Information Paper
for
CAS Board of Directors

Subject: Annual Research Report

Responsible Officer: Alice Underwood, Vice President – Research and Development

1. Background

The Board of Directors receives an annual report on CAS research activities at its November meeting.

2. Information

The 2014 Report is attached. The report consists of two components:
A. Overview and Status of 2013-2014 CAS Research Activities
   Details on CAS research projects are provided in this attachment, organized by topic.

   Annual funding commitments to research projects and call paper programs are summarized in a spreadsheet.
CAS Research: 2014 Overview

During the 2013 – 2014 year the CAS Research Department completed a number of significant projects, including
- Call for Essays on the Impact of Climate Change on the Insurance Industry
- Actuarial Measures of Housing Value
- Regulatory Risk and North American Insurance Organizations (joint with NAAC)
- Predictive Modeling two-book project: Volume 1
- Medicare Secondary Payer Status, findings to be presented at Centennial Meeting
- Report on Capital Allocation
- Update of and webinar about the RPP II literature survey
- 2014 Reserves Call for Papers (5 papers published)
- Collection of essays on How to Review an ORSA (joint with JRMS)
- Bornhuetter-Ferguson Initial Expected Losses Working Party presented its findings based on survey conducted in 2012 and is now finalizing its report.

Notable work currently in progress includes
- Actuarial Climate Volatility Index RFP, Phase 2 (construction of index)
- Two new RFPs to support work in Capital Allocation
- 2015 Ratemaking Call for Papers (2 papers in progress for the two-year cycle)
- Ratemaking Practice Note
- 2015 Reinsurance Call for Papers (11 proposals received)
- 2015 Reserves Call for Papers
- Credit Risk Compendium: research underway
- Real Data for Testing, a project of the Dynamic Risk Modeling Committee
- Several projects jointly sponsored with TAF
- Predictive Modeling two-book project: Volume 2
- Open Source Software Committee’s R wiki
- Healthcare wiki

In addition, we have worked to streamline the R&D committee structure and wrap up or discontinue stalled projects.
- For a project started in 2009, Modeling Driver Culpability in Multiple-Vehicle Collisions Using Conditional Regression, the researcher agreed to complete the work by year end with no additional payments
- Economic Capital Working Party disbanded
- Low Interest Rate Environment Working Party (established in 2011) report is under committee review

We are pleased to see work begun in three new areas: Kickstarter Task Force, Automated Vehicles Task Force and Cyber Risk Task Force. The work of the Kickstarter TF is near completion as a new crowdsourcing tool on the CAS online community, called Idea Share, is now open to capture ideas from members on research projects. The ATVF has completed its report on a NHTSA causation survey for automated vehicles and has been asked to present on the subject at non-CAS events. The Cyber Risk TF has drafted a plan of work for the coming year.

The CAS has also continued to pursue cooperation with other actuarial organizations. We
are a key partner and funder of ERM-related research through the Joint Risk Management Section, which is jointly sponsored by the CIA, SOA and the CAS (several JRMS projects are listed below). The CAS also meets regularly about research topics with members of the North American Actuarial Council (some relevant projects listed below). The VP-R&D participates in a regular call with GIRO and CAS representatives attended the 2014 GIRO meeting in Newport, Wales. We are pursuing other opportunities for collaborative projects.

CAS Research continues to work with Professional Education to disseminate the results of research projects to the membership and to sponsor projects that will advance the technical skills of the CAS members.

I am confident that the incoming Vice President, Research and Development, Dave Cummings, together with the CAS Research staff and Research chairs and volunteers, will make continued progress during the 2014-2015 year. I thank you for the opportunity to serve you in this capacity since 2011.

Sincerely,

Alice Underwood
VP – Research & Development
Status of 2014 CAS Research Activities

Research Projects by Topic

1. Climate Change

- **Project**: Actuarial Climate Volatility Index RFP, Phase 2
  **Project Oversight Group**: Climate Change Committee
  **Contact**: Vijay Manghnani, Caterina Lindman
  **Purpose/Topic**: This project continues the work started in Phase 1 of the project by working to build both an Actuaries Climate Index and an Actuaries Climate Risk Index. The Actuaries Climate Index will be a global index, and will educate the general public about how Climate is changing, while the Actuaries Climate Risk Index (ACRI) will be an Index that measures economic or insured risk in Canada and the U.S.
  **Funding Approved**: $25,000. Total funding of $63,000 will come from all three sponsoring organizations (SOA, CAS, CIA). Additional funding of $15,000 approved in September 2014 for Web site development.
  **Status**: The project was begun in August 2013 by Solterra Solutions, who completed Phase 1 of the project as well. The group meets bi-weekly with the researchers to make sure project stays on target. A unique branded Web site will be developed and paid for jointly by the four organizations.

- **Project**: Call for Essays on the Impact of Climate Change on the Insurance Industry
  **Project Oversight Group**: Climate Change Committee
  **Contact**: Vijay Manghnani, Betty-Jo Walke
  **Purpose/Topic**: The Call for Essays is an attempt to capitalize on the RFPs from the committee keep the index project in the spotlight as work on the Actuarial Climate Index and Actuaries Climate Risk Index is underway.
  **Funding Approved**: $2,000 (for prize money to recognize the best essays)
  **Publication**: Winter 2014 E-Forum
  **Status**: Seven essays published. 3 prizes awarded for best essays.

2. Dynamic Risk Modeling

- **Project**: DRM Handbook Subcommittee
  **Date Announced**: Announced in November 2009
  **Project Oversight Group**: Dynamic Risk Modeling Committee
  **Chairpersons**: Chris Diamantoukos,
  **Purpose/Topic**: This subcommittee was focused on rewriting the Dynamic Financial Analysis Handbook, specifically Chapters 6 & 7, which were never finished. The Dynamic Risk Modeling Handbook is intended to provide a basic understanding and practical guidelines for the development and implementation of dynamic risk models common to the property and casualty insurance industry. In addition, it is hoped that this Handbook will become a basic reference source for the educational needs of future modelers and the practical day-to-day application needs of experienced practitioners.
Presentations: CAS Annual Meeting, November 2012
Publication: Chapters 6 & 7 are now available on the CAS Web site with the other finished chapters (http://www.casact.org/research/drm/)
Status: The committee is now looking to incorporate a longer-term project with this that involves reviewing all chapters to create consistent terminology, format, and presentation. There are likely some common elements to be further introduced or subjects that should be addressed in a common area, e.g., correlation.

- **Project: Public-Access DFA Model Subcommittee**
  Date Announced/Completed: Announced in August 2004
  **Project Oversight Group:** Dynamic Risk Modeling Committee
  **Contact:** Patrick Crowe
  **Purpose/Topic:** This subcommittee is charged with making updates and enhancements to the public-access DFA model.
  **Presentations:** 2005 Annual Meeting, 2006 CLRS, 2007 Spring Meeting, 2008 Spring Meeting
  **Publication:** The DFA Model is available on the CAS Web Site.
  **Status:** A new subcommittee has formed for this project and the group intends to put out an RFP in the next 6-12 months related to updating the model and doing continued work on it.

- **Project: Economic Capital Model Working Party**
  This working party was disbanded in April, 2014, after it was determined that Sholom Feldblum, the working party’s chairperson, would be done solely by him and his colleagues at Liberty Mutual.

- **Project: Real Data for Testing**
  Date Announced: Announced in August 2013
  **Project Oversight Group:** Dynamic Risk Modeling Committee
  **Contact:** Chris Diamantoukos
  **Purpose/Topic:** The group Chris was working with on the Reserving Chapter was very interested in getting their hands on data to have a common set, so link was sent out to the committee with an Excel spreadsheet containing 20 years’ worth of transaction-level data along several lines of business. It will serve as a good resource for the subcommittee working on this chapter.

3. **Enterprise Risk Management**

- **Project: Sustained Low Interest Rate Environment: Can It Continue? Why It Matters**
  Date Announced: Funding was awarded in January 2013
  **Project Oversight Group:** Joint Risk Management Section
**Purpose/Topic:** This project’s goals were to describe the impact on assets and liabilities if nominal interest rates remained low for an extended period of time. (The CAS also has a working party addressing this issue.)

**Funding:** $15,000 total from JRMS

**Seminar/Meeting Presentations:** TBD

**Publication:** Available on CAS website.

**Status:** Work completed in June 2014.

- **Project:** Regulatory Risk and North American Insurance Organizations RFP
  
  **Date Announced:** Funding was awarded in February 2013

  **Project Oversight Group:** NAAC Collaborative Research Group

  **Purpose/Topic:** To examine the regulatory risk faced by insurance companies in North America and their actuaries

  **Funding:** $54,000 total, including $15,000 in funding from CAS

  **Seminar/Meeting Presentations:** TBD

  **Publication:** TBD

  **Status:** Work completed in August 2014.

- **Project:** 2014 ERM Call for Papers
  
  **Date Announced:** Call for Papers announced in August 2013

  **Project Oversight Group:** Joint Risk Management Section plus PRMIA Institute and The Actuarial Foundation.

  **Contact:** Steven Siegel, SOA

  **Purpose/Topic:** Papers that explore risk management topics.

  **Funding:** Three $5,000 awards were presented funded by the three sponsoring organizations.

  **Seminar/Meeting Presentations:** 2014 ERM Symposium, Chicago.

  **Publication:** Papers are available from the 2014 ERM Web site (linked from CAS Web site).

  **Status:** Completed.

- **Project:** Risk Management: Part Five – How to Review an ORSA
  
  **Date Announced:** January 2014

  **Project Oversight Group:** Joint Risk Management Section.

  **Contact:** David Schraub, SOA

  **Purpose/Topic:** Submission of essays explored the processes for reviewing an ORSA.

  **Seminar/Meeting Presentations:** Webinar presented in September 2014 for ORSA in Canada.

  **Publication:** Papers are available on the SOA Web site (linked from CAS Web site); published in Spring 2014.

  **Status:** Completed.

- **Project:** Risk Management: Part Four - Incentive Compensation- the Critical Blind Spot in ERM Today
  
  **Date Announced:** January 2013

  **Project Oversight Group:** Joint Risk Management Section.

  **Contact:** Bob Wolf and Louise Francis

  **Purpose/Topic:** Submission of essays explored the misalignment between incentive compensation practices and risk management.
Seminar/Meeting Presentations: Webinar presented in May.
Publication: Papers are available on the SOA Web site (linked from CAS Web site); published in Spring 2013.
Status: Completed.

- Project: An Empirical Investigation of CDS Spreads Using a Regime Switching Default Model
  Date Announced/Completed: Funding was awarded in April 2009.
  Researcher(s): Andreas Milidonis
  Topic: Recipients intend to use data on CDS spreads reported by Datastream for publicly traded companies to develop a default risk model. We believe that CAS members, in general, have an interest in this topic given our economic circumstances.
  Funding: $9,000 ($3,000 from CAS, $6,000 from The Actuarial Foundation)
  Status: Paper is in progress. Author has received first payment of $1,500 from CAS, (payable upon signing the letter of agreement) and the second payment of $1,000, (payable when paper was received by a refereed journal). In January 2012, researcher submitted revised paper for 2nd round review.

4. Health Care

- Project: Medicare Secondary Payer Status –The Current and Future Impact on Workers Compensation RFP
  Date Announced/Completed: Announced in April 2013
  Project Oversight Group: Committee on Health Care Issues
  Contact: Steve DiCenso
  Purpose/Topic: This project seeks the potential future financial impact to the Property & Casualty insurance and/or self-insurance industry because of Section 111 of the Medicare, Medicaid, and SCHIP Extension Act of 2007.
  Funding Approved: $20,000
  Status: Milliman has completed their report and it is under review by the committee before publication. Researchers will be presenting results at Centennial Meeting 2014.

5. Ratemaking

- Project: 2015 Ratemaking Call for Papers
  Date Announced/Completed: Announced in March 2013
  Project Oversight Group: Committee on Ratemaking
  Contact: Ben Newton
  Purpose/Topic: Papers on all ratemaking topics are accepted.
  Funding Approved: $2,500, for the best papers.
  Publication: Completed papers will be published in a future issue of the eForum.
  Status: Neither of the papers from the one-year cycle were ultimately published by the CAS. There are two papers remaining on the two-year cycle after a number of authors dropped out. The final drafts are due to the committee in October, and the committee will review them at the CAS Centennial Meeting in November and determine if there is a prize-winner, and whether or not the papers will be published.

- Project: Ratemaking Practice Note
  Date Announced: September 2013.
Contact: Ben Newton
Topic: Every year COPLFR puts out a practice note on reserving – it is essentially the bible for reserving actuaries. It provides guidance, gives sample wordings, situations, summarizes ASOPs, etc. On the ratemaking side, there is no such animal and a few issues are starting to bubble up. One is this issue of price optimization – if more is charged than expected, is the rate actuarially sound, and is it legal (adequate, not excessive, nor unfairly discriminatory)? The idea is to gather a subcommittee from the Ratemaking Committee to brainstorm around current or best practices, and distribute a document would be helpful to the profession.

Status: The subcommittee is in the process of getting feedback on their final draft from key people before it’s submitted.

6. Reinsurance

- Project: 2015 Reinsurance Call for Papers
  Date Announced: April 2014
  Project Oversight Group: Committee on Reinsurance Research
  Contact: James Heer, Gerry Palisi
  Purpose/Topic: The Committee welcomes all papers on Reinsurance topics. Areas related directly to topics of current interest were preferred: Sub-prime mortgage, moving towards International Accounting Standards, risk inflation, and risk transfer.
  Funding Approved: $2,000 for the Reinsurance Prize for the best paper
  Presentation: 2015 Seminar on Reinsurance
  Publication: Upcoming issue of E-Forum
  Status: Eleven proposals received. First drafts due in December 2014.

7. Reserves

- Project: Bornhuetter-Ferguson-Initial Expected Losses Working Party
  Date Announced/Completed: Announced in September 2004
  Project Oversight Group: Committee on Reserves
  Contact: Lynne Bloom
  Purpose/Topic: The goal of this working party is to produce a paper regarding the initial expected loss assumption in the Bornhuetter-Ferguson reserving method. The working party is not expected to engage in primary research, but instead will leverage initial expected loss approaches already in use. With many competent actuaries using the Bornhuetter-Ferguson method, there are probably many very good initial expected loss approaches already in use, but not documented.
  Presentations of Interim Reports: 2005 CLRS, 2005 Annual Meeting
  Presentation of Final Results: 2013 CLRS
  Publication: TBD
  Status: The BF working party presented the results of the 2012 survey at the 2013 CLRS in Boston. In addition, the committee has used industry Schedule P Data to test the consistency and efficacy of various BF methods over time and against actual carried industry levels for several lines of business. The main methods tested for initial expected loss ratios are prior year’s ultimate indications, Cape Cod methods, and trended loss ratio methods. These results were included in the presentation at CLRS. A paper is still in the works for Fall 2014 that will outline the results and provide details of the survey and testing.
• **Project: 2014 Reserves Call for Papers**
  *Date Announced:* Announced in October 2013
  *Date Completed:* September 2014
  *Project Oversight Group:* Committee on Reserves
  *Contact:* Lynne Bloom, Denise Ambrogio
  *Purpose/Topic:* Papers were requested on the topics of: opinion issues; best estimates, variability, and ranges; methodologies; unique or changing exposures; and other matters affecting reserving.
  *Funding Approved:* $6,000 ($5,000 for the best papers and $1,000 for the best practical tool)
  *Presentations:* 2014 Casualty Loss Reserve Seminar
  *Publication:* 2014 Summer Volume II E-Forum
  *Status:* Five papers published. 3 papers presented at 2014 CLRS. Prize awarded to 1 winning paper and 1 runner-up paper.

• **Project: 2015 Reserves Call for Papers**
  *Date Announced:* Announced in September 2014
  *Date to be Completed:* November 2015
  *Project Oversight Group:* Committee on Reserves
  *Contact:* Lynne Bloom, Denise Ambrogio
  *Purpose/Topic:* Papers were requested on the topics of: opinion issues; best estimates, variability, and ranges; methodologies; unique or changing exposures; and other matters affecting reserving. Committee was interested in trying the non-technical twist again to see if more papers would be published.
  *Funding Approved:* $6,000 ($5,000 for the best papers and $1,000 for the best practical tool)
  *Presentations:* 2015 Annual Meeting
  *Status:* Call Paper Program launched in early September. Proposals to be due in mid-November.

• **Project: Incorporate the Dependence Structure in Estimating Loss Reserves**
  *Date Announced/Completed:* Funding was awarded in April 2010.
  *Researcher(s):* Dr. Jun Zhou
  *Topic:* The project will establish a model to incorporate the dependence structure in loss reserving process.
  *Funding Approved:* $14,000 ($5,000 from CAS, $9,000 from The Actuarial Foundation)
  *Status:* The paper is in progress. The author has received the first allotment of the payment, due when a signed copy of the agreement was made. Researcher requested extension until Dec 2011 or Jan 2012. In February, the title was changed to: Incorporate the Dependence Structure in Estimating Pure Premium. Mr. Zhou believes this study will have a more significant impact if we use that in pricing instead of reserving.

**Date Announced/Completed:** Funding was awarded in February 2008.  
**Researcher(s):** Katrien Antonio, Universiteit van Amsterdam  
**Topic:** Put focus on the development of three issues in stochastic reserving: micro models for run off, incorporating expert opinion in reserving techniques and the interaction of reserving techniques with extreme value methodology.  
**Funding:** $7,500 ($2,500 from CAS, $2,500 from The Actuarial Foundation and $2,500 from the SOA’s Committee on Knowledge Extension Research)  
**Status:** Paper is in progress. Author has received first payment of $833 from CAS, (payable upon signing the letter of agreement) and the second payment of $666.67, (payable when paper was received by a refereed journal). In September 2011 the paper was rejected by JASA. They advised them to submit to an Actuarial Journal. It will be submitted to NAAJ. The paper won the annual prize of the Dutch actuarial association for the best scientific work in actuarial science. See this link: [http://home.medewerker.uva.nl/k.antonio/bestanden/18-6-Ver.nieuws[1].pdf](http://home.medewerker.uva.nl/k.antonio/bestanden/18-6-Ver.nieuws[1].pdf) In February 2012, it was submitted to NAAJ and to the ASTIN bulletin.

### 8. Risk Theory

- **Project:** Empirical Estimation of Dependence in a Portfolio of Insurance Claims  
  **Date Announced/Completed:** Funding was awarded in June 2003.  
  **Researcher(s):** Emiliano Valdez, Andrew Chernih  
  **Topic:** To investigate the presence of “dependencies” in individual claims in a portfolio of insurance policies. The researcher will be using motor vehicle claim information from Singapore to attempt to fit a copula.  
  **Funding:** $12,000 ($6,000 from CAS, $6,000 from AERF)  
  **Status:** The final report has been completed, but final payment is still outstanding until paper is accepted by a peer-reviewed publication. *Variance* conditionally accepted the paper, pending revisions, but the researchers are also interested in submitting paper to *Insurance: Mathematics & Economics*. *Variance* is still interested if revisions are made. An addendum was signed in early 2013 with a deadline of June 30, 2013. Dr. Valdez did not meet the deadline so final payment was cancelled. He requested permission to submit final paper to the European Actuarial Journal. Both TAF and CAS approved of this plan. Dr. Valdez will notify us if it is accepted. No payments will be made since the paper was not completed or submitted to *Variance* per the addendum.

- **Project:** Risk Premium Project Update RFP  
  **Date:** August 2009  
  **Project Oversight Group:** Committee on Theory of Risk  
  **Contact:** Ed Bradford  
  **Purpose/Topic:** The CAS wishes to capitalize on the extensive review of the actuarial and financial literature review by the Risk Premium Project through 2000 by updating that review. Prof. Eling has agreed to continually update the project at a cost of $10,000 for two years.  
  **Funding:** $10,000  
  **Presentations:**  
  **Publication:** 2014 Update available on CAS Website  
  **Status:** The CAS posted Eling’s 2013 update in June of 2014 and contracted him for another two-year agreement. He will have continued updates for the 2014 and 2015 years.
- **Project: RFP on Capital Allocation**
  - **Date:** August 2012
  - **Project Oversight Group:** Committee on Theory of Risk
  - **Contact:** Ed Bradford
  - **Purpose/Topic:** The principal objective of this consulting project is to advance the understanding of the concepts and practical methods of calculating the capital costs appropriate for lines and sub-lines as presented in the Management Summary and Thematic Category of “Allocation of Capital” found in the Risk Premium Project 2 Report. Specifically, the consultant should address the suggested Allocation of Capital research description and be familiar with the general thrust of the allocation of capital literature as listed in the RPP2 Thematic category and found in the RPP2 database under Risk Management, Allocation of Capital category. An analysis of several reasonable allocation methods on a common set of property casualty insurance data, including both short and long-tailed lines would be required. In the event that actual data are unavailable, realistic simulated data for several lines, both short and long-tailed lines may be used.
  - **Funding:** $38,000 for two separate RFPs
  - **Presentations:** Authors will present their completed paper at the CAS Centennial Meeting in November 2014
  - **Publication:** TBD
  - **Status:** Two new RFPs were issued for this project. One is for “An Expert Review of the Theory Development and Computer Software for Specific Allocations” that’s been issued for $8,000 and will be completed in March, 2015. The other is for “An Extension/Adaptation of the Project of The Allocation of Costs of Holding Capital”, taken on by the original authors for the sum of $30,000.

9. **Open-Source Software Committee**

10. **Accounting Changes Committee (merged with Valuation, Finance and Investments Committee into new Financial Reporting and Analysis Committee)**
    - **Project: FASB and IASB Papers**
      - **Date Announced:** January 2013
      - **Contact:** Orin Linden
      - **Purpose/Topic:** The committee will work on the drafts of the FASB and IASB papers and provide updates to them.
      - **Presentations:** 2013 CLRS
      - **Publications:** TBD
      - **Status:** After many years in development, the FASB and IASB released new proposals of Insurance Contracts accounting standards in June 2013, with a comment deadline in late October 2013. The proposals are likely to change how P&C loss and LAE reserves are established and described in disclosures. Discounting and risk margins have been key elements of the Boards' discussions. Members of the committee will review the latest proposals, the outlook for timing, and potential effects on P&C reserving. Work is still ongoing under new FRAC.

11. **Valuation, Finance & Investments (merged with Accounting Changes Committee into new Financial Reporting and Analysis Committee)**
- **Project: Credit Risk Resources Compendium and Application of Property-Casualty Actuarial Methodologies to Credit Risk: Development of a Theory and Model RFP**
  - **Date Announced/Completed:** Funding was awarded in May 2012.
  - **Researcher(s):** Mathieu Boudreault and Jean-Philippe Boucher, University of Quebec at Montreal.
  - **Project Oversight Group:** Committee on Valuation, Finance & Investments
  - **Contact:** Rasa McKean
  - **Purpose/Topic:** The two goals of this project are: (1), to develop an organized set of resources on credit risk for the practicing actuary. The resources will be tailored to actuarial applications such as reinsurance credit risk, mortgage guaranty insurance and actuarial modeling of fundamental credit risk of assets/investments for cash flow modeling, intrinsic valuations of structured credits, and enterprise risk management purposes. (2), to describe the general US P&C actuarial approach to mortgage credit risk management, by surveying knowledgeable CAS members and consolidating their responses. Identified members will be asked how they would apply an “actuarial approach” if they had risk management responsibility for mortgage credit risk, primarily in the context of mortgage insurance. Other mortgage credit risk contexts (e.g., bonds, other investments including derivatives, reinsurance) may also be considered provided actuarial methods have been applied by the survey respondents.
  - **Funding:** $32,500
  - **Status:** Agreement signed with researchers in September 2012. Survey created and emailed to certain CAS members in October 2013. They did not receive a satisfactory response rate and will include their own analyses in the report that is still in progress. Work is still ongoing under new FRAC.

- **Project: Contingent Capital RFP**
  - **Date Announced/Completed:** Funding was awarded in December 2011.
  - **Researcher(s):** Kailan Shang, Manulife Financial
  - **Project Oversight Group:** Committee on Valuation, Finance & Investments
  - **Contact:** Rasa McKean
  - **Purpose/Topic:** The goal of this project is to extend the theory and actuarial tools currently available to evaluate and structure alternative risk capital forms to traditional reinsurance and equity or hybrid capital.
  - **Funding:** $17,500
  - **Status:** Completed in February 2013 and published in Spring E-Forum.

- **Project: Establishing Actuarial Values of Housing Markets**
  - **Date Announced/Completed:** Funding was awarded in January 2013.
  - **Researcher(s):** Shaun Wang, Risk Lighthouse
  - **Project Oversight Group:** Committee on Valuation, Finance & Investments
  - **Contact:** Rasa McKean
  - **Purpose/Topic:** The goal of this project is to establish actuarial measures of property values that can help actuaries offer valuable professional services to the appraisal industry and the lenders. Knowing the relative relationship of actuarial measures and market values can help regulators to effectively manage systemic risks for the housing market, and their impacts on other sectors of the economy.
  - **Funding:** $50,000

12. Data

- **Project:** Data & Technology Working Party  
  **Date Announced/Completed:** Announced in August 2014  
  **Project Oversight Group:** Research Oversight Committee  
  **Contact:** Peter Bothwell, Mary Jo Kannon  
  **Purpose/Topic:** The Data & Technology Working Party seeks to research and identify the knowledge and skills actuaries must possess to participate in the changes brought about by a rapidly evolving technology supporting data and analytics. With more formal education and research on these topics, CAS actuaries will be better positioned to partner with IT to use the combination of technology and analysis to improve insurance generally.  
  **Presentations/Publications:** TBD  
  **Status:** The Working Party is just getting underway in Fall 2014 and is hoping to finish its charge, a white paper, within a year, by end of 2015. After the writing of the paper, the group also hopes to deliver presentations at CAS meetings/seminars.

13. Kickstarter Task Force

- **Project:** Idea Share Initiative  
  **Date Announced:** Announced in August, 2013  
  **Project Oversight Group:** Research Oversight Committee  
  **Contact:** Rasa McKean  
  **Purpose/Topic:** The core concept of the initiative is crowdsourcing ideas, The CAS would seek to get members and other interested parties to suggest ideas for research projects based on practical problems they face in their work. For the body of proposed ideas people could vote on the importance of the ideas, indicate willingness to volunteer for a research effort, and indicate willingness to lead a research effort. As on Kickstarter, ideas that receive enough “funding” in the form of interest and volunteerism would actually be pursued in some form. Projects receiving lots of volunteers could be assigned to the appropriate research committee for coaching, as we do with call papers. Ideas that generate lots of interest but few volunteers could be targeted for RFPs, and/or we could solicit volunteers.  
  **Presentations/Publications:** TBD  
  **Status:** The task force launched the Idea Share section of the CAS’s online community in late September, 2014. They plan to review the site regularly and pull ideas and initiatives suggested to use for further research.

14. Automated Vehicles Task Force

- **Project:** Research use of Automated Vehicles and their impact on the industry  
  **Date Announced:** Announced in November, 2013  
  **Project Oversight Group:** Research Oversight Committee  
  **Contact:** Michael Stienstra
Purpose/Topic: The CAS Taskforce on Automated Vehicles aims to clarify the risks surrounding this developing technology by highlighting the technological and regulatory developments to the actuarial community, performing analyses that further the understanding of the technology’s riskiness, and identifying opportunities for the CAS and the insurance industry to influence and improve the risk identification and quantification process. 

Presentations/Publications: First report published in the CAS Fall 2014 Eforum, a presentation planned for the CAS Centennial Meeting in November. 

Status: The task force has plans for six projects in 2015 with a goal of 1-4 additional papers.

15. Cyber Risk Task Force

- **Project: Research Cyber Risk**
  - **Date Announced:** Announced in April, 2014
  - **Project Oversight Group:** Research Oversight Committee
  - **Contact:** Alex Krutov
  - **Purpose/Topic:** Broadly defined, cyber risk is rapidly increasing in importance. Cyber Risk insurance has been called the fastest-growing insurance line. However, the involvement of actuaries in the analysis of cyber risk has been minimal or nonexistent. Professionals from other fields have been trying to fill this void. The task force has an opportunity to assume leadership in the analysis of contingent events arising from cyber risk and of the financial implications of these events. At the same time, we recognize the need to incorporate non-actuarial input in the analysis. The task force expects to work with other organizations and to include experts from outside of the actuarial field. Conducting this research and providing related educational opportunities will be the primary goals of the Task Force on Cyber Risk.

  - **Presentations/Publications:** TBD

- **Status:** The task force is currently underway with members conducting research and providing feedback on their experience with Cyber Risk.

16. Other Topics

- **Project: IAA Discount Rate Monograph**
  - **Date Announced:** August 2010
  - **Purpose/Topic:** The EC passed a motion to approve a maximum contribution of $15,000 for development of the IAA educational monograph on issues associated with the determination of discount rates for financial reporting purposes, with the condition that the CAS is allowed representation on the project oversight group.

  - **Status:** Completed. The monograph is now complete and officially available through the IAA.

- **Project: Sequential Analysis of Actuarial Risks and Credibility**
  - **Date Announced/Completed:** Funding was awarded in April 2010.
  - **Researcher(s):** Dr. Michael Baron
  - **Topic:** This project focuses on the development of rigorous sequential statistical
tools for the assessment of actuarial risks and credibility.

**Funding Approved:** $10,000

**Status:** The paper is in progress. The author has received the first allotment of the payment, due when a signed copy of the agreement was made. The author received the second payment in August 2012, when the CAS received evidence that the paper had been received by a referred journal, in this case *Variance*. It is being reviewed by *Variance*.

- **Project:** Robust-Efficient Methods for Regression Credibility
  **Date Announced/Completed:** Funding was awarded in April 2010.
  **Researcher(s):** Vytaras Brazauskas
  **Topic:** The purpose of this research project is to robustify regression-type credibility models.
  **Funding Approved:** $27,000
  **Status:** The paper is completed. The author has received the first allotment of the payment, due when a signed copy of the agreement was made. The author received the second payment in June 2011, when the CAS received evidence that the paper had been received by a referred journal, in this case *Variance*. They have received two referee reports in June 2012; they require substantial revision. The paper has been revised and re-submitted to *Variance*. It has been accepted by *Variance* and was published.

- **Project:** Micro-econometric Modeling of Personal Lines Insurance
  **Date Announced/Completed:** Funding was awarded in April 2010.
  **Researcher(s):** Dr. Jed Frees, M. Yunjie Sun
  **Topic:** This project will assess the joint effects of auto and homeowner claims. Modeling these two types of claims jointly will enable the examination of the complicated relationships using underlying characteristics of a household (such as the risk taking preference). Both the frequency and severity of the claims in the multivariate framework will be modeled.
  **Funding Approved:** $15,000 ($10,000 from CAS, $5,000 from The Actuarial Foundation)
  **Status:** The paper is in progress. The author has received the first allotment of the payment, due when a signed copy of the agreement was made. Ms. Sun graduated and relocated to Germany. She has been unable to complete her paper. The project manager requested that she complete the work.

- **Project:** Nonparametric Regression in the Presence of Missing Data
  **Date Announced:** June 2011
  **Researcher(s):** Sam Efromovich
  **Topic:** this paper focuses on developing innovative statistical theory, methodology and methods of data-driven nonparametric estimation of multivariate regression with missing continuous and categorical data, motivated by and tested on actuarial applications with the main one being the fair usage of credit scoring as a rating variable.
  **Funding Sources:** $25,000 ($8,500 TAF, $8,000 CAS, $8,500 CKER)
  **Status:** The paper is in progress. The authors have received the first allotment of the payment, due when a signed copy of the agreement was made. The authors have received the second payment when they submitted evidence that the paper had been received at a refereed journal.
Project: Flexible Predictive Model for Pure Premium Estimation  
**Date Announced:** June 2011  
**Researcher(s):** John B. Henry, III, and Edward Yorty  
**Topic:** To present theoretical and empirical arguments for how a new pricing model outperforms GLMs.  
**Funding Sources:** $22,000 (CAS)  
**Status:** The paper is in progress. The authors have received the first allotment of the payment, due when a signed copy of the agreement was made.

Project: IAA Educational Monograph  
**Date Announced:** August 2011  
**Purpose/Topic:** The EC passed a motion to approve a maximum contribution of $15,000, contingent on the project’s addressing P&C issues, for development of the IAA educational monograph on issues associated with the application of risk and uncertainty to the measurement of the liability of insurance contracts in the context of general purpose accounting as adopted by the IASB.  
**Status:** The CAS received an invoice for only $8,550, as that is all that is needed by the researchers from the CAS. The project is progressing, albeit somewhat slower than what had originally been hoped for. Its status was discussed at the IAA's upcoming meeting in Nassau, The Bahamas, in November 2012. The work is being reviewed as of October 2013.

Project: Mixed Erlang moment-based approximation: applications in actuarial science and risk management  
**Date Announced/Completed:** Funding was awarded in May 2012  
**Researcher(s):** Hélène Cossette, David Landiault, Etienne Marceau.  
**Topic:** To approximate the mixed Erlang distribution function by a member of this class using moment-matching method.  
**Funding Sources:** $22,500 ($6,250 TAF, $10,000 CAS, $6,250 CKER)  
**Status:** The paper is in progress. The authors have received the second allotment of the payment, due when we have received evidence that the paper had been received by a refereed journal, NAAJ.

Project: Conditional Tail Expectation for Portfolio Losses with Applications to Credit Risk Management  
**Date Announced/Completed:** Funding was awarded in May 2012  
**Researcher(s):** Qihe Tang and Zhongyi Yuan.  
**Topic:** Model portfolio losses in the presence of asymptotically dependent extreme risks, derive exact asymptotic formulas for the CTE, develop hybrid method, and apply results to risk management.  
**Funding Sources:** $24,200 ($8,200 TAF and $16,000 CAS)  
**Status:** Complete. The authors have received the first allotment of the payment, due when a signed copy of the agreement was made. Delivered presentations at IME, International conference on Quantitative Finance and Risk Management, ARC. Submitted to NAAJ in October 2012. Accepted by NAAJ in July 2013.

Project: Bounds on the expected payments of insurance instruments: A novel computational approach.  
**Date Announced/Completed:** Funding was awarded in June 2012
Researcher(s): Luis Zuluaga, and others.

Topic: To develop a novel, yet simple optimization-based procedure to compute semi-parametric bounds on the expected payments of general insurance instruments on a single underlying loss (or many losses that can be compounded into a single total loss).

Funding Sources: $18,000 (CAS)

Status: The paper is in progress. The authors have received the second allotment of the payment, due when we have received evidence that the paper had been received by a refereed journal, Variance.

• Project: Tail Negative Dependence and Its Applications for Aggregate Loss Modeling
  Date Announced/Completed: Funding was awarded in May 2013
  Researcher(s): Lei Hua, PhD, ASA
  Topic: The research project is aimed at developing an aggregate loss model that can account for dependence between loss frequency and severity, and the objects are: (1) develop new theory and statistical models to capture dependence structures between loss frequency and severity; (2) conduct statistical analysis on a dataset for medical expenditures of the United States.
  Funding Sources: $8,000 (CAS)
  Status: The paper is in progress. The authors have received the second allotment of the payment, due when the CAS received evidence that the paper had been received by a referred journal. (It was not accepted by Variance and will be published in the E-Forum.)

• Project: Rapid Anomaly Detection and Classification in Massive Complex Financial Systems
  Date Announced/Completed: Funding was awarded in April 2013
  Researcher(s): Aleksey S. Polunchenko, Phd, and Xingye Qiao, PhD
  Topic: This research effort’s goal is to build the next generation of statistical machinery for robust surveillance and fastest anomaly detection and classification in massive complex financial systems, capable of breaking the existing technological, engineering and scientific barriers.
  Funding Sources: $20,000 (CAS)
  Status: The paper is in progress. The authors have received the first allotment of the payment, due when a signed copy of the agreement was made.

• Project: A Transformed Linear approximation to Copula Regression
  Date Announced/Completed: Funding was awarded in May 2013
  Researcher(s): Rahul Parsa, PhD
  Topic: This research will investigate, and attempt to quantify, the relationship between the estimates arrived at using these two methods – Copula Regression and the \( CDF \) transformed linear approximation to Copula Regression. In addition, it is the goal of this research to investigate the effect on estimates from the general use of transformations, in general, within regression analysis.
  Funding Sources: $15,000 (CAS)
  Status: The paper is in progress. The authors have received the first allotment of the payment, due when a signed copy of the agreement was made. They have completed the research and it is in the hands of Variance.
- **Project: Spatio-Temporal Credibility Models and Applications**  
  **Date Announced/Completed:** Funding was awarded in May 2013  
  **Researcher(s):** Yi Lu, PhD.  
  **Topic:** The focuses of this project are (i) to obtain linear form of prediction formulas for generalized credibility model, and (ii) to explore estimation methods for structure parameters by using the existing knowledge in spatial statistics and spatio-temporal statistics.  
  **Funding Sources:** $8,000 (CAS), $7,000 (SOA)  
  **Status:** The paper is in progress. The authors have received the second allotment of the payment, due when we have received evidence that the paper had been received by a refereed journal, NAAJ.

- **Project: Factor copula approaches for assessing spatially dependent high-dimensional risks**  
  **Date Announced/Completed:** Funding was awarded in June 2014  
  **Researcher(s):** Lei Hua, PhD, ASA, Sanjib Basu, PhD, and Michelle Xia, PhD  
  **Topic:** The project aims to develop factor copula models for assessing insurance risks that exhibit spatial dependence. The researchers will develop models that capture the spatial dependence structure and perform case studies using real loss data.  
  **Funding Sources:** $9,000 (CAS), $9,000 (SOA)  
  **Status:** The paper is in progress. The authors have received the first allotment of the payment, due when a signed copy of the agreement was made.

- **Project: Spatial Dependence and Climate Change Impacts on Weather Risk Pricing**  
  **Date Announced/Completed:** Funding was awarded in June 2014  
  **Researcher(s):** Robert Erhardt, PhD  
  **Topic:** The purpose of this research is to study the role that actuarial science can have in the rapidly growing field of weather risk management. Products known as weather derivatives are bought by organizations seeking financial protection against certain undesirable weather outcomes.  
  **Funding Sources:** $9,054 (CAS), $5,388 (SOA)  
  **Status:** The paper is in progress. The authors have received the first allotment of the payment, due when a signed copy of the agreement was made.

- **Project: Reinsurance, Dividends and Capital Optimisation in General Insurance Companies**  
  **Date Announced/Completed:** Funding was awarded in June 2014  
  **Researcher(s):** Corina Constantinescu, PhD, Joseph Lo, PhD, and David Siska, PhD  
  **Topic:** The aim of the project is to investigate the optimal level of reinsurance versus capital reserve an insurance company should have, given its current risks and historical claim data.  
  **Funding Sources:** $20,800 (CAS)  
  **Status:** The paper is in progress. The authors have received the first allotment of the payment, due when a signed copy of the agreement was made.

- **Project: TMV-based Capital Allocations for Multivariate Risks**  
  **Date Announced/Completed:** Funding was awarded in June 2014  
  **Researcher(s):** Maochao Xu
**Topic:** In this project, the researcher proposes to study a novel model for capital allocations based on the Tail-Mean Variance (TMV) principle for multivariate risks.

**Funding Sources:** $10,483 (CAS)

**Status:** The paper is in progress. The authors have received the first allotment of the payment, due when a signed copy of the agreement was made.

- **Project: Predictive Modeling Two-volume Book Project**
  - **Date:** October 2011
  - **Project Oversight Group:** Research Oversight Committee
  - **Contact:** Richard Derrig
  - **Purpose/Topic:** The first volume introduces basic concepts and a wide range of techniques designed to acquaint actuaries with this sector of problem solving techniques. The second volume would be a collection of applications to P&C problems, written by authors who are well aware of the advantages and disadvantages of the first volume techniques but who can explore relevant applications in detail with positive results.
  - **Funding:** $30,000
  - **Status:** The first Volume of the Predictive Modeling Book is completed and is available for purchase through Amazon and Cambridge University Press. Volume 2, which will focus on case studies to use those techniques and make both code and data available online related to the book, is in the early stages.

- **Project: Actuarial Supply and Demand**
  - **Date:** April 2014
  - **Project Oversight Group:** NAAC Consultative Research Group
  - **Contact:** Steve Siegel, SOA
  - **Purpose/Topic:** To explore the supply and demand of actuaries in Canada, U.S. and Mexico.
  - **Funding:** $80,000 estimate provided by NAAC
  - **Status:** Work in Progress. Survey completed to academics (supply side) and companies (demand side).