

**CSSI, INC.**

*Research to Reality in Air Traffic Management*



# Investigation of Operator Benefits from Reducing Horizontal Separations in North Atlantic Organized Track System

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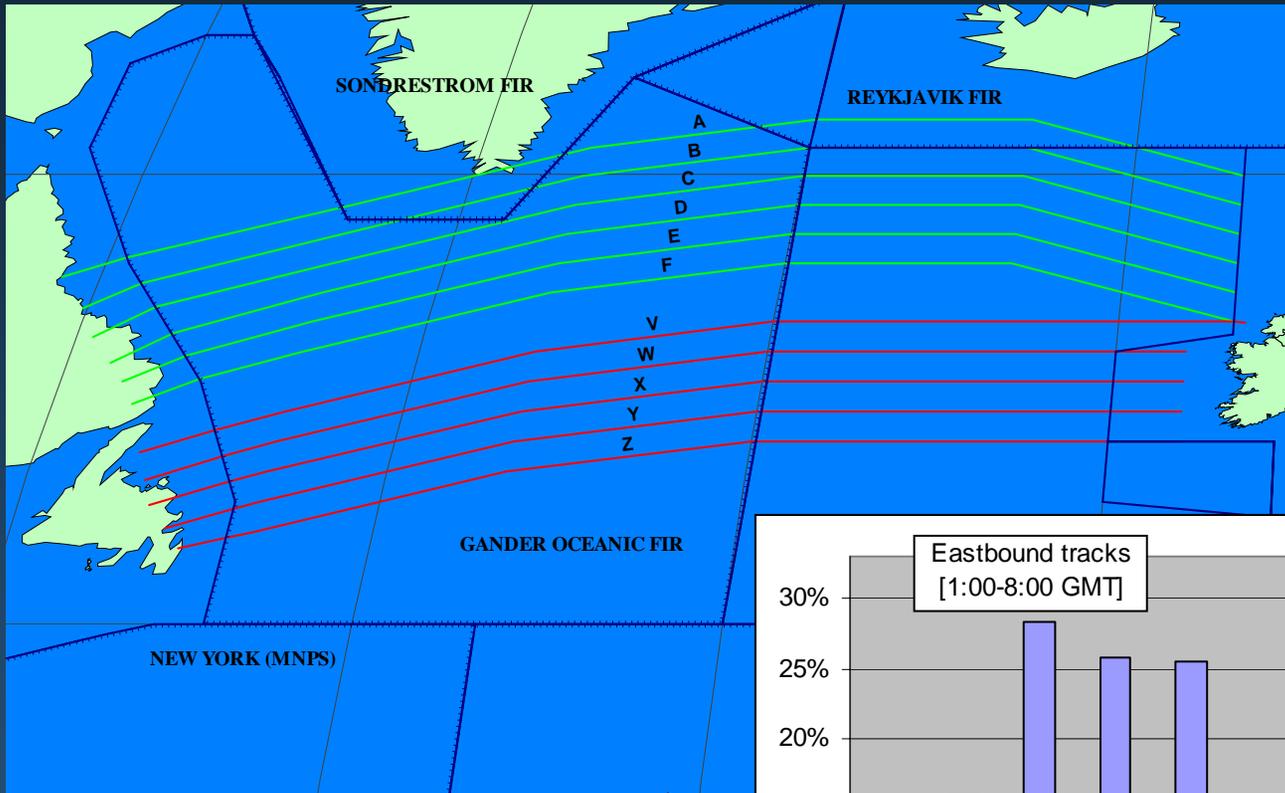
**May 2006**

# Project Objective

- Determine benefits of reduced horizontal separations in the North Atlantic Track System as a function of equipage levels and demand growth for up to 2015
- Determine improvements in flight efficiency through metrics such as fuel and time cost savings, and additional cargo revenue potential (by flight and by airframe)
- Determine improvements in system performance through metrics such as approved alt. change requests, and duration at sub-optimal altitude



# NAT OTS: October 2, 2004



**Scheduled: 88%**

**Non-sch.: 6%**

**Military: 2%**

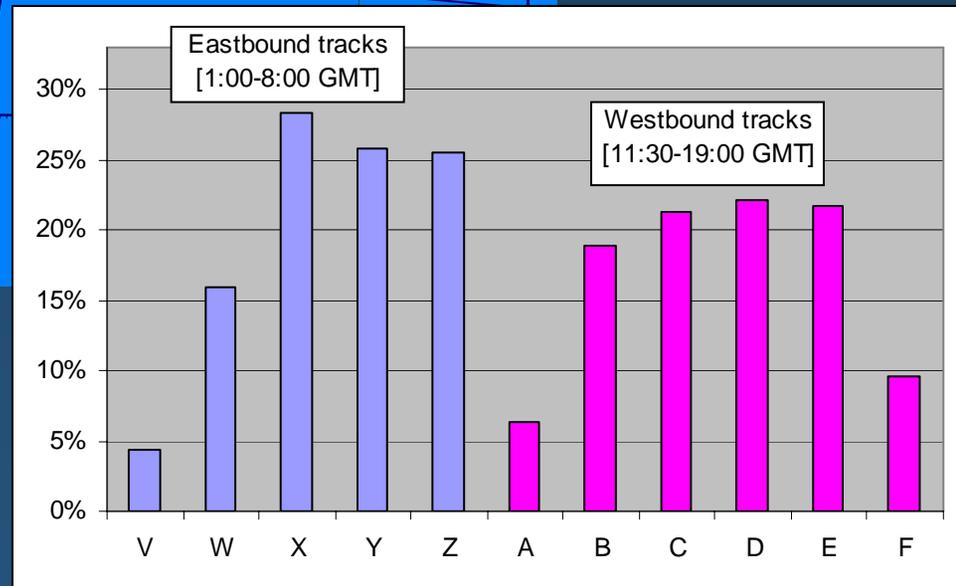
**GA: 2%**

**Cargo: 1%**

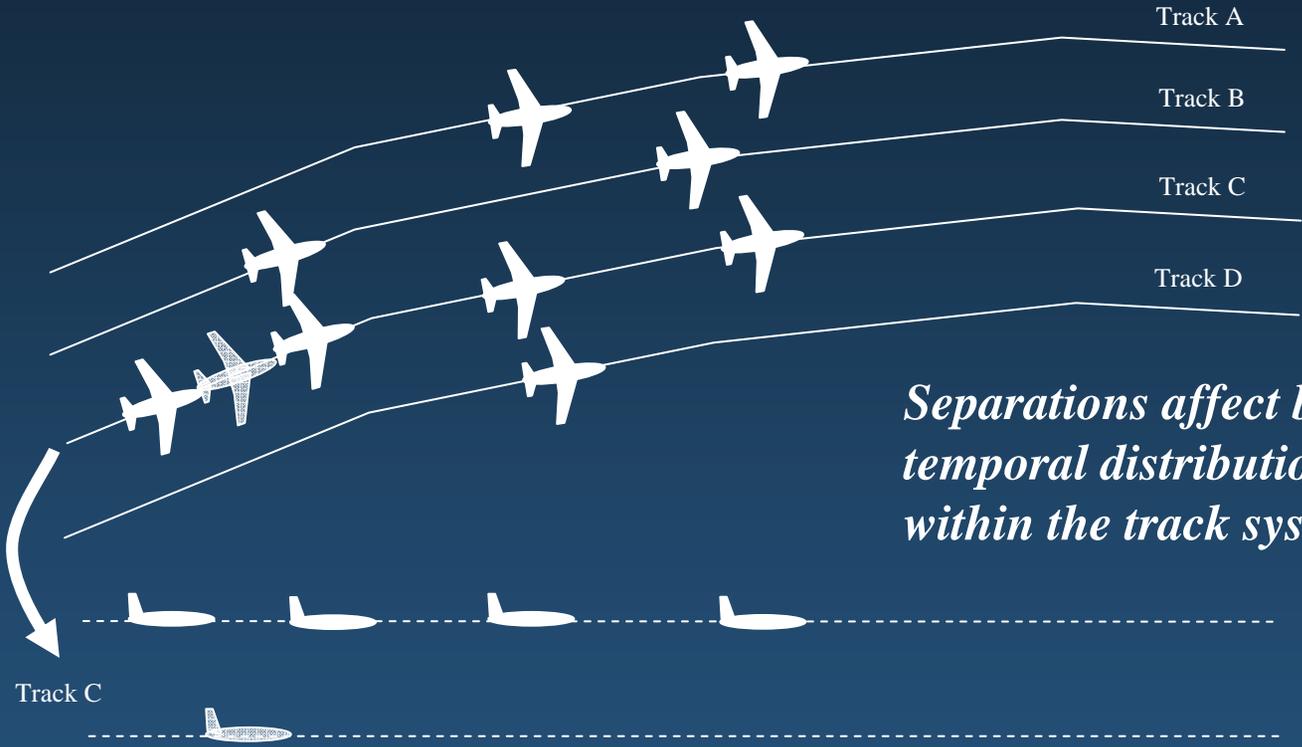
**ADS: 27%**

**Datalink: 34%**

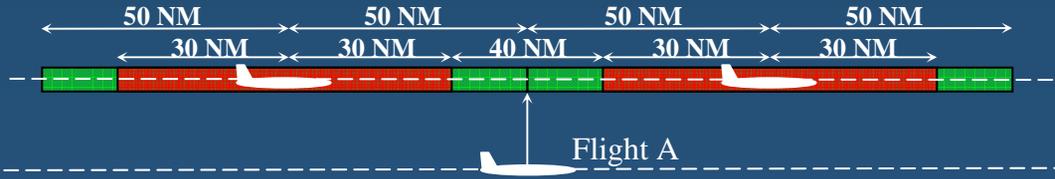
**RNP: 99%**



# Benefits Mechanisms due to Separations Reduction



*Separations affect both spatial and temporal distribution of flights within the track system*



# Benefits Mechanisms

- Improved routes, altitude and speed profiles
  - Lower fuel consumption
  - Shorter flight times
  - Additional cargo potential
- Improved ability to estimate fuel requirements
  - Contingency fuel reduction
  - Improved schedules
  - Additional cargo potential
- Improved system performance
  - Accommodation of higher demand levels, accommodation of user preferred choices, including denied alt. change requests, duration at sub-optimal altitude, etc.



# Modeling Requirements

- Future traffic generator to determine traffic demand levels, and fleet and equipage for the future years of interest
- Fuel consumption optimization model to determine optimal trajectories, step-climb and speed profiles for each of the flights (ISO atmosphere and forecasted wind data)
- Track selection model to determine user-preferred tracks for the future flights
- Track operations simulation models to impose restrictions due to traffic interactions (modify optimal altitude and speed profiles)
- Fuel consumption model to determine fuel requirements for the constrained trajectories



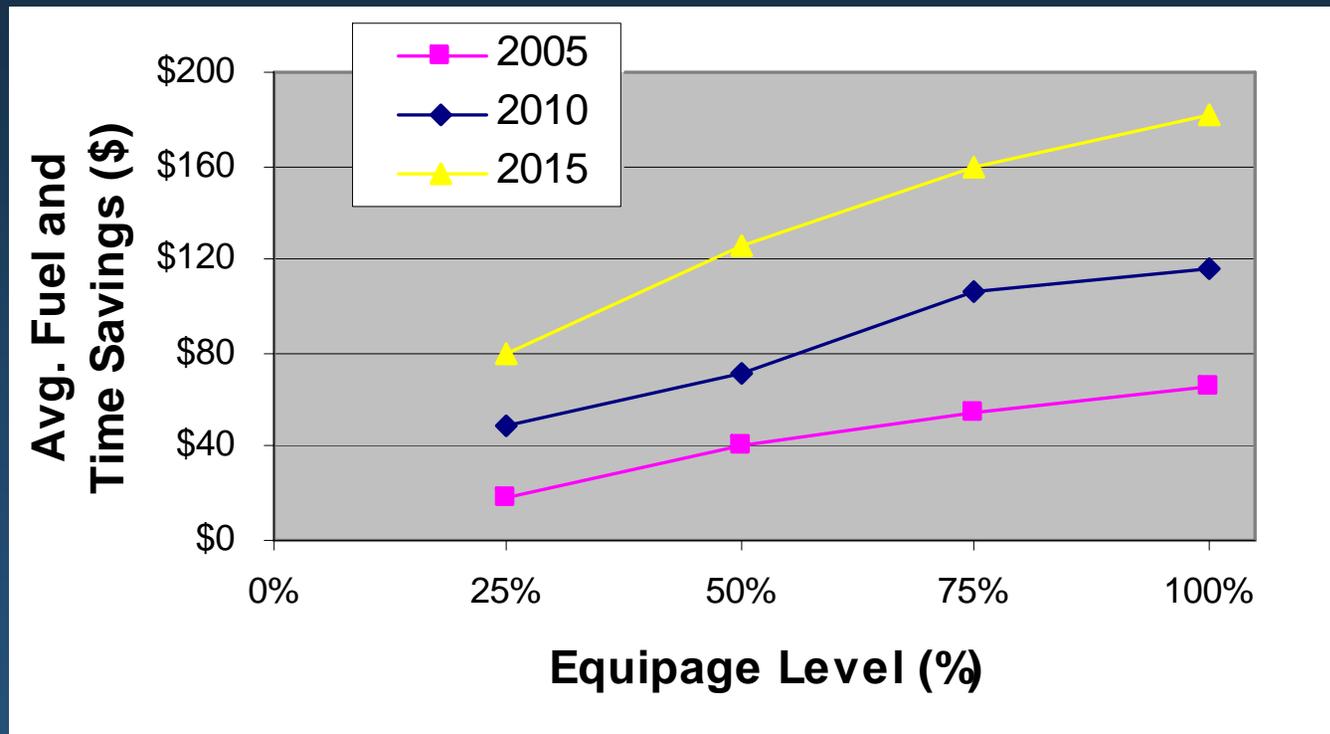
# Project Scenarios

- Three Demand levels: 2005, 2010, and 2015
- Five Equipage levels: 0, 25, 50, 75, and 100
- 2 sets of tracks: early morning eastbound (V-Z) and early afternoon westbound tracks (A-F).
- Three types of track configuration:
  - *Regular*: current tracks with mixed equipage operations
  - *Segregated*: some tracks not accessible to non-equipped flights
  - *Additional Segregated*: new tracks established between two adjacent segregated tracks

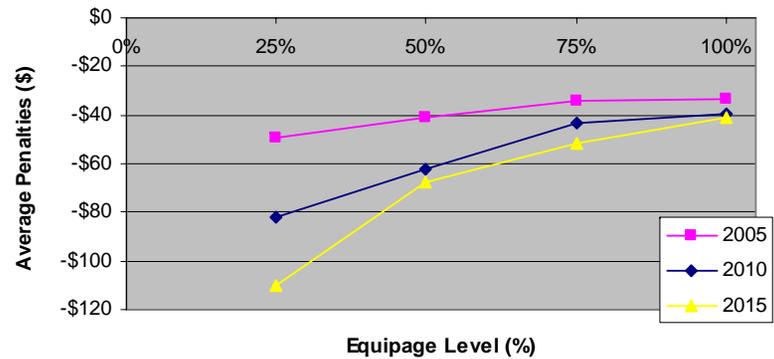
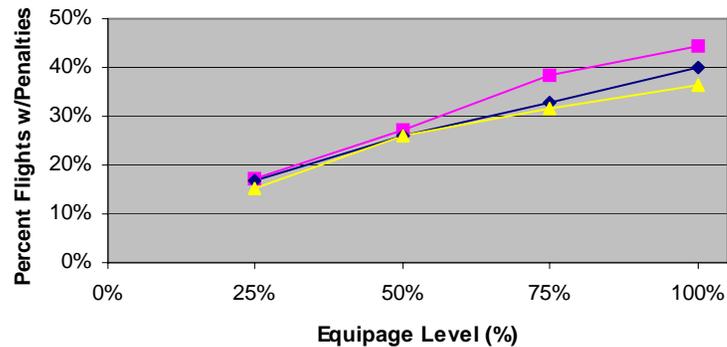
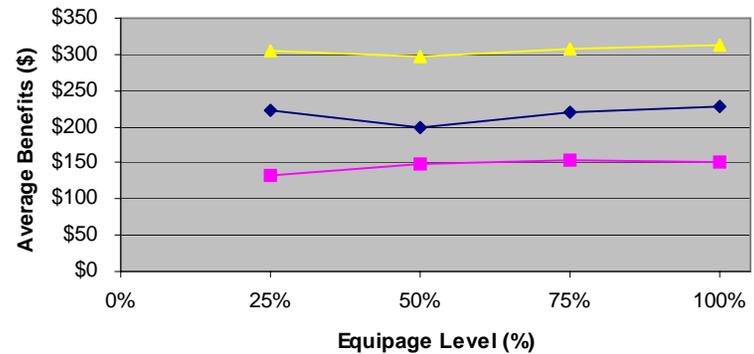
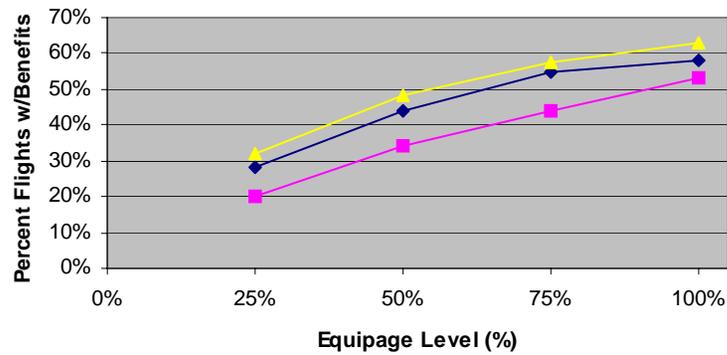
**=> 72 fast time simulation scenarios (+9)**



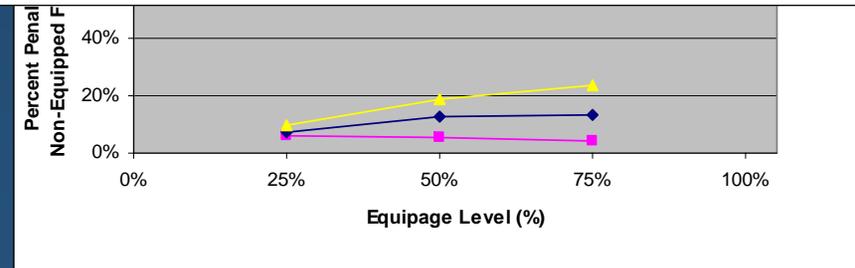
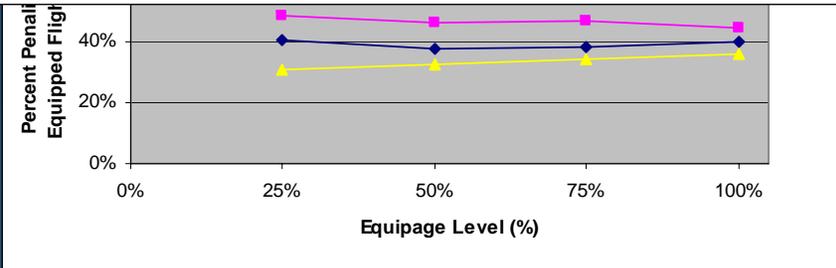
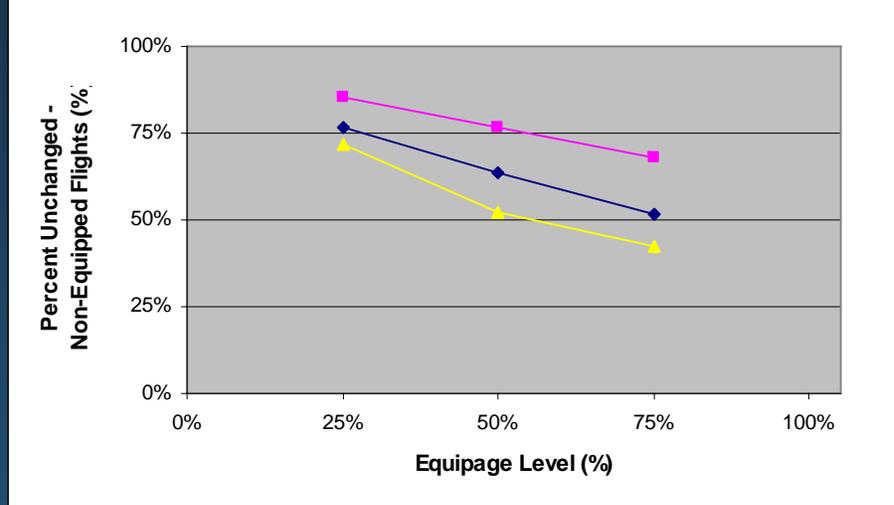
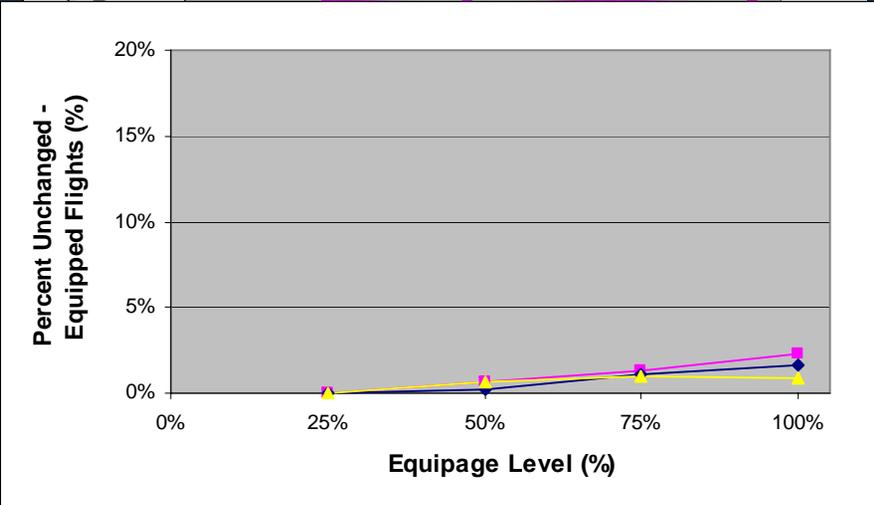
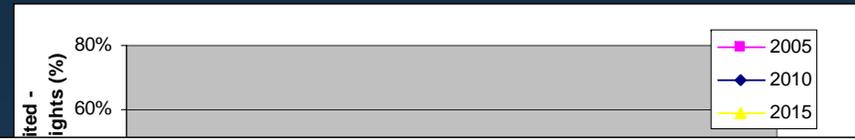
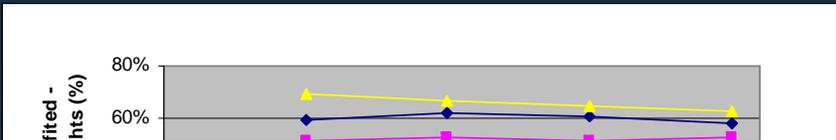
# Regular Tracks: Average Fuel and Time Savings (per flight)



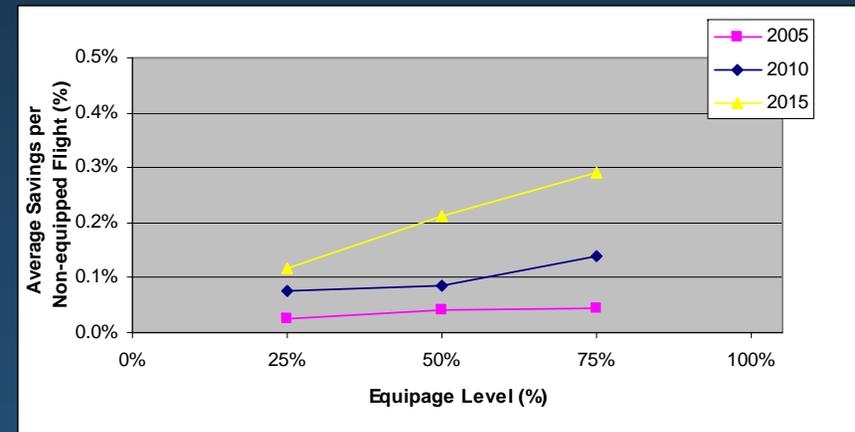
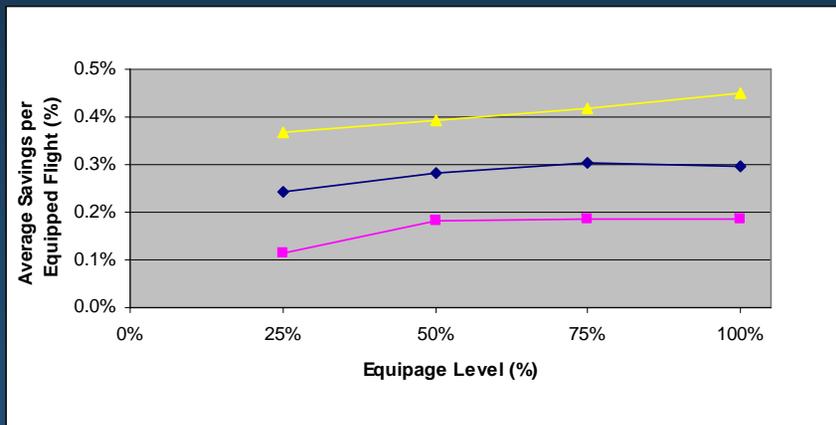
# Regular Tracks – Fuel and Time Savings: Benefits vs. Penalties



# Regular Tracks – Fuel and Time Savings: Equipped vs. Non-equipped Flights



# Regular Tracks: Equipped vs. Non-equipped Flights (cont.)



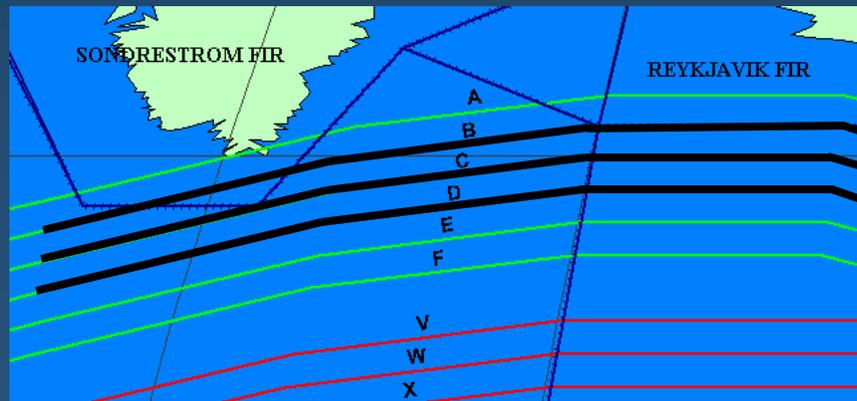
# Regular Tracks: Total Annual Benefits Summary

- With no additional cargo demand, operators will be able to take maximum advantage of potential fuel savings, and annual benefits can reach \$27M, \$51M and \$106M in 2005, 2010 and 2015, respectively (all operators, all flights)
- If, however, operators do find additional cargo to transport, the total annual benefits potential may be up to 4.7-5.5 time higher!
- (So far, no surprises, but ...)

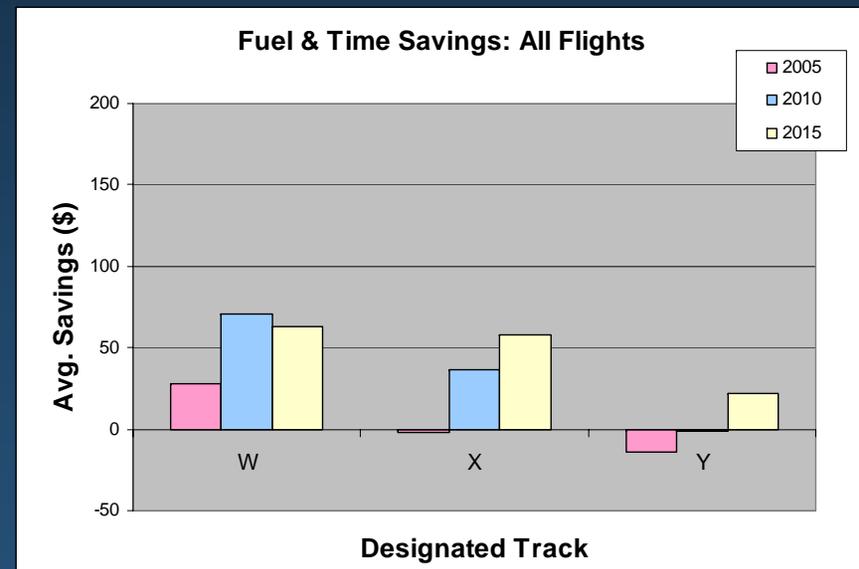
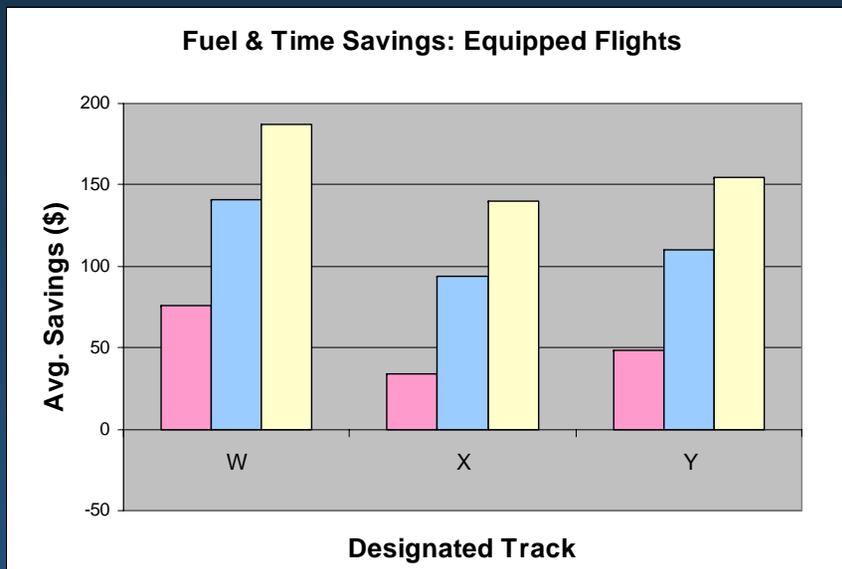


# Segregated and Additional Segregated Tracks: Assumptions

- Segregated Tracks are chosen based on:
  - Preferences of the equipped flights
  - Equipage level: 25% equipage - one, 50% equipage – two, and 75% equipage three segregated tracks
- Potential candidates for segregated tracks do not include outside tracks
- Additional tracks can be established only between two adjacent segregated tracks



# Sensitivity of Benefits to Segregated Track Selection



# Conclusions

- Yes, both equipped and non-equipped flights will benefit
- Equipped flights are 2-5 times more likely to experience savings than non-equipped flights, and on average save 1.5-4.6 times more
- The sooner an air carrier equips its fleet, the better off it will be (provided that sufficient overall equipage is reached)
- Designating certain tracks for exclusive use by equipped flights is controversial and will require careful examination

	2005				2010				2015			
	25%	50%	75%	100%	25%	50%	75%	100%	25%	50%	75%	100%
Regular Tracks	\$ 36 M	\$ 78 M	\$ 113 M	\$ 133 M	\$ 106 M	\$ 162 M	\$ 251 M	\$ 277 M	\$ 213 M	\$ 334 M	\$ 440 M	\$ 512 M
Segregated Tracks	\$ 8 M	\$ 62 M	\$ 91 M	\$ 133 M	\$ 45 M	\$ 146 M	\$ 205 M	\$ 277 M	\$ 139 M	\$ 353 M	\$ 413 M	\$ 512 M
Additional Segregated Tracks		\$ 71 M	\$ 105 M	\$ 151 M		\$ 160 M	\$ 233 M	\$ 300 M		\$ 354 M	\$ 459 M	\$ 569 M

