REDAC NAS Ops

Summer 2015

Optimized Route Capability (ORC)

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Federal Aviation Administration

Research Question

Can *Intelligent Offloading* leverage unused capacity to mitigate delays in the NAS?

- The Optimized Route Capability is an automated, data driven tool for Traffic Managers to generate balanced airport arrival streams when projected demand exceeds capacity

Intelligent Offloading

- **Intelligent Offloading**
  - Data driven processes to predict exceeding capacity limits
  - Identify optimal routing options to balance capacity
  - Performed in a timely and safe fashion

- **Benefits of Intelligent Offloading**
  - Improving overall system efficiency by utilizing data-driven traffic flow management decisions to optimize route configurations
  - Reducing delay and fuel consumption by minimizing the need for holding and tactical maneuvering (i.e., vectoring)
  - Enhanced utilization of PBN routing and other NextGen capabilities (OPDs, RNP established etc.)
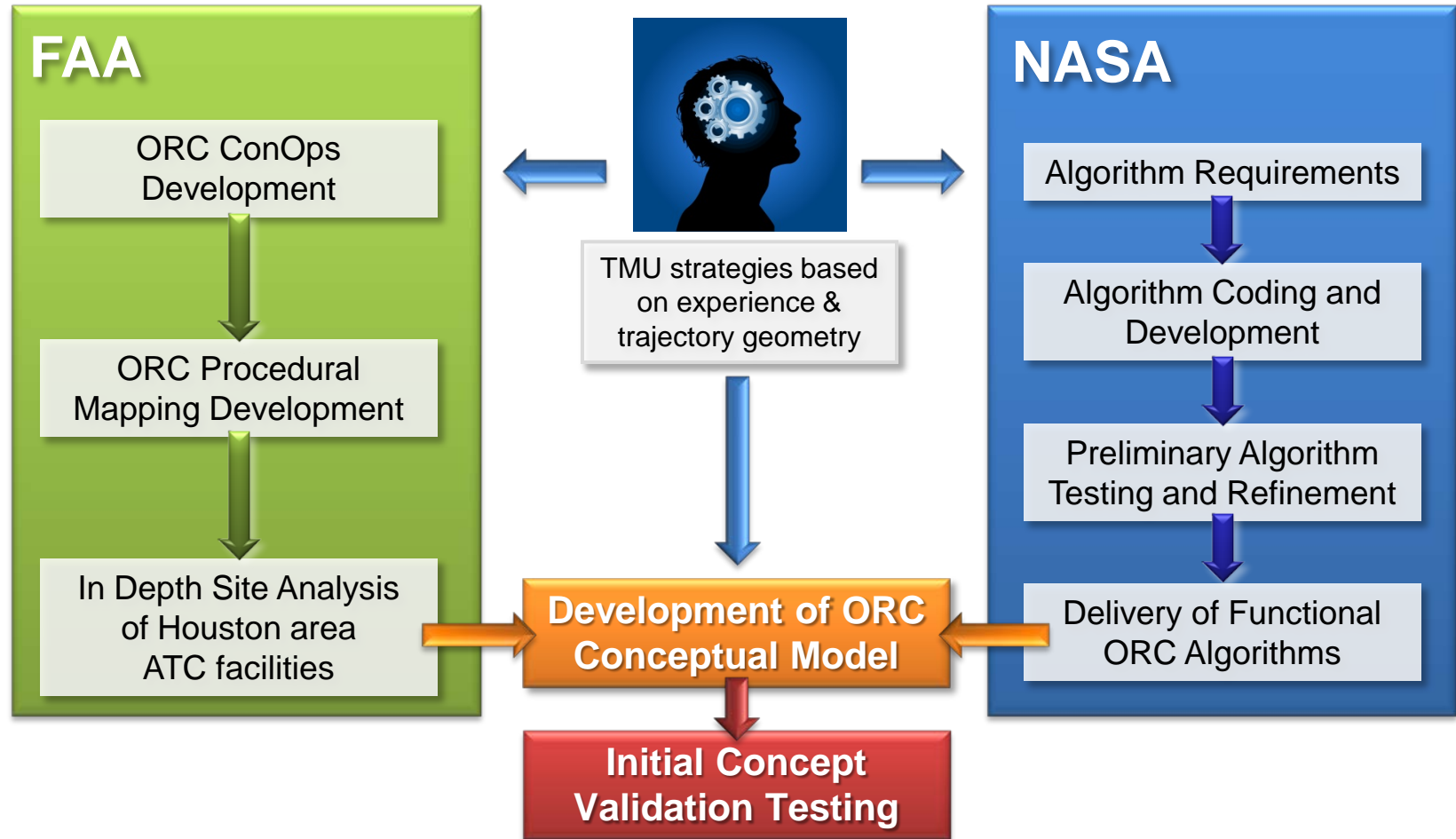 - Augments today's metering capabilities

Scope

ORC Scope

– Initially ORC scope included NAS wide route optimization

– Focus was rescoped to intelligent arrival fix allocation

– Current focus concentrates on *intelligent offloading* of <u>arrival</u> streams to an airport (Houston selected as model)

ORC Concept

- **Decision-support tool to assist Traffic Managers**
  - <u>Gather and analyze relevant data</u> to adjust traffic flow

  - <u>Use *Intelligent Offloading*</u> to deliver balanced arrival feeds from ARTCCs to TRACONs using "data-driven" constraint evaluation logic (delay mitigation)

  - <u>Select optimized route assignments</u> maximizing use and efficiency of new <u>NextGen capabilities</u> (PBN, OPDs, etc.)

  - <u>Facilitate coordination and collaboration</u> on a common platform, thereby promoting a common situational awareness of reroute options between adjacent ARTCCs and TRACONs

  - <u>Enhance SAFETY</u> by alleviating congestion and <u>reducing the need for tactical vectoring</u>, reducing controller workload while leveraging available capacity

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Algorithm & Concept Development

FAA

- ORC ConOps Development
- ORC Procedural Mapping Development
- In Depth Site Analysis of Houston area ATC facilities

TMU strategies based on experience & trajectory geometry

NASA

- Algorithm Requirements
- Algorithm Coding and Development
- Preliminary Algorithm Testing and Refinement
- Delivery of Functional ORC Algorithms

Development of ORC Conceptual Model

Initial Concept Validation Testing
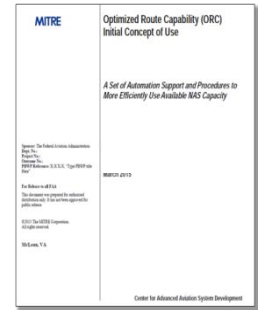
Status

- **Completed**
  - ORC ConOps v1.0 (December 2012)
  - Model Attributes Defined (March 2015)
  - ORC ConUse / Procedures (March 2015)
  - Procedural Mapping (July 2015)
  - Initial Prototype Algorithm (July 2015)

ConOps   Conuse/ Procedures

- **Upcoming**
  - ORC ConOps v2.0 (August 2015) – further refined
  - Test Plan (February 2016)
  - Initial Prototype Algorithm (March 2016)
  - Site Specific Analysis Report-Houston (May 2016)
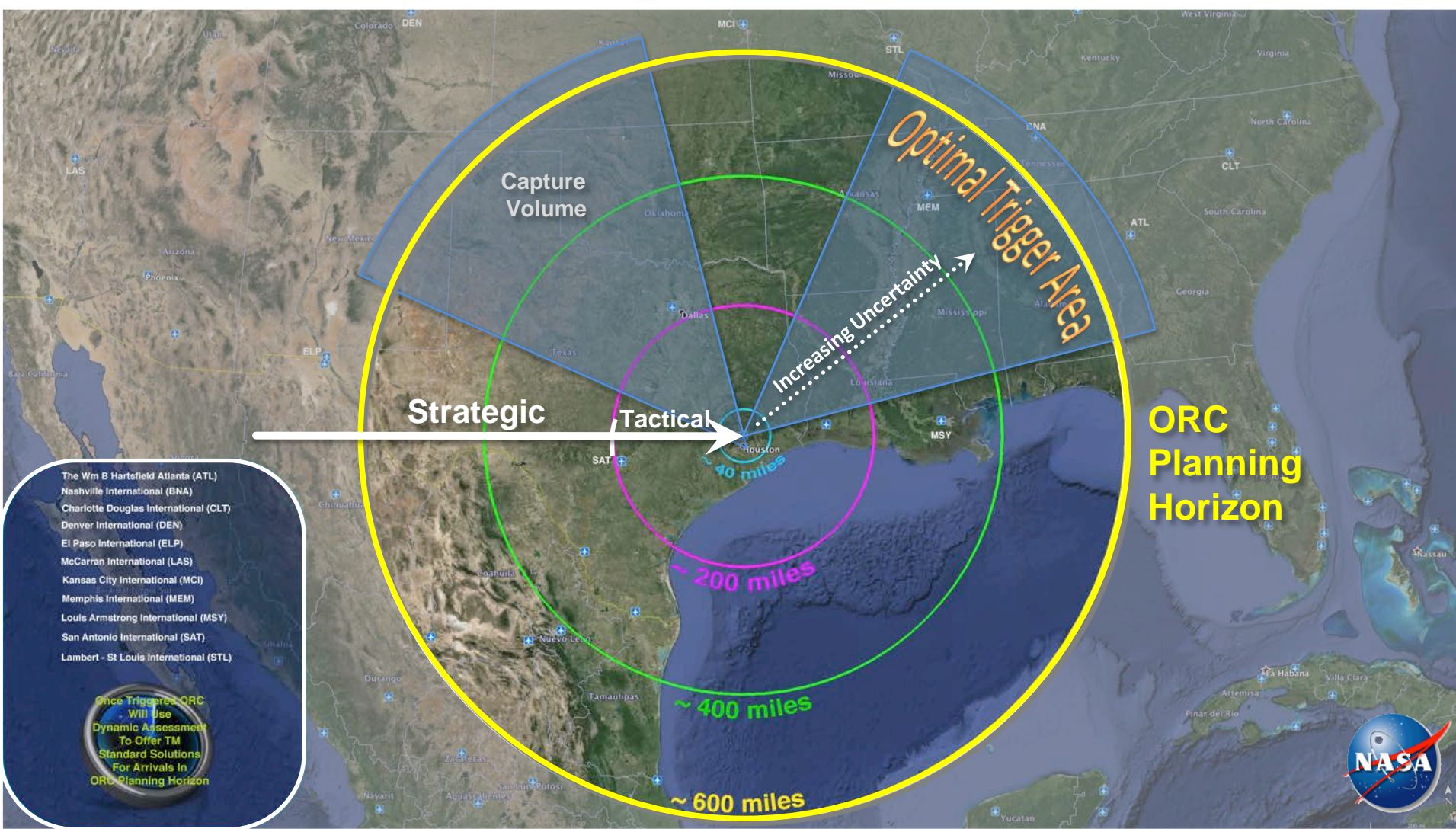 - ORC Conceptual Model & Final Report (May 2016)

ORC

Concept Benefits

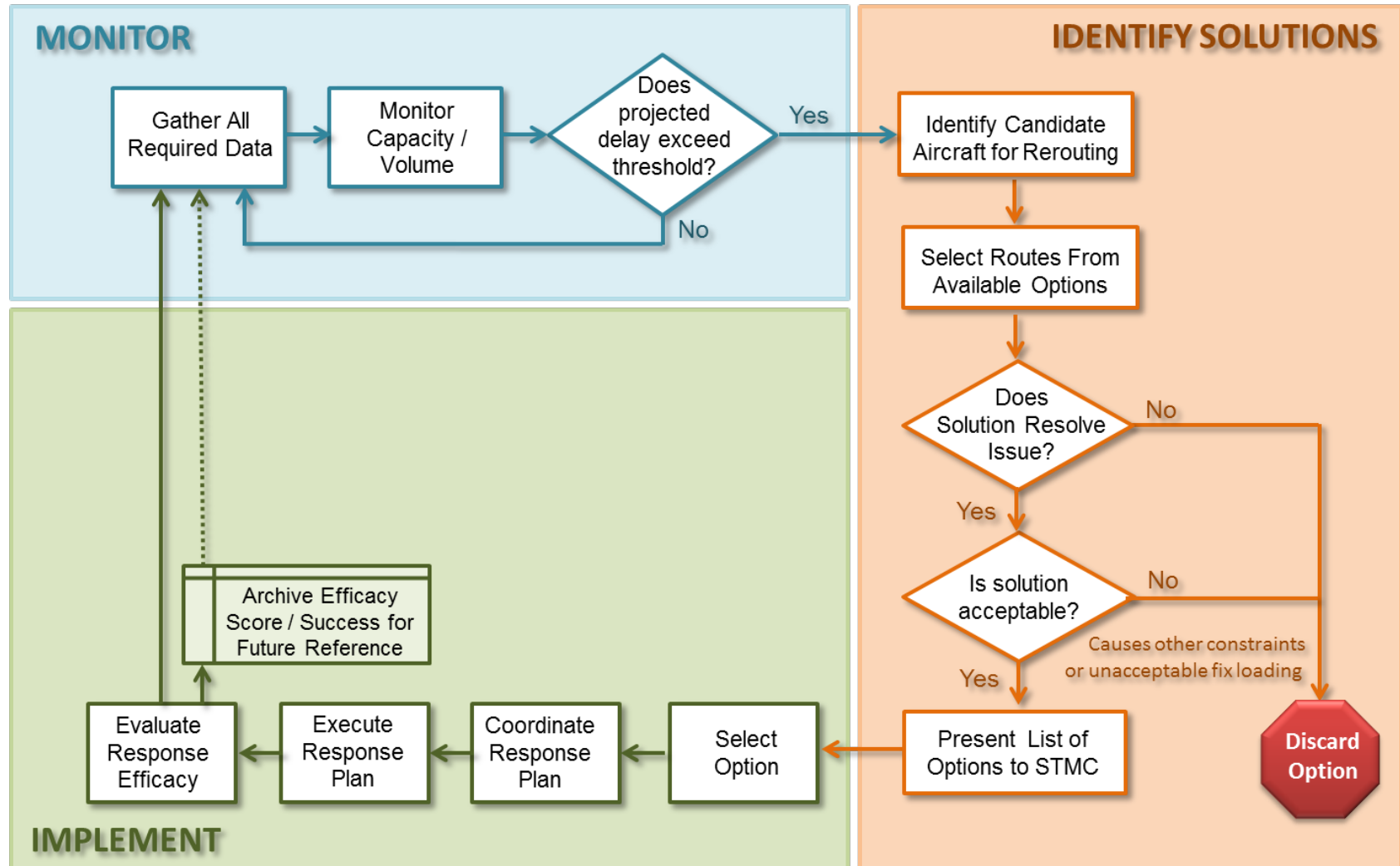| NAS Today	ORC Benefit
For capacity imbalances, Traffic Managers typically rely on standard TMIs (miles-in-trail, internal call for release, ground stops and ground delay programs).	ORC utilizes intelligent offloading for fixed load balancing to mitigate need for typical TMIs.
Traffic managers may not recognize an imbalance or may be focused on a myriad of other duties.	ORC continuously monitors incoming data across all routes and identifies when a higher priority situation occurs and provides the traffic manager with a new set of solutions.
Traffic management units are dispersed and conduct individual assessments. TMUs may select competing solutions.	ORC provides optimal solutions based on evaluation across all routes and outcomes of past operational implementations.
Accessing and processing relevant information for decision making is time and labor intensive.	ORC automates simultaneous monitoring of all relevant data for all arrival streams to predict when traffic demand exceeds capacity.

Concept Benefits *continued*

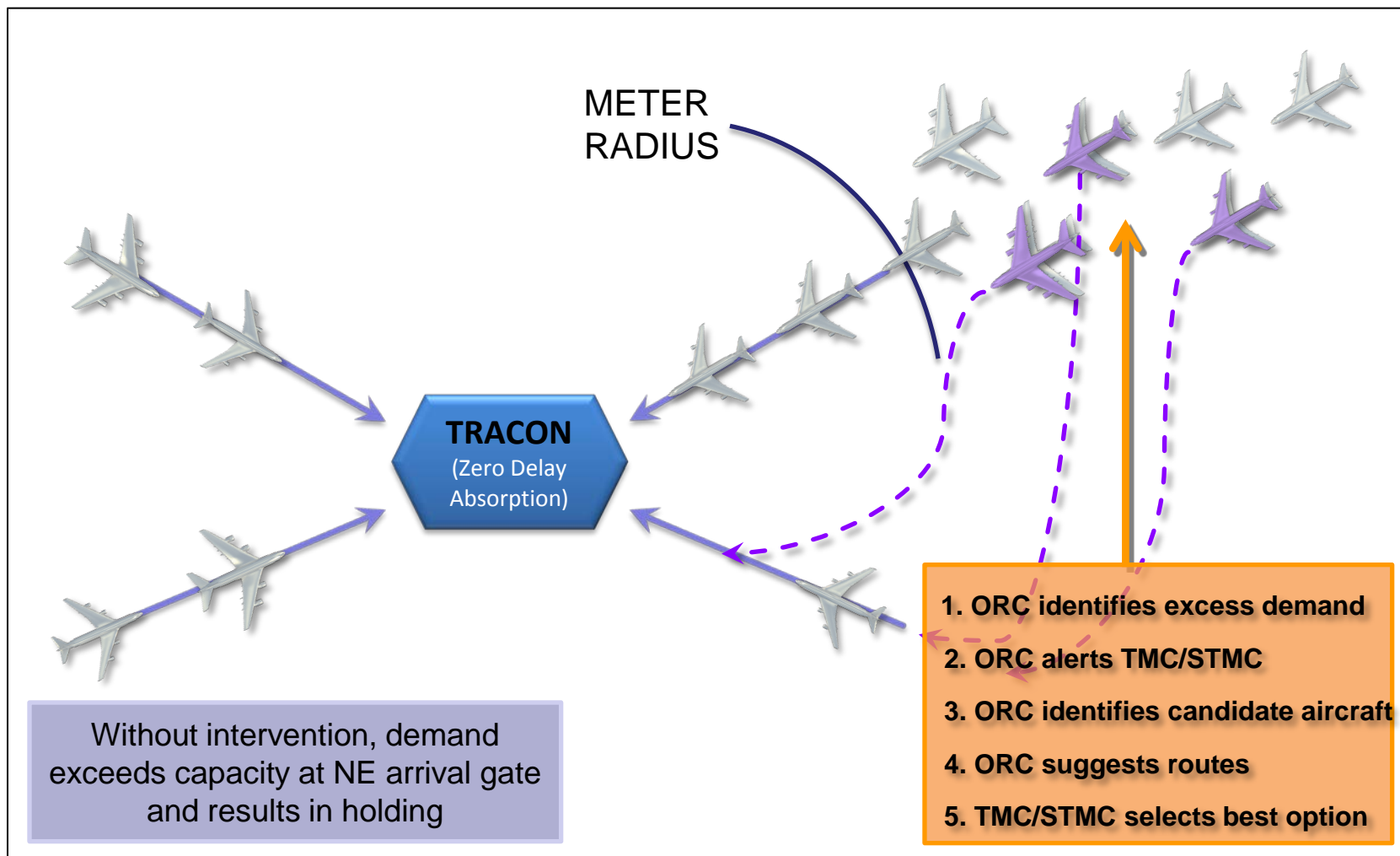| NAS Today	ORC Benefit
Coordination between TMUs is labor intensive. Communication of the solution may be a conference call or daisy chained – both take significant time to describe and disseminate. Quick response is essential to minimize operational impacts.	The TMC/STMC selects one available option which is disseminated simultaneously to all TMUs on a common platform.
The impact of a TMI solution selected by one facility may not fully resolve an issue. Conflicting TMI solutions are common.	ORC facilitates the selection of an optimal solution that is followed by all NAS service providers (facilities, TMUs, controllers)
Controllers must identify aircraft eligible for NextGen capabilities (PBN, OPDs etc.) This is difficult when managing saturated routes.	ORC promotes NextGen capabilities. ORC identifies eligible aircraft for PBN routes and OPDs, assigns them to the appropriate route, and facilitates their timing in sequence with other aircraft streams.

Houston ORC Operational Map

ORC Process Flow Diagram

ORC: Meter Fix Overload Example

METER RADIUS

TRACON (Zero Delay Absorption)

Without intervention, demand exceeds capacity at NE arrival gate and results in holding

1. ORC identifies excess demand

2. ORC alerts TMC/STMC

3. ORC identifies candidate aircraft

4. ORC suggests routes

5. TMC/STMC selects best option

Future Research

Near-Term

- **Enhance algorithm to refine triggers and integrate additional filters / input parameters**
- **Integrate aircraft equipage and route selection criteria (PBN)**
- **Expand tool to include multiple airports within a metroplex**
- **Initial user interface**

Far-Term

- **Matured user interface**
- **Validate ORC tool in operational environment**
- **Integrate into existing / NextGen automation**