Very Light Jet (VLJ) Operational Impact Analysis: ATC Workload Implications

Work in progress

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  - Forecast information and flight profiles based on TSAM model
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  - AwSim™ simulation model dataset development

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Image source: adamaircraft.com

Motivation

- **How will VLJs impact the NAS operationally?**
  - So far, rhetoric about “sky black with dentists”
  - Industry financial impact, ATO financial impact, but not NAS operational impact
- **Overtaking conflicts, traffic flow management**
  - Slower cruise speed may create unexpected increase in conflicts, workload
- **Analogy: tractors on the interstate**

Approach

- **Run flight plan set in 4-D simulation tool (AwSim™) to measure conflicts**
- **Compare conflicts in baseline with future scenarios**
- **Conflicts are a proxy for ATC workload**
  - Although not all ATC workload is associated with conflict resolution; e.g. sector loads are another component
- **Examine airspace >18,000ft**
  - Including cruise and transitioning aircraft

Experimental Design

- **Reference (2005) + 2x2 design (2015)**

	Low FL	*High FL*	
On-demand Success	Treatment A	Treatment B	Initial results
On-demand Failure	Treatment C	Treatment D	Pending

- **Additional hypothetical control (2015)**

Two VLJ flight profiles

- TSAM = Transportation Systems Analysis Model
- SATS = Small Aircraft Transportation System

	TSAM flight set	***SATS flight set***
Average cruise altitude (FL)	**248**	**286**
Average flight time (min)	**43**	**78**

Forecast parameters (2015)

	On-demand success	*On-demand failure*
VLJ fleet	**5000**	**3000**
Utilization	**70%@1400 hrs/yr** **30%@400 hrs/yr**	**all@400 hrs/yr**
Total VLJ hrs flown	**5.5M hrs/yr**	**1.2M hrs/yr**

Flights derived from flight time

- Total flight hrs / avg. flight time = daily flights

Flight time	*TSAM FS: 43 min*	*SATS FS: 78 min*
On-demand Success: 5.5M hrs/yr	**Treatment A: 19,111 flights**	**Treatment B: 11,977 flights**
On-demand Failure: 1.2M hrs/yr	**Treatment C: 4170 flights**	**Treatment D: 2613 flights**

Data source (baseline)

- **April 20, 2005**
  - High volume, good weather
- **ETMS FZ messages**
  - Flight plans

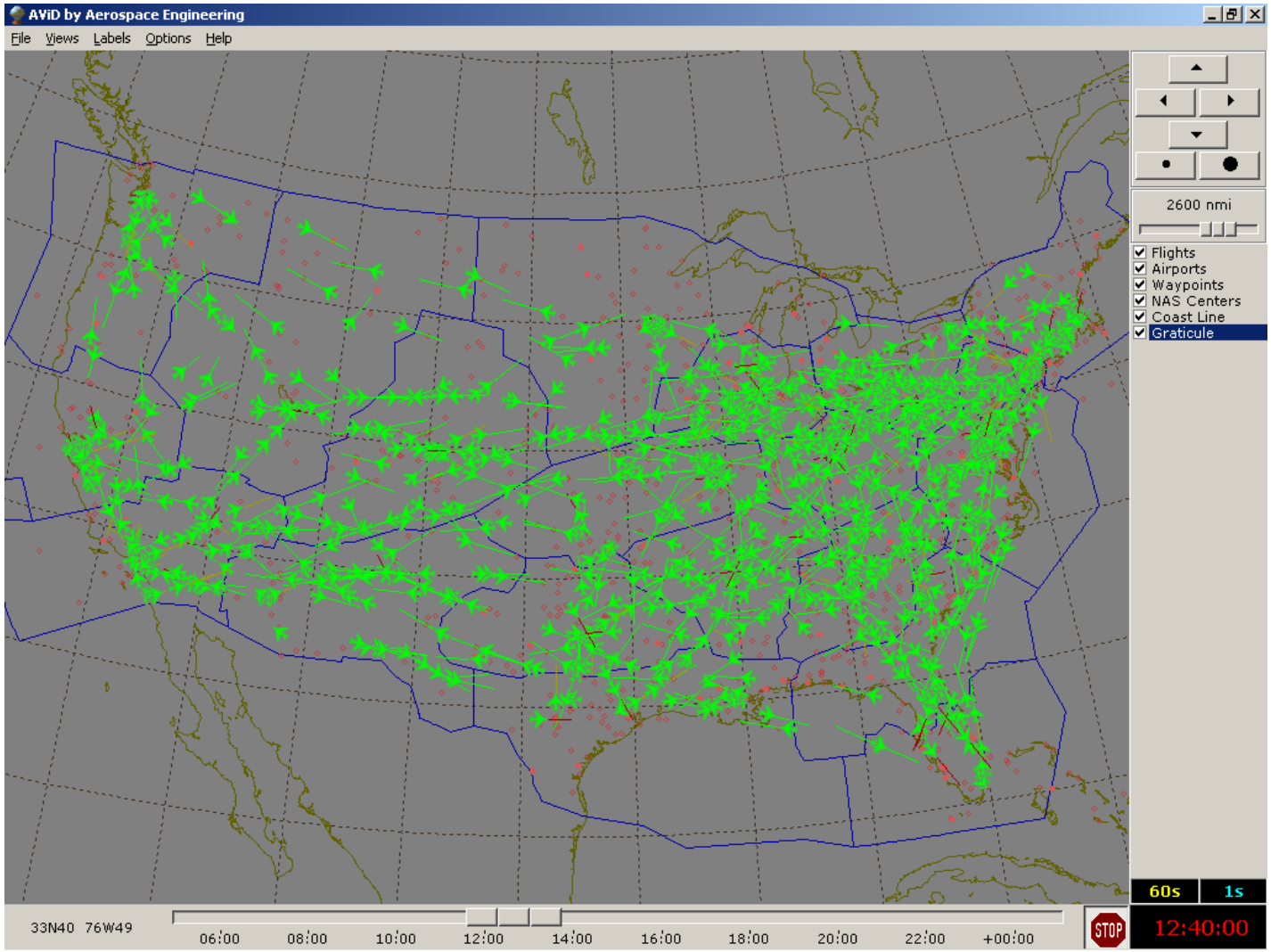
- **Flight plans**
- **Pref routes** → **trajectories → filtering**
- **Waypoints**

Data augmentation

- **2005 → FDG → +VLJ**
  - 16 AC type classes
  - VLJ is 17th AC type class created from Eclipse 500 performance
- **Conflicts: loss of separation**
  - 1000 ft vertical
  - 5 nmi radius

Image source: eclipseaviation.com

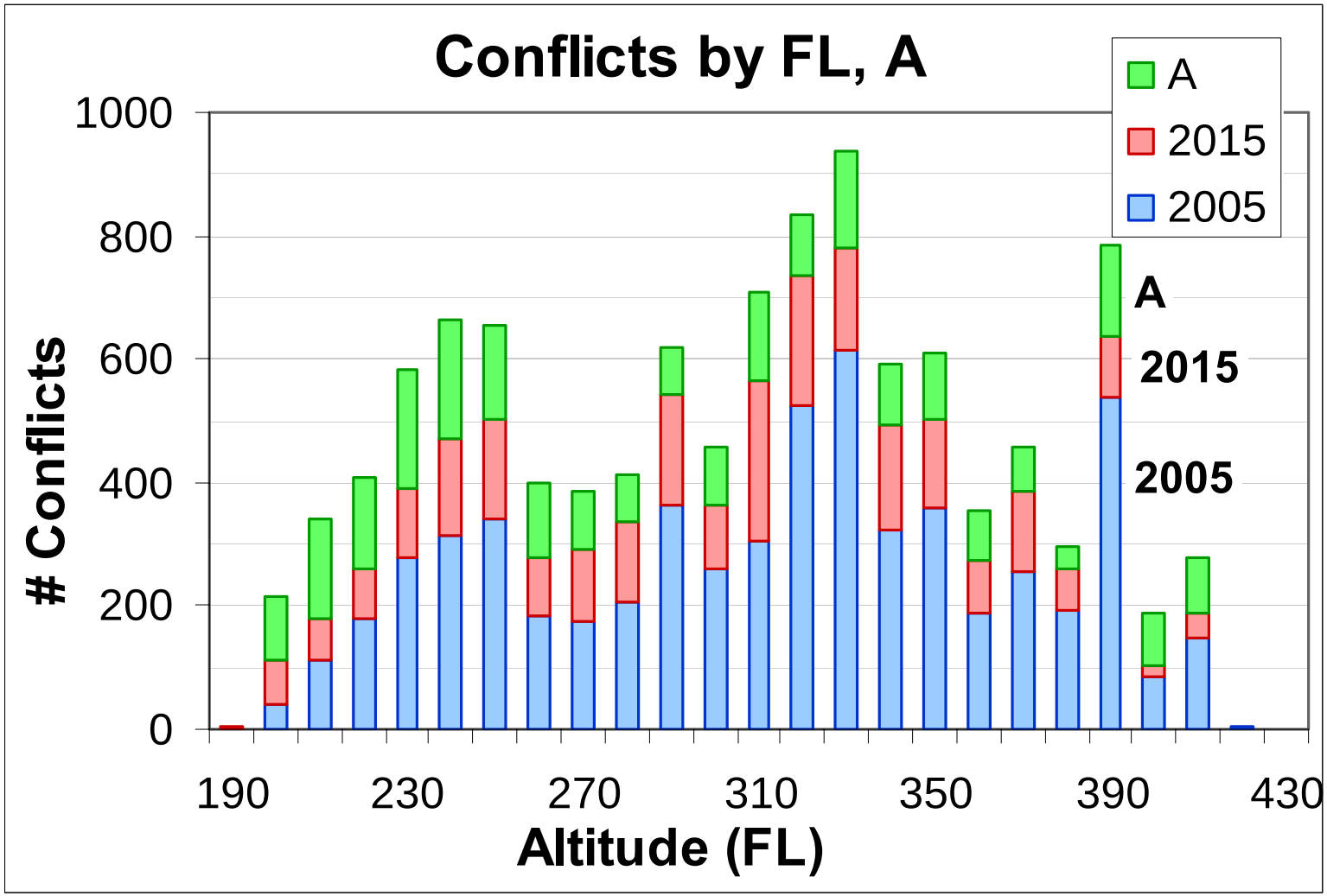
Run the simulations in AwSim™



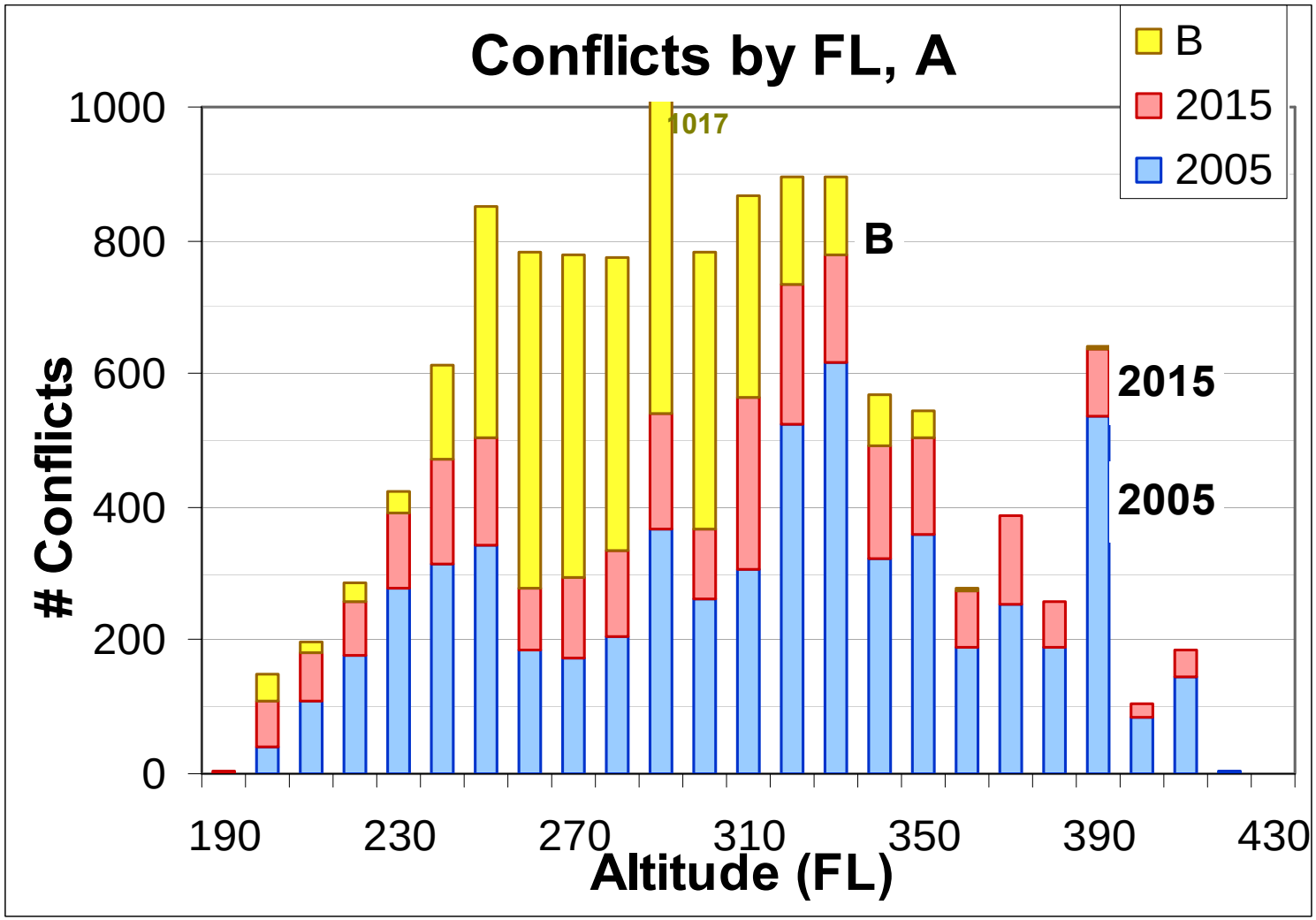
Results I: overall comparison

	2005	*2015*	*A (2015, TSAM)*	*B (2015, SATS)*
nonVLJ Flights	47,208	53,533	53,533	53,533
VLJ Flights	0	0	19,111	11,977
Total flights	47,208	53,533	72,644	65,510
Total conflicts	6032 (13%/fl)	8711 (16%/fl)	11,284 (16%/fl)	12,367 (19%/fl)

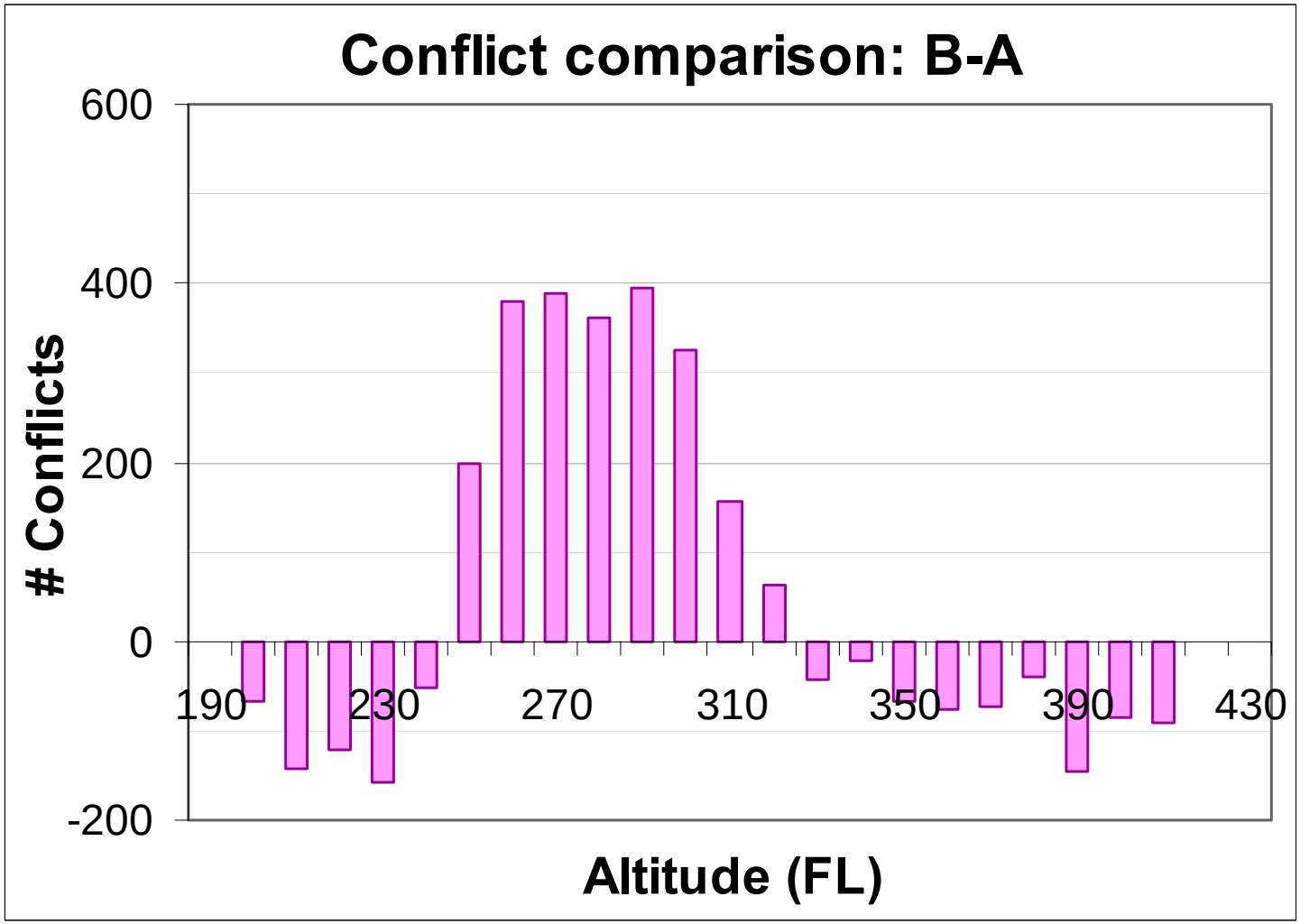
Results IIa: by FL



Results IIb: by FL (continued)

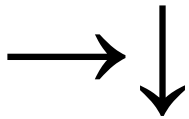


Results llc: by FL (continued)



Results IIIa: by conflict direction

Head-on



Crossing

Overtaking

	2005	*2015*	*A (2015, TSAM)*	*B (2015, SATS)*
Total conflicts	6032	8711	11,284	12,367
head-on/ crossing/ overtaking	1914 (32%)/ 2506 (42%)/ 1612 (27%)	2570 (30%)/ 3295 (38%)/ 2846 (33%)	3580 (32%)/ 4479 (40%)/ 3225 (29%)	3929 (32%)/ 5266 (43%)/ 3172 (26%)

Results IIIb: overtaking by AC type class

- **VLJ-other AC type overtaking conflicts as a percentage of total conflicts**

AC type	Treatment A	Treatment B
HJet	11%	10%
LJet	12%	10%
SJet	13%	9%
VLJ	18%	7%
LTP	22%	36%
STP	23%	14%

Preliminary observations

- **VLJ contributes to overall workload increase**
  - But not unexpectedly
  - Workload increase may have been much more without DRVSM
- **VLJ impact highly dependent on FL choice**
  - Higher FL trajectory set has more conflicts
- **Seems like no great increase in overtaking conflicts**
  - Perhaps not enough speed difference
  - Greater % overtaking VLJ-turboprop

Next steps

- **Finalize Treatment A & B results**
- **Treatments C, and D**
  - On-demand flop scenarios
- **Corroboration of results with other models**
- **Other workload measures**
  - TFM, sector load,
- **Terminal phase of flight**
  - Not just airport demand, or OD market demand

Ask now or email later:

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FAA,
ATO,
Operations Planning,
Office of Strategy

Image source: embraer.com