

COMPOSITE MANUFACTURING DIVISION

Bangalore, India





The Company traces its roots to the pioneering efforts of an industrialist with extraordinary vision, the late Seth Walchand Hirachand, who set up Hindustan Aircraft Limited at Bangalore in association with the erstwhile princely State of Mysore in December 1940. The Government of India became a shareholder in March 1941 and took over the Management in 1942. Hindustan Aeronautics Limited (HAL) came into existence on 1st October 1964. The Company was formed by the merger of Hindustan Aircraft Limited with Aeronautics India Limited and Aircraft Manufacturing Depot, Kanpur.

Today, HAL has 20 Production Units and 10 Research & Design Centres and one Facility Management division in 8 locations in India. HAL has been successful in numerous R & D programs developed for both Defence and Civil Aviation sectors. HAL has made substantial progress in its current projects such as Advanced Light Helicopter – Weapon System Integration (ALH-WSI), Tejas - Light Combat Aircraft (LCA), Intermediate Jet Trainer (IJT), Light Combat Helicopter (LCH), Light Utility Helicopter (LUH), Various military and civil upgrades. Composite Manufacturing Division (CMD) is a part of Helicopter Complex, Bangalore.

Vision

“To become a significant global player in the aerospace industry.”

Mission

“To achieve self reliance in design, development, manufacture, upgrade and maintenance of aerospace equipment diversifying into related areas and managing the business in a climate of growing professional competence to achieve World Class Performance Standards for global competitiveness and growth in exports.”

Composite Manufacturing Division (CMD)

HAL's growing involvement in aircraft design and manufacture is reflected in establishment of world class facilities across India. The Composite Manufacturing Division (CMD) of HAL was conceived as early as the dates of design of LCA and ALH and having over 20 years of experience in designing and analysing aircraft structures made of composites. Over the years until 1st April 2007, the scope and role of the facility was defined, refined from Advanced Composites Shop to Centre of Excellence ; then the division became fully functional as Strategic Business Unit (SBU) of HAL.

CMD - Highlights

- Four major dedicated work centers namely, Fixed Wing, Rotary Wing, Space and Export Centre.
- A division with a blend of youth and experienced professionals.
- 300+ work force, trained in aerospace domain.
- Prestigious National Projects such as LCA, ALH, GSLV and development projects such as LCH, LUH & UAVs.
- Strategic partnerships for exports with leading aircraft manufacturers in the world.
- AS 9100 C certified for manufacture of composite parts and assemblies.
- Environmental Management Systems (EMS) to ISO 14001: 2004.
- The Division holds NADCAP accreditation for special processes such as Surface Enhancement (SE), Composite manufacturing and Non-Destructive Testing (NDT).
- Composite Materials Testing Laboratory of the division is NABL accredited for Mechanical testing and NDT as per standard ISO/IEC 17025:2005.

The power of People and Processes

CMD is not a top-down organization; we cultivate leadership. Every department is an integrated Full Life Cycle Business, featuring a Full Life Cycle Leader empowered to make business decisions. This approach instills an entrepreneurial spirit, distributes authority among numerous stakeholders and create leaders.

Leadership through Learning and Robust Processes

Our best-in-class global talent and entrepreneurial leadership frame work increase customer intimacy and reduces decision cycles, while our learning and development strategies are designed to create better business outcomes for customers.

We know that business success is proportional to the implementation of robust processes in critical areas, such as project management, quality management and information systems. Efficient processes ensure timely and optimal use of resources and identify opportunities. CMD has implemented several benchmarked processes through Lean Initiatives such as KEP (Knowledge Enrichment) and AOP (Action Oriented) with which our customers control projects.



Performance when it matters most

Defence
Civil
Space
Exports



Composites in Dhruv

Composite structures offer unique advantages for aerospace applications and allow for innovative design solutions. HAL has demonstrated capability to develop complex composite structures from initial concept to production through, the flagship design of HAL, Advanced Light Helicopter (Dhruv). The result of several years of research, development, and testing, our proprietary approved methods and processes allow for affordable and producible composite structure designs by over 70% of surface area and 30% by weight of Dhruv, including the flight critical parts such as hinge less main rotor blade, bearing less tail rotor blade, hub plate, single structure of cockpit, tail boom etc.



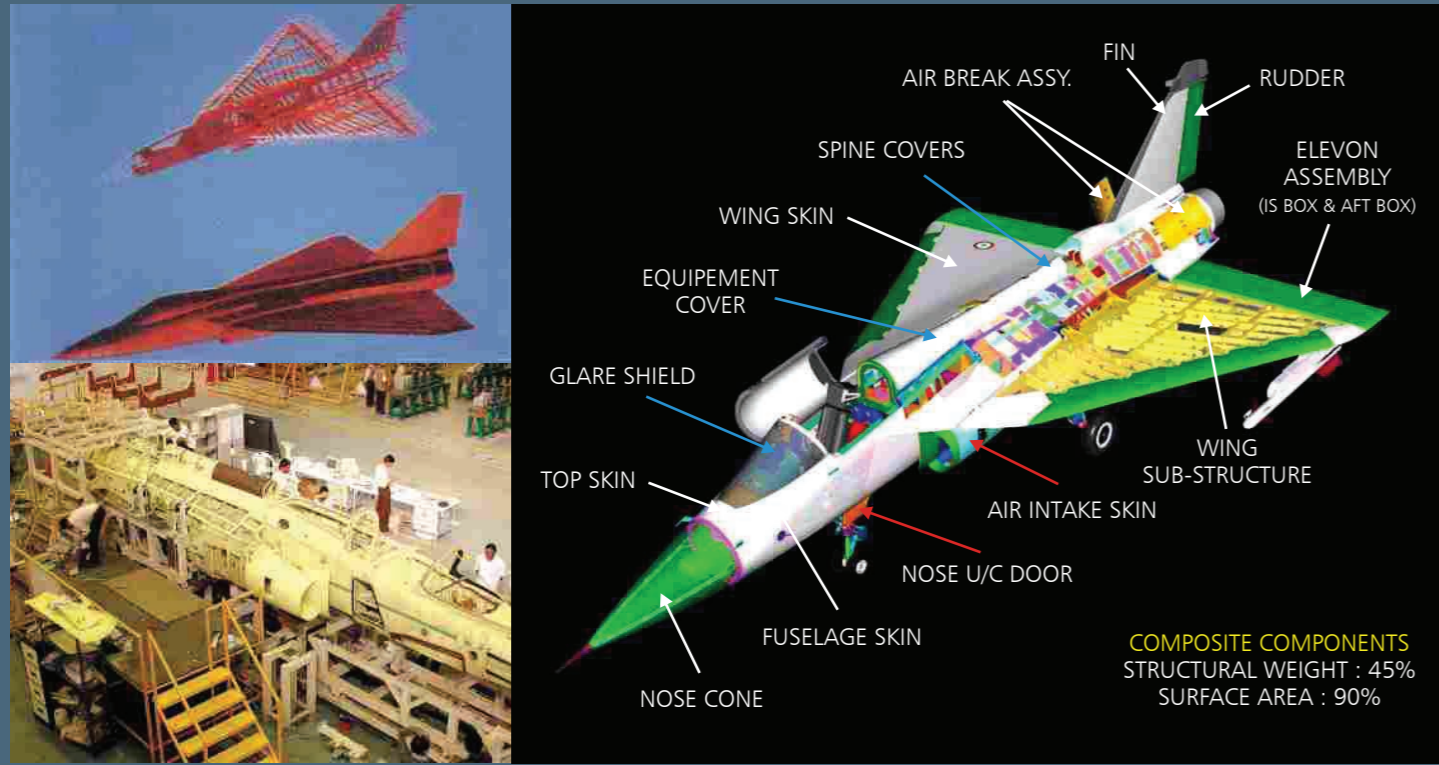
Composite components for Light Combat Helicopter (LCH)

The LCH, a derivative of Dhruv, is a dedicated attack helicopter built to meet the requirements of armed roles for defence operations. The dynamic systems of the Dhruv (ALH) have been adapted in it, making it both formidable and dependable. This beauty has a narrow fuselage with tandem crew seating.



Composites in Tejas

CMD has successfully produced state of the art Primary Structural Components for Tejas (LCA) using advanced composite materials. A few examples are control surfaces using co-cured construction, fuselage doors, hatches using sandwich and monolithic construction and large airbrake skins. We have specialised in Design and Manufacture of Carbon Fiber Composite (CFC) wing assemblies consisting of a number of CFC spars, monolithic skin panels, etc.



Dedicated technical excellence in the field of advanced structural composite technology is available in design and development of tooling for composite components at CMD. All CFC components are designed using state of the art CAD techniques using 3D and solid modeling to develop complex geometries by using 'CATIA & UG' software on new generation computers. Ply stacking and optimising of CFC components is achieved by indigenously developed 'AUTOLAY' package.

Component Design is supported by Finite Element Analysis (FEA) programmes like 'ELFINI', 'MSC NASTRAN' etc., which can optimise full aircraft structures.



CMD - Customer's Delight

CMD caters to the needs of composite structures for Indian Air Force, Navy, Army, Coast Guard and ISRO. The division, in addition to defence and aerospace customers, cater to the requirements of global customers.

Delivering customer delight is a CMD promise. It led us to evolve into a customer oriented organisation. One that is distinguished by:

- An inclination and willingness to adopt a proactive approach to providing solutions
- A commitment to view the customer's problems as ours
- An ability to offer and deliver services which are promised and committed
- Having the resources to be a single window service provider with accountability to the customers

Spearheading a revolution of a unique customer oriented educational-cum-training programme on 'Aircraft Composite Structure Repairs' is an initiative to educate the customers, seek their feedback on the products and ascertain grey areas for remedial solutions. The objective of educating operators about our products at field units, is in conformity with our core value of Customer Satisfaction.



Key Customer Engagement



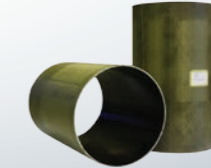
National Project



GSLV



GSLV Heat Shield



Sandwich Cylinder

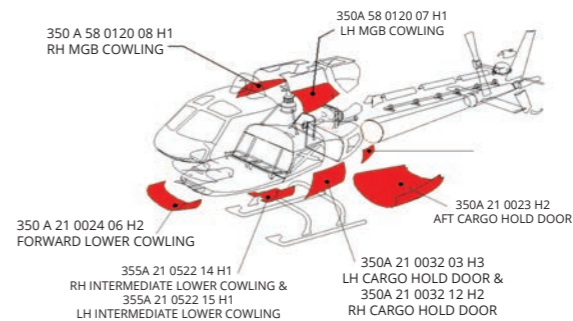


Nose Cone

Global Customers



Ecureuil AS350 B2



MGB Cowling



UAV



Motor Tube



Landing bag tube



Horizontal stabilizer



Pod Assembly



G-150 Executive Jet



Angle assembly



Baggage Door



APU Service Door



Engine Shield

Facilities

... to go from detailed analysis to individual products

Composite technology is influenced by a combination of several factors such as optimum design, choice of materials, process technique, tooling, testing and quality assurance.

Tooling plays a very important role being directly capable of making the final composite part a success. A concurrent approach involving the design of a composite part and the development of the tooling required to build it, would provide the strong foundation for product success. Tooling for composite covers a wide range of technologies such as:

- Aluminium alloys/invar
- High temperature ureols and foams
- Low temperature moulds
- NC trim fixtures
- Electro deposition of Nickel etc.



Fixed wing layup shop



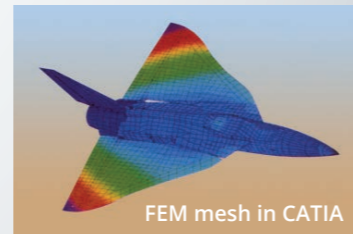
Autoclave

Design and Analysis

- Over 20 years of experience in aircraft structures made of composites and metallic materials.
- CMD has state-of-art tool design and production capabilities such as:
 - High end graphic work stations in a networked PDM environment
 - CATIA V5 R22
 - UG-NX8.5
 - Advanced FEM with thermal analysis
 - NC VERICUT
 - All Standard and translators
- Has proven capabilities on Static, Dynamic and Non-linear structural analysis.
- Primary composite structures to optimize weight, performance and cost.
- Integrated Network facility with R&D centres having work stations to create and clear the drawings of components in PDM making revolution in paperless design office and effective change management.
- The Integrated network enables concurrent engineering as manufacturing/ procurement agency can view the models to initiate the procurement of raw materials, jig, fixture and tool design etc, resulting in reduction in development time.



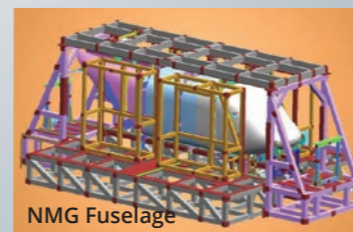
Cowling



FEM mesh in CATIA



Wing top skin engineering



NMG Fuselage

Manufacture of composites is capital-intensive in nature and requires environmentally controlled conditions for storage of prepregs & resins and during the lay up of the prepregs. Apart from this, specialised plant and machinery such as autoclaves, hot platen presses and walk-in freezers, fabric cutters, filament winding machines, Laser Projection Systems (LPS) and Laser Tracker are needed.

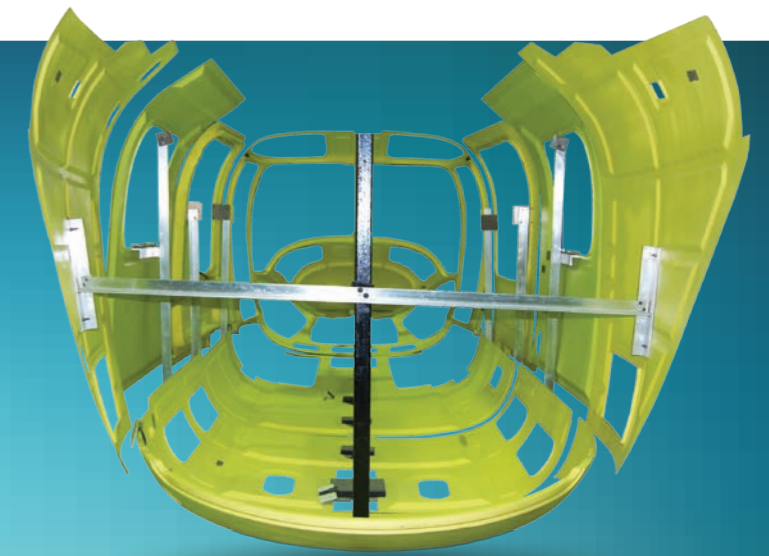
Testing of composites plays a very important role in the design and development of composite structures. As the composite fabrication is process-oriented, the material properties of the structure tend to have much wider distribution of data (or scatter of values) depending on the chosen process. Further, the test results for composite are more scattered than those for metallic materials. This variability is generally treated statistically.

Thus it is seen that, on one hand composites provide tremendous flexibility in the range of properties, but on the other hand it becomes absolutely essential to verify whether the properties obtained for a given composition are what it has been designed for. Additionally, there is substantial batch to batch variation in properties.

Quality assurance is adhered by a number of Non Destructive Techniques (NDT) that are available for checking manufacturing and service - related defects. Visual inspection, tap testing, X-ray radiography, ultrasonic test, through transmission test, pulse echo method, C-scan and CT-scan are some of them. The design and the optimised process and manufacturing techniques decide the type of NDT techniques to be followed for verification.



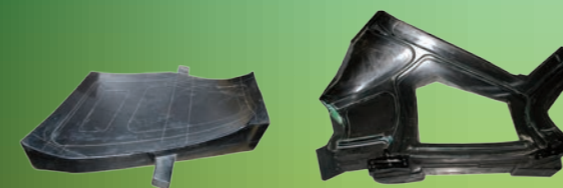
High precision 5 axis NC machine



Fuselage



Laser Tracker



Master models



Computed Tomography (CT - Scan)

Manufacturing

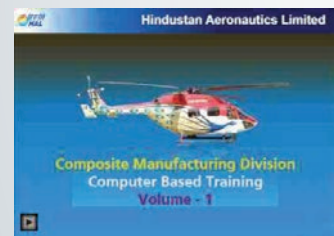
CMD fabricates complex shape composite parts for aircraft components, sub-assemblies and unmanned aerial vehicle (UAV). These components are integrated into key programs such as the Light Combat Aircraft (LCA), Advanced Light Helicopter (ALH), Light Combat Helicopter (LCH), Light Utility Helicopter (LUH) Launch Vehicles, UAV etc. The division has supplied the composite panels for ISRO's Mars Orbiter Mission (MOM). The Division manufactures rubberized flexible fuel tanks for Helicopter (ALH). The Division also supports for Repair and Overhauling (ROH) activities of ALH Dynamic parts such as Main Rotor Blade, Tail rotor blade, Hub Plate, etc.,

CMD employs leading-edge material and manufacturing technologies to achieve fabrication costs competitive with metallic designs: Low weight, High Fatigue / Strength /Stiffness and corrosion resistance. We select composite materials to fit the specific application including advanced materials such as aerospace grade epoxy, bismalimide, phenolic and polyimide materials such as Avimid N and AFRPE-4.



CMD design and makes the moulds and tooling required for both development and production programs. Our engineers employ semi-automated equipment and fixtures for high-volume, series production programs to maximize learning curve efficiencies that produce the most economical products for our customers. Mechanical, electrical and chemical testing is conducted in-house to fulfill contract requirements for product qualification testing.

With average production rates of several thousand parts annually for many of our products, CMD is one of the top, high volume producers of advanced aerospace composite products in the country. The following Methods and Techniques are employed in the manufacturing process to further Increase Productivity.



Computer Based Training

CBT is a virtual training tool for revolutionary approach to build highly skilled workforce on continuous basis. Day to day processes are visualised through this interactive e-learning to update/improve the skill level. CBT enhances to update core capability of the company on continuous basis for innovativeness, process standardisation and new product development.

Lean Initiatives

- Lean initiatives are used to design of assembly line to increase productivity.
- Process maps used to improve production cell through-put.
- Lean tools such as 5-S, Kaizen events, Kanban, Cellular layouts etc are extensively used.
- Six sigma approach to sustain quality.



Automated Ply Cutting Machine



Painting Booth & Baking Oven



Flexible Rubberized Fuel Tank



Computer Controlled air circulating oven

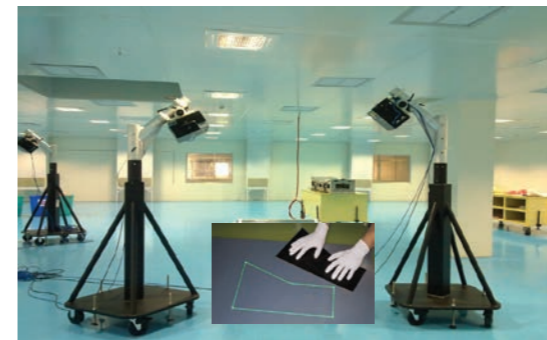
Total Productive Manufacturing

TPM is a critical adjunct to lean manufacturing. We are extensively adopting TPM in our manufacturing practices to prevent any kind of slack before occurrence to maintain "zero error, zero work-related accident, and zero loss".

CMD is an industry leader in the use of aerospace-quality composite products using advanced manufacturing processes such as compression molding and autoclave cure such as co-cured, co-bonded structures etc.,



Rotary Wing Layout Shop



Laser Projection System



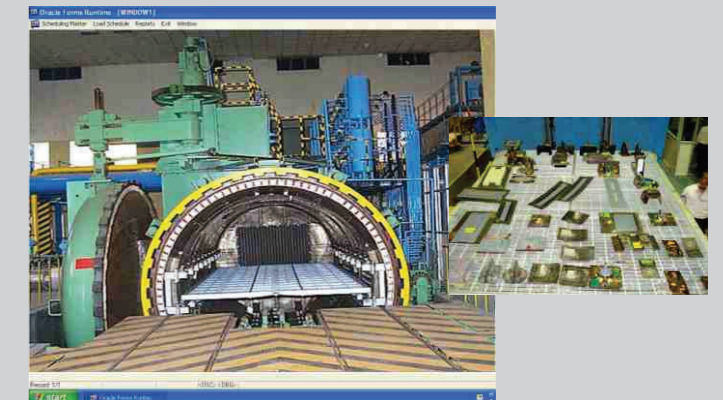
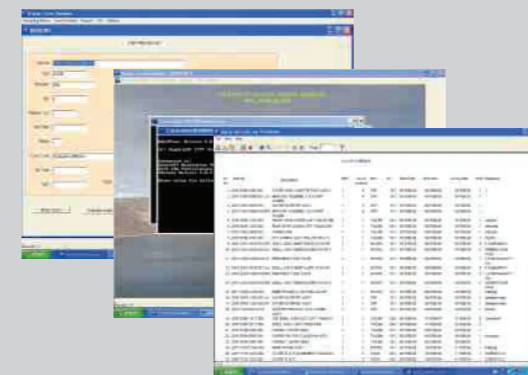
Hot Platen Press



Surface Enhancement Machine (Shot peening)

Parivarthan Asthra

CMD has developed an advanced software tool to schedule production, based on Autoclave "Pull System", by optimising 20 variables and process parameters such as material, cure cycles, tooling etc. This method aligns all other processes in the entire production system to its full capacity utilisation enabling enhanced productivity.

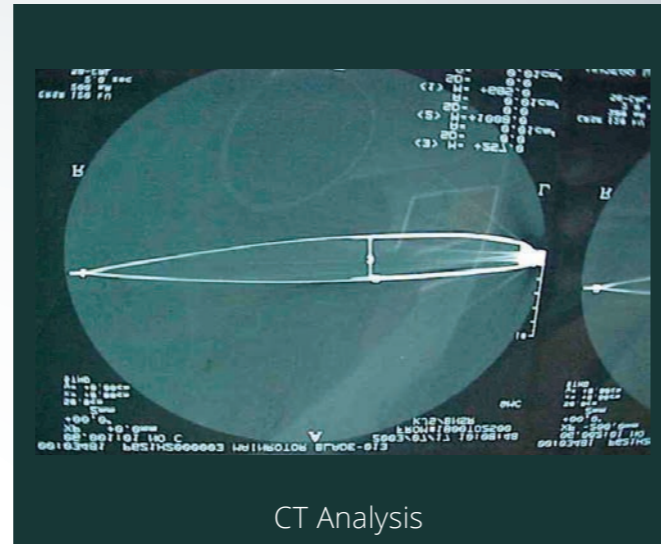


Quality Assurance

Quality Management System

CMD maintains a Quality Management System (QMS) that meets the requirements of AS 9100 C and Environmental Management Systems (EMS) to ISO 14001:2004. The division holds NADCAP accreditations for special processes such as Surface Enhancement – SE, Composite Manufacturing and NDT. Composite Material testing laboratory of the division is NABL accredited for Mechanical testing and NDT as per standard ISO/IEC/17025:2005.

CMD sees quality as being each employee's responsibility. Technicians on the floor take pride in their work and strive to products that meet or exceed customer expectations. Management supports the concept of helping to create quality products by empowering employees and continually works to ensure that resources are available to produce the quality products expected by our customers. CMD has an exclusive Material Testing Laboratory which has most modern equipments such as thermal analyser consisting of DMA, DSC, TGA, TMA, DEA, high performance Liquid Chromatography, Infra Red Spectrometer, Viscometer, environmental test chambers, Chemical Analysis & 20 Ton UTM. NDT facilities such as C-Scan, CT-scan, X-ray Fluoroscapy, Bond Tester, Portable Ultrasonic Scanners & Ultrasonic thickness gauges are available.



CT Analysis

Quality Policy of CMD

Committed to produce quality products that meet or exceed the quality requirements of Customers and Regulatory authorities, encompassing functional, safety, aesthetic and life characteristics, ensuring cost effectiveness and deliveries within agreed time schedules, with the aim to reach global standards of excellence through continuous improvement of its business processes.



Dynamic Mechanical Analyser



C-Scan



Chemical Analysis



Thermo Mechanical Analyser



Differential Scanning Calorimeter

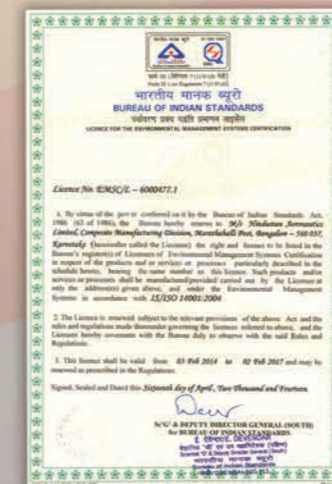


UTM



Physical Analysis

Awards & Recognition





HAL's Aerospace practice is more than equipped for the task of keeping your flag flying in the global engineering space. Discover how you can reach newer horizons of performance and achievement by partnering with HAL.

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