

**INTRODUCTION:**

*The primary objective of this Project Readiness Package (PRP) is to describe the proposed project by documenting requirements (customer needs and expectations, specifications, deliverables, anticipated budget, skills and resources needed, and people/ organizations affiliated with the project. This PRP will be utilized by faculty to evaluate project suitability in terms of challenge, depth, scope, skills, budget, and student / faculty resources needed. It will also serve as an important source of information for students during the planning phase to develop a project plan and schedule.*

*In this document, italicized text provides explanatory information regarding the desired content. If a particular item or aspect of a section is not applicable for a given project, enter N/A (not applicable). For questions, contact Mark Smith at 475-7102, [mark.smith@rit.edu](mailto:mark.smith@rit.edu).*

**ADMINISTRATIVE INFORMATION:**

- Project Name (tentative): Fuser Bearing Life Measurement System Revisited
- Project Number, if known: P13505
- Preferred Start/End Quarter in Senior Design:  
 Fall/Winter     Fall/Spring     Winter/Spring
- Faculty Champion: *(technical mentor: supports proposal development, anticipated technical mentor during project execution; may also be Sponsor)*

Name	Dept.	Email	Phone
Bill Nowak	MSD	<a href="mailto:wjnddm@rit.edu">wjnddm@rit.edu</a>	(585) 259-2210

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

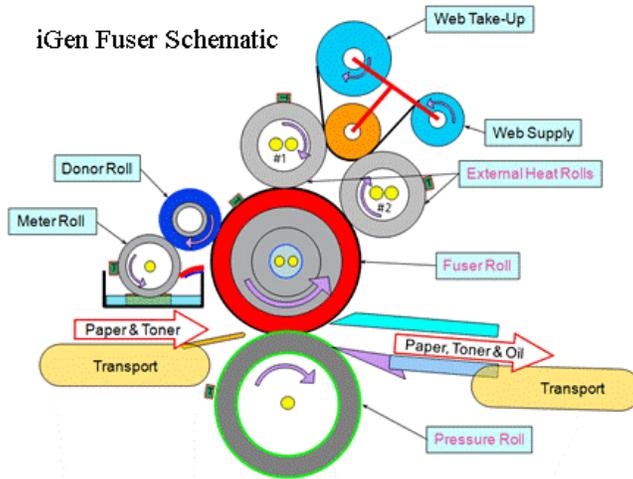
Name	Dept.	Email	Phone
Dr. Jason Kolodziej	ME	<a href="mailto:jrkeme@rit.edu">jrkeme@rit.edu</a>	

- Project “Guide”: Bill Nowak  
 Adjunct Faculty, RIT [wjnddm@rit.edu](mailto:wjnddm@rit.edu), (585) 259-2210,  
 Principal Engineer, Xerox Corp., [William.Nowak@Xerox.com](mailto:William.Nowak@Xerox.com), (585) 422-4822
- Primary Customer: Erwin Ruiz  
 Xerox Corporation, [Erwin.Ruiz@Xerox.com](mailto:Erwin.Ruiz@Xerox.com), (585) 422-8543
- Sponsor(s): *(provider(s) of financial support)*

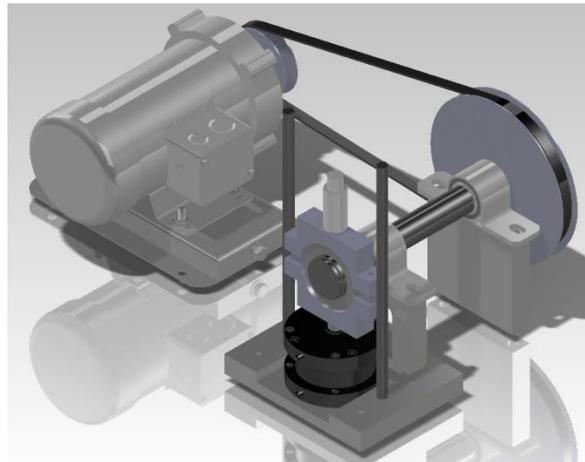
Name/Organization	Contact Info.	Type & Amount of Support Committed
Donald Bott/ Xerox Corp.	<a href="mailto:Donald.Bott@Xerox.com">Donald.Bott@Xerox.com</a>	\$1.5K (min) to \$3.0K (max)

**PROJECT OVERVIEW:**

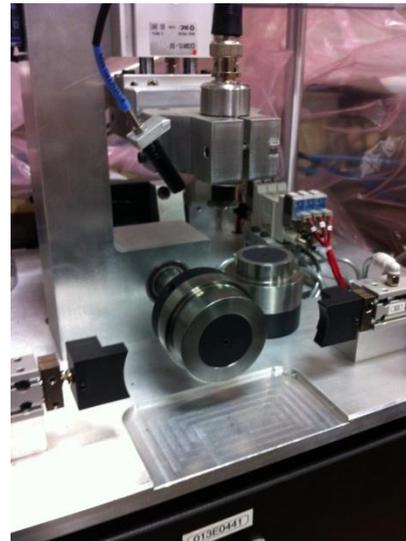
Printers are complex pieces of machinery that include many parts that all move together to get the most precise image quality possible. The Xerox Corporation has been a leader in the printer and copier industry, paralleled by none in terms of quality and durability. The fuser roll in the production iGen printer sees many different forces and loads as the printer runs its cycle. The heat rolls apply heat to the fuser, while the pressure roll applies the force needed to secure the image to the paper. All these loads are seen by the bearings that support the fuser roll, one on each side of the roll. As the fuser rolls come back for remanufacturing every 200,000 prints, there is no quantitative approach to determine if the bearings need to be replaced when the fuser is rebuilt with new fuser rolls. As a result, many bearings that could have been reused were scrapped, leading to wasted money and resources. Replacement cost of the two bearings adds ~\$200 in cost to a single fuser rebuild which could occur to a single iGen fuser unit as many as 5 times resulting in an \$1000 of potentially unnecessary cost over the life of a fuser.



Xerox would like a Senior Design Team to come up with a measurement system design to measure bearing life parameters under representative loading conditions in order to “pass” or “fail” an already used bearing for the next fuser rebuild. The Design Team will evaluate the efforts of P11511 with their design schematically shown below, and develop an improved measurement system design with improve performance to meet customer needs.



Xerox would also like this Senior Design Team to familiarize with as well as utilize a pre-existing bearing measurement system (see below) which Xerox has purchased for bearing measurement to determine whether data acquired from this system is representative of passing or failing used bearings for subsequent rebuilds. As part of testing both the Team’s measurement system design as well as the pre-existing bearing measurement system shown below, Xerox would like the Senior Design Team to perform a Measurement System Analysis of both measurement systems to determine if either or both systems are reliably predictive of bearing life and re-use.



**DETAILED PROJECT DESCRIPTION:**

The goal of this section is provide enough detail for faculty to assess whether the proposed project scope and required skills are appropriate for 5<sup>th</sup> year engineering students working over two quarters. The sequence of the steps listed below may depend on your project, and the process is usually iterative, so feel free to customize. Emphasis is on the “whats” (qualitative and quantitative), not the “hows” (solutions), except for the section on “potential concepts,” which is necessary to assess the appropriateness of required skills and project scope. Not all of the information in this section may be shared with students. (Attach extra documentation as needed).

• **Customer Needs and Objectives:**

Need #	Import 9,3,1	Description	Comment/Status
CN1		Need to measure bearing life	
CN2		Need to measure a signal from test fixture	
CN3		Need to understand how the acoustic system measures bearing life	
CN4		Need to “pass” or “fail” bearing	
CN5		Need to qualify accuracy/repeatability of acoustic measurement system	Meas. Sys. Analysis
CN6		Need to qualify accuracy/repeatability of Senior Design Team measurement system	Meas. Sys. Analysis
CN7		Need to determine pass/fail quickly	
CN8		Need to determine pass/fail accurately	
CN9		Need to determine what measurement quantity is most representative	Sound, vibration, temperature rise, other?
CN10			
CN11			
CN12			
CN13			
CN14			
CN15			

- **Functional Decomposition:** Functions and sub-functions (verb-noun pairs) that are associated with a system/solution that will satisfy customer needs and objectives. Focus on “what” has to be achieved and not on “how” it is to be achieved – decompose the system only as far as the (sub) functions are solution independent. This can be a simple function list or a diagram (functional diagram, FAST (why-how) diagram, function tree).
- **Potential Concepts:** Generate a short list of potential concepts (solutions) to realize the system and associated functions. This may involve benchmarking or reverse engineering of existing solutions. For each concept and its associated function(s), generate a list of key tasks or skills needed to design and realize the function(s), and identify which disciplines (ME, EE, CE, ISE, ...) are likely to be involved in the design and realization of the function(s). See the “PRP Checklist” document for a list of student skills by department. **Potential concepts, skills, and tasks should not be shared with students.**
- **Specifications (or Engineering/Functional Requirements):** Translates “voice of the customer” into “voice of the engineer

Spec. #	Import. 9,3,1,0	Source	Function	Specification (metric)	Unit of Measure	Marginal Value	Ideal Value	Comments/Status
S1								
S2								
S3								
S4								
S5								
S6								
S7								
S8								
S9								
S10								
S11								
S12								
S13								
S14								
S15								

- **Constraints:** *External factors that, in some way, limit the selection of solution alternatives. They are usually imposed on the design and are not directly related to the functional objectives of the system but apply across the system (eg. cost and schedule constraints). Constraints are often included in the specifications list but they often violate the abstractness property by specifying “how”.*
- **Project Deliverables:**
  1. A new/improved bearing measurement system.
  2. An operational understanding of a Xerox supplied bearing measurement system.
  3. A Measurement System Analysis of each measurement system to predictive reliability of bearing life and re-use.
  4. Operating/User manuals of each measurement system.
- **Budget Estimate:** \$1.5K (min) to \$3.0K (max).
- **Intellectual Property (IP) considerations:**  
The Xerox iGen printing product is a launched product and currently in the public domain. It is well known that iGen fusers are refurbished over the life of an iGen printer.
- **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:**

- **Skills Checklist:** *Complete the “PRP\_Checklist” document and include with your submission.*
- **Anticipated Staffing Levels by Discipline:**

Discipline	How Many?	Anticipated Skills Needed ( <i>concise descriptions</i> )
EE		
ME	4 to 5	Mechanical vibrations, solid body mechanics, motion control, structural mechanics.

CE		
ISE	1 (?)	Design of Experiments as applied to Measurement System Analyses (could also be ME)
Other		

**OTHER RESOURCES ANTICIPATED:**

*Describe resources needed to support successful development, implementation, and utilization of the project. This could include specific faculty expertise, laboratory space and equipment, outside services, customer facilities, etc. Indicate if resources are available, to your knowledge.*

Category	Description	Resource Available?
<b>Faculty</b>		<input type="checkbox"/>
		<input type="checkbox"/>
<b>Environment</b>	<b>Dedicated workbench space in the Senior Design Center</b>	<input type="checkbox"/>
		<input type="checkbox"/>
<b>Equipment</b>	<b>Life measurement system to be loaned by Xerox for Winter &amp; Spring quarter</b>	<input type="checkbox"/>
		<input type="checkbox"/>
<b>Materials</b>		<input type="checkbox"/>
		<input type="checkbox"/>
<b>Other</b>		<input type="checkbox"/>

Prepared by: Bill NowakDate: 11/25/12