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ECONOMIC UPDATE

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EXECUTIVE SUMMARY

AMERICAS: THE U.S. TRADE DEFICIT SHRANK LAST YEAR, THE FIRST DECLINE SINCE 2013. The deficit in goods and services shrank 1.7% last year. Prices for imports rose 0.5%. **U.S. GDP** expanded 2.1% in the fourth quarter, with full-year growth at 2.3%. **Shipment volume in the U.S.** by truck, rail, air and barge plunged in December compared to a year earlier. It was the 13th month in a row of year-over-year declines and the steepest drop since November of 2009 during the financial crisis. **Consumer spending and wage gains** eased at the end of last year, signs the U.S. economy is returning to a more moderate pace of growth. The **share of workers in labor unions** fell to a fresh record low last year. **Employers** added more jobs in January than expected but manufacturing employment continued to shrink. **U.S. consumer confidence** climbed sharply, driven by a positive assessments of the labor market and increased optimism about future job prospects. **Manufacturing** returned to growth in January for the first time since last July. The **federal government** will spend \$1 trillion more than it collects in 2020, and deficits will exceed that amount every year for the foreseeable future.

OVERSEAS: THE SPREAD OF CORONAVIRUS THREATENS PROSPECTS FOR ECONOMIC GROWTH. The **World Health Organization** has declared the coronavirus outbreak a global public-health emergency. **Eurozone manufacturing** continued to weaken at the start of the New Year, but at a noticeably slower rate. **The International Monetary Fund** trimmed back its global growth forecasts, mainly due to a sharper-than-expected slowdown in India and other emerging markets. The IMF now sees growth at 3.3% this year.

STEEL: U.S. IMPORTED STEEL VOLUMES LAST YEAR WERE AT THEIR LOWEST LEVEL SINCE 2010. The **Trump Administration tariffs** will be expanded in February to cover products made of steel and aluminum, such as nails, tacks, staples, cables, certain types of wire and bumpers and other parts for cars and tractors. **ArcelorMittal** said it is more optimistic about the apparent demand outlook for 2020 and forecasts global steel demand to rise 1%-2% this year after expanding 1.1% in 2019. "The coronavirus will likely have a short-term negative demand impact in China and to a lesser degree elsewhere," said the ArcelorMittal chief executive.

METALS/COMMODITIES: APPLE PLANS TO REDUCE RELIANCE ON THE MINING INDUSTRY and is making progress with its "Daisy" robot. The device breaks apart 200 old iPhones per hour so that 14 minerals, including lithium, can be extracted and recycled. Apple is already using recycled tin, cobalt and rare earths in some of its products, with plans to add to that list. **The price of rhodium** reached an eleven-year high in January. Used to curb auto exhaust emissions, rhodium is now six times pricier than gold.

AEROSPACE: THE GLOBAL SPACE INDUSTRY COULD GENERATE REVENUE OF MORE THAN \$1 TRILLION BY 2040, up from \$350 billion currently, according to a study by **Morgan Stanley**. Yet, the most significant short and medium-term opportunities may come from satellite broadband Internet access. **Unmanned aerial vehicles (UAVs)** will be one of the most dynamic growth sectors of the world aerospace industry. A market analysis estimates that UAV production worldwide will total \$99 billion over the next ten years.

AUTOMOTIVE: GM CRUISE REVEALED NEW ROBOTAXI - TOASTER-SHAPED WITH NO STEERING WHEEL. The company said the all-electric vehicle, **Cruise Origin**, is a fully engineered vehicle that's on its way to production. GM said the market for autonomous ride-hailing could exceed \$1 trillion and suggested that profits from a future service could exceed that of GM's traditional vehicle-manufacturing business. **In a recent Wards survey**, 44% of automotive engineers and designers said that in 10 years vehicle materials and architectures will be "totally different" than they are today and 67% said they would be "somewhat different" in just five years.

MEDICAL: EPIC IS PUSHING OUT A SOFTWARE UPDATE TO HELP SPOT CORONAVIRUS. It is meant to help providers nationwide detect potential cases of the Wuhan coronavirus. **DexCom** plans to double capacity for its G6 continuous glucose management system by the end of 2020, while advancing development of its less expensive and much thinner G7 CGM. The **mobile health devices and wearables** trend is accelerating this year, with 546 digital health and 635 wearable devices touted at the annual CES show in Las Vegas.

ENERGY: PEPSICO IS ON TRACK TO ACHIEVE 100% RENEWABLE ELECTRICITY FOR ITS U.S. OPERATIONS this year as part of the company's push to cut its global emissions by 20%. Pepsi currently uses renewable energy in the form of solar and wind power at seven of its U.S. manufacturing sites. **An offshore strategy developed at MIT** proposes situating reactors in relatively deep water, far away from coastal populations and linked only by an underwater power transmission line. Offshore floating nuclear power plants promise to be safer, less expensive by using streamlined construction methods and easier to deploy than today's land-based plants.

INNOVATION: NEURALINK SEEKS TO BUILD BRAIN IMPLANTS TO COMMUNICATE WITH MACHINES and hopes to begin trials on human patients by the end of 2020. The ultimate goal of **Neuralink** is to allow humans to achieve "a sort of symbiosis with artificial intelligence". Reducing single-use packaging and increasing recycling of some of the biggest global brands is taking a big leap forward with **TerraCycle's Loop**, a new zero waste platform. **Stainless steel** plays a key role with its durability and sterilizing properties.



THE AMERICAS

- **U.S. employers** added 225,000 jobs in January and the unemployment rate ticked up to 3.6% from 3.5% in December, an increase that reflected more Americans looking for work. Manufacturing employment fell by 12,000. Motor vehicles and parts lost 11,000 jobs over the month.
- **The U.S. trade gap** in goods and services expanded 11.9% to \$48.9 billion in December. Exports rose 0.8% although imports increased by a greater amount, rising 2.7% from November and potentially signaling somewhat softer GDP in the 4thQtr. The deficit in goods and services shrank 1.7% last year to \$616.8 billion, the first decline since 2013. Exports declined last year by 0.1% and imports fell by 0.4%.
- **U.S. import prices** were up 0.3% in December, the largest monthly advance since March. Prices for imports rose 0.5% for all of 2019, after decreasing 0.9% in 2018. U.S. export prices fell 0.2% in December. Prices for overall exports declined 0.7% in 2019, following a 1.1% increase in 2018.
- **U.S. consumer confidence** jumped 3.4 points to 131.6 in January, as measured by the Conference Board. The gain was driven by a positive assessment of the labor market and increased optimism about future job prospects.
- **U.S. retail sales** rose 0.3% in December from a month earlier to \$530 billion. December department store sales slipped 0.8% from November, and declined 5.5% from a year earlier. Sales at nonstore retailers, a category that includes internet merchants, were up 0.2% on the month and rose 19.2% compared with a year earlier.
- **U.S. consumer prices** edged up 0.2% in December after climbing 0.3% in November. The core CPI increased 0.1% after November's rise of 0.2%. For all of 2019, the CPI accelerated 2.3% compared to 1.9% in 2018 and the core CPI gained 2.3% after 2018's increase of 2.2%. Healthcare costs surged 4.6% in 2019 compared to 2.0% in 2018.
- **The U.S. Leading Economic Index (LEI)** declined 0.3% in December. The LEI has now declined in four out of the last five months. Its six-month growth rate turned slightly more negative in the final quarter of 2019, with the manufacturing indicators pointing to continued weakness in the sector.
- **U.S. industrial production** fell 0.3% in December, as unseasonably warm weather reduced demand for heating from utilities. Factory output improved 0.2%. Output at auto plants fell 4.6% after a November surge following the end of the GM strike. Mining output increased 1.3% due to gains in extracting oil and natural gas. Total industrial production, which includes the manufacturing, mining and utilities sectors, slumped 1% over the past year.

- **U.S. producer prices** edged up in December as a increase in the cost of goods was offset by weakness in services. The producer price index for final demand ticked up 0.1% after being unchanged in November. Excluding the volatile food, energy and trade services components, producer prices nudged upward 0.1% in December. For all of 2019, the PPI rose 1.3%, the smallest gain since 2015.
- **The U.S. and China** signed a trade deal that may lead to a sharp increase in sales of U.S. goods and services to China, further open Chinese markets to foreign firms and provide strong new protections for trade secrets and intellectual property. The eight-part agreement acts as a cease-fire in a two-year trade war that has roiled markets world-wide and cut into global growth. China has consented to increase imports from the U.S. by \$200 billion over two years.

Key Update: Chinese officials are hoping that the U.S. will agree to flexibility on some promises in the Phase 1 trade deal as China deals with the outbreak of coronavirus.
- **Durable goods orders** rose 2.4% in December, a month when Congress passed funding bills that included a boost in military spending. Demand for military equipment surged, with orders for defense capital goods up 90.2% on the month. New orders for transportation equipment were up 7.6%, boosted by a 168% jump in orders for defense aircraft. Motor vehicles and parts orders fell 0.9%. However, core capital goods orders fell 0.9%. Excluding transportation and defense, new orders fell by 2.5% in December.
- **U.S. manufacturing** returned to growth in January. The ISM manufacturing index rose to 50.9 from 47.2 in December, indicating expansion for the first time since July, as new orders and production picked up. However, global manufacturing is likely to suffer a fresh setback due to China's isolation in response to the coronavirus outbreak.
- **U.S. factory orders** increased 1.8% in December, bolstered by robust demand for defense aircraft. However, persistently weak business spending on equipment pointed to limited scope for a sharp rebound in manufacturing. Excluding defense, factory orders dropped 0.6% in December after edging up 0.1% in the prior month. Underlying weakness in manufacturing was underscored by a 0.5% jump in inventories at factories in December.
- **U.S. gross domestic product** rose by 2.1% from October to December, with full-year growth in 2019 of 2.3 percent.



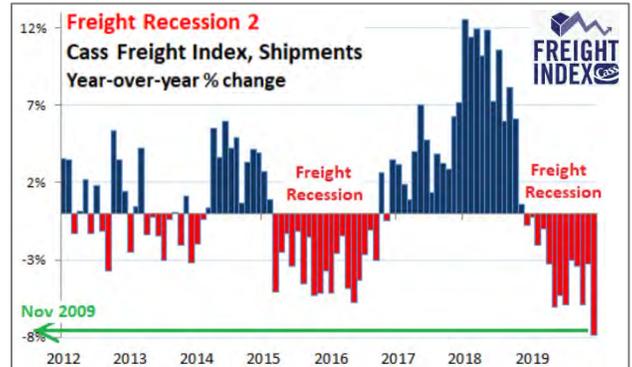


- **The share of American workers in labor unions** fell to a fresh record low last year of 10.3%, despite an uptick in the ranks of unionized state-government employees.
- **U.S. services sector activity** picked up in January, with industries reporting increases in new orders, suggesting the economy could continue to grow moderately this year even as consumer spending is slowing. The ISM non-manufacturing activity index increased to a reading of 55.5 last month, the highest level since last August.
- **The U.S. housing market** finished 2019 on solid footing. Existing home sales increased 3.6% in December to an annual rate of 5.54 million. The median sales price for an existing home in December was up 7.8% YOY to \$274,500. Housing starts surged 16.9% to the highest level in 13 years. Builders started construction on 1.61 million homes. New home sales fell 0.4% to 694,000, but for all of 2019, new home sales climbed 10.3% to 681,000 units.
- **Consumer spending and wage gains** eased at the end of last year, signs the U.S. economy is returning to a more moderate pace of growth. Personal-consumption expenditures rose 0.3% in December after a 0.4% rise in November. Spending for all of 2019 was up 4%, the smallest annual increase since 2016. Wages for private-sector workers rose 3% year-over-year in the fourth quarter.

Key Update: The stalling of wage growth puzzles economists. One possibility is that a decades-long decline in union membership has kept a lid on workers' bargaining power. Another potential reason could be the aging population: highly paid baby boomers are retiring and being replaced by younger, lower-paid workers.
- **Sustained federal budget deficits and debt** will hit the highest levels since World War II over the next decade. The U.S. government will spend \$1 trillion more than it collects in 2020, and deficits will exceed that amount every year for the foreseeable future. As a share of GDP, the deficit will be at least 4.3% every year through 2030. That would be the longest stretch of budget deficits exceeding 4% of GDP over the past century, according to CBO. Public debt will be 81% of GDP this year and is projected to reach 98% by 2030.
- **Spending on U.S. construction projects** edged down 0.2% in December, closing out a year when total construction registered its first annual decline in eight years. For 2019, construction spending fell 0.3%, the first setback since a 2.6% decrease in 2011. For last year, home building was down 4.7%, while nonresidential construction was basically flat and public construction posted a 7.1% increase.



- **Shipment volume in the U.S.** by truck, rail, air and barge plunged 7.9% in December 2019 compared to a year earlier. It was the 13th month in a row of year-over-year declines, and the steepest year-over-year decline since November 2009 during the financial crisis. In December, total freight expenditures (the amount shippers, such as manufacturers, retailers, or industrial companies, spent on freight by all modes of transportation) dropped 6.2% from a year ago.



- **Trump administration tariff exemptions** have now slumped by 91%. The Commerce Department is currently granting fewer exemptions on tariffs for Chinese imports, with the approval rate recently falling to 3% in the third round of levies (25% on \$250 billion in imports) from 35% in the first two rounds of tariffs (25% on \$50 billion in imports).
- **The global autonomous ships market** is expected to reach \$13.4 billion by 2025, registering a CAGR of 13.5% over the forecast period. Autonomous ships use several systems and components including sensors, propulsion systems and intelligent navigation systems involving the use of Artificial Intelligence (AI) and Internet of Things (IoT). Use of such systems reduces the operational cost of ships, which is one of the key factors driving the market growth. Shipbuilding is a major market for the steel industry. (See **Appendix: Steel**, page 8)
- **U.S. Steel** expects its shipments to decline 6.5% this year to 10 million tons, partially due to its preparation for a major outage at its Gary Works flat-rolled mill, which has a capacity of 7.5 million/tons/year. Shipments in the 1stQtr will likely come in lower than the 4thQtr, as the company builds up inventory in preparation for a 48-day maintenance outage of a blast furnace that begins in April.

Key Update: The company said it lost \$680 million in the 4thQtr versus earnings of \$592 million in the year-ago period.
- **Steel mills** in the U.S. shipped 7.665 million tons of steel in November, a 3.1% drop from October and a 2.1% decline from November 2018. Steel mill product shipments year-to-date through November were 88.157 million tons, a gain of 0.8% over 2018 shipments for eleven months.



- **U.S. raw steel production** for this year- through February 1 was 8.769 million tons at a capability utilization rate of 82.3%, an increase of 2.4% from the same period in 2019 when the utilization rate was 80.4 percent.
- **Steel imports into the U.S.** were 1.553 million tons in December, including 1.347 million tons of finished steel (down 0.5% and up 1.2% respectively vs. November). For the full year 2019, total and finished steel imports were 27.905 million tons and 21.042 million tons, down 17.3% and 18.1% vs. 2018. Finished steel import market share was an estimated 15% in December and 19% for full year 2019. Steel imports in 2019 were at their lowest level since 2010.
- **A confederation of importers and end users** have called for a sunset on U.S. aluminum and steel tariffs. In a letter to the Senate Finance Committee, the Coalition of American Metal Manufacturers and Users (CAMMU) urged leadership to include a sunset provision in Section 232 reform legislation currently under consideration. The group blamed the tariffs for slowing economic growth.
- **Plans to broaden tariffs** on foreign steel and aluminum were announced by President Trump. He said the existing tariffs had not proved as effective as hoped in reviving American production. Imports of steel and aluminum into the U.S. have declined since the tariffs went into effect, but imports of products made with those metals have significantly increased. The net effect has been to erode the customer base for U.S. producers of aluminum and steel and to undermine the effect of original tariffs, he added. As a result, the U.S. has expanded its tariffs on February 8, 2020, to cover products made of steel and aluminum, such as nails, tacks, staples, cables, certain types of wire and bumpers and other parts for cars and tractors.
- **Ford Motor** posted a 4thQtr net loss of \$1.7 billion vs. a loss of \$100 million a year earlier, and it provided a weaker-than-expected 2020 forecast due to continued higher warranty costs, lower vehicle sales, lower results from Ford Credit and higher investment in future transportation. The No. 2 U.S. automaker is struggling to complete a long-running restructuring and is faced with continued losses in China. The quarter included a loss of \$2.2 billion due to higher contributions to its employee pension plans.
- **GM's new autonomous vehicle**, the Cruise Origin, will be produced at its Detroit-Hamtramck plant, cementing the company's hometown as a hub of future technology. Manufacturing of the Cruise will come "soon after" the reopened facility starts building its first new vehicle, an EV pickup truck, in late 2021. The self-driving Origin has no steering wheel, pedals or other manual driving controls.

- **Tesla** posted the second quarterly profit (\$105 million) in a row on record vehicle deliveries in the 4thQtr and said it would deliver more than 500,000 units this year. Tesla noted that the manufacturing process at its new Shanghai factory was running as expected and production of the mass-market Model 3 will be increased due to strong demand in China. The company started production of its new Model Y, an electric crossover utility vehicle, at its Fremont, California, plant in January and plans to deliver the first models by the end of March, ahead of schedule.
- **Electric vehicle start-up Rivian**, backed by Amazon and Ford, showed off its pickup truck and SUV in San Francisco. Scheduled to be delivered at the end of this year, the R1T pickup with 300 miles of range is expected to list at \$69,000 and the R1S SUV with similar range at \$72,000. Amazon has ordered 100,000 electric delivery vehicles from the start-up, the first of which will be delivered in 2021 and built in Normal, Illinois. (See **Appendix: Automotive**, page 11)
- **Monthly new-vehicle sales reporting**, the long-standing auto industry practice, is now more or less over. Toyota, Audi, BMW, Nissan, Porsche and Volkswagen have made back-to-back announcements that they will stop reporting monthly sales results across the U.S., switching instead to quarterly reports. The stampede away from tradition follows similar decisions by U.S. automakers last year.
- **Arconic** expects to lose \$400 million in sales and may cut jobs this year as a result of Boeing's halted production of the 737 MAX. The uncertainty over MAX production is the biggest challenge facing Arconic in 2020, complicating plans to split the company into one business focused on aerospace parts and another focused on aluminum rolling. Arconic said it still expects to complete its break into two companies by April, separating the aerospace components and aluminum-rolling businesses into separate entities.
Key Update: Like Arconic, 600 major MAX suppliers and hundreds of smaller companies are weighing whether to cut expenses by laying off staff who could be tough to rehire when output resumes.
- **MIT engineers** have developed a method to produce aerospace-grade composites without the enormous ovens and pressure vessels. The technique may help speed up the manufacturing of airplanes and other large, high-performance composite structures, such as blades for wind turbines. It is a new approach to making airplane parts, minus the massive, costly infrastructure.





- **SpaceX** conducted a successful test of the abort manoeuvre to be used if one of its crew-carrying rockets ever developed a problem during flight. The rehearsal at Kennedy Space Center saw a Falcon-9 vehicle's ascent into the sky deliberately terminated just 80 seconds after lift-off. The Dragon astronaut capsule on top fired its escape engines to carry itself clear of the "faulty" booster. Parachutes brought the vessel to a safe splashdown some 30km off Florida. This test was considered to be the last major milestone for SpaceX before NASA certifies the firm to carry astronauts to the International Space Station later this year.



(See **Appendix: Aerospace**, page 10)

- **Boeing's deliveries and new orders** for jetliners hit their lowest point in more than a decade as the global grounding of the 737 MAX undermined the aerospace giant's business. In 2019, Boeing delivered 380 aircraft, including military versions of its jetliners, a 14-year-low that compares with a record 863 deliveries last year by rival Airbus. Boeing delivered 806 planes in 2018, a high for the company, but last year it only secured new orders for 246 commercial jets of all types. However, Boeing's combined deliveries of military jets and helicopters more than doubled last year.

Key Update: *Boeing expects more than \$18 billion in costs related to the grounding of its 737 MAX jets and indicated it would cut production of its bigger 787 Dreamliner aircraft. Boeing's 4thQtr core operating loss was \$2.53 billion, compared with a profit of \$3.87 billion a year earlier. Boeing reported a full-year loss of \$636 million for 2019.*

- **Unmanned aerial vehicles (UAVs)** will be one of the most dynamic growth sectors of the world aerospace industry this decade, according to Teal Group's latest market analysis. It estimates that UAV production will increase from current worldwide UAV production of \$7.3 billion annually in 2019 to \$10.2 billion in 2029, totaling \$98.9 billion over the next ten years. Military UAV research spending would add another \$61 billion over the decade. The study predicts that the U.S. will account for almost 80% of total military worldwide RDT&E spending on UAV technology over the next decade and about 47% of the military procurement.
- **Exxon Mobil** is in talks to sell its oil assets in Equatorial Guinea, the country's oil minister said. It might be replaced there by a Russian company—among other options—as U.S. companies retreat to shale projects and Moscow strengthens its foothold in African resources.

- **The Boeing 777X's first flight** in January was powered by two GE9X engines, an engine that makes use of composite materials and 3D printed parts. The engine has a composite fan case and 16 fourth-generation carbon fiber composite fan blades, 3D printed parts and ceramic matrix composite (CMC) material in the combustor and turbine. GE Aviation is wrapping up certification testing for the GE9X and expects the engine to be certified later this year.

- **PepsiCo** is on track to achieve 100% renewable electricity for its U.S. operations this year as part of the company's push to cut its global emissions by 20%. The company's U.S. manufacturing sites comprise half of its global electricity consumption. Pepsi currently uses renewable energy in the form of solar and wind power at seven of its U.S. manufacturing sites. The company will cover the rest of its electricity use with renewable energy certificates, credits which support green energy generation at its other sites.

(See **Appendix: Energy**, page 12)

- **Certain GE electronic health care equipment** was the subject of a FDA warning to healthcare providers and facilities over cybersecurity vulnerabilities that may introduce risks to patients while being monitored. The flaw affects some GE healthcare clinical information central stations and telemetry servers. The vulnerabilities could "allow an attacker to remotely take control of the medical device and to silence alarms, generate false alarms and interfere with alarms of patient monitors connected to these devices," the FDA said.

- **Johnson & Johnson's profit and sales** rose for the 4thQtr, with increased pharmaceutical and consumer-product sales helping to offset a slight drop in medical-device sales. J&J reported net income of \$4.01 billion compared with \$3.04 billion in the year-ago period. U.S. sales rose 1.4% to \$10.77 billion, and international sales rose 2.1% to \$9.97 billion. Sales in its medical-devices business fell 0.5% to \$6.63 billion due to a decline in surgery products.

- **DexCom** plans to double capacity for its G6 continuous glucose management (CGM) system by the end of 2020, while advancing development of its less expensive and much thinner G7 CGM. The company said preliminary 4thQtr numbers show it brought in about \$457 million, which was an increase of more than 35% vs. 4thQtr18. For this year, Dexcom currently anticipates total revenue of \$1.7 to \$1.8 billion, growth of 17% to 21% over 2019. (See **Appendix: Medical**, page 13)

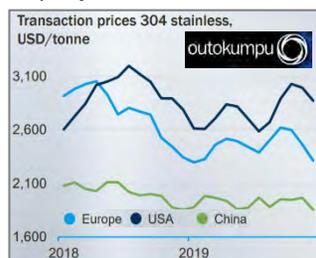


EUROPE, AFRICA & THE MIDDLE EAST

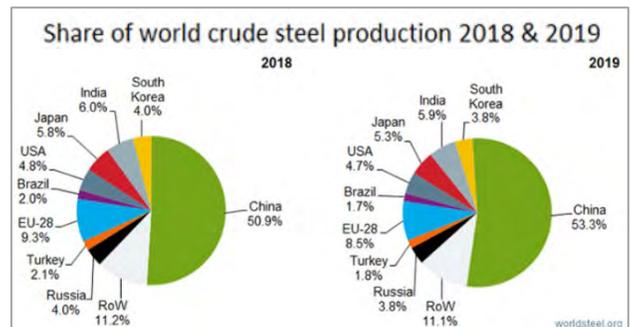
- **Eurozone manufacturing** continued to weaken at the start of the New Year, but at a noticeably slower rate. The IHS Markit Eurozone Manufacturing PMI registered 47.9 in January compared to December's 46.3. Although the index has now remained below the crucial 50.0 no-change mark for 12 months in succession, the latest reading was the highest since April of 2019.
- **The German economy** grew by only 0.6% last year, the slowest rate since 2013 at the height of the eurozone's debt crisis. Output in the manufacturing sector excluding construction, which accounts for around a quarter of the overall economy, fell by 3.6%. Private consumption rose robustly, helping support growth. German car production fell to its lowest level in almost a quarter of a century last year. Weakness in the auto sector likely trimmed German growth by 0.75 percentage point in 2019. About 14% of auto companies have shortened working hours to avoid layoffs.

Key Update: *The auto workforce in Germany has shrunk by 1.3% since the start of 2019.*

- **Sales of new gasoline, diesel and hybrid cars** will be banned in Britain from 2035—five years earlier than originally planned. The country is due to host COP26, the next big UN climate summit, later this year and is keen to assert its environmentalist credentials. Britain is already committed to a target of net-zero carbon emissions by 2050.
- **The "Phase One" U.S.-China trade agreement** could violate WTO rules, according to EU Trade Commissioner Phil Hogan, whose team will analyze the document in detail. At issue is whether China's pledge to increase purchases of U.S. goods and services by at least \$200 billion over the next two years is WTO-compatible.
- **Outokumpu 2019 full year results** showed sales fell to €6.403 billion (-6.8%) as the company suffered a net loss of -€75 million. Stainless steel deliveries were 10% lower compared to 2018, but the company's product mix was significantly better in 2019 for both Europe and the Americas. Outokumpu said that the dynamics in the stainless steel market have shifted as a result of trade wars and intensified Asian competition. Outokumpu expects the stainless steel market to strengthen during the 1stQtr, supported by typical seasonality. The company said its stainless deliveries will also increase from the 4thQtr of 2019 in all business areas.



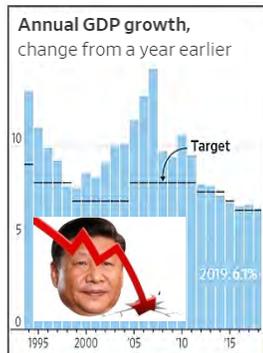
- **ArcelorMittal 4thQtr results** were better than expected with EBITDA of \$925 million. The company said it is more optimistic on the apparent demand outlook for 2020 and forecasts global steel demand to rise 1%-2% this year after expanding 1.1% in 2019. For now, "the coronavirus will likely have a short-term negative demand impact in China and to a lesser degree elsewhere," the company said, forecasting overall steel demand in China rising by as much as 1% this year. (See **Appendix: Steel**, page 8)
- **Global crude steel production** reached 1.870 billion tonnes for the year 2019, up by 3.4% compared to 2018. Output contracted in all regions in 2019 except in Asia and the Middle East. China's crude steel production reached 996.3 Mt, up by 8.3% on 2018. The EU produced 159.4 Mt of crude steel in 2019, a drop of 4.9% compared to 2018. The U.S. produced 87.9 Mt of crude steel, up by 1.5% on 2018.



- **Airbus** agreed to pay penalties of €3.6 billion to settle corruption probes by U.S., U.K. and French authorities into contract dealings, lifting a reputational and legal cloud that has hung over the company for years. Resolution of the issue comes about four years after Airbus first announced it was under investigation for using third-party consultants suspected of paying bribes on behalf of the company to secure lucrative orders for its aircraft.
- **British car production** fell 14% in 2019 to 1.3 million, the worst year since 2010. The decline of diesel, falling sales to China and production shutdowns in anticipation of Brexit all hit output, pushing exports down by 14.7% and production for the home market down by 12.3 per cent.
- **Volkswagen** is ready to hit back at Tesla after the market value of the EV maker surpassed the German car giant for the first time in late January. "The company which adapts fastest, is most innovative and which has enough scale in the changing world will win the race," VW CEO Herbert Diess said at the World Economic Forum. "We're doing the right things to be competitive." He pointed out that Tesla is paving the way in electric cars, though VW is buying software companies and ramping up investments in sustainable vehicles and battery cells.

ASIA/PACIFIC, JAPAN, AUSTRALIA & INDIA

- China's economy** expanded by 6.1% in 2019, the worst figure in 29 years. Trade, investment, consumer spending and business confidence are all retreating. The economy continues to suffer from debt that had helped fund its remarkable bulk-up and now is proving difficult to slash. China also faces longer-term stresses such as an aging population and a birth rate that has fallen to the lowest level since 1961.
- The coronavirus outbreak** is already affecting China's economy on a significant scale. On the first day of the Lunar New Year there was a 41.6% decline YOY in civil air travel, 41.5% reduction in rail travel and 25% drop in road transport. Morgan Stanley said the coronavirus outbreak in China is likely to hurt global growth in the near-term and could shave up to 1% off Chinese growth in the 1stQtr.
- The International Monetary Fund** trimmed back its global growth forecasts, mainly due to a sharper-than-expected slowdown in India and other emerging markets. With trade wars weighing on exports and investment, the global economy expanded 2.9% last year, its slowest pace since the global financial crisis, despite near synchronized central bank easing that added 0.5% to global growth. The IMF now sees growth at 3.3% this year vs. October projections for 3.4%, and it also cut its 2021 forecast to 3.4% from 3.6%.
- South Korea's economic growth rate** slowed to just 2% in 2019, down from 2.8% in 2018. This is the lowest yearly increase since the global financial crisis more than a decade ago. However, there are signs of improvement. The slump in semiconductors, a large chunk of exports, seems to have bottomed out. Consumer confidence, retail sales and business activity in the service sector all improved in the final quarter of 2019, suggesting that the government's fiscal stimulus, along with the Bank of Korea's interest-rate cuts, are beginning to work.
- South Korean steelmaker POSCO** posted a 56.1% drop in its 4thQtr operating profit as higher raw material costs squeezed its margins. In 2019, prices of iron ore, a key raw material for making steel, soared more than 140% from 2018 due to Brazilian supply cuts following a dam collapse at one of Vale's mine in Brazil. The company said it expected lower sales in 2020 on weaker global steel demand growth. POSCO is the world's fifth-largest steelmaker.



- Top brass at Nissan** were reported to be talking about a secret contingency plan to potentially split from Renault which has been ramped up since Carlos Ghosn's dramatic escape from Japan in December. Denying media reports of a break-up, Renault and Nissan said their alliance, which includes Mitsubishi, was in no danger of being dissolved.
- Fiat Chrysler and Foxconn parent Hon Hai** plan to set up a joint venture to manufacture electric vehicles that also are wirelessly connected for the Chinese market. The companies are aiming for a final deal to be signed in the coming months. The tie-up with Foxconn would be one of Fiat Chrysler's most significant efforts at selling electric vehicles in China, where automakers are investing in battery powered cars to meet government regulations.
- Sentiment in Asian steel markets** has deteriorated amid a rapid spread of the Wuhan coronavirus. Delayed resumption of construction and manufacturing activity after the country's Lunar New Year holiday has dampened the outlook for steel and iron ore demand. The Chinese government has imposed travel restrictions across large swathes of the country, affecting the movements of about 56 million people. Market participants expect the fallout from the virus to have an effect on steel markets for the foreseeable future.
- Jiangyin Comat Metal Products** halted production in December after a financial crisis at its parent company resulted in the freezing of Comat's assets, leaving it unable to buy raw materials. Comat, the largest privately-owned maker of tinplate and flat-rolled steel in China, could be poised for a government bailout to restart its production lines and safeguard more than 1,000 jobs at its sprawling factory in eastern China's Jiangsu province.



Key Update: Chinese Officials are struggling to contain a crisis in the steel sector as firms that borrowed heavily to fund ambitious expansion plans are unable to service their debts. Since 2014, about 480 companies have defaulted on bond payments worth about US\$46.4 billion.
- Nickel, the world's hottest commodity in 2019**, is having a poor start in 2020, dropping to its lowest level since July. The metal was trading for just above US\$5.75 a pound on the LME the first week of February, after breaking past US\$8 in September. Complicating markets, the emergence of the coronavirus in China has sparked fears about that country's economic prospects. **Appendix: Commodities**, page 15)

ECONOMIC UPDATE: APPENDIX TO FEBRUARY 2020 REPORT

STAINLESS STEEL: STAINLESS ‘NANO’ NEEDLES PROVIDE A NOVEL TOOL FOR BRAIN SURGERY



Surgery that precisely targets tiny areas of the body is not new, but now researchers at the Massachusetts Institute of Technology have taken this even further, developing a miniaturized system that can deliver tiny quantities of medicine to areas of the brain as small as one cubic millimeter. Professor Canan Dagdeviren, lead author of the research and the LG Electronics Career Development Assistant Professor of Media Arts and Sciences at the university explained, “In this research we aim to bridge the gap between cutting edge neuroscience research and novel engineered devices, by developing a multi-functional neural device capable of exploring and eventually treating Parkinson’s disease.” **The device Professor Dagdeviren’s team developed is comprised of several tubes, encased inside a steel needle the size of a human hair. Drugs are then administered through these tubes, with their minute size making it possible for them to be highly targeted. Stainless steel is an ideal material for this technique as it is chemically inert, non-absorbent and can be sharpened to an incredible edge.** Dagdeviren adds that steel is flexible, meaning the tubes can bend to reach the incredibly small areas of the brain that require the drugs. Surgeons are able to chart complex routes through the soft tissue of the brain to adjust for errors in needle trajectory and avoid obstructions. Trials on rats demonstrated this specificity, with researchers distributing the drug muscimol to the substantia nigra, an area of the brain that helps control movement, in order to simulate the effects of Parkinson’s. Despite the substantia nigra’s location deep inside the brain, the team found they were in fact able to simulate the effects with the device and to halt them with a wash of saline. Researchers hope that the technology will be developed further and used to research other brain disorders, though their current focus is to explore the underlying mechanisms of Parkinson’s and eventually treat the disease. “Any brain disorders that can be treated with drug therapy could be explored with this device,” Dagdeviren said. “It could pave the way towards an adaptive, multimodal treatment for neurologic diseases and eventually revolutionize therapy for patients.”

STEEL: ARTIFICIAL INTELLIGENCE, STEEL AND THE FUTURE OF SHIPPING

The age of autonomous shipping has arrived, made possible by the powerful combination of artificial intelligence and steel. The maritime sector is experiencing unprecedented disruption. Experts are now in agreement that automation is a necessity if the industry is to stay relevant in the decades ahead. If shipping companies can successfully implement fresh solutions based on technologies like artificial intelligence, they will be able to streamline and enhance their operations. The result will be cost-savings, better routing and the ability to identify new business areas. Tomorrow’s ships will be complex hubs filled with sensors and data-capturing devices with significantly enhanced connectivity capabilities due to improvements to satellite technologies. When it comes to the design, building and testing of vessels and their components, cloud technologies will also have a big impact. **An example of the future of shipping in action is the Yara Birkeland, an autonomous, electric**



and zero-emissions container vessel from Norway, which is expected to launch in 2020. Within two years, Yara Birkeland will move from manned to autonomous operations, marking a world-first for the sector. The ship will directly replace around 40,000 truck journeys per year, reducing NOx and CO2 emissions significantly. **In the Yara Birkeland project and others like it, steel has an important part to play, acting as a key enabler for advances in shipping automation and other future technologies.** Vessels like the Yara Birkeland make use of steel throughout their designs, including the paneling of the hull, the engines and on-board solar panel systems. As autonomous shipping takes off, more and more companies are entering the race and hoping to get in on the action. For example, a “future-proof” ship concept called Electric Blue was revealed by leading brand Rolls-Royce in 2017. It



includes steel-built modular components that can easily be replaced or upgraded as necessary in the future, as well as featuring a clean design focused on low building and maintenance costs. As the technologies powering the world’s most important industries change, steel remains central to greater business efficiencies, positive sustainability outcomes and cutting-edge design.

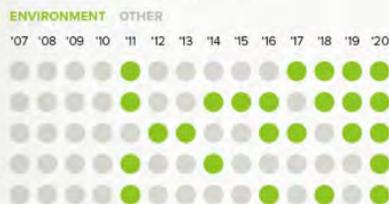
GLOBAL ECONOMY: VISUALIZING THE BIGGEST RISKS IN 2020 ACCORDING TO WORLD ECONOMIC FORUM



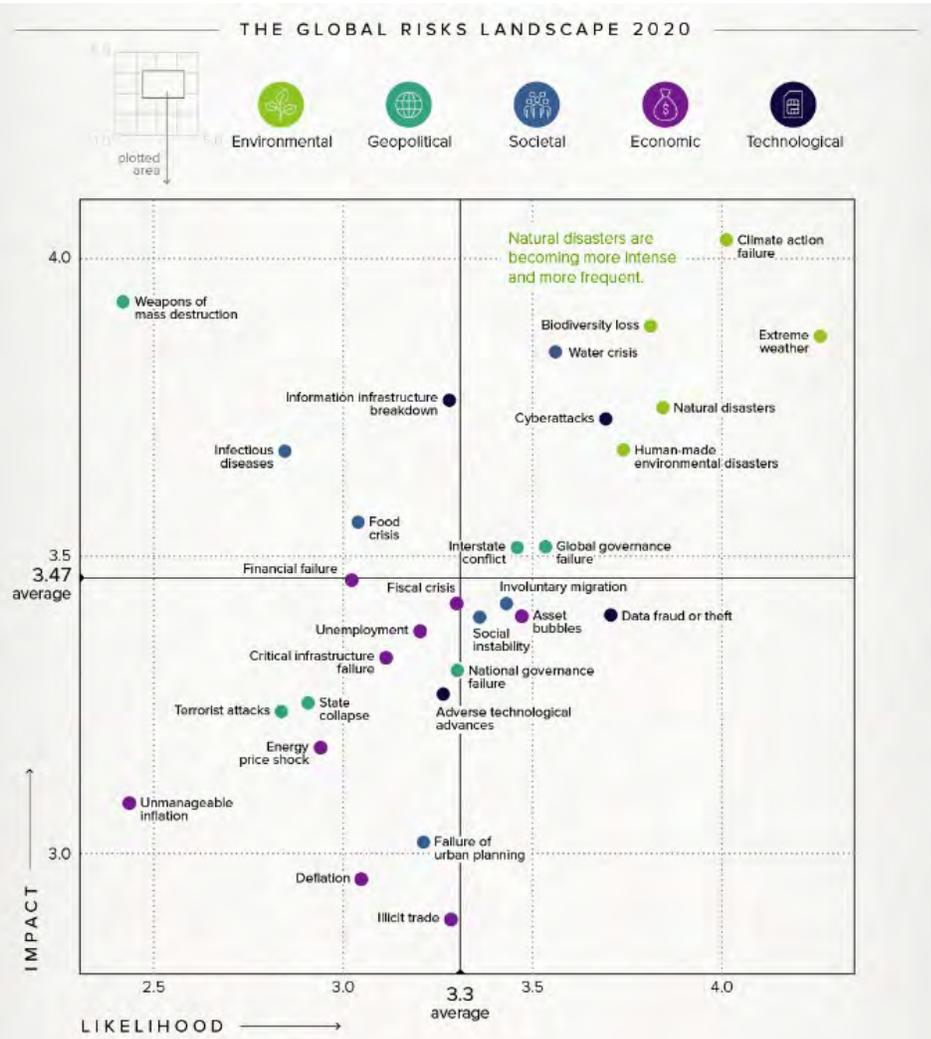
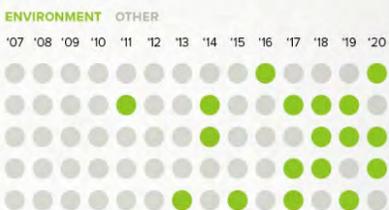
Ahead of the organization's annual meeting in Davos, the World Economic Forum has once again published its Global Risks Report.

The report, based on a survey of 800 leaders across business, government, and non-profit organizations, paints an entirely new risk landscape for 2020 — one dominated by environmental concerns.

Top 5 Global Risks in Terms of LIKELIHOOD



Top 5 Global Risks in Terms of IMPACT



Front and Center

Today's chart uses data from the World Economic Forum's annual [Global Risks Report](#), which surveyed 800 leaders from business, government, and non-profits to showcase the most prominent economic risks the world faces.

According to the data in the report, here are the top five risks to the global economy, in terms of their likelihood and potential impact:

Top Global Risks (by "Likelihood")		Top Global Risks (by "Impact")	
#1	Extreme weather	#1	Climate action failure
#2	Climate action failure	#2	Weapons of mass destruction
#3	Natural disasters	#3	Biodiversity loss
#4	Biodiversity loss	#4	Extreme weather
#5	Humanmade environmental disasters	#5	Water crises

A Tough Road Ahead

In a recent [survey](#), actuaries ranked climate change as their top risk for 2019, ahead of damages from cyberattacks, financial instability, and terrorism—drawing strong parallels with the results of this year's Global Risk Report.

These growing concerns are well-founded. 2017 was the costliest year on record for natural disasters, with \$344 billion in global economic losses. This daunting figure translated to a record year for insured losses, totalling \$140 billion.

Although insured losses over 2019 have fallen back in line with the average over the past 10 years, [Munich RE](#) believes that long-term environmental effects are already being felt:

- Recent studies have shown that over the long term, the environmental conditions for bushfires in Australia have become more favorable;
- Despite a decrease in U.S. wildfire losses compared to previous years, there is a rising long-term trend for forest area burned in the U.S.;
- An increase in hailstorms, as a result of climate change, has been shown to contribute to growing losses across the globe.

ENVIRONMENTAL DISASTERS are getting more expensive and harder to ignore:

Economic losses from natural catastrophes in 2018 totalled \$165B, well above the previous 10-year annual average of \$71B.



JAPAN FLOODS

Estimated losses of **\$9.8B**

Japan's worst weather disaster in 36 years killed at least 176 people and caused significant damage to industrial and public infrastructure.

Experts have reported that torrential rains are becoming more frequent, potentially due to global warming.



CAMP FIRE

Estimated losses of **\$16.5B**

The Camp Fire in Northern California was 2018's most expensive natural disaster, and resulted in the complete destruction of several towns.

Drought is viewed as a potential catalyst — one of the affected towns saw only a small fraction of the autumn rain it has historically received.



AUSTRALIA BUSHFIRES

Damage ongoing **\$68B**

This year's bushfire season is proving to be particularly devastating. With over 6,000 buildings destroyed thus far, the ongoing fires are 25 times the size of 2009's Black Saturday Fires, which caused \$3B in damages. Forecasts for the total losses from these fires are significantly larger, with upper estimates reaching \$68B.

Damage to the ecosystem is also severe. An estimated one billion animals have been lost to the fires so far.



AEROSPACE: BRAZE ALLOYS FOR SPACE LOWER COSTS AND IMPROVE SAFETY

The space industry is predicted to be worth \$1.1 trillion by 2040, up from \$384 billion in 2017.

Between space exploration, satellite communications and the possibility of space tourism, more applications demand the ability to enter orbit or beyond. However, the massive costs involved in vehicle launches could slow that growth. The complexity of space travel leads to exorbitant costs. NASA estimates that the average space shuttle launch cost \$450 million per mission. In addition, more manned flights make safety a huge concern for exploration and tourism, demanding careful engineering and proven systems. Brazing, a long-standing technique to join two metals by heating and melting a filler alloy that bonds to the two pieces, can play a role in improving safety and lowering costs.



Gold, palladium and other precious metals used in brazing are becoming increasingly scarce, driving up commodity prices. Engineers are often reluctant to move away from years of research and development data that shows the alloys are tested and reliable. Non-precious metal alloys made from nickel, chromium and cobalt are already successful in aviation applications, and researchers are working to make them fit for orbit and beyond. Two of Morgan Advanced Materials' braze alloys were engineered and used by NASA on the space shuttle main engine. Morgan engineers developed an alloy to replace the older gold/nickel *Nicro* braze alloy. Reducing the amount of gold and replacing it with copper and manganese made the braze alloy significantly less dense and provided crucial weight savings, while maintaining -240°C to 700°C temperature performance. NASA plans to continue using the Morgan alloys on

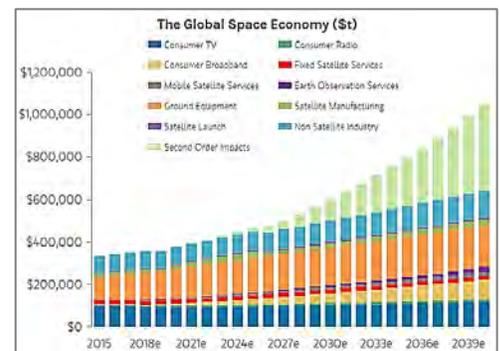
its Space Launch System (SLS), a vehicle planned to take a crewed mission to Mars. **Brazed alloys in space equipment allow sensors to be mounted as close as possible to engines.** Mission control and crew can then accurately read and measure data and output on fuel efficiency, temperature and gas flow and monitor for fire detection or abnormalities. If these sensors are placed too far away from the engines, data readings become inaccurate, potentially compromising missions. The challenge is that some sensors are made from ceramic, due to the need to resist corrosion and high temperatures, typically up to 950°C. These ceramic sensors then need to be joined to metallic parts of the engine, requiring different braze alloys. This is where "active alloys" come in. Unlike regular braze alloys that join metal to metal, these alloys can join metal to ceramic, or even ceramic to ceramic. Industry standard active alloys were developed up to 40 years ago but are still in use today. New alloys are also currently in development to withstand much higher temperatures.



Active alloys join ceramic sensors to engines.

AEROSPACE: MORGAN STANLEY LOOKS AT INVESTING IN SPACE, THE FINAL FRONTIER

It's been nearly half a century since humans left footprints on the moon and during that time, human space exploration has largely centered on manned low-Earth orbit missions and unmanned scientific exploration. Now, high levels of private funding, advances in technology and growing public-sector interest is renewing the call to look toward the stars. The investment implications for a more accessible, less expensive reach into outer space could be significant, with potential opportunities in fields such as satellite broadband, high-speed product delivery and perhaps even human space travel. The most recent space exploration efforts have been driven by a handful of private companies. However, creation of the U.S. Space Force and growing interest from Russia and China means public-sector investment may also increase in the coming years. A single transformative technology shift often can spark new eras of modernization, followed by a flurry of complimentary innovations. Development of reusable rockets may provide such a turning point. Near term, space as an investment theme is also likely to impact a number of industries beyond Aerospace & Defense, such as IT Hardware and Telecom sectors. **Morgan Stanley estimates that the global space industry could generate revenue of more than \$1 trillion by 2040, up from \$350 billion currently.** Yet, the most significant short- and medium-term opportunities may come from satellite broadband Internet access. Beyond the opportunities generated by



satellite broadband Internet, the new frontiers in rocketry offer some tantalizing possibilities. Packages currently delivered by airplane or truck could be delivered more quickly by rocket. Private space travel could become commercially available. Mining equipment could be sent to asteroids to extract minerals—all possible, theoretically, with the recent breakthroughs in rocketry. Initiatives by large public and private firms suggest that space is an area where there will be significant development, potentially enhancing U.S. technological leadership and addressing opportunities and vulnerabilities in surveillance, mission deployment, cyber and artificial intelligence.

AUTOMOTIVE: THE RELATIONSHIP BETWEEN WEIGHT AND EMISSIONS CHANGING - WARDS SURVEY

Big changes are coming to vehicle architectures and the way the auto industry looks at lightweighting, emissions and fuel economy. Electrification, advanced driver-assist systems and autonomous features are forcing automakers to rethink vehicle design from top to bottom. In a recent Wards survey, 44% of automotive engineers and designers said that in 10 years, vehicle materials and architectures will be “totally different” than they are today and 67% said they would be “somewhat different” in just five years. In an industry where four-year product cycles are the norm, five years is just around the corner. **Wards did not ask questions about Tesla’s shocking Cybertruck concept because little public information was available during the survey period, but it is yet another sign change is in the wind. While details still are sparse, it is known the Cybertruck’s body is made of ultra-hard, cold-rolled stainless steel that reportedly is twice as thick as the aluminum body panels on Ford’s F-150 pickups and three times as thick as the steel body panels used on conventional mainstream full-size pickups.**



Wards collaborated with the AISI on the survey and questions, which looked not just at future materials use but also cost factors and how changing automotive technology will impact the allocation of future research and development resources. When asked “Where is your company concentrating the majority of R&D and engineering resources?”, 42% of OEM respondents checked battery-electric vehicles and only 18% said lightweighting. Almost all respondents (94%) reported the new focus on making electrification and self-driving technologies has had an impact on the funding of activities like body & chassis engineering and R&D, including 46% who report it has had a major impact. “These responses reinforce what AISI has seen in the industry, with 94% confirming that electrification and automated driving technologies are impacting core functions of R&D, body and chassis engineering,” said Jody Hall, AISA vice president-Automotive Program. “This diversion of resources makes it even more critical that automakers have reliable materials like advanced high-strength and 3rd Gen steels and manufacturing processes to ensure mass efficient, safe and durable vehicle architectures.” A thought-provoking question asked relates to managing EV performance and emissions strategies: “If the cost of EV batteries and the cost of watts per kilowatt hour continue to decrease, will automakers stop paying a premium for lightweighting to increase range?” Responses were mixed here. Suppliers tend to think OEMs will never pay extra for anything, but there are instances where automakers do pay premiums for lightweight materials. Ford’s aluminum-intensive F-150 is a key example (although no other pickup manufacturer has followed suit) and the new cost-sensitive C8 Corvette has at least one major carbon-fiber structural part. When asked about the three principal drivers of materials portfolios, by far cost was the most popular response, followed by mass/weight and durability.

AUTOMOTIVE: GM CRUISE REVEALS NEW ROBOTAXI - TOASTER-SHAPED, NO STEERING WHEEL

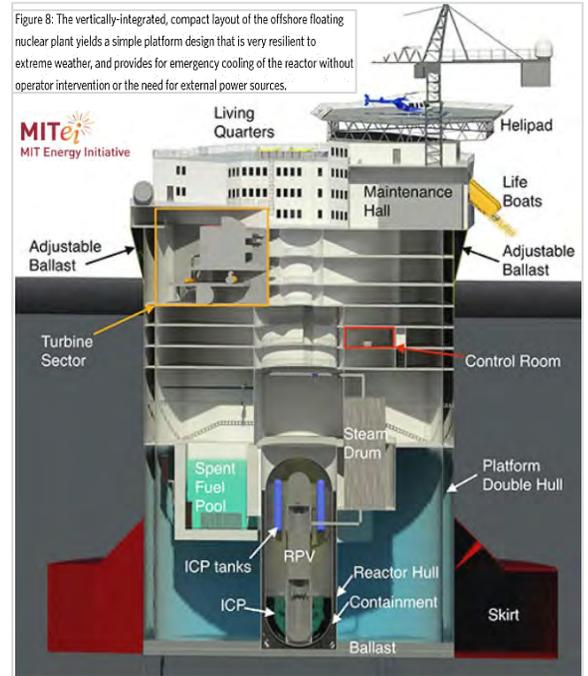
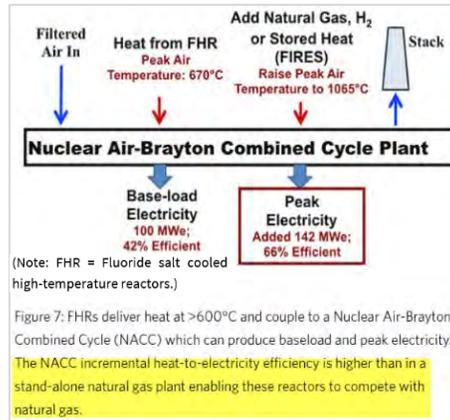


General Motors’ autonomous car unit, Cruise, revealed a toaster-shaped robot taxi that it says will be cheaper than taking a human-driven, ride-hailing service or driving a car. The company said the all-electric vehicle, called Cruise Origin, is a fully engineered vehicle that’s on its way to production. The Origin would be a driverless vehicle, without a steering wheel and featuring passenger seats facing each other. The white-and-orange model displayed had a roomy interior, seats for six and doors that slide open like an elevator. While it looks big, the vehicle takes up the footprint of an average car. It was engineered with backup sensors, computing and other critical features. . **GM executives**

have said the market for autonomous ride-hailing could exceed \$1 trillion and have suggested that profits from a future service could exceed that of GM’s traditional vehicle-manufacturing business. GM has said it was on pace to spend about \$1 billion on Cruise last year. Cars without steering wheels can’t legally be on public roads today. The industry is still working on technical and safety issues associated with introducing driverless technology. GM will build the vehicles, while Cruise plans to own and operate them within its own ride-hailing service. Driverless-car developers have pressed federal regulators for rules that would let them deploy vehicles without traditional steering wheels or foot pedals—equipment designed for human drivers but not needed in a self-driving car. A bill that stalled in Congress last year would have directed regulators to set requirements for autonomous vehicles. A bipartisan group of lawmakers in Congress is drafting another bill, staffers say, but the lack of direction from the federal government is challenging for car companies and startups trying to advance the technology. Two years ago, GM asked the National Highway Traffic Safety Administration for a waiver to rules that require manual vehicle controls like brakes and steering wheels. The agency hasn’t ruled on the request.

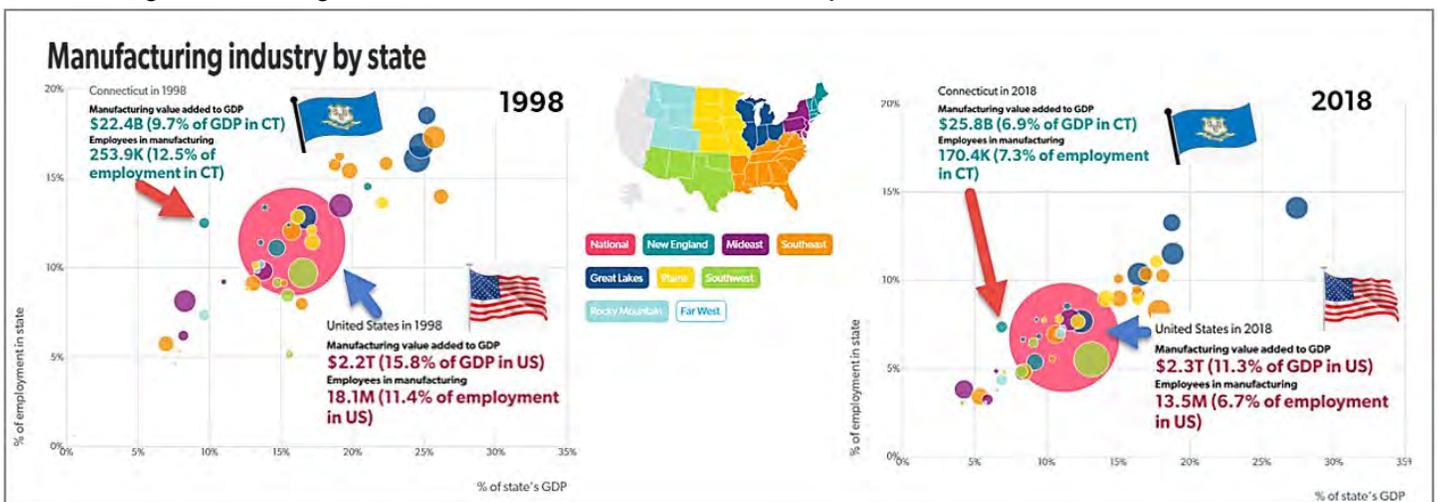
ENERGY: OFFSHORE FLOATING NUCLEAR PLANTS - SAFER, LESS EXPENSIVE AND EASIER TO DEPLOY

Offshore floating nuclear plants promise to be safer, less expensive and easier to deploy than today's land-based plants. Currently, building a nuclear plant is a long and expensive process plagued by site concerns such as sourcing water for cooling and providing for the safety of the neighboring population. **An offshore strategy developed at MIT proposes situating reactors in relatively deep water far away from coastal populations, linked only by an underwater power transmission line.** Building nuclear plants in shipyards, like deep-sea oil platforms, would make it possible to use greatly streamlined methods of construction and significantly cutting costs. In addition, offshore siting minimizes safety concerns by eliminating risks of earthquakes and tsunamis as accident initiators, access to the essentially infinite ocean heat sink and ensuring no one resides within the plant's emergency planning zone.



MANUFACTURING: THE DIMINISHING ROLE OF MANUFACTURING IN THE AMERICAN ECONOMY

The phrase “Made in America” carries significance across the county, but the role manufacturing plays in the American economy has decreased in the past few decades. Manufacturing’s smaller role is apparent in all but a few states and subsectors of the industry. In 2018, 13.5 million people were employed full- or part-time in American manufacturing or 6.7% of all jobs. The manufacturing industry accounted for \$2.3 trillion in American gross domestic product (GDP), or 11% of the whole. While the 2018 GDP and employment numbers are up from the 2009 Great Recession, manufacturing’s share of the economy is down. In 2009, 12.5 million people worked in manufacturing, or 7% of all employment, with the industry adding \$2.0 trillion (accounting for inflation) to the GDP or 12% of the total. The decline of the manufacturing sector in the U.S. economy is greater looking back further in time. **In 1998, there were 18.1 million manufacturing jobs, 11% of total jobs and 5.6 million more than in 2018. In addition, while total GDP increased 47% from 1998 to 2018, the manufacturing sector increased just five percent. In 2018, manufacturing was the third-largest contributor to GDP after government and real estate.** However, while the industry remains a large segment of the American economy, the data shows that the manufacturing sector has not grown at the same rate as the rest of the economy.





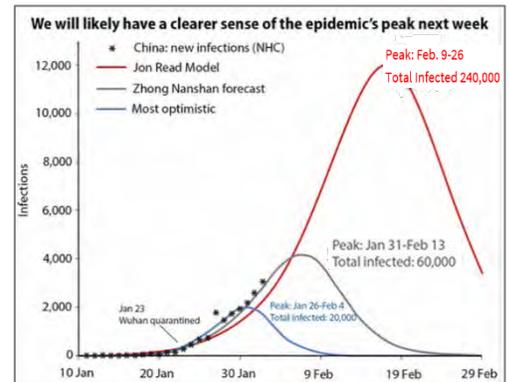
MEDICAL: EPIC PUSHES OUT SOFTWARE UPDATE TO HELP SPOT CORONAVIRUS

It's a virus scientists have never seen before. Health officials don't know exactly where it came from, but it has traveled more than 7,000 miles since it was discovered late in December in central China. New infections are confirmed every day despite an unprecedented quarantine. The death toll is rising, too. It is a coronavirus, which makes it a relative of the pathogens that cause severe acute respiratory syndrome, or SARS, and Middle East respiratory syndrome, or MERS. Those diseases have sickened thousands of people around the world and caused hundreds of deaths. **Responding rapidly, Epic sent out an update to its healthcare customers, meant to help providers nationwide detect potential cases of the Wuhan novel coronavirus, or 2019-nCoV.** (Epic Systems Corporation, or Epic, is a privately held healthcare software company. According to the



Coronavirus (photo: National Institutes of Health)

company, hospitals that use its software hold medical records of 54% of patients in the U.S.) Epic standardized a new travel screening questionnaire in an effort to ensure clinicians and other front-line medical staff ask patients about recent international travel. **If patients say they have traveled from China or show symptoms consistent with Wuhan novel coronavirus, providers are now advised to start isolation precautions to help contain potential infection.** Epic says this new update was developed in collaboration with biocontainment experts and infectious disease physicians with guidance from the U.S. Centers for Disease Control. In late January, the Epic Travel and Communicable Disease Advisory Board, which comprises infectious disease clinicians practicing at healthcare organizations using Epic, started discussing updates to the travel screening in Epic to detect possible cases of 2019-nCoV. Members of the advisory board include experts at Providence St. Joseph Health in Washington State, which, upon treating the first 2019-nCoV case in the U.S., quickly turned on an electronic prompt for doctors and nurses to ask travel screening questions. The board determined that healthcare organizations will automatically get the new coronavirus alert within Epic's travel screening activity. Rapid response to an outbreak is critical to contain it. The World Bank estimates that 90% of the economic damage from health epidemics stems from people's fear of associating with others. If that's right, the world economy should brace itself for the impact of the Wuhan coronavirus.



MEDICAL: CES 2020 - MOBILE HEALTH DEVICES AND WEARABLES TREND ACCELERATING THIS YEAR

The mobile health devices and wearables trend appears to be accelerating this year, with 546 digital health and 635 wearable devices being touted at the annual Consumer Electronics Show in Las Vegas. Digital health devices and wearables on display were up from the 505 and 620 devices, respectively, presented at CES 2019. Health and medical devices shown included surgical robots for microsurgery,



handheld electric stimulation devices for pain relief and non-invasive diabetes alert systems. **NightWatch touted its epilepsy detection wearable.** The device is a bracelet that is worn on the upper arm during sleep that can alert caregivers of possible epileptic seizures that could result in unexpected death. The device detects tonic seizures, tonic-clonic seizures, hyper motion seizures and clustered myoclonic seizures, and closely monitors heart rate and motion while users are lying down. NightWatch features an audio and visual alert system with alarms that can be forwarded to cellphones

and call systems. It can be connected to the NightWatch Portal where users can see a readout of a wearer's heart rate and motion data.

AerBetic showcased a wearable, non-invasive diabetes alert system that employs nanotechnology-based gas sensors. The nano-gas sensors test exhaled breath to identify diabetic status. When paired with a smartphone app or text notification, the device can push visual and haptic cues to caretakers to remotely safeguard users. AerBetic uses inputted glucose levels to continuously learn over time and fine-tune alerts to a patient. **UrgoTech's**

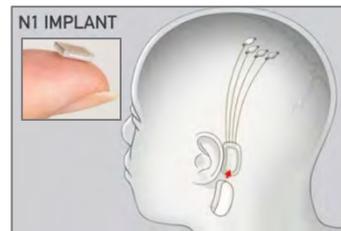
UrgoNight sleep training system trains the brain to produce brainwaves that are clinically associated with sleep. The device gives people who have problems falling and staying asleep a drug-free way to naturally improve quality and duration of sleep. UrgoNight features a wearable electroencephalogram headband and accompanying app to help people naturally learn to increase brainwaves that can impact sleep. It uses neurofeedback therapies with real-time displays of brain activity, audio and visual cues to teach people to identify and modify behavior.





INNOVATION: NEURALINK UNVEILS BRAIN-IMPLANT TECHNOLOGY TO BRING MEDICAL ADVANCES

Neuralink, the Elon Musk-backed company seeking to build brain implants to communicate with machines, hopes to begin trials on human patients by the end of 2020. **The CEO of Tesla and SpaceX said the ultimate goal of Neuralink is to allow humans to achieve “a sort of symbiosis with artificial intelligence”.** Musk said humans risk being overtaken by AI-equipped machines, but **“if the brain can be enhanced with computer connectivity, we can go along for the ride”.** The company has begun testing on rats and is working with the University of California, Davis on monkeys. “A monkey has been able to control a computer with its brain,” he said. Neuralink is just one player in an emerging field that could enhance human functionality or equip paraplegics with robots they could control with their minds. Others include Facebook and CTRL-labs, the Amazon Alexa Fund-backed start-up that is trying to take a less invasive approach by focusing on neural signals anywhere on the body. Neuralink intends to insert proprietary chips and information strips it calls “threads” into people’s brains, which it said could bring huge medical advances. “I’ve been humbled by how helpless we are treating neurological diseases,” said Matthew MacDougall,



Neuralink's sewing machine-like robot

Neuralink’s head surgeon. “We have the potential, for the first time in history, to solve some of these problems.” Executives said their first emphasis will be to help patients with severe brain disorders, but the goal of the company is to design a miniature, wireless implant that ordinary individuals would elect to install — something more like Lasik eye surgery, said Dr MacDougall, and then control it through an iPhone app. He spoke of communication via thought alone and of restoring motor and sensory functions, such as giving sight to the blind. The company said one of its biggest achievements to date was the design of a robot capable of rapidly and precisely implanting into the brain hundreds of “threads” — information strips thinner than human hair — which could “increase by orders of magnitude the number of neurons you can read from and write to in safe, long-lasting ways”. The start-up has a proprietary 4mm sensor, called the N1, which it seeks to implant into the brain and then connect to a device a person would wear behind the ear. Max Hodak, Neuralink’s president, said the company will seek approval from the FDA to start clinical trials on humans as early as this year. The company said it has performed at least 19 surgeries on animals to insert its “threads”. Hodak acknowledged that the pathway to development would be long and would require tremendous outside help and academic partnerships.

INNOVATION: REDUCING SINGLE-USE PACKAGING WITH TERRACYCLE’S LOOP AND STAINLESS STEEL

Reducing single-use packaging and increasing recycling of some of the biggest global brands is taking a big leap forward with TerraCycle’s Loop, a new zero waste platform. Stainless steel has a key role with its durability and sterilizing properties. TerraCycle has been working with major companies like P&G, Nestlé, PepsiCo, Unilever and others to develop the new platform. This initiative aims to establish a new model of consumption that ends society’s dependence on disposability and eliminates the idea of waste. It supports responsible consumption with clear benefits to consumers, businesses, governments and the environment. **Loop is now available in Paris and parts of the U.S., including NJ, PA, DE, VT, CT and RI.** Residents in serviced areas are able to buy items like ice cream and shampoo in sleek, stainless steel containers. UPS is partnering on the initial pilot to both deliver orders and pick up empty containers. Currently, products are available solely through Loop’s e-commerce site. The order is delivered in a reusable tote, designed by engineers at UPS to withstand repeated journeys. When products are used up, the empty containers are put back in the

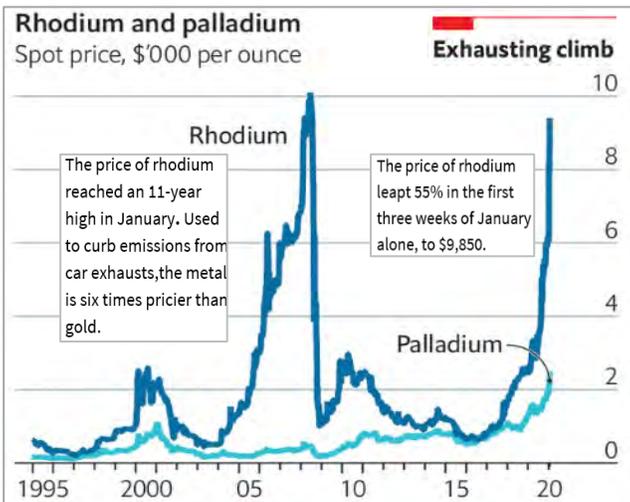


reusable tote. The tote will be picked up or may be dropped off when full, and delivered to a cleaning and sterilization facility. With the largest brands now acknowledging that current packaging practices need this kind of revolution, there will be great interest in seeing whether this model can be proven to work in today’s world. Stylish stainless steel packaging is being developed to play a key role in convincing consumers to make this significant change in their consumption and recycling habits. From refillable deodorant to ice cream that remains frozen, to diaper and hygiene product bins that filter out unpleasant odors, each package is designed for 100 or more uses. Through its pilot programs, Loop will test how the system works, including the durability of containers, the impacts on manufacturing operations, delivery and whether consumers reorder products this way. Loop currently ships around 100 products with plans to increase the number to 300-400 in the near

future. Loop products will eventually be in brick-and-mortar stores, positioned next to similar products with single-use packaging. Loop is expanding. **The objective is to have the entire world ‘in the Loop’ and stainless steel will make those journeys possible.**



METALS: COMMODITY PRICES – NICKEL, ALUMINUM, COPPER, IRON ORE, RHODIUM AND PALLADIUM



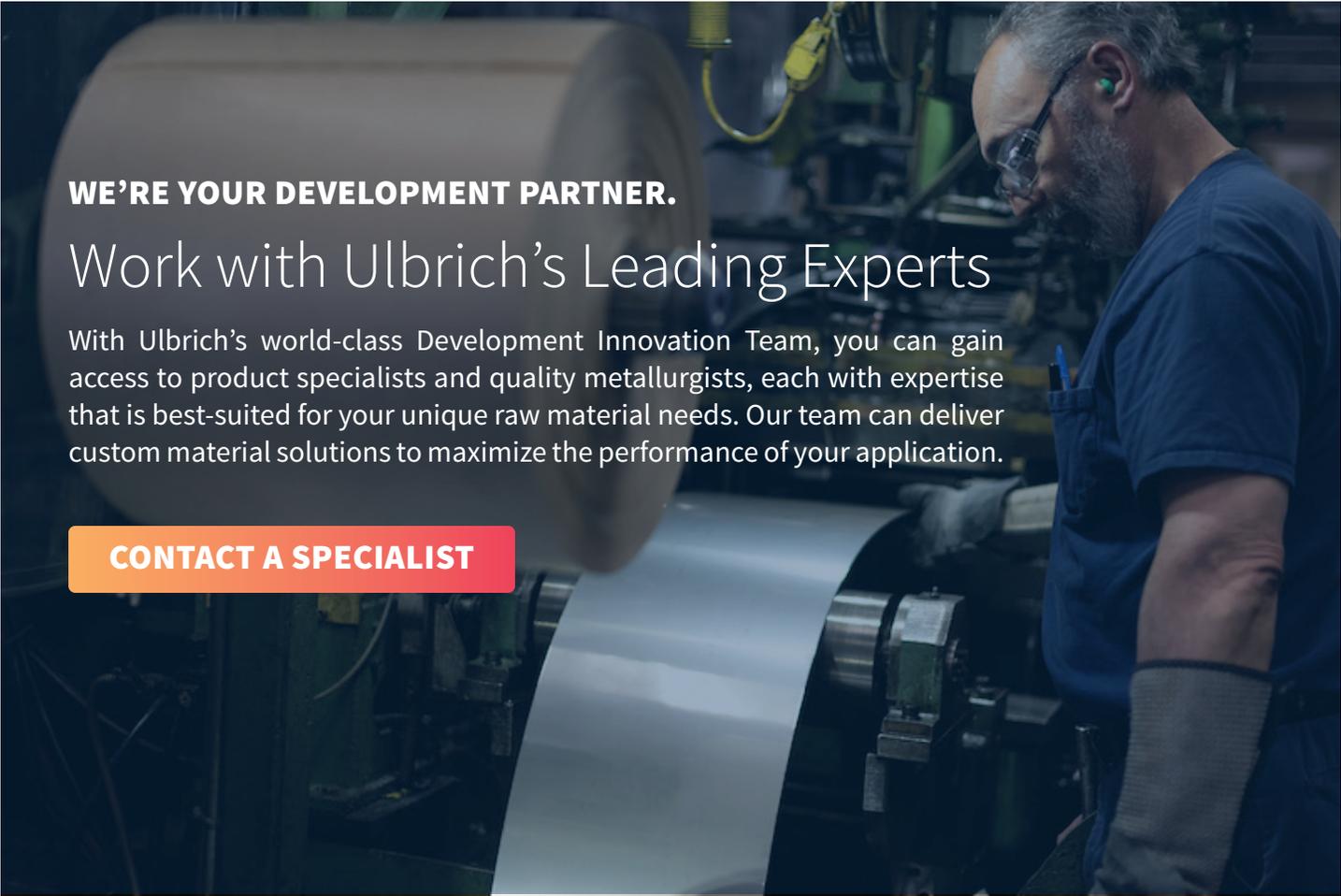
COMMODITIES: APPLE'S ROBOT BREAKS APART IPHONES TO RECYCLE MINERALS

Apple is planning to become a "closed-loop" manufacturer that does not completely rely on the mining industry and it is going some of the way with its "Daisy" robot. **The device breaks apart 200 old iPhones per hour so that 14 minerals, including lithium, can be extracted and recycled.** With the rising popularity of electric vehicles, newly mined minerals will be needed on an even larger scale, and Apple recognizes that reality. "We're not necessarily competing with the folks who mine," explained the company's head of environmental policy. "There's nothing for miners to fear in this development." Apple is already using recycled tin, cobalt and rare earths in some of its products, with plans to add to that list. In December, the company bought the first commercial batch of carbon-free aluminum from a joint venture between Rio Tinto and Alcoa. Daisy, less than 20 yards in length, uses a four-step process to remove an iPhone battery with a blast of 176°F air, and then pops out screws and modules, including the haptic module that makes a phone vibrate. The components are then sent off to recyclers for the minerals to be extracted and refined.



Daisy – Apple's new iPhone recycling robot

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