RNAV STAR Procedural Adherence
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Next Steps
Data Visualization Step 3

Method

Why we looked at OPD STARs

How Procedures Have Changed

Descriptive Data
How Procedures Have Changed

No Procedures
Flying was dangerous and not standardized

Instrument Approach Procedures
A method to consistently guarantee certain distances

STARs (conventional)

STARs (RNAV OPD)
Rules and procedures for navigation and automation (FAA 2014)
No Procedures

Flying was dangerous and not standardized
Just north of Chey. Reser about one mile on standard Beacon.

8500 safe at site. Can circle a radius of about 4 miles, at this elevation.

Increase to 9200' coming from chey, and 9500' from the west. The above altitude will clear anything on the hill.

Two pages from Elrey Jeppesen’s “Little Black Book”: The Arps Ranch (far left) and Bitter Creek. At first, Jeppesen collected this navigational information to help his fellow pilots.
STARs (conventional)

Standardized Routing & Terrain Clearance
STARs (RNAV OPD)

Noise reduction, fuel savings, route standardization, and flow management. (FAA, 2014)
Why we looked at OPD STARs

ASRS Reports from Pilots
1. Controller interventions
2. Autopilot and FMS errors
3. Procedure design

ASRS Reports from Controllers
1. Inter-controller communications
2. Pilot non-compliance
3. Misinterpreted instructions

Factors Influencing Adherence
- Weather
- Mixed Equipment Performance
- Traffic
Method
Overlay Flights on Routes

- Entry Waypoint
- Waypoint in route
- Exit Waypoint

- Identify route flown
- Determine adherence of lateral flight trajectory with waypoint restrictions
- Characterize lateral adherence (join late/skip/early exit)

Full Lateral Adherence of VKTRY2 into KDFW
Data Source

Past
ARTCC radar tracks (CTAS data)

NOW
TRACON data (Sherlock2.0)

Longterm
Aircraft sensors (FOQA-type)

Expand Capability

Procedural Characteristics
- Waypoint type, window size
- Speed Restrictions
- Altitude Restrictions
- Route name (e.g., transition)
- Slope-degrees angles
- Leg type (e.g., track to fix)

Environmental Variables
- Wind (bullwind component)
- Temperature (Rapid Refresh NOAA)

Aircraft Variables
- Type and equipment suffix
- Groundspeed
- Altitude (several samples)
- Rate of descent
- Required slope to next restriction
- # of flights on the arrival
Procedural Characteristics
- Waypoint type, window size
- Speed Restrictions
- Altitude Restrictions
- Route name (e.g., transition)
- Slope-degree angles
- Leg type (e.g., track to fix)

Environmental Variables
- Wind (tailwind component)
- Temperature (Rapid Refresh NOAA)

Aircraft Variables
- Type and equipment suffix
- Groundspeed
- Altitude (several samples)
- Rate of descent
- Required slope to next restriction
- #of flights on the arrival

TRACON data (Sherlock2.0)

Longterm Aircraft sensors (FOQA-type)
Descriptive Data

Assess Levels of Use

Identify Human Intervention
Assess Levels of Use
Identify Human Intervention
Waypoint: JOBEE

Magnitude of Excursion (ft) (bin)

Count of Waypoint

-3000 -2800 -2600 -2400 -2200 -2000 -1800 -1600 -1400 -1200 -1000 -800 -600 -400
Excursion above restriction

Excursion below restriction

Excursion Percentage

WP Type

AT
AT or Below
AT or Above
Window
Next Steps

Data Visualization & synthesis

- Monitor trends
- Observe efficacy of mitigation strategies
- Observe factors that influence degradation
- Set acceptability metrics
- Decision support for designers
Monitor trends

Observe efficacy of mitigation strategies

Observe factors that influence degradation

Set acceptability metrics

Decision support for designers
RNAV STAR Procedural Adherence

Next Steps
- Data visualization and analysis
- Implementation strategies
- Feedback from stakeholders

Method
- Statistical analysis
- Case studies
- Expert interviews

Descriptive Data
- Demographics
- Procedure characteristics
- Outcome measures

Why we looked at OPD STARs
- Understanding of current procedures
- Identification of gaps and opportunities
- Comparison with benchmarks