Product Design

ESDU by IHS Markit Accelerate Aerospace Design and Development

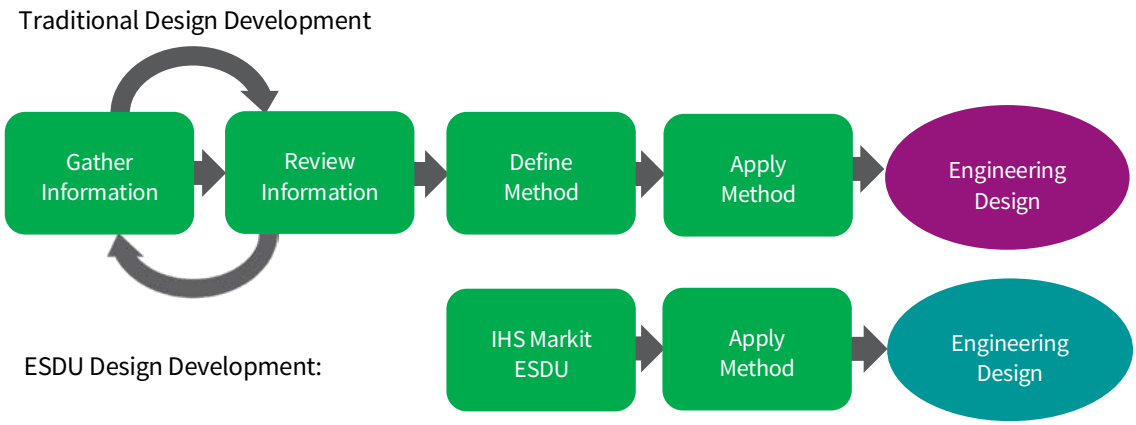
Customer Testimonials from Academia and Commercial Engineers

Originally developed to support WWII efforts in Europe, ESDU today has a worldwide group of committees composed of members from some of the largest companies and organizations in the world. ESDU produce design guides, Data Items and analysis methodologies for all engineering disciplines and work together to meet the demands of aircraft design and construction – from bolts to wing design efficiency and beyond.

ESDU Technical Committees have been established to ensure authoritative expertise and work quality is adhered to in the development of all ESDU data, bridging a gap between aircraft and aerospace research and industry requirements. The result is an unmatched collection of validated design guides, Data Items, and methodologies for the aircraft and the various engineering disciplines involved.

With an ESDU subscription, users have direct access to ESDU engineers and their expertise. To have this level of access to such expertise is extremely rare, highly valuable, and cost effective when it comes to ensuring quality and industry safety in products worldwide. ESDU engineers well-versed in aircraft and aerospace design and methodology can help technical aircraft professionals, students and instructors alike to better understand the variables involved.

What Makes ESDU Unique



ESDU Aerospace Content

Discover the data critical to support aerospace and aircraft design in these ESDU data series:

- Aerodynamics - A wide range of data and methods applicable to aircraft design, atmospheric properties; aerodynamics of controls, flaps and leading-edge devices; aircraft stability, aerodynamics of internal flow systems, and more.
- Aircraft Noise - Reliable methods for the prediction of sound levels generated by various sources, and an understanding of the control and suppression of noise.
- Aerospace Structures - Data are given on elastic or inelastic stresses, strains, displacements or buckling loads under static loading. They range from general data, with application regardless of component form, to the analysis of specific components in metallic, compound (sandwich) or composite structures

ESDU Aerospace Content (Continued)

- Performance - The information on performance estimation can be used for design and development, project and research studies, pre-flight specification and, finally, the synthesis of precise operational data based on flight test results.
- Stress and Strength - Applicable and relevant to the metals used in engineering and to any other isotropic material such as glass, rubber, or plastic.
- Transonic Aerodynamics - Series is concerned with the flow around aerofoils, wings, bodies and cowls at high subsonic, transonic and (in a few cases) low supersonic speeds.
- Vibration & Acoustic Fatigue – Used to design reliable structures for use in areas which is excited by noise; provides methods for estimating the response and fatigue life of structures when subjected to acoustic loading.

From University Experience to Life Experience

For those in our academic communities, we would like to share a few testimonials from students and faculty members at Cranfield University and the University of Loughborough to validate the value of ESDU and to demonstrate the work-life experiences students gain with ESDU.

Student #1 – *Sizing up the problem*

"During the initial sizing period of my project, ESDU Data sheets helped me a lot with accurate graph and good examples easy to understand." Joffrey Bouriez

Student #2 – *Dealing with details*

"ESDU has assisted with detail stressing of an Aluminium Aircraft Control Surface, providing additional understanding of analysis when conservative geometry limitations from taught university courses become to constraining for design. Multiple ESDU sheets have been used including 71005, 91008, 76016, 75035, 02.01.08, 01.01.01 (this is not an exhaustive list)." Scott Griffin

Student #3 – *Aircraft structural analysis methods and techniques*

"I have found the ESDU data sheets to be a great help in understanding and implementing new methods and techniques of structural analysis. It has also helped in understanding the behaviors of structures particularly with geometric and buckling failure modes." Mike John

Student #4 – *ESDU scorecard*

ESDU rating from student, Chinmaya Hattikal:

Good: 1. Excellent resources
2. Very systematically presented
3. Worked examples are a boon
4. Accurate search results

Bad: Some documents come with MS-Excel based macros (like ESDU 91008). When I tried to use it, it asks for "Connect Key". If it's already licensed to use, I don't

What University Lecturers Are Saying

Phil Stocking, Lecturer and Senior Stress Engineer, Cranfield College of Aeronautics: "Universities must prepare students to provide practical and immediate value to industry. The demand for students to be better prepared for industry is greater than ever. Cranfield are strong in this area and recognise the contribution tools like ESDU can make in their mission."

Dr. Peter Render, University of Loughborough: "The increased availability of ESDU Data for students, including access from their rooms via the Internet coupled with the power of the search engine to rapidly locate the appropriate techniques is significantly increasing the efficiency of their learning process."

The Span of ESDU in the Commercial Sector

Aside from the access to ESDU Engineers and the committee work that goes into every aspect of ESDU, ESDU data and methodologies go beyond the testing, validation and design tools for aircraft and aerospace engineers. ESDU series options span across industries and commercial organizations that support aerospace innovation.

The utilization of ESDU can result in global significance for discovery, design, and success in commercial industries as well as preparing students and technical professionals for future aircraft design requirements. Here are a number of testimonials from our commercial customers as examples of how ESDU supports some of the largest aerospace companies in the world.

Chief Engineer within the SAFRAN Group:

"Based on the problem described and a recent example I came upon, far too long! If the right senior engineer isn't on the team the problem goes round several loops of analysis while the guys try to work out what to do and finally it ends up with me. The trouble with project teams is we don't encounter each problem too often. Hence the blank faces and much scratching of heads. The outcome of this recent one was several loops of hand calcs, followed by some FEA with bending of bolts and all sorts, before I got involved and I just asked the Engineers to refer to the ESDU method to fix a pre-tension that was between the bolt yield and separation and that minimized the fatigue cycles on the bolt."

Head of Advanced Aerodynamic Design for Cessna Aircraft:

"The value of ESDU is that it helps us move much more quickly to the correct answer. On average, we have reduced the amount of time required to design aerodynamic surfaces by 50% compared to the traditional approach. The answers that we obtain using the ESDU methods also tend to be more accurate because they are based on a combination of theory and experimental data, rather than theory alone."

Senior Specialist in Heat Transfer and Fluid Flow, NNL:

"We have used ESDU data and design methods for the past twenty five years. We have found benefits from using this information to support design and safety functions in the company. This is because the methods are continuously reviewed and updated and this gives us confidence that we are using the most up to date methods and that we are using validated data. This is particularly important when we make licence submissions to Regulatory bodies."

Senior Design Engineer, Northrop Grumman

An ESDU sales representative called on Grumman (now Northrop Grumman). Whilst in the reception area, he noticed a display of aircraft models designed and built by the company. Among them was the Lunar Excursion Module (LEM) in which Neil Armstrong made the first lunar landing.

Not knowing Grumman had participated in building the LEM, the representative made an enquiry of it during his appointment with a senior design engineer. He learned that this particular engineer had been involved in the LEM project and that ESDU was used extensively throughout. The engineer went on to explain that since there was no previous experience on which to draw, they had to predict the effects of vibration and stress on the craft after take-off, during flight and after landing on the moon. The goal was to design a craft that could withstand such vibration and stress with a minimum weight penalty.

ESDU Aircraft Structures Stress and Strength and Vibration and Acoustic Fatigue Series were used in the design calculations. The Senior Design Engineer's comment remains, "I don't know how we could have done it without ESDU".

Vertical Take-Off Development – The Harrier

The original design work carried out at the Royal Aircraft Establishment on the 'Flying Bedstead' was the basis of the design of the Harrier. This was the first aircraft to be able to take off and land vertically and be capable of near supersonic speeds in normal flight. The design was well provided in the Falklands war as well as in the Gulf conflict. There, its ability to vector the thrust of its engines enabled flying manoeuvres with which conventional aircraft could not cope. It was a radical design and Chief Designer, John Fozzard, a deep enthusiast of ESDU's work, admitted heavy reliance on ESDU data. He remarked, "without ESDU's data, many additional years of work would have been required and I doubt if the project would have been completed."

McDonnell Douglas C14 Modification

McDonnell Douglas had problems modifying the rear fuselage design of the C14 to enable the steep angle of take-off and the incorporation of load doors. ESDU data was used and was credited by them as being vital in resolving the problem. Gratefully, someone acknowledged, "ESDU saved us months of time and probably hundreds of thousands of dollars."

Bell Helicopters

A senior design engineer at Bell Helicopters in Canada stated, "ESDU provides unique validated data. I spend up to 30% of my time trying to validate some of the data used by our engineers. ESDU saves more than the cost of an engineer".

Solving problems in an industry environment

"ESDU Aerodynamics Data Items are an invaluable resource and tool for the Aerodynamics Engineer, not only during the Initial Projects Office (IPO) type of investigations into preliminary design of new aircraft projects, but also in the ongoing design support of in-service aircraft and the incorporation and approval of new modifications and design changes. The Performance and Transonic Aerodynamics series are also useful sources of information and guidance to the Aerodynamicist.

A couple of recent specific cases of significant ESDU Aerodynamics Data Item use are:

- aircraft tailplane re-sizing study investigating the effects of possible span and chord increases.
- aircraft control hinge moment investigations. At an early stage of the project design, relevant ESDU Data Items were programmed up using MATLAB, for use in comparison with data for previous versions of the aircraft and prediction of values for the new version.

In general, I can think of many instances when use or part-use of Data Items has been incorporated into solutions:

- determination of aerodynamic drag, lift and side-loads on external items such as antennas, instruments, undercarriage, or other protuberances
- as part of consideration of aircraft 'aerodynamic smoothness', determination of aerodynamic drag caused by excrescences and recommendations on techniques for reducing the adverse effects
- International Standard Atmosphere (ISA) equations used to calculate the standard atmospheric parameters
- advice on vortex generator sizing & location choice
- boundary layer thickness estimation
- 'difference' calculations, wherein two or more similar configurations or cases are run through the ESDU method to get a feel for the effect of the small change (effectively 'believing' the difference rather than the absolute overall results)
- drag increment due to rear fuselage upsweep
- lift, drag, pitching, rolling & yawing moment due to control deflections
- downwash at the tailplane
- aircraft stability, longitudinal & lateral

Also, it is important to emphasize the relative cheapness and quickness of the methods in comparison with CFD model construction and running, or Wind Tunnel model construction and testing."

Sanity check on the right answers

"Apart from the sheet for International Standard Atmosphere (ISA) for performance calculations, which forms the basis for an in-house program which gets used all the time, I don't often use ESDU Data Items. However, the point about using ESDU is that it provides a sanity check on what the right answer should be. We had issues during a flight test programme with aircraft rudder hinge moments, and it was the existence of an ESDU based calculation as to what b1 and b2 should be that convinced me the numbers we had calculated from the instrumentation must be wrong and that there was a factor of 0.5 somewhere in the calibration. This was later proved to be correct. I have to say that it was the ESDU numbers, rather than those calculated by integrating vortex lattice results, which may have been susceptible to processing errors, which gave me the confidence to say that the instrumentation was wrong.

The previous time I did anything serious with ESDU was on a project for which I worked out a lift curve slope for the outboard pylon. Given the tight timescales something that could be worked out in an hour or so was our only chance, even Computational Fluid Dynamics (CFD) software would have taken weeks, and someone wanted loads a lot quicker than that.

Regarding ESDU Software – I agree that ESDU really comes into its own in those 2 ways – speed of obtaining results, and 'feel' for values, the latter being a major difference between being an engineer and a program-runner."

Item by item – the value of ESDU data in action

This engineer listed some of the ESDU Data Items he found to be most valuable:
• ESDU 86002 – Drag and pressure recovery characteristics of auxiliary air inlets at subsonic speeds. (Pressure distribution and flows in connected compartments - for bay ventilation. Embodied as part of code to derive pressures and flows at different flight conditions.)

- ESDU 86002 – Drag and pressure recovery characteristics of auxiliary air inlets at subsonic speeds. (Pressure distribution and flows in connected compartments - for bay ventilation. Embodied as part of code to derive pressures and flows at different flight conditions.)
- ESDU 77021 Standard Atmosphere. (Anti-ice performance prediction)
- ESDU 83037 Pressure losses in curved bends: single bends. (Anti-ice duct design)
- ESDU 73022 Pressure losses in three-leg pipe junctions: dividing flows. (Anti-ice duct design)
- ESDU 83042 Estimation of spray patterns generated from the sides of aircraft tyres running in water or slush. (Contaminated runway assessment. Never actually used but planned to be as a precursor to doing a water trough test.)

To discover more about ESDU and all of the Series, Handbooks and Data Items available, visit www.ihsesdu.com.

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