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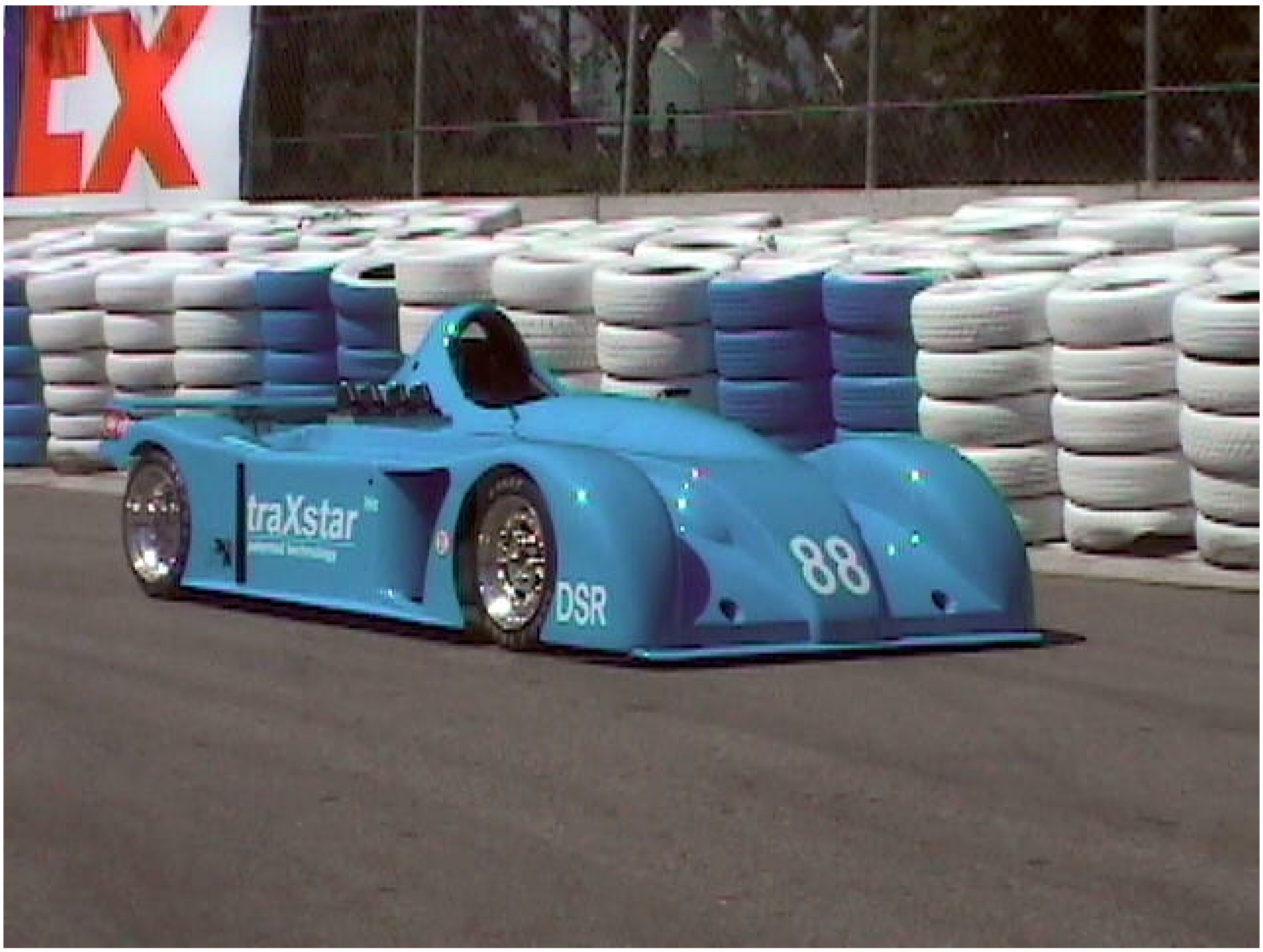
traXstar

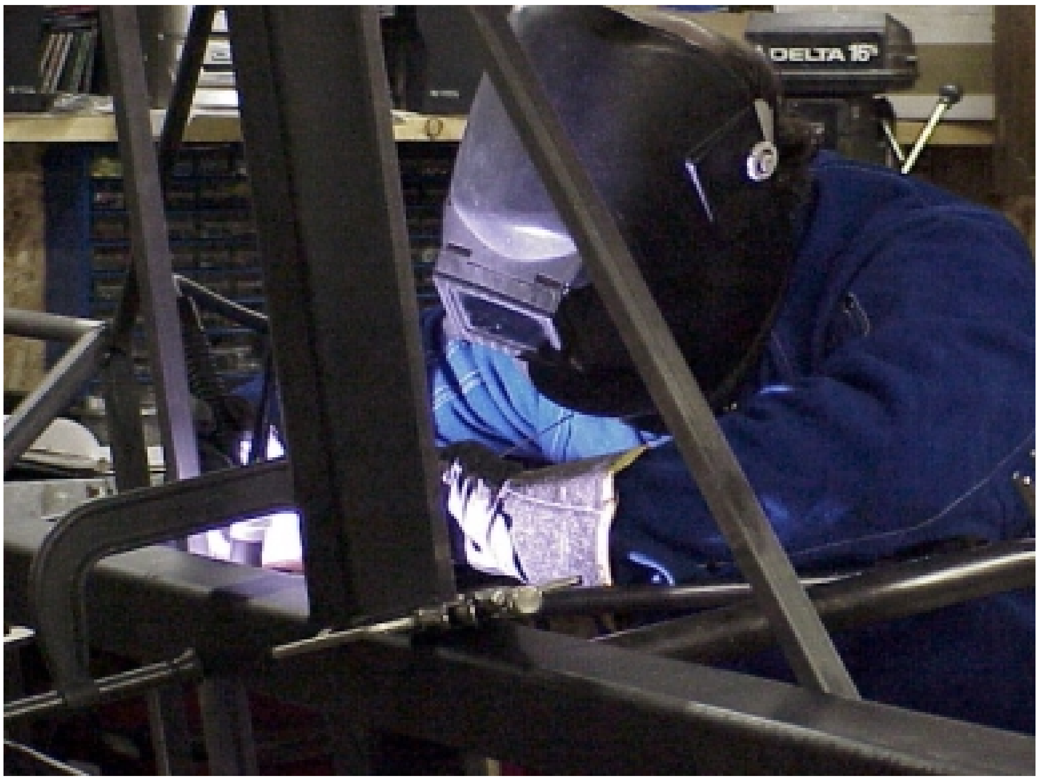
technical & business development projects

Description: ***traXstar sports racing car.***
Period of the work: ***January 2001 to June 2002.***
Date of this report: ***December 11, 2002.***
Author: ***Peter R.J.Derviller***



Official rollout of the traXstar
2002 Molson Indy, Vancouver, BC, Canada.

3D computer modeling and finite element analysis of the structural frame finalized, working drawings were produced. This brought the computer modeling phase to the point where the aerodynamic bodyshell could be virtually overlaid on the chassis to produce the best aerodynamic flow of air to the coolant radiators and the smallest possible total car cross section. By the end of 2000, the team had completed the fabrication of the car's frame and all suspension parts; prepared two engines; and fabricated or procured most of the subsystems.

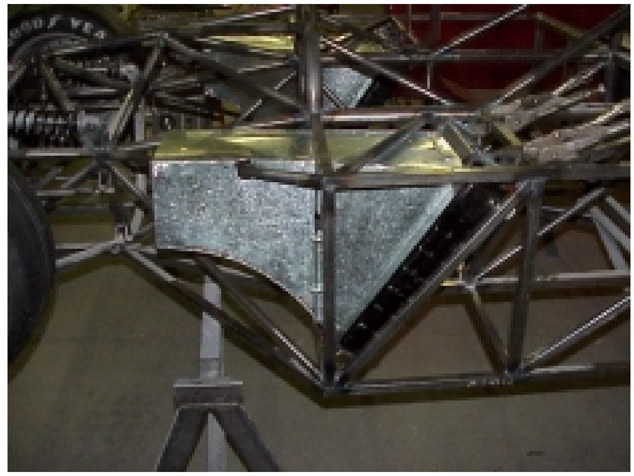


TIG (Tungsten Inert Gas) welding the prototype frame

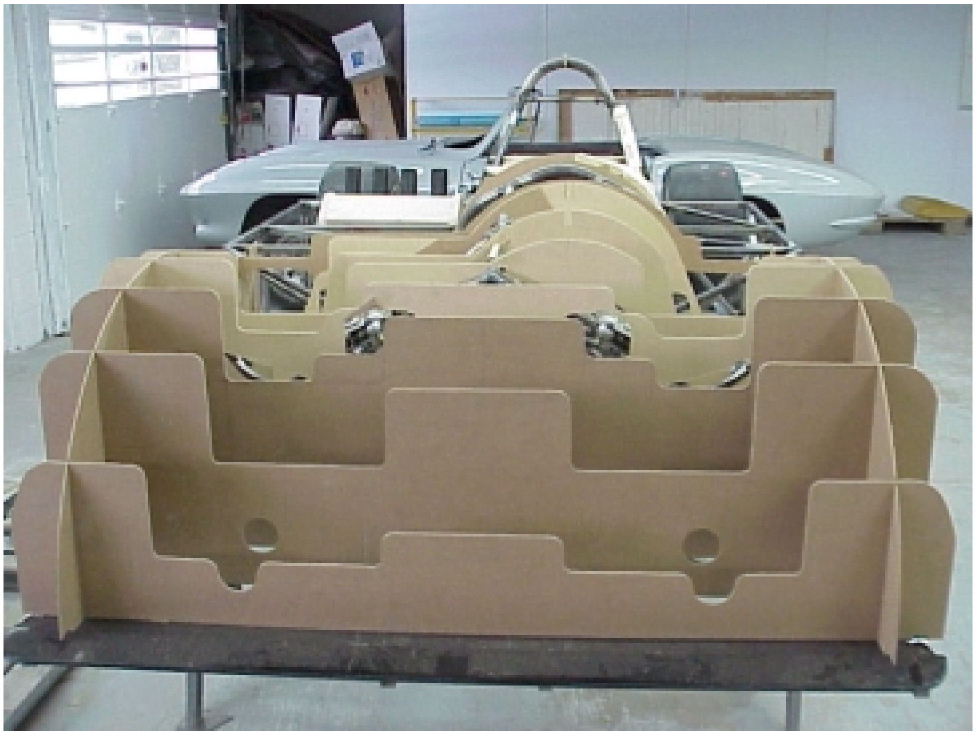
This brought the project to the beginning of physical fabrication of the aerodynamic body shell and actual construction of the prototype car, which commenced in January 2001.

Methodology and Work Done – 2001

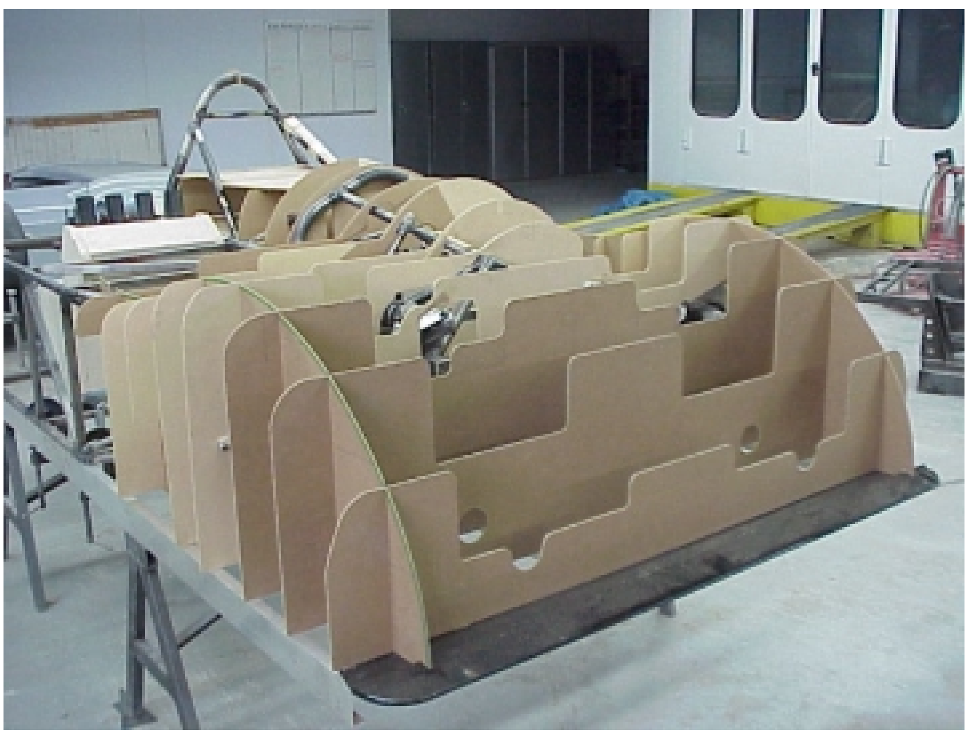
In preparation for bodyshell styling, sculpting and mould-making, the suspension was installed and radiator inlet duct moulds were fabricated from sheet metal and accurately located within the chassis so that the bodyshell could be made to perfectly match the duct inlets.



MDF templates were created from the SolidWorks 3D model and assembled on top of the space frame with suspension and wheels in the full bump position. Care was taken to ensure that the bodyshell would wrap tightly around the frame and suspension without interference when the suspension was compressed with the front wheels turned to full lock.



An engine was mocked up in foam for setting top deck clearances.



Flat surfaces were modeled in MDF and edges and corners formed with spruce and oak inserts. Brian G. Taylor P.Eng advised on aerodynamics issues such as ducting, air inlets, air outlets and cockpit, rear deck and wing profiling. The overall envelope shape followed the concepts developed on the previously wind tunnel tested ¼ scale models and the earlier prototype cars.

From past experience we knew the style lines of the computer generated 3D model, which could only be viewed in 2D on a computer monitor, must be checked against the real world three-dimensional sculpture. Numerous detail adjustments were made to create a well-proportioned shape. *The mainstream automotive industry has also reverted to an integrated human/machine methodology in favor of direct computer to CNC machining of the buck.*

It looks crude but “styling” with temporary strips of masking tape and bits of cardboard help the modeler to visualize the finished contours. Many hours were spent studying the car from all angles until we were sure it looked right from every viewpoint.

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When the entire bodyshell was defined in wood and MDF, closed-cell urethane foam blocks were hot glued into the spaces between the templates and onto flat surfaces …

Urethane foam is brittle and easily shaped. At this stage the contours of the sculpture began to emerge. Tip: tape up your sleeves and button your overalls. This stuff gets into everything! Wear a mask when cutting and sanding the foam. Keep the work area clean. Sweep up often. If you have a portable forced air dust extraction system, so much the better.

With the basic shape defined in foam, the next step was to add a layer of plaster that could be sanded to an accurate and smooth finish. Brake cooling and radiator inlets and outlets were sculpted at this stage...

Rather than exclusively relying on the underlying computer generated profiles, the human eye determines the final shape, flow and proportion of the sculpture.

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Cardboard templates guided the plasterer as he developed the required contours.

Accuracy was constantly checked – the final bodyshell had to meet close tolerances. Quality of the original sculpture dictates the fit and finish of the finished part.

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Here a template is used to check the “Coke bottle” side contour. An aerodynamic principal known as “area rule” inspired this waisted shape.

We fabricated Lexan sweeps to accurately contour large surfaces. There are no flat surfaces on a well-built car. All surfaces that appear “flat” actually have compound curves so they are mechanically stable and create attractive light reflections. It is also very important that the sculpture is shaped to allow the final part to release from the mould – this is usually termed “draft”. Where the final body part has “returns” or inward folds, the mould must have removable parts that must be tightly sealed to maintain vacuum during the cure.

A coffee cup happened to be exactly the right taper and size for the brake cooling ducts. Several important design features are illustrated in this picture:

1. The front splitter is not part of the nose section because it is prone to damage and is therefore a separately repairable/replaceable part.

2. The car's radiators are not in the vulnerable nose but instead are inside the well-protected sidepods. Mid-mounted radiators also contribute to concentrating the car's mass close to its center-of-gravity.

3. The vertical wall above the front splitter generates a high-pressure zone on the splitter's top surface.

4. A sports racer with the weight of a D/SR needs ducted ram air front brake cooling.

5. The top decks of the cooling air channels on either side of the nosecone are as low as possible to the top of the front suspension control arms to create a smooth flow to the radiator intake ducts. Airflow is aided by blisters (or "fairings") around the suspension pushrods and bellcranks.

6. The wheel housings (sometimes call "pontoons") are only as wide as required to accommodate vertical wheel motion and steering action.

7. The nosecone is purposely made long enough to house a crushable structure in front of the driver's feet, which are no further forward than the front wheel axle axis.

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