J2 Aircraft Dynamics Case History
EDM UK Ltd/J2 Full 6-Axis G Seat Simulation Package

AIRCRAFT MODELLING AND SIMULATION SOLUTION

KEY BENEFITS

- No lag between Pilot input , motion of the seat and visuals.

- Powerful modelling environment can be used to run other aircraft models built in any code across all fidelity levels up to and including level 6D

- G-seat provides highly realistic Cue's as an aide to Pilot training in an open or closed cockpit format.

- Easily supported j2 software provides a highly adaptable platform easily networked onto any company system.

- Skid mounted design means that units can be located and moved to any location for training purposes, even ship based.

- G cuing seat .provides a uniquely immersive environment that far exceeds fixed base simulation where actions and timing of the pilot to deliver manoeuvres are taken from the effect of G on the body.and not where they are in the sky.

G SEAT PILOT TRAINER

J2 Aircraft Dynamics Ltd recently joined forces with EDM UK Ltd to launch a full 6-axis G seat into the Global G seat Pilot Trainer Market. This represents a significant advance in the use of Aerodynamic models to drive a simulated environment.

As one of only 3 select companies in the world who manufacture simulated ejection seats under license from Martin Baker, EDM have teamed up with j2 Aircraft Dynamics to deliver a significant first – the ability to fly a G seat in real time without lag or delay in response between controls and seat actuation.

The simulated seats are already used within a Pilot training environment e.g. Eurofighter Typhoon, M35 Hawk and F35 lightning 2.
However the bringing together of the 6 axis moving G seat combined with the latest dynamic aircraft modelling technology from j2 aircraft makes this a truly unique product proposition

HOW DOES THE G CUEING SEAT WORK

A development of the replica seat is the G Cueing Seat. This type of seat incorporates electric actuators or motors which provide "movement" within various parts of the seat.

The seat movement simulates the movement of the aircraft within the simulated environment. This movement coupled with a highly realistic visual and sound simulation, plus in some cases a simulated anti G suit, provides the pilot with an environment that stimulates his/her sensory perception.

It is this sensory stimulation that sets the G-cueing seat apart from fixed base simulators, especially where the actions and timing of actions of a pilot to

deliver specific manoeuvres are taken from the effect of G on the body not where they are in the sky.

The actuators within the seat work in a coordinated way to provide simulated movement aligned to the pilot's centre of gravity which in itself is aligned to the aircraft primary axis X,Y and Z.

The actuators are stimulated from a complex 6 axis flight model developed by j2 Aircraft Dynamics. This is the intelligent core of the product offering. The model, within the simulation, calculates in real time, simultaneous equations of motion based on the centre of gravity of the pilot within the simulated aircraft model i.e. Hawk, Typhoon, and F35 etc. This provides the pilot with "surge" "heave" and "sway" cues.

PRODUCT FEATURES

The EDM/j2 G Cueing seat is already fully commercial with seats already installed in the Royal Air Force Hawk T MKII Full Mission Simulators. In developing the solution for the RAF, EDM/j2 has produced a seat with the following key features:

•Retention of all key simulated equipment on the seat to allow highly realistic ingress and egress training

•Integrated 6 axis modular actuation system providing real time G-cueing in "surge", "sway" and "heave".

•Innovative rolling motion through the use of asymmetric movement of the seat pan

•Seat actuator modules are designed for removal and re-fit with the seat in the simulator cockpit thus providing a high degree of maintainability

•Control of the seat actuators is via a high speed CANBUS network

•Actuators and control system are Commercial Off The Shelf (COTS) items.

•Communication to the seat from the aircraft and visual system simulation is via a standard Ethernet connection.

SUMMARY COMPONENT SPECIFICATION

Open Format (not cockpit fitted)

The open format system incorporates a number of commercially available packages that are fully integrated into the dynamic flight model and G seat product offering. These include:

- A dynamic sidestick and throttle unit which is fully integrated into the simulation. (Sterling Dynamics)
- The dynamic flight model at the core of the product has been specifically developed by j2 Aircraft Dynamics and is based on a generic fast jet training aircraft. The model is fully customisable to

provide highly realistic handling characteristics and failure modes. J2 are a specialist aerodynamic software modelling company who's software is used by Embraer and EADS(Cassidian)amongst others on the whole aircraft design process from concept to completion and into simulation.

- The open 'plug in' format uses the Genesis RTX ™visual database supplied by Cogent 3D and Diamond Visionics.
- Computing power for the image generation is standard while the high definition projectors are controlled through Mersive Technology's SOL ™ image blending software.
- The Head Up Display (HUD) package is provided by DISTI. This is customisable to suit any specified aircraft lay out.

The resulting collaborative and fully integrated package has resulted in a product that will show how diverse off the shelf and bespoke products can be integrated through industry common software standards such as CIGI (Common Image Generator Interface).

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j2 AIRCRAFT DYNAMICS' AEROSPACE ENGINEERING AND AIRCRAFT DESIGN SPECIALISTS HAVE DELIVERED A 'FULLY CODED' AND INTEGRATED SOLUTION THAT ENABLES THE j2 UNIVERSAL TOOL–KIT TO INVESTIGATE ALL ASPECTS OF AIRCRAFT HANDLING AND PERFORMANCE.
…………..NO MORE CODING FOR ANALYSES.

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 thousands of man hours by streamlining your process, maximizing your analysis capability and reducing 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 j2 offer begins and interacts with this key framework.

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.

IMAGINE IF YOU COULD PREDICT THE FUTURE? NOW YOU CAN……….

To find out more about j**2 Aircraft Dynamics**, our software and associate consultancy programme, 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 Developer
A Software Development Kit (SDK) for all users to write their own components and libraries with an interface into J2 Aircraft Models.

J2 Freedom
Provides flight dynamics simulation of aircraft data models, allowing you to evaluate the complete flight envelope.

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

J2 Classical
J2 Classical, a fully integrated component of the **J2 Universal Tool-Kit,** will take the results of previous steady state analyses and linearise the aircraft about that point. At the same time it will calculate a state space set of matrices and all derivatives about the chosen point. From the state space system the eigenvalues and eigenvectors are established, and the subsequent modes of motion that these relate to. All this can be performed on the complete set of trim results in a matter of minutes. From these results we can then look at the stability characteristics.

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Predicting Performance