NextGen CDA: Solutions for Aviation Challenges

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UPS Advanced Flight

Our Current Noise Challenge:

European Commission via Eurocontrol has mandated 100 Airports establish Continuous Descent Arrivals by 2013

Develop a simple, effective arrival procedure to reduce noise:

- with the ultimate goal of a P-RNAV solution

Defining and measuring success using standardized methodology:

- each airport manages noise differently

Educate ATC & Pilots about noise, airspace design, and develop vectoring/flight techniques to minimize noise signature

UPS European Airports with CDAs:

East Midlands (EMA): Vectored CDA

Stansted (STN): Vectored CDA

Stockholm (ARN): P-RNAV CDA

Cologne (CGN): Vectored CDA

CDA Developments:

WAW: CDA Test phase began 14 OCT 2008
- MD11 & B757
- Flt 8, CGN-WAW, 0530-0600 local arrival
- Vectored CDA designed with UPS

CGN: Test phase June-November 2008
- Implementation: 1st Quarter 2009
- Radar Vectored CDA
- RNAV CDA in development: 2009

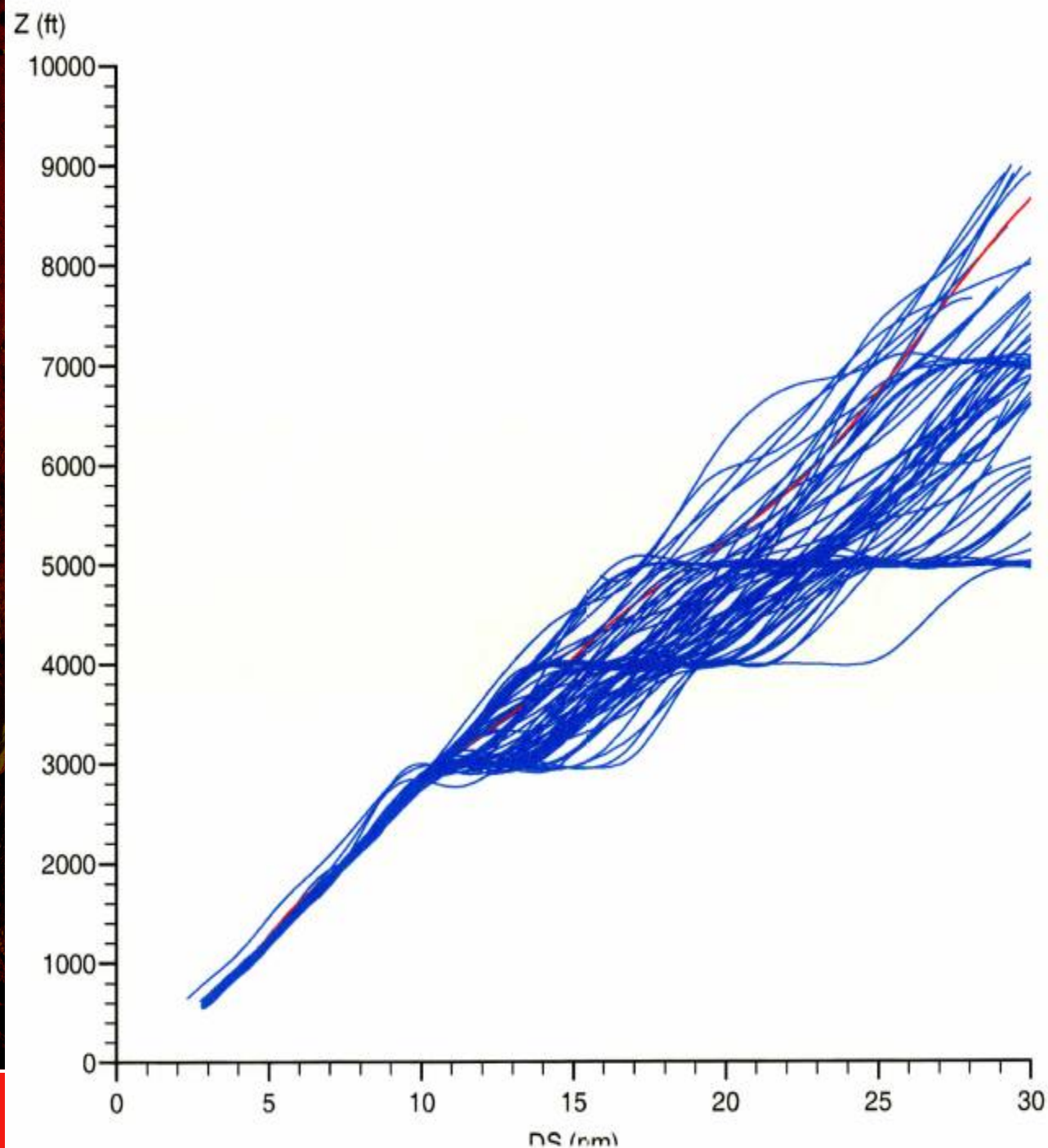
CGN Noise Test

Requested by the Airport Director: Wolfgang Klapdor

Parameters:

- Incremental Implementation: Radar Vectors 1st then RNAV
- No changes to published arrival procedures
- Develop a Vectored CDA: reduces noise only
- Minimal Training for Pilot & ATC
- Participants: 80 aircraft arriving in a 150 minutes

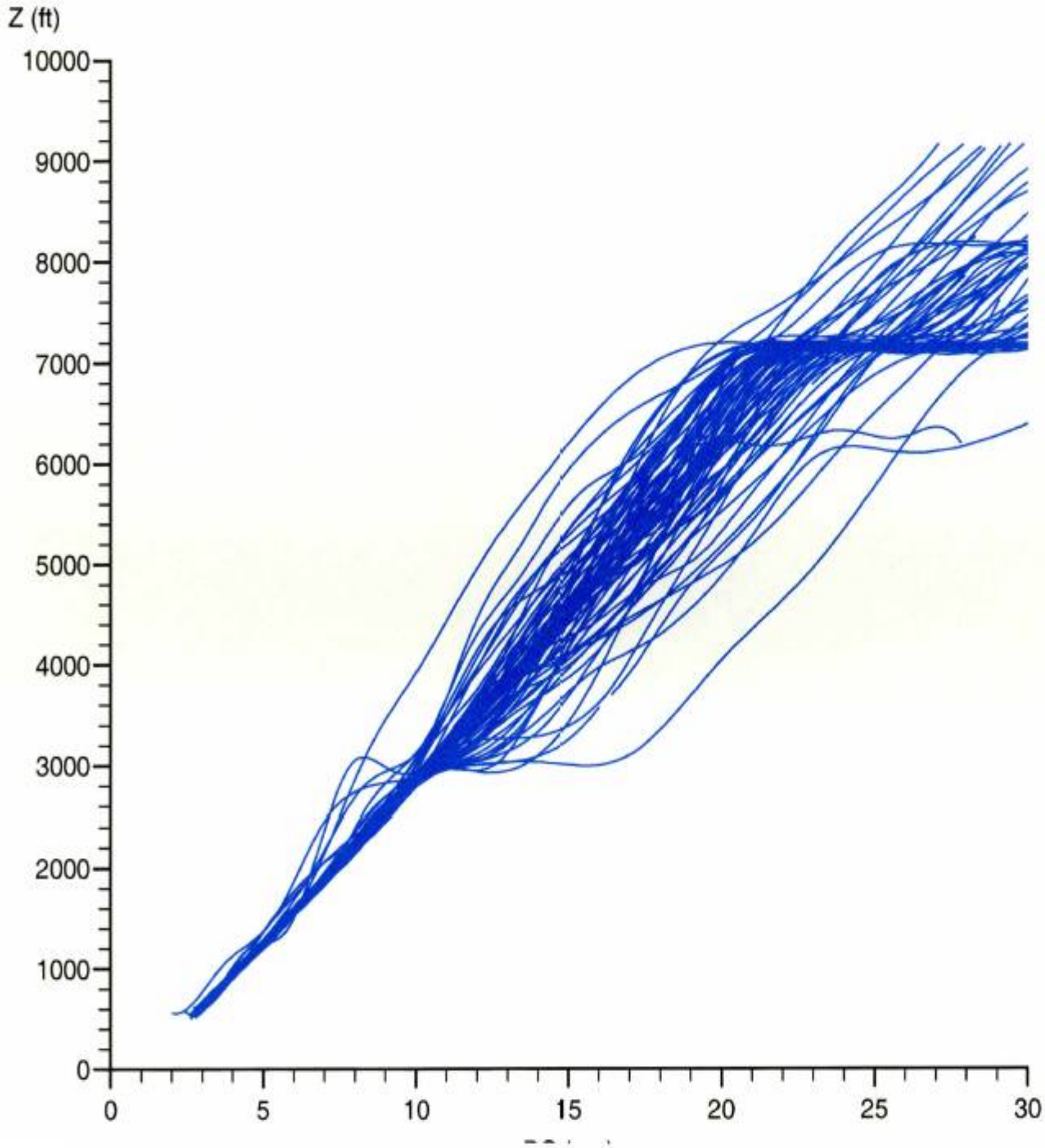
Langen Radar	CGN Environmental Office
UPS (A300, MD11, 767/757)	Star (767) MMG (A300)
Tuifly (737 NG)	German Wings (A319)



Fanomos EDDK On-line
2008-06-11 07:32:58

UTC Period	2008-06-03 20:00:00 2008-06-04 02:00:00
Airport	EDDK
Flight Type	Arrival
Nr. of flights	77

Arrivals without CDA



Fanomos EDDK On-line
2008-06-11 06:36:30

UTC Period	2008-06-10 20:00:00 2008-06-11 02:00:00
Airport	EDDK
Flight Type	Arrival
Nr. of flights	73

1st Night of CDA Test

Initial Feedback:

Airport:

- 77% Success rate for August
- Measurable Noise Reduction during all phases of the arrival
- MD11:
  - noise reduction of 8db > 24-12 track miles
- A300/B767/A319/B737NG:
  - 4-6 db average reduction > 24 -12 track miles
- Impact on arrival rate: minimal

Langen Radar (ATC):

- Uneven deceleration rates between aircraft types
- Controller workload not as heavy as anticipated

Initial Feedback:

Pilots:

Not knowing if they were going to fly the CDA or not
Altimetry: setting QNH, passing Transition Level

FOQA: 99% + Stabilization Rate at 1000’
No ASAP reports to date

Our Current Noise Challenge:

UPS destinations designing CDAs

- Budapest (BUD)
- Madrid (MAD)
- Malmo (MMX)
- Oslo (OSL)

(Source: Eurocontrol)

Key to Success for a successful Noise Program:

Partnership: Air Carriers & Airport & ATC

Effective Communication of challenges between participants

Standardization of procedures to the maximum extent possible

Achievable Goals

SDF NextGen CDA: Update

UPS Implementation

Definition of NextGen CDA:

Fly Continuous Descent Arrivals (CDA)

- **30% reduction in noise** *(up to 6 dB)* *2004 CDA trials*
- **34% reduction in nitrous oxide (NOx) emissions** (Below 3000 ft) *2004 CDA trials*
- Reduces time enroute and burns less fuel

Utilize Merging and Spacing

- Spacing task is delegated to the flight crew
- Allows CDA operations with minimal impact to throughput
- Enables full time use of CDA

UPS Implementation of RNAV / ADS-B

Three tools required for NextGen CDA:

- Flight deck tools
- RNAV arrival
- Airline Based Enroute Sequencing & Spacing (ABESS)

UPS Implementation

Flight Deck Tools

- Dual Boeing Class 3 EFBs
- Single ADS-B Guidance Display (AGD)
- ACSS ADS-B SafeRoute System
- ACSS/Astronautics CDTI
- Retrofit to UPS B-757/767 Fleets


NO SMOKING
767
EFB

UPS Implementation

Boeing/Astronautics EFB

Dual processor/dual hard drive

- Windows side-Class 2
  - Document Browser-Type A
  - Terminal Charts-Type B
- Linux side-Class 3
  - ACSS/Astronautics CDTI-Type C
  - ACSS SafeRoute Applications-Type C

UPS Implementation

- ACSS SafeRoute System (ADS-B Apps)
  - Surface Area Movement Management (SAMM)
  - Merging & Spacing (M&S)
  - CDTI Assisted Visual Separation (CAVS)

M&S and CAVS require AGD device

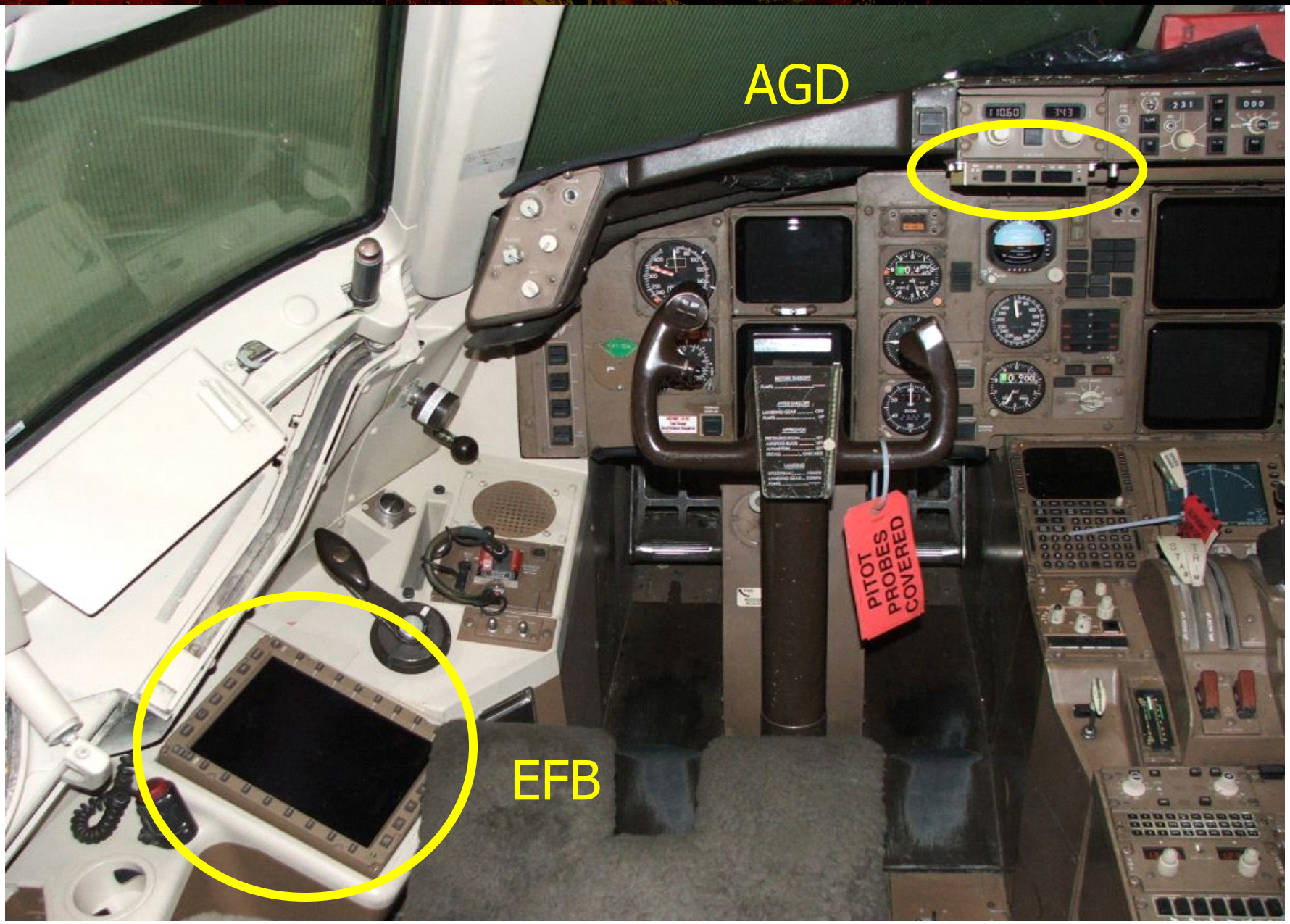
ADS-B Guidance Display (AGD)

Single unit on Captain's side

Provides

- Command Speed (M&S only)
- Differential Ground Speed
- Distance to Target
- CDTI Message Advisories/Alerting

Easily Viewed by Either Pilot


AGD
EFB
PITOT PROBES COVERED

CDA Development Status

High Density Traffic Merging and Spacing

- Multi-post arrival scheme
  - RNAV Development Team met 16-18 June 08
    - Initiated FAA 18-Step RNAV approval process
    - Developed to optimize continuous descent profile
    - Process will address ATC concerns
- Presently being tested in UPS simulators for all fleets
- Deployment anticipated Dec 2009

SDF EMA RNAV Arrival

LOUISVILLE INTL-STANDIFORD D-ATIS 118.72

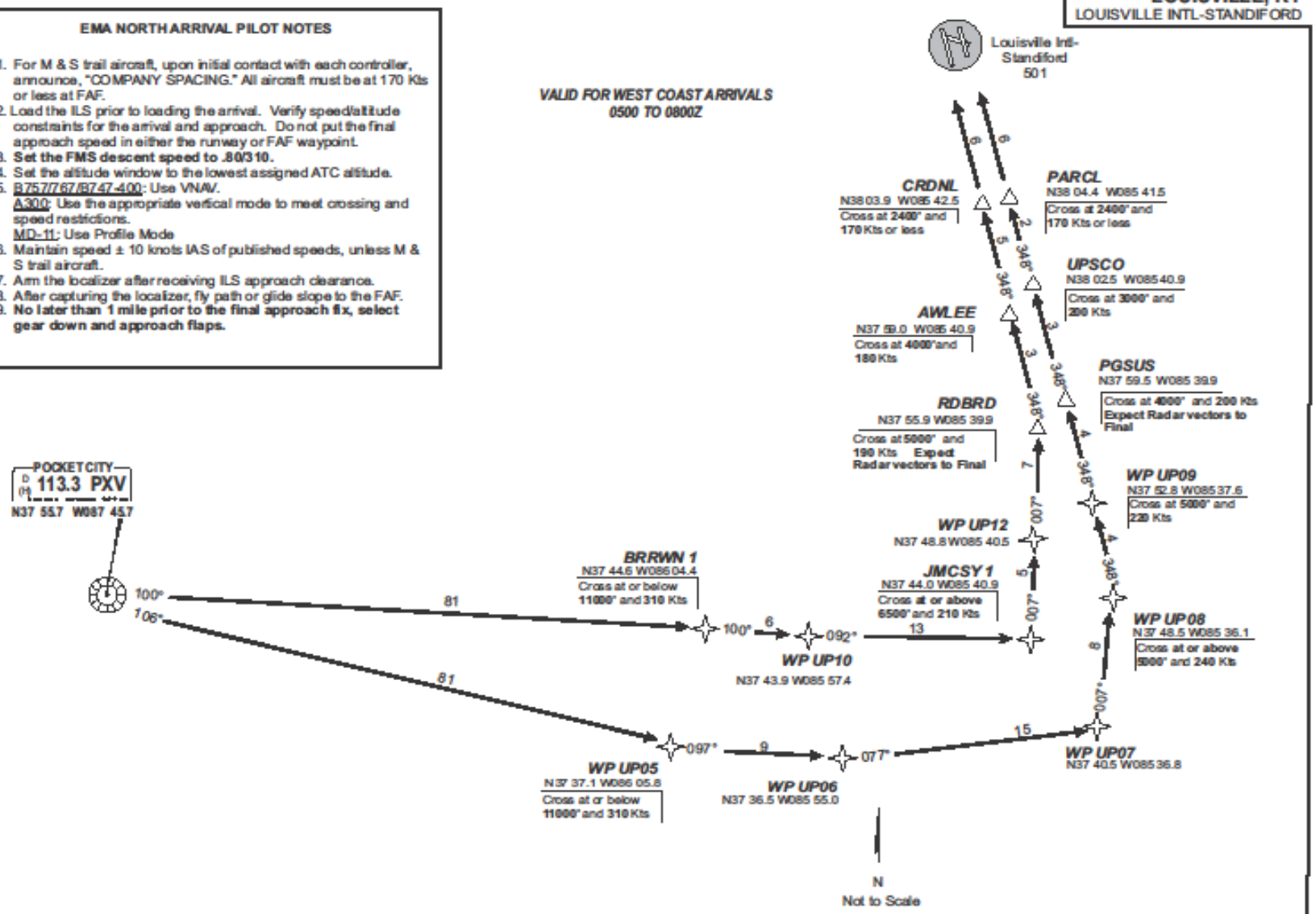
UPS Airlines

13 Nov 08

LOUISVILLE, KY
LOUISVILLE INTL-STANDIFORD

EMA NORTH ARRIVAL PILOT NOTES

1. For M & S trail aircraft, upon initial contact with each controller, announce, "COMPANY SPACING." All aircraft must be at 170 Kts or less at FAF.
2. Load the ILS prior to loading the arrival. Verify speed/altitude constraints for the arrival and approach. Do not put the final approach speed in either the runway or FAF waypoint.
3. **Set the FMS descent speed to .80/310.**
4. Set the altitude window to the lowest assigned ATC altitude.
5. B757/767/B747-400: Use VNAV.
   A300: Use the appropriate vertical mode to meet crossing and speed restrictions.
   MD-11: Use Profile Mode
6. Maintain speed ± 10 knots IAS of published speeds, unless M & S trail aircraft.
7. Arm the localizer after receiving ILS approach clearance.
8. After capturing the localizer, fly path or glide slope to the FAF.
9. **No later than 1 mile prior to the final approach fix, select gear down and approach flaps.**



SDF SACKO South RNAV Arrival

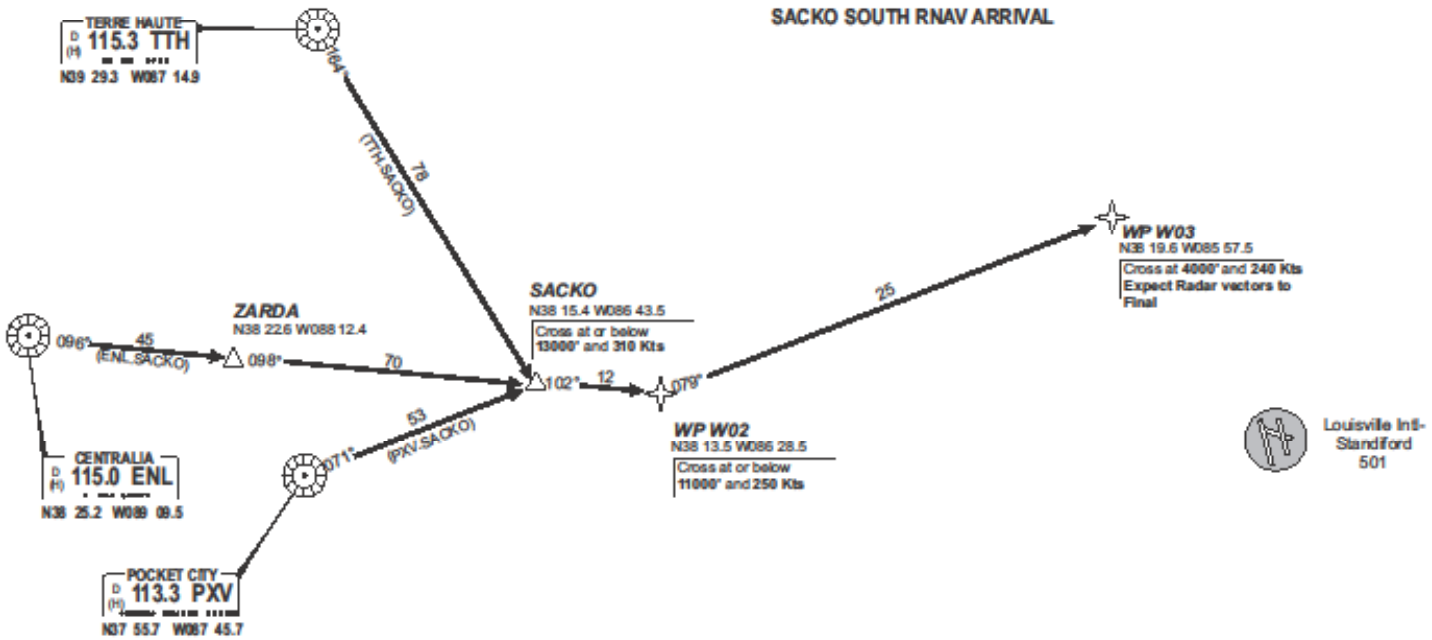
LOUISVILLE INTL-STANDIFORD D-ATIS 118.72

UPS Airlines

4 Nov 08

LOUISVILLE, KY
LOUISVILLE INTL-STANDIFORD

SACKO SOUTH RNAV ARRIVAL



N
Not to Scale

SACKO SOUTH ARRIVAL PILOT NOTES

1. For M & S trail aircraft, upon initial contact with each controller, announce, "COMPANY SPACING." All aircraft must be at 170 Kts or less at FAF.
2. Load the ILS prior to loading the arrival. Verify speed/altitude constraints for the arrival and approach. Do not put the final approach speed in either the runway or FAF waypoint.
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7. Arm the localizer after receiving ILS approach clearance.
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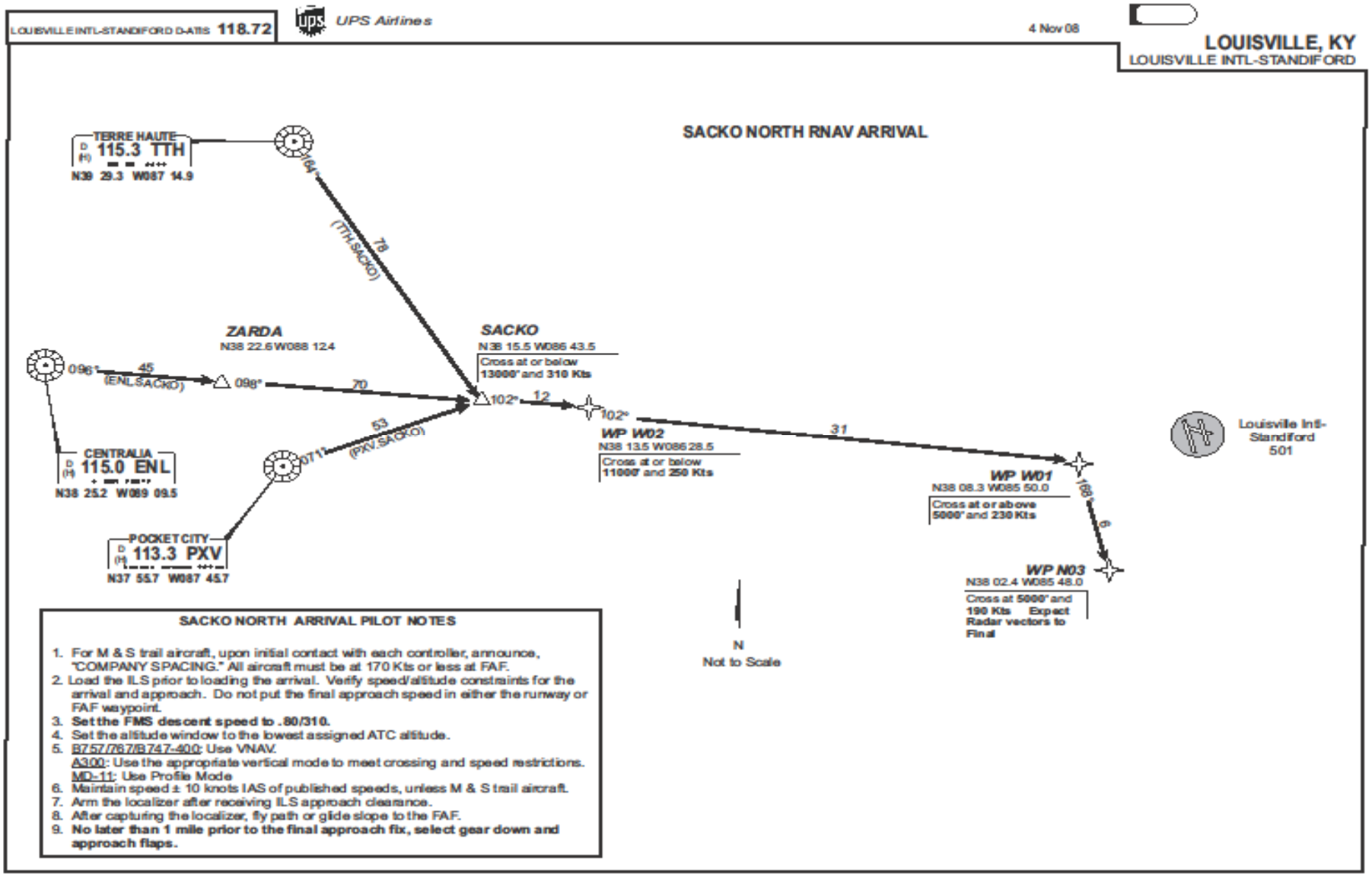
9. **No later than 1 mile prior to the final approach fix, select gear down and approach flaps.**

SDF SACKO North RNAV Arrival



Surface Area Movement Management

Airport surface map and traffic displayed in the cockpit provides surface situational awareness leading to:

- Reduction in runway incursions and traffic conflicts
- Tracking the movements of own aircraft and other ground and airborne traffic in the terminal area using ADS-B
- Alerting crews of potential conflicts with traffic

UPS

ABESS Status

- Two track development effort
  - Original MITRE effort was not viable
  - Mosaic ATM version development efforts started to provide alternative to MITRE version
    - May 08/Aug 08 Field Test showed more improvement needed in MITRE version
    - Mosaic ATM version needs additional support and funding to complete
- Next Field Test set for 18-20 Nov 08

Issues

Ownship GPS/LDPU Position Drop

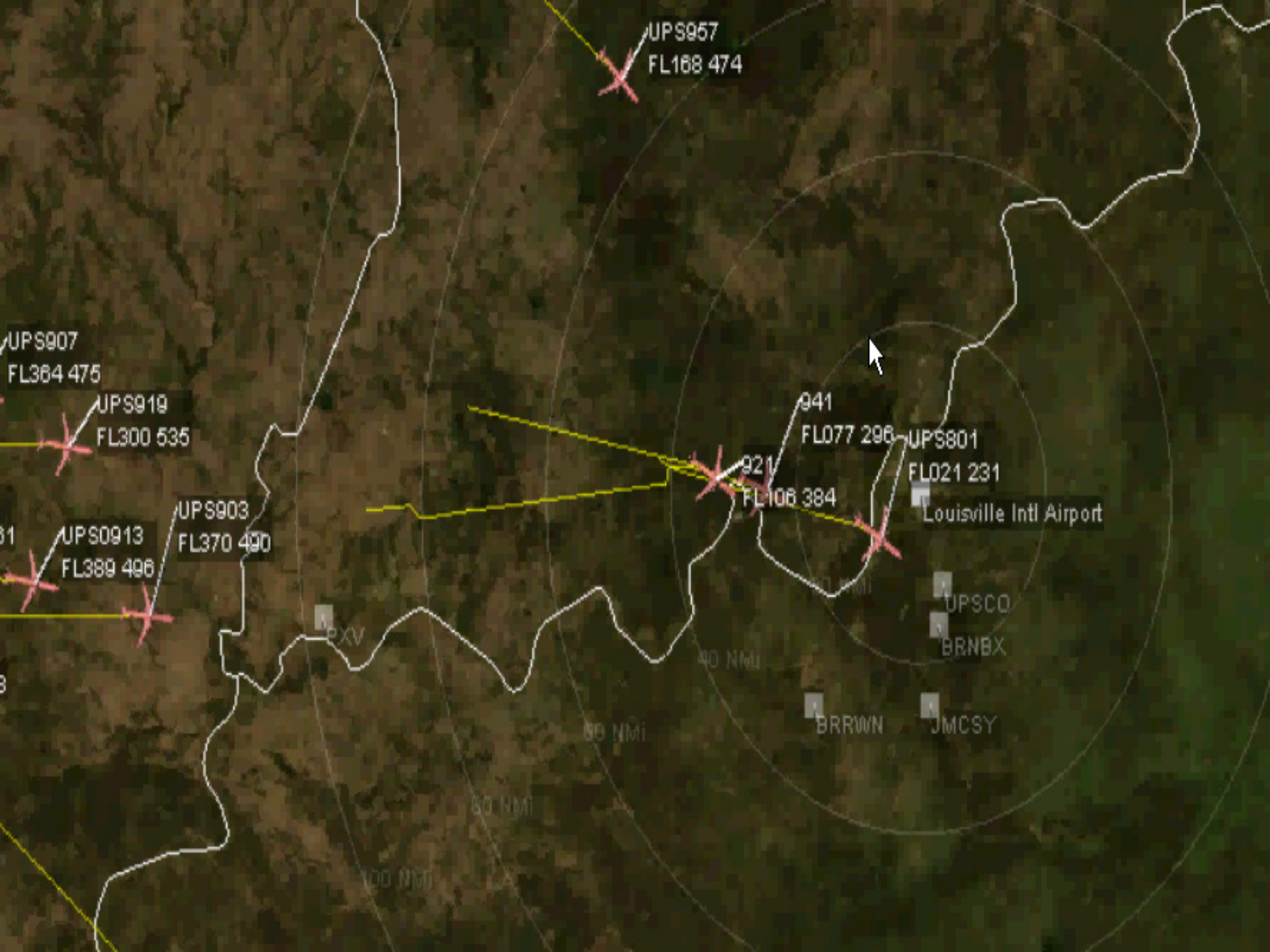
- Target Degrade
- Flashing Amber: ADS-B, Pos, Track

15 knot A/S differential in Algorithm

- Aggressive AGD Speed Commands
- Variable distances at Threshold

MS Windows Failures

- Loss of Term Charts and Doc Browser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FL021 231
921
FL106 384
Louisville Intl Airport
UPSCO
BRNBX
BRRWN
JMCSY
40 NMi
60 NMi
80 NMi
100 NMi

UPS NextGen CDA Statistics

- Received 757 Operational Approval in December 07
- 84 successful NextGen CDAs flown since 18 Jan 2008
- Fuel savings over normal arrival:
  - 250 to 465 # of fuel (2004 CDA Test)
  - 757 = 21% (last 25-min of flight)
  - 767 = 31% (last 25-min of flight)
- Intense data collection effort underway
- Received 767 SafeRoute STC in 24 July 08
- Expect 767 Operational Approval in November 08

Next Steps to Achieve NextGen CDAs

- Ensure easily accepted by controllers and pilots
- Remain motivated by Safety, Capacity and Efficiency gains short term
- Maintain portability to other airports and operators (PHL)
- Continued development of SafeRoute to support high density operations
- Develop RNAV procedures for multi-post arrival
- Install ground tool to establish inbound flow for both sequencing and initial spacing

Questions?