Mr. Chairman and members of the Committee:

Thank you for holding this hearing on the use of technology to improve TARP and financial oversight. Thank you as well for giving me the opportunity to appear before you. I will outline for you a technology that my colleagues and I at the Probity Group have developed, known as the "Probity Gradient™," which we believe can help achieve the twin goals of improved financial oversight and optimal allocation of future TARP funds.

By way of background, I am a professor at Duke University's Fuqua School of Business, and my colleagues at the Probity Group include a Wharton School professor and several executives with extensive experience in risk management. We established The Probity Group to help business executives and policymakers develop strategies and policies for assessing and mitigating high-impact risks to complex systems of tangible and intangible assets.

Gradient analysis was first developed to assess and mitigate risks to tangible asset systems, primarily infrastructure facilities ranging from stock exchanges and computer centers to oil refineries and transportation systems. We have also developed a technology known as "PSI" to assess and mitigate risks to intangibles such as reputation and policy.

The hallmark of the Probity Gradient™—and the main reason we think that Gradient analysis could be so useful for improving financial system oversight and allocating future TARP funds—is its holistic *systems* approach. Like systems of financial assets, infrastructure systems composed of physical assets are extraordinarily complex, with many interdependent parts connected through myriad channels. As a result, and as demonstrated in the financial crisis that our nation and the world faced a year ago, a failure or breach in one part of the system has the potential to cascade throughout the entire system, with potentially dire and far-reaching consequences. The Gradient's systems approach provides a way of visualizing and quantifying such possible consequences.

Although Gradient analysis relies on sophisticated computer software, the core methodology is straightforward. First, vast amounts of data on thousands of dissimilar system assets and their components—for example, geographically dispersed physical and cyber components in an electrical grid or national securities trading system—are decomposed and re-assembled into a comprehensive, highly structured "Asset Space Registry." Next, inter-relationships among the assets are examined, and a rigorous analytic engineering approach is used to determine the system-wide "value-at-risk" of adverse events. The results are expressed as both a numeric "figure of merit," and a Gradient, which provides a visual indication of specific areas of high-impact vulnerability. With this analysis in hand, it is possible not only to quantify and visualize risk consequences, but also to identify areas of critical vulnerability—*before something actually goes wrong.*

The Gradient has its roots in a systems engineering approach known as "Failure Modes and Effects Analysis," which has yielded precise failure and breach consequence measures for complex weapons and industrial systems since the 1960s. It also builds on "Trusted System" technology promoted by the National Security Agency since the 1970s. My colleagues adapted these approaches to the analysis and protection of critical infrastructure, applying it to such systems as a regional stock exchange, a global application service provider, and an online cyber collaboration environment used by military executives for oversight and decision-making. The success of the approach is due largely to the ability it provides to drill down to threat, vulnerability and breach details and then aggregate up to global consequences—illuminating both individual and systemic effects.

Although the Gradient's roots lie outside of the field of finance, public discussion and analysis of the devastating financial crisis that began last September motivated us to explore how Gradient analysis could be applied to a complex financial system—one whose overall performance depends on the valuation of myriad interdependent, dissimilar assets and the viability of the numerous enterprises that hold them. In the words of one *Washington Post* op-ed last March, "…We have a set of overseers who evaluate financial institutions one by one, but 'systemic risk' is created by the interactions between institutions" (Sebastian Mallaby, March 2, 2009). A GAO report released the same month (March 19) pointed to the failure of the U.S. financial regulatory system to recognize such interdependencies—and by implication, the need to take these independencies into account in future regulatory efforts aimed at preventing yet another major systemic disruption.

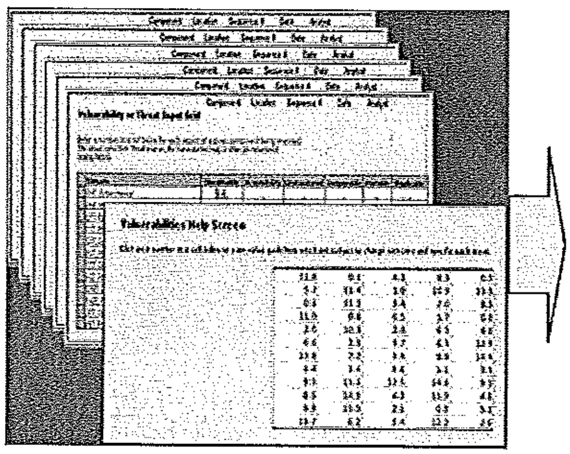
In our opinion, Gradient analysis represents a low-cost, highly accurate tool with proven reliability that would enable regulators to take exactly this type of big picture perspective. Gradient analysis would also help policymakers and regulators choose the best way to allocate TARP funds, by identifying assets whose failure or breach would have the most devastating and far-reaching systemic consequences. Additionally, the systems engineering approach embodied in the Gradient could supplement existing financial analysis tools to assess the risk consequences of various forms of financial malfeasance, such as fraud, privacy invasion, insider trading, and valuation tampering.

Thank you again, Mr. Chairman and members of the Committee, both for the opportunity to tell you why we believe that the Probity Gradient can help achieve the important goal of strengthening oversight of our complex financial system, and also for the strong oversight that your subcommittee is providing in this important area.

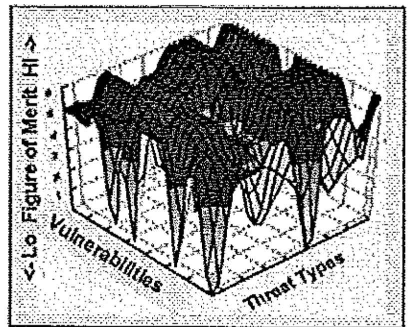
A rigorous approach to combining data into an aggregate figure-of-merit:

Asset Value x $10^{-(FOM)}$ = Value-at-Risk

Where FOM is the volume under the Gradient (in log scale); which represents the relative probability of breach



Visualize assets' vulnerability-threat pairs in a 3-dimensional "gradient":



- Exhibits total figure of merit
- Highlights areas of concern
- Traces changes in both

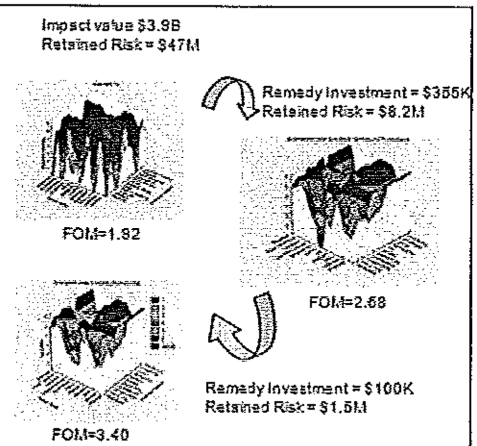
We could establish priorities; focus attention on high-impact risks

Facilitate strong oversight and responsible disclosure

1. Image and Figure-of-merit (FOM) show "what-if" results, or actual status and improvement
2. Protects sensitive information while showing due diligence to stakeholders

Adjust expenditures commensurate with exposure; optimally allocate resources among mitigation options

1. Adjust asset composition and mix
2. Hedge/transfer risk
3. Mitigate specific risks
4. Accept (and disclose)



Explore "what-if" scenarios