



# Direct-To Controller Tool

Dave McNally  
Direct-To Project Lead  
Automation Concepts Branch

Heinz Erzberger  
Senior Scientist  
Aviation Systems Division

FAA/NASA Joint University Program Meeting  
NASA Ames Research Center  
April 4-5, 2002





# Origins

- Under current day operations aircraft generally fly on fixed routes and en route Center radar controllers have very limited automation to help them work traffic more efficiently.
- Potential of a Direct-To Tool was discovered unexpectedly during field tests of CTAS Conflict Probe / Trial Planning functions at Denver Center (Sept. 97) and was confirmed at Fort Worth Center (Nov. 98)
- At both centers, controllers pointed out a preferred use for the Trial Planning function: Searching for and evaluating direct routes that are conflict free.
- The Direct-To Tool was built to automate the search for and execution of direct route trajectories.





# Direct-To (D2) Features

- Radar controller tool for analysis and input of route and altitude options
- Advisories for traffic conflicts and time-saving (wind-favorable) direct routes
- Trial Planner analyzes traffic conflicts, wind effect on flying time, preferential routing restrictions, special use airspace
- Rapid feedback software design and sparse information display well suited to radar controller
- Based on CTAS trajectory analysis methodology and software. One additional module connected to CTAS TMA system





# D2 Route Advisories

Direct-To identifies aircraft that can save at least one minute by flying direct to a down-stream fix on their route of flight.

Route advisories are displayed in the flight data block (FDB) and an optional list on the controller's traffic display

Direct-To Sector 39, 94						
TP	ACID/EQUIP/DEST	Mins. Saved	Fix/Hdg	OK/C	-	
<input type="checkbox"/>	6 N797FA/G/SDL	2.9	TXO/279	OK	<input type="checkbox"/>	
<input type="checkbox"/>	SWA30/I/ABQ	1.7	ABQ/270	OK	<input type="checkbox"/>	
<input type="checkbox"/>	AAL1227/A/LAX	1.4	ABQ/271	3	<input type="checkbox"/>	

The Trial Planner allows controllers to easily display, modify, and input Direct-To flight plan amendments to the Host computer.

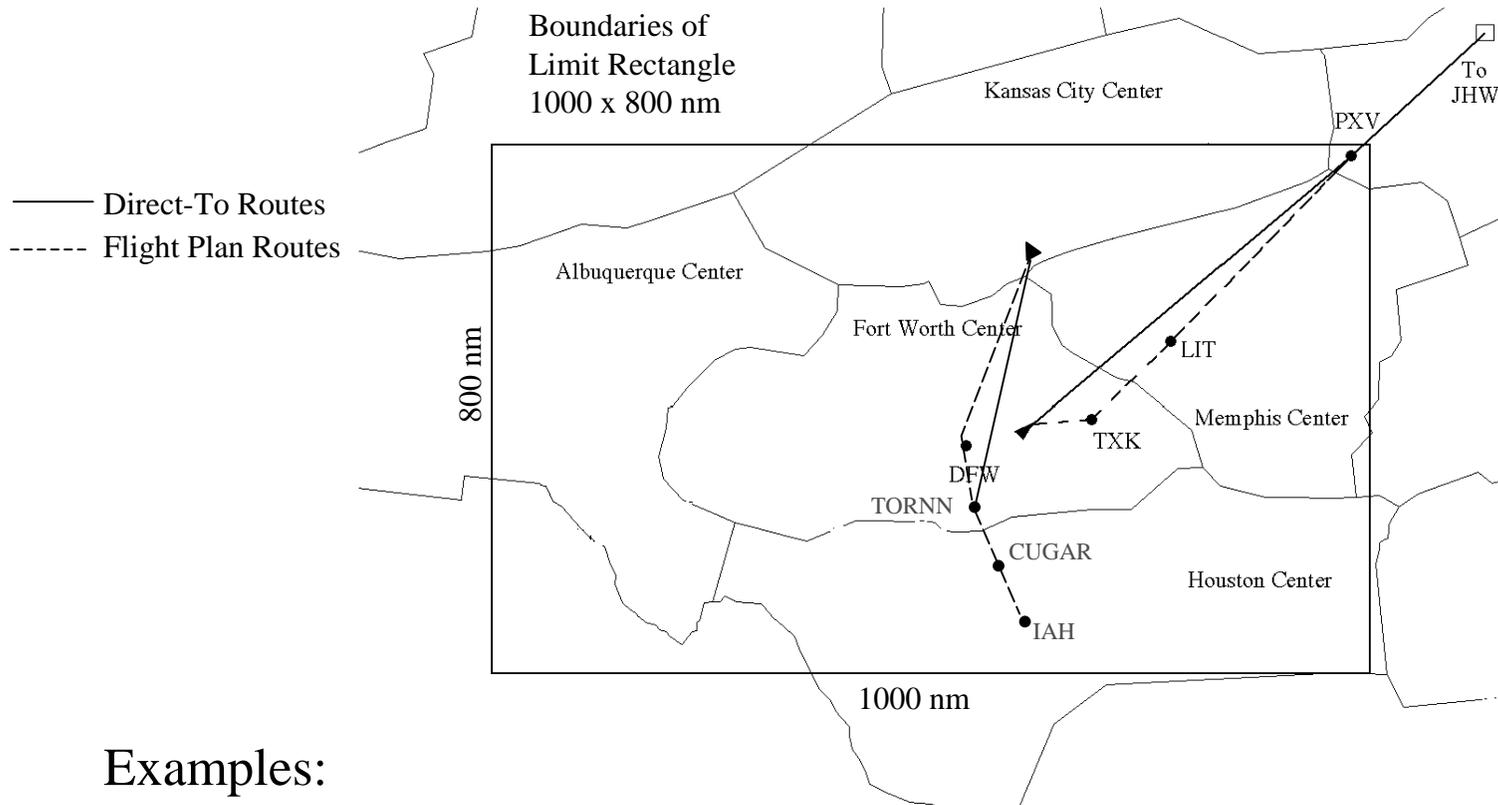
Potential savings in flying time for Ft. Worth Center airspace is approximately 1,800 minutes per day or about 2.5 minutes per Direct-To clearance advisory.

N797FA > 6  
 330 C  
 215 390





# D2 Routing Algorithm



Examples:

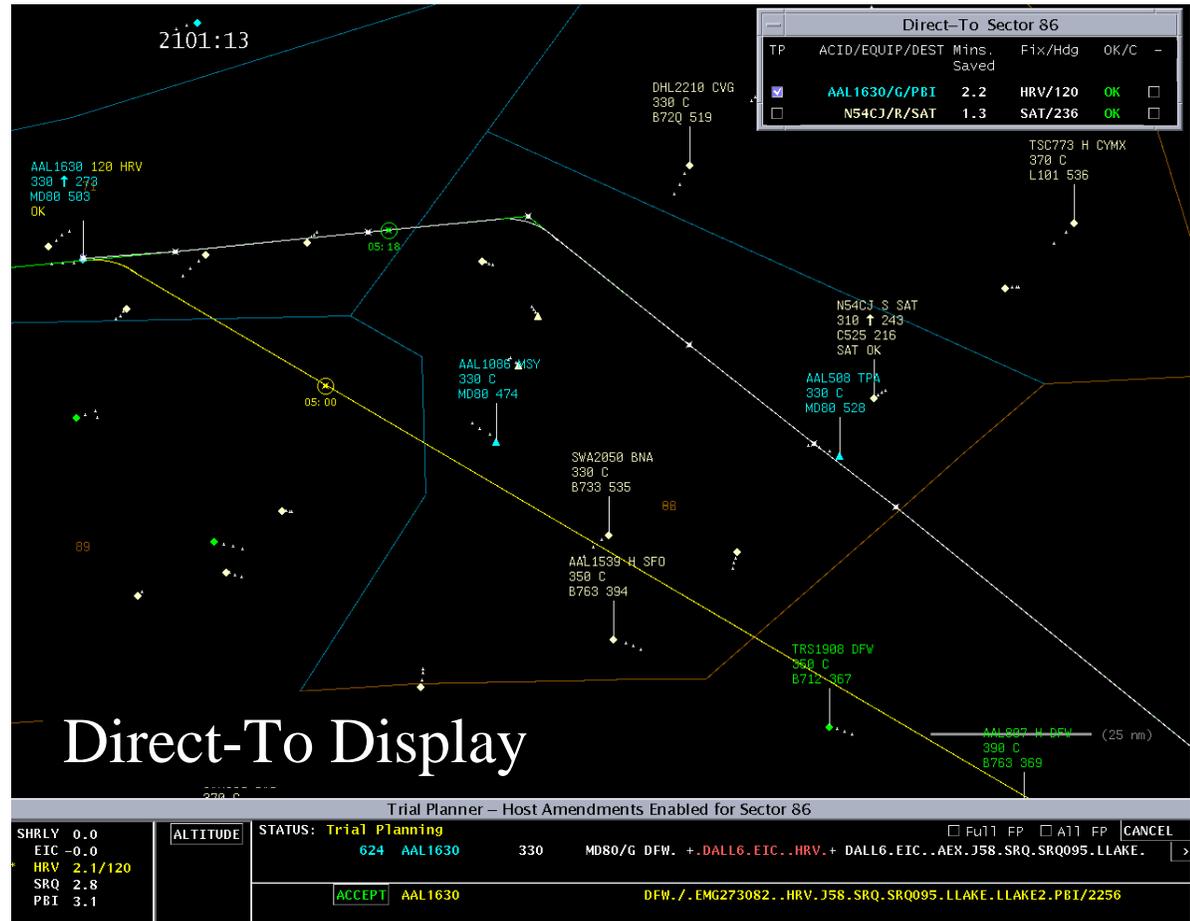
DFW.DALL5.TXK ..LIT.J131.PXV.J29.JHW.J82.ALB.GDM2.BOS  
MSP./.TUL.J87.BILEE.CUGAR6.IAH





# Trial Planner

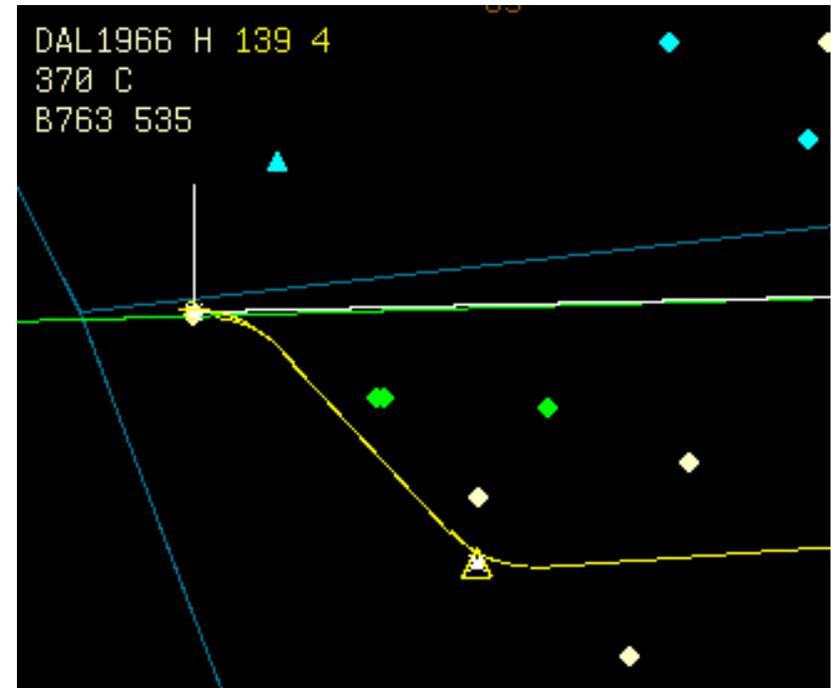
- Click D2 advisory (list or FDB) to activate Trial Planner
- Trial Plan status updates every 1 sec
  - Graphic display
  - Traffic Conflicts
  - Pref. Routings
  - Time Savings
  - Special Use Airspace
- Click fix menu to modify route
- Click “Accept” to amend flight plan





# Auxiliary Waypoints

- Click and drag anywhere on trial plan route to add auxiliary waypoint
- Wind-corrected magnetic heading to the waypoint appears in flight data block
- Waypoint automatically added to flight plan amendment message

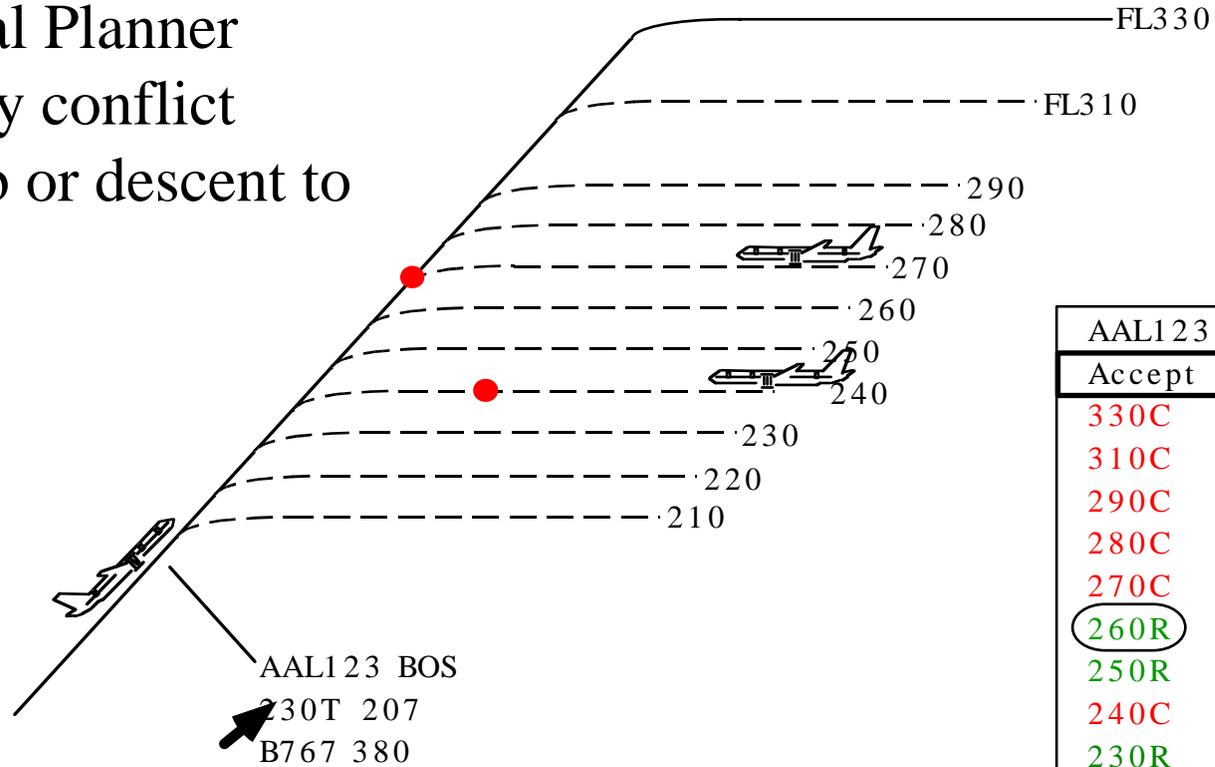






# Automatic Altitude Probe

Altitude Trial Planner  
automatically conflict  
probes climb or descent to  
any altitude



Climb Example





# Direct-To Operational Testing





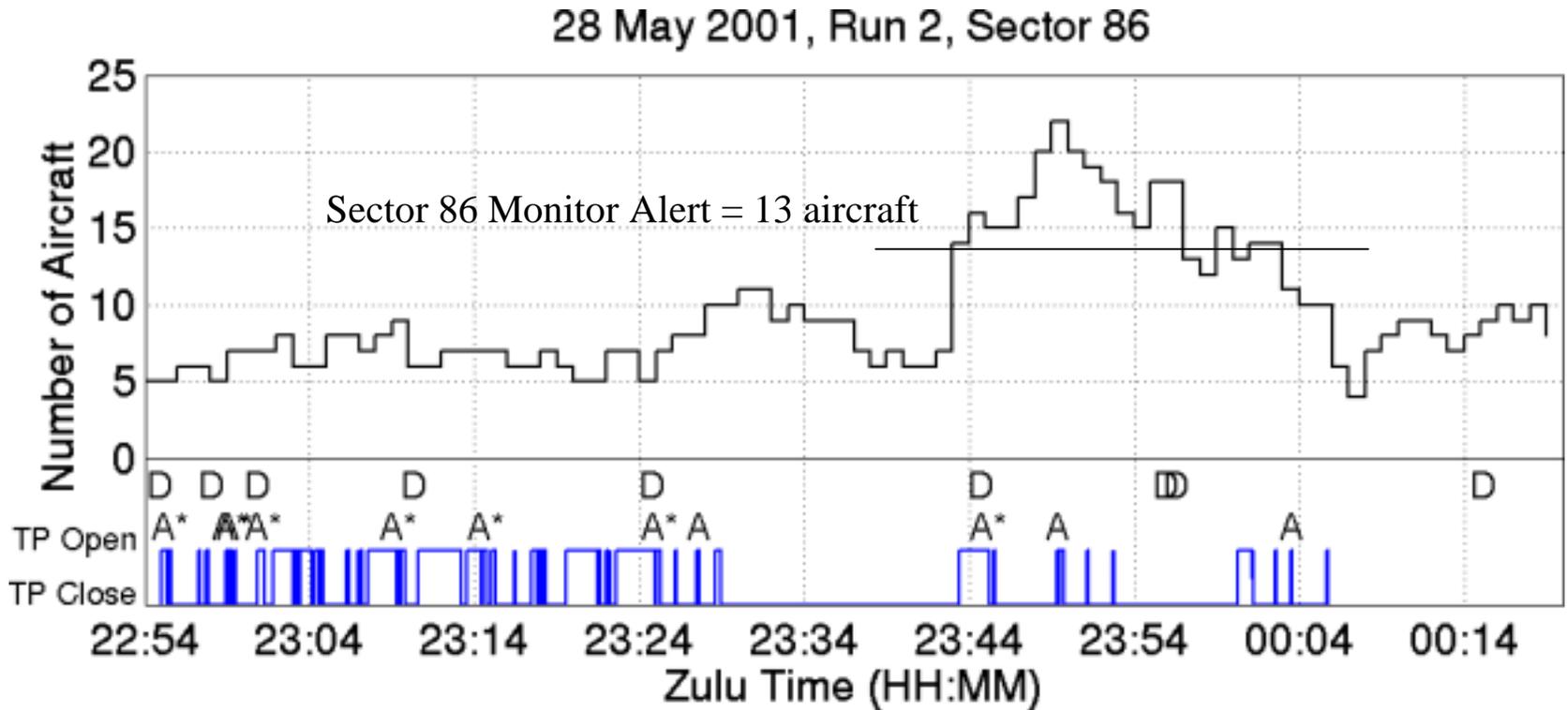
# Field Test Operations

- 3 high altitude sectors, Fort Worth Center, May 21 - June 14, 2001.
- 9 member controller team
- D-Side controller operated Direct-To Tool
- 4 weeks, 4 days/week, 136 sector-hours
- 3204 trial plans, 1198 flight plan amendments





# Trial Planner Usage - Monitor Alert Period





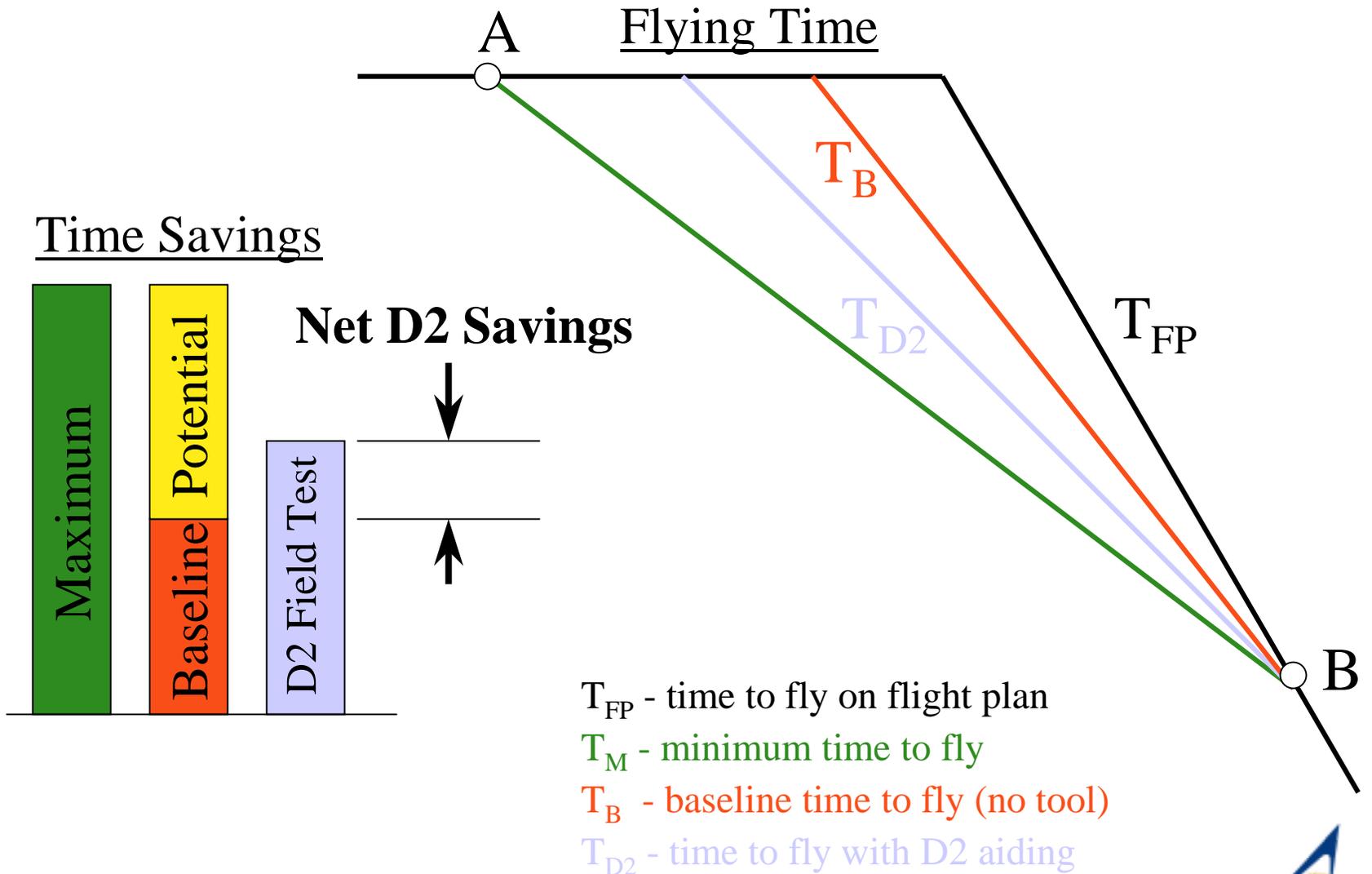
# Direct-To Usage vs. Traffic Count







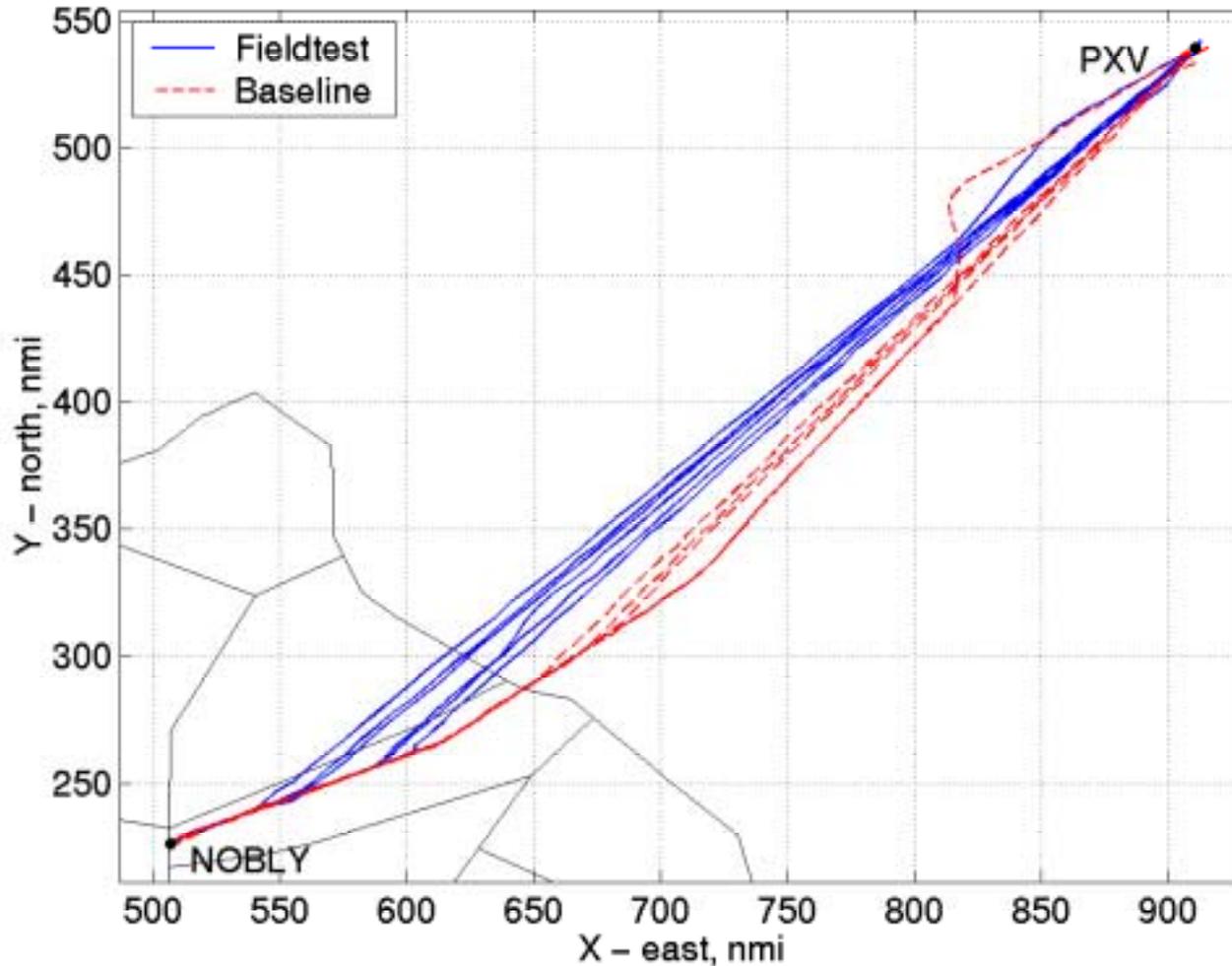
# Flying Time Savings Model





# Texarkana/PXV - DAL204

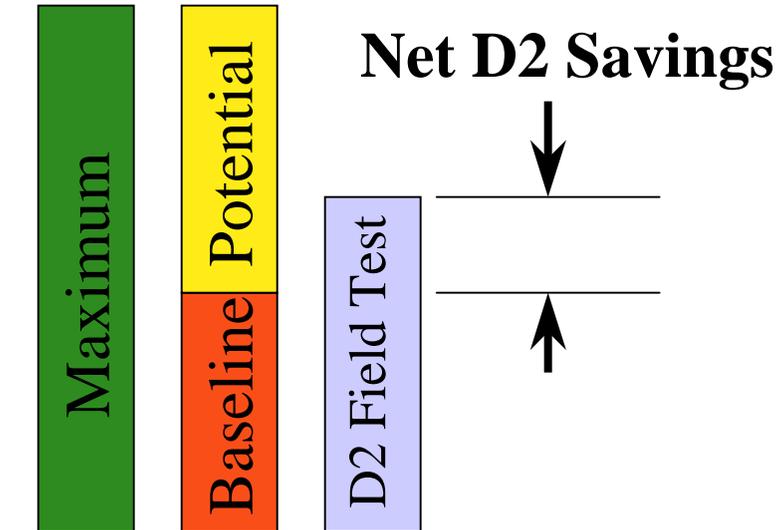
Average Net D2 Savings = 0.96 Minutes





# Normalized Net D2 Savings

## Time Savings



$$S = \frac{\text{Net D2 Savings}}{\text{Potential Savings}}$$

	No. Field Test Flts.	No. Base-line Flts.	<b>S</b>
DAL204	6	5	59%
All 90/PXV	25	51	35%
AAL1614	4	6	66%
All 86/HRV	18	27	51%





# Conclusions

- Direct-To is suitable for the R-Side traffic situation display and will provide substantial benefit to the R-Side controller.
- Direct-To facilitates a net savings in flying time for aircraft operating in Fort Worth Center.
  - 1 minute on common routes
  - 5 minutes or more on obsolete weather avoidance routes
  - 50% of facility-wide potential savings
- Direct-To and TMA can run on a common CTAS system under operational conditions.





# Current Research

- Merge D2 with operational radar displays (DSR R-Side)
- Develop methods for integration of D2 with Traffic Flow Management and arrival metering





# References

[www.ctas.arc.nasa.gov](http://www.ctas.arc.nasa.gov)

## Publications

UPR Papers

Direct-To Papers

POC: Dave McNally

[dmcnally@arc.nasa.gov](mailto:dmcnally@arc.nasa.gov)

(650) 604-5440

