Wake Turbulence Recategorization (RECAT)

ATC Human Factors Issues During Implementation

Presented to: WakeNet Europe
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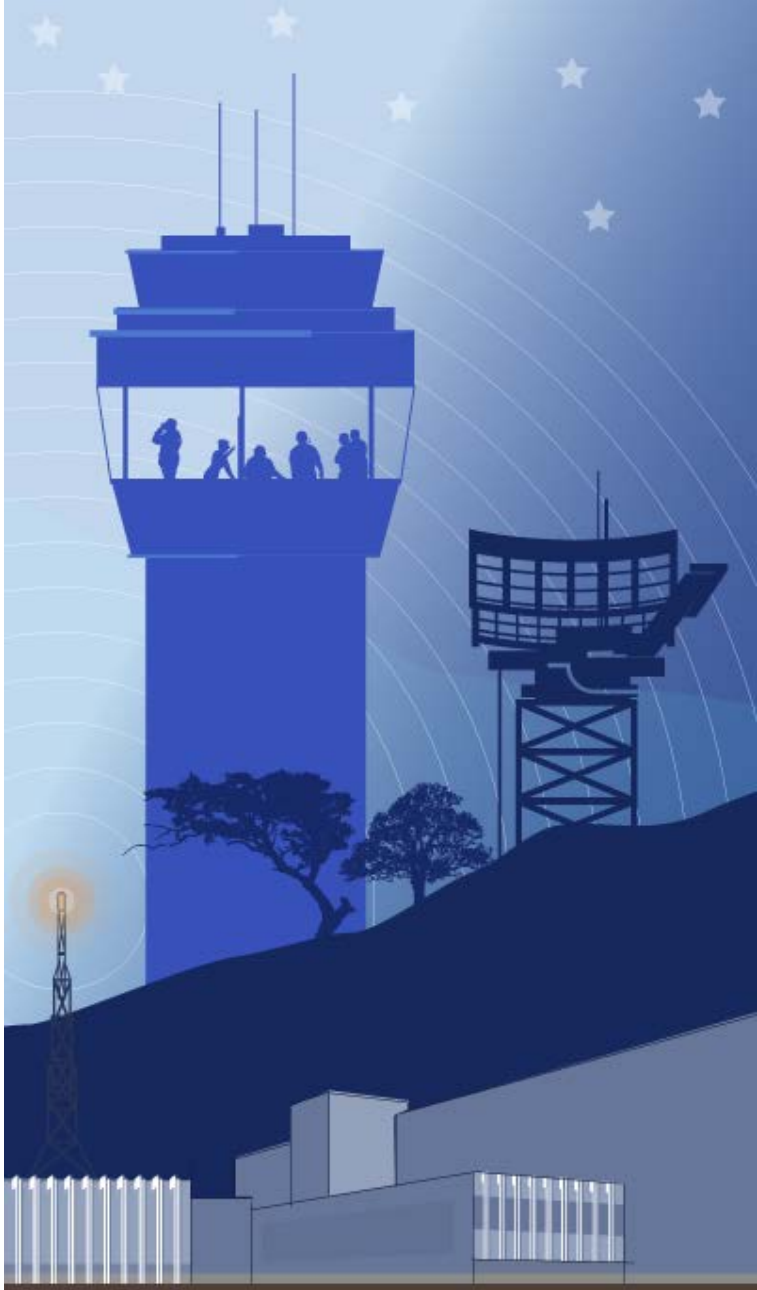


Terminal Services

Overview

- Recat Refresher – Separation Reference Cards
- Phase I Implementation Key Sites
- Memphis ATCT (MEM) Observations
- Louisville ATCT (SDF) Observations
- Flight Progress Strips & Tracon Display
- Controller Comments – Separation Standards
- Lessons Learned
- Atlanta Large TRACON (A80) & Atlanta Tower (ATL) Implementation
- Questions

RECAT

- The FAA has approved a re-categorization of wake turbulence separation minima from the current standard to a new standard (RECAT Phase I).
  - Based on years of joint research and development by the FAA, EUROCONTROL, scientific experts in wake, and experts in safety and risk analysis.
  - Categories are now based on weight, certified approach speeds, and wing spans.
  - RECAT places aircraft into six categories (labeled A-F) for both departure and arrival separation.
    - Data have shown the six categories to be as safe as, or safer than, today's separation standards
    - RECAT provides the opportunity for increased efficiency for NAS operations by reducing wake turbulence delays.

RECAT Separation for Departures

(Directly Behind)

Wake Turbulence Separation Table for "Directly Behind"							
		Follower					
		A	B	C	D	E	F
Leader	A		5NM	6NM	7NM		8NM
	B		3NM	4NM	5NM		
	C				3.5NM		5NM
	D						5NM
	E						
	F						

RECAT Separation On Approach

Wake Turbulence Separation Table for "On Approach"							
		Follower					
		A	B	C	D	E	F
Leader	A		5NM	6NM	7NM		8NM
	B		3NM	4NM	5NM		7NM
	C				3.5 NM		6NM
	D						5NM
	E						4NM
	F						

RECAT Phase 1

- In use today at key sites
  - MEM, SDF, CVG
  - Controller training in progress at Atlanta (A80 & ATL ATCT). Planned IOC June 1
- Revises the ICAO single runway wake separation that addresses both capacity and safety improvements
- Utilizes six (6) aircraft categories (labeled A-F)
- Applies to both departure and arrival separation

RECAT at Memphis

Activity	Dates
Air Traffic Training	Training conducted by MEM*
RECAT Initial Operational Capability	November 1, 2012
2-Month Post-Installation Evaluation	February 5-7, 2013
6-Month Post-Installation Evaluation	June 3-6, 2013

FedEx Cargo Airline Fleet at Memphis

Aircraft Type	Number in Active Fleet	RECAT Wake Turbulence Category
Airbus A300	71	C
Airbus A310	24	D
ATR 42/72	34	E
Boeing 757	85	D
Boeing 767	4	C
Boeing 777	25	B
McDonnell-Douglas DC-10	61	C
McDonnell-Douglas MD-11	63	C
Total	**367**	

Notes: Aircraft types and numbers from Planespotter.net
http://www.planespotters.net/Airline/Federal-Express-(FedEx)
Not all 367 FedEx aircraft are based at MEM

RECAT Operations at Memphis
(2-Month Post-Deployment)

	Observation Period	Mean Aircraft/ Hour	Number of Observation Periods	Controller DID apply reduced separation	Controller did NOT apply reduced separation	*Pilot did NOT use Recat	Total Flights Observed	% of Flights Observed with Reduced Separation
M03 TRACON Arrivals	Rush Mid-Shift	53	18	9	291	0	300	3%
MEM Tower Departures	Push Mid-Shift	68	18	127	148	12	287	44%
	Evening Shift	58	6	43	9	6	58	74%

It is important to note: These figures are a result of direct observations by ATC Subject Matter Experts (SMEs).

SMEs attribute the low percentage of Recat usage during arrivals was due to lack of demand. Even though aircraft spent less time in terminal airspace after Recat procedures were established, demand during arrival periods did not pressure arrival sectors.

*Pilot requested 2 minute separation or SME observed a significant delay with pilot executing control instructions

Arrival figures included visual approaches.

RECAT Operations at Memphis
(6-Month Post-Deployment)

	Observation Period	Mean Aircraft/ Hour	Number of Observation Periods	Controller DID apply reduced separation	Controller did NOT apply reduced separation	Pilot did NOT use RECAT	Total Flights Observed	% of Flights Observed with Reduced Separation
M03 TRACON Arrivals	Rush Mid-Shift	55	15	9	402	0	411	2%
	Evening Shift	19	23	8	164	0	172	5%
MEM Tower Departures	Push Mid-Shift	67	21	203	130	1	334	61%
	Evening Shift	47	7	95	38	5	138	69%

Controller Comments Regarding RECAT at Memphis

- For the wake categories in general, the participating controllers reported that the RECAT wake categories:
  - Decreased the workload for arrivals (TRACON)
  - Caused the controllers to use different strategies for spacing aircraft (ATCT)
  - Increased arrival and departure efficiency (TRACON & ATCT)
  - Were easy to understand (TRACON)

RECAT at Louisville

Activity	Dates
Air Traffic Training	August 19-30, 2013*
RECAT Initial Operational Capability	September 9, 2013
2-Month Post-Installation Evaluation	November 12-14, 2013
6-Month Post-Installation Evaluation	March 18-21, 2014

UPS Cargo Airline Fleet at Louisville

Aircraft Type	Number in Active Fleet	RECAT Wake Turbulence Category
Airbus A300	52	C
Boeing 747	13	B
Boeing 757	75	D
Boeing 767	60	C
McDonnell-Douglas MD-11	38	C
Total	**238**	

Notes: Aircraft types and numbers from Planespotter.net
http://www.planespotters.net/Airline/United-Parcel-Service-%28UPS%29
Not all 238 UPS aircraft are based at SDF

RECAT Operations at Louisville
(2-Month Post-Deployment)

	Observation Period	Time (Local)	Mean Aircraft/ Hour	Number of Observation Periods	Controller DID apply reduced separation	Controller did NOT apply reduced separation	Pilot did NOT use RECAT	Total Aircraft Pairs Observed	% of Flights Observed with Reduced Separation
SDF TRACON Arrivals	Rush Mid-Shift	2245 - 0130	37	17	16	226	0	242	7%
	Morning Shift	0930 - 1145	12	11	6	12	0	18	33%
SDF Tower Departures	Push Mid-Shift	0300 - 0530	54	9	46	201	2	249	18%
	Evening Shift	1600 - 1830	19	12	14	12	1	27	52%

SMEs believe the low percentage during the Mid-Shift Push is due to aircraft departing on identical initial routing. Enroute Sectors require additional spacing under these conditions. However, this is not confirmed and under investigation

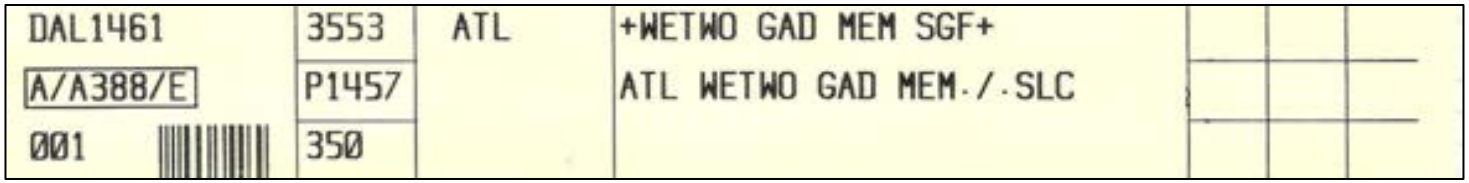
RECAT Operations at Louisville
(6-Month Post-Deployment)

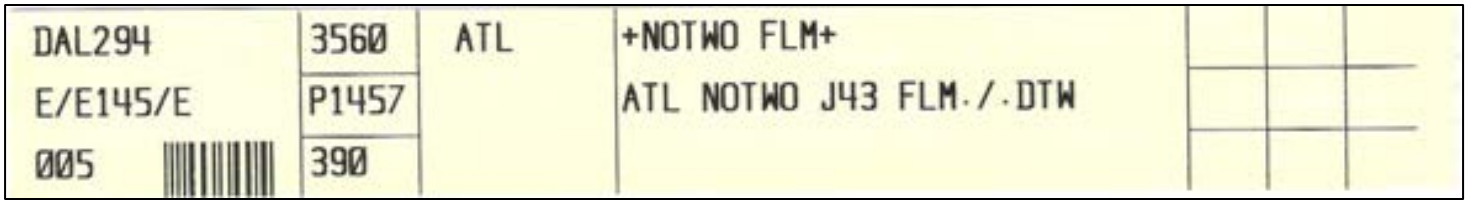
	Observation Period	Time (Local)	Mean Aircraft/ Hour	Number of Observation Periods	Controller DID apply reduced separation	Controller did NOT apply reduced separation	2nd Aircraft Delayed	Pilot did NOT use RECAT	Visual Approach	Total Aircraft Pairs Observed	% of Flights Observed with Reduced Separation
SDF TRACON Arrivals	Rush Mid-Shift	2245 - 0130	31	18	5	5	4	0	30	44	36%
	Morning Shift	0930 - 1145	11	1	0	1	0	0	0	1	0%
SDF Tower Departures	Push Mid-Shift	0300 - 0530	39	15	30	135	1	0	N/A	166	18%
	Evening Shift	1600 - 1830	14	10	15	8	6	1	N/A	30	50%

Controller Comments Regarding RECAT at Louisville

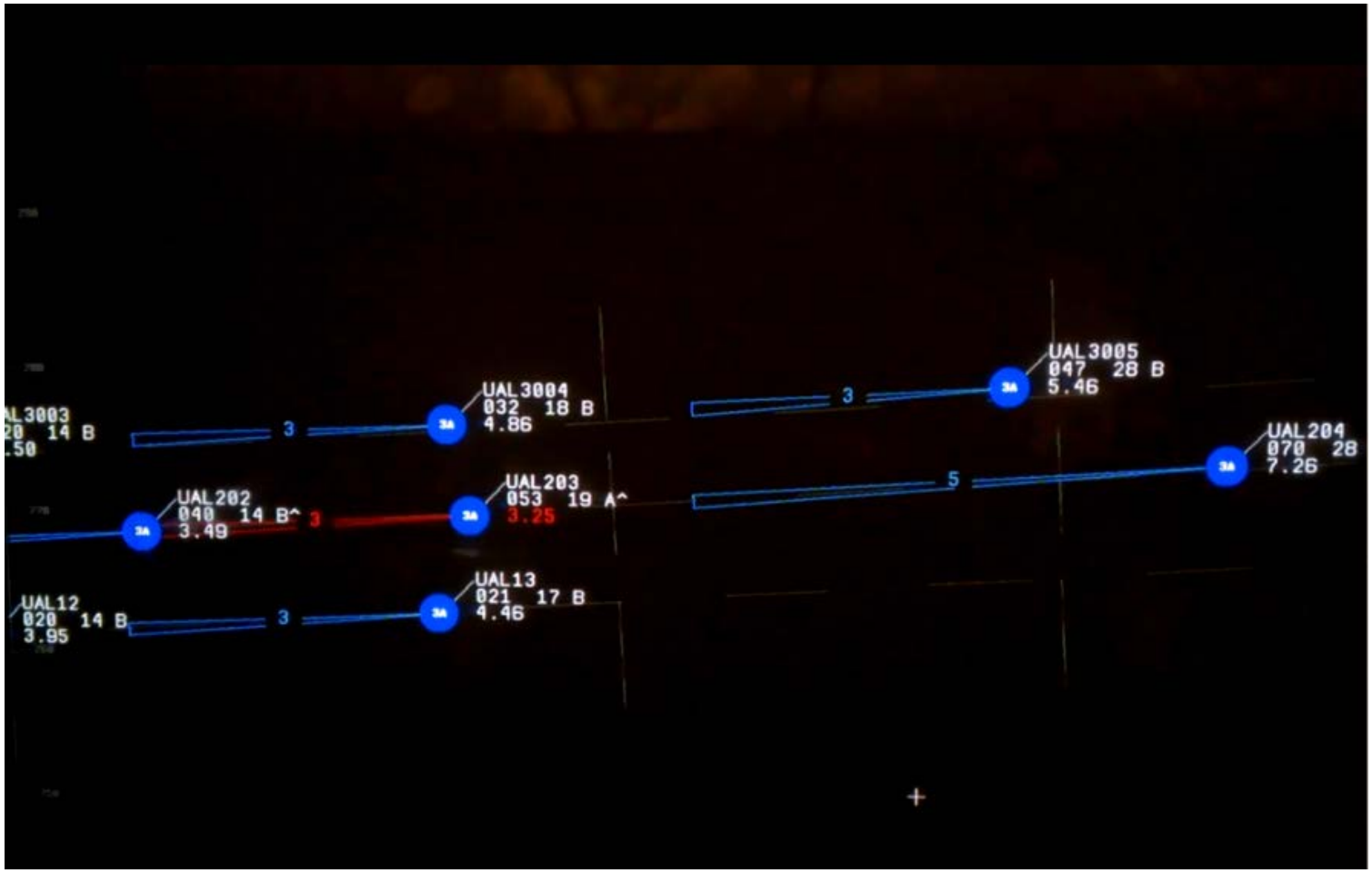
- For the wake categories in general, the participating controllers reported that the RECAT wake categories:
  - Caused the controllers to use different strategies for spacing aircraft
  - Increased arrival and departure efficiency
- Controllers reported the RECAT Wake Category Indicator
  - In the data block was:
    - Meaningful
    - Easy to find
  - In the flight strip* was:
    - Easy to find

Electronic Flight Strip Transfer System (EFSTS)





TRACON Display



Controller Comments Regarding RECAT at Memphis & Louisville

- Generally high praise for RECAT program
  - Example comment:
    - "The revised separation between heavy jets makes for a more efficient operation."
- Nearly all controllers questioned the rationale for increased horizontal and vertical separation for Category F aircraft following Category B & D aircraft
  - Example comment:
    - "An F behind a D has increased separation. Theoretically, I could have a deal (operational error) in this situation where in every other place in the USA, this would be legal (4 miles). … In addition, vertical separation in this case is 1,000 ft., even if the F is VFR. This is very strong as opposed to 500 ft. everywhere else."

Implementation Evolution

(Our Message to Controllers)

- While operational experience is gained, wake science has progressed
- Phase I separation changes behind B757 were intentionally conservative in a planned “go slow” approach
- While separation changes are not driven by controller desire, it is coincidental that the program has been addressing some of the same separations that controllers identify as possibly conservative
  - 1000 ft. vertical for F crossing below D
  - F behind D on same runway arrivals and departures
  - F behind E on approach
- Current D-F separation standards have little adverse effect in most terminal environments. However, there are exceptions such as MIA, where fleet and private aircraft mix creates increased separation due to in-trail and crossing routes.

Lessons Learned/Implementation Limitations

- MEM ATCT, the first Recat facility, was trained by local staff personnel. This created some issues due to lack of in-depth knowledge behind procedure development. Subsequent facilities have been trained by instructors designated by the program office.

- Electronic Flight Strip Transfer System (EFSTS) equipment availability (required to print appropriate characters on flight progress strips) is extremely limited. Software modifications to Flight Data Input/Output (FDIO) printers are underway which will add the character printing functionality. Modifications could be completed as early as October, 2014.

Atlanta Large TRACON (A80) - Atlanta Tower (ATL) Implementation

A80 will be the first Large TRACON to utilize Recat. Due to EFSTS equipment issues, the facility has elected to implement in stages.

- June 1, 2014, ATL and A80 TRACON airspace will operate using Recat procedures.
- Satellite ATCTs will continue to operate under current standards.
- Agreements have been modified with these facilities (including 3 military installations) to provide 5 miles in-trail departure spacing unless other coordination has been accomplished.
- When FDIO modifications are completed, satellite facilities will be trained and operate under Recat procedures.
- The Atlanta implementation could be used as a model for other Large TRACONs such as NCT, SCT, PCT and N90.

Questions ?