ADMINISTRATIVE INFORMATION:

- Project Name (tentative): Agitator redesign for corrosive environments
- Project Number, if known: _____
  - Preferred Start/End Quarter in Senior Design: Fall/Spring 2012
  - Faculty Champion: *(technical mentor: supports proposal development, anticipated technical mentor during project execution; may also be Sponsor)*

Name	Dept.	Email	Phone
Mario Gomes	ME	mwgeme@rit.edu	475-2148

For assistance identifying a Champion: B. Debartolo (ME), G. Slack (EE), J. Kaemmerlen (ISE), R. Melton (CE)

- Other Support, if known: *(faculty or others willing to provide expertise in areas outside the domain of the Faculty Champion)*

Name	Dept.	Email	Phone

- Project "Guide" if known:
- Primary Customer, if known (name, phone, email): *(actual or representative user of project output; articulates needs/requirements)*
  - *Coating Technology Inc., S. J. Dahle, (585) 546-7170, sd@coatingtechnologyinc.com*
- Sponsor(s): (*provider(s) of financial support)*

Name/Organization	Contact Info.	Type & Amount of Support Committed
Coating Technology Inc.	S. J. Dahle (company president)	$2500
	Eric Peterson (ep@coatingtechnologyinc.com)	

PROJECT OVERVIEW:
Coating Technology Inc. is a metal finishing company which specializes in coatings for metallic and non-metallic substrates. One of their coating processes requires a cleaning phase where the objects to be coated are cleaned by submersion in a hydrogen peroxide bath over the period of several days. The object is continuously agitated in the bath in order to speed up and improve the cleaning process. The current slider crank agitator needs to be improved to increase reliability.

The following is a list of information from an interview conducted with the customer, on Nov. 2011:

-increase reliability of the agitator
-reduce wear points
-the motor/gearbox is replaced too often
-gearboxes can last 1 year or 3-4 years
-no chloride particles can be allowed to fall into and contaminate the bath (i.e. no PVC can be used), possible other material incompatibilities exist.
-currently the motor/gearbox is above the tank and is subjected to chemical vapors, the customer thinks moving the motor/gearbox to another location not above the tank would decrease corrosion and perhaps lead to fewer failures.
-Current output shaft rotation period is approximately 2 sec./revolution
-Each batch is continuously agitated for 6 days, but the parts are removed each day for a short time period for inspection and cleaning
-The customer wants a single engineered and improved prototype which uses off-the-shelf parts.
-Day-shift hours 7am-3:30pm
-Tanks are square and are approximately 3 ft. on a side.
-There is some room behind the tank but the front of the tank must remain clear.

Constraints:
-Maintain existing cycle period of 2sec. per rev.
-lifetime of at least 5 years

Additional Questions:
Stroke length of current agitator?
Do you want adjustable stroke length?
Do you want to be able to adjust cycle period?
What limits cycle period and stroke length?
How could we measure premature failure (Dr. Kolodziej as consultant)?
Is accelerated lifecycle testing possible (desirable) in corrosive environment?
Does the current up/down agitation cycle need to be maintained? Can a swirling pattern work?
What limits the agitation motion?

Project Deliverables:
(1) Working prototype
(1) Accelerated lifetime test demonstrating key subsystem operation without failure of new design for an equivalent number of cycles that would be seen by the design in the corrosive environment.
(1) Report with photographs and measurements documenting the top 5 reasons for the previous motor/gearbox agitators hardware failures, are they due to chemical corrosion, mechanical design issues, or other reasons?
Postmortem of all previous hardware failures that currently exist giving top 5 reasons for failure.
(1) Complete set of drawings and detailed final Bill of Materials

(1) Well-written operation/maintenance manual including dissasembly/assembly instructions

-Team will present a summary report on assigned and assimilated benchmarking activities sometime during weeks 3-5. Successful completion of this project requires a solid understanding of the basic operational characteristics of solid mechanics, machine design, kinematics, mechanical/chemical failure analysis, and chemical corrosion. Student will acquire this knowledge via lecture, reading, observation, and experimentation.

-Team will conduct (2) Project Reviews during MSD 1. A system level review will be held sometime during weeks 4-6, The failure analysis of the previous devices will be a mandatory component of this first review, along with several proposed new agitator designs. A detailed design review will be held sometime during weeks 7-9.

-Team will conduct a final week 11 review with their Guide.

-Team members will supply Peer Evaluations at the end of weeks 3, 6, 9 per guide's direction.

-Intellectual Property (IP) considerations:
Note that it must be clearly stated to the customer that all information that is posted on SR. design group's EDGE website is publicly available.

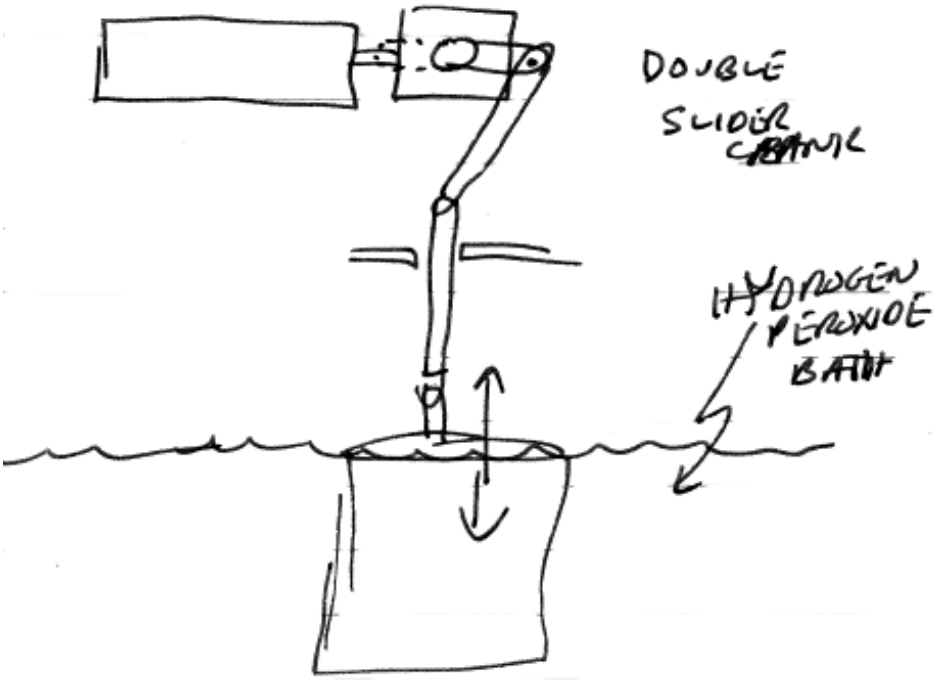

Figure 1: schematic of current agitation system. Note that a single gear reduced motor is used to drive two sets of blanks.

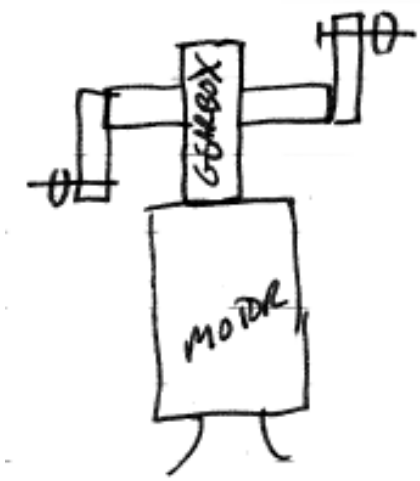

Figure 2: current motor gearbox setup driving two slider cranks agitation mechanisms (top-view)

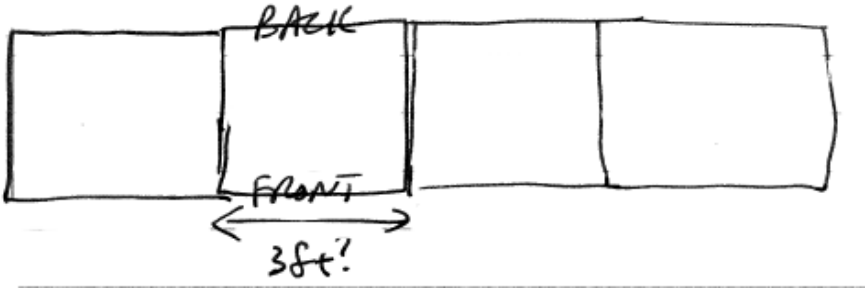

Figure 3: Layout of agitation tanks (top-view)

DETAILED PROJECT DESCRIPTION:

- Customer Needs and Objectives: (1: most important, 3: least important)

Customer Need #	Importance	Description
CN1	1	Increase reliability of the agitator
CN2	1	Determine the reasons for previous agitator failures
CN3	1	Produce an improved prototype agitator
CN4	1	Design and perform an instrumented accelerated lifetime componont test
CN5	2	Collect data on the current agitator set-up
CN6	2	Interpret data from tests
CN7	1	Document prototype designs so it can be replicated by customer
CN8	2	New prototype is easy to maintain
CN9	3	New prototype looks great

Specifications (or Engineering/Functional Requirements):

	Source	Function	Specification (metric)	Ideal Value	Unit of Measure	Marginal Value
S1		System	Area footprint	1x3	ft	3x3
S2		System	System height	<2	Ft.	5
S3		System	System cost	2500	$	
S4		System	Agitation period	2	Sec	2.5
S5		System	Stroke length	Unkown	m	
S6		System	Motor horsepower	Minimize	Hp	1/2
S7		System	Maximum load on crankshaft	Unknown	N*m	
S8		System	mass of blank sets to be agitated	1?	kg	
S9		System	Estimated time between failures	7	Years	5
S10		System	Estimated time between maintenance (no longer than 10min.)	1	Year	0.75
S11		System	Number of stacks agitated	2	integer	2
S12		System	Cycle period	2	S	Unknown
S13		System	Maximum acceleration of stack	Same as current	m/s^2	1.2*current max accel

- Other Information: *Describe potential benefits and liabilities, known project risks, etc.*

- Continuation Project Information, if appropriate: *Include prior project(s) information, and how prior project(s) relate to the proposed project.*

STUDENT STAFFING:

Discipline	How Many?	Anticipated Skills Needed
ME	3	ME1: Kinematics engineer: Design of mechanism to transfer motion from gearbox to moving blanks up and down. Model of loads seen by blanks moving through the fluid. ME2:Motor/Gearbox engineer, responsible for motor and gearbox selection and determining failure modes of existing historical gearboxes. ME3:Testing Engineer, Data collection and failure modes engineer, accelerated lifetime test design.
CHEME	1	CHEME1: Corrosion engineer: responsible for determining the materials to be used to achieve a lifetime of 5 years without maintenance due to corrosion or contamination of agitation bath. Also responsible for examining previous corrosion rates on failed items.

OTHER RESOURCES ANTICIPATED:

Category	Description	Resource Available?
Faculty		☐
Environment	**MSD Design Center**	☒
	EE Senior Design lab	☒
	Machine Shop & Brinkman lab	☒
Equipment		☐
		☐
		☐
Materials		☐
		☐
		☐

Other		☐
		☐
		☐

Prepared by: Mario Gomes Date: 8/16/12