2 PURPOSE AND NEED

The CEQ regulations implementing NEPA require that EAs include a "brief discussion of the need for the proposal."[36] FAA Order 1050.1E expands on this requirement, stating that an EA must include a discussion that "identifies the problem facing the proponent (that is, the need for an action), the purpose of the action (that is, the proposed solution to the problem), and the proposed timeframe for implementing the action."[37] This chapter discusses each of these items separately, as they relate to the Houston OAPM project.

2.1 Need for the Houston OAPM Project

By law, the FAA must "develop plans and policy for the use of the navigable airspace and assign by regulation or order the use of the airspace necessary to ensure the safety of aircraft and the efficient use of airspace."[38] The Houston OAPM Study Team concluded that existing published (i.e., charted) air traffic procedures[39] in the Houston Metroplex are less efficient, less flexible, and more complex than what recent advances in technology would enable (further discussed below).

The Houston OAPM Study Team materials reflected three key factors as causes for the inefficiencies and complexities in the Houston Metroplex (see Appendix E for airspace and route structure analysis by the Study Team):

1. Limitations of the conventional, ground-based navigation system and existing RNAV procedures
2. Limited flight path predictability and flexibility, particularly during adverse weather conditions
3. High occurrence of voice communications among controllers and pilots, leading to excessive workload, and increased hear-back and read-back errors[40]

The following sections discuss each of these factors individually.

2.1.1 Inefficiencies of the Conventional Ground-Based Navigation System and Existing RNAV Procedures

The conventional navigation system, in use since the 1950s, uses conventional point-to-point routes between ground-based NAVAIDs. However, aircraft seldom fly full

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[36] *Code of Federal Regulations,* Title 40, sec. 1508.9(b).
[37] FAA Order 1050.1E, Chg. 1, para. 405c.
[38] *U.S. Code,* Title 49, sec. 40103(b)(1).
[39] Charted air traffic procedures include standard instrument departure procedures (SIDS), standard terminal arrival routes (STARs), and standard instrument approach procedures (SIAP), as regulated by *Code of Federal Regulations,* Title 14, Part 97. FAA publishes current procedures at http://aeronav faa.gov/index.asp?xml=aeronav/applications.
[40] "Hear-back and read-back error" is defined as an inadvertent introduction of error caused by a pilot incorrectly repeating controller instructions, and the failure of the controller to recognize the error.

conventional approach procedures as published from an initial approach fix (first point on the approach procedure), except for training purposes or when surveillance radar is unavailable. Instead, controllers typically use radar to vector (i.e., give compass headings to) aircraft to join the final approach course, bypassing much of the published procedure to reduce miles flown. Similar types of shortcuts via radar vectoring also can occur on arrival or departure procedures. These actions reduce distances flown and allow a controller to merge aircraft coming from different directions into a single line. This sometimes results in increased pilot-controller radio transmissions and, when compared to a published procedure, results in a less predictable flight track[41] for the pilot. PBN techniques like RNAV provide a solution to this problem because they enable more direct flight paths similar to the routes offered by radar vectoring, affording controllers greater predictability and flexibility, and reducing the need for pilot-controller interaction.[42] In some locations within the EA study area, the close proximity between arrival and departure corridors causes controllers to more actively monitor aircraft activity along proximate or crossing flight routes (i.e., confliction points) and be prepared to intervene to maintain safe separation.

ATC manages confliction points and ensures safe separation of aircraft using the following techniques:

- Assigning level flight segments where arrival and/or departure flight routes intersect to ensure adequate vertical separation between aircraft
- Radar vectoring (i.e., ATC directed temporary flight path deviations and changes to the previously granted clearance[43] or routings published on navigation charts) to avoid other aircraft on nearby flight routes, a common practice applied to arriving and departing aircraft
- Increasing horizontal spacing between aircraft
- Coordinating with pilots and controllers of neighboring airspace in proximity of aircraft (point-outs)

These ATC actions require verbal communication among controllers and pilots, increasing workload and adding to system complexity. In addition, radar vectoring and “level-offs” reduce flight efficiency. Finally, longer flight routes caused by radar vectoring, and interrupted climbs/descents add distance and time to flights, resulting in unnecessary delays and not taking full advantage of aircraft performance capabilities.

[41] A “flight track” isroute and altitude profile of an aircraft’s flight.
[42] Conventionally equipped aircraft without RNAV capability must continue to have access to the NAS. For this reason, proposed changes to arrival/departure procedures must continue to accommodate varying aircraft operator types and must be redesigned to safely separate aircraft of different equipage levels.
[43] For more information, see Appendix D.

Currently, there are RNAV standard terminal arrival routes (STARs)[44] and standard instrument departures (SIDs)[45] serving IAH, HOU, and other satellite airports in the Houston terminal area. The FAA first introduced these procedures in 2009. As currently designed, however, these procedures do not take full advantage of the capabilities that PBN offers. For example, the existing RNAV STARs often require air traffic controllers to intervene during descent, giving instructions to a pilot to level off and maintain a fixed altitude before clearing the aircraft to begin descent again. These "stair-stepped" approaches are less efficient and increase radio transmissions compared to new optimized profile descents (OPDs),[46] in which an aircraft can descend at reduced power from top-of-descent to final approach with minimal controller interaction. Furthermore, the existing RNAV STARs do not have separate runway transitions[47] that differentiate between airport flow conditions, based primarily on wind direction and speed (i.e., landing to the east versus to the west). The existing RNAV SIDs are not procedurally deconflicted[48] from arrivals, thus requiring intervention by controllers to ensure adequate aircraft separation.

2.1.2 Limited Flight Path Predictability

Due to the limitations of ground-based NAVAIDs, air traffic controllers routinely perform radar vectoring to provide shorter routes to individual aircraft as compared to published procedures. As a result, air traffic control removes aircraft from published procedures, causing less predictable flight paths and increased pilot-controller radio communications.

2.1.3 Frequent Occurrence of Voice Communications

Existing arrival and departure procedures do not include predefined altitude instructions or optimum lateral paths, requiring air traffic controller instructions such as radar vectoring and altitude assignments. Numerous radio voice transmissions between pilots and controllers are necessary to issue and verify these instructions. Frequent radio transmissions increase workload, frequency congestion, and the potential that ATC instructions are misunderstood (e.g., hear-back and read-back errors). When

[44] Standard Terminal Arrival (STAR): A preplanned instrument flight rule (IFR) ATC arrival procedure published for pilot use in graphic and/or textual form. STARs provide transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area. (FAA, *Pilot-Controller Glossary*, July 26, 2012.)

[45] Standard Instrument Departure (SID): A preplanned instrument flight rule (IFR) air traffic control (ATC) departure procedure printed for pilot/controller use in graphic form to provide obstacle clearance and a transition from the terminal area to the appropriate en route structure. SIDs are primarily designed for system enhancement to expedite traffic flow and to reduce pilot/controller workload. ATC clearance must always be received prior to flying a SID. (FAA, *Pilot-Controller Glossary*, July 26, 2012.)

[46] An OPD is a procedure in which the aircraft's on-board flight computer facilitates a continuous descent from the top of descent to touchdown, without level-off segments. For more information, see Appendix D.

[47] "Runway transition" refers to separate lateral paths to or from specific runways that are depicted on navigation charts.

[48] "Procedural deconfliction" means defining mandatory altitude or lateral restrictions as part of a procedure to keep aircraft from conflicting with others on routes in close proximity.

frequent radio transmissions occupy the attention of controllers, they have less time to devote to other tasks.

2.2 Purpose of the Houston OAPM Project

The purpose of the Houston OAPM project is to address the three components of the need, as described in Section 2.1 . The FAA's primary drivers are improved efficiency of airspace operations, increased flight path predictability and flexibility, and decreased errors in controller/pilot voice communication, along with preserved or improved air traffic safety. In order to address the need, the FAA intends to implement readily available NextGen technologies designed to support these types of improvements. The following sections discuss each element of the purpose.

2.2.1 Improving Operational Efficiency with PBN Technology

The addition of new PBN procedures to provide more precise, predictable lateral and vertical flight path guidance would improve operations through the Houston Metroplex airspace. In many cases, the new PBN procedures would replace existing, less efficient PBN procedures. Optimized climbs and descents and shorter lateral paths reduce inefficient level flight segments and total distance flown. Implementation of new and improved PBN procedures would allow the FAA to accomplish the following:

- Create more efficient vertical flight profiles (i.e., climbs and descents).
- Implement more direct lateral flight paths to reduce flight miles.
- Deconflict arrival and departure procedures to enhance safety and optimize vertical profiles.
- Provide airport-specific arrival and departure routes, reducing complexity through added route separation in certain cases.
- Provide specific transitions that differ depending upon airport flow in use at any given time
- Realign departure routes to the most commonly used destinations.
- Decrease use of current departure procedures that rely on initial radar vectors in favor of more precise RNAV departure routings.

2.2.2 Increase Flight Path Predictability

Implementation of new PBN procedures would improve lateral flight path accuracy (i.e., the extent to which the aircraft flight track matches the published procedure), increasing predictability. More predictable flight paths would support procedural deconfliction and allow pilots to more accurately plan the routing, duration, and fuel requirements for a particular flight.

2.2.3 Decrease Required Controller/Pilot Voice Communication

Implementation of new PBN procedures would reduce the need for numerous radio voice transmissions between pilots and controllers because PBN procedures would include more precise lateral and/or vertical flight path guidance within the published procedure itself and/or readily available in the aircraft's flight computer. Reduced transmissions would result in less frequency congestion, which could potentially reduce listening and repetition errors during verbal instructions (i.e., hear-back and read-back errors). In addition, the consolidation of clearances associated with PBN procedures would reduce pilot workload and provide a more efficient work environment, which would allow more time for the pilot and crew to focus on tasks during high-workload situations (e.g., departures and arrivals).

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