CNS/ATM FOCUSED TEAM

A Demonstration of the Evaluation Process for the U.S. Terminal Area

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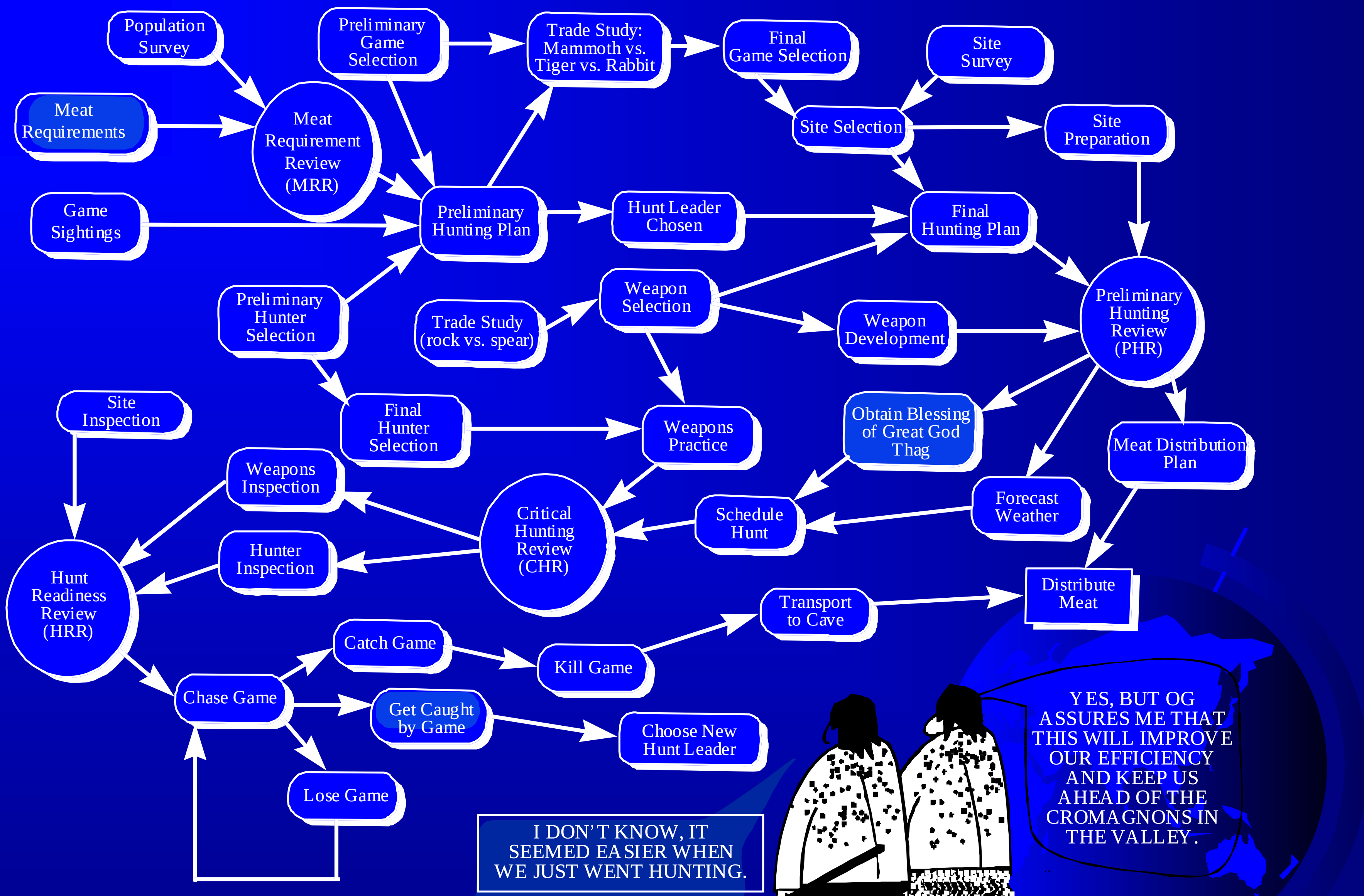
OBJECTIVE AND TOPICS

OBJECTIVE:

Demonstrate the CNS/ ATM evaluation process with a specific example of the US Terminal Area

TOPICS:

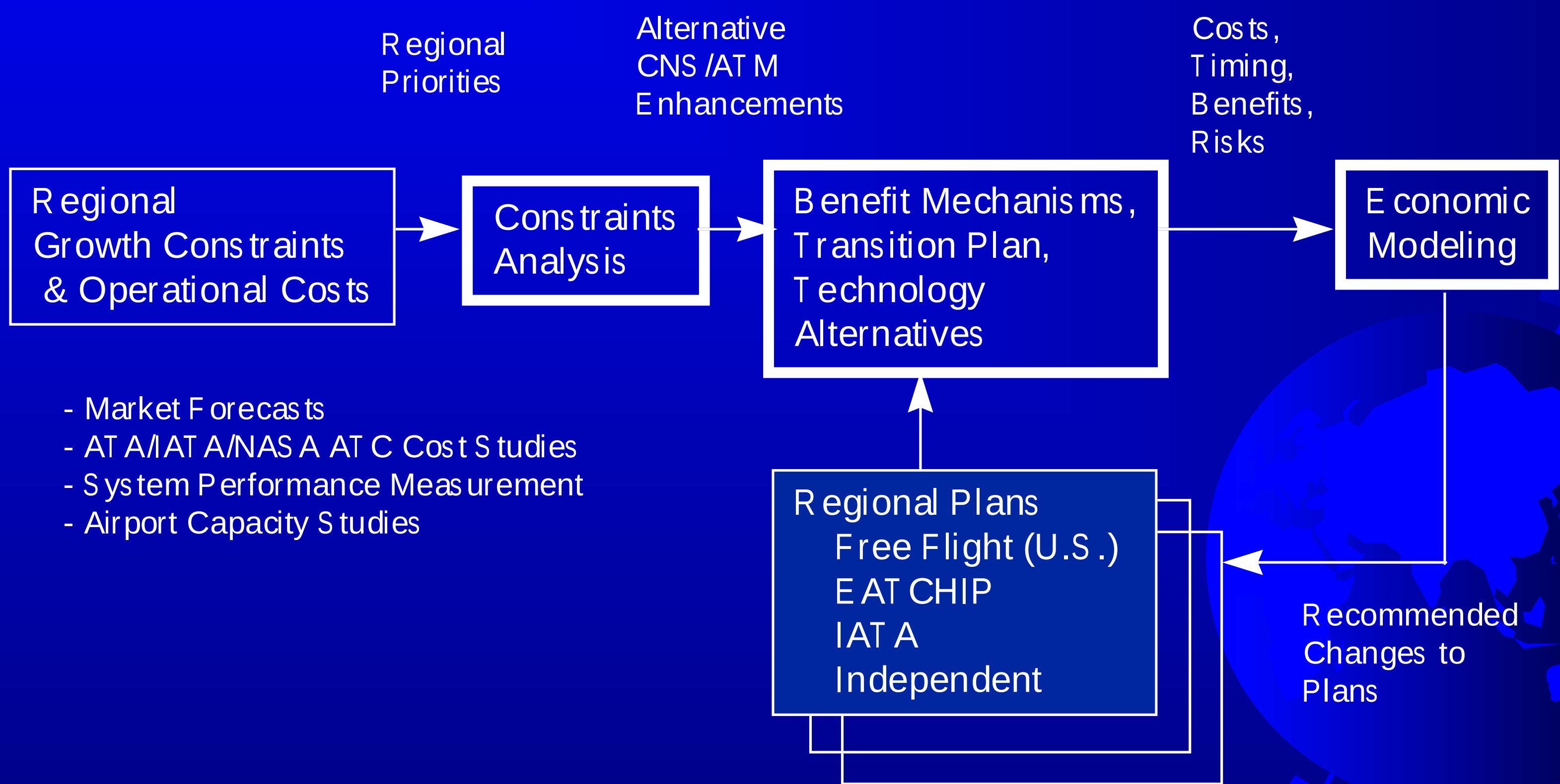
- Process Overview
- Constraints
- Solutions
- Benefits
- Costs
- Risks
- Example One Detail
- Example Two Detail
- Summary



Why Neanderthals Became Extinct

CNS/ATM Focused Team

Analysis Process

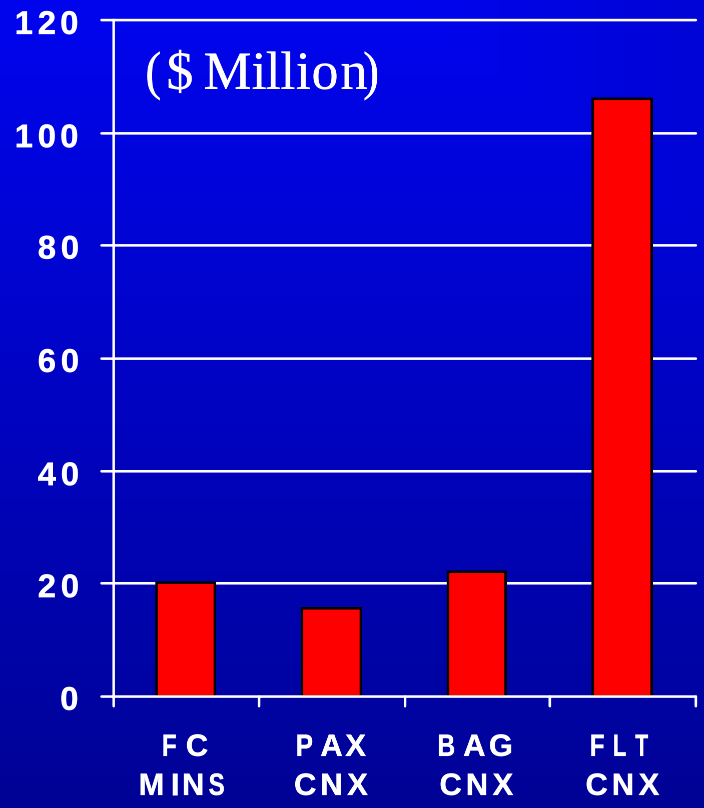


CONSTRAINT ANALYSIS

- Airport capacity is typically scheduled up to and sometimes over VFR capacity
- However, often, the airport operates below VFR capacity because of:
  - Visibility
  - Weather (winds, snow, thunderstorms)
  - Converging or crossing operations
    - Missed approach interference
    - Departure dependence
  - ATC outages
  - Instrument approach capability
  - Wake vortex avoidance
  - Control of arrival spacing interval
- As a result, inefficiency occurs

SOME COSTS ASSOCIATED WITH REDUCED TERMINAL CAPACITY

(UAL 1996 DATA)

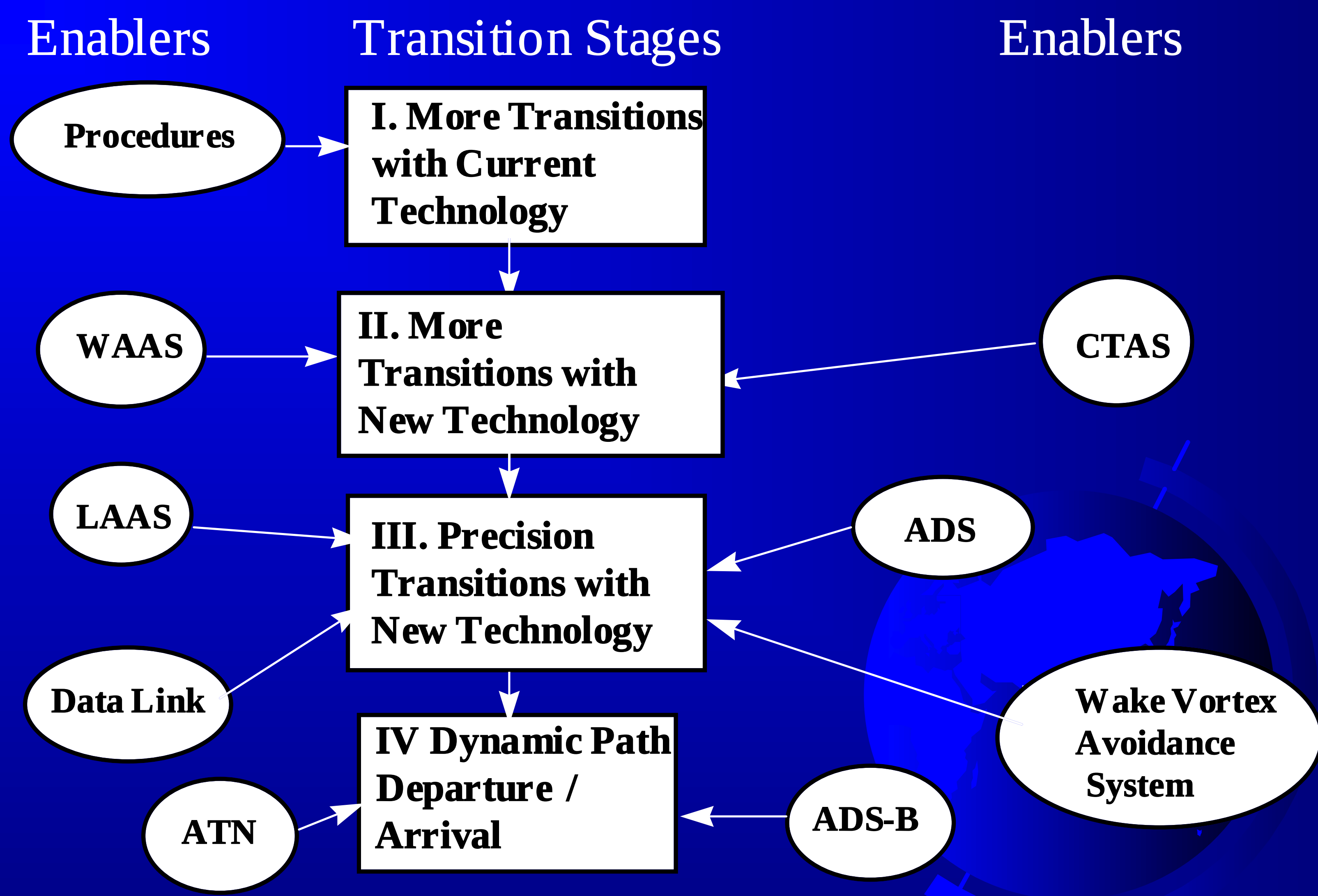


- Domestic costs only
- FC MINS: Based on 813,663 flow control gate delay minutes valued at $25/minute
- FLT CANX: Includes all domestic weather and flow control cancellations and secondary cancellations valued at $10,000
- Does not include additional en route, terminal and taxi time caused by terminal area restrictions

TERMINAL AREA SOLUTIONS

- Converging Runway Display Aid (CRDA)
- RNAV approaches/missed approaches/departures
- Center Tracon Automation System (CTAS)
- Wide Area Augmentation System (WAAS)
- ADS /ADS-B
- Local Area Augmentation System (LAAS)
- Wake Vortex Avoidance System
- GPS approaches/missed approaches/departures
- Datalink
- ATN
- Dynamic arrival and departure paths

TERMINAL AREA TRANSITION DIAGRAM



TRANSITION LOGIC OPERATING ASSUMPTIONS

- **Box I**

  RNAV based approaches and departures, CRDA implemented at candidate airports

  - Shorter approaches with less fuel consumption at spoke airports during marginal VFR conditions
  - More optimal top of descent approaches with less fuel burn at hubairports during marginal VFR conditions
  - Reduced delays at airports which are currently planning to use CRDA in the near future

- **Box II**

  RNP-based navigation (GPS/WAAS) with CTAS to provide better use of existing runways

  - Higher capacity at hub airports-both VFR and IFR conditions

TRANSITION LOGIC OPERATING ASSUMPTIONS (CONT'D)

- **Box III:**

  RNP based navigation (GPS/LAAS) for lower operating minima and more efficient arrival and departure paths.

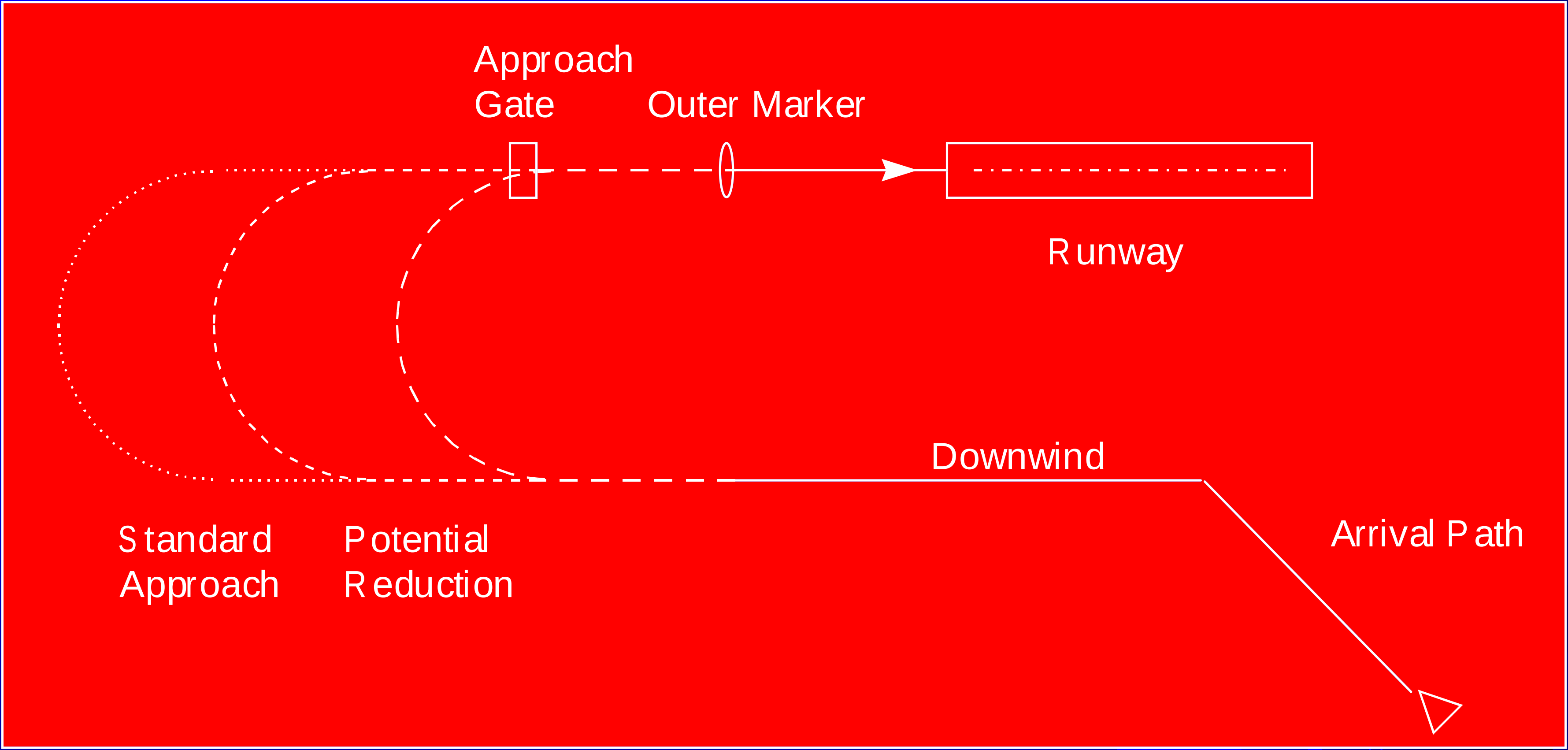
  – CAT I, II, III approaches

- **Box IV**:

  Dynamic arrival and departure flexible paths to maximize runway system throughput ADS-B used for simultaneous approaches at airports with very closely spaced parallel runways

  – Very efficient sequencing through advanced automation tools, datalink communications and cockpit automation support

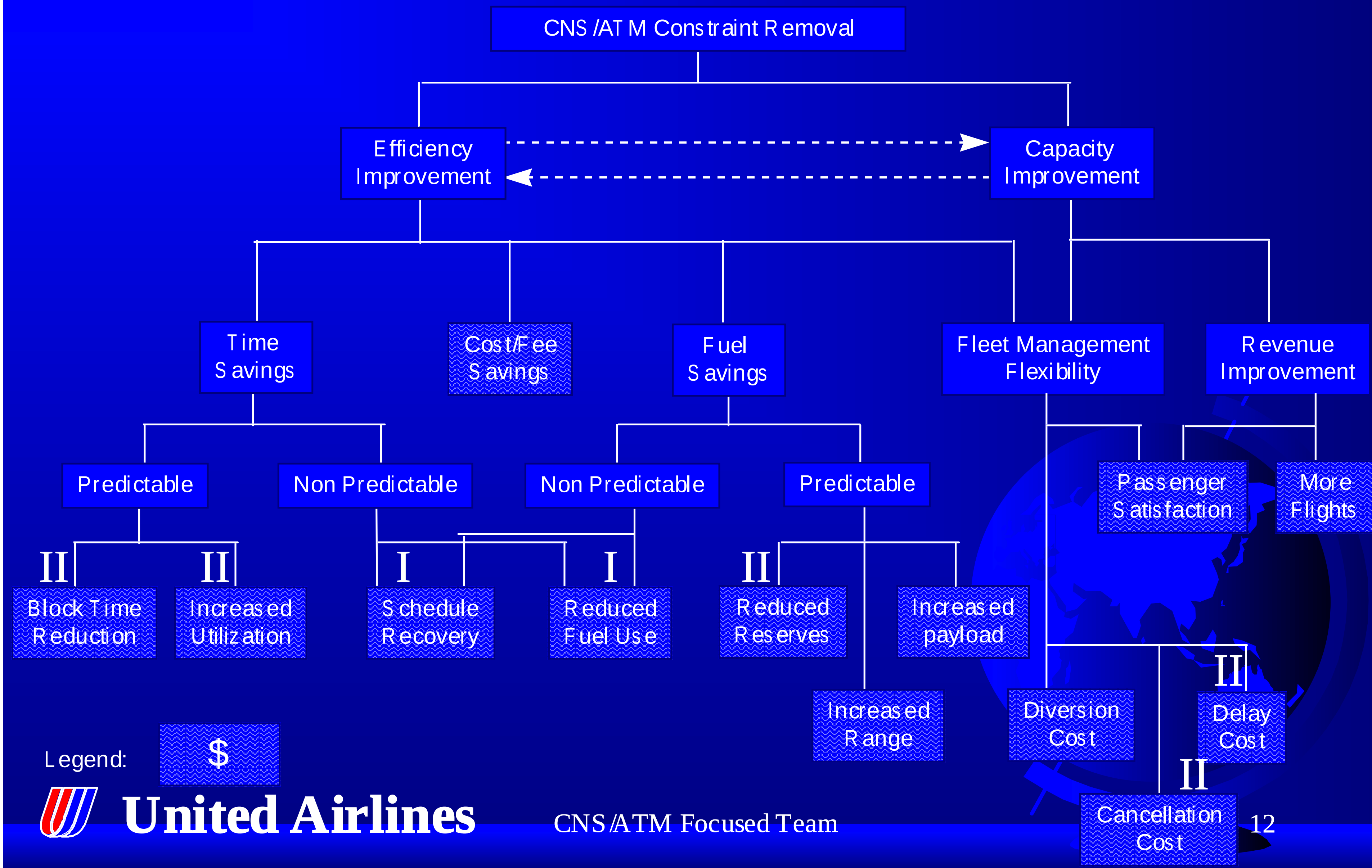
I. Terminal Area Savings:
Shorter Approaches During Marginal VFR



- Pilot checks weather and requests RNAV approach declared available on ATIS and stored in FMS database
- ATC clears aircraft for RNAV approach
- ATC monitors separation through radar surveillance

ECONOMIC MODELING: BENEFITS

TERMINAL AREA TRANSITIONS I AND II



ECONOMIC MODELING: COSTS

TERMINAL AREA TRANSITIONS: I AND II

I.

FAA:	Procedure development, testing, certification
Users:	Pilot training

II.

FAA:	WAAS and CTAS concept research and development Capital (hardware, program costs, software development, deployment) Procedure development, site adaptation, testing and certification
Users:	Pilot training WAAS ongoing maintenance

ECONOMIC MODELING: RISK

TERMINAL AREA TRANSITIONS I AND II

I. Procedure development /little risk

II. Funding issues
Technical issues
Stakeholders issues

COST BENEFIT SUMMARY : I

Assumptions:

- 50% of all flights into spokes equipped with an FMS save 3 minutes and 500 lbs per approach
- All flights into HUBS equipped with an FMS save 200 lbs per approach
- CRDA supports increased operation only in marginal VFR conditions
- CRDA benefits based on 5 airports currently without approved procedures
- Benefits and costs go through 2015
- Costs and Benefits NPV based on 3% cost of capital for FAA and 7% for users

FAA

Costs	$ 85 M
RNAV	$ 66 M
CDRA	$ 19 M
Benefits	$ 0 M

Users

Costs	$ 0 M
Benefits	$ 2,652 M
RNAV	
Fuel	$ 2,600 M
CRDA	
Gnd Dlys:	$ 52 M

COST BENEFIT SUMMARY : II

Assumptions:

- WAAS provides no immediate operational benefit to Majors, but in removing avionics in long-term
- FAA benefits from WAAS in reduction in maintenance cost of ATC infrastructure in long-term
- CTAS saves 3 mins and 200 lbs for flights in all weather for hub airports
- Costs and Benefits NPV based on 3% cost of capital for FAA and 7% for users

FAA

Costs		$ 2,826 M
Capital		
	CTAS:	$ 95 M
	WAAS:	$ 336 M
	INFRA:	$ 1109 M
Operating:		
	CTAS:	$ 47 M
	WAAS:	$ 840 M
	INFRA:	$ 373 M
R&D		
	WAAS:	$ 26 M
Benefits		$ 1,800 M

Users

Costs		
	WAAS:	$ 67 M
Benefits		
	CTAS	$ 2,267 M

SUMMARY

	Timeframe	Cost	Benefit
I. More Transitions with Current Technology	1996-2000	$85M	$2,652M
II. More Transitions with New Technology	2000-2005	$2,893M	$4,067M
III. More Precision Transitions with New Technology	2005-2010		
IV. Dynamic Path Arrivals/Departures	2010 +