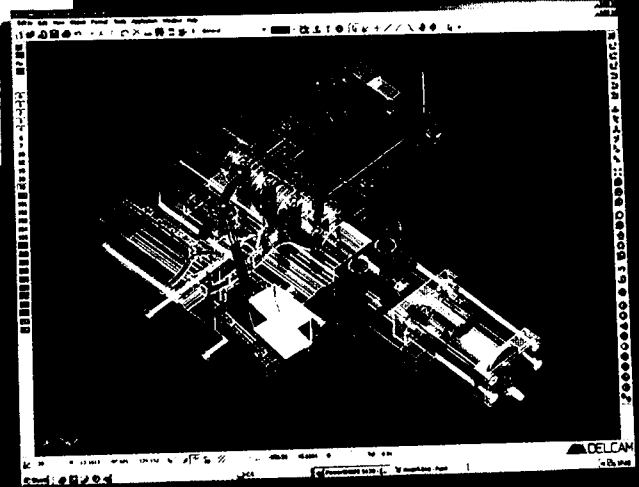
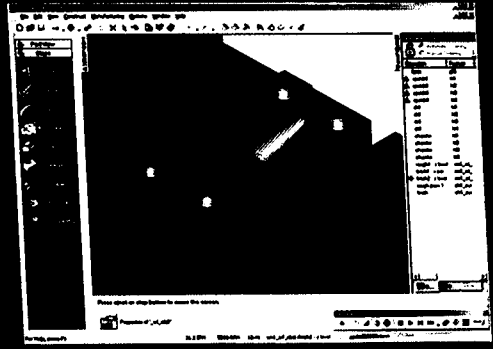


# TOOLING & PRODUCTION

Technology for production metalworking

# 2003 SOFTWARE REPORT



**Mark Stover**  
**Tooling Around**

**Stan Modic**  
**Straight Talk**

# 'Bio-proof' coolant cuts waste for Rolls Royce

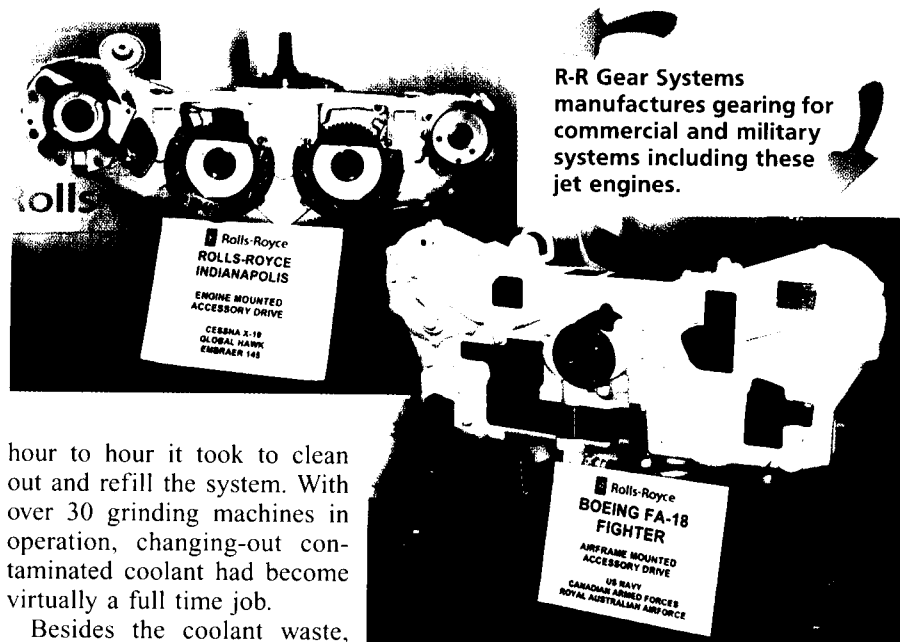
*Turns gear systems plant into award winner*

**R**olls-Royce (R-R) Gear Systems' modern, 200,000 square-foot facility in Park City, Utah, employs almost 200 people. In 1999, the management team at R-R Gear Systems faced a major problem. Waste disposal costs were skyrocketing out of control. The facility, which provides engineering, machining, assembly, and testing systems for military and commercial aircrafts, was disposing of more than 16,000 gallons a year of contaminated liquid waste.

This volume, though not uncommon in the industry, forced the facility into a regulated waste category. As a result, R-R Gear Systems faced disposal costs of \$2.35 to \$7.50 per gallon versus 25 cents per gallon for unregulated waste. In addition to the high disposal costs, the company faced increased pressure for environmental controls such as ISO 14001. Management formed a task force to find ways to reduce waste.

The task force identified two main sources of hazardous waste. First, gallons of machining coolant were routinely disposed of due to contamination by organic solvents and bacteria. At any one time, the facility had almost 3,000 gallons of coolant in the stand-alone sumps of its 30 grinding machines. When new coolant was added to the sumps, it began souring and stinking from fungus and bacteria after only a week's time, requiring a complete change-out.

To change out the sump, not only did 100 gallons of contaminated coolant have to be hauled out as hazardous waste, but machine production had to be stopped completely during the half



R-R Gear Systems manufactures gearing for commercial and military systems including these jet engines.

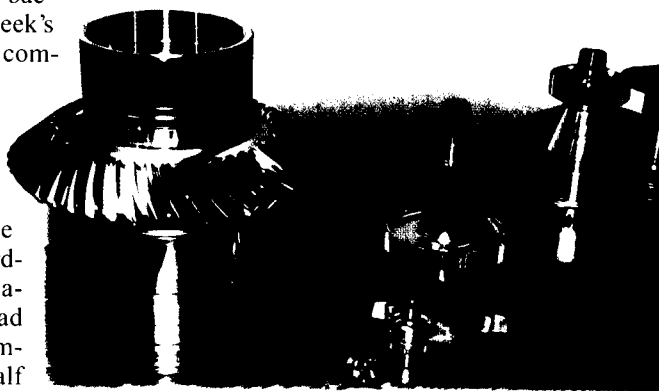
hour to hour it took to clean out and refill the system. With over 30 grinding machines in operation, changing-out contaminated coolant had become virtually a full time job.

Besides the coolant waste, disposal costs, and downtime, operators constantly complained about the foul smell and mess in their work environment. There were issues with dermatitis and potential health hazards from misting of the contaminated coolant into the air that the operators breathed. According to Fua Tukuafu, coolant manager for R-R Gear Systems, who took over the coolant management in 1999 and worked on the waste reduction task force, "Coolant was a constant headache for everyone

back then. The smell and mess made the work environment unpleasant, and all the time spent refilling and maintaining coolant took away from production. Finding solutions to this issue became a top priority."

The second source of hazardous waste was organic solvents that were contaminating the aqueous cleaners used at the site. Stoddard solvents, Biodyne, DYKEM, remover, M.E.K., TCE, paints, and more became mixed with the coolant and had to be changed out regularly. In addition, mop water, chip bins, tramp oil, and steam cleaners were dumped into a 2,000-gallon waste

coolant tank that had to be disposed of as hazardous waste. After identifying these two major sources, the task force implemented four steps to reduce the quantity of hazardous waste.



R-R Gear Systems machines metal parts for military and commercial aircraft engines

**Extend coolant life**

One of the first goals was to find a way to extend the sump life of the coolants. If R-R Gear Systems could find a product that would resist bacterial and fungal growth, the company would be able to dramatically reduce the amount of coolant dumped.

The company invited seven coolant manufacturers, including the incumbent, to trial their product, each in a different cutting/grinding machine. R-R Gear Systems evaluated the different coolant products according to the following criteria: quality, machinability, longevity, ease of maintenance, and recyclability.

Trialing began in January 2000. The first products were eliminated after only a week or two of use. Some products foamed. Some products began souring. Of the seven, by June only one product remained as a truly biostable product—Hocut 795<sup>®</sup> from Houghton International. With this product, R-R Gear Systems was able to use one-sixth the amount of coolant and change out sumps every four to six weeks instead of once a week. Most important, because the new coolant did not sour, the amount of hazardous waste that needed to be disposed was cut dramatically. In addition, operator complaints about smells and dermatitis virtually stopped.

“We went from using six drums of coolant a month to using two drums every three months. We were able to use less product to do the same job. Hocut 795 is truly superior to anything else we’ve seen out there,” says Travis Larsen, environmental health and safety manager for Rolls-Royce Gear Systems.

**Maintaining the coolant**

To further reduce waste, the R-R Gear Systems management team implemented strict procedures on coolant use and disposal. Operators were trained, and specific usage guidelines posted on machines and around the facility. For example, during regular cutting and grinding operations, tramp oil routinely gets mixed into the coolant, creating a source for coolant contamination. In the past, this mixture

was simply removed from the sump and dumped as hazardous waste. Now, a Work Instruction Sheet outlines the five steps on how operators can separate tramp oil from coolant so the coolant can be reused in the machine.

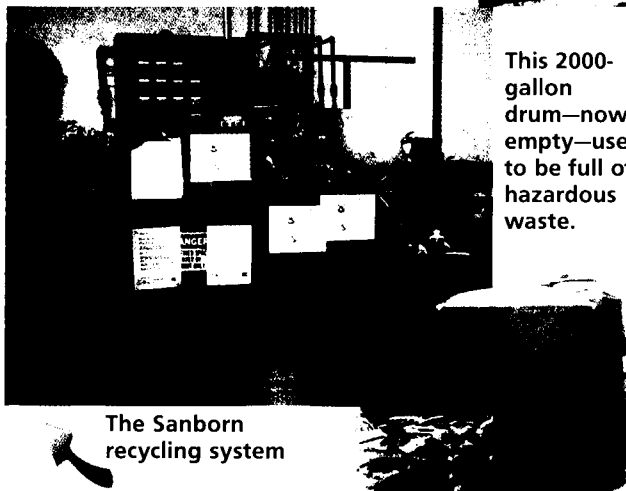
Should operators have any questions or problems with the posted instructions, they are urged to contact maintenance or the environmental health and safety office for immediate assistance.

Management also implemented detailed procedures to prevent mixing of waste streams and contamination of coolant by cleaners, solvents, mop water, Dykem, and other chemicals and hazardous materials that are commonly used in the machining areas. In this way, R-R Gear Systems is assured that the facility is operating in accordance with federal, state, and local hazardous materials and hazardous waste regulations in order to reduce health hazards and environmental impact.

Operators received similar Work Instruction Sheets on how to manage oil/coolant spills and mop water, how to change out machining coolant, how to prevent mixing of waste streams, etc. “With our new, strict procedures in place, there were no gray areas,” explains Larsen. “Procedures are documented and posted in machining areas, and we train operators to follow these procedures exactly. Our goal was to cause a facility-wide culture change, and I believe we have succeeded. All of our operators and staff are aware of our accomplishments in terms of reducing waste, and they are proud to be part of the effort.”



Machining coolant was the primary source of hazardous waste.



The Sanborn recycling system

This 2000-gallon drum—now empty—used to be full of hazardous waste.

**Recycling the coolant**

R-R Gear Systems had a Sanborn (Patriot) fluid recycling system in place since 1990, but by 1999 it was no longer being used. The management team decided to make it a priority to get the system up and running again to further extend coolant life. Now, when coolant sumps are changed out, the old coolant goes through the recycling unit where the relatively small percentage of oils and contaminants are extracted as hazardous waste. The recycled, “clean” coolant is then held in a tank, ready to be delivered to the sump tanks as needed.

Under the new system, operators follow fast and efficient procedures to change-out coolant. First, they empty the sump with a sump sucker and transport the used coolant to the recycling room where it goes through the system. Clean coolant is transported from the recycling unit to each ma-

## fluids

chine via hoses throughout the facility. The operators simply turn on spigots at each machine to fill sumps with clean coolant. With the recycler, 10,000 to 12,000 gallons of coolant is recycled per year and the amount of hazardous waste is reduced to two to five gallons per month.

The hazardous waste is now stored in a 55-gallon drum instead of a 2,000-gallon drum. The drum receives the by-product of the recycler as well as the by-product of the mop water, roto-jet, steam cleaner, clarifier/sewer, and non-VOC tramp oil after it has gone through the drum evaporator.

The first year showed the most marked reduction in waste—from 16,100 to 2,460 gallons—with further reductions every year since. R-R estimates that it will dispose of only 200 gallons of waste in 2003. This translates to reductions in hazardous waste disposal costs from \$67,276 in 1999 to an estimated \$618 in 2003—a 98.5 percent cost savings since 1999.

### Award winner

In 2000, Gear Systems won the Rolls-Royce most prestigious corporate award—the Chief Executive's Global Quality Award, given to the project that provides the best example of cost savings and customer satisfaction. This was the first time the award was won by a U.S. facility.

"Dedicated employees are what continue to make our facility better," says Larsen. "We can put procedures in place and create an environment that encourages motivation, but it comes down to people that make programs successful. Our people take tremendous pride in their work, and it pays off."

The facility was the first Rolls-Royce plant in the U.S. to

Work Instruction Sheet illustrated below outlines the five steps on how operators can separate tramp oil from coolant so the coolant can be reused in the machine

#### Work Instruction Number EHS-WI-22

##### TRAMP OIL/COOLANT SEPARATOR INSTRUCTIONS

**STEP 1:** Fill tramp oil separator (blue drum) with tramp oil from the machine skimmer buckets

**STEP 2:** Let the mixture sit for at least three hours (this allows the oil to separate from the coolant)

**STEP 3:** Open valve #1 (make sure there is a 2-gallon bucket under valve). Fill bucket with oil (stop if coolant comes out). Pour oil into "Oil" 5-gallon bucket located on the bottom shelf.

Note: if coolant comes out of valve #1, close valve and follow STEP 4

**STEP 4:** Open valve #2 and drain coolant into "Coolant" 5-gallon bucket. When coolant is emptied from the tramp oil separator, close valve #2 and empty "Coolant" 5-gallon bucket back into machine.

**STEP 5:** When "Oil" 5-gallon bucket is full, empty into 275-gallon "TRAMP OIL" tote located in the Waste control Area (oil room).

The Work Instruction Sheet outlines how to use and dispose of hazardous materials in machining areas.

#### Work Instruction Number EHS-WI-15

##### USE AND DISPOSAL OF HAZARDOUS MATERIALS IN MACHINING AREAS

- Hazardous materials shall be properly labeled at all times (i.e., spray bottles, drums, etc.)
- Hazardous materials shall be used in a way that does not create a health hazard (e.g., wearing gloves, safety glasses/goggles/face shield when working with chemicals, etc.)
- Solvents/markings paint shall not be sprayed over chip bins, garbage cans, floors, coolant or oil sumps, mop buckets, biodyne tanks, etc.
- Dykem remover usage: Spray on a rag when used as a wipe solvent; Use over IPC 105 solvent tank (Stoddard solvent) when removing DYKEM.
- Trichloroethylene, methyl ethyl ketone, isopropyl alcohol, acetone, and denatured alcohol shall not be used in any manufacturing areas without prior approval from the EH&S office.
- Ensure that dykem is completely dry before machining a part.
- Oily materials (i.e., rags, cardboard, etc.) shall be disposed of in an oil solids drum.
- Solvent materials (i.e., rags contaminated with solvents, etc.) shall be disposed of in a solvent solids drum.

achieve ISO 14001 environmental registration. And in September, R-R Gear systems received certification to the new ISO9001-2000 standard. "This new certification, with no audit findings on the first attempt, sends a strong signal that Rolls-Royce Gear Systems is well positioned to meet the evolving needs of its customers in a progressive and effective manner," says Steve Rusk, president, Rolls-Royce Gear Systems Inc.

Travis Larsen was asked to present the facility's waste reduction program to the State of Utah at a 2001 award ceremony – where R-R Gear Systems received the 2001 Pollution Prevention Award. Today R-R Gear Systems stands as an example of safety, efficiency, and compliance – one of the most environmentally responsible metalworking facilities in the country.

**Houghton International**