

**Information Paper
for
CAS Board of Directors**

Subject: Annual Research Report

Responsible Officer: David Cummings, 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 2016 Report is attached. The report consists of two components:

- A. Overview and Status of 2015-2016 CAS Research Activities
Details on CAS research projects are provided in this attachment, organized by topic.
- B. CAS Research Commitments and Expenditures (2003-2017)
Annual funding commitments to research projects and call paper programs are summarized in a spreadsheet.

CAS Research: 2016 Overview

During the 2015 – 2016 year the CAS Research Department completed a number of significant projects, including

- Two JRMS research projects completed of which the CAS is a partner: annual Emerging Risk Survey and Risk Implications of Unemployment and Underemployment.
- Bornhuetter-Ferguson Initial Expected Losses Working Party Report
- Capital Asset Management (CAPM)
- Credit Risk Resources Compendium
- Data & Technology Working Party Reports
- Fundamental Approach to Cyber Risk
- 2016 Reserves Call for Papers (4 papers published)
- 2017 Ratemaking Call for Papers (one fast-tracked paper published)
- Update of the RPP II literature survey, and Risk Assessment Database (RAD)

Notable work currently in progress includes

- Actuarial Climate Volatility Index RFP, Phase 2 (construction of index, near completion)
- Developing Adaptive Climate Indices for Evaluation of the Impact of Climate Change on Insurance Risks
- The Effect of Health Insurance Coverage Expansion on Property Casualty Claims (project near completion)
- Continued work on an RFP in Capital Allocation
- Research use of Automated Vehicles and their impact on the industry (three articles under final review)
- 2018 Ratemaking Call for Papers (four papers in one-year cycle, four in two)
- 2017 Reinsurance Call for Papers (four papers)
- Several projects jointly sponsored with TAF and the SOA (Individual Grants Competition)
- Two projects with the Canadian Institute of Actuaries: Actuarial Review of Insurer Impairments/Insolvencies and Future Preventions and Flood and other Catastrophe Model Results in Pricing and Underwriting Strategies
- New JRMS projects: Parameter Uncertainty and Country Risk Officer
- Predictive Modeling two-book project: Volume 2
- Acquiring “Studio” for Open Source Software Committee’s Use to promote R to the CAS Membership (announced in February, later dropped as not necessary)
- Cyber Risk Management Healthcare Breaches RFP

A significant undertaking in 2016 has been to set CAS Research Priorities for the next couple years. With assistance by the CAS Staff Actuary, these five project areas were highlighted and approved by the Executive Council:

- 1) Predictive modeling and data analytics
- 2) Modeling in general
- 3) Reserving
- 4) Economic scenarios and stress-testing
- 5) Cyber risk

Starting at the 2015 Annual Meeting, we started recruiting for short-term, volunteer-led

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working parties whose work would be completed within one to two years, following the GIRO model. Six working parties are under way with more being added from the CLRS.

The Ratemaking Committee is also exploring an initiative to put together a repository of databases for research purposes and for education, and perhaps even as a basis for exam questions as part of the iCAS credential.

We are looking to promote CAS Research in complimentary webinars to the membership and have received funding to do so. We are looking to offer webinars on the work of the AVTF, the Actuarial Climate Index, and the final report on the Effect of Health Insurance Coverage Expansion on Property Casualty Claims.

In addition, we are close to issuing a final report on the R&D streamlining efforts and wrap up or discontinue stalled projects. We continue to have discussions with researchers whose projects were initially funded five years ago or more to define a plan for completion or sunsetting the work.

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. In fact, one research report, "Analyzing the Disconnect between the Reinsurance Submission and Global Underwriter's Needs," between the CAS's Casualty Actuaries in Reinsurance and GIRO was recently awarded the 2016 Brian Hey prize.

We have begun to explore efforts in promoting ASTIN research opportunities to CAS members. We continue to work with organizers of the Actuarial Research Conference each year to offer P&C-related sessions. We have begun a collaborative project with the SOA and the Property Casualty Insurers Association on auto loss cost trends.

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 this year I will continue with the CAS Research staff and Research chairs and volunteers to make progress during the 2016-2017 year. I thank you for the opportunity to serve you in this capacity since 2014.

Sincerely,

David Cummings
VP – Research & Development

Status of 2015 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: Doug Collins, 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, and 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. Matrix Group is taking on the Web site development, with launch expected in mid-November. After launch of ACI with Web site, work will begin on development of ACRI Web site.
- **Project: Developing Adaptive Climate Indices for Evaluation of the Impact of Climate Change on Insurance Risks**
Project Oversight Group: Climate Change Committee
Contact: Doug Collins
Purpose/Topic: This project has two purposes: 1.) To perform a statistical analysis of a number of claims due to floods, heavy rain and storms with respect to varying frequencies and magnitudes of climatic events; and 2.) to develop a new data-driven adaptive climate risk index that links future climate projections with insurance risks.
Funding Approved: \$31,500
Status: This project is underway. Researchers checking in every other month with updates.

2. Enterprise Risk Management (also including JRMS research projects)

- **Project: Parameter Uncertainty**
Date Announced: 2015
Project Oversight Group: Joint Risk Management Section
Purpose/Topic: To create a resource to help actuarial practitioners advance the development of best practices for evaluating and measuring parameter uncertainty. The Joint Risk Management Section Research Committee is seeking a researcher(s) to: 1. Perform a review of existing literature related to insurance risks summarizing research on parameter uncertainty. Insurance risks include life, pension, health, and general insurance. In addition to actuarial literature, the researcher is encouraged to survey literature in other disciplines where the same challenges exist. 2. Develop a

practical methodology for calculating parameter uncertainty for insurance risks. The practical methodology can be focused on one insurance specialty.

Funding: \$10,475 from JRMS

Seminar/Meeting Presentations: TBD

Publication: TBD

Status: Researcher selected. Work in progress.

- **Project: Annual Emerging Risk Survey (since 2007)**
Date Announced: Yearly.
Project Oversight Group: Joint Risk Management Section
Purpose/Topic: This annual survey attempts to track the thoughts of risk managers about emerging risks across time.
Funding: \$20,000 from JRMS.
Seminar/Meeting Presentations: At various CAS events.
Publication: Available on CAS website. Last report: 2015 published in September 2016.
Status: Annual. Recurring. Report printed the following year.
- **Project: Country Risk Officer**
Date Announced: July 2015
Project Oversight Group: Joint Risk Management Section and the CIA ERM Research Subcommittee
Purpose/Topic: To advance the practice of ERM at a country level to serve the public, beyond its traditional applications in the financial sector, by introducing a Country Risk Officer position.
Funding: \$30,000 from JRMS
Seminar/Meeting Presentations: TBD
Publication: Not yet.
Status: Work in progress. Contract signed with SimErgy Consulting LLC in June 2016.
- **Project: Risk Implications of Unemployment and Underemployment**
Date Announced: March 2014
Project Oversight Group: Joint Risk Management Section
Purpose/Topic: To explore the risk implications of unemployment and under-employment from an actuarial perspective. Research and education is needed to identify the key drivers of unemployment and under-employment, the major sources of raw data by country, best practices in terms of building insightful models for projections, and identification/quantification of correlations across countries in industrialized and emerging markets.
Funding: \$35,000 from JRMS
Seminar/Meeting Presentations: TBD
Publication: October 2016.
Status: Completed.

3. Health Care

- **Project: The Effect of Health Insurance Coverage Expansion on Property Casualty Claims**

Date Announced/Completed: Announced in December 2014
Project Oversight Group: Committee on Health Care Issues
Contact: Annie Petrides, Glen Leibowitz
Purpose/Topic: RAND is investigating the relationship between expanded health care coverage from the Affordable Care Act and the propensity to file auto and workers compensation claims.
Funding Approved: \$50,000
Presentations: 2015 Casualty Loss Reserve Seminar, 2016 Spring Meeting, 2016 Annual Meeting
Status: Project is underway and nearly finished. WC report available on RAND Web site, but executive summary asked for by committee not yet complete. Auto report still being edited, nearly complete.

4. Ratemaking

- **Project: 2017 Ratemaking Call for Papers**
Date Announced/Completed: Announced in March 2015
Project Oversight Group: Committee on Ratemaking
Contact: Morgan Bugbee
Purpose/Topic: Papers on Predictive Modeling topics are accepted.
Funding Approved: \$2,500, for the best papers.
Seminar/Meeting Presentations: Ratemaking & Product Management Seminar, March 2016, March 2017
Publication: Papers will be peer-reviewed this time around with the intention of publishing them in *Variance*.
Status: One paper was published, the papers that were in the two-year track ultimately dropped out of the call, and no prize money was awarded.
- **Project: 2018 Ratemaking Call for Papers**
Date Announced: Announced in March, 2016
Project Oversight Group: Ratemaking Committee
Contact: Morgan Bugbee
Purpose/Topic: Papers on Ratemaking topics are accepted.
Funding Approved: \$2,500, for the best papers.
Seminar/Meeting Presentations: Ratemaking & Product Management Seminar, March 2017, March 2018
Publication: Papers will be peer-reviewed this time around with the intention of publishing them in *Variance*.
Status: Four papers were accepted into the one-year cycle, and four proposals into the two-year cycle. The final drafts of the one-year cycle papers are due November, 2016, and the first drafts of the two-year cycle are expected December, 2016.
- **Project: Predictive Modeling RFP**
Date Announced: TBD
Project Oversight Group: Ratemaking Committee
Contact: Morgan Bugbee
Purpose/Topic: To put forth an RFP related to Predictive Modeling in which the CAS will provide data for researchers to use.
Funding Approved: TBD.
Seminar/Meeting Presentations: TBD
Publication: TBD
Status: Members of the committee are currently working with Rick Gorvett to try

and obtain a dataset that researchers can use since that sort of material can be very difficult to come by. The hope is it will be obtained in October, 2016, and an announcement for an RFP can go out before the end of the year.

5. Reinsurance

- **Project: 2017 Reinsurance Call for Papers**

Date Announced: May 2016

Project Oversight Group: Committee on Reinsurance Research

Contact: 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: \$5,000

Funding Expended: Up to \$2,500 will be awarded the Reinsurance Prize for the best paper, and up to \$2,500 will be awarded for the most practical paper.

Presentation: Papers will eventually be presented at 2017 Seminar on Reinsurance.

Publication: Papers will eventually be published in 2017 issue of E-Forum.

Status: Five proposals submitted, four papers currently being written with first drafts due in December.

6. 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, 2015 Annual Meeting

Publication: Upcoming issue of E-Forum.

Status: A paper has been completed and submitted for publication.

- **Project: 2016 Reserves Call for Papers**

Date Announced: Announced in October 2015

Project Oversight Group: Committee on Reserves

Contact: Nancy Arico, 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: All four papers were presented at 2016 Casualty Loss Reserve Seminar.

Publication: Four papers were published in the 2016 Summer E-Forum.

Status: Complete.

- **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 project was terminated due to lack of progress.

7. Risk Theory

- **Project: Risk Premium Project Update RFP**
Date: August 2016
Project Oversight Group: Theory of Risk Committee
Contact: Alietia Caughron
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: 2015 Update available on CAS Website
Status: The CAS posted Eling's 2015 update in June of 2016 which fulfills year one of his two-year agreement. He will have a continued update the 2016 year.
- **Project: Allocation of Costs of Holding Capital**
Date: January, 2015
Project Oversight Group: Theory of Risk Committee
Contact: Alietia Caughron
Purpose/Topic: The CAS signed researchers Zanjani and Bauer to another contract to expand on their 2015 original report. They're going to expand on the research in order to generate comparable results for more conventional property and casualty lines. In addition to securing suitable data and adjusting the parameters to corresponding data, extensions of the theory need to be explored.
Funding: \$30,000
Presentations:
Publication: TBD
Status: The researchers are finalizing their report; securing the data took longer than anticipated.
- **Project: RFP on Capital Asset Management (CAPM)**
Date: July 2015
Project Oversight Group: Committee on Theory of Risk
Contact: Alietia Caughron
Purpose/Topic: The principal objective of this consulting project is to modify the CAPM for use in insurance pricing. In particular, these modifications should reflect the impact of disasters on the performance of the CAPM. Recent financial literature introduces a disaster component into the CAPM, to reflect occurrences of economic downturns and other company-specific issues. Potential extensions of these theories

for Property Casualty insurance companies could include the difference between short-tailed and long-tailed lines of business as well as the interaction of natural disasters and company reinsurance programs.

Funding: \$25,000

Presentations: The authors will present at the CAS Annual Meeting in November 2016

Publication: The authors have been invited to submit their paper to an upcoming issue of *Eforum*

Status: The researchers were paid in July 2016 for their accepted, completed report.

8. Open-Source Software Committee

- **Project: Acquiring “Studio” for Open Source Software Committee’s Use to promote R to the CAS Membership**

Date: February 2016

Project Oversight Group: Open-Source Software Committee

Contact: Ben Escoto

Purpose/Topic: The Open Source Software Committee would like to make available a sandbox for CAS members which would allow them to code in the R language (<https://www.r-project.org/>) which is currently viewed as one of the leading programming languages for statistical analysis. It is free as it is open source and there is a very nice development environment called RStudio (<https://www.rstudio.com/>).

Funding: \$3,000

Status: It was determined that it was not needed, and therefore dropped.

9. 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: Work was completed by the researcher in September 2016. Under final review by the committee.

10. 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: 2016 RPM Seminar, 2016 Annual Meeting
Publications: Upcoming issue of E-Forum.
Status: The Working Party has completed its work and submitted their report to the E-Forum for publication.,

11. 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: Currently working on several reports.
Status: The task force is finalizing reports with assistance from Rick Gorvett.

12. Cyber Risk

- **Project: Fundamental Approach to Cyber Risk**
Date Announced: February 2015
Project Oversight Group: Cyber Risk Task Force
Contact: Dave Cummings
Purpose/Topic: A researcher from Innsbruck University in Austria was contracted to produce a research document discussing an overview of the existing research most relevant to the analysis of cyber risk for cyber insurance and proposing a general approach and methodology for cyber insurance modeling, building on the previous research by the professor and the latest developments in cyber insurance and cyber risk modeling research, as specified in the research proposal, the terms of which are incorporated herein by reference.
Funding: \$30,000
Presentations/Publications: A final report was submitted to the task force in May 2016; they are working with the researcher to have it submitted for publication to *Variance*.

Status: The researcher has been paid; once the report is published it will be complete.

- **Project: Cyber Risk Management: Identification and Quantification of Unreported Healthcare Data Breaches**
Date Announced: Contracted April, 2016
Project Oversight Group: Cyber Risk Task Force
Contact: Dave Cummings
Purpose/Topic: A researcher from Drexel University was contracted to provide an article describing the research involving quantitative analysis of healthcare data breaches and its conclusions (the “Article”) performed as part of the research described in Appendix A.
Funding: \$30,000
Presentations/Publications: TBD
Status: The contract has been signed and at this point the researchers are waiting on data to be made available to them.

13. Other Topics

- **Project: Actuarial Review of Insurer Impairments/Insolvencies and Future Preventions**
Date Announced: Contracted July 2016
Project Oversight Group: CIA, CAS, SOA
Contact: Dale Hall, SOA
Purpose/Topic: The Canadian Institute of Actuaries (CIA), Casualty Actuarial Society (CAS) and Society of Actuaries (SOA) are sponsoring this research project educating the profession on past insurer impairments and insolvencies. The study will look at their causes, the decisions made by management, regulators and policyholders as situations unfolded. In turn, the study will look at ways the profession can be equipped to prevent or mitigate future insolvency situations. In addition to directly benefitting the profession, the work will also help assist other insurance industry practitioners understand the complexities of insurance company solvency and the benefit of keeping the actuarial profession in the forefront of company management, operations and regulatory communication.
Funding: \$32,000 (CAS)/\$50,650 (SOA)/\$15,000 (CIA)
Presentations/Publications: TBD
Status: The contract has been signed with Risk & Regulatory Consulting and work has begun.
- **Project: Flood and other Catastrophe Model Results in Pricing and Underwriting Strategies**
Date Announced: Contracted September 2016
Project Oversight Group: Canadian Institute of Actuaries Research Committee
Contact: Étienne Plante-Dubé, on behalf of CIA
Purpose/Topic: Damage from water and other climate related perils have emerged in recent years to replace fire and theft as the largest claims cost for Canada’s property insurers. Given these upward trends, Canadian insurers are becoming more interested in extending coverage for personal property to include residential flood protection. In the view of the CIA, significant knowledge gaps exist for Canadian P&C actuaries attempting to properly incorporate results from catastrophe models (e.g. earthquake, flood, wind/hail, etc.) into their pricing and underwriting strategy. The goal of this research project is thus intended to alleviate this gap by stimulating the development

of innovative pricing approaches that better incorporate existing catastrophe model output into traditional pricing and underwriting strategies of P&C insurers.

Funding: \$25,000 (CAS)/\$22,000 (SOA)/CAD\$28,000 (CIA)

Presentations/Publications: TBD

Status: The contract has been signed with AIR Worldwide and work has begun.

- **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: Report completed. To appear in Issue 10:2 of *Variance*.
- **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: Project terminated due to lack of submission of report.
- **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: Report completed. To appear in Issue 10:1 of *Variance*.
- **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. Exposure draft to be issued in November 2016 with publication expected early in 2017.

- **Project: Mixed Erlang moment-based approximation: applications in actuarial science and risk management**
Date Announced/Completed: Funding was awarded in May 2012
Researcher(s): H el ene 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: Report completed. To appear in Issue 10:1 of *Variance*.
- **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: Report completed. To appear in Issue 10:1 of *Variance*.
- **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: Report completed. To appear in Issue 9:2 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: Report completed. Appeared in *NAAJ*, December 2015.

- **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: Report completed. Under review by *NAAJ*.
- **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: Report completed. To appear in Issue 9:2 of *Variance*.
- **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 second allotment of the payment, due when the CAS received evidence that the paper had been received by a referred journal.
- **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: Report completed. To appear in Issue 10:2 of *Variance*.
- **Project: Flexible Bayesian nonparametric credibility models**
Date Announced/Completed: Funding was awarded in April 2015
Researcher(s): Liang Hong and Ryan Martin
Topic: The first objective is to propose a flexible Bayesian nonparametric model. The second objective is to provide numerical examples that demonstrate the benefit of the researchers' model compared to others in the credibility theory literature.
Funding Sources: \$8,750 (CAS), \$8,750 (SOA)
Status: Report completed. Under review by *NAAJ*.

- **Project: Erlang Based Methods for estimating IBNyR reserves in general insurance**
Date Announced/Completed: Funding was awarded in April 2015
Researcher(s): Andrei Badescu, Jacqueline Friedland, Dameng Tang
Topic: The objectives of this research is to propose an extension of Norberg (1993)'s theoretical loss reserving framework; to construct tailor-made statistical algorithms for estimating the right-truncated reporting lag; to increase the robustness of the "micro-level reserving" approach; to explore possible dependence structures among different components of the model; and to improve the applicability of the "micro-level reserving" approach.
Funding Sources: \$13,000 (CAS)
Status: Project terminated. Researcher changed focus of research.
- **Project: Risk Measurement Based on Available Information**
Date Announced/Completed: Funding was awarded in April 2015
Researcher(s): Yiqing Chen and Rahul Parsa
Topic: In this project, the researchers will focus on the measurement of a risk variable associated with a few other risk variables, interpreted for example as risk factors, which are exactly or partially known.
Funding Sources: \$6,000 (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.
- **Project: Numerical Optimization for Actuarial Applications**
Date Announced/Completed: Funding was awarded in March 2016
Researcher(s): Alexandru Valentin Asimit, PhD; Junlei Hu; and Tao Gao
Topic: Therefore, the objectives of our project are: a) Provide a review of related decisional problems that aim to identify the "best possible" risk transfer for two or a group of insurance players; b) Explain how to implement numerical optimization methods to solve such problems and discuss the advantages and drawbacks of various methods for specific problems; c) Identify numerical solutions for non-convex problems that are usually more problematic, indicating appropriate algorithms to solve our sought problems,
Funding Sources: \$8,500 (CAS), \$8,500 (SOA)
Status: Agreement signed. Work in progress.
- **Project: Enhanced Predictive Modeling for Usage-Based Auto Insurance**
Date Announced/Completed: Funding was awarded in March 2016
Researcher(s): Jennifer, Chan, PhD; Boris Choy, PhD; and Udi E. Makov, PhD
Topic: In this research project, the researchers explore the plausibility and benefits of machine learning procedures in enhancing UBI-based predictive models. In particular, the aim is to explore how machine learning algorithms can boost the classical GLM, resulting in new methodologies which retain a modeling context familiar to actuaries and DOI's, while relieving the GLM of inadequacies in rooted in telematics data.
Funding Sources: \$7,000 (CAS), \$7,000 (SOA)
Status: Agreement signed. Work in progress.

- **Project: Nonparametric Estimation for Data Modified by Truncation and Censoring**
Date Announced/Completed: Funding was awarded in March 2016
Researcher(s): Sam Efromovich, PhD; Wenui Lu, FSA; and Jerome Tuttle, FCAS, CPCU; Pankaj K. Choudhary, PhD
Topic: Intellectual Merit of the proposal is defined by the following three objectives. (1) To advance knowledge and understanding of nonparametric (that is assuming no parametric formula/shape) estimation of the hazard rate and related distribution functions, develop the theory of sharp minimax nonparametric estimation of the hazard rate with left truncated and right censored data. This theory will allow actuaries and data-analysts to know how the truncation and censoring affect the constant of the MISE convergence. Furthermore, the theory should shed light on choosing the interval of estimation. Developing this theory is based on the recent result Efromovich (2015a) on estimation of the hazard rate for direct data. (2) Expand the asymptotic theory of optimal estimation to statistical inference including confidence bands and hypotheses testing. (3) Based on the asymptotic theory, suggest feasible data-driven statistical estimators, together with inference procedures, for "small" samples.
Funding Sources: \$20,000 (CAS)
Status: Agreement signed. Work in progress.
- **Project: Machine Learning and 'Big Data' Methodologies for Policyholders' Retention and Conversion Modeling**
Date Announced/Completed: Funding was awarded in March 2016
Researcher(s): Giorgio Alfredo Spedicato, PhD, ACAS; Luca Lombardi; and Christophe Dutang, PhD
Topic: The project subject of funding proposal aims to investigate to what extent machine learning methodologies improve policyholders' retention and conversion estimation with respect to classical GLM. The investigation will both review the machine learning algorithms currently used in business application and develop a practical application of such algorithms on a real insurance data set to compare their performance with a standard logistic GLM approach.
Funding Sources: \$6,500 (CAS), \$6,500 (SOA)
Status: Agreement signed. Work in progress.
- **Project: Embedded predictive analysis of misrepresentation risk in GLM ratemaking models**
Date Announced/Completed: Funding was awarded in March 2016
Researcher(s): Michelle Xia, PhD
Topic: For the current project, we aim to develop GLM ratemaking models that embed predictive analyses of misrepresentation risk. The particular objectives include: (1) to confirm whether the proposed model gives valid inference on how various risk factors affect the probability of misrepresentation, when we model the relationship under the GLM framework with regular ratemaking data; (2) to verify whether the ratemaking model can identify the misrepresentation probabilities and risk effects, when there are multiple risk factors subject to misrepresentation; (3) to assess the possible impact from and on other risk factors that do not suffer from misrepresentation; (4) to conduct simulation studies to confirm the theoretical findings, as well performing case studies using the Medical Expenditure Panel Survey (MEPS, [1]) data.
Funding Sources: \$12,500 (CAS)

Status: Agreement signed. Work in progress.

- **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 near completion.

CAS Research Commitments and Expenditures (2003-2018)

As of October 26, 2016

FY 2018 (Budgeted to Research Fund: \$)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
Ratemaking	2018 Call Paper Prize	5,000.00	-	5,000.00
TOTAL		\$ 5,000.00	\$ -	\$ 5,000.00

FY 2017 (Budgeted to Research Fund: \$307,705)

Sponsor	Project / Researcher	Original Commitment	³⁰⁷⁷⁰⁵ Expense to Date	Commitment Balance
Reinsurance	2017 Call Paper Prize	5,000.00	-	5,000.00
Ratemaking	2017 Call Paper Prize	5,000.00	-	5,000.00
TOTAL		\$ 10,000.00	\$ -	\$ 10,000.00

FY 2016 (Budgeted to Research Fund: \$288,230)

Sponsor	Project / Researcher	Original Commitment	²⁸⁸²³⁰ Expense to Date	Commitment Balance
Reserves	2016 Call Paper Prize <i>(Note: not all prize awarded)</i>	6,000.00	5,000.00	-
Open Source Software Comm	Acquire Rstudio <i>(project terminated)</i>	3,000.00	-	-
Research Oversight Comm	Webinar funding	5,600.00	-	5,600.00
CAS	Support L. Francis - ASTIN Colloquium	2,500.00	2,097.00	-
CAS	2016 Actuarial Research Conference	2,300.00	2,272.00	-
CAS	Efromovich, "Nonparametric Estimation for Data Modified by Truncation and Censoring"	20,000.00	5,500.00	14,500.00
CAS	Xia, "Embedded predictive analysis of misrepresentation risk in GLM ratemaking models"	12,500.00	3,500.00	9,000.00
CAS/SOA	Spedicato, "Machine Learning and 'Big Data' Methodologies for Policyholders' Retention and Conversion Modeling"	6,500.00	3,500.00	3,000.00
CAS/SOA	Chan, "Enhanced Predictive Modeling for Usage-Based Auto Insurance"	7,000.00	2,000.00	5,000.00
CAS/SOA	Asimit, "Numerical Optimization for Actuarial Applications"	8,500.00	5,000.00	3,500.00
CAS/CIA/SOA	"Actuarial Review of Insurer Impairments/Insolvencies and Future Preventions"	32,000.00	<u>1,379.00</u>	30,621.00

CAS/CIA/SOA	"Incorporation of Flood and Other Catastrophe Model Results in Pricing and Underwriting Strategies (Canada)"	25,000.00	-	25,000.00
TOTAL		\$ 130,900.00	\$ 30,248.00	\$ 96,221.00

FY 2015 (Budgeted to Research Fund: \$251,043)

Sponsor	Project / Researcher	Original Commitment	²⁵¹⁰⁴³ Expense to Date	Commitment Balance
Reinsurance	2015 Call Paper Prize	2,000.00	2,000.00	-
Reserves	Non-Technical Call Paper Prize (<i>Note: not all prize awarded</i>)	5,000.00	2,500.00	-
Rate-making	2015 Call Paper Prize (<i>Note: no prize awarded</i>)	5,000.00	-	-
Climate Change	Developing Adaptive Climate Indices for Evaluation of the Impact of Climate Change on Insurance Risks	31,500.00	8,500.00	23,000.00
COTOR	Risk Premium Project Continual Update	10,000.00	-	10,000.00
COTOR	Capital Assets Pricing Model (CAPM) Modifications Appropriate for Insurance Companies	25,000.00	25,000.00	-
Health Care	Effect of Health Insurance Coverage Expansion on P/C Claims	50,000.00	15,000.00	35,000.00
Cyber Risk TF	Fundamental Approach to Cyber Risk Analysis and the Research Agenda for Cyber Insurance	40,000.00	7,500.00	32,500.00
Cyber Risk TF	Health Care Data Breaches	30,000.00	15,000.00	30,000.00
Cyber Risk TF	Assessment of requirements to create a cyber risk information resource	25,000.00	-	25,000.00
CAS/SOA	Hong/Martin, "Flexible Bayesian nonparametric credibility models"	8,750.00	8,750.00	-
CAS	Badescu, et. al., "Erlang Based Methods for estimating IBNyR reserves in general insurance" (<i>project terminated</i>)	13,000.00	3,500.00	-
CAS	Chen/Parsa, "Risk Measurement Based on Available Information"	6,000.00	3,000.00	3,000.00
NAAC	Actuarial Supply and Demand Study	33,152.00	33,152.00	-
CAS	Monograph Editorial Board Prize	50,000.00	50,000.00	-
TOTAL		\$ 334,402.00	\$ 173,902.00	\$ 158,500.00

FY 2014 (Budgeted to Research Fund: \$236,535)

Sponsor	Project / Researcher	Original Commitment	236535 Expense to Date	Commitment Balance
Reserves	2014 Call Paper Program	6,000.00	3,500.00	-
Climate Change	Develop ACI website	15,000.00	-	15,000.00
DRMC	Update Loss Simulation Model	6,560.00	6,560.00	-
COTOR	Risk Premium Project Continual Update	12,000.00	12,000.00	-
COTOR	Expert Review of Allocation of Costs of Holding Capital Report <i>(Note: Amount authorized was more than we needed.)</i>	10,000.00	8,000.00	-
COTOR	Follow-up Study to "Allocation of the Costs of Holding Capital"	30,000.00	876.05	29,123.95
CAS/SOA	Erhardt, "Spatial Dependence and Climate Change Impacts on Weather Risk Pricing" <i>(Note: Amount authorized was more than we needed.)</i>	9,054.17	7,220.83	-
CAS/SOA	Hua, et. al., "Factor copula approaches for assessing spatially dependent high-dimensional risks"	9,000.00	9,000.00	-
CAS	Xu, "TMV-based Capital Allocations for Multivariate Risks"	10,483.00	10,483.00	-
CAS	Constantinescu, et. al., "Reinsurance, Dividends and Capital Optimisation in General Insurance Companies"	20,800.00	10,800.00	10,000.00
TOTAL		\$ 128,897.17	\$ 68,439.88	\$ 54,123.95

FY 2013 (Budgeted to Research Fund: \$206,255)

Sponsor	Project / Researcher	Original Commitment	206255 Expense to Date	Commitment Balance
Reinsurance	2013 Call Paper Prize	2,000.00	2,000.00	-
Ratemaking	2013 Call Paper Program	2,500.00	2,500.00	-
Reserves	2013 Non-Technical Research Prize	5,000.00	5,000.00	-
Climate Change	Call for Essays	2,000.00	1,400.00	-
Climate Change	Phase II Project	25,000.00	25,000.00	-
Health Care	Medicare Secondary Payer Status	19,500.00	19,500.00	-

COTOR	RPPII Webinar	2,000.00	2,000.00	-
CAS	2013 Actuarial Research Conference	5,000.00	5,000.00	-
CAS/SOA/TAF	Lu, "Spatio-Temporal Credibility Models and Applications" (<i>Note: Amount authorized was more than we needed.</i>)	8,000.00	5,000.00	-
CAS	Polunchenko and Qiao, "Rapid Anomaly Detection and Classification in Massive Complex Financial Systems" (<i>project terminated</i>)	20,000.00	5,000.00	-
CAS	Hua, "Tail Negative Dependence and Its Applications for Aggregate Loss Modeling"	8,000.00	8,000.00	-
CAS	Parsa and Ferrara, "A Transformed Linear Approximation to Copula Regression"	15,000.00	15,000.00	-
VFIC	Wang, Proposal to Establish Actuarial Measures of Property Value	50,000.00	50,000.00	-
NAAC	Segal, Regulatory Risk and North American Insurance Organizations	15,000.00	15,000.00	-
TOTAL		\$ 179,000.00	160,400.00	\$ -

FY 2012 (Budgeted to Research Fund: \$192,850)

Sponsor	Project / Researcher	Original Commitment	192850 Expense to Date	Commitment Balance
Data Management & Information	2012 Call Paper Program	2,500.00	2,500.00	-
Dynamic Risk Modeling Committee	2012 Call Paper Program	5,000.00	5,000.00	-
COTOR	Capital Allocation	30,000.00	30,000.00	-
COTOR	RPPII Webinar	2,000.00	2,000.00	-
VFIC	Contingent Capital RFP	18,000.00	17,500.00	-
VFIC	RFP on Credit Risks Resources Compendium and Credit Risk Methodologies	32,500.00	32,500.00	-
CAS	Monograph Series - Stochastic Reserving	15,000.00	-	15,000.00

CAS/SOA/TAF	Cossette, et. al., "Mixed Erlang moment-based approximation: applications in actuarial science and risk management"	10,000.00	10,000.00	-
CAS/TAF	Tang, et. al., "Conditional Tail Expectation for Portfolio Losses with Applications to Credit Risk Management"	16,000.00	16,000.00	-
CAS	Zuluaga, et. al., "Bounds on the expected payments of insurance instruments: A novel computational approach"	18,000.00	18,000.00	-
Reserves	2012 Call Paper Prize	5,000.00	2,250.00	-
IAA	Educational Monograph	15,000.00	8,550.00	-
CAS/SOA/TAF	Predictive Modeling Book Project	30,000.00	28,500.00	1,500.00
TOTAL		\$ 391,850.00	172,800.00	\$ 16,500.00

FY 2011 (Budgeted to Research Fund: \$184,148)

Sponsor	Project / Researcher	Original Commitment	184148 Expense to Date	Commitment Balance
COTOR	Wang et al -"Liquidity and Credit Risk in the Valuation of Assets and Liabilities in a Going Concern"	42,000.00	42,000.00	
COTOR	Risk Premium Project Continual Update	10,000.00	10,000.00	-
Institute of Actuaries of Australia Dependency Working Party	Data processing of NAIC Schedule P for use in research projects	5,000.00	5,000.00	-
CAS	Henry/Yorty - A Flexible Predictive Model for Pure Premium Estimation	20,000.00	7,000.00	13,000.00
CAS/SOA/TAF	Efromovich - Nonparametric Regression in the Presence of Missing Data	8,000.00	8,000.00	-
Dynamic Risk Modeling & Reserves	2011 Call Paper Prize (<i>Note: Remaining prize money redistributed for LSM project.</i>)	10,000.00	5,000.00	-
Dynamic Risk Modeling & Reserves	Loss Simulation Model Updates	5,000.00	5,000.00	-
Ratemaking	2011 Call Paper Prize	2,500.00	2,500.00	-
Reinsurance	2011 Call Paper Prize	2,000.00	2,000.00	-
TOTAL		\$ 104,500.00	\$ 86,500.00	\$ 13,000.00

FY 2010 (Budgeted to Research Fund: \$100,000)

Sponsor	Project / Researcher	Original Commitment	100000 Expense to Date	Commitment Balance
IAA	Funding for Discount Rate book	15,000.00	15,000.00	
CAS	NAAC Research Project - Risk of Severe Inflation and Deflation on North American Financial Security Systems and Industries RFP	15,000.00	15,000.00	-
CAS	Brazauskas - "Robust-Efficient Methods for Regression Credibility"	27,000.00	27,000.00	-
CAS/TAF	Frees/Sun - "Micro-econometric Modeling of Personal Lines Insurance" (Note: <i>Project cancelled.</i>)	10,000.00	3,000.00	-
CAS/TAF	D'Arcy - "Capital Allocation in the Property-Liability Insurance Industry"	10,000.00	10,000.00	-
CAS	Baron - "Sequential Analysis of Actuarial Risks and Credibility"	10,000.00	10,000.00	-
CAS/TAF	Zhou - "Incorporate the Dependence Structure in Estimating Loss Reserves" (Note: <i>Project cancelled.</i>)	5,000.00	1,500.00	-
Professional Education Program Committee	Annual Meeting Assistance - 2007 Variance Prize Winner Travel to Boston	1,500.00	1,500.00	-
Professional Education Program	Annual Meeting Assistance - Introduction	5,000.00	5,000.00	-
Management Data	2010 Call Paper Prize (Note: <i>Not all prize money awarded.</i>)	2,500.00	1,500.00	-
VFIC	2010 Call Paper Prize	4,000.00	4,000.00	-
Reserves	2010 Call Paper Prize (Note: <i>Not all prize money awarded.</i>)	5,000.00	2,250.00	-
TOTAL		\$ 110,000.00	95,750.00	\$ -

FY 2009 (Budgeted to Research Fund: \$169,540)

Sponsor	Project / Researcher	Original Commitment	169540 Expense to Date	Commitment Balance
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Reinsurance Research	2009 Call Paper Prize	2,000.00	2,000.00	-
Institute of Actuaries of Australia Dependency Working Party	University of Wisconsin Data Extraction Actuarial Climate Volatility Index RFP (<i>An additional \$5,000 was approved Feb. 2010</i>)	5,000.00	5,000.00	-
Climate Change Committee	Risk Premium Project Update RFP (<i>Note: Additional funding was approved May 2010. Actual funding is 38,000 Euros. Funding of up to \$2,500 was approved in October 2010 to send researchers to CAS Annual Meeting. Not all money used for Annual Meeting travel.</i>)	32,500.00	31,833.00	-
Theory of Risk	Putting Mark to Market Accounting on a Going Concern Basis RFP [<i>Note: Committee decided not to pursue.</i>]	30,000.00	-	-
Theory of Risk	Testing of Insurance Liability Valuation Models RFP	25,000.00	-	-
VFIC	Risk Margins RFP (<i>Note: Project terminated; half of budget awarded.</i>)	25,000.00	12,500.00	-
VFIC	2009 Call Paper Prize (<i>Note: Not all prize money awarded.</i>)	5,000.00	2,500.00	-
Dynamic Risk Modeling	Loss Simulation Model RFP	25,000.00	24,054.00	-
Dynamic Risk Modeling	2009 Call Paper Prize (<i>Note: No prize money awarded.</i>)	2,500.00	-	-
Health Care Issues	Cox, Lin, Milidonis - Regime Switching Models: Applications to Mortality Modeling and Pricing	4,000.00	4,000.00	-
CAS/SOA	Milidonis - An Empirical Investigation of CDS Spreads using a Regime Switching Default Risk Model	3,000.00	3,000.00	-
CAS/AERF/SOA	Parsa - Copula Regression	5,000.00	5,000.00	-
CAS/CKER	Weibel - Modeling Driver Culpability in Multiple-Vehicle Collisions Using Conditional Regression (<i>Note: Project cancelled.</i>)	7,200.00	3,000.00	-
CAS	2009 Call Paper Prize (<i>Note: No prize money awarded.</i>)	2,500.00	-	-
Ratemaking				
TOTAL		\$ 188,700.00	\$ 107,887.00	\$0.00

FY 2008 (Budgeted to Research Fund: \$75,000)

75,000.00

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
Reserves	2008 Call Paper Prize (<i>Note: Not all prize money awarded</i>)	2,500.00	2,000.00	-
Management Data	2008 Call Paper Prize	2,500.00	2,500.00	-
CAS/AERF/SOA	Antonio - Stochastic Claims Reserving	2,500.00	2,500.00	-
CAS/AERF/SOA	AERF Project: Robust and Efficient Methods for Quantitative Risk Management; Brazauskas	5,000.00	5,000.00	-
CAS/AERF	Fu - Optimal Layers for Excess Catastrophe Loss Reinsurance	5,000.00	5,000.00	-
CAS/AERF	Kim - Estimating Allocated Capital Using the Bootstrap	5,000.00	5,000.00	-
CAS/AERF	AERF Project: New Goodness-of-Fit Tests for Pareto Distribution; Rizzo	5,000.00	5,000.00	-
TOTAL		27,500.00	27,000.00	-

FY 2007 (Budgeted to Research Fund: \$50,000)

Sponsor	Project / Researcher	Original Commitment	Expense to Date	Commitment Balance
Ratemaking	2007 Call Paper Prize (<i>Note: No prize awarded.</i>)	2,500.00	-	-
CAS/AERF	AERF Project: Property-Liability Insurance Loss Reserve Ranges Based on Economic Value, D'Arcy (<i>Note: Not all approved money was provided to author.</i>)	20,000.00	15,000.00	-
CAS/AERF	AERF Project: Multivariate Conditional Density Estimation, Efromovich	10,000.00	10,000.00	-
CAS/AERF	AERF Project: Bounds for Ruin Probabilities and Value at Risk, Cox	7,500.00	7,500.00	-
IAA	IAA Project: Stochastic Methods Used in Actuarial Science	15,000.00	15,000.00	-
CAS/SOA	Ph.D. Grants Program – Jun Zhou	10,000.00	10,000.00	-
TOTAL		65,000.00	57,500.00	-