The President's Letter
By Chris Pilliod

This is my 54th President's Letter.

Although James B. Longacre is much more famous for designing the Indian cent then Shield Nickel in 1866, I am sure he had absolutely no clue that the alloy he and his fellow employees selected would become the center of so much discussion 150 years later. While the Shield Nickel design lasted only 18 years, the 5-cent alloy they concocted is in its 150th year. Its composition of 75% copper- 25% nickel has remained the same as in 1866, making it quite possibly the longest running coining alloy in the world today. Let's face it, 150 years is a long time for anything.

In working with the Mint on developing alternative coining alloys, a few interesting historical pieces of numismatica surrounding the Shield Nickel have illuminated themselves as myths. One regards the poor die life for the Shield Nickels, with dies breaking up quickly during usage from premature failure. It has been a long-held dogma that the design of the Shield Nickel was the cause, specifically the "Bars and Stars" reverse created a design too difficult to strike. While this may have created some issues, it is unlikely the true reason based on research I've performed in working with the U.S. Mint the past five years in developing a new coining alloy for the 5-cent piece. The true reason for such poor die life was uncovered during testing of alloys for this project, and the real cause has nothing to do with the design of Shield 5-cent piece… but that's a lengthy story that can wait for another day.

Another numismatic myth that may not hold quite enough water in my opinion is the origins of the nickel composition. While the political influence of Joseph Wharton in the 1860's and his discovery of nickel in Pennsylvania has long been credited for its use as an alloying element with copper, fundamental metallurgy may hold a stronger argument. By 1866, the United States already had a number of circulating coins that were copper - the small cent, the Large Cent which was still widely circulating and the two-cent piece. Copper has always been considered a financial "base" metal, "cheap" in comparison to silver or gold, and its dull brown color connotes the same. Anything of metallic value is either white like silver or brilliant gold.

Five cents could go a long way in 1866 and anything with considerable spending power had to have the attributes of such, and striking in a base metal like copper was undeserving. In addition, confusion with the smaller denominations had to be given consideration — those of us old enough surely spent Susan B. Anthony's in change thinking they were quarters. Some confusion between small cents, Large Cents, two-cent pieces and a potential copper 5-cent piece would have surely been a consideration. Copper does not become grayish white in color until approximately 20% nickel is added to it. So to produce a white coin like the five cent silver pieces it would replace the 5-cent piece would require at least 20% nickel, having specified 25% nickel in the composition suggests color may have been a driving force in the alloy design.

But now in 2016, the composition of 75% copper – 25% nickel is in jeopardy due to rising metal prices. At its peak, the Mint was spending over 11c to produce each nickel and nearly 2.5c to produce each penny. This prompted Congress to pass the Coin Modernization, Oversight and Continuity Law 111-302 in 2008 with the goal to reduce the cost of producing our nation's coinage. After several years of canvassing alternative metals, it was determined that no other candidate metals for the cent are viable that would reduce cost for the cent, so the next bus stop for the penny is the graveyard. On the other hand, the 5-cent piece is very likely to have a long life ahead of it, but perhaps with a new, lower-cost alloy composition.

And you have to give credit where credit is due. After having spent the past five years working with the U.S. Mint on a new coining alloy, a few revelations have made themselves clear. For a couple years, I have been in contact with the Mint on almost a monthly basis, at times more frequently. Included in this have been several trips to their Coining Research Department in Philadelphia for a first hand look at testing of alternative metals, including an alloy I developed.

First of all, as far as being shrewd businessmen, the Mint takes a backseat to few. Ninty-five percent of our business is private sector—Boeing, General

Electric, Rolls-Royce being significant customers. The Mint has equipped themselves as well, if not superior, to their business counterparts in the private sector. They possess an extraordinarily keen sense of the business aspects associated with circulating coinage. They know the average life of each denomination, how many transactions are currency versus credit, and so on. Additionally, as far as understanding the "voice of the customer" as we call it, the Treasury has executed this extremely well, primarily fueled by some of the currency catastrophes other nations have struggled with, where lower cost metal alternatives have led to counterfeiting as well as general confusion.

Hey, America is Already Great!!!

For commercial use, the United States has the most premium coining alloys of the entire world. I would call them Cadillac coins for commerce. I can think of no other nation employing copper-base metals for all but one denomination. Most nations have done away with denominations as small as the cent, or even the 5-cent piece. It has been even longer since cheaper alloys have been introduced for the other circulating issues. Why hasn't the US followed suit???

While it is not official, the cart below I feel plays an important role in the answer. Essentially our coinage is copper-based with the exception of the cent. A look at the chart below shows the pricing trend for copper over the past five years.

For the sake of making a point, approximately half of the cost of producing a coin is raw material. The price of copper is half of its historical levels, and that's not adjusted for inflation. Nickel (the 5-cent piece has 25% nickel in it) has experienced an even more catastrophic drop—it's about 20% of peak price. So the price of producing a coin has dropped in line. Furthermore, even during the extreme price peaks for copper and nickel, the Mint still ran at a profit for manufacturing dimes and quarters, combined with numismatic sales, they ran a surplus every year. Does the Mint get to keep the profits they generate? The answer is "no. It all goes to the GSA to pay off the national deficit each year.

Why, you ask, have the prices of copper and nickel plunged? Can you say "China"???

China is the world's largest consumer of copper and nickel, in large part for steelmaking but nonferrous production as well, such as electrical motors, wiring and so on. And we have all read about the economic slowdown in China the past couple years. It's the simple "supply and demand" argument.

While the financial component of the initiative has been fascinating and quite a learning curve, the technical component is even more illuminating, especially for the numismatist. And it really has taken years for my simple mind to peel away the onion layers to get at the crux of what's critical to the change. The technical issues are much more complicated than the public can imagine. The dance the Mint is performing has been an exhausting and seemingly endless tango of finance and metallurgy. But before any basic metallurgy discussion some fascinating historical perspective is in order.

Change has been few and far between. Only twice in the entire Mint's history dating back to 1792 has the composition of a coin been significantly amended for the direct purpose of reducing cost. There have been size changes to accommodate cost reductions, notably the Large Cent shrinking in 1795 and 1857, as well as changes in the weight in silver coins in 1853. Now that standardization of size is critical for banking and commerce, there will be no future changes of any denomination with respect to physical size. Excluding gold issues, the only two substantial changes of composition to any coinage has been eliminating silver in 1964, and elimination of copper from the cent in favor of zinc in 1982. The work I'm doing could be the third, so it's cool to be part of this process.

Despite their difference in color, silver and copper have remarkably similar metallurgical properties. While silver enjoys superior corrosion resistance, the two metals have almost identical electrical properties, making the change seamless as far as acceptance in vending, parking meter, laundromats and other applications are concerned. The biggest difference is color. Copper is one of only two metals that is not white or gray, gold being the other. In 1964, the Mint had to insure the denominations remained unchanged in

color, so the Mint added an outer cladding of cupro-nickel (the exact same chemistry as the 5-cent piece) to the dime and quarter, and later on the half dollar, as mentioned the only reason being color.

What's important in making a coin?

From a technical perspective, there are several key factors of prime importance in evaluating any alternative alloy's functionality as a coin. While the Mint tests 27 key attributes for evaluating any alloy, the following are the main "go/no go" technical factors. Obviously, cost is the driving force, but these five factors will determine the direction of any new alloy. Much of this was discussed at a Stakeholder's Meeting hosted by the Department of the Treasury a year ago, and which I was fortunate to attend.

1. Can the alloy be coined? Is the material soft enough to be readily coined and not be detrimental to die life? Any loss of die life has a dramatic negative impact on production costs. Any metal requiring excess tonnage above 54 tons of striking pressure for the 5-cent piece will not be considered for a coining alloy regardless of how cheap it is (unless it's free of course). If a die wears out prematurely, this creates downtime and loss of productivity at the Mint.

Imagine taking a cross-country trip in your vehicle, expecting to drive from New York City to San Francisco in three days. If your car breaks down every 400 miles, you don't just have the added financial burden of a car repair. You now have a towing charge, a hotel charge, extra meals, loss of opportunity for your time, and so on. It's what keeps accountants employed. Even though the cost of a die is negligible at the Mint, the downtime costs associated with a changeover become enormous.

The Mint has studied in detail die life and what variables affect how many strikes a die can deliver before retirement is necessary-- either due to wear, die breakage, cracks and so on. Not surprisingly, striking pressure is a leading variable, that is, how many tons of pressure are required to bring up a full image. If a pressure beyond a threshold standard is required, die life is greatly depreciated. While at the Mint, I observed that the incumbent metal of cupro-nickel was producing acceptable strikes below this level.

2. Is the new coining metal corrosion resistant? The composition of the 1943 Steel cents would be a definite "no go" for this reason. The issue with corrosion is not the just the corrosion, but that most oxidized metals turn an ugly color—cosmetics are important in coinage! I think you can make an easy case that the two worst coining alloys in United States history both occurred during World War II, with the cent and the nickel. The steel cents corroded easily and the War nickels laminated badly and turned dark during circulation. "Why don't you just abolish the penny?" several asked.

"Don't change a thing!!!" an attendee at the Stakeholders meeting whispered. I turned around and it was the supplier of the cent planchets. While the losses on the cent by a percentage basis are far higher than the nickel, the Mint represents one of the supplier's major customers and losing them would be a financial blow to their company.

3. Is the new coining alloy non-magnetic? Unlike other nations, it has been deemed critical that any new alloy introduced into U.S. coinage be non-magnetic. The reason being that many coin counting couriers, like Dunbar, Garda, Loomis, and so on utilize magnets to cull out slugs and counterfeit pieces. Herein lies an issue with iron and or steel alloys. Iron is one of three metals that are magnetic in their pure state, nickel and cobalt being the others. Iron carries extreme appeal because of its cost. While copper sells today for $2 per pound and nickel is at $4 per pound, iron is practically free at 10c per pound.

4. Will it work in a vending machine? Vending machines are equipped with Eddy current testers evaluating with a high level of discrimination the electromagnetic signature of every coin casually dropped into the slot. Electromagnetic signature is roughly related to a metal's electrical conductivity; with each alloy and metal possessing a unique "signature" when measured. At the Stakeholders Meeting last March, this single issue was perhaps the central theme.

"Don't change a thing!!!" several attendees yelled out again. To my left were lobbyists who attended in full force and whose machines are supplied to the cafeterias, commissaries, breakrooms, boardwalks and so on. In all likelihood, any new alloy will not have a signature matching the current 5-cent piece and would require re-programming of every vending machine in the country. At what cost? $4 billion, according to the vending industry. Or about ten times the savings a new alloy might offer.

5. Specific gravity or density. The diameter and thickness is not allowed to change per the law—this would cause catastrophic issues with banking and commerce. As a result, any new coining metal that does not have the exact same density as copper will have a weight that is different than today's 5.00 gram 5-cent piece. This is extremely critical to the Gardas and Brink's guys. To reduce costs and handling issues, many bank-to-bank transactions of coinage are performed by weight only. So having nickels with two different weights complicates matters significantly.

"Don't change a thing!!!" several attendees once again said to Mint representatives at a coffee break last March. This time, it was the lobbyists representing Garda, Loomis, Brinks, Dunbar and so on whose job is to weigh bags of nickels and certify their values to the next bank or Federal Reserve. A new 5-cent piece with a different weight would create error in every transaction. The only question I asked during the meeting was "How does the industry deal with pennies with two different weights, those pre-1982 and those post-1982?"

The answer was the Federal Reserve publishes a number periodically with an estimated percentage of pre-1982 cents co-circulating with the zinc issues. For example, 17% of the cents in circulation are pre-1982, so the coin carriers who weigh the penny bags simply factor this into every sack of pennies they weigh and stamp "$50" on each, knowing full well the chances of each bag containing exactly $50 is highly remote.

So everyone is now shouting "Don't change a thing"! But here's the problem with no change. The same people yelling no change are also the ones that sit at home and yell at the government about the mounting national debt. You can't have your cake and eat it too. To be fair, the losses the Mint is accruing on the cent and nickel are blip on the screen of the total national debt.

When I look at my crystal ball, it seems to me that any new alloy the Mint decides upon will be iron-base. Iron is the only practical base metal that moves the needle on cost and has similar density to copper. So how do you make iron corrosion resistant and non-magnetic? There are nearly 50,000 different alloys of iron—steels, stainlesses, tool steels, and so on. Perhaps 10% of them are non-magnetic. Many of these premium non-magnetic types have roughly 75% iron, possess great corrosion resistance and are non-magnetic. And guess what? The incumbent alloy has 75% copper, so it's a one-for-one iron for copper replacement. So you're taking $2 per pound copper and replacing it with 10c per lb iron.

So where is all of this going? The truthful answer is "Nobody knows." But it's been a great ride so far, full of fascinating discovery and adventure, and the best news is that the trip is a long way from being over, so stay tuned.