

**Department of Transportation  
Federal Railroad Administration**

**1 INFORMATION COLLECTION SUPPORTING STATEMENT  
Design and Evaluation of a Robust Manual Locomotive Operating Mode  
OMB CONTROL NUMBER 2130-0623**

Summary of Submission

- This information collection renewal is an extension w/out change as there are no programmatic changes just general adjustments.
- The estimated total number of burden hours requested is 273 hours.
- The estimated total number of responses changed from 30 to 90, as a better breakout of participate activities was completed.

**INTRODUCTION**

This is to request renewal from 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 continue 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 statues, 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 designed 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 included 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, which has yet to be completed, 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 Federal Register Notice were published in the Federal Register on October 5 2020 (see 85 FR 62797). FRA received no comments.

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

The participants will be compensated via gift cards commensurate with a typical wage. For expert participants (i.e., locomotive engineers), the U. S. Bureau of Labor Statistics estimates medium hourly wage of \$32.26 per hour. The novice population will likely be drawn from the MIT student population. Graduate teaching/research assistants at MIT typically earn approximately \$12.00 per hour. 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. Therefore, the cost would be  $\$32.26 \times 182 \text{ hours} = \$5,871.32$  and  $\$12.00 \times 91 \text{ hours} = 1,092$  for a total of \$6,963.32. This is an estimated cost.

**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.**

	Total Annual Responses	Average Time (hours)	Total Annual Burden Hours	Total Annual Dollar Cost Equivalent*
Simulator Familiarity and Training - Engineers	20	3	60.00	\$1,935.60
Simulator Familiarity and Training - College Students	10	3	30.00	\$360.00
Experimental Sessions in Simulator - Engineers	20	6	120.00	\$3,871.20
Experimental Sessions in Simulator - College Students	10	6	60.00	\$720.00
NASA-TLX Completions (Questionnaire) - Engineers	20	0.1	2.00	\$64.52
NASA-TLX Completions (Questionnaire) - College Students	10	0.1	1.00	\$12.00
<b>TOTAL</b>	<b>90.00</b>	<b>18.20</b>	<b>273.00</b>	<b>\$6,963.32</b>

*\* Per the Bureau of Labor and Statistics, Occupational Employment and Wages, May 2019, (53-4011) Locomotive Engineers, the median hourly wage is \$32.26 per hour. The minimum wage, as of September 2020, for Massachusetts is \$12.00 per hour. Therefore, the cost would be  $\$32.26 \times 182 \text{ hours} = \$5,871.32$  and  $\$12.00 \times 91 \text{ hours} = 1,092$  for a total of \$6,963.32. This is an estimated cost. The actual cost will vary based upon current locomotive engineer wages. 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 is based on likely average participant salaries as discussed above in question 12 and is at most \$6,693.32 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 this 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 \$100 for novice subjects.

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

While there were no program changes, the estimated total number of responses changed from 30 to 90, as a better breakout of participant activities was completed. Additionally, the total burden hours increased by 1 hour due to rounding of time it is anticipated to take the participants to complete each individual activity.

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

Results will be published as a FRA technical reports. The timeframe for a final publication has not been determined.

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

None needed. Not applicable.

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

None. Not applicable.