Dynamics of Air Transportation System Transition

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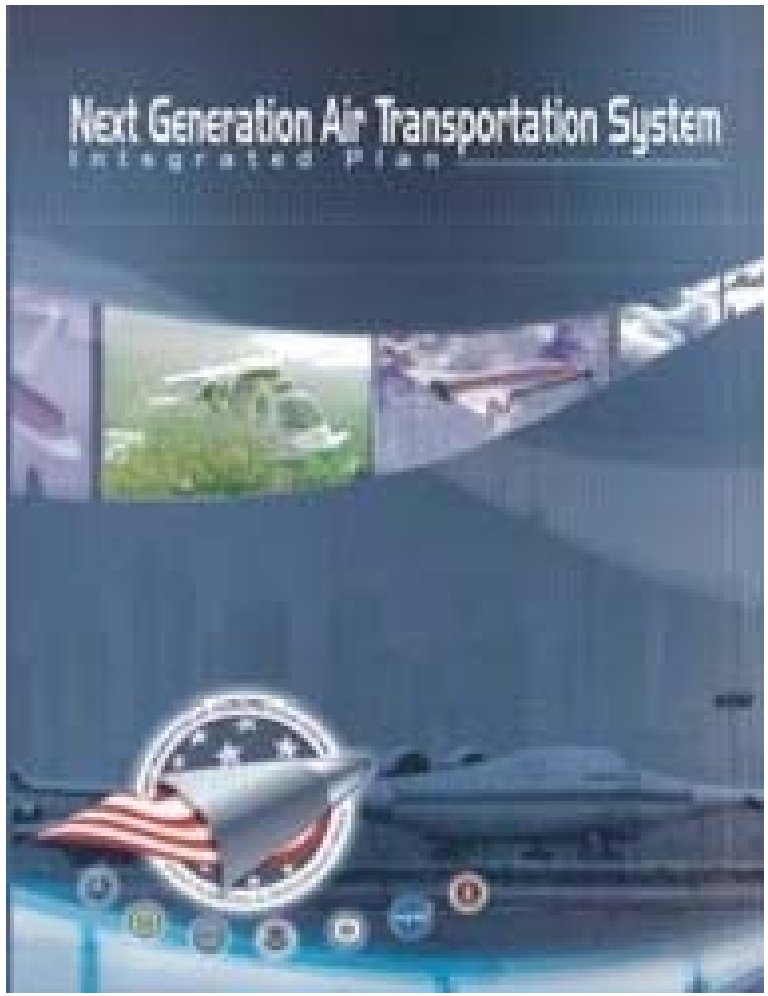
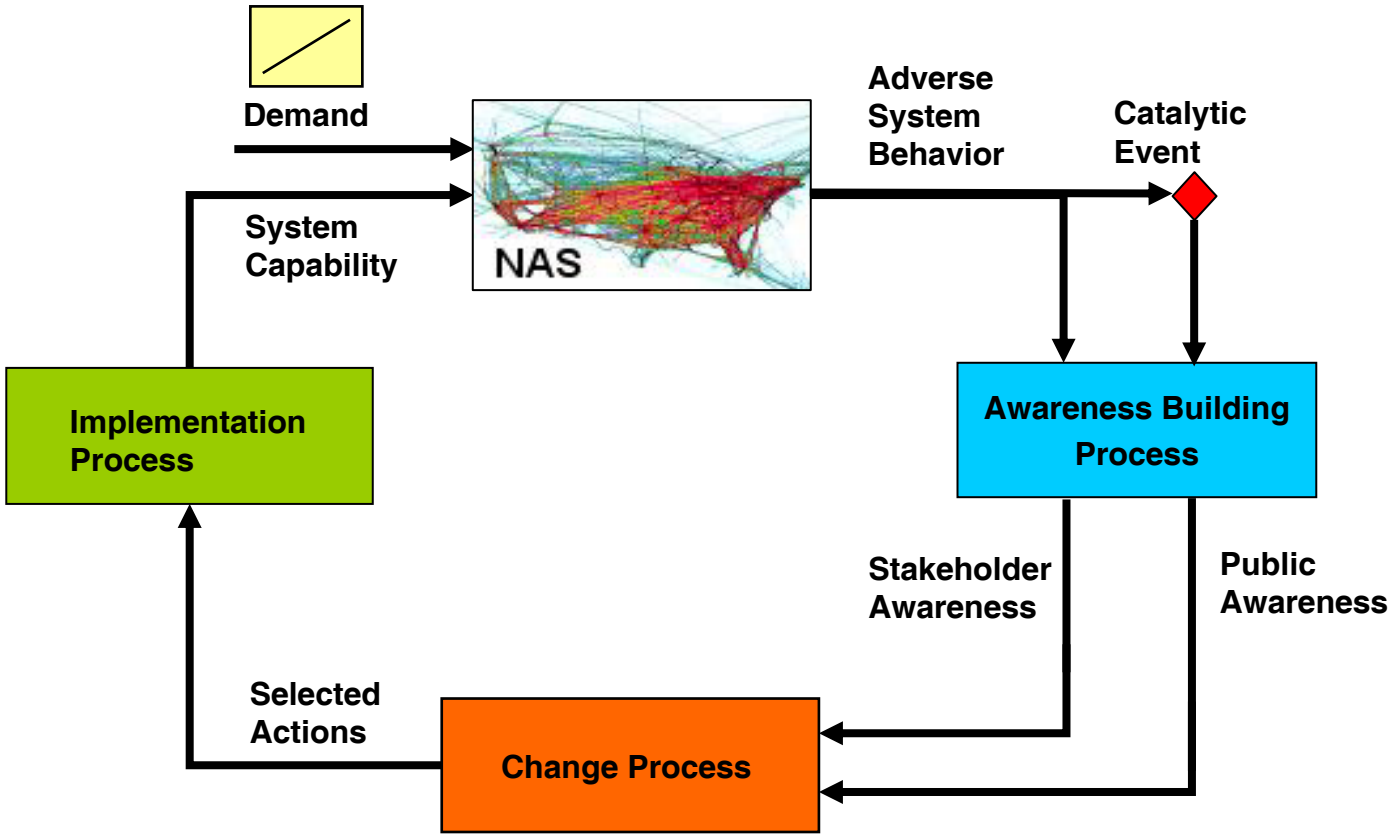
Need for System Transition

- **Existing US ATM system is not sufficient to meet future demands**
- **Need for major transformation has been recognized**
  - Reflected in NextGen plans for system change
- **Magnitude of planned changes is unprecedented**
- **Ability to achieve system transition is a key future core competency in the air transportation systems**



Feedback Model of System Change



- Model developed based on 20 case studies (successful and unsuccessful) of past changes in the US Air Transportation System, control theoretic approaches, and agenda setting literature

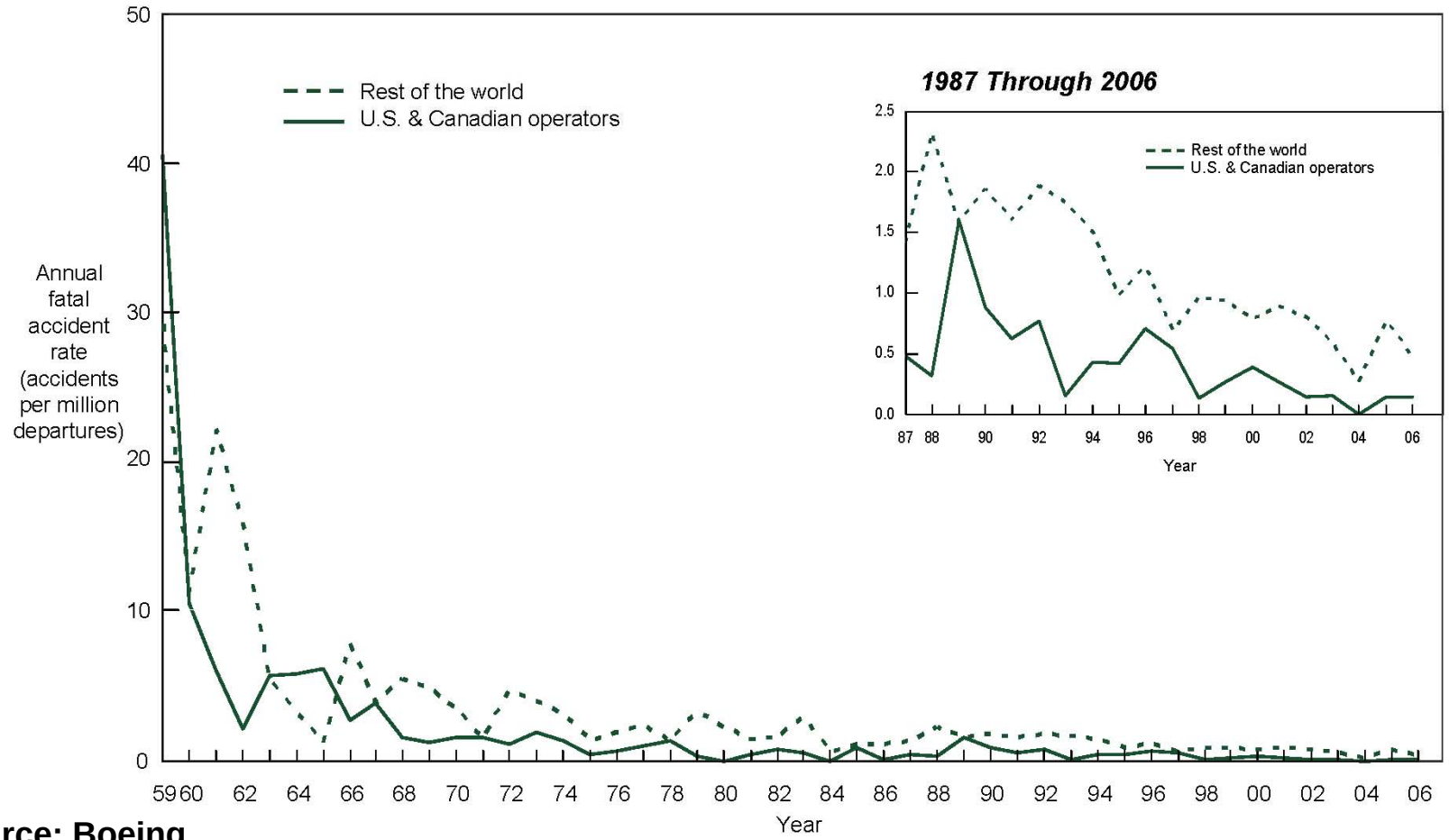
Past System Changes Have Been Driven by Safety Catalytic Events

Catalytic Event	Casualties	New System Capability
Grand Canyon, AZ (June 30, 1956) Midair collision between two commercial aircraft in uncontrolled airspace over the Grand Canyon.	120	
Los Cerritos, CA (August 31, 1986) Midair collision between a commercial and general aviation (GA) aircraft occurred above a residential neighborhood.	82	
Dulles, VA (December 1, 1974) A Controlled Flight into Terrain (CFIT) accident of a Trans World Airlines jet occurred near Berryvilla VA while on approach to Dulles International Airport.	92	
Cali, Colombia (December 20, 1995) A CFIT crash of an American Airlines jet near Buga Columbia while on approach to an airport in Cali Columbia.	159	
New York, NY (June 24, 1975) A rapidly evolving weather phenomenon called a microburst caused an Eastern Airlines jet to crash during a thunderstorm while on approach to John F. Kennedy International airport.	113	
Charlotte, NC (July 2, 1994) A USAir jet crashed after encountering a miroburst while attempting to land at Charlotte-Douglas International Airport.	37	

Opportunities for Safety Driven Change Have Decreased

U.S. and Canadian Operators Accident Rates by Year

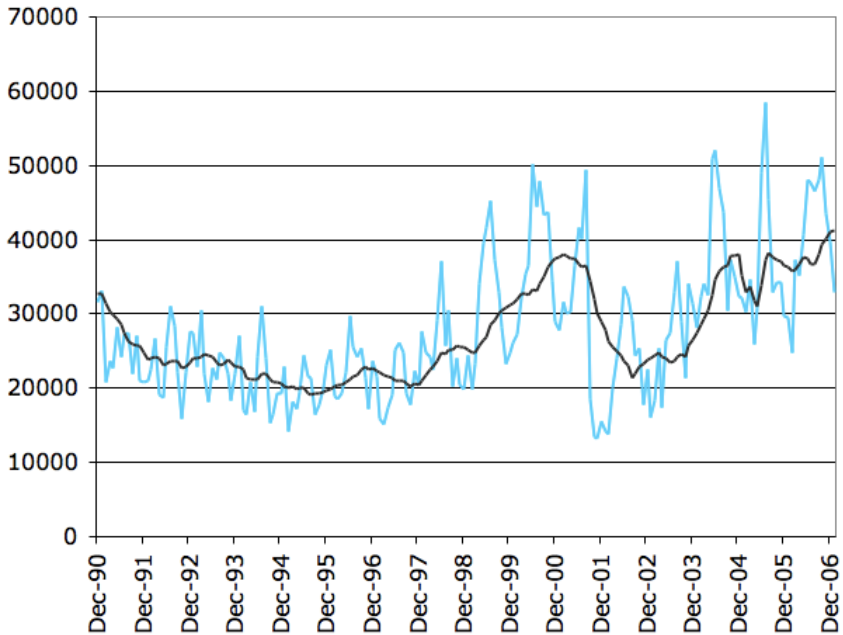
Fatal Accidents – Worldwide Commercial Jet Fleet – 1959 Through 2006



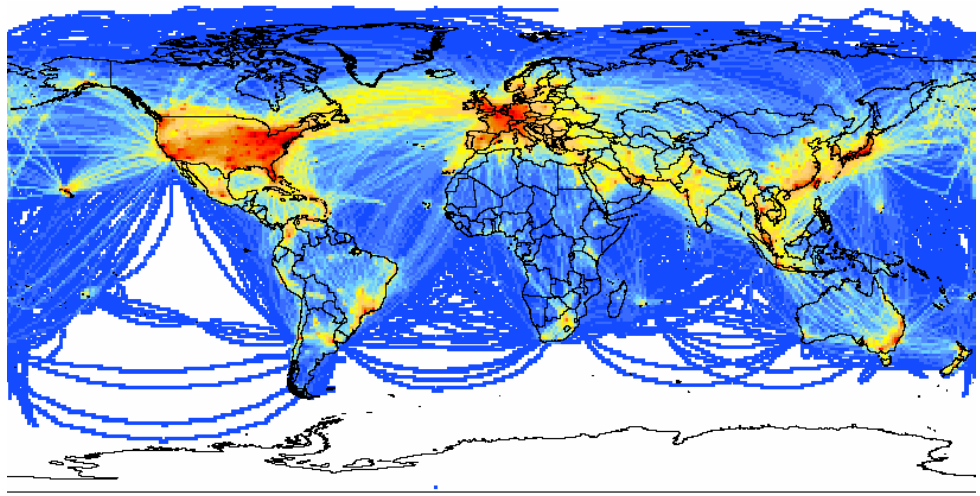
Source: Boeing

New Transition Drivers

- **Capacity**



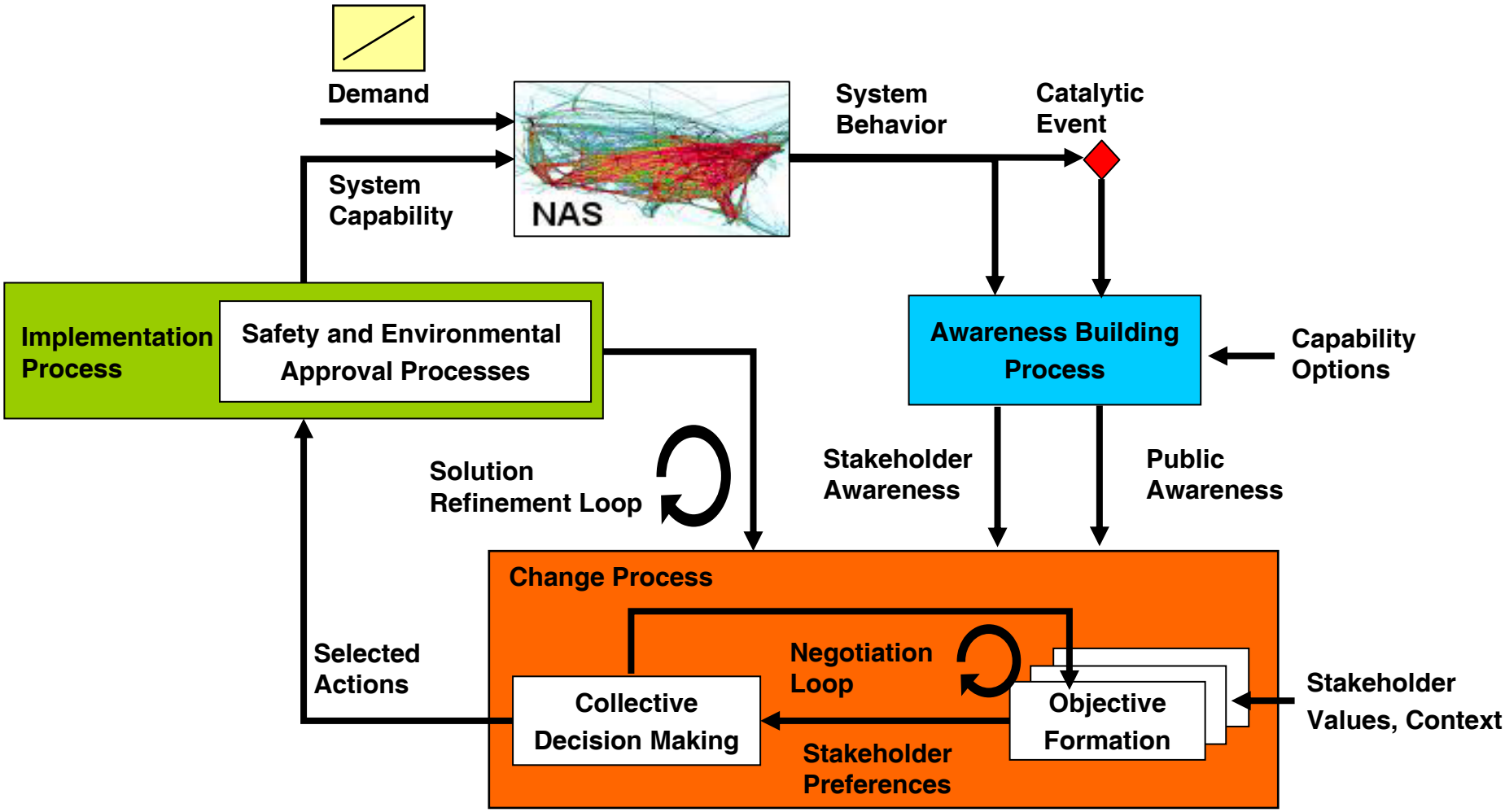
- **Environmental Constraints**



Traffic Source: Sage Analysis courtesy Prof Ian Waitz

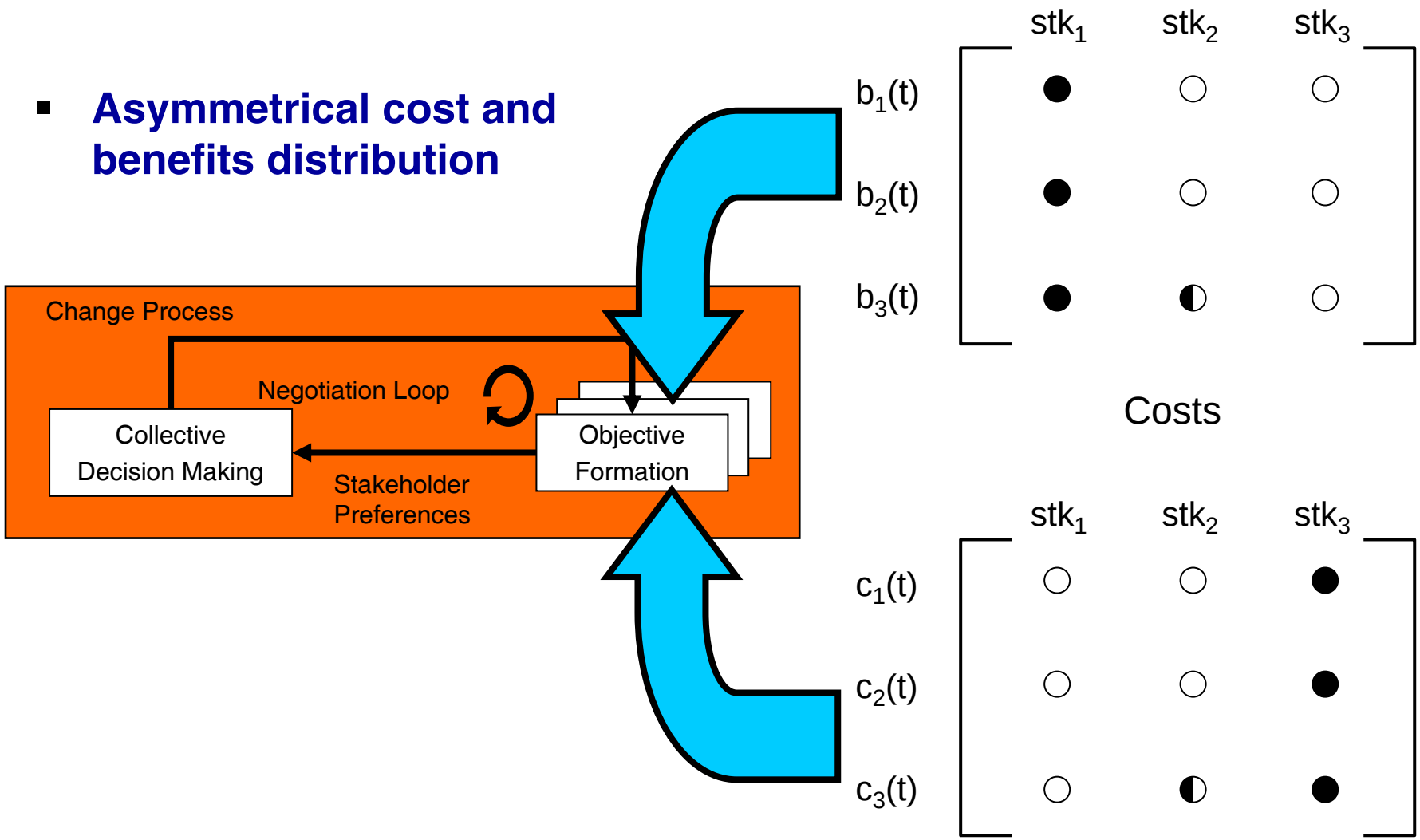
- **How will the system respond to capacity and environmental transition drivers?**

Multi-Stakeholder Nature of System Makes Transition Difficult



Stakeholder Objectives Driven by Perceived Costs and Benefits

- **Asymmetrical cost and benefits distribution**



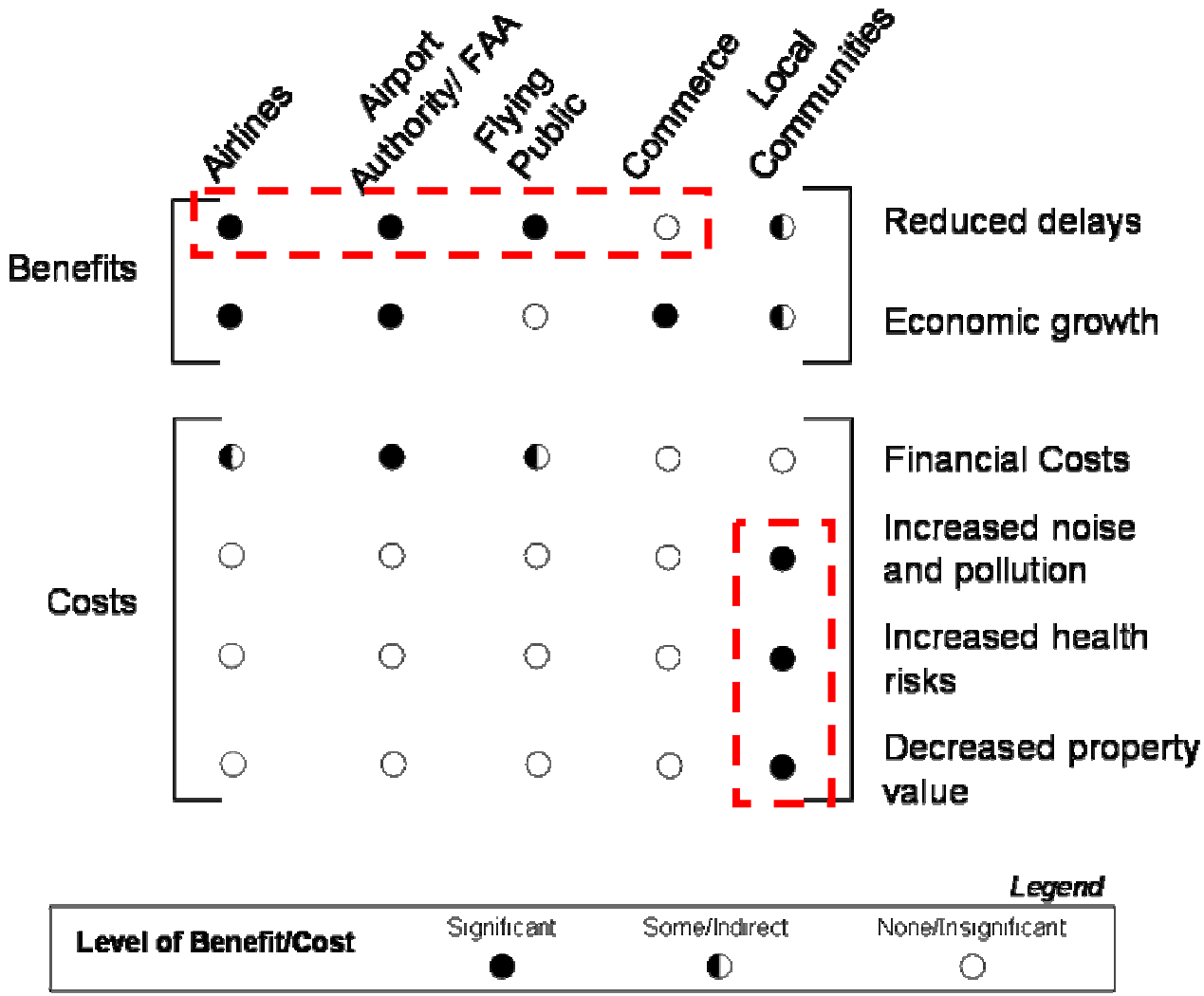
Adapted from: (Dr. Karen Marias & Prof. Annalisa Weigel (MIT)

Increasing Airport Infrastructure to Increase System Capacity

- **Current FAA OEP airports with ongoing or planned projects**
  - Philadelphia
  - Los Angeles
  - Seattle
  - Washington Dulles
  - Chicago O'Hare
  - Charlotte
  - Atlanta
  - Dallas-Ft. Worth
  - Fort Lauderdale
  - Portland
  - Las Vegas

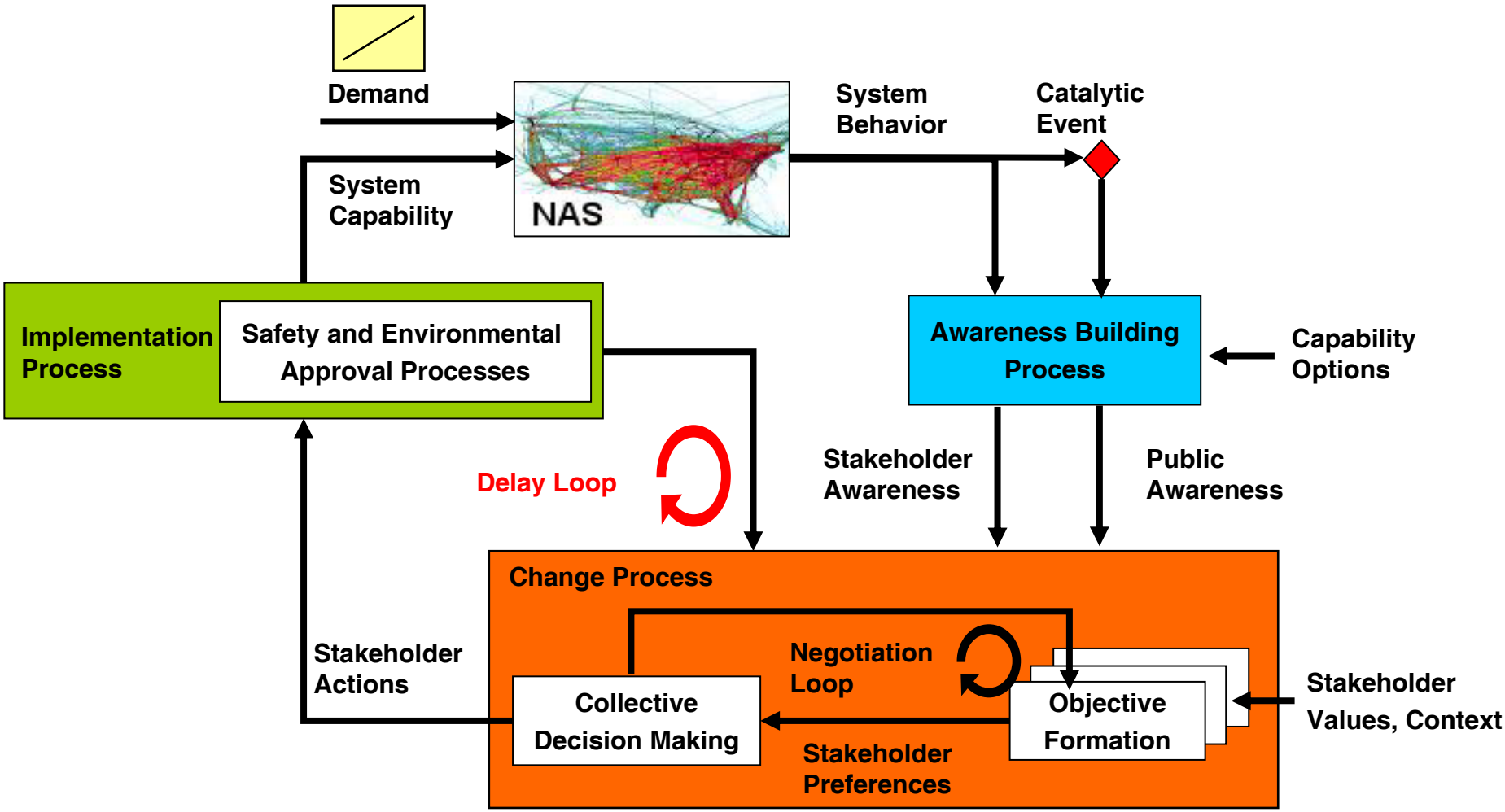
Asymmetrical Costs and Benefits lead to Disenfranchised Stakeholders

- **Runway Expansion Example**



Environmental Review Process Can Delay Implementation

- Environmental process provides a mechanism for disenfranchised stakeholders to block implementation



Expansion Projects May not be Realized in Time to meet Demand

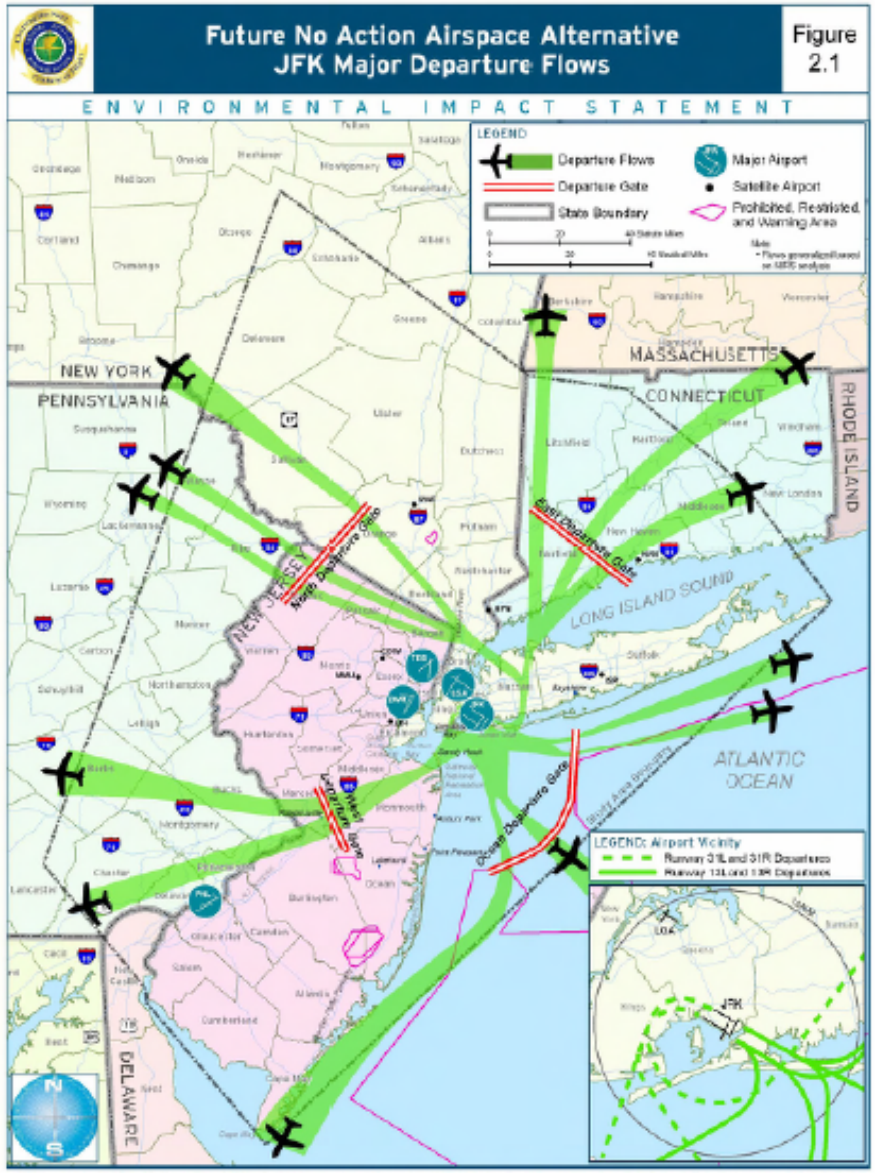
Top 30 Congested Airports in 2005

Pending Expansion Projects

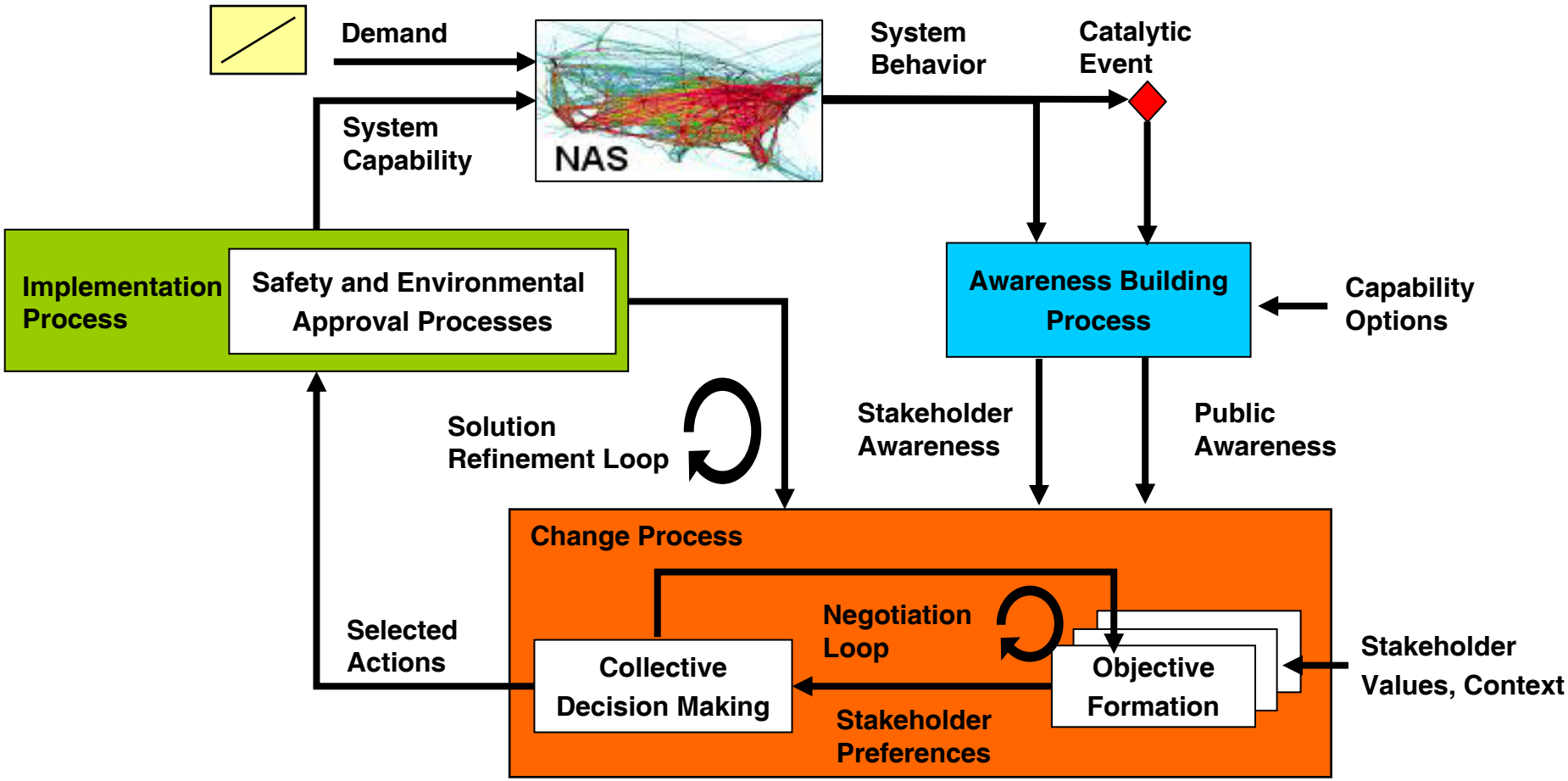
Completed Expansion Projects

Airspace Redesign Projects are also Facing Environmental Barriers

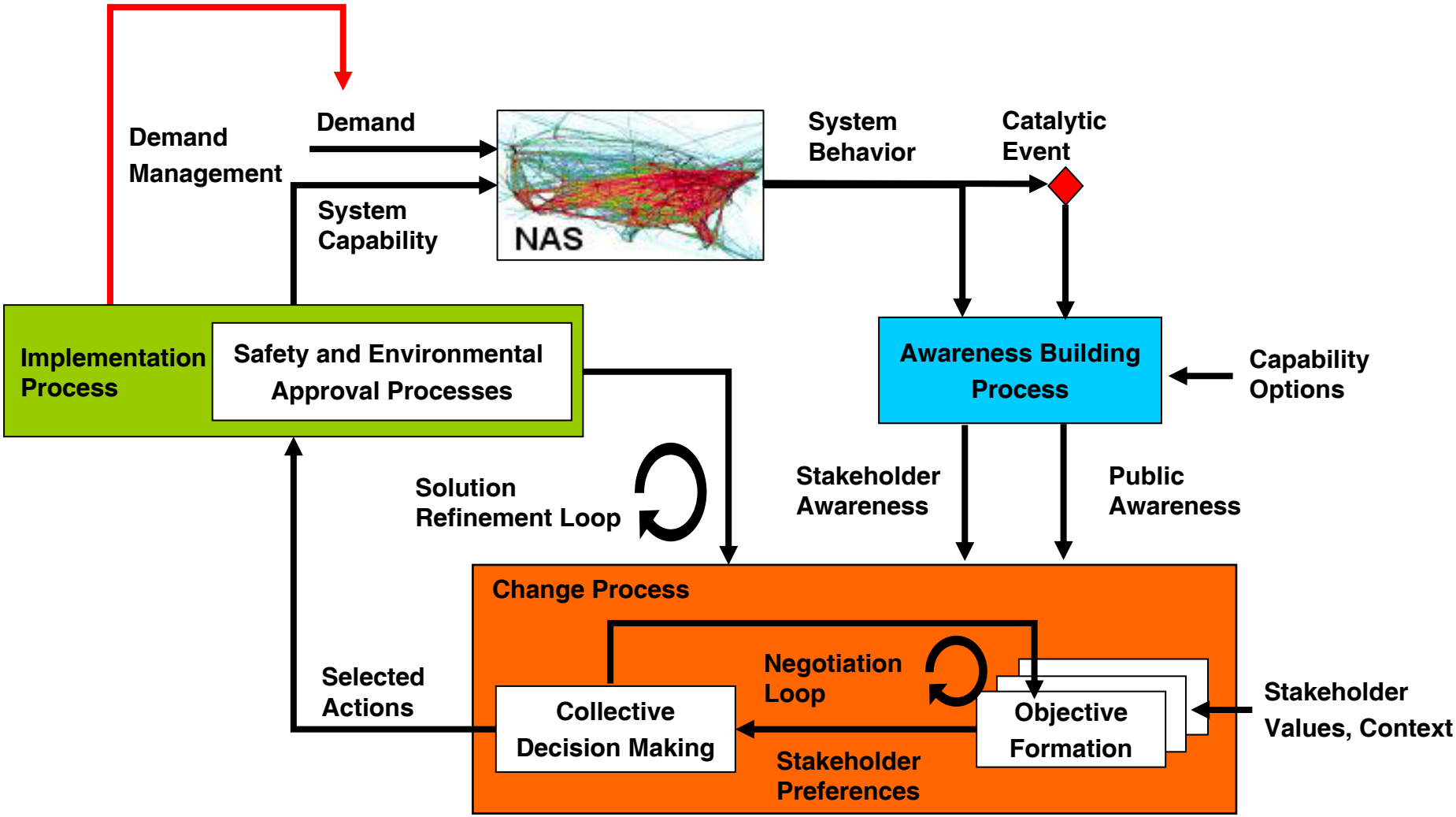
- NY Airspace is one of the busiest in the world
- Planned changes would allow for more efficient use of resources
- Lawsuits threaten to delay or derail changes



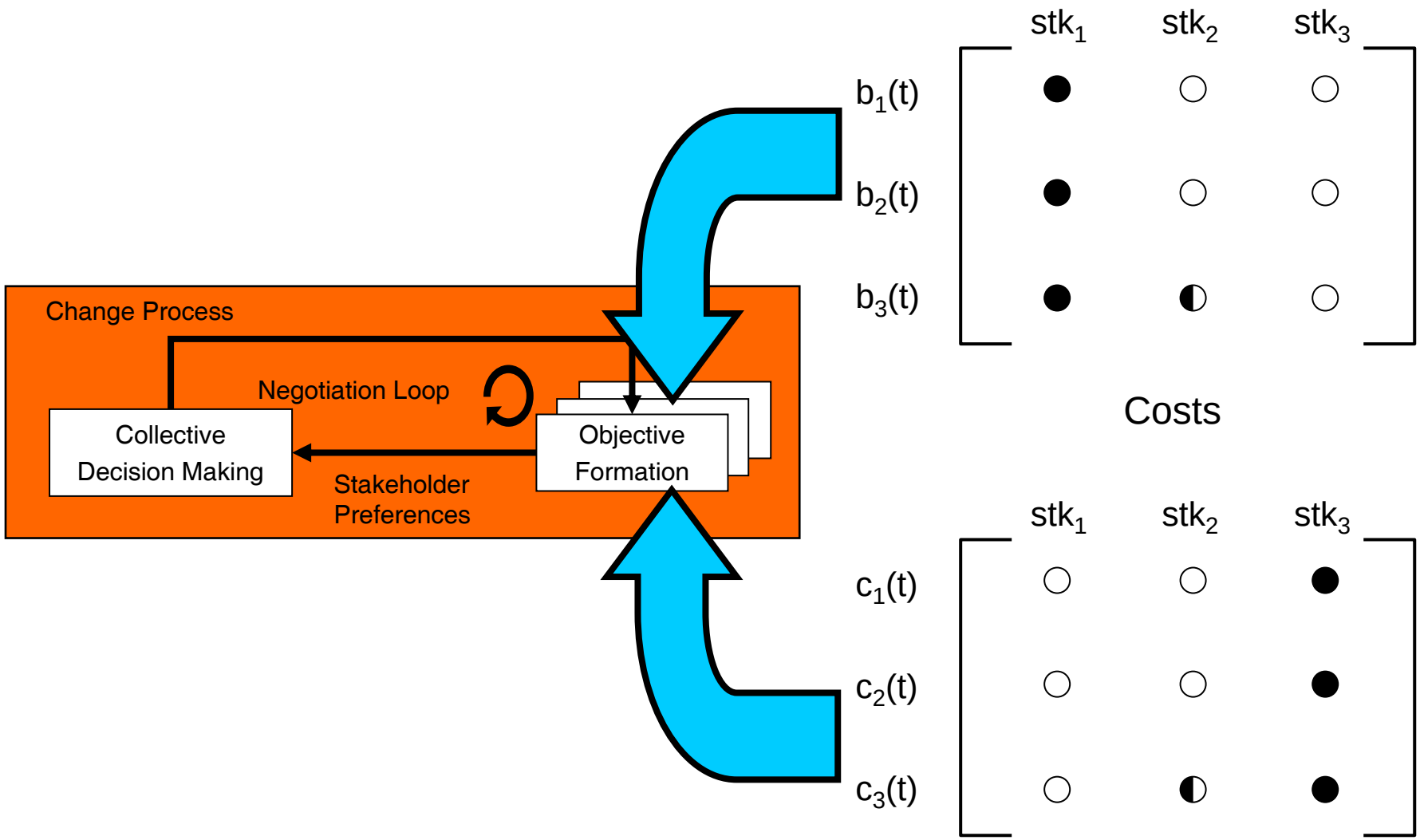
Role of Capacity Catalytic Events



Demand Management is the Only Rapid Alternative



Stakeholder Objectives also Driven by Timing of Benefits



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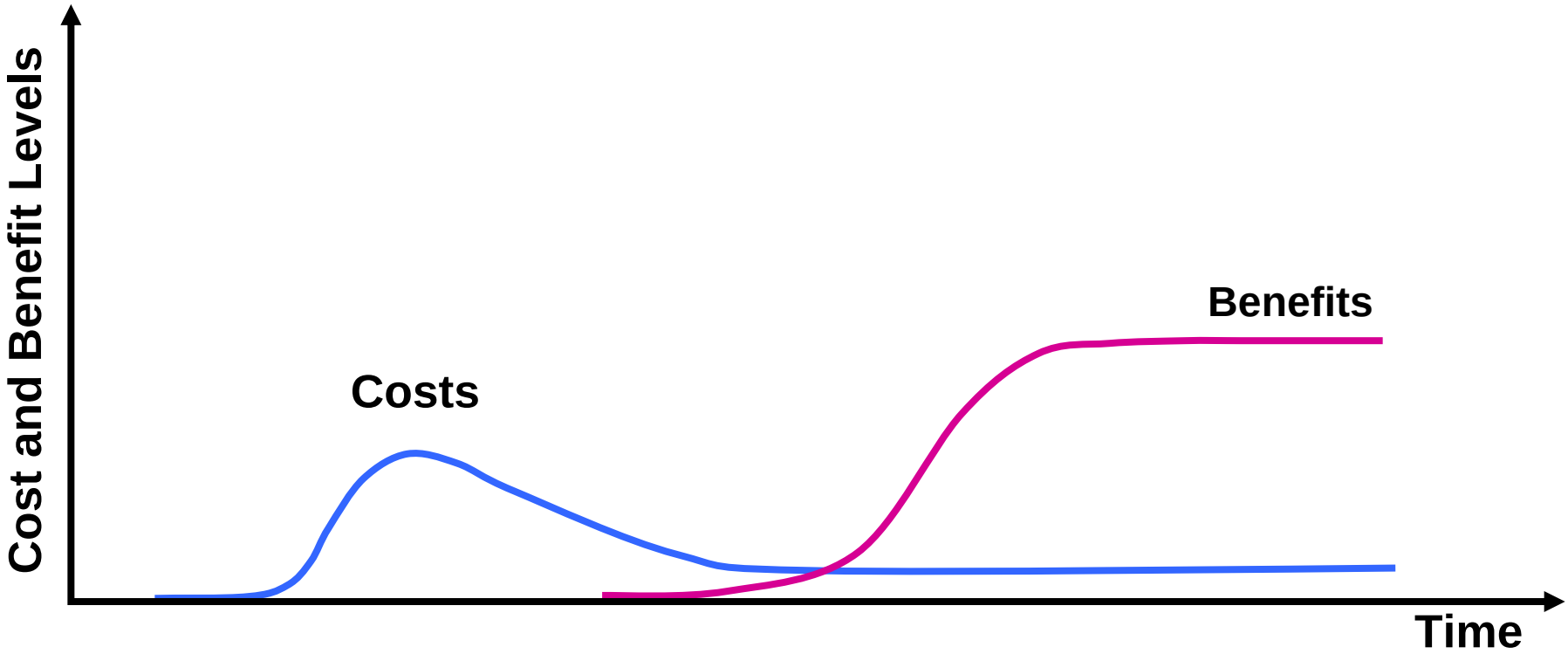
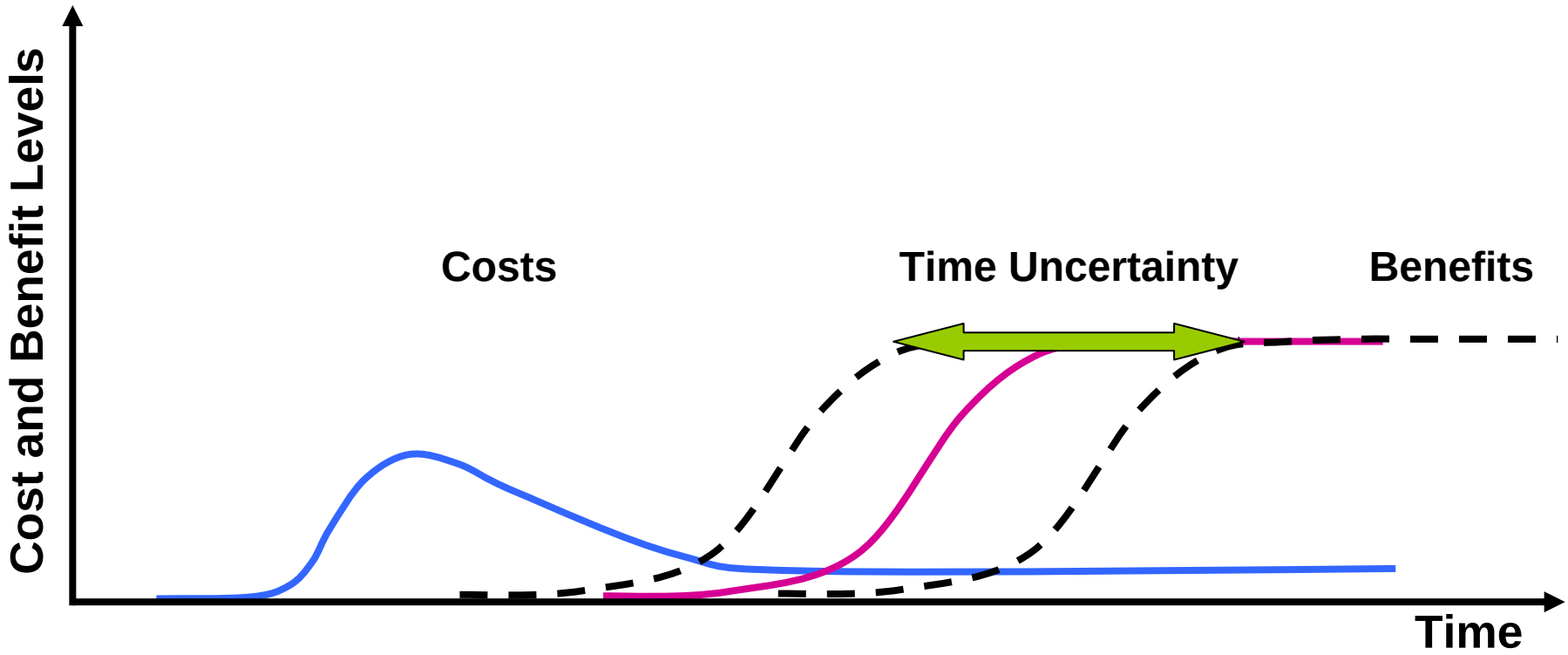
Temporal Distribution of Costs and Benefits



- Stakeholder objectives modeled using net present value (NPV)

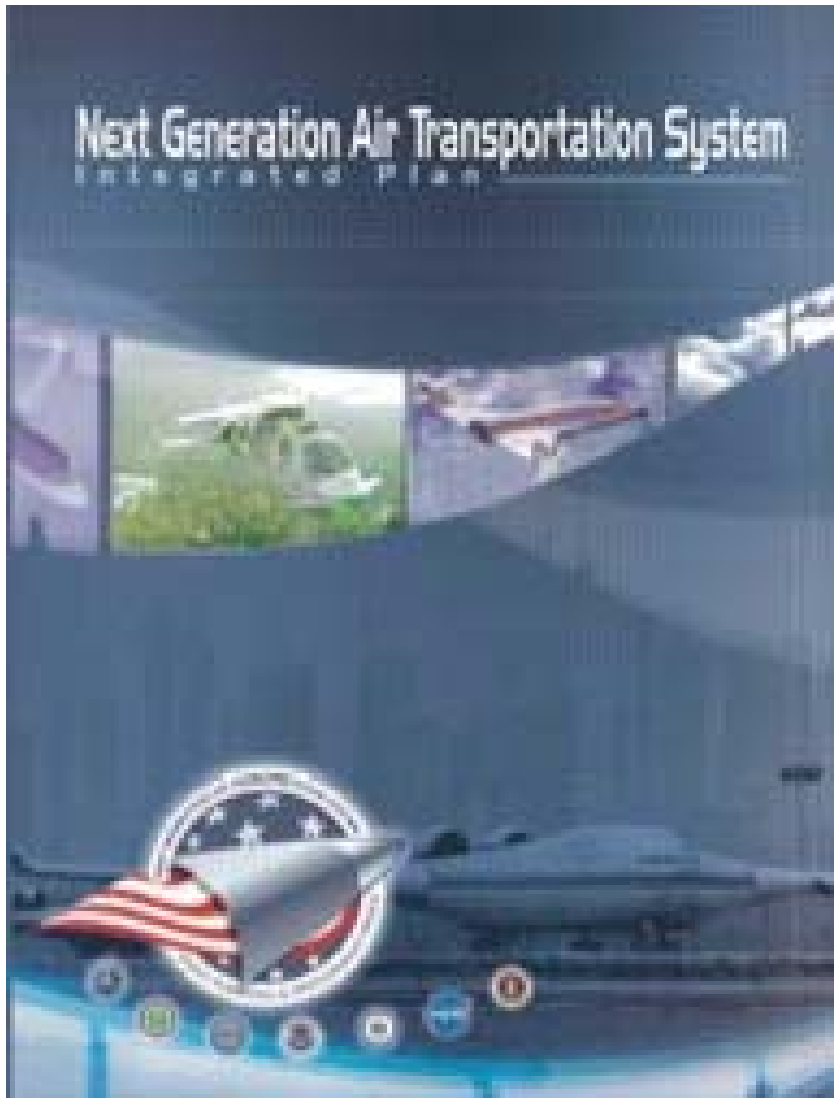
Delays in Timing of Operational Capability Reduces Benefits



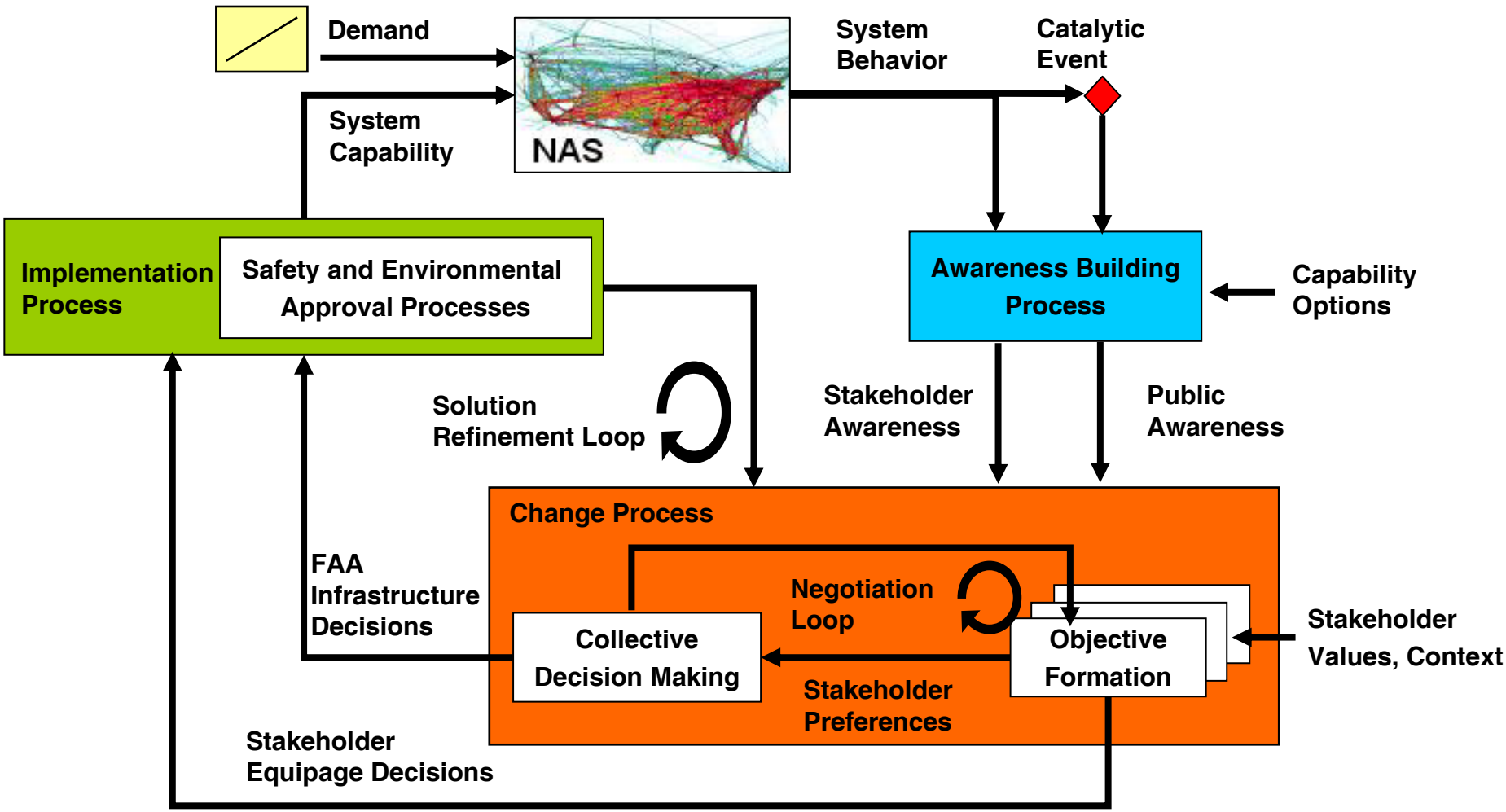
- Accelerating delivery of benefits has significant value
- Concerns about implementation will degrade perceived value of a change
- Trust and confidence in benefits delivery is critical

Many Planned Changes Require Stakeholder Equipage

- Required Navigation Performance (RNP)
- Area Navigation Routes (RNAV)
- Automatic Dependent Surveillance Broadcast System (ADS-B)

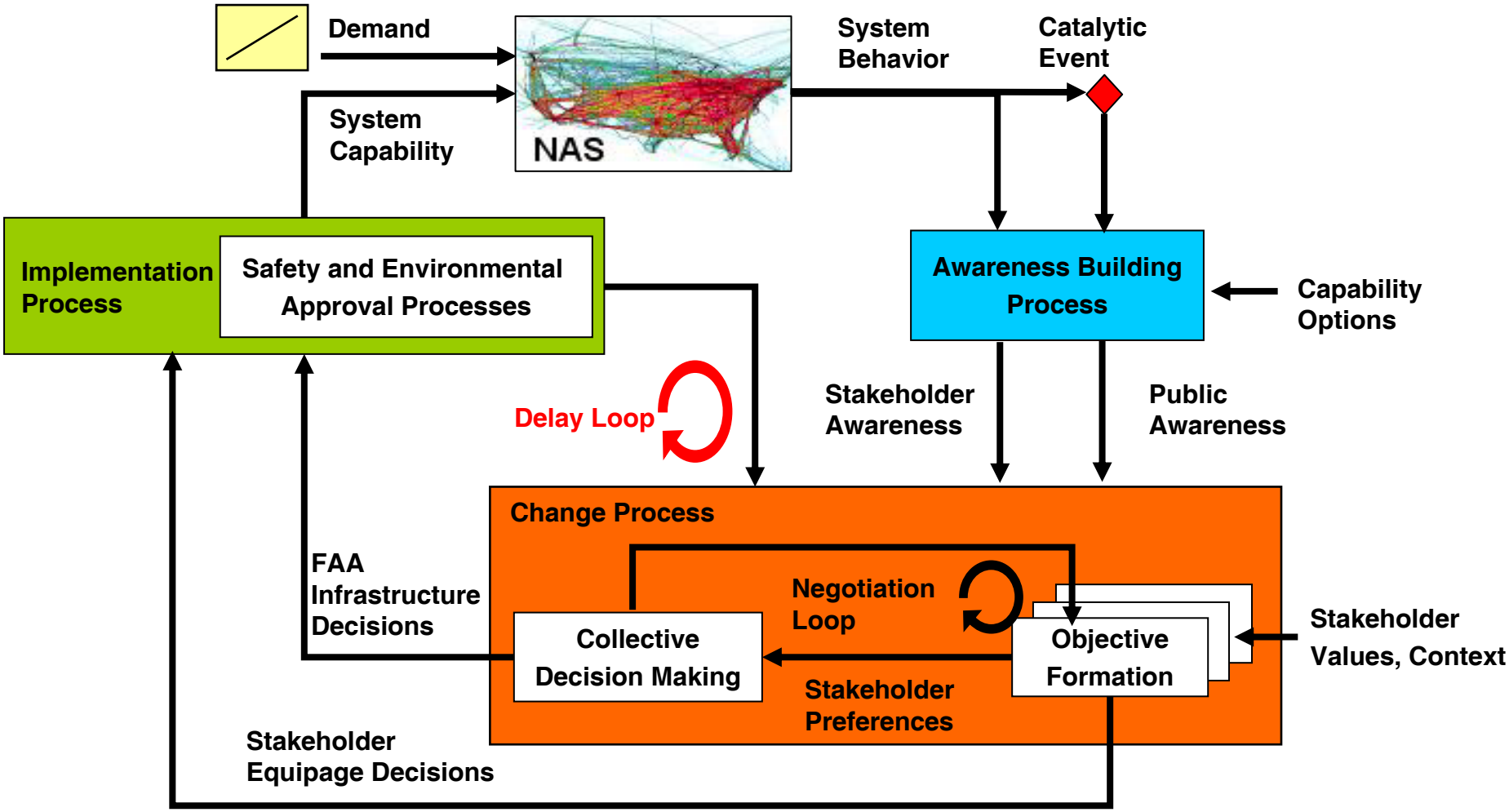


Individual Equipage Decisions

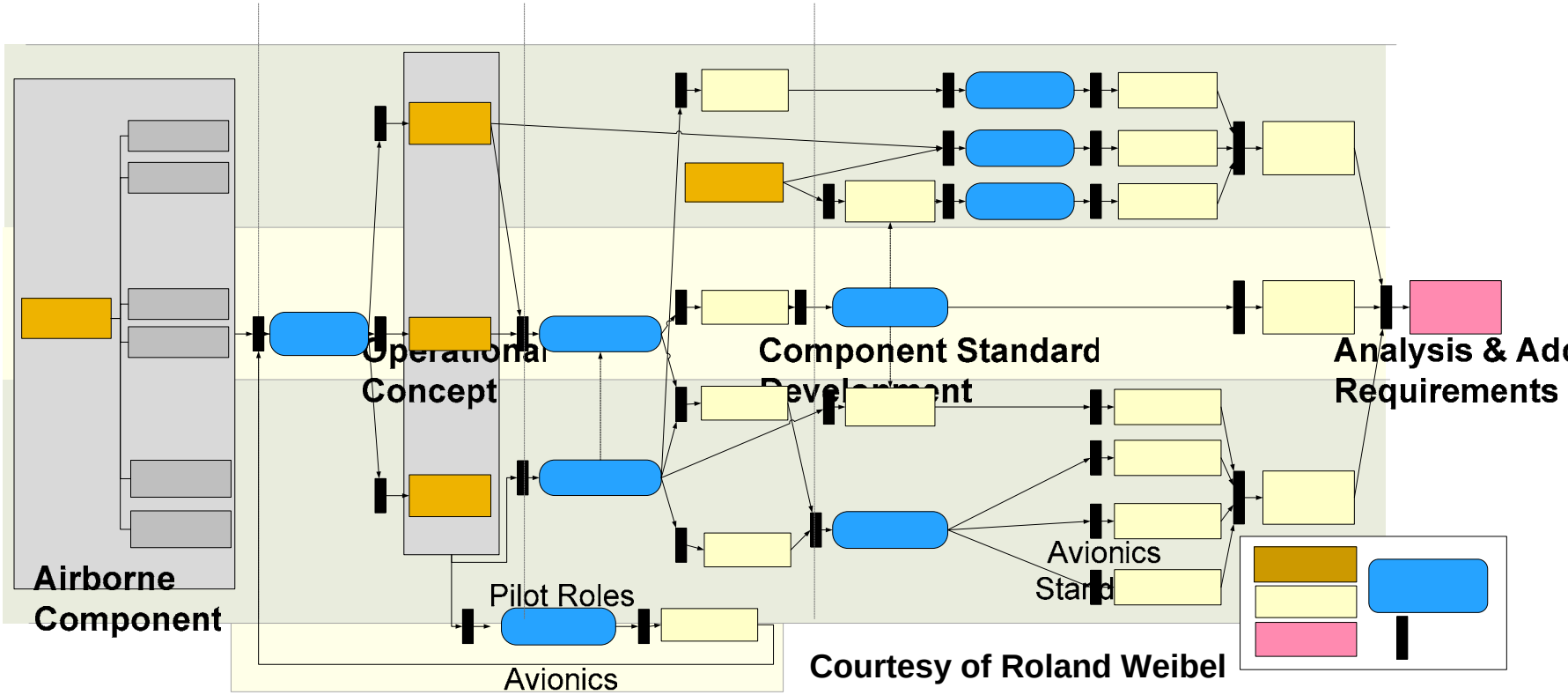


- **Delivery of benefits can be dependent upon the actions of other stakeholders**

Safety Certification and Approval Processes Delay Implementation



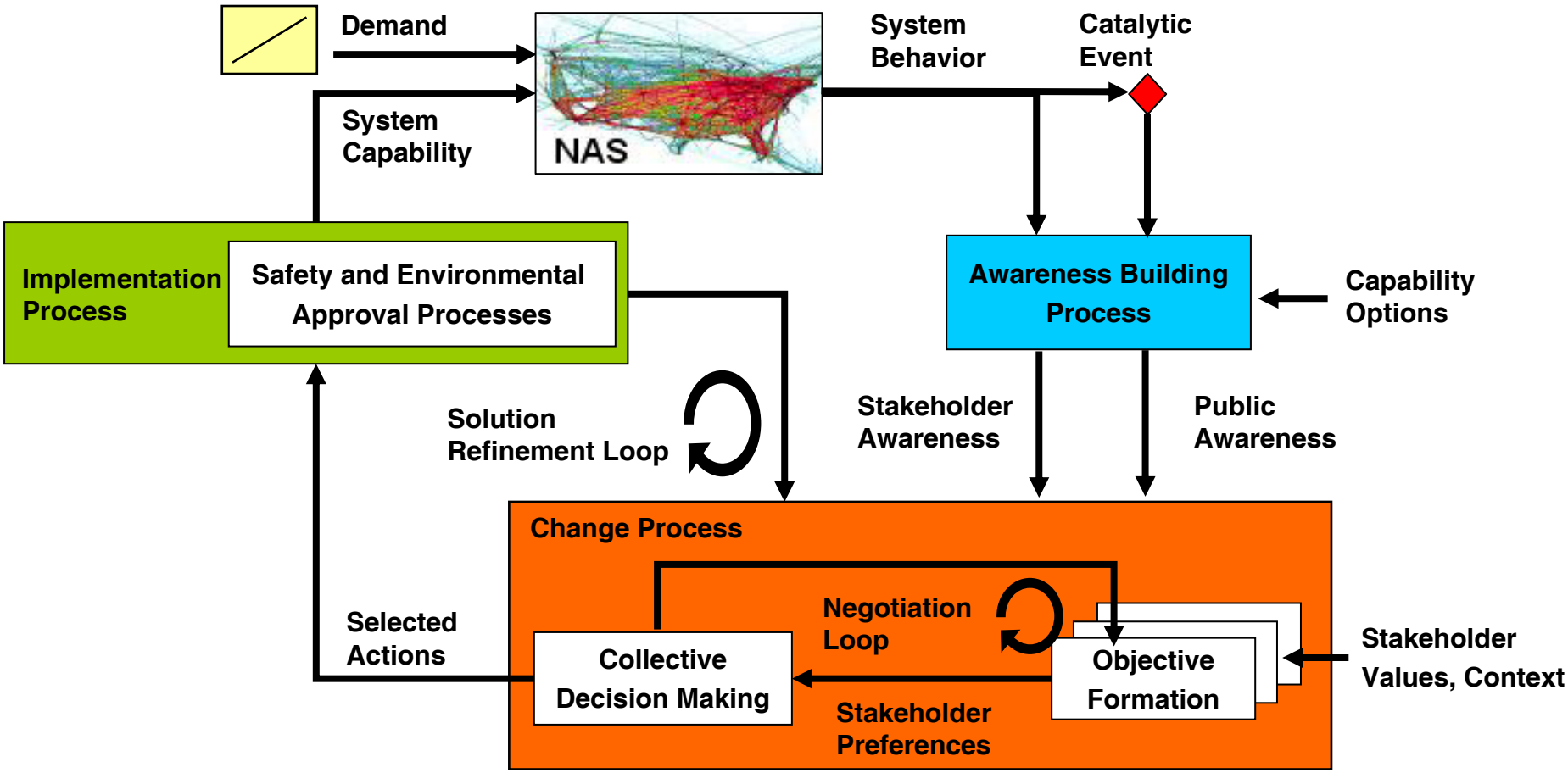
Simplified Representation of Safety Review and Approval Steps



- Complexity of safety certification and approval process poses a challenge to the approval of new capabilities
- There is a need to improve the efficiency and speed of these processes

Air/Ground Interface | Operational Concept | Procedures | Applications | Standard Development | Application Standards | Modeling & Risk Assessment

Questions


Demand
System Capability
NAS
System Behavior
Catalytic Event
Implementation Process
Safety and Environmental Approval Processes
Awareness Building Process
Capability Options
Solution Refinement Loop
Stakeholder Awareness
Public Awareness
Change Process
Selected Actions
Collective Decision Making
Negotiation Loop
Objective Formation
Stakeholder Preferences
Stakeholder Values, Context