Big Iron

Almira Williams and Stephane Mondoloni
CSSI, Inc.
Washington D.C.

Diana Liang, Steve Bradford, and Richard Jehlen
FAA
Washington D.C.

Outline

- The Big Iron Concept
- Future Airspace Operations
- Big Iron Pro’s and Con’s
- Description of Research
  - Simulation Model
  - Financial Model
- Summary

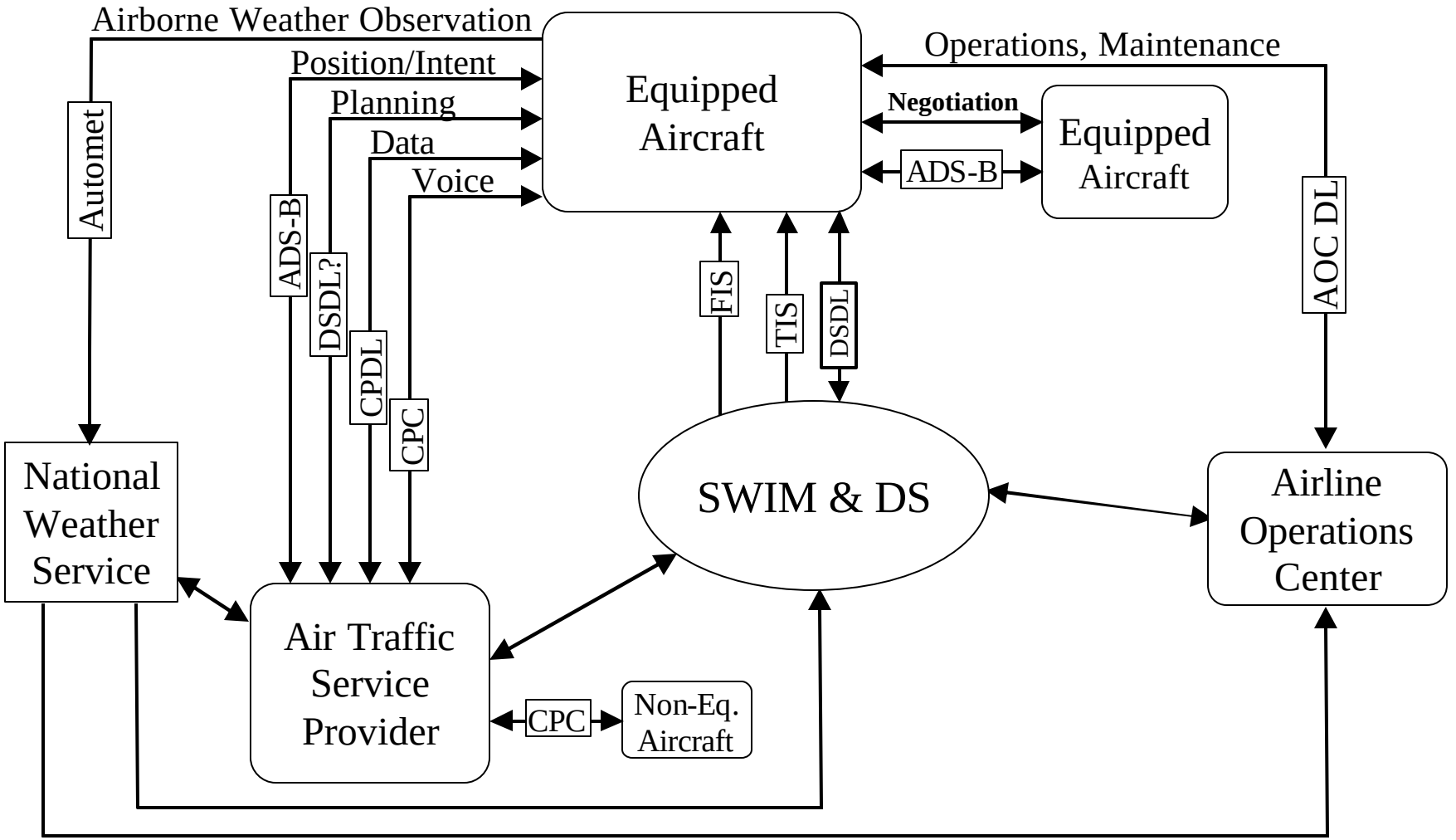
The Big Iron Concept

- Ground based decision support for:
  - Aircraft Operators (indirectly for unequipped)
  - Air Traffic Service Providers
  - Airline Operation Centers
- Centralized information assembly and processing
  - Surveillance
  - Weather
  - NAS Status
  - Other Advisories

Future Airspace Operations

- Shift authority for separation and trajectory alterations to appropriately equipped aircraft and their crews
  - Free Flight
  - Distributed Air-Ground Traffic Management (DAG-TM)
  - Delegated Responsibilities
- Key Players: ATSP, Equipped aircraft, Non-equipped aircraft, and AOCs
- Automated and on-demand decision support
- Common information

Future Airspace Operations: Information Flow & DS



Big Iron: Pro's and Con's

- Expected advantages:
  - Homogeneous aeronautical information
  - Versatility and access to new applications and resources
  - Enhanced predictability of trajectories of other users
  - Potential cost-effectiveness
- Expected disadvantages:
  - Additional strain on communication links
  - System-preferred as opposed to the user-preferred trajectory re-planning solution

Big Iron Research

- Air/Ground Communications Simulation Model
  - Discrete event
  - Controller/Pilot and DS message flow
  - Data link
- Financial Model
  - Compares costs of equipping fleet with on-board (distributed) vs. centralized decision support
  - Aircraft, Airline and NAS-level analysis

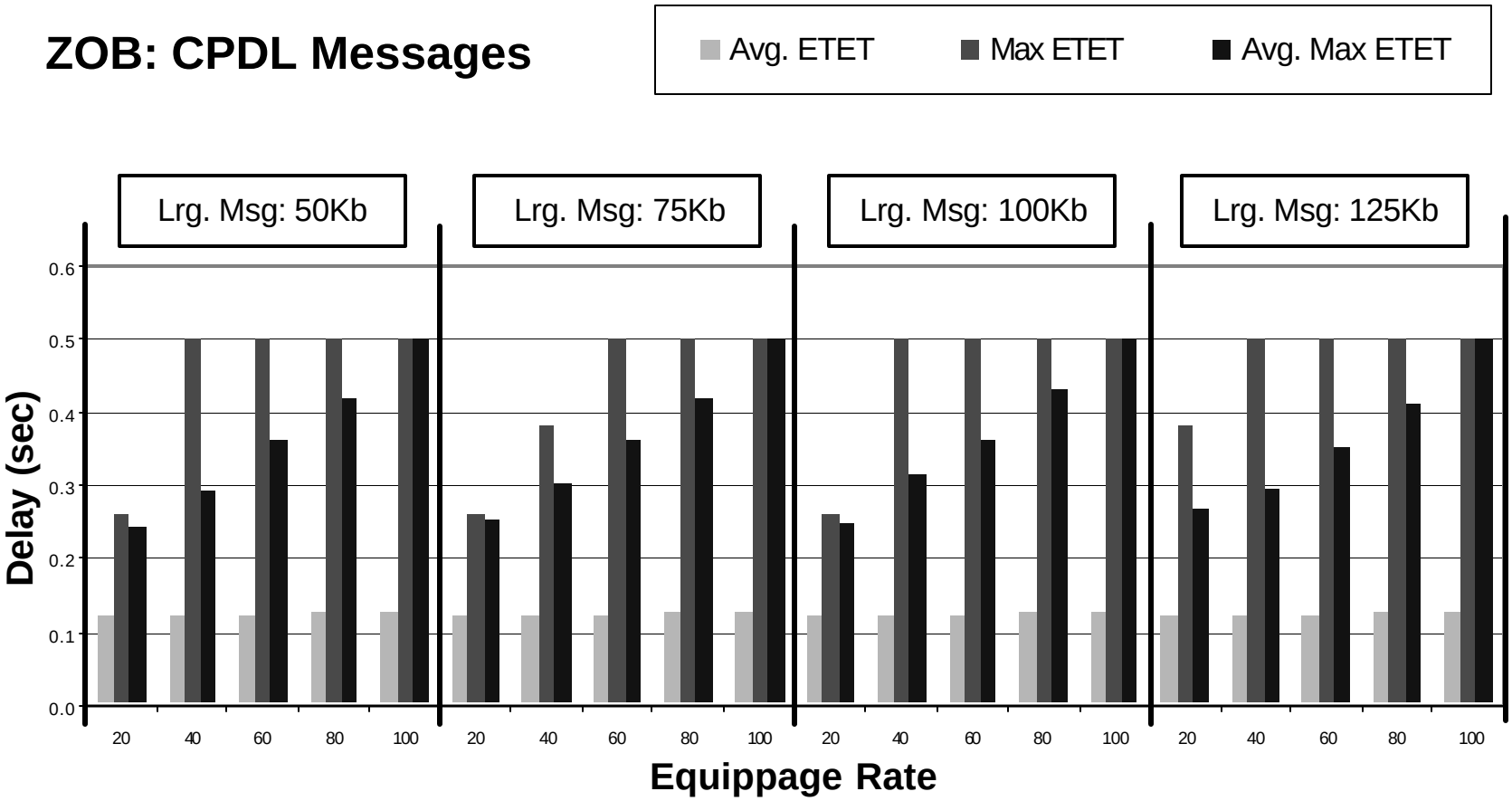
Air/Ground Communications Simulation Model

- Morning rush operations forecasted for 2015
- Three centers: ZID, ZAU, and ZOB
- Fleet equipage levels (%): 20, 40, 60, 80, & 100
- Decision support message sizes (Kb): 0 (DS messages not implemented), 25, 50, 75, 100, & 125
- Probability of DS message request upon sector entry: 25%
- CPDL and DSDL via VDL Mode 3
- Other supporting services fully operational (TIS, FIS, etc.)

VDL Mode 3

- Supports time critical A/G data link applications and digital voice
- Time Division Multiple Access (TDMA) technology
- Four virtual channels per single 25 KHz frequency assignment
- Effective data rate 19.2 kbps per channel
- Simultaneous transmission of voice and data to/from multiple aircraft

Simulation Results



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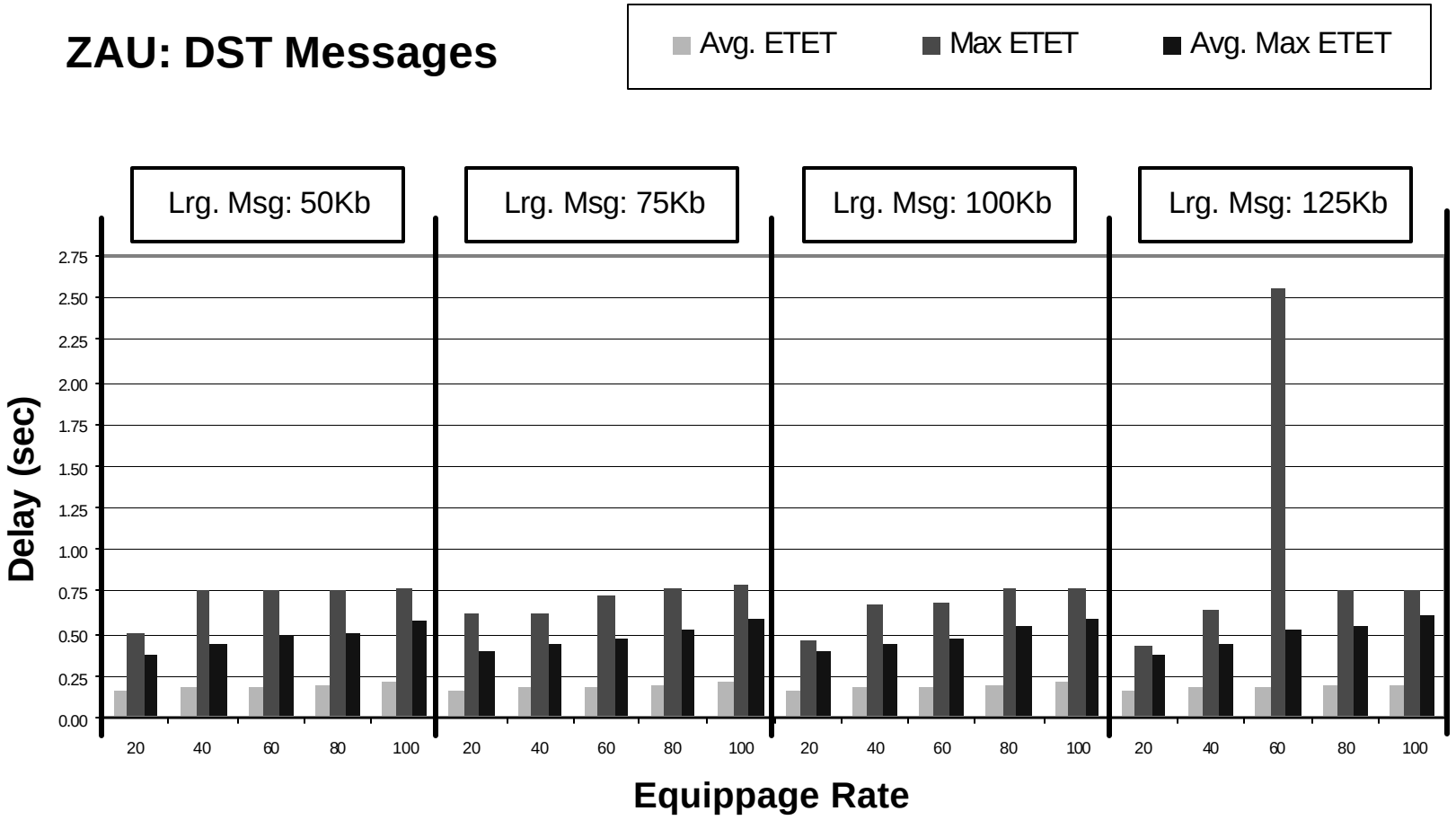
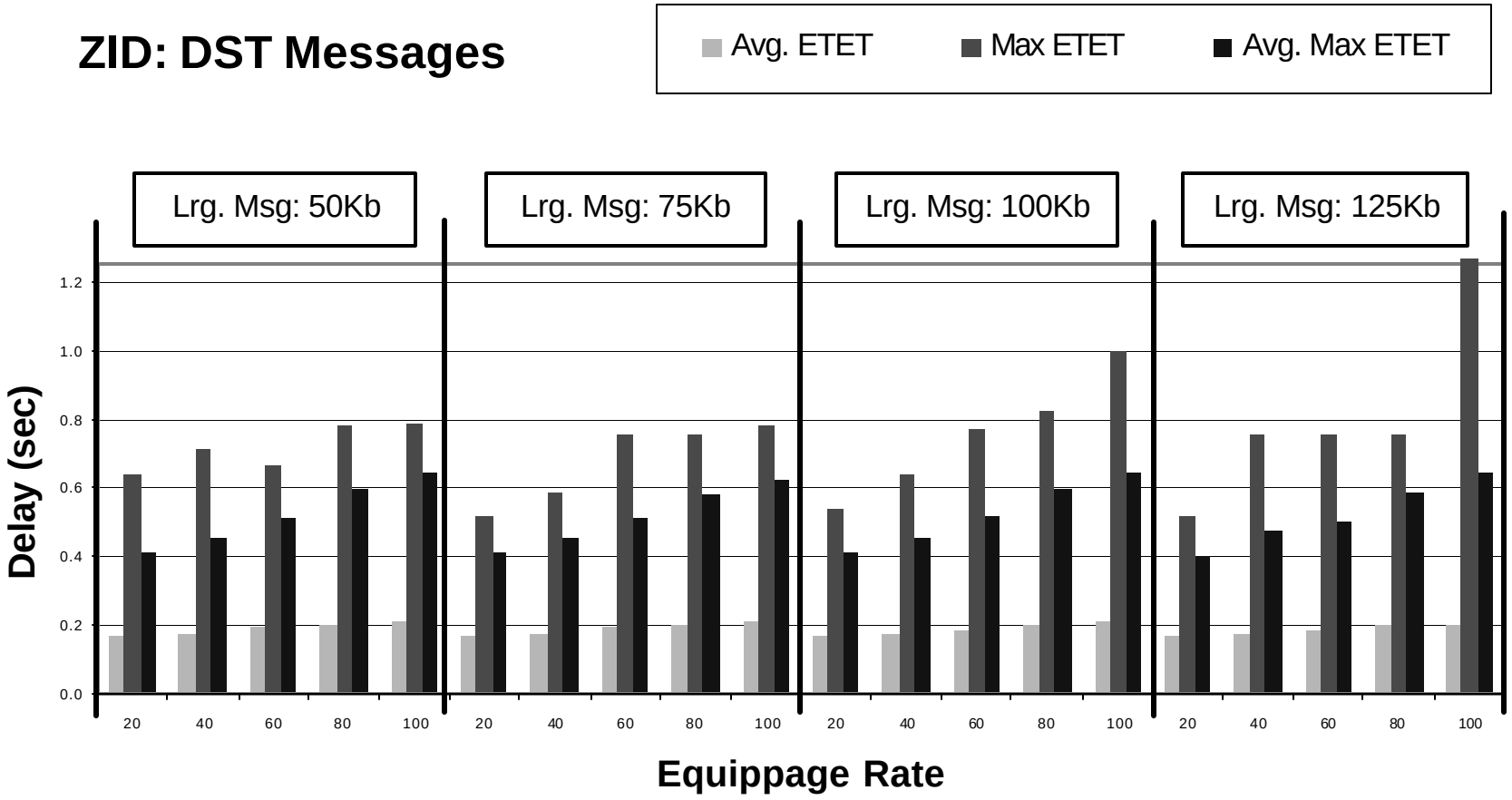
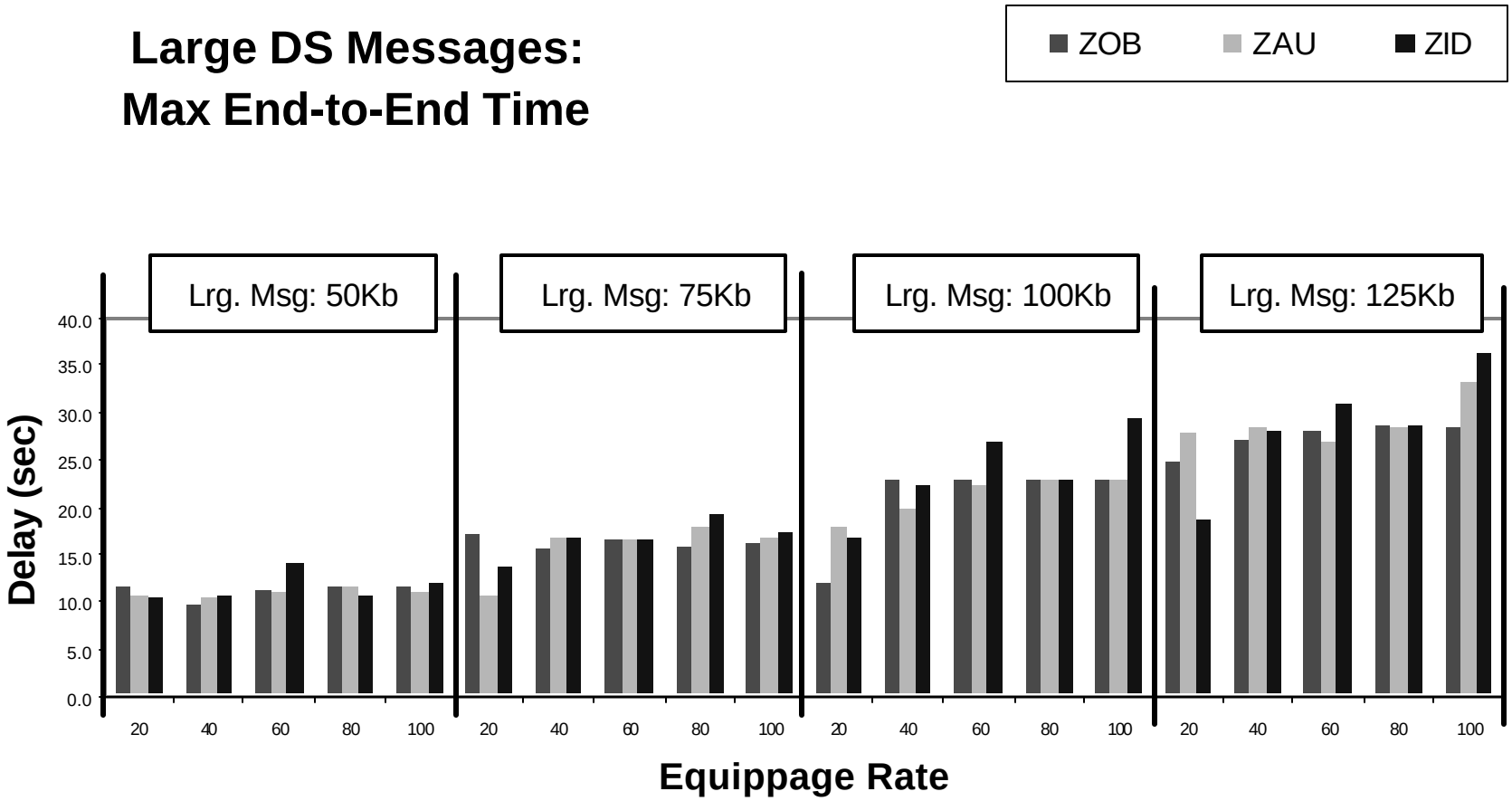


Simulation Results



Simulation Results

Large DS Messages:
Max End-to-End Time



Potential Cost Effectiveness

- Installation, maintenance, certification and upgrade
- *Many* airborne vs. *few* ground based DST
- Major airline investments vs. FAA investments
- Introduction of new applications/resources

Financial Model

- Determine the number of years that would be necessary for benefits to outweigh the investment
- Aircraft retro-fitting vs. forward-fitting costs (typical)
- Cost data based on historical data from recent FAA and airline investments (host replacement, ERAM, FMS, TCAS, etc.)
- Typical, best and worst case

Financial Model Results: Payoff Period

	Best Case	Typical Case	Worst Case
Single Aircraft	1 vs. 1	1 vs. 4	2 vs. >30
NAS-wide	2 vs. 3	4 vs. 7	7 vs. >30

* Ground based centralized DST vs. on-board decentralized DST (year)

Summary

- Big Iron assures uniformity of aeronautical information
- Increased A/G message traffic can be accommodated and would not decrease the quality of air/ground communications
- Airlines would likely recover their required investment within the first year of operations

Contact Info

Almira Williams
awilliams@cssiinc.com

CSSI, Inc.
http://www.cssiinc.com