

## National Conference on Weights and Measures (NCWM) Annual Meeting

Tulsa, Oklahoma, July 15-19, 2018

July 17, 2018 - President's Address by Under Secretary of Commerce for Standards and Technology and NIST Director, Walter G. Copan.

- Thank you, Doug for the introduction and to all of you for the warm welcome. Loren, thank you for your leadership in NCWM.
- I'd like to recognize Jim and Don, and Kenny here in Oklahoma, and everyone who made this meeting possible. It's great to be back in Tulsa! This is my first NCWM meeting as director of NIST, and I am very pleased to join with our American community of metrology here.
- The city of Tulsa has deep roots in the oil business. Actually, my first job right out of college was as a chemist dealing with fuels and lubricants, petroleum and specialty chemicals.
- From the beginning of my career in physical and analytical chemistry, I came to appreciate the work that all of you do! I learned early on about the importance of accurate in-line metering of fuel additives to make sure that each gallon of fuel was treated with exactly the right amount of performance additives to meet and exceed top tier detergency standards.

- As a young chemist, I was recognized with a corporate innovation award for developing a new analytical technique to rapidly and precisely analyze fuels for detergent levels. It was a proud moment.
- I also used to visit Bartlesville, from time to time – and just north of Bartlesville is the town of Copan, Oklahoma – it’s right by the shores of Copan Lake. No wonder I feel right home here! Despite the name, as far as I know, there’s no family relationship....
- Tulsa really took off during the oil boom of the late 19th and early 20th century. And for most of the 20th century, it was considered the oil capital of America.
- Oil still plays a significant role in the economy of Tulsa. The city has diversified, too - and is now home to new industries, including aviation, telecommunications, technology and manufacturing.
- I came to NIST after a diverse career in large and small companies, government service and non-profit leadership.
- I’ve admired NIST, then known as NBS – the National Bureau of Standards – since the beginning of my career, and it’s an exciting place to be. I learn something new every hour of every day, and I’m very grateful to the leadership and people of NIST for adopting me as one of their own.

- It's an enormous responsibility to lead one of the nation's most respected federal labs and a world leading science and technology institute. It is an honor, and also humbling, to have the opportunity to serve my country in this way.
- The founders of our nation realized how essential it was to have a trusted system of weights and measurements. This would ensure that our country could flourish, and that commerce would be fair.
- George Washington, in his first State of the Union Address on January 9, 1790, said "Uniformity in the currency, weights, and measures of the United States is an object of great importance, and will, I am persuaded, be duly attended to."
- He could never have imagined how far we've come in realizing his prediction.
- And I'm delighted to have come to NIST at such a particularly exciting time. This is the beginning of a new age for measurements science.
- For nearly a century, the **meter** was defined as the distance between two lines inscribed on a platinum-iridium bar.
- Since it was first made, the meter has undergone two redefinitions. The first occurred in 1960, when it was defined as a precise number of

wavelengths of light emitted from a krypton lamp. But this was only a temporary definition, because greater precision would become available.

- In 1983, the meter was defined as the distance light travels in a vacuum in a little less than one three hundred millionth of a second.
- Light in a vacuum always travels at the same speed, and nothing can travel faster. That speed limit is woven into the very fabric of the universe.
- Together with the atomic clock, which uses the vibration of atoms as a natural and unwavering pendulum, the meter is now fixed forever in these fundamental terms. It can be realized anywhere.
- We no longer need to rely on material objects to define it. This elegant and timeless definition is among the greatest achievements of the 20th century.
- As many of you know, we are now on the brink of another momentous change.
- For the past 30 or so years, scientists at NIST and around the world have been working to redefine how the kilogram, the world's mass standard, can be expressed in terms of fundamental constants of nature.
- Much like the meter before it, the kilogram, is defined as the mass of a small cylinder of platinum and iridium called the International Prototype

Kilogram. It is kept at the BIPM (which is the International Bureau of Weights and Measures) just outside of Paris, France.

- Forged in the 1880s, the kilogram artifact was specifically designed to resist change, but uncertainty has crept into the system.
- The mass of the prototype cannot change - by definition. But the masses of the *copies* of the one official kilogram that are used to define mass throughout the world have been changing relative to it.
- Some have slightly gained mass, and some have slightly lost mass. It's as if your five-gallon prover had an invisible hole in it.
- The differences in mass are a bit of a mystery – and these are the kinds of things that keep metrologists up at night.
- We don't know exactly why these changes have occurred.
- And we'll leave discovering the exact reasons to our scientists. Those of us in the practical business of measurement science are looking ahead to the permanent solution.
- It's been an intensive journey getting to this point, and this underscores the importance of basing our measurement units on constants that are truly timeless and unchanging. This is as critical to science as it is to commerce. This November, we plan to see the kilogram undergo such a redefinition.

- Using updated versions of a sophisticated instrument first created in the United Kingdom called the Kibble Balance, scientists at NIST and around the world have realized the kilogram—with unparalleled accuracy—in terms of electrical force.
- Essentially, what we and our collaborators have done is build an electromagnet and measured the amount of electricity necessary to just lift a kilogram artifact off the ground and no more.
- We can use that exact quantity to make and verify new kilograms, thus freeing the world's mass standard from its platinum-iridium shackles.
- Now, every country will be able to build electromagnetic Kibble balances and realize the mass unit for themselves. There will no longer be a need for metrologists to hand-carry these chunks of metal to France to compare them against the original.
- Now, some may be disappointed that they might no longer get to travel to Paris, the City of Lights, for work every few years, but I think the fact that they will be able to sleep a little more peacefully should count for something.

- I can also assure you that this redefinition will be seamless and will have no effect on your work. The kilogram is still the kilogram. It's just defined in a different and fundamentally accurate way, so you, too, can rest easy.
- And the kilogram is not the only international measurement unit getting a makeover.
- The unit of electric current, the **ampere**, has long been an embarrassment of sorts to the metrological community.
- Its definition is physically impossible to realize as defined, which calls for measuring the magnetic force between two infinitely long wires held one meter apart.
- In fact, we have had to define the ampere by appealing to two of its derived units—the **volt** and the **ohm**.
- We finally have the chance, and the laboratory skills and know-how, to realize the ampere as the flow of a specific number of electrons past a point in one second, a great step forward.
- Also coming along for the redefinition ride are the kelvin, the unit of temperature; the mole, the unit for amount of substance; and the candela, the unit of brightness.

- Change may seem hard, especially when you're talking about units that are supposed to be timeless and universal. But sometimes change is warranted, and other times it is unavoidable.
- It is always better to start preparing and planning as early as possible. We must not wait until we have no choice.
- Every civilization has recognized how vital accurate weights and measures are to ensuring fair trade and orderly marketplaces. NIST and the NCWM share a commitment to this work, and I am here to reaffirm our unwavering support for this organization and for your mission.
- Weights and measures inspectors have always been on the front-line guarding against fraud and abuse, and helping to ensure fair competition.
- Weights and measures inspectors, by their very nature, are "sticklers" for the details.
  - Those of you who are inspectors approach your jobs in the same way all compliance officers do: You trust, but you verify.
- While our mission stays the same, what and how we measure changes as new technologies and products emerge. Increasingly, we are using digital scales rather than analog.

- Weighing and measuring systems are often interfaced with computer systems and software programs to provide enhanced functions and new features for businesses and consumers.
- Increasingly, proprietary software is being used in legal metrology. As our measurement infrastructure has become more complex, our ability to ensure transparency and accuracy in the measurement transaction has become more challenging.
- However, regulators and manufacturers alike have had to rise to that challenge. Inspectors must not only be proficient provers, but many are now being called upon to investigate high-tech crimes. And manufacturers have frequently stepped in to lend their expertise to solving these problems.
- This body has in the past few years made great strides in keeping up with emerging technologies and markets.
- Certifying GPS-based measurement systems for calculating fares for transportation services, for instance, was a great move forward in regulating the new ride-hailing industry. And it also laid the groundwork for addressing other applications where weighing and measuring systems

make use of “apps” to make measurements or process metrologically significant information.

- We also face the challenge of verifying the accuracy of “apps”, especially when software is updated frequently. What if the software can be changed in ways that could give regulators one figure and charge customers another? How must our inspection procedures change to adequately address these systems?
- I’m reminded of a similar app-centered issued, when a diesel engine control program, a “defeat device,” changed parameters when it was in the emissions test mode versus normal operations. Now, that work involved the EPA and the California Air Resources Board – but the principles apply broadly in markets where products are controlled by software.
- How do we protect these consumers and businesses and make sure that the measurements are correct, and that prices charged are proper?
- We are in the era of all-electric and plug-in hybrid vehicles -- and there may well come a time when fossil-fuel powered vehicles will disappear entirely.
  - Will we be ready for that change? Our answer is **“Yes!”** Whatever the economy needs to assure fairness and accuracy in commerce, we will be there.

- We have already developed standards for addressing commercial systems used for electric vehicle fueling.
- We must continually assess what changes are needed to our procedures and standards, to the infrastructure, to establish testing laboratories, and to provide necessary training and procedures to maintain traceability of those measurements.
- There's also the matter of **e-Commerce**.
- Twenty-four years after the founding of Amazon, the Supreme Court has just ruled that states can collect sales tax on items sold over the internet. Slowly, but surely, the government is getting a handle on the virtual marketplace, and we must keep up.
- Online retailers are selling everything over the internet. We can get just about whatever we want via overnight or even same-day delivery.
- And I'm sure that all of you have heard that some retailers are looking to employ fleets of drones to deliver orders to your door, in less time than it would have taken to go to the store yourself.
- It's exciting, and it brings new challenges together with the opportunities.

- A category of products with which we are all intimately familiar, groceries, are also increasingly being sold online, both by traditional grocery stores and other retailers that are new to the grocery business.
- There is tremendous innovation in progress that promises to save us time and grant greater independence to people with mobility and other issues who have difficulties getting to the store.
- Of course, we will continue to use measurement standards and perform other tests to ensure that the scales are fair at the stores and distribution centers. But what happens when we leave? How will we assure integrity of measurements and reporting?
- And what are the logistics of checking stores that are virtual, and use remote-fulfillment warehouses? Or where the goods are coming directly from wholesalers or a variety of different retailers?
- The approaches for products and delivery systems will need to adapt to this new paradigm.
- These are all questions for future meetings of the NCWM. While I believe that the past has set our foundation, it need not dictate our future.
- The established methods are sound, and let us be thoughtful about how we apply them going forward.

- We need to be strategic about how and when to best apply our expertise.
  - We need to be forward thinking and proactive.
  - We must ensure that our measurement infrastructure meets the needs of those we serve.
- NIST is your partner in the evolution of technology and commerce. NIST can help support your priorities and assist you in developing the tools you need to do your jobs ever better.
- Change also requires learning. Since July of last year, the NIST team has trained some 880 weights and measures officials across the nation, and helped them earn a total of over 1400 continuing education units. And the people trained at NIST go on to train thousands more.
- The NIST Office of Weights and Measures training program regularly receives re-accreditation from the International Association of Continuing Education and Training
- We provide this accredited program of training because we recognize its importance in achieving uniformity and “fixing the standard of weights and measures” as it is laid out in the Constitution. It is one of the reasons for which NIST was established in the first place—to support and maintain the

nation's measurements needed for commerce. And also why each of **you** are vital, for your states, and for American **prosperity with integrity**.

- Infrastructure and methods must change with the times to fit the needs of each generation and the introduction of new technologies.
- Our NIST staff will always be on hand to give you the technical support you need. We will help assure the traceability of your state calibration laboratories.
- We'll also provide insights into emerging technologies and the markets they will open, and we'll introduce you to experts in those new industries.
- So, let's keep looking ahead. Let's set our gaze to our future horizon and prepare now for the arrival of these new products, new business models, new ways to deliver value, and novel ways to buy and sell.
- We are in a brave new world of weights and measures. This is a time of great innovation.
- We'll be creative and strategic in our thinking. I know that, together, we can rise to any challenge the future may bring!

Thank you **all** for the great work you do!