

Optimising Aircraft Using the J2 Universal Tool-Kit

AIRCRAFT MODELLING AND PERFORMANCE PREDICTION SOFTWARE

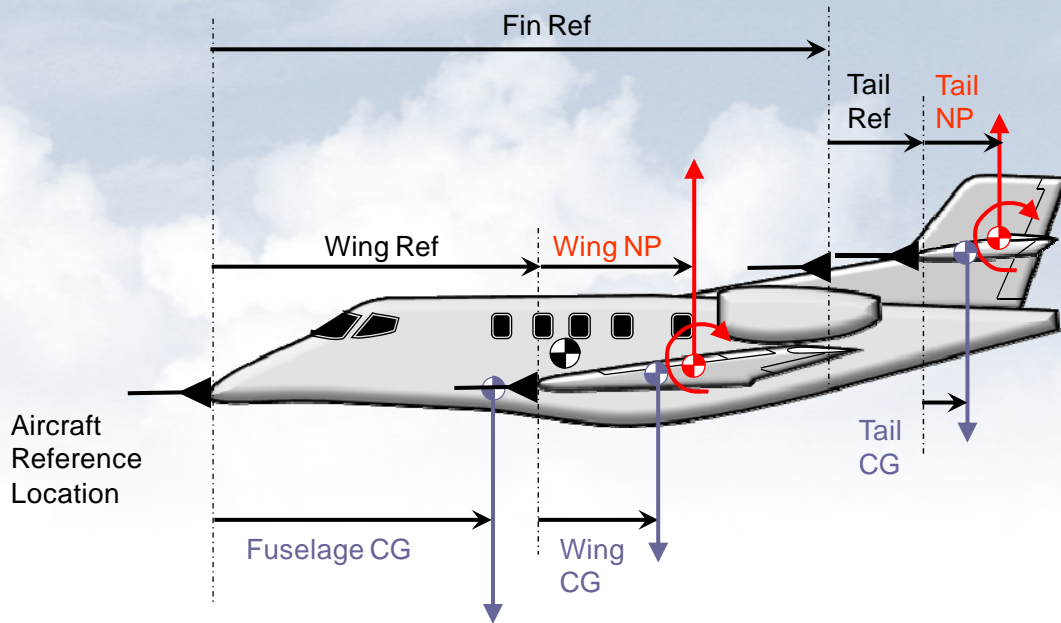
KEY ASPECTS

- *OPTIMISE FROM THE START*
Rapidly Construct Models at Any Stage in Development
- *INVESTIGATE ALL OPTIONS*
Perform Trade/Sensitivity Studies
- *FOCUS EFFORT ON PROBLEM AREAS*
Assess Complete Envelope
- *EFFICIENTLY MANAGE PROJECTS*
Centralised Tool
- *COST EFFECTIVE WORKFLOW*
Integrated Environment

OPTIMISE FROM THE START

Rapidly Construct Models at Any Stage in Development

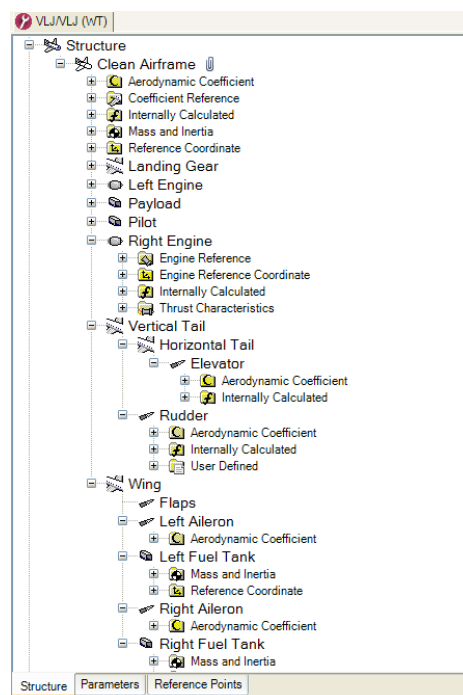
This helps to start the investigation very early in the aircraft lifecycle when costs of modifications are much cheaper. As a result more possibilities can be assessed and eliminated earlier, resulting in the best possible scenario.



Building the Aircraft from its component parts, in a logical hierarchy helps keep everything together as Systems and Subsystems, matching the real aircraft structure. The J2 Universal Tool-Kit will total up contributions from each part to give resultant force and moment coefficients as well as total Mass, Inertia and CG information.

With the **J2 Universal Tool-Kit** it is possible to rapidly construct aircraft models very early in the aircraft lifecycle from any information source. No longer are users waiting for detailed Wind Tunnel or CFD data before they can start assessing the aircraft. The Hierarchical Model Structure and integrated Strip Theory enable aircraft models to be built in hours from an initial 3-View. From this point it is then possible to start the analysis process.

Because the models can be built early in the lifecycle, in record time with even the most basic of data multiple options, configurations and ideas can be assessed for minimal cost. This helps to expand the understanding of different design characteristics and to focus on the big issues.



Logical hierarchy for Aircraft Model matches the real aircraft structure.

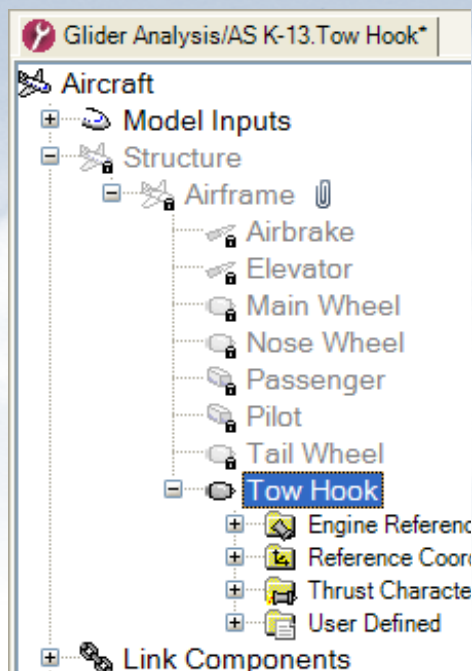


AIRCRAFT DYNAMICS
Predicting Performance



INVESTIGATE ALL OPTIONS

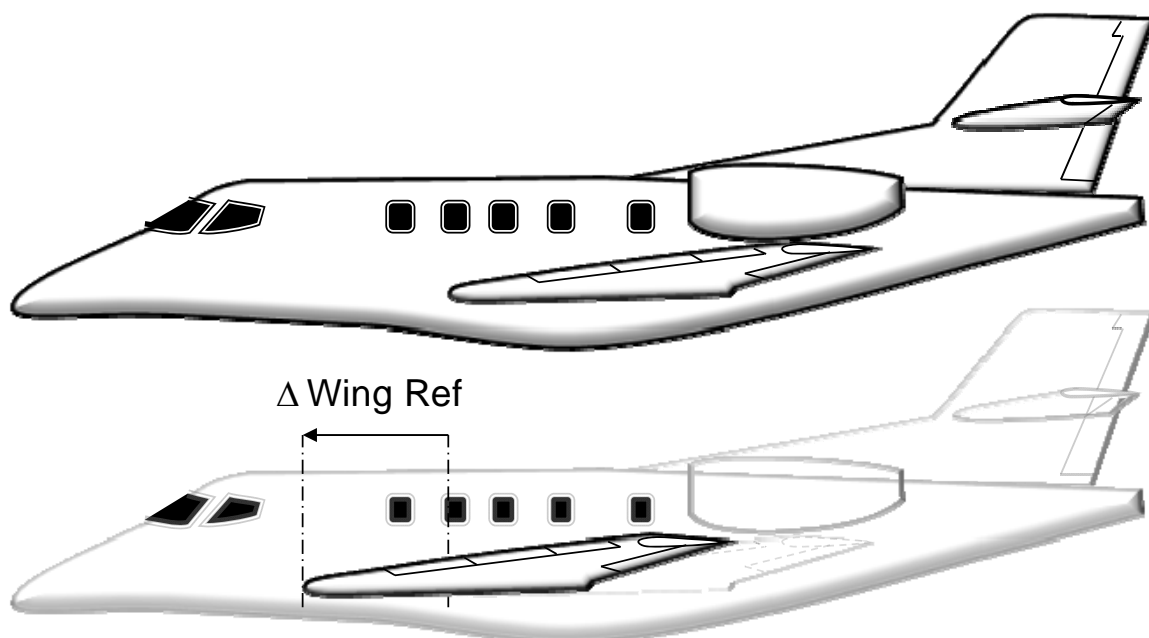
Perform Trade/Sensitivity Studies



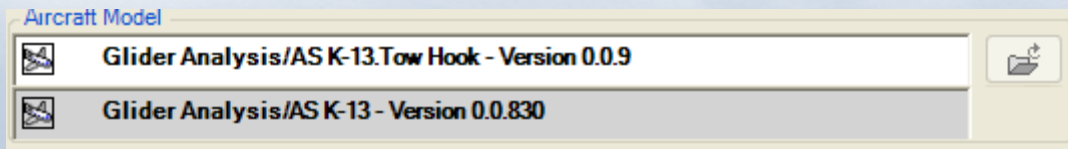
Having created the first Aircraft model, variants take even less time to build. It is possible, with the **J2 Universal Tool-Kit** to create "delta" models from a baseline project.

With the delta model it is possible to add just the changes to the baseline aircraft and instantly have two variants which can be flown using the same manoeuvres and the results compared. The delta model references the baseline aircraft so any changes made to the baseline are automatically incorporated into the delta. This helps to keep all variants aligned.

Delta Model showing just the changes to the original Aircraft



By just adding the change (delta) to the wing reference location enables a new aircraft to be created that can be compared to the baseline to evaluate the impact of wing location.



When performing an Analysis, the user is informed of the version of the delta, and the version of the baseline model that it references. This ensures that all analyses are configuration managed and consistent with the correct aircraft version.

FOCUS EFFORT ON PROBLEM AREAS

Assess Complete Envelope

With the J2 Universal Tool-Kit, you do not have to look at specific design points and assume other cases work just as well. Complete flight envelopes covering any number of manoeuvres/situations can be constructed and analysed in minutes giving a complete understanding of the whole flight regime. From here the problem areas can easily be identified and an understanding as to where to focus design effort can be developed.

| Run | Res | Run Date | Trim Rule 5 | Trim Rule 6 |
|---|------|---------------|-----------------------|--------------------------|
| <input type="checkbox"/> Run | Good | 24/06/2008... | ALT-FX : H = 18000 ft | VEL-FX : TAS = 350.0 kts |
| <input checked="" type="checkbox"/> Error -.. | Bad | 24/06/2008... | ALT-FX : H = 20000 ft | VEL-FX : TAS = 80.0 kts |
| <input checked="" type="checkbox"/> Error -.. | Bad | 24/06/2008... | ALT-FX : H = 20000 ft | VEL-FX : TAS = 105.0 kts |
| <input type="checkbox"/> Run | Good | 24/06/2008... | ALT-FX : H = 20000 ft | VEL-FX : TAS = 130.0 kts |
| <input type="checkbox"/> Run | Good | 24/06/2008... | ALT-FX : H = 20000 ft | VEL-FX : TAS = 155.0 kts |
| <input type="checkbox"/> Run | Good | 24/06/2008... | ALT-FX : H = 20000 ft | VEL-FX : TAS = 180.0 kts |
| <input type="checkbox"/> Run | Good | 24/06/2008... | ALT-FX : H = 20000 ft | VEL-FX : TAS = 205.0 kts |
| <input type="checkbox"/> Run | Good | 24/06/2008... | ALT-FX : H = 20000 ft | VEL-FX : TAS = 230.0 kts |
| <input type="checkbox"/> Run | Good | 24/06/2008... | ALT-FX : H = 20000 ft | VEL-FX : TAS = 255.0 kts |
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| <input checked="" type="checkbox"/> Error -.. | Bad | 24/06/2008... | ALT-FX : H = 22000 ft | VEL-FX : TAS = 80.0 kts |
| <input checked="" type="checkbox"/> Error -.. | Bad | 24/06/2008... | ALT-FX : H = 22000 ft | VEL-FX : TAS = 105.0 kts |
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In minutes it is possible to establish initial conditions from any possible configuration and flight point. Analysis will highlight all areas where the aircraft can/cannot achieve

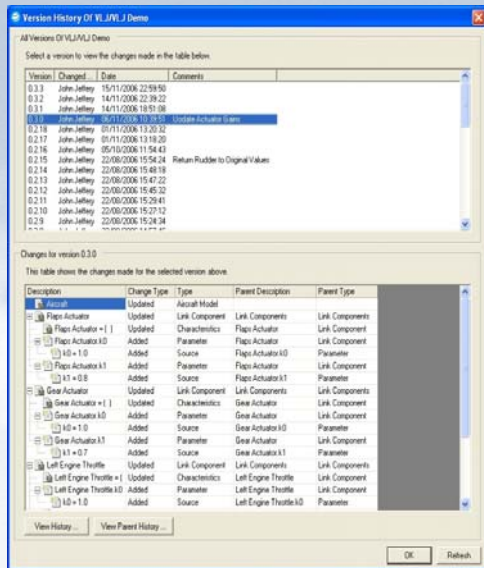
Example

Spoilers are often classed as too complex to model due to their non-linearity. This can be a reason why analysis is left until later on when significant resources have been spent in calculating their characteristics. At this point it may be too late to modify the spoilers as the design has been fixed.

By building a model in J2 Builder with spoilers located on each wing reducing lift and increasing drag with deflection, it is possible to quickly see how spoilers affect controllability. Create several deltas and modify spoiler characteristics. Assess all the deltas across all points of interest and see what impact spoiler design has on characteristics. If effect is minimal, something else is driving design, if impact is major, then effort needs to be focused on spoiler characteristics.

EFFICIENTLY MANAGE PROJECTS

Centralised Tool

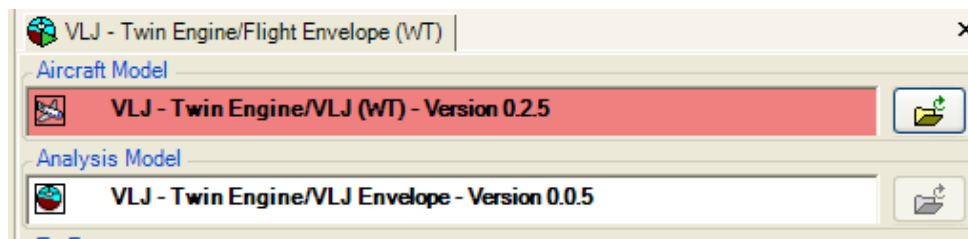


Changes and Modifications are all logged to track who has changed what and when

All engineers working from the same central data source significantly reduces communication time and errors. With the **J2 Universal Tool-Kit**, data is stored in a central database that can be accessed by all engineers on the project.

This means that all the different disciplines (Weights, Aerodynamics, Flight Mechanics, Flight Control Systems, etc.) can enter data directly into a central hub to construct the model and run analyses. From this approach there is no longer the delay whilst everybody gets all their information together before passing it on to the next group who have been working on out of date information from the previous version.

Integrated Version Control and Configuration Management means that all modifications are tracked and logged against engineers along with version numbers. This enables the project to be more effectively managed as at a single glance it is possible to find out any analyses that are out of date and who has performed what analysis on which version of the aircraft.



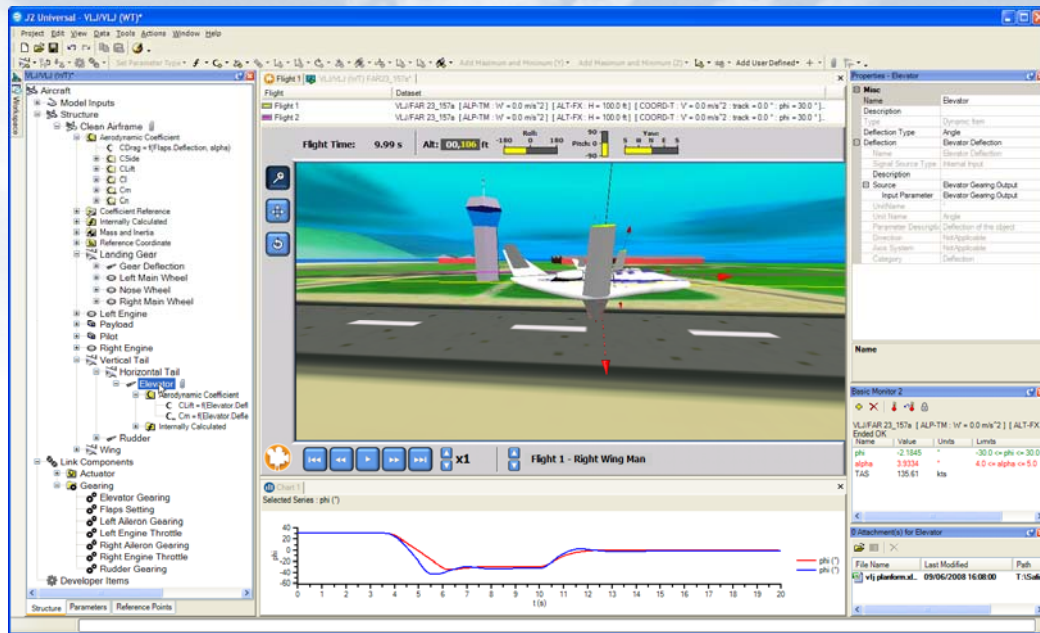
Models are automatically highlighted when changes are made since the analysis was performed. Results can be instantly updated to the latest version with 3 mouse clicks

COST EFFECTIVE WORKFLOW

Integrated Environment

All the functionality to build and analyses models is built into the J2 Universal Tool-Kit so there is no need to continually transfer data from one application to another for analysing and post processing this maintains the consistency of the data and avoids mistakes being made.

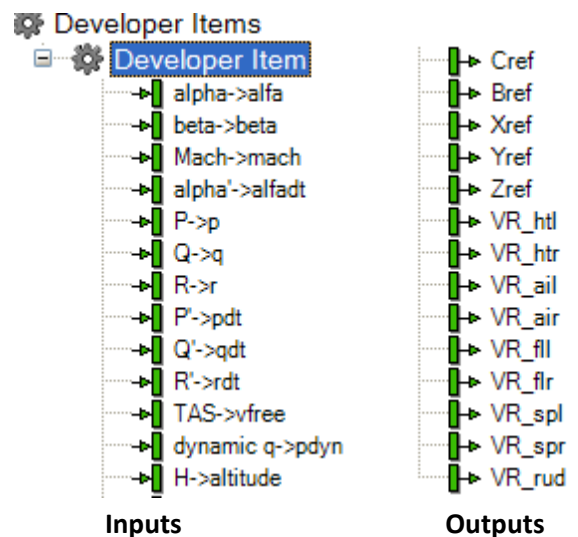
Data from charts can be copied into reports, and fully documented reports of aircraft models can be automatically generated



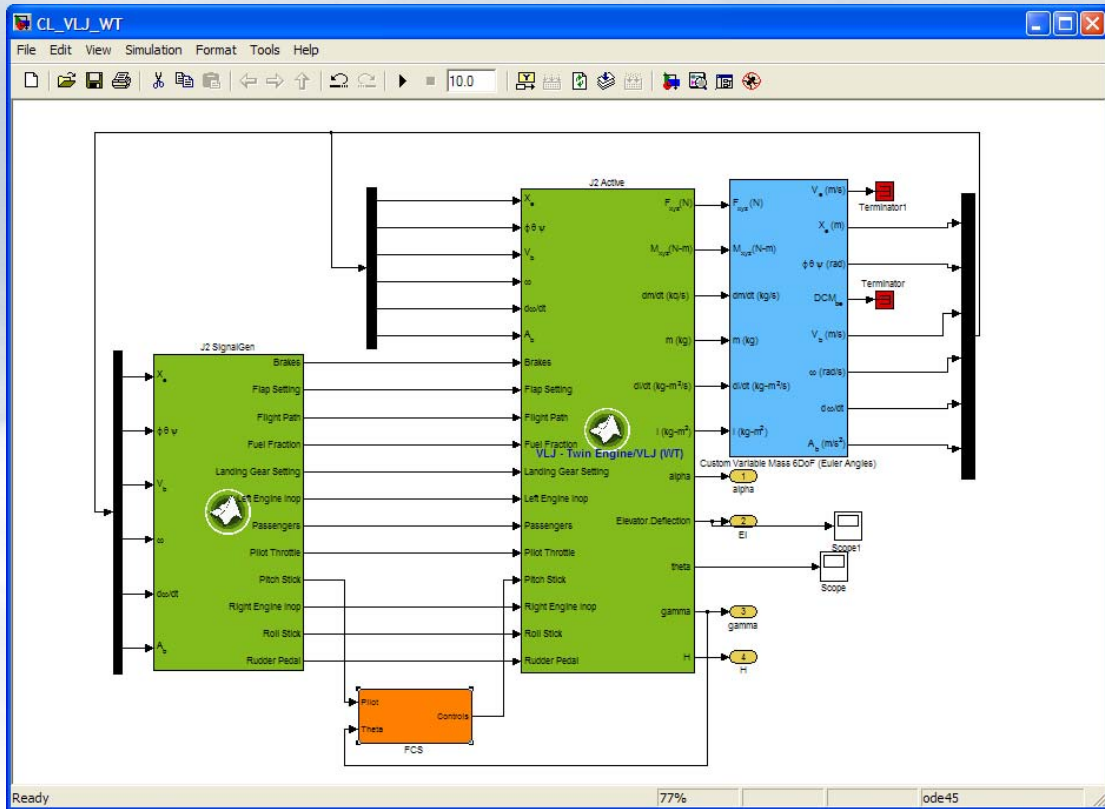
The integrated environment provided by the J2 Universal Tool-Kit avoids the need to move data between different applications via files, thus avoiding inconsistencies and possible mistakes.

Open interfaces via **J2 Active** and **J2 Developer** means that the **J2 Universal Tool-Kit** can integrate with existing tools and processes to ensure consistency. Thus loads and performance analysis can work with the same models and take advantage of version control. Results can be stored back in the database for visualisation, comparison and charting.

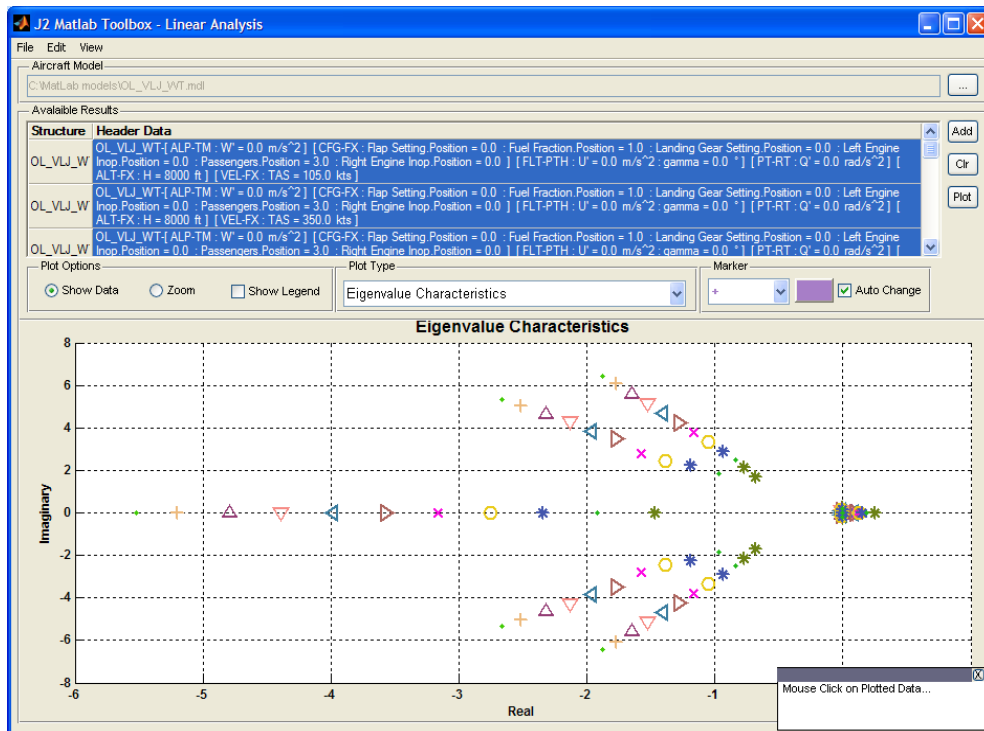
When developing Flight Control Systems, the J2 Universal Tool-Kit goes one stage further and has integrated Matlab/Simulink via the J2 Matlab Toolbox. This combines the power of Matlab systems design with the capability of the J2 Universal Tool-Kit to give unprecedented “closed loop” non linear and linear analysis capability.



Connecting external libraries into Aircraft Models is just a question of mapping parameters



J2 Matlab Toolbox (in green) provides direct links into the J2 Universal Tool-Kit to access aircraft models and flight manoeuvres. The 'live links' mean that all version control is maintained between Matlab/Simulink and the J2 Universal Tool-Kit



Non-Linear models can be automatically linearized about any point in the envelope and characteristics charted and compared.

IT TOOK J2 AIRCRAFT DYNAMICS' AEROSPACE ENGINEERING AND AIRCRAFT DESIGN SPECIALISTS OVER 10 YEARS TO BUILD THE 'CODE' THAT ENABLES THE UNIVERSAL TOOL –KIT TO INVESTIGATE ALL ASPECTS OF AIRCRAFT HANDLING AND PERFORMANCE.

WE HAVE DONE ALL THIS SO THAT YOU DON'T HAVE TO.

This state-of-the-art, but easy-to-use software suite gives you unprecedented power to design and 'fly' multiple configurations of the complete flight envelope in a 3-D virtual environment – all at the click of a mouse! When using the J2 Universal Tool Kit, you can save hundreds of thousands of dollars by streamlining your process, maximizing your analysis capability and reduce the risk of serious project flaws.

At the heart of J2's software is the **J2 Universal Framework**, a cutting-edge configuration control and data management platform that hosts all steps of the design process. Everything we offer begins and interacts with this key framework.



Now it's time to investigate our range of plug-ins. 'Mix and match' their additional design and analysis capabilities using floating licenses. Take control of a bespoke package that perfectly fits your requirements. This way, you get the right functionality and maximise the return on your investment.

ARE YOU READY TO RETHINK THE WAY YOU DEVELOP YOUR AIRCRAFT?

To find out more about **J2 Aircraft Dynamics**, our software and our consultancy services, visit www.j2aircraft.com

PLUG-INS



J2 Builder

An easy-to-use graphical interface that rapidly develops aircraft models and builds multiple variants for comparison.



J2 Elements

Enables automatic calculation of total aerodynamic coefficients and derivatives through integrated strip theory.



J2 Developer

A Software Development Kit (SDK) for all users to write their own components and libraries and then an interface into J2 Aircraft Models into which these libraries can be plugged in.



J2 Freedom

Provides flight dynamics simulation of aircraft data models, allowing you to evaluate the complete flight envelope.



J2 Active

An open COM interface that instantly integrates your existing design packages with the power of the J2 Universal Tool-kit.



J2 Matlab Toolbox

Allows the full capability of the J2 Universal Tool-Kit with Simulink Model files. Manoeuvres developed from within J2 can also be flown on Simulink Models. It is possible to run analyses from within J2 using J2 Matlab Response and J2 Matlab Trim analyses.



J2 Visualize

Instant understanding and evaluation of aircraft behaviour through data visualization and graphic displays.



J2 Virtual

View any results in a virtual 3-D real-world, to understand what exactly happens during unexplained/complex manoeuvres.



Imagine if you could predict the **future**.
You would choose the best **aircraft design**.
And get it right **first time**.



Use the power of the **J2 Universal Tool-kit** to optimise your aircraft design from first concept through to final flight trials, slash development costs and fast-forward your time to market. Our **industry-leading software suite** allows you to fly your design in a realistic virtual environment, to predict its performance and behaviour, stability and control with unprecedented accuracy. Design changes can be made quickly and cheaply, all at the click of a mouse.

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