REQUEST FOR APPROVAL under the Generic Clearance for NASA Education Performance Measurement and Evaluation, OMB Control Number 2700-0159, expiration 04/20/2018

I. TITLE OF INFORMATION COLLECTION:
NASA Office of Education STEM Challenges Impact Surveys: Educator Retrospective Instrument

II. TYPE OF COLLECTION:

- ☑ Attitude/Behavior Scale
- ☐ Baseline Survey
- ☐ Cognitive Interview Protocol
- ☐ Consent Form
- ☐ Focus Group Protocol
- ☐ Follow-up Survey
- ☐ Instructions
- ☑ Satisfaction Survey
- ☐ Usability Protocol

GENERAL OVERVIEW: NASA Office of Education Science, Technology, Engineering, and Mathematics (STEM) Engagement line of business activities are designed to provide opportunities for participatory and experiential learning activities that connect learners to NASA-unique resources. NASA Education's STEM Engagement line of business activities are based on best practices in motivation, engagement, and learning in formal and informal settings and include the following areas:

- ***Public Education Activities*** that foster interactions with learners of all ages to spark an interest in STEM disciplines using NASA-unique materials and resources. These may be part of a larger public event and are often shorter in duration than Experiential Learning Opportunities and STEM Challenges. Public Education Activities often require close coordination with the NASA Office of Communications.
- ***Experiential Learning Opportunities*** that enable learners to acquire knowledge, understand what they have learned, and apply that knowledge through inquiry-based and project-based activities. NASA opportunities include participatory activities designed to increase involvement, knowledge, understanding/comprehension, and application of learning in one or more STEM disciplines using NASA's resources.
- ***STEM Challenges*** that provide creative applications of NASA-related science, technology, engineering, mathematics, and cross-cutting concepts. They challenge existing assumptions and encourage learners to demonstrate their knowledge of STEM subjects while enhancing innovation, critical thinking, and problem-solving skills. (nasa.gov, 2016)

This baseline instruments information collection is specific to determining the impact of engineering design and scientific research STEM Challenge activities on middle school students (grades 5 through 8, depending on the school system of record in the U.S.)

III. INTRODUCTION AND PURPOSE: STEM Challenge activities are based on best practices in motivation, engagement, and learning for students and educators in formal and informal settings (e.g., Farland-Smith, 2012; Gasiewski, Eagan, Garcia, Hurtado, & Change, 2012; Kim, et al., 2015; Leblebicioglu, Metin, Yardimci, & Cetin, 2011; Maltese & Tai, 2011. The constructs of interest for these baseline surveys are the engineering design and scientific research processes. In a NASA engineering design challenge (EDC) activity, the focus is a design task in which students must meet certain criteria through

a series of steps that engineers follow to arrive at a solution to a problem. This engineering problem is within the context of NASA-unique content and subject matter experts. Similarly, in an a scientific research challenge (SRC) activity, students are connected with opportunities to participate in science data collection by conducting real, hands-on science according to the scientific method, a body of techniques for investigating phenomena, acquiring new knowledge in an empirical or measurable manner, and then correcting and/or integrating previous knowledge subject to specific principles of scientific reasoning.

While other related surveys explore our interest in understanding why, how, and in what ways students are impacted in the short-, intermediate, and long-term by participation in STEM Challenge activities with an engineering design or scientific research process focus, these instruments explore impact on educators. Thus, the purpose for pilot testing is to develop valid instruments that reliably explain the ways in which educator participants' attitudes and behaviors are impacted by participation in these challenge activities. Guided by the most current STEM education and measurement methodologies, it is the goal of this rigorous instrument development and testing procedure to provide information that becomes part of the iterative assessment and feedback process for the NASA STEM Engagement line of business.

Hence, the goals of this cycle of pilot testing are as follows:

- Determine clarity, comprehensibility, and preliminary psychometric properties (e.g., validity, reliability) of these instruments. And, to explore individual item functioning, and to make any necessary adjustments in preparation for large-scale testing as the basis for more sophisticated statistical testing.
- Determine an accurate response burden for these instruments.

IV. RESEARCH DESIGN OVERVIEW: NASA Education is pilot testing a retrospective survey and a short version of the survey. Despite the absence of a control group, the retrospective design can still yield strong causal effects when effort is made to satisfy requirements of quasi-experimentation such as identifying and reducing the plausibility of alternative explanations for the intervention- as- treatment effect (Shadish, Cook, & Campbell, 2002), identifying conceivable threats to internal validity, and statistically probing likelihood of treatment-outcome covariation (Mark & Reichardt, 2009).

Empirical research (e.g., Howard, 1980; Drennan & Hyde, 2008; Nimon, 2014) suggests that a retrospective pretest (then-test) may provide a more accurate pre-intervention measure than a traditional pretest if it happens that respondents change their perceptions of their initial level of functioning as a consequence of the intervention. In other words, respondents change their internal standards of measurement having gained in experience or familiarity with the self-rating dimension(s) (Nimon, 2014). According to Norman (2003), "[r]esponse shift theory presumes that [participants'] prior state is adjusted in retrospective judgment on the basis of new information acquired in the interim, so that the retrospective judgment is more valid" (p. 243). The statistical manifestation of rating oneself on a different dimension or metric at post-test results in a mismatch between pre- and post-test scores known as response shift bias (Goedhart & Hoogstraten, 1992). The retrospective pretest is considered to be a valid assessment tool when respondents cannot be expected to know what they do not know at the onset of an intervention (Pelfrey and Pelfrey, 2009). Such may be the case with respondents who are participating in a NASA activity and/or are completing an attitude and behavior or knowledge survey for the very first time.

Following this pilot phase of testing and subsequent determination of instrument psychometric properties, indeed NASA Education has tentative research questions and hypotheses to test regarding the impact of challenge activity training on NASA STEM Challenge educator participants. Thus, this work is integral to the iterative assessment and feedback process for the NASA STEM Engagement line of business.

V. TIMELINE: Pilot testing of surveys will take place approximately September 1, 2016 through February 28, 2017, coordinated with the implementation periods of the STEM Challenge activities.

VI. SAMPLING STRATEGY: Since the number of educator participants is 200 or below, NASA Education will administer surveys for testing to the census of educator participants.

Table 1. *Calculation chart to determine statistically relevant number of respondents*

Data Collection Source	(N) Population Estimate for FY16	(A) Sampling Error +/- 5% (.05)	(Z) Confidence Level 95%/ Alpha 0.05	(P) *Variability (based on consistency of intervention administration) 50%	Base Sample Size	Response Rate	(n) Number of Respondents
EDC Educators	200	N/A	N/A	N/A	200	N/A	200
SRC Educators	10	N/A	N/A	N/A	10	N/A	10
TOTAL							**210**

VII. BURDEN HOURS: Burden calculation is based on a respondent pool of individuals as follows:

Data Collection Source	Number of Respondents	Frequency of Response	Total minutes per Response	Total Response Burden in Hours
EDC Educators	200	1	20	67*
SRC Educators	10	1	20	3
TOTAL				**70**

*If the decision is made to test the short version of the Educator instrument, then the total response burden will be lower.

VIII. DATA CONFIDENTIALITY MEASURES: Any information collected under the purview of this clearance will be maintained in accordance with the Privacy Act of 1974, the e-Government Act of 2002, the Federal Records Act, and as applicable, the Freedom of Information Act in order to protect respondents' privacy and the confidentiality of the data collected.

IX. PERSONALLY IDENTIFIABLE INFORMATION:

1. Is personally identifiable information (PII) collected? ☑Yes ☐ No

2. If yes, will any information that is collected by included in records that are subject to the Privacy Act of 1974? ☑Yes ☐ No

3. If yes, has an up-to-date System of Records Notice (SORN) been published?
☑Yes ☐ No

Published March 17, 2015, the Applicable System of Records Notice is NASA 10EDUA, NASA Education Program Evaluation System - http://www.nasa.gov/privacy/nasa_sorn_10EDUA.html.

APPLICABLE RECORDS:

4. Applicable System of Records Notice: SORN: NASA 10EDUA, NASA Education Program Evaluation System - http://www.nasa.gov/privacy/nasa_sorn_10EDUA.html

5. Completed surveys will be retained in accordance with NASA Records Retention Schedule 1, Item 68D. Records will be destroyed or deleted when ten years old, or no longer needed, whichever is longer.

X. PARTICIPANT SELECTION APPROACH:

1. Does NASA Education have a respondent sampling plan? ☑Yes ☐ No

If yes, please define the universe of potential respondents. If a sampling plan exists, please describe? The universe of potential respondents is the census of educator participants in the engineering design and scientific research STEM Challenge activities.

If no, how will NASA Education identify the potential group of respondents and how will they be selected? Not applicable.

XI. INSTRUMENT ADMINISTRATION STRATEGY

Describe the type of Consent: ☐ Active ☑ Passive

6. How will the information be collected:

☑ Web-based or other forms of Social Media (95%)
☐ Telephone
☐ In-person
☐ Mail
☑ Other (5%)

If multiple approaches are used for a single instrument, state the projected percent of responses per approach. The feedback forms will be administered via the web. Because it is preferable that all baseline surveys be administered at the start of an activity, hard copy surveys will be made available to collect survey responses in the event web access is temporarily unavailable. In the past, no more than 5% of respondents were asked to complete hard copy surveys due to internet or computer difficulties.

7. Will interviewers or facilitators be used? ☐ Yes ☑ No

XII. DOCUMENTS/INSTRUMENTS ACCOMPANYING THIS REQUEST:

☐ Consent form
☑ Instrument (attitude & behavior scales, and surveys)
☐ Protocol script
☐ Instructions NOTE: Instructions are included in the instrument
☐ Other (Specify _____)

XIII. GIFTS OR PAYMENT: ☐ Yes ☑ No If you answer yes to this question, please describe and provide a justification for amount.

XIV. ANNUAL FEDERAL COST: The estimated annual cost to the Federal government is $168. The cost is based on an annualized effort of 4 person-hours at the evaluator's rate of $42/hour for administering the survey instruments, collecting and analyzing responses, and editing the survey instruments for ultimate approval through the methodological testing generic clearance with OMB Control Number 2700-0159, exp. 04/30/2018.

XV. CERTIFICATION STATEMENT:

I certify the following to be true:

1. The collection is voluntary.
2. The collection is low burden for respondents and low cost for the Federal Government.
3. The collection is non-controversial and does raise issues of concern to other federal agencies.
4. The results will be made available to other federal agencies upon request, while maintaining confidentiality of the respondents.
5. The collection is targeted to the solicitation of information from respondents who have experience with the program or may have experience with the program in the future.

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Date: 10/21/2016

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