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**“Science, Engineering and Innovation:
Science Foundation Arizona (SFAz)”**
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On the trip here this morning, I took an opportunity to re-read a piece that recently appeared in the state’s major daily paper, the Arizona Republic — call me a glutton for punishment. The article is titled “Challenges Await Science Foundation Arizona's Leader”— now there’s a headline to get my attention.

Jon Talton wrote it. Talton is the much loved, and/or loathed, columnist who writes for the Republic’s business section. I enjoy reading Talton’s columns, which is why I am starting with his “challenges” article. According to Talton, my challenges loom large, run deep and reside in three ugly buckets:

The first major roadblock noted by the author is the state’s dependence on construction and real estate as economic drivers.

The second thing against me, the article goes on to say, is the state’s overall lack of commitment to education — stemming from the lack of a tradition and culture that places importance on education.

The third: no clear, collective epiphany that we must *truly change* in order to succeed.

I look at this idea of epiphany, of a clear demonstrable desire to change, as the greatest hurdle because it is a collective mind shift. For an individual, this typically occurs at a specific moment in time. However, in a state’s population, change rarely happens overnight — rather, it happens slowly, and in a steady fashion. But when it does, it can be a fierce, and powerful force capable of great things. Ireland is an example of a state that experienced just such an “epiphany”.

What Talton doesn’t know about me is that not only am I tirelessly patient but extraordinarily agile as well — I can jump hurdles with the best of ‘em! So, I welcome the Talton “Challenges” but also welcome your help in meeting them!

I appreciate the opportunity to be with you today in Flagstaff -- this is an extraordinarily beautiful place. I want to discuss how to build a competitive advantage for Arizona *statewide* – so that we may compete with the best in the world and I want to thank the leadership of GFEC, the city of Flagstaff and NAU for the opportunity to further this discussion.

Today I will review for you why I believe America and Arizona need a new attitude toward their economic competitiveness. I will also talk about how Ireland, against all odds, achieved success in these areas and I will share a few of the secrets of its game, so to speak. I will deal with competitiveness in the context of larger issues that relate to competitiveness in biotechnology, information technology, and really, a sustainable Arizona. I want to connect this focus with ideas that I hope you, as leaders in Arizona, can act upon to secure the state’s future. Frankly, I do not believe that Arizona or, for that matter, America will keep pace with the world’s new

global competition without changing approaches dramatically. We must experience that collective epiphany.

The United States has enjoyed phenomenal economic success. Other nations have broken the code of this success. If Arizona wants to compete successfully in the 21st century, it must adapt a new strategy that sets it apart from other states and nations. If it does, it can set a new example for how America can prosper in the decades ahead. If it doesn't, other countries will pass us by as the world's leader of innovation and knowledge-development – and that, which flows, from them, namely economic strength. I am going to focus in part on China because China and Ireland began to work together in 2002, and that has given me a chance to see first hand this Chinese “juggernaut” everyone talks about. And let me tell you: what you have heard is mostly true.

There is a sense of energy and urgency in China that reminds me of the post-Sputnik years in the U.S. China's goal is to replace “made in China” with “designed in China.” Both China and India have huge populations and, through an institutionalized commitment to science, mathematics, and engineering as the core of their education systems, will produce significantly more scientists and engineers than we will produce. These nations will leave the west behind by exploiting their brainpower. We need to understand that fact and make sure that we make a commitment to excellence in science and mathematics as we did following Sputnik as successful economies in the 21st century are going to depend even more on science, mathematics and engineering to develop more flexible and robust opportunities for their citizens.

At the end of this talk, I want to give you a list of things I think Arizona can and must do to truly compete globally. And the first one, and the one that is threaded through and connected to everything is this:

- Make education excellence a *core* value to Arizonans, including in science, math, and engineering.

Not so long ago, I would have said that Arizona needed only to compete with the best of the other states in the US. Our country seemed to be on a roll in the 1990s, following the fall of the Berlin wall and for the first time in decades building a surplus in the federal budget. At least that is how I saw the world in mid-2001, before moving to Dublin, Ireland. My view has since dramatically and most profoundly changed. Our competition is not limited to our neighboring state of California. Nor is our major competition our neighboring region. We must be prepared to meet the challenge of global competition.

My current view of the competitive position of the US has been shaped by important events of the past five years and also from personal experiences and responsibilities that I have had in Ireland. Living and working in Ireland has been a profoundly important experience as it put me directly at the heart of the most dynamic economy in Europe, if not the world. Ireland has been transformed more than any other European country in the past 20 years. A 1988 cover of the *Economist* magazine suggests Ireland is the poorest place of rich Europe. The country was essentially written off. Last year The *Economist* cover stated Ireland was “Europe's top economy”. It also allowed me to view the United States through the lens of distance.

I believe Ireland offers lessons for Arizona, and other states in the U.S. Over these past five years, I developed the strong view that if American states continue to depend on extremist politicians for wisdom and leadership, we will fail our children. More significantly, the country risks drifting further and ending up unable to lead *or* inspire, with its treasury depleted, its high-tech industry outsourced, its medical system bankrupt, and its R&D system seriously weakened.

My *first goal* today is to cause you some anxiety. The US — and Arizona — needs a wake-up call – not about a dangerous world and terrorism – but about economic diversification and prosperity.

My *second goal* is to begin helping to put some things in perspective to work together to develop a vision for Arizona in 2020 – a vision that will guide Science Foundation Arizona. I hope we can agree on the general framework needed for Science Foundation Arizona and to recognize we must be opportunistic and strategic. Brave and deliberate. I have no interest in accepting the status quo – or to be part of a place driven by the idea that education is not important or is good enough as it is, or that the research system just needs some gloss, that we do not need to build a seriously competitive high-tech component to Arizona's economy.

And *my third goal* is to ask what I hope will be helpful, tough, and candid questions to propel us forward.

To help focus us all on the end game, let me begin with what I call seven US myths. Each myth, I believe, is vital for Arizonans to understand because each contributes to our complacency.

Myth 1: The crown jewels of the US – R&D – will remain in the US and not be outsourced. FALSE.

Myth 2: Universities in the US are easier to work with than foreign universities, and companies prefer to work with them in the US. FALSE.

Myth 3: No place can offer the advantages for software creativity or production available in the US. FALSE.

Myth 4: Technically educated people from Europe and Asia will keep coming to the US as we are THE magnet and everyone wants to be here. FALSE, particularly for the young people who are increasingly developing a negative view of the US as a place for them. Also, the global economy now incentivizes the Asians and Europeans to return to their roots and there is a growing pressure in the Asian and European countries to reverse the brain drain that has so benefited the US.

Myth 5: The US is the melting pot that welcomes everyone and assimilates them. FALSE.

Myth 6: We have the best health system in the world. True *or* False? The jury is out in my opinion. Our system is fine if you are rich but fails to meet the needs of roughly 45 million people who are uninsured. And the system breaks down entirely when assets that took a lifetime to acquire are gobbled up by the medical machine in the final months of one's life.

The stress on American families versus European families is starkly different, based on my experience living abroad. While there, I met a number of Irish medical doctors who, after practicing in the U.S. elected to return to Ireland out of frustration or concern with our system. And, the way we pay for our medical system in the USA may be creating a competitive *disadvantage* for the private sector in a global economy.

Myth 7: We have the best research university system in the world. True. As of today, no one can easily compete with the top 25 or so USA based research universities. But, can we keep letting the K-12 system fail the country and then catch up and win with our university system? Does anyone recall how we as citizens viewed Toyota and GM in 1973? We are now in the first stage of what I call the “G.M.-itization” of the university system. We are like the proverbial frog in the boiling water that doesn’t realize the change in which it is immersed.

Now let’s think for a moment about those myths — and how they apply to the situation in Arizona, in our own backyard. Arizona’s education system is at the bottom of the nation’s rankings. Not close to the bottom, not the bottom half, but at the bottom. Young, technically educated people are not coming to Arizona in the numbers that they should be. While our universities are making great strides, and becoming known worldwide in research, many of our most gifted and talented children are leaving the state upon graduation. And they’re not coming back. But why?

Let me tell you a bit about my experiences of the past five years – not specifically about Science Foundation Ireland, but instead about how my work as the lead person for an R&D partnership with China, India and the US influenced my thinking. And, what I have learned, since early on in my tenure at SFI, from visiting a significant number of VP’s for research of major US corporations in the computer science, technology and biotech space to find out firsthand their plans and ambitions.

I was the leader of the R&D partnership with China for Ireland. It is a significant arrangement, initiated by the Prime Minister (Taoiseach). He took 300 fellow Irishmen to China two years ago, including all of the university presidents, four to five top ministers, and business leaders. His message was simple: China is a market with a potential of 1.5 billion people. Ireland is a country of four million. It needs big markets to sell products to create wealth.

You don’t create wealth selling to each other in a small country or state.

During the Irish delegations’ visit to China, the Irish citizens were fully informed of the progress on a daily basis. Thus, each day extensive reports appeared in the Irish media about the effort to promote Ireland in China and the effort of the universities to establish partnerships. The trip did *and* continues to pay dividends to Ireland’s economy. When we left China, the *China Daily* newspaper stated at the end of an article on the Irish visit to China:

“When you study economics today in school, the last four words in the text should be: Now, go study Ireland.”

In Ireland, economic performance is now understood to be a precondition to social justice and a fair and civil society. Economic performance is tied to education. So you don't have debates about the importance of education – what you debate is how to make the system better. If a state's education system isn't a priority to the leaders of that state, how will its economy compete in the 21st century?

Ireland gets it. The leadership, regardless of political party affiliation, understood the competition from globalization. They understood they have almost NO natural resources. All they have are people – highly educated people – and a beautiful place to live. And they understood that if they wanted to seed and nurture wealth and build new businesses and create a high-tech component to their economy, they needed strategic investments. To compete in the 21st century, a successful country/economy needs brains *and* speed to get things done – flexibility and focus.

Now, you might think this was pretty bold for a small country, let alone one not known for its research system. But this is not nearly as bold as deciding in the late 1980s to build an international financial center in the slum-like docklands of Dublin and to challenge other financial centers in Europe for market share. It was bold. And, it worked.

Arizona is also a small place, population-wise. It cannot afford to let talent slip away. It must be a “can do” state that values education as the cornerstone to a high quality of life for its citizens and a place where we have a broad-based economy so that our children will elect to remain, work and live here. My contention is very simple: *much of what we must do together is about human capital and talent*. Unless we have the right kind of talent available and growing, we cannot be successful in the long-term. And this talent should be grown from the bottom, up.

So let me quickly tell you about the things that Ireland decided to do over the last few years alone. In 1988, Ireland had an unemployment rate of approximately 18% and the average salary per capita income was 60% that of the EU average or about \$10,000.

Leap forward to the present and you find that Ireland's per-capita income is approximately 140% of the EU average at almost \$42,000 – tied with Switzerland as the highest per-capita income in Europe. Unemployment in Ireland is about 4.5%. Those here today who may be familiar with Irish history probably conclude this economic data proves beyond a shadow of doubt that there really are leprechauns and they are the answer for Ireland's success! The other possible explanation is that Ireland employed a long-range plan encompassing brains as a natural resource, a global economic focus and a determination to provide a place where one's children can stay and raise their families.

In 1999, near the end of what was being termed the “Celtic Tiger”, a decade of incredible growth, Ireland's leaders recognized that its short-term economic success was not sustainable for the long-term. In the spirit of boldness and leadership we must admire and emulate, they brought together a group of people from the academic community, business community, and government and carried out a Technology Foresight Study. When it was done, the group sent a recommendation to the government to invest almost \$800M in research. The idea was to jump-start the research investment over a five-year period.

They committed to invest in research in strategic areas – to position Ireland’s economy to benefit from its academic institutions in an economy that would have a significant innovation component going forward. For a country that only ten years earlier had virtually no research investment, this decision to invest strategically – and at a time when they had a large surplus – is instructive for us in Arizona given the reality of change and competition. Indeed, that investment decision was made by the once tattered and struggling figure of Europe.

With this bold investment, amid success, when it would have been easy to sit back and enjoy, the political and business leadership created Science Foundation Ireland as a mechanism to fund research on an internationally competitive basis to better serve the needs of the economy. Importantly, in a nation with a reputation for political disagreements, this investment decision was supported strongly – and almost unanimously by all political parties; all recognized the need to catalyze innovation and encourage partnership to benefit “Ireland, Inc.”

The results? With the government’s support, Science Foundation Ireland is helping Ireland’s universities and institutes of technology keep the best scientists in Ireland and recruit them from around the world. By leveraging its reach and competitive grant giving system, Science Foundation Ireland now funds more than 1,000 projects with grants totaling \$770 million — and this has all occurred in the past five years. Just five years.

These projects are primarily in the information technology, science, engineering and biotechnology areas and include 2,500 individuals, research teams, centers, and visiting researchers from Australia, Belgium, Canada, England, Germany, Japan, Russia, Scotland, Slovakia, South Africa, Switzerland, and the United States.

Ireland is now a base for more than 1,100 multinational companies. It is the *world’s largest software exporter*, ahead of the US. It accounts for almost one-third of all foreign direct investment in Europe in pharmaceuticals and health care. And biotech companies in Ireland get to feed off *and* cooperate with companies now based there, including Merck, Pfizer, Roche, Glaxo, and Wyeth. In fact, nine of the world’s top ten drug companies call Ireland home. So do 15 of the top 20 medical devices companies.

Dell, Microsoft, Proctor and Gamble, Intel, Lucent, HP, IBM, Bosch, Motorola, Medtronic – they all have operations based in Ireland. This includes research partnerships that each of them has, together and separately, with universities in Ireland, stimulated by grants from Science Foundation Ireland.

A Science Foundation Ireland program provides that leverage, with grants worth as much as \$30 million over five years. These industry-academic partnerships are the feeding ground for new ideas, and they will be the genesis of inventions and discoveries that spawn new advances, new leaps in knowledge, and, yes, new companies.

Meanwhile, Science Foundation Ireland is connecting its investments to the secondary schools with special incentives to bring the university and secondary teachers together in new ways to benefit the young students and the people of Ireland. So the investment in R&D and the *core*

value of education tie together. Can't we in Arizona also aggressively seek opportunities to bring teachers together with researchers to collaborate and learn, bringing their deeper, newfound knowledge in science and their excitement for it back into the classroom — to share that excitement with your children, and your children's children? We should applaud and aggressively grow programs where young people are able to discover firsthand the excitement in science and technology. The Flagstaff Festival of Science is an excellent example of this sort of public/private partnership that will help to build a culture around science and technology.

At Science Foundation Ireland, we said we would be friendly to science and science-friendly. It was a simple but potent theme, and it has become a call to arms. We opened everything to international review, tried to attract and retain the best and the brightest, and began to build a scientific culture that could compete with anyone, anywhere. We built a process focused on Ireland's strategic advantages. We pursued partnerships with companies where Ireland had a strategic advantage. And we built a system that was flexible, focused and made rapid decisions so the scientists with the grants could get to work. We wanted to minimize bureaucracy and encourage cooperation, innovation and entrepreneurship – all predicated on merit and excellence.

These are the key ingredients: An aggressive attitude, international peer review, a strategic focus, strategic partnerships, and speed. *And a little fear doesn't hurt either* – fear of how fast the other countries/states are working, fear of slipping back – the kind of fear about competitiveness that America and Arizona need a strong dose of.

So what does all this talk of Ireland mean to you here in Northern Arizona? What does it mean to the people and our economy across the state? Let me first underscore to you the fact that Science Foundation Arizona — the formation of this organization — may be the first of its kind in the US. It is a bold public-private partnership. We may well serve as a model for other states in the future.

Science Foundation Arizona's goal is simple — we will serve as a determined advocate of science and engineering by supporting programs where the best researchers come to and remain in Arizona. SFAz will be a thoughtful partner in the educational and research programs already underway. We want to stimulate innovation with a light but consistent touch, promoting a strong creative atmosphere, and magnify the impact of good ideas.

So here is my starting point at this time, in this place, and which I offer to you as our collective challenge:

We must create the systems that let *quality* flourish and encourage innovation from young people. We must avoid at all costs suffocating the system by preventing young people's ideas and curiosity from blossoming. We must change the way government supports and encourages innovation to insure we can be driven by cooperation and partnerships, with peer review and competitive position as our guides in making choices. We must have greater speed in our decision-making.

In order to truly prosper, we must support innovation in a manner to rival the economic development units of places like Ireland and Singapore. This means we have to provide a

business friendly culture and “one stop shopping” to help them set up operation in AZ. A place where the WL Gore’s or Machine Solutions of the world can launch and grow. Competition is global and fierce. We want to be known as a place that encourages innovation and wealth creation so that we can have a society that is civil and successful.

We must have an open attitude that allows us to listen and learn from the frustrated CEOs and VPs for research of major companies who elect not to do R&D in Arizona or to expand manufacturing here.

We must ferment a realistic approach and strategic focus to what we can do in science, engineering and high-tech, and a serious industrial sector with things like medical devices and start-ups. We want a strategic competitive advantage for Arizona.

Flagstaff has much to be proud of. You have made great strides in strengthening Northern Arizona University, and in developing a good business infrastructure and new technologies. A true opportunity exists to exploit good ideas and create new companies. An opportunity that is unique and ownable over time. Things are headed in the right direction – but I believe they could be better.

Flagstaff is home to the world leader in anthrax-related research. But, I don’t think you have adequately leveraged federal support for this asset. It is also home to one of the most innovative developers of medical products such as heart patches and synthetic blood vessels that have been implanted in millions of patients. But, I believe it could be even more successful if it explored serious collaborative partnerships and new R&D models that are more similar to what is going on in Singapore and Ireland.

Flagstaff has a significant number of solar and wind energy-related companies. Why can’t Flagstaff or Prescott, or other cities in this northern region be known globally for advancements in these technologies?

NAU is recognized by *U.S. News & World Report* as having one of the top undergraduate engineering programs in the US. NAU just recently hit a milestone in enrollment — the largest in its 107-year history, with a student population of well over 20,000. The State of Arizona should “exploit” this engineering talent resource as it recruits companies. NAU is an asset of this great state, not just Flagstaff! Why not overtly promote your engineering advantage?

I mentioned earlier that our competition was global – but that does not mean we should underestimate the competition that exists stateside. Our neighbor, California, and in particular, Silicon Valley with its extraordinary density of successful technology-based companies, world-class research-intensive universities, its thriving capital market, and a cultural fixation on getting to the future first is most certainly our competition. But we should not be intimidated; rather, we should pirate from the best aspects of this model, while capitalizing on our unique strengths, all the while identifying new areas in which to be competitive.

Arizona is behind. You and I know that. There is an old saying: If you do things as you have always done them, you will keep getting what you always got.

So as I near the conclusion of my remarks, let me leave with you some questions we must confront:

- Can Arizona really be competitive in the high tech economy if its K-12 system ranks near the bottom of all the states? Arizona needs to be at the very top or surely in the top 10 in the US. Then, we begin to focus on world league tables to have the economy and social structure we want in the 21st century.
- Why should Arizonans accept the fact that the per capita income in Arizona puts it at or below the US average? Let's agree that Arizonans are and should be above average and strive for that. And we should measure our progress constantly.
- Why is there all this talk of Flagstaff vs. Phoenix vs. Tucson? Or ASU vs. NAU vs. U of A? We need to get beyond that and talk about "Arizona, Inc." We must get past the petty egos. Success in Arizona means success *for* Arizona.
- And, finally, why not expect the universities and community colleges to work together to keep costs down and share new ways of increasing student matriculations? We need more four-year graduates. Bring down the institutional Berlin Walls at last.

Ireland used its Science Foundation as a tool to catalyze innovation, cooperation and partnership. Can SFaz be a similar tool for Arizona? It is up to you, the leaders of Flagstaff and the surrounding communities to seize and develop this new Arizona asset: Science Foundation Arizona.

We in Arizona need new approaches to excel. You rise *or* you sink – but you do not stay the same. That is what history teaches us. We can't afford to be complacent.

Let's not wait for our state's economy to hit bottom to then decide to do something about our future. Great strides and bold decisions have been made in the last several years. We are moving in the right direction, but more must be done. We must invest in spawning a generation of thinkers devoted to the scientific method in order to create an ecosystem of scientific and engineering capital that is sure to pay dividends.

I have been inspired by a significant number of the leaders in this state – business, philanthropic, academic and political. The leadership of Arizona – especially the business leaders in Flagstaff 40, GPL, and SALC – has driven the concept to create Science Foundation Arizona. With your help, the SFaz, as a public-private partnership, will stimulate greater innovation and cooperation across the state in future years.

Science Foundation Arizona is a tool that will catalyze cooperation to support research activities that are both strategic and opportunistic. When large numbers of entrepreneurs, financiers, engineers, designers, and other smart, creative people are constantly bumping into one another inside and outside of work, business ideas are more quickly formed, sharpened, executed and if successful — expanded. The more smart people, and the denser the connections, the faster it all

goes. We can use Science Foundation Arizona to create a “buzz” nationally and internationally that something very important and exciting is happening in this beautiful place called Arizona. We can use Science Foundation Arizona to rattle the system, wake things up, and get a new kind of competition going that says we finished competing with one another within the state and are ready to compete on a global scale.

We have the energy, I believe we have the can-do attitude, and we have institutional leaders who are ambitious for the state and not simply for themselves. I am excited by the opportunities in Arizona and the potential of this state and its people.

So let me challenge and invite this group to engage the debate about the future and explore new ways to leverage and influence the federal investment strategy. We can begin by using Science Foundation Arizona as model for strategic investments to create a competitive advantage for Arizona.

My pledge to you is to listen carefully to smart people on how we can work together to try to synthesize good ideas and work aggressively to help SFAZ employ all its resources for greatest advantage for Arizona in the world. Arizona has the opportunity to be a model for America as it begins a renewal of its historic commitment to hard work, innovation and opportunity for all.

Which leads me to two final questions?

Why not here in the Flagstaff area? Why not now?

Thank you very much for the opportunity to be with you in Flagstaff today.