ROCKET communications




# United States Space Force (SMC / ECX / EGS)

## Space Enterprise User Experience Design System (UXDS)

## Design Guidance And Specifications For Flight Dynamics Service (FDS)

April 9, 2020

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# Contents (Continued)

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# Overview

# Overview

The Flight Dynamics Service (FDS) Application is designed to support orbital analysis, spacecraft maneuvers, and reporting. There are three tiers of capability or tools upon which the Flight Dynamics Service application is built upon:

**Orbit Determination (OD)**
Allows the user to perform orbit determinations, generate ephemerides and two-line element sets (TLEs), as well as generate reports.

**Maneuvering***
Allows the user to perform various types of maneuvers to include station keeping, attitude control, conjunction assessment, collision avoidance (COLAs), and thrusts-and-burns.

**Reporting***
Allows the user to generate, compare, and manage orbital analysis reports and other products.

**While the Maneuvering and Reporting tools have not been researched, tested, and designed to the same depth as the Orbit Determination Tool, they have been considered throughout the research and design process from the broader perspective of the application.*

# Overview - Users & Use Case

A common use case and user roles were identified in order to understand and organize FDS requirements, as well as to ensure that users can effectively and efficiently accomplish task requirements within their respective roles.

## Users

The intended users of the Flight Dynamics Service application are orbital analysts, engineers, flight directors and/or any users performing orbital analysis and spacecraft maneuvers. User roles can range from entry-level to more advanced engineer-level roles.

## Use Case

The use case that helped to identify system requirements for orbit determination was centered around the task of performing an OD and and generating an ephemeris.

# Overview - Application Paradigm

The FDS application paradigm consists of a main application view that displays one tool at a time, which are accessed via tabs. Each tool features utilities that are contextual to its related task flows.

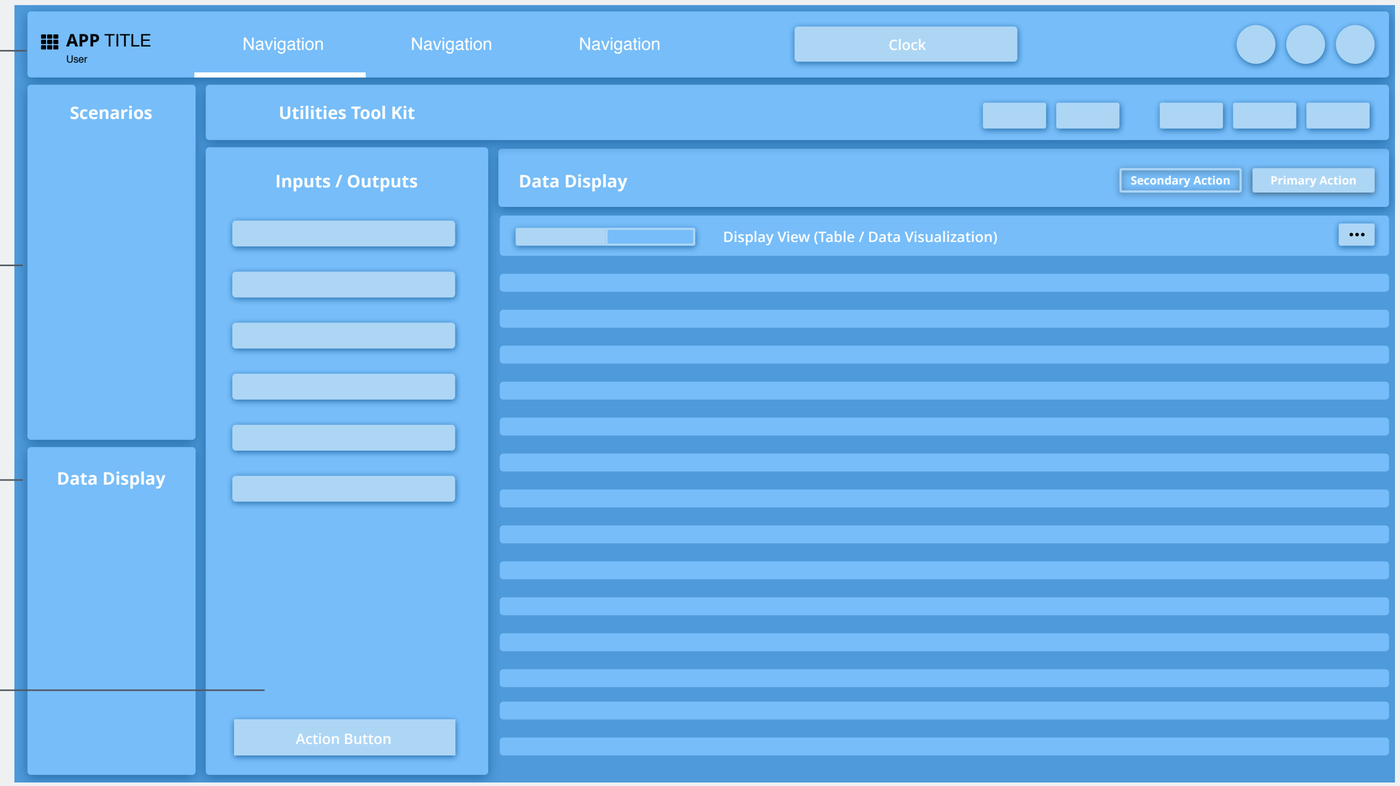
Utilities allow users to access secondary actions and tools when they need them, and dismiss them when they don't. Utilities launch in draggable, scalable modal windows. Users can work interchangeably between the tool and utility windows.


Dual-Monitor Setup

# Overview - Tool Framework

Based on system requirements and user research, functionality has been categorized and organized into frameworks for developers to build from, including sections for a global status bar, a scenario library, data input/outputs, data display, and a utility toolkit. It's important to note that the labels, icons, and specific data included in the wireframes are for demonstrative purposes and are agnostic to the various flight dynamics missions.

## Basic Tool Framework




**Global Status Bar**
Reserved for global status, global command and top-level navigation.

**Scenario Library**
Controls what data displays in the application

**Scenario Data Display**
Displays data for selected scenario library items

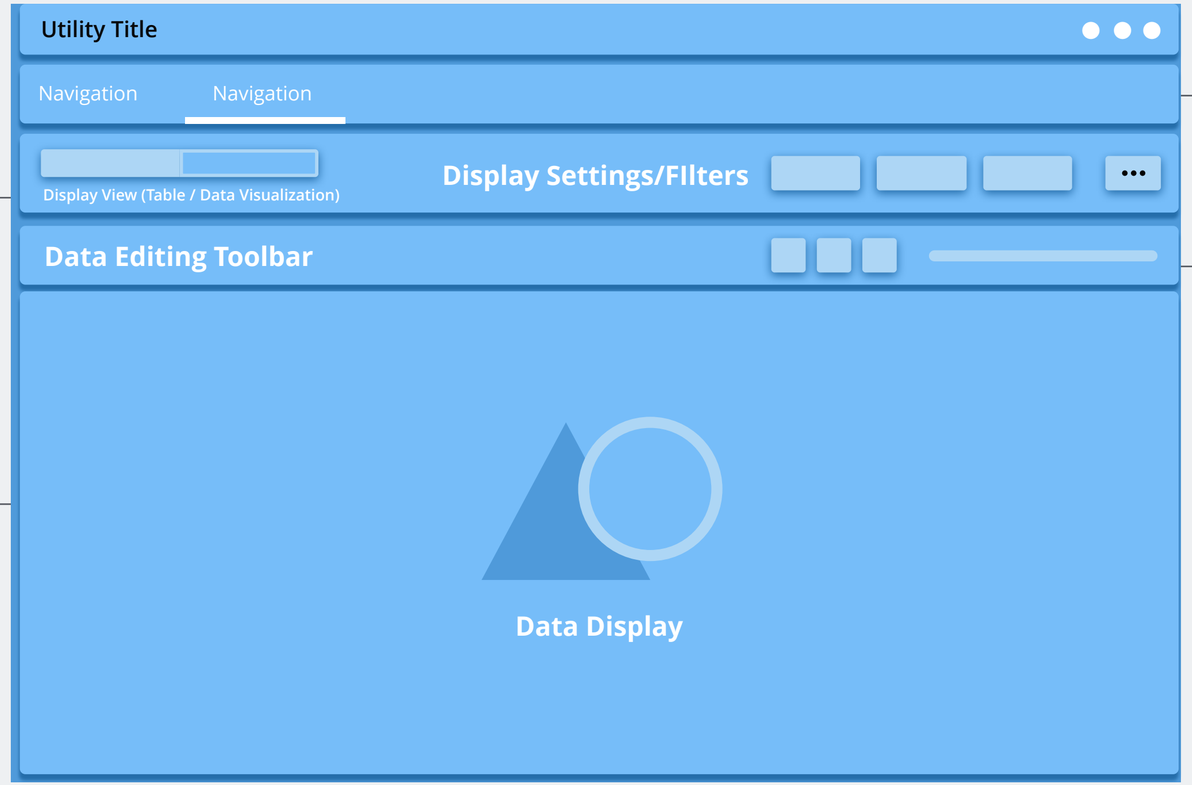
**Data Inputs/Outputs**
Input necessary data and select necessary data for output

**Utility Toolkit**
A collection of useful utilities that are contextual to the tool

**Output Data Display**
Displays data that results from data inputs

# Overview - Utility Toolkit Framework

## Basic Utility Toolkit Framework




**Display Settings/Filters**
Controls contents and view of the utility

**Data Display**
Displays data that results from data inputs

**Navigation**
Allows user to navigate between tabs

**Data Editing Toolbar**
A grouping of contextual editing controls used for real time data feedback and analysis

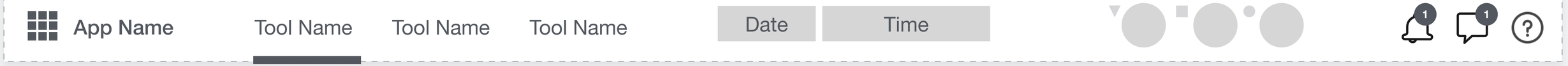
# Global Components

# Global Components - Global Status Bar

The Global Status Bar is a full width component that spans the top of all EGS Services applications; it is reserved for an app switcher menu, top-level navigation, date and time, monitoring icons and ancillary functionality like notifications, chat, and user profiles.

See the Astro UXDS guidelines to learn more about the Global Status Bar.

## FDS Global Status Bar Features




The **App Switcher Menu** allows the user to launch new instances of different apps, log in/log out, and edit preferences.

The App Name appears directly to the right of the menu.

**Top-Level Navigation** allows the user to switch between workspaces.

**Date (DOY)** and **Time (UTC)**

**Monitoring Icons*** communicate status to users. Each icon displays a color associated with the status level and a badge to indicate the number of alerts.

**Usage and functionality for monitoring icons in the FDS application is to be determined but might become useful as missions scale.*

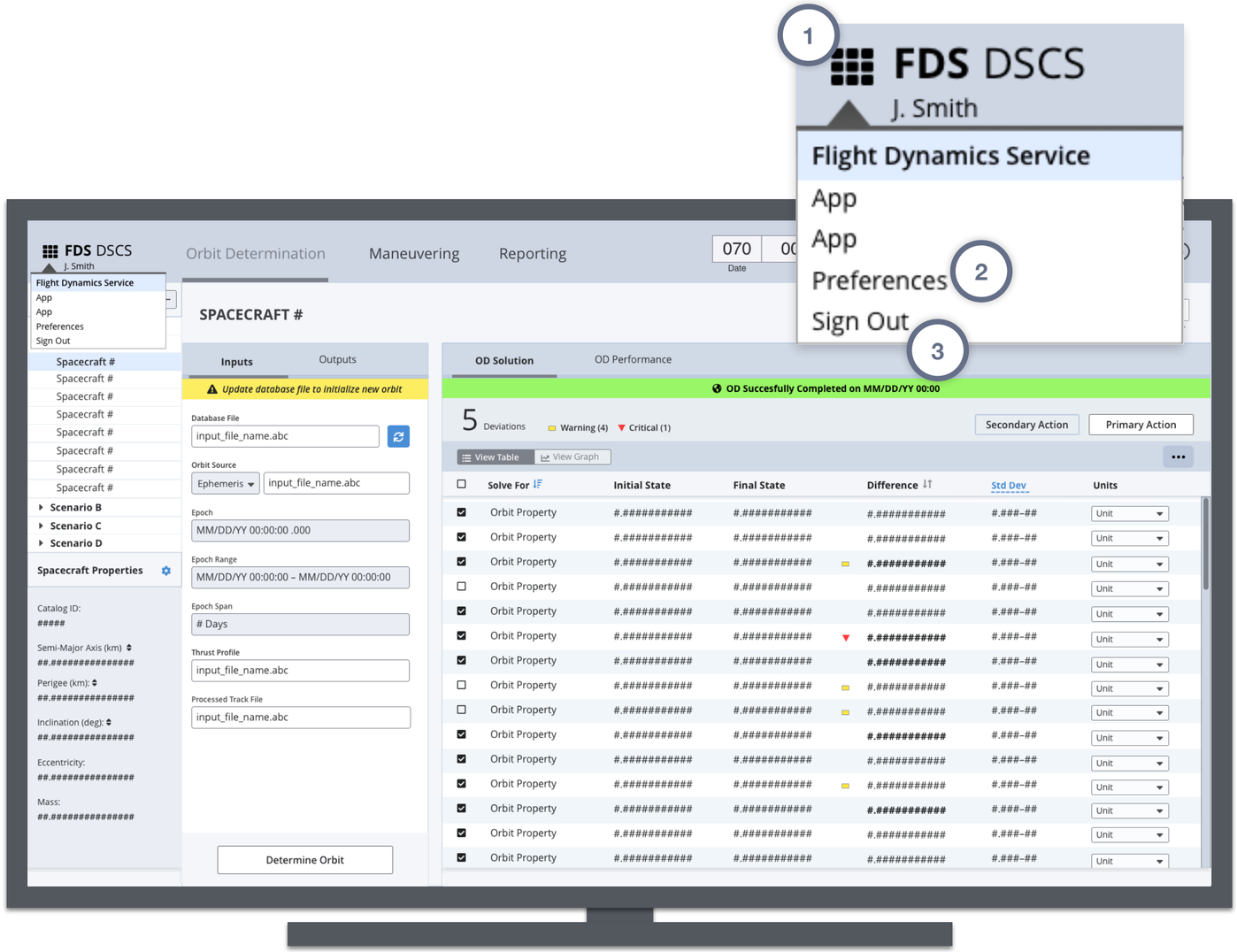
**Notification, Chat, and Help Icons*** Notifications show system messages, while chat handles human-to-human messaging.

**Functionality for these components is pending user testing.*

# Global Components - App Switcher Menu

## Functionality

The App Switcher Menu allows the user to launch new instances of different applications, sign in/sign out of the application, and edit preferences.




## Features & Interactions

1. **Launching Apps**
   Clicking an application in the App Switcher Menu launches an instance of the application in a new browser window.

   **Some FD missions may require the inclusion or integration of additional applications (i.e. a scheduling app). Those additional apps would be housed in the app switcher menu.*

2. **Preferences**
   Preferences are used to configure and customize the appearance and behavior of the FDS app.

3. **Sign In/Out**
   Users can sign in or out of the application through the App Switcher Menu.

# Global Components - Sign In/Out Flow

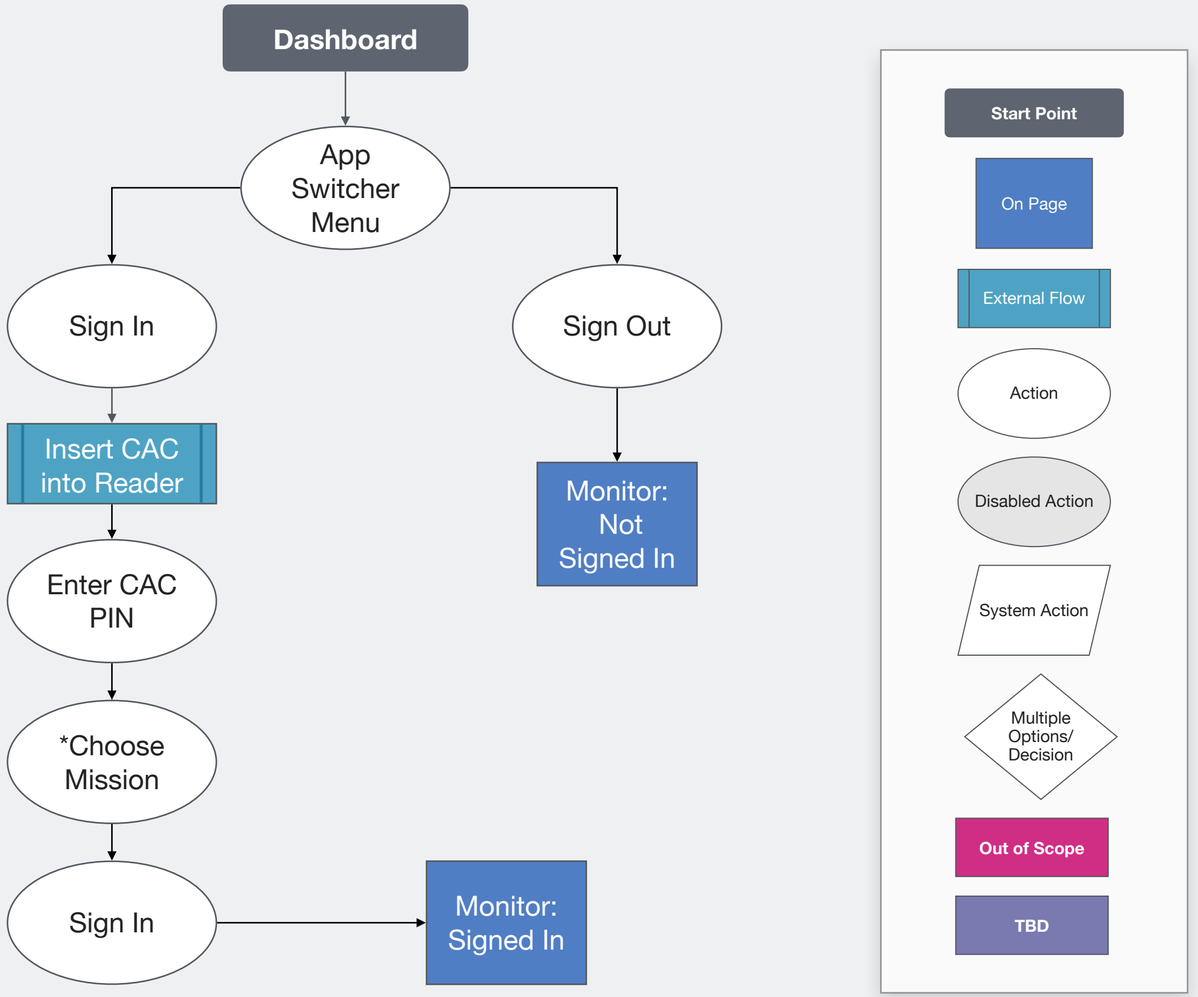
This user flow shows the actions involved in signing in or out of the FDS Application.

If the user works on multiple missions, mission is either pre-selected by system or user selects desired mission.

Sign In/Sign Out Flow may vary mission-to-mission.

**Optional if user is only assigned to one mission*

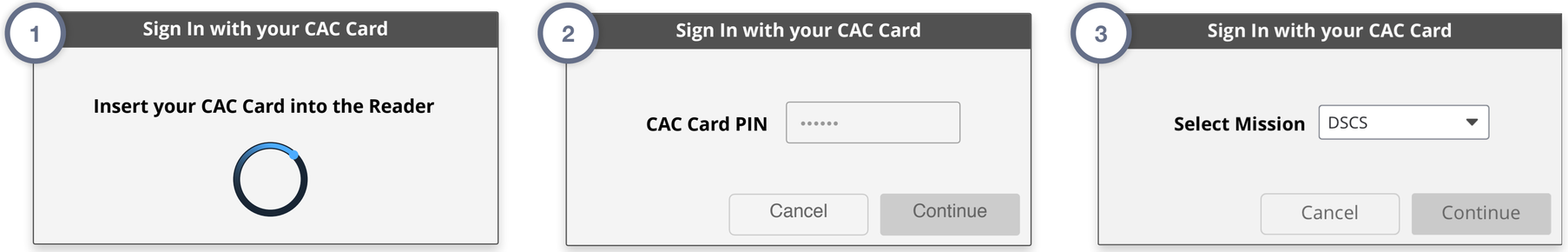
## Sign In/Out Task Flow



# Global Components - Sign In/Out Steps

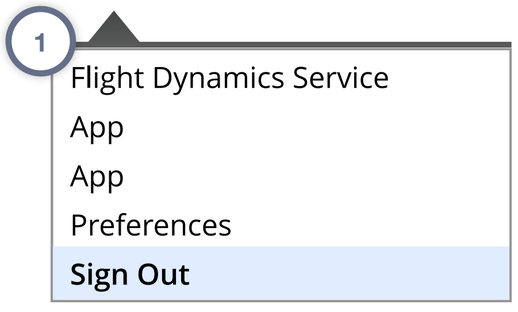
## Sign In Steps

1. Insert Common Access Card (CAC) into the external reader.
2. Enter CAC PIN.
3. Select mission, then click “Sign In”.




## Sign Out Steps

1. Click the App Switcher Menu icon, then click “Sign Out.”

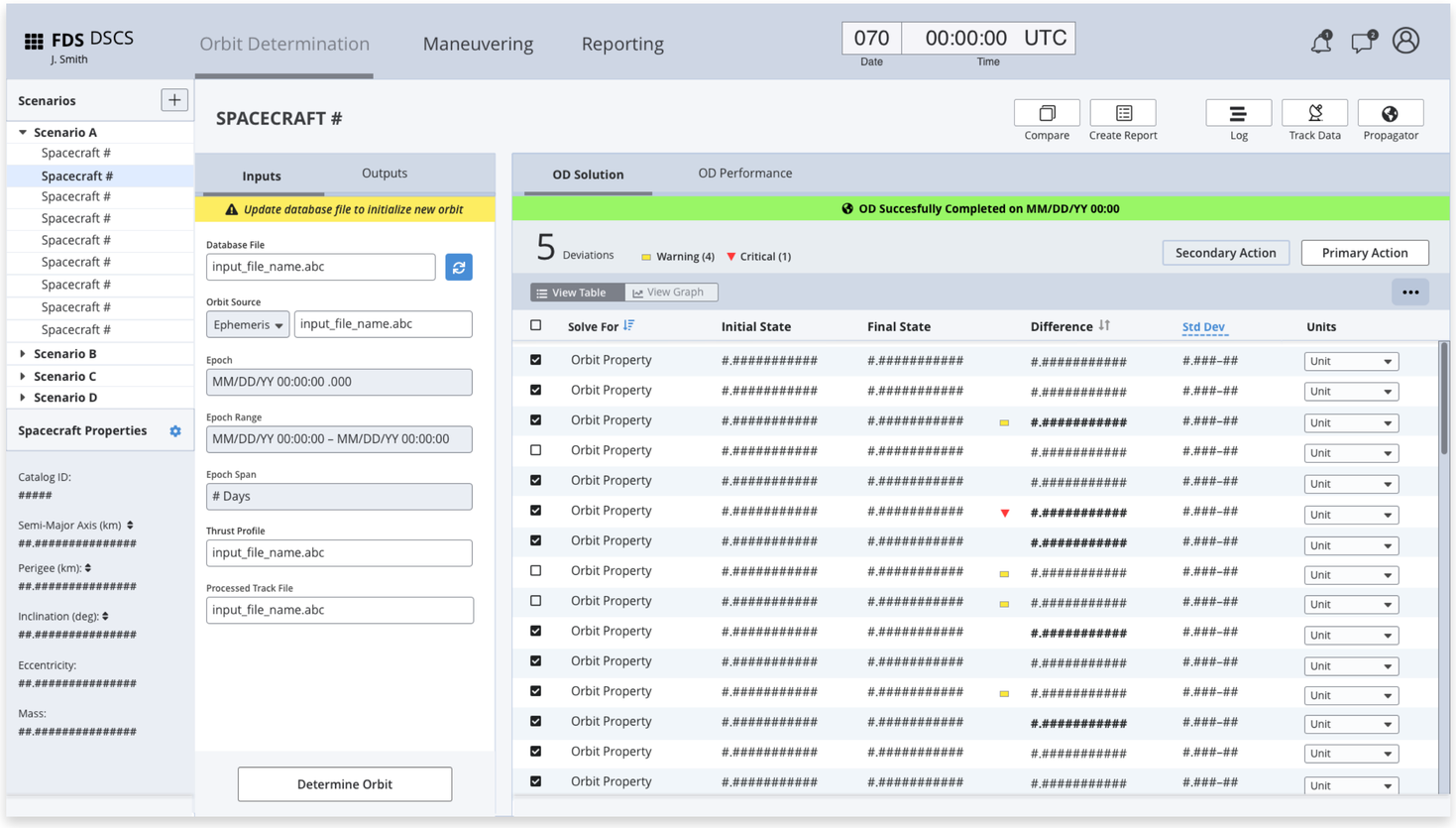


# Orbit Determination Tool

# Orbit Determination - Default View

The Orbit Determination (OD) Tool allows users to perform orbit determinations, generate ephemerides and two-line element sets (TLEs), as well as generate OD-related products and reports.

In its initial view, the OD Tool shows the last state for the most recently completed OD, for whichever spacecraft is selected in the Scenario Library.




*FDS Wireframes.pdf, page 6*

# Orbit Determination - Scenario Library

## Functionality

The Scenario Library allows users to group their tasks by scenario for quick access and efficiency. Users can also create new scenarios. Clicking on a spacecraft displays its properties in the Spacecraft Properties pane below.

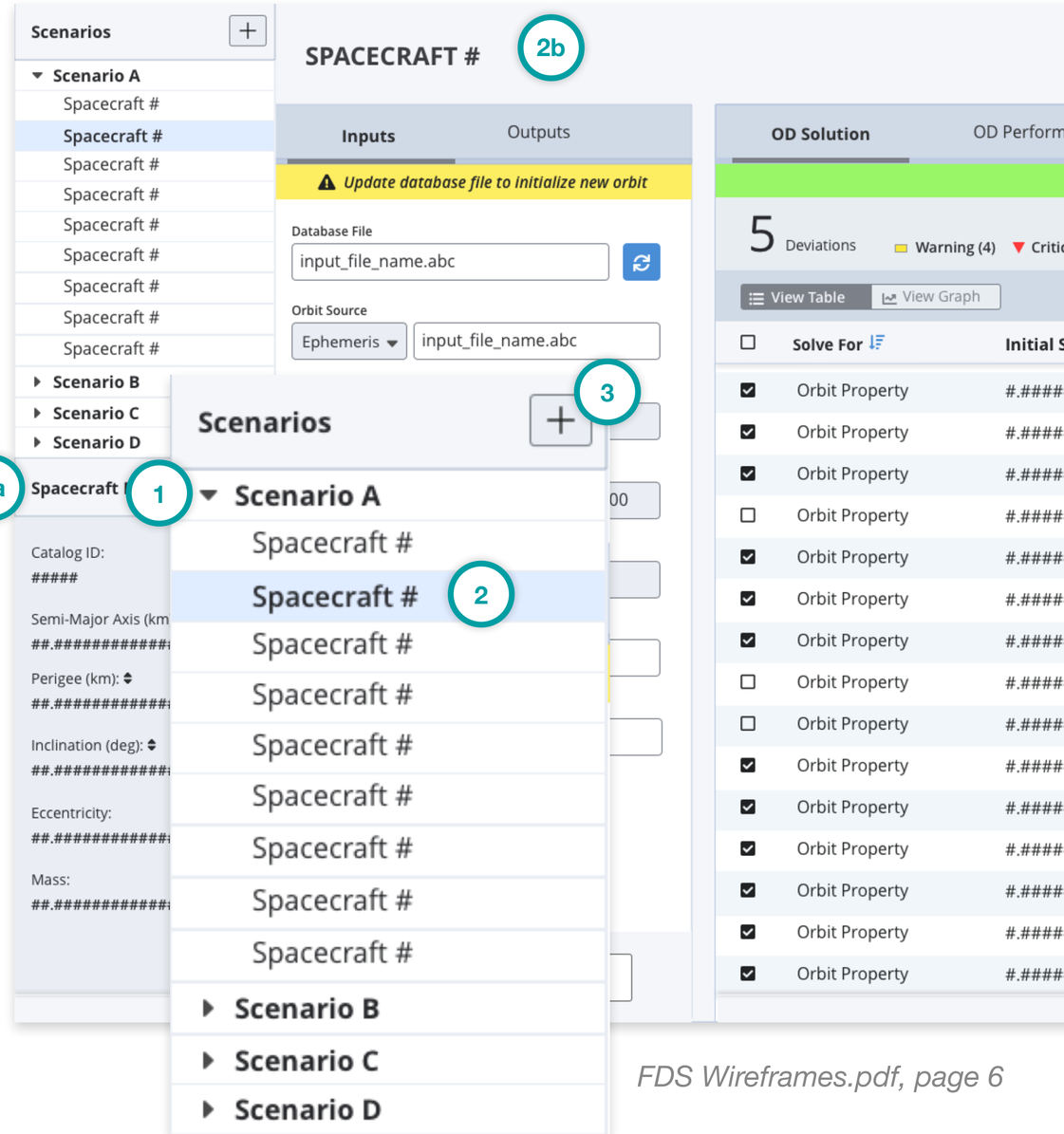
## Features & Interactions

1. **Expandable/Collapsible Scenario Groups**
   Expands to show items, such as spacecrafts, grouped in the respective scenario.

2. **Select Group Item**
   Information for the selected group item displays in the main view (to the right of the library) which houses the input and output display areas **(2b)**.

   Properties for the selected group item display in the properties pane **(2a)** below the list of library items.

3. **Create New Scenario**
   Allows users to create and name new scenarios.




*FDS Wireframes.pdf, page 6*

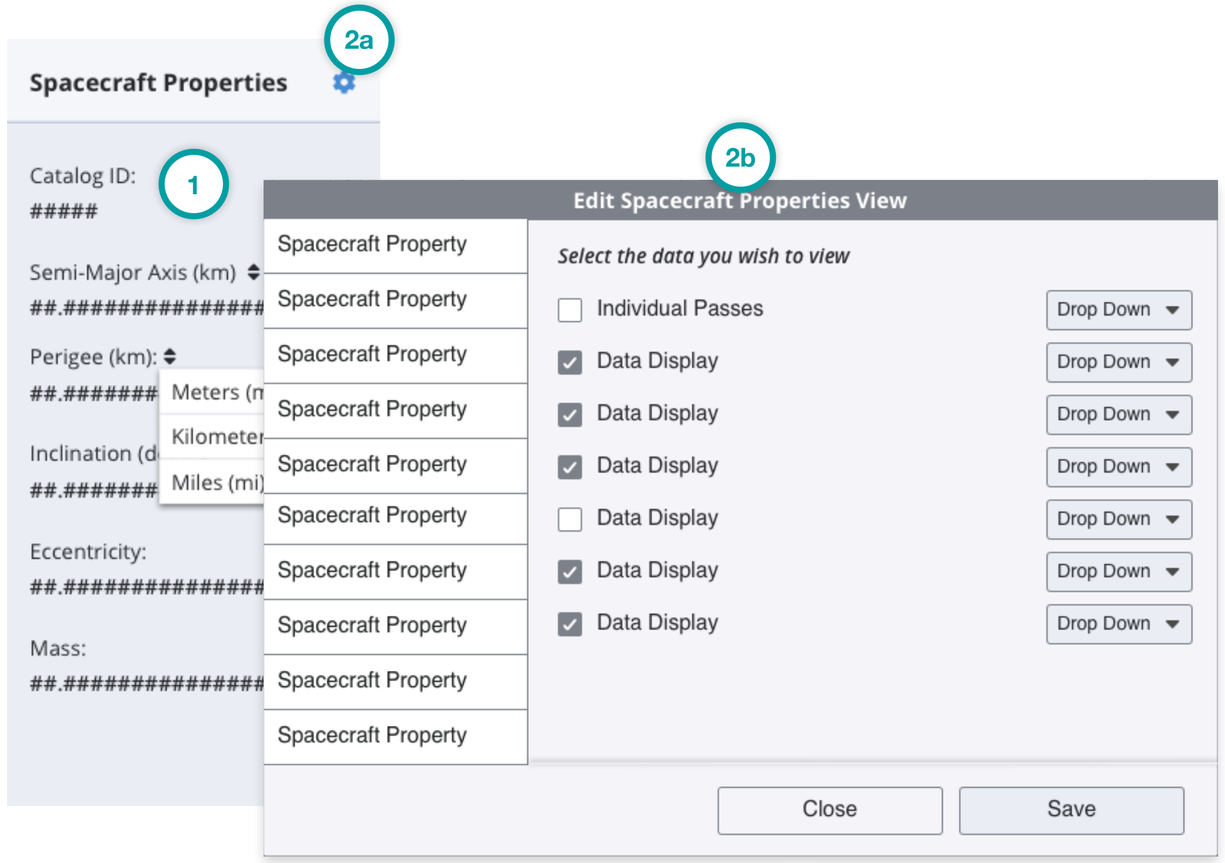
# Orbit Determination - Properties Pane

## Functionality

The Spacecraft Properties pane displays various attributes an operator may view for the selected spacecraft.

## Features & Interactions

1. **Properties**
   Displays various object properties.
2. **Properties Settings**
   Users can edit what properties are displayed in the properties pane using the property settings feature.




*FDS Wireframes.pdf, page 9*

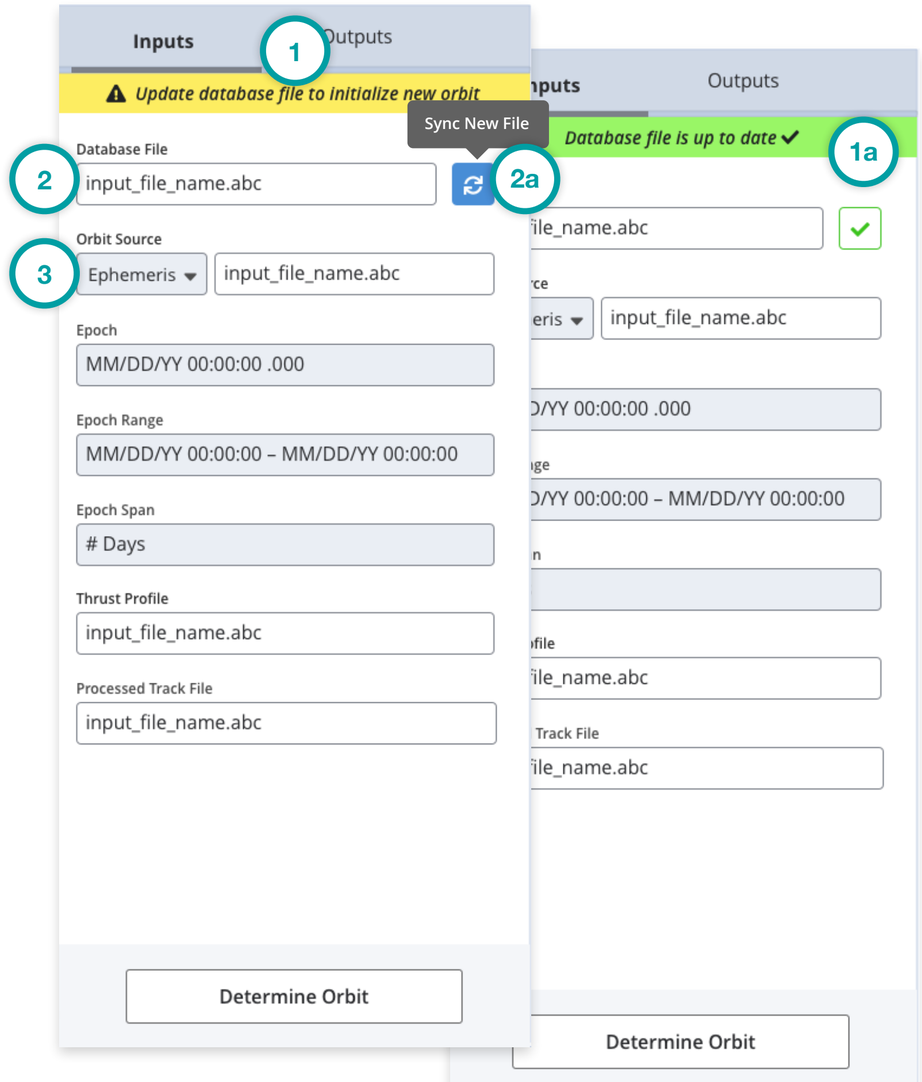
# Orbit Determination - Inputs/Outputs Pane (Inputs Tab)

## Functionality

The Inputs Tab houses the initial inputs needed in order to run an orbit determination.

## Features & Interactions

1. **Notification Banner**
   Indicates whether the latest database file has been synced. Once the latest file has been synced the notification banner indicates that the file is up-to-date and the blue sync button changes to a green check to indicate its in sync **(1a).**
2. **Database File**
   Shows the database file that will be used to determine orbit. The most recent database file can be loaded/synced using the blue sync button (2a). It's recommended that any primary input that has other dependent inputs are placed at the top.
3. **Orbit Source**
   Shows what source is being used to determine orbit. Source type can be selected from the dropdown while the actual source file can be selected by clicking into the interactive input field.




*FDS Wireframes.pdf, page 6 & 17*

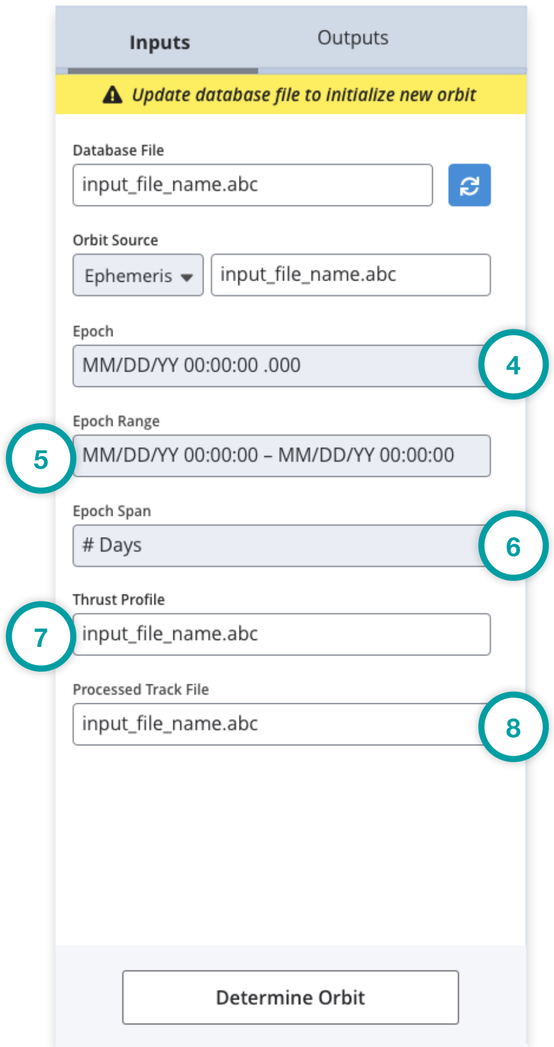
# Orbit Determination - Inputs/Outputs Pane (Inputs Tab Continued)

## Functionality

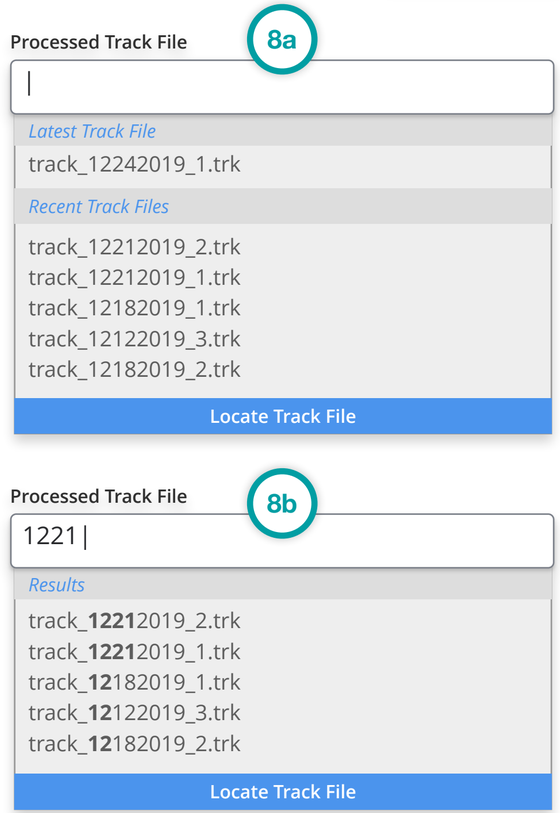
The Inputs Tab houses the initial inputs needed in order to run an orbit determination.

## Features & Interactions

4. **Epoch**
   Set desired epoch time for OD by date and time.
5. **Epoch Range**
   Set desired epoch time for OD by date and time range.
6. **Epoch Span**
   Set desired epoch time for OD by number of days.
7. **Thrust Profile**
   Shows the database file that will be used to determine orbit.
8. **Processed Track File**
   Shows the processed track file that will be used to determine orbit.
   For input fields like this, either click **(8a)** or type **(8b)** into the field to reveal a dropdown of available files.




*FDS Wireframes.pdf, page 6*




*FDS Wireframes.pdf, page 14 & 15*

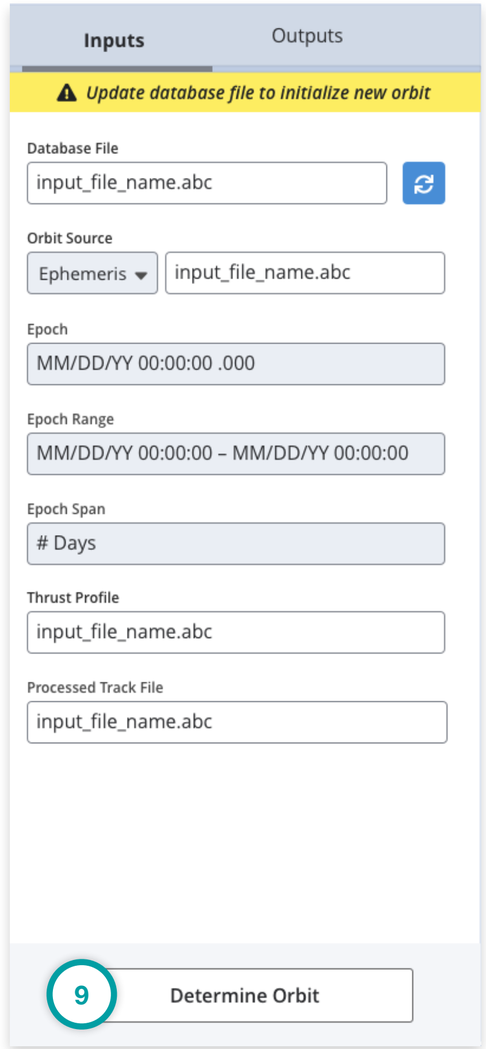
# Orbit Determination - Inputs/Outputs Pane (Inputs Tab, Continued)

## Functionality

The Inputs Tab houses the initial inputs needed in order to run an orbit determination.

## Features & Interactions

5. **Determine Orbit Button**
   Initiates orbit determination.

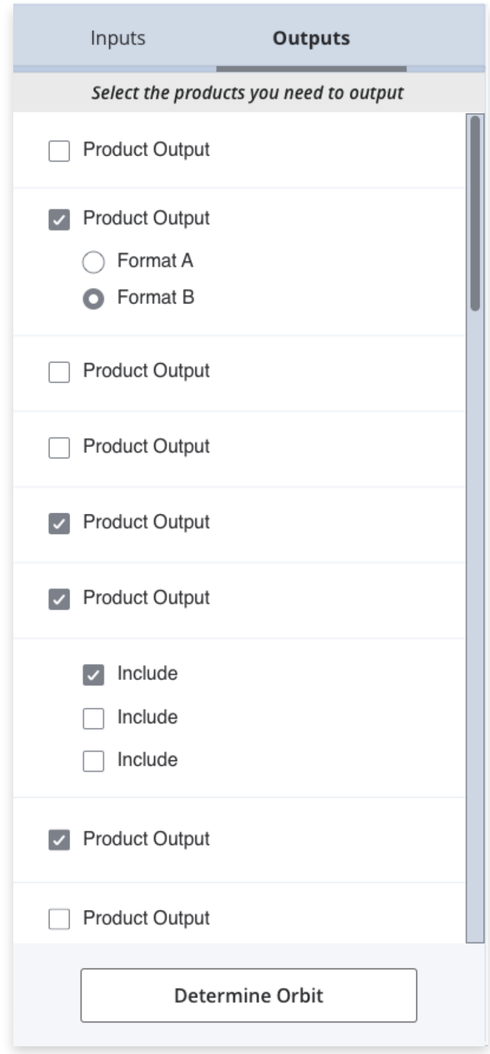



*FDS Wireframes.pdf, page 6*

# Orbit Determination - Inputs/Outputs Pane (Outputs Tab)

## Functionality

The Outputs Tab allows the user to select the products they wish to output as a result of an orbit determination.




*FDS Wireframes.pdf, page 10*

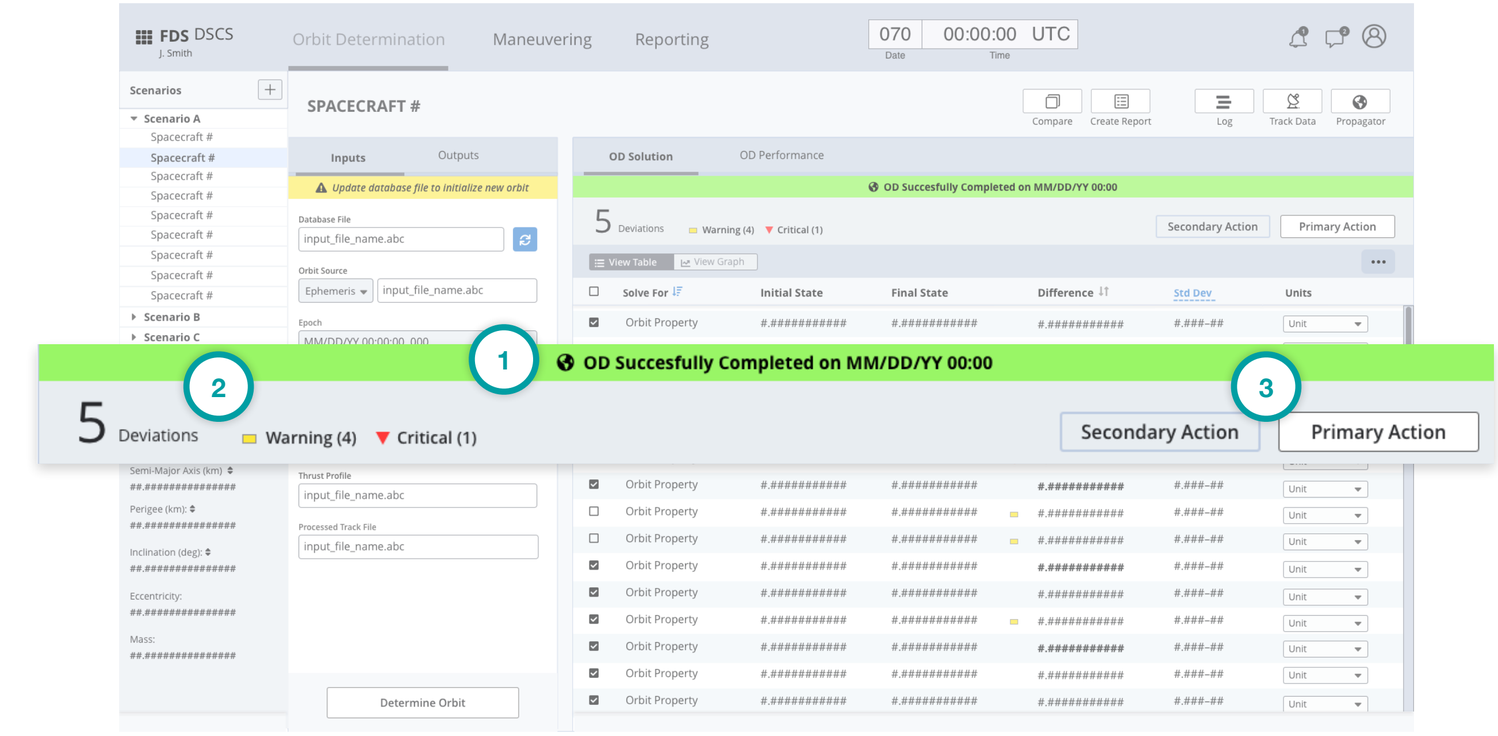
# Orbit Determination - Data Display

## Functionality

The Data Display shows OD solutions and performance results.

## Features & Interactions

1. **Notification Banner**
   Shows the status for the latest orbit determination.
2. **Deviation Count**
   Shows total number of deviations *(violations of the standard deviation)* found in the OD results.
3. **Primary/Secondary Action Buttons**
   Can be set to display desired primary and/or secondary actions. Recommended for quick actions related to OD results (i.e. Create TLE).




*FDS Wireframes.pdf, page 6*

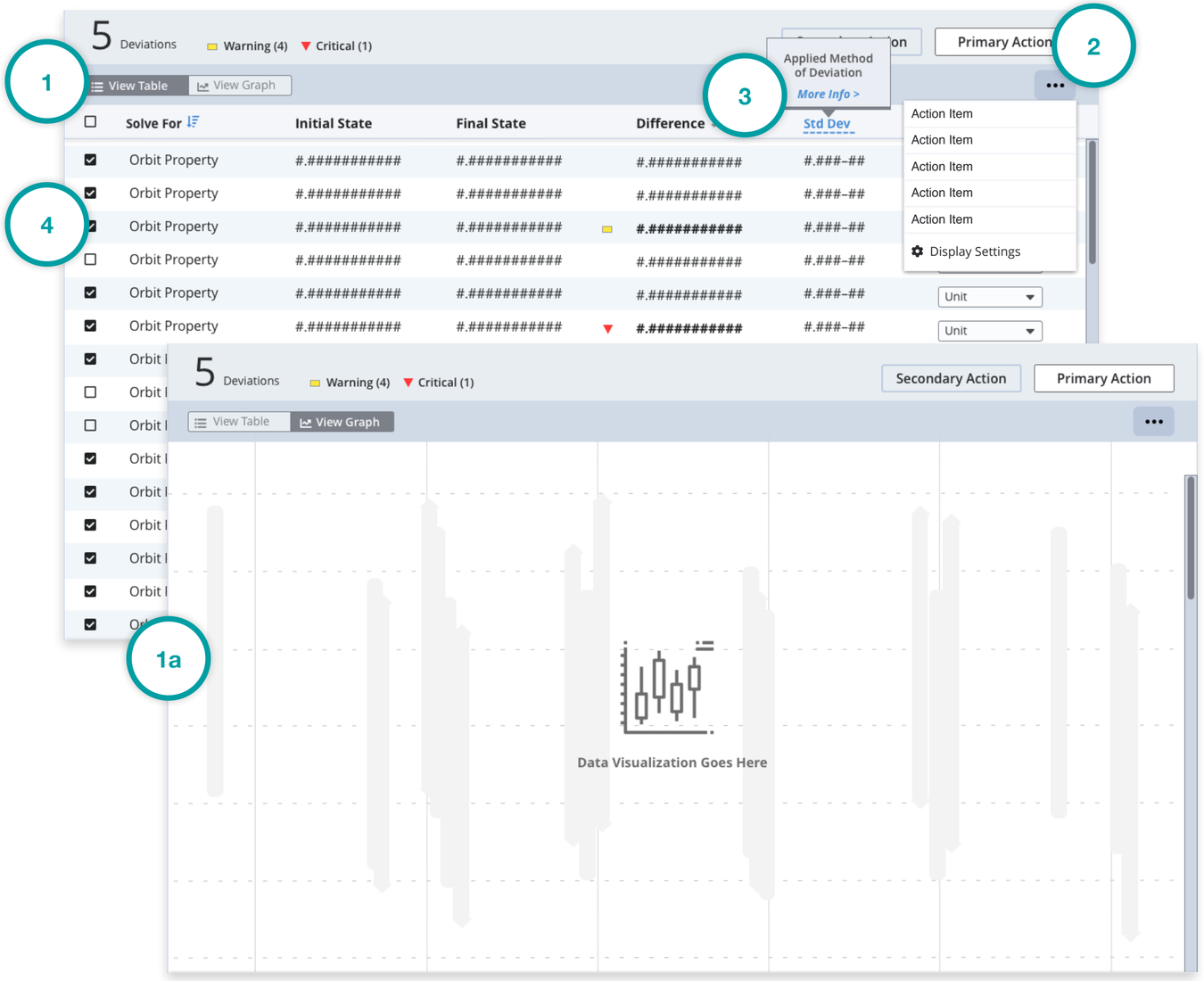
# Orbit Determination - Data Display (Continued)

## Functionality

The Data Display shows OD solutions and performance results.

## Features & Interactions

1. **Table View Switch**
   Switches between a tabular view and visual/graph view **(1a)** of the OD results.
2. **Action Menu**
   Displays table action items and display settings, export, save, print, etc.
3. **Interactive Click State**
   Blue text with a dotted underline indicates a click state that can be drilled into for more information. Recommended for click states that may feature additional information with an action item.
4. **Selectable Table Rows**
   Table rows can be selected/unselected in order to be included or not included in an orbit determination solution.




*FDS Wireframes.pdf, page 13*

# Orbit Determination - OD Solution Table (Continued)

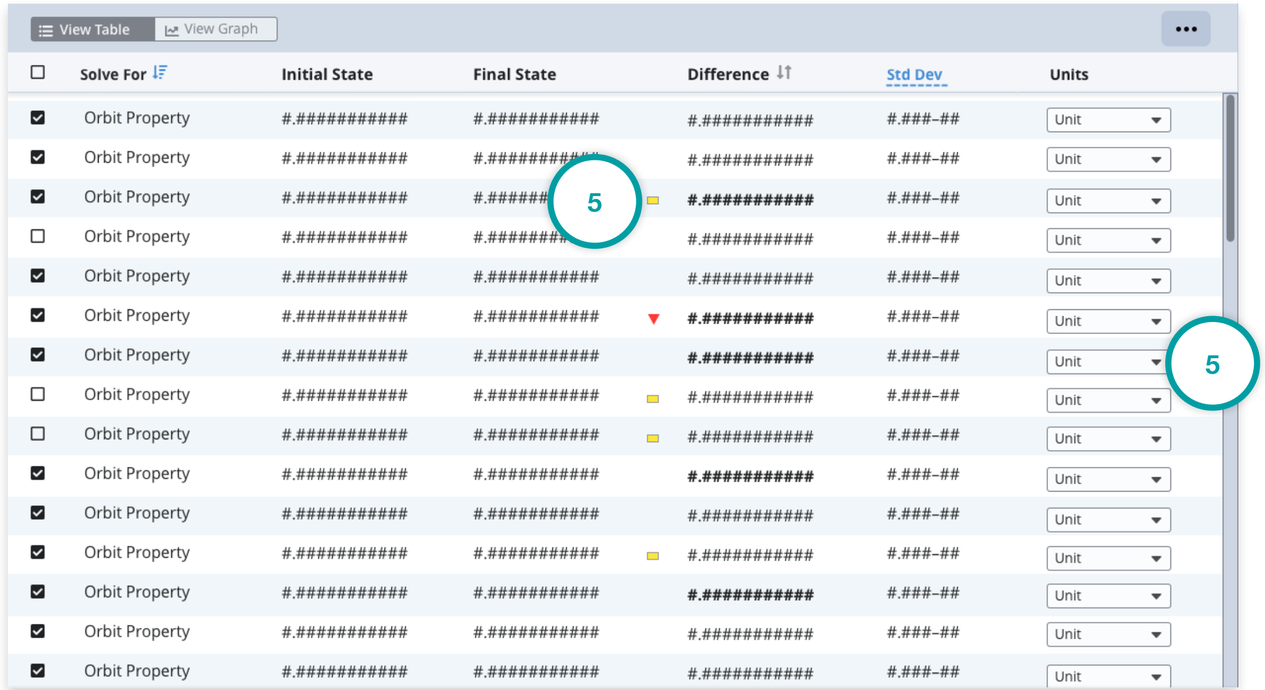
## Functionality

The OD Solution Table shows orbit determination results.

## Features & Interactions

5. **Status Icons**
   Status icons indicate the status of a feature. In the example to the right, status icons indicate violations of the acceptable deviation limits in the data returned in the OD results.

6. **Editable Table Data (Dropdown Menu)**
   Allows user to view table data in different units of measurement.




*FDS Wireframes.pdf, page 14*

# Orbit Determination - Utility Toolkit

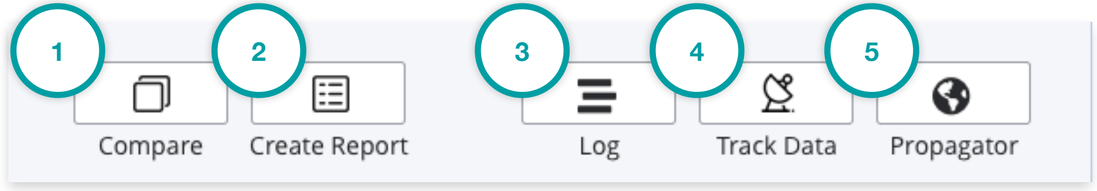
## Functionality

The Utility Toolkit is a collection of contextual utilities that house secondary actions and tools.

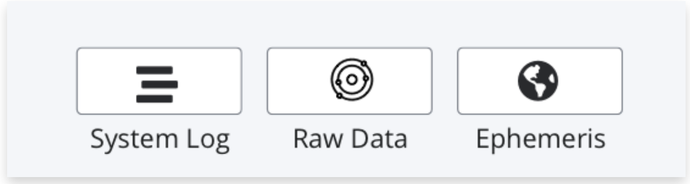
***Note:*** *Labels and icons are mission-agnostic and should be named according to mission needs.*

## Features & Interactions

5. **Compare**
   Allows user to compare reports or products.
6. **Create Report**
   Allows user to create reports contextual to the current orbit determination.
7. **Log**
   Shows a log of application and system messages, including errors, information messages, and warnings.
8. **Track Data**
   Allows user to filter and edit raw track data.
9. **Propagator**
   Allows user to generate ephemerides and TLE's.




**Sample Utility Toolkit**
*Labels and icons are mission-agnostic*




**Utility buttons with different icons and labels**
*Labels and icons will differ mission to mission*

*FDS Wireframes.pdf, page 17*

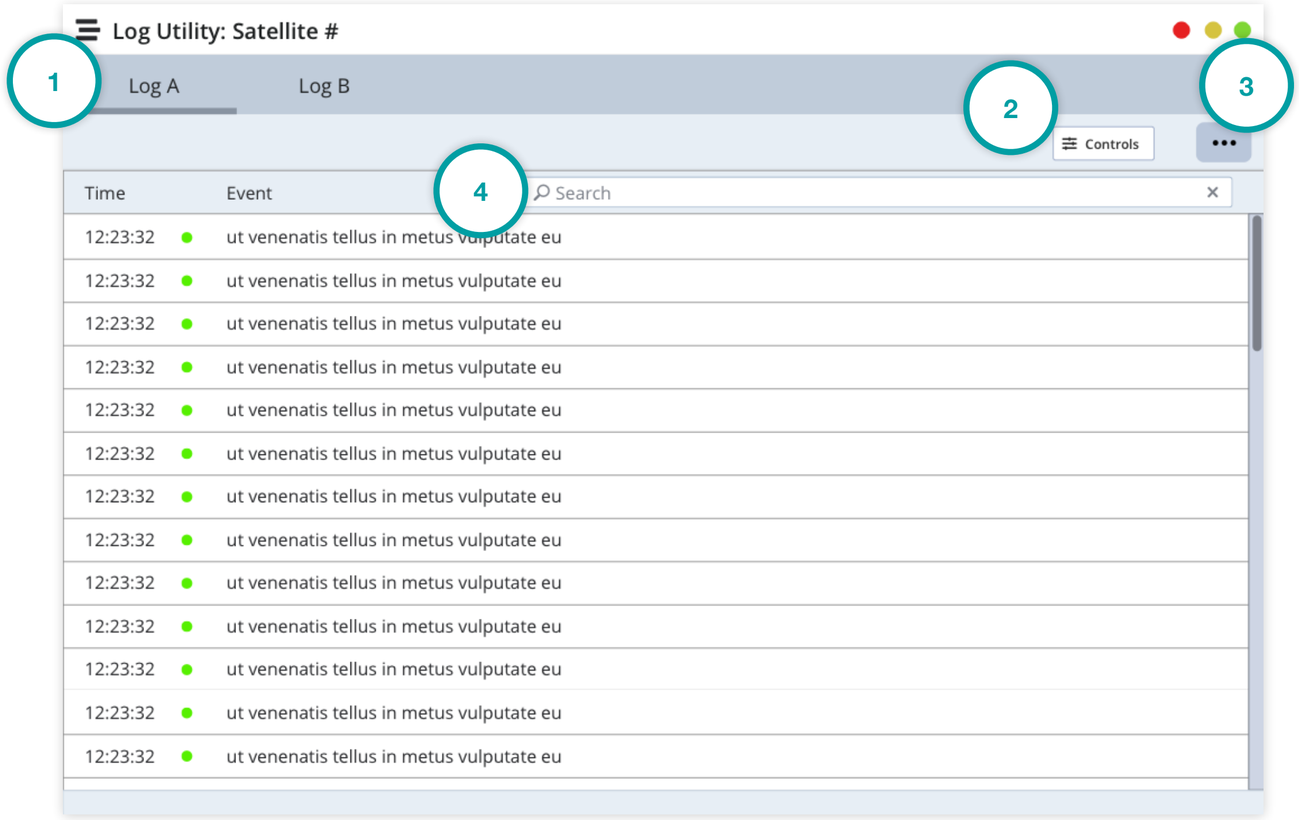
# Orbit Determination - Log Utility

## Functionality

The Log Utility shows a log of application and system messages. Usage and functionality for this utility is mission-agnostic.

## Features & Interactions

1. **Tabs**
   Allows for more than one view/category of log messages.
2. **Controls Buttons**
   Triggers a sliding pane that houses controls for the event log.
3. **Action Menu**
   Displays action items and display settings.
4. **Search Bar**
   Allows user to query log messages.




*FDS Wireframes.pdf, page 41*

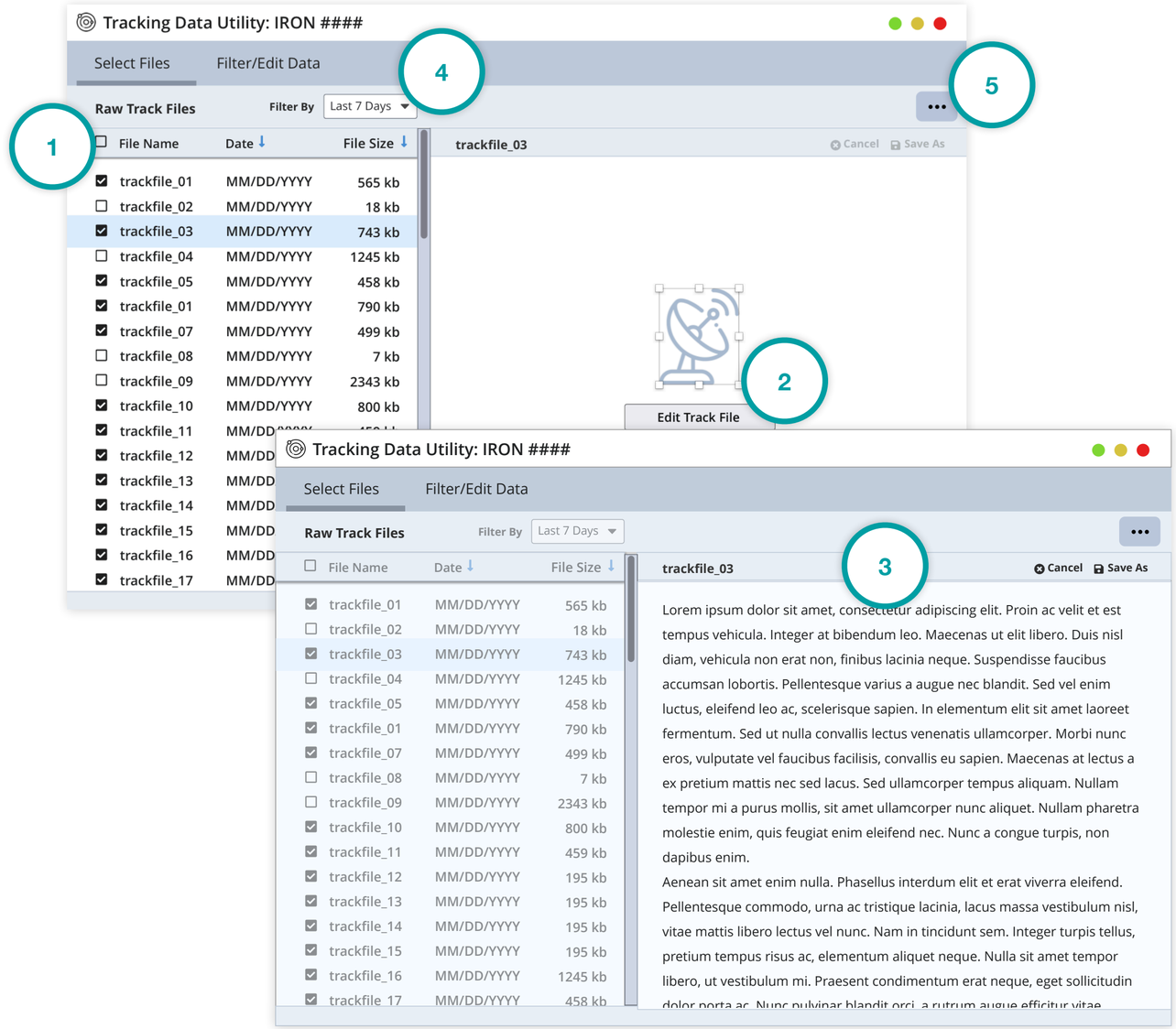
# Orbit Determination - Track Data Utility (Select Files)

## Functionality

Select Files allows users select and edit track files.

## Features & Interactions

1. **File List**
   Displays available raw tracking files.
2. **Edit Track File Button**
   Clicking the Edit Track File button puts track file in an editable state.
3. **Text Editor**
   Allows the user to edit and save the text in a track file.
4. **Filter Dropdown**
   Allows the user to filter the track file list.
5. **Action Menu**
   Displays action items and display settings.




*FDS Wireframes.pdf, page 23 & 24*

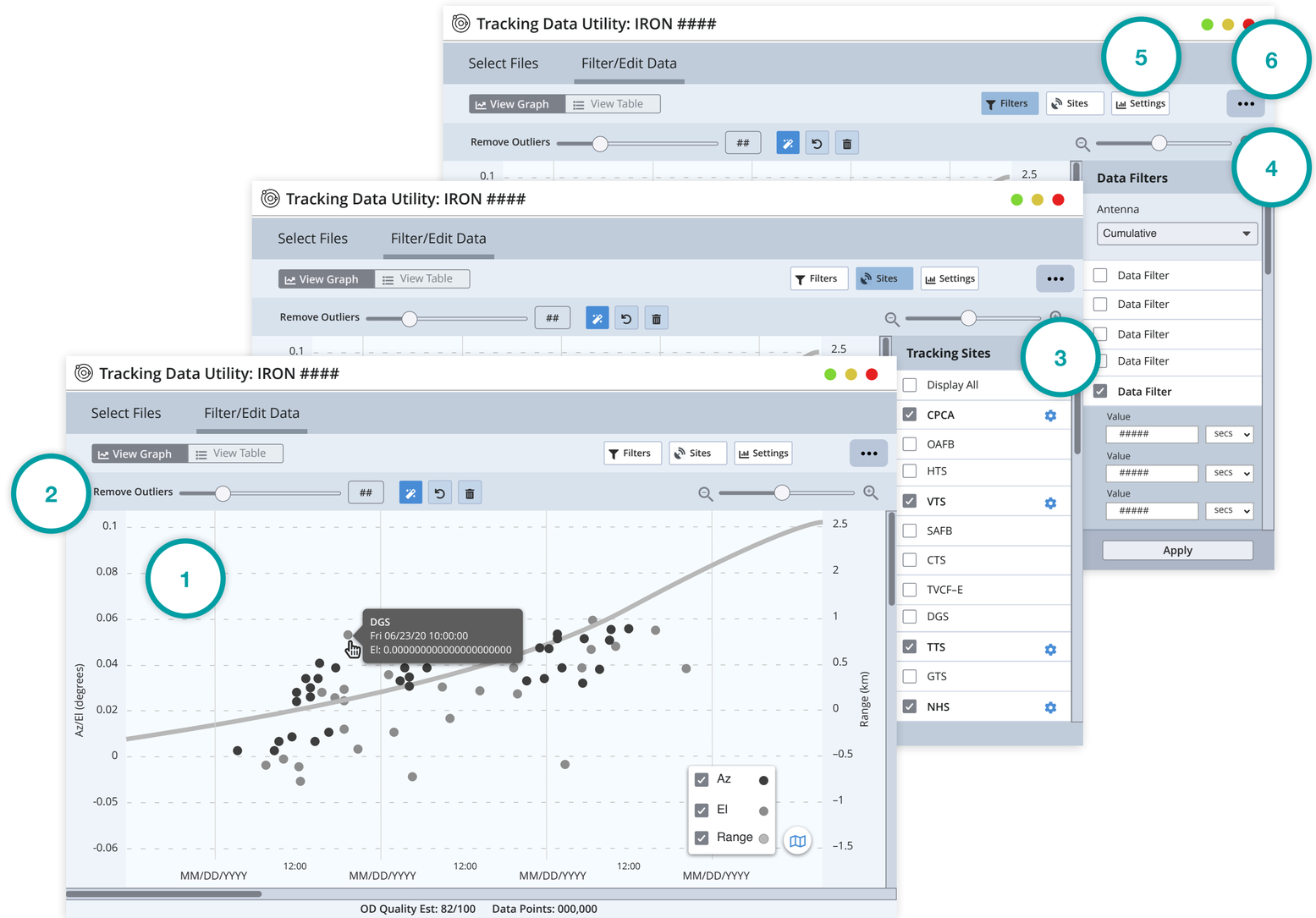
# Orbit Determination - Track Data Utility (Filter/Edit Data)

## Functionality

Filter/Edit Data allows users filter and edit track data points.

## Features & Interactions

1. **Data Graph**
   Displays individual tracking data points. More details shows on hover.
2. **Remove Outliers**
   Users can remove data points by selecting and deleting points, deleting points with a range selector or via system automation (auto-remove outliers button).
3. **Sites Button**
   Displays tracking site settings.
4. **Filter Button**
   Displays data filter settings.
5. **Settings Button**
   Displays general settings.
6. **Action Menu**
   Displays action items.



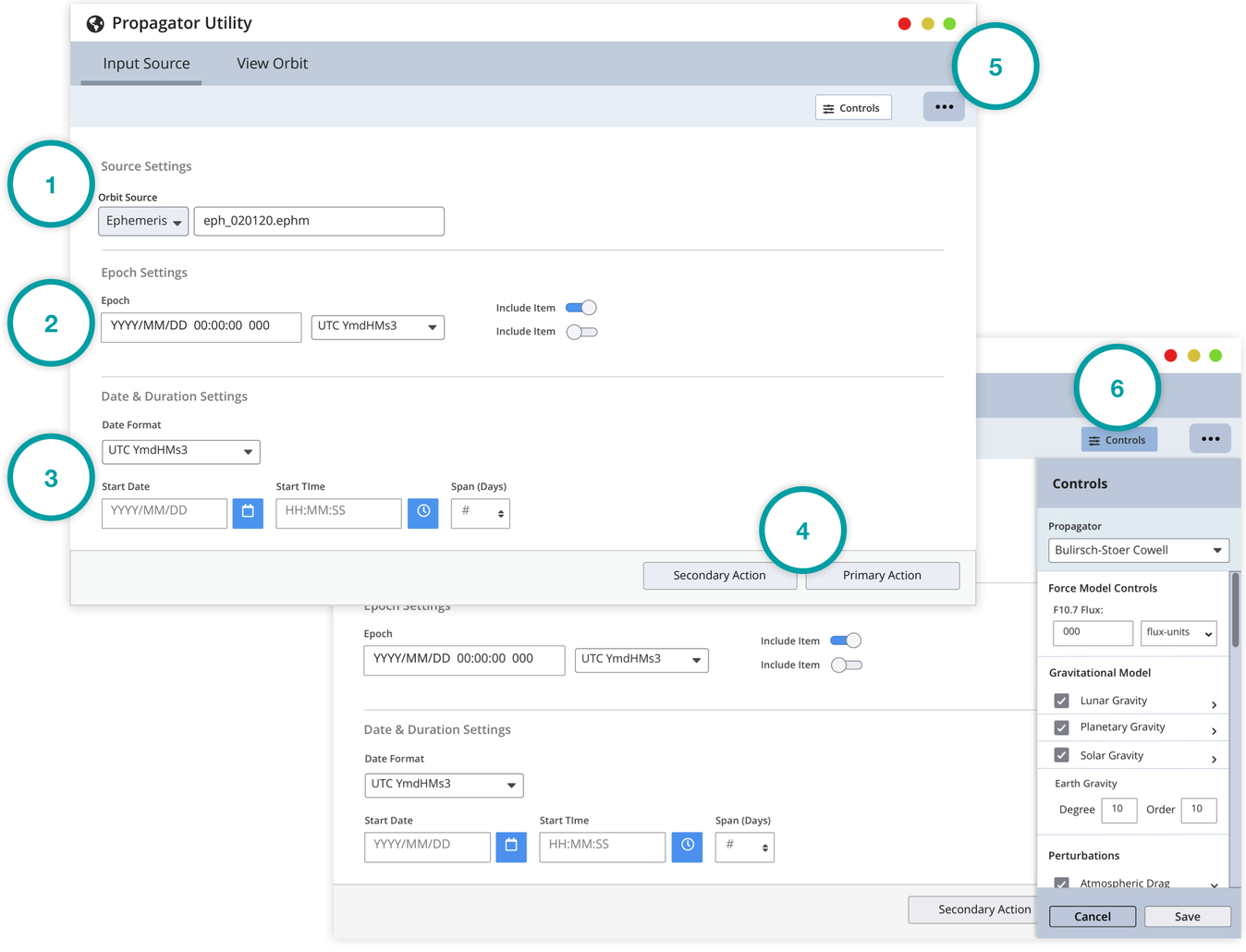

*FDS Wireframes.pdf, pages 29–31*

# Orbit Determination - Propagator Utility (Input Source)

## Functionality

Allows user to input source, epoch and date and time settings in order to generate an ephemeris.

1. **Source Settings**
   Allows user to select an orbit source and input a source file.
2. **Epoch Settings**
   Allows user to set epoch time.
3. **Date & Duration Settings**
   Allows user to set date and duration.
4. **Action Buttons**
   Allows user to apply actions to an ephemeris.
5. **Action Menu**
   Displays action items.
6. **Controls Button**
   Triggers a sliding pane that houses propagator controls.



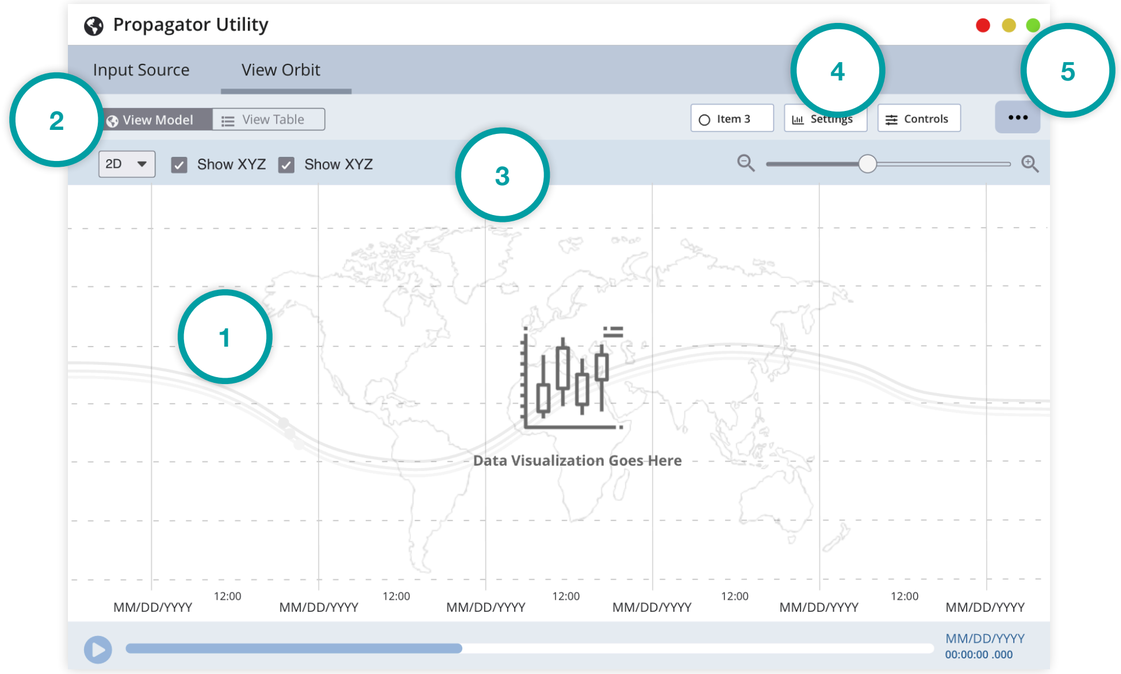

*FDS Wireframes.pdf, page 35 & 39*

# Orbit Determination - Propagator Utility (View Orbit)

## Functionality

Allows user to view a visual representation of ephemeris data.

1. **Orbit Data Display**
   Displays orbit data.
2. **Table View Switch**
   Switches between a tabular view and visual/graph view of orbit data.
3. **View Settings**
   Controls the data display view.
4. **Settings & Controls Button**
   Displays general settings.
5. **Action Menu**
   Displays action items.




*FDS Wireframes.pdf, page 38*

# Maneuvering & Reporting Tools

# Maneuvering - Basic Tool Framework

The framework for the Maneuvering and Reporting Tools and Utilities is similar to the frameworks from the OD Tool. These basic frameworks, along with the higher fidelity OD Tool wireframes and specifications, and the Astro Design System should provide developers a starting point from which to build additional tools. More research and user testing is required to finalize the design for these tools.

## Basic Frameworks