

The Operator-Friendly Cat 525

Picture yourself in a nicely cushioned seat, temperature control set just where you like it, your favorite tape in the cassette player, your hand resting comfortably on a high tech steering wheel with built-in push button controls. Are you cruising down the interstate in a late model luxury car? No. Look outside. You're on a rutted old logging road in the middle of a dense forest. You're in the Cat 525 Wheel Skidder.

For over twenty years, Caterpillar's Model 518C Wheel Skidder had set the industry standard for heavy terrain logging machines, but recent years had brought a drop in sales. Bill Morris, Engineering Supervisor for the Skidder Product Group at Caterpillar, described the status of the Skidder this way: "The 518C had outlived its usefulness in its original design, and market acceptance was rapidly diminishing." Responding to market research into customers' preferences, Caterpillar management decided to design a totally new cab, incorporating many comfort features originally found only in automobiles.

With an accelerated delivery schedule and the target date only ten months away, Caterpillar asked RFA/Minnesota Engineering for assistance with design changes

affecting the cab and hood. Describing the role RFA played, Morris said, "This was a very complicated task. RFA came in, rolled up their sleeves and worked directly with our designers, participated in reviewing options and assisted in determining which route to take. They accepted the challenge and met the target."

Prior to RFA's involvement, Caterpillar's Tech Center, a research and development facility, had begun to build a full-scale wood and plastic "vision" model

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Caterpillar's Model 525 Wheel Skidder

of the cab, which contained many preliminary design concepts. The task was to develop these design concepts into production designs. The new machine would be named the Cat 525 Wheel Skidder.

The new Roll Over Protective Structure (ROPS) cab was designed as a self-contained modular unit, prepainted and ready for mounting to the frame. While the earlier version was simply hard-mounted to the frame, the new ROPS is mounted with resilient rubber isolators for noise reduction.

Inside the cab, Caterpillar's concept called for high technology and operator comfort. With assistance from RFA, they totally changed the 20-year-old multi-lever operator control system. The old-fashioned tiller bar of the former model was replaced by a modern steering wheel with fingertip control buttons. The operator's left hand now controls not only direction, but speed and shifting as well, leaving the right hand free to operate the four-position joystick which controls the grapple and tong. And, since it is necessary for the operator to look to the rear when operating the grapple, they replaced the fixed operator seat with a swivel seat that turns a full 30 degrees to the right, significantly reducing operator fatigue.

Behind the seat is the heart of the new upgraded air conditioner. RFA helped Caterpillar design a compact, efficient air handling system, fitting the coils and fan snugly behind the operator's seat and using the cab's new plastic interior

components for air ducting to various parts of the cab. The new operator-friendly cab is completely sealed, pressurized and sound suppressed to 85 decibels.

Dave Thoma, RFA's project engineer on the project, commented, "The project was fairly complex. Many components competed for space, which at times led to a 'snowballing' effect. Good working communications between Caterpillar and RFA were critical in order to meet the target dates." This snowballing effect led to the relocation of some interior features. In the old unit, for example, the batteries had been located at the rear of the cab, but with the air conditioning unit now occupying that spot, the batteries had to be moved to the front of the engine.

RFA also assisted Caterpillar in redesigning the old window framing system, narrowing the frame and at the same time creating an improved method of retaining the glass within the frame. The new curved sweeps are another step taken to improve visibility for the operator. Sweeps are structural members which run from the top front corners of the hood to the top of the cab. Their function is to "sweep" branches away from the windshield, directing them up and over the cab. While branches simply scraped along the old straight sweeps, the new curved version actually lifts the branches up and over and adds to the smooth, curved look Caterpillar wanted for the exterior. They also rerouted the exhaust pipe so that, from the operator's viewpoint, it lines up with the right sweep, eliminating another visual obstruction for the driver.

The most significant design change, according to Bill Morris, was to the hood. The goal was to create a more modern, streamlined, sloped hood with rounded corners. The sides of the hood or "engine covers" were made of perforated metal to allow adequate ventilation to the engine. The RFA team had aesthetic considerations to deal with as well, including the placement of the new Caterpillar logo and the red stripe that runs the length of the cab and hood, accentuating the new sloped, curved design.

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The Cat 525 project demonstrates a "concurrent engineering" effort that brought two resourceful groups together in a fast-paced process. The entire team needed to know how all the components fit together, and that was accomplished through good communications. The net result, Thoma said, was "a machine that a prospective buyer wants to get into and doesn't want to get out

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RFA Capabilities

Over the past 53 years, RFA / Minnesota Engineering has assisted clients with engineering projects. RFA works as an extension of the client's own engineering staff, providing design, analysis and detail documentation services. All work is completed to the client's standards on compatible CAD systems by the RFA staff located in Minneapolis, Minnesota.

RFA's capabilities hinge on the quality and experience of its personnel. Of the staff of 75, one third are degreed engineers, one third designers and one third drafters. These employees have a wide variety of engineering experience and can assist clients with their engineering needs.

For CAD compatibility with our clients, RFA has 120 CAD softwares (14 different types), such as Pro/ENGINEER (currently 34 seats), CV CADD5, HP SOLIDS, CADAM, Autocad and more. RFA provides solid modeling, 3-D wireframe and 2-D detail documentation.

RFA's analytical tools are comparable to many engineering groups' own capabilities. RFA offers a wide range of software/hardware combinations that are available on an as-needed basis to all of our clients. These tools allow RFA to offer uninterrupted product design programs by eliminating the need to wait for feedback from outside analytical suppliers.

RFA's primary finite element software is Swanson and Associate's ANSYS family of F.E.A. products. RFA uses two versions of



RFA staff (Fall 1995)

ANSYS, a PC-LINEAR package and a full ANSYS package installed on a Hewlett Packard 9000 series work station.

The PC-LINEAR package ANSYS is an excellent tool for stress analysis. This module provides dependable solutions for static linear structural analysis problems and has analyzed models in excess of 30,000 elements. Currently installed on a Pentium computer with a 4G hard drive, the PC-LINEAR package provides analysis for most of RFA's programs.

The full-suite ANSYS utilizing the H.P. computer allows for many forms of structural as well as thermal and magnetic analysis. The various forms of structural analysis include non-linear analysis, for such applications as castings, and large deflection analysis for structures. The thermal analysis handles both 2-D and 3-D prob-

lems. This package is faster than the PC-LINEAR package, an important advantage when large models are needed.

To enhance the smooth flow of data from our design staff into the finite element area, RFA has added several software modules. One of the most heavily used packages is Parametric Technologies' Pro-Mesh module, which is an internal mesh generator within P.T.C.'s ProENGINEER software. RFA has 34 seats of ProENGINEER and has floating licenses of Pro-MESH available to all 34 seats. An engineer is able to quickly convert a ProENGINEER solids model into a meshed model ready for ANSYS F.E.A. This eliminates the costly and time consuming practice of creating a new model of the same object within the F.E.A. software; the design model serves as the model.

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of, one that an operator can run all day long with maximum comfort and increased productivity.”

Caterpillar took a risk in the marketplace by creating such an apparent contradiction: comfort and style in a machine known mainly for its muscle. With the help of RFA/Minnesota Engineering, the risk is paying off.

RFA's software library also includes Algor's Houdini Mesh Generator. In addition to our F.E.A. capabilities, a variety of softwares such as Working Model (Kinematics program) and TK Solver are used to assist employees in the engineering design process.

Of course, all this design capability would be less than effective without frequent interaction with the client. Communication occurs in a variety of ways, including phone contacts, faxes and other data transfer methods. Drawings are frequently couriered to the client for approval and engineers and other staff often travel to the client's location for in-person review meetings.

For the past 53 years, RFA has provided its clients with a variety of engineering tools to assist them through all phases of the design process. Clients can request services from RFA similar to the services they request from their own internal engineering staff, including design, analysis, detail documentation, project planning, project management, prototype build and production follow-up. RFA assists clients in managing their ever-changing workload by providing a quality engineering resource with timely and appropriate results.

RFA's Quality Statement

RFA's quality control procedure is driven by the only measure of quality that counts - customer satisfaction. This is the standard by which we and others measure our performance. Successful projects result in successful clients and successful clients result in repeat business and long term relationships. Over 90% of our business is repeat business.



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