios
  - 2022 all-cargo flights at 102 airports for each of the five scenarios
  - 2022 itinerant flights by GA aircraft at 2,865 airports for each of the five scenarios

BACKUP CHARTS

WHAT IS A VALUE PROPOSITION?

- An organization's "Value Proposition" is the best articulation of why its product or service is compelling to customers.
- If customers understand the value proposition, they know why a given provider of products or services offers the best choice in a given market.
- It is useful for organizations focused on continuous improvement to develop and execute against a value proposition because such an exercise tends to sharpen focus and highlight strengths.
- Key steps in the construction of a value proposition include:
  - Careful definition of customer groups and key stakeholders
  - Thorough, although not necessarily complex, description of key product offerings
  - Clear illustration of the operational improvement offered to the customer
  - "ROI" analysis that demonstrates specific justification to the customer

SUPPLY/DEMAND METRICS

- Enroute capacity: Supply of airspace
- Terminal capacity: Supply of airspace
- Separation: Demand based on traffic
- Taxi times: Demand based on efficiency of operations
- Flight plan deviation: Demand on airspace
- Arrival and departure rates: Supply of airspace
- Length of visual approach: Supply of airspace
- Greater runway usage: Demand on fixed infrastructure

OPERATIONAL METRICS

- Reliability: Scheduled vs. actual
- On-time departures: Scheduled vs. actual
- Availability: Facility and service downtime
- Ground delays: Schedule adherence
- Ground stops: Schedule adherence
- Controller workload: FAA operations
- Passenger efficiency: Sunk labor costs
- Hub performance: Asset utilization

FISCAL METRICS

- Margin (RASM-CASM): Target vs. actual
- Fuel burn: Target vs. actual
- Labor efficiency: Target vs. actual
- Load factors: Service attractiveness
- Yield: Service attractiveness/reliability
- Turnaround time: Asset utilization
- Average daily block time/flight segments: Target vs. actual
- Infrastructure investment: Allocation of scarce resources
- Full price of travel: Value to customer

ENUMERATION OF SCENARIOS

Scenario Number	GDP Growth High/Low	Airline Yields High/Low	Limits to Av. System Growth Many/Few	Substitutes to Commercial Aviation Poor/Good
1	High	High	Few	Good
2*	**High**	**High**	**Few**	**Poor**
3	High	High	Many	Good
4*	**High**	**High**	**Many**	**Poor**
5	High	Low	Few	Good
6*	**High**	**Low**	**Few**	**Poor**
7*	**High**	**Low**	**Many**	**Good**
8	High	Low	Many	Poor
9	Low	High	Few	Good
10*	**Low**	**High**	**Few**	**Poor**
11	Low	High	Many	Good
12*	**Low**	**High**	**Many**	**Poor**
13*	**Low**	**Low**	**Few**	**Good**
14*	**Low**	**Low**	**Few**	**Poor**
15	Low	Low	Many	Good
16	Low	Low	Many	Poor

* = plausible scenarios

ESTIMATING GROWTH IN GA PASSENGER MILES

Estimating baseline (year 2000) GA transported passenger miles (TPMs):

- Use FAA GA Survey values for flight hours for corporate, business, personal and air taxi users, by aircraft type
- Estimate available GA passenger seat miles using averages for seats per aircraft type and aircraft speed
- Estimate GA TPMs using assumed 65% load factor

Estimating GA passenger activity for scenarios:

- Recognize differing growth rates for different aircraft types (single engine, multi-engine and jet engine), with jet engine GA transport experiencing most active growth
- Current GA share (2.6%) of total domestic passenger miles (domestic passenger RPMs plus GA TPMs) used as central tendency for future GA share
- Poor environment for GA (due to few limits to system growth and unattractive substitutes to scheduled service models) reduces future GA share; good environment increases GA share
- Current split of GA transported passenger miles among vehicle types used as expected split in least aggressive GA growth scenario (#6); faster GA growth more concentrated in jet engine aircraft
- GA transported passenger mile growth rates imputed from scenario GA future share and activity split among aircraft types

102 LMINET AIRPORTS

Airport	Hub Status	FAA Cargo Airport?	Airport	Hub Status	FAA Cargo Airport?
ABQ	M	yes	CRP	S	no
ALB	S	yes	CVG	L	yes
ANC	M	yes	DAB		no
ATL	L	yes	DAL	M	no
AUS	M	yes	DAY	S	yes
BDL	M	yes	DCA	L	no
BFL		no	DEN	L	yes
BHM	S	yes	DFW	L	yes
BNA	M	yes	DSM	S	yes
BOI	S	yes	DTW	L	yes
BOS	L	yes	ELP	M	yes
BTR	S	no	EUG		no
BUF	M	yes	EWR	L	yes
BUR	M	no	FAT		yes
BWI	L	yes	FLL	L	yes
CHS	S	no	FNT		yes
CLE	M	yes	GFK		no
CLT	L	yes	GRR	S	yes
CMH	M	no	GSO	S	yes
COS	S	yes	HNL	L	yes

102 LMINET AIRPORTS (CONT.)

Airport	Hub Status	FAA Cargo Airport?	Airport	Hub Status	FAA Cargo Airport?
HOU	L	no	MIA	L	yes
HPN	S	no	MKE	M	yes
IAD	L	yes	MLB		no
IAH	M	yes	MSN		no
ICT	S	yes	MSP	L	yes
IND	M	yes	MSY	M	yes
ISP	S	no	OAK	M	yes
JAX	M	yes	OKC	M	yes
JFK	L	yes	OMA	M	yes
JNU		no	ONT	M	yes
LAN		yes	ORD	L	yes
LAS	L	yes	ORF	S	yes
LAX	L	yes	PBI	M	no
LGA	L	no	PDX	L	yes
LGB		no	PHF		no
LIT	S	no	PHL	L	yes
MCI	M	yes	PHX	L	yes
MCO	L	yes	PIT	L	yes
MDW	L	no	PVD	M	yes
MEM	M	yes	RDU	M	yes

102 LMINET AIRPORTS (CONT.)

Airport	Hub Status	FAA Cargo Airport?	Airport	Hub Status	FAA Cargo Airport?
RIC	S	yes	TVC		no
RNO	M	yes	TYS	S	yes
ROC	S	yes			
RSW	M	yes			
SAN	L	yes			
SAT	M	yes			
SBA		no			
SDF	M	yes			
SEA	L	yes			
SFO	L	yes			
SJC	M	yes			
SLC	L	yes			
SMF	M	no			
SNA	M	no			
STL	L	yes			
SWF		yes			
SYR	S	yes			
TPA	L	yes			
TUL	M	yes			
TUS	M	yes			

Hypothetical Point-to-Point Matrix

Service Regression Results

Market	Distance	Seats	Statute Miles	Intercept	R-Squared	Load Factors
large	long	0.006006942	-0.001271873	2.2303	0.94	0.7
large	short	0.006624361	-0.012321804	6.8956	0.73	0.6
small	long	0.696095181	-0.001423347	0.6961	0.77	0.6
small	short	0.037807886	-0.002793974	0.7272	0.53	0.5
	Daily Service = seats * x + statute miles * y + intercept					
	Rounded up to whole flight					
	No service where Daily service <= .499999					
	Data source is OAG					

Long versus short split at 500 miles
Large versus small split at 100 daily passengers