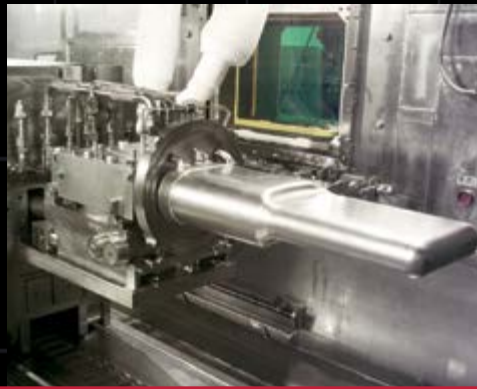


E.H. WACHS



**ENGINEERED
PRODUCTS**
CUSTOM SOLUTIONS



E.H. WACHS[®]
A Division of **TW**

Superior Equipment. Complete Support.™

ehwachs.com

ENGINEERED PRODUCTS GROUP



E.H. WACHS 1932

A HISTORY OF SUCCESS

For over 125 years E.H. Wachs has been in the forefront of field portable pipe and tube cutting, beveling and weld preparation technologies. As an engineering driven firm, E.H. Wachs offers unparalleled depth of experience and expertise in the design and manufacturing of precision machinery.

WHO WE ARE

Over 40 years ago E.H. Wachs formed a Special Projects Engineering Group to address the ongoing demand for specialized machinery. The primary purpose of this group was to develop alternative tools for meeting unique project requirements.

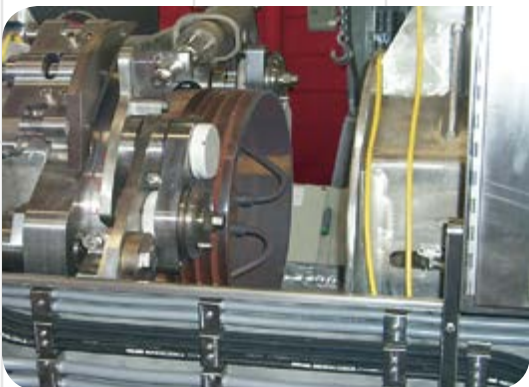


E.H. WACHS TODAY

Today our group consists of a diversely talented collection of engineers with over two centuries of shared experience developing machine tool solutions. Added to this engineering core is a dedicated staff of accomplished project managers, skilled field support personnel and a team of award winning manufacturing experts.

WHAT WE DO

Discover, Design, Build and Support innovative machine tools and purpose built systems.



Discover

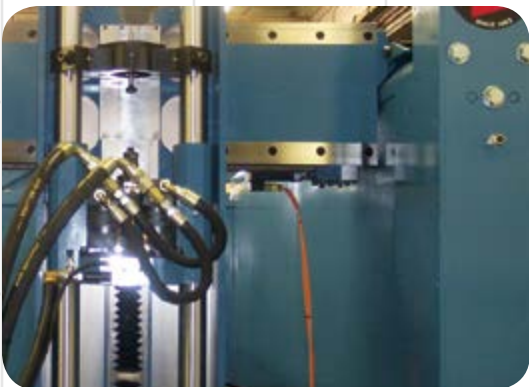
Determining the best technology for a particular application starts with evaluating many project requirements. A concept is formulated and reviewed with the client for meeting the scope of work and project expectations.

Design

The approved concept is further developed during detailed design. A highly disciplined development process is implemented with our clients and our entire Engineered Products group. An innovative design is created by merging new technologies and our prior legacy of work.

Build

Design details are further developed and tested. Every component is assembled, inspected and refined for exceptional performance. Decades of experience manufacturing precision machinery are integrated into every engineered product we produce.



Support

Entire team support philosophy. It's not just our detailed manuals and field professionals that impress our clients, it's the continued support from a group of individuals with a passion for what they do.



INNOVATIVE MACHINE TOOLS

Our Special Products Group engineers are experts at combining the best technologies to create a machining system for challenging applications. Every tooling system we deliver comes with new innovations built from our legacy of work.

The chart below shows the cutting technology innovations we have developed for various machine industry markets.

MARKET Related Industries	CUTTING TECHNOLOGIES						
	Lathe	Mill	Saw	Drill	Chipless	Abrasive	Automation
Machine Adaptations standard products / special tooling	X	X	X	X	X	X	X
Demilitarization chemical weapons / armaments	X				X		X
Sustainment missiles / nuclear / ordinances	X				X		X
Remote cutting hot cell / subsea / nuclear	X		X		X	X	X
New construction carriers / submarines / power plants	X	X	X	X			X
Refueling and maintenance naval ships / power plants	X	X		X	X		X
Subsea pipeline repair remote / diver / deep sea	X	X	X	X		X	X
Decommissioning nuclear / ships / offshore / weapons	X	X	X	X	X		X



OUR CLIENTS

As a recognized leader in field machining, E.H. Wachs Engineered Products has partnered with some of the industry's most respected names, including:

- ▶ AREVA
- ▶ Bechtel
- ▶ BP Amoco
- ▶ Brookhaven Nat'l Lab
- ▶ Chevron Pipeline Company
- ▶ CH2M Hill
- ▶ Fluor Daniels

- ▶ General Atomics
- ▶ General Dynamics Electric Boat
- ▶ Idaho Nat'l Laboratory
- ▶ Lockheed Martin
- ▶ Los Alamos
- ▶ Northrop Grumman
- ▶ Oakridge National Laboratory

- ▶ Parsons
- ▶ Savannah River
- ▶ Shaw
- ▶ Siemens
- ▶ US Army
- ▶ US Navy
- ▶ UT Battelle
- ▶ Washington Group

Girth Cutting & Weld Preparation Machine

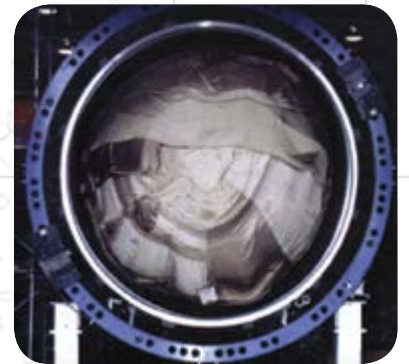
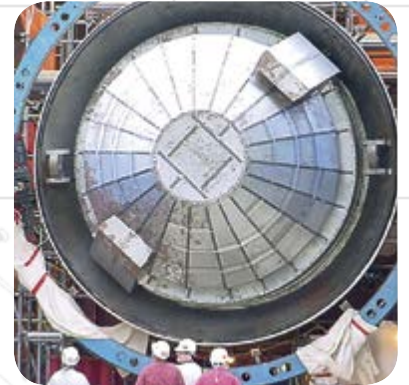
PROJECT SCOPE

Simultaneously perform precise machine cuts and weld preparations on both the existing steam drums and the new replacement sub assemblies measuring 16' 9" OD x 6.54" wall.

WACHS SOLUTION

Custom design and build a total of two specialized OD mounted split frame machines, each consisting of twin opposing tool carriers and 12 integral clamping pads for fine positioning. The girth machine was fabricated into four equal quadrants having a final OD dimension of 21'.

Northeast Utilities Millstone Nuclear Power Station



M117A3 Bomb Decommissioning Station

PROJECT SCOPE

Provide a remote means for severing an estimated 30,000 WWII remnant stockpile of M117A3 bombs which were stored at a facility in Guam.

WACHS SOLUTION

Custom design and build (5) remotely operated stations capable of being used in a production type environment - working (24) hours a day, (7) days a week.

World Wide Demil LLC & Parsons Infrastructure

Lathe cutting is used when a project requires 360° machining of objects like pipe, vessels, cylinders and conical objects. Lathe machines achieve high accuracy and repeatability by utilizing a rotating frame with fixed tooling. Lathe operations include cutting, beveling, counterboring and facing.

155mm High Speed Projectile Cutter

PROJECT SCOPE

Provide a means for remotely severing 155MM chemical projectiles to enable the safe retrieval and disposal of GB, VX and other Biohazard chemical agents housed inside the projectile.

WACHS SOLUTION

Custom design and build multiple high speed lathe cutting machines capable of severing a 155MM 1-1/2" outer carbon steel casing within 90 seconds or less. Designed to be fully remote controlled for performing cutting operations inside an air-tight chamber and withstand over 250,000 repeated cycles without requiring system maintenance.

United States Army Chemical Demilitarization Program



Platform Internal Casing Cutter (PICC)

PROJECT SCOPE

Furnish all equipment and associated tools required to cut existing 42" and 48" OD spirally welded and rolled steel pipe piles which are submerged in a turbulent river having very low or no visibility. Cut locations are to be controlled within +/- 1.0" at depths up to 30' without diver assistance.

WACHS SOLUTION

Custom design and build an ID to OD cutting system comprised of a self centering clamping arrangement. A lathe cutting module is integrated to the clamping system and is manually lowered to the pre-determined cutoff location. Top side controls are used for clamping and energizing the lathe cutting module.

Washington Group International

MILL CUTTING

Subsea Rail Mill Machine

PROJECT SCOPE

A decommissioning system was needed to segment 24"-7-5/8" OD string casings in a subsea environment.

WACHS SOLUTION

Custom design and build a portable rail platform equipped with a bi-directional milling head for performing uninterrupted 10' axial segmentation cuts in both directions.

Stolt Offshore



Pocket Milling Machine

PROJECT SCOPE

The new steam generators being installed at Callaway Nuclear Station required the flange pedestals or bearing surface pockets to be re-machined for matching existing column elevations. Estimated amount of material to be removed per surface is between 0.500" - 0.750" and held within a flatness tolerance of 0.002".

WACHS SOLUTION

Custom design and build a 6" shell mill cutting module integrated to an extended Flange Clamp and a Drop Deck Interface Support Table for X-Y positioning the milling module to the desired machining elevation.

SGT, LTD / Ameren UE

Milling utilizes a rotating cutter mounted to a carrier that follows a linear or radial path. Compared to Lathe cutting, Milling produces fine chip debris and is not limited to a 360 degree operation; this is particularly useful for localized machining or partial segmentation. Milling operations include cutting, beveling, facing, grooving, pockets and windows.

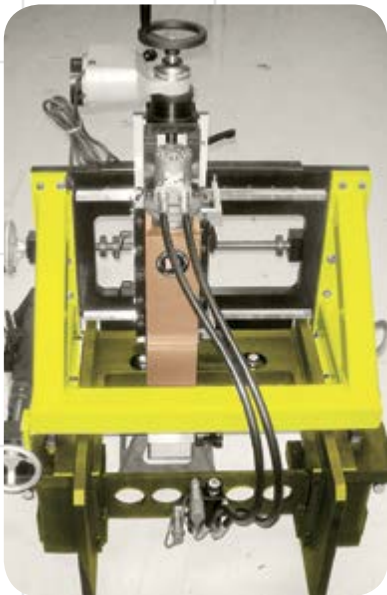
Pressure Vessel Refurbishment Machine

PROJECT SCOPE

A refurbishment system was needed to remove MOS remnant and surface PT indications on reactor omega seals to support the Navy's refueling activities. The surface flatness requirement was 0.002" over a span of 85" inches.

WACHS SOLUTION

Custom design and build a precision solid rotational platform equipped with a CNC controlled milling module.



Steam Generator Keyway Slot Machine

PROJECT SCOPE

A portable machine was needed to resurface Diablo Unit 1 Nuclear Station's steam generator keyway slots. Each keyway slot consists of (3) perpendicular surfaces which were irregular in flatness. Prior to installing the new generators, the keyway surfaces had to be machined to its "best possible" flatness condition without removing more than 0.250" of parent material.

WACHS SOLUTION

Custom design and build an arbor mounted face mill supported by an indexable right-angle spindle. The spindle is coupled to a 3-axis slide deck for positioning the milling head to the surface being machined.

SGT, Ltd / Pacific Gas And Electric

RECIPROCATING

Remote Guillotine® Saw

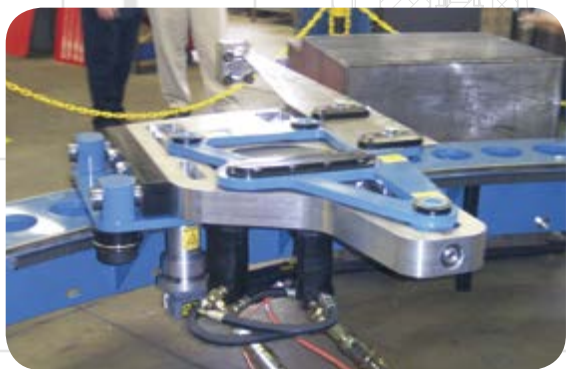
PROJECT SCOPE

Out of Service Flygt Pumps once used for transferring contaminated wastes to and from multiple tank farms located at Hanford's DOE site needed to be remotely severed for decommissioning purposes.

WACHS SOLUTION

Custom design and build a specialized Guillotine® saw outfitted with auto feed / auto clamp features for remotely attaching and severing the contaminated Flygt Pumps in the field.

CH2M HILL - HANFORD



Superhackzall Saw

PROJECT SCOPE

A specialized reciprocating severing saw system was required for the dismantlement of a large complex cylindrical structure measuring 32' in diameter at Knolls Atomic Power Laboratory. The structure is comprised of a matrix of materials consisting of armor steel plate, lead, borated poly, asbestos, and fiberboard with wall thickness variations ranging from 18"- 42".

WACHS SOLUTION

Custom design and build a 12' straight and a 12' radius rail mounting arrangement for employing a universal carrier for housing either the drilling module for creating the blade's starting slot or the reciprocating module used for segmenting the cylindrical structure in both the vertical and horizontal planes.

**General Dynamics Electric Boat /
Knolls Atomic Power Lab**

Reciprocating utilizes a straight blade moving in repeated forward and backward motion. E.H. Wachs reciprocating machines feature an advanced elliptical cutting action that lifts the blade on the return stroke, enhancing cutting efficiency and minimizing blade wear. Reciprocating operations include severing solid bar, nested materials and irregular shaped workpieces.

SNS Mercury Target Cutting Station

PROJECT SCOPE

A cutting system was required to expose internal mercury target segments for further analysis and subsequent testing. The mercury target is comprised of a matrix of stainless steel materials and is controlled inside a hot cell environment. High radiation levels prohibit any human intervention and are destructive to most electronic components.

WACHS SOLUTION

Custom design and build a reciprocating saw system utilizing available hot cell manipulators for controlling the system's entire operation. A pair of sliding clamp plates secures the mercury target in close proximity to the cutting plane while a hydraulically driven reciprocating saw module makes circumferential cuts through the mercury target.

UT Battelle - Oakridge National Laboratory



Submarine Hull Cutting System

PROJECT SCOPE

Provide a system for cold cutting a large rectangular window section through the outer shell and mating skeleton to facilitate the construction of a new Top Sail section on an existing 688 class submarine.

WACHS SOLUTION

A reciprocating system comprised of straight and radius rail mounting arrangements for housing a universal hydraulic reciprocating saw module delivering up to 8" of stroke was designed and built. A 20' x 28' rectangular section from a 32' diameter cylindrical vessel positioned in the horizontal orientation was successfully removed at Electric Boat's shipyard in Groton.

General Dynamics Electric Boat

CHIPLESS CUTTING

MLRS Segmentation Equipment

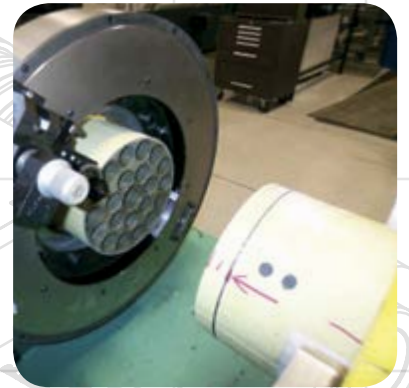
PROJECT SCOPE

A total of (3) segmentation cuts were required to be performed on a single multiple launch rocket system (MLRS) without producing any metal chip debris. The rockets are made out of aluminum materials having an approximate wall thickness of .130". The machine was required to perform over 50,000 cutting cycles without requiring the need of service maintenance.

WACHS SOLUTION

Two solid bearing rotating platforms were custom designed and built for seamless integration to the U.S. Army's de-mating module. The platforms housed a total of (3) self feeding and end cycle retracting chipless wheel carriers. The MLRS segmentation process is remotely operated behind a protective barrier.

U.S. Army Aviation & Missile Center



Omega Support Tube Chipless Cutting

PROJECT SCOPE

A portable machine was needed for severing motor tube support seals without introducing any foreign materials or debris inside the tube ID.

WACHS SOLUTION

A solid bearing machine tool frame equipped with cut elevation fixtures and a self centering leg clamping system was specially designed and built for this effort. The machine frame housed (2) opposing self indexing chipless wheel carriers for segmenting the support tube seals.

Northrop Grumman Shipbuilding Newport News

Chipless cutting utilizes a sharp edge wheel that orbits around a workpiece while inward pressure is applied to displace material and ultimately sever workpiece. Chipless cutting or FME (Foreign Material Exclusion) is used for applications where chip debris cannot be tolerated. Chipless cutters are used in hot cells, high purity settings, and for D&D of chemical agents and explosive munitions.

Bechtel Ton Container Station

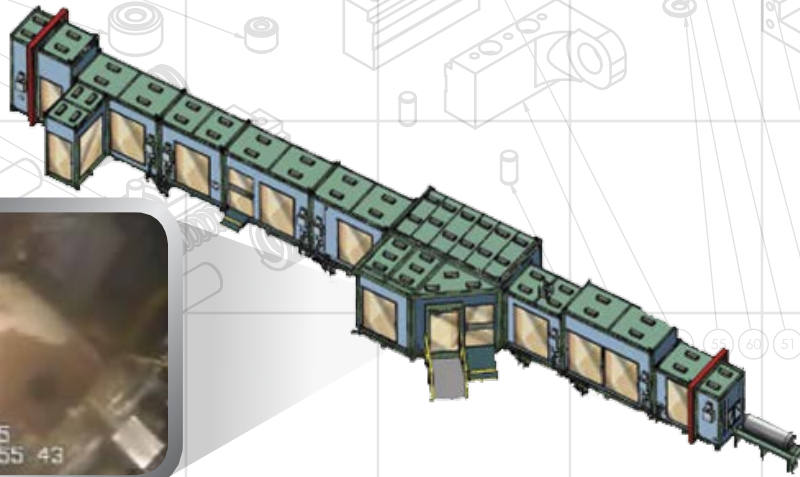
PROJECT SCOPE

U.S. Department of Defense needed to destroy a WWII stockpile of chemical agent stored inside ton containers (TC) at a military base in Maryland. The TC is a steel cylinder measuring 6.5 feet in length x 30" OD with a wall thickness of 5/8". The project required the ton containers to be severed in half without generating metal debris and accomplish all operating functions remotely as the agent is open to the atmosphere within the isolation chamber.

WACHS SOLUTION

Our team was responsible for the advancement of chipless wheel cutting and metal displacement during proof of principle testing with the U.S. Army. The data captured from these development test studies yielded performance gains of 700%, and became the basis for our 1st generation TC cutting station. Over 1800 TC were safely destroyed, ending (61) years of agent storage at this facility.

Bechtel National, Inc



DRILLING - THREADING

Trunnion Drilling Machine

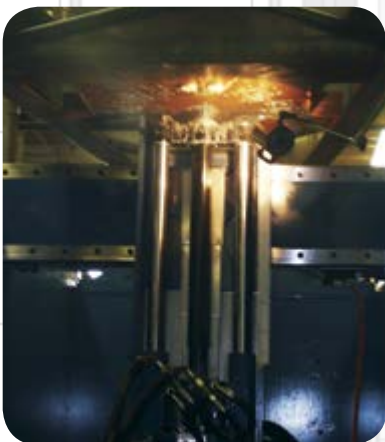
PROJECT SCOPE

Bio-wall interferences surrounding Diablo's 2-2 steam generator required the two trunnion lifting assemblies to be mounted at a different location. A total quantity of (40) 1-1/2"- 8UN tapped holes was needed for bolting each trunnion lifting assembly at the new opposing sides of the generator.

WACHS SOLUTION

We custom designed and built a power drill outfitted with a 360 degree swivel platform. This platform was then attached to a precision ground steel template fixture which housed guide bushings for accurately reproducing true "bolt hole" locations.

SGT / Pacific Gas & Electric



Bulkhead Drilling Machine

PROJECT SCOPE

The production requirements for new CVN 21st Century aircraft carrier required a drilling system to be positioned under the 36" thick bulkhead to perform vertical drilling operations and achieve a range in bore diameters from 2" thru 10" in diameter. A 0.007" inch of wander per inch of bulkhead depth or a loss of perpendicularity not greater than 0.4 degrees was specified.

WACHS SOLUTION

A maneuverable, self driven rigid two axis machining platform outfitted with a high tolerance pendent controlled boring module was designed and built. The drilling machine weighed over 16 tons and accomplished the 2" thru 10" bore diameters in less than 2 hours.

Northrop Grumman Shipbuilding Newport News

Drilling and Threading utilize a rotating cutter that is advanced axially into a workpiece to remove material. Drilling machines cover a wide range of applications such as drilling multiple 10" diameter holes through 42" hardened steel while maintaining close tolerances in size and perpendicularity.

Support Column Bolt Threading Machine

PROJECT SCOPE

The steam generator connections between the support column block to the support pad are held together by a series of 1½"-12UN bolts. The possibility existed of having more than one of the bolts becoming wedged or incapable of being fully extracted. This condition requires the head of the lodged bolt to be severed for releasing the OSG and fully welding together the down ending bracket for securing the new replacement generator. Potential delays in the project's schedule required the severed bolt's shaft to be threaded for accepting a captivated nut.

WACHS SOLUTION

We custom designed and built a machine tool which is capable of threading both a straight bolt diameter shank to 1½"-12UN as well as turning and threading a reduced diameter shank to the next size bolt diameter. The entire process including equipment set-up time was achieved in less than 1 hour.

SGT / Pacific Gas & Electric



Subsea Hydraulic Pin Drill

PROJECT SCOPE

Sub-Sea drills were needed for creating "access points" for inserting solid rigging bars for securing and lifting detached casings after segmentation.

WACHS SOLUTION

Large pin drills were developed for accurately positioning and drilling 1" thru 4" diameter holes through the ID of casings, enabling divers to safely install solid rigging bars underwater.

Devon Energy

ABRASIVE CUTTING

Abrasive cutting utilizes a hard matrix material bonded to the leading surface of various shaped cutting end effectors. One of the newer types of abrasive cutting is Diamond Wire cutting which uses a diamond matrix cable traveling at high speed while fed into a workpiece with controlled force. Diamond wire cutting is used when material collapse is present or when cutting mixed material types like concrete and steel. Wachs offers a complete line of specialized wire saws for pipe sizes ranging from 4" to 84".

Hot Cell Cannister Cutting Machine

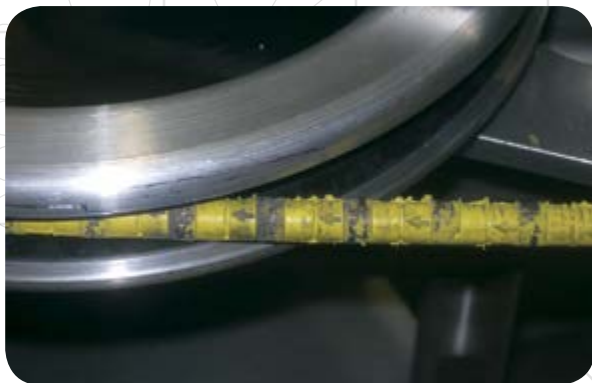
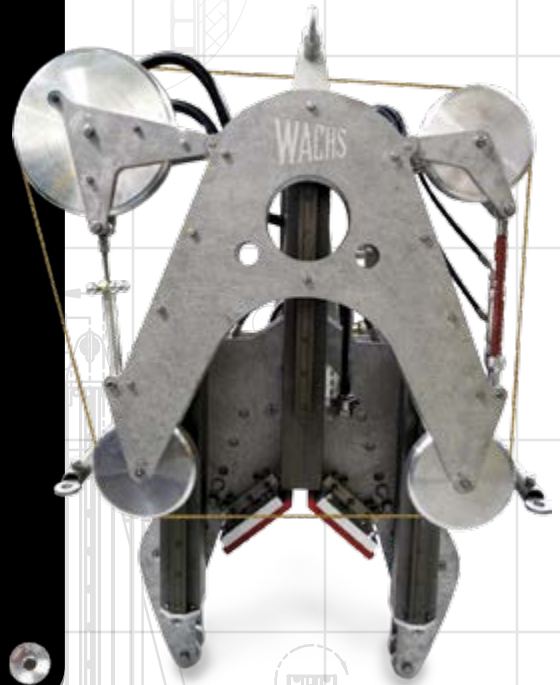
PROJECT SCOPE

Perform destructive cutting on a coaxial bundle of carbon steel pipe liners (24" x .687" wall / 16" x .500" wall & 12.750" x 0.250" wall) with no internal supports except for pea gravel lining in between each OD liner. The goal was to extract a final container housing of nuclear waste. Segmentation of the workpiece was to be performed in a hot cell utilizing robotic arms to control the cutting process.

WACHS SOLUTION

Design and build a modified hydraulic powered Diamond Wire Saw, controlled remotely using a Wachs Topside Control Unit housed outside of the hot cell. The saw is equipped with an adjustable power clamping system ensuring uniform and secure clamping onto the workpiece, plus wire cooling performed via an integrated CO2 cooling system.

Idaho National Labs / Idaho Cleanup Project



AUTOMATION

Engineered Products offers a host of Automation Technologies where human interaction is either unwise or impossible, such as in hot cells and deep subsea operations. We are experts in creating products that feature automation choices such as remote control, topside control, redundant controls, ROV power and control, and complete sequence automation with system integration.

Subsea Multi-String Casing Cutter

PROJECT SCOPE

Design, build and test a safe mechanical cutting solution for the remote segmentation of multi-string well conductors.

WACHS SOLUTION

This project demanded the cutting system have the ability to accurately segment damaged well conductors at depths up to 450 feet (137M) in a zero visibility environment. The system mounted to drive pipes and severed internal casings that were non-concentric and non-coaxial. These challenges further required advanced feedback, command, and control technologies.

British Petroleum



Subsea Combination Prep Tool

PROJECT SCOPE

Design, build and test a Combination Prep Tool for pipe severing, pipe end-beveling, pipe weld seam removal and epoxy coat removal on varied size oil pipelines at a subsea depth of 10,000 feet. All processes are performed by an ROV submarine with no diver intervention.

WACHS SOLUTION

Several individually proven machine modules were integrated onto a modular machine platform for remote operation on a pipeline. The system included a clamp feature for transferring the machine along the pipeline axis for tool positioning. A PC operated remote hydraulic machine control was developed to operate all machine operations 10,000 feet below the surface of the sea.

Chevron Pipeline Oil Company



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