

**Department of Transportation  
Federal Railroad Administration**

**1INFORMATION COLLECTION SUPPORTING STATEMENT  
Design and Evaluation of a Robust Manual Locomotive Operating Mode  
OMB CONTROL NUMBER 2130-NEW**

Summary of Submission

- This information collection request is a new submission. The proposed assessment is intended to identify and evaluate the potential for human error within the operation of system and automation in locomotive cabs.
- The estimated total number of burden hours requested for this submission is 270 hours.
- The estimated total number of responses for this submission is 30.
- The required 60 and 30 Day Federal Register Notice were published in the Federal Register on May 2, 017 (see 82 FRA 20530) and September 13, 2017 (see 82 FRA 43078), respectively.

**INTRODUCTION**

This is to request the Office of Management and Budget’s (OMB) to issue a three-year approved clearance for the information collection entitled, “Design and Evaluation of a Robust Manual Locomotive Operating Mode.”

**Part A. Justification**

**1. Circumstances that make the collection of information necessary.**

The purpose of this work study is to design and evaluate a prototype locomotive operating mode that allows an operator to “manually” control a train by providing a desired speed target while the control system determines the notch changes required. This research addresses the DoT strategic goal of safety. Particular statutes, legal or administrative requirements are not applicable.

**2. How, by whom, and for what purpose is the information to be used.**

Information collected from this research will be used by GE researchers and equipment designers to study merit in a prototype display and control configuration that maximizes both use of automation and human capabilities. The information will assist the Federal government in recommending display design requirements to the rail industry for future displays. The results may help design future displays and controls for locomotives.

Simulator-Laboratory research. The work will be conducted through a contracted research organization responsible for experimental design, recruitment of human subjects, conduct and analysis of the research. The proposed work has three phases.

In the first phase, the research team will work to design a speed controller which is robust to communications delay and predictive user interface which both takes input from an online operator intent model and the control system and allow the operator to provide guidance to the control system.

The second phase will include upgrading and preparing the Cab Technology Integration Lab (CTIL), a full-sized locomotive cab simulator in Cambridge, Mass., with the prototyped speed controller display, for the study that will take place in the final phase using human subjects.

In the final phase, locomotive crew will be used to evaluate the control schemes and predictive user interface under varying communications delays. In the final phase, human subjects testing and data analysis will be accomplished through various experimental conditions compared empirically using a set of scenarios in a realistic simulation environment (the CTIL). University students will be recruited for the apprentice group and current or former freight train engineers for the experienced group will be recruited from railroads and operating unions. Each group of compensated volunteers will perform the scenarios with and without the predictive display and speed input cases. The NASA-TLX subjective workload questionnaire, a very short questionnaire administered while in the simulator, is expected to be used to confirm workload measures.

**The purpose of this research study is not to make recommendations or regulations. It is to explore the feasibility of and the human performance effects of new cab technologies.**

### **3. Extent of automated information collection.**

Automated event logs from the simulator and videos of the crew (overview of the cab, and from behind), the engineer, views of the displays of the locomotive automated systems, and eye-tracking data. No other form of automated data collection is planned or needed.

### **4. Describe efforts to identify duplication.**

The concept of collaborative control systems is a relatively new concept with few systems having been studied from a human factors perspective. In particular, there are no known implementations or human factors studies of collaborative control systems for the rail domain

### **5. Efforts to minimize the burden on small businesses.**

Not applicable. Laboratory research being conducted.

### **6. Impact of less frequent collection of information.**

Not applicable. Laboratory research being conducted.

**7. Special Circumstances.**

No special circumstances. Not applicable. Laboratory research being conducted.

**8. Compliance with 5 CFR 1320.8(d).**

The required 60 and 30 Day Federal Register Notice were published in the Federal Register on May 2, 017 (see 82 FRA 20530) and September 13, 2017 (see 82 FRA 43078), respectively. See 82 FR 18341.

FRA received a comment from the Association of American Railroads (AAR) concurring with the conduct of this study. The FRA responded with a memo to the AAR acknowledging agreement on the merits of this research. The FRA will hold periodic meetings with the AAR for updates on the progress of this research. The AAR will host a meeting with the FRA to discuss other areas of AAR interest in automation research.

**9. Payment or gifts to respondents.**

The participants will be compensated via gift cards commensurate with typical daily wage. For expert participants (i.e., locomotive engineers), the U. S. Bureau of Labor Statistics estimates average salary of \$61,020 annually (see [BLS Statistics](#)), \$235/weekday. The novice population will likely be drawn from the MIT student population. Graduate teaching/research assistants at MIT typically earn \$33,000/year or about \$125/day. In the event that expert participants will remain compensated by their employer for the course of the study (as was the case in our previous study) a nominal amount (e.g., \$50) will be given. Total estimated maximum cost is then \$5,950 (10\*\$125 + 20\*\$235) and may be as low as \$2,250

**10. Assurance of confidentiality.**

The research will be presented to an independent/institutional review board for approval as required by 45 CFR 46. The review is required as protection from harm and confidentiality of human subjects of biomedical and behavioral research. Identity of human subjects is not reported. Performance of human subjects in the simulator laboratory is kept anonymous. No laboratory research involving human subjects will be conducted without this approval.

**11. Justification for collection of sensitive information.**

Not applicable. No sensitive information to be collected.

**12. Estimate of burden hours for information requested.**

	Respondent Universe	Total Annual Responses	Average Time per Response	Total Annual Burden Hours
Simulator Experience	30 Engineers and college students (10 college students, and 20 engineers)	30	9.06 hours  (3.0 hrs training, 6 hour experiment session including 2 hours for NASA TLX)	272 hours

Hours training and simulator familiarity 3.0 hrs training x 30 subjects = 90 hours  
 Experimental sessions in the simulator: 6.0 hour sessions x 30 subjects = 180 hours  
 NASA-TLX completions: 1 min x 4 scenarios x 30 subjects = 120 min. or 2 hours

Per the Bureau of Labor and Statistics, Occupational Employment and Wages, May 2016, (53-4099) Rail Transportation Workers, All Others, the median hourly wage is \$29.05 per hour. Therefore, the cost would be \$29.05 x 270 hours = \$7,843.50. This is an estimated cost. The actual cost will vary based upon current locomotive engineer wages.

**13. Estimate of the total annual costs burden.**

The total burden based on likely average participant salaries as discussed above in question 9 is at most \$5,950 and will be fully compensated by the study incentives.

**14. Estimates of costs to the Federal Government.**

The total estimated cost to the Government to complete the 2-year study is \$990,000 under a cost-share agreement with the researchers to design and develop the prototype system in the first year and to test and evaluate (with human subjects) in the second year.

Per question 9 above, included in the total cost to the government, there will be a payment to the participants in the estimated amount of \$235 for expert subjects and \$125 for novice subjects.

**15. Explanation of the program change or adjustments.**

Not applicable. No changes or adjustments needed.

**16. Publication of results of data collection.**

Not applicable. Laboratory research being conducted. Results will be published as FRA technical reports.

**17. Approval for not displaying the expiration date of OMB approval.**

None needed. Not applicable.

18. **Exceptions to the certification statement.**

None. Not applicable.