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Introduction  BY JERRY WALLIS, IRUA EXECUTIVE DIRECTOR

Welcome to the first edition of Volume 25 and introducing a new look as we close out Our first quarter century! IRUA’s JOR is now 25 Years old.

We hope that you like this new approach and welcome your comments either positive or negative. We have returned to showing the article titles on the front page as this should assist in the future when looking for a specific item. You can, of course, also access the Journal archive on line at www.irua.org.

In this edition we present a total of SIX articles. Again, a varied series of topics covering areas of interest to as many of our readers as possible.

With insurers increasing use of drones our first article entitled: Unmanned Aircraft Systems: The Promise and the Challenge – A Primer for the Insurance Sector, by the American Insurance Association’s James Whittle and Brian Kuzdak, is a valuable treatise on the benefits and responsibilities of the use of unmanned aircraft and the legal and regulatory environment in which they may be operated.

Back on land, the second article, Analytics Offer Unlimited Opportunities to Actuaries, by Gary Wang of Pinnacle Actuarial Resources, Inc., discusses the continued expansion in analytics through data capture and interpretation and how this can benefit actuaries in their traditional (and non-traditional) property and casualty roles.

Next, we turn to Europe, where an important new regulation, which becomes effective on May 25, 2018, will impact global reinsurers and insurers. John Stephens of Goldberg Segalla LLP reveals all in: GDPR Signals New Era of Data Risk. In this article, he details how the General Data Protection Regulation being introduced throughout the European Union significantly increases measures companies and entities with EU exposure must take to ensure the privacy of personal data of clients and customers. The penalties for non-compliance are stiff so this is a must read for anyone with EU exposure.

Article number four details the latest legal decision in the incredibly long running argument over whether the stated limit in a facultative certificate, absent specific language, is extended by the inclusion of loss adjustment expenses or is capped at the stated dollar amount. Susan Mack of Adams & Reese LLP explains all in: Evolution of the Species – Facultative Certificate Expenses from Bellefonte to Global.

Back on the road now with our next piece: Effect of Autonomous Vehicles on Insurance Markets and How to Capitalize. This was another of our 2017 Scholars Essay program winners. Patrick Levandoski, now a graduate of the University of Georgia’s Terry College of Business, thoroughly covers this evolving topic which will have a significant impact on the auto insurance (and reinsurance) market as it continues to develop.

Finally, and complementing David Wright’s article in our prior edition of the Journal, we have the benefit of PwC’s team, led by Joseph Calandro, view of Disruption and Reinsurance – An Overview and Perspective. Innovation through disruption is the name of the game for the Twenty-Teens and beyond and the old ways will not be the new ways. One of the old ways that one hope’s will not change is the need for professional advancement and education which is a perfect segue into a non-disruptive plug for the IRUA’s upcoming education & networking events all “Now Open”, on line, at www.irua.org.


• May 15 - Next Generation Reinsurance Leadership Conference – a one-day event of interactive discussion among current and future leaders in such areas as the market technology and where it is headed; breakout groups to consider the value chain of re/insurance and how current leaders have embraced and adapted to recent industry change. A very different and thought provoking seminar well worth your support! To Register Click Here: https://www.irua.org/events/registration-event/?event_id=4246&step=1

• May 16 – Lunch n’ Learn session on Blockchain. This edition author, Joseph Calandro of PwC will explain all! To Register Click Here: https://www.irua.org/wp-admin/post.php?post=4424&action=edit

Our website and weekly IRUA Newsletter has details of these event and if you are not receiving it by email, please let us know and we will be happy to add you to our complementary subscription list.

Just a reminder that all member company and individual members and Journal subscribers can access free of charge all articles published by following the JOR Archive link on the website homepage at www.irua.org.

Best regards,

Jerry Wallis, IRUA Executive Director
Unmanned Aircraft Systems: The Promise and The Challenge
A Primer for The Insurance Sector

BY JAMES J. WHITTLE, ESQ. AND BRIAN A. KUZDAK

What do the following have in common— a sick child in the wilderness miles from the nearest road; a lightning strike-damaged 1200 foot power station chimney; and a terrorist threat to sabotage a 765kV transmission line in a remote location? Drones can address them all.

Drones or, more formally, unmanned aircraft systems (UAS), are changing the world. They are used in all manner of activities, personal and commercial, and are transforming commercial enterprises, from deliveries to security to claims investigations and more. The expanded use of UAS holds both great promise and challenges from the insurance sector’s perspective. Here we examine drone fundamentals, their potential benefits and many challenges. We overview the legal regime regulating UAS in the United States and present public policy recommendations relevant to the insurance sector.

The promise of drones is real; if we inform ourselves and public policy decision makers, their full promise will be realized as well.

About the Authors
Jim Whittle is Associate General Counsel and Chief Claims Counsel with the American Insurance Association. Jim is responsible for automobile, catastrophe, claims and property issues. He has over 27 years of legal experience in these subjects both with AIA and in corporate and private practice. A long-time litigator before he left private practice to join AIA in 2004, Jim is a Martindale-Hubbell AV Preeminent® rated Lawyer. He is admitted to Bars of the District of Columbia, Maryland and United States Supreme Court.

Brian Kuzdak is a Legal Research Intern with the American Insurance Association. Brian is a full-time law student at Michigan State University College of Law, graduation expected May 2019.

The authors remind readers that the views expressed here are their own and do not necessarily represent the views of the American Insurance Association or its members.

Abstract
The development and usage of Unmanned Aircraft Systems (UAS) has taken off in the 21st Century and this article looks at the types, development, and potential benefits and opportunities for the insurance and reinsurance industry both in terms of usage and as insurable assets with insurable activities. The current legal and regulatory climate is also explored at both the Federal and State level.

What do the following have in common—a sick child in the wilderness miles from the nearest road; a lighting strike-damaged 1200 foot power station chimney; and a terrorist threat to sabotage a 765kV transmission line in a remote location? Drones can address them all. A child’s medicine can be delivered, chimneys can be inspected without climbing to perilous heights, and transmission lines can be examined, monitored, even guarded by companies and governments using drones.

Drones or, more formally, unmanned aircraft systems (UAS), are changing the world. They are used in all manner of activities, personal and commercial, and are transforming commercial enterprises, from deliveries to security to claims investigations and more. The expanded use of UAS holds both great promise and challenges from the insurance sector’s perspective. Here we examine drone fundamentals, their potential benefits and many challenges. We overview the legal regime regulating UAS in the United States and present public policy recommendations relevant to the insurance sector.

The promise of drones is real; if we inform ourselves and public policy decision makers, their full promise will be realized as well.

UNMANNED AIRCRAFT SYSTEMS
Though the technology was developed earlier, the potential of drones probably crystallized for many when they were deployed against combatants in Afghanistan and Iraq after 9/11. Those drones—the armed forces prefer to call them Unmanned Aerial Vehicles or UAVs—were large, capable of surveillance, reconnaissance and delivering devastating blows remotely against hard to find targets.

At the opposite end of the spectrum from UAVs are extremely small, mini-drones. Most often used recreationally, these drones can range down in size to a quad copter barely larger than 1.5 inches across. One, the so-called Wallet Drone, is half an inch thick, and like many

Continued on page 4
UAS already permit routine and catastrophic aerial claims photography while allowing claims professionals to stay on the ground.

many instances—this will improve worker’s compensation and occupational accident experiences.

And, of course, drones will be undertaking activities for which people and enterprises will want insurance against risk. Whether making deliveries, taking photos, conducting research, engaging in preventative measures or more, UAS will fail and people, property, products, and the devices themselves will all be at risk. UAS owners, operators and manufacturers will want to reduce the risk with these and many other new opportunities.

As a result, there is strong demand for a variety of liability and property products specifically related to UAS.

As insurers seek to use and insure drones, there are more than operational challenges to consider. One is legal uncertainty and another is varied local legal requirements. By legal uncertainty, we mean not knowing which authorities have jurisdiction over UAS—is it federal, state or local governance or a combination—and whether they will permit drones to meet our sector’s needs and, indeed, whether regulations will prevent UAS from achieving their full potential as a force for change. Varied local laws is a form of legal uncertainty, but it’s more. For example, though we may be certain that drone laws change at two towns’ border, the very existence of that level of variability could adversely impact the promise of drones by making drone operations less efficient, discouraging innovation. We examine these challenges more expansively later, as they are key considerations for public policy decision makers.

AN OVERVIEW OF THE LEGAL FRAMEWORK
The U.S. legal system will inform the development of UAS and possibly pose challenges to it. No examination of UAS is complete without some baseline understanding of the legal framework around drone operation.

THE FEDERAL FRAMEWORK
The Federal Aviation Administration (FAA) has exclusively regulated aviation operation since Congress passed the Federal Aviation Act of 1958. In 2012, Congress passed the FAA Modernization and Reform Act (FAAMRA) requiring the integration of drones by 2015 and bringing them within FAA regulation. To facilitate that integration, section 332(a)(2) of FAAMRA required FAA to undertake a rulemaking to “allow for civil operation of such systems in the national airspace system, to the extent the systems do not meet the requirements for expedited operational authorization under section 333 of this Act.”

Thus, Section 333 of FAAMRA provided a process to permit UAS operation before the final rule making. Under “Section 333 Exemption,” the FAA could exempt applicants from more formal aviation regulations if they made a proper showing of operational safety. During the pendency of the Section 332 rulemaking many insurers took advantage of this and obtained Section 333 exemptions to operate UAS for a variety of activities such as risk assessment, risk management, loss control, research and development, imagery analytics in underwriting, catastrophe response, claim resolution,
monitoring infrastructure, etc. Nonetheless, the Section 333 process was time consuming, producing a backlog of applicants awaiting exemptions to operate and often resulted in varied outcomes and ongoing limitations on the meaningful use of UAS. Consequently, many eagerly awaited the rules authorized by Section 332.

The Section 332 rulemaking produced the Small Unmanned Aircraft System regulations (Part 107) effective on August 29, 2016. Part 107 largely replaces the Section 333 exemption process and permits UAS operation under certain circumstances. Prominent Part 107 requirements include:

1. UAS registration if it is not a model aircraft;
2. That the UAS be less than 55 pounds;
3. Pilot requirements are met;
4. Visual line of sight operation;
5. Flight below 400 feet off the ground or the uppermost point of a structure;
6. Daytime only flight; and
7. No flight over people, moving vehicles or in the vicinity of airports (without prior authorization from Air Traffic Control) or other manned aircraft. However, many of the limitations can themselves be waived under 14 C.F.R. §§ 107.200-107.205.

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STATES are also examining regulation of UAS. Some states have enacted operating laws similar to the FAA but, for the most part, the states have focused on invasive and criminal activity as well as penalizing unlawful drone conduct. Currently, 40 states have adopted UAS legislation related to issues such as trespass, invasion of privacy, nuisance, proper search and seizure, limitations on the police use of drones, harassment, voyeurism, and the permissibility of drone operations. Eight states prohibit localities from regulating private UAS. Nine states explicitly allow commercial UAS activity with certain limitations if the commercial use is in compliance with FAA requirements.

We now examine the interplay of federal and state law. Ultimately, when states are limiting criminal or invasive activity, rather than aeronautic operation, they seem to be on much stronger constitutional ground given their historic police powers.

RECONCILING STATE AND FEDERAL LAW

In 1946 an early aviation trespass case suggested that aircraft may tortuously impact some property rights. In United States v. Causby the Supreme Court held that an aircraft flown at a low enough altitude and resulting in interference with a property owner’s then existing use above their land can be a trespass. Thus, under a Causby standard, in the right circumstances a UAS flying at low altitude might interfere with property rights, potentially generating a trespass claim.

However, subsequent developments, including adoption of the Federal Aviation Act, have seemingly expanded the scope of federal jurisdiction over aircraft including UAS. For example, the United States Government has exclusive sovereignty of airspace of the United States. 49 U.S.C. § 40103(a)(1). The FAA is responsible for air traffic flight and safety including “protecting individuals and property on the ground.” 49 U.S.C. § 40103(b) (2). All civil aircraft are subject to FAA safety regulation. 49 U.S.C. § 44701. UAS are aircraft as defined in the statute. 49 U.S.C. §40102(a)(6) (“any contrivance invented, used, or designed to navigate, or fly in, the air.”), and Code of Federal Regulations, 14 C.F.R. § 1.1 (both as aircraft and small unmanned aircraft).

Very recently, a suit challenging local limitations on UAS operations examined the current scope of federal jurisdiction. In Singer v. City of Newton, a local ordinance prohibited UAS from operating below 400 feet. Given the general federal limitation against drone operation above 400 feet this effectively meant no drones could fly in Newton, Massachusetts. Dr. Singer filed suit arguing that parts of the ordinance directly contradicting federal law were preempted. The court ruled that federal law preempted the prohibition for flight below 400 feet and other local operational limitations. This case is now on appeal.

Clearly there is continuing disagreement over the depth and breadth of federal preemption of local laws pertaining to drones and whether federal, state or local authorities have jurisdiction and, if so, over what? The law is only now developing but there are strong arguments supporting federal preemption of state and local law regulating the operation of drones if not criminal activity that may be otherwise implicated. Space limitations do not permit a full examination of this issue but interested readers are directed to Jol A. Silversmith, You Can’t Regulate This: State Regulation of the Private Use of Unmanned Aircraft, 26 Air & Space L. 1, 23 (2013) as a starting point.

To encourage UAS deployment and its many benefits, it will be important to resolve these jurisdictional issues while enhancing clarity and uniformity of legal requirements. A possible way forward has very recently presented itself—President Trump’s October 25, 2017 Executive Order to speed up UAS integration into the national airspace. The Order recognizes the need for a cooperative approach amongst the private sector and all levels of government stakeholders to “develop and enforce regulations on UAS operations in their jurisdiction.” The insurance sector looks forward to participating in this collaboration.

FORWARD LOOKING PUBLIC POLICY

The American Insurance Association has identified several important public policy considerations as governments encourage, yet regulate UAS going forward. These proposals aim to enhance certainty, improve UAS use and performance, and reduce obstacles to the deployment of UAS. First, the business use of UAS should be encouraged. Enhanced commerce, innovation, improved efficiencies and reduced risks are obvious benefits of the commercial use of UAS. The insurance sector and other reputable businesses will have a paramount interest in operating UAS responsibly and safely. Consequently, even if states seek to restrict the operation of UAS, we believe that there should be a legitimate business use exemption from such limitations as long as the operation otherwise comports with federal requirements. Nonetheless, this would not make an operator immune for any criminal or invasive activities such as voyeurism. It would simply mean they are permitted to operate lawfully.

Second, with the proliferation of localities trying to regulate drone operations, the states should follow the lead of several examined above and adopt laws reserving for the states only the ability to regulate, prohibit or restrict UAS to the extent not preempted by federal law. This will avoid a balkanized regulatory approach of differing local standards that will complicate testing, development and deployment of this important technology. Imagine, for example, the drone that cannot cross the street to take images after a catastrophe simply because of a town boundary and, as a result, insurance relief is slowed to citizens on the wrong side of the road. State preemption of local regulation will provide greater certainty and encourage UAS use and innovation.
Third, the insurance sector supports reasonable language to protect privacy interests related to the utilization of UAS for business functions that do not conflict with or prevent executing existing legal obligations. However, we also believe privacy protections implemented by insurers to comply with existing state law already adequately address the concerns that may arise with UAS usage. For example, claims adjusters have taken pictures at high elevations for many years and those same privacy considerations should not change because the picture comes from a UAS hovering over a roof rather than a person standing on it. Our sector should not be restricted from using UAS derived data for legitimate business purposes so long as personally identifiable information is protected as already required.

Fourth, the insurance sector must be permitted to develop the knowledge, experience, products and pricing to insure UAS activities. The inevitable risks of commercial and personal UAS usage can be managed and insurance can be a meaningful part of that effort. To be able to adequately insure such risks, our sector needs the freedom to develop products and underwriting criteria for this new exposure. Accordingly, states and regulators must forbear from adopting new insurance requirements and, where needed, provide exemption from existing regulations to permit meaningful knowledge, product and price development.

**CONCLUSION**

The promise of drones is real for the insurance sector and for the economy at large. By avoiding outdated, balkanized and overly prescriptive regulations, public policy decision makers can permit the full promise of UAS to be realized. ▲

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4 Anthony Domanico, This drone claims to be the world’s smallest, cnet.com, May 8, 2015, https://www.cnet.com/news/the-wallet-drone-drone-is-so-small-you-can-take-it-anywhere/

5 14 C.F.R. § 107.


15 Id. (emphasis added).

16 Id. at Sec. 333.


19 Id.

20 14 C.F.R. § 107.41.


26 United States v. Cosby, 328 U.S. 256, 266 (1946); See also Brown v. United States, 73 F.3d 1100, 1106 (Fed. Cir. 1996)(stating that “Cosby and its progeny require direct, immediate and substantial interference with use and enjoyment.”).


28 Id.

29 Id. at 5.

30 Id.

31 See also Andrew Zimmitti, A Look At Federal Preemption Of State Drone Laws, Law360, Oct. 2016 (examining the dichotomy in preemption that permits states and localities to retain their “historic police powers.”); William V. O’Connor, May State And Local Gov’t Control Low-Flying Drones? Law360, Dec. 2014.

32 Presidential Memorandum for The Secretary of Transportation, October 25, 2017, 2017 WL 4803943

33 Id.

34 See e.g. MD CODE ANN., ECON. DEV. § 14-301
Analytics Offer Unlimited Opportunities to Actuaries

BY GARY WANG, PINNACLE ACTUARIAL RESOURCES, INC.

About the Author
Gary Wang is a senior consulting actuary with Pinnacle Actuarial Resources, Inc. in their Bloomington, Illinois office. He is a Fellow of the Casualty Actuarial Society and a Member of the American Academy of Actuaries. He has been with Pinnacle for 12 years and has worked in the property/casualty industry for 18 years. At Pinnacle, Mr. Wang has worked extensively on the application of modeling techniques to the insurance process.

Abstract
The actuarial practice is analytical in nature. As such, the continuing advances in analytics and increased availability of data will profoundly affect the actuarial profession. This article discusses the opportunities and challenges the current analytics environment poses to the traditional actuarial practices, and how the actuarial profession has responded.

As Dr. Andrew Ng observed, the most common source of realizable economic value resides with the capacity of algorithms and processing power to predict outcomes from inputs. How does this align with what actuaries do? The Casualty Actuarial Society defines a property and casualty actuary as “a professional skilled in the analysis, evaluation, and management of the financial implications of future contingent events primarily with respect to general insurance, including property, casualty, and similar risk exposures.” In practice, the core exercises commonly associated with the defined roles involve the pricing of insurance products and reserving for claims arising from such products. The core questions actuaries are tasked to answer in the realm of pricing and reserving fall squarely within this category. As such, it behooves us as actuaries to deliberately consider the current state of analytics vis-à-vis what we do, and how our jobs may evolve as analytics do.

“99% OF THE ECONOMIC VALUE CREATED BY AI TODAY IS THROUGH ONE TYPE OF AI, WHICH IS LEARNING A TO B, OR INPUT TO OUTPUT MAPPINGS.”

-Dr. Andrew Ng, at EmTech 2017[1]

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Insurance product pricing is difficult since production costs are unknown at the time prices or premiums are quoted and bound for insurance contracts. Furthermore, most insurance products cover rare events. For the majority of insureds, typically for any year with adverse claims that causes the product to be a net loss to the insurance company, there will be several years during which little to no claim activity occurs and the product is a net profit to the company. The actuary is tasked with creating a pricing plan such that, in this rare events environment, each insured is priced according to their risk potential. To this end, actuaries rely on data, and models that make sense of that data.

When it comes to predicting risk potential, current advances in algorithms and model structures offer strong alternative designs.

The current modeling design standard for developing an insurance product pricing plan is Generalized Linear Models (GLM), a generalization of the classic linear regression technique. In addition to reasonable predictions in practice, several features of this model structure are aesthetically pleasing to companies and regulators. The model’s structure fits neatly into insurance carriers’ traditional multiplicative pricing structure, in which one can look up relativities associated with each rating element and directly calculate the overall premium through simple arithmetic. The model also provides an intuitive interpretation whereby one can study the relativities along each dimension and assess the impact of changes along that dimension upon the overall premium charged. This transparency in how each variable affects overall premium makes for relatively easy discussions with state regulators on the factors considered in rating plan design, and the impacts various rating elements have on premium.

It is worth noting that even in the GLM-based modeling environment, transparency can be illusory, particularly in situations where multiple rating elements are derived from the same or highly-correlated raw information. In these cases, one must take into account all relevant dimensions so that all effects are discussed and a complete picture is presented.

When it comes to predicting risk potential, current advances in algorithms and model structures offer strong alternative designs. Consider the recently-completed Kaggle competition, Porto Seguro’s Safe Driver Prediction, where the aim is to predict whether a driver will file an insurance claim within the next year. Given the infrequent nature of multiple claims for a given vehicle in a given policy year, the modeling exercise is essentially a classic frequency modeling problem an actuary may undertake as part of a pricing analysis. On the discussion board, the winner of the contest described his winning submission as an ensemble of one Light Gradient Boosted Model and five Neural Networks. The superior performance of his design is notable, especially if you compare it with the typical business practice of utilizing GLM here in the United States. However, the level of complexity in the relation between the rating elements and the likelihood of a future claim is equally notable, and the increased complexity poses challenges from a business perspective.

The perception among most of the actuarial community is that, given the lack of intuitiveness regarding the relationships between the various rating elements and premium, the current regulatory environment is highly unlikely to accept a filing directly based on this ensemble model solution. The community expects similar difficulty in educating agents to properly present and discuss premium with potential insurance product buyers.

Today, presented with the two options, most companies will choose to stay with the GLM-based one, given the ease of overcoming implementation hurdles in systems, marketing, agent training and regulatory approval. It is not hard to envision how having both models can help an insurer improve its operations. Suppose, for practical reasons, the company chooses to go with the traditional GLM design despite having an alternative model with more predictive power. It can analyze the two sets of predictions to understand where forecasts diverge, and in these situations whether the implemented plan is presenting too low a price or too high a price compared to the filed pricing scheme. In either situation, if segments are sizeable and can be reasonably defined, the analyst can engineer new variables to properly segment these potential policyholders and feed that new information back into the GLM model to specifically differentiate these risks. Even if the company chooses not to refine the GLM-based pricing plan, the company has guidance on profit expectations associated with writing these risks and can make business decisions accordingly.

This is consistent with today’s trend, whereby companies accept the necessity of a regression structure to the model for business considerations. They focus efforts on utilizing feature engineering to improve how existing variables are handled in the rating plan, while constantly seeking out promising new variables to incorporate. In the personal and commercial auto insurance arena, usage-based insurance data has great potential. The driver generates data, as does the vehicle as it is used, and raw information regarding when, where and how the vehicle is driven is then processed, analyzed and scored. This type of intelligence represents the first time in the insurance pricing arena that the volume of data and the frequency with which data is generated comes close to what other industries generally consider Big Data. Moreover, this data has great intuitive appeal in that the public generally accepts driving patterns as having a causal relationship with accident potential. On the regulatory front, many departments accept the intellectual property nature of the information and its analysis, creating an environment in which greater complexity of model design can be utilized and tested. Given the voluntary nature of allowing a company to capture this information, it remains to be seen if the insurance industry can work with the necessary partner agents, such as the government and consumer groups, to create a future in which data capture becomes the norm rather than the exception. This would provide analytics the opportunity to showcase its full array of insurance capabilities.

In the homeowners and commercial property insurance space, image analytics offers similar potential. Drone utilization enabled large amounts of data imagery to be gathered, and advances in image analysis are, coincidentally, among today’s hottest research and development topics. Consider the recent annual ImageNet competition, where competitors were tasked with designing models to locate and categorize objects within images. In the 2017 ImageNet competition, the leading model achieved an impressive classification error rate of 2.25%. The convergence of availability of data, coupled with improvements in image recognition models, makes for a...
ripe environment for business utilization like property inspection or claims investigation.

In a reserving exercise, building the case to disrupt the traditional process is a major hurdle. For credibility and computational considerations, actuaries have historically aggregated claims development data before analyzing patterns to make ultimate loss predictions. They aggregate, typically to accident year, pertinent information such as incurred and paid claims counts and loss amounts, maturity in twelve-month increments and lines of business. Today, we have sufficient computational power to leave the data at the individual claims level, then model on more detailed information. Furthermore, doing so allows some nuances to naturally flow through, to the extent information is captured as part of the claims detail. For example, the categorization of medical claims by severity of injuries is intuitively an indicator of likely differing development patterns. When aggregating data, a shift in the claims mix over the years would be hidden by the summarization and require an insightful actuary to note and take into account the changing mix.

But the reserving analysis is not exposed to competitive pressures in the same manner as the pricing analysis. As such, more latitude is given to the relative accuracy of the point estimate. In a stable environment, most traditional techniques put us in the right ball park, requiring nudges year to year, but generally within reason. This creates a disincentive for companies to disrupt the existing processes to improve the reserving methodologies in place, since the current reserving process is of sufficient rigor to meet regulatory and accounting requirements. While recent emphasis in the range and variability of the estimates may serve as an invitation for claim-based methods to show their mettle, in practice, aggregated data-based methods have arisen to handle the variable estimations.

Interestingly, a case for improvements to the reserving process may eventually result as a byproduct of other current insurance company trends. Of note, companies have exhibited great interest in understanding claims development and ways to predict and manage potentially explosive claims that blow up through unreported complexity and/or litigation involvement. Such supervised training models are likely to include predictions of expected ultimate claim amounts, and this information can then be leveraged as part of the reserving process.

Supervised learning challenges are not limited to classic pricing and reserving issues. In addition to the aforementioned claims-handling opportunities, there are other often-posed questions to which one versed in supervised learning problems can become a valuable resource:

- Which company policyholders are most likely to renew?
  - Are they a profitable segment of the portfolio?
  - If not, how will corrective adjustments to the rating plan affect retention?
- Which quoted policies are more likely to convert?
  - Are they consistent with the target market?
- Which properties are more likely to have unmitigated hazardous conditions?
- Which claims are more likely to be fraudulent?

Given the current state of analytics, an increase in available tools is making algorithms more accessible to interested business analysts. An actuary should not lose sight of the fact that they are not alone in the analytics arena. For example, many insurance company research labs currently staff a non-negligible number of statisticians and data scientists, clearly signaling actuaries have no monopoly on an insurer’s analytics. As more tools are built to improve methodology and processing efficiency, the pool of professionals qualified to manage them will grow.

As tools become more sophisticated, greater data processing and model iterating automation will become the norm rather than the exception. This is not a bad thing. Just as monitoring reports evolved from manual creation to template updating to automated batch processing, one should embrace increasing analytics automation. There are many repetitive data processing steps that are generally variations of a theme when it comes to assembling the data for modeling and, to some extent, for exploratory data analysis. As automation takes over these tasks, it behooves us to ask ourselves how we can best support it – and be supported by it.

Does all of this spell doom for actuaries? I am optimistic for the profession in this environment. Our primary focus is in the domain expertise, with sufficient grounding in statistics to support the typically-expected pricing and reserving work. Actuaries often expand their skillsets over time to move beyond these classic exercises and become core members of teams handling other issues companies may face.

Given an actuary’s limited time resources, they should not expect to become a master of all relevant insurance industry domain knowledge areas, the relevant programming and coding skills and statistical and machine learning. Each of these three key categories contains information that would take lifetimes to learn, and each continues to evolve by the minute.

As an analytics-oriented actuary, a good grounding in each of the three areas is to be expected. The Casualty Actuarial Society recognizes this need, and its subsidiary, the CAS Institute, created a Certified Specialist in Predictive Analytics specialty track to specifically recognize practitioners who possess just such a foundation. Once an actuary has built this knowledge base, many variations of specialization are possible and the sky’s the limit.

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The General Data Protection Regulation (GDPR), which becomes effective May 25, 2018, will enable European Union (EU) citizens to better control their personal data. But what does that mean for companies, nonprofit or government institutions, risk managers, insurers, reinsurers, and others in the United States and around the world — those for which controlling or using personal data is the lifeblood of business?

Quite a bit, actually. The regulation seeks to establish one single set of rules regarding the collection, processing, storage, and disposal of data across Europe and beyond to wherever that data is located worldwide. The penalty for noncompliance can be a fine of up to 20 million euros, or up to 4 percent of the annual worldwide turnover of the preceding financial year in case of an enterprise, whichever is greater. This article will provide some basic information regarding the GDPR and why it is important to be aware of it, and in many instances, make sure you are compliant before the looming deadline.
The regulation provides specific suggestions for what kinds of security action relating to a person who can be identified, directly or indirectly, in particular by reference to an identifier (such as a name, an identification number, location data, or an online identifier) or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that person.

PII — is defined in both the 1995 directive and the GDPR as any information relating to a person who can be identified, directly or indirectly, in particular by reference to an identifier (such as a name, an identification number, location data, or an online identifier) or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that person.

The regulation provides specific suggestions for what kinds of security actions might be considered “appropriate to the risk,” including:

- The pseudonymisation and/or encryption of personal data.
- The ability to ensure the ongoing confidentiality, integrity, availability and resilience of systems and services processing personal data.
- The ability to restore the availability and access to data in a timely manner in the event of a physical or technical incident.
- A process for regularly testing, assessing, and evaluating the effectiveness of technical and organizational measures for ensuring the security of the processing.

LAWFUL BASIS FOR PROCESSING

Data can only be processed if there is at least one lawful basis to do so.

The lawful bases for processing data are:

- The data subject has given consent to the processing of his or her personal data for one or more specific purposes.
- Processing is necessary for the performance of a contract to which the data subject is party or in order to take steps at the request of the data subject prior to entering into a contract.
- Processing is necessary for compliance with a legal obligation to which the controller is subject.
- Processing is necessary in order to protect the vital interests of the data subject or of another natural person.
- Processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller.
- Processing is necessary for the purposes of the legitimate interests pursued by the controller or by a third party, except where such interests are overridden by the interests or fundamental rights and freedoms of the data subject that require protection of personal data, in particular where the data subject is a child.

CONSENT

Where consent is used as the lawful basis for processing, consent must be explicit for data collected and for the purposes data are used. Consent for children must be given by the child’s parent or custodian, and must be verifiable. Data controllers must be able to prove “consent” (opt-in) and consent may be withdrawn.

RIGHT OF ACCESS

The right of access is a data subject right. This gives citizens the right to get access to their personal data and information about how these personal data are being processed. A data controller has to provide, upon request, an overview of the categories of data that are being processed as well as a copy of the actual data.

RIGHT TO ERASURE

A right to be forgotten was replaced by a more limited right to erasure in the version of the GDPR adopted by the European Parliament in March 2014. Article 17 provides that the data subject has the right to request erasure of personal data related to them on any one of a number of grounds including non-compliance with article 6.1.

DATA PORTABILITY

Under the GDPR, a person is able to transfer their personal data from one electronic processing system to and into another, without being prevented from doing so by the data controller. Data that has been sufficiently anonymized is excluded, but data that has only been de-identified but remains possible to link to the individual in question, such as by him or her providing the relevant identifier, is not. In addition, the data must be provided by the controller in a structured and commonly used open standard electronic format.

DATA PROTECTION BY DESIGN AND BY DEFAULT

Data protection by design and by default requires that data protection is designed into the development of business processes for products and services. This requires that privacy settings must be set at a high level by default and that technical and procedural measures should be taken by the controller in order to make sure that the processing, throughout the whole processing lifecycle, complies with the regulation.

Records of Processing Activities

Records of processing activities must be maintained. These records need to include purposes of the processing, categories involved, and envisaged time limits, and they must be made available to the supervisory authority on request.

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All organizations, including small to medium-sized companies and large enterprises, must be aware of all GDPR requirements and, if applicable, must be prepared to comply by May 25, 2018.

Larger companies, on top of changing their own policies and procedures, might have thousands of contracts to update. Complicating that challenge is that it needs to be done late in the compliance process. Still, as of this writing, lot of firms have not done any review, let alone renegotiation, of contract terms.

**HOW MUCH COULD COMPLIANCE COST?**

A recent survey by Media Post indicates that it will cost Fortune 500 firms around $1 million just for technology alone.

It’s a large line item in each company’s budget — but that does not mean they are spending the funds. As of the October 2017 survey, only 10 percent of firms in the UK and 9 percent in the U.S. had purchased new technology.

**THINGS TO SORT OUT**

The GDPR casts a much broader net for what constitutes personally identifiable information. Companies will need to provide the same level of protection for things like an individual’s IP address or cookie data as they do for name, address, and Social Security number.

Since the law is new, there will no doubt be challenges to its definitions and its jurisdictional reach. It does not help that the GDPR leaves much to interpretation. It says that companies must provide a “reasonable” level of protection for personal data, for example, but does not define what constitutes “reasonable.” This gives the GDPR governing body a lot of leeway when it comes to assessing fines for data breaches and noncompliance.

**THE TIME TO ACT IS NOW**

All organizations, including small to medium-sized companies and large enterprises, must be aware of all GDPR requirements and, if applicable, must be prepared to comply by May 25, 2018.

It may not be easy. And it likely won’t be inexpensive. But by taking proactive steps to comply with GDPR requirements, businesses will benefit from avoiding costly penalties while improving customer data protection and trust.

It’s not too late to effectively implement data protection policies and solutions now. As with any major change, it all starts with taking that first, crucial step. For complying with the GDPR, that first step is to designate a DPO to build a data protection program that meets the GDPR requirements.

**WHO IS RESPONSIBLE? ROLES UNDER THE GDPR**

The GDPR defines several roles that are responsible for ensuring compliance: data controller, data processor, and the data protection officer (DPO).

**Controller:** The data controller defines how personal data is processed and the purposes for which it is processed. The controller is also responsible for making sure that outside contractors comply.

**Processor:** Data processors may be the internal groups that maintain and process personal data records or any outsourcing firm that performs all or part of those activities.

**DPO:** The GDPR requires the controller and the processor to designate a DPO to oversee data security strategy and GDPR compliance. Companies are required to have a DPO if they process or store large amounts of EU citizen data, process or store special personal data, regularly monitor data subjects, or are a public authority.

**THIRD-PARTY CONTRACTS:**

**AN EXTRA LAYER OF LIABILITY**

The GDPR does not distinguish the liability on data controllers and data processors. If a third-party processor not in compliance contracts with a company, that company is considered not in compliance.

GDPR compliance means that all existing contracts with processors (e.g., host servers, ADP payroll, other vendors) and customers need to be rewritten to address the GDPR requirements and detail each party’s responsibilities. The revised contracts also need to define consistent processes for how data is managed and protected, and how breaches are reported.

Vendors suddenly became a greater concern than just a source of potential breaches. Third-party vendors that are processing data have access to EU citizens’ data, so the GDPR requires that the contracting party has the obligation to ensure that all of those third parties are adhering to the GDPR and processing the data accordingly.

The 72-hour reporting window that the GDPR requires makes it especially important that vendors know how to properly report a breach. If a vendor was hacked, it must notify the contracting party timely — or both will be found liable for violating the GDPR notice provision.

It’s necessary to have built into the contract a clearly defined path for notice to get to a designated person at the other contracting party’s organization. The GDPR essentially requires the contracting parties to have policies, procedures, and a response structure in place to provide notice and address a breach.

**A NEW MINDSET AND THE JOB AT HAND**

It is very likely the GDPR will change the view businesses currently have of data. Most see their data and the processes they use to mine it as an asset, but the GDPR’s explicit detail consent requirement will alter that view. Companies will have to look more closely at how data is collected, processed, disseminated, and used, since there is now a whole new set of potential liabilities with the implementation of the GDPR.

Much of the new regulation details the processes and system changes needed to comply — which in many instances require companies to make fundamental changes in the way they collect, process, store and disseminate EU citizens’ data.

BY SUSAN E. MACK

About the Author:
As Special Counsel with the Jacksonville, Florida office of Adams and Reese LLP, Susan E. Mack’s law practice encompasses both insurance and reinsurance transactions and dispute resolution. Before her recent move to private practice, she enjoyed a 25-year career as an industry senior manager. In addition to acting as Head Reinsurance Counsel to Aetna and General Counsel to St. Paul Re, Inc., Transamerica Reinsurance and The Main Street America Group, she also served as Chief Claims Executive and Chief Treaties Officer. Significantly, she is one of the founding directors of ARIAS-US. Ms. Mack holds the distinction of being a certified ARIAS-US umpire and qualified ARIAS-US mediator. She is listed on the American Arbitration Association’s list of commercial arbitrators.

Abstract:
Susan E. Mack discusses the evolution in case law as to the often recurring subject of how facultative certificates of reinsurance pay cedents’ allocated loss adjustment expenses. In so doing, she considers whether and to what extent the seminal case of Bellefonte v. Aetna, 903 F.2d 910 (2d Cir. 1990), has continuing validity in view of the New York Court of Appeals’ December 14, 2017 decision in Global Reins. Corp. of America v. Century Indem. Co., 30 N.Y.3d 508 (N.Y. 2017).

I. INTRODUCTION
Twenty-eight years ago, John F. Shea, Jr., a retired Connecticut Superior Court Judge, called me into his office at Aetna Casualty and Surety Company (“Aetna”) and offered me the position of the company’s first internal reinsurance specialty attorney. Realizing that this position made me the Aetna Claim Law Department’s chief negotiator with Lloyd’s, General Re and other prominent reinsurers, I was both delighted by and in awe of the coming challenge. So I asked Judge Shea, quite innocently, “Can you refer me to any significant reinsurance case law you would like me to know?” He handed me only one case and replied “This is all you need to know for now.” The case was Bellefonte Reins. Co. v. Aetna Cas. and Sur. Co., 903 F.2d 910 (2d Cir. 1990).

For the next six years, I dealt with a kaleidoscope of issues that impacted Aetna and its reinsurers – numbers of occurrences, allocation, and the recoverability of declaratory judgment expenses among them. But most prominent among the issues addressed was trying to deal with the Bellefonte case, which Aetna, at the time, considered to be a prime example of hard facts making hard-to-stomach case law. Because of my unique perspective, this article will trace the evolution of Bellefonte-related jurisprudence as to how courts have come to view reinsurers’ obligations to pay allocated loss adjustment expense under facultative certificates of reinsurance.

Of course, that evolution has recently culminated in the December 2017 New York Court of Appeals decision in Global Reins. Corp. of America v. Century Indem. Co., 30 N.Y.3d 508 (N.Y. 2017) (“Global II”). The New York Court of Appeals responded in the negative to a question certified by the Second Circuit, namely, to whether:

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narrowly confined to the Second Circuit. Also, I maintained that, with zealous advocate that I was, I maintained that the case was narrowly confined to the Second Circuit. Also, I maintained that, with certificates which clearly related to expense supplemental underlying policies, reinsurance industry custom and practice held that facultative reinsurers’ certificates were concurrent with those policies...

III. AETNA VS. HOME (STILL A.H. ROBINS)-FOLLOW, FOLLOW, FOLLOW

Even though in the Second Circuit, the U.S. District Court for the Southern District of New York in Aetna Cas. and Sur. Co. v. Home Ins. Co. ("Aetna v. Home") 882 F. Supp. 1328 (S.D.N.Y. 1995) deviated from the Bellefonte case holding. Much of the underlying factual scenario was the same as Bellefonte, as again the reinsured expenses related to the excess policies issued by Aetna’s policyholder, A.H. Robins. However, there were factual distinctions with a difference. First, the applicable facultative reinsurance certificates were Home Insurance Company manuscript forms, rather than standard facultative certificates. In fact, the parties stipulated that these manuscript forms superseded the more standard facultative certificates issued by the applicable reinsurance brokers. Id. at 1333. Second, Aetna had approached the Home Insurance Company about its 1977 Interim Agreement with A. H. Robins. This Interim Agreement clarified the A. H. Robins’ policies, specifying that Aetna had an obligation to pay A. H. Robins’ expenses where, arguably, none previously existed. Importantly, Home Insurance Company executive John Hilton consented in writing to follow this settlement. Id. at 1334-35. Third, the court found that Home Insurance Company was kept apprised of the 1984 settlement previously mentioned. Id. at 1334.

In reaching its holding that the Home Insurance Company had to pay...
Aetna for expenses supplemental to what was purported to be the reinsurance limit, the court heavily relied on the concrenecy of obligation between the Aetna excess policies and the Home Insurance Company reinsurance forms. Id. at 1344. The Home Insurance Company reinsurance forms and the Aetna policies were stated to have only “loss” limitations, that is, limitations on liability for insurer/reinsurer ultimate net loss, while the certificates in the Bellefonte case were found to have an overall cap.5 Id. at 1335. Since there was no stated cap or other contrary provision to alter the concurrency principle, Home Insurance Company had to pay for expenses above the loss limitation.

IV. BELLEFONTE IN EXTREMIS

Aetna v. Home was one of the few bright spots for cedents in Bellefonte-related case law from 1993 to 2017. Reinsurers favoring the existence of a cap for expenses in facultative certificates were heartened by the case of Unigard Sec. Ins. Co. v. North River Ins. Co., 4 F.3d 1049 (2d Cir. 1993). Cendent North River submitted evidence of the reinsurer’s past practice in paying expenses supplemental to the facultative certificate “cap,” however, the court held that “Bellefonte’s gloss upon the written agreement was conclusive.” Id. at 1070. The court reasoned that, as in Bellefonte, the relevant certificate provides that Unigard agreed to reinsure North River “in consideration of the reinsurance premium and subject to the terms, conditions, limits of liability . . . and the Certificate provisions set forth herein.” Id. The Bellefonte case’s reach ultimately bled into other jurisdictions. In Cont’l Cas. Co. v. MidStates Reinsurance Corp., 24 N.E.3d 122 (Ill. App. Ct. 2014), the Illinois Court of Appeals affirmed a circuit court’s judgment on the pleadings, agreeing that the relevant reinsurance certificates provide a clear reasoning of Bellefonte, even though it was not binding precedent in Illinois.


With respect to another property case, the New York Court of Appeals first addressed the issue of facultative certificate expense obligations in Excess Ins. Co. v. Factory Mutual Ins. Co., 3 N.Y.3d 577 (N.Y. 2004). While it was clearly not obligated to follow a federal circuit’s pronouncements, the court’s majority cited Bellefonte with approval for the proposition that a follow-the-fortunes clause cannot supplant the stated “cap” within a facultative certificate. In a vociferous dissent, the majority’s reasoning was criticized as the subject certificate contained no “subject to” clause (see discussion of Unigard case above).

V. THE IMPORT OF THE NEW YORK COURT OF APPEALS’ HOLDING IN GLOBAL II

The certified question to the New York Court of Appeals in Global Reins. Corp. of America v. Century Indemnity Co. (Global II, supra.) was predicated on the issue of whether the reasoning in the Excess case, supra., constitutes an invariable rule. Accordingly, the court provided its pronouncement on New York law as to the recurring issue of “whether defense costs, insofar as they are reinsured by a facultative reinsurance policy, count toward the limit in the ‘Reinsurance Accepted’ rule.” That pronouncement is a resounding “it depends.”

The Global II court cautioned that the language of the reinsurance contract must be examined above all else:

“Our cases in the insurance context confirm that even modest variations on the face of a written agreement can alter the meaning of a critical term. Id. at 2007.

Furthermore, the Global II court indicated that the certificate should be examined to determine if it is a fully integrated contract. The strong implication was that future courts could construe contracts which are not so integrated differently than the Bellefonte certificates.

VI. CAN A REINSURER STILL RELY ON BELLEFONTE TO INSIST A LIMIT IS A LIMIT?

I must hazard a guarded “yes” to the above question, based on the above case guidance. The New York (state) Court of Appeals in Global II did not even mention Bellefonte, decided as it was by the (federal) Second Circuit. Bellefonte has not been explicitly overruled.

In conclusion, here are the likely indicia of scenarios, pursuant to some or all of which facultative reinsurers can still claim that “a limit is a limit.”

• Issuance of facultative contracts which unequivocally state a “Limit” or “Reinsurance Accepted” provision;

• Use of reinsurance contracts which state that expenses are “subject to” “Limits” or “Reinsurance Accepted” provision;

• Issuance of fully integrated facultative contracts; and/or

• Situations in which it is doubtful that underlying policies pay expenses as a limits-supplemental benefit.


2 Global Reins. Corp. of America v. Century Indemnity Co., 843 F.3d 120 (2d Cir. 2016) (“Global I”).

3 Besides Bellefonte Re, the other facultative reinsurers were Constitution Re, Insurance Co. of the State of Pennsylvania, Mission Insurance, North American Company for Prop. and Cas. Ins. Co. and Gerling Global Reins. Corp. of America. Gerling Global Reins. Corp. of America is now known as Global Reins. Corp. of America.

4 In the original federal district court action involving Aetna and the six reinsurers, both Aetna and the reinsurers filed motions for summary judgment. To do so, the parties had to argue there was no material issue of fact but, as a matter of law, the contracts were plain and unambiguous. See Bellefonte Reins. Co. v. Aetna Cas. and Sur. Co., No. 85-Civ-2706 (JFK), 1989 U.S. Dist. LEXIS 10432 (S.D.N.Y. Sept. 5, 1989).

5 While Home Insurance Company agreed that its own facultative reinsurance forms superseded the intermediary-issued facultative certificates the intermediary-issued certificates had wording similar to the Bellefonte certificates.
Effect of Autonomous Vehicles on Insurance Markets & How to Capitalize

BY PATRICK M. LEVANDOSKI

About the Author
Patrick Levandoski was selected as a recipient of an award by the IRUA's Scholars Committee for this paper. He graduated from the University of Georgia Terry College of Business in December 2017 with degrees in Risk Management & Insurance and Real Estate. Currently he is Barcelona, Spain interning for a European housing provider specializing in study abroad programs and young professionals called Comforts of Home. In April 2018 he will begin Zurich's Underwriter Training Program and eventually aspires to work with insurance of autonomous vehicle because of his interest in innovation.

Abstract
With technology innovation driving a dynamic future change of the automotive industry, the insurance industry must adapt the way we interpret actuarial data, underwrite, sell auto insurance, and handle claims. Below is an opportunity to learn how to best prepare for the impact Autonomous Vehicles will have on insurance markets.

EXECUTIVE SUMMARY:
AUTONOMOUS VEHICLES FUELING CHANGE IN THE AUTOMOTIVE INSURANCE MARKET

The Magnitude and Rate of Change: Autonomous cars could be hitting the roads sooner than you think. Numerous major automotive companies, such as Ford, General Motors, Tesla, Volkswagen Group, BMW, Alphabet’s Waymo, and Volvo, are racing to get self-driving cars on the road first. By 2025, the partially and fully autonomous vehicle market is expected to reach $42 billion.1 By 2035, the market value is projected to reach $77 billion with 12 million fully autonomous and 18 million partially autonomous vehicles projected to sell globally per year.1

Automotive manufacturers are adapting to changing consumer demands, as should the insurance industry. The $247 billion auto insurance marketplace anticipates a short term increase in premium collection followed by a market shrinkage, roughly 70% or $137 billion by 2050, because of loss frequency and total losses reduction, resulting in reduction of premiums.2,3 Due to the complexity of the market, insurers who hone their policies, gather actuarial data, underwrite effectively, and market their products properly, can capitalize on the short-term growth in the automotive insurance industry due to the increased premium. However, insurers must be aware of the market projections. Reports estimate 90% reduction in accident frequency by 2050, a shrink in auto insurance market size, and the adoption of ride sharing that will render less need for personal auto coverage.4

The autonomous vehicles market is growing at a notable pace, and insurance companies should be on the forefront of response to capitalize on the financial opportunity, gain market share, and mitigate the disruption on the automotive insurance industry.

Challenges of Integration: four main aspects of autonomous driving will cause hitches in the chain in the integration of autonomous vehicles on the road—Legal and liability regulation, technology imperfections, public perception, and data collection.

Legal and Liability Challenges: What happens if an autonomous vehicle is driving a passenger to their morning business meeting when it begins to travel on a back road that has not undergone construction since the 1980’s? The outdated road is not properly marked with road surface markers. The infrastructure is not suitable for an autonomous vehicle. If the car were to be in an accident, the government infrastructure, driver, and product manufacturer are all potentially liable. Against, I predict fault to be assessed on a case by case basis, but for fully autonomous vehicles to take over road, infrastructure must be updated and frequently maintained.

Technology Imperfections: Autonomous safety features are making vehicles increasingly reliant on the manufacturing and technology capabilities, less reliable on the driver. This concept raises the question, who will be liable in an accident. Was the car driving itself? If the driver was in the car, at the time of the accident, how can you not hold him or her responsible? I expect accidents to be handled on a case by case basis and determined by the car’s level of automation and whether the car was in autopilot at the time of the accident. Further, I predict a positive correlation between cars’ level of automation and the product’s liability claims—meaning higher capability cars will result in a higher product liability claims frequency. In turn, we will also see a decrease in personal auto claims.

Public Perception: As with any new product, lag times until the product is fully accepted is usual. I believe this is especially true with a product that people will trust their lives. I believe humans will be hesitant, at first, to adopt autonomous vehicles; however, time will pass and hesitancy will dissipate enabling us to manufacture human error out of driving. This puts greater pressure on perfecting the engineering in car manufacturing and technology.

Data Issue: Companies collecting autonomous driving data are sitting on a gold mine. As time progresses, the data’s value will climb because the increasing prevalence of autonomous driving. It is because companies have no frame of reference and historical data to go off of that will make accurately insurance vehicles difficult. Limited data, technology uncertainty, and liability uncertainty will all play a major role in the insufficient data.

The Fleet of the Future: The future of the automotive insurance industry depends on how we overcome the challenges of integration, policy adaption, and availability to driving data.
3 New Lines of Insurance: I am proposing 3 new lines of insurance to cover the liabilities present with self-driving vehicles—Cybersecurity, Product Liability, and Infrastructure Insurance. Autonomous vehicles will be hurt, I predict, the automotive insurance industry but provide these insurance aspects with potential.

Economies of Scale: Like the first gas, solar, and electric powered cars, I expect the first fully autonomous vehicles will be too expensive for a middle class to own. However, this will eventually change as markets adapt and as research and development progress.

Autonomous Driving Data, Forecasting Models, and Claim Handling: Data accuracy on forecasting models, loss runs, and loss ratios will be difficult to predict. Handling claims will be on a case-by-case basis. I believe, self-driving vehicle data, forecasting models, and claims handling all 3 have uncertainties that play into each other.

PART 1 - WHERE ARE THEY AND HOW FAR DO THEY HAVE TO GO? THE MAGNITUDE AND RATE OF CHANGE

The Technology that Turns the Gears: In 2009, Google’s self-driving car project began. By 2012, Google accomplished over 300,000 highway self-driven miles and transitioned to complex city streets. The Google self-driving car project, known as Waymo since 2016, reached an astounding 3 million of self-driving on public roads, both freeway and city streets, as of May 2017. Self-driving miles are taking off at an exponential rate, allowing data collection at an unprecedented rate. The more miles driven allow for greater technology exposure to public roads and continuous collection of vast amounts of information. The hardware technology encompassed in the self-driving vehicles boils down to these features:

- **LIDAR**
- **Short and Medium-Range Radars**
- **Long-Range Radar**
- **High-Powered Cameras**
- **Ultrasound**
- **GPS**

LIDAR, Laser Illuminating Detection and Ranging, potentially the most important part of the vehicle, allows the car to “see” by bouncing short-range, medium-range, and long-range radar beams off objects around the car to determine the distance and profile of the object. Unlike Waymo, Tesla has relied on high-powered cameras to provide sight for their vehicle, but the concept is the same. Ultrasonic sensors operate as a backup primary sensor system in vehicles in the event of a technological mishap. Technology of autonomous vehicles vary slightly from vehicle to vehicle, but the vision is the same. See the actions of surrounding vehicles, cyclists, and pedes-

Automakers, such as Ford and Volvo, are aiming for a Level 4 autonomous car before 2021. Volvo announced the pursuit of a Level 4 XC90 within this time frame; however, Level 5 is the ultimate goal and fleet of the future. Currently, car manufacturers are pushing towards levels 3, 4, and 5 as Congress is taking up bills to speed up self-driving testing. Key distinctions between Levels 3, 4, and 5 are that in Level 3, the vehicle is conditionally automatic and can only operate by itself in certain situations like on the freeway. In a Level 4, the highly autonomous vehicle will handle the situation itself if something goes wrong, and a driver will be in the driver seat to intervene in the event of a software or hardware malfunction. The captivating Level 5 driving capability is fully autonomous. Cars with Level 5 capability will be advanced enough to where manufacturers will not even put pedals and steering wheels in the vehicle because they will be wasteful expenditures. Currently, no automaker has set a clear timeline for when Level 5 driving will be possible, but I predict a fully autonomous vehicle available for sale to the public by late 2020’s to 2030, based on research and development efforts. Skeptic Kathy Winter, Vice President of Automated Driving Solutions for Intel, is optimistic that cars will have the ability to see and think like humans at Level 5 before 2030. As vehicle capability progresses to Levels 3, 4, and eventually 5 vehicles, the importance of insurance companies responding to the change in the automotive, product liability, and infrastructure insurance industries becomes increasingly prevalent.

The Introduction of Autonomous Vehicles on Insurance Markets: Autonomous vehicles will have a significant impact on the insurance industry, but the question is, how volatile will the affect be? In the U.S., Property and Casualty Insurance is a $200 billion market—Motor insurance accounting for 42%. Comprehensive auto insurance policies cover loss attributed to theft, fire, and collision. Collisions account for roughly 80% of the total claim cost. From a societal standpoint, the appeal behind autonomous

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fatalities to 35,200 for 2015.\(^\text{15}\) Because collision frequency accounts for the majority of claim costs, collision frequency is responsible for the majority of premium. A decreasing premium will result due to the reduction in collision frequency, property damage, personal injury protection, and collision, caused by the implementation of autonomous vehicles on our road, I predict. The total shrinkage in premium collection is estimated to be roughly 75% or $150 billion.\(^\text{11}\)

**When we will see Self-Driving Cars affect Insurance Markets:** Lag effect on technology adoption, manufacturer uncertainty, and the evolution of fully autonomous vehicles, among many reasons, makes it difficult to create a firm timeline of when insurance markets will see the effect of autonomous cars. I predict consumers to finish driving the car they are driving now and then purchase a new car with autonomous capability. Another reason that it is difficult to predict when the industry will be affected is because there will be a grey area as cars progress in Automation Level—both manufacturer capability, Level 3 to 5, and public adaption, ending of driving Levels 0, 1, and 2 cars. Through 2030, new cars will be Level 4 or below and have both an autonomous and a human driving option.\(^\text{14}\) Sometime between 2030-2050 car sales will be predominantly autonomous only.\(^\text{14}\) According to a predictive 2030 auto report released by McKinsey & Company, up to 15% of vehicle sales will be fully autonomous (make sure facts line up).\(^\text{14}\) The more dominant autonomous vehicles become on our roads, the swifter the insurance industry will react.

Regarding regulations, lawmakers have been relatively silent until recently. The blind spot aided self-driving car enthusiast and manufacturers to be on the forefront of innovation and to capitalize while there have not been legislative hoops to jump through.\(^\text{6}\) On July 19th, 2017, a House Energy and Commerce subcommittee voted to advance a bill to speed up development of self-driving cars and establish a federal framework for regulation—the Highly Automated Vehicle Testing and Deployment Act of 2017. The bill is anticipated to go before the entire House in the fall and gives the National Highway Traffic Safety Administration broad oversite of the autonomous car industry.\(^\text{16}\) Law makers appear to be aiming for a comfortable median of the strictness of legislation and relaxed approach, based on my evaluations. A complete laissez-faire approach and legislatures’ run the risk of impeding magnitude, pace, and implementation of autonomous vehicles. No regulation leaves too much room for unreliable products to enter roadways—creating chaos. Lawmakers are searching for the regulation that will not significantly impede growth but require safety.\(^\text{16}\)

The data below assumes that Level 5, fully autonomous, vehicles are available for sale and legal to drive on public roads by 2020 or shortly after. Depicted is a timeline that predicts price expectations and percentage of total vehicle sales for autonomous vehicles.\(^\text{41}\)

### PART 2- THE STOP SIGNS TO BECOMING FULLY AUTONOMOUS: CHALLENGE OF INTEGRATION

New products tend to lag in consumer adoption. I believe data can be categorized into 2 types—Driving data and Activity data. 5 key components, software perfection, legal regulation, legal responsibility, public perception, and data collection, are challenging integration of self-driving vehicles and will affect how insurance markets respond.

**Software Perfection—Capability, Reliability, Activity, and Collection:**

The largest challenge in tackling the autonomous vehicle race lies within software and data collection. Fully autonomous vehicles are a software limitation.\(^\text{21}\) Hardware necessary to implement Level 5 vehicles are available today, according to Tesla’s Elon Musk.\(^\text{21}\) Software development is paramount to the success, safety, and mass utilization of autonomous vehicles. Software plays an astronomical role to the development and utilization of autonomous cars. Aspects of concerns for self-driving software are:

- **Product Capability and Reliability**
- **Cybersecurity—Terrorism and Hacker Exposures**
- **Data Collection**

First and foremost, product quality must be taken into account. Software capability is the limiting factor to autonomous vehicles. The software delay is embedded in programmers’ inability to figure out human behavior, traffic idiosyncrasies, and teaching a car to use knowledge requiring massive amounts data and computing power.\(^\text{20}\) Precise maps and artificial intelligence are limiting factors to development of Level 5 proficient software.\(^\text{21}\)

Along with insufficient software, technology is also a limiting factor because autonomous vehicles are likely to rely on vehicle to vehicle communication, once self-driving cars hit the road in mass, which exposes software to hackers.\(^\text{22}\) Cybersecurity risk of autonomous vehicles, holds a large presence in the exposure to autonomous vehicles. A survey, conducted by Munich RE, revealed that 55% feel cyber security is the greatest insurance concern with self-driving vehicles.\(^\text{31}\) Self-driving car software could contain vulnerabilities that hackers or terrorists potentially could get into and trick vehicle’s sensors to look at a stop sign as a yield sign—essentially recoding the vehicles software.\(^\text{23}\) Recoding and terrorism will be of big concern for the fleet of the future.

Autonomous vehicles require vast amounts of data to be processed in split seconds. Software exposes the safety of its passengers from the aspect of lack of sufficient data to make these decisions and a breach of data
A cyber breach could put vast amounts of personal data, such as travel tendencies, location, driver identity, and conversational information, at the hands of a hacker. It is plausible that vehicles will save video and audio data records from everything around and inside the vehicle to protect manufacturing companies from an insurance perspective. From a software standpoint, autonomous vehicles need to focus on product capability/reliability, cybersecurity for software coding and personal data, and driving data collection.

**Legal Regulation:** Legislature holds a major impact on when autonomous vehicles hit roads. In 2017, thirty-three states have introduced legislation thus far, which is up from the twenty states that introduced legislation in 2016. Based on my evaluation of current legislation, I believe the increasing legislation aims to put guidelines on autonomous driving, which I expect to be laissez-faire. I anticipate legislation to simply be a yield sign, while there is a lot of research and development going on instead of production. Reason being, legislators understand the importance of partially and fully autonomous driving in progressing vehicle safety. Regulators desire to bring autonomous vehicles to the roads safely but without creating so many stop signs so the technology will get to the market promptly.

I forecast legal regulations will not slow down the autonomous vehicle industry until Level 4, potentially Level 5, vehicles are nearly ready to roll. I believe the reason to waiting to slow the growth until this point is so that research & development, software, and hardware could develop at a substantial rate while the industry remained attractive to manufacturers and investors. I attribute the tightening of legislation upon Level 4 conception to the preparation for a Level 5, fully autonomous vehicle to hit the road, and increased focus on infrastructure deficiencies. While President Obama held office in 2016, the administration proposed spending $4 billion, over a ten-year period, to research projects and infrastructure improvements associated with autonomous vehicles. Legal restrictions will not become a factor until fully autonomous vehicles are approaching completion and infrastructure needs to be up to date in order to protect consumer’s safety.

**Legal Responsibility:** Scenarios arise where an Autonomous Vehicle (AV) is involved in an accident with a Manual Operated Vehicle (MOV). Who is at fault? The driver of the MOV, the driver of the AV, infrastructure constructor, the car manufacturer, or the software manufacturer? This question is tricky and the answer will come on a case by case basis, for now. There are three scenarios that I expect to determine responsibility of fault if a vehicle is in autonomy phase—manufacturer or product defect, informational defects, or design defect. I will elaborate on these later.

**Public Perception:** The fourth major challenge of integrating autonomous vehicles on public roads is the social acceptance and financial ability to purchase autonomous vehicles among all income classes. I anticipate the adoption of autonomous cars to equal Ford’s Model T. At first, a small portion of the population will personally own because the general population will not be ready to give control of the wheel to a computer—the richest and biggest believers. Next, the vehicles will begin social acceptance as the product excels and remains reliable, pushing the products into mass production at an exponential rate, where eventually everyone will personally own an autonomous vehicle or have accessibility via ride-sharing. The greater the ratio of autonomous vehicles to manually operated vehicles, the more we will see auto insurance coverages shift and claims change. Social adoption of autonomous vehicles possesses the power to make or break the fleet of the future, and I predict a positive universal growth on the logistic curve because of sociological behavior regarding consumer’s adoption of technology. My point and case: the technology will be adapted by consumers at a fast pace like other technologies of the 21st century.

The pace at which the fleet of the future is hitting the roads is a growing concern for labor unions because shifting job markets. Labor unions are urging a slowdown to lawmaker’s fast track legislation to put autonomous vehicles on public roads. However, I do not think labor unions hold power against the progression of mass production of autonomous vehicles once they are ready to hit the roads. Labor union’s growing concern is attributed to autonomous vehicles causing a massive job dislocation, hence, labor unions lobbied for the house to include a weight limit of 10,000 pounds in legislation, keeping semi-trucks as MOVs (manual operated vehicles). As demonstrated by labor unions and the implementation of a weight limit, a negative public perception has potential to hinder autonomous vehicle growth. However, research conducted by McKinsey & Company reveal enthusiastic consumer acceptance and willingness to pay, which should sustain, if not speed up, the adoption of autonomous vehicles.

**Collection of Self-Driving Vehicle Data—Driving Data:** The fifth and final major challenge of insuring autonomous vehicles is collecting and analyzing autonomous driving data. Interconnected with software challenges, autonomous vehicle’s brain must make the best decision, imaginably reducing loss frequency and severity, while being as consistent as possible—but is this quantifiable and what policy would insure self-driving vehicles? Dramatically different technologies and new applications in driving makes predicting the future, via forecasting models, significantly harder because you don’t have reliable data about the past to predict the future—a main principle of insurance. Autonomy will affect pricing, underwriting, and claims processing as vehicles develop and data is collected. Data collecting is challenging but a necessity for financial longevity. I predict risk seeking insurers to put together an experimental hybrid policy based on limited data in an attempt to capitalize on the volatility of the market.

**3 Lines of Insurance Coverage to Capitalize on Magnitude of Insurance Markets:**

As auto insurance markets shift away from their traditional roots, I expect three lines of insurance coverage to cover ground. Below are the 3 lines of coverage and their 2025 premium generation.

1. **Cybersecurity—Software Breach, $64 billion**

Continued on page 20
2. Product Liability—Sensors and Software Malfunction, $14 billion
3. Infrastructure Insurance, $3 billion

Cyber Liability Coverage—Understanding cyber security risk is of great importance for insurance companies moving forward. Manufacturers of AVs will need coverage against cyber-attacks, hacking, and breaches of private activity data as liability shifts to manufacturers. According to a Munich RE survey, 42% of respondents perceive auto theft via hacking and overtaking data systems as the greatest threat to autonomous vehicles.\(^{31}\) Cyber insurance, specifically on AVs, is tricky because the threat of terrorism that comes with breach of personal data. Insurers could be capitalizing on growth or looking for trouble. In 2016, cyber insurance premium was valued at $1.3 billion—35% larger than 2015.\(^{32}\) Cyber insurance market is set to reach at least $75 billion by 2020.\(^{33}\) Aon Benfield gives global cyber premiums the chance to reach $10 billion by 2020.\(^{34}\) The cyber insurance market is experiencing expansion. I believe insurers should prepare for autonomous vehicles to affect the cyber insurance market and try to capitalize.

Product Liability Coverage—Obviously, self-driving vehicles will be equipped with hardware and technology that manual operated vehicles do not possess, such as cameras and sensors. The presence of these products theoretically reduces the risk of human error; however, the presence of products on the vehicles increases risk associated with products liability. I believe we are going to start seeing car insurance liability become a topic of product liability. Products liability insurance, manufacturer protection for product-related defects, was responsible for $2,796,758 in net written premium in 2015.\(^{35}\) As the number of AVs on the road and the level of automation increases on cars, products liability premium is anticipated to increase—shifting away from auto liability and towards manufacturer liability. Backing the shift towards product liability, Tesla has strategically been selling car insurance with their vehicles in Asia to capitalize on the fact that their vehicles are safer than traditional vehicles.\(^{36}\) Tesla’s actions demonstrate the disruptive shift away from traditional auto insurance. Further, the malfunction of software poses a large exposure, as stated earlier. Human drivers will be putting their property and more importantly life in the software functionality. The software product that manufacturers implement into autonomous vehicles is a large exposure and insurers should keep a careful eye on this.

Infrastructure Coverage—The third coverage I see as pertinent to a package policy for autonomous vehicle coverage is infrastructure coverage. Increasing levels of automation and number of autonomous vehicles on the road heighten the risk of accidents attributed to inadequate public infrastructure. From a cyber security perspective, 36% of respondents perceive failure of smart road infrastructure technologies as the largest threat to autonomous vehicles—the second highest answer behind hacking of software systems at 42%.\(^{37}\) Regardless of the technology embedded in road infrastructure, autonomous vehicles will rely on quality infrastructure—adequate road markings, street signs, and stoplights. I predict that as the prevalence of autonomous cars increases, there will be a greater investment in smart road infrastructure—infrastructure and technology incorporated to increase road safety. At least, I believe this should be the case to nurture the growth and implementation of autonomous vehicles.

From an insurance perspective, I believe, companies can capitalize through policy creation by incorporating the exposure as a part of new auto policy or insuring smart infrastructure developers in the case that there is a technological problem with smart road infrastructure. Currently, conditional autonomous vehicles can run on existing infrastructure; however, to reduce the amount of vehicle software malfunctions, product defects, collision frequency, and accident expenditures, intelligent transport infrastructure should be implemented and money should be invested on infrastructure. The size of the smart road infrastructure insurance market is up for debate. I predict it to be around $3 billion. As self-driving cars research and development progress, we should see more and more money being invested into smart road infrastructure and see the insurance market here grow. Finally, I believe insurers who package auto policies with cybersecurity, product liability, and infrastructure insurance, will capitalize on the expanding market.

Economies of Scale and New Market Competition: As like the problem with the original introduction of motorized vehicles to roads and production of smart cars, creating an autonomous vehicle which is economical the average person is a challenge. The overall cost of self-driving vehicles is of concern for mass distribution of AVs. Following the economics principle of supply and demand, the greater the quantity supplied of self-driving cars, the lower the price. The shift to mobility as a service is forcing traditional car manufacturers to compete with tech giants, such as Uber and Google, and emerging OEMs, such as Tesla. As manufacturers begin producing autonomous vehicles for at an economically friendly, price will fall and there will be a greater demand for insurance on these vehicles.

Autonomous Driving Data—Hybrid policy and Forecasting Models: From an insurance perspective, insufficient data creates questions behind the accuracy of pricing models. Actuary’s will need new pricing tools and algorithms to create new models to evaluate, access, and price the risk associated with self-driving technology. I see two routes available for insurance carriers—risk seeking and risk averse. For risk seeking insurance carriers, there must be a sense of urgency for data collection to prepare for the insurance industry disruption autonomous cars will cause. Companies could also pursue the acquisition of the data from a research source. Pricing models need historical data and companies currently collecting self-driving data, such as Waymo and Tesla, are sitting on a gold mine of information.

Solving the Underwriting and Brokerage Problem: As the current automotive insurance market changes to fit the autonomous vehicle market, underwriting components of the automotive insurance industry will change. Traditional automotive insurance will be a thing of the past and as
stated earlier, cyber security, public infrastructure, and product liability will be the main exposures. Further, the Level of Automation determines what vehicle and driver characteristics to focus on when underwriting. Below are components I believe are important to consider when evaluating the risk for the different levels.

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From Levels 0-3 of automation, traditional underwriting will apply. Company to company, different characteristics are implemented in the underwriting process. Listed above are the general components to successful underwriting I believe. Progressing in automation levels, I predict underwriting to be based less on personal driver characteristics and more emphasis placed on manufacturer components. By Level 4, underwriters should focus their concentration on the manufacturing company, car type, age of the car, geographical locations the car will be driven, and the gender & age of the driver. I predict Level 4 vehicles to be rated mainly on manufacturing components with a small portion of focus on personal characteristics. At Level 5 autonomy, I believe manufacturers should assume full responsibility to reflects confidence in their product. Companies, such as Volvo, will accept all liability when its cars are in autonomous mode. By manufacturing companies insuring its own vehicles, it incentivizes manufacturers to strive for frequency reduction and severity reduction. I expect the underwriting components to be all manufacturing with geographical location considered, leaving personal information out of the equation.

Further, I expect the automotive insurance industry to grow, short-term, because of lofty premiums attributed to data uncertainty. I predict around 2025 we will begin to see premium prices decline from large to moderate. Around 2040 we will see minimal premium prices. Pure premium rates, insurer rates less profits, dividends, taxes, general expenses, acquisition expenses, and commissions, will drop 20% under their 2015 levels by 2035, according to Aon Benfield. Further, under the same trajectory premiums could decrease by more than 40% if full adoption of autonomous vehicles occurs by 2050, as expected. 

Claims: Many components of an accident factor into an auto insurance claim. For example, was the driver speeding or did vehicle 2 have the right of way? In the event of an accident involving a self-driving vehicle, I believe there are 3 different scenarios, for fully autonomous vehicles, claims analysts could use to interpret the accident. I expect conditionally and highly autonomous vehicle claims, Levels 3 and 4, will be handled the same way if the vehicle is in a fully autonomous stage, but personal auto insurance will be triggered if the driver is manually operating the vehicle. Currently personal auto claims make up 86% of auto losses.

1. Autonomous Vehicle and Software Manufacturers liable under Product Liability: Products liability protects the manufacturer or seller of a product from legal liability resulting from a defect or damage causing personal injury or damage. In 2015, net written premium for products liability insurance was $2,796,758. As the timeline progresses and the fleet of the future hits the roads, I predict the products liability insurance market to intensely grow. The product liability market will have a lot of growth to capitalize on, I predict.

2. Software Manufacturers liable under Cyber Liability: Vehicles are becoming more connected to each other and technologically advanced. The increasing presence of self-driving cars on public roads increases the risk of cyber exposure. Estimated at roughly $3 billion, the cyber insurance market is expected to see growth to $14 billion by 2022. I expect cyber liability claims to increase significantly because of autonomous cars and the world’s technology progression. Like products liability, I anticipate a lucrative growing insurance market; however, the growing cyber liability market will bring a growing number of claims.

3. Infrastructure Constructors liable due to Design Defects: Entities, private and public, will work on the improvements of roads, I predict. If there is a scenario where the road has not been kept up or the vehicle and infrastructure stop communicating with each other, that is when I predict claims on infrastructure constructors to come into play.

PART 4: CONCLUSION

Autonomous vehicles are going to be disruptive to insurance markets. Autonomous vehicles are going to affect the volatility and pace of insurance markets at a notable pace as explained above. Further, there are 5 major challenges that I believe are going to affect the pace and magnitude of integration of autonomous cars on the insurance markets. These 5 challenges being: legal regulation, liability regulation, technology imperfections, public perception, and data collection. Continuing, there is a need to respond and adapt to autonomous vehicles. 3 lines of insurance coverage, autonomous driving data, underwriting, brokerage, and claims will all undergo disruptive changes. I believe, knowledgeable risk-seeking people will capitalize on the opportunities presented in the insurance markets.

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12. SOURCE REMOVED UPON REVISIONS
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Disruption and Reinsurance – An Overview and Perspective
BY JOSEPH CALANDRO, JR., MARIE CARR, VIVEK PAHARIA, FRANCOIS RAMETTE, AND JAMIE YODER
OF PwC INSURANCE ADVISORY

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Joseph Calandro, Jr. as a Managing Director in PwC’s Insurance Practice, he assists clients with M&A valuation, value realization, strategic planning, and how to effectively leverage the use of information to enhance business productivity. His experience spans the commercial P&C insurance industry and financial services sector with clients ranging from Fortune 50 firms to mid-tier funds. Marie Carr is a Principal in PwC’s Financial Services Practice. Marie also co-leads PwC’s Financial Services Cross Line of Services Sector Council for the Greater Chicago Market. She has served FS clients across retail brokerage, institutional money management, and insurance. While her insurance experience has spanned all sectors of insurance (P&C, Life, Health and Group), she has particularly deep experience in Group Insurance (including Worksite Marketing & Voluntary). Vivek Paharia is a Director for Strategy& in PwC’s Advisory Practice with 14 years of Industry experience, largely in P&C focused on strategic market assessment, capability driven growth strategies, product design/innovation and insurance operations. Francois Ramette is a partner in PwC’s Advisory Insurance practice, with more than 15 years of strategy and management consulting experience with Fortune 100 insurance, telecommunications and high-tech companies. Jamie Yoder is PwC’s Global Insurance Advisory Practice Leader. He has 28+ years of experience advising senior executives of leading U.S. and International companies in Insurance and Financial Services on a range of strategy and management issues. He also leads PwC’s global research program on the “Future of Insurance”, and has met with hundreds of executives to help them understand and address the potential opportunities and risks for the insurance industry driven by changes around social, technological, economic, environmental, and political factors.

Abstract
Reinsurance is often thought of as a mature, rather staid, industry. However, it has nevertheless been the subject of innovation over the past couple of decades, albeit from a purely financial perspective (e.g., catastrophe bonds, sidecars, “hedge fund re” start-ups, etc.). For a variety of reasons—some of which we will discuss—the reinsurance industry may soon be transitioning to a new phase of competition, one that is characterized by a variety of innovative strategic, operational and/or technological initiatives (i.e., beyond merely financial ones). To help put the competitive environment into context, we profile similar considerations that have led direct insurers (or cedents) to make significant investments over the recent past. We next profile several currently innovative initiatives in the reinsurance marketplace, which seemingly have the potential to disrupt the business of global reinsurance (assumed and ceded). Finally, we conclude with suggestions that reinsurers can practically consider, such as the selection of an appropriate Enterprise Innovation Model, when they are confronting innovation either offensively or defensively as part of their strategic planning processes.

INTRODUCTION
Successful businesses are founded on some form of innovation. When innovative products and services are broadly accepted in the marketplace, the firms that provide them grow, creating both jobs and favorable investment returns in the process.

The concept of innovative or disruptive technologies was made famous by the best-selling book, The Innovator’s Dilemma (Christensen, 1997). This book postulates that established and well-managed technological firms can be disrupted by newer, more innovative technologies because established firms are overly-focused on their existing (or sustaining) technologies. This is an insightful way to explain what was, and is, broadly happening in the technological marketplace.

There are various venture funding processes in place to help finance select new businesses, but increasingly mature firms are beginning to form innovation functions to identify, season and develop potentially disruptive new businesses. A recent example is Northrop Grumman, which announced on January 29, 2018 that it is forming a new business unit focused on “innovative technology.” This trend is broadly applicable across industries, including the reinsurance industry.

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INDUSTRY PROFILE AND SELECT TRENDS

Reinsurance is a very profitable industry; however, profit margins could increasingly come under pressure as a result of what is occurring in the broader insurance marketplace. For example, direct insurers are under significant pressure on both sides of their balance sheets as interest rates remain at low levels and the pricing environment continues to be soft/soften. These dynamics raise a number of strategic reinsurance questions such as: What do direct insurers/cedents now require from their partners to best achieve their strategic objectives? And how might their reinsurance expectations have changed?

Historically, reinsurers have offered various kinds of advisory services as part of their value propositions (e.g., underwriting, claims, risk, and/or analytics advisory); however, many direct insurers now have an abundance of these capabilities themselves and therefore do not need such services from third-party providers to the extent they once may have. In contrast, and as a consequence of the marketplace dynamics mentioned above, many direct insurers are now actively seeking some type of expense relief. For example, the Chief Reinsurance Officer of one global insurer told us, “The reinsurer that helps me take out 20 or 30% of my back office costs is going to get my business.”

In general, global reinsurance operations—assumed and ceded alike—have not been subject to any real form of efficiency initiative, unlike those on the direct-side such as policy administration system transformation, claims transformation, mid-to-back office business process reengineering and offshoring, etc. Global reinsurance operations, therefore, are generally at risk of disruptively innovative solutions. This has not gone unnoticed. For example, global reinsurers, brokers and direct insurers have begun collaborating under the B3i initiative to explore reinsurance blockchain solutions.2 To illustrate the potential of initiatives like this, we will profile select solutions and savings that some direct insurers are realizing.

To begin, it is important to understand that seventy-four-percent of the panel on the right-side provides an accident year view. As can be seen, across the majority of the years depicted, reinsurers have had more favorable development, which has influenced and enhanced their profitability. However, leading reinsurers are beginning to recognize the need for potentially disruptive innovation in order to maintain and/or enhance their competitive positions by differentiating their value propositions in a marketplace of more and more new entrants, a glut of global capital, and progressively demanding cedent expectations. As a result, there has been notable strategic, operational and technological reinsurance initiatives across the past year or so, beyond the purely financial initiatives that have become commonplace. For example, in 2010, USAA started a venture fund (USAA Ventures) devoted to InsurTech investments (Primack, 2016), and Allstate has launched a non-insurance tech start-up (Arity) in November of 2016 to power transportation analytics and innovation.5 The larger theme of innovation with direct insurers has implications for the reinsurance sector. For example, the proportion of such deals with reinsurance participation has gone from less than five-percent in 2012 to over sixty-percent in 2016.6 Clearly, something has changed in the marketplace.

**REINSURANCE DISRUPTION**

The current reinsurance environment (assumed and ceded) is generally viewed as operationally challenged and, indeed, many reinsurers have deferred investments to improve their systems and internal operations. Over time, this has resulted in layers of outdated systems, suboptimal processes and significant amounts of manual data manipulation.

One might speculate that the reason for limited operational investment has to do with limited reinsurance profitability, but this is not the case. For example, Exhibit 1 below profiles the reserve development for property and casualty (P&C) reinsurers compared to the overall P&C industry. The panel on the left-side of the exhibit provides a calendar year view, while the panel on the right-side provides an accident year view. As can be seen, from third-party providers to the extent they once may have. In contrast, and as a consequence of the marketplace dynamics mentioned above, many direct insurers are now actively seeking some type of expense relief. For example, the Chief Reinsurance Officer of one global insurer told us, “The reinsurer that helps me take out 20 or 30% of my back office costs is going to get my business.”

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The use of sensor technology, especially on certain specialty lines (e.g., long-haul trucking, rail, etc.), has the potential to mitigate risk exposures and (drastically) reduce claims frequencies and severities.

Exhibit 1: Historical Reinsurance Reserve Variability

Blockchain does seem to be the right reinsurance solution at the right time as it offers substantial potential to improve front-to-back office reinsurance-related efficiencies (Calandro, et al., 2016). To explain, blockchain technology can be designed to cede/retrocede risk across a block that is specifically designed to process treaties, notify all parties of the status of each treaty, and process premium, commission and claims payments once bound, all in a much more efficient and secure environment compared to today. For example, our analysis reflects that improvements in just claims efficiency alone (including reduced reinsurance claims leakage) could result in ten-to-twenty-five percent expense reductions. Significantly, estimates like this do not consider any potential “boost” in performance due to improved cedent satisfaction and related premium/retention effects.

Artificial intelligence (AI) is also receiving a great deal of attention across all industries, but it is having some impact in both the insurance and reinsurance industries. For example, Munich Re is generally recognized as a leader in the exploration of AI through its own dedicated innovation team and through significant investments in InsurTech firms. As an example, one of the company’s most recent announcements is a partnership with Starmind, whereby Munich Re will utilize Starmind’s technology, Onemind, to change the organization’s approach to knowledge management through the application of self-learning algorithms. This example gives way to other forms of partnerships designed to generate actionable insights, reduce expenses and/or drive potentially disruptive innovations. While partnerships are not a new concept, the focus of the partnerships we refer to here seek complementary capabilities to enhance strategic direction. For example, Allianz has partnered with Lemonade whereby Allianz gains access to advanced technology, which aligns with Allianz’s push to become more digitally-focused. Such partnerships could extend into reinsurance if reinsurers transform or otherwise improve their core systems to be compatible with digitally-enabled and analytically-driven platforms. Such platforms would also help support future mobile applications and analytical advances, which could improve underwriting performance and help to attract new, younger talent to an industry desperately in need of such talent.

Another area that some reinsurers have begun exploring is integrated account underwriting. Such solutions entail approaching select cedents with integrated solutions designed to assume all of the risk the accounts wish to cede, after which the overall portfolio of assumed risks will be optimally retroceded and/or hedged on the back-end. Offerings like this obviously require a deep capital base and significant analytical skills, but if it pans out, it could offer select cedents an overall lower cost of reinsurance at reduced levels of administrative (i.e., mid-to-back office) costs. In fact, if the direct insurance market stays soft long enough and margins start to materially compress, such offerings could become strategically significant.

A still further area select reinsurers are considering is direct involvement with insurers and InsurTech firms on potentially disruptive sensor-based solutions. The use of sensor technology, especially on certain specialty lines (e.g., long-haul trucking, rail, etc.), has the potential to mitigate risk exposures and (drastically) reduce claims frequencies and severities. Reinsurers also have an opportunity to team with direct insurers and technology providers to prototype solutions that could be extremely disruptive in certain white-space risks (e.g., emerging risks from autonomous vehicles, robotics, etc.). Reinsurer roles in these solutions may vary from being directly involved in the prototype to extending various risk consultative capabilities or to purely providing the capacity behind testing/commercializing such solutions. Reinsurers can also influence and support direct insurers in developing new products for such solutions, and in so doing, structure the arrangements in a way that fit their corporate strategies and long-term growth objectives.

The reinsurance landscape will continue to evolve over time, both incrementally and disruptively. In order for reinsurers to efficiently assume more emerging risks (e.g., cyber) as it evolves, the industry will likely experience new forms of partnerships and alternative risk management approaches. Extraordinary Re is a primary example of such exploration. It is working towards an outcome where reinsurance contracts can become tradeable through its innovative technology platform. Such a solution could provide more efficient ways for insurers and reinsurers alike to manage their risk profiles, especially if the recently announced NASDAq and Extraordinary Re partnership proves-out.

CONCLUSION

Reinsurers have generally had a lower impetus to modernize and, as a result, many are now saddled with legacy technologies that limit their competitive agility in an increasingly challenging marketplace. Even though the reinsurance industry has been generally slow to operationally innovate, leading reinsurers have many inherent strengths that could facilitate disruptively innovative solutions. To both augment and develop such strengths, a number of reinsurers are beginning to address potentially disruptive innovations by:

• Harnessing best-in-class technologies such as mobile-enabled and cloud-based technologies to improve operating efficiency;
• Exploring ways to use innovative technologies such as blockchain to achieve both internal and external efficiencies;
• Developing new and more flexible products such as potential holistic, integrated account solutions;
• Embedding new data and analytical capabilities such as AI to augment traditional approaches to risk modeling;
• Forming partnerships to secure access to emerging solutions and technologies; and
• Modifying their operating models to foster innovation by cutting across silos to quickly test-and-learn potentially disruptive initiatives and offerings.

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Disruptive innovation occurs so episodically that mature firms typically do not have optimal capabilities, processes, and systems to address it (Christensen, 2000 [1997]). In contrast, such firms often tend to be predisposed to prioritize initiatives that promise near-term profits and, as a result, disruptive innovations often require the creation of autonomous units with focused operating models to properly season them (Christensen and Raynor, 2003). Reinsurers should therefore carefully take stock of the capabilities and resources required to successfully identify and manage potentially disruptive innovations in a manner consistent with their corporate strategies. In doing so, reinsurers should focus on selecting the right Enterprise Innovation Model (EIM). EIMs feature three primary approaches to supporting innovation-based corporate strategy: (1) partnering via innovation centers or hubs, (2) building capabilities via incubators, and (3) buying capabilities via a strategic ventures division. Each approach is profiled in Exhibit 2.

**Exhibit 2: Enterprise Innovation Model (EIM) Required Capabilities**

<table>
<thead>
<tr>
<th>Innovation Center</th>
<th>Incubator</th>
<th>Strategic Venture Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Source</strong></td>
<td>Ideas sourced from both inside and outside the company</td>
<td>Ideas mainly sourced from outside the company</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Dedicated corporate team, constantly monitors trends and markets</td>
<td>Usually an external structure, but also “soft” internal incubators</td>
</tr>
<tr>
<td><strong>Operation</strong></td>
<td>External connection with the ability to “plug” innovations into business units</td>
<td>Incubator explores and manages ventures to drive from ideation to execution</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td>Stage-gating process to balance procedural burden and risk</td>
<td>Expert panel (not executive) provides high-level guidance and approval</td>
</tr>
<tr>
<td><strong>Go-to-Market</strong></td>
<td>Ideas/ventures adopted under the company’s brand</td>
<td>Venture can go to market under its own brand or the company’s brand</td>
</tr>
</tbody>
</table>


**References**


Endnotes

* The authors would like to thank Laura Groves, Caitlin Marcoux and Miguel Palomares for their assistance in the research and drafting of this paper.

1 Following their acquisition of Orbital ATK in 2018, the companies will launch Northrop Grumman Innovation Systems focused on “the creation of new, cutting-edge technologies” (Insinna, 2018).


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