ICAO AERODROME PAVEMENT WORKSHOP

Introduction to FAARFIELD 2.1

Presented to: ICAO Aerodrome Pavement Workshop
Dakar, Senegal

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Date: 24 October 2024

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Download & Install FAARFIELD 2.1 Software

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Download FAARFIELD 2.1

- **Link: https://airporttech.tc.faa.gov/Products/Airport-Safety-Papers-Publications/Airport-Safety-Detail/faarfield-21**
  - Alternate - Search "FAARFIELD 2.1"

FAARFIELD can only be installed on Windows OS
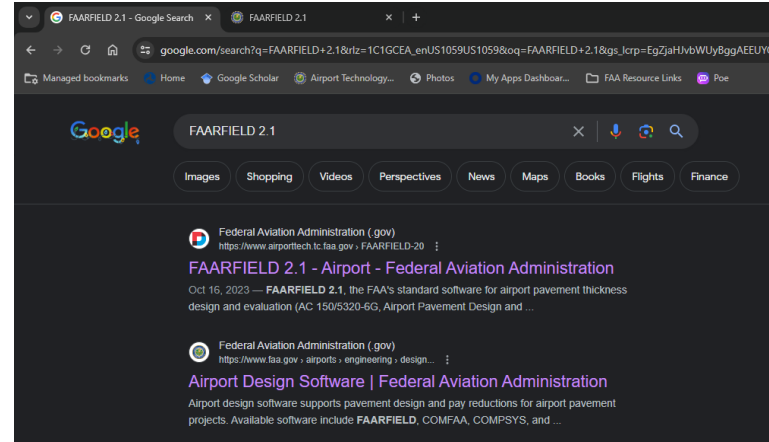
Download FAARFIELD 2.1

- **Click "Installation Files" to download**
  - Approximately 50 MB
  - Downloaded as compressed ZIP file
- **Source Code is also available at this webpage**

Monday, October 16, 2023

FAARFIELD 2.1

FAARFIELD 2.1 is the standard software accompanying the following FAA Advisory Circulars: AC 150/5320-6G - Airport Pavement Design and Evaluation, AC 150/5335-5D - Standardized Method of Reporting Pavement Strength - PCR

FAARFIELD 2.1, the FAA's standard software for airport pavement thickness design and evaluation (AC 150/5320-6G, Airport Pavement Design and Evaluation) and pavement strength reporting using the ACR/PCR method (AC 150/5335-6D, Standardized Method of Reporting Pavement Strength – PCR), features the following:

- Improved User Interface (UI) functionalities.
- The UI displays Slab Edge Stress and Slab Interior Stress for all aircraft in the Traffic mix, when performing Thickness Design or Life analysis of New Rigid pavement. The UI also shows the Most Demanding Aircraft.
- Performs Reduced Cross Section design for New Flexible and New Rigid.
- Enhanced capabilities to create and save Traffic Mix in the job file.
- Automatically downloads the most up-to-date aircraft library from PAVEAIR when users open the program.
- Improved ACR-PCR analysis.
- Modified information for numerous aircraft in the aircraft library.

Please note that:

- FAARFIELD stands for FAA Rigid and Flexible Iterative Elastic Layered Design. FAARFIELD 2.1 incorporates full 3D finite element responses to aircraft loads for new rigid pavements and rigid overlays. The 3D finite element models used for rigid pavement designs are computationally intensive and may result in long run times, depending on the computer characteristics. Your comments on this program and your suggestions for improvement are appreciated.
- FAARFIELD 2.1 is compatible with Windows™ operating systems. Windows 10 or higher is recommended. Installation instructions are available in the readme file.
- For questions, comments, or further information regarding this program, please contact Dr. David R. Brill, FAA Airport Technology R&D Branch, ANG-E262.
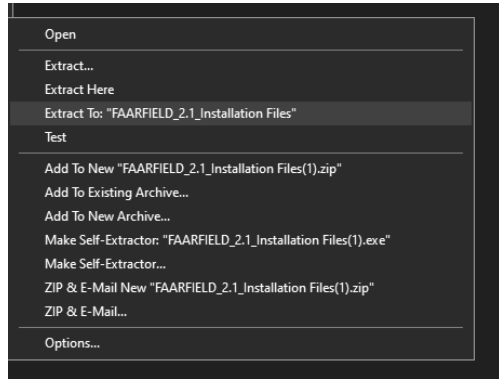
FAARFIELD 2.1 replaces all previous versions of FAARFIELD. To download the previous version FAARFIELD 1.42, use the following link: FAARFIELD 1.42

Documents to download

- FAARFIELD 2.1 readme
- FAARFIELD_2.1_Installation Files
- FAARFIELD_2.1_SourceCode

Install FAARFIELD 2.1

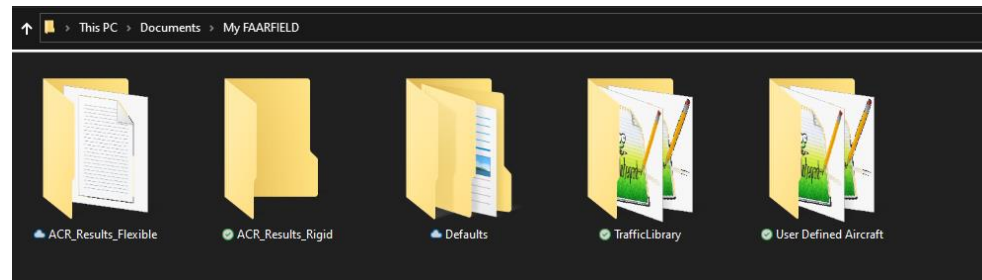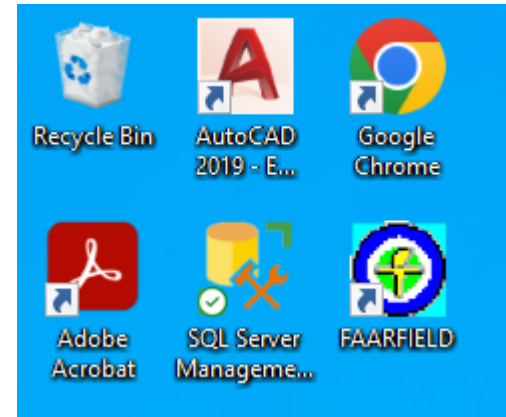- **Extract the downloaded ZIP file**
- **Run .MSI file to begin installation**

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Install FAARFIELD 2.1

To confirm the installation, look for:

- FAARFIELD application on your desktop
- FAARFIELD in Windows menu
- *My FAARFIELD* folder in your Documents directory

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Navigating FAARFIELD 2.1 Software

FAARFIELD 2.1 Organization

Aircraft Library

Aircraft Traffic Mix

Pavement Structure

FAARFIELD MAIN PROGRAM

- Thickness Design
- Life
- Compaction
- PCR

INPUT

OUTPUT

3D FEM Analysis

LEAF
Layered Elastic Analysis

FAAMesh
3D Mesh Generation

ICAO-ACR
ACR Numbers

FAARFIELD LIBRARIES

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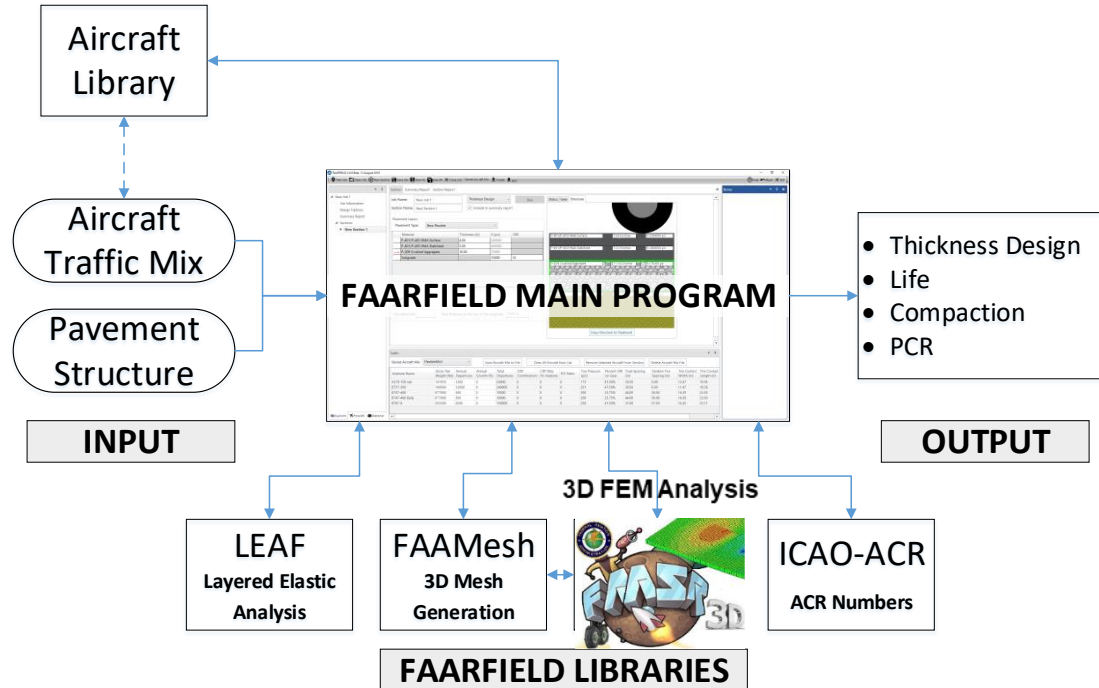
FAASR3D – FAA Structural Analysis in 3D

- Visual Basic.NET library.

- Replaces obsolete NIKE3D Fortran program.

- Managed Code - compatible with Microsoft .NET memory management services.

- Improves performance. Old code was subject to memory conflicts and crashing.

- Freely distributable code.

- Continued updates to improve speed & efficiency.

Navigating FAARFIELD 2.1

FAARFIELD 2.0 – Toolbar

FAARFIELD 2.1 – Explorer Navigation

- FAARFIELD 2.1 supports multiple jobs open at the same time.

- Use the Explorer to navigate between jobs, and display:
  - Sections
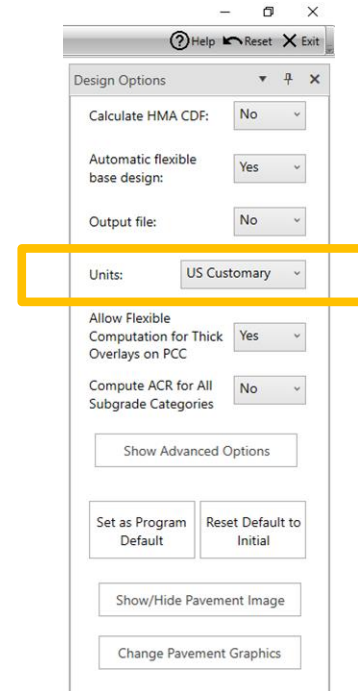 - Section Reports
  - PCR Reports/Graphs
  - 5010 Reports
  - Summary Reports (high-level run information on selected sections in a job)

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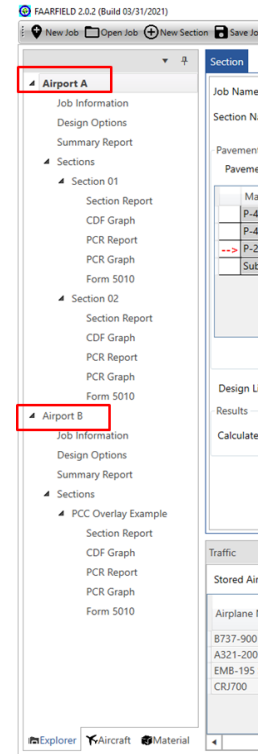
FAARFIELD 2.1 – Options

- Toggle between U.S. and metric units.

- Set user preferences for graphic display.

- One click restores default options.

FAARFIELD 2.1 – Pavement Section Area

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FAARFIELD 2.1 – Traffic Table (dockable)

Aircraft SelectionTools

Selected Aircraft Data

Airplane Name	Gross Taxi Weight (lbs)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (psi)	Percent GW on Gear	Dual Tire Spacing (in.)	Tandem Tire Spacing (in.)	Tire Contact Width (in.)	Tire Contact Length (in.)	Tire Contact Area (in.^2)
B737-900	174700	3000	0	60000	0.02	0.04	1.34	204	0.475	34.0	0.0	12.7	20.4	203.4
A321-200 opt	207014	2500	0	50000	0.98	0.98	1.31	212	0.475	36.5	0.0	13.4	21.5	226.0
EMB-195 STD	107916	4500	0	90000	0	0	1.36	147	0.475	34.0	0.0	11.5	18.4	166.4
CRJ700	72500	3500	0	70000	0	0	1.53	142	0.95	0.0	0.0	9.9	15.8	122.1

Stored Aircraft Mix: ExampleMix1 | Save Aircraft Mix to File | Clear All Aircraft from List | Remove Selected Aircraft from Section | Delete Aircraft Mix File

Aircraft Selection

Aircraft library has been completely reorganized and updated for FAARFIELD 2.1!

FAARFIELD 2.0 – Aircraft Library

User-Defined Aircraft Mode

Create, edit and save user-defined aircraft within the program.

User-Defined Aircraft Mode

- **FAARFIELD treats UDA just like other library aircraft, except they have (UDA) appended to the aircraft name.**

- **UDA data are stored in files in: C:\Users\[user]\Documents\My FAARFIELD\User Defined Aircraft**

- **UDA data are also saved to the job file – useful if a job is sent to another user.**
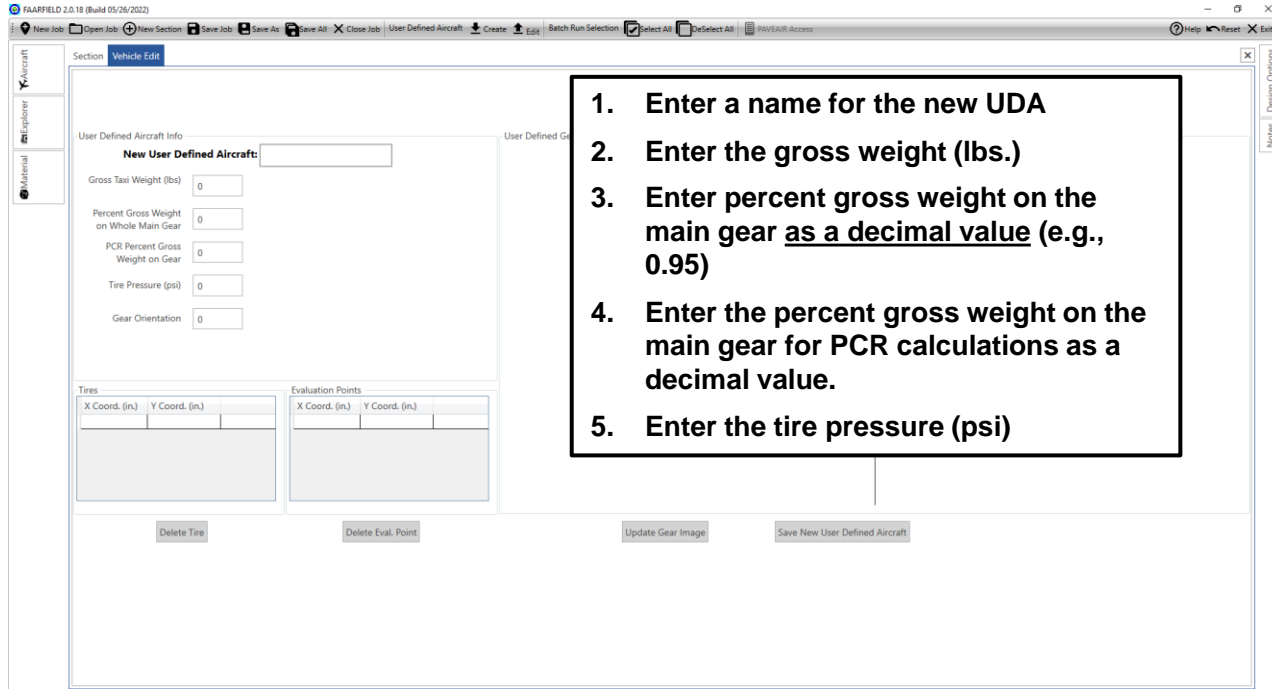
FAARFIELD 2.1 – User Defined Aircraft

Access the editor using the
User Defined Aircraft tools on the toolbar.

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FAARFIELD 2.1 – User Defined Aircraft Mode

1. Enter a name for the new UDA
2. Enter the gross weight (lbs.)
3. Enter percent gross weight on the main gear **as a decimal value** (e.g., 0.95)
4. Enter the percent gross weight on the main gear for PCR calculations as a decimal value.
5. Enter the tire pressure (psi)

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User-Defined Aircraft Mode

Define the tire coordinates.

- **X-coordinate is lateral.**
- **Y-coordinate is longitudinal (in direction of travel)**
- **Only enter coordinates for <u>one</u> set of wheels (left or right, doesn't matter). They will be reflected on the centerline.**

Define the evaluation points. These are used for layered elastic analysis computations.

- **Must have <u>at least one</u> evaluation point.**
- **Typically, under the wheel, at the gear CG, and evenly spaced between.**
- **Again, only enter coordinates for <u>one</u> set of points (left or right, doesn't matter).**
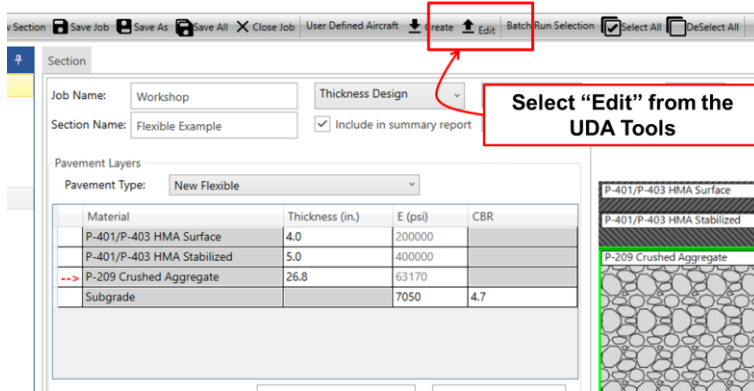
User-Defined Aircraft Mode

- **New UDA will appear in your External Library group.**

- **Identified by the suffix (UDA)**

- **Can be used in designs the same as internal library aircraft.**

- **Use the editor to define non-airplane vehicles (ARFF vehicles, tugs, etc.) not in the internal library.**
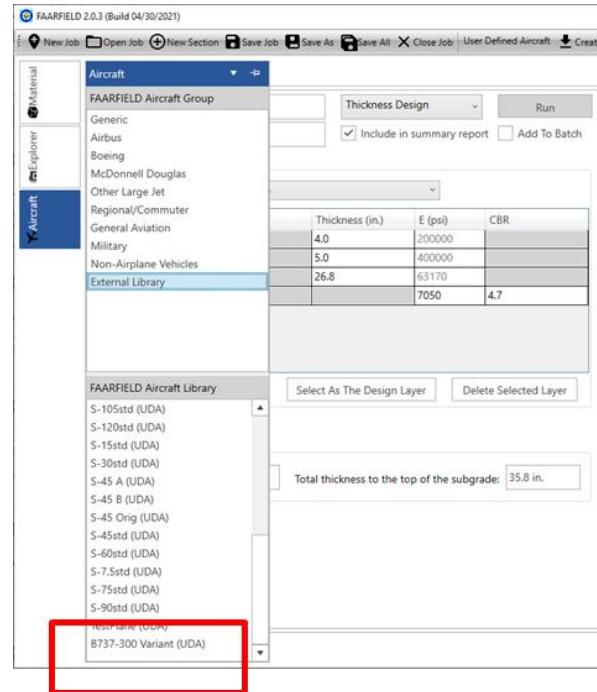
Editing an Existing UDA
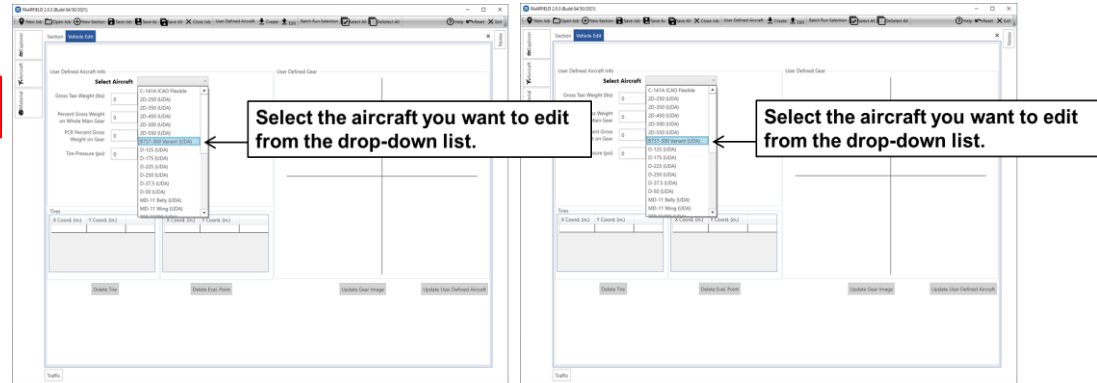
Select "Edit" from the UDA Tools

1

Select the aircraft you want to edit from the drop-down list.

2

Select the aircraft you want to edit from the drop-down list.

3

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Four Functions in FAARFIELD 2.1
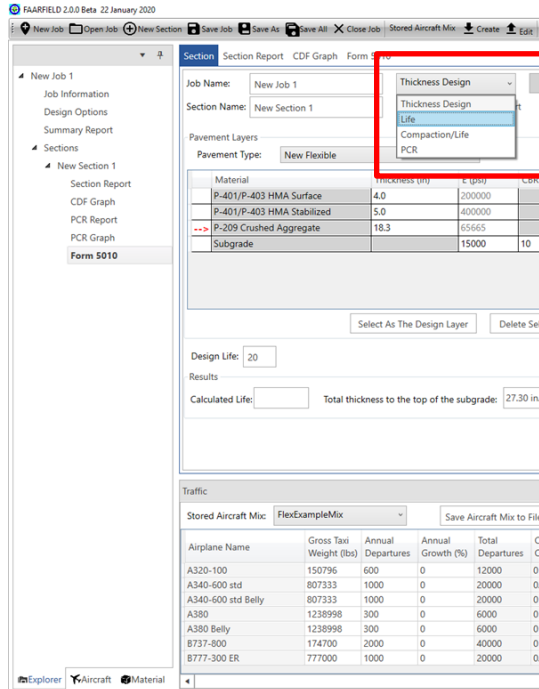
- **THICKNESS DESIGN** – Compute required thickness per AC 150/5320-6.

- **LIFE** – Compute structural life for a given structure and traffic mix.

- **COMPACTION** – Compute subgrade compaction requirements per AC 150/5320-6 for a given structure and traffic mix. (Applies to completed designs.)

- **PCR** – Compute Pavement Classification Rating (PCR) for the structure and traffic mix following AC 150/5335-5D.

FAARFIELD 2.1 Provides PCR

- **Directly uses FAARFIELD structure and traffic list.**

- **Replacement for COMFAA 3.0 & support spreadsheets.**

- **Method yields uniquely defined PCR – no more looping through all aircraft in the list.**

- **Implemented in FAARFIELD 2.1**
  - Solves problem of computing PCR for mixed traffic (i.e., many narrow bodies and few long range aircraft) without unnecessary operating weight restrictions on the LRs.
  - Seamlessly handles HMA overlays on rigid pavements (topic of afternoon presentation).
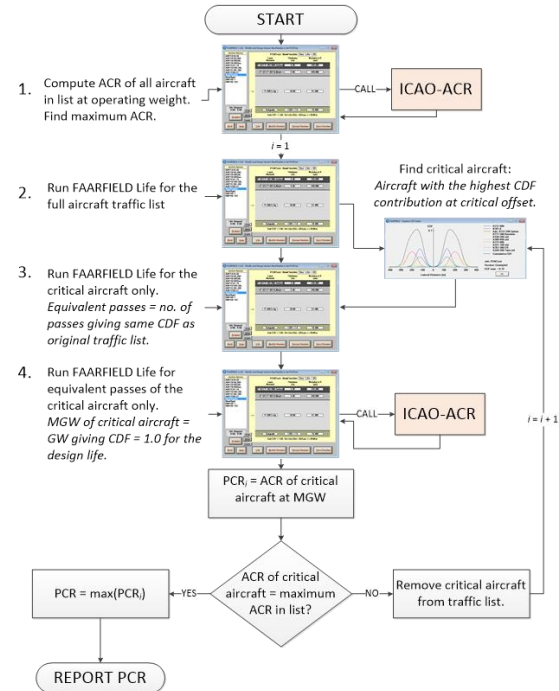
FAARFIELD 2.1 Help File

- **Completely rewritten for FAARFIELD 2.0.**

- **This is the <u>first</u> resource you should go to with your questions on FAARFIELD.**

- **Contains examples.**

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New Features in FAARFIELD 2.1

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FAARFIELD 2.1 –
New Features and Links to FAA PAVEAIR

- **FAA PAVEAIR**
  - FAA's web-based airport pavement management system (APMS)
  - https://faapaveair.faa.gov/

- **Data Integration with FAA PAVEAIR**
  - Log in to PAVEAIR using PAVEAIR user credentials
  - Update to current library version (and eventually to current software version) online
  - Access user-owned PAVEAIR databases
  - Populate Job Information from PAVEAIR data
  - Upload/download/store FAARFIELD job files

- **More New Features**
  - Display critical design stresses for rigid slabs (and most demanding aircraft for A-1 joint design).
  - Option to automatically perform reduced cross section design (1% of traffic).
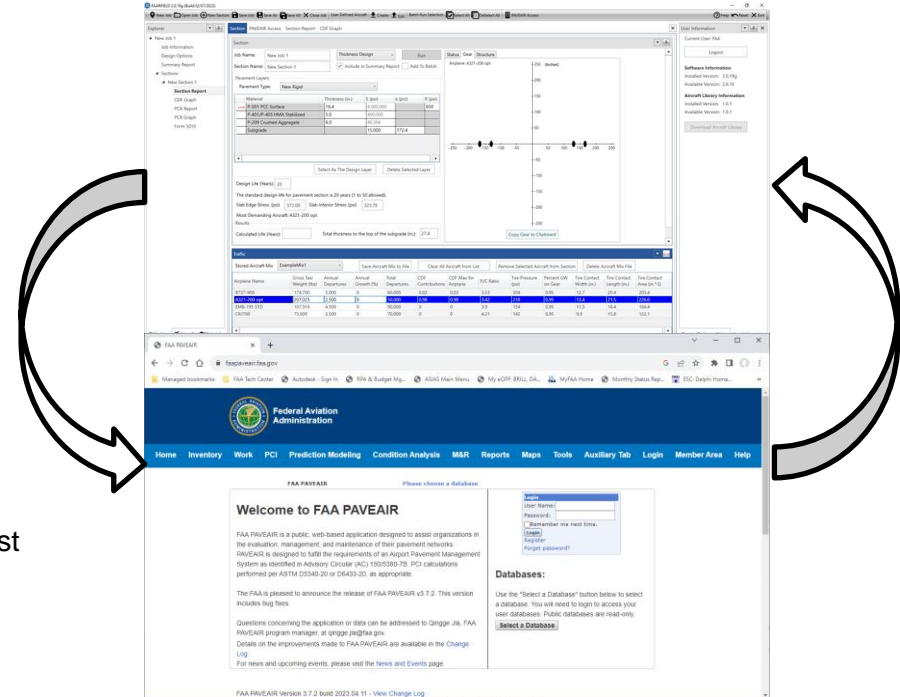
FAARFIELD User Sign-In

- **Select "User Information" tab at right**

- **Sign in using existing PAVEAIR account login and password.**

- **Panel displays installed and currently available versions of software and aircraft library.**

- **If your aircraft library is out of date, you have the opportunity to download the latest version.**

- **In the future, you will be able to update to a newer version of FAARFIELD, run software patches and bug fixes, etc.**

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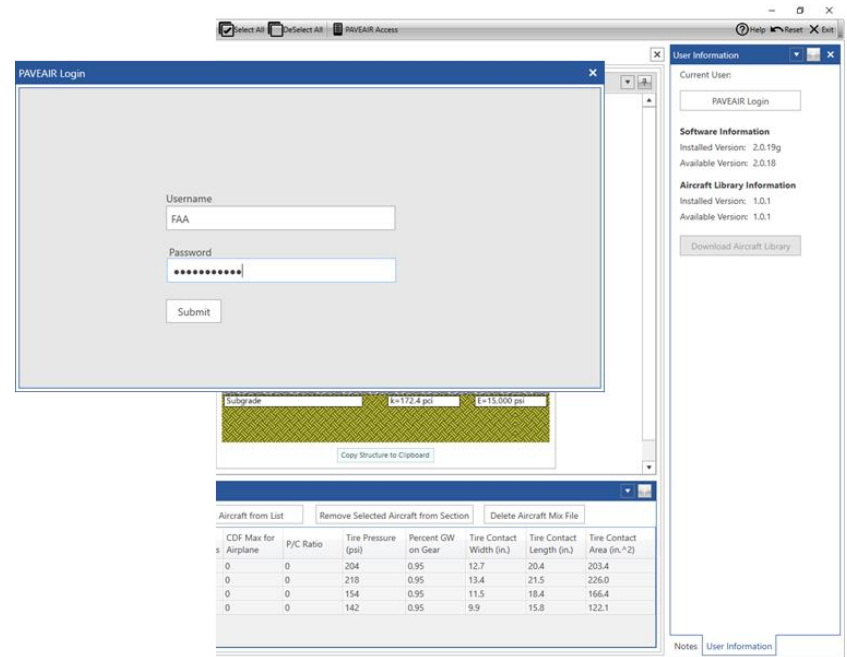
FAARFIELD – PAVEAIR Access Screen

- **Once signed in, you have access to all user-owned databases in PAVEAIR.**
- **Navigate to Network/Branch/Section**
- **Four possible actions:**
  - **Upload Job** – Uploads the current FAARFIELD job to the selected PAVEAIR Network/Branch/Section
  - **Download Job** – Downloads and opens the selected job from the PAVEAIR list in FAARFIELD
  - **Update Job** – Overwrites the selected job
  - **Delete Job** – Deletes the selected job from the PAVEAIR database. (Does not delete from FAARFIELD or the FAARFIELD job file).
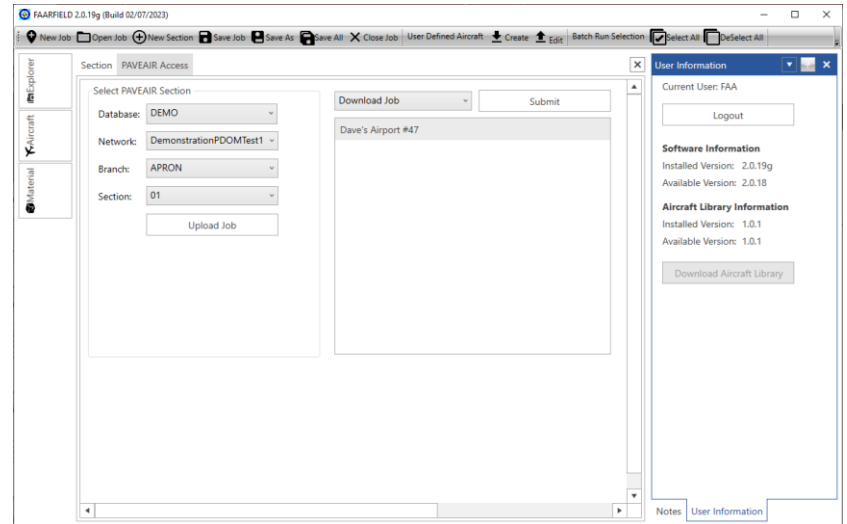
Data Organization

- **The same FAARFIELD job can be uploaded to multiple locations in a PAVEAIR database.**

- **Note to users of FAARFIELD 2.0: "Sections" have been renamed to "Structures." This is to avoid confusion with sections as defined in APMS.**

- **For the PAVEAIR user, structures can represent:**
  - Asphalt vs. concrete options, for use in PAVEAIR LCCA tool
  - Before/after overlay or replacement of section
  - Different possible traffic mixes
  - Etc.

PAVEAIR Side | FAARFIELD Side

DATABASE → NETWORK → BRANCH

FAARFIELD Sections are now Structures!

SECTION A → JOB1 → STRUCTURE 1, STRUCTURE 2

SECTION B → JOB1 → STRUCTURE 1, STRUCTURE 2

JOB2 → STRUCTURE 3, STRUCTURE 4
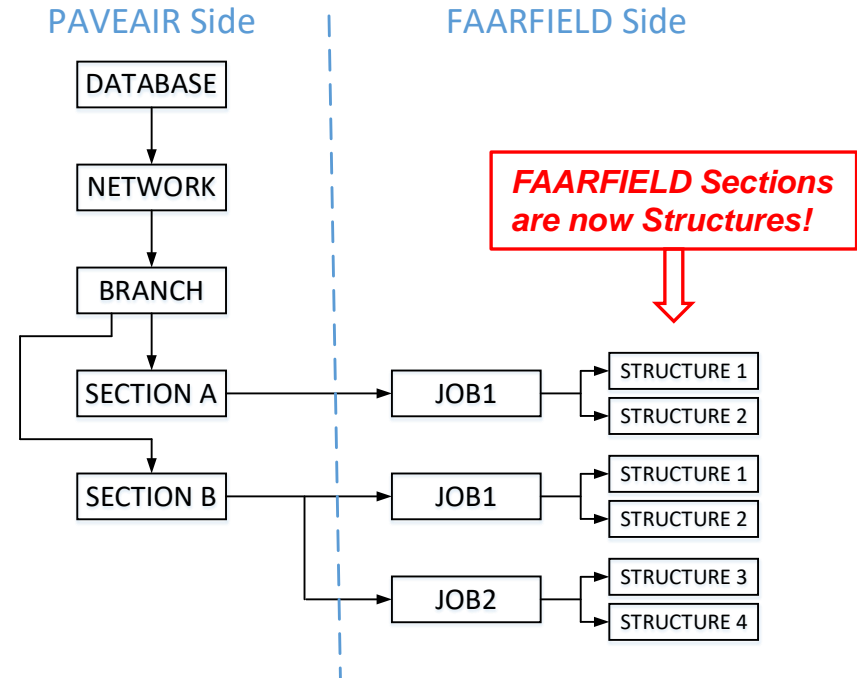
Thank You!

Acknowledgments:

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