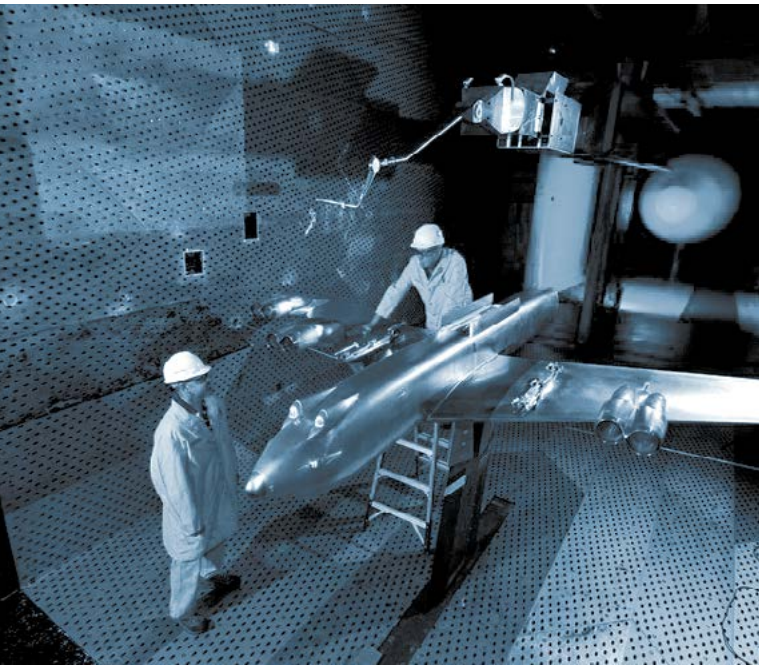
iTAC®

INNOVATIVE TECHNOLOGY
APPLICATIONS COMPANY

Innovative Technology Applications Company (ITAC), LLC is a R&D and engineering services firm focusing on advanced technology development for aerospace, defense, and wind energy applications.

Aeroacoustics ✪ Aerodynamics ✪ Flow Control ✪ Optical Diagnostics



SOFTWARE & TECHNOLOGY

ITAC's proprietary software and technology systems enable engineers and manufacturers to enhance the performance and control of aerodynamic and propulsion systems through systematic design and development of advanced technology and engineering concepts in areas of aerodynamics, aeroacoustics, flow control, and optical diagnostics.

INSIGHT & EFFICIENCY

ITAC provides CFD software with services to advance capabilities, reduce product development costs, decrease process times, and offer deep insights into the physics of complex products and systems.

CUSTOMERS & PARTNERS

ITAC's customers have included all branches of the United States military, other agencies of the US Department of Defense (DoD), NASA, as well as private companies. ITAC, LLC is a privately-owned, for-profit, small business in the US.

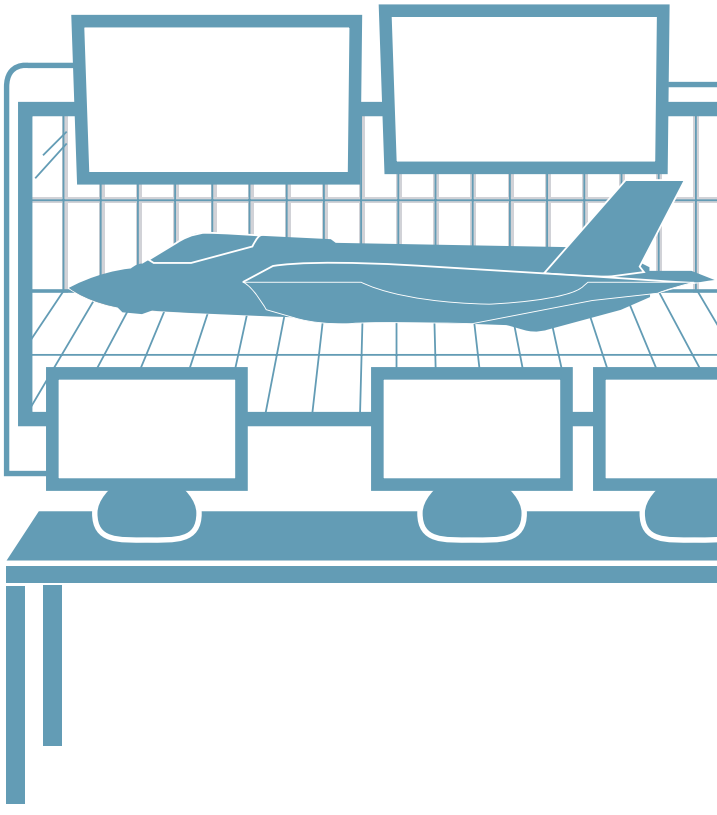
Read more about
OUR PRODUCTS ⟩

EXPERTISE

Facility Control Software

Wind tunnel facilities require stringent control of test parameters such as wind speed, temperature, pressure, etc. ITAC's advanced neural network-based control system, built on mathematical models from physical principles (customized for specific facility characteristics and behavior), provides accurate feedforward control of wind tunnels and test facilities in high-speed control architectures.

The software, developed in collaboration with the University of Notre Dame (UND) researchers, optimizes running efficiency and enhances accuracy and precision of test facilities such as wind tunnels, power plants, large vehicles, as well as other hardware-in-the-loop systems involving multiple parameters with complex interactions that are otherwise difficult to characterize.



EXPERTISE

Diagnostic Instruments for Hypersonics

Flight tests of hypersonic vehicles are a challenging but necessary endeavor. While ground tests and numerical simulations provide important guidance regarding vehicle performance, they are both limited in their reach. Likewise surface-based measurements during flight tests do not provide sufficient insights into the complex flowfield to allow unambiguous conclusions to be drawn from the flight data.

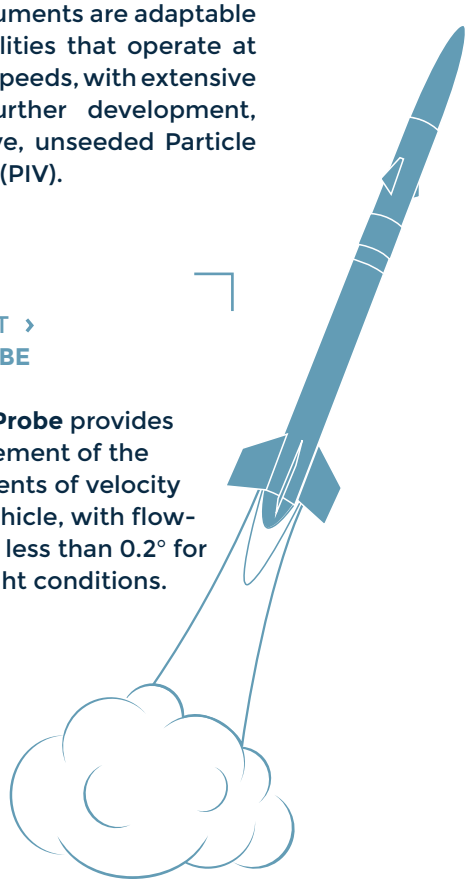
ITAC, in conjunction with UND and under sponsorship by the US Air Force, has developed fully nonintrusive, optical instruments for off-body flowfield measurements on hypersonic flight-test vehicles. Both instruments are adaptable to ground test facilities that operate at compressible flow speeds, with extensive opportunity for further development, such as nonintrusive, unseeded Particle Image Velocimetry (PIV).

ITAC PRODUCT ›
BOUNDARY LAYER INSTRUMENT

Boundary Layer Instrument provides direct measurement of boundary-layer state (laminar/turbulent) and thickness, local flow speed and density, as well as inferred measurements of local Mach number and air temperature.

ITAC PRODUCT ›
AIR DATA PROBE

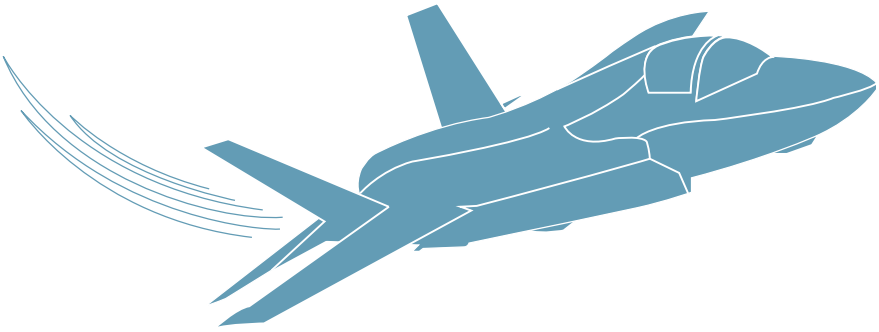
ITAC Air Data Probe provides direct measurement of the three components of velocity of the flight vehicle, with flow-angle errors of less than 0.2° for hypersonic flight conditions.



EXPERTISE

Software for Jet Noise Prediction

ITAC has extensive experience in jet noise research and the development of advanced software for aeroacoustics applications. What follows are ITAC's newest products and capabilities that are available to customers looking to advance technology development in the area of aeroacoustics.

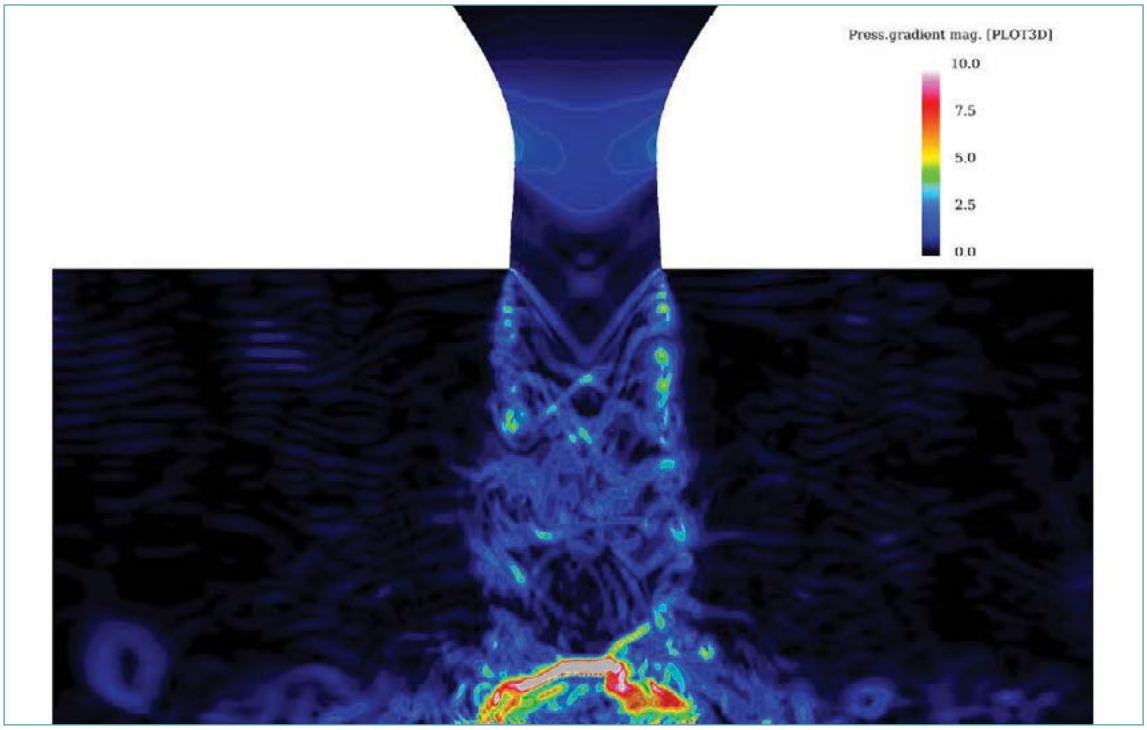


ITAC PRODUCT ›

CHOPA

The **Compressible High Order Parallel Acoustics (CHOPA)** code is ITAC's proprietary high-resolution computational aeroacoustics solver, developed jointly with Dr. Philip Morris from The Penn State University (PSU). CHOPA provides effective engineering predictions of the acoustic nearfield using moderate resources such as those available to even small and medium sized businesses (i.e., no supercomputers required).

CHOPA accomplishes this, in part, through the use of an immersed boundary method for small geometric features, such as chevrons or vortex generators. This is combined with a block structured mesh with non-matching block boundaries to allow users more freedom to cluster grid points where they are truly needed and coarsen the mesh where they are not needed. While the primary applications of CHOPA to date have been in hot supersonic jet noise, it is by no means restricted to these configurations.

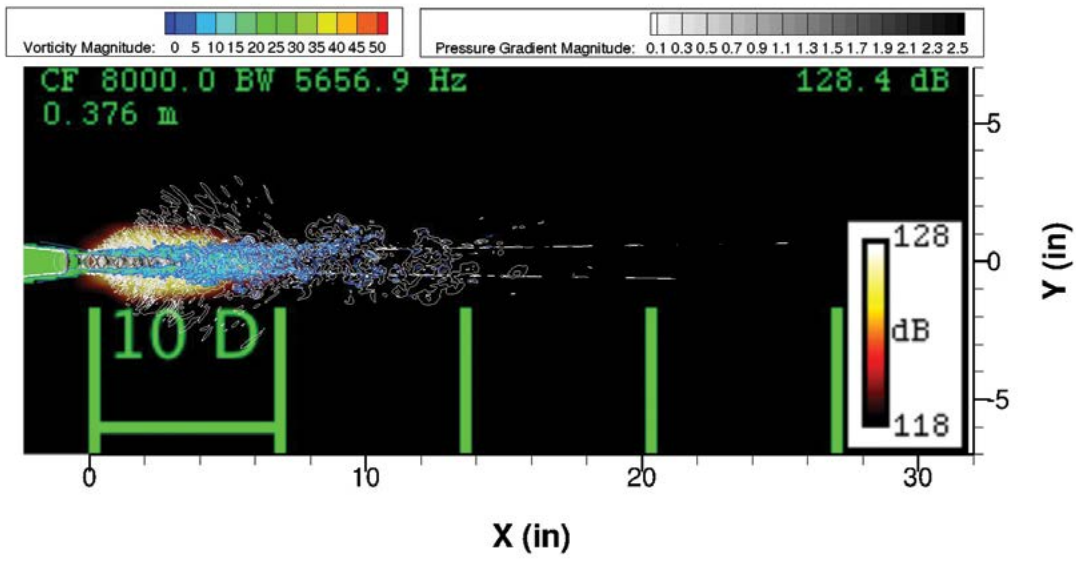


This impinging jet flowfield was computed using the CHOPA solver on a mesh with 8.6 million points using 225 cpu cores.

ITAC PRODUCT ›

NOISE SOURCE MODELING AND PREDICTION

In partnership with Dr. Philip Morris , ITAC has developed a new wavepacket-based model for jet noise sources. This model, in partnership with OptiNav, Inc., has been implemented into a Beamform Interactive microphone array data processing package, which provides significantly improved detection of noise producing regions in jet plumes. The Beamform Interactive package is available to customers from our partner OptiNav.



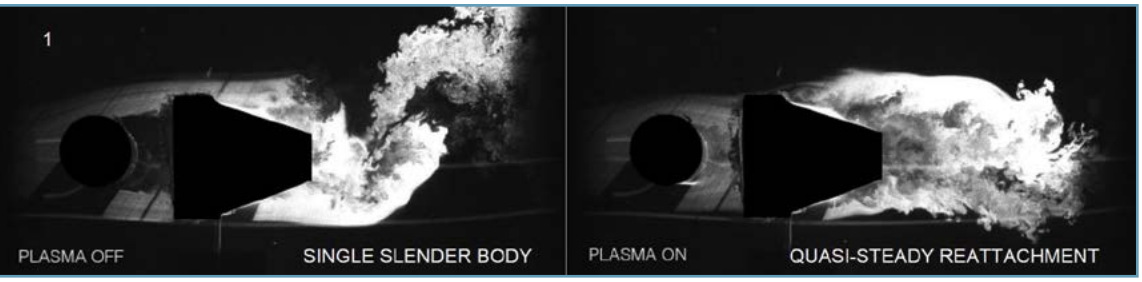
Noise source locations predicted using synthetic microphone array data superimposed on a snapshot of the CFD-predicted flowfield.

ITAC PRODUCT ›

PLASMA FLOW CONTROL

Dielectric Barrier Discharge (DBD) plasma actuators have been found to be powerful tools for a variety of flow control and noise reduction applications. With very low power requirements (approximately 20 Watts per linear span under steady, continuous operation) and no moving parts, the plasma actuator technology offers significant advantages over more conventional methods in many situations.

ITAC, in partnership with Dr. Thomas C. Corke and his team at UND, has developed a plasma modeling software that allows us the ability to both model the effects of plasma actuation as well as design hardware systems to systematically incorporate this innovative technology for customer-specific applications and products.



Visualization of flow around a landing gear-like configuration showing the ability of plasma actuation to stabilize the wake

ITAC PRODUCT ›

AERODYNAMIC ENHANCEMENT

Over the past 10 years, ITAC and UND have developed a number of DBD actuator systems for various flow control applications. For example, these systems can be used as virtual vortex generators for control of flow separation or virtual flaps and slats for enhanced aerodynamic control of aircraft surfaces. This technology offers many aerodynamic and structural advantages for such applications; e.g., there is no hardware protrusion into the flow and the technology enables a fully electronic, dynamic control system for efficient control of unsteady flows.

ITAC PRODUCT ›

NOISE REDUCTION

DBD systems have also been used to reduce noise on critical hardware components. The flexible nature of the plasma actuation technology allows it to be turned on only when needed; when inactive, the flush-mounted actuators have no impact on the flow, which minimizes performance penalties. As with more conventional flow control applications, ITAC's system can predict the performance of DBD plasma actuators and allow customers to custom designhardware or retrofit for use on specific systems.

ITAC PRODUCT › **POWERED RESONANCE TUBE**

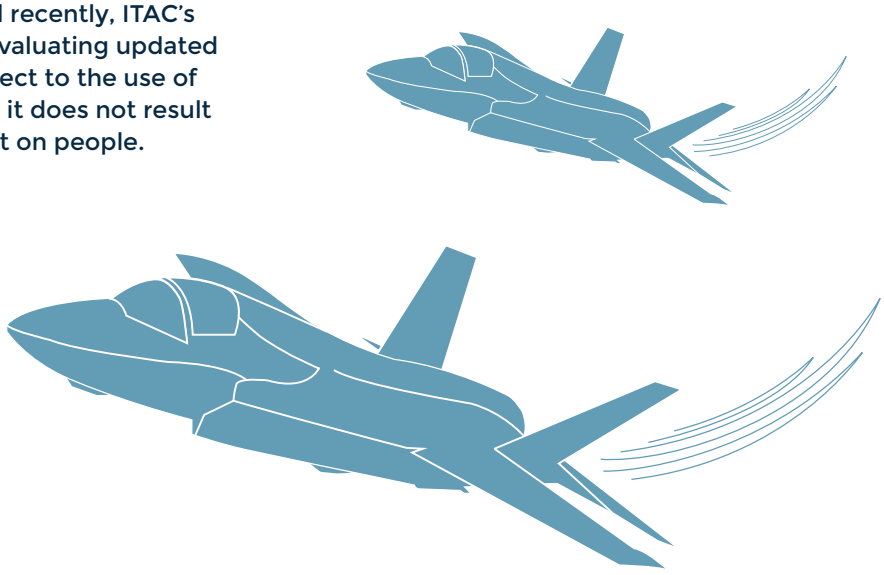
ITAC, in collaboration with The Illinois Institute of Technology (IIT), has developed a reduced-footprint, tunable powered resonance tube (PRT) technology for flow control applications. ITAC's incorporation of a Helmholtz resonator into the PRT design allows for a much smaller footprint than a conventional PRT design while still maintaining the range of tunable frequencies and the signal strength. ITAC can assist customers with both design and analyses of these systems to address specific needs.

Impinging Jet Tone Reduction

ITAC and IIT have successfully demonstrated application of PRTs to reduce impingement jet tones by up to 20 dB and reduce broadband noise by up to 5-10 dB.

Ultrasonic Design

Another application of PRTs is the use of ultrasonic designs for flow control and noise reduction.This idea dates back to the 1940s, and recently, ITAC's partner IIT has been evaluating updated designs. The ideal aspect to the use of ultrasonic PRTs is that it does not result in any negative impact on people.



EXPERTISE

CFD Consulting

ITAC has extensive experience in the development and application of CFD codes and customized modeling software to a wide variety of problems. ITAC leverages its proprietary and government software, along with 3rd party commercial software, to meet the diverse needs of its government and commercial customers. Following are some examples of the flow solvers ITAC employs for solving problems.

CHOPA

The CHOPA solver, as discussed above, is a high-resolution aeroacoustics solver, designed for jet noise problems, but not at all restricted to such applications. CHOPA is an ITAC-proprietary product available, with support, to our customers who need time-accurate information about thebacoustic nearfield using moderate computational resources.

WIND-US

ITAC personnel have been instrumental in the development and maintenance of the Wind-US solver for many years. This extremely flexible general-purpose compressible flow solver is used for quick implementation of custom modules, and for more general applications which require its broad range of turbulence models, chemistry, and/or thermodynamics models. Wind-US is a U.S. government code, which means it is freely available to U.S. organizations, who can then incorporate any ITAC-developed solutions without incurring exorbitant licensing costs.

FUN3D

ITAC is using FUN3D for adjoint-based shape optimization problems. Its ability to address numerous classes of multi-disciplinary applications, along with the flexibility of geometry that comes with a robust unstructured mesh solver, makes it an attractive option for customers facing this sort of problem. FUN3D is also a government code, freely available to U.S. organizations.

Read more about ITAC CONSULTING ⟩

OVERFLOW

ITAC has used OVERFLOW for a number of applications involving moving bodies. These applications include both prescribed motion and free falling objects. OVERFLOW's speed and comprehensive suite of built-in tools for this class of problem make it a good choice when our customers need to model parts in relative motion. OVERFLOW too is a government solver, which means ITAC-developed solutions can be inexpensively incorporated into our customers' toolkits—no additional license fees required.

POWERFLOW

ITAC uses Exa's PowerFLOW solver for its unique capability to compute high resolution unsteady flowfields about extremely complex geometries for subsonic flows with unrivaled speed. For many such cases, this Lattice Boltzmann Method is more than an order of magnitude faster than a comparable Navier-Stokes solver (if the latter can even handle the complex geometry). ITAC can put this power to use to address our customers' most challenging low-speed flow problems.

ITAC › CONTACT US

ITAC, LLC is a high-technology, small business company providing contract research and development, and consulting services for the aerospace, defense, and energy sectors. Combining fundamental research capabilities and leading-edge expertise, ITAC collaborates with academic and industry experts to provide its customers high-performance solutions and products in areas of aerodynamics, aero-optics, aero-acoustics, and computational flow physics.

Contact us for tech-transition & research opportunities!

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