

Notice of Meeting

UNIVERSITY OF HAWAI‘I

BOARD OF REGENTS COMMITTEE ON RESEARCH AND INNOVATION

Date: Tuesday, May 17, 2016

Time: 3:00 p.m.

Place: University of Hawai‘i at Mānoa
2465 Campus Road
Executive Dining Room
Honolulu, HI 96822

AGENDA

I. Call Meeting to Order

II. Approval of Minutes of the April 6, 2016 Meeting

III. Public Comment Period for Agenda Items: All written testimony on agenda items received after posting of this agenda and up to 24 hours in advance of the meeting will be distributed to the board. Late testimony on agenda items will be distributed to the board within 24 hours of receipt. Registration for oral testimony on agenda items will be provided at the meeting location 15 minutes prior to the meeting and closed once the meeting begins. Written testimony may be submitted via US mail, email at bor@hawaii.edu, or facsimile at 956-5156. Oral testimony is limited to three (3) minutes.

IV. Agenda Items

A. For Action

1. Recommend Approval of Proposed Amendments to Regents Policy Chapter 12, Research (RP 12.201, RP 12.207)

B. For Information

1. Update on Research and Innovation Performance Metrics
2. The Organized Research Units at Mānoa: History, Present Status, and How We Compare

V. Adjournment



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UNIVERSITY OF HAWAII
BOARD OF REGENTS

Office of the Vice President for Research and Innovation

#17603

16 MAY -5 A9:38

May 4, 2016

MEMORANDUM

TO: Eugene Bal, Chairperson
BOR Committee on Research and Innovation

VIA: David Lassner
President

FROM: Vassilis L. Syrmos
Vice President for Research and Innovation

**SUBJECT: BOR COMMITTEE ON RESEARCH AND INNOVATION AGENDA
MATERIALS FOR MAY 2016 MEETING**

Please find attached the following material that will be discussed at the April 2016 BOR Committee on Research and Innovation meeting:

- BOR Action Memo: Proposed Amendments to Regents Policy Chapter 12, Research (RP 12.201, RP 12.207)
- Update on Research and Innovation Performance Metrics
 - "R&I Performance Metrics" presentation
 - R&I Performance Metrics – FY2016 Third Quarter Report
 - R&I Performance Measures

Attachments

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PRESIDENT'S OFFICE

16 MAY -4 P4:23

RECEIVED



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Office of the Vice President for Research and Innovation

#17603

May 3, 2016

MEMORANDUM

TO: Eugene Bal, Chairperson
Board of Regents Committee on Research and Innovation

VIA: David Lassner President

FROM: Vassilis L. Syrmos Vice President for Research and Innovation

SUBJECT: PROPOSED AMENDMENTS TO REGENTS POLICY CHAPTER 12 – RESEARCH (RP 12.201, RP 12.207)

SPECIFIC ACTION REQUESTED:

It is requested that the Board of Regents approve the proposed amendments to Regents Policy Chapter 12 – Research (RP 12.201, RP 12.207). The proposed amendments update and clarify the broad statements of principle and philosophy that guide the research, innovation and other scholarly endeavors of the University of Hawai'i (UH).

RECOMMENDED EFFECTIVE DATE:

The recommended effective date is upon Board approval.

ADDITIONAL COST:

There are no additional costs associated with this request.

PURPOSE:

The purpose of this request is to continue the process of reviewing and updating the University's research policies and procedures by updating and clarifying the Regents Policies (RPs) that provide guidance for its research, innovation and other scholarly endeavors. This included consideration of what statements of principle and philosophy

should be contained in the RPs and the administrative direction that should be contained in Executive Policies (EP) and related Administrative Procedures (AP) as defined under EP 12.201, Systemwide Policies and Procedures.

BACKGROUND:

In 2013, the University administration started a process to update and harmonize UH's policies and procedures, some of which have not been updated for 20 years or more. In 2014, EP 2.201, Systemwide Policies and Procedures and AP 2.201, New or Amended Policies were issued to guide the drafting, formatting, and vetting of policies and procedures. In addition, the Policies and Procedures Information Systems (PPIS) web site was released in late 2014 to host all UH policies and procedures.

The Vice President for Research and Innovation (VPRI) convened a Research Policy Task Force (RPTF) in spring of 2015 to review and recommend updates to UH's research policies and procedures starting with the Regents Policies (RPs).

At the April 6, 2016 BOR Committee on Research and Innovation meeting, the following actions were taken:

- Moved to submit proposed changes to the following RPs:
 - RP 12.202 – Principal Investigator
 - RP 12.203 – Right to Investigate and Disseminate
 - RP 12.208 – Awards for Excellence in Research to the full Board for approval
- Deferred proposed changes to RP 12.206 – Establishment and Review of Organized Research Units
- Asked administration to consider additional revisions to the following RPs to address Committee comments:
 - RP 12.201 – Ethical Standards of Conduct
 - RP 12.207 – Research Corporation of the University of Hawai'i

The table below summarizes the intent of the proposed amendments:

RP	Title	Intent
12.201	Ethical Standards of Conduct	Clarify policy to apply to research and scholarly activities and update examples of misconduct.
12.207	Research Corporation of the University of Hawai'i ("RCUH")	Clarify what RCUH service order transactions need to be approved by the Board; clarify when RCUH direct projects

	may be used; and clarify that University President periodically reviews UH-RCUH master agreement.
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The administration has considered the comments and is resubmitting revised RPs for the Committee's review and recommendation for full Board approval.

ACTION RECOMMENDED:

It is recommended that the Board of Regents approve the proposed amendments to the Regents Policy Chapter 12 – Research (RP 12.201, RP 12.207) since the proposed amendments update and clarify the broad statements of principle and philosophy that guide the research, innovation and other scholarly endeavors of the University of Hawai'i.

Attachments

- Description of Changes Made in Response to Board Comments
- Clean copies of amended Regents Policy Chapter 12 – Research sections
- Ramseyer format copies of amended Regents Policy Chapter 12 – Research sections

c: Cynthia Quinn, Executive Administrator and Secretary to the Board of Regents

Description of Changes Made to RP 12.201 & RP 12.207 in Response to Board Comments

During the April 6, 2016 meeting, the Board of Regents Committee on Research & Innovation (R&I) asked the administration to consider further revisions to RP 12.201 – Ethical Standards of Conduct and RP 12.207 – Research Corporation of the University of Hawai'i.

The R&I committee comments and the actions taken by the administration to address those comments are summarized below.

RP 12.201 – Ethical Standards of Conduct

R&I comments

- Suggested that the phrase “but is not limited to” should be restored because RP 12.201, III.A contains a list of examples of misconduct that is not all inclusive.
- Questioned the deletion of “property violations, the failure to report observed fraud” from the list of examples of misconduct.

Administration response

- Agree that the phrase “but is not limited to” should be restored.
- Disagree that “property violations, the failure to report observed fraud” should be restored. Rationale is that “plagiarism” and “misappropriation of resources” covers the intent of the deleted phrase. The concern is over theft of ideas and data and misuse of funds or other resources. Encouraging faculty, staff or students to report observed fraud will be covered under a proposed whistleblower policy.

Revised RP 12.201, III.A.

“In the conduct of research and scholarly activities, faculty and staff shall adhere to strict ethical standards of conduct. Failure to adhere to ethical standards includes, but is not limited to falsification of data, plagiarism, breach of confidentiality, dishonesty in publications, deliberate violations of regulations, misappropriation of resources, utilizing one’s official capacity to gain undue benefits for oneself or others, exploiting subordinates, including students, and failing to disclose and properly manage potential conflicts of interest.”

RP 12.207 – Research Corporation of the University of Hawai'i

R&I comments

- Suggested that bond funds be removed from the definition of intramural funds.
- Suggested that the authority of the Board chair to appoint UH Board members to the RCUH board be included.

- Suggested clarification on whether the Board or administration be responsible for executing and amending the agreement between UH and RCUH.

Administration response

- Suggested changes have been made.
 - Although bond funds have been removed from the definition, we understand that they could still be service ordered subject to review and approval by the UH Board unless explicitly prohibited by law.
 - The Hawai'i Revised Statutes (HRS) do not allow UH Board member appointments to the RCUH board to go beyond their UH Board appointment. Thus, annual appointments by the UH Board chair will allow UH to be compliant with the HRS.
 - Because the administration works with RCUH on a regular basis, the President or President's designee is in a better position to evaluate and negotiate the terms of the agreement between UH and RCUH. This also allows the UH Board to objectively evaluate and critique the agreement as it was not directly involved in the process.
 - Periodic review has replaced annual review. Twenty years have passed since the current agreement was executed and the majority of amendments were to revise the management fee. Any major amendments will be subject to approval by both the UH and RCUH boards.

Revised RP 12.207 sections

RP 12.207, II. B.

“Intramural funds – Refers to funds appropriated to the University such as research and training revolving funds (RTRF) and tuition and fee special funds. In the context of this policy, intramural funds excludes general funds. Intramural funds are exempt from RP 12.207 III.C.1 when they will be used for mandatory cost sharing or matching purposes.”

RP 12.207, III.A.

“The RCUH was established by state statute, in part, to facilitate the research and training efforts of the University of Hawai'i. It is a corporate body governed by an independent board with members of the university community. A statutorily determined number of members comprise the RCUH board. The Board chairperson shall assign two UH Board members to the RCUH board annually.”

RP 12.207, III.F.

“The President or President's designee shall execute a document of relationship between the University and RCUH delineating the parameters of service to be rendered. This document shall be reviewed periodically and amended as necessary.”



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BOARD OF REGENTS

Board of Regents Policy, RP 12.201
Ethical Standards of Conduct

Page 1 of 2

Regents Policy Chapter 12, Research

Regents Policy RP 12.201, Ethical Standards of Conduct

Effective Date:

Prior Dates Amended: Oct. 31, 2014 (recodified)

Review Date: August 2019

I. Purpose

To set forth policy regarding ethical standards of conduct in research and scholarly activities.

II. Definitions

No policy specific or unique definitions apply.

III. Policy

A. In the conduct of research and scholarly activities, faculty and staff shall adhere to strict ethical standards of conduct. Failure to adhere to ethical standards includes, but is not limited to falsification of data, plagiarism, breach of confidentiality, dishonesty in publications, deliberate violation of regulations, misappropriation of resources, utilizing one's official capacity to gain undue benefits for oneself or others, exploiting subordinates, including students, and failing to disclose and properly manage potential conflicts of interest.

IV. Delegation of Authority

There is no policy specific delegation of authority.

V. Contact Information

Office of the Board of Regents, 956-8213, bor@hawaii.edu

VI. References

- A. <http://www.hawaii.edu/offices/bor/>
- B. EP 12.211, Policy for Responding to Allegations of Research and Scholarly Misconduct
- C. EP 12.214, Conflicts of Interest and Commitment

- D. EP 12.218, Compliance with United States Export Control Laws and Regulations
- E. AP 12.211, Administrative Procedure for Responding to Allegations of Research and Scholarly Misconduct
- F. AP 5.504, Procedures for Disclosing and Addressing Conflicts of Interest and Commitment
- G. AP 8.025, Fiscal Responsibilities Within the University
- H. AP 8.926, Administrative and Financial Requirements for Extramurally Financed Research and Training Programs/Activities of the University
- I. AP 8.956, Financial Conflicts of Interest (FCOI) for Public Health Services (PHS) Grants, Cooperative Agreements and Contracts
- J. Regulation and Compliance (NCURA) – A copy is on file at the Office of Research Services for examination for faculty and staff who wish to see a summary of Federal regulations that impact research and scholarly activities.

VII. Exhibits and Appendices

No Exhibits and Appendices found

Approved:

Approved as to Form:

Cynthia Quinn
Executive Administrator and
Secretary of the Board of Regents

Date



Regents Policy Chapter 12, Research
Regents Policy RP 12.201, Ethical Standards of Conduct
Effective Date:
Prior Dates Amended: Oct. 31, 2014 (recodified)
Review Date: August 2019

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Approved:

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Executive Administrator and
Secretary of the Board of Regents

Date



Regents Policy Chapter 12, Research

Regents Policy RP 12.207, Research Corporation of the University of Hawai'i ("RCUH")

Effective Date:

Prior Dates Amended: Oct. 31, 2014 (recodified)

Review Date: August 2019

I. Purpose

To set forth policy regarding the relationship between the University and RCUH and the Board conditions for service ordering University funds to RCUH.

II. Definitions

- A. Extramural contracts and grants – Refers to external sponsorship of research, training or other activities via a contract, grant or other agreement. In the context of this policy, extramural contracts and grants includes Federal formula funds, but excludes student financial aid.
- B. Intramural funds – Refers to funds appropriated to the University such as research and training revolving funds (RTRF) and tuition and fee special funds. In the context of this policy, intramural funds excludes general funds. Intramural funds are exempt from RP 12.207 III.C.1 when they will be used for mandatory cost sharing or matching purposes.
- C. Mandatory cost sharing or matching – Refers to a sponsor imposed requirement to share or match intramural funds in order to receive sponsor funds under a grant or other agreement.
- D. Research or training project – Refers to research, training or other activities that are funded by external contracts and grants or through an application of intramural funds. Examples of intramural funds that are for research and training projects include a formal seed money grant program as well as projects funded by separately accounting for an academic or research units' appropriated funds such as RTRF or unrestricted gifts toward pilot projects or faculty start-up costs.
- E. Service order – a formal request by the University to utilize RCUH services to assist the University in carrying out its instruction, research, training, or public service mission.

F. University funds – Refers to extramural contracts and grants and intramural funds received by the University.

III. Policy

- A. The RCUH was established by state statute, in part, to facilitate the research and training efforts of the University of Hawai'i. It is a corporate body governed by an independent board with members of the university community. A statutorily determined number of members comprise the RCUH board. The Board chairperson shall assign two UH Board members to the RCUH board annually.
- B. The University service orders extramural contracts and grants to RCUH. However, RCUH shall not be used to circumvent statutes, Board policies, contracts, settlements, or regulations.
- C. Service ordering of intramural funds to RCUH shall be for the direct support of research or training projects, including mandatory cost sharing or matching.
 1. Prior Board approval is required for service order of intramural funds for:
 - a. Major construction (CIP) and repair and maintenance (R&M) projects in accordance with the threshold delineated in RP 8.201, Section B.1;
 - b. Purchases of goods or services in accordance with the threshold delineated in RP 8.201, Section III.E.1; or
 - c. Consultant contracts in accordance with the threshold delineated in RP 8.201, Section III.C.1.
- D. Extramural proposals and awards must be processed by the University's office responsible for the administration of research and training grants and contracts. Proposals may not be submitted by or awards made to RCUH on behalf of the University unless the President or the President's designee has made a determination that the research or training project should be processed as an RCUH direct project and RCUH has accepted the responsibility.
- E. In the case of intramural funds, requests to service order to RCUH must be received by University officials delegated with approving authority to make such determinations by the President or the President's designee. Upon receipt, a determination by the University shall be made as to service ordering to RCUH based on this policy.

- F. The President or President's designee shall execute a document of relationship between the University and RCUH delineating the parameters of service to be rendered. This document shall be reviewed periodically and amended as necessary.

IV. Delegation of Authority

There is no policy specific delegation of authority.

V. Contact Information

Office of the Board of Regents, 956-8213, bor@hawaii.edu

VI. References

- A. <http://www.hawaii.edu/offices/bor/>
- B. AP 8.910, Procedures for the Preparation and Submission of Proposals to External Sponsors and the Review/Approval of Sponsored Agreements
- C. AP 8.930, Service Orders to the Research Corporation of the University of Hawai'i
- D. AP 8.931, Revolving Fund Service Orders to the Research Corporation of the University of Hawai'i

VII. Exhibits and Appendices

No Exhibits and Appendices found

Approved:

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Cynthia Quinn
Executive Administrator and
Secretary of the Board of Regents

Date



Regents Policy Chapter 12, Research

Regents Policy RP 12.207, Research Corporation of the University of Hawai'i ("RCUH")

Effective Date:

Prior Dates Amended: Oct. 31, 2014 (recodified)

Review Date: August 2019

I. Purpose

To set forth policy regarding the ~~establishment of RCUH and its relationship to between the University and RCUH and the Board conditions for service ordering University funds to RCUH.~~

II. Definitions

~~No policy specific or unique definitions apply.~~ A. Extramural contracts and grants
~~– Refers to external sponsorship of research, training or other activities via a contract, grant or other agreement. In the context of this policy, extramural contracts and grants includes Federal formula funds, but excludes student financial aid.~~

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C. Mandatory cost sharing or matching – Refers to a sponsor imposed requirement to share or match intramural funds in order to receive sponsor funds under a grant or other agreement.

D. Research or training project – Refers to research, training or other activities that are funded by external contracts and grants or through an application of intramural funds. Examples of intramural funds that are for research and training projects include a formal seed money grant program as well as projects funded by separately accounting for an academic or research units' appropriated funds such as RTRF or unrestricted gifts toward pilot projects or faculty start-up costs.

E. Service order – a formal request by the University to utilize RCUH services to assist the University in carrying out its instruction, research, training, or public service mission.

F. University funds – Refers to extramural contracts and grants and intramural funds received by the University.

III. Policy

A. The RCUH was established by state statute, in part, to facilitate the research and training efforts of the University of Hawai'i. It is a corporate body governed by an independent board, separate from with members of the university community. A statutorily determined number of members of the board also comprise the RCUH board. The Board chairperson shall assign two UH Board members to the RCUH board annually.

B. The University service orders research extramural contracts and grants to RCUH. However, RCUH shall not be used to circumvent statutes, Board policies, contracts, settlements, or regulations.

C. Service ordering of intramural funds to RCUH shall be for the direct support of a research or training projects, including mandatory cost sharing or matching, and shall not include major construction (CIP) and repair and maintenance (R&M) projects, employment of any person in excess of one year, purchases in excess of \$500,000 (total value), as a means to supplement existing university contracts or salaries, and contracting of services exceeding \$500,000 in total value unless prior board approval is obtained.

1. Prior Board approval is required for service order of intramural funds for:

- a. Major construction (CIP) and repair and maintenance (R&M) projects in accordance with the threshold delineated in RP 8.201, Section B.1;
- b. Purchases of goods or services in accordance with the threshold delineated in RP 8.201, Section III.E.1; or

c. Consultant contracts in accordance with the threshold delineated in RP 8.201, Section III.C.1.

D. No university funds, regardless of source, shall be directed to RCUH or any external agency without being received by the university's office responsible for the administration of research and training grants and contracts. Extramural proposals and awards must be processed by the University's office responsible

for the administration of research and training grants and contracts. Proposals may not be submitted by or awards made to RCUH on behalf of the University unless the President or the President's designee has made a determination that the research or training project should be processed as an RCUH direct project and RCUH has accepted the responsibility.

D.E. In the case of intramural funds, requests to service order to RCUH must be received by University officials delegated with approving authority to make such determinations by the President or the President's designee. Upon receipt, a determination by the University shall be made as to service ordering to RCUH based on this policy.

E.F. The board President or President's designee shall execute a document of relationship between the University and RCUH delineating the parameters of service to be rendered. This document shall be reviewed periodically annually to allow for periodic and amend~~ed~~ments as necessary.

IV. Delegation of Authority

There is no policy specific delegation of authority.

V. Contact Information

Office of the Board of Regents, 956-8213, bor@hawaii.edu

VI. References

- A. <http://www.hawaii.edu/offices/bor/>
- B. EP 12.227AP 8.910, Procedures for the Preparation and Submission of Proposals to External Sponsors and the Review/Approval of Sponsored Agreements
- C. AP 8.930, Service Orders to the Research Corporation of the University of Hawai'i
- B.D. AP 8.931, Revolving Fund Service Orders to the Research Corporation of the University of Hawai'i

VII. Exhibits and Appendices

No Exhibits and Appendices found

Approved:

Approved as to Form:

Cynthia Quinn
Executive Administrator and
Secretary of the Board of Regents

Date

R&I Performance Metrics

VASSILIS L. SYRMOS
VICE PRESIDENT FOR RESEARCH AND INNOVATION



Office of the Vice President for Research and Innovation
www.hawaii.edu/research

Locations

- Quarterly report
- Less frequent updates
 - Research dashboard (online)
 - UH Strategic Directions (online) – STEM Degrees Awarded



Quarterly Report (Key metrics)

- Total extramural funds received
- Extramural expenditures
- Invention disclosures
- US patents issued
- Licenses/options executed
- Licensing royalty received



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Office of the Vice President for Research and Innovation
www.hawaii.edu/research

Extramural Sponsor Awards Quarterly Summary

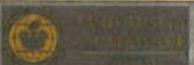
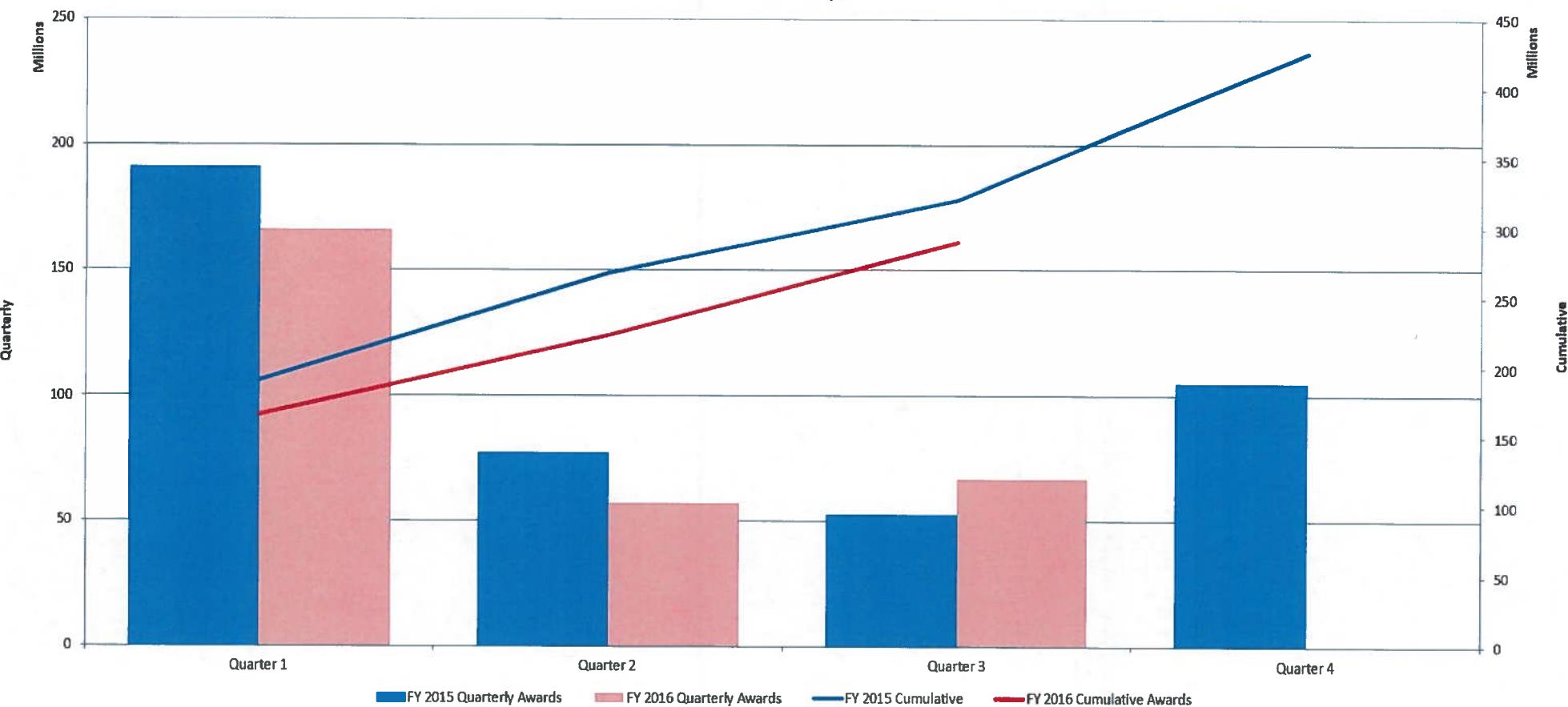
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	<u>Count</u>	<u>Amount</u>	<u>Count</u>	<u>Amount</u>
Research	204	\$ 41,276,085	200	\$ 31,982,360
Non-Research	189	\$ 27,680,981	137	\$ 21,889,772
Total	393	\$ 68,957,066	337	\$ 53,872,132



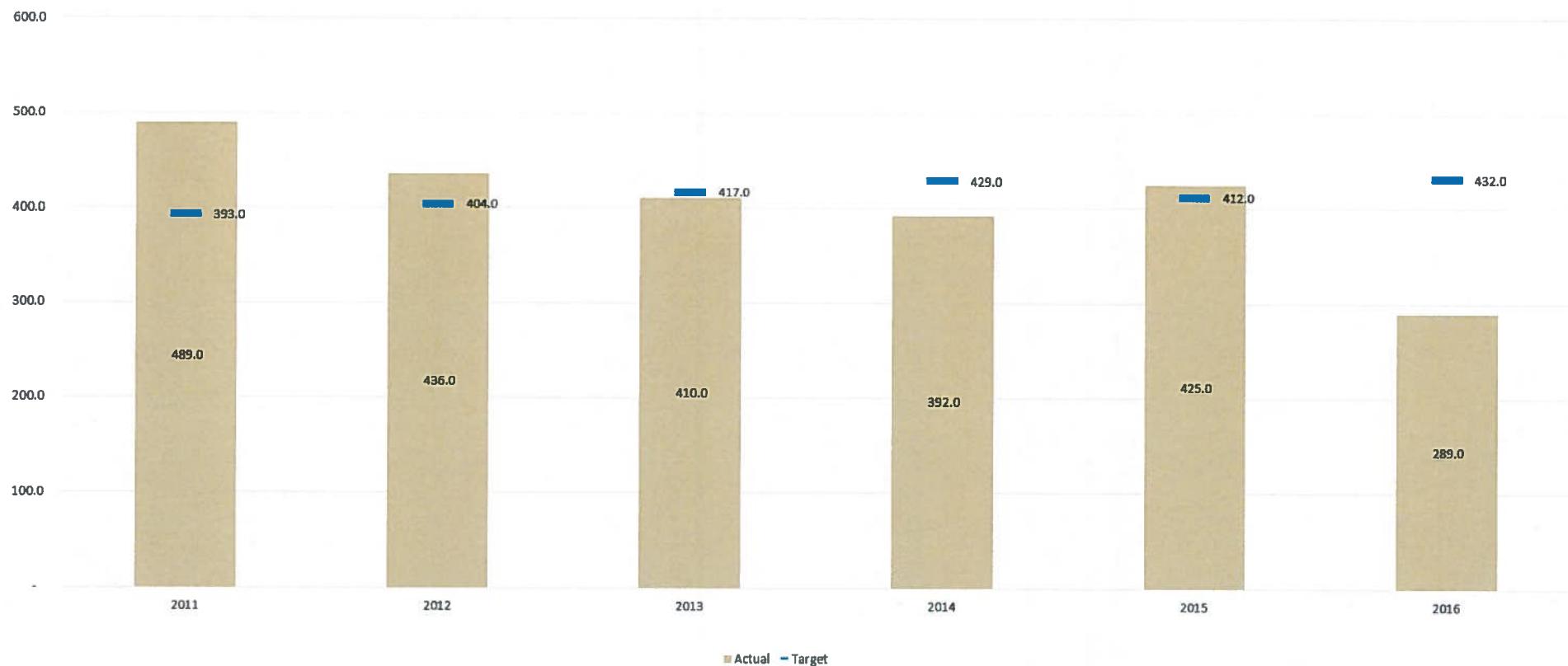
University of Hawaii
System

Office of the Vice President for Research and Innovation
www.hawaii.edu/research

Contracts and Grants Awards
Amount Awarded by Quarter



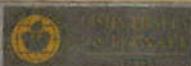
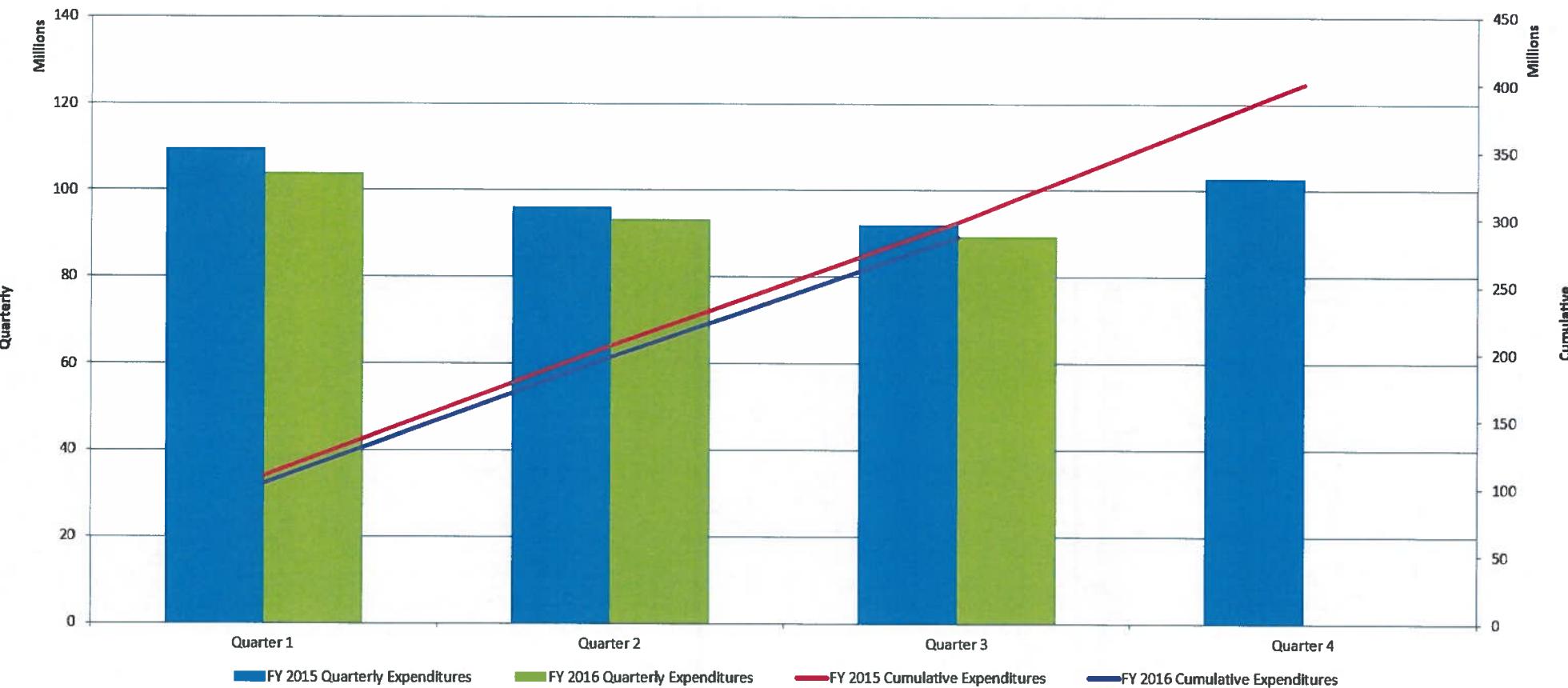
Extramural Awards - as of 3rd Qtr FY 2016
(in millions)



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AT MANOA

Office of the Vice President for Research and Innovation
www.hawaii.edu/research

Contracts and Grants Awards Expenditures by Quarter

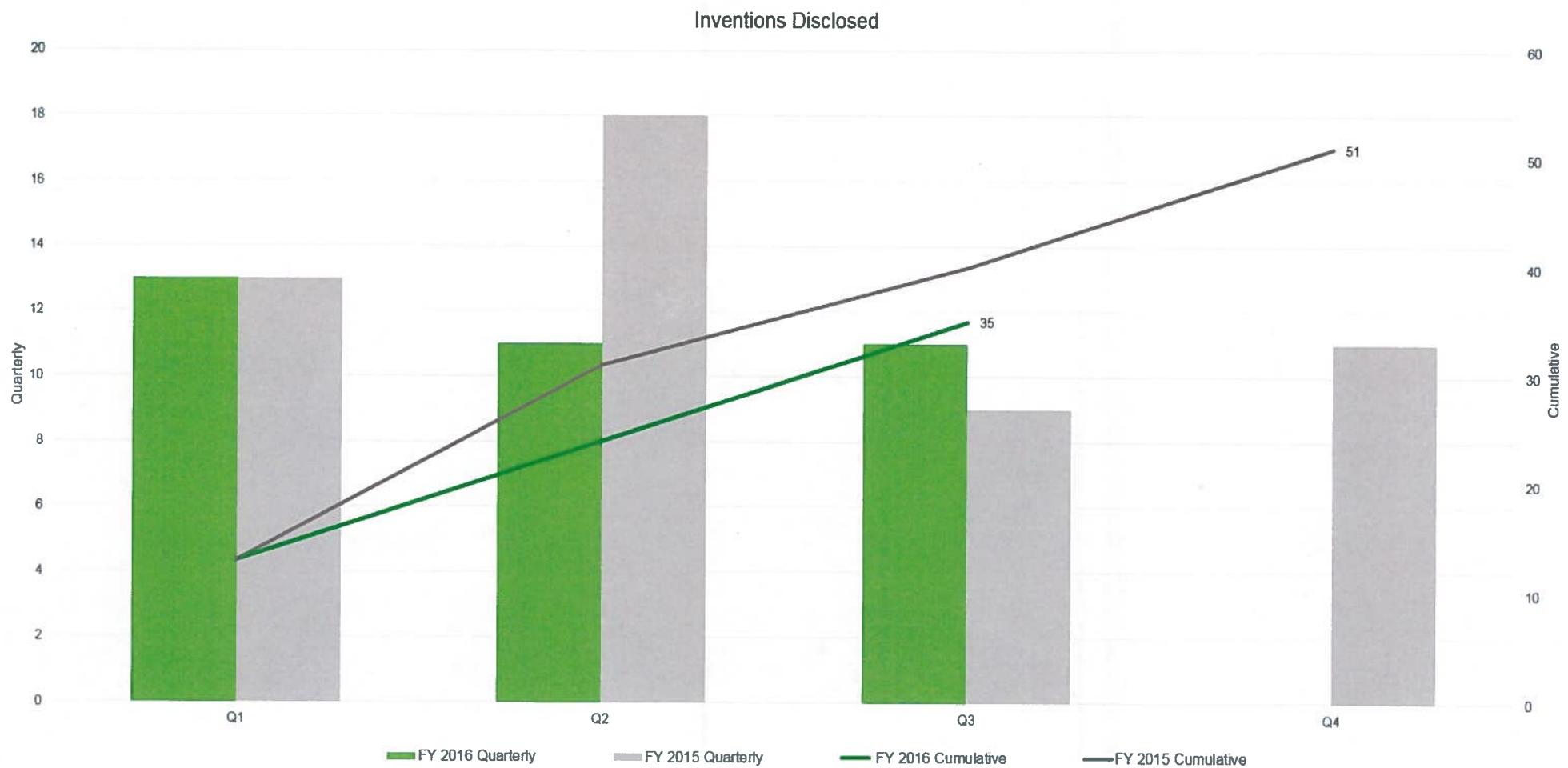


OTTED Research & Innovation Metrics

FY 2016 – Third Quarter Summary

<u>Metric</u>	<u>FY 2016</u> <u>1/1/16 – 3/31/16</u>	<u>FY 2015</u> <u>1/1/15 – 3/31/15</u>
Invention Disclosures	11	9
U.S. Provisional Patents Filed	8	8
U.S. Non-Provisional Patents Filed	1	2
U.S. Non-Provisional Patents Issued	2	2
License Agreements	4	1
Royalty Revenue	\$271,580.33	\$124,269.10

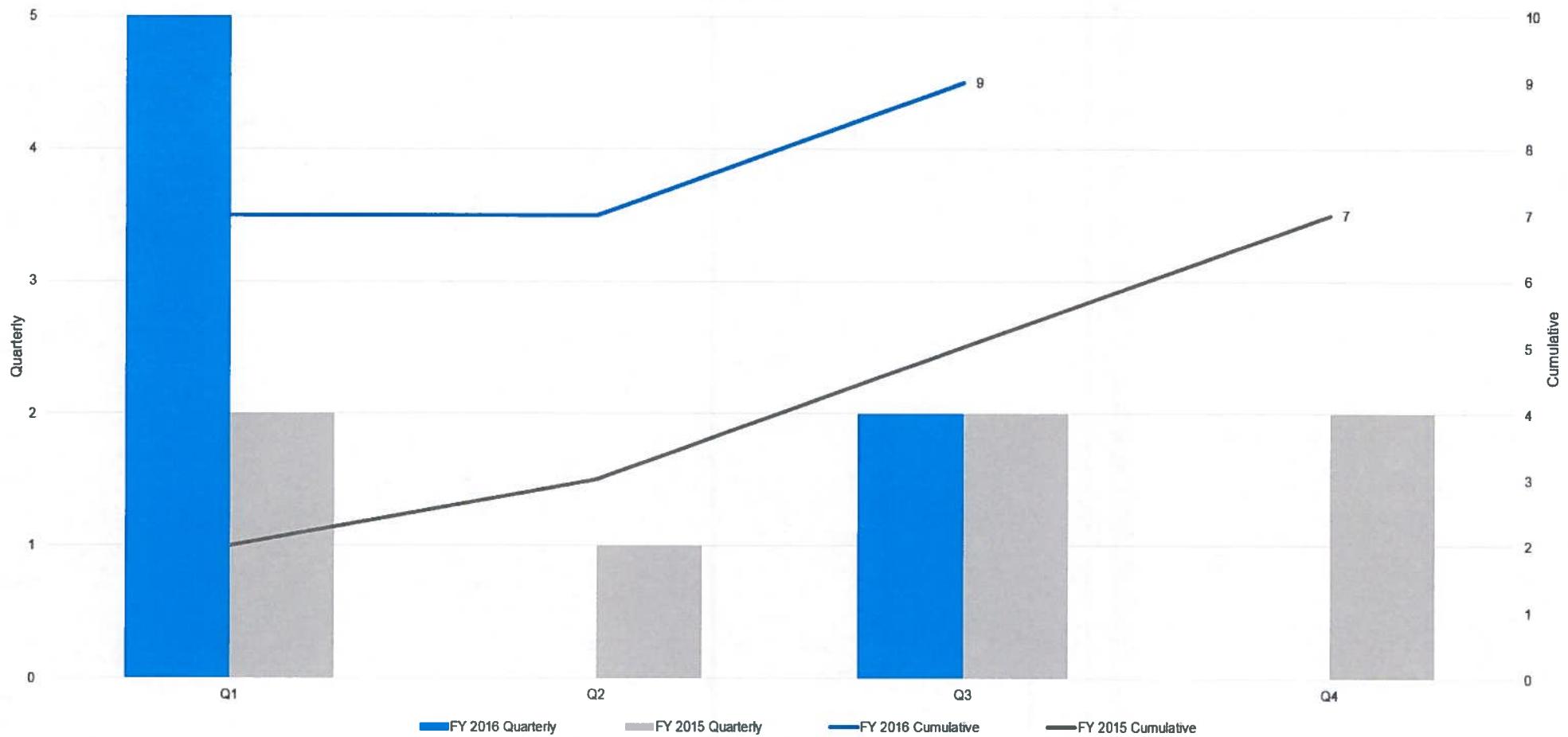




UNIVERSITY OF HAWAII
AT MANOA

Office of the Vice President for Research and Innovation
www.hawaii.edu/research

U.S. Non-Provisional Patents Issued



License/Option Agreements Executed

7

6

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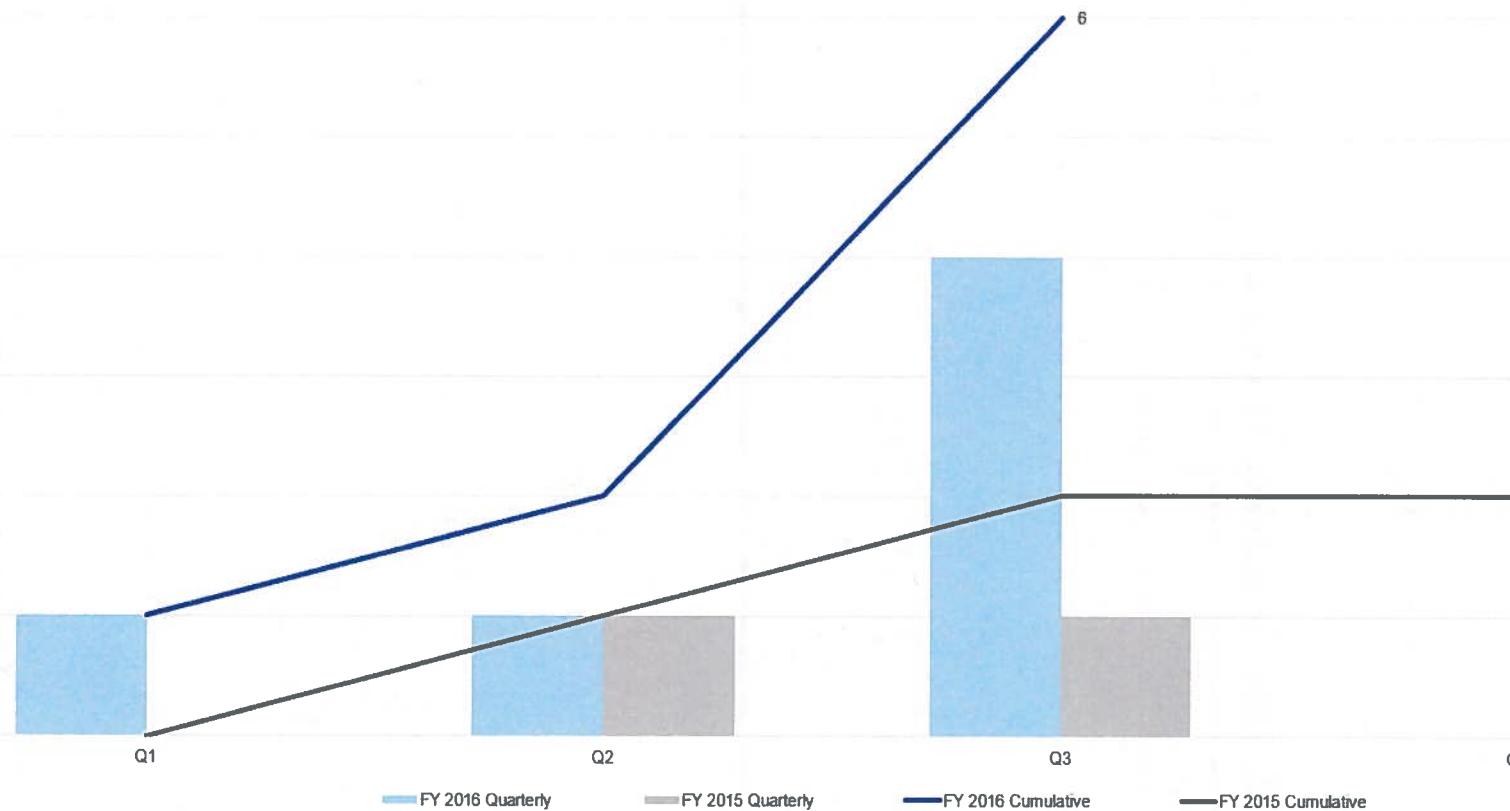
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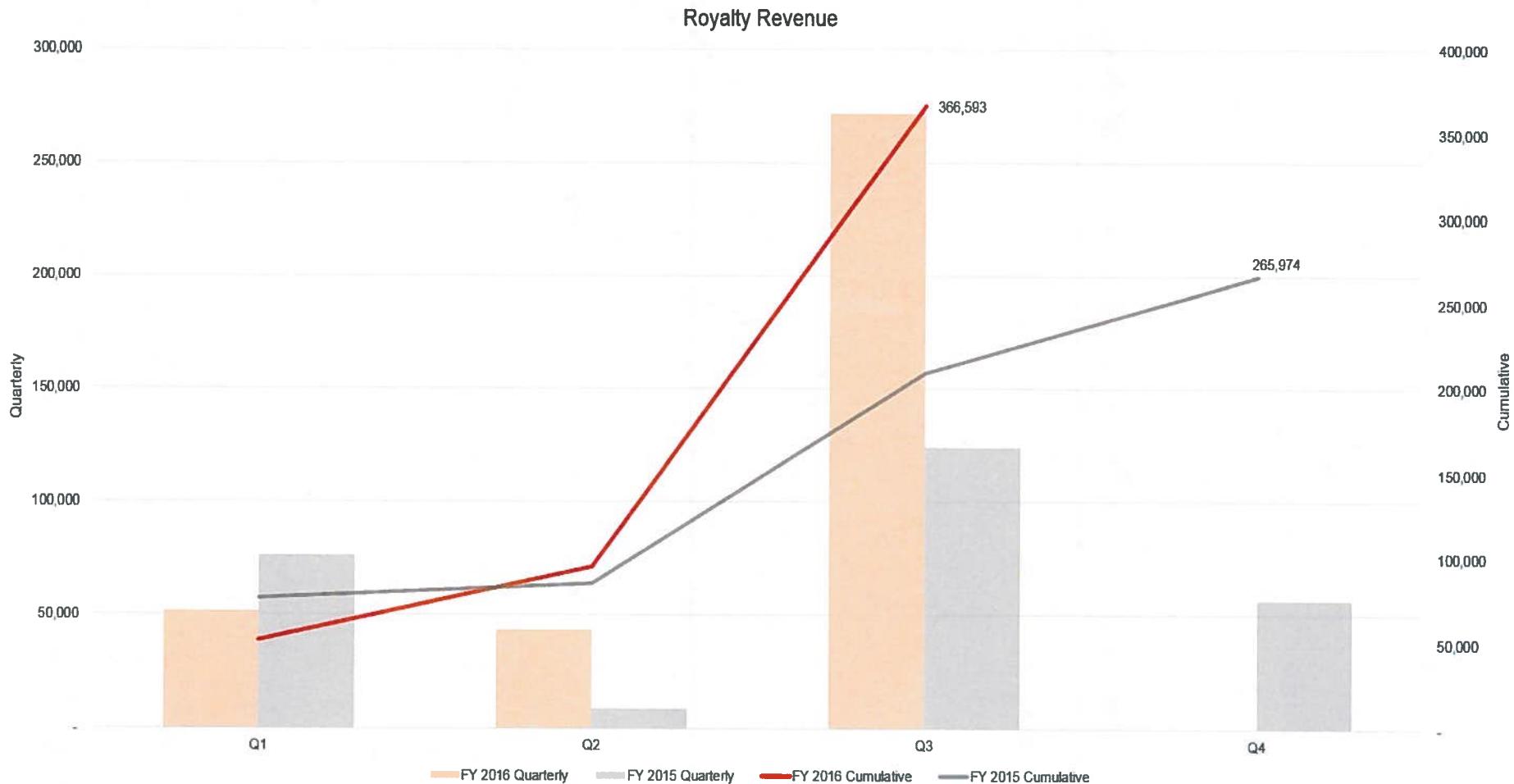
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Research Dashboard

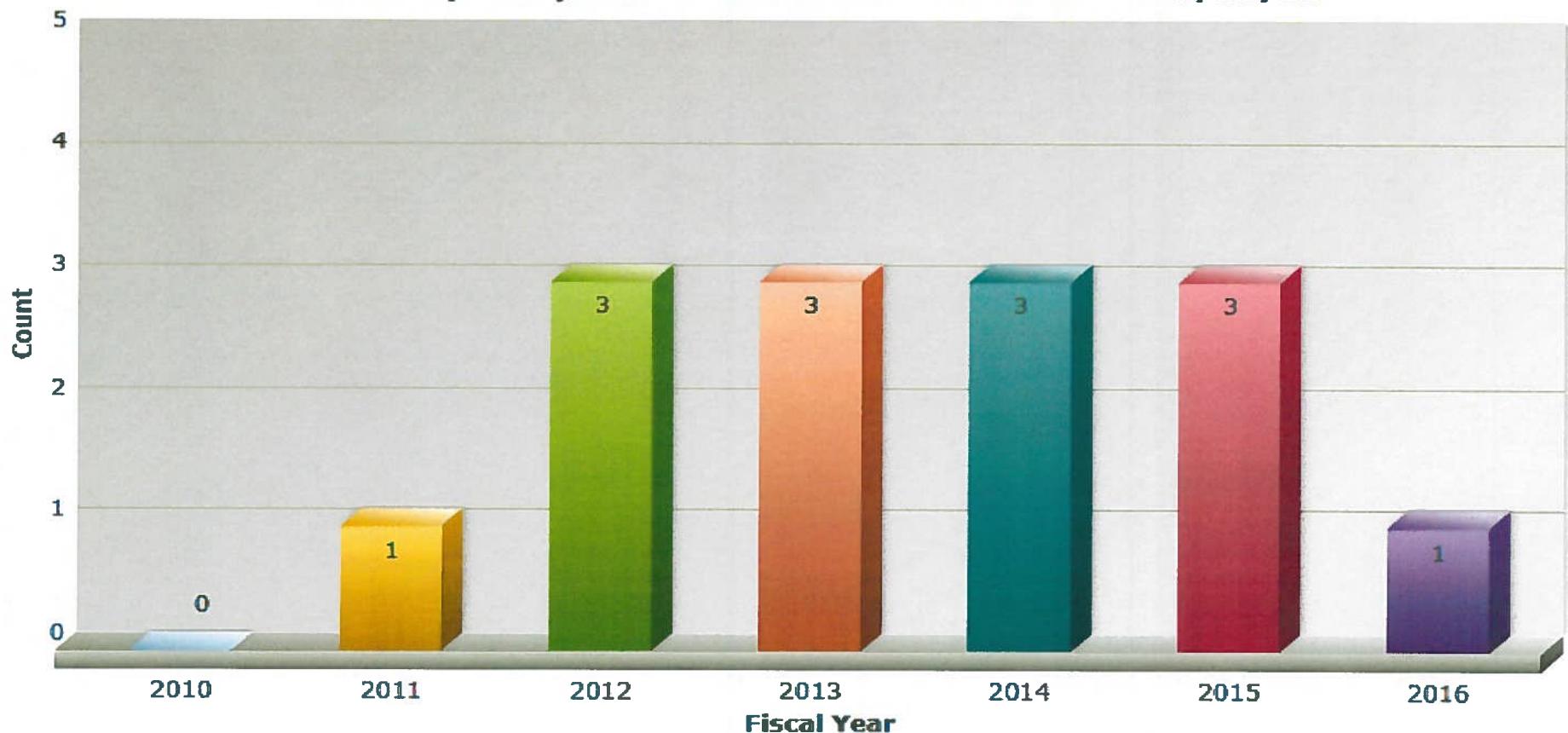
- Start-up Companies Created
- XLR8UH Cohorts

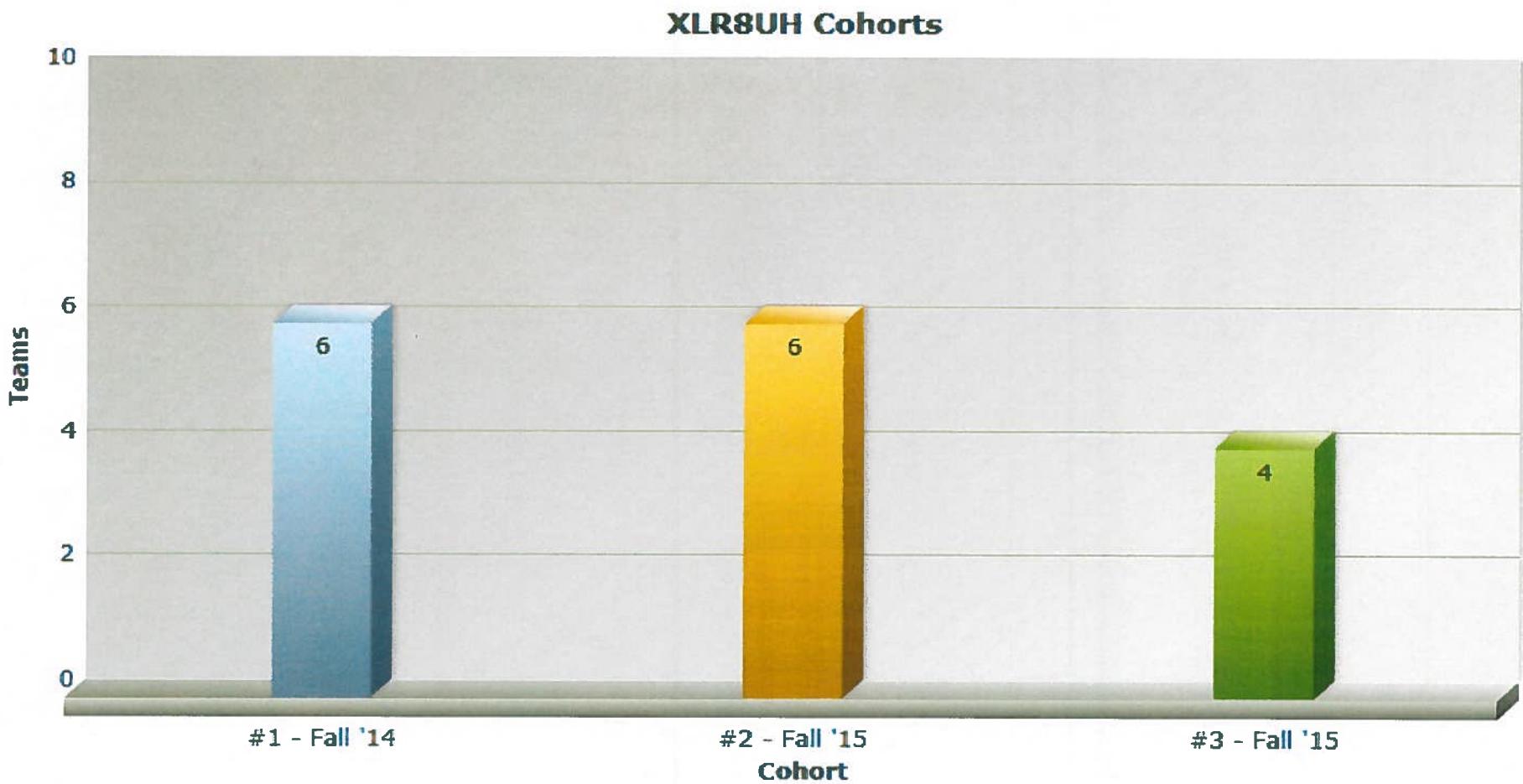


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Office of the Vice President for Research and Innovation
www.hawaii.edu/research

Start-Up Companies Created - incl. FY 2016 as of 3/31/16





Extramural Sponsor Awards FY 2016 - Third Quarter Summary

<u>Program Type</u>	Jan 1 – Mar 31 2016		Jan 1 – Mar 31 2015	
	<u>Count</u>	<u>Amount</u>	<u>Count</u>	<u>Amount</u>
Research	204	\$ 41,276,085	200	\$ 31,982,360
Non-Research	189	\$ 27,680,981	137	\$ 21,889,772
Total	<u>393</u>	<u>\$ 68,957,066</u>	<u>337</u>	<u>\$ 53,872,132</u>

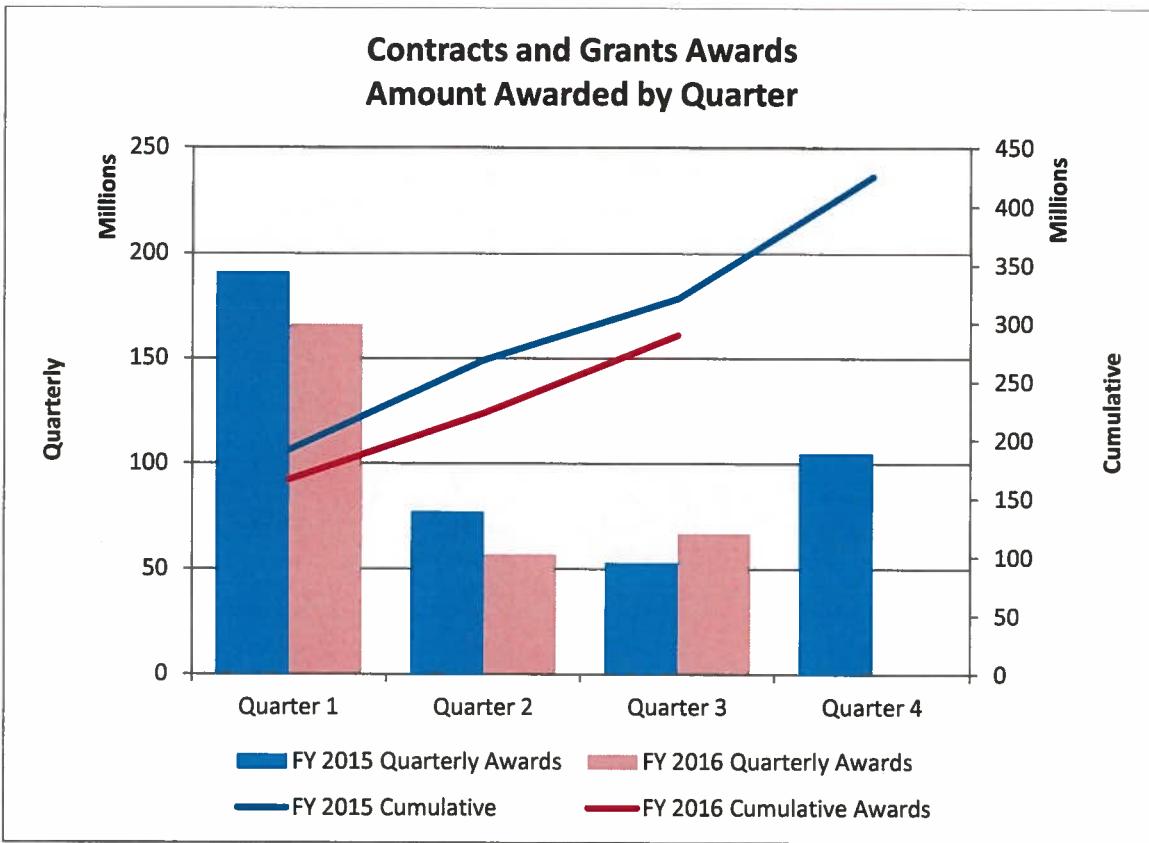
Note: The detailed award listing is available at:

<http://www.ors.hawaii.edu/index.php/bor-reports>

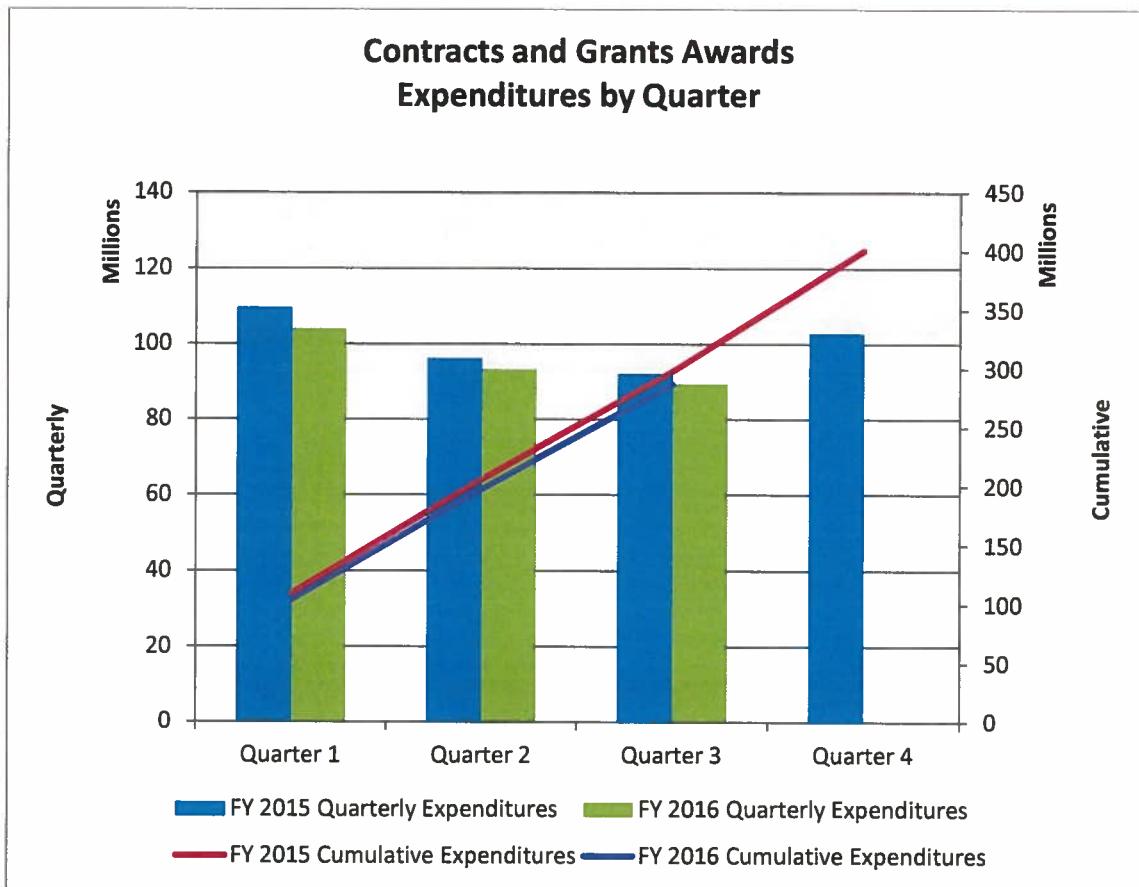
The FY 2015 year-to-date total was: \$320,841,165

The unofficial FY 2016 year-to-date total is: 1364 awards totaling
\$288,956,984

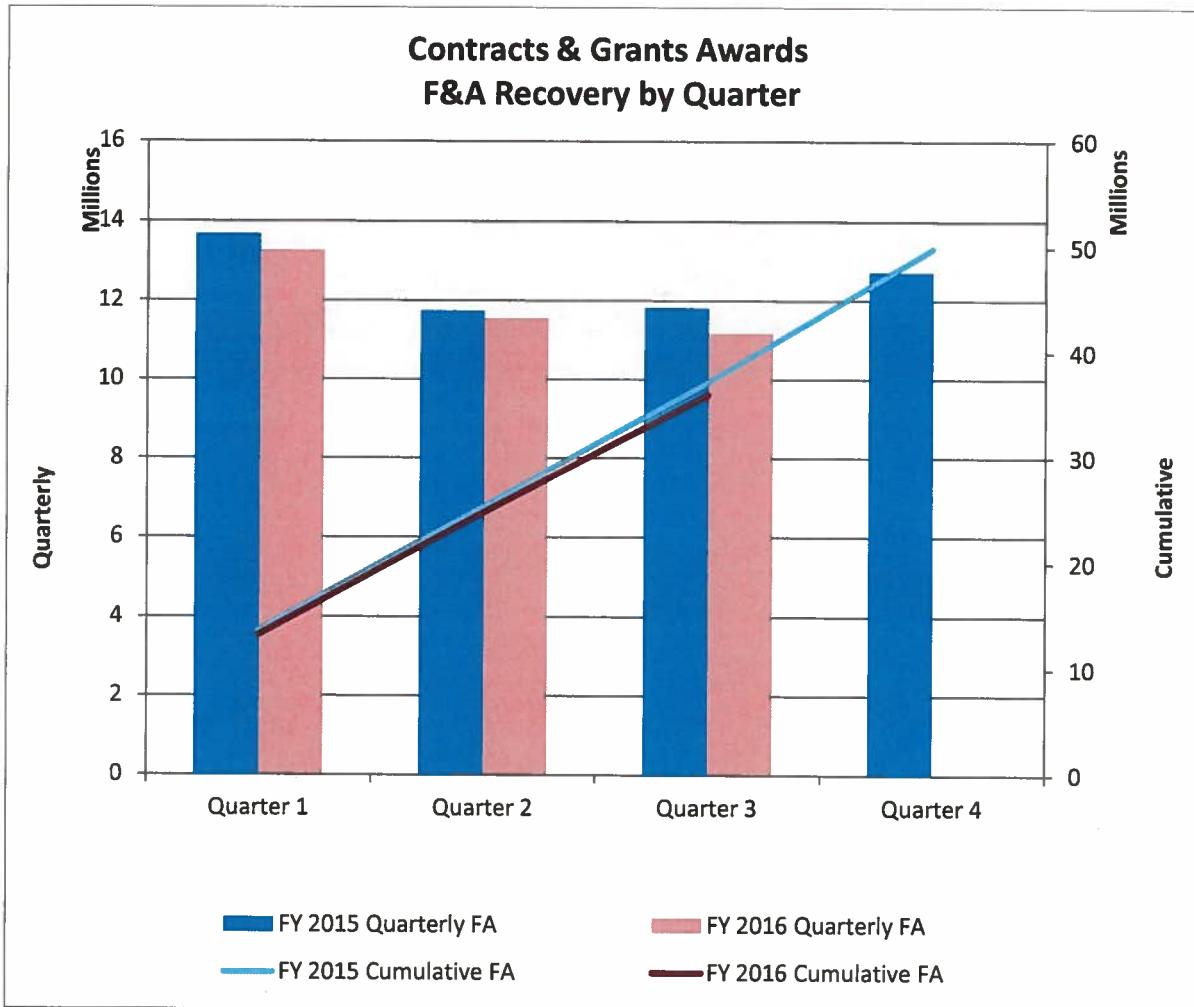
Contracts and Grants Awards
As of Quarter Three – FY 2016



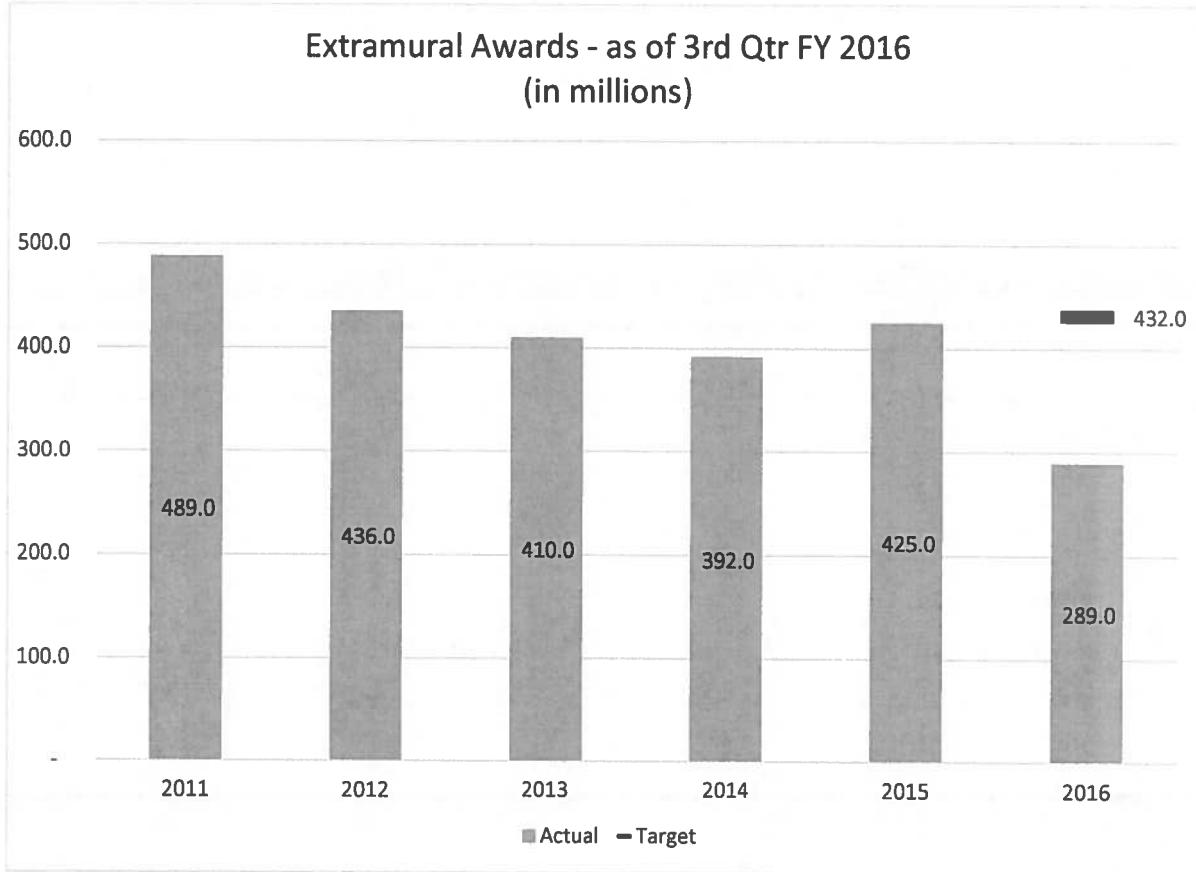
Contracts and Grants – Expenditures
As of Quarter Three – FY 2016



Contracts and Grants Awards – F&A Recovery
As of Quarter Three – FY 2016



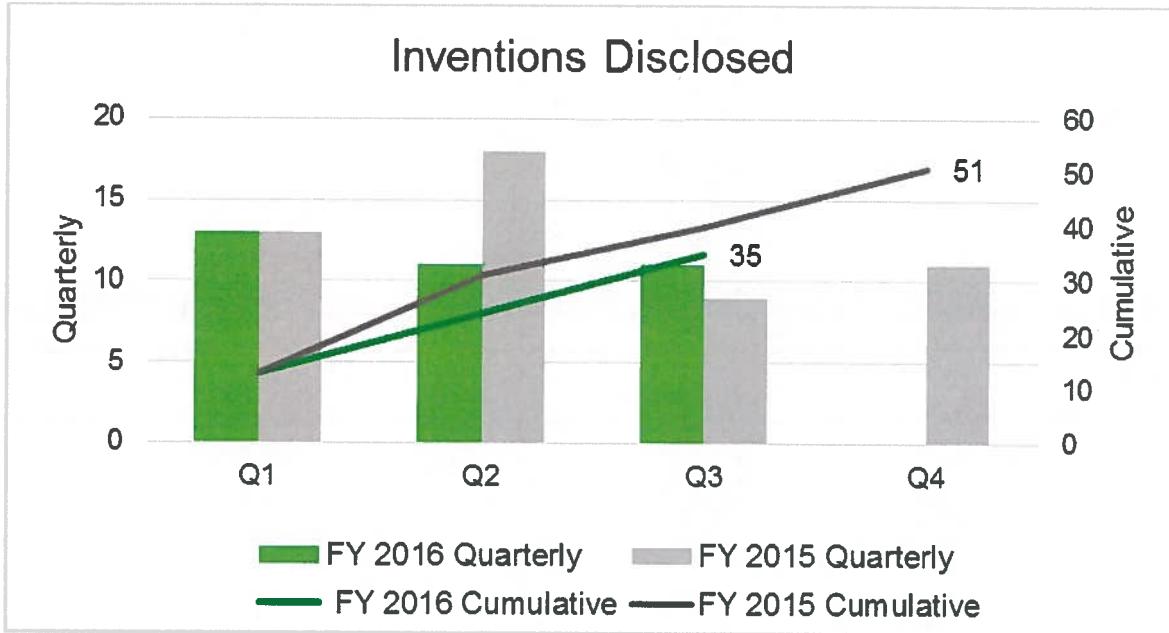
Extramural Awards
As of Quarter Three – FY 2016



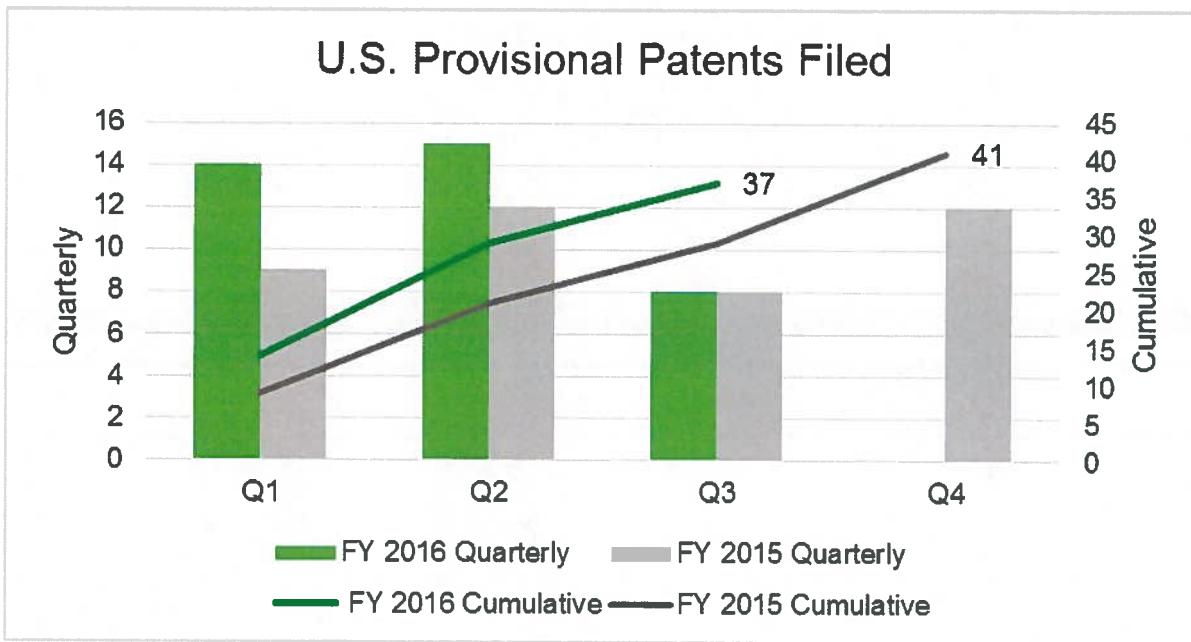
OTTED Research & Innovation Metrics
FY 2016 – Third Quarter Summary

<u>Metric</u>	<u>FY 2016</u>	<u>FY 2015</u>
	<u>1/1/16 – 3/31/16</u>	<u>1/1/15 – 3/31/15</u>
Invention Disclosures	11	9
U.S. Provisional Patents Filed	8	8
U.S. Non-Provisional Patents Filed	1	2
U.S. Non-Provisional Patents Issued	2	2
License Agreements	4	1
Royalty Revenue	\$271,580.33	\$124,269.10

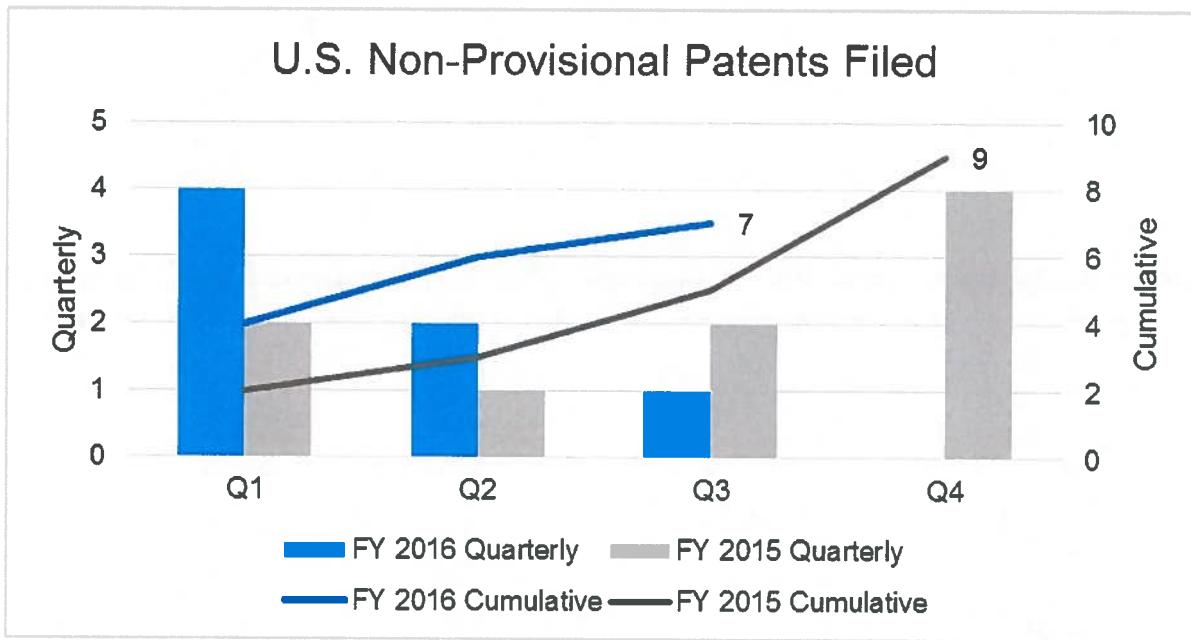
Invention Disclosures
As of Quarter Three – FY 2016



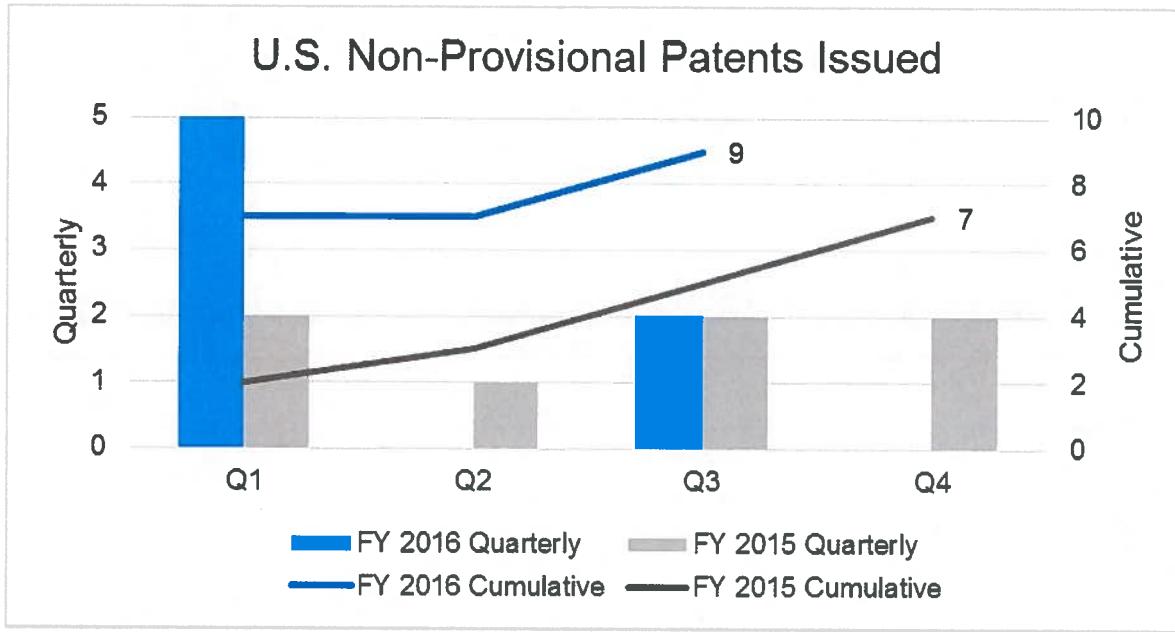
**U.S. Provisional Patents Filed
As of Quarter Three – FY 2016**



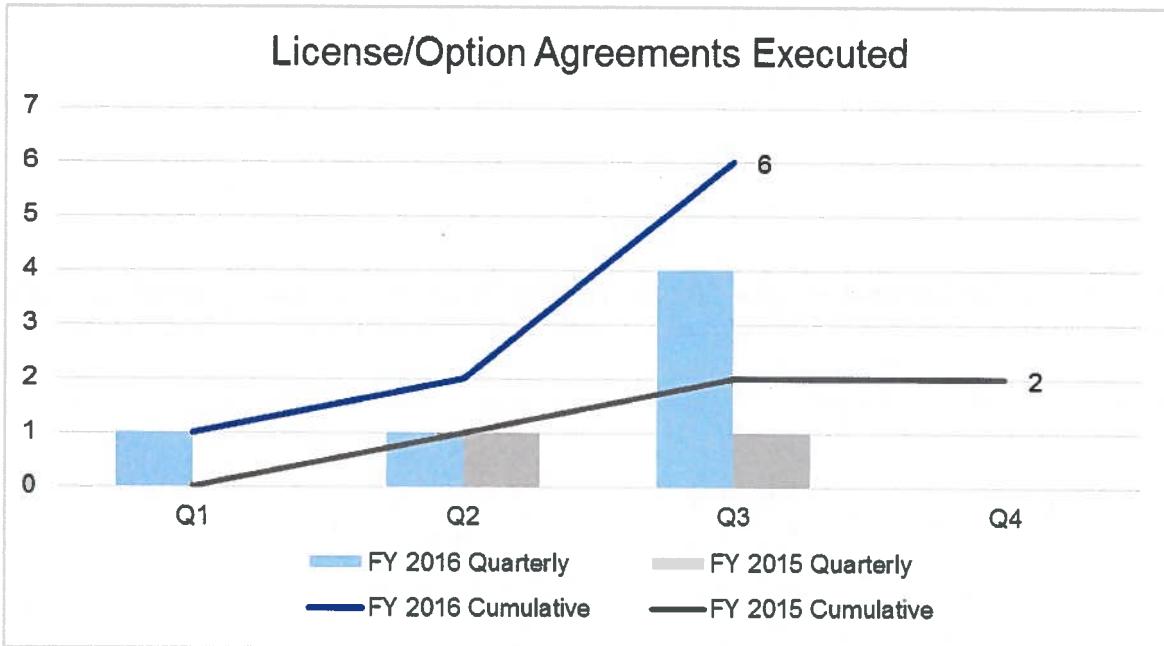
**U.S. Non-Provisional Patents Filed
As of Quarter Three – FY 2016**



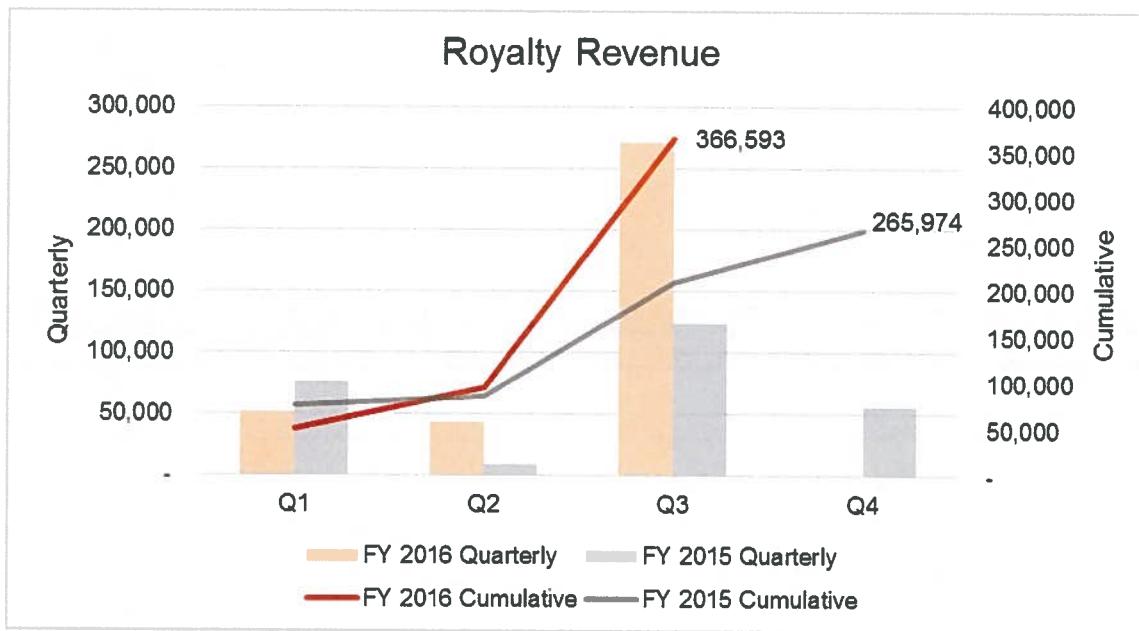
**U.S. Non-Provisional Patents Issued
As of Quarter Three – FY 2016**



License/Option Agreements
As of Quarter Three – FY 2016



Royalty Revenue
As of Quarter Three – FY 2016



University of Hawai'i
 Research & Innovation Performance Measures
 Strategic Directions (Board approved) and Other Metrics
 Reference: QR = Quarterly report; DB = Research dashboard (online); SD = Strategic Directions (online)

Metric	Reference/Comments	Description	Measures	Category
Invention disclosures	QR6; QR7	Number of new, potentially patentable inventions disclosed by UH inventors	Generation of new technology that could have commercial value	Strategic Directions (Board approved)
US patents issued	QR6; QR10	Number of new US patents issued to UH inventors	Inventions for which UH has exclusive rights to commercialize	Strategic Directions (Board approved)
Licenses/options executed	QR6; QR11	Number of new licenses or license options executed for UH patents	Efforts to get UH patents into hands of those that could commercialize it	Strategic Directions (Board approved)
Start-up companies created	<i>DB - Technology Transfer: Start-up Companies Created</i>	Number of new companies started utilizing a UH licensed technology	Situations in which a new company was started with UH technology	Strategic Directions (Board approved)
Total extramural funds received	QR1; QR2; QR5	Number and dollar value of new award commitments received by the UH	Confidence and willingness of external sponsors to have UH investigators conduct research, training or other sponsored projects	Strategic Directions (Board approved)
STEM degrees awarded ¹	<i>SD - UH Strategic Directions Measures: Number of STEM Degrees Awarded</i>	Number of new Science Technology Engineering & Math (STEM) degrees awarded to UH students	Proxy for knowledge transfer from UH faculty to students	Strategic Directions (Board approved)
Total R&D expenditures ²	<i>DB - Other Metrics: Total R&D Metrics of UH Manoa Peer Institutions</i>	Per National Science Foundation (NSF) Higher Education Research & Development (HERD) expenditures survey , total R&D expenditures from all sources for UH Manoa	Extramural funds received only measures commitments; expenditures are used as a proxy for research activity and can be verified from the accounting system	Other Metrics
Total R&D expenditures per tenured/tenure track faculty ²	Under development	NSF HERD survey R&D expenditures divided by Integrated Postsecondary Education Data System (IPEDS) tenured/tenure track faculty count for UH Manoa	Measures faculty excellence using R&D expenditures per faculty as a proxy	Other Metrics
Industry funded research as a percentage of total R&D expenditures ²	Under development	Per NSF HERD survey, percentage of annual R&D expenditures from the business sector for UH Manoa	Measures engagement with business and industry	Other Metrics
Other sponsored project expenditures	QR3 - Currently, total is reported and not split between research and non-research	Non-research expenditures	R&D centric measures only tell part of the story; in this case expenditures are used as a proxy for non-research activity	Other Metrics
Licensing royalties received	QR6; QR12	Royalty income received from UH patents	Commercial value of UH patents	Other Metrics
Other New Companies	<i>DB - Technology Transfer: XLR8UH Cohorts</i>	Number of new student or faculty companies that are incorporated in the state and received assistance from the university in the form of entrepreneurial education or training, legal advice, marketing help or services, help in securing financing, accounting assistance, subsidized office space in business incubator, or other support	Efforts of UH to stimulate local entrepreneurship by providing training, financial or other assistance to start-up companies such as through XLR8UH	Other Metrics

University of Hawai'i
 Research & Innovation Performance Measures
 Strategic Directions (Board approved) and Other Metrics
 Reference: QR = Quarterly report; DB = Research dashboard (online); SD = Strategic Directions (online)

Metric	Reference/Comments	Description	Measures	Category
Campus competitions (innovation)	Will be working with respective units to identify and report relevant data	Number of students participating in competitions	Efforts of UH to provide students with hands-on experience in innovation competition (e.g., PACE Breakthrough Innovation Challenge)	Other Metrics
Campus competitions (general business plans)		Number of students participating in competitions	Efforts of UH to provide students with hands-on experience in general business plan competition (e.g., PACE Business Plan Competition; UH Retail Business Plan Competition)	Other Metrics
iLab Concept Impact		Number of projects developed by students utilizing lab space	Efforts of UH to provide students with access to facilities and specialized equipment in order to innovate (e.g., Engineering Fab Lab; in the future i-Lab)	Other Metrics
Community colleges innovation classes (TBD)		For example, number of classes that teach innovation skills – VPRI to work with VP Community Colleges to identify appropriate metrics	Efforts of community colleges to build the innovation workforce through classroom instruction	Other Metrics
Community colleges students transferring into STEM degrees (TBD)		For example, number of students with two-year degrees transferring into four-year STEM degrees – VPRI to work with VP Community College to identify appropriate metrics	Efforts of community colleges to provide pathway for its students to earn four-year STEM degrees for workforce development	Other Metrics

NOTES:

¹ Availability of fiscal year data is dependent on when institutional research office finishes compiling and validating data.

² Availability of peer comparison data for a fiscal year is dependent on release of data by the National Science Foundation and National Center for Education Statistics. For example, FY 2014 NSF data is expected to be released February 2016.



UNIVERSITY
of HAWAII
MĀNOA

UNIVERSITY OF HAWAII
BOARD OF REGENTS

Office of the Vice Chancellor for Research

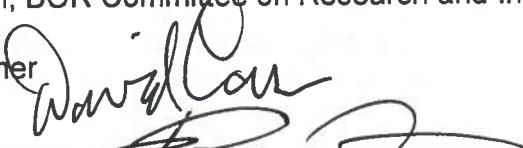
#17622

16 MAY 11 P1:36

May 10, 2016

MEMORANDUM

TO: Eugene Bal
Chairperson, BOR Committee on Research and Innovation

VIA: David Lassner
President 

VIA: Vassilis L. Syrmos 
Vice President for Research and Innovation

FROM: Michael Bruno 
Vice Chancellor for Research, UH Mānoa

UNIVERSITY OF HAWAII
PRESIDENT'S OFFICE

16 MAY 11 A9:29

RECEIVED

**SUBJECT: BOR COMMITTEE ON RESEARCH AND INNOVATION AGENDA
MATERIALS FROM THE OFFICE OF THE VICE CHANCELLOR FOR
RESEARCH, UH MĀNOA**

Please find attached the following materials for the Office of the Vice Chancellor for Research, UH Mānoa, which will be discussed at the May 2016 Committee on Research and Innovation meeting:

- "The Organized Research Units at Mānoa: History, Present Status, and How we Compare" – Presentation by Michael Bruno, Vice Chancellor for Research, UH Mānoa.
- Organized Research Units at the University of Hawai'i at Mānoa: History and Present Status

Attachments

The Organized Research Units at Mānoa: History, Present Status, and How We Compare

**M. Bruno
Vice Chancellor for Research
May 17, 2016**

Context

Research:

- inspires, informs, and supports the educational mission, from the recruitment of faculty who are leaders in their profession to the opportunities for experiential student learning in leading-edge laboratories, centers, and studios.
- is transferred to our constituents and stakeholders for the public good.

The University of Hawai‘i at Mānoa:

- Education, Scholarly Work (Research), and Service
- Carnegie Classification™ : “Research 1” (115 out of 4,664 universities)
- NCSES FY14: 70th overall, 45th among public universities in research expenditures
- Land-grant, Sea-grant, and Space-grant university



Viewing Policy EP 12.213

Title

Establishment and Review of Organized Research Units

Header

Executive Policy Chapter 12, Research

Executive Policy EP 12.213, Establishment and Review of Organized Research Units

Effective Date: October 2014

Dates Amended: August 2014, April 1991

Responsible Office: Office of the Vice President for Research and Innovation

Governing Board of Regents Policy 12.206, Establishment and Review of Organized Research Units

Review Date: August 2019

A. PURPOSE

1. ORUs are established to advance the University's research and training mission... ORUs benefit the State of Hawai'i directly through programs of applied research, extension service, and training in areas which meet community and regional human and economic needs...

C. SCOPE

1. Most ORUs are interdisciplinary in scope... ORUs are normally established and maintained only in areas where the University has intrinsic research advantages or particular capabilities to respond to special needs. Such advantages and capabilities are considered long-term. No ORU will be established or maintained if its goals are short-term...

D. FUNDING

1. ...In most cases, funding is obtained from both State and Federal sources, the ratio of external to core funding is greater than one, and more than one external funding source is involved...

Bottom Line Up Front

- The University of Hawai‘i at Mānoa is a world leader in applied research and education in domains of critical importance to the State and the Pacific region.
- The investments by the State in these areas have in nearly every case been long-lived (50 to 100+ years).
- The Organized Research Units are a primary – *but not the only* – home for leading-edge research, education, and service at Mānoa.

Bottom Line Up Front (cont.)

- A systematic review of the Organized Research Units is needed, in the context of present needs & opportunities, and multi-disciplinary capabilities across the Mānoa campus. Not simply a performance review.
- There is a need to more strongly integrate the research and educational missions of the University.
- There is a need to break down the barriers and silos that prevent innovative and relevant collaborative work across schools, colleges, and ORUs. Success will drive growth in the volume AND impact of research at Mānoa.
- Recent changes to ORU Research faculty teaching and external salary support are a positive step, but much more remains to be done to enable the seamless participation of all faculty in the university's educational mission.
- None of what we say here should be interpreted to mean that we are satisfied with the status quo.

History of the Organized Research Units

- 1908: UH President John W. Gilmore - "our teaching should be in accordance with the environments."
- 1912: marine biology lab at Waikiki, later Hawai'i Institute of Marine Biology at Coconut Island
- 1912: Pineapple Research Institute, closed in 1973
- 1958: Hawai'i Institute of Geophysics, later Hawai'i Institute of Geophysics and Planetology

Hawai'i Revised Statute §304A-1501 (§304-42) : “shall undertake basic research and training in geophysics, and shall disseminate knowledge of geophysics affecting Hawai'i, and to the extent its facilities permit, may serve to apply the results of its research to geophysical problems in the State.”

History of the Organized Research Units

- 1960: Pacific Biosciences Research Center
- 1964: Water Resources Research Center
- 1967: Institute for Astronomy (IfA)
- 1968: Hawai'i Sea Grant
- 1974: Hawai'i Natural Energy Institute (HNEI). Act 253 (2007):
 - Diminish Hawaii's dependence on imported fossil fuels;
 - Meet the state's increasing energy demands with little or no environmental degradation;
 - Contribute to the technology base for finding solutions to the national and global energy shortage;
 - Coordinate with state and federal agencies; and,
 - Demonstrate and deploy efficient end use technologies, including those that address peak electric demand issues.
- 1981: Cancer Research Center of Hawai'i, later University of Hawai'i Cancer Center

Status of the Organized Research Units

- **School of Ocean and Earth Science & Technology (SOEST)** : includes four Departments and five Organized Research Units (HIGP, HIMB, HNEI, PBRC and Sea Grant).
 - Consistently ranked among the top 5 schools in the nation in the marine sciences and geophysics.
 - World-class research programs including oceanography, coral reef ecology, volcanology, remote sensing, cosmo-chemistry, renewable energy, tropical meteorology and climate modeling.
 - The most advanced team of microbiome researchers in the nation, including 3 members of the National Academy. Simons Collaboration on Ocean Processes and Ecology (SCOPE), funded by the Simons Foundation at \$80 million.
 - 15 degree programs; world-class facilities including numerous analytical laboratories, modeling & simulation; two large surface vessels and two advanced submersibles.

Status of the Organized Research Units

- **School of Ocean and Earth Science & Technology (SOEST)** : includes four Departments and five Organized Research Units (HIGP, HIMB, HNEI, PBRC and Sea Grant). Not counting PBRC:
 - FY14: 870 employees; approximately **two of every three** supported by extramural funds.

Fiscal Year	2013	2014	2015
G+S+RTRF funds	\$29,569,441	\$29,596,855	\$29,469,362
Extramural	\$91,512,217	\$104,333,701	\$100,796,658
Extramural/State funds	3.1	3.5	3.4

Status of the Organized Research Units

- **Hawai‘i Institute of Geophysics and Planetology**
 - 100 employees
 - Hawai‘i Space Flight Laboratory supports the emerging field of small satellite development, including a nascent capability to launch these satellites from the islands.
 - Keck Cosmo-chemistry Laboratory provides capabilities for agencies such as NASA and many national and international clientele.
 - Research on earthquakes, tsunamis, volcanic activity, geothermal resources
 - The Center for the Study of Active Volcanoes provides training in volcano hazards monitoring.
 - Provides critical data and support for the Treaty on the Non-Proliferation of Nuclear Weapons and the Chemical Weapons Convention arms control treaty.

Status of the Organized Research Units

- **Hawai‘i Institute of Marine Biology**
 - 107 employees
 - Coconut Island - surrounded by 64 acres of coral reef designated by the state of Hawai‘i for research activities only.
 - Research in coral ecology, biogeochemistry, evolutionary genetics and marine diseases.
 - Both graduate and undergraduate students from 8 different departments and programs conduct research at the Coconut Island facility.

Status of the Organized Research Units

- **Pacific Biosciences Research Center**

- Hawai'i has the largest number of endangered animals and plants in the U.S., as well as a plethora of invasive species, and all of the Earth's climate types. It is therefore a microcosm for biodiversity research in both terrestrial and marine systems.
- PBRC sponsors a large fraction of all the undergraduate research training programs at UH Mānoa, including minority-serving programs targeting Native Hawaiians and Pacific Islanders, and the educators that serve them.
- Outreach activities to high-school teachers, the native Hawaiian community, and small business researchers.

Status of the Organized Research Units

- **Hawai‘i Natural Energy Institute**
 - More than 70 employees
 - Technically sound, cost effective solutions and practical strategies that can be implemented to deliver commercially viable renewable energy.
 - Unconventional academic enterprise - bringing together people from a wide range of disciplines and organizations; rapidly transfers new knowledge and new technologies to the field.
 - Supports units including SOEST, the College of Engineering, CTAHR, the School of Architecture, the College of Social Sciences, Kauai Community College, and Maui College.
 - Recent or ongoing projects of state interest include the Wave Energy Test Site at MCBH, the development of the Hawai‘i Bioenergy Master Plan, and the Maui Smart Grid Initiative.

Status of the Organized Research Units

- Pacific Biosciences Research Center:
 - 70 employees, two out of every three supported by external grants.

Fiscal Year	2013	2014	2015
G+S+RTRF funds	\$3,478,046	\$3,325,872	\$3,477,986
Extramural	\$5,259,842	\$2,546,375	\$3,778,961
Extramural/State funds	1.5	0.8	1.1



Greetings:

The White House Office of Science and Technology Policy (OSTP) is pleased to invite you to attend an event on microbiome research on May 13, 2016 in Washington, DC. This event will highlight new efforts and actions to advance microbiome applications for areas such as health care, food safety and security, environmental protection, and bioenergy production.

It is our hope that you can be a part this event.

Event Information

Date: **May 13, 2016**
Time: **1:00 – 4:00 PM ET.** Attendees should plan to arrive between 12:15 and 12:45 PM to allow time for White House security processing.
Location: **Eisenhower Executive Office Building**
Logistics: Additional logistical information will be provided prior to the event and upon receipt of your RSVP.

Status of the Organized Research Units

- **Institute for Astronomy**
 - Fundamental research into the stars, planets, and galaxies that make up our Universe.
 - Pan-STARRS and ATLAS observatories are providing the world's best early-warning system for dangerous asteroids
 - The Mauna Kea Weather Center (MKWC) was created to provide custom forecasts for the observatories. Recently, MKWC adapted its computer programs to predict the dispersion of Vog from the Kilauea volcano, at no cost to the State.
 - All tenure track and tenured Research faculty in the IfA have an obligation to teach. This has made possible the development of one of the largest and most highly ranked astronomy graduate programs in the nation. Recently the IfA faculty in close cooperation with the College of Natural Sciences initiated two popular undergraduate programs in Astronomy and Astrophysics.

Status of the Organized Research Units

- Institute for Astronomy:

- 224 employees, 3 out of every 4 supported by extramural funds.

Fiscal Year	2013	2014	2015
G+S+RTRF funds	\$10,985,934	\$11,340,434	\$11,008,735
Extramural	\$21,687,757	\$23,748,509	\$22,227,055
Extramural/State funds	2.0	2.1	2.0

Status of the Organized Research Units

- UH Cancer Center: one of 69 National Institutes of Health (NIH) National Cancer Institute (NCI) designated cancer centers

Fiscal Year	2013	2014	2015
G+S+RTRF funds	\$5,445,523	\$4,253,253	\$5,063,756
Net Cigarette Tax Fund	\$2,721,940	\$2,591,302	\$3,804,219
Extramural	\$21,383,663	\$22,097,128	\$25,107,708
Extramural/State funds	2.6	3.2	2.8

The “non-ORUs” – 50% of all research

- JABSOM: \$52.5 million in extramural funding in FY15
- College of Natural Sciences: \$35 million in extramural funding in FY15
 - Pacific Cooperative Studies Unit: \$14 - \$15 million extramural funding/year
- College of Education: \$20 million in extramural funding in FY15
- College of Tropical Agriculture and Human Resources: \$18 million in extramural funding in FY15
- College of Social Sciences: \$16.5 million in extramural funding in FY15

How do We Compare?

- Florida Solar Energy Center, University of Central Florida
 - Created by the Florida Legislature in 1975
 - photovoltaics, electric vehicles, smart grid technology, energy efficient buildings, alternative transportation fuels, tech transfer & education.
 - Receives \$3 million in state operating funds
 - Five-year average extramural funding = \$7.9 million
 - Ratio of Extramural/State funds = 2.6
- Institute for Geophysics, University of Texas
 - Founded in 1972
 - 50 employees
 - climate, energy, marine geosciences & tectonics, and planetary & polar geophysics.
 - Receives \$2 million in state operating funds and \$9 million in extramural
 - Ratio of Extramural/State funds = 4.5

How do We Compare?

- Rutgers Coastal Ocean Observational Lab
 - Leading university in the development and utilization of unmanned underwater systems, high frequency RADAR systems, and high-resolution ocean and weather computer forecast systems.
 - Funding from NSF, NOAA, ONR, others
 - 36 employees, including 5 faculty assigned to the Lab
 - Approximately \$9 million in extramural funding in FY15
 - University funding:
 - 9-month salaries for 5 faculty. These faculty all teach 2+ courses/yr
 - 12-month salaries for 2 administrative support staff
 - Average of 2 post-doctoral scholars per year
 - Minimum return of 10% IC (can be as high as 30%)

How do We Compare?

- University of California Observatories
 - Operates the Lick Observatory on behalf of all UC campuses
 - Designs and fabricates instrumentation for Lick and Keck Observatories
 - Facilitates UG & G instruction and PhD training throughout the UC system
 - Located on the UC Santa Cruz campus
 - 190 employees
 - Extramural funding: \$11 million/year average over 5 years (2006-2010)
 - 100% State support for core staff (7 engineers, 15 staff specialists)
 - 100% State support for 14 tenure-track faculty: 80%/20%
 - 80% support via UCO budget (Office of the President)
 - 20% support via UC Santa Cruz budget in return for teaching 1 class per year in the UCSC Department of Astronomy & Astrophysics

How do We Compare?

- Others

How do We Compare?

- We are not unique in providing university salary support for research faculty.
- We are not unique in having research centers that are not fully engaged in the university's educational mission, *although that is changing and we will be addressing this via our Strategic Plan.*
- We appear to be rather unique in providing tenure to Research faculty, although we are not alone in this regard (e.g., UCO). There are institutions (e.g., Woods Hole Oceanographic Institution) that grant tenure to grant-supported researchers.

Research at Mānoa, Next Steps

Research Strategic Planning initiated in February.

Increase the volume and impact of UH Mānoa research ACROSS disciplines.

1. Faculty research development support

- Coordinate/support Grant Development Offices across campus
- Grant writing workshops
- Host visits by funding agencies, foundations, and industry

2. Research administrative burden

- Pre & Post-award – reporting, procurement, hiring, travel, etc. (an “urgent care” facility for PIs?)

3. Research facilities

- Shared facilities, off-campus facilities, funding of O&M

4. Enabling and Supporting student research

5. Understanding – and communicating – the impact of research

Conclusions

- The University of Hawai‘i at Mānoa is a world leader in applied research and education in domains of critical importance to the State and the Pacific region.
- The investments by the State in these areas have in nearly every case been long-lived (50 to 100+ years).
- The Organized Research Units are a primary – *but not the only* – home for leading-edge research, education, and service at Mānoa.

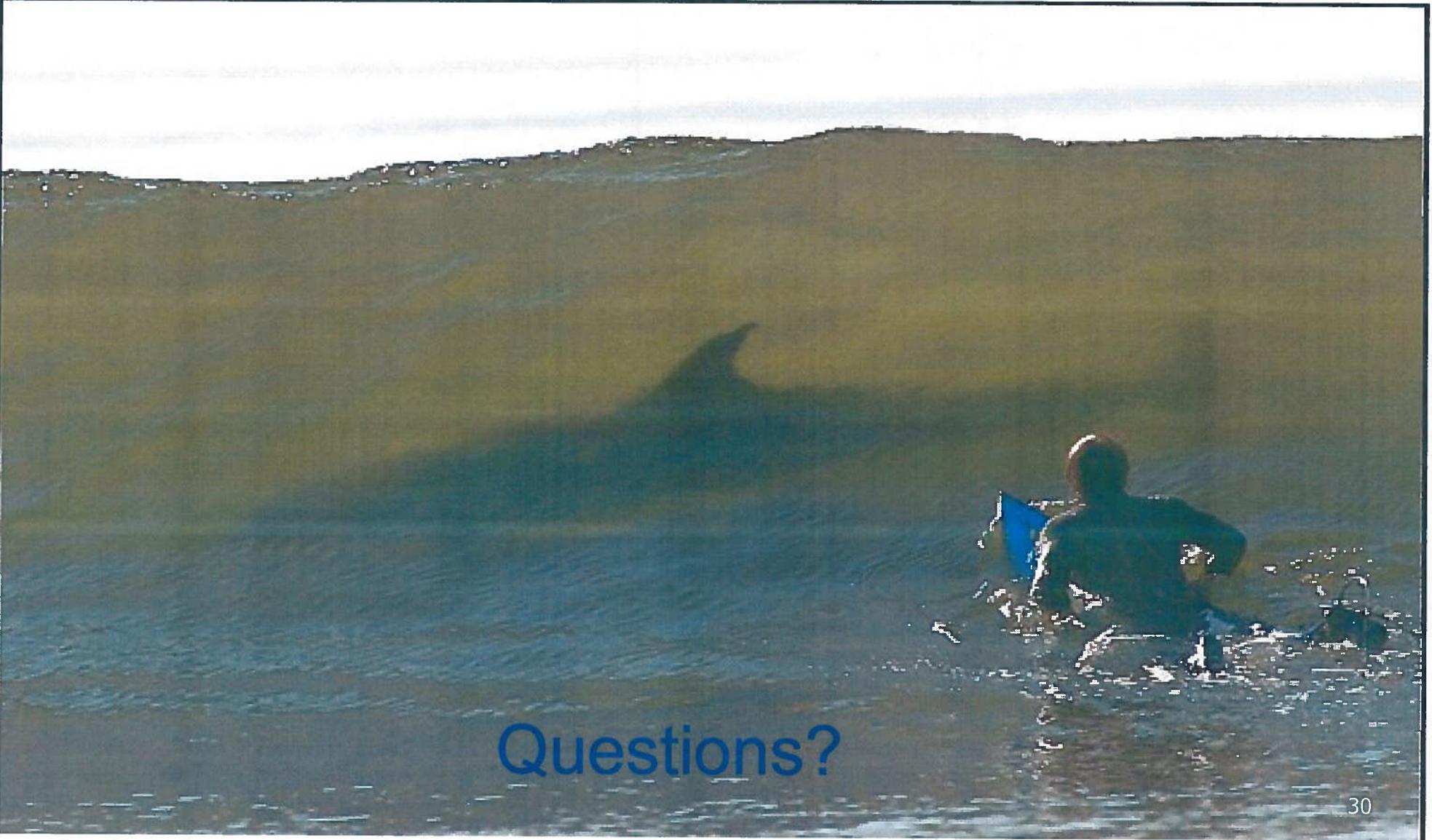
Conclusions (cont.)

- A systematic review of the Organized Research Units is needed, in the context of present needs & opportunities, and multi-disciplinary capabilities across the Mānoa campus. Not simply a performance review.
- There is a need to more strongly integrate the research and educational missions of the University.
- There is a need to break down the barriers and silos that prevent innovative and relevant collaborative work across schools, colleges, and ORUs. Success will drive growth in the volume AND impact of research at Mānoa.
- Recent changes to ORU Research faculty teaching and external salary support are a positive step, but much more remains to be done to enable the seamless participation of all faculty in the university's educational mission.
- We have started a Strategic Planning process with the aim of increasing the volume AND impact of research (including impact on education).

Rankings by total R&D expenditures (\$000) 2014

	Rank	Percentile	expenditures
Total R&D expenditures			67154642
Brown University	66	11	341531
University of California, Irvine	67	11	340056
University of Kentucky	68	11	328239
Washington State University	69	11	326414
University of Hawaii at Manoa	70	11	324342
Indiana University-Purdue University, Indianapolis	71	11	324261
Rockefeller University, The	72	12	316368
Oregon Health & Science University	73	12	314802
Iowa State University	74	12	313263
Colorado State University	75	12	307978
Yeshiva University	76	12	306826
University of Kansas	77	12	301534
Princeton University	78	13	293274
Louisiana State University, Baton Rouge	79	13	290076
University of Nebraska-Lincoln	80	13	278299
Uniformed Services University of the Health Sciences	81	13	262489
University of Connecticut	82	13	258056
University of Oklahoma, The	83	13	255268
Florida State University	84	14	252548
Carnegie Mellon University	85	14	251222



A photograph of a person swimming in the ocean. The water is dark blue and textured with small waves. A large, dark, silhouetted shape of a shark is visible in the water, casting a long, dark shadow across the surface towards the swimmer. The swimmer is wearing a dark wetsuit and is positioned in the lower right quadrant of the frame, facing away from the camera.

Questions?

What we're doing to the Earth has no parallel in 66 million years, scientists say

By Chris Mooney March 26

This story has been updated.

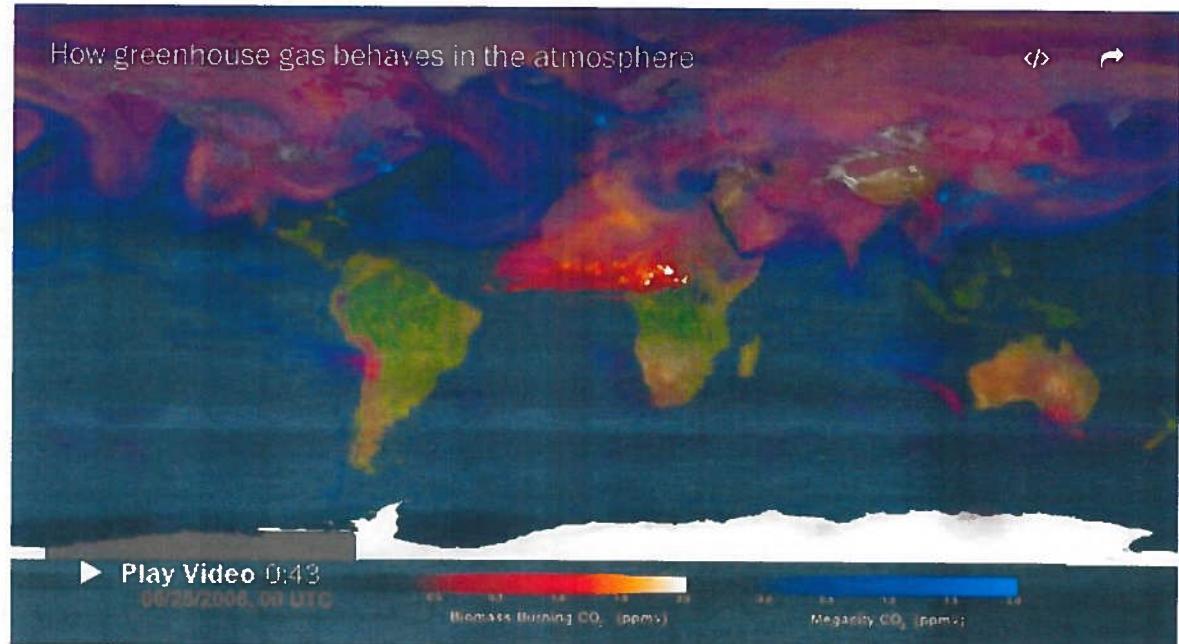
If you dig deep enough into the Earth's climate change archive, you hear about the Paleocene-Eocene Thermal Maximum, or PETM. And then you get scared.

This is a time period, about 56 million years ago, when something mysterious happened — there are many ideas as to what — that suddenly caused concentrations of carbon dioxide in the atmosphere to spike, far higher than they are right now. The planet proceeded to warm rapidly, at least in geologic terms, and major die-offs of some marine organisms followed due to strong acidification of the oceans.

The cause of the PETM has been widely debated. Some think it was an explosion of carbon from thawing Arctic permafrost. Some think there was a huge release of ancient methane that somehow made its way to the atmosphere — and that the series of events might have been kickstarted by major volcanic eruptions.

In any case, the result was a hothouse world from pole to pole, some 5 degrees Celsius warmer overall. But now, new research suggests, even the drama of the PETM falls short of our current period, in at least one key respect: We're putting carbon into the atmosphere at an even faster rate than happened back then.

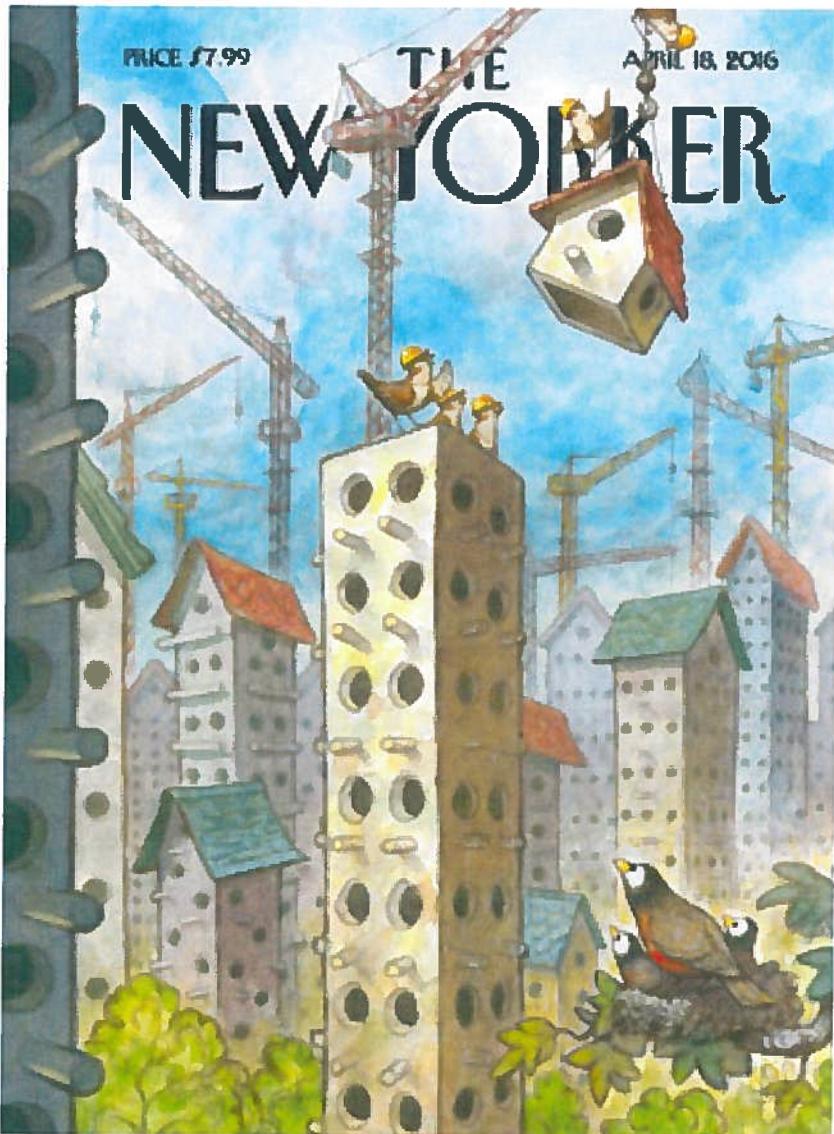
Such is the result of a new study in *Nature Geoscience*, led by Richard Zeebe of the University of Hawaii at Manoa, and colleagues from the University of Bristol in the UK and the University of California-Riverside.



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UNNATURAL SELECTION

What will it take to save the world's reefs and forests?

BY ELIZABETH KOLBERT



Researchers are hoping to "assist" evolution in order to produce harder corals and tougher trees.

ILLUSTRATION BY HARRY CAMPBELL

Ruth Gates fell in love with the ocean while watching TV. When she was in elementary school, she would sit in front of "The Undersea World of Jacques Cousteau," mesmerized. The colors, the shapes, the diversity of survival strategies—life beneath the surface of the water seemed to her more spectacular than life above it. Without knowing much beyond what

Organized Research Units at the University of Hawai‘i at Mānoa: History and Present Status

Prepared by: Michael S. Bruno, Vice Chancellor for Research
May, 2016

Introduction

As the flagship campus of the only public university in the State of Hawai‘i, the University of Hawai‘i at Mānoa serves a diverse community of students and public and private stakeholders, providing a world-class education and performing scholarly work and service in areas of critical importance to our State, the Pacific region, and the nation. Some may view these three components of the university’s mission – education, scholarly work (research), and service – as mutually exclusive pursuits. In fact, if the University is to achieve success in any one of these components, it must excel in all of them, as they are strongly integrated and, to a great extent, interdependent. The education of students is the core mission of the University; it is the reason we exist. Research serves to inspire, inform, and support the educational mission, from the recruitment of faculty who are leaders in their profession to the opportunities for experiential learning in leading-edge laboratories, centers, and studios. Service to the community and to the profession ensures that the work of the University is transferred to our constituents and stakeholders for the public good.

Definition of a Research University

Starting in 1970, the Carnegie Commission on Higher Education developed a classification of U.S. colleges and universities to support its program of research and policy analysis. This classification became known as the Carnegie Classification™. In the Carnegie Classification announced in February, 2016, 4,664 U.S. postsecondary institutions were assessed. Of these, 2,665 universities confer 4-year or higher degrees as their main focus. Only 115 universities (4.3% of the 2,665 and 2.5% of the total) were classified as Highest Research Activity, also commonly referred to as “Research 1” or “R1” universities. The University of Hawai‘i at Mānoa is one of only 81 public universities included in this elite group. Further evidence of the high national standing of the research enterprise at the University of Hawai‘i at Mānoa can be found in the annual rankings of the National Science Foundation’s National Center for Science and Engineering Statistics (NCSES). The most recent ranking (FY2014) placed the University of Hawai‘i at Mānoa 70th overall and 45th among U.S. public universities in the level of extramural research expenditures.

The role of a public research university in supporting the intellectual, cultural and commercial health of their communities has long been recognized, dating back to the Morrill Act, signed by President Abraham Lincoln in 1862. The act provided federal lands to establish “colleges for the benefit of agriculture and the Mechanic arts” as well as “scientific and classical studies,” with the goal of preparing the population for beneficial participation in an increasingly industrialized nation. These colleges are often referred to as “land grant” colleges. The act created a set of

institutions that would evolve over time—a new system of publicly supported American higher education that would respond to the needs of Americans in every state and territory.¹

The University of Hawai‘i at Mānoa was founded in 1907 as a land-grant college of agriculture and mechanical arts. From its creation, the research performed at the University has focused on the needs of the local community, the State, and the Pacific region. These evolving needs, and the unique opportunities for scholarly inquiry in a physical and cultural environment unique in the world, have led to the development of a number of leading-edge research enterprises at the University. Among the largest and oldest of these enterprises have been the Organized Research Units.

Organized Research Units – Background and History

According to UH Executive Policy 12.213, "Establishment and Review of Organized Research Units", Organized Research Units "benefit the State of Hawai‘i directly through programs of applied research, extension service, and training in areas which meet community and regional human and economic needs". Further, "ORUs are normally established and maintained only in areas where the University has intrinsic research advantages or particular capabilities to respond to special needs". With regard to financial sustainability, the policy states: "In most cases, funding is obtained from both State and Federal sources, the ratio of external to core funding is greater than one, and more than one external funding source is involved". By all of these expectations and measures, the existing UH ORUs have been successful.

The Hawai‘i Pineapple Research Institute (PRI), founded in 1912 as the Pineapple Packers Association experiment station and renamed in 1938, produced the MD-2 pineapple cultivar, the predominant pineapple cultivar for fresh fruit export worldwide. The PRI was closed in 1973, reflecting the decreased commercial importance of the crop in the State’s economy. Meanwhile, several new ORUs were formed, as new challenges emerged in the State and in the nation, ranging from space exploration to the sustainable use of energy and water resources. These ORUs remain as some of the primary engines for externally-sponsored research, scholarly work, and community service in the University. According to the University of Hawai‘i Economic Research Organization (UHERO), in FY 2012, the University of Hawai‘i at Mānoa and the supporting Research Corporation of the University of Hawai‘i spent a total of \$878 million in support of its education mission; the State General Fund paid \$198 million of the total. Adding money spent by the privately funded UH Foundation, spending by students, out-of-town visitor spending related to UH Mānoa-sponsored professional meetings, the total UH Mānoa-related expenditures amounted to \$1.40 billion in FY2012. This \$1.40 billion of education-related expenditures generated \$2.45 billion in local business sales, \$735 million in employee earnings, \$131 million in state tax revenues, and slightly under 20,000 jobs in Hawai‘i in FY 2012.²

¹ Public Research Universities. Recommitting to Lincoln’s Vision: An Educational Compact for the 21st Century. American Academy of Arts & Sciences. The Lincoln Project: Excellence and Access in Public Higher Education. 2016. ISBN: 0-87724-109-0. 40 pp.

² The Contribution of the University of Hawai‘i at Mānoa to Hawai‘i’s Economy in 2012. January 15, 2013. University of Hawai‘i Economic Research Organization. 18 pp.

In the following, we summarize the history and current status of the Organized Research Units at the University of Hawai‘i at Mānoa.

SOEST

The School of Ocean and Earth Science and Technology (SOEST) includes four Departments and five Organized Research Units to be described later (HIGP, HIMB, HNEI, PBRC and Sea Grant). Consistently ranked among the top 5 schools in the nation in the marine sciences and geophysics, SOEST maintains world-class research programs in areas as varied as oceanography, coral reef ecology, volcanology, remote sensing, cosmo-chemistry, renewable energy, tropical meteorology and climate modeling. The School is operational 24/7/365, with programs and people around the world. SOEST faculty work with community groups and agencies at local, state, and federal levels, to perform the fundamental and applied research that underlies policy development in water quality, renewable energy, natural hazard management, climate change impacts, and sustainable ecosystems. SOEST is home to the most advanced team of microbiome researchers in the nation. This team – housed in C-MORE and PBRC – includes three members of the National Academy. Their efforts have led to the creation of the Simons Collaboration on Ocean Processes and Ecology (SCOPE), funded by the Simons Foundation at \$80 million over 10 years, to advance our understanding of the biology, ecology and biogeochemistry of microbial processes that dominate the global ocean.

SOEST is also a significant contributor to the University’s educational mission, offering 15 degree programs including undergraduate programs in geology and geophysics, meteorology, marine biology (joint with Biology), and environmental sciences, and graduate programs in geology and geophysics, meteorology, oceanography, marine biology, and ocean and resources engineering. With two large research vessels, several coastal vessels, two submersibles, a deep-ocean cabled observatory, a satellite fabrication facility, a private island devoted to marine biology research, and dozens of other specialized laboratories, students within SOEST have access to world-class, state-of-the-art facilities.

HIGP

The Hawai‘i Institute of Geophysics (HIG) was established in 1958. Hawai‘i Revised Statute §304A-1501 (§304-42) mandated the formation of an institute of geophysics at the University of Hawai‘i that “shall undertake basic research and training in geophysics, and shall disseminate knowledge of geophysics affecting Hawai‘i, and to the extent its facilities permit, may serve to apply the results of its research to geophysical problems in the State.” In 1994 the Planetary Geosciences group, then in the Department of Geology and Geophysics, merged with HIG to form the Hawai‘i Institute of Geophysics and Planetology (HIGP).

HIGP’s positive economic impact extends well beyond its extramural funding. Through the Hawai‘i Space Flight Laboratory, HIGP is building a cottage industry of technicians and engineers to support the emerging field of small satellite development, including a nascent capability to launch these satellites from the islands. HIGP research has spun off multiple high-tech companies in the State, employing dozens of personnel not captured in a listing of the 100 HIGP faculty, staff and administrators. HIGP operates state-of-the-art equipment, such as the Keck Cosmo-chemistry Laboratory, which provides fundamental capabilities for agencies such as NASA and attracts a host of national and international clientele.

As mandated, HIGP serves the State, the Nation and the world in researching and sharing knowledge about geophysical problems involving earthquakes, tsunami, volcanic activity, geothermal resources, sound in the ocean and atmosphere, and the physical properties of materials. HIGP's Hawai'i Groundwater and Geothermal Resources Center partners with Hawai'i's Department of Land and Natural Resources, Department of Business, Economic Development & Tourism, Department of Health, and the Hawaiian Electric Company to disseminate information related to the State's natural resources via the internet. The Center for the Study of Active Volcanoes provides training in volcano hazards monitoring. HIGP researchers provide critical data and support for the Treaty on the Non-Proliferation of Nuclear Weapons and the Chemical Weapons Convention arms control treaty. HIGP engineers support first responders worldwide through the development of innovative technologies such as stand-off sensors to detect explosives at distances of hundreds of feet.

Recognizing that education and research are mutually enhanced when accomplished together, HIGP's Space Grant Consortium supports fellowships, training programs, workshops for teachers and public exhibitions that promote the appreciation and understanding of scientific research within the broader community. Students get hands-on experience with HIGP research faculty, building and deploying instruments in environments ranging from Mars to the bottom of the ocean. These students in turn serve as role models, encouraging and inspiring younger generations to follow in their footsteps. This succession of knowledge and experience that HIGP has developed is critical to sustainably building the skilled workforce necessary to support the State of Hawai'i's bid to diversify its economy through a high-tech industry.

HIMB

Soon after his arrival in 1908, the University of Hawai'i's first president John W. Gilmore noted that "our teaching should be in accordance with the environments." He proposed the creation of a marine biological laboratory. A laboratory was established in 1912 in a wooden structure on the shores of Waikiki with funds from the Charles M. Cooke Estate. This lab functioned in association with the Waikiki Aquarium. In 1919, both facilities were turned over to the University of Hawai'i. In 1947, the late Edwin W. Pauley provided an opportunity to establish a marine laboratory on Coconut Island. In 1951, Mr. Pauley helped establish the Hawai'i Marine Lab on Coconut Island and leased the necessary land to the State "rent free". In 1965, the name of the Hawai'i Marine Lab was changed to the Hawai'i Institute of Marine Biology. In 1993, the Pauley family provided funds to purchase the private portion of Coconut Island and construct a new world-class marine laboratory on the island. The new marine laboratory focuses on two aspects of tropical marine biology: biodiversity and biotechnology. This new addition gives the University of Hawai'i a world-class facility for marine biology.

HIMB is today a world-renowned marine research institute, providing leading edge research facilities for faculty, students, and visiting scientists coupled with convenient access to a diverse range of marine environments. Coconut Island is surrounded by 64 acres of coral reef designated by the state of Hawai'i for research activities only. The research at HIMB covers many disciplines of tropical marine science, including coral ecology, biogeochemistry, and evolutionary genetics. In addition, HIMB faculty are recognized authorities in marine diseases, neuroendocrinology, microbial organisms, and sensory systems of marine mammals and elasmobranchs. Importantly, both graduate and undergraduate students conduct research at the

Coconut Island facility. These students are primarily enrolled in the departments of Zoology and Oceanography. However, students from a number of different departments and programs across campus also participate in the research, including the departments of Microbiology, Geography, Molecular Biosciences and Bioengineering (MBBE), Human Nutrition, Food and Animal Sciences (HNFAS), and the Global Environmental Sciences program in the department of Oceanography.

HNEI

The Hawai‘i Natural Energy Institute (HNEI) was established in 1974 to coordinate and undertake the development of natural energy sources for Hawai‘i. It was established in statute in 2007 under ACT 253, with an expanded mandate to explicitly include coordination with state and federal agencies and to undertake the development of Hawaii’s abundant natural energy sources in order to:

- Diminish Hawaii's dependence on imported fossil fuels;
- Meet the state's increasing energy demands with little or no environmental degradation;
- Contribute to the technology base for finding solutions to the national and global energy shortage;
- Coordinate with state and federal agencies; and,
- Demonstrate and deploy efficient end use technologies, including those that address peak electric demand issues.

HNEI conducts essential energy research relevant to Hawaii and the world. Programs focus on identifying technically sound, cost effective solutions and practical strategies that can be implemented to deliver commercially viable renewable energy. The ultimate goal is to achieve a stable and cost-effective energy mix for Hawai‘i, while reducing our dependence on oil and other fossil fuel resources. To accomplish this goal, HNEI has developed into a rather unconventional academic enterprise - bringing together people from a wide range of disciplines and organizations to tackle the urgent and complex sustainable energy needs of the State and the nation in a way that rapidly transfers new knowledge and new technologies to the field. Analysis, research, engineering, economics, and policy are integrated to develop technologies, strategies and policies that have significant positive impact on the energy mix.

HNEI supports faculty, staff and researchers across multiple campuses, colleges, and departments, including SOEST, the College of Engineering, CTAHR, the School of Architecture, the College of Social Sciences, Kauai Community College, and Maui College. Recent or ongoing projects of state interest include the Wave Energy Test Site at MCBH, the development of the Hawai‘i Bioenergy Master Plan, and the Maui Smart Grid Initiative to demonstrate advanced SG technology and controls, among others.

PBRC

The Pacific Biosciences Research Center was established as an ORU in 1960, and currently has a faculty of 24. It hosts leading-edge and well-funded research programs in the areas of marine science, neurobiology and behavior, ecology, conservation, and evolutionary and developmental biology. Hawai‘i has the largest number of endangered animals and plants in the nation, as well as a plethora of invasive species, and all of the Earth’s climate types. It is therefore an exemplary

microcosm for biodiversity research in both terrestrial and marine systems. The research, training, and outreach activities at PBRC are focused largely on this unique opportunity.

Although as an ORU the primary responsibility of the PBRC is research rather than formal classroom instruction, its faculty actively engages in hands-on mentoring of undergraduate, graduate, and postdoctoral students, complementing and augmenting the education provided in lecture-based classes. PBRC sponsors a large fraction of all the undergraduate research training programs at UH Mānoa, including minority-serving programs targeting Native Hawaiians and Pacific Islanders, and the educators that serve them. For example, PBRC has been funded by the National Institutes of Health, Minority Access to Research Careers (MARC) program nearly continuously since 1978. Over 150 UH undergraduates have participated in this program. Over the last decade PBRC has also trained many students and small-college educators, not only from UH, but also from the other Pacific Islands, in programs such as COSEE (Centers for Ocean Science Education Excellence-Pacific Partnerships). Other federally funded educational programs managed by PBRC include Undergraduate Mentoring in Environmental Biology (UMEB), Undergraduate Research Mentoring (URM), and Integrated Graduate Education and Research Training (IGERT). All three of these National Science Foundation-sponsored programs have targeted Native Hawaiian and Pacific Islander students.

In addition, each year PBRC's outreach activities touch many of the State's citizens beyond the University, including high-school teachers, the native Hawaiian community, and small business researchers. PBRC researchers collaborate with and advise State, federal, and community stakeholders. These interactions have led to participation in K-12 education, promotion of local and international biodiversity awareness, and effective conservation efforts.

Sea Grant

The National Sea Grant College Program Act of 1966, which was signed into Public Law 89-688 by President Lyndon B. Johnson, was modeled after the Land Grant Act of 1862 and established what is now a network of 33 university-based programs focused on understanding and communicating conservation and the sustainable use of coastal and ocean resources for the betterment of coastal communities across all US coastal states, Great Lakes states, Puerto Rico and Guam. Hawai'i Sea Grant was established in 1968.

The National Sea Grant College Program Act established the Sea Grant Colleges as a partnership program with core federal funding requiring a match of non-federal funds from the states where they are located. Each Sea Grant College Program must demonstrate non-federal matching funds and a commitment from the state in the amount of 1 dollar for every 2 federal dollars received.

Hawai'i Sea Grant is a highly leveraged program with 5 FTE supported by institutional funds, an additional 10 FTE supported by federal funds and 30 FTE that are project-based and supported by other extramural funds. Its research and educational programs are aimed at supporting culturally, economically and socially inclusive and resilient coastal communities. To achieve this aim, the program conducts research and outreach to better understand, develop, and communicate policy in areas related to disaster resilience and preparedness, coastal processes such as beach erosion and sea level rise, and the sustainable use of fresh water resources, renewable energy, and food sources.

IfA

The Institute for Astronomy (IfA) was founded in 1967 to manage the Haleakalā Observatories on Maui and the Mauna Kea Observatories on the Big Island, and to carry out its own program of fundamental research into the stars, planets, and galaxies that make up our Universe. The IfA has a total staff of 224, including 42 faculty. The Institute has from its outset been viewed as an economic driver for the State of Hawai'i, in particular for the Big Island. A recent study by the UH Economic Research Organization (UHERO) showed that in 2012 astronomy had a total economic impact of \$168 million, a job creation impact of 1,400, and generated State taxes of \$8.2 million.³ Astronomy has other direct benefits to the State. It directly provides close to 1,000 jobs in a high-tech activity that offers employment opportunities in STEM fields to local young people. The IfA astronomy outreach programs are particularly effective in sparking interest among Hawaii's youth for all types of STEM-related fields - not just astronomy.

The Pan-STARRS and ATLAS observatories are providing the world's best early-warning system for dangerous asteroids, such as the one that struck Russia in February, 2013. The Mauna Kea Weather Center (MKWC) was created to provide custom forecasts for the observatories. Recently, MKWC adapted its computer programs to predict the dispersion of Vog from the Kilauea volcano, at no cost to the State. Twenty years ago, a \$2 million up-front contribution from the Mauna Kea observatories expedited the installation of fiber-optic communications infrastructure on Hawai'i Island. These are just a few examples of how the innovative technology at IfA is a broad catalyst for future economic development in Hawai'i that goes far beyond astronomy.

All tenure track and tenured Research faculty in the IfA have an obligation to teach. This has made possible the development of one of the largest and most highly ranked astronomy graduate programs in the nation. Recently the IfA faculty in close cooperation with the College of Natural Sciences initiated two popular undergraduate programs in Astronomy and Astrophysics.

WRRC

The Water Resources Research Act of 1964, which was signed into Public Law 88-379 by President Lyndon B. Johnson, was established to promote the understanding of critical state and regional water management and policy issues through research, community outreach and engagement, and public education, ultimately creating the National Institutes of Water Resource Research. The Water Resources Research Center at the University of Hawai'i at Mānoa was established in 1964 and is part of a 54 program network including programs in the 50 US states, the District of Columbia, Puerto Rico, the US Virgin Islands, and Guam.

The Water Resources Research Act established the Water Resource Research Institutes as a partnership program with core federal funding requiring a match of non-federal funds from the states where they are located. Each institute must demonstrate non-federal matching funds and a commitment from the state in the amount of 2 dollars for every 1 federal dollar received.

³ The Economic Impact of Astronomy in Hawai'i. August 28, 2014. University of Hawai'i Economic Research Organization. 20 pp.

The UH WRRC focuses on addressing the unique water and wastewater management problems and issues of the State of Hawai‘i and the Pacific region. WRRC faculty, staff and students:

- Serve as the Water Research Center in Hawai‘i and coordinate and conduct research to identify, characterize, and quantify water-related problems in the State.
- Assist Pacific Island and Asian governments facing water problems similar to those we face in Hawai‘i by making WRRC expertise available to them.
- Facilitate access to interdisciplinary expertise within the university to enhance the understanding of environmental problems and to identify effective solutions.

Cancer Center

The University of Hawai‘i Cancer Center is the only National Cancer Institute-designated center in Hawai‘i and the Pacific, and one of only 69 such centers in the nation. The Center’s mission is to reduce the burden of cancer through research, education and patient care with an emphasis on the unique ethnic, cultural and environmental characteristics of Hawai‘i and the Pacific. The Center directly employs 300 faculty and staff, with another 200 affiliate members through the UH Cancer Consortium.

The UH Cancer Center was established by the University of Hawai‘i Board of Regents in 1981, and prior to 2011 was known as the Cancer Research Center of Hawai‘i. In its early development, the Center was supported by the National Cancer Institute Planning and Support Grants and in 1979, a construction grant from the NCI coupled with local matching contributions supported the building of a five-story structure in downtown Honolulu. In 1996, the Center was designated by the National Cancer Institute and received funding from a Cancer Center Support Grant. Currently, the Center is conducting more than 100 cancer research projects in four interdisciplinary programs.

Waikiki Aquarium

Founded in 1904, the Waikiki Aquarium is the second oldest public aquarium in the United States. The Aquarium has been an institution of the University of Hawai‘i at Mānoa since 1919. Originally known as the Honolulu Aquarium, it was established by the Honolulu Rapid Transit Authority as a destination to entice travelers to ride the trolley all the way to the end of the line at Queen Kapi‘olani Park. It was built on land donated by James Bicknell Castle with funds from Charles Montague Cooke and his wife Anna Rice Cooke. In 1955, the Aquarium moved to its present location 200 yards south of the original site, and changed its name to the Waikiki Aquarium.

The Aquarium is home to more than 3,500 organisms and 490 species of marine plants and animals. Each year, over 330,000 people visit, and over 30,000 schoolchildren participate in the Aquarium’s education activities and programs. The Waikiki Aquarium was designated a Coastal Ecosystem Learning Center of the Coastal America Partnership.

Lyon Arboretum

The Lyon Arboretum was founded in 1918 as the Mānoa Arboretum by the Hawaiian Sugar Planters' Association (HSPA). The first director of the Arboretum was Dr. Harold L. Lyon, a botanist from Minnesota who was the plant pathologist for the HSPA. During his tenure, Lyon planted nearly 2,000 species of trees on the site. In 1953, at Dr. Lyon's urging, the HSPA

conveyed the Arboretum site to the University of Hawai‘i, with the stipulation that the site continue to be used as an arboretum and botanical garden in perpetuity. After Lyon's death in 1957, the Arboretum was renamed in his honor.

The mission of the Lyon Arboretum is to increase the appreciation of the unique flora of Hawai‘i and the tropics, by conserving, curating, and studying plants and their habitats; providing inclusive educational opportunities; encouraging use by the broader community; and supporting the educational, scientific, and service activities of the University of Hawai‘i. The Arboretum continues to develop its extensive tropical plant collection, while emphasizing native Hawaiian plants. Its over 15,000 accessions focus primarily on the monocot families of palms, gingers, heliconias, bromeliads, and aroids. Native and Polynesian cultivated and wild species are displayed in the ethnobotanical, native ecosystems, and Hawaiian sections of the gardens. The Lyon Arboretum also maintains an active seed bank.

In the early 1990's the horticulture aspect was expanded to include micro-propagation of rare & endangered Hawaiian plants, and native forest restoration began. This Hawai‘i Rare Plant Program has greatly expanded and is a leader in the field of plant conservation. Several University of Hawai‘i departments utilize the garden for research or instruction. High school and college groups, community service groups, corporate groups, and others have participated in large service projects that help maintain the Arboretum while providing opportunities for learning and community service. In recent years an annual average of over 10,000 schoolchildren and teachers visit the Arboretum using STEM curriculum developed specifically for the Arboretum, and 1,500 adults attend the Arboretum's adult classes. Lyon Arboretum's trained docents guide an annual average of 1,500 visitors on garden tours. Recently several ancient Hawaiian lo‘i (taro growing fields) were reopened, and a new Hale Halawai (traditional Hawaiian meeting house) was built. Wood harvested from the grounds have been used to create traditional canoes, tools and other educational and cultural resources, and many classes that perpetuate cultural knowledge are offered.

Organized Research Units – Financials

Although university research cannot be judged simply on the basis of financial contribution to the university budget and the State economy, there must be an expectation – particularly in times of reduced State support – that university research can function as a financially sustainable enterprise. We here examine the fiscal status of the ORUs.

SOEST and PBRC

Table 1 summarizes the distribution of funding sources (internal and external) for SOEST over the last three fiscal years. These figures include the four Departments and four of the five Organized Research Units (HIGP, HIMB, HNEI, and Sea Grant) organized under SOEST. The fifth ORU in SOEST, PBRC was re-organized under SOEST during the present fiscal year and so we present the PBRC financials separately in Table 2.

<i>Fiscal Year</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>
<i>G+S+RTRF funds</i>	\$29,569,441	\$29,596,855	\$29,469,362
<i>Extramural</i>	\$91,512,217	\$104,333,701	\$100,796,658
<i>Extramural/State funds</i>	3.1	3.5	3.4

Table 1: Distribution of funding sources for SOEST

<i>Fiscal Year</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>
<i>G+S+RTRF funds</i>	\$3,478,046	\$3,325,872	\$3,477,986
<i>Extramural</i>	\$5,259,842	\$2,546,375	\$3,778,961
<i>Extramural/State funds</i>	1.5	0.8	1.1

Table 2: Distribution of funding sources for PBRC

The figures in Table 1 clearly indicate that SOEST, by far the largest of the Organized Research Units – in reality a hybrid of ORUs and academic departments and centers - has been very successful in leveraging State support to attract external funding, with a “multiplier effect” of more than 3 over the last 3 years. This leveraging is also evident in the staffing within SOEST. In FY14, a total of 870 people were employed in SOEST, including tenure track faculty, non-tenure track faculty, staff, E/M, and graduate students. Approximately **two of every three** of these FTE positions were supported by extramural funds.

In PBRC, 24 FTE are supported by the university, while 46 other faculty and staff, or **two out of every three** of the total, are supported by external grants.

This leveraging of university-supported faculty and staff to significantly increase the overall size of these and other research enterprises at Mānoa has been one of the keys to sustaining both the capacity and the agility of our research enterprises.

In SOEST, new Research faculty appointees are promised 11 months of university support in their first year; 10 months in their 2nd year; and 9 months thereafter, with the remainder of their funding coming from extramural funds. Every tenure-track faculty member is also required to mentor graduate students and to teach at least one course every two years.

IfA

Table 3 summarizes the distribution of funding sources (internal and external) for the Institute for Astronomy (IfA) over the last three fiscal years.

<i>Fiscal Year</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>
<i>G+S+RTRF funds</i>	\$10,985,934	\$11,340,434	\$11,008,735
<i>Extramural</i>	\$21,687,757	\$23,748,509	\$22,227,055
<i>Extramural/State funds</i>	2.0	2.1	2.0

Table 3: Distribution of funding sources for IfA

The figures in Table 3 clearly indicate that IfA, one of the top astronomy research enterprises in the world, has been very successful in leveraging State support to attract external funding, with a

“multiplier effect” of greater than 2 over the last 3 years. This leveraging is also evident in the staffing within IfA. At present, a total of 224 individuals are employed at IfA, including tenure track faculty, non-tenure track faculty, staff, E/M, and graduate students. Approximately 76% of these FTE positions, or **3 out of every 4** are supported by extramural funds.

As in the case of SOEST, new Research faculty appointees in IfA are promised 11 months of university support in their first year; 10 months in their 2nd year; and 9 months thereafter, with the remainder of their funding coming from extramural funds. Every tenure-track faculty member in IfA is required to teach at least one course (3 credits) per year. This is about 1/4 the teaching load of an Instructional faculty member in the department of Physics and Astronomy. In a novel arrangement, the Physics and Astronomy department keeps 4 I-faculty positions open, which are cut into 16 “quarter” positions to support the IfA faculty instructors. A total of 24 IfA faculty are currently teaching in the department; 16 are supported in this fashion and the rest of the teaching is donated by the IfA. This arrangement has supported the new undergraduate programs in Astronomy and Astrophysics.

UH Cancer Center

Table 4 summarizes the distribution of funding sources (internal and external) for the Cancer Center over the last three fiscal years. The listed State support includes cigarette tax revenues, less the funds used for bond debt service, repairs and maintenance, utilities, and equipment purchase (here labelled “net cigarette tax fund”). Extramural funding shown includes Federal grants and contracts, as well as gifts, and private grants and contracts.

<i>Fiscal Year</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>
<i>G+S+RTRF funds</i>	\$5,445,523	\$4,253,253	\$5,063,756
<i>Net Cigarette Tax Fund</i>	\$2,721,940	\$2,591,302	\$3,804,219
<i>Extramural</i>	\$21,383,663	\$22,097,128	\$25,107,708
<i>Extramural/State funds</i>	2.6	3.2	2.8

Table 4: Distribution of funding sources for the UH Cancer Center

Water Resources Research Center

Table 5 summarizes the distribution of funding sources (internal and external) for the Water Resources Research Center (WRRC) over the last three fiscal years. This ORU has had a rather uneven record of procuring extramural resources to support its research programs over recent years.

<i>Fiscal Year</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>
<i>G+S+RTRF funds</i>	\$3,478,046	\$3,325,872	\$3,477,986
<i>Extramural</i>	\$5,259,842	\$2,546,375	\$3,778,961
<i>Extramural/State funds</i>	1.5	0.8	1.1

Table 5: Distribution of funding sources for WRRC

Lyon Arboretum and Waikiki Aquarium

Both the Arboretum and the Aquarium support their operations largely on the funds generated by admission fees and private donations. At the time of this writing, those figures were not available but we expect to have the figures by mid-May.

Other Research Units at Mānoa

Although a good proportion (approximately half) of the overall \$300+ million per year in externally-sponsored research at Mānoa is conducted within the “official” ORUs discussed here, there is significant long-term sustained research being conducted in colleges, schools, and research centers across campus.

The John A. Burns School of Medicine conducts leading edge research in a number of domains, including several that capitalize on our State’s unique environment and population. These include the Center for Native and Pacific Health Disparities Research, and the Pacific Center for Emerging Infectious Diseases Research, among many. The School’s faculty received more than \$52 million in external research grants and contracts during FY15. The next largest contributor to the University’s research portfolio, after SOEST and the School of Medicine, is the College of Natural Sciences. The College’s faculty received more than \$35 million in external research grants and contracts during FY15. Noteworthy within the College is the *Pacific Cooperative Studies Unit (PCSU)*, founded in 1973. PCSU presently employs 345 people and conducts projects aimed at protecting the cultural and natural biodiversity of the Pacific region. PCSU averages total awards of approximately \$14 to \$15 million per year. Of the 345 staff members, all but 2.25 FTE are funded by external funds.

The College of Education (approximately \$20 million in extramural funding in FY15), the College of Tropical Agriculture and Human Resources (\$18 million), and the College of Social Sciences (\$16.5 million) are also strong contributors to the University’s research enterprise. We should also mention that leading edge research and training is also conducted in grant-supported centers across the University. The *Center on Disability Studies (CDS)* within the College of Education was established in 1988 as the Hawai‘i University Affiliated Program. The CDS conducts education, research, and service activities that improve the quality of life of persons with disabilities in Hawai‘i. The Center presently has 69 full-time employees, all but 3.5 of whom are supported entirely by external funding. The *Social Science Research Institute (SSRI)* is a core unit of the College of Social Sciences (CSS), with applied research programs that address critical social, economic, behavioral, and environmental issues affecting people and communities in Hawai‘i and the Pacific region. In 2015, SSRI’s faculty members (7 UH funded and 8 extramurally funded) generated approximately \$6.2 million of extramural funding, employing 78 people, 23 of whom are graduate research assistants enrolled in UHM graduate degree programs. SSRI’s nine administrative staff members (only 4 UH-funded positions) also provide fiscal, administrative, and grant development support for faculty members in the 12 academic departments in the CSS.

The success of the various non-ORU centers and “traditional” schools and colleges in attracting significant external funding for leading-edge research is further affirmation of the goal of the OVCR to support the expansion of research and scholarly work across the campus rather than focus only on the ORUs. Of course, the ORUs must play a major role in the expansion of multi-disciplinary, relevant and leading-edge research (and education) at Mānoa. This may require the re-organization of the research enterprise to more closely align (or perhaps integrate) the ORUs and the appropriate academic units, as has been done within SOEST.

Organized Research Units – present participation in teaching

A question that must be asked – and is being asked in the present Research Strategic Planning Committee deliberations – is this: *to what extent are UH undergraduate students being afforded the benefit of instruction and mentoring by the world-class researchers in the ORUs?*

The answer at the present time is rather mixed, although some progress is being made in several areas.

The Institute for Astronomy is an exemplar for what is possible when an ORU and an academic department join forces to develop an educational program founded largely on the expertise and disciplinary focus of the ORU faculty. As mentioned earlier, the department of Physics and Astronomy in the College of Natural Sciences has created undergraduate programs in Astronomy and Astrophysics. Rather than hire 4 new Instructional faculty in these domains, the department has partnered with IfA to use the funds to support the teaching by IfA faculty of 16 different courses/sections. Eight additional sections are taught by IfA free of charge to the department. Discussions are ongoing for the creation of a “School of Astronomy and Astrophysics” that would be jointly administered by the department and IfA.

We have already mentioned the fact that PBRC sponsors a large number of undergraduate students in research training programs, including minority-serving programs targeting Native Hawaiians and Pacific Islanders. Many of these programs are supported by federal agencies including the National Science Foundation and the National Institutes of Health. This is perhaps an exemplar for the other ORUs with respect to how our research organizations can procure external funding to support the educational mission of the University.

In HIMB, two new Research faculty hires are being re-configured as 75% Research and 25% Instructional. The expectation is that the 25% Instructional responsibility will be fulfilled via activities that will include teaching a 3 credit class and/or by developing new courses that leverage experiential learning opportunities at the Institute.

There are many barriers that exist to ORU Research faculty being engaged in teaching. At the organizational level, there is no system in place to account for tuition generated by joint programs with ORUs, e.g., the joint graduate program in Marine Biology between SOEST and the College of Natural Sciences. This issue will become more significant if the University moves towards a budget model that ties unit budgets to tuition revenues. If an eventual solution is developed, it might pave the way for joint undergraduate programs between ORUs and academic departments as has been pioneered with IfA and the College of Natural Sciences. As we move forward, we will need to carefully consider organizational changes and other measures that will enable the seamless participation of our research-active faculty in the educational mission of the university.

Strategic Hiring

This discussion of how we might more closely connect the ORUs to the instructional mission of the University should also be placed in the context of present and anticipated budget constraints, and the need for the University to be agile in responding to future needs and opportunities in both research and education. There is a need for the University to develop a hiring strategy that

will enable hires and joint appointments across ORUs and academic departments that will build capacity and critical mass in domains of high value to our constituents.

Organized Research Units – a few words on quality

A university is defined by its faculty. The faculty develop the curricula, they create new knowledge and new understanding that is transmitted to the students and transferred to use for the betterment of society. Through their research and scholarly work, the faculty drive the reputation of the university, which in turn drives student and faculty recruitment, donations, and the receipt of external grants and contracts. As outlined here, the Organized Research Units at Mānoa are a primary – but not the only – centers for faculty research.

One indicator of the quality of the Mānoa ORU research enterprise, and the esteem in which Mānoa researchers are held, is the number of National Academy members among their ranks. Four faculty from SOEST are members of the National Academy of Sciences, including Professors Steven Stanley in Geology & Geophysics, David Karl and Ed DeLong in Oceanography, and Margaret McFall-Ngai in PBRC. Dr. David Ward of the Cancer Center is a member of the National Academy of Sciences, and Dr. Suzanne P. Murphy, Emeritus Professor at the Cancer Center, and Professor Jerris Hedges, interim Director, are members of the National Academy of Medicine. In ifA, Professor Len Cowie is a Fellow of the Royal Society of the United Kingdom, Director and Professor Guenther Hasinger is a member of the German National Academy and a foreign member of the Austrian National Academy, and Professor Rolf Kudritzki is a member of the German National Academy.

Three of our members of the National Academy of Sciences – Karl, DeLong, and McFall-Ngai – work in the exciting and rapidly changing field of microbiome research. Their work – and UH – will be highlighted at a White House event on May 13, 2016 that will celebrate new efforts and actions to advance microbiome applications for areas such as health care, food safety and security, environmental protection, and bioenergy production.