Groundwork for future

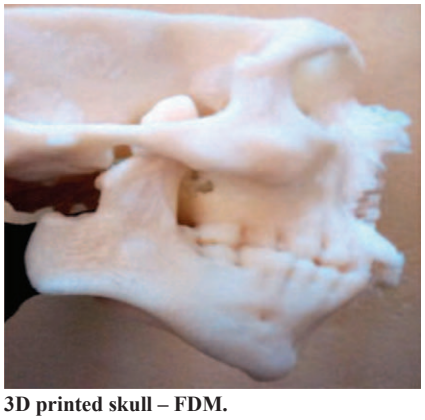
3D printing has become an indispensable tool for enlightening young minds to invent, explore and innovate the next breakthrough.

To excel in the keen competition in the job market, it is essential for education institutions to equip students with the most advanced technologies in the industry that can bridge the gap between school and actual workforce. Providing the best technical training to the students is the guiding maxim for engineers at the National Institute of Technology, Warangal (NITW).

Founded in 1959, the school is one of the federally funded Institutes of National Importance (INI) in the country, dedicating to innovative teaching approaches such as 3D printing to help students achieve higher levels of technical excellence. In 2006, the Department of Mechanical Engineering of NITW established the Rapid Prototyping Laboratory, aiming at providing students with more comprehensive training for the computer aided design (CAD) data.

Innovating approach to engineering education

Envisioning the life-changing applications performed by 3D printing technology, the Institute has adopted 3D printing since 2006 to aid aspired engineers in their learning and creating an innovative mind set in the highly competitive industry. Emphasised by Dr Y Ravi Kumar, early exposure to 3D printing technology would empower students with the necessary skills to excel in their future career, particularly



3D printed skull – FDM.

Assembled mandible and upper jaw.

in new product development. After careful research and comparison, NITW invested in a Stratasys Dimension 3D printer to accelerate research, prototyping and testing among students and staff.

Powered by FDM® technology, the Dimension 3D printer is suitable for low volume production and is able to print ABS thermoplastic in nine different colours. With the strong printing material, students can produce prototypes that can withstand functional tests such as snap fit or living hinges in convenience. In NITW, students usually create model and fabricate complex shaped objects that are used in the engineering and industrial applications. They also take up R&D projects for the hospitals in the vicinity.

Dimension printers enabling cost-effective prototyping

Cost and time of printing prototypes are the two most challenging issues engineering institutes need to overcome. Generally conventional manufacturing processes, such as CNC machining or metal-cutting, are time consuming in addition to the high cost incurred. According to Dr Y Ravi Kumar, in the past students had to spend 2 days or more to build a prototype. The prolonged lead time doesn't encourage design perfection as every iteration is costly, explained by Dr Y Ravi Kumar.

On the contrary, with the Dimension printers, students can create digital design and generate a 3D CAD file. Revised designs can also be easily printed so as to reduce design errors of the final models. Now engineering students at NITW only spend 4 to 5 hours on average to print a prototype and can proceed to various testing before showing it to industrial partners. It becomes possible to manufacture structures of complex shapes and sizes at relatively lesser time and lower costs.

In addition, students also print various models for medical research such as skull, femur bone, cranial implants and implants for jaw reconstruction. Customised models can be 3D printed within 6 hours to create the necessary shape for patient, explained Dr Y Ravi Kumar. The time saved for building one prototype has reached up to 30 hours and total cost savings achieved up to 20%.

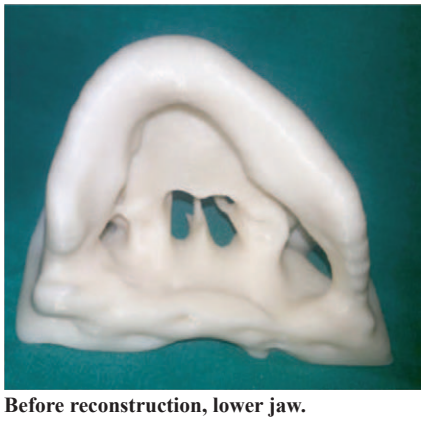
In pursuit of perfection

In fact, students at NITW have been actively engaged in projects outside of the engineering and industrial design spectrum since the implementation of the two Dimension 3D printers. Yet there is a more compelling advantage of adopting 3D printing to achieve higher accuracy in building models.

Given its complex structural characteristics, some medical models such as skull cannot be easily produced in the

Implant and skull.

conventional process due to complex geometries. Alternatively, 3D printing technology helps unlock the barrier of mechanical design. Dr Y Ravi Kumar added, for example in medical applications, the initial impression of a dental implant had to be taken from the patient's mouth yet in no way would it be comfortable for patients. But in the case of 3D printing, this can be done through CT scan to ensure accuracy.



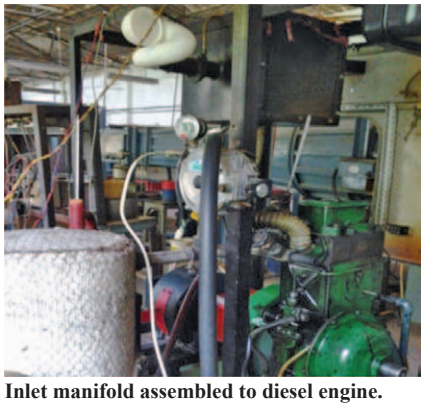
Before reconstruction, lower jaw.

Adopting 3D printing technology can enhance precision not only in design, also during the printing process. According to Dr Y Ravi Kumar, material quality played a significant role in NITWs consideration in purchasing the Dimension printer. They looked for better mechanical properties like strength and good weight to strength ratio.

Prototypes printed in the StratasysABSplus are reliable and durable to withstand repeated functional tests such as thermal, chemical, vibration and pressure challenges. In addition, students can create good surface finish in medical models simply by removing support material through automated soluble support removal process.

Towards technological enlightenments

3D printing technology enlightens student inventors to push the limits of possibilities and develop better designs such as wind turbine and inlet manifold



Inlet manifold assembled to diesel engine.

for diesel engines. On the other side of the expedition to unlimited innovation, witnessing these innovative creations is a rewarding experience to educators. Having a skilled workforce ready to use 3D printing technology presents a great match for the opportunities available at the professional level in India, concluded Professor Ravi Kumar. ■

(Pune-based DesignTech Systems Ltd worked with Stratasys to install the system at NITW)