



AEROSPACE & DEFENSE

Design, Testing and Evaluation Capabilities

Our customers expect us to create custom filtration systems and technologies that deliver superior performance, quality they require and the peace of mind they want.

Our research and product development facilities are some of the best in the industry. Through the use of our advanced computer modeling capabilities, we can optimize filter design and exhaust system solutions. We can design, manufacture and test proprietary media in order to reach optimum filtration performance.

Look to Donaldson for thoroughness and reliability in design, testing and quality control facilities.

CAD (Computer Aided Design)

Donaldson uses the latest CAD software to model new products and calculate product properties such as mass, center of gravity, and moments of inertia. Additionally, interference and tolerance stack up can be checked with this software to eliminate design errors. Over 100 Unigraphics seats are used within Donaldson, as well as capabilities using Pro-Engineer, and Calma.

CFD (Computational Fluid Dynamics)

One of the most powerful tools Donaldson has is our CFD software and expertise in using it. Donaldson uses STAR-CCM software to predict properties such as pressure loss, flow distributions, and particle trajectories. This analysis is key to reducing unnecessary pressure losses in the filters and maximizing filter life.

FEA (Finite Element Analysis)

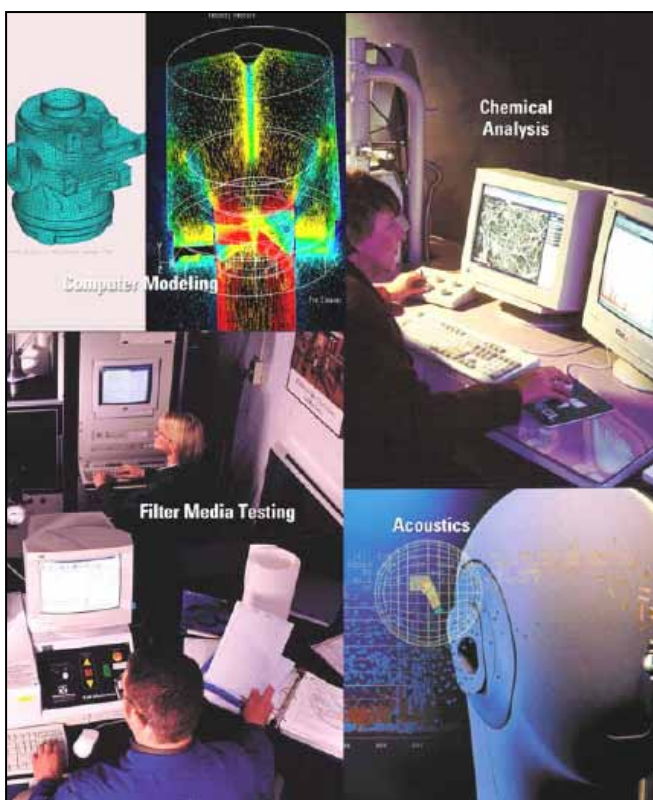
Donaldson also uses our FEA capabilities (ANSYS) to ensure structural integrity of our designs and optimize weight, strength and cost of our products.

Acoustical Computer Modeling

Engine exhaust and other products requiring acoustical expertise are an important part of Donaldson. Because of this, Donaldson has invested in significant acoustical modeling and test capabilities. Both WAVE and COMET software packages are used to model the acoustics of product designs within Donaldson. Among the capabilities these packages offer are fluid to surface interactions and radiated (shell) noise.

Filter and Media Models

Donaldson has many internally developed proprietary computer models which enable us to predict media performance for a given fiber mixture, initial pressure loss for filter elements of various configurations, and filter loading with many different contaminants. This enables us to quickly work through many design concepts to optimize the filtration system for a unique application.





Prototype Filter Media Lab Capabilities

Unique to the industry, the Donaldson filter media research and development facility provides a capability to develop, test, and produce pilot quantities of proprietary media formulations. This facility supports advanced filtration needs for applications as diverse as military tanks, computer disc drives, and semiconductor processing. Filter media development capabilities include:

- Laser displacement meter
- Pore size distribution measurement
- True density measurement
- Submicron salt loading and efficiency
- Mullen Burst
- TMI Monitor/Burst for evaluation of bursting strength of paper
- Submicron particulate loading and efficiency
- TexTest, bimodal dust bench,
- Gravimetric loading benches
- EJA Material Thwing-Albert Tensile Tester to evaluate breaking strength, elongation and tensile energy adsorption
- Gurley Stiffness
- Permeability
- Three Point Bend Tester to obtain physical measurements of effective flexural rigidity, effective stiffness, and/or effective modulus of elasticity for filter media
- Low Efficiency Flat Sheet (LEFS) to measure the initial efficiency of media
- Fractional efficiency bench to measure the penetration and efficiency versus particle size on a given piece of media. It can use two types of aerosol contaminants, NaCl and DOP, and can test up to 12 particle sizes ranging from .015 to .4 microns.
- Salt Loading to determine the life of a given filter media
- Filter media hand sheet fabrication equipment
- Pilot paper mill



Structural & Environmental Test Capabilities

- MIL-STD-810 Environmental Testing including:
 - Temperature
 - Fluid Contamination
 - Rain/Humidity
 - Salt Fog
 - Sand & Dust
 - Vibration
 - Shock, Gunfire Shock & Ballistic Shock
 - And many others
- AR70-38 Extreme Climatic Conditions
- RTCA DO-160D Environmental Conditions and Test Procedures for Airborne Equipment
- Customer/Application specific test requirements such as ATPD 2167 for the M1 Abrams
- MIL-STD-461 Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
- Tensile and compression testers

Air Filtration Lab Capabilities

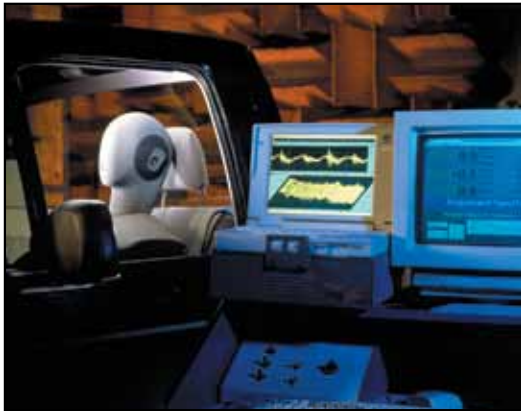
- High flow test bench laboratory--a large, single-source test area with greater than 22,000 cfm capability that is used for full-scale qualification testing of high-flow rotorcraft products.
- Flow bench test laboratory: a climate controlled custom airflow bench laboratory specifically built for military and defense products that includes seven flow test stations, ensuring maximum data accuracy under a variety of conditions and specifications.
- Military Air Cleaner & Filter Testing - MIL-PRF-46736 & MIL-PRF-62048
- Air Cleaner Testing – ISO 5011, SAE J726
- Air Filter Testing – ASHRAE 52-1
- HEPA Testing Proxy to MIL-STD-282
- Passenger Compartment Filter Testing - J1669
- Optical particle counting (fixed benches & mobile), Coulter Multisizer, & gravimetric analysis
- Fractional Efficiency Test Bench
- Multicontaminant, Low Concentration Test Bench (Chemical & Molecular)



Liquid Filtration Lab Test Capabilities

- Fabrication Integrity (Bubble Point) – ISO 2942
- High & low flow multi-pass - ISO 16889, ISO 4548-12
- Cyclic Flow Multipass - ISO 16889, ISO 4548-12, ISO 23369
- Pressure Impulse Fatigue - NFPA T3.10.17-1995, ISO 10771-1:2001
- Multi-Purpose Oil Flow Test System - ISO 2941, ISO 3968, ISO 23181
- Flow Fatigue Test System - ISO 3724, ISO 2941
- Static Material Compatibility Test - ISO 2943
- Dynamic Hot Flow Test - ISO 3968, ISO 2943, ISO 3724
- Environmental Chambers - NFPA T3.10.17-1995, ISO 4548-6
- Low Viscosity Pressure Drop Test - ISO 3968
- Medium Viscosity, High Flow, Pressure Drop Test - ISO 3968
- High Viscosity Pressure Drop Test - ISO 3968
- High Pressure Burst Test System - NFPA T3.10.17-1995, ISO 4548-6
- Fuel/Water Separation, Filter Efficiency Test - SAE J1488, SAE J1839
- Fuel Filter Efficiency & Capacity Test - SAE J1985 Efficiency, SAE J905 Capacity
- Mini-Flow/Flat Sheet Media Multipass Capacity & Efficiency Test - ISO 16889
- Fuel/Water Separation, Flat Sheet Media Efficiency Test - SAE J1488, SAE J1839
- Fuel Filter Analysis
- Karl Fischer Volumetric Titration
- Interfacial Surface Tension Fluid Density
- Gravimetric Analysis - ISO 4405
- MSEP Micro-Separometer





Chemical Services Lab Instrument Capabilities

- Infrared Spectroscopy
- High Performance Liquid Chromatography
- Ion Chromatography
- Gel Permeation Chromatography
- Reverse Phase Chromatography
- Normal Phase Chromatography
- Thermal Analysis
- Differential Scanning Calorimeter (DSC)
- Aerospace Chemical Breakthrough Bench
- Thermogravimetric Analyzer (TGA)
- Thermogravimetric Mass Spectroscopy
- Accelerated Surface Area and Porosity System
- Chemical Breakthrough Bench
- Gas Chromatography
- Coulter Multisizer
- Scanning Electron Microscope (SEM)
- Energy Dispersive Spectroscopy (EDS)
- Ultraviolet Visible Spectroscopy

Acoustic Lab Capabilities

- Large and small semi-anechoic chambers
- Automated flow benches
- Real time analyzers
- Engine dynamometers (5)
- Chassis dynamometers (2)
- Test track
- Transmission loss test bench
- Insertion loss test bench
- Gas analyzers
- Dilution tunnel
- Aachen head



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Brochure No. F112237 (11/10)

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