U.S. Department
of Transportation
Federal Aviation
Administration

Aviation Environmental Design Tool (AEDT)

Version 2c Service Pack 1

AEDT Standard Input File (ASIF) Reference Guide

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1 Introduction

The AEDT Standard Input File (ASIF) provides a standard file format to allow for the import of data into AEDT. The ASIF format allows users to create a new study by importing a complete study including airports, scenarios, cases, operations, tracks, and other study definitions. Users can also use the partial ASIF import to update existing AEDT studies.

This guide provides a description of the ASIF format for the ASIF schema version 1.2.12. It also provides an overview of ASIF usage and annotated sample studies. The guide is intended for analysts and programmers who wish to create ASIF.

It is recommended to use the ASIF schema documentation, **AsifMerge.html**, in conjunction with the guide. It provides diagrams that illustrate the structure and contents of each XML element as well as rules and properties of each element, see Section 1.2.

1.1 Overview of the ASIF Format

ASIF is based on the XML file format. XML is a text-based file format that is readable by both humans and computers. Data values are tagged with elements and organized in a hierarchical manner such that the elements can contain other elements or data. XML elements can also have attributes which provide metadata that affect how the ASIF importer processes the data in the XML file. This document assumes users have basic familiarity with the XML file format. For additional information about XML, see http://xmlfiles.com/xml/.

An ASIF can be created and edited in a standard XML editor. The *XML Notepad* and *Notepad++* are XML editors that can be downloaded for free online.

1.2 ASIF Schema Documentation

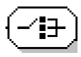
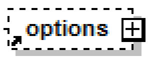
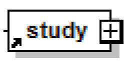
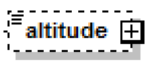
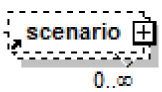
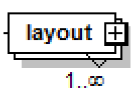
The ASIF schema (.xsd) files are located under *C:\Program Files\FAA\AEDT\Examples* directory.

- ASIF.xsd
- ASIF_Airport.xsd
- ASIF_Common.xsd
- ASIF_Fleet.xsd
- ASIF_Receptors.xsd

The ASIF schema documentation, **AsifMerge.html**, is located under the *C:\Program Files\FAA\AEDT\Examples\ASIF Schema Reference* directory. This is a HTML file which contains schema diagrams that illustrate the structure and contents of each XML element. The links in the HTML file facilitates understanding the schema hierarchy and the rules and properties of each element.

The following table describes the notations used in the ASIF schema diagram.

Notation for Schema Diagram

Notation	Icon	Description
Choice indicator		Only one of the elements contained in the selected group can be present
Sequence indicator		Child elements must appear in the specified sequence
Element	 	Represented by a rectangle with solid or dotted border Solid rectangle – required element Dotted rectangle – optional element
Element with (+) sign	 	Indicates that the element has child element(s) and/or attribute(s)
Element with min and max bound	  	Specifies the min/max number of times an element can occur in the parent element

1.3 Importing External Studies

AEDT also supports import of INM and EDMS studies by converting these legacy tools into ASIF format and importing into AEDT. See the AEDT User Guide for more information on importing legacy studies.

2 ASIF Import Types

There are two types of ASIF import files: a full-study import and a partial-study import. The following sections describe each type of import file.

2.1 Full Study Import

AEDT supports the creation of new studies via ASIF. For a full-study import, the ***content*** attribute of the ***AsifXML*** element must be set to "study".

Please see Section 3 for two sample studies.

2.2 Partial ASIF Import

Partial ASIF is used to import specific pieces of data into an existing AEDT study. A partial ASIF file is organized similarly to a full ASIF, except that it contains a single type of data – the ***content*** attribute of the ***AsifXML*** element must specify the data type. There are twelve data types that can compose a partial ASIF:

- airportLayoutSet
- annualization
- case
- fleet
- receptorSets
- scenario
- boundary
- trackOpSet
- runup
- userGroundSupportEquipmentSet
- stationarySourceSet
- operationalProfileSet

The format for a partial ASIF is outlined below. The header is the same as a full ASIF, except that the ***content*** attribute is not "study". Instead, the ***content*** attribute should specify the data element that appears in the file.

```
<AsifXml xmlns:AsifXml="http://www.faa.gov/ASIF"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2.12"
content="ENTER_CONTENT_TYPE_HERE">

<!-- The content block follows here: -->

      <*content type here*>

       ...

      </*end content type*>

</AsifXml>
```

Note that some of these elements rely on information provided in other data blocks. If this information is not provided by the base study when loading the partial ASIF, an error will be generated. For example, attempting to load a partial ASIF containing scenario data that references an airport that does not exist in the base study will cause an error.

2.3 Sample ASIF Files

Sample ASIF files, including full study files and partial ASIF files, are located in *C:\Program Files\FAA\AEDT\Examples* directory.

Full study ASIF

- asif_emissions_study.xml
- asif_sensor_path_study.xml
- asif_small.xml

Partial ASIF

- PartialASIF_airportLayoutSet.xml
- PartialASIF_annualization.xml
- PartialASIF_boundary.xml
- PartialASIF_operationalProfileSet.xml
- PartialASIF_receptorSets.xml
- PartialASIF_runup.xml
- PartialASIF_scenario.xml
- PartialASIF_stationarySourceSet.xml
- PartialASIF_userGroundSupportEquipmentSet.xml

3 ASIF Examples

This section provides simple steps to assist in the creation of ASIFs for possible studies. See Section 3.1 on developing an ASIF for a simple study and Section 3.2 for an emissions dispersion study.

3.1 Create a Simple Study

Follow the steps below to develop an ASIF for a simple study:

1. Create an empty study file.
2. Populate the airport section.
3. Create receptor set.
4. Create scenario and case hierarchy.
5. Populate the case with tracks and air operations.
6. Create annualization.

The following sections provide examples of each of the above steps. This example should be used as an aid for understanding the ASIF format, and not as a data reference.

Step 1: Create empty study file

At a minimum, an ASIF consists of the standard XML declaration, a study section, and study metadata.

```xml
<AsifXml version="1.2.12" content="study"
xmlns:AsifXml="http://www.faa.gov/ASIF"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

 <study xmlns:asif="http://www.faa.gov/ASIF">
  <!-- User-defined study name -->
  <name>ASIF_example</name>

  <!-- Study type - Emissions, Dispersion, Noise and Emissions, or Noise and
Dispersion -->
  <studyType>Noise and Emissions</studyType>

  <!-- Indicate the units used in the study -->
  <emissionsUnits>Kilograms</emissionsUnits>

  <!-- User-defined study description -->
  <description>A sample study</description>

  <!-- Optional - Set the boundaries of the study area -->
  <boundary>
   <polygon>
    <vertex>
     <latitude>40.636993970695244</latitude>
     <longitude>-89.21758333055047</longitude>
    </vertex>
    <vertex>
     <latitude>40.636993970695244</latitude>
     <longitude>-86.59119444944956</longitude>
    </vertex>
    <vertex>
     <latitude>43.3047921364604</latitude>
```

```
     <longitude>-86.53522348936178</longitude>
    </vertex>
    <vertex>
     <latitude>43.3047921364604</latitude>
     <longitude>-89.27355429063823</longitude>
    </vertex>
   </polygon>
  </boundary>

  <!-- Add airport layouts here -->

  <!-- Add receptors here -->

  <!-- Add scenarios here -->

 </study>
</AsifXml>
```

Step 2: Populate airport layouts section

AEDT requires all airports in the study area to be declared. The airport runway definitions are specified using the ***runwaySet*** element. If runways are not specified in ASIF, then the runway data from the Airport database will be used during the ASIF import.

In the example below, KORD is defined using system runways, and KMDW is defined using user-defined runways.

```
  <airportLayoutSet>

   <airportLayout>
    <!-- Airport with no runway tags will import runways from the AEDT system
data. -->
    <airportCode type="ICAO">KORD</airportCode>
   </airportLayout>

   <airportLayout>
    <!-- User can specify an airport with user-defined runway -->
    <airportCode type="ICAO">KMDW</airportCode>

    <!-- Airports can have one or more runways defined -->
    <runwaySet>
     <runway>
      <!-- Runway length (in feet) -->
      <length>5932</length>

      <!-- Runway width (in feet) -->
      <width>150</width>

      <!-- One or more runway ends -->
      <runwayEnd>
       <!-- user-defined name for runway end -->
       <name>04R</name>

       <!-- latitude and longitude of runway end -->
```

```
        <latitude>41.779496</latitude>
        <longitude>-87.75876</longitude>

        <!-- elevation in feet -->
        <elevation>0.0</elevation>

        <!-- threshold crossing height (in feet) -->
        <threshCrossHeight>50.0</threshCrossHeight>

        <!-- glide slope for an approach to this runway end -->
        <glideSlope>3.0</glideSlope>

        <!-- displaced threshold for departure-->
        <depDispThresh>0.0</depDispThresh>

        <!-- displaced threshold for approach -->
        <appDispThresh>0.0</appDispThresh>

        <!-- Percent change in airport average headwind -->
        <percentWind>0.0</percentWind>
       </runwayEnd>
       <runwayEnd>
        <name>22L</name>
        <latitude>41.791167</latitude>
        <longitude>-87.743554</longitude>
        <elevation>0.0</elevation>
        <threshCrossHeight>50.0</threshCrossHeight>
        <glideSlope>3.0</glideSlope>
        <depDispThresh>0.0</depDispThresh>
        <appDispThresh>0.0</appDispThresh>
        <percentWind>0.0</percentWind>
       </runwayEnd>
      </runway>
     </runwaySet>
    </airportLayout>
   </airportLayoutSet>
```

Step 3: Create receptor set

If the study includes noise or dispersion analysis, then one or more ***receptorSet*** elements must be created. Receptor sets define locations (grid or point) where noise/dispersion measurements are taken. The example below defines a grid type receptor set.

```
  <receptorSet>
   <!-- user-defined name -->
   <name>gridfile_100x100</name>
   <grid>
    <!-- Latitude and longitude of southwest corner of grid -->
    <latitude>41.97872</latitude>
    <longitude>-87.90439</longitude>

    <!-- Width and height of grid (in nautical miles) -->
    <width>100.0</width>
    <height>100.0</height>

    <!-- Number of points across height and width of grid -->
```

```
    <numWidth>100</numWidth>
    <numHeight>100</numHeight>
   </grid>
  </receptorSet>
```

Step 4: Create scenario and case hierarchy

Scenarios contain a set of cases (i.e. operation group) that are used to group aircraft tracks and operations.

The following example demonstrates a simple scenario and case structure. A case can contain one or more child cases.

```
  <scenario>
   <!-- user-defined scenario name and description -->
   <name>Baseline_1990</name>

   <!-- user-defined start time for scenario -->
   <startTime>2009-11-10T15:02:00</startTime>

   <!-- Duration of scenario (in hours) -->
   <duration>24</duration>

   <!-- Taxi model for scenario -->
   <taxiModel>UserSpecified</taxiModel>

   <!-- Aircraft performance model -->
   <acftPerfModel>SAE1845</acftPerfModel>

   <!-- Enable/disable bank angle calculations for aircraft performance
modeling -->
   <bankAngle>true</bankAngle>

   <!-- Sulfur related settings -->
   <sulfurConversionRate>0.05</sulfurConversionRate>
   <fuelSulfurContent>6.8E-4</fuelSulfurContent>

   <!-- A description of the scenario -->
   <description>Simple scenario</description>

   <!-- List of airports to use for the scenario -->
   <scenarioAirportLayoutSet>
    <scenarioAirportLayout>
     <airportLayoutName>KMDW</airportLayoutName>
    </scenarioAirportLayout>
    <scenarioAirportLayout>
     <airportLayoutName>KORD</airportLayoutName>
    </scenarioAirportLayout>
   </scenarioAirportLayoutSet>

   <caseSet>
    <!-- One or more case elements -->
    <case>
     <!-- sequential case number unique in this scenario -->
     <caseId>0</caseId>
```

```
    <!-- user-defined case name -->
    <name>PlanB</name>

    <!-- Noise emissions source -->
    <source>Aircraft</source>

    <!-- Case start time and duration -->
    <startTime>2009-11-10T15:02:00</startTime>
    <duration>24</duration>

    <!-- Add trackOpSet elements here -->

   </case>
  </caseSet>
 </scenario>
```

Step 5: Populate cases with tracks and air operations

The ***trackOpSet*** element defines a single track and any number of aircraft operations to be flown on that track. Tracks can be composed of subtracks with dispersion values. Operations defined for the track will be dispersed based on the dispersion weight amongst any subtracks that make up the track.

```
     <trackOpSet>
      <!-- Single track element -->
      <track>
       <!-- user-defined track name -->
       <name>DJM04R_EON.10803</name>
       <!-- Track operation type: A = Arrival, D = Departure, O = Overflight
-->
       <optype>D</optype>

       <!-- Airport and runway for this track -->
       <airport type="ICAO">KMDW</airport>
       <runway>04R</runway>

       <!-- tracks can be composed of multiple dispersed subtracks -->
       <subtrack>

        <!-- the user-defined ID for the subtrack -->
        <id>0</id>

        <!-- The sum of the dispersionWeights for all subtracks within a
given track must equal 1 -->
        <dispersionWeight >1.0</dispersionWeight>

        <!-- Set of trackNode or trackVector elements, all must be the same
for each subtrack -->
        <trackNodes>
         <trackNode>
          <latitude>40.65640</latitude>
          <longitude>-73.71322</longitude>
         </trackNode>
         <trackNode>
          <latitude>40.65640</latitude>
          <longitude>-53.71322</longitude>
         </trackNode>
```

```xml
    </trackNodes>

   </subtrack>
  </track>

  <operations>
   <!--operation element represents one or more flights on a track-->
   <operation>
    <!-- user-defined operation id -->
    <id>T9.1</id>

    <!-- AEDT aircraftType for this operation -->
    <aircraftType>
     <airframeModel>Raytheon Beech 1900-C</airframeModel>
     <engineCode>PT67B</engineCode>
     <engineModCode>NONE </engineModCode>
    </aircraftType>

    <!-- number of times to fly this operation -->
    <numOperations>1.0</numOperations>

    <!-- user-defined flight number -->
    <flightNumber>CKE545</flightNumber>

    <!-- user-defined operation type  -->
    <userType>MU3001</userType>

    <!-- user-defined parameter data -->
    <userParam>J</userParam>

    <!-- arrival or departure airport and runway -->
    <departureAirport type="ICAO">KMDW</departureAirport>
    <departureRunway>04R</departureRunway>
    <arrivalAirport type="FAA">LIT</arrivalAirport>

    <!-- offTime for departures or onTime for arrivals -->
    <offTime>2009-11-10T15:02:00</offTime>

    <!-- aircraft profile  for this operation -->
    <saeProfile>STANDARD</saeProfile>
   </operation>
  </operations>
 </trackOpSet>
```

Step 6: Create annualization

Annualization is the process of performing a weighted summation[1] over the noise and emission results from some or all of the cases within a scenario in order to create results that represent noise and emissions exposures over a time period of interest. Each scenario element may contain an annualization element describing the weighted annualization tree.

```
<annualization>
 <!-- user-defined scenario annualization name -->
 <name>Alternative.config</name>

 <!-- Define one or more groups of cases and groups -->
 <annualizationGroup>

  <!-- Define rollup weight for this group -->
  <weight>2.0</weight>

  <annualizationGroup>
   <weight>0.7</weight>

   <!-- Associate scenario case with this annualization group -->
   <annualizationCase>

    <!-- Specify case name to include -->
    <name>PlanB</name>

    <!-- Define rollup weight for this case -->
    <weight>1.0</weight>

   </annualizationCase>
  </annualizationGroup>
 </annualizationGroup>
</annualization>
```

Step 7: Full ASIF

The full study ASIF is as follows:

```
<AsifXml version="1.2.12" content="study"
xmlns:AsifXml="http://www.faa.gov/ASIF"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

 <study xmlns:asif="http://www.faa.gov/ASIF">

  <!-- User-defined study name -->
  <name>ASIF_example</name>

  <!-- Study type - Emissions, Dispersion, Noise and Emissions, or Noise and
Dispersion -->
  <studyType>Noise and Emissions</studyType>
```

[1] The word 'summation' is used figuratively and the actual process of correctly summing or adding together noise or emissions results depends upon the metric being used. For example: energy metric results would not be directly added together for a result since they are logarithmic values, but would rather be log-added.

```
  <!-- Indicate the units used in the study -->
  <emissionsUnits>Kilograms</emissionsUnits>

  <!-- User-defined study description -->
  <description>A sample study</description>

  <!-- Optional - Set the boundaries of the study area -->
  <boundary>
   <polygon>
    <vertex>
     <latitude>40.636993970695244</latitude>
     <longitude>-89.21758333055047</longitude>
    </vertex>
    <vertex>
     <latitude>40.636993970695244</latitude>
     <longitude>-86.59119444944956</longitude>
    </vertex>
    <vertex>
     <latitude>43.3047921364604</latitude>
     <longitude>-86.53522348936178</longitude>
    </vertex>
    <vertex>
     <latitude>43.3047921364604</latitude>
     <longitude>-89.27355429063823</longitude>
    </vertex>
   </polygon>
  </boundary>

  <airportLayoutSet>
   <airportLayout>
    <!-- Airport with no runway tags will import runways from the AEDT system
data. -->
    <airportCode type="ICAO">KORD</airportCode>
   </airportLayout>

   <airportLayout>
    <!-- User can specify an airport with user-defined runway -->
    <airportCode type="ICAO">KMDW</airportCode>

    <!-- Airports can have one or more runways defined -->
    <runwaySet>
     <runway>
      <!-- Runway length (in feet) -->
      <length>5932</length>

      <!-- Runway width (in feet) -->
      <width>150</width>

      <!-- One or more runway ends -->
      <runwayEnd>
       <!-- user-defined name for runway end -->
       <name>04R</name>

       <!-- latitude and longitude of runway end -->
       <latitude>41.779496</latitude>
       <longitude>-87.75876</longitude>
```

```xml
      <!-- elevation in feet -->
      <elevation>0.0</elevation>

      <!-- threshold crossing height (in feet) -->
      <threshCrossHeight>50.0</threshCrossHeight>

      <!-- glide slope for an approach to this runway end -->
      <glideSlope>3.0</glideSlope>

      <!-- displaced threshold for departure-->
      <depDispThresh>0.0</depDispThresh>

      <!-- displaced threshold for approach -->
      <appDispThresh>0.0</appDispThresh>

      <!-- Percent change in airport average headwind -->
      <percentWind>0.0</percentWind>
     </runwayEnd>
     <runwayEnd>
      <name>22L</name>
      <latitude>41.791167</latitude>
      <longitude>-87.743554</longitude>
      <elevation>0.0</elevation>
      <threshCrossHeight>50.0</threshCrossHeight>
      <glideSlope>3.0</glideSlope>
      <depDispThresh>0.0</depDispThresh>
      <appDispThresh>0.0</appDispThresh>
      <percentWind>0.0</percentWind>
     </runwayEnd>
    </runway>
   </runwaySet>
  </airportLayout>
 </airportLayoutSet>

 <receptorSet>
  <!-- user-defined name -->
  <name>gridfile_100x100</name>
  <grid>
   <!-- Latitude and longitude of southwest corner of grid -->
   <latitude>41.97872</latitude>
   <longitude>-87.90439</longitude>

   <!-- Width and height of grid (in nautical miles) -->
   <width>100.0</width>
   <height>100.0</height>

   <!-- Number of points across height and width of grid -->
   <numWidth>100</numWidth>
   <numHeight>100</numHeight>
  </grid>
 </receptorSet>

 <scenario>
  <!-- user-defined scenario name and description -->
  <name>Baseline_1990</name>
```

```xml
   <!-- user-defined start time for scenario -->
   <startTime>2009-11-10T15:02:00</startTime>

   <!-- Duration of scenario (in hours) -->
   <duration>24</duration>

   <!-- Taxi model for scenario -->
   <taxiModel>UserSpecified</taxiModel>

   <!-- Aircraft performance model -->
   <acftPerfModel>SAE1845</acftPerfModel>

   <!-- Enable/disable bank angle calculations for aircraft performance
modeling -->
   <bankAngle>true</bankAngle>

   <!-- Sulfur related settings -->
   <sulfurConversionRate>0.05</sulfurConversionRate>
   <fuelSulfurContent>6.8E-4</fuelSulfurContent>

   <!-- A description of the scenario -->
   <description>A sample scenario</description>

   <!-- List of airports to use for the scenario -->
   <scenarioAirportLayoutSet>
    <scenarioAirportLayout>
     <airportLayoutName>KMDW</airportLayoutName>
    </scenarioAirportLayout>
    <scenarioAirportLayout>
     <airportLayoutName>KORD</airportLayoutName>
    </scenarioAirportLayout>
   </scenarioAirportLayoutSet>

   <caseSet>
    <!-- One or more case elements -->
    <case>
     <!-- sequential case number unique in this scenario -->
     <caseId>0</caseId>

     <!-- user-defined case name -->
     <name>PlanB</name>

     <!-- Noise emissions source -->
     <source>Aircraft</source>

     <!-- Case start time and duration -->
     <startTime>2009-11-10T15:02:00</startTime>
     <duration>24</duration>

     <trackOpSet>
      <!-- Single track element -->
      <track>
       <!-- user-defined track name -->
       <name>DJM04R_EON.10803</name>
```

```xml
       <!-- Track operation type: A = Arrival, D = Departure, O = Overflight
-->
       <optype>D</optype>

       <!-- Airport and runway for this track -->
       <airport type="ICAO">KMDW</airport>
       <runway>04R</runway>

       <!-- tracks can be composed of multiple dispersed subtracks -->
       <subtrack>

        <!-- the user-defined ID for the subtrack -->
        <id>0</id>

        <!-- The sum of the dispersionWeights for all subtracks within a
given track must equal 1 -->
        <dispersionWeight >1.0</dispersionWeight>

        <!-- Set of trackNode or trackVector elements, all must be the same
for each subtrack -->
        <trackNodes>
         <trackNode>
          <latitude>40.65640</latitude>
          <longitude>-73.71322</longitude>
         </trackNode>
         <trackNode>
          <latitude>40.65640</latitude>
          <longitude>-53.71322</longitude>
         </trackNode>
        </trackNodes>

       </subtrack>
      </track>

      <operations>
       <!--operation element represents one or more flights on a track-->
       <operation>
        <!-- user-defined operation id -->
        <id>T9.1</id>

        <!-- AEDT aircraftType for this operation -->
        <aircraftType>
         <airframeModel>Raytheon Beech 1900-C</airframeModel>
         <engineCode>PT67B</engineCode>
         <engineModCode>NONE </engineModCode>
        </aircraftType>

        <!-- number of times to fly this operation -->
        <numOperations>1.0</numOperations>

        <!-- user-defined flight number -->
        <flightNumber>CKE545</flightNumber>

        <!-- user-defined operation type  -->
        <userType>MU3001</userType>
```

```
        <!-- user-defined parameter data -->
        <userParam>J</userParam>

        <!-- arrival or departure airport and runway -->
        <departureAirport type="ICAO">KMDW</departureAirport>
        <departureRunway>04R</departureRunway>
        <arrivalAirport type="FAA">LIT</arrivalAirport>

        <!-- offTime for departures or onTime for arrivals -->
        <offTime>2009-11-10T15:02:00</offTime>

        <!-- aircraft profile  for this operation -->
        <saeProfile>STANDARD</saeProfile>
       </operation>
      </operations>
     </trackOpSet>

    </case>
   </caseSet>

   <annualization>
    <!-- user-defined scenario annulalization name -->
    <name>Alternative.config</name>

    <!-- Define one or more groups of cases and groups -->
    <annualizationGroup>

     <!-- Define rollup weight for this group -->
     <weight>2.0</weight>

     <annualizationGroup>
      <weight>0.7</weight>

      <!-- Associate scenario case with this annualization group -->
      <annualizationCase>

       <!-- Specify case name to include -->
       <name>PlanB</name>

       <!-- Define rollup weight for this case -->
       <weight>1.0</weight>

      </annualizationCase>
     </annualizationGroup>
    </annualizationGroup>
   </annualization>
  </scenario>
 </study>
</AsifXml>
```

3.2 Create an Emissions Dispersion Study

An emissions dispersion study contains the same core elements as a simple study (Section 3.1). In addition, it requires data on stationary sources and airport features.

1. Create an empty study file.
2. Populate the airport section.
    a. Basic airport layout
    b. Stationary sources
    c. Airport gates/terminals
    d. Taxiways
    e. Runways
    f. Taxipaths
    g. Tracks
    h. Airport configurations
3. Create receptor set.
4. Create scenario and case hierarchy.
    a. Airport scenario properties
    b. Non-aircraft operations case
    c. Aircraft operations case
5. Create annualization.

The following sections provide examples of the steps. This example should be used as an aid for understanding the ASIF format, and not as a data reference.

Step 1: Create empty study file

```
<?xml version="1.0" encoding="utf-8"?>
<AsifXml xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2.12"
content="study">

 <study>
  <name>emissions_sample_asif_short</name>
  <studyType>Dispersion</studyType>
  <emissionsUnits>Kilograms</emissionsUnits>
  <description>A sample emissions study</description>

  <!-- Add airport layouts here -->
  <!-- Add receptors here -->
  <!-- Add scenarios here -->

 </study>
</AsifXml>
```

Step 2: Populate airport layouts section

AEDT requires all airports in the study area to be declared. In addition to runways, declare stationary sources of emissions, such as generators, training fires, or boilers in this section. Also declare gates, terminals, and taxiways.

This sample demonstrates a simple case similar to the STUDY_PVD study included with AEDT installation. This sample uses simplified taxiway definitions, a single runway, and a single aircraft type.

Step 2a: Declare basic airport layout

The basic airport information and surrounding buildings can be defined according to the following example.

```
<airportLayoutSet>
 <airportLayout>
  <name>Baseline-Theodore Francis Green State-2004</name>
  <airportCode type="ICAO">KPVD</airportCode>
  <!-- Start date of the study-->
  <startDate>2004-01-01</startDate>
  <!--Elevation of the airport above MSL in feet-->
  <elevation>55</elevation>
  <latitude>41.723999</latitude>
  <longitude>-71.428221</longitude>
  <buildingSet>
   <building>
    <!--Name of the building-->
    <name>Terminal</name>
    <!--Elevation of the building in meters-->
    <elevation>16.764</elevation>
    <!--Height of building in meters-->
    <height>0</height>
    <polygonCoords>
     <vertex>
      <latitude>41.74214308945087</latitude>
      <longitude>-71.413044097333525</longitude>
     </vertex>
     <vertex>
      <latitude>41.7418685788759</latitude>
      <longitude>-71.4124212593739</longitude>
     </vertex>
     <vertex>
      <latitude>41.742856388006238</latitude>
      <longitude>-71.411523291021965</longitude>
     </vertex>
     <vertex>
      <latitude>41.743130903444673</latitude>
      <longitude>-71.4121461346995</longitude>
     </vertex>
    </polygonCoords>
   </building>
  </buildingSet>
```

Step 2b: Create stationary sources

Define each stationary source with an individual location definition, as well as other properties that describe the nature or amount of emissions. Each stationary source may have different elements associated with it. The example below gives the declaration for a simple emergency generator.

```
  <stationarySourceSet>
   <stationarySource>
    <!-- Name of the stationary source -->
    <name>Emergency Generator-Baseline-KPVD-2004</name>
    <pointStationarySource>
     <pointCoord>
```

```
      <!-- Lat/lon coordinates-->
      <latitude>41.743248909982285</latitude>
      <longitude>-71.41216809054572</longitude>
     </pointCoord>
     <!--Elevation in meters-->
     <baseElevation>16.764</baseElevation>
     <!-- Release height in meters-->
     <releaseHeight>12.192</releaseHeight>
     <!-- Velocity of release gas in meters/sec-->
     <gasVelocity>15</gasVelocity>
     <!-- Diameter of stack where gas escapes the source in meters-->
     <stackDiameter>0.100584</stackDiameter>
     <!-- Temperature at point in Fahrenheit-->
     <temperature>400</temperature>
    </pointStationarySource>
    <categoryGenerator>
     <!-- Type code of object-->
     <typeCode>2</typeCode>
     <!-- Horsepower rating-->
     <powerRatingHorsepower>1340</powerRatingHorsepower>
     <!-- Emissions factors-->
     <CO_EF>3.03</CO_EF>
     <TOC_EF>1.14</TOC_EF>
     <NOx_EF>14</NOx_EF>
     <SOx_EF>0.93</SOx_EF>
     <PM10_EF>0.998</PM10_EF>
     <!-- Percent of emissions removed by pollution control measures-->
     <pollutionControlFactorTOC>0</pollutionControlFactorTOC>
     <pollutionControlFactorCO>0</pollutionControlFactorCO>
     <pollutionControlFactorNOx>0</pollutionControlFactorNOx>
     <pollutionControlFactorSOx>0</pollutionControlFactorSOx>
     <pollutionControlFactorPM10>0</pollutionControlFactorPM10>
     <pm25ToPm10Ratio>1</pm25ToPm10Ratio>
    </categoryGenerator>
   </stationarySource>
  </stationarySourceSet>
```

Step 2c:Define airport gates/terminals

Airport gates can be defined as a point or a polygon. In AEDT, a polygon gate is referred as a terminal. This example declares a terminal which is defined by a set of latitude and longitude coordinates.

```
  <gateSet>
   <gate>
    <name>AC</name>
    <!-- Elevation of the gate in meters-->
    <elevation>16.76</elevation>
    <releaseHeight>1.499616</releaseHeight>
    <!-- Horizontal dispersion parameter-->
    <sigmaY>0.1</sigmaY>
    <!-- Vertical dispersion parameter-->
    <sigmaZ>0.1</sigmaZ>
    <polygonCoords>
     <!-- Coordinates of gate vertices-->
     <vertex>
      <latitude>41.745139411257995</latitude>
```

```xml
     <longitude>-71.41015590887973</longitude>
    </vertex>
    <vertex>
     <latitude>41.744540948170368</latitude>
     <longitude>-71.408847926936545</longitude>
    </vertex>
    <vertex>
     <latitude>41.739914698948347</latitude>
     <longitude>-71.412700203804789</longitude>
    </vertex>
    <vertex>
     <latitude>41.740535077331714</latitude>
     <longitude>-71.414048427453068</longitude>
    </vertex>
    <vertex>
     <latitude>41.74214308945087</latitude>
     <longitude>-71.413044097333525</longitude>
    </vertex>
    <vertex>
     <latitude>41.741863092355707</latitude>
     <longitude>-71.4124359172483</longitude>
    </vertex>
    <vertex>
     <latitude>41.743155492229967</latitude>
     <longitude>-71.411380309528937</longitude>
    </vertex>
    <vertex>
     <latitude>41.743501289605305</latitude>
     <longitude>-71.411515795554152</longitude>
    </vertex>
   </polygonCoords>
  </gate>
 </gateSet>
```

Step 2d: Declare taxiways

Taxiways are line segments that link gates, runways, and other taxiways. They are composed of sequences of latitude and longitude coordinates, and specify the speed of aircraft that use them at each node.

```xml
 <taxiwaySet>
  <taxiway>
   <name>AC to 23</name>
   <!-- Width of emmission dispersion around taxiway in meters-->
   <dispersionWidth>20</dispersionWidth>
   <taxiNodeSet>
    <taxiNode>
     <latitude>41.742510605080867</latitude>
     <longitude>-71.411486738878608</longitude>
     <!-- Elevation in meters)-->
     <elevation>16.76</elevation>
     <!-- Speed of aircraft at node in meters/sec-->
     <speed>17.26</speed>
    </taxiNode>
    <taxiNode>
     <latitude>41.746840990965104</latitude>
```

```xml
      <longitude>-71.397780701297123</longitude>
      <elevation>16.76</elevation>
      <speed>17.26</speed>
     </taxiNode>
    </taxiNodeSet>
   </taxiway>
   <taxiway>
    <name>AC to 5</name>
    <dispersionWidth>20</dispersionWidth>
    <taxiNodeSet>
     <taxiNode>
      <latitude>41.742510605080867</latitude>
      <longitude>-71.411486738878608</longitude>
      <elevation>16.76</elevation>
      <speed>17.26</speed>
     </taxiNode>
     <taxiNode>
      <latitude>41.730402908060768</latitude>
      <longitude>-71.411541169494924</longitude>
      <elevation>16.76</elevation>
      <speed>17.26</speed>
     </taxiNode>
    </taxiNodeSet>
   </taxiway>
  </taxiwaySet>
```

Step 2e: Create runways

Runways are used by departing and arriving aircraft, and are linked by taxiways. A runway in AEDT is defined using two runway ends.

```xml
  <runwaySet>
   <runway>
    <!-- Length of runway in feet-->
    <length>7069</length>
    <!-- Width of runway in feet-->
    <width>150</width>
    <runwayEnd>
     <name>05</name>
     <latitude>41.730402908060768</latitude>
     <longitude>-71.411541169494924</longitude>
     <!--Elevation of the runway in feet-->
     <elevation>54.986875960838894</elevation>
     <!-- Glide slope for runway's endpoint in degrees-->
     <glideSlope>3</glideSlope>
    </runwayEnd>
    <runwayEnd>
     <name>23</name>
     <latitude>41.746840990965104</latitude>
     <longitude>-71.397780701297123</longitude>
     <elevation>54.986875960838894</elevation>
     <glideSlope>3</glideSlope>
    </runwayEnd>
   </runway>
  </runwaySet>
```

Step 2f: Assemble taxipaths

Taxipaths are a series of taxiways that guide an aircraft from a gate to a runway. In this example, simple two-point taxiways are used to connect the gate and the runway. In other studies, taxipaths can be composed of multiple taxiway line segments, and separate taxipaths may share taxiways in common as paths across the airport.

```
<taxipathSet>
 <taxipath>
  <!-- Name of the gate associated with the path-->
  <gateName>AC</gateName>
  <!-- Name of the runway associated with the path-->
  <runwayName>05</runwayName>
  <!-- Traffic direction-->
  <direction>Outbound</direction>
  <!-- Name of the taxiways in the path-->
  <taxiwayName>AC to 5</taxiwayName>
 </taxipath>
 <taxipath>
  <gateName>AC</gateName>
  <runwayName>05</runwayName>
  <direction>Inbound</direction>
  <taxiwayName>AC to 5</taxiwayName>
 </taxipath>
 <taxipath>
  <gateName>AC</gateName>
  <runwayName>23</runwayName>
  <direction>Outbound</direction>
  <taxiwayName>AC to 23</taxiwayName>
 </taxipath>
 <taxipath>
  <gateName>AC</gateName>
  <runwayName>23</runwayName>
  <direction>Inbound</direction>
  <taxiwayName>AC to 23</taxiwayName>
 </taxipath>
</taxipathSet>
```

Step 2g: Define tracks

Tracks are paths flown by aircraft, and are defined for an aircraft type (fixed-wing or rotary-wing) and an operation type (arrival, departure, or touch & go). Each track is made up of nodes and defined for a runway. The following example provides the structure for one track – a full study must have at least one track defined for each operation type, runway, and wing type of aircraft in the study.

```
<trackSet>
 <track>
  <name>05_A_FixedWing</name>
  <!-- Operation type for the track; arrival (A), departure (D), or touch
  & go (T)-->
  <optype>A</optype>
  <!-- Wing type; fixed (F) or rotary (R)-->
  <wingtype>F</wingtype>
  <airport type="ICAO">KPVD</airport>
  <runway>05</runway>
  <subtrack>
```

```xml
      <!-- ID of the subtrack-->
      <id>0</id>
      <!-- Dispersion of traffic across this subtrack-->
      <dispersionWeight>1</dispersionWeight>
      <trackNodes>
       <!-- Nodes that make up this track-->
       <trackNode>
        <latitude>40.328096427261926</latitude>
        <longitude>-72.555207007324171</longitude>
       </trackNode>
       <trackNode>
        <latitude>41.730402908060768</latitude>
        <longitude>-71.411541169494924</longitude>
       </trackNode>
       <trackNode>
        <latitude>41.746840990965104</latitude>
        <longitude>-71.397780701297123</longitude>
       </trackNode>
      </trackNodes>
     </subtrack>
    </track>
```

Step 2h: Create airport configurations

Airport configurations give the number of arrivals and departures per hour, and the distribution of flights across associated runways. A single configuration is used in the following example, but multiple configurations could be used in a study.

```xml
<airportConfigGroupSet>
 <airportConfigGroup>
  <groupName>Baseline-Theodore Francis Green State-2004</groupName>
  <airportConfig>
   <configurationName>Configuration</configurationName>
   <!-- Flag to use an operation distribution-->
   <useDistribution>false</useDistribution>
   <airportCapacity>
    <!-- Pareto curve points for airport operations-->
    <capacityPoint>
     <arrivalsPerHour>27</arrivalsPerHour>
     <departuresPerHour>52</departuresPerHour>
    </capacityPoint>
    <capacityPoint>
     <arrivalsPerHour>52</arrivalsPerHour>
     <departuresPerHour>27</departuresPerHour>
    </capacityPoint>
   </airportCapacity>
   <runwayAssignmentSet>
    <runwayAssignment>
     <!-- Aircraft size for assignments; small (S), large (L),
     or heavy (H)-->
     <aircraftSize>S</aircraftSize>
     <runway>23</runway>
     <!-- Percent of arrival operations on runway; all arrival
     percentages must sum to 100%-->
     <arrivalPercentage>60</arrivalPercentage>
```

```
     <!-- Percent of departure operations on runway; all departure
     percentages must sum to 100%-->
     <departurePercentage>60</departurePercentage>
     <!-- Percent of touch & go operations on runway; all touch & go
     percentages must sum to 100%-->
     <tgoPercentage>60</tgoPercentage>
    </runwayAssignment>
    <runwayAssignment>
     <aircraftSize>S</aircraftSize>
     <runway>05</runway>
     <arrivalPercentage>40</arrivalPercentage>
     <departurePercentage>40</departurePercentage>
     <tgoPercentage>40</tgoPercentage>
    </runwayAssignment>
    <runwayAssignment>
     <aircraftSize>L</aircraftSize>
     <runway>23</runway>
     <arrivalPercentage>60</arrivalPercentage>
     <departurePercentage>60</departurePercentage>
     <tgoPercentage>60</tgoPercentage>
    </runwayAssignment>
    <runwayAssignment>
     <aircraftSize>L</aircraftSize>
     <runway>05</runway>
     <arrivalPercentage>40</arrivalPercentage>
     <departurePercentage>40</departurePercentage>
     <tgoPercentage>40</tgoPercentage>
    </runwayAssignment>
    <runwayAssignment>
     <aircraftSize>H</aircraftSize>
     <runway>23</runway>
     <arrivalPercentage>60</arrivalPercentage>
     <departurePercentage>60</departurePercentage>
     <tgoPercentage>60</tgoPercentage>
    </runwayAssignment>
    <runwayAssignment>
     <aircraftSize>H</aircraftSize>
     <runway>05</runway>
     <arrivalPercentage>40</arrivalPercentage>
     <departurePercentage>40</departurePercentage>
     <tgoPercentage>40</tgoPercentage>
    </runwayAssignment>
   </runwayAssignmentSet>
  </airportConfig>
 </airportConfigGroup>
</airportConfigGroupSet>
```

Step 2i: Declare operational profiles

Three profiles are required when using operational profiles in AEDT – quarter-hourly, daily, and monthly. These profiles provide a weighting factor that determines how often activity occurs during the time period. Aircraft, stationary sources, and ground vehicles can all be assigned operational profiles. For this example, the same three profiles are being used for all vehicles, but in practice profiles will differ for GSEs, aircraft, and stationary sources.

Only the first part of the quarterly-hour profile is shown here for brevity. The entire profile is given in the example file.

```
    <quarterHourlyProfileSet>
     <quarterHourlyProfile>
      <profileName>Example Quarter-Hour-Baseline-KPVD</profileName>
      <!-- Weighting of operations at this time bin-->
      <temporalFactor startHour="0" startMinutes="0">0.1777</temporalFactor>
      <temporalFactor startHour="0" startMinutes="15">0.1777</temporalFactor>
      <temporalFactor startHour="0" startMinutes="30">0.1777</temporalFactor>
      <temporalFactor startHour="0" startMinutes="45">0.1777</temporalFactor>
      <temporalFactor startHour="1" startMinutes="0">0.0967</temporalFactor>

  ...

     </quarterHourlyProfile>
    </quarterHourlyProfileSet>

    <dailyProfileSet>
     <dailyProfile>
      <profileName>Example Daily-Baseline-KPVD</profileName>
      <temporalFactorSunday>0.7939</temporalFactorSunday>
      <temporalFactorMonday>0.9916</temporalFactorMonday>
      <temporalFactorTuesday>0.9867</temporalFactorTuesday>
      <temporalFactorWednesday>1</temporalFactorWednesday>
      <temporalFactorThursday>0.9245</temporalFactorThursday>
      <temporalFactorFriday>0.8743</temporalFactorFriday>
      <temporalFactorSaturday>0.7887</temporalFactorSaturday>
     </dailyProfile>
    </dailyProfileSet>

    <monthlyProfileSet>
     <monthlyProfile>
      <profileName>Example Monthly-Baseline-KPVD</profileName>
      <temporalFactorJanuary>0.6265</temporalFactorJanuary>
      <temporalFactorFebruary>0.6791</temporalFactorFebruary>
      <temporalFactorMarch>0.775</temporalFactorMarch>
      <temporalFactorApril>0.8322</temporalFactorApril>
      <temporalFactorMay>0.8741</temporalFactorMay>
      <temporalFactorJune>0.9033</temporalFactorJune>
      <temporalFactorJuly>1</temporalFactorJuly>
      <temporalFactorAugust>0.9876</temporalFactorAugust>
      <temporalFactorSeptember>0.7994</temporalFactorSeptember>
      <temporalFactorOctober>0.9428</temporalFactorOctober>
      <temporalFactorNovember>0.8522</temporalFactorNovember>
      <temporalFactorDecember>0.7806</temporalFactorDecember>
     </monthlyProfile>
    </monthlyProfileSet>

    <activityProfileSet>
     <activityProfile name="ActivityProfile-Baseline-KPVD-6-5-6">
      <quarterHourlyProfile>Example Quarter-Hour-Baseline-
KPVD</quarterHourlyProfile>
      <dailyProfile>Example Daily-Baseline-KPVD</dailyProfile>
```

```
      <monthlyProfile>Example Monthly-Baseline-KPVD</monthlyProfile>
     </activityProfile>
  </activityProfileSet>
```

Step 3: Create receptor set

The receptor set defines a set of points or a grid in which noise or emission concentrations will be modeled. One or more ***receptorSet*** is required in order to generate emissions dispersion results.

```
  <receptorSet>
   <name>CartesianReceptors-Baseline-KPVD</name>
   <pointReceptor>
    <name>01</name>
    <latitude>41.75569223042968</latitude>
    <longitude>-71.401734633637048</longitude>
    <!-- Elevation above MSL in feet-->
    <elevation>54.986875960838894</elevation>
    <!-- Height of the receptor above ground in feet-->
    <receptorHeight>5.9099999269584984</receptorHeight>
   </pointReceptor>
   <pointReceptor>
    <name>01D</name>
    <latitude>41.732126660490067</latitude>
    <longitude>-71.4141821642798</longitude>
    <elevation>54.986875960838894</elevation>
    <receptorHeight>5.9099999269584984</receptorHeight>
   </pointReceptor>
   <pointReceptor>
    <name>01S</name>
    <latitude>41.762630555759486</latitude>
    <longitude>-71.386077230440634</longitude>
    <elevation>54.986875960838894</elevation>
    <receptorHeight>5.9099999269584984</receptorHeight>
   </pointReceptor>
  </receptorSet>
```

Step 4: Create scenario and case hierarchy

A scenario contains a set of cases, which contain groups of aircraft operations, non-aircraft operations, and runup operations.

Step 4a: Define airport scenario properties

Define the basic scenario properties including airport information, weather data, and study time.

```
  <scenario>
   <name>2004-Baseline</name>
   <!-- Scenario start time-->
   <startTime>2004-01-01T00:00:00</startTime>
   <!-- Scenario duration in hours-->
   <duration>8760</duration>
   <!-- Taxi model type for scenario-->
   <taxiModel>Sequencing</taxiModel>
   <!-- Time in mode; either Performance or ICAO-->
   <timeInModeBasis>Performance</timeInModeBasis>
   <!-- Aircraft performance model-->
   <acftPerfModel>SAE1845</acftPerfModel>
```

```xml
<!-- Flag to include bank angle calculations-->
<bankAngle>false</bankAngle>
<!-- Portion of fuel that becomes sulfuric acid when combusted-->
<sulfurConversionRate>0.005</sulfurConversionRate>
<description>A sample emissions study scenario</description>
<scenarioAirportLayoutSet>
 <scenarioAirportLayout>
  <airportLayoutName>Baseline-Theodore Francis Green State-2004
  </airportLayoutName>
  <!-- Height where vigorous mixing of gases takes place, in feet-->
  <mixingHeight>2226</mixingHeight>
  <!-- Flag to use hourly meteorological data, rather than
  annual averages-->
  <useHourlyMetData>true</useHourlyMetData>
  <!-- Average temperature in Fahrenheit-->
  <averageTemperature>50.4</averageTemperature>
  <!-- Average daily high temperature in Fahrenheit-->
  <dailyHighTemperature>69.35</dailyHighTemperature>
  <!-- Average daily low temperature in Fahrenheit-->
  <dailyLowTemperature>48.65</dailyLowTemperature>
  <!-- Average barometric pressure in inches Hg.-->
  <pressure>29.92</pressure>
  <!-- Average barometric pressure at MSL in inches Hg.-->
  <pressureMSL>29.92</pressureMSL>
  <!-- Relative humidity percentage-->
  <humidty>60</humidty>
  <!--Wind speed at surface-->
  <windSpeed>8</windSpeed>
  <!-- Wind direction in degrees-->
  <windDirection>0</windDirection>
  <!--Ceiling in feet-->
  <ceiling>99999.99</ceiling>
  <!--Visibility in miles-->
  <visibility>50</visibility>
 </scenarioAirportLayout>
</scenarioAirportLayoutSet>
```

Step 4b: Define the case for non-aircraft operations

This study contains two cases. The first case contains non-aircraft operations (i.e., stationary source operations and GSE populations). The second case contains aircraft operations and GSEs specifically assigned to those aircraft.

The example below declares the first case (non-aircraft operations). The second case (aircraft operations) is described in the next Step 4c.

```xml
<case>
 <caseId>-1623425151</caseId>
 <name>2004_Baseline_Theodore Francis Green State_NonAircraft</name>
 <startTime>2004-01-01T00:00:00</startTime>
 <duration>8760</duration>
 <stationarySourceOperationSet>
  <stationarySourceOperation>
   <refName>Emergency Generator-Baseline-KPVD-2004</refName>
   <emissionsUsage>
```

```
      <!--Annualized ammount of emissions-->
      <yearlyValue>500</yearlyValue>
      <activityProfile>ActivityProfile-Baseline-KPVD-6-5-6
      </activityProfile>
     </emissionsUsage>
    </stationarySourceOperation>
   </stationarySourceOperationSet>
   <groundSupportEquipmentPopulationOperationSet>
    <groundSupportEquipmentPopulationOperation>
     <!--ID for GSE type-->
     <gseID>30</gseID>
     <!--Fuel used by the GSE-->
     <fuelType>Diesel</fuelType>
     <!--GSE type-->
     <gseType>Generator</gseType>
     <!--Number of GSEs-->
     <numUnits>1</numUnits>
     <!--Operation time, yearly, in hours-->
     <annualOpTime>1630</annualOpTime>
     <!--Profile of activity to use-->
     <activityProfile>ActivityProfile-Baseline-KPVD-6-5-6</activityProfile>
     <!--Horsepower of GSE-->
     <horsepower>158</horsepower>
     <!--User nonroad flag-->
     <useNonRoad>false</useNonRoad>
     <groundSupportEquipmentGateAssignmentSet>
      <groundSupportEquipmentGateAssignment>
       <!--Gate the GSE is assigned to-->
       <gate>AC</gate>
       <!--Fraction of GSE assigned to gate-->
       <fractionAssigned>1</fractionAssigned>
      </groundSupportEquipmentGateAssignment>
     </groundSupportEquipmentGateAssignmentSet>
    </groundSupportEquipmentPopulationOperation>
   </groundSupportEquipmentPopulationOperationSet>
  </case>
```

Step 4c:Define the case for aircraft operations

This case defines aircraft operations, as well as GSEs assigned specifically to those aircraft. In this example, a single aircraft type is used with a simplified set of assigned GSEs. In practice, a variety of aircraft types and GSEs would appear in a single study.

```
  <case>
   <caseId>466140608</caseId>
   <name>2004_Baseline_Theodore Francis Green State_Operations</name>
   <startTime>2004-01-01T00:00:00</startTime>
   <duration>8760</duration>
   <!--Number of minutes to complete a taxi-in-->
   <totalTaxiInTime>7</totalTaxiInTime>
   <!--Number of minutes to complete a taxi-out-->
   <totalTaxiOutTime>19</totalTaxiOutTime>
   <!--Number of minutes to complete an unimpeded taxi-in-->
   <unimpededTaxiInTime>0</unimpededTaxiInTime>
   <!--Number of minutes to complete an unimpeded taxi-out-->
```

```xml
<unimpededTaxiOutTime>0</unimpededTaxiOutTime>
<operation>
 <id>D_1</id>
 <aircraftType>
  <!--Aircraft type-->
  <airframeModel>Airbus A319-100 Series</airframeModel>
  <!--Engine type-->
  <engineCode>3CM028</engineCode>
  <!--APU type-->
  <apuName>APU GTCP 36-300 (80HP)</apuName>
  <!--GSEs assigned to the aircraft-->
  <groundSupportEquipmentLTOOperationSet>
   <groundSupportEquipmentLTOOperation>
    <gseID>13</gseID>
    <fuelType>Gasoline</fuelType>
    <horsepower>107</horsepower>
    <!-- Loading of the GSE-->
    <loadFactor>0.55</loadFactor>
    <!--Operation time for a departure-->
    <departureOpTime>38</departureOpTime>
    <!--Operation time for an arrival-->
    <arrivalOpTime>37</arrivalOpTime>
   </groundSupportEquipmentLTOOperation>
   <groundSupportEquipmentLTOOperation>
    <gseID>14</gseID>
    <fuelType>Gasoline</fuelType>
    <horsepower>107</horsepower>
    <loadFactor>0.5</loadFactor>
    <departureOpTime>24</departureOpTime>
    <arrivalOpTime>24</arrivalOpTime>
   </groundSupportEquipmentLTOOperation>
  </groundSupportEquipmentLTOOperationSet>
 </aircraftType>
 <!--Number of operations-->
 <numOperations>5</numOperations>
 <!--Type of operation; A, D, or T-->
 <opType>D</opType>
 <departureAirport type="ICAO">KPVD</departureAirport>
 <departureGate>AC</departureGate>
 <!--Operation time for APU for departure in minutes-->
 <departureApuTime>3.5</departureApuTime>
 <!--Taxi-out duration in minutes-->
 <taxiOutDuration>10.72</taxiOutDuration>
 <!--Taxi-in duration in minutes-->
 <taxiInDuration>6.24</taxiInDuration>
 <!--Activity profile to use-->
 <activityProfile>ActivityProfile-Baseline-KPVD-6-5-6</activityProfile>
 <!--Aircraft's weight in pounds-->
 <actypeWeight>146100</actypeWeight>
 <!--Sulfur content of the fuel used in this operation in percentage-->
 <fuelSulfurContent>0.00068</fuelSulfurContent>
</operation>
<operation>
 <id>A_1</id>
 <aircraftType>
  <airframeModel>Airbus A319-100 Series</airframeModel>
```

```xml
      <engineCode>3CM028</engineCode>
      <apuName>APU GTCP 36-300 (80HP)</apuName>
      <groundSupportEquipmentLTOOperationSet>
       <groundSupportEquipmentLTOOperation>
        <gseID>13</gseID>
        <fuelType>Gasoline</fuelType>
        <horsepower>107</horsepower>
        <loadFactor>0.55</loadFactor>
        <departureOpTime>38</departureOpTime>
        <arrivalOpTime>37</arrivalOpTime>
       </groundSupportEquipmentLTOOperation>
       <groundSupportEquipmentLTOOperation>
        <gseID>14</gseID>
        <fuelType>Gasoline</fuelType>
        <horsepower>107</horsepower>
        <loadFactor>0.5</loadFactor>
        <departureOpTime>24</departureOpTime>
        <arrivalOpTime>24</arrivalOpTime>
       </groundSupportEquipmentLTOOperation>
      </groundSupportEquipmentLTOOperationSet>
     </aircraftType>
     <numOperations>5</numOperations>
     <opType>A</opType>
     <arrivalAirport type="ICAO">KPVD</arrivalAirport>
     <arrivalGate>AC</arrivalGate>
     <arrivalApuTime>3.5</arrivalApuTime>
     <taxiOutDuration>10.72</taxiOutDuration>
     <taxiInDuration>6.24</taxiInDuration>
     <activityProfile>ActivityProfile-Baseline-KPVD-6-5-6</activityProfile>
     <actypeWeight>137800</actypeWeight>
     <fuelSulfurContent>0.00068</fuelSulfurContent>
    </operation>
   </case>
```

Step 5: Create annualization

Like the noise study (Section 3.1), the emissions results must be annualized in order to create results that represent emissions over a time period of interest.

```xml
  <annualization>
   <!-- user-defined scenario annualization name -->
   <name>Sample Annualization</name>

   <!-- Define one or more groups of cases and groups -->
   <annualizationGroup>

    <!-- Define rollup weight for this group -->
    <weight>1.0</weight>

    <annualizationGroup>
     <weight>1.0</weight>

     <!-- Associate scenario case with this annualization group -->
     <annualizationCase>

      <!-- Specify case name to include -->
```

```
        <name>2004_Baseline_Theodore Francis Green State_Operations</name>

        <!-- Define rollup weight for this case -->
        <weight>1.0</weight>

      </annualizationCase>
     </annualizationGroup>
    </annualizationGroup>
 </annualization>
```

Step 6: Full ASIF

The full emissions dispersion sample ASIF is as follows:

```
<?xml version="1.0" encoding="utf-8"?>
<AsifXml xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.2.12"
content="study">

 <study>
  <name>emissions_sample_asif_short</name>
  <studyType>Dispersion</studyType>
  <emissionsUnits>Kilograms</emissionsUnits>
  <description>A sample emissions study</description>
  <airportLayoutSet>
   <airportLayout>
    <name>Baseline-Theodore Francis Green State-2004</name>
    <airportCode type="ICAO">KPVD</airportCode>
    <!-- Start date of the study-->
    <startDate>2004-01-01</startDate>
    <!--Elevation of the airport above MSL in feet-->
    <elevation>55</elevation>
    <latitude>41.723999</latitude>
    <longitude>-71.428221</longitude>
    <buildingSet>
     <building>
      <!--Name of the building-->
      <name>Terminal</name>
      <!--Elevation of the building in meters-->
      <elevation>16.764</elevation>
      <!--Height of building in meters-->
      <height>0</height>
      <polygonCoords>
       <vertex>
        <latitude>41.74214308945087</latitude>
        <longitude>-71.413044097333525</longitude>
       </vertex>
       <vertex>
        <latitude>41.7418685788759</latitude>
        <longitude>-71.4124212593739</longitude>
       </vertex>
       <vertex>
        <latitude>41.742856388006238</latitude>
        <longitude>-71.411523291021965</longitude>
       </vertex>
       <vertex>
```

```xml
      <latitude>41.743130903444673</latitude>
      <longitude>-71.4121461346995</longitude>
     </vertex>
    </polygonCoords>
   </building>
  </buildingSet>
  <stationarySourceSet>
   <stationarySource>
    <!-- Name of the stationary source -->
    <name>Emergency Generator-Baseline-KPVD-2004</name>
    <pointStationarySource>
     <pointCoord>
      <!-- Lat/lon coordinates-->
      <latitude>41.743248909982285</latitude>
      <longitude>-71.41216809054572</longitude>
     </pointCoord>
     <!--Elevation in meters-->
     <baseElevation>16.764</baseElevation>
     <!-- Release height in meters-->
     <releaseHeight>12.192</releaseHeight>
     <!-- Velocity of release gas in meters/sec-->
     <gasVelocity>15</gasVelocity>
     <!-- Diameter of stack where gas escapes the source in meters-->
     <stackDiameter>0.100584</stackDiameter>
     <!-- Temperature at point in Fahrenheit-->
     <temperature>400</temperature>
    </pointStationarySource>
    <categoryGenerator>
     <!-- Type code of object-->
     <typeCode>2</typeCode>
     <!-- Horsepower rating-->
     <powerRatingHorsepower>1340</powerRatingHorsepower>
     <!-- Weighting factors for emissions elements-->
     <CO_EF>3.03</CO_EF>
     <TOC_EF>1.14</TOC_EF>
     <NOx_EF>14</NOx_EF>
     <SOx_EF>0.93</SOx_EF>
     <PM10_EF>0.998</PM10_EF>
     <!-- Percent of emissions removed by pollution control measures-->
     <pollutionControlFactorTOC>0</pollutionControlFactorTOC>
     <pollutionControlFactorCO>0</pollutionControlFactorCO>
     <pollutionControlFactorNOx>0</pollutionControlFactorNOx>
     <pollutionControlFactorSOx>0</pollutionControlFactorSOx>
     <pollutionControlFactorPM10>0</pollutionControlFactorPM10>
     <pm25ToPm10Ratio>1</pm25ToPm10Ratio>
    </categoryGenerator>
   </stationarySource>
  </stationarySourceSet>
  <gateSet>
   <gate>
    <name>AC</name>
    <!-- Elevation of the gate in meters-->
    <elevation>16.76</elevation>
    <releaseHeight>1.499616</releaseHeight>
    <!-- Horizontal dispersion parameter-->
    <sigmaY>0.1</sigmaY>
```

```
    <!-- Vertical dispersion parameter-->
    <sigmaZ>0.1</sigmaZ>
    <polygonCoords>
     <!-- Coordinates of gate vertices-->
     <vertex>
      <latitude>41.745139411257995</latitude>
      <longitude>-71.41015590887973</longitude>
     </vertex>
     <vertex>
      <latitude>41.744540948170368</latitude>
      <longitude>-71.408847926936545</longitude>
     </vertex>
     <vertex>
      <latitude>41.739914698948347</latitude>
      <longitude>-71.412700203804789</longitude>
     </vertex>
     <vertex>
      <latitude>41.740535077331714</latitude>
      <longitude>-71.414048427453068</longitude>
     </vertex>
     <vertex>
      <latitude>41.74214308945087</latitude>
      <longitude>-71.413044097333525</longitude>
     </vertex>
     <vertex>
      <latitude>41.741863092355707</latitude>
      <longitude>-71.4124359172483</longitude>
     </vertex>
     <vertex>
      <latitude>41.743155492229967</latitude>
      <longitude>-71.411380309528937</longitude>
     </vertex>
     <vertex>
      <latitude>41.743501289605305</latitude>
      <longitude>-71.411515795554152</longitude>
     </vertex>
    </polygonCoords>
   </gate>
  </gateSet>
  <taxiwaySet>
   <taxiway>
    <name>AC to 23</name>
    <!-- Width of emmission dispersion around taxiway in meters-->
    <dispersionWidth>20</dispersionWidth>
    <taxiNodeSet>
     <taxiNode>
      <latitude>41.742510605080867</latitude>
      <longitude>-71.411486738878608</longitude>
      <!-- Elevation in meters)-->
      <elevation>16.76</elevation>
      <!-- Speed of aircraft at node in meters/sec-->
      <speed>17.26</speed>
     </taxiNode>
     <taxiNode>
      <latitude>41.746840990965104</latitude>
      <longitude>-71.397780701297123</longitude>
```

```xml
      <elevation>16.76</elevation>
      <speed>17.26</speed>
     </taxiNode>
    </taxiNodeSet>
   </taxiway>
   <taxiway>
    <name>AC to 5</name>
    <dispersionWidth>20</dispersionWidth>
    <taxiNodeSet>
     <taxiNode>
      <latitude>41.742510605080867</latitude>
      <longitude>-71.411486738878608</longitude>
      <elevation>16.76</elevation>
      <speed>17.26</speed>
     </taxiNode>
     <taxiNode>
      <latitude>41.730402908060768</latitude>
      <longitude>-71.411541169494924</longitude>
      <elevation>16.76</elevation>
      <speed>17.26</speed>
     </taxiNode>
    </taxiNodeSet>
   </taxiway>
  </taxiwaySet>
  <runwaySet>
   <runway>
    <!-- Length of runway in feet-->
    <length>7069</length>
    <!-- Width of runway in feet-->
    <width>150</width>
    <runwayEnd>
     <name>05</name>
     <latitude>41.730402908060768</latitude>
     <longitude>-71.411541169494924</longitude>
     <!--Elevation of the runway in feet-->
     <elevation>54.986875960838894</elevation>
     <!-- Glide slope for runway's endpoint in degrees-->
     <glideSlope>3</glideSlope>
    </runwayEnd>
    <runwayEnd>
     <name>23</name>
     <latitude>41.746840990965104</latitude>
     <longitude>-71.397780701297123</longitude>
     <elevation>54.986875960838894</elevation>
     <glideSlope>3</glideSlope>
    </runwayEnd>
   </runway>
  </runwaySet>
  <taxipathSet>
   <taxipath>
    <!-- Name of the gate associated with the path-->
    <gateName>AC</gateName>
    <!-- Name of the runway associated with the path-->
    <runwayName>05</runwayName>
    <!-- Traffic direction-->
    <direction>Outbound</direction>
```

```
      <!-- Name of the taxiways in the path-->
      <taxiwayName>AC to 5</taxiwayName>
     </taxipath>
     <taxipath>
      <gateName>AC</gateName>
      <runwayName>05</runwayName>
      <direction>Inbound</direction>
      <taxiwayName>AC to 5</taxiwayName>
     </taxipath>
     <taxipath>
      <gateName>AC</gateName>
      <runwayName>23</runwayName>
      <direction>Outbound</direction>
      <taxiwayName>AC to 23</taxiwayName>
     </taxipath>
     <taxipath>
      <gateName>AC</gateName>
      <runwayName>23</runwayName>
      <direction>Inbound</direction>
      <taxiwayName>AC to 23</taxiwayName>
     </taxipath>
    </taxipathSet>
    <trackSet>
     <track>
      <name>05_A_FixedWing</name>
      <!-- Operation type for the track; arrival (A), departure (D), or touch
& go (T)-->
      <optype>A</optype>
      <!-- Wing type; fixed (F) or rotary (R)-->
      <wingtype>F</wingtype>
      <airport type="ICAO">KPVD</airport>
      <runway>05</runway>
      <subtrack>
       <!-- ID of the subtrack-->
       <id>0</id>
       <!-- Dispersion of traffic across this subtrack-->
       <dispersionWeight>1</dispersionWeight>
       <trackNodes>
        <!-- Nodes that make up this track-->
        <trackNode>
         <latitude>40.328096427261926</latitude>
         <longitude>-72.555207007324171</longitude>
        </trackNode>
        <trackNode>
         <latitude>41.730402908060768</latitude>
         <longitude>-71.411541169494924</longitude>
        </trackNode>
        <trackNode>
         <latitude>41.746840990965104</latitude>
         <longitude>-71.397780701297123</longitude>
        </trackNode>
       </trackNodes>
      </subtrack>
     </track>
     <track>
      <name>05_D_FixedWing</name>
```

```
      <optype>D</optype>
      <wingtype>F</wingtype>
      <airport type="ICAO">KPVD</airport>
      <runway>05</runway>
      <subtrack>
       <id>0</id>
       <dispersionWeight>1</dispersionWeight>
       <trackNodes>
        <trackNode>
         <latitude>41.730402908060768</latitude>
         <longitude>-71.411541169494924</longitude>
        </trackNode>
        <trackNode>
         <latitude>41.746840990965104</latitude>
         <longitude>-71.397780701297123</longitude>
        </trackNode>
        <trackNode>
         <latitude>43.13711787619534</latitude>
         <longitude>-70.202867639680548</longitude>
        </trackNode>
       </trackNodes>
      </subtrack>
     </track>
     <track>
      <name>05_T_FixedWing</name>
      <optype>T</optype>
      <wingtype>F</wingtype>
      <airport type="ICAO">KPVD</airport>
      <runway>05</runway>
      <subtrack>
       <id>0</id>
       <dispersionWeight>1</dispersionWeight>
       <trackVectors>
        <trackVector>
         <type>S</type>
         <distance>60761.15234375</distance>
        </trackVector>
        <trackVector>
         <type>R</type>
         <angle>180</angle>
         <radius>18228.345703125</radius>
        </trackVector>
        <trackVector>
         <type>S</type>
         <distance>121522.3046875</distance>
        </trackVector>
        <trackVector>
         <type>R</type>
         <angle>180</angle>
         <radius>18228.345703125</radius>
        </trackVector>
        <trackVector>
         <type>S</type>
         <distance>60761.15234375</distance>
        </trackVector>
       </trackVectors>
```

```
    </subtrack>
   </track>
   <track>
    <name>23_A_FixedWing</name>
    <optype>A</optype>
    <wingtype>F</wingtype>
    <airport type="ICAO">KPVD</airport>
    <runway>23</runway>
    <subtrack>
     <id>0</id>
     <dispersionWeight>1</dispersionWeight>
     <trackNodes>
      <trackNode>
       <latitude>43.13711787619534</latitude>
       <longitude>-70.202867639680548</longitude>
      </trackNode>
      <trackNode>
       <latitude>41.746840990965104</latitude>
       <longitude>-71.397780701297123</longitude>
      </trackNode>
      <trackNode>
       <latitude>41.730402908060768</latitude>
       <longitude>-71.411541169494924</longitude>
      </trackNode>
     </trackNodes>
    </subtrack>
   </track>
   <track>
    <name>23_D_FixedWing</name>
    <optype>D</optype>
    <wingtype>F</wingtype>
    <airport type="ICAO">KPVD</airport>
    <runway>23</runway>
    <subtrack>
     <id>0</id>
     <dispersionWeight>1</dispersionWeight>
     <trackNodes>
      <trackNode>
       <latitude>41.746840990965104</latitude>
       <longitude>-71.397780701297123</longitude>
      </trackNode>
      <trackNode>
       <latitude>41.730402908060768</latitude>
       <longitude>-71.411541169494924</longitude>
      </trackNode>
      <trackNode>
       <latitude>40.328096427261926</latitude>
       <longitude>-72.555207007324171</longitude>
      </trackNode>
     </trackNodes>
    </subtrack>
   </track>
   <track>
    <name>23_T_FixedWing</name>
    <optype>T</optype>
    <wingtype>F</wingtype>
```

```
      <airport type="ICAO">KPVD</airport>
      <runway>23</runway>
      <subtrack>
       <id>0</id>
       <dispersionWeight>1</dispersionWeight>
       <trackVectors>
        <trackVector>
         <type>S</type>
         <distance>60761.15234375</distance>
        </trackVector>
        <trackVector>
         <type>R</type>
         <angle>180</angle>
         <radius>18228.345703125</radius>
        </trackVector>
        <trackVector>
         <type>S</type>
         <distance>121522.3046875</distance>
        </trackVector>
        <trackVector>
         <type>R</type>
         <angle>180</angle>
         <radius>18228.345703125</radius>
        </trackVector>
        <trackVector>
         <type>S</type>
         <distance>60761.15234375</distance>
        </trackVector>
       </trackVectors>
      </subtrack>
     </track>
    </trackSet>
    <airportConfigGroupSet>
     <airportConfigGroup>
      <groupName>Baseline-Theodore Francis Green State-2004</groupName>
      <airportConfig>
       <configurationName>Configuration</configurationName>
       <!-- Flag to use an operation distribution-->
       <useDistribution>false</useDistribution>
       <airportCapacity>
        <!-- Pareto curve points for airport operations-->
        <capacityPoint>
         <arrivalsPerHour>27</arrivalsPerHour>
         <departuresPerHour>52</departuresPerHour>
        </capacityPoint>
        <capacityPoint>
         <arrivalsPerHour>52</arrivalsPerHour>
         <departuresPerHour>27</departuresPerHour>
        </capacityPoint>
       </airportCapacity>
       <runwayAssignmentSet>
        <runwayAssignment>
         <!-- Aircraft size for assignments; small (S), large (L), or heavy
(H)-->
         <aircraftSize>S</aircraftSize>
         <runway>23</runway>
```

```
         <!-- Percent of arrival operations on runway; all arrival
percentages must sum to 100%-->
         <arrivalPercentage>60</arrivalPercentage>
         <!-- Percent of departure operations on runway; all departure
percentages must sum to 100%-->
         <departurePercentage>60</departurePercentage>
         <!-- Percent of touch & go operations on runway; all touch & go
percentages must sum to 100%-->
         <tgoPercentage>60</tgoPercentage>
        </runwayAssignment>
        <runwayAssignment>
         <aircraftSize>S</aircraftSize>
         <runway>05</runway>
         <arrivalPercentage>40</arrivalPercentage>
         <departurePercentage>40</departurePercentage>
         <tgoPercentage>40</tgoPercentage>
        </runwayAssignment>
        <runwayAssignment>
         <aircraftSize>L</aircraftSize>
         <runway>23</runway>
         <arrivalPercentage>60</arrivalPercentage>
         <departurePercentage>60</departurePercentage>
         <tgoPercentage>60</tgoPercentage>
        </runwayAssignment>
        <runwayAssignment>
         <aircraftSize>L</aircraftSize>
         <runway>05</runway>
         <arrivalPercentage>40</arrivalPercentage>
         <departurePercentage>40</departurePercentage>
         <tgoPercentage>40</tgoPercentage>
        </runwayAssignment>
        <runwayAssignment>
         <aircraftSize>H</aircraftSize>
         <runway>23</runway>
         <arrivalPercentage>60</arrivalPercentage>
         <departurePercentage>60</departurePercentage>
         <tgoPercentage>60</tgoPercentage>
        </runwayAssignment>
        <runwayAssignment>
         <aircraftSize>H</aircraftSize>
         <runway>05</runway>
         <arrivalPercentage>40</arrivalPercentage>
         <departurePercentage>40</departurePercentage>
         <tgoPercentage>40</tgoPercentage>
        </runwayAssignment>
       </runwayAssignmentSet>
      </airportConfig>
     </airportConfigGroup>
    </airportConfigGroupSet>
    <quarterHourlyProfileSet>
     <quarterHourlyProfile>
      <profileName>Example Quarter-Hour-Baseline-KPVD</profileName>
      <!-- Weighting of operations at this time bin-->
      <temporalFactor startHour="0" startMinutes="0">0.1777</temporalFactor>
      <temporalFactor startHour="0" startMinutes="15">0.1777</temporalFactor>
      <temporalFactor startHour="0" startMinutes="30">0.1777</temporalFactor>
```

```
      &lt;temporalFactor startHour="0" startMinutes="45"&gt;0.1777&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="1" startMinutes="0"&gt;0.0967&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="1" startMinutes="15"&gt;0.0967&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="1" startMinutes="30"&gt;0.0967&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="1" startMinutes="45"&gt;0.0967&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="2" startMinutes="0"&gt;0.046&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="2" startMinutes="15"&gt;0.046&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="2" startMinutes="30"&gt;0.046&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="2" startMinutes="45"&gt;0.046&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="3" startMinutes="0"&gt;0.0683&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="3" startMinutes="15"&gt;0.0683&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="3" startMinutes="30"&gt;0.0683&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="3" startMinutes="45"&gt;0.0683&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="4" startMinutes="0"&gt;0.18&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="4" startMinutes="15"&gt;0.18&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="4" startMinutes="30"&gt;0.18&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="4" startMinutes="45"&gt;0.18&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="5" startMinutes="0"&gt;0.4146&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="5" startMinutes="15"&gt;0.4146&lt;/temporalFactor&gt;
      &lt;temporalFactor startHour="5" startMinutes="30"&gt;0.4146&lt;/temporalFactor&gt;
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```

```
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```
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startMinutes="45">0.3655</temporalFactor>
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      <temporalFactorSunday>0.7939</temporalFactorSunday>
      <temporalFactorMonday>0.9916</temporalFactorMonday>
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      <temporalFactorThursday>0.9245</temporalFactorThursday>
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      <temporalFactorMarch>0.775</temporalFactorMarch>
      <temporalFactorApril>0.8322</temporalFactorApril>
      <temporalFactorMay>0.8741</temporalFactorMay>
      <temporalFactorJune>0.9033</temporalFactorJune>
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      <temporalFactorAugust>0.9876</temporalFactorAugust>
      <temporalFactorSeptember>0.7994</temporalFactorSeptember>
      <temporalFactorOctober>0.9428</temporalFactorOctober>
      <temporalFactorNovember>0.8522</temporalFactorNovember>
      <temporalFactorDecember>0.7806</temporalFactorDecember>
     </monthlyProfile>
    </monthlyProfileSet>
    <activityProfileSet>
     <activityProfile name="ActivityProfile-Baseline-KPVD-6-5-6">
      <quarterHourlyProfile>Example Quarter-Hour-Baseline-
KPVD</quarterHourlyProfile>
      <dailyProfile>Example Daily-Baseline-KPVD</dailyProfile>
      <monthlyProfile>Example Monthly-Baseline-KPVD</monthlyProfile>
     </activityProfile>
    </activityProfileSet>
```

```xml
    </airportLayout>
   </airportLayoutSet>
   <receptorSet>
    <name>CartesianReceptors-Baseline-KPVD</name>
    <pointReceptor>
     <name>01</name>
     <latitude>41.75569223042968</latitude>
     <longitude>-71.401734633637048</longitude>
     <!-- Elevation above MSL in feet-->
     <elevation>54.986875960838894</elevation>
     <!-- Height of the receptor above ground in feet-->
     <receptorHeight>5.9099999269584984</receptorHeight>
    </pointReceptor>
    <pointReceptor>
     <name>01D</name>
     <latitude>41.732126660490067</latitude>
     <longitude>-71.4141821642798</longitude>
     <elevation>54.986875960838894</elevation>
     <receptorHeight>5.9099999269584984</receptorHeight>
    </pointReceptor>
    <pointReceptor>
     <name>01S</name>
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     <longitude>-71.386077230440634</longitude>
     <elevation>54.986875960838894</elevation>
     <receptorHeight>5.9099999269584984</receptorHeight>
    </pointReceptor>
   </receptorSet>
   <scenario>
    <name>2004-Baseline</name>
    <!-- Scenario start time-->
    <startTime>2004-01-01T00:00:00</startTime>
    <!-- Scenario duration in hours-->
    <duration>8760</duration>
    <!-- Taxi model type for scenario-->
    <taxiModel>Sequencing</taxiModel>
    <!-- Time in mode; either Performance or ICAO-->
    <timeInModeBasis>Performance</timeInModeBasis>
    <!-- Aircraft performance model-->
    <acftPerfModel>SAE1845</acftPerfModel>
    <!-- Flag to include bank angle calculations-->
    <bankAngle>false</bankAngle>
    <!-- Portion of fuel that becomes sulfuric acid when combusted-->
    <sulfurConversionRate>0.005</sulfurConversionRate>
    <description>A sample emissions study scenario</description>
    <scenarioAirportLayoutSet>
     <scenarioAirportLayout>
      <airportLayoutName>Baseline-Theodore Francis Green State-
2004</airportLayoutName>
      <!-- Height where vigorous mixing of gases takes place, in feet-->
      <mixingHeight>2226</mixingHeight>
      <!-- Flag to use hourly meteorological data, rather than annual
averages-->
      <useHourlyMetData>true</useHourlyMetData>
      <!-- Average temperature in Fahrenheit-->
      <averageTemperature>50.4</averageTemperature>
```

```xml
      <!-- Average daily high temperature in Fahrenheit-->
      <dailyHighTemperature>69.35</dailyHighTemperature>
      <!-- Average daily low temperature in Fahrenheit-->
      <dailyLowTemperature>48.65</dailyLowTemperature>
      <!-- Average barometric pressure in inches Hg.-->
      <pressure>29.92</pressure>
      <!-- Average barometric pressure at MSL in inches Hg.-->
      <pressureMSL>29.92</pressureMSL>
      <!-- Relative humidity percentage-->
      <humidty>60</humidty>
      <!--Wind speed at surface-->
      <windSpeed>8</windSpeed>
      <!-- Wind direction in degrees-->
      <windDirection>0</windDirection>
      <!--Ceiling in feet-->
      <ceiling>99999.99</ceiling>
      <!--Visibility in miles-->
      <visibility>50</visibility>
     </scenarioAirportLayout>
    </scenarioAirportLayoutSet>
    <caseSet>
     <case>
      <caseId>-1623425151</caseId>
      <name>2004_Baseline_Theodore Francis Green State_NonAircraft</name>
      <startTime>2004-01-01T00:00:00</startTime>
      <duration>8760</duration>
      <stationarySourceOperationSet>
       <stationarySourceOperation>
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        <emissionsUsage>
         <!--Annualized ammount of emissions-->
         <yearlyValue>500</yearlyValue>
         <activityProfile>ActivityProfile-Baseline-KPVD-6-5-
6</activityProfile>
        </emissionsUsage>
       </stationarySourceOperation>
      </stationarySourceOperationSet>
      <groundSupportEquipmentPopulationOperationSet>
       <groundSupportEquipmentPopulationOperation>
        <!--ID for GSE type-->
        <gseID>30</gseID>
        <!--Fuel used by the GSE-->
        <fuelType>Diesel</fuelType>
        <!--GSE type-->
        <gseType>Generator</gseType>
        <!--Number of GSEs-->
        <numUnits>1</numUnits>
        <!--Operation time, yearly, in hours-->
        <annualOpTime>1630</annualOpTime>
        <!--Profile of activity to use-->
        <activityProfile>ActivityProfile-Baseline-KPVD-6-5-6</activityProfile>
        <!--Horsepower of GSE-->
        <horsepower>158</horsepower>
        <!--User nonroad flag-->
        <useNonRoad>false</useNonRoad>
        <groundSupportEquipmentGateAssignmentSet>
```

```xml
      <groundSupportEquipmentGateAssignment>
       <!--Gate the GSE is assigned to-->
       <gate>AC</gate>
       <!--Fraction of GSE assigned to gate-->
       <fractionAssigned>1</fractionAssigned>
      </groundSupportEquipmentGateAssignment>
     </groundSupportEquipmentGateAssignmentSet>
    </groundSupportEquipmentPopulationOperation>
   </groundSupportEquipmentPopulationOperationSet>
  </case>
  <case>
   <caseId>466140608</caseId>
   <name>2004_Baseline_Theodore Francis Green State_Operations</name>
   <startTime>2004-01-01T00:00:00</startTime>
   <duration>8760</duration>
   <!--Number of minutes to complete a taxi-in-->
   <totalTaxiInTime>7</totalTaxiInTime>
   <!--Number of minutes to complete a taxi-out-->
   <totalTaxiOutTime>19</totalTaxiOutTime>
   <!--Number of minutes to complete an unimpeded taxi-in-->
   <unimpededTaxiInTime>0</unimpededTaxiInTime>
   <!--Number of minutes to complete an unimpeded taxi-out-->
   <unimpededTaxiOutTime>0</unimpededTaxiOutTime>
   <operation>
    <id>D_1</id>
    <aircraftType>
     <!--Aircraft type-->
     <airframeModel>Airbus A319-100 Series</airframeModel>
     <!--Engine type-->
     <engineCode>3CM028</engineCode>
     <!--APU type-->
     <apuName>APU GTCP 36-300 (80HP)</apuName>
     <!--GSEs assigned to the aircraft-->
     <groundSupportEquipmentLTOOperationSet>
      <groundSupportEquipmentLTOOperation>
       <gseID>13</gseID>
       <fuelType>Gasoline</fuelType>
       <horsepower>107</horsepower>
       <!-- Loading of the GSE-->
       <loadFactor>0.55</loadFactor>
       <!--Operation time for a departure-->
       <departureOpTime>38</departureOpTime>
       <!--Operation time for an arrival-->
       <arrivalOpTime>37</arrivalOpTime>
      </groundSupportEquipmentLTOOperation>
      <groundSupportEquipmentLTOOperation>
       <gseID>14</gseID>
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       <loadFactor>0.5</loadFactor>
       <departureOpTime>24</departureOpTime>
       <arrivalOpTime>24</arrivalOpTime>
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     </groundSupportEquipmentLTOOperationSet>
    </aircraftType>
    <!--Number of operations-->
```

```xml
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      <!--Type of operation; A, D, or T-->
      <opType>D</opType>
      <departureAirport type="ICAO">KPVD</departureAirport>
      <departureGate>AC</departureGate>
      <!--Operation time for APU for departure in minutes-->
      <departureApuTime>3.5</departureApuTime>
      <!--Taxi-out duration in minutes-->
      <taxiOutDuration>10.72</taxiOutDuration>
      <!--Taxi-in duration in minutes-->
      <taxiInDuration>6.24</taxiInDuration>
      <!--Activity profile to use-->
      <activityProfile>ActivityProfile-Baseline-KPVD-6-5-6</activityProfile>
      <!--Aircraft's weight in pounds-->
      <actypeWeight>146100</actypeWeight>
      <!--Sulfur content of the fuel used in this operation in percentage-->
      <fuelSulfurContent>0.00068</fuelSulfurContent>
     </operation>
     <operation>
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      <fuelSulfurContent>0.00068</fuelSulfurContent>
     </operation>
    </case>
   </caseSet>
```

```
   <annualization>
    <!-- user-defined scenario annulalization name -->
    <name>Sample Annualization</name>

    <!-- Define one or more groups of cases and groups -->
    <annualizationGroup>

     <!-- Define rollup weight for this group -->
     <weight>1.0</weight>

     <annualizationGroup>
      <weight>1.0</weight>

      <!-- Associate scenario case with this annualization group -->
      <annualizationCase>

       <!-- Specify case name to include -->
       <name>2004_Baseline_Theodore Francis Green State_Operations</name>

       <!-- Define rollup weight for this case -->
       <weight>1.0</weight>

      </annualizationCase>
     </annualizationGroup>
    </annualizationGroup>
   </annualization>
  </scenario>
 </study>
</AsifXml>
```

4 ASIF Design Consideration

4.1 Event Consolidation

AEDT calculates noise for all air operations (e.g. all instances of an aircraft and track) in a given case, which differs from the legacy tool, NIRS. In order to optimize noise modeling performance in AEDT, it is suggested to combine like operations in a case into a representative single air operation for entry into the ASIF.

4.2 Number of Operations in a Case and Results Reuse

AEDT has the ability to reuse previously calculated results when running a new job. The smallest unit of results that can be reused is a set of air operations in a case. Run time can be optimized by designing the ASIF with this capability in mind.

4.3 Control Codes in AEDT

The ***nodeControlType*** in ASIF schema specifies the control code definition. AEDT will fly AtOrBelow control codes as close to the specified altitude as possible, which differs from the legacy tool NIRS that accepts any altitude at or below the specified altitude. Similarly, AEDT will fly AtOrAbove control codes as close to the specified altitude as possible while NIRS accepts any altitude at or above the specified altitude.

AEDT will not use control codes below 500 ft. AFE. Since NIRS does not use control codes below 3000 ft. AFE, any NIRS control codes that are converted to ASIF that are at or below 3000 feet should be changed to the AEDT AtOrBelow control code.

When modeling runway to runway operations using sensor path data, define the flight path using the ASIF ***sensorPath*** element rather than the track element. Sensor paths provide more direct control of altitude for an aircraft trajectory.

AEDT will fly the length of ground tracks without requiring altitude control codes at the beginning and end of the tracks.

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5 Procedural Profiles

This section describes procedural profiles for civil aircraft and helicopters. Military aircraft utilize fixed point profiles. For more information on how to set up an ANP profile in the ASIF, see the ***anpProfile*** element in the ASIF schema documentation.

5.1 Civil Airplane Procedures

The following sections describe civil aircraft procedure steps and how they are combined into procedural profiles. Flap identifiers referred to in this section are created using the ***anpFlaps*** element. The recommended naming conventions for flap identifiers is as follows:

- Include a number in the flaps identifier to indicate the number of degrees that the flaps are extended.
- For approach identifiers, use the prefix “U”, to indicate that the gear is up during descent and the prefix “D” to indicate that the gear is down.
- Use “ZERO” to indicate that flaps are retracted. ZERO is often used in both departure and approach procedures, even though it is categorized as a departure identifier.

5.1.1 Aircraft Profile Operation Types

There are five types of flight operations for aircraft. The valid ASIF identifier is listed in the Operation Type column.

Operation Type	Full Name
A	Approach
D	Departure
T	Touch and go
F	Circuit flight
V	Overflight

5.1.2 Aircraft Procedure Step Types

The procedure step types available in AEDT are listed in the table below. The valid ASIF identifier is listed in the Step Type column.

Step Type	Full Name	Description
T	Takeoff	Start-roll to takeoff rotation, or touch-and-go power-on point to takeoff rotation
C	Climb	Departure climb to final altitude at constant calibrated airspeed
M	Cruise-Climb	Climb at constant angle to final altitude and speed
A	Accelerate	Departure climb and accelerate to final speed

Step Type	Full Name	Description
P	Accel-Percent	Departure climb and accelerate using a constant energy split between acceleration and climbing
V	Level	Maintain altitude and speed
U	Level-Decel	Maintain altitude and reduce speed
W	Level-Idle	Maintain altitude over a given distance with engines at idle
S	Level-Stretch	Special step used to designate where to stretch a circuit flight profile to fit a touch-and-go track
D	Descend	Descend at constant angle to final altitude
E	Descend- Decel	Descend while reducing airspeed
F	Decend-Idle	Descend at a constant angle with engines at idle
L	Land	Land and roll a given distance
B	Decelerate	Used on approach after touchdown, brake with starting thrust for a given distance

5.1.2.1 Takeoff Step

For a takeoff step, input a flaps identifier and a thrust type. The flaps identifier should not have a U or D prefix because these coefficients are appropriate for descending flight paths.

MaxTakeoff thrust is typically used for takeoff, but other thrust types are available:

- MaxClimb thrust means that an airplane takes off using reduced thrust, thus requiring a longer runway.

- UserValue thrust means that the user supplies the takeoff thrust value. The thrust value is the corrected net thrust per engine in pounds or in percent of static thrust. AEDT uses the input value at both the start-roll point and at the rotation point.

For MaxTakeoff and MaxClimb thrust, AEDT uses jet or prop coefficients and SAE-AIR-1845 equations to compute thrust values. For jets, the start-roll thrust is computed at 0 knots, and the rotation thrust is computed using the takeoff speed, which comes from another SAE equation. For jets, the thrust is larger at start-roll than at rotation. For props, the thrust is the same at both points and equal to the thrust computed at the rotation point.

5.1.2.2 Climb Step

For a Climb step, enter a flaps identifier, thrust type, and input the final altitude (the "climb-to" altitude). The final altitude must be higher than the initial altitude. The calibrated air speed on a climb segment is constant, and it is equal to the final speed used on the previous step.

AEDT computes the climb angle and the ground distance based on the airplane weight and average thrust that can be generated for the given conditions. If the computed climb gradient is too small (1%), AEDT processing will stop and log it in the log file.

Typically, MaxTakeoff thrust is used for initial climb segments and MaxClimb thrust for later climb segments, but other thrust types are available:

- UserValue thrust can be assigned to the final climb-to point. AEDT does not adjust this input value for airport elevation, temperature, and pressure.

- UserCutback thrust can be assigned to the whole segment. The difference between UserValue and UserCutback is that AEDT applies the user-value-thrust to a point, whereas user-cutback-thrust is applied to a segment. For the cutback case, AEDT reduces the thrust over a 1000-foot segment, keeps it constant at the user-cutback value over the climb distance (less 1000 feet), and then returns it to normal thrust over a second 1000-foot segment. The input thrust is corrected net thrust per engine. AEDT does not correct for airport conditions.

5.1.2.3 Accelerate Step
For an Accelerate step, input a flaps identifier, thrust type, climb rate, and final speed (the "accelerate-to" speed). The final speed must be larger than the initial speed.

AEDT uses these input parameters and the SAE-AIR-1845 equations to compute the change in altitude and the distance flown.

The climb rate should be consistent with a sea-level standard-day profile. If necessary, AEDT adjusts the climb rate to account for the actual airport elevation, temperature, and pressure.

Zero climb rate is a valid input. AEDT computes a zero change in altitude, and the thrust is used to accelerate the airplane more quickly.

The five climb thrust types discussed above for the Climb step are also available for an acceleration segment.

5.1.2.4 Accel-Percent Step
For an Accel-Percent step, input a flaps identifier, thrust type, energy-share percentage, and final airspeed.

Energy-share comes from the notion that all available thrust is divided between acceleration and climbing. Unlike steps that maintain a constant airspeed while climbing, this step holds the energy-share constant for a given amount of thrust. For the energy-share percentage, enter the percent thrust dedicated to acceleration. An input of 70, for example, would result in 70% of thrust going to acceleration and the remaining 30% of thrust going to climbing.

5.1.2.5 Cruise-Climb Step
For a Cruise-Climb step, input a flaps identifier (usually ZERO), final altitude, climb speed, and the climb angle for the segment.

AEDT calculates the distance flown based on the change in altitude and the climb angle. AEDT calculates the corrected net thrust per engine by using the SAE-AIR- 1845 descent equation with a positive angle, rather than a negative angle.

The difference between Climb and Cruise-Climb is that thrust for Climb is user-defined, whereas AEDT calculates thrust for Cruise-Climb based on the input climb angle. Climb thrust is larger than Cruise-Climb thrust. Climb steps are used after takeoff when near-maximum thrust is applied. During cruise, less thrust is used in climbing from one altitude to another.

5.1.2.6 Level-Stretch Step

For a Level-Stretch step, input a flaps identifier. A Level-Stretch step is used to create circuit flight profiles. Its purpose is to define where to put a variable length segment so that a CIR profile fits on top of a TGO track.

- There can be only one Level-Stretch step in a CIR profile.
- A Level-Stretch step must have a Level step before it and after it. This pair of Level steps should have the same altitude and speed values.

5.1.2.7 Level Step

For a Level step, input a flaps identifier, altitude, speed, and distance flown along the segment. The flaps identifier should be ZERO, or perhaps one with a U prefix (indicating that the landing gear is up).

Input the altitude and speed parameters logically:

- A previous Climb final altitude must equal the Level altitude.
- Also, the Level altitude must equal the next Descend start altitude.
- AEDT computes the amount of thrust needed to maintain level flight at constant speed for the given flaps configuration.

The difference between a Level step and a zero-climb Accelerate step is that the Level step uses a constant speed on the segment, and it uses a smaller value of thrust (and thus, lower noise level) than the Accelerate step. If speed changes during level flight, use a zero-climb Accelerate step.

5.1.2.8 Level-Decel Step

For a Level-Decel step, input a flaps identifier, altitude, initial airspeed, and distance flown along the segment. Unlike the Level step, airspeed is not held constant but allowed to decrease over the segment. AEDT computes the amount of thrust needed to maintain level flight while decelerating.

The Level-Decel step is subject to the same airspeed and altitude considerations as the Level step, e.g. a preceding climb segment has to end at the same altitude as the Level-Decel step.

5.1.2.9 Level-Idle Step

For a Level-Idle step, input the altitude, initial airspeed, and distance flown along the segment. Airspeed is allowed to decrease over the segment. Unlike Level and Level-Decel steps, thrust is calculated using idle thrust coefficients rather than a force balance.

The Level-Idle step is subject to the same airspeed and altitude considerations as the Level step, e.g. a preceding climb segment has to end at the same altitude as the Level-Idle step.

5.1.2.10 Descend Step
For a Descend step, input a flaps identifier, the starting altitude, starting speed, and the descent angle for the segment.

If a Level or Descend step follows the Descend step, it must have a lower altitude. The following step can have the same or a different speed.

5.1.2.11 Descend-Decel Step
For a Descend-Decel step, input a flaps identifier, the starting altitude, starting speed, and the descent angle for the segment. The Descend-Decel step differs from the Descend step in that it more explicitly accounts for deceleration effects during thrust calculations.

If a Level or Descend step follows the Descend-Decel step, it must have a lower altitude. The following step can have the same or a different speed.

5.1.2.12 Descend-Idle Step
For a Descend-Idle step, input the initial airspeed, initial altitude, and descent angle. The Descend-Idle step does not require that a flap setting be specified. The other Descend steps that require flap settings utilize a force balance equation to calculate thrust, but this step calculates the aircraft idle thrust directly from engine idle thrust coefficients.

5.1.2.13 Land Step
For the Land step, select a flaps identifier and input the touchdown rolling distance, which is the distance that the airplane moves before reversing thrust and/or braking.

The last Descend step and the Land step must both use a flaps identifier that has a D prefix (meaning that the landing gear is down).

AEDT computes the touchdown speed by using a SAE-AIR-1845 equation.

5.1.2.14 Decelerate Step
For a Decelerate step, input the segment distance, the starting speed, and the percent of static thrust at the start of the segment. When applicable, the percent of static thrust at the start of the segment represents the level of reverse thrust.

AEDT uses the percent value and the airplane static thrust to compute a thrust setting value for accessing the NPD curves. For those airplanes that use percent type noise, the percent value is used to access the NPD curves.

5.1.3 Aircraft Thrust Types and Parameters

The thrust types available in AEDT are listed in the table below. The valid ASIF identifier is listed in the Thrust Type column.

Thrust Type	Full Name
T	MaxTakeoff
C	MaxClimb
N	MaxContinuous
H	ReduceTakeoff
Q	ReduceClimb
S	MaxTakeoffHiTemp
B	MaxClimbHiTemp
M	MaxContinuousHiTemp
G	ReduceClimbHiTemp
P	ReduceClimbHiTemp
I	IdleApproach
J	IdleApproachHiTemp
R	MinimumThrust
K	UserCutback
U	UserValue

The following table shows the remaining parameters needed to create a procedural profile. These fields are called PARAM1, PARAM2, and PARAM3. They take on a different meaning for each combination of operation type, procedure type, and thrust type, see the two tables below.

PARAM	Full Name
THR	Thrust (lbs)
ALT	Altitude (ft AFE)
SPD	Speed (kts)
DIST	Distance (ft)
ANG	Angle (deg)
PCT	Percent
CLM	Climb Rate (ft/min)

Op Type	Step Type	Flap ID	Thrust Type	PARAM1	PARAM2	PARAM3
A,D,T,F,V	V	ID		ALT	SPD	DIST
A,T,F,V	D	ID		ALT	SPD	ANG
A,T,F,	L	ID	T,C,H,Q	DIST	0	0
A,F	B		U	DIST	SPD	PCT
D,F	T	ID	T,C,H,Q	0	0	0
D,F	T	ID	U	0	0	THR
T	T	ID	T,C,H,Q,R	0	SPD	0
T	T	ID	K,U	0	SPD	THR
D,T,F	C	ID	T,C,H,Q,R	ALT	0	0
D,T,F	C	ID	K,U	ALT	0	THR
D,T,F	A	ID		CLM	SPD	0
D,T,F	A	ID		CLM	SPD	THR
A,D,F,V	M	ID		ALT	SPD	ANG
F	S	ID		0	0	0
A	U	ID		ALT	SPD	DIST
A	W			ALT	SPD	DIST
A	E	ID		ALT	SPD	ANG
A	F			ALT	SPD	ANG
D,T,F	P		T,C,H,Q,R	PCT	SPD	0
D,T,F	P		K,U	PCT	SPD	THR

5.1.4 How to Build an Approach Profile

Standard approach procedures generally have four Descend steps, a Land step, and two Decelerate steps, as follows:

- The four Descend steps start at 6000, 3000, 1500, and 1000 feet AFE. They bring an airplane from zero-flaps configuration, terminal-area entrance speed, down to landing-gear/flaps configuration, final-approach speed.

- For most AEDT airplanes, a 3-degree descent angle is used to model IFR approaches. For single-engine piston airplanes and for BEC58P, a 5- degree descent angle is used to model VFR approaches.

- For the Land step, the touchdown-roll distance is 10% of the total rollout distance. For those airplanes using 3-degree approaches, the relationship between the total roll-out distance and the max landing distance is:

(Roll-out distance) = 0.9 (Max landing distance) - 954

- For those airplanes using 5-degree approaches, the 954-foot value is replaced with 572 feet (the angle is steeper, so the in-air portion of the flight path after crossing the end of the runway is shorter).

- The first Decelerate distance is 90% of the total roll-out distance. The starting speed is less than the touchdown speed. The starting percentage thrust is 40% for narrow-body jets, 10% for wide-body jets, and 40% for props. The first deceleration segment represents reverse thrust action.

- The second Decelerate distance is zero, indicating the end of the profile. The starting speed is 30 knots, representing taxi speed. The starting percentage thrust is 10% of static thrust, representing taxi thrust.

5.1.5 How to Build a Departure Profile

AEDT standard departure procedures for civil jet airplanes tend to follow a pattern (but there are exceptions). A typical civil jet departure profile consists of the following procedure steps:

1. Takeoff using MaxTakeoff thrust and extended flaps.
2. Climb to 1000 feet using MaxTakeoff thrust and takeoff flaps.
3. Accelerate 10-20 knots using MaxTakeoff thrust, takeoff flaps, and 2/3 of the initial climb rate.
4. Accelerate 15-30 knots using MaxTakeoff thrust, reduced flaps, and ½ of the initial climb rate.
5. Accelerate to Vzf (zero-flaps minimum safe maneuvering speed) using MaxClimb thrust, minimal flaps, and 1000-fpm climb rate.
6. Climb to 3000 feet using MaxClimb thrust and zero flaps.
7. Accelerate to 250 knots using MaxClimb thrust, zero flaps, and 1000-fpm climb rate.
8. Climb to 5500 feet using MaxClimb thrust and zero flaps.
9. Climb to 7500 feet using MaxClimb thrust and zero flaps.
10. Climb to 10000 feet using MaxClimb thrust and zero flaps.

A standard departure profile for propeller-driven civil airplanes also tends to follow a pattern of procedure steps:

1. Takeoff using MaxTakeoff thrust and takeoff flaps.
2. Accelerate 10-15 knots using MaxTakeoff thrust, takeoff flaps, and a standard rate of climb.
3. Climb to 1000 feet using MaxTakeoff thrust and takeoff flaps.
4. Accelerate to Vzf using MaxTakeoff thrust, takeoff flaps, and a standard climb rate.

5. Climb to 3000 feet using MaxClimb thrust and zero flaps.

6. Climb to 5500 feet using MaxClimb thrust and zero flaps.

7. Climb to 7500 feet using MaxClimb thrust and zero flaps.

8. Climb to 10000 feet using MaxClimb thrust and zero flaps.

An AEDT standard airplane usually has more than one departure profile. AEDT profiles are distinguished by profile stage numbers from 1 to 9. Departure procedure steps are almost the same for all profile stages. Usually, the change is in the Accelerate step where the final speed value increases for heavier airplanes and the climb rate decreases for heavier airplanes.

5.1.6 How to Build an Overflight Profile

An overflight profile can be built with one procedure step. For example: Level using ZERO flaps, at 5000-foot altitude, at 250 knots, for a distance of 300,000 feet (about 50 nmi).

5.1.7 How to Build a Touch and Go Profile

A user-defined touch-and-go profile consists of the following steps:

1. Start in level flight at airport pattern altitude.

2. Descend.

3. Touch down on the runway.

4. Roll out.

5. Take off.

6. Climb.

7. End after leveling off at pattern altitude.

After associating a touch-and-go profile with a touch-and-go track, but before calculating flight path points, AEDT reorders and modifies the set of profile points so that the profile starts and ends at the touchdown point. While reordering the points, AEDT inserts an extra level segment in the downwind portion of the profile (between the last departure point and first approach point), so that the profile distance is the same as the track distance. Also, a final touchdown point is added at the end. When finished, the new profile starts at touchdown, ends at touchdown, and has horizontal coordinate distance equal to the touch-and-go ground track distance.

5.1.8 How to Build a Circuit Profile

A user-defined circuit profile consists of the following steps:

1. Start on the runway as a standard departure.

2. Take off.

3. Climb to pattern altitude.

4. Level out.

5. Descend from pattern altitude.

6. Land.

7. Decelerate to taxi speed.

After associating a circuit profile with a touch-and-go track (there are no circuit tracks in AEDT), AEDT inserts an extra level segment in the downwind portion of the profile, so that the profile distance is the same as the track distance. The place where the extra segment is inserted is determined by the "Level-Stretch" procedure step, which is provided by the user. After modifying a touch-and-go or circuit profile, AEDT merges the new profile points and the ground track points to compute a three-dimensional flight path.

5.1.9 Airplane Procedure Step Transitions

Procedure steps are combined in prescribed sequences. Certain sequences are not allowed. For example, a climb step may not be followed by a descend step. Procedures must comply with the step transition diagrams provided here.

The step transition diagrams use a simple convention to represent procedures:

- Ellipses represent procedure steps.
- Arrows represent a valid transition from one step to another.
- Arrows point in the direction of the allowed transition – e.g. Land to Decelerate is accepted, but Decelerate to Land is not.
- A double sided arrow means that the transition is valid in both directions.
- An arrow looping back to a step indicates that the step can be repeated.
- A box surrounding two or more steps is used to simplify the diagram.
- Arrows connected to the box apply to each step within.
- Each step within the box can transition to any other within the box.

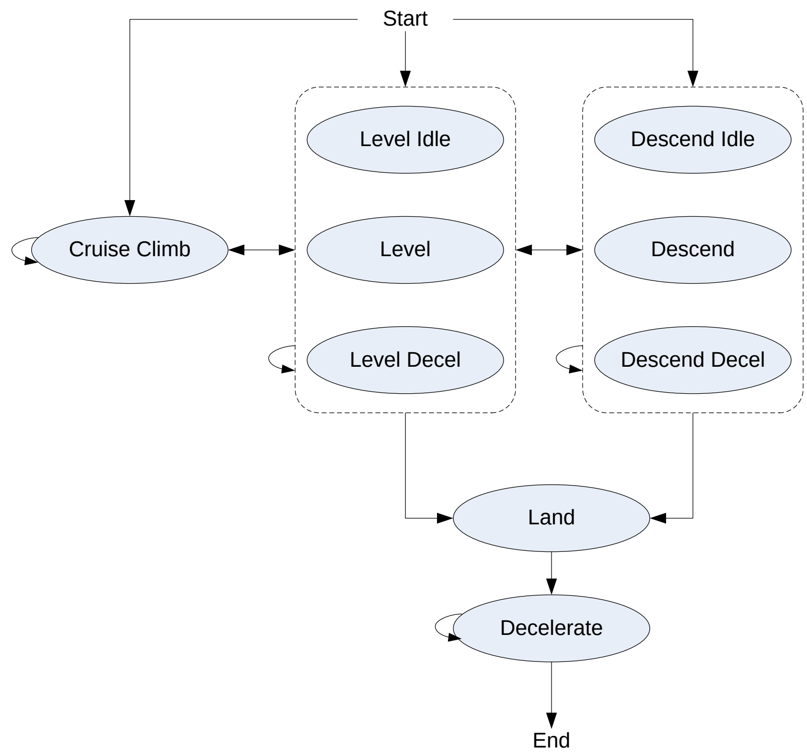

Figure 1: Airplane Approach Step Transition Diagram

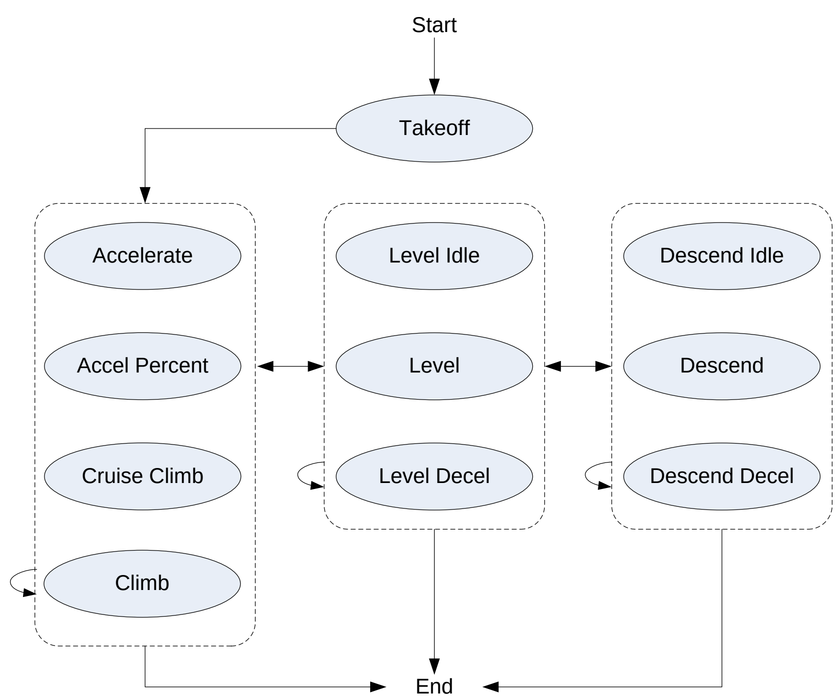

Figure 2: Airplane Departure Step Transition Diagram

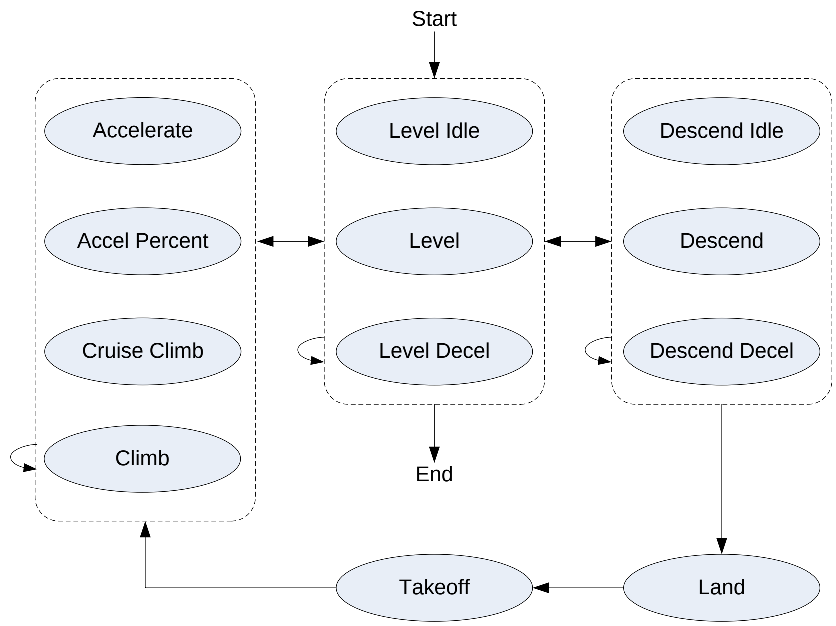

Figure 3: Airplane Touch and Go Step Transition Diagram

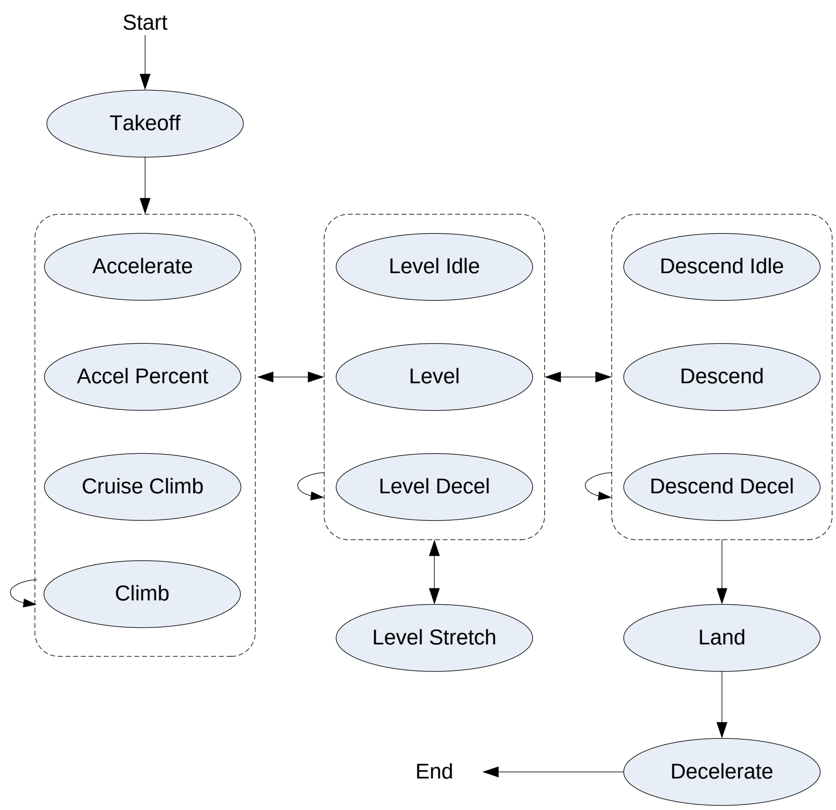

Figure 4: Airplane Circuit Step Transition Diagram

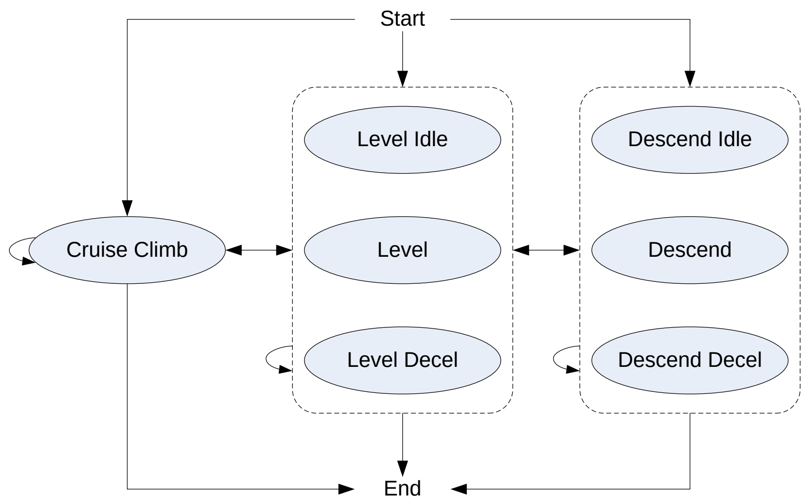

Figure 5: Airplane Overflight Step Transition Diagram

1.1 Helicopter Procedures

The following sections describe helicopter procedure steps and how they are combined into procedural profiles.

5.1.10 Helicopter Profile Operation Types

There are four types of flight operations for helicopters:

Abbreviation	Single-Letter Identifier	Description	Begin	End
APP	A	Approach	In Air	Helipad
DEP	D	Departure	Helipad	In Air
TAX	T	Taxi	Helipad	Helipad
OVF	V	Overflight	In Air	In Air

5.1.11 Helicopter Procedure Step Types

The following table describes the procedure steps that are used to define helicopter profiles. The first seven types are the primary NPD operating modes. The next nine are secondary NPD operating modes which can be derived from the primary modes or defined as separate curves. The last step (start altitude) facilitates profile creating as is not associated with an NPD operating mode.

Step Type	Description	State	Parameters
A	Approach at constant speed	Move	Dist Alt
D	Depart at constant speed	Move	Dist Alt
X	Level flyover at constant speed	Move	Dist
G	Ground idle	Static	Dur
H	Flight idle	Static	Dur
I	Hover in ground effect	Static	Dur
J	Hover out of ground effect	Static	Dur
V	Vertical ascent in ground effect	Static	Dur Alt
W	Vertical ascent out of ground effect	Static	Dur Alt
Y	Vertical descent in ground effect	Static	Dur Alt
Z	Vertical descent out of ground effect	Static	Dur Alt
B	Approach with horizontal deceleration	Move	Dist Spd
C	Approach with descending deceleration	Move	Dist Alt Spd
E	Depart with horizontal acceleration	Move	Dist Spd
F	Depart with climbing acceleration	Move	Dist Alt Spd
T	Taxi at constant speed	Move	Spd
S	Start altitude at constant speed	--	Alt spd

Parameter values are defined as below:

PARAM	Full Name
Dist	Distance (ft)
Dur	Duration (s)
Alt	Altitude (ft AFE)
Spd	Airspeed (kts)

5.1.11.1 Additional Helicopter Step Type Information

Step Type	Description
Start Altitude	This step is used to start a profile at a given altitude and speed. Input the starting altitude and speed.
Level Fly	This step is used to maintain altitude and speed for a given distance. Input the track distance covered by the step. Altitude and speed are defined by the previous step.
App Const Speed	This step is used to descend at constant speed to a given altitude over a given distance. Input the track distance covered by the step and the final altitude. The initial altitude and speed are defined by the previous step.
App Desc Decel	This step is used to descend and decelerate to a final altitude and speed over a given distance. Input the track distance covered by the step, the final altitude, and the final speed. The initial altitude and speed are defined by the previous step.
App Horiz Decel	This step is used to decelerate to a final speed at constant altitude over a given distance. Input the track distance covered by the step and the final speed. The altitude and initial speed are defined by the previous step.
App Vertical	This step is used to maintain horizontal position while descending to a final altitude over a given duration. Input the duration of the step and the final altitude. The horizontal position of the step is calculated from the previous step and the horizontal speed is zero.
Hover	This step is used to maintain altitude and horizontal position for a given duration. Input the duration of the step. The altitude is defined by the previous step, the horizontal position of the step is calculated from the previous step, and the horizontal speed is zero.
Ground Idle	This step is used to maintain ground idle for a given duration. Input the duration of the step. The altitude is zero, the horizontal position of the step is calculated from the previous step, and the horizontal speed is zero.
Flight Idle	This step is used to maintain flight idle for a given duration. Input the duration of the step. The altitude is zero, the horizontal position of the step is calculated from the previous step, and the horizontal speed is zero.
Dep Vertical	This step is used to maintain horizontal position while ascending to a final altitude over a given duration. Input the duration of the step and the final altitude. The horizontal position of the step is calculated from the previous step and the horizontal speed is zero.
Dep Horiz Accel	This step is used to accelerate to a final speed over a given distance. Input the track distance covered by the step and the final speed. The altitude and initial speed are defined by the previous step.
Dep Climb Accel	This step is used to climb and accelerate to a final altitude and speed over a given distance. Input the track distance covered by the step, the final altitude, and the final speed. The initial altitude and speed are defined by the previous step.

Step Type	Description
Dep Const Speed	This step is used to climb at constant speed to a given altitude over a given distance. Input the track distance covered by the step and the final altitude. The initial altitude and speed are defined by the previous step.
Taxi	This step is used to taxi at a given speed. Input the speed. The track distance is calculated based on the assigned taxi ground track, and the altitude is defined by the previous step. Helicopters defined as not having wheels must taxi at an altitude greater than zero.

Helicopter procedure steps explicitly define a helicopter's flight path. There are no thrust calculations for helicopter flight paths as there are for fixed-wing aircraft. Rather, each procedure step correlates with a helicopter flight operational mode and each mode has its own set of NPD data.

Some helicopter procedure steps correlate with different helicopter flight operational modes (and therefore different NPD and directivity data) depending on their altitude. When constructing flight paths with the Hover, DepVertical, and App Vertical procedure steps, AEDT calculates a ground effect altitude as follows:

Ground Effect Altitude = 1.5 x Main Rotor Diameter

If the procedure step stays below the ground effect altitude, the procedure step correlates with the corresponding In Ground Effect flight operational mode. If the step stays at or above the ground effect altitude the procedure correlates with the corresponding Out of Ground Effect flight operational mode. If a given Dep Vertical or App Vertical procedure step crosses the ground effect altitude, AEDT automatically divides the step into two at the ground effect altitude and assigns flight operational modes to the two steps as appropriate.

5.1.12 How to Build a Helicopter Approach Profile

Helicopter approach profiles can be much more dynamic than fixed-wing airplane approach profiles. There are many more ways to operate a helicopter than there are to operate an airplane. AEDT provides a standard approach profile for each helicopter in the database, however these standard profiles may not be appropriate for all helicopter modeling. Additionally, general guidelines are not as appropriate for helicopter approach operations as they are for fixed-wing airplanes. It is strongly recommended to evaluate the helicopter flight operations being modeled to determine if using the standard AEDT helicopter procedures is appropriate. In most cases consulting with helicopter operators to design helicopter profiles that are appropriate for your study is needed. All helicopter approach profiles must start with a Start Altitude step.

For reference, AEDT standard helicopter approach procedures consist of the following procedure steps:

1. Start Altitude, with altitude set to 1000 feet AFE and speed set equal to the helicopter's level reference speed.

2. Level Fly, with distance set to 87250.0 ft (approximately 14 nautical miles).

3. App Horiz Decel, maintaining an altitude of 1000 ft while decelerating to the helicopter's approach reference speed over a distance of 5000 ft.

4. App Const Speed, maintaining the helicopter's approach reference speed while descending to an altitude of 500 feet AFE over a track distance of 4800 feet.

5. App Desc Decel, descending to an altitude of 15 feet AFE while decelerating to a speed of 0 knots over a distance of 2850 feet.

6. App Vertical, maintaining horizontal position while descending to 0 feet AFE over a duration of 3 seconds.

7. Flight Idle for a duration of 30 seconds.

8. Ground Idle for a duration of 30 seconds.

5.1.13 How to Build a Helicopter Departure Profile

Helicopter approach profiles can be much more dynamic than fixed-wing airplane approach profiles. There are many more ways to operate a helicopter than there are to operate an airplane. AEDT provides a standard approach profile for each helicopter in the database, however these standard profiles may not be appropriate for all helicopter modeling. Additionally, general guidelines are not as appropriate for helicopter approach operations as they are for fixed-wing airplanes. It is strongly recommended to evaluate the helicopter flight operations being modeled to determine if using the standard AEDT helicopter procedures is appropriate. In most cases consulting with helicopter operators to design helicopter profiles that are appropriate for your study is needed.

For reference, AEDT standard helicopter departure procedures consist of the following procedure steps:

1. Ground Idle for a duration of 30 seconds.

2. Flight Idle for a duration of 30 seconds.

3. Dep Vertical, maintaining horizontal position while ascending to an altitude of 15 ft AFE over a duration of 3 seconds.

4. Dep Horiz Accel, maintaining altitude while accelerating to a speed of 30 knots over a distance of 100 feet.

5. Dep Climb Accel, climbing to an altitude of 30 feet AFE while accelerating to the helicopter's depart reference speed over a distance of 500 feet.

6. Dep Const Speed, maintaining speed while climbing to an altitude of 1000 feet AFE over a track distance of 3500 feet.

7. Dep Horizontal Accel, maintaining altitude while accelerating to the helicopter's level reference speed over a track distance of 2800 feet.

8. Level Fly, with distance set to 93100 feet (approximately 15 nautical miles).

5.1.14 How to Build a Helicopter Overflight Profile

A typical helicopter overflight profile begins in the air at the start of an overflight track, follows the track, and ends in the air. Overflight profiles may include any of the steps defined in section 6.2.2 except for the Taxi step, and it must start with a Start Altitude step.

5.1.15 How to Build a Helicopter Taxi Profile

A typical helicopter taxi profile consists of the following steps:

1. Start with Ground Idle
2. Flight Idle
3. Departure Vertical
4. Taxi
5. Approach Vertical
6. Flight Idle
7. Ground Idle

5.1.16 Helicopter Procedure Step Transitions

Procedure steps are combined in prescribed sequences. However, certain sequences are not allowed. For example, an approach profile cannot use an ascent step. Procedures must comply with the step transition diagrams provided here.

The step transition diagrams use a simple convention to represent procedures:

- Ellipses represent procedure steps.
- Arrows represent a valid transition from one step to another.
- Arrows point in the direction of the allowed transition – e.g. you can go from Flight, Idle to Ground, Idle on an approach, but not back.
- A double sided arrow means that the transition is valid in both directions.
- An arrow looping back to a step indicates that the step can be repeated.
- A box surrounding two or more steps is used to simplify the diagram.
- Arrows connected to the box apply to each step within.
- Each step within the box can transition to any other within the box. However, speeds and altitudes must be compatible. For example, on an approach a transition from an App.Horiz.Decel step to a Hover step is valid only when the App.Horiz.Decel step has a speed of 0 knots.

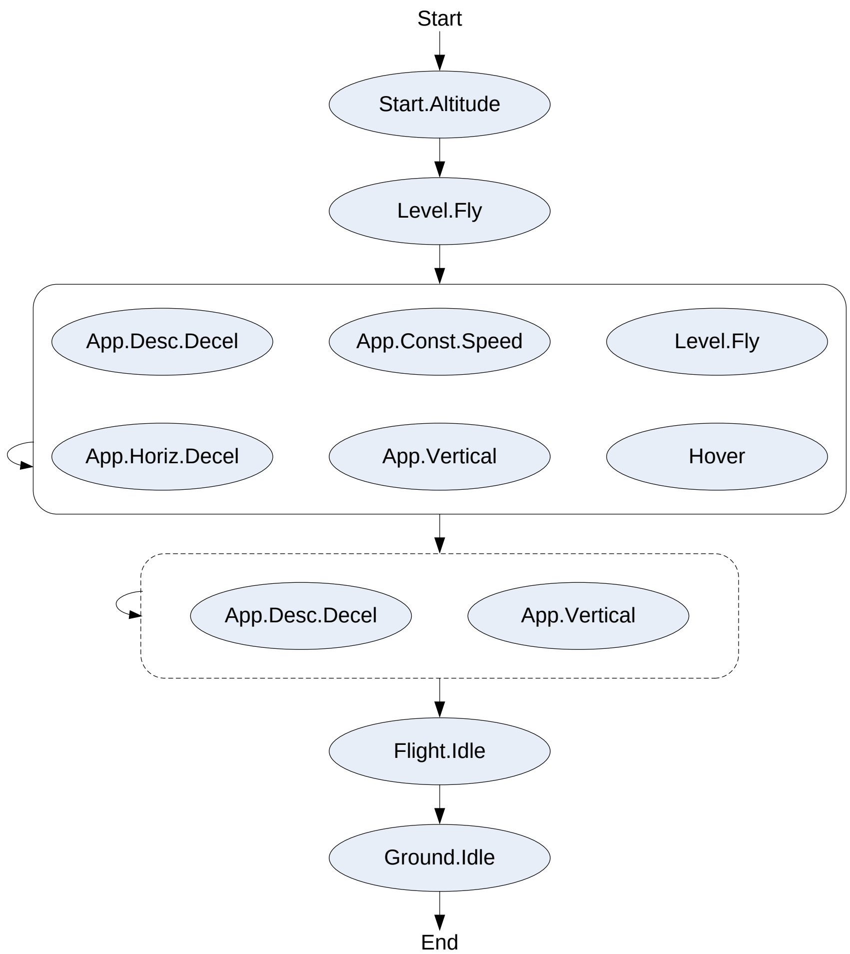

Figure 6: Helicopter Approach Step Transition Diagram

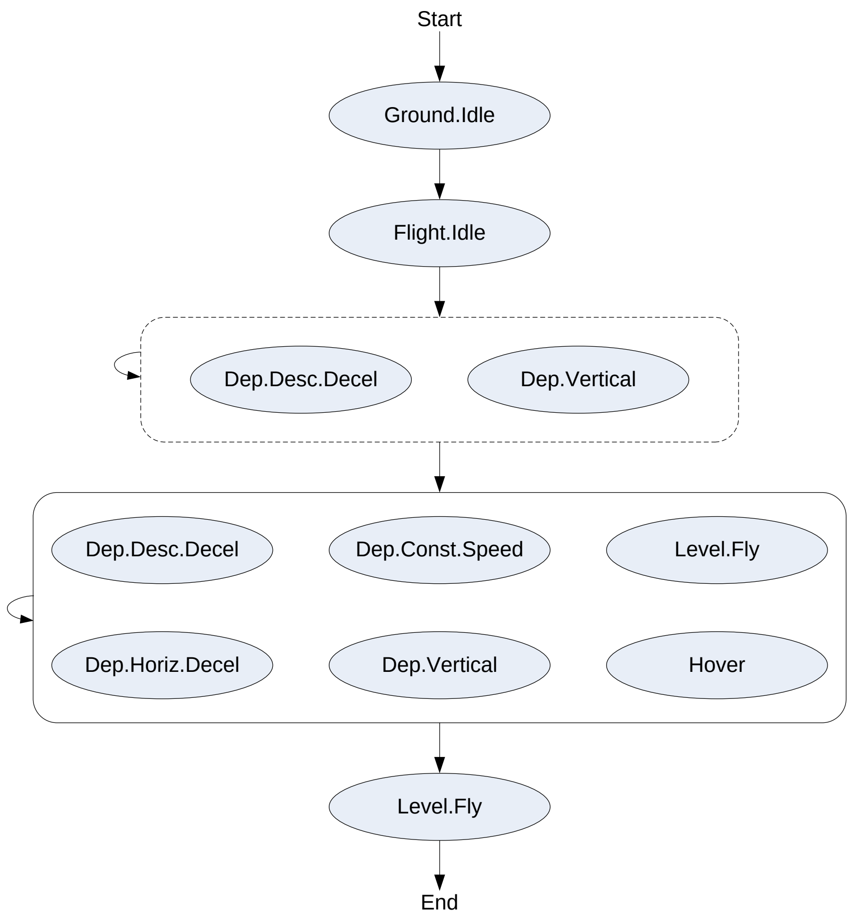

Figure 7: Helicopter Departure Step Transition Diagram

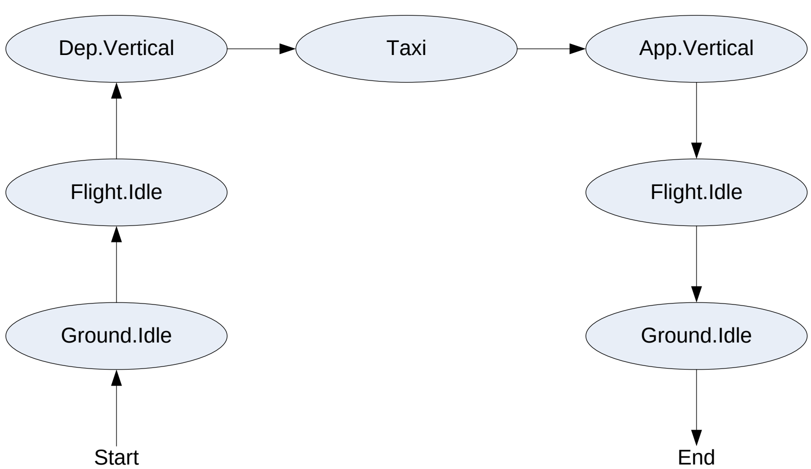

Figure 8: Helicopter Taxi Transition Diagram

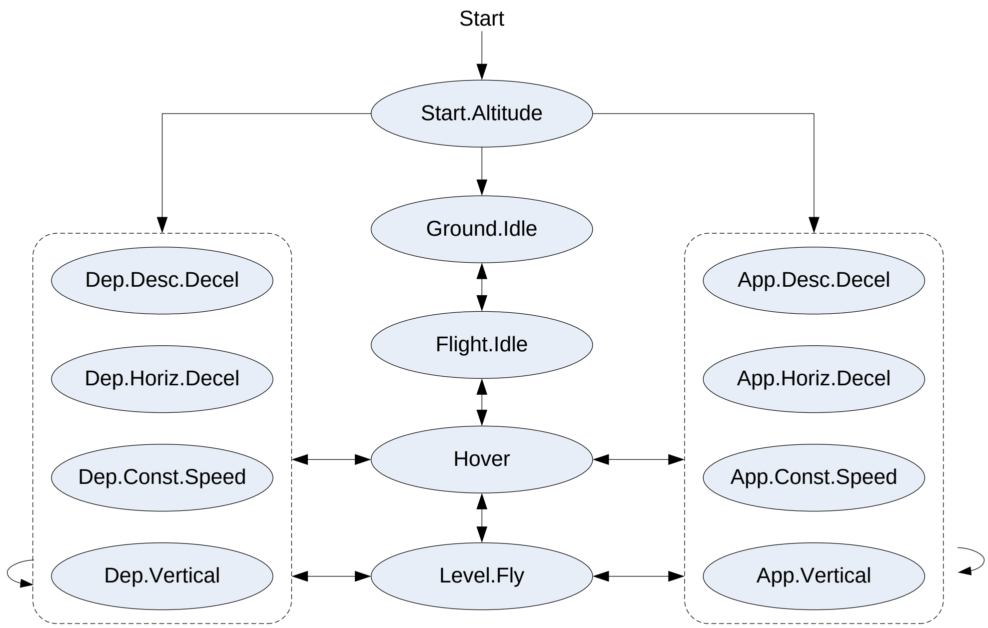

Figure 9: Helicopter Overflight Step Transition Diagram