En Route Data Link Benefits Overview

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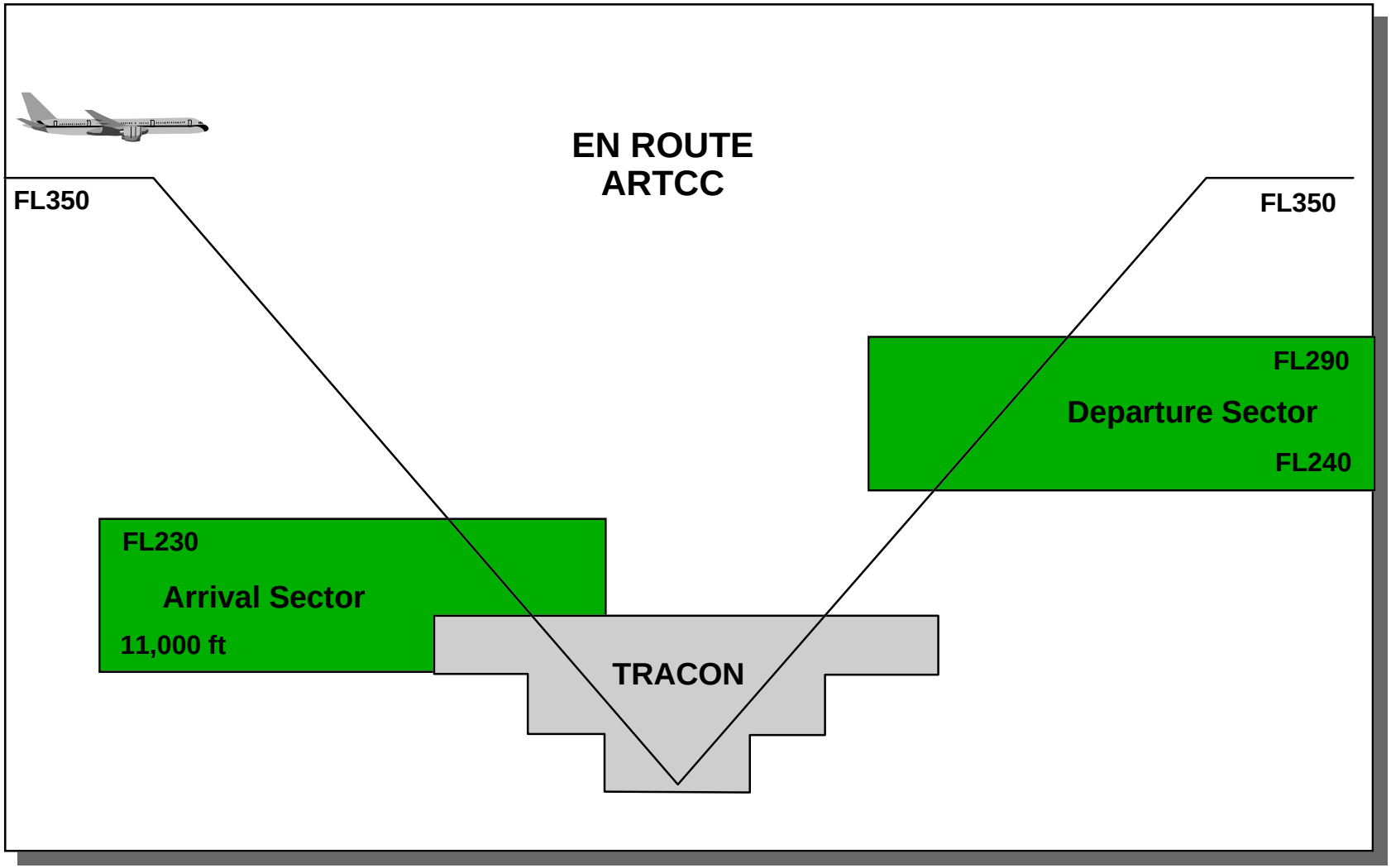
Overall Approach

- Define benefits analysis scope
- Case study methodology
- Data collection for selected ARTCC and sectors via manned simulation exercises
- Extrapolate to national deployment via survey and derived mathematical model
- Compute national economic benefit

Scope

- Domestic en route operations
- Sectors which enforce restrictions due to communications volume saturation
- 1994 traffic levels

En Route and Terminal Airspace Relationship



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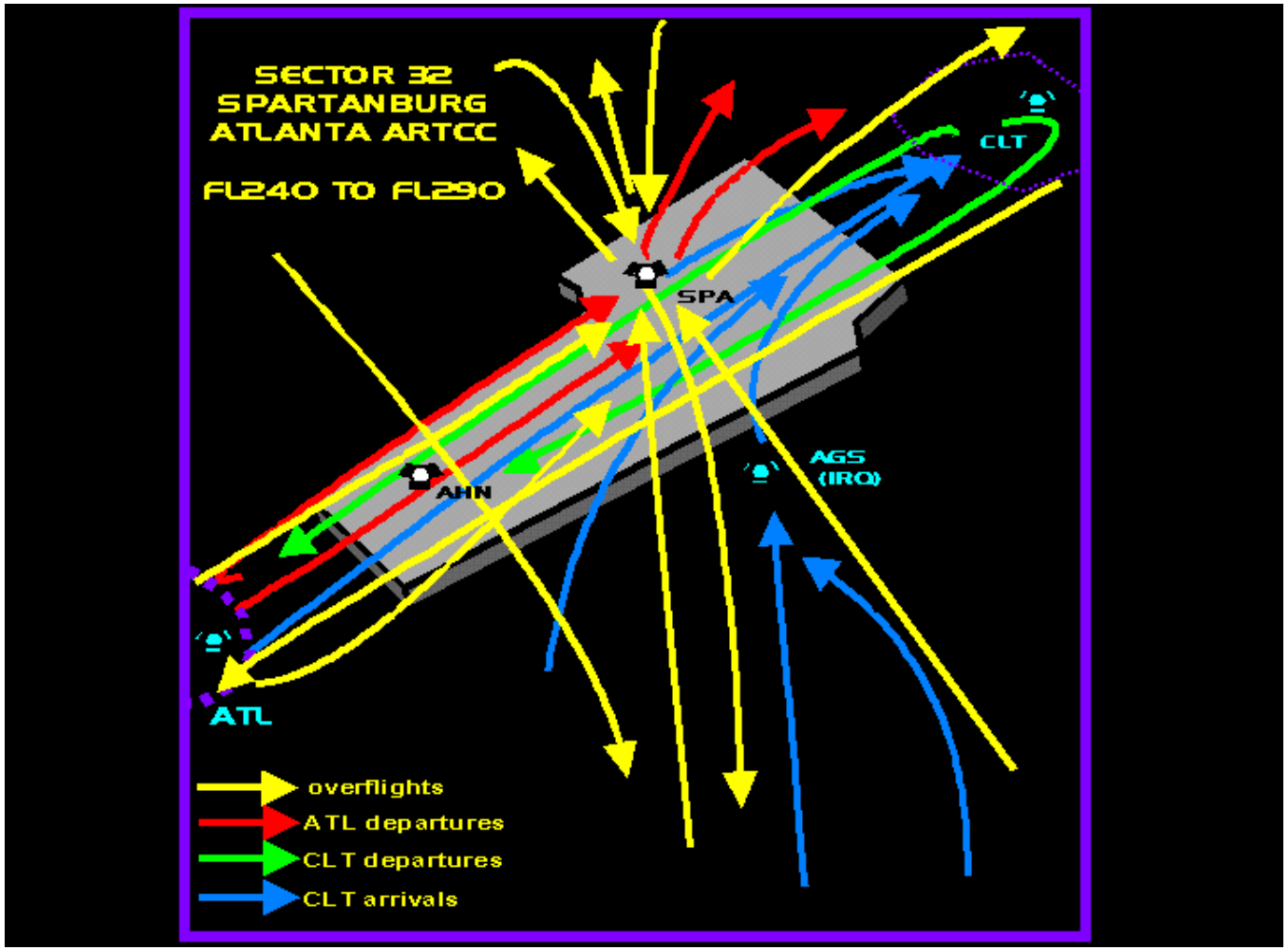
Selected Case

- Subject ARTCC and Sectors
  - Select ZTL as representative of two typical voice frequency congestion problems
    - Sector 32: restriction of departures due to voice com saturation
    - Sector 09: disruption to arrival sequencing due to voice com saturation
- Baseline Traffic Scenarios
  - SAR tapes of sector 32 with 20 MIT restriction on ATL departures
  - SAR tapes of sector 09 during times controllers cannot achieve the specified MIT for ATL arrivals

Selected Case (Concluded)

- Controller Subjects
  - Full performance level ATC specialists from ZTL with experience at the subject sectors
  - 3 controllers and 1 supervisor for each team
  - Total of 2 sectors x (3 controllers + 1 supervisor) x 3 full replications
  - Extensive data link training given
- Pilot Subjects
  - WJHTC pseudo pilots

Atlanta ARTCC Sector 32, Spartanburg



This photo is courtesy of the FAA.

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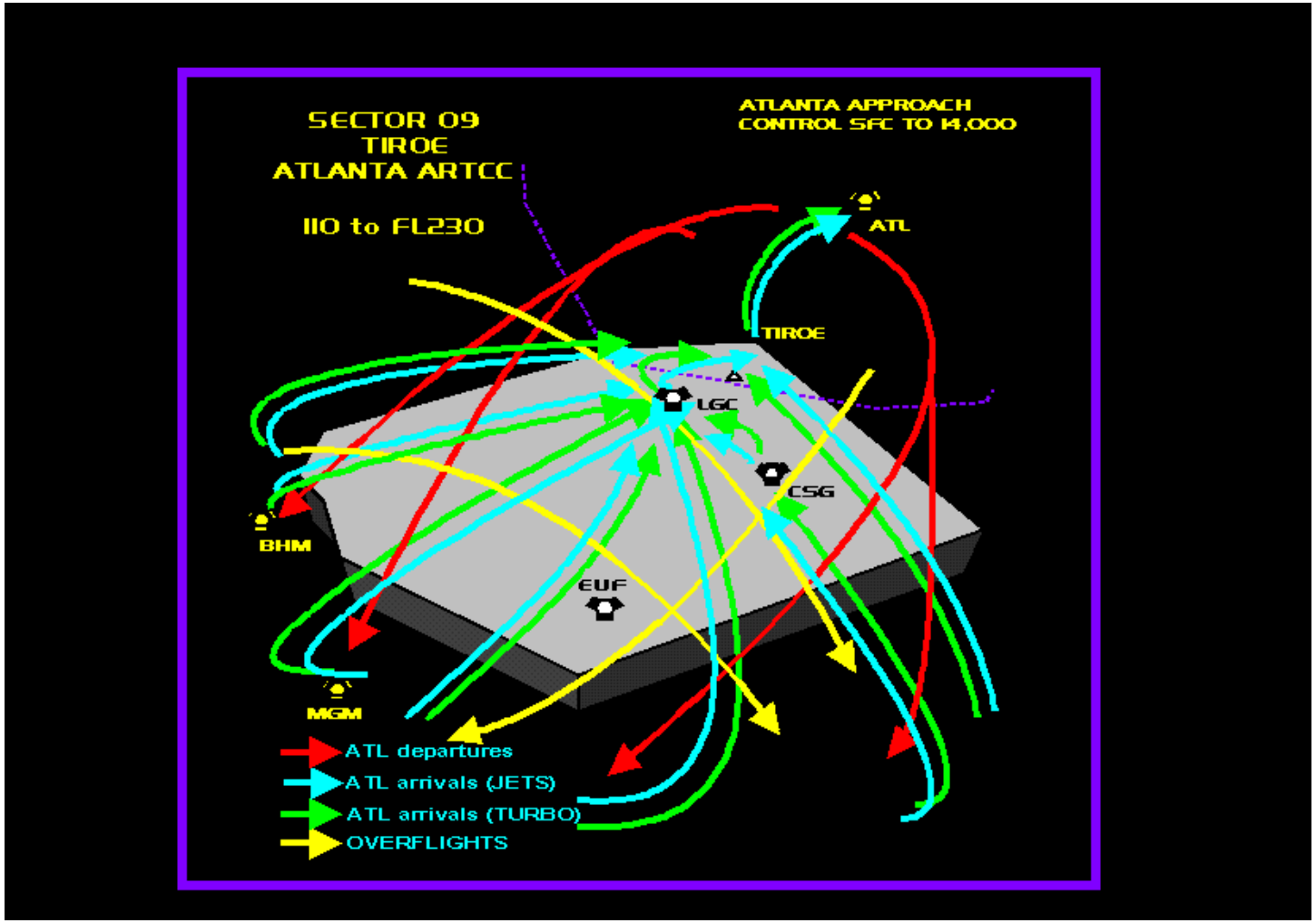
Sector 32 - Departure Sector

- Sector 32, Spartanburg, is an Atlanta departure sector whose primary task is to control departures of jet aircraft climbing from the Atlanta airport.
- During peak traffic periods, 20 miles in trail (MIT) are required for departures entering this sector
  - This translates into ground delays for aircraft entering sector 32 as well as other aircraft waiting behind these aircraft on the ground
- Data link allowed the reduction of the 20 MIT to minimum MIT (5 miles)
  - This resulted in total delays for all 48 aircraft in the study from 1,795 minutes to 687 minutes or a 62% reduction (p37)
- Controller teamwork/delegation of tasks, with the additional communications capacity led to more efficient and higher capacity use of the existing airspace

Atlanta ARTCC Sector 09, Tiroe



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Sector 09 - Arrival Sector

- Sector 09, Tiroe, is an Atlanta arrival sector whose primary task is to sequence aircraft inbound to the Atlanta approach
- During the peak periods, controllers in sector 09 cannot consistently provide the minimum MIT to the approach control
  - This prevents efficient merging of traffic and forces extensive vectoring and holding
- Data link provided the controller team to work more efficiently resulting in elimination of holding and improved vectoring
  - The average flight time was decreased from 18 to 14 minutes
  - The total miles flown was decreased from and average of 111 miles to 89 miles

Data Collection

- Traffic Scenarios
  - Departure Sector 32 historical ZTL SAR tape salted with additional traffic at the sector boundaries to represent 3 levels of reduced MIT (15, 10, 5) restriction besides baseline 20 MIT
  - Arrival Sector 09 historical ZTL SAR tape salted with additional arrival traffic to represent 4 levels of growth (10, 20, 30, 40%) besides the baseline level
- Manned Simulation Facilities
  - WJHTC NAS Enroute Lab
  - WJHTC TGF with pseudo pilots
  - B727 (2), B747 (2), GAT, and RCS flight simulators

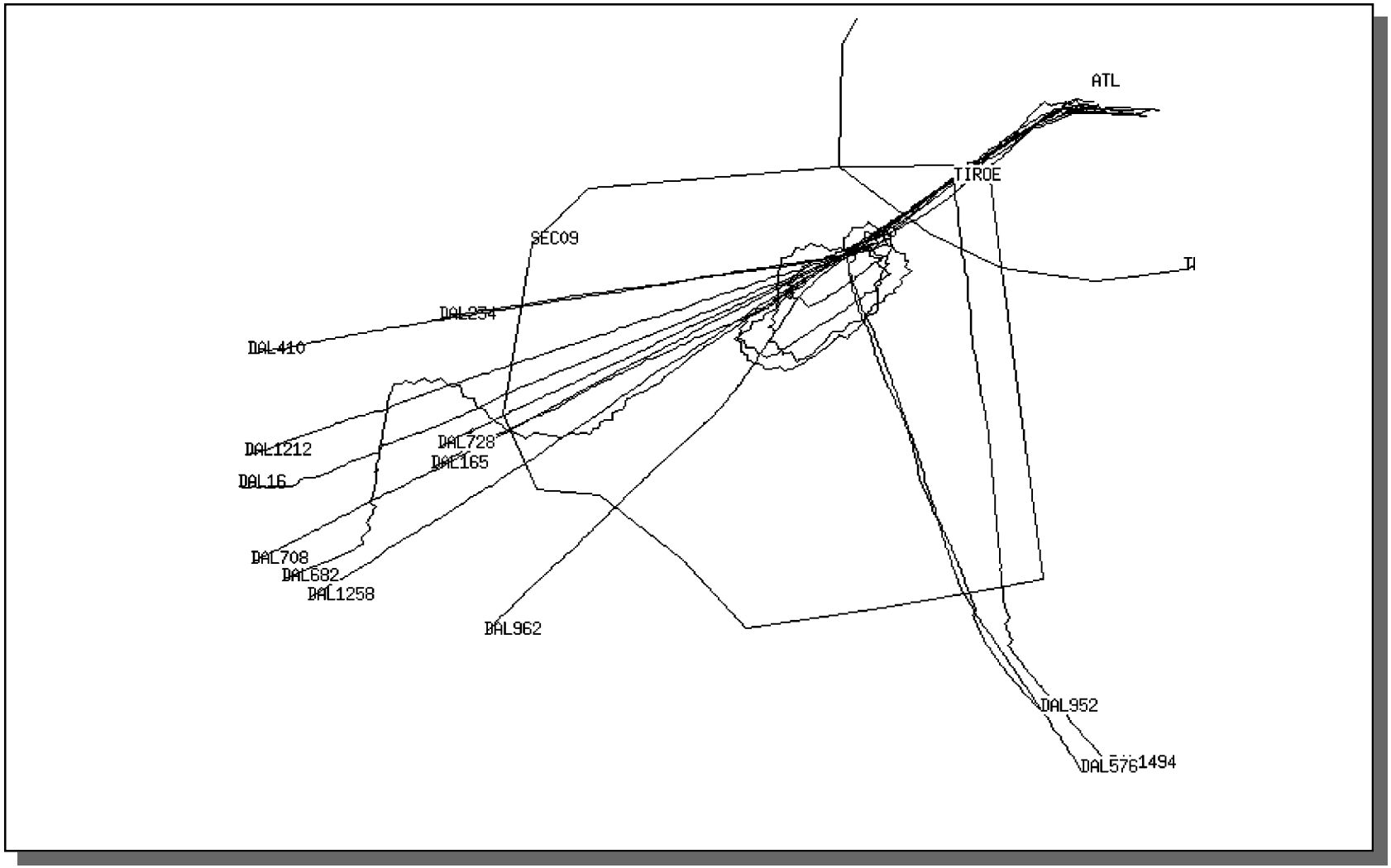
Data Collection (Concluded)

- Test Matrix
  - Departure Sector: all runs made with voice + ADL to determine MIT at which safety breaks down (no runs with voice only)
  - Arrival Sector: all runs made with voice + ADL to determine traffic level at which safety breaks down (no runs with voice only) (SIMMOD was used to estimate metrics for voice only condition at increased traffic levels)
  - Field SAR data was used as the voice only baseline for each sector
  - Voice only compared with Voice + Data Link to determine time savings

Computation of Economic Benefits

- Factors Included
  - Airborne and ground operational delay changes between voice only and voice +ADL
  - Number of problem days per year
- Operating Costs
  - Average airline direct operating cost from 1994 data:
    - taxi delay = $26.20 per minute
    - airborne delay = $31.50 per minute

Selected Atlanta Arrivals from the En Route Benefit Study Baseline



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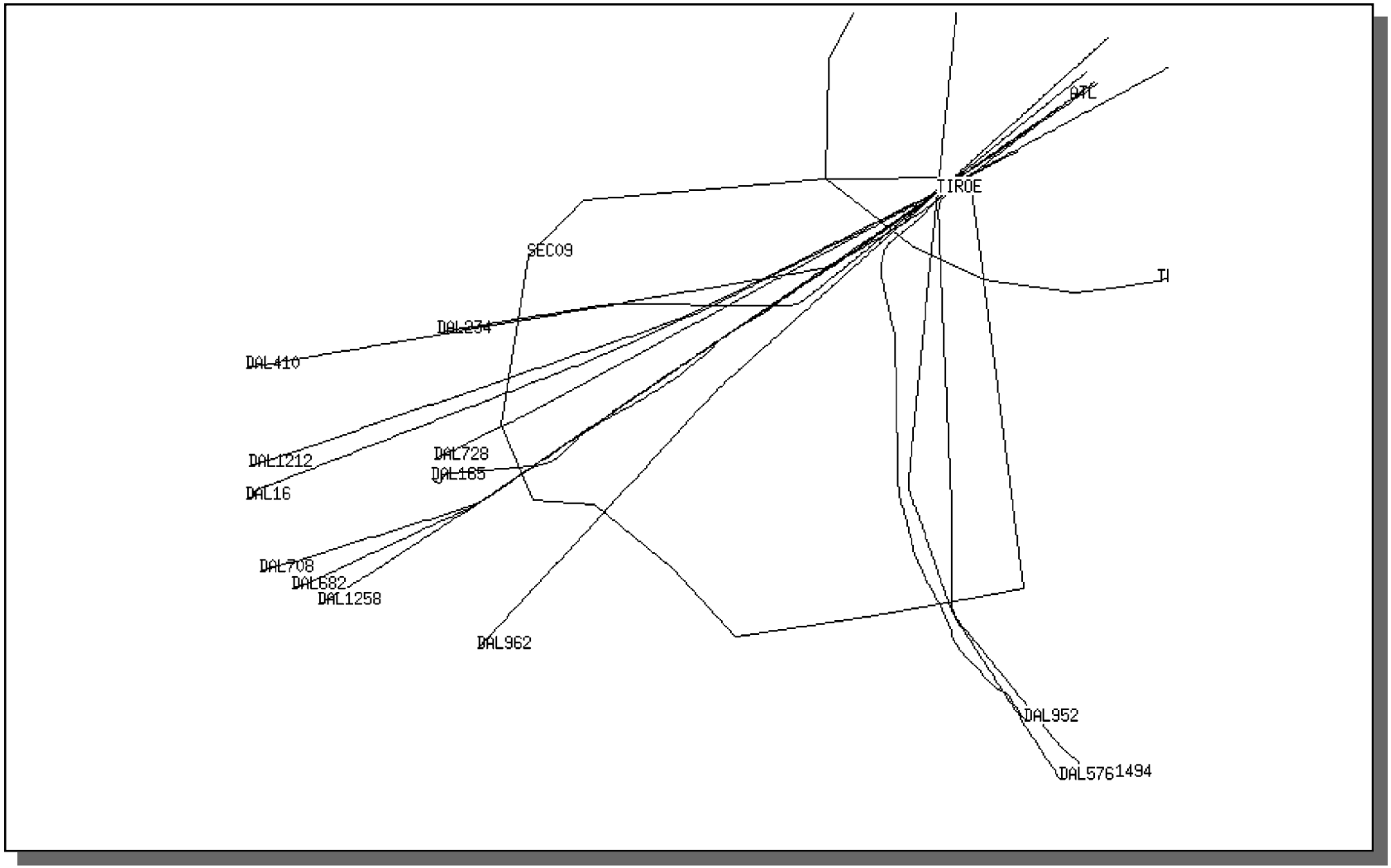
Effect of CPDLC Usage with the Selected Atlanta Arrivals, Team 2



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CPDLC Benefits Overview

- Total $$ savings:
  - Savings at the two sectors in Atlanta is in excess of 48.6 million annually
  - 43 sectors nationally where identified to have the same characteristics of sectors 32 and 09
  - Savings nationally is in excess of $337 million

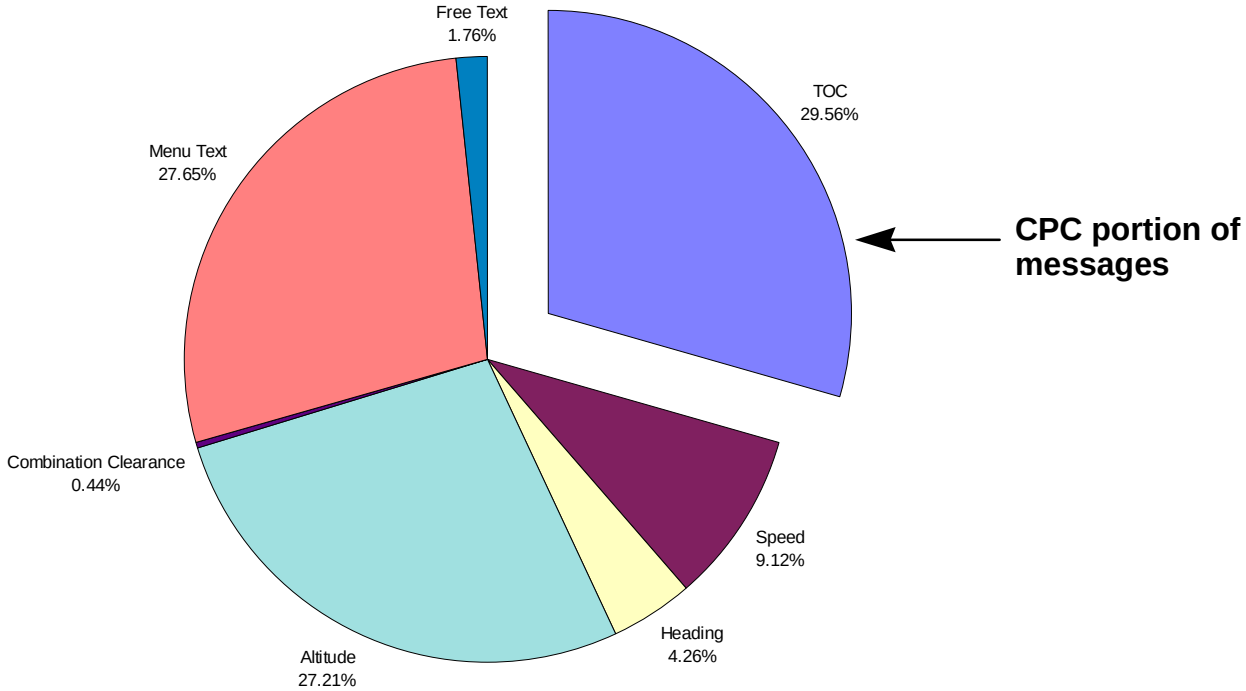
Extrapolation to National Context

- Methodology Used
  - Telephone survey of domestic ARTCCs to determine number of sectors with problems similar to Sectors 32 and 09
  - Identified sectors analyzed for comparability to case study
  - Mathematical model developed to prorate savings according to comparability metrics
  - Savings for each sector computed and aggregated to get national benefit
- Inputs
  - delay savings per aircraft per traffic type
  - % of each traffic type involved for each problem sector
  - problem time periods for each identified problem sector
  - actual sector traffic counts (from ETMS) during problem periods

Extrapolation to National Context (Concluded)

- Key Assumptions
  - Aircraft mix is representative of FAA cost model's mix
  - Resectorization activities will not change numbers significantly

En Route Benefit Study Uplink Messages



- Initial contact was used in the benefits study (i.e., no voice check in)
- Altimeter setting, while not used in the benefits study, is part of CPC and is required below 18,000 ft.

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