Improving ATC Efficiency through an Implementation of a Multi Sector Planner Position

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Summary

- ***Objective***
  - Determine if the efficiency of using limited ATC resources can be improved by introduction of a Multi Sector Planner (MSP) position
  - Improvement in efficiency: percent difference in ATC controller positions needed under the current ATC and the MSP scenarios
- ***Approach***
  - Parametric analysis based on empirical data
  - Monitor Alert Parameters (MAP) used as a simple approximation of traffic complexity and workload requirements
- ***Focus***
  - The U.S. CONUS centers
  - Atlanta ARTCC: limitations due to center area configurations

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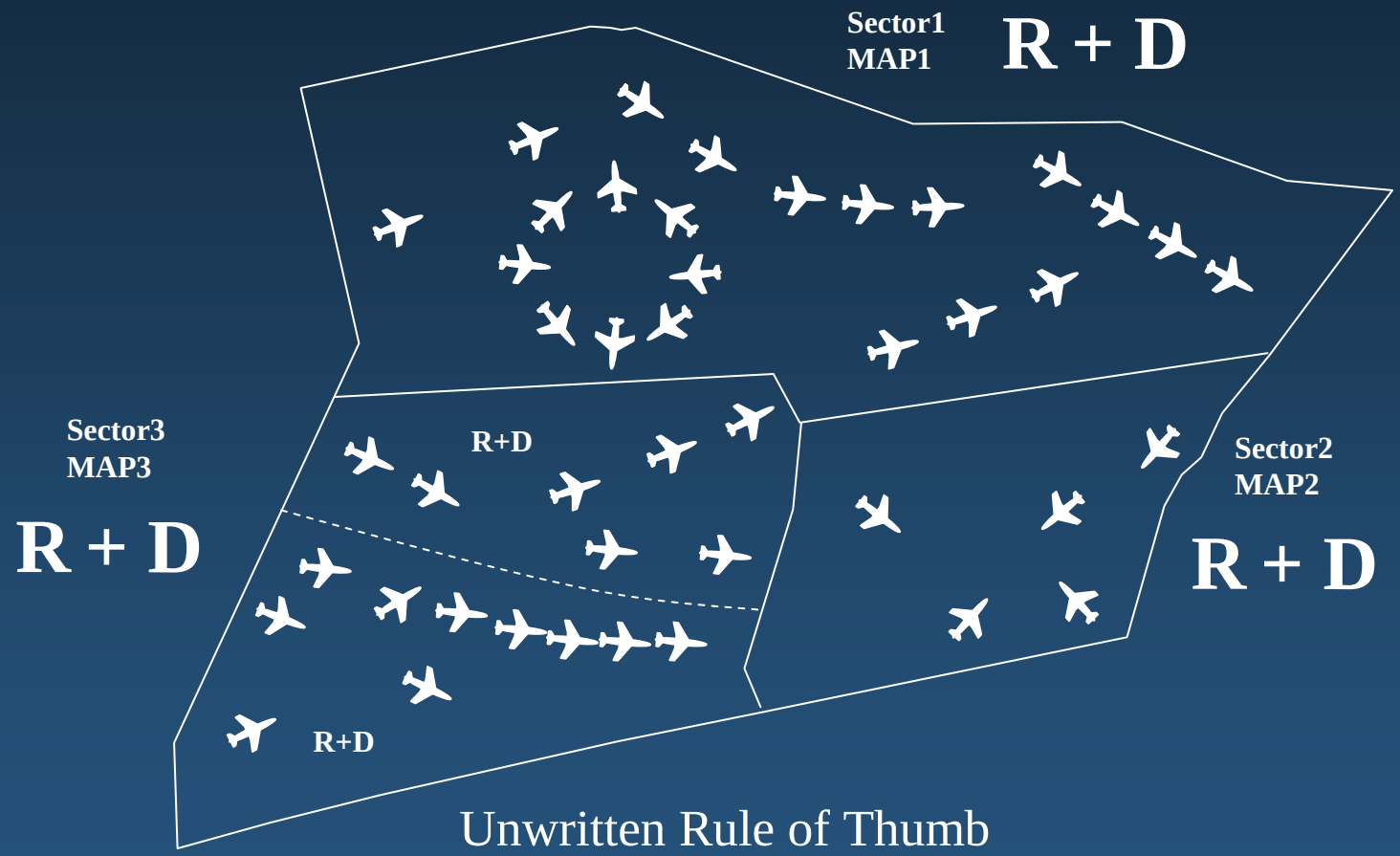
Current ATC Staffing

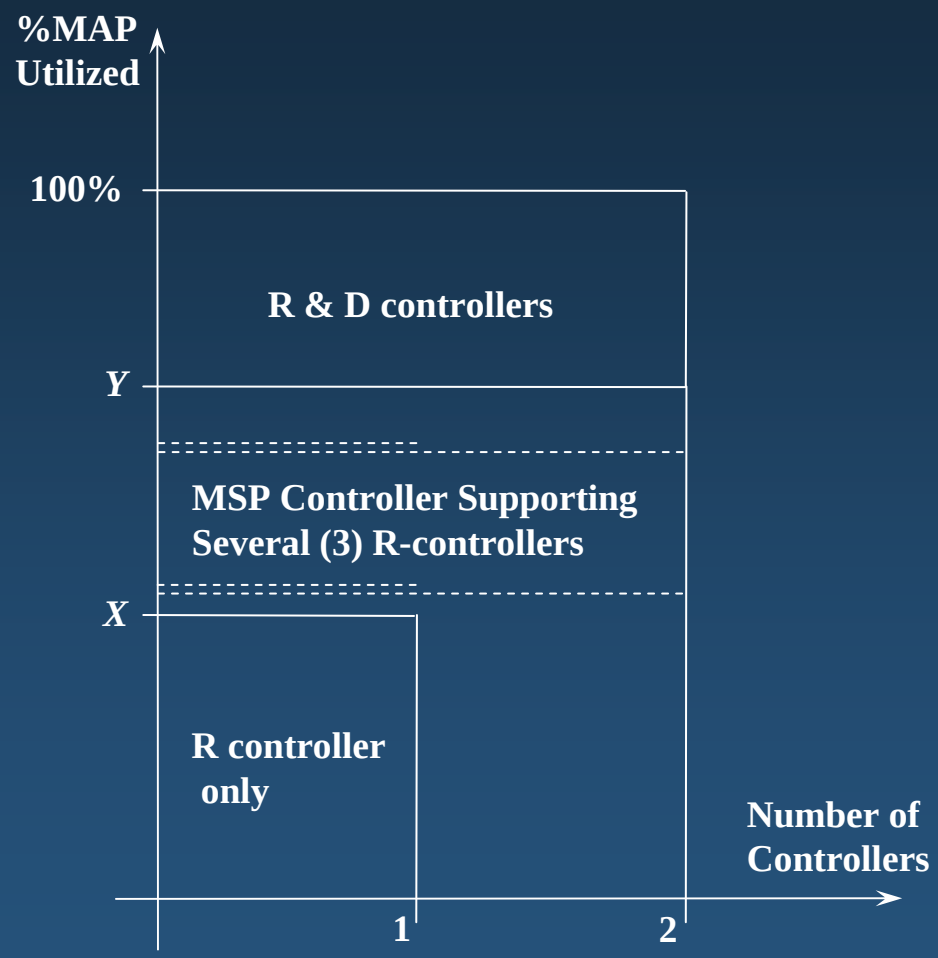


Unwritten Rule of Thumb

Expected max sector load < X% of MAP ⇒ R

Expected max sector load ≥ X% of MAP ⇒ R&D

ATC Staffing with MSP



- ***MAP***
  - Numerical trigger used to point out that sector efficiency may be degraded during a specific period of time
- ***Current ATC scenarios***
  - Each sector is controlled by at least R-side controller
  - D-side is introduced if sector loads are forecasted to exceed max %MAP utilized of level *X*
- ***MSP scenarios***
  - Each sector is controlled by at least R-side controller
  - MSP controller is introduced if max sector loads are forecasted to exceed %MAP utilized of level *X*, but not exceed level *Y*

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Data

- ***Empirical Data***
  - CONUS sector data
    - Source: Air Traffic Control System Command Center (ATCSCC)
    - Geographic layout and altitude coverage
    - Sector MAP values
  - Atlanta Air Route Traffic Control Center (ZTL ARTCC)
    - Area configurations based on controller certification
    - Area configuration MAP values
  - Traffic Data
    - Enhanced Traffic Management System (ETMS)
- ***Derived Data***
  - Sector pierces, transition times and max instantaneous loads for 15min intervals
  - Inter-sector flows
  - Busiest 4-hr periods for each center (highest max and avg loads)

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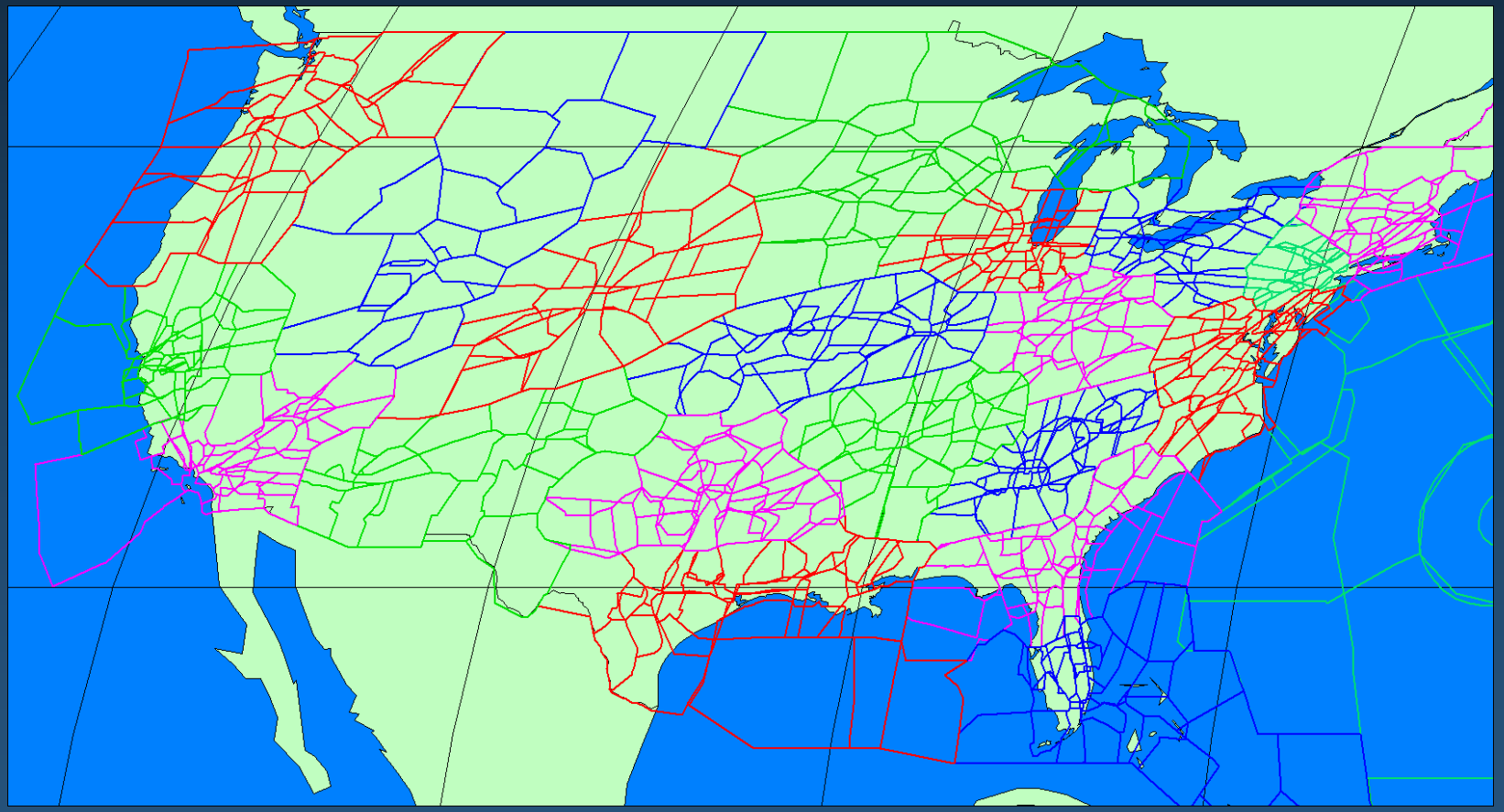
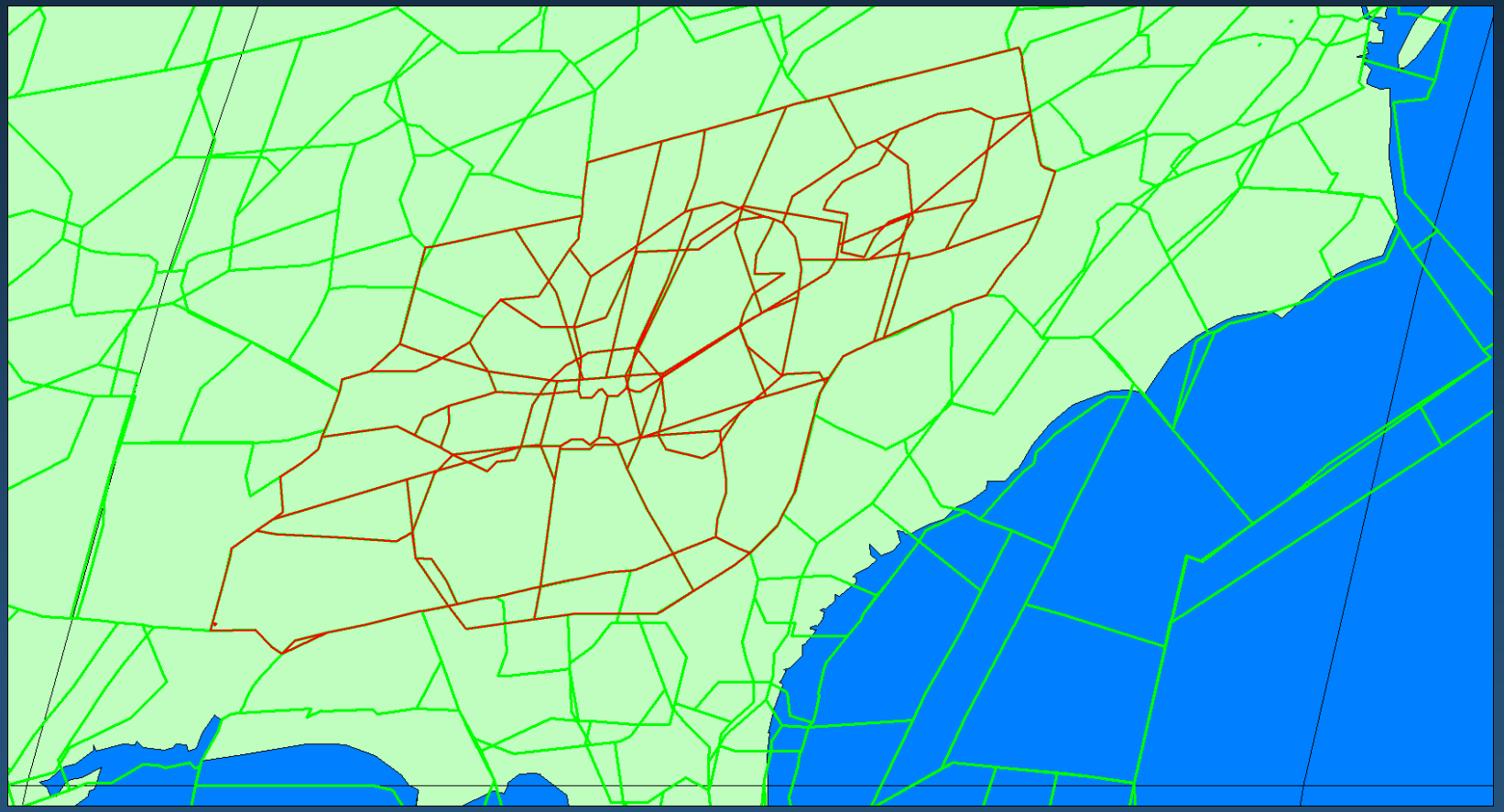
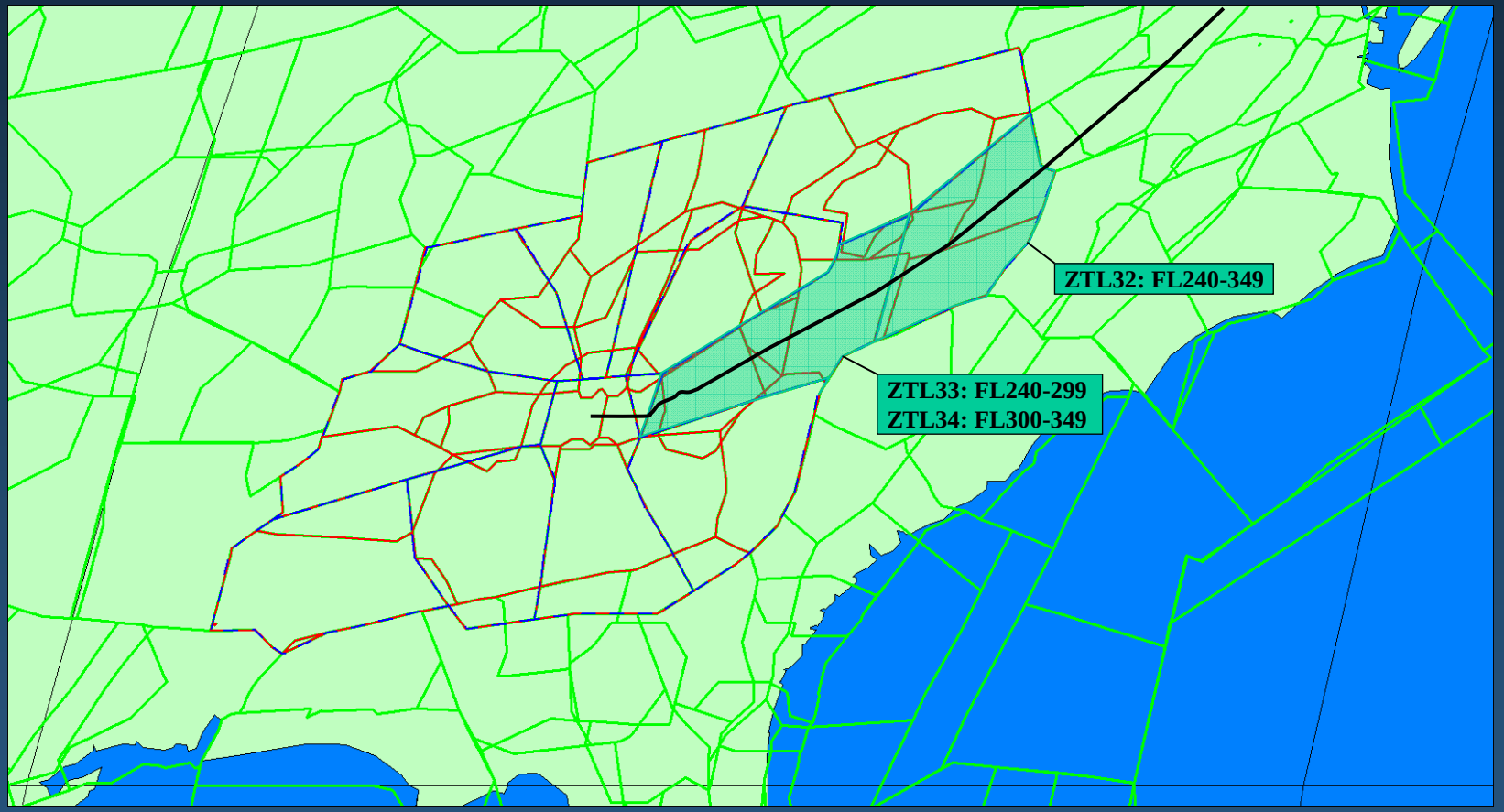
CONUS Centers & Sectors



Atlanta ARTCC (ZTL)

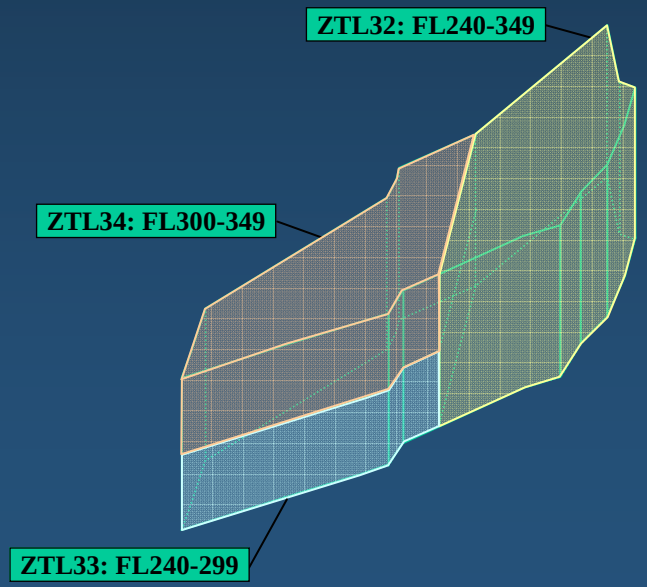


ZTL High Alt. Sectors



Efficiency Improvement Potential

- Function of the number and the distribution of the sectors with predicted %MAP between levels *X* and *Y*
- MSP areas chosen by combining adjacent sectors with
  - Primary Objective: High(est) number of boundary crossings, and
  - Secondary Objective: Highest improvement in efficiency



R+D	ATC	MSP	Improvement
3+0	3	3	0 positions/0%
3+1	4	4	0 positions/0%
3+2	5	4	1 position/20%
3+3	6	4	2 positions/33%

Other potential benefit mechanisms were not considered

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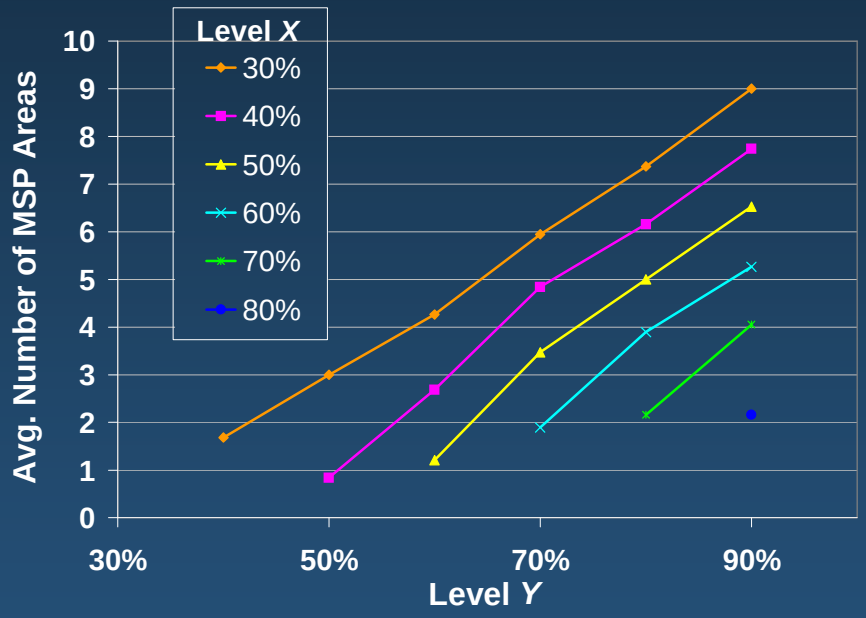
Results: Number of MSP Areas



Range						
X \ Y	40%	50%	60%	70%	80%	90%
30%	0 - 4	0 - 6	2 - 8	3 - 10	3 - 11	3 - 14
40%		0 - 3	0 - 5	2 - 7	3 - 10	3 - 12
50%			0 - 4	1 - 6	1 - 9	2 - 11
60%				0 - 4	0 - 7	0 - 9
70%					0 - 4	0 - 7
80%						0 - 5

S.D.						
X \ Y	40%	50%	60%	70%	80%	90%
30%	1.3	1.6	1.6	1.8	2.3	2.9
40%		1.0	1.4	1.5	1.9	2.4
50%			1.3	1.5	1.9	2.6
60%				1.4	2.0	2.8
70%					1.8	2.5

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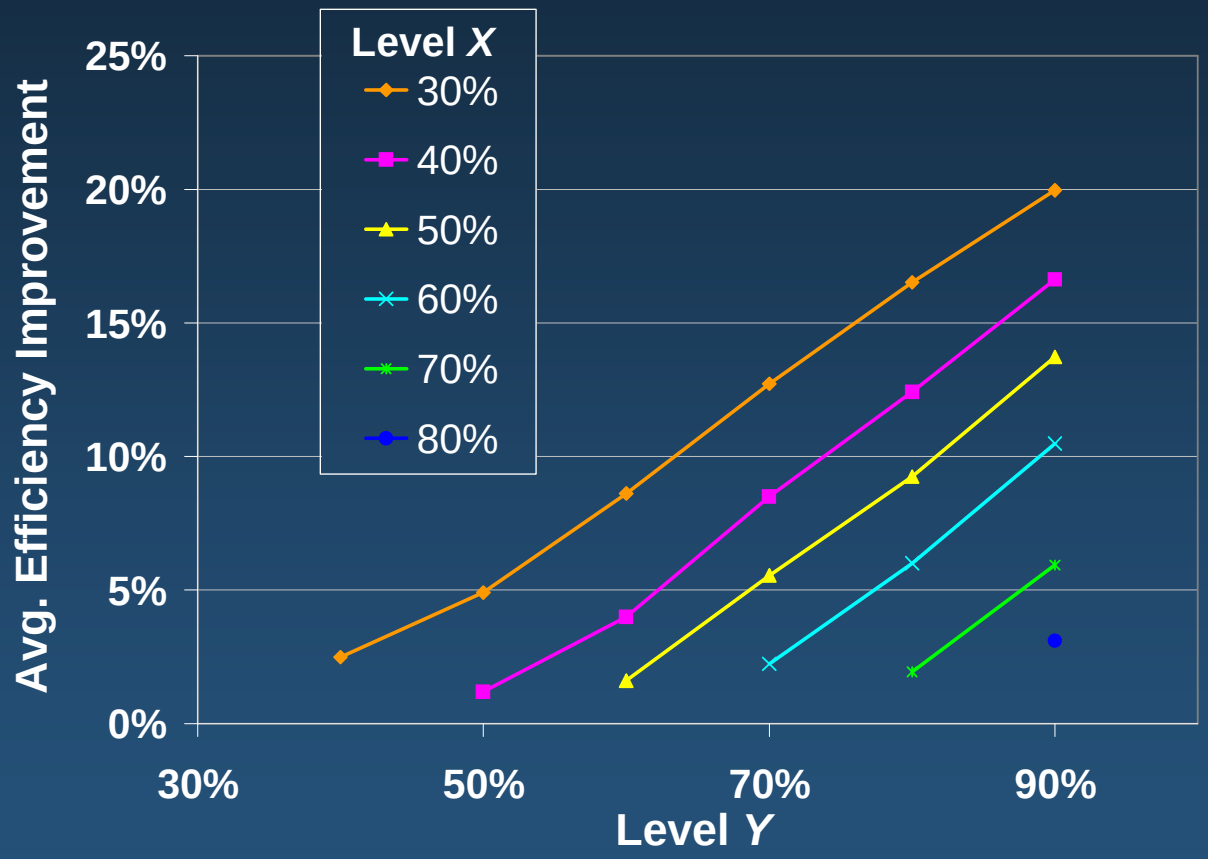
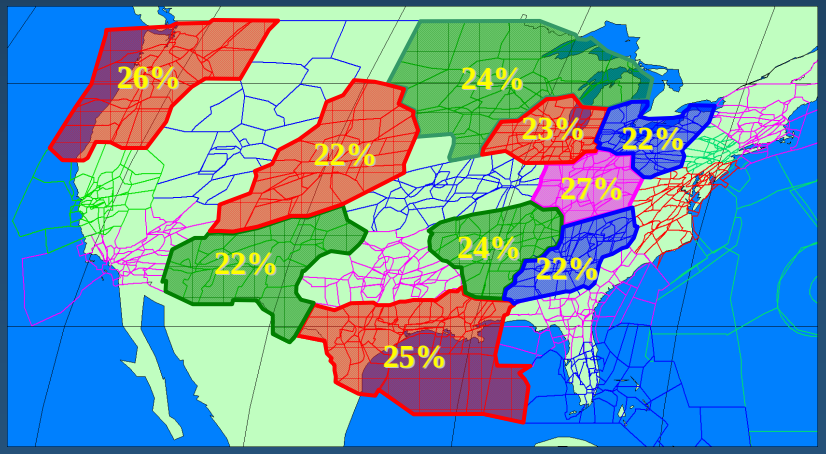
Results: Efficiency Improvement



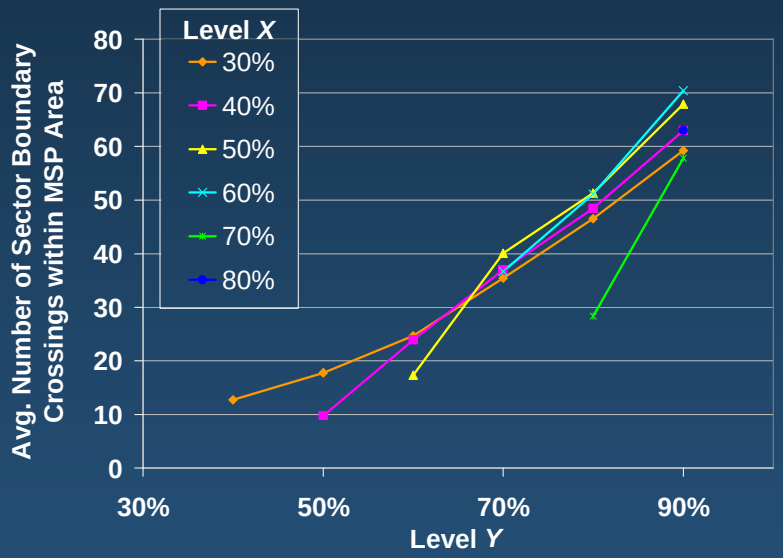
Results: Efficiency Improvement (cont.)

Range						
X \ Y	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
30%	0.0 - 8.6%	0.0 - 14.3%	1.4 - 18.6%	6.8 - 22.9%	11.1 - 24.4%	12.9 - 26.9%
40%		0.0 - 3.6%	0.0 - 11.1%	3.4 - 13.7%	7.1 - 20.5%	7.1 - 26.0%
50%			0.0 - 4.8%	1.8 - 10.1%	2.8 - 17.4%	2.8 - 21.7%
60%				0.0 - 7.7%	0.0 - 15.4%	0.0 - 18.6%
70%					0.0 - 7.7%	0.0 - 15.3%
80%						0.0 - 11.1%

S.D.						
X \ Y	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
30%	2.0%	3.1%	3.9%	3.8%	3.7%	4.3%
40%		1.1%	2.7%	3.1%	3.7%	5.3%
50%			1.5%	2.4%	3.6%	5.4%
60%				2.0%	3.9%	6.1%
70%					2.2%	4.8%
80%						2.8%



Results: Avg. Number of Sector Boundary Crossings within MSP Area



Range						
X \ Y	40%	50%	60%	70%	80%	90%
30%	0 - 45	0 - 37	9 - 38	22 - 54	27 - 71	27 - 102
40%		0 - 39	0 - 41	16 - 91	16 - 83	19 - 105
50%			0 - 63	10 - 91	10 - 89	16 - 111
60%				0 - 98	0 - 89	0 - 125
70%					0 - 113	0 - 119
80%						0 - 119

S.D.						
X \ Y	40%	50%	60%	70%	80%	90%
30%	11.8	11.0	7.9	9.3	13.1	20.5
40%		12.0	11.1	16.8	18.0	25.9
50%			20.3	16.4	20.1	26.4
60%				29.4	27.9	33.6
70%					32.0	42.9
80%						48.9

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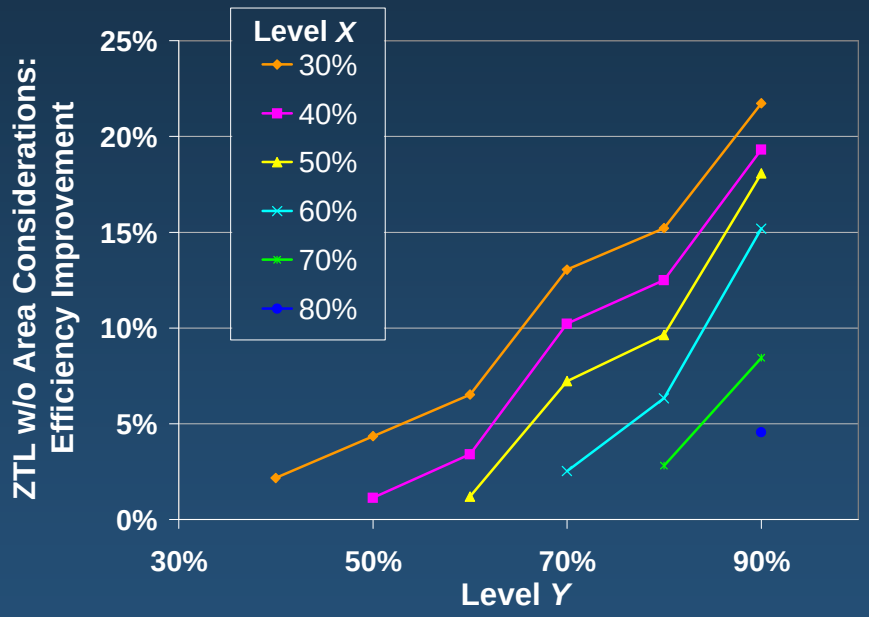
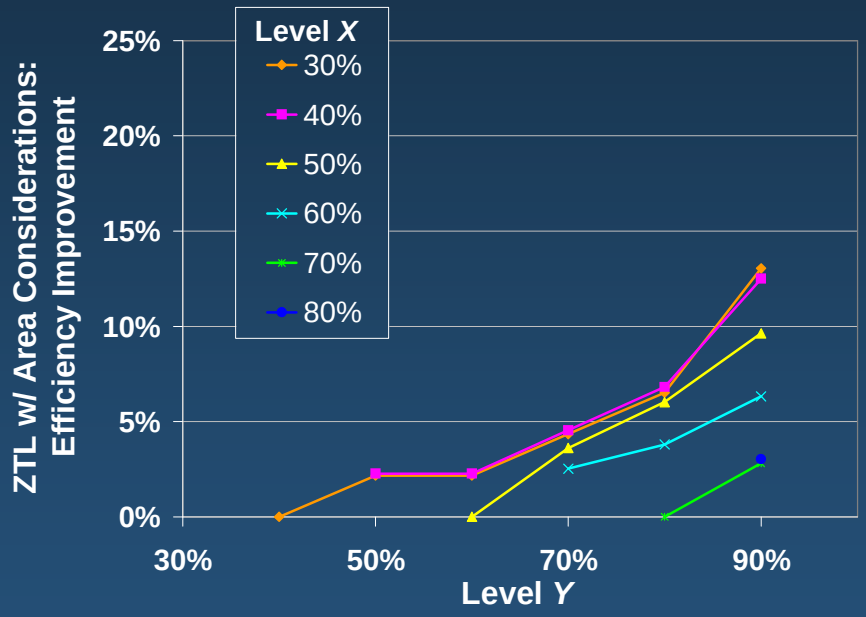
Results: Efficiency Improvement Limitations due to Area Configurations





Conclusions

- Simple methodology for investigating improvement potential in the efficiency of using limited ATC resources
- Yes, significant improvement potential was demonstrated (however...)
- Further research
  - Sensitivity of outcomes to traffic volume
  - Realistic values for the levels *X* and *Y*
  - Should %MAP be replaced by a better estimate of workload limitations
    - Is there a better metric to use instead?
    - Can %MAP or such better metric be observed across all (three) sectors as opposed to within the individual sectors?
  - How do the adopted MSP operational procedures, information displays, DST and training impact the assumptions used in this study?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