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# **Identifying Communication and Coordination Issues in the U. S. Air Traffic Control System**

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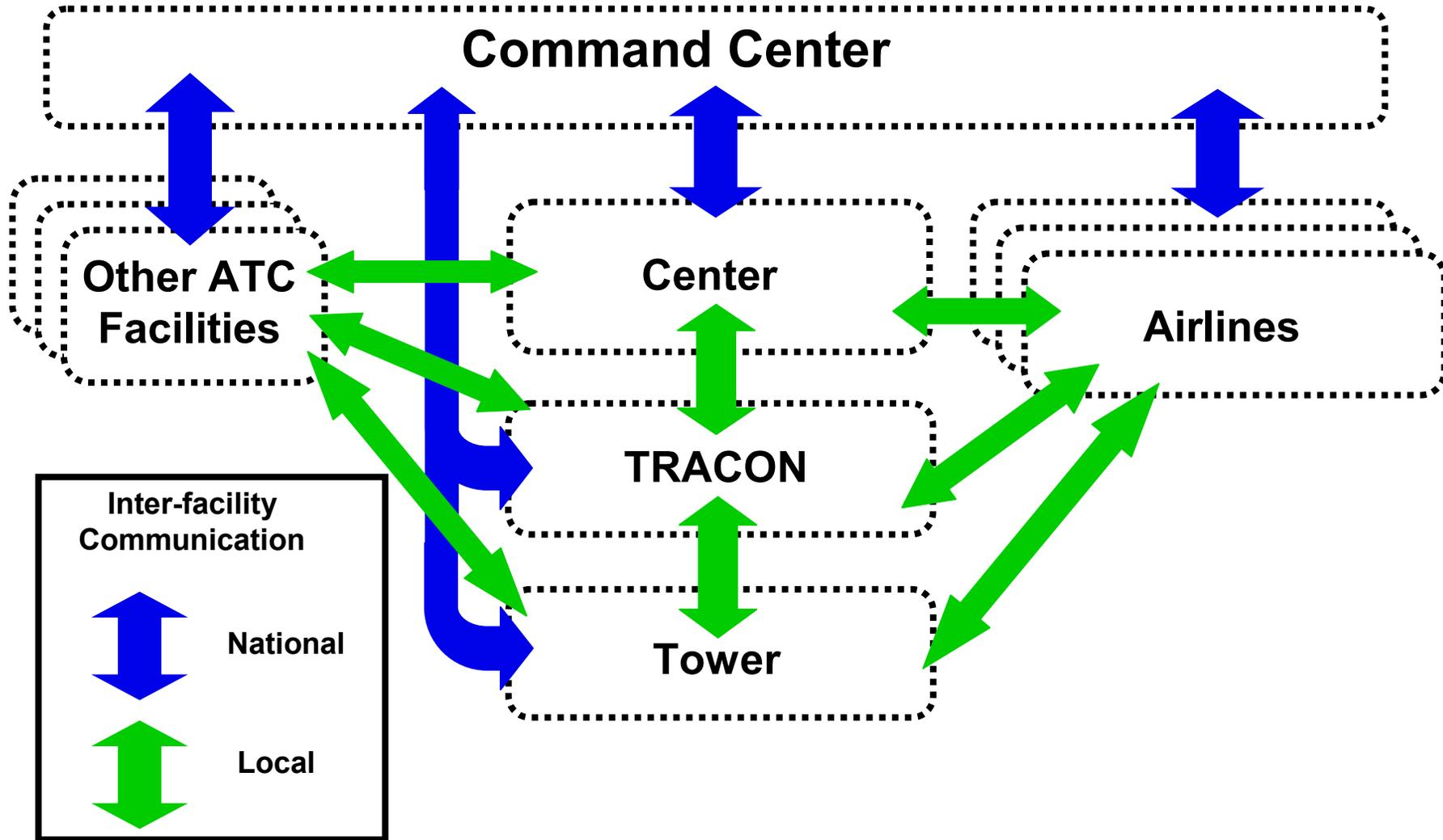
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# Motivation

- **As air traffic demand increases, opportunities must be found to make the ATC system as efficient as possible**
- **Many of the current ATC enhanced coordination initiatives (e.g., CDM) have concentrated on the strategic (or schedule level) coordination**
- **There appear to be opportunities to improve information sharing at the inter-facility level, where efficiency gains can have an effect at the more tactical levels (flow and flight levels) as well as at the schedule level (e.g., during dynamic weather re-routes)**

# Local and National Communication Paths





# Traffic Management Coordinator Responsibilities

- **Primary link in inter-facility communications**
- **Responsible for monitoring workload of tactical controllers**
- **Responsible for determining restrictions needed to reduce high traffic flows into the facility**
- **Responsible for the timely communication of new restrictions from other facilities to the tactical controllers**
- **Responsible for communicating and negotiating traffic initiatives with other facilities**



# Goal and Approach

- **Goal**

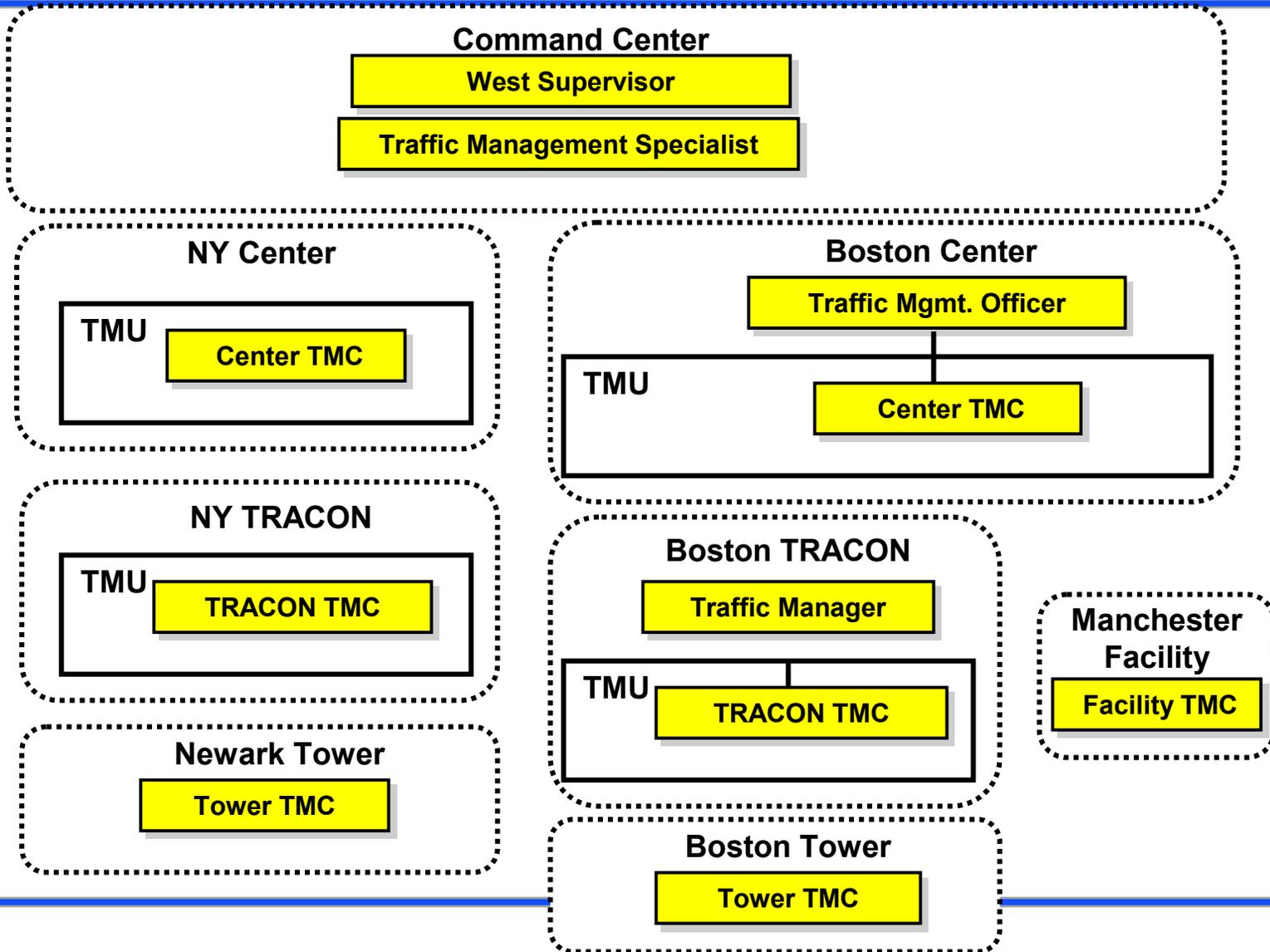
- Identify current communication/coordination structure of Traffic Management Coordinators (TMCs) to investigate with whom, when and why they coordinate with others and how coordination/communication can be improved

- **Approach**

- Perform series of focused interviews and field observations of TMCs at single and multi-terminal ATC facilities
  - Boston
  - New York
  - ATC System Command Center
- Determine controllers' coordination and information needs & how it relates to bottlenecks in the ATC system
- Suggest possible remedies to communications problems



# Facility TMC Interviews Conducted





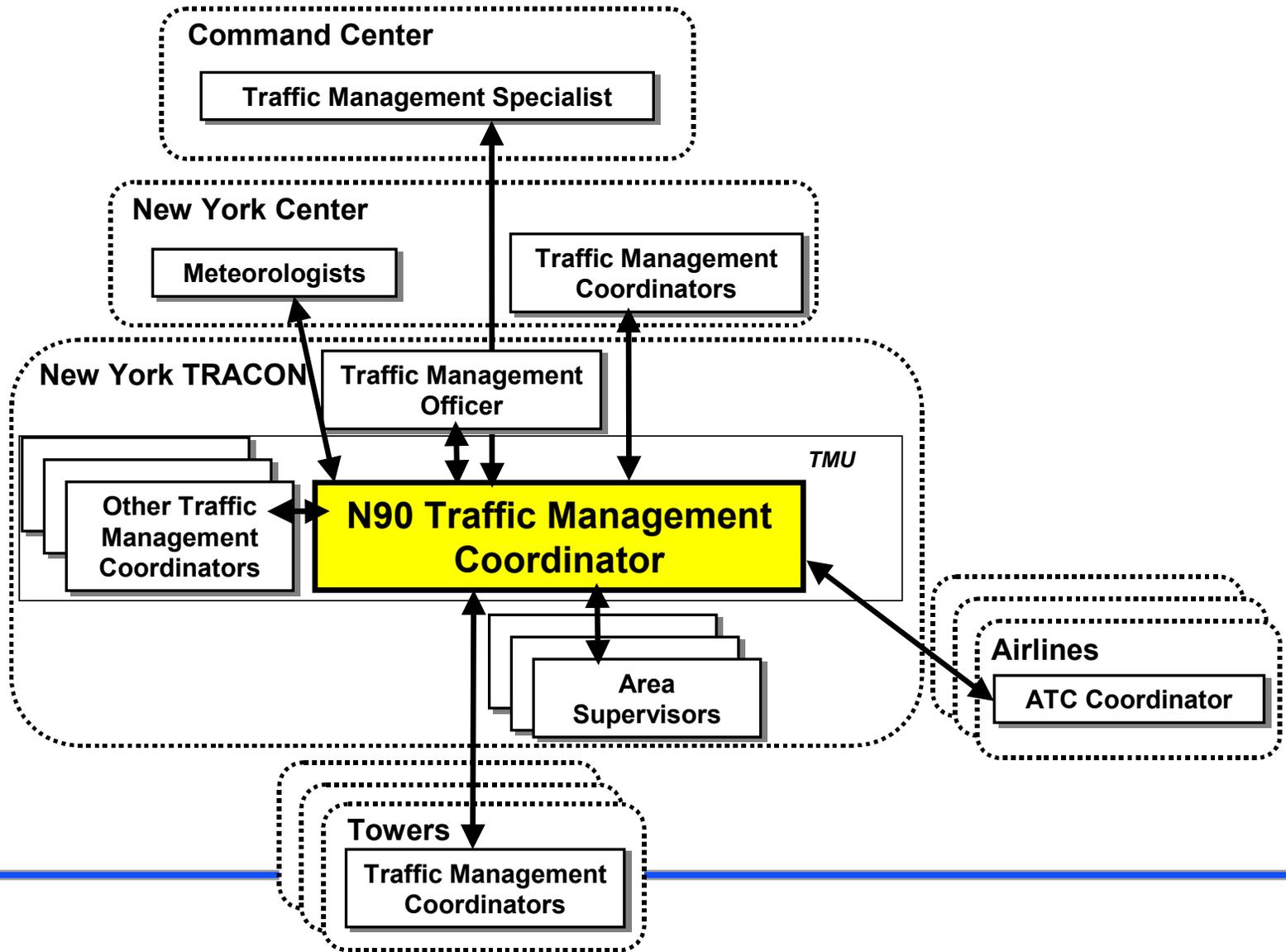
# Example Case Studies

- **New York TRACON Traffic Management Coordinator**
- **New York Center Traffic Management Coordinator**
- **Command Center Traffic Management Specialist**

**Exhaustive results can be found in: Davison, H. J. & Hansman, R. J. (2001). *Identification of Interfacility Air Traffic Control Communication and Coordination Issues*. Technical report ICAT-2001-2. Department of Aeronautics and Astronautics, Massachusetts Institute of Technology.**



# Coordination Structure- New York TRACON TMC Example





# Communication & Coordination Issues (New York TRACON)

- **Problems**

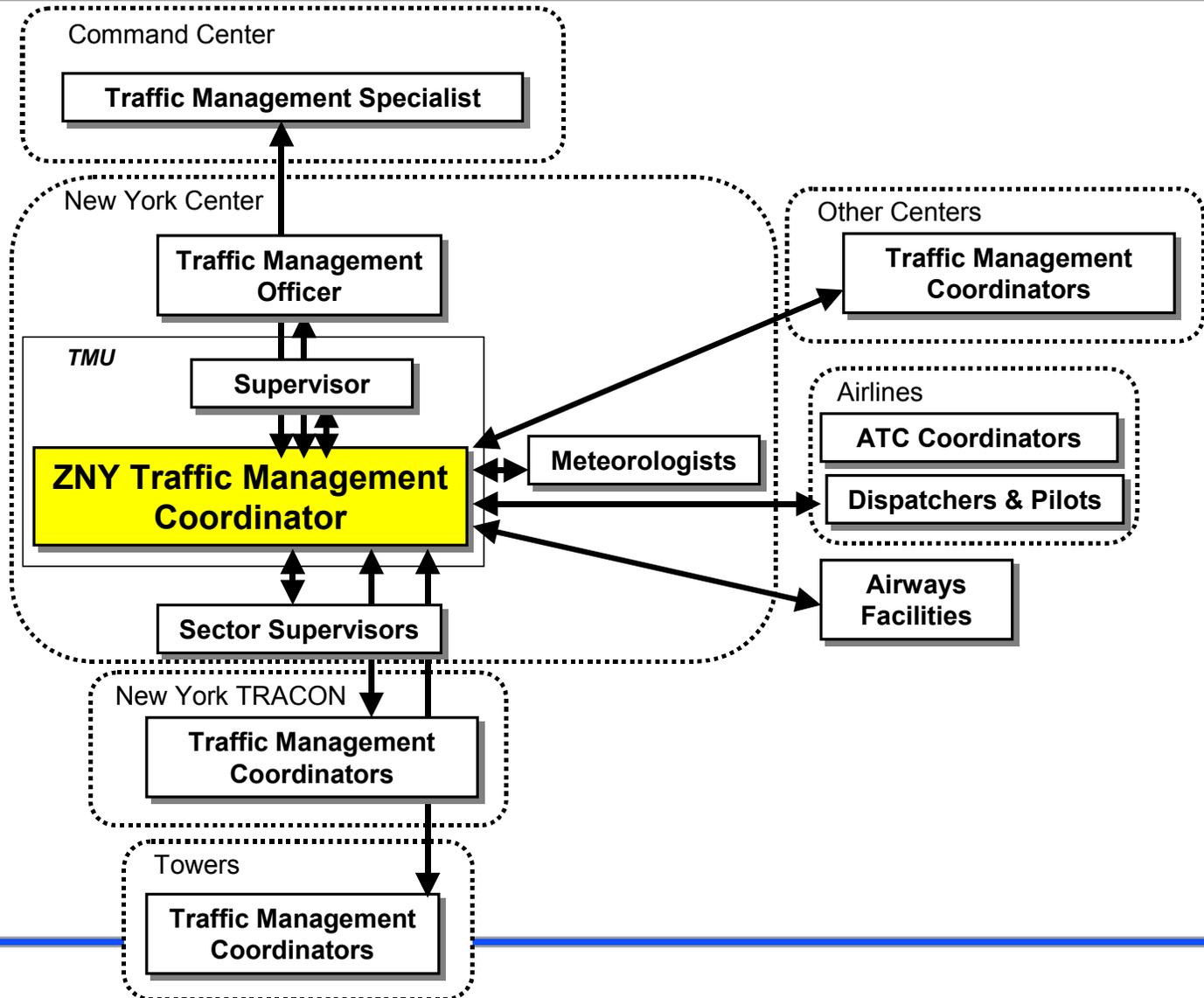
- Communication equipment (e.g., stationary phones) is inappropriate for the TMC position
- TRACON TMCs reported that they do not have enough input into Command Center decisions
- Command Center TMSs are often not familiar with the peculiarities of the New York airspace
- Not enough time for interaction between the TRACON TMCs and the TRACON controllers
- Need more information about arrival and departure flows at Newark Airport
- Excessive amount of time in propagating restrictions to towers

- **Suggested Solutions**

- Improve communication equipment (e.g., cordless telephones)
- Increase input into Command Center decisions (arrival and departure restrictions)
- Better familiarize Command Center TMSs with the airspace over which they are responsible
- Allow more time for TMC interaction with floor controllers at the TRACON
- Redistribute New York airspace



# Coordination Structure- New York Center TMC Example





# Communication & Coordination Issues (New York Center)

- **Problems**

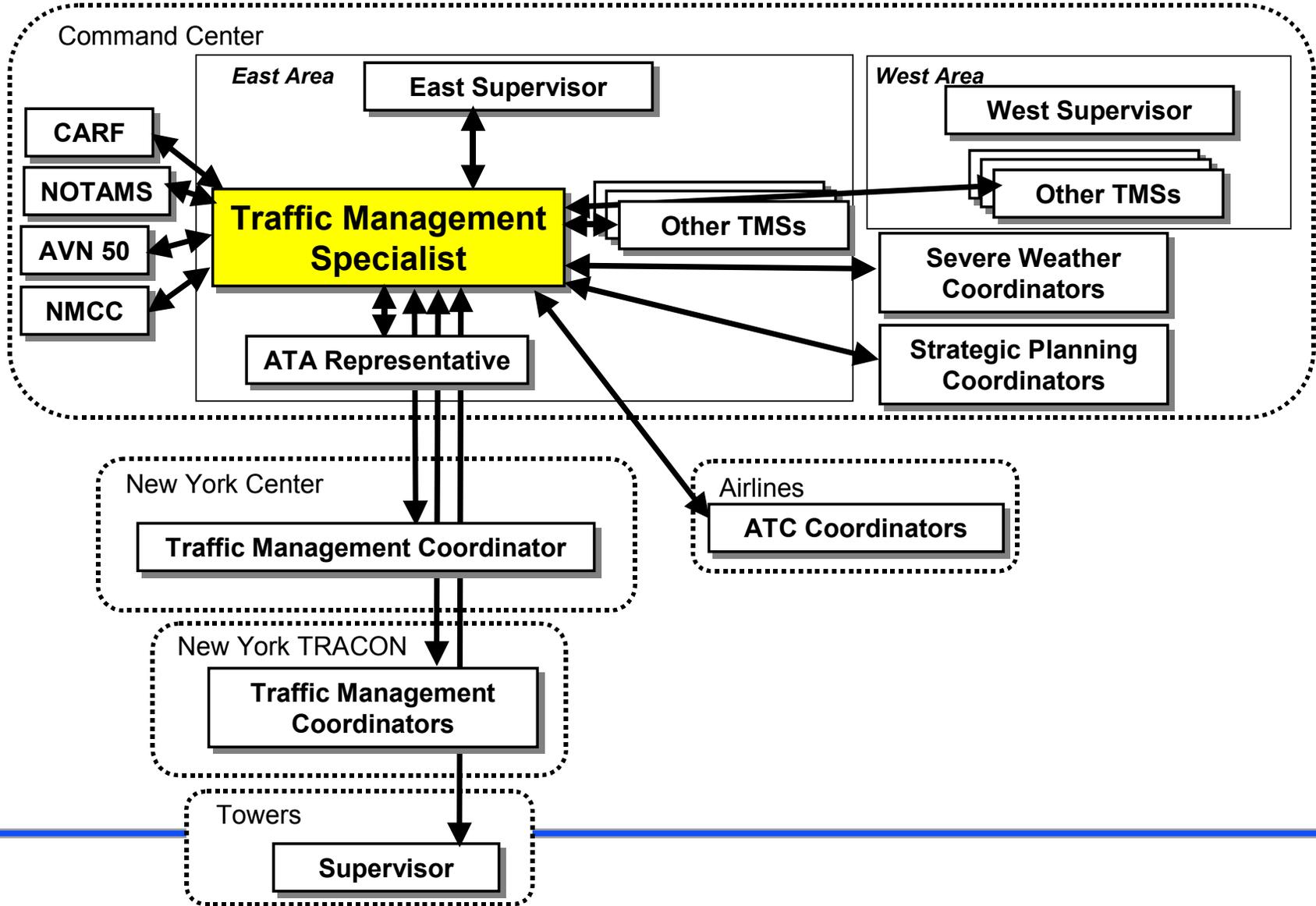
- Different sets of information are used to predict sector workload at the Center and Command Center
- TMCs reported that Collaborative Decision Making (CDM) involves too many people and it breaks down the Center's authority over the TRACONS and the Towers
- The hotline is not proceduralized and information is not getting to the right people
- Inter-facility coordination needed to activate initiatives slows the implementation process
- TMCs report conflicts resolving their responsibility to ensure safety while maintaining efficiency
- Collaborative traffic management often conflicts with controller training, which is more hierarchical

- **Suggested Solutions**

- Re-structure hotlines and teleconferences
- Clarify the ATC structure so that TMCs can be aware of their authority, or lack thereof



# Coordination Structure- Command Center TMS Example





# Communication & Coordination Issues (Command Center)

- **Problems**

- Each TMS is responsible for becoming proficient in all East (or West) airspace
- The TMS position is saturated with information, so task-shedding occurs during periods of high workload
- Selfish parties ruin CDM efforts— all parties must provide information and compromise for the efforts to work
- TMSs reported that there is little job satisfaction in being a Command Center TMS because often the TMSs leave for the day feeling as if they have not helped the National Airspace System situation, unlike their counterparts, the tactical controllers
- TMS position requires different skills than were trained at the facility level
- TMS is balancing competing goals

- **Suggested Solutions**

- Allow TMSs to specialize in one airspace
- TMSs should be more proactive and flexible

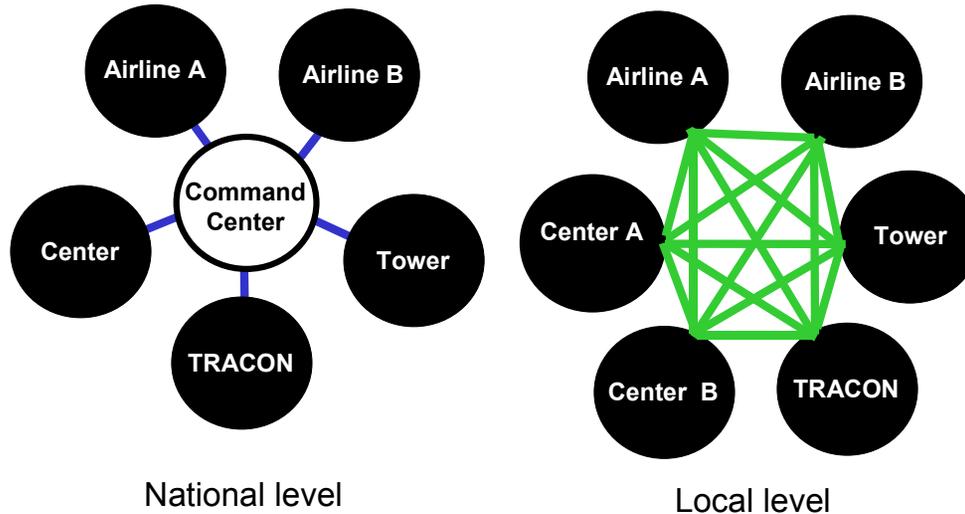


# Emergent Themes

- **Organizational structure issues**
- **Information flow issues**
- **Coordination issues**
- **Organizational culture issues**
- **Importance of personal relationships**

# Organizational Structure Issues

- **ATC organizational structure: centralized or decentralized?**



- **Implications for ambiguous ATC organizational structure**
  - ❑ May result in low motivation and low morale, poor decision making, lack of coordination, and failure to respond creatively to challenging circumstances
    - As supported by literature (Child, 1977)
    - Such low morale was reported by Command Center TMS
  - ❑ How the facilities cope: minimize national coordination by responding to traffic through local measures (e.g., Miles-in-Trail, Departure Spacing Programs)
- **Improving the efficiency of communications may reduce tension caused by ambiguity of organizational structure**



# Information Flow Issues

- **Information Flow issues observed**
  - Unavailable information
  - Poor-quality information
  - Conflicting sets of information
  - Information saturation
  
- **Opportunities to enhance information flow**
  - Provide improved information on:
    - Predicted traffic demand
    - Weather
    - Controllers' traffic load limitations
    - Controller staffing information
    - Rationale behind issued restrictions from the Command Center to the local facilities
    - Rationale behind the need for a traffic initiative from the local facilities to the Command Center
  - Integrate information sources to reduce data inputting and to reduce information saturation
  - Proceduralize communication of new and revised restrictions



# Coordination Issues

- **Awkward coordination was observed and reported**
  - ❑ Disorganized inter-facility communication hampers efficient re-routing of traffic flows during periods of severe weather and heavy traffic demand
  - ❑ Unstructured hotlines and teleconferences cause information to be passed redundantly among multiple channels
- **Methods to enhance coordination**
  - ❑ Proceduralize commonly used re-routes
  - ❑ Re-structure teleconferences and hotlines (e.g., separate into “Arrivals only” and “Departures only” connections)



# Organizational Culture Issues

- **Organizational culture issues**
  - ❑ TMCs have conflicting goals of safety vs. efficiency
  - ❑ Common basic training for TMCs and controllers results in a controller-based “protectionist” attitude rather than collaborative attitude at the TMC level
- **Resolving organizational culture issues**
  - ❑ Innate differences between positions of TMC and tactical controller should be recognized, and implications for training should be considered
  - ❑ Command Center TMSs should be recognized as a prestigious position within the ATC system due to the influence that the Command Center has on NAS operations
  - ❑ Training of Command Center TMSs should be improved, and the TMSs should be allowed to specialize in a particular airspace
  - ❑ Command Center should respect and thoroughly understand the procedures and problems occurring at the local ATC facilities as well



# Importance of Personal Relationships

- **In order to improve collaboration, the development of personal relationships between TMCs of different facilities should be encouraged**
- **Methods of exploring the benefits of personal negotiations:**
  - ❑ Increase the familiarization visits between facilities to improve the knowledge of TMCs as well as to build informal relationships among TMCs
  - ❑ Encourage TMCs to periodically rotate working at different facilities to improve knowledge of ATC as a system
  - ❑ Encourage informal meetings between TMCs



# Conclusions

- **Communication and coordination between facilities is critical in maintaining efficiency of the NAS**
- **Opportunities exist to improve inter-facility ATC communications and should be considered a high priority**
  - ❑ Technical means (providing better quality information, integrate information sources, appropriate communication equipment)
- **Opportunities also exist to improve inter-facility ATC coordination and should be considered as well**
  - ❑ Organizational means
  - ❑ Social means

Please contact Hayley Davison at [hayley@mit.edu](mailto:hayley@mit.edu) to request a copy of the thesis upon which this presentation was based