

111<sup>TH</sup> CONGRESS  
2<sup>D</sup> SESSION

# H. R. 4709

To award planning grants and implementation grants to State educational agencies to enable the State educational agencies to complete comprehensive planning to carry out activities designed to integrate engineering education into K–12 instruction and curriculum and to provide evaluation grants to measure efficacy of K–12 engineering education.

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## IN THE HOUSE OF REPRESENTATIVES

FEBRUARY 25, 2010

Mr. TONKO (for himself, Mr. HARE, Mr. HONDA, Ms. NORTON, and Mr. SIRES) introduced the following bill; which was referred to the Committee on Education and Labor

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## A BILL

To award planning grants and implementation grants to State educational agencies to enable the State educational agencies to complete comprehensive planning to carry out activities designed to integrate engineering education into K–12 instruction and curriculum and to provide evaluation grants to measure efficacy of K–12 engineering education.

1       *Be it enacted by the Senate and House of Representa-*  
2       *tives of the United States of America in Congress assembled,*

1 **SECTION 1. SHORT TITLE.**

2 This Act may be cited as the “Engineering Education  
3 for Innovation Act” or the “E<sup>2</sup> for Innovation Act”.

4 **SEC. 2. FINDINGS.**

5 Congress finds the following:

6 (1) There is a national concern that the Na-  
7 tion’s preeminence in science and innovation is erod-  
8 ing. According to the National Science Board’s 2010  
9 Science and Engineering Indicators, only 5 percent  
10 of college graduates in the United States major in  
11 engineering, compared with 12 percent of European  
12 students and 20 percent of those in Asia. The report  
13 also notes that the performance of elementary and  
14 secondary school students in the United States lags  
15 behind many nations on international assessments of  
16 mathematics and science.

17 (2) While women earn 58 percent of all bach-  
18 elor’s degrees, they constitute only 18.5 percent of  
19 bachelor’s degrees awarded in engineering.

20 (3) African-Americans earn only 4.6 percent of  
21 bachelor’s degrees awarded in engineering and His-  
22 panics earn only 7.2 percent.

23 (4) The introduction of engineering education  
24 has the potential to improve student learning and  
25 achievement in science and mathematics, increase  
26 awareness about what engineers do and of engineer-

1       ing as a potential career, and boost students’ techno-  
2       logical literacy, according to a new report, “Engi-  
3       neering in K–12 Education” from the National  
4       Academy of Engineering (NAE) and the National  
5       Research Council (NRC).

6               (5) The report described in paragraph (4) also  
7       identifies the following 3 core principles for K–12  
8       engineering education:

9                       (A) Emphasize engineering design process.

10                      (B) Incorporate important and develop-  
11       mentally appropriate mathematics, science, and  
12       technology knowledge and skills.

13                      (C) Promote engineering habits of mind in-  
14       cluding systems thinking, creativity, collabora-  
15       tion, communication, and attention to ethical  
16       considerations.

17               (6) While exposure to formal engineering edu-  
18       cation has increased dramatically over the past 15  
19       years, reaching several million K–12 students, most  
20       students in the United States have never experienced  
21       an engineering course or lesson.

22               (7) There is also a lack of diversity in these ex-  
23       isting K–12 engineering education opportunities.  
24       The number of girls and underrepresented minorities  
25       participating in K–12 engineering education does

1 not correspond to their proportion of the general  
2 population.

3 (8) Only a handful of States have integrated  
4 engineering into their core academic K–12 stand-  
5 ards.

6 (9) K–12 engineering education in the United  
7 States is supported by a relatively small number of  
8 curricular and teacher professional development pro-  
9 grams.

10 (10) While science, technology, engineering, and  
11 mathematics education is viewed as a national edu-  
12 cation policy, often the implementation of policies  
13 and initiatives focuses exclusively on mathematics  
14 and science and overlooks the engineering and tech-  
15 nology education components.

16 (11) Schools, policy makers, and other stake-  
17 holders often narrowly refer to the term “techno-  
18 logically literate” as the ability to use educational  
19 technologies. Although educational technology is im-  
20 portant, it is far from the only type of technology we  
21 depend on in a modern society. In 2006, the Na-  
22 tional Academy of Engineering and the National Re-  
23 search Council’s report, “Technically Speaking”,  
24 outlined a broader view of “technological literacy”,  
25 one more consistent with how scientists, engineers,

1 and technologists see the world. In this view, techno-  
2 logical literacy includes—

3 (A) knowledge of technology, the engineer-  
4 ing design process, and impacts on society;

5 (B) critical thinking and decisionmaking  
6 weighing benefits, risks, costs, and tradeoffs;  
7 and

8 (C) capability to use a variety of tech-  
9 nologies, apply the design process, fix simple  
10 technological problems, and obtain and under-  
11 stand information about technological issues.

12 (12) The Standards for Technological Literacy,  
13 developed by the International Technology Edu-  
14 cation Association and passed by a formal review by  
15 the National Academy of Engineering and the Na-  
16 tional Research Council, closely align with the Acad-  
17 emies' concept of technological literacy in paragraph  
18 (11).

19 (13) To support an innovation economy and  
20 maintain our country's vitality and security, we  
21 must expand students' understanding of technology  
22 and engineering and widen the pipeline to careers in  
23 these fields so that a diverse array of talented stu-  
24 dents can pursue them.

1           (14) The Federal Government has an interest  
2           in expanding K–12 engineering and technology edu-  
3           cation. Testing of technological design skills will be  
4           assessed as part of the new National Assessment of  
5           Educational Progress Science 2009 assessment to be  
6           given to students throughout the United States. The  
7           National Assessment Governing Board is currently  
8           developing a National Assessment of Educational  
9           Progress Technological Literacy probe study to be  
10          administered in 2012 that will assess design and  
11          systems, information and communication technology,  
12          and technology and society.

13          (15) To further expand K–12 engineering edu-  
14          cation, this Act seeks to support planning and imple-  
15          menting grants for educational agencies to invest in  
16          programs and activities to integrate engineering edu-  
17          cation into K–12 instruction and curriculum and to  
18          fund research on, and evaluation of, such efforts.

19 **SEC. 3. DEFINITIONS.**

20          In this Act:

21           (1) **HIGH-NEED LOCAL EDUCATIONAL AGEN-**  
22           **CY.**—The term “high-need local educational agency”  
23           means a local educational agency—

1 (A)(i) that serves not fewer than 10,000  
2 children from families with incomes below the  
3 poverty line; or

4 (ii) for which not less than 20 percent of  
5 the children served by the agency are from fam-  
6 ilies with incomes below the poverty line; and

7 (B)(i) for which there is a high percentage  
8 of teachers not teaching in the academic sub-  
9 jects or grade levels that the teachers were  
10 trained to teach; or

11 (ii) for which there is a high percentage of  
12 teachers with emergency, provisional, or tem-  
13 porary certification or licensing.

14 (2) STATE EDUCATIONAL AGENCY.—The term  
15 “State educational agency” includes the State edu-  
16 cational agency in a State in which the State edu-  
17 cational agency is the sole educational agency for all  
18 public schools.

19 (3) TECHNOLOGICAL LITERACY.—The term  
20 “technological literacy”—

21 (A) means the capacity to use, understand,  
22 and evaluate technology as well as to apply con-  
23 cepts and processes to solve problems and reach  
24 one’s goals; and

1 (B) encompasses the 3 areas of technology  
2 and society, engineering design and systems,  
3 and information and communication technology  
4 (as considered by the National Assessment Gov-  
5 erning Board in 2010).

6 **SEC. 4. PLANNING GRANTS.**

7 (a) PROGRAM AUTHORIZED.—

8 (1) IN GENERAL.—The Secretary of Education,  
9 in consultation with the Director of the National  
10 Science Foundation and other relevant heads of  
11 Federal agencies, is authorized to award planning  
12 grants to State educational agencies to enable such  
13 agencies to complete comprehensive planning to  
14 carry out activities designed to integrate engineering  
15 education into K–12 instruction and curriculum.

16 (2) GRANT PERIOD.—A planning grant awarded  
17 under this section shall be for a period of not more  
18 than 2 years.

19 (3) NONRENEWABILITY.—The Secretary of  
20 Education shall not award a State educational agen-  
21 cy more than 1 planning grant under this section.

22 (4) MAXIMUM GRANT AMOUNT.—A planning  
23 grant awarded under this section shall not exceed  
24 \$1,000,000 over the period of the grant.

25 (5) RESERVATION FOR SMALL STATES.—



1           (A) IN GENERAL.—Except as provided in  
2           subparagraph (B), the Secretary of Education  
3           shall reserve not less than 15 percent of the  
4           funds appropriated to carry out this section for  
5           each fiscal year to award grants under this sec-  
6           tion to States with populations of less than  
7           2,600,000 on the date of enactment of this Act.

8           (B) WAIVER.—The Secretary of Education  
9           may waive the 15 percent requirement under  
10          subparagraph (A) after notifying Congress of  
11          such intention.

12         (b) APPLICATION.—

13           (1) IN GENERAL.—Each State educational  
14           agency desiring a planning grant under this section  
15           shall submit an application to the Secretary of Edu-  
16           cation at such time, in such manner, and accom-  
17           panied by such information as the Secretary of Edu-  
18           cation may require.

19           (2) APPLICATION CONTENTS.—Each application  
20           described in paragraph (1), at a minimum, shall—

21           (A) include a description of how the State  
22           educational agency proposes to use the planning  
23           grant funds to develop a plan designed to inte-  
24           grate engineering education into K–12 instruc-  
25           tion and curriculum;

1 (B) describe the roles and responsibilities  
2 of the partners participating in the planning  
3 under this section;

4 (C) provide a budget for the use of the  
5 planning grant funds; and

6 (D) provide such additional assurances and  
7 information as the Secretary of Education de-  
8 termines to be necessary.

9 (c) PARTNERSHIP.—A State educational agency re-  
10 ceiving a planning grant under this section shall complete  
11 comprehensive planning to carry out activities designed to  
12 integrate engineering education into K–12 instruction and  
13 curriculum in coordination with partners, including the  
14 following:

15 (1) The Governor of the State or the designee  
16 of the Governor.

17 (2) Not less than 1 faculty member from a  
18 school of engineering at an institution of higher edu-  
19 cation located in the State.

20 (3) Not less than 1 faculty member from a  
21 school of education at an institution of higher edu-  
22 cation located in the State.

23 (4) Not less than 1 public elementary school ad-  
24 ministrator employed in the State.

1           (5) Not less than 1 public elementary school  
2 teacher employed in the State.

3           (6) Not less than 1 public secondary school ad-  
4 ministrator employed in the State.

5           (7) Not less than 1 public secondary school en-  
6 gineering or technology teacher employed in the  
7 State.

8           (8) Not less than 1 representative of the  
9 science, technology, engineering, and mathematics  
10 business community in the State.

11           (9) Not less than 1 representative from an in-  
12 formal science education center, if available, or a  
13 nonprofit organization with a demonstrated history  
14 of working in engineering education.

15           (10) Not less than 1 representative from a pro-  
16 fessional engineering society or an academy of  
17 science with a chapter or other presence in the  
18 State.

19           (11) Any additional representatives identified  
20 by the State educational agency who possess an ex-  
21 pertise in developing high-quality K–12 engineering  
22 education materials and resources.

23           (d) REQUIRED ACTIVITIES.—A State educational  
24 agency receiving a planning grant under this section shall

1 use the planning grant funds to carry out each of the fol-  
2 lowing activities:

3           (1) REVIEW.—The State educational agency  
4 shall review resources and programs across the State  
5 educational agency and its partners that are relevant  
6 to the objectives of the grant, and coordinate any  
7 new plans and resources under this section with  
8 such existing resources and programs.

9           (2) PLAN.—The State educational agency shall  
10 develop an implementation plan to achieve the objec-  
11 tive of integrating engineering education into K–12  
12 instruction and curriculum. The plan shall include a  
13 description of how the State educational agency will  
14 carry out the following:

15                   (A) Set intermediate and long-term meas-  
16 urable goals.

17                   (B) Develop and implement a coherent  
18 plan for achieving the goals, including the fol-  
19 lowing core set of activities:

20                           (i) An analysis of the State’s existing  
21 K–12 content standards and assessments  
22 to determine—

23                                   (I) the extent to which they ad-  
24 dress the integration of engineering

1 education into K–12 instruction and  
2 curriculum; and

3 (II) the extent to which they  
4 align with workforce and postsec-  
5 ondary expectations.

6 (ii) An analysis of the State’s existing  
7 K–12 engineering education curricula,  
8 which shall include the development of a  
9 baseline analysis of key indicators that  
10 measure—

11 (I) the number and diversity of  
12 students who are exposed to this cur-  
13 ricula, including populations under-  
14 represented in engineering fields, for  
15 example, girls and underrepresented  
16 minorities; and

17 (II) the effectiveness of the cur-  
18 ricula at improving student learning,  
19 including—

20 (aa) increasing under-  
21 standing of engineering;

22 (bb) increasing science, tech-  
23 nology, engineering, and mathe-  
24 matics career aspirations;

1 (cc) increasing technological  
2 literacy skills; and

3 (dd) increasing student  
4 achievement in science, tech-  
5 nology, engineering, and mathe-  
6 matics subjects for all students.

7 (iii) An analysis of the State’s K–12  
8 engineering and technology education  
9 teaching workforce, which shall include the  
10 development of a baseline analysis of key  
11 indicators that measure—

12 (I) the number of K–12 teachers  
13 who received any certificates or cre-  
14 dentials in engineering or technology  
15 education, including the number who  
16 received professional development in  
17 engineering education;

18 (II) the number and types of pre-  
19 service, induction, and professional  
20 development engineering and tech-  
21 nology education programs; and

22 (III) the effectiveness of the iden-  
23 tified preservice, induction, and pro-  
24 fessional development engineering and

1 technology education programs as  
2 they relate to—

3 (aa) increasing under-  
4 standing of engineering;

5 (bb) increasing science, tech-  
6 nology, engineering, and mathe-  
7 matics career aspirations;

8 (cc) increasing technological  
9 literacy skills; and

10 (dd) increasing student  
11 achievement in science, tech-  
12 nology, engineering, and mathe-  
13 matics subjects.

14 (C) Create a plan for ongoing collection  
15 and analysis of data on outcomes, including  
16 progress toward outcomes.

17 (e) SPECIAL RULE.—In the event a State educational  
18 agency declines or does not submit an application under  
19 this section, the Secretary of Education shall provide for  
20 another entity or consortium, with the capacity to carry  
21 out the activities under this section, in partnership with  
22 the partners listed in subsection (c), in such State, to sub-  
23 mit an application.

1 (f) AUTHORIZATION OF APPROPRIATIONS.—There  
2 are authorized to be appropriated to carry out this section  
3 \$12,500,000 for each of fiscal years 2011 through 2015.

4 **SEC. 5. IMPLEMENTATION GRANTS.**

5 (a) PROGRAM AUTHORIZED.—

6 (1) IN GENERAL.—The Secretary of Education,  
7 in consultation with the Director of the National  
8 Science Foundation and other relevant heads of  
9 Federal agencies, is authorized to award grants to  
10 State educational agencies to pay the Federal share  
11 of the cost of implementing innovative, integrative  
12 engineering education initiatives into K–12 instruc-  
13 tion and curriculum.

14 (2) PARTNERSHIP.—A State educational agency  
15 receiving an implementation grant under this section  
16 may partner with such entities (including the enti-  
17 ties listed in section 4(c)) that the State chooses in  
18 order to carry out the activities described in this sec-  
19 tion.

20 (b) MINIMUM AMOUNT.—The Secretary of Education  
21 shall award a grant under this section in an amount that  
22 is not less than \$10,000,000, or a comparably sufficient  
23 amount relative to the amounts appropriated to carry out  
24 this section. Such amount shall be pro-rated over the pe-  
25 riod of the grant.



1 (c) DURATION AND RENEWAL.—

2 (1) DURATION.—The Secretary of Education  
3 shall award grants under this section for not more  
4 than 4 years.

5 (2) RENEWAL.—The Secretary of Education  
6 may renew a grant awarded under this section sub-  
7 ject to the progress of the State educational agency  
8 in meeting the benchmarks described in subsection  
9 (h).

10 (d) PRIORITY.—

11 (1) IN GENERAL.—In awarding grants under  
12 this section, the Secretary of Education shall give  
13 priority to State educational agencies that submit an  
14 application under subsection (e) that dem-  
15 onstrates—

16 (A) satisfaction of the required activities or  
17 comparable activities under section 4(d), as de-  
18 termined by the Secretary;

19 (B) that a significant percentage of per-  
20 sons served by the grant will be students from  
21 population underrepresented in engineering  
22 fields; and

23 (C) that the State's partners under sub-  
24 section (a)(2) agree to pay a portion of the non-  
25 Federal share costs, provided in cash or in-kind,

1 of the programs and activities carried out under  
2 the grant.

3 (2) SMALL STATE GUARANTEE.—

4 (A) IN GENERAL.—In each fiscal year in  
5 which a grant is awarded under this section,  
6 the Secretary of Education shall ensure that  
7 not less than 1 grant be awarded to a State  
8 with a population of less than 2,600,000 on the  
9 date of enactment of this Act.

10 (B) WAIVER.—The Secretary of Education  
11 may waive the requirement under subparagraph  
12 (A) after notifying Congress of such intention.

13 (e) APPLICATIONS.—A State educational agency that  
14 desires to receive a grant under this section shall submit  
15 an application to the Secretary of Education at such time,  
16 in such manner, and containing such information as the  
17 Secretary of Education may require. Each such applica-  
18 tion shall include a description of how the State edu-  
19 cational agency will integrate engineering education into  
20 K–12 instruction and curriculum through programs and  
21 activities described in subsection (f).

22 (f) USES OF FUNDS.—A State educational agency  
23 that receives a grant under this section shall use the grant  
24 funds to pay the Federal share of carrying out the fol-

1 lowing programs and activities in collaboration with the  
2 State's partners under subsection (a)(2):

3           (1) Implementing challenging academic content  
4 standards, achievement standards, and curricula  
5 frameworks that include engineering.

6           (2) Developing new or obtaining effective cur-  
7 ricula in engineering education.

8           (3) Designing and implementing engineering  
9 education assessment items and tools.

10           (4) Developing or improving elementary and  
11 secondary teacher preservice, induction, and profes-  
12 sional development engineering and technology edu-  
13 cation programs, including those that lead to a cer-  
14 tificate or other credential in engineering or tech-  
15 nology education.

16           (5) Recruiting qualified teachers to provide en-  
17 gineering education for high-need local educational  
18 agencies and high-need schools.

19           (6) Establishing distance learning modules for  
20 teachers or students in engineering education.

21           (7) Creating online engineering education tools  
22 that are widely accessible.

23           (8) Investing in after-school engineering edu-  
24 cation programs.

1 (g) TECHNICAL ASSISTANCE.—The Secretary of  
2 Education is authorized to reserve not more than 1 per-  
3 cent of the amounts available to carry out this section to  
4 provide technical assistance, directly or by grant or con-  
5 tract with nonprofit organizations with demonstrated ex-  
6 pertise in designing, implementing, or evaluating relevant  
7 programs, in order to help State educational agencies pre-  
8 pare for, qualify for, apply for, and maintain a grant  
9 under this section.

10 (h) BENCHMARKS.—

11 (1) BENCHMARKS.—Each State educational  
12 agency desiring a grant under this section shall—

13 (A) develop quantifiable benchmarks for  
14 the activities supported under the grant, which  
15 shall include increasing student achievement in  
16 science, technology, engineering, and mathe-  
17 matics subjects, and may include—

18 (i) increasing student knowledge and  
19 competency of grade-appropriate engineer-  
20 ing design skills;

21 (ii) increasing the number of students  
22 who are taught engineering education;

23 (iii) increasing the number of edu-  
24 cators who are prepared to teach engineer-  
25 ing education; and

1 (iv) increasing the number and diver-  
2 sity of students who plan to enroll in post-  
3 secondary engineering courses and pursue  
4 an engineering degree; and

5 (B) submit the benchmarks for approval to  
6 the Secretary of Education in order to receive  
7 grant funds under this section.

8 (2) REPORTS.—Each State educational agency  
9 receiving a grant under this section shall—

10 (A) annually measure and report to the  
11 Secretary of Education the progress of the  
12 State educational agency in achieving the  
13 benchmarks developed under paragraph (1);  
14 and

15 (B) collect and report data of those served  
16 by the grant relating to the student bench-  
17 marks, disaggregated by race, ethnicity, gender,  
18 disability status, migrant status, English pro-  
19 ficiency, and status as economically disadvan-  
20 taged, except that such disaggregation shall not  
21 be required in a case in which the number of  
22 students in a category is insufficient to yield  
23 statistically reliable information or the results  
24 would reveal personally identifiable information  
25 about an individual student.

1           (3) GUIDANCE.—The Secretary of Education  
2 shall provide guidance regarding acceptable data  
3 sources and methodologies for—

4                   (A) establishing baselines and performance  
5 benchmarks; and

6                   (B) measuring progress by State edu-  
7 cational agencies receiving such grants.

8           (i) NON-FEDERAL SHARE; SUPPLEMENT, NOT SUP-  
9 PLANT.—

10           (1) NON-FEDERAL SHARE.—

11                   (A) IN GENERAL.—A State educational  
12 agency that receives a grant under this section  
13 shall provide the non-Federal share of the costs  
14 of the programs and activities described in sub-  
15 section (f) that are carried out under the grant.  
16 The amount of the non-Federal share under  
17 this section for a fiscal year shall be not less  
18 than 50 percent. The non-Federal share may be  
19 in cash or in-kind, and may be provided from  
20 local resources, contributions from private orga-  
21 nizations, contributions from the State’s part-  
22 ners under subsection (a)(2), or a combination  
23 of such sources.

24                   (B) FINANCIAL HARDSHIP WAIVER.—The  
25 Secretary of Education may waive or reduce the

1 non-Federal share of a State educational agen-  
2 cy that has submitted an application for a  
3 grant under this section if the State educational  
4 agency demonstrates a need for such waiver or  
5 reduction due to extreme financial hardship.

6 (2) SUPPLEMENT, NOT SUPPLANT.—Grant  
7 funds provided under this section shall be used to  
8 supplement, and not supplant, any other Federal or  
9 State funds otherwise available to carry out the ac-  
10 tivities described in this section.

11 (j) SPECIAL RULE.—In the event a State educational  
12 agency declines or does not submit an application under  
13 this section, the Secretary of Education shall provide for  
14 another entity or a consortium, with the capacity to carry  
15 out the activities under this section in such State, to sub-  
16 mit an application.

17 (k) AUTHORIZATION OF APPROPRIATIONS.—There  
18 are authorized to be appropriated to carry out this section  
19 \$125,000,000 for each of fiscal years 2012 through 2015.

20 **SEC. 6. RESEARCH AND EVALUATIONS.**

21 (a) IN GENERAL.—The Institute of Education  
22 Sciences shall support, directly or through grants or con-  
23 tracts, research on engineering education and evaluation  
24 of the grants awarded under this Act, including studies  
25 and evaluations that—

1           (1) assess the effectiveness of the programs and  
2 activities carried out by each State educational agen-  
3 cy receiving a grant under section 5 in—

4           (A) improving student achievement in  
5 science, technology, engineering, and mathe-  
6 matics subjects;

7           (B) improving student understanding of  
8 engineering;

9           (C) enhancing technological literacy of stu-  
10 dents;

11           (D) increasing numbers and diversity of  
12 students with science, technology, engineering,  
13 and mathematics career aspirations; and

14           (E) increasing the supply of engineering  
15 and technology education teachers;

16           (2) assess how the programs and activities car-  
17 ried out by each State educational agency receiving  
18 a grant under section 5 can be replicated by a vari-  
19 ety of State educational agencies and local edu-  
20 cational agencies;

21           (3) assess how the programs and activities car-  
22 ried out by each State educational agency receiving  
23 a grant under section 5 lead to students developing  
24 engineering design ideas, practices and habits of



1 mind over time, and the types of conditions nec-  
2 essary to support these developments;

3 (4) identify and assess how science inquiry and  
4 mathematical reasoning can be connected to engi-  
5 neering design in K–12 curricula and teacher profes-  
6 sional development; and

7 (5) include any other information or assess-  
8 ments the Secretary of Education may require.

9 (b) DISSEMINATION.—The Secretary of Education  
10 shall, based on the results of each evaluation completed  
11 under subsection (a), disseminate information and anal-  
12 ysis to the public, and provide technical assistance to State  
13 educational agencies, on best practices and promising in-  
14 novations in the field of K–12 engineering education.

15 (c) AUTHORIZATION OF APPROPRIATIONS.—There  
16 are authorized to be appropriated to carry out this section  
17 \$5,000,000 for each of fiscal years 2013 through 2015.

○