Mr./Ms. Chairperson and Commissioners,

We would like to thank the commission for allowing us to participate in this vital discussion about Geomagnetic disturbances and the potential impacts to the bulk power system.

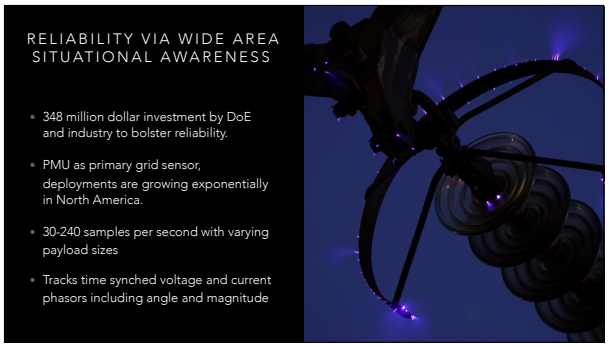
We've been working diligently over the past two years specifically on this issue and look forward to providing you with some of our insights, specifically the techniques, technologies and methodologies that we employ and how they can aid the industry on this specific issue and potentially others.

PingThings, Inc. is a software company specializing in “Big Data” analytics. We bring advanced data science and machine learning to the electric utility industry. PingThings has built the first internet scale, real time stream analysis engine with applications for high frequency sensor data received from phasor measurement units. We analyzed this data in conjunction with data from external systems which provides unparalleled situational awareness of the power system to its operators.

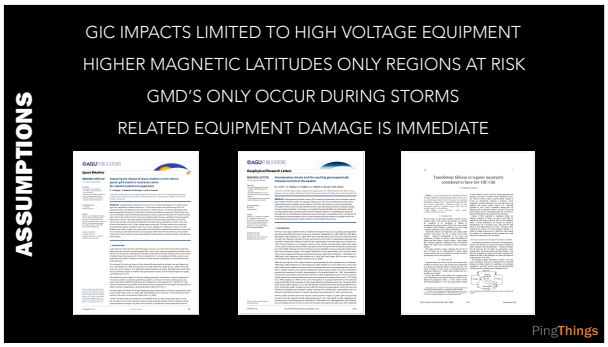
We are a small startup out of Southern California but have attracted the attention of a number of high profile investors including General Electric. PingThings is the only seed stage investment that GE has ever made and we are very pleased to have them as an investor and partner.

"PingThings is a great example of the type of disruptive software that industries need to scale up the Industrial Internet, and we're delighted to make an investment in the company."

William "Bill" Ruh, CEO, GE Digital



Our early assessment was that the stage was set for new opportunities and insights around data with the investment and deployment of phasor measurement units in the past several years. Through our initial conversations with Alison Silverstein and the North American Synchrophasor Initiative (NASPI) we became aware of the FERC 779 order and with her support, set a path to prove that synchrophasors could aid and assist in detecting anomalies such as geomagnetic induced currents including their potential impacts. In October 2014, after receiving data from Bonneville Power Authority, American Transmission Corp. and Manitoba Hydro we presented our first findings at the NASPI conference. In those finding we demonstrated early indications of geomagnetic induced current flows during a storm. We have since continued our work and seek to extend our abilities through additional data acquired from reliability coordinators such as Peak Reliability in WECC and ISO-NE.



To reasonably discuss the case for monitoring the grid in real time for Geomagnetic induced activity we'd like to lay some initial groundwork. We've highlighted some assumptions that we hear commonly in the marketplace that we'd like to discuss and hopefully mitigate. We know from our very own data analysis of truly operational data acquired from PMU's throughout North America that GIC flows are not an event. They are ever present on the grid, a constant which can fluctuate dramatically with or without significant storm activity. These perturbations are not limited to the northern magnetic latitudes and, in fact, exist and are potentially as volatile equatorially on our planet. Also it should be noted that the impact of geomagnetic storms as manifested on the grid has potentially significant wide spread impact on devices beyond the traditional demarcation points of the transmission or distribution systems. We've included three citations of studies that highlight and provide analysis that such assumptions are misplaced. We are of the camp that in all likelihood the sky is not falling, but we hedge our position with full admitting that there a many unknowns and variables that have yet to be seen or documented.

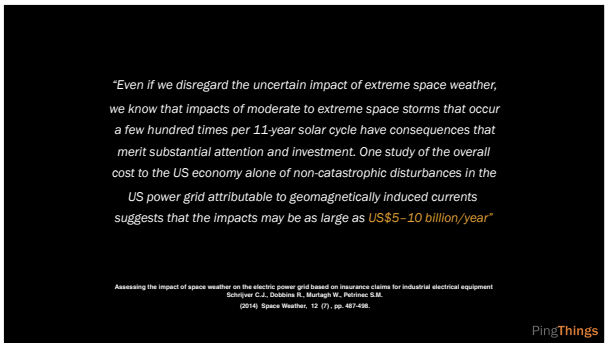
Here in lies the rub, without active monitoring, analysis and active assessment we will remain blind to the nuances, underpinnings and ultimately the impact of these storms. That monitoring needs to acquire and retain all the data in its most granular state so that progress can be made.

All the studies cited have something in common, that the phenomena is still not well understood. Sans real time operational data from the bulk power system we will not truly understand how the grid will respond to these events, both large and small.

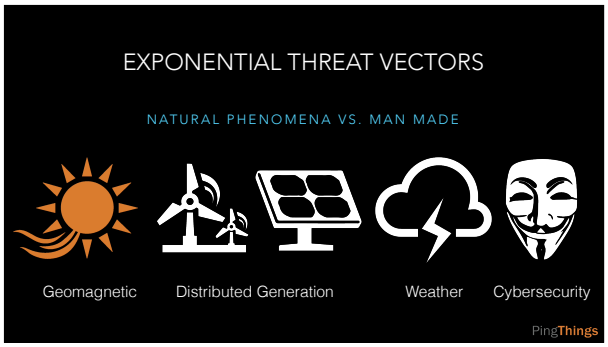
Gaunt, C. T., and G. Coetzee. "Transformer Failures in Regions Incorrectly Considered to Have Low GIC-risk." 2007 IEEE Lausanne Power Tech(2007). Print.

Carter, B. A., E. Yizengaw, R. Pradipta, A. J. Halford, R. Norman, and K. Zhang. "Interplanetary Shocks and the Resulting Geomagnetically Induced Currents at the Equator." Geophys. Res. Lett. Geophysical Research Letters42.16 (2015): 6554-559. Print.

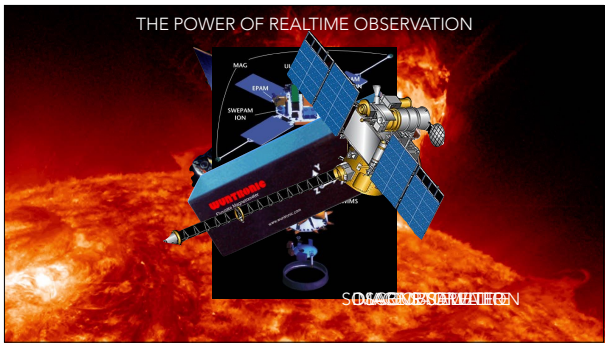
Schrijver, C. J., R. Dobbins, W. Murtagh, and S. M. Petrinec. "Assessing the Impact of Space Weather on the Electric Power Grid Based on Insurance Claims for Industrial Electrical Equipment." Space Weather12.7 (2014): 487-98. Print.



This particular study that was performed and documented in 2014 assesses a cost to the economy that most would find disconcerting. We might argue about the size and reality of these numbers but to ignore the potential cost of non-catastrophic solar storm impacts is kicking the can down a very precarious road. We find ourselves in an age almost devoid of non-electronic interactions. GIC is very real, as are the potential consequences that this world would face if left ignored or minimized.



The grid is literally in an unprecedented dynamic state due to multiple threat vectors. Between the ever changing results of mother nature and her induced damage, cyber and physical threats and the new normal of distributed variable generation the grid is being changed moment by moment. The grids prior solid anchor in deterministic sciences has been pulled into a world of somewhat incalculable variables. The insertion of stochastic events not originally conceived during the grids formative years have forever changed both our ability to manage it or fully understand its behavior under normal and stressed conditions.



What differentiates PingThings platform from other potential monitoring systems is finding the systems behavioral response within the data sent from sensors in real time at internet scale. Where magnetometers and Hall effects transducers are discrete sensors meant for monitoring some single phenomena, our system monitors and deduces multiple types of events from the same PMU data streams. We draw upon the latest techniques and architectures primarily found on the internet and developed by companies such as Google, Facebook and LinkedIn. Each of those entities process, in real time, petabytes of data on a daily basis, draw conclusions, provide recommendations and produce assertions based on that analysis.

Additional aspects of our system is the fundamental use of “side channel” data which strengthens and extends are abilities in providing insights. Though our primary sensor is a PMU, we do process magnetometer data from both space and ground based stations. We are able to ingest SCADA data, IED’s, digital fault recorders, social network data, smartphone sensor data, structured and unstructured data with each of these data streams providing additional insights and producing powerful new features and functionality. The size and scope of the data acquired and analyzed through our system gives us unprecedented visibility to both the origin of the event and ultimately the effect over time of that event.

Today, the bulk power systems understanding of this problem is rudimentary at best and needs further analysis and exploration. We have a significant opportunity to leverage the previous investments made by the Department of Energy and the utility industry in synchrophasor deployments. We can meet the fundamental requirement of identifying GIC flows and additionally assessing the impacts. All the while acquiring operational data over large regions and covering every state which will enhance both our understanding and ultimately, our ability, to mitigate the phenomena.

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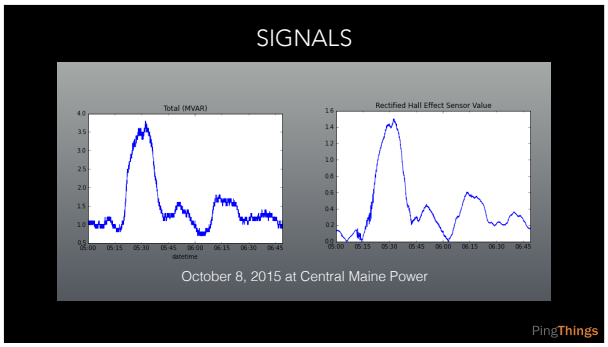
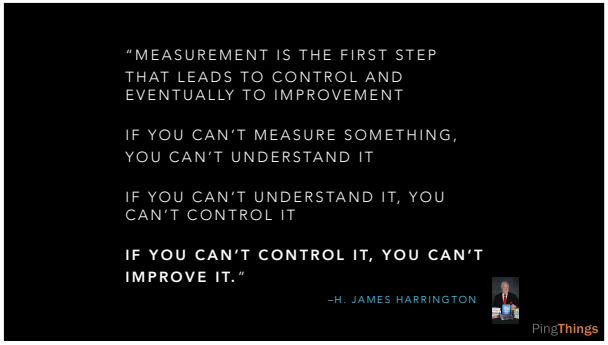


The state of our work today is wholly dependent on the acquisition and analysis of real operational data across a myriad number of topologies. We are currently working with two ISO's in North America and also directly with several large utilities that are impacted by GIC. We have just scratched the surface, even with a limited data set that surrounds geomagnetic storms but we've been able to identify certain manifestations indicative of GIC flows. While magnetometers give us a good understanding of storm conditions geographically depending on where the magnetometer is located, it in no way reflects the actual bulk power systems behavior during a storm. We can make some assumptions from magnetometers using magnitude and extrapolate what we believe will be the impact against assets but we cannot evolve our assumptions dynamically, they're fixed in our equations. We cannot include dynamic stochastic events occurring from assets in the systems topology that potentially effect the location, duration and ultimately the impact of the GIC. Mitigation techniques and solutions like non-blocking devices, series capacitors can introduce new behaviors to GIC flows that are still not fully understood. Sensors and monitoring with real time analysis at all spectrums is needed for the industry to fully mitigate and manage this and other potential threats.



Thank you again for allowing us to participate and contribute to this discussion. We look forward to answering any questions or comments that the commission might have regarding this presentation.