

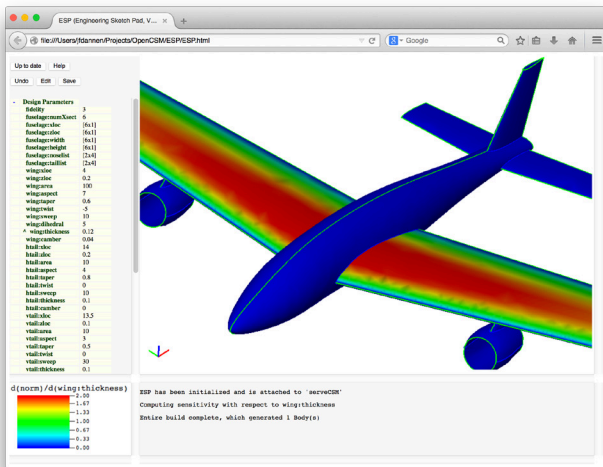


# Training

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The “Engineering Sketch Pad” (**esp**) system is software specifically built to facilitate *Design through Analysis*. As opposed to most commercially-available geometry-generating CAD systems, **esp** is designed for geometries encountered in aerospace applications for which CFD/Structural Analysis computations are desired (and at various levels of fidelity).

**esp** is architected with a client-server model, where the back-end runs on most modern operating systems (Windows 7/8/10, Mac OSX, and Linux) and the front-end runs in modern web browsers (Firefox, Google Chrome, Safari), without the need for plug-ins.



## INSTRUCTORS

John Dannenhoffer III, Syracuse University  
Bob Haimes, MIT

## WHEN

Tuesday Afternoon, 5 June 2018  
Software Install (optional)  
Wednesday/Thursday, 6-7 June 2018  
Friday Morning, 8 June 2018  
Programming UDPs (optional)

The distinguishing features of this system includes:

- Feature-based parametric solid modeler
- Full suite of feature-tree branch types
- Compiled user-defined primitives (UDPs):  
*Custom features*
- Scripted user-defined components:  
*Commonly used parts* and operations
- Configuration files that are readable ASCII text:  
*Explicit design intent*
- Persistent attribution between models
- Sensitivities:  
Rapid, accurate derivatives of the BRep with respect to the design parameters
- Open-source, licensed under LGPL 2.1

## WHERE

University of Dayton Research Institute  
1700 South Patterson Boulevard  
Dayton, OH 45469

<https://www.udri.udayton.edu/CONTACTUS/Pages/VisitingUDRI.aspx>

## SUGGESTED HOTEL

Marriott at the University of Dayton  
1414 South Patterson Boulevard, Dayton, OH  
937-223-1000

## REGISTRATION

Limited to 30 participants, attendance at the complete training will have priority.  
Please bring your own laptop

**EMAIL:** [michelle.walker.11.ctr@us.af.mil](mailto:michelle.walker.11.ctr@us.af.mil)

**CC:** [dean.bryson@us.af.mil](mailto:dean.bryson@us.af.mil)

**SUBJECT:** ESP Registration

Name: \_\_\_\_\_

Organization: \_\_\_\_\_

Contact Information

(email / phone): \_\_\_\_\_

Optional Sessions: \_\_\_\_\_

# esp Training Agenda

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## SESSION 0: INSTALLATION (OPTIONAL)

Installation on your own laptop  
MAC OSX 10.9+, Linux, Windows 7, 8, or 10  
Firefox, Google Chrome, Safari

## SESSION 1: OVERVIEW

Background and objectives  
esp architecture  
Distinguishing features  
BRep terminology  
Overview of training  
esp Graphical User Interface (GUI)  
Hands-on exercises  
Muddy cards

## SESSION 2: SKETCHING FUNDAMENTALS

Introduction  
Creating a Sketch  
Editing an existing Sketch  
Image manipulation in the Sketcher  
Sketching Best Practices  
Hands-on exercises

## SESSION 3: SOLIDS FUNDAMENTALS

Constructive solid modeling process  
Feature Tree  
Branch types  
    primitives  
    grown Bodys (from Sketches)  
    Boolean combinations  
    transformations  
    applied features  
    miscellaneous  
Hands-on exercises

## SESSION 4: CSM SCRIPTS

Reading the documentation  
Format of the .csm file  
Special characters  
Valid CSM statements  
Number rules  
Parameter rules  
Expression rules  
Attribute and Csystem rules  
Patterns, If/then, and Throw/catch  
Hands-on exercises

## SESSION 5: USING UDPs, UDFs AND UDCs

Difference between UDPs, UDFs, and UDCs  
Using user-defined primitives (UDPs)  
    list of UDPs shipped with esp  
    calling a UDP

Using user-defined functions (UDFs)  
    list of UDFs shipped with esp  
    calling a UDF  
Using user-defined components (UDCs)  
    list of UDCs shipped with esp  
    calling a UDC  
Writing a UDC  
    creating the interface  
    example UDC  
Hands-on exercises  
    fuselage

## SESSION 6: SENSITIVITIES

Background / Objective  
Alternative approaches  
    analytic derivatives  
    code differentiation  
    finite differences  
Computed examples  
Application to grid generation  
Conclusions  
Computing sensitivities in esp  
Hands-on exercises

## SESSION 7: INTEGRATION WITH OTHER SYSTEMS

OpenCSM  
    object types  
    programming interface  
EGADS  
    object types  
    programming interface  
Hands-on exercises

## SESSION 8: PUTTING IT ALL TOGETHER

Multi-fidelity, multi-disciplinary models  
Attribution strategy  
Using UDCs to build aircraft components  
Assembling an aircraft  
Hand-on exercises  
Course summary

## SESSION 9: WRITING A UDP OR UDF (OPTIONAL)

Review of EGADS geometry and topology models  
EGADS documentation  
Steps to writing a UDP  
Sample UDP  
    structure of code  
    code walk-through  
    stand-alone execution  
    execution as a UDP  
Tire UDP

Download at → <http://acdl.mit.edu/ESP>