KNIGHTHAWK TECH NOTES

PHONE: (281) 282-9200 • FAX: (281) 282-9333
WEBSITE: www.knighthawk.com

August, 2010 *Issue 10.05*

"Machine Design – Heavy Industrial Applications"

You are at whit's end. The new boss you have has asked that you reduce the down time for cleaning a vessel and removing scale. The overall goal is to reduce a planned plant shutdown by one week. Of course the unit you are in charge of and a particular vessel is the culprit, right in the middle of all the talk and focus. Cleaning and doing maintenance on the internals involves several steps of which the most import is the safety of the personnel doing the work. The internals cannot be rebuilt or changed out until the vessel is cleaned and scale is removed. The problem is that internal welds would be contaminated and the vapor caused by reacting with the scale is hazardous. Typically the first part of the operation involves specially trained personnel wearing "space suits" to enter the vessel to clean it. The training would include but not be limited to vessel confined space entry procedures. This part of the operation is more than one week in itself and depending on ambient air conditions it could take much longer.

Sitting home at night watching the news on how much of the deepwater work is being done remotely, you ask the question why can't a robot or machine be designed to clear and clean the hazardous scale off the vessel. The answer is a clear, it can.

Usually a project of this type takes at least several months to design and build the equipment. If the return on investment of the equipment is millions of dollars to your company's bottom line it is worth it. The typical steps involved with a project like this would include but not be limited to the following:

1. Selection of a Design Team to execute the work. The team should include not only the design engineers but operations, maintenance, process, electrical, controls, metallurgical and materials, and site safety personnel.
2. Mechanical Equipment Specification – This is an important step to layout expectations of the design, for example.
   - Mechanical constraints
   - Geometric constraints
   - Metallurgical and material considerations
   - Operation sophistication – This is an important step because this will define how much automation and sophistication the device is to have.
   - Process considerations
   - Controls considerations
   - Safety device systems – this is import as the equipment could have pinch points or jam points that could injure someone.
3. Mechanical Equipment Specification Review – After an initial draft is completed by the design team it should be circulated to the Design Team. Comments should be made by all team members and full agreement should be made on the final draft.
4. Conceptual Design Layout – Typically the designers will come up with three conceptual designs to meet the goals and objectives of the project. The Design Team will get together and select one concept. This concept is usually refined with all comments incorporated into the design. It is not unusual for this type of equipment to be robotic in nature with full optical visualization. It is also wise at this point to present the design to operations management for their blessing before any detail design starts.
5. Detailed Design – In this step the complete design is executed.
6. Operations Review – Operations including safety representatives performs a final review. A HAZOP is also conducted at this point as well.
7. Fabrication – During this phase of the operation a detailed schedule should be developed and milestone identified for inter -stage inspections and testing.
8. Testing – This step is executed to validate the design as fit for purpose
9. Simulation – During this phase, especially for "fly by wire" simulations should be done to train operators and personnel for the job to be done. In the situation described in this article it might be a "mock" vessel.
10. Actual Operations – During this phase of the project the equipment should be continuously monitored to ensure that it and the operation of the equipment is meeting expectation. Finally it has to get the job done.

While this article is focused on a vessel, it can be many applications where a "serial number 1" device can save your company a lot of money on the bottom line. A typical engineering budget for such a device as described would be on the order of $500K. Usually the cost of the device is cheaper than the engineering. But this device described could pay for itself 10 times over on one shutdown. A typical return is 10 to 1, not to mention a safer way to get the job done. This project should be directed and the equipment designed under the supervision of a professional engineer competent in this type work.

Cliff's Notes: KnightHawk has its name on many serial number 1 devices in industry designed to get tough jobs done. We are a multidiscipline firm with designers, electrical, controls, process, mechanical, metallurgical and materials engineers. We are a one stop shop that has designed specialty cleaning devices and tooling jigs to special heavy lift complex rigging to reduce shutdown time and save our clients money.

I hope everyone has had a great summer, as I sure have had. This week as I wrote this newsletter, I was at the Sturgis bike rally which is the largest in the world. Up in the mountains (In Houston a mountain is a geological formation over 150 feet high) of South Dakota it is beautiful and we have ridden our Harley's many miles. This is such a large territory in the Black Hills National Forrest that even 850,000 guest has plenty of room.

God Bless you and we look forward to working with you to solve your toughest challenges.

Cliff Knight
cknight@knighthawk.com

KnightHawk Project Update

- Water Pump Failure Analysis – Nuclear
- Weldability Testing – Fabrication
- Bolting Failure – Automotive
- Centrifugal Compressor Failure Analysis – Petrochemical
- Vessel Destructive Testing – Oil & Gas
- Cryogenic Tank FFS – Petrochemical
- Coupling Failure – Gas Pipeline
- Corrosion Analysis – Gas Pipeline
- Flare System Analysis – Petrochemical
- Reactor Failure Analysis – Petrochemical
- Riser Flange Analysis – Off Shore
- Oxidizer Redesign – Petrochemical
- Creep Tensile Testing – Communications
- Gasifier Equipment Design – Power
- Pump Vibration Analysis – Petrochemical
- Reverse Engineering – Manufacturing
- High Temperature Molten Salt Tank Design – Green Energy
- CFD Ethylene Furnace – Petrochemical
- TLE Fit for Service Analysis - Petrochemical
- Oxidizer Redesign – Petrochemical
- Inlet Cone Design for TLE's - Petrochemical
- Bearing Design – Heavy Manufacturing
- Vaporizer Design – Petrochemical
- Mechanical Equipment Design – Off Shore
- Transient Fluid Dynamics – Petrochemical
- Waste Heat Boiler Failure – Petrochemical
- Liquids & Solids Separation Technology Development – Coal