

Precision Departure Release Capability (PDRC)

NASA to FAA Research Transition

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On behalf of NASA's Airspace Systems Program

6 August 2013



PDRC Highlights

- Potential to assist in tactical departure clearances impacting metered airports
 - Over 30,000 aircraft per month will get improved departure clearances into constrained overhead/enroute flows
 - 22% of arrival aircraft will have significantly improved arrival meter schedules



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- A field-validated automation tool leveraged off existing FAA systems (TMA and SDSS)
 - OFF Time compliance improvement from 54% to 83%
 - Nearly a 1-minute improvement in both mean and standard deviation of OFF Time predictability

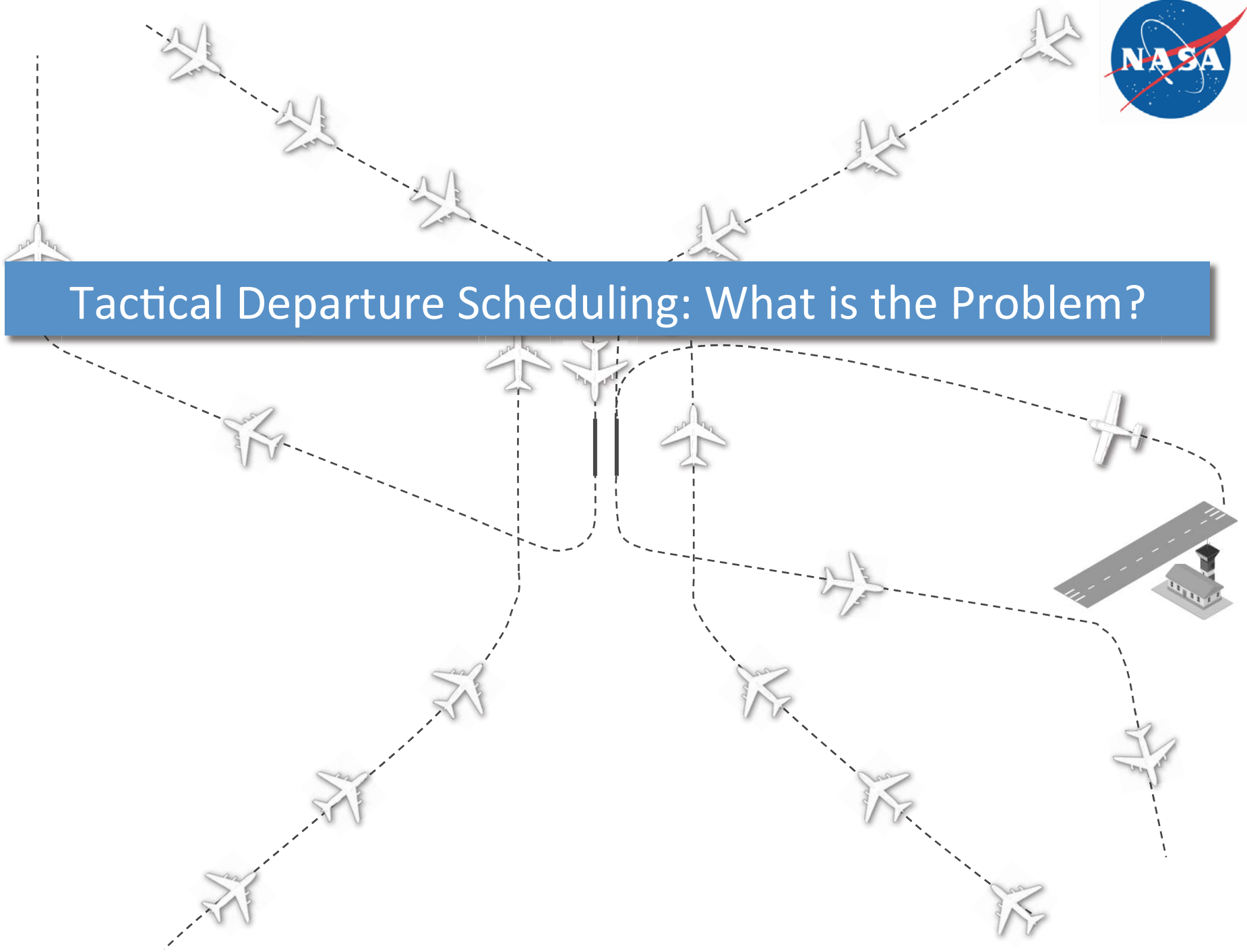


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- A field-validated automation tool leveraged off existing FAA systems (TMA and SDSS)
 - OFF Time compliance improvement from 54% to 83%
 - Nearly a 1-minute improvement in both mean and standard deviation of OFF Time predictability
- Concept of Operations, Technology Description and Operational Evaluation results all handed over to the FAA



Tactical Departure Scheduling: What is the Problem?



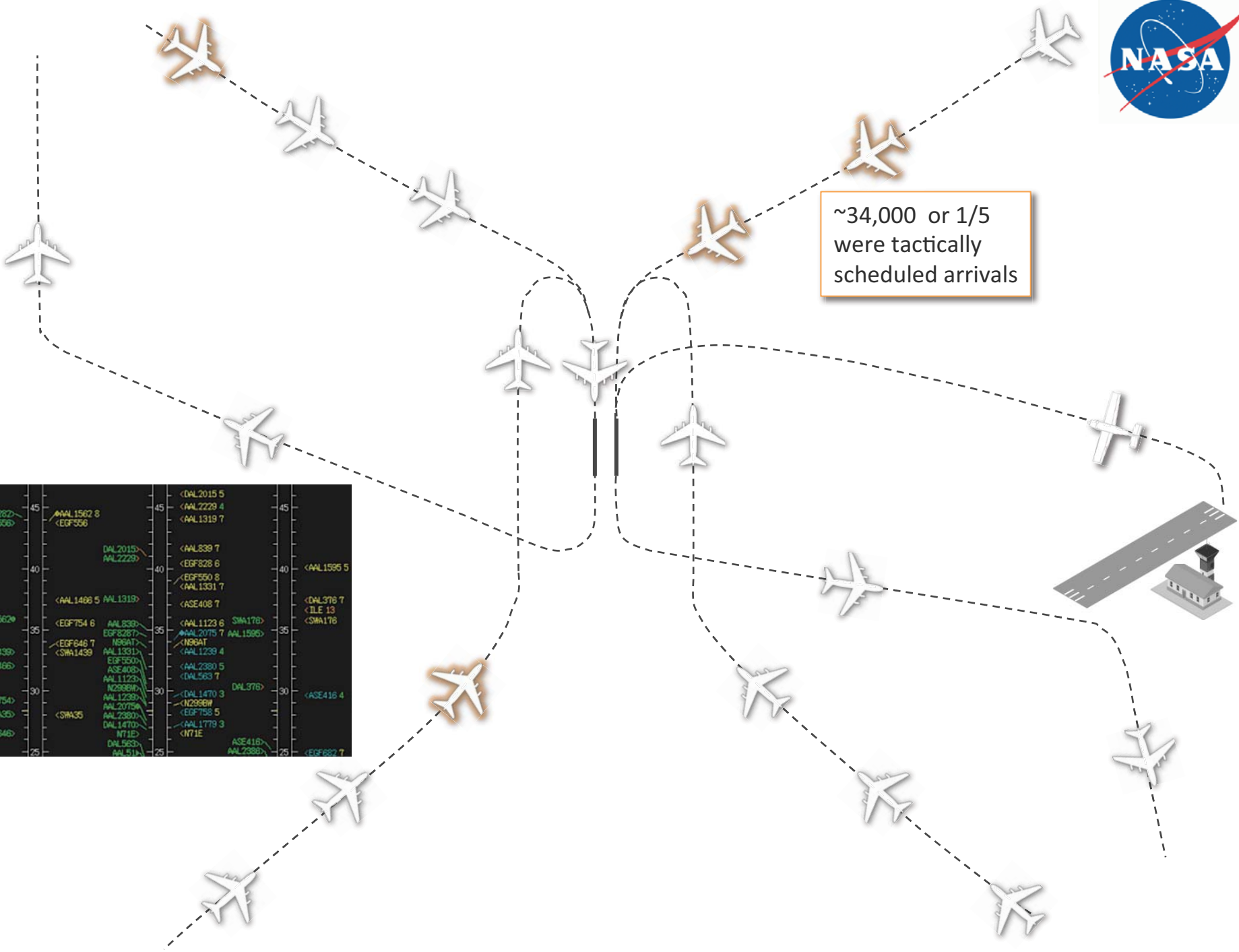
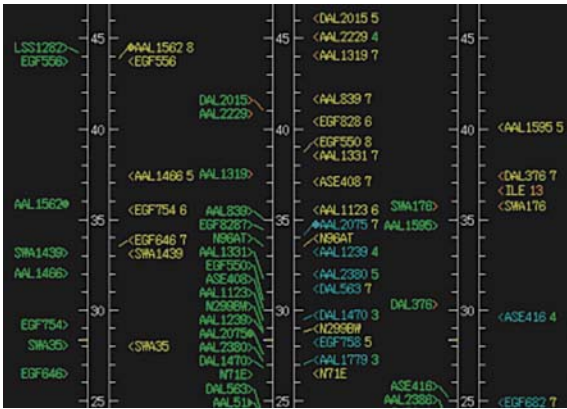
150,000+ TMA Metered flights in January 2011

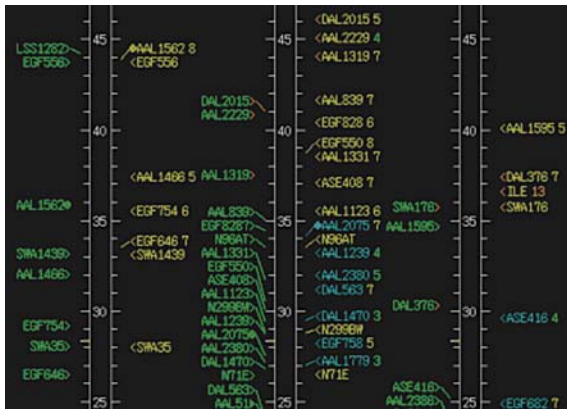


LSS1287 EGF506	ANAL1562 8 (EGF506)	DAL2015 AAL2229	ANAL1488 5 AAL1319	EGF754 6 AAL839 EGF8287 N98AT	EGF846 7 (SWA1439)	ANAL1531 EGF550 ASE408 AAL1123 N299BN AAL1239 AAL2079A AAL2689 DAL1470 N71E DAL563 AAL511	DAL2015 5 AAL2229 4 AAL1319 7	AAL839 7 EGF828 6 EGF550 8 AAL1351 7 ASE408 7	AAL1123 6 SWA178 AAL2075 7 AAL1596 N98AT AAL1238 4 AAL2380 5 DAL583 7	DAL1470 3 N299BN EGF758 5 AAL1779 3 N71E	ASE416 AAL2689	AAL1595 5	DAL378 7 ILE 13 (SWA178)	ASE416 4	EGF682 7
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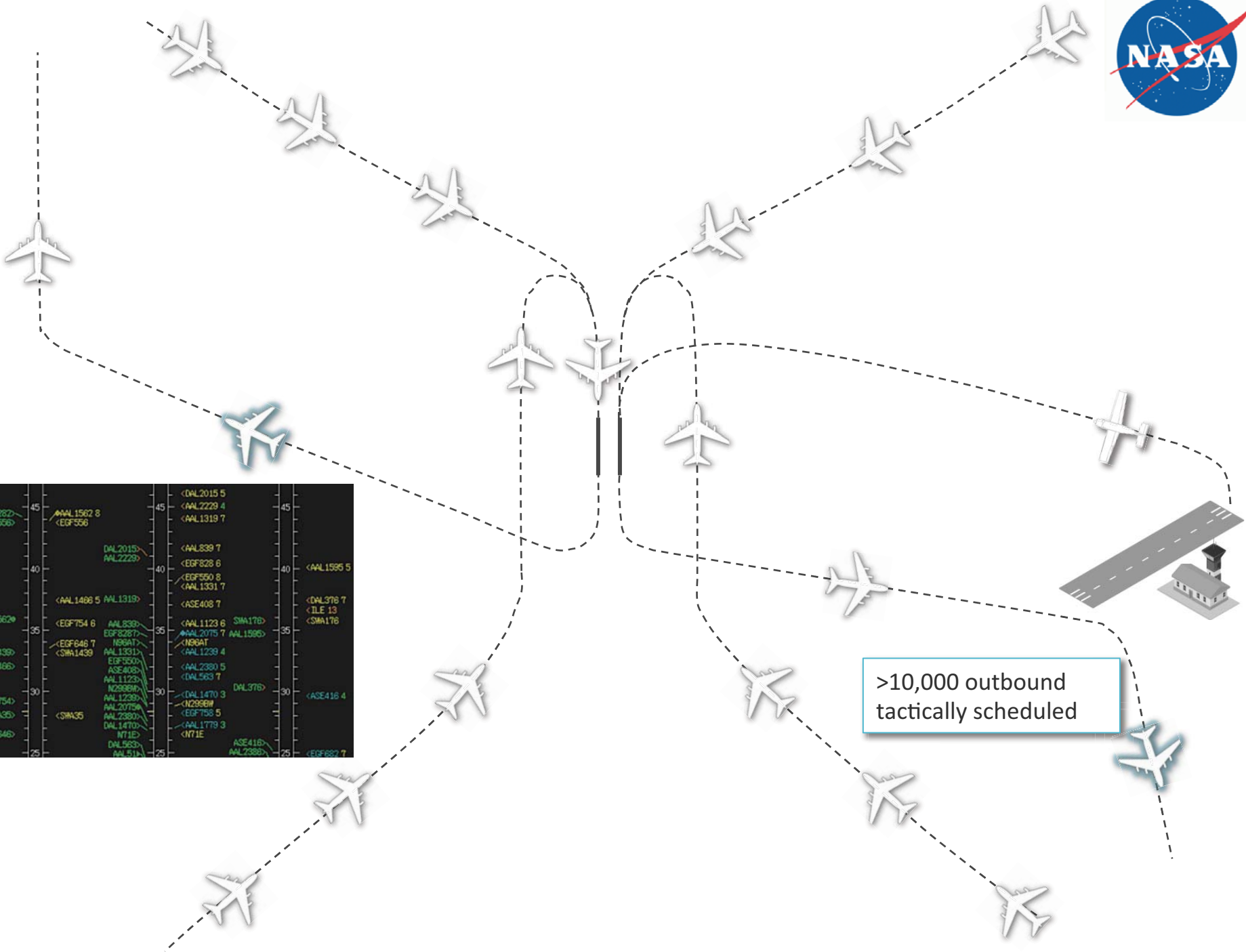


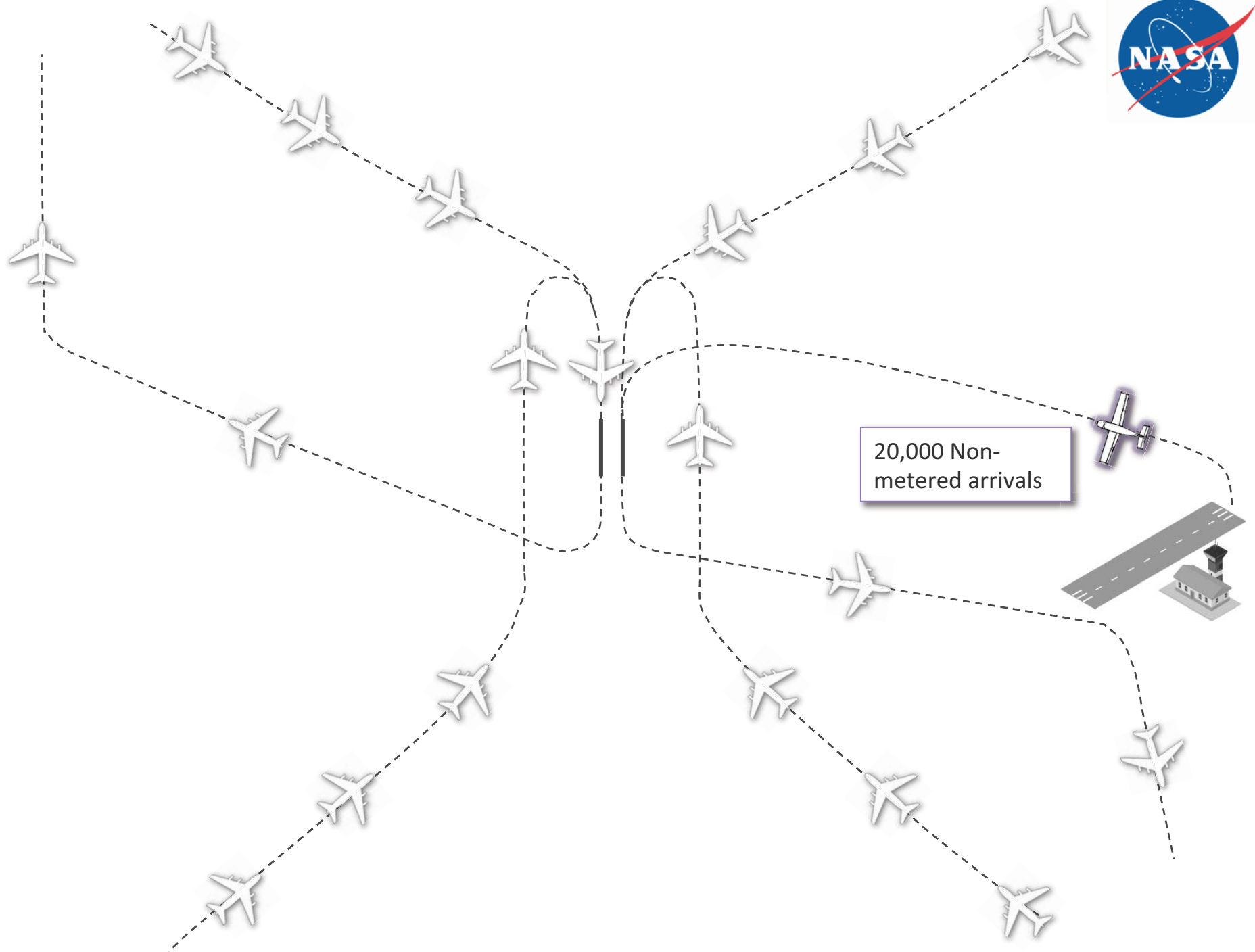
~34,000 or 1/5 were tactically scheduled arrivals



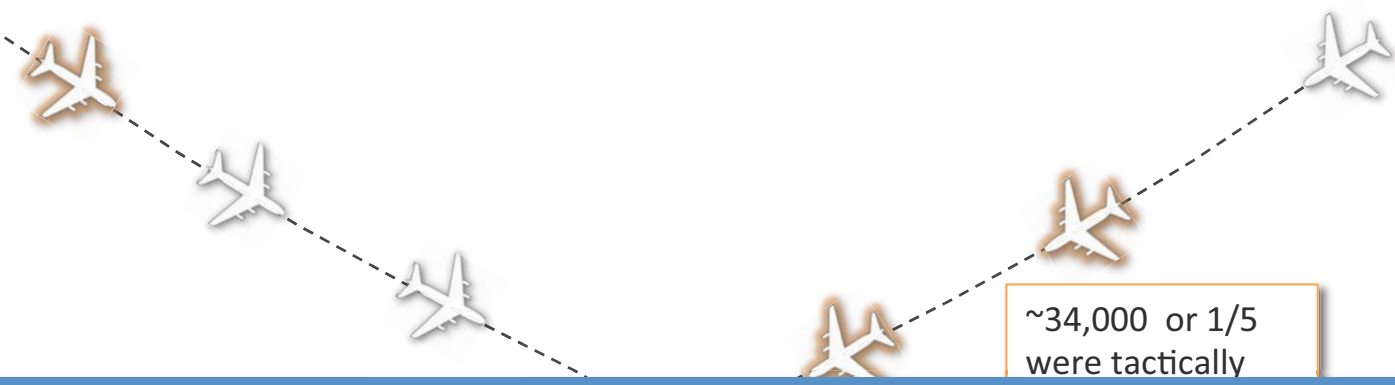


>10,000 outbound
tactically scheduled



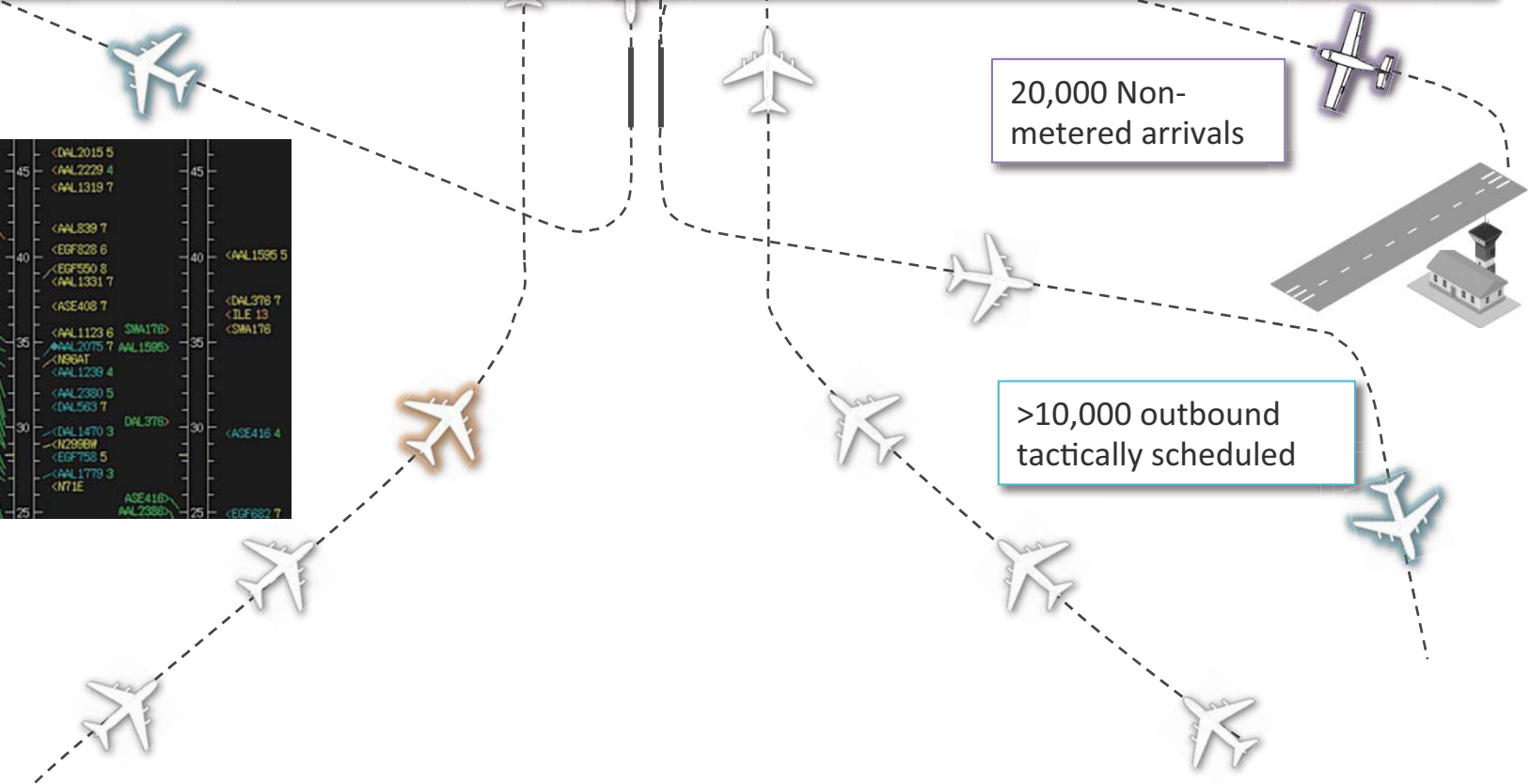


20,000 Non-metered arrivals



~34,000 or 1/5 were tactically

PDRC has the potential to significantly improve and increase tactical departure clearance compliance to metered airports



20,000 Non-metered arrivals

>10,000 outbound tactically scheduled

LSS1287 EGF306	ANAL1562 8 (EGF306)	DAL2015 AAL2229	ANAL1488 5 AAL1319	EGF754 6 AAL839 EGF8287 N96AT	EGF846 7 (SWA1439)	ANAL1531	EGF550	ASE408 7	AAL1123 6 SWA178	AAL2075 7 AAL1596	N96AT	AAL1238 4	DAL1470 3 DAL376	DAL1470 3 (N299EM) EGF758 5	AAL1778 3 (N71E)	ASE416 4	DAL583 AAL511	DAL2015 5	AAL2229 4	AAL1319 7	AAL839 7	EGF828 6	AAL1595 5	DAL376 7	ILE 13 (SWA178)	AAL1238 4	AAL2380 5	DAL583 7	DAL1470 3	(N299EM)	EGF758 5	AAL1778 3	(N71E)	ASE416 AAL7388	EGF682 7
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Today's Departure Operations



ARTCC



Technology Imbalance

En route trajectory-based decision support tool develops tactical departure schedules using...



ARTCC

TRACON

Manually-computed OFF time predictions



Today's Departure Operations



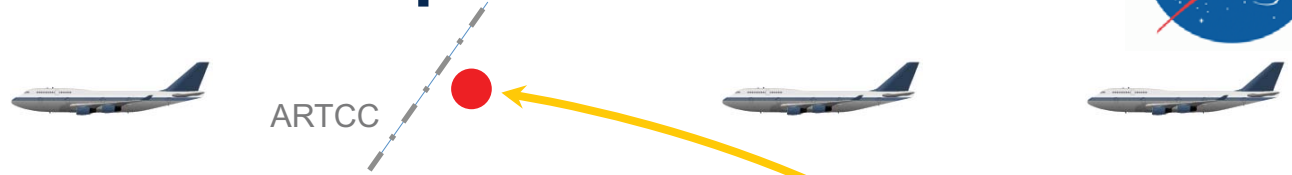
Technology Imbalance



Can be addressed with information from NextGen surface trajectory-based operations tools



PDRC Concept Overview



2115:24

Center DST

Schedule a Departure

TWY Arrival: AAL100J DFW RWY 08B

Original Estimate

ViewChart

Light To No 08:14 23Hz

ETE 23Hz

Eth

Alcane Requested

Aircraft-Ready Time (z): 2115

Host Data

Current

2119

Delete Release

Free Release

Desired STA (z): 2134

Schedule

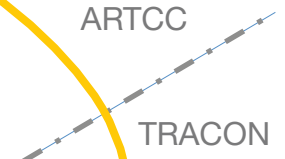
Current Available STA (z): 2135

Suggested Dep (z): 2129 Delay: +2

Scheduled Dep (z): 2129

Delay Scheduled Flights for This Aircraft Only

Freeze Accept Close

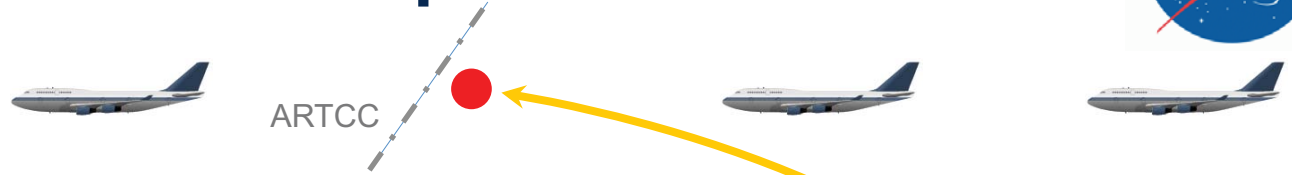


Tower DST

EGF3333 SOLOO 816	18013146	FERRA	254	1801	
COM3103 SOLOO 816	AAL100J	18022139	ORNTZ	141	1801
18L2111 TRISS 287	2-C-7969	18021219	TRISS	0558	1801
AAL742 TRISS C35	AAL1575	18012026	JAGPA	1418	1801
AAL878 TRISS A34	EGF2941	18012147	SOLOO	141	1801
EGF2903 CLARE D6	AAL241	18012517	BLECO	141	1801
EGF0154 GRABE B3					
EGF2985 ARDIA B21					
AAL868 NOBLE A36					
AAL892 TRISS C13					
OTHER AGUNA D10					
EGF2903 CLARE B80					
AAL1315 SOLOO A26					
AAL431 GRABE A19					
AAL2083 NOBLE A36					
EGF2763 SOLOO 816					
EGF2990 AGUNA B14					
EGF2891 GRABE B18					
EGF2941 SOLOO 841					
21:20:02					
EGF2111 CLARE B13					
EGF3339 CLARE B27					

Current time: 21:20:02 GMT Configuration: A.318R.17C.17L.11

PDRC Concept Overview



2115:24

Center DST

Schedule a Departure

TWY Arrival: AAL1001 DFW 0800

NO TOLDO TIME FOR TWY TIME

WAGCALHILE_INCR.LK000

Original Estimate

ViewChart

Light To No 08:14 23Hz

ETC Etn

Release Requested

Aircraft-Ready Time (z): 2115

Host Data 2115

Current 2115

Free Release

Desired STA (z): 2134

Slotgate

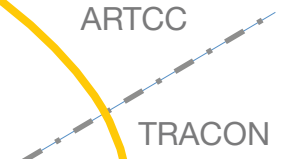
Closest Available STA (z): 2135

Suggested Dep (z): 2129 Delay: +2

Scheduled Dep (z): 2129

Delay Scheduled Flights for This Aircraft Only

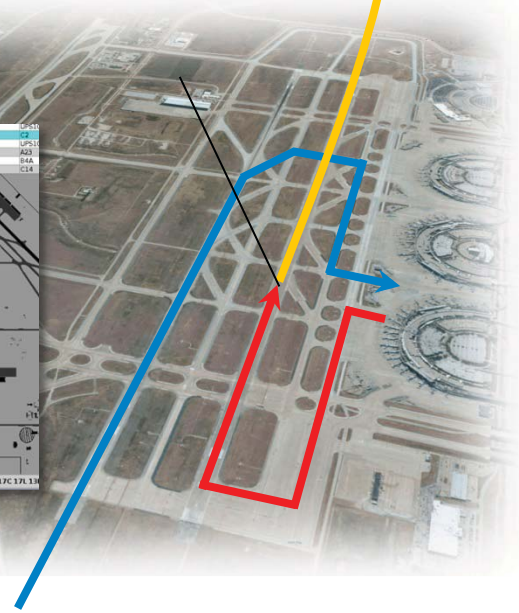
Freeze Accept Close



Tower DST

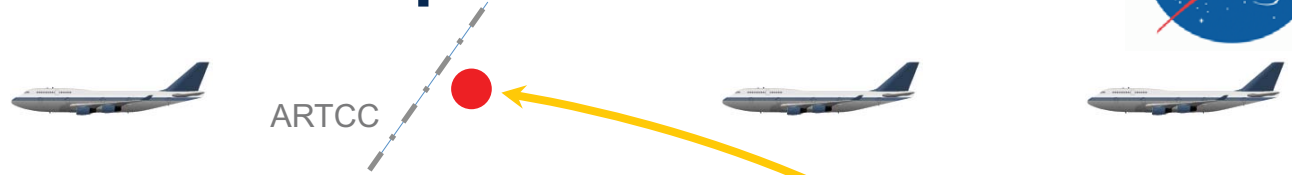
EGF303 SODO 816	18013146	FERRA	204	08:11	
COM303 SODO 816	AAL1001	18012139	ORNTZ	IMT	CR
AAL211 TRISS 287	EGF309	18012137	TRISS	0808	UP:1
AAL742 TRISS C35	AAL1575	18012129	JASPA	ANR	AJ3
AAL728 TRISS A34	EGF2941	18012147	SODO	AK	BA4
EGF293 CLARE D6	AAL241	18012117	BLECO	AK	C14
EGF254 ARDA B21					
EGF295 ARDA B21					
AAL68 NOBLE A36					
AAL492 TRISS C18					
EGH27 AGUNA D10					
EGF293 CLARE B80					
AAL1515 SODO A26					
AAL431 GRABE A19					
AAL208 NOBLE A36					
EGF2763 SODO 816					
EGF293 AGUNA B14					
EGF2811 GRABE E18					
EGF2941 SODO 841					
21:20:02					
EGF211					
EGF3339 CLARE B27					

Current time: 21:20:02 GMT Configuration: A.318R.17C.17L.11



Surface system OFF times and runway assignments predictions

PDRC Concept Overview



Communication of assigned OFF times and more accurate departure scheduling

Field	Value
Flight Number	11W Arrival: AAL1100/DFW 0800
Original	11W
Destination	DFW
Altitude	35000
Speed	480
Departure Time	0800
Arrival Time	1100
Desired STA (z)	2134
Current Available STA (z)	2135
Suggested Dep (z)	2129 Delay: +2
Scheduled Dep (z)	2129



Center DST

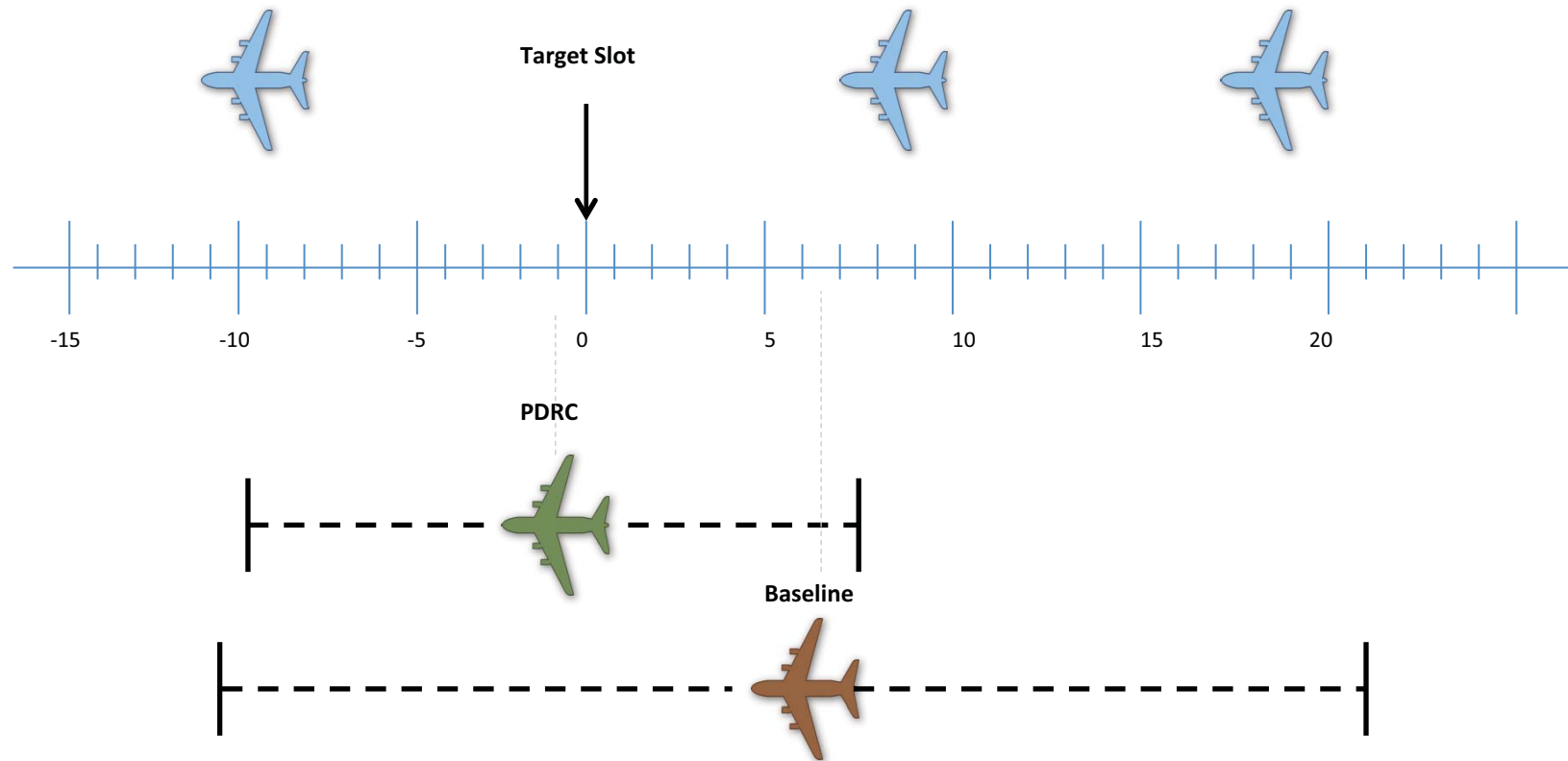
Surface system OFF times and runway assignments predictions

Flight	Time	Status
EGF3339 CLARE B27	21:20:00	ARRIVE
EGF3339 CLARE B27	21:20:00	ARRIVE
EGF3339 CLARE B27	21:20:00	ARRIVE

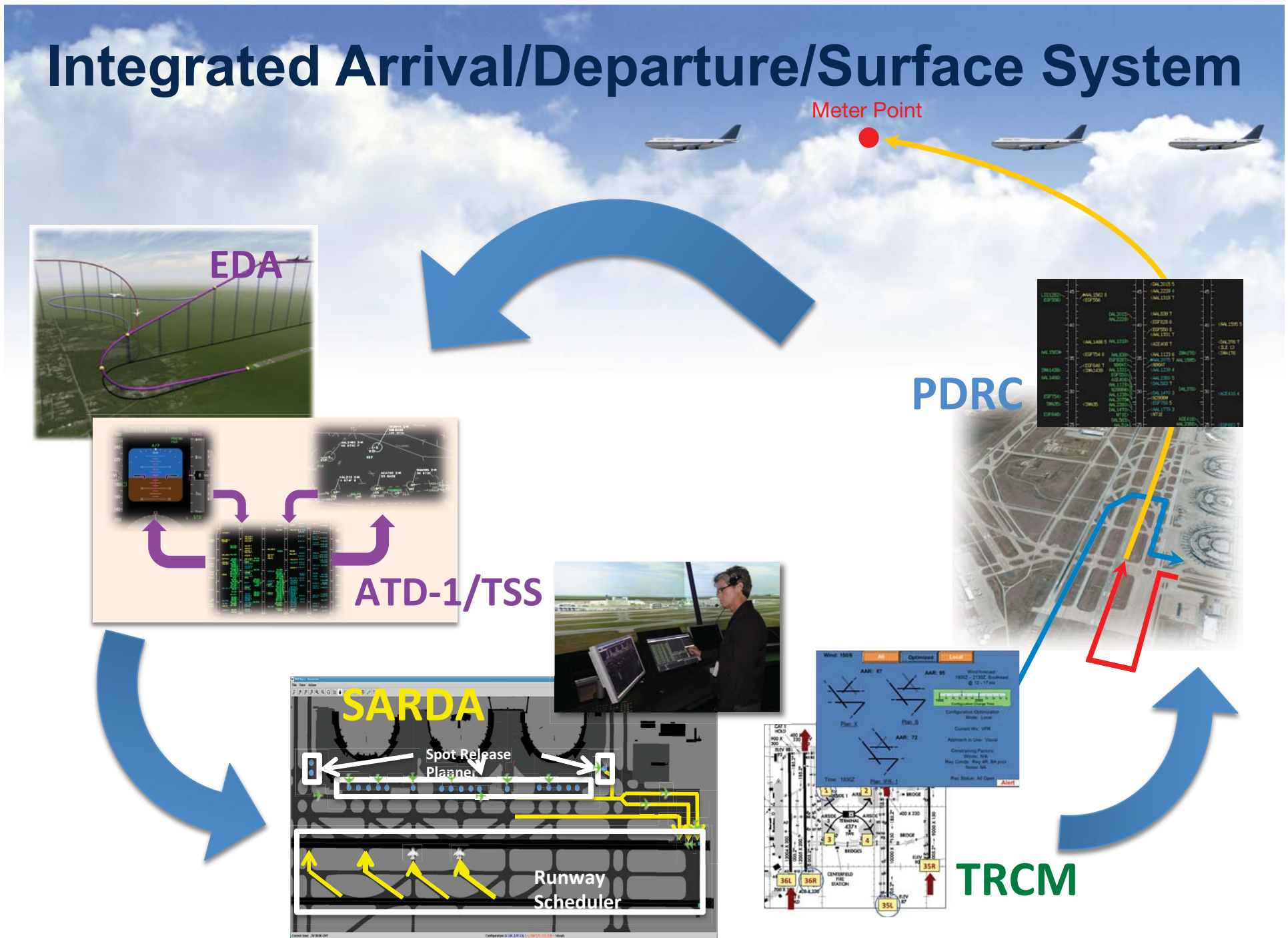
Tower DST



Improved Ability to Fit into Overhead Stream



Integrated Arrival/Departure/Surface System



IADS Research Transition Team



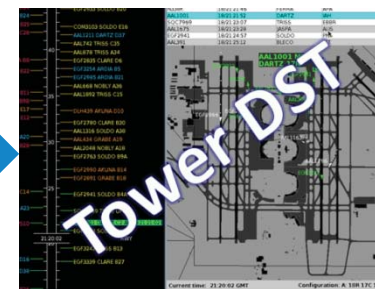
- NASA and FAA established the Research Transition Teams to ensure NASA's NextGen R&D products are identified, quantified, and effectively transferred to the FAA.
- Key PDRC events in coordinating transition of NASA research products
 - Jun 2009 NASA initiated PDRC research activity
 - Sep 2009 PDRC product defined in IADS RTT plan
 - Sep 2010 PDRC TIM @ NASA Ames
 - Mar 2011 PDRC briefing and demo at ASP TIM
 - Nov 2011 PDRC stakeholder update @ FAA HQ
 - Jun 2012 preliminary PDRC tech transfer
 - Jun 2013 final PDRC tech transfer
- Represented by:
 - NASA NextGen SAIE Project
 - FAA NextGen organization (ANG) and Air Traffic Organization (ATO)
- Next meeting August 7th to discuss selected IADS RTT efforts.



Prototype System Overview

Traffic Management Advisor (TMA)

- 1997 NASA → FAA tech transfer
- FAA further developed and deployed throughout the NAS



Surface Decision Support System (SDSS)

- 2004 NASA → FAA tech transfer
- NASA and FAA use for NextGen surface research and TFDM development



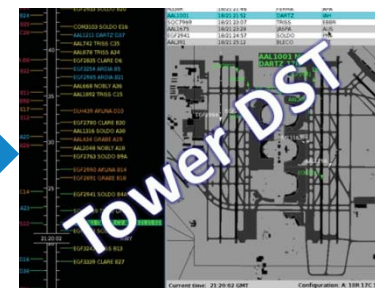
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PDRC enhancements

- Two-way data exchange between tools
- Enable use of surface information (predicted runway and OFF time) in TMA departure scheduling
- Automate Center/Tower release time coordination
- Departure prediction improvements for both TMA and SDSS



Surface Decision Support System (SDSS)

- 2004 NASA → FAA tech transfer
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NASA/FAA Collaboration



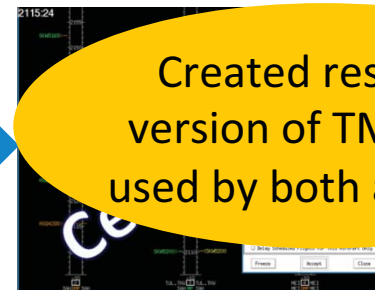
PDRC enhancements

- Two-way data exchange between tools
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- Departure prediction improvements for h

Tactical surface data exchange (TSDE) air carrier interface

Traffic Management Advisor (TMA)

- 1997 NASA → FAA tech transfer
- FAA further developed and deployed throughout the NAS



Created research version of TMA now used by both agencies



Collaborate on SDSS development for NextGen surface R&D

Surface Decision Support System (SDSS)

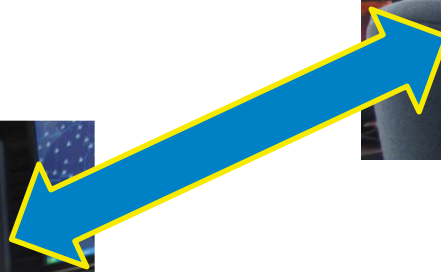
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PDRC Operational Evaluations



Objectives

- Validate PDRC concept
- Demonstrate system performance



PDRC Operational Evaluations

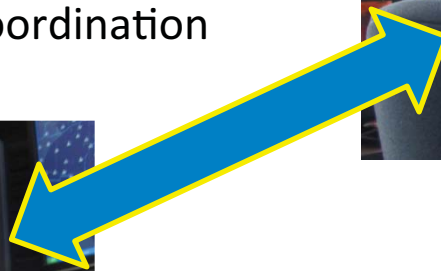
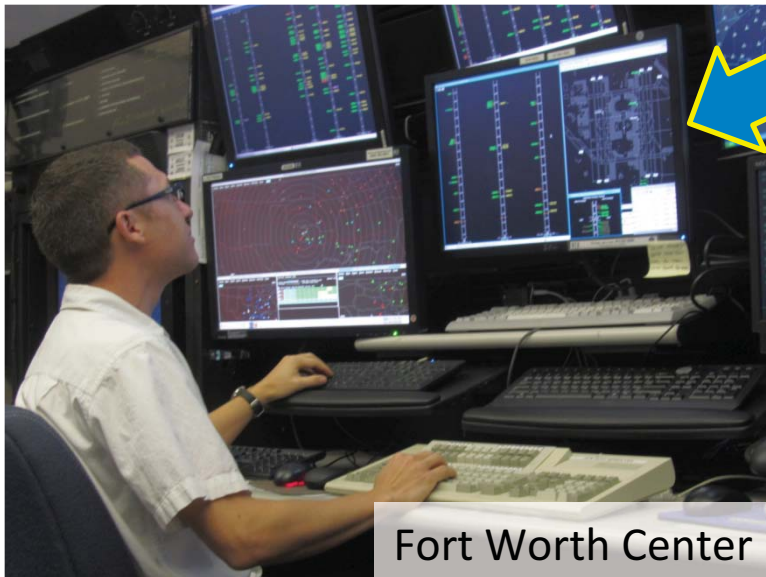


Objectives

- Validate PDRC concept
- Demonstrate system performance

Environment and Methodology

- DFW Tower and Fort Worth Center TMU
- Operational flights subject to Call For Release
- Use PDRC for OFF time predictions, scheduling and release time coordination



PDRC Operational Evaluations

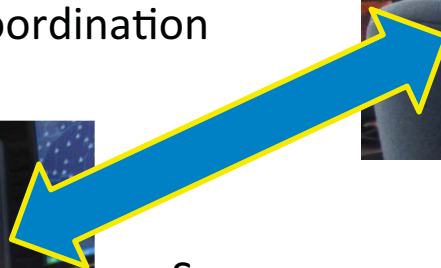
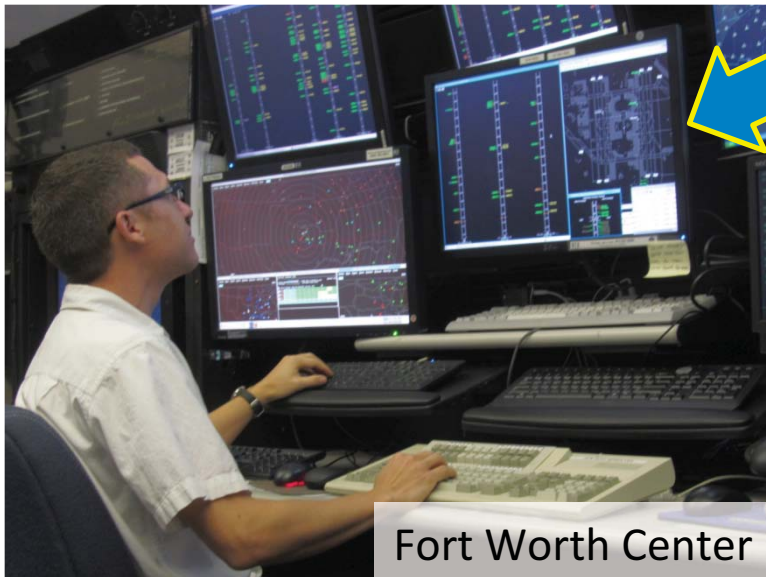


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Summary

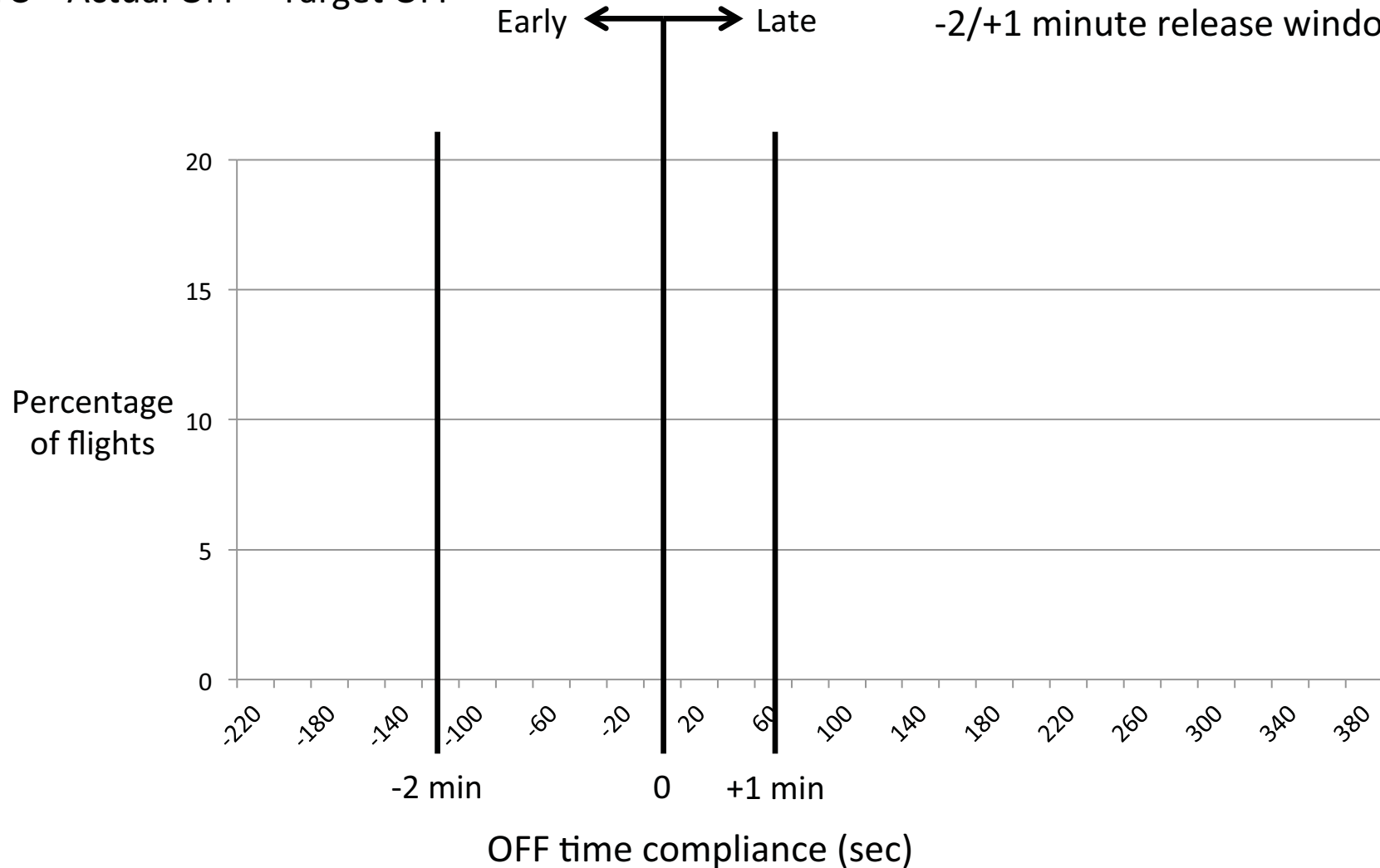
- Two phase evaluation over 29 weeks
 - May 2012 – Jul 2012 120 flights
 - Nov 2012 – Feb 2013 118 flights
- Block 2 includes new versions of SDSS and TMA plus adaptation upgrades

OFF Time Compliance Improvements



OFF Time Compliance (OTC)
OTC = Actual OFF – Target OFF

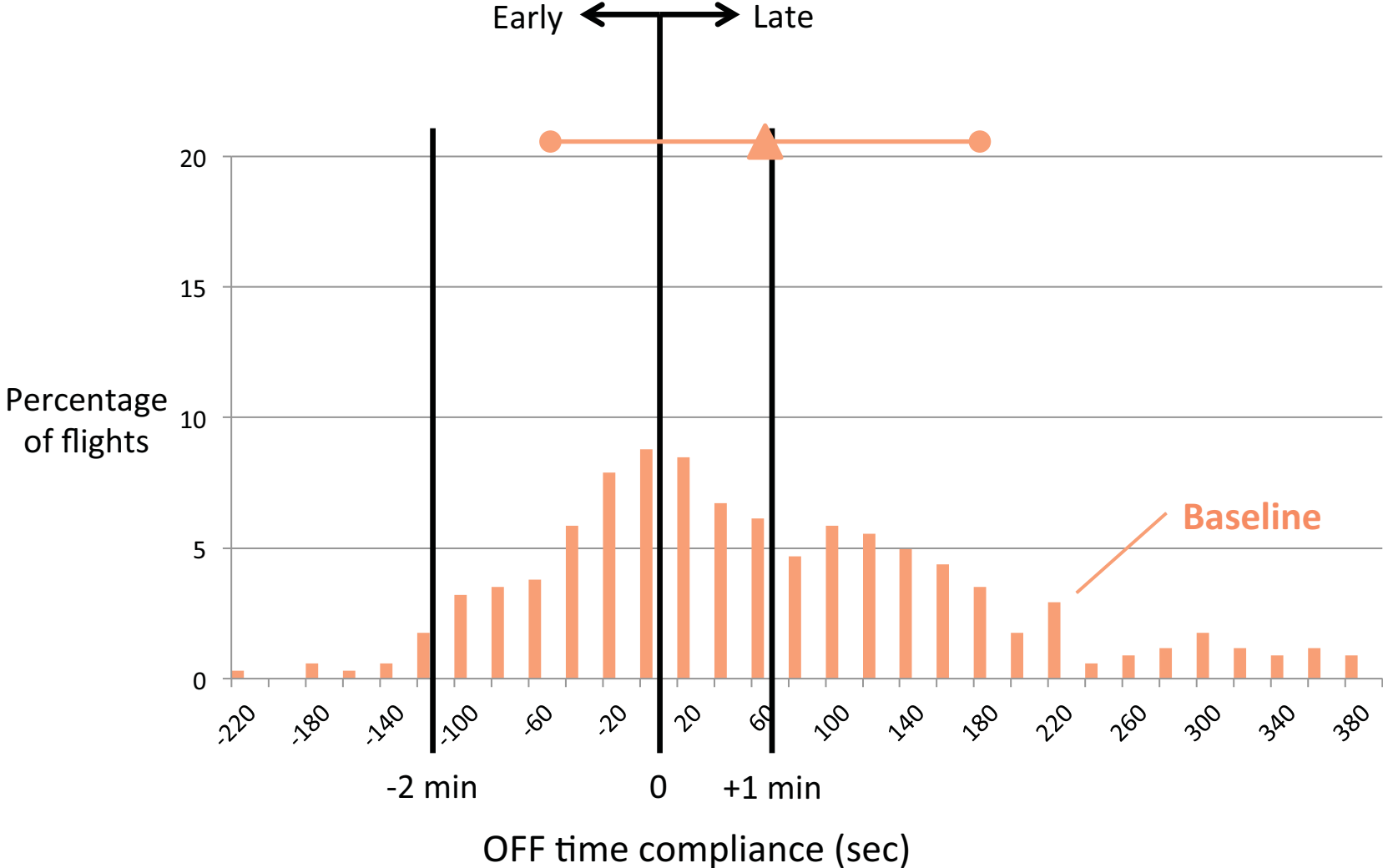
Call for Release operations
generally seek to meet a
-2/+1 minute release window



OFF Time Compliance Improvements



Comply with -2/+1 window
Baseline = 54%



OFF Time Compliance Improvements

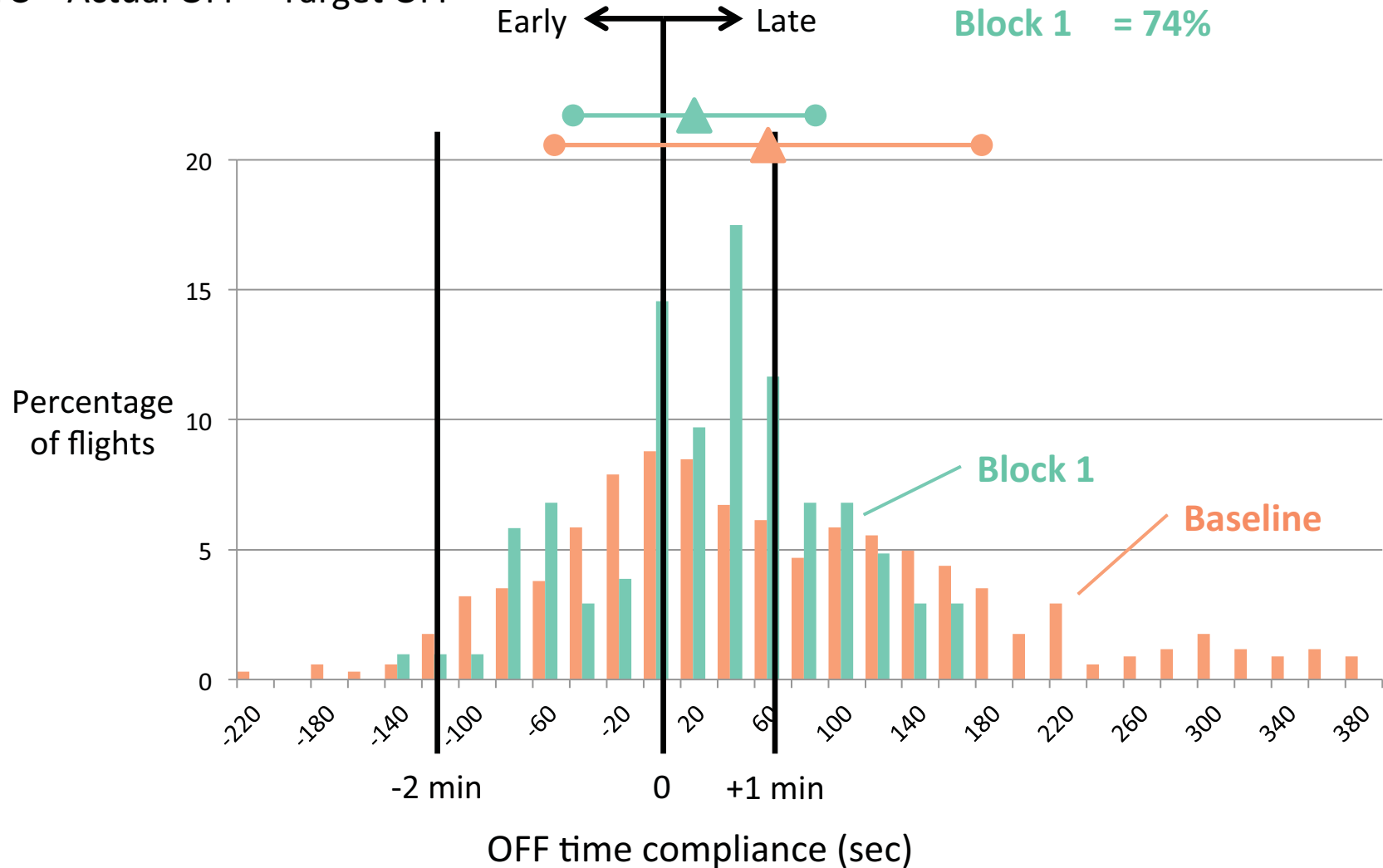


OFF Time Compliance (OTC)
OTC = Actual OFF – Target OFF

Comply with -2/+1 window

Baseline = 54%

Block 1 = 74%



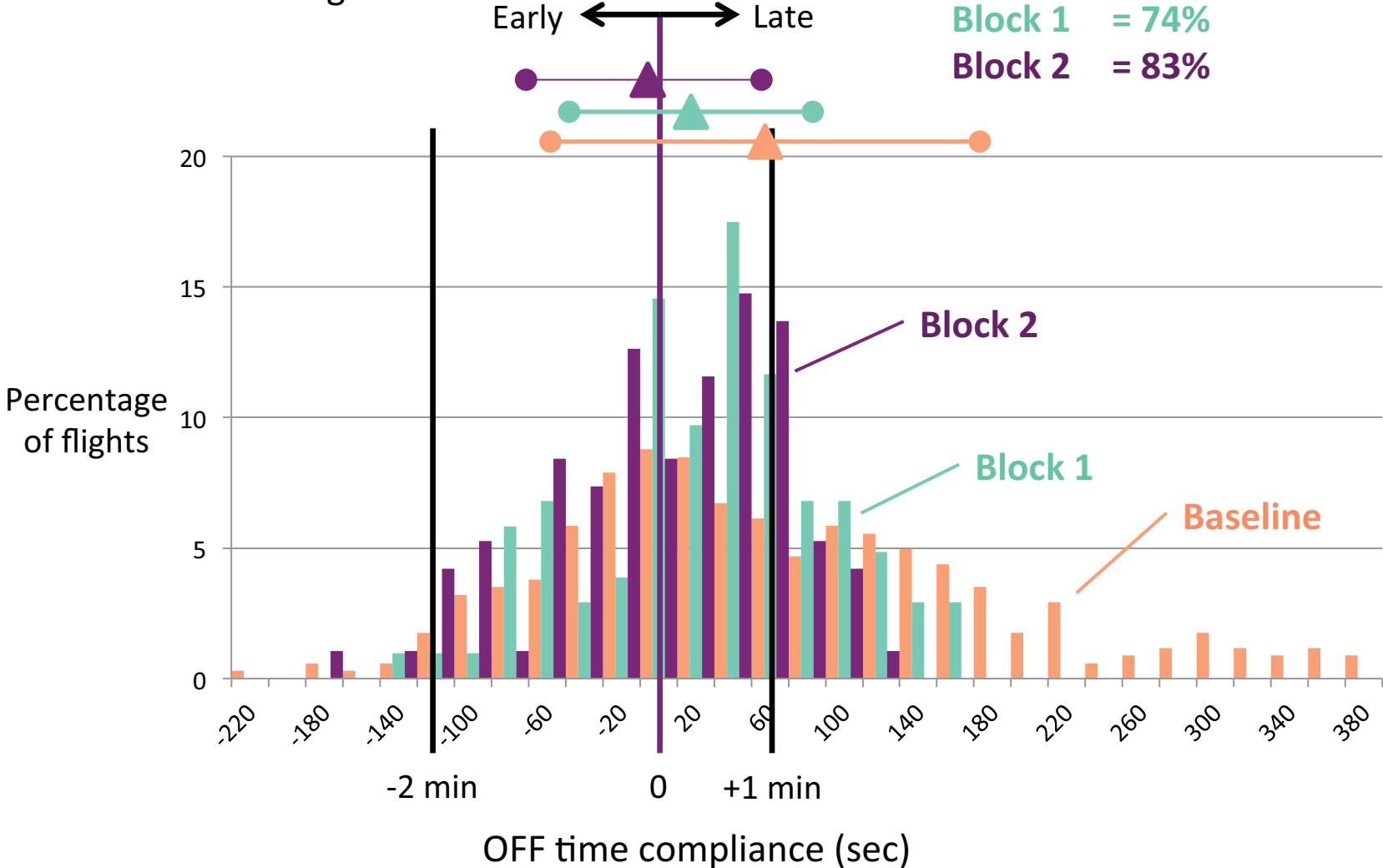
OFF Time Compliance Improvements



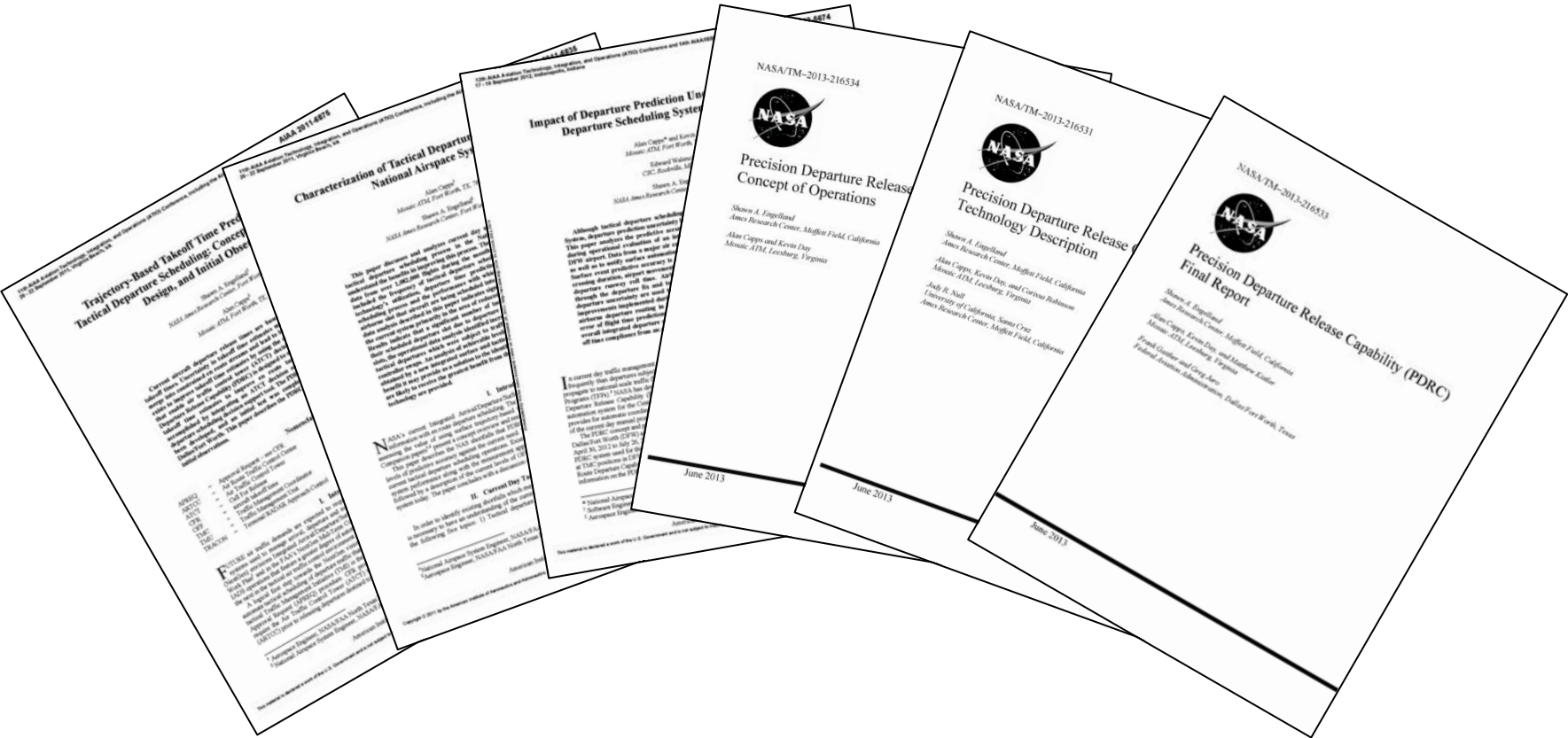
OFF Time Compliance (OTC)
 OTC = Actual OFF – Target OFF

Comply with -2/+1 window

- Baseline = 54%
- Block 1 = 74%
- Block 2 = 83%



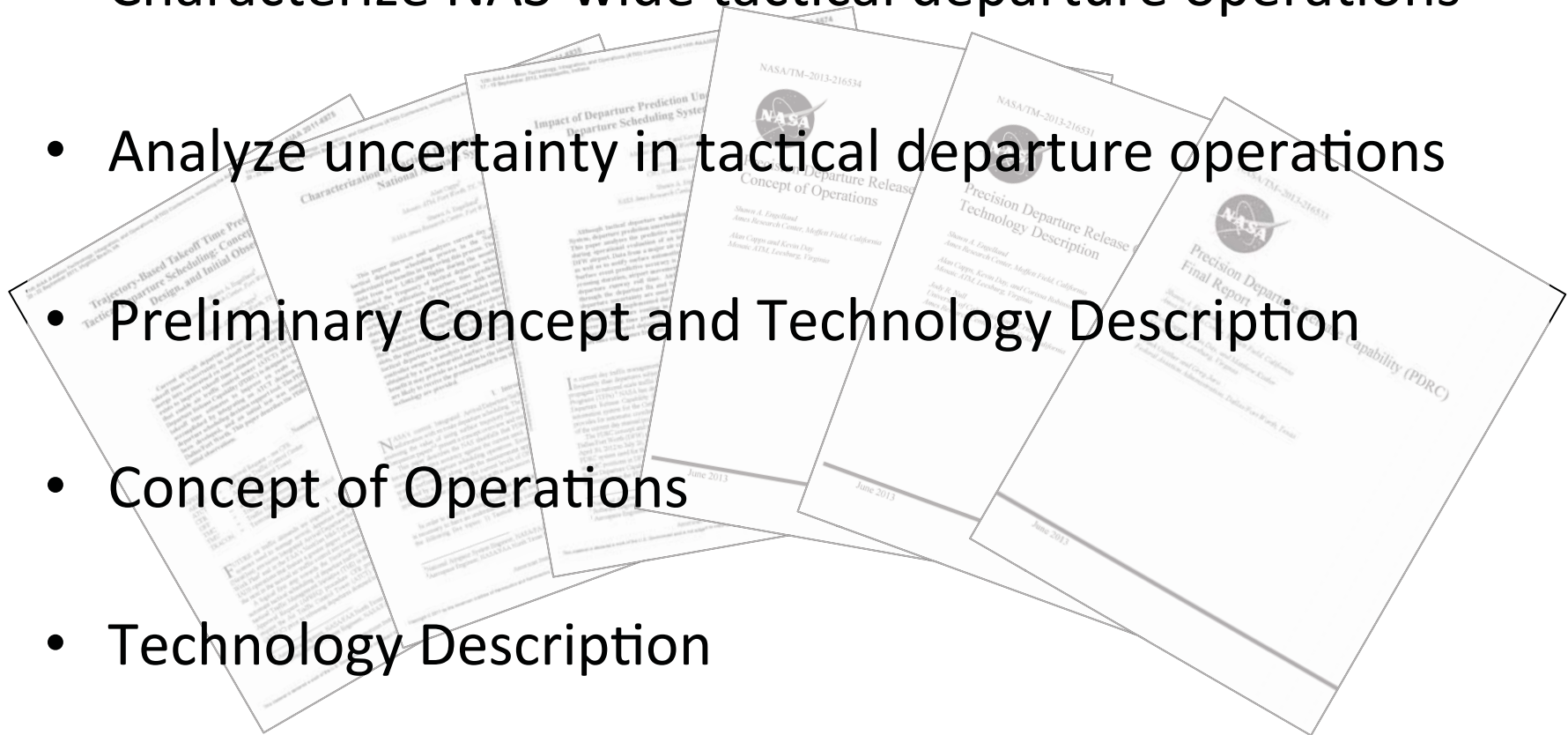
PDRC Research Products





PDRC Research Products

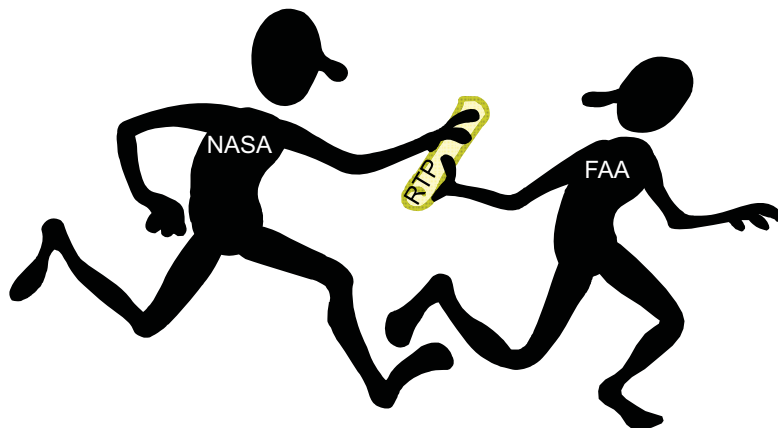
- Characterize NAS-wide tactical departure operations
- Analyze uncertainty in tactical departure operations
- Preliminary Concept and Technology Description
- Concept of Operations
- Technology Description
- Operational evaluation results



NASA/FAA Research Partnerships



- FAA NextGen organization (ANG)
 - Facilitated tech transfer via Research Transition Team
 - Joint development of Surface Decision Support System
 - Supported enhancements to TMA
 - Collaborated on two-way air carrier interface
- FAA Air Traffic Organization (ATO)
 - Provided input on PDRC development and evaluation plans
 - Active, ongoing dialogue to ensure successful research transition
 - DFW TRACON (D10) and Fort Worth Center (ZFW) test/eval



Key to success was jointly defining what the “baton” needed to be and where the exchange was to occur.

Next Steps



- PDRC is complete
- New work will be planned within the IADS RTT
- Future tactical departure scheduling research builds on the PDRC foundation

