

## Bookings Down -15.3% in November Backlog Declines by \$2.5 Billion

### Regional Performance:

World sales are up +8.3% YTD in November, with North America achieving the highest growth at +16.4%.

Worldwide, orders were down -2.8% YTD. Japan has had the worst performance at -11.8% YTD.

### Industry Outlook:

With soft order demand, Bishop's 2022 sales forecast remains at \$83,822 million, up +7.5% over 2021 sales.

### Industry Backlog:

November backlog was down \$2,548 million from October as the industry ships their orders off the books with little backfill.

### 2022 Currency Impact:

The industry grew +8.3% YTD in November in USD and 0% in local currencies. Sales growth is 8.3 percentage points lower when stated in local currencies.

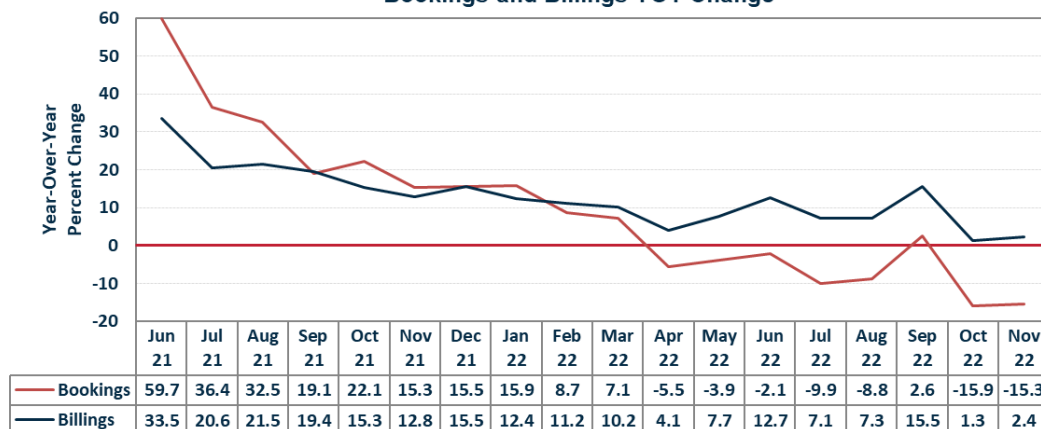
### Merger and Acquisition Services

#### Buy & Sell-Side

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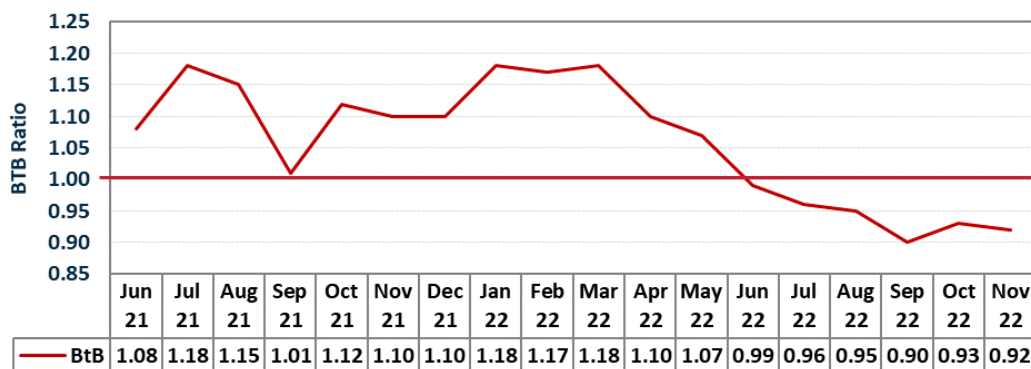
November bookings were down -15.3%. Billings were up +2.4%, continuing a 27-month string of growth. Bookings, however, have been generally trending down. The backlog decreased by \$2,548 million in November to approximately 14.5 weeks due to declining orders and shipments in the quarter.

Bookings and Billings YOY Change



The book-to-bill ratio in November was 0.92 and YTD was 1.01.

Connector Industry Book-to-Bill

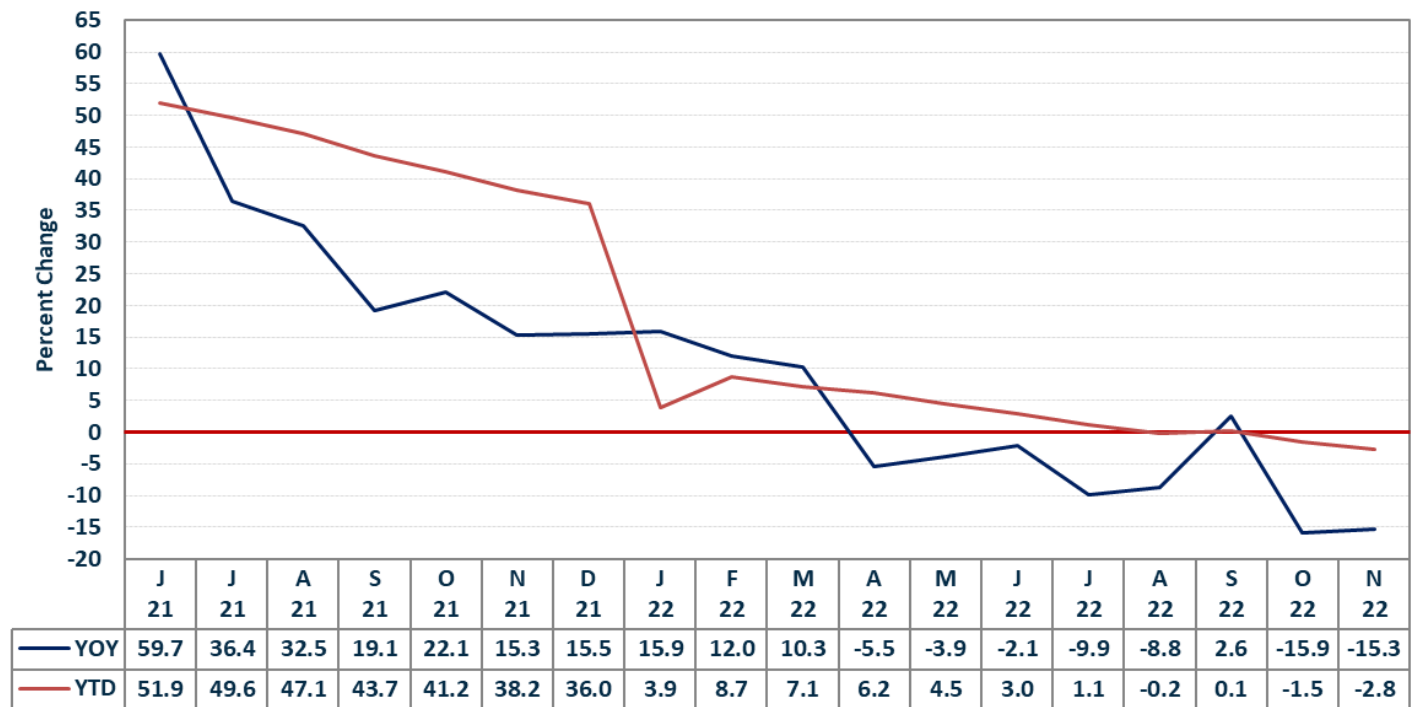


## Booking Highlights and Conclusions

### Sequential, Year-Over-Year, and Year-To-Date Bookings Percentage Change – 2020/2021/2022

Month	Sequential			Year-Over-Year			Year-To-Date		
	2020	2021	2022	2020	2021	2022	2020	2021	2022
Jan	0.2%	2.3%	2.6%	3.9%	24.7%	15.9%	3.9%	24.7%	15.9%
Feb	5.5%	17.7%	10.4%	1.8%	38.9%	8.7%	2.8%	32.0%	12.0%
Mar	-1.4%	-3.5%	-5.3%	5.0%	34.5%	7.1%	3.5%	32.8%	10.3%
Apr	-27.2%	3.2%	-8.5%	-21.8%	81.9%	-5.5%	-2.7%	42.9%	6.2%
May	2.9%	5.1%	7.0%	-24.8%	86.4%	-3.9%	-7.3%	50.5%	4.5%
Jun	7.0%	-8.3%	-6.7%	-11.6%	59.7%	-2.1%	-8.0%	51.9%	3.0%
Jul	15.2%	-1.9%	-9.6%	-1.0%	36.4%	-9.9%	-7.0%	49.6%	1.1%
Aug	10.7%	6.6%	8.0%	1.8%	32.5%	-8.8%	-5.8%	47.1%	-0.2%
Sep	-0.9%	-11.9%	-1.0%	8.4%	19.1%	2.6%	-4.3%	43.7%	0.1%
Oct	4.7%	6.8%	-12.4%	13.0%	22.1%	-15.9%	-2.6%	41.2%	-1.5%
Nov	15.2%	9.3%	10.2%	17.5%	15.3%	-15.3%	-0.6%	38.2%	-2.8%
Dec	-7.2%	-7.0%		18.3%	15.5%		1.0%	36.0%	

### Bookings - YOY and YTD



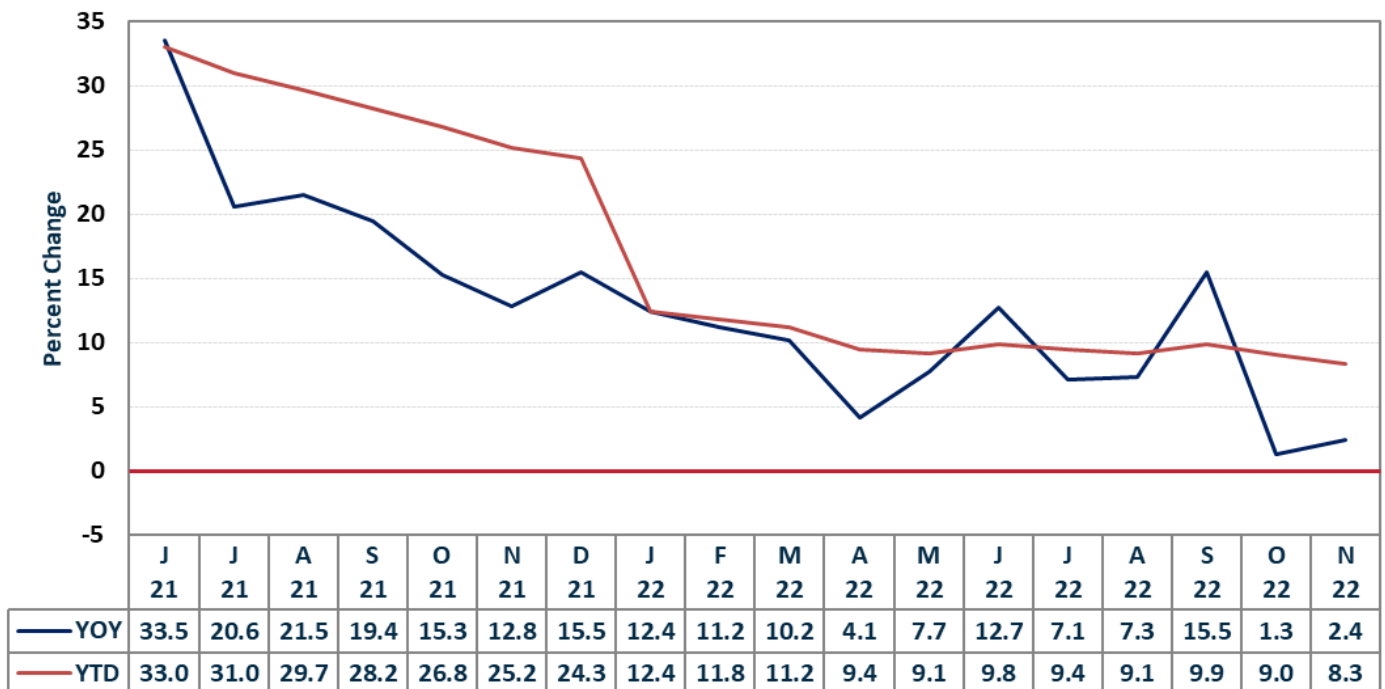
- November bookings decreased -15.3% YOY. Bookings are down -2.8% YTD.
- Orders increased +10.2% sequentially.
- The book-to-bill ratio for November was 0.92. The YTD ratio is 1.01.

## Billing Highlights and Conclusions

### Sequential, Year-Over-Year, and Year-To-Date Billings Percentage Change – 2020/2021/2022

Month	Sequential			Year-Over-Year			Year-To-Date		
	2020	2021	2022	2020	2021	2022	2020	2021	2022
Jan	-2.8%	-1.6%	-4.3%	-3.1%	19.0%	12.4%	-3.1%	19.0%	12.4%
Feb	5.5%	12.6%	11.4%	-4.3%	26.7%	11.2%	-3.7%	22.9%	11.8%
Mar	-0.9%	-1.1%	-2.0%	-2.0%	25.5%	10.2%	-3.1%	23.8%	11.2%
Apr	-21.2%	-1.2%	-6.6%	-19.9%	49.5%	4.1%	-7.2%	29.4%	9.4%
May	8.8%	7.0%	10.7%	-20.0%	47.1%	7.7%	-9.9%	32.8%	9.1%
Jun	5.8%	-3.8%	0.7%	-11.6%	33.5%	12.7%	-10.2%	33.0%	9.8%
Jul	9.0%	-2.0%	-7.1%	-1.6%	20.6%	7.1%	-9.0%	31.0%	9.4%
Aug	9.0%	8.7%	8.9%	-0.3%	21.5%	7.3%	-7.8%	29.7%	9.1%
Sep	1.7%	-2.3%	5.1%	5.0%	19.4%	15.5%	-6.3%	28.2%	9.9%
Oct	-1.0%	-3.4%	-15.3%	7.6%	15.3%	1.3%	-4.9%	26.8%	9.0%
Nov	11.4%	9.4%	10.7%	9.1%	12.8%	2.4%	-3.6%	25.2%	8.3%
Dec	-7.7%	-5.6%		13.4%	15.5%		-2.2%	24.3%	

### Billings - YOY and YTD

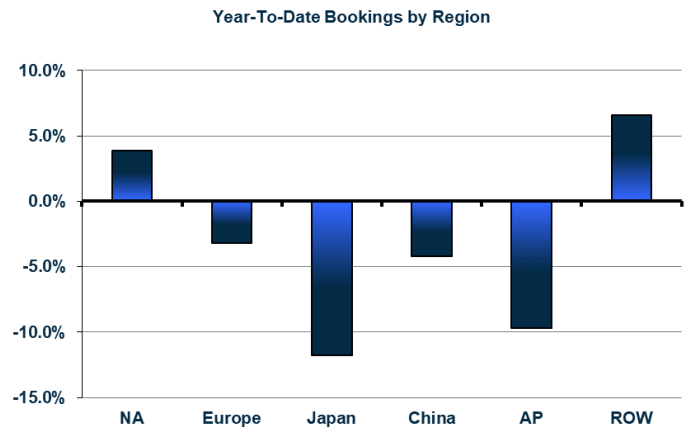


- November billings increased +2.4% YOY. YTD, billings are up +8.3%.
- Sequentially, billings increased +10.7% in November.

## Regional Performance: BOOKINGS

### November 2022 Bookings

Region	Sequential	YOY	YTD
NA	6.9%	-9.5%	3.8%
Europe	15.9%	-11.9%	-3.2%
Japan	0.8%	-26.6%	-11.8%
China	5.0%	-18.7%	-4.2%
AP	20.5%	-23.8%	-9.7%
ROW	15.6%	3.1%	6.6%
Total	10.2%	-15.3%	-2.8%

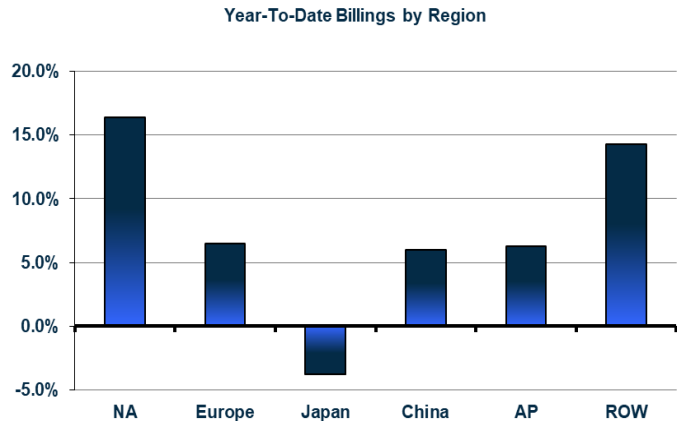


- November bookings decreased -15.3% YOY.
- All regions except ROW declined YOY, with all but North America exhibiting double-digit declines.
- Japan's YOY growth was down the most at -26.6%.
- The book-to-bill ratio was 0.92.

## Regional Performance: BILLINGS

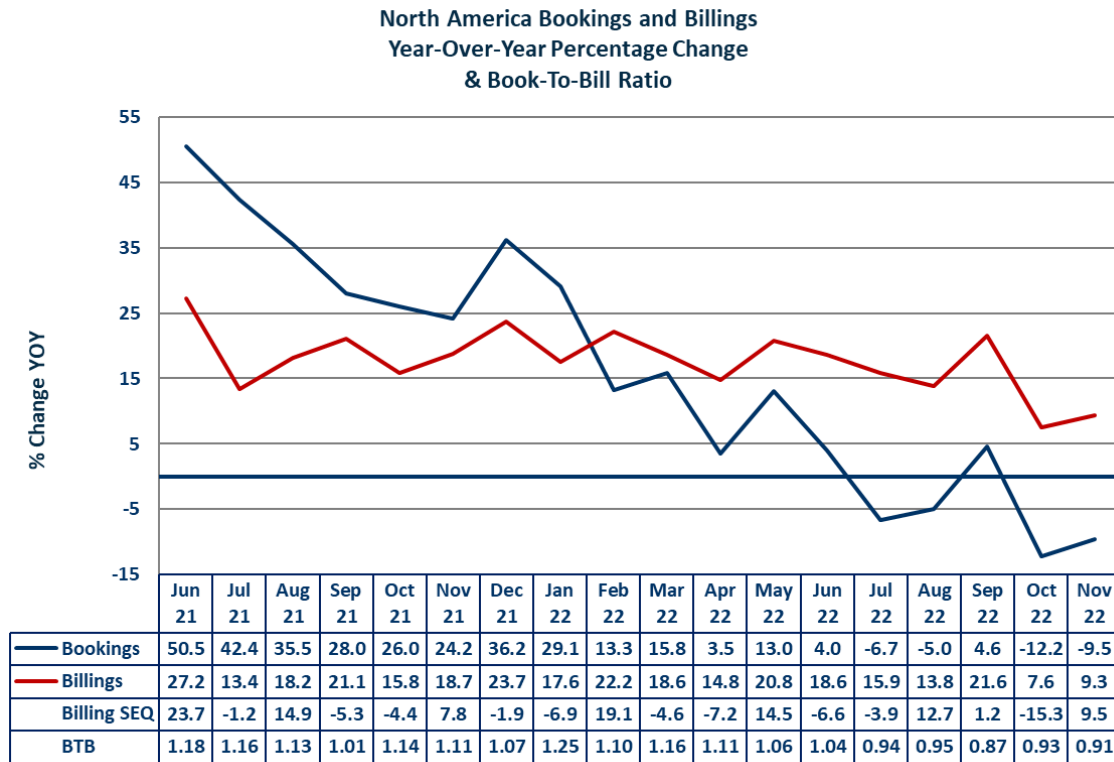
### November 2022 Billings

Region	Sequential	YOY	YTD
NA	9.5%	9.3%	16.4%
Europe	15.9%	3.1%	6.5%
Japan	8.3%	-9.9%	-3.8%
China	8.2%	0.1%	6.0%
AP	9.9%	-2.9%	6.2%
ROW	6.7%	7.3%	14.3%
Total	10.7%	2.4%	8.3%



- November connector sales increased +2.4% YOY, making this the 27th consecutive month of sales growth.
- Sales are up +8.3% through November, but we expect continued slowing of demand in December. Full year 2022 will probably result in growth around +7.5%.
- All regions grew sequentially.
- Even though industry growth is +8.3% year-to-date, performance in local currencies is 0% (see page 15). Given the 8.5% average inflation rate in US dollars, this means that growth measured in units is likely negative.

**North America:** The following chart displays the year-over-year percentage change in bookings and billings for the last 18 months. The monthly book-to-bill (BTB) ratio is also displayed.



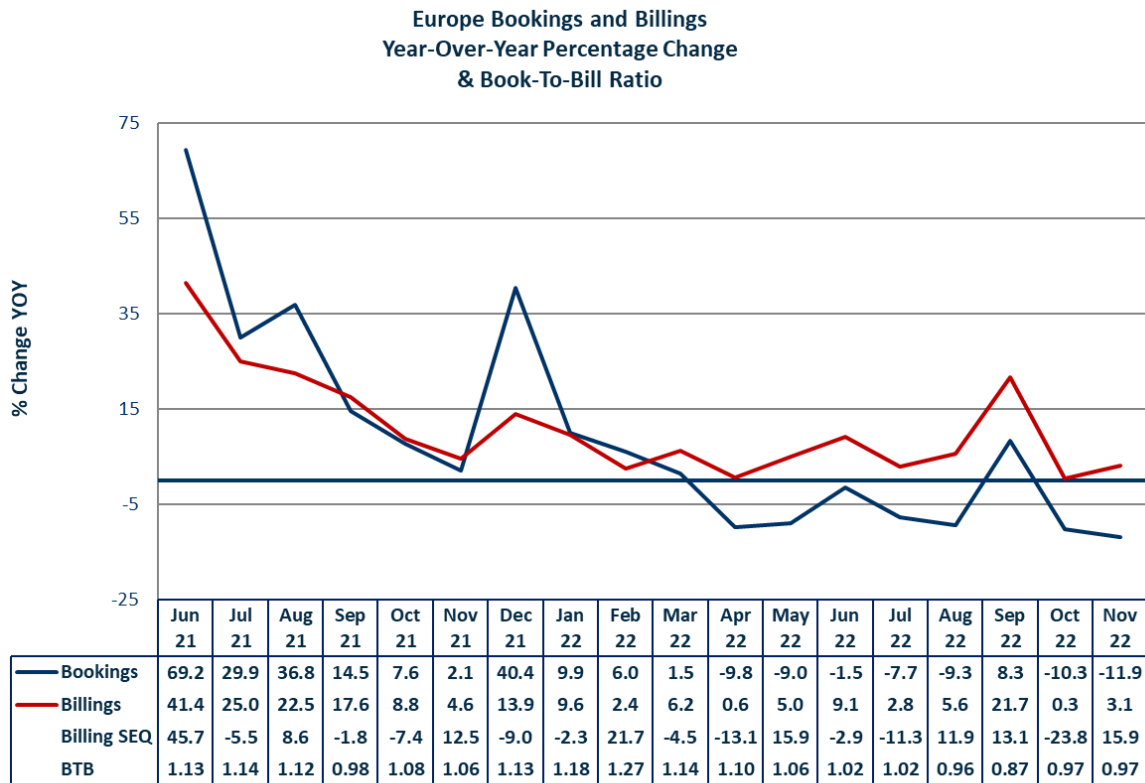
## North America Performance

- Sales grew +9.3% and orders were down -9.5% YOY in November. North American billings were up sequentially +9.5%. The book-to-bill was 0.91.
- The regional economic numbers will be included in the January report. Many regions have not yet reported their numbers this early in the month.

## Conclusions

Higher prices/inflation, continuing supply chain issues, rising interest rates, an unstable financial market, and the situation in Ukraine are a few of the headwinds. The production of new vehicles is still slow due to the shortage of semiconductors. China's "zero COVID" initiative is continuing to hamper manufacturing and logistics worldwide. These issues are negatively impacting the connector industry worldwide.

**Europe:** The following chart displays the year-over-year percentage change in bookings and billings for the last 18 months. The monthly book-to-bill ratio is also displayed.



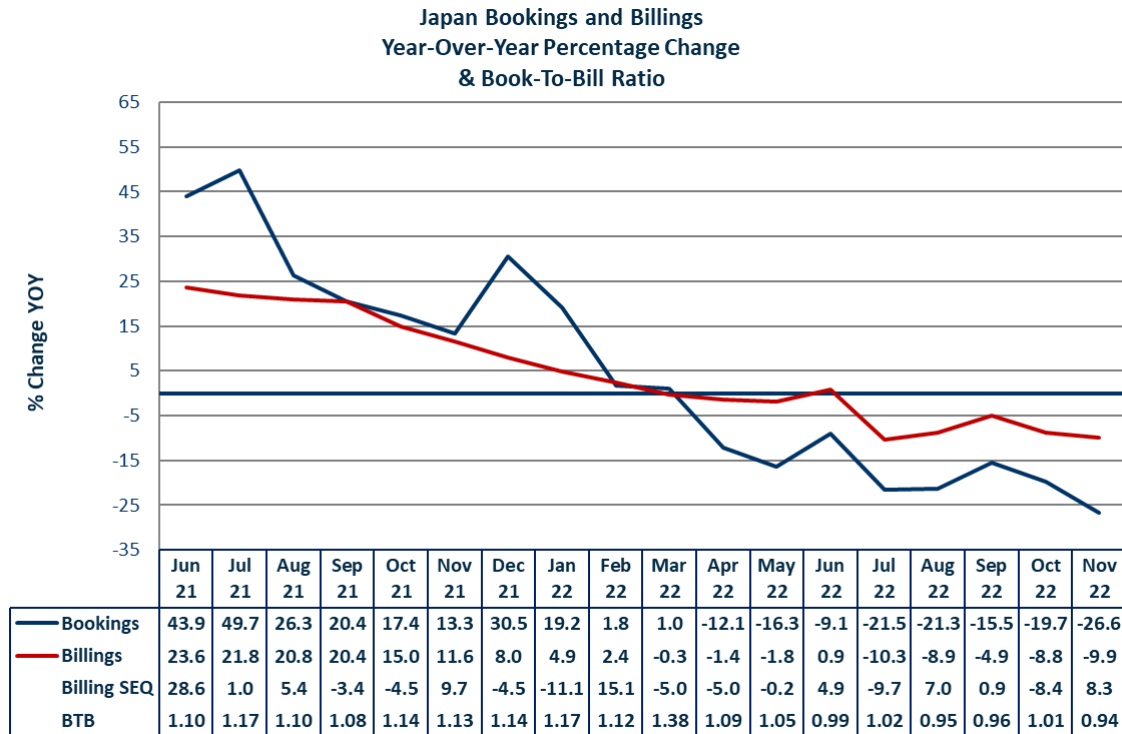
## Europe Performance

- YOY billings were up +3.1% and orders were down -11.9%. The book-to-bill ratio was 0.97. Sequentially, sales were up +15.9%.
- The regional economic numbers will be included in the January report. Many regions have not yet reported their numbers this early in the month.

## Conclusions

The connector industry appears to be headed for a difficult 2023 in Europe given the ongoing semiconductor shortages, possible energy rationing, high inflation, the situation in the Ukraine, and supply chain issues that will likely continue.

**Japan:** The following chart displays the year-over-year percentage change in bookings and billings for the last 18 months. The monthly book-to-bill ratio is also displayed.



## Japan Performance

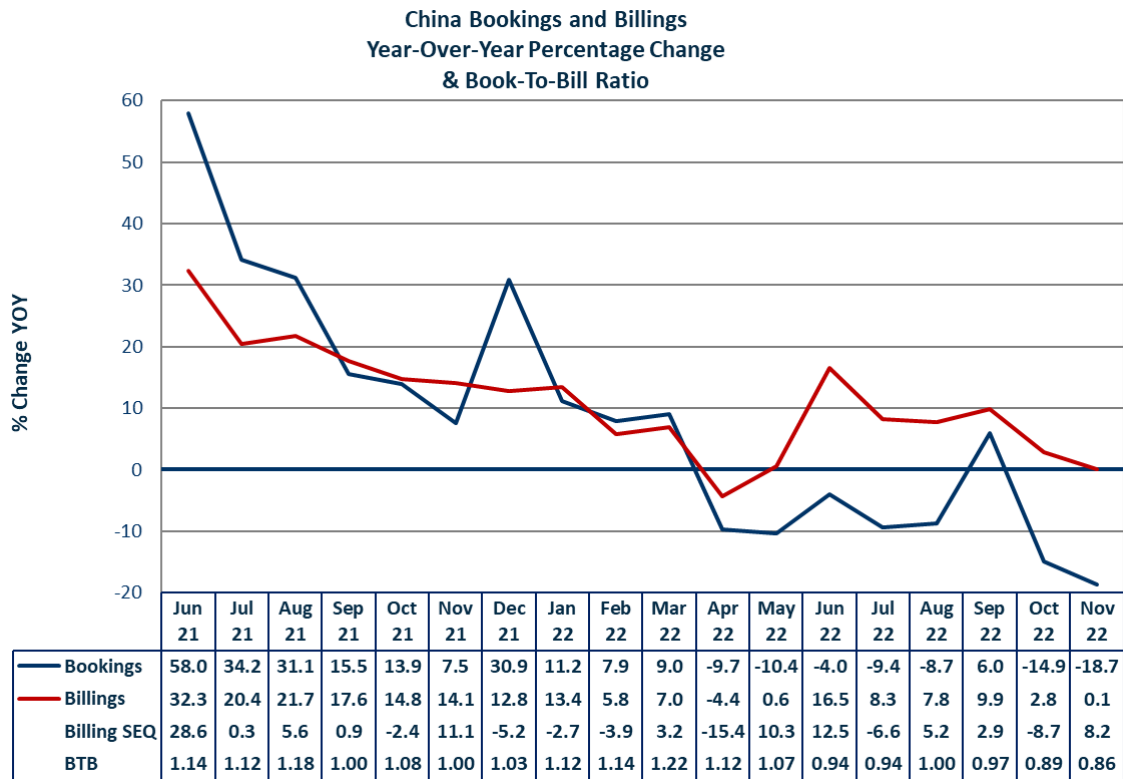
- Bookings were down -26.6% in November. Sales declined -9.9%, and sequentially were up +8.3%. Japan's book-to-bill ratio was 0.94.
- The regional economic numbers will be included in the January report. Many regions have not yet reported their numbers this early in the month.

## Conclusions

The shortage of semiconductors has held back growth in automotive industry sales in 2022. Billings have been weak for the last eight months primarily due to the devaluation of the yen against the US dollar.



**China:** The following chart displays the year-over-year percentage change in bookings and billings for the last 18 months. The monthly book-to-bill ratio is also displayed.



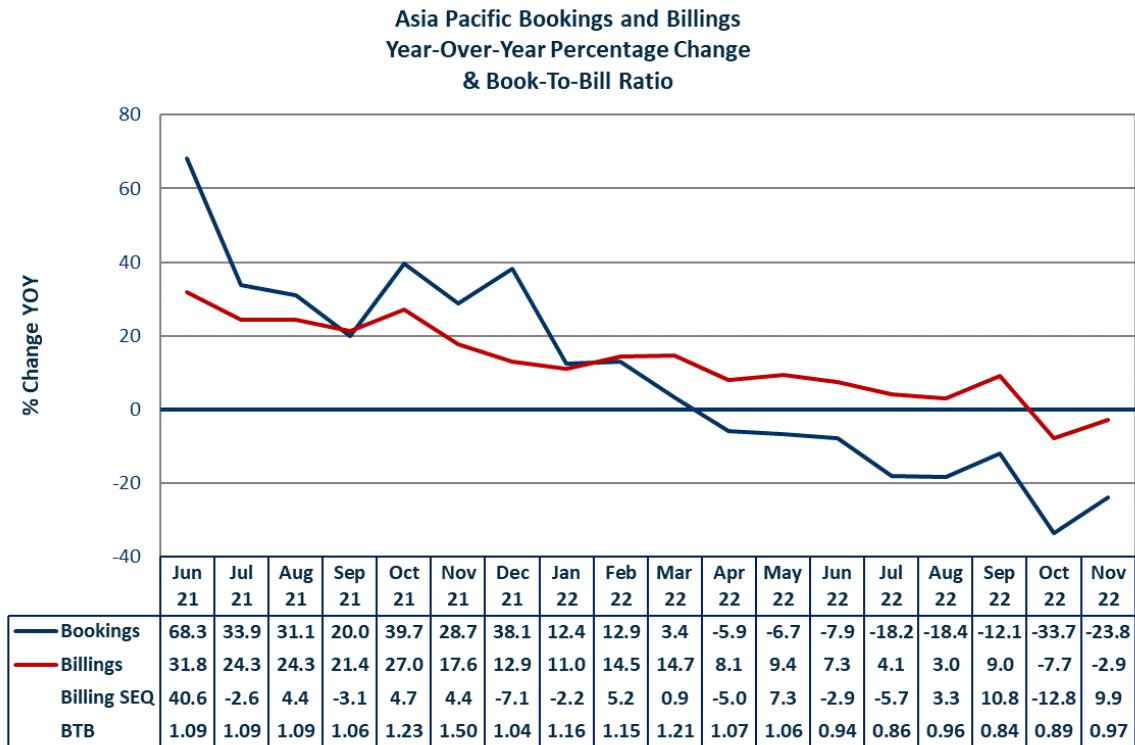
## China Performance

- China's sales increased +0.1% YOY and orders decreased -18.7% YOY. The BTB was 0.86, which is a record low for China. Sequentially, sales increased +8.2% in November.
- The regional economic numbers will be included in the January report. Many regions have not yet reported their numbers this early in the month.

## Conclusions

As has been noted in the past, China's economy is slowing. Their headwinds include slowing sales domestically and internationally; recurring outbreaks of COVID variants (and strict lockdowns); supply chain issues; material shortages; power shortages; and political disagreements within the CCP. They have already stated that they do not believe they will achieve their GDP goals for 2022. These headwinds are already affecting the growth of the Chinese connector industry in 2022 and will likely affect them in 2023.

**Asia Pacific:** The following chart displays the year-over-year percentage change in bookings and billings for the last 18 months. The monthly book-to-bill ratio is also displayed.



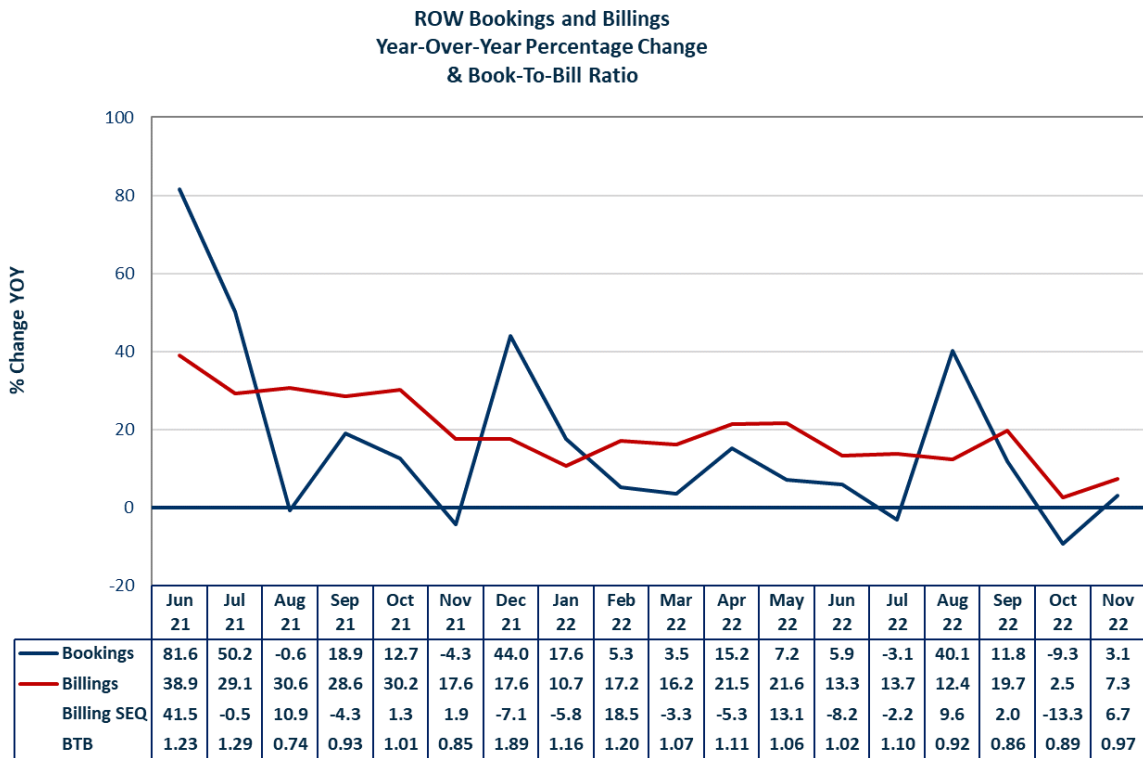
## Asia Pacific Performance

- Orders were down -23.8% in November and sales decreased -2.9% YOY. The book-to-bill ratio was 0.97. Sequentially, sales increased +9.9%.
- The regional economic numbers will be included in the January report. Many regions have not yet reported their numbers this early in the month.

## Conclusions

India's and South Korea's economies continue to grow YOY but not robustly. South Korea's connector sales have a positive outlook with growth anticipated in the electronics and automotive industries. India's economic growth has been weak. India has a smaller connector market than South Korea, reducing the impact on regional connector sales.

**Rest of World:** The following chart displays the year-over-year percentage change in bookings and billings for the last 18 months. The monthly book-to-bill ratio is also displayed.



## Rest of World Performance

- Orders increased +3.1% and sales increased +7.3% YOY in November. Sequentially, sales in the region increased +6.7%. The book-to-bill ratio was 0.97.
- The regional economic numbers will be included in the January report. Many regions have not yet reported their numbers this early in the month.

## Conclusions

The region continues to experience growth within their connector industries. For the second time since November of 2020, YOY sales did not exhibit double-digit growth.

We anticipate that slowing economic growth in both countries will adversely affect connector growth in 2023. The black swan event for the region is Russia's invasion of Ukraine and the economic sanctions imposed by many NATO and Western countries on Russia. We anticipate a continued contraction of the Russian economy in the coming months although they are not a large connector market due in part to the majority of their connector sales being captive.

## Industry Backlog Shrinks \$2.5 Billion

The industry backlog was \$21,828 million at the end of November. This is down \$2,548 million from the October backlog of \$24,396 million. Based on the industry average weekly sales of \$1,502 million, we have 14.5 weeks of backlog.

The following table displays the industry backlog year-to-date November 2022. The industry has booked \$77,789 million and shipped \$77,459 million in 2022.

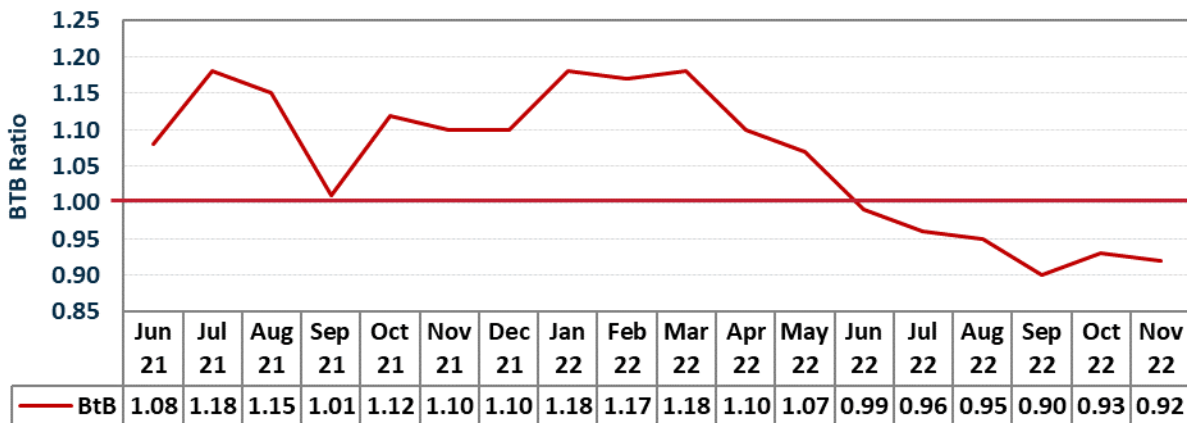
### Industry Backlog

	2021	YTD Nov 2022
BtB Ratio	1.14	1.01
Beginning Backlog	\$10,530	\$21,499
Bookings	\$88,910	\$77,789
Billings	\$77,991	\$77,459
Ending Backlog	\$21,499	\$21,828
Backlog in Weeks	14.3	14.5

\$ Millions

The industry has reported six consecutive months of below 1.0 book-to-bill ratios. This is shown in the following graph. November's BTB ratio is 0.92 to 1.0. Note that the backlog declined by \$2.5 billion but the weeks of backlog decreased to 14.5. This is because weekly shipments are also declining.

### Connector Industry Book-to-Bill



Since the end of May, the backlog has declined \$4,545 million.

## Ending Backlog Since May

Month	Ending Backlog	BTB Ratio
May	\$26,373	1.07
June	\$26,302	0.99
July	\$26,036	0.96
August	\$25,673	0.95
September	\$24,846	0.90
October	\$24,396	0.93
November	\$21,828	0.92

\$ Millions

It is evident that demand is slowing down:

- November sales were up only +2.4%. The sales increase was obviously the function of shipping backlog which declined by \$2,548 million in November.
- Semiconductor sales declined -3.0% in September and -4.6% in October. This is not a good sign for connector demand because semiconductors normally lead connector demand by a couple of months.

## **2022 Industry Outlook**

Connector sales were up +2.4% in November, making this the 27<sup>th</sup> consecutive month of monthly sales increases. However, November's sales growth was only slightly higher than October's +1.3% which was the slowest growth so far this year.

Another sign of slowing connector demand is the book-to-bill ratio has been below 1.0 for six consecutive months erasing \$4,545 million from the backlog.

Year-to-date world connector sales, however, are up 8.3%, ensuring that the industry will report a year with positive sales growth.

The following table displays our forecast for the full year 2022 growth of +7.5%. North America will have the best performance with growth of +13.6%.

**Bishop Forecast by Region**

Region	2021	2022	Percent Change
North America	\$16,484	\$18,719	13.6%
Europe	\$16,278	\$17,249	6.0%
Japan	\$5,276	\$5,173	-2.0%
China	\$24,978	\$26,494	6.1%
Asia Pacific	\$11,384	\$12,195	7.1%
ROW	\$3,590	\$3,993	11.2%
<b>Total World</b>	<b>\$77,990.6</b>	<b>\$83,821.7</b>	<b>7.5%</b>

\$ Millions

## **Strong U.S. Dollar Reduces Growth from 8.3% in USD to 0% in Local Currencies**

The dollar has been strengthening against the euro, the yen, and the yuan. The following table measures the impact for November 2021 versus November 2022 and shows results for these three currencies.

### **Local Currency to One USD November 2021 versus November 2022**

<b>Currency</b>	<b>2021</b>	<b>2022</b>	<b>% Change</b>
Euro	0.8764	0.9800	11.8%
Yuan	6.3910	7.1709	12.2%
Yen	114.0245	142.1990	24.7%

Europe, China, and Japan account for approximately 60% of world connector sales. Currency fluctuation against the US dollar can have a significant impact on our reporting of sales performance in US dollars.

The following table shows November YTD sales performance by region in US dollars and local currencies.

### **Industry Sales Performance YTD November 2022 USD-vs-Local Currencies**

<b>Region</b>	<b>U.S.\$</b>	<b>Local Currency</b>
North America	16.4%	16.4%
Europe	6.5%	-6.1%
Japan	-3.8%	-27.6%
China	6.0%	-6.9%
Asia Pacific	6.2%	6.2%
ROW	14.3%	14.3%
<b>World</b>	<b>8.3%</b>	<b>0.0%</b>

Connector sales are 8.3 percentage points lower when stated in local currencies rather than in US dollars, putting industry performance at 0% growth in November (versus +8.3% in US dollars). This is the result of a stronger US dollar, on average, compared to the three primary currencies. This clearly shows no real growth in Europe, China, and Japan in unit volume.

## **Significant Events**

### **Aptiv Completes the Acquisition of Intercable Automotive Solutions**

Aptiv PLC has completed the acquisition of an 85% equity stake in Intercable Automotive Solutions from Intercable S.r.l. As an industry leader in high voltage power distribution and interconnect technology, Intercable Automotive Solutions will enhance Aptiv's position as a global leader in vehicle architecture systems. The transaction is valued at €595 million, subject to customary post-closing adjustments, and is expected to be accretive to earnings per share starting in 2023.

"Intercable Automotive Solutions further strengthens our capabilities to design and deliver fully optimized high voltage architecture solutions that reduce vehicle weight, mass, and cost," said Kevin Clark, chairman and chief executive officer. "By leveraging Aptiv's global reach, Intercable Automotive Solutions will be able to expand its footprint and deliver innovative technologies to more customers worldwide. We are excited to welcome them to the Aptiv team."

Intercable Automotive Solutions will operate as a stand-alone business unit within Aptiv's Signal & Power Solutions segment and will continue to go to market under its current industry-leading brand.

### **PEI-Genesis Acquires Testco Inc., Trusted IP&E Supplier**

PEI-Genesis Acquired California-Based Testco Inc., a supplier of passive, electromechanical, and interconnect components with 40 years of customer excellence. It was announced today by Steven Fisher, President & CEO of PEI-Genesis. The purchase allows the company to better serve a broader range of customers' needs for IP&E product solutions.

"We consider ourselves to be the industry's Trusted Advisors focused on solving our customers' interconnect problems," says Fisher. "This acquisition enhances that capability, further encouraging our customers to partner with us for a broader range of products and services."

Testco supplies passive, electromechanical, and interconnect components with superior technical expertise and broad product knowledge. Serving technology companies worldwide for over 40 years, Testco offers creative supply chain solutions to meet customer requirements. With flexible blanket orders, bonded inventory, consolidated shipments, and annual pricing programs, Testco can solve the most difficult supply challenges. Both companies share common core values, integrating integrity, excellence, service, and commitment to customers into every decision. This partnership will continue to bring great quality products and highly professional service to all customers in the future.

"Being a part of the PEI-Genesis family allows Testco to have the additional resources needed to grow our capabilities and better support our supplier partners and customers," says Jeff Meyer, President of Testco. "I and the Testco team are excited about this new partnership and opportunity."

PEI-Genesis will operate Testco as a separate company, continuing to work with Testco as an authorized supplier partner. The Testco division will now be championed by Richard Watt, Vice President of North America Sales at PEI-Genesis. Testco's, Jeff Meyer, will remain as President to help grow and integrate its operations into PEI-Genesis. PEI will continue to support the existing Testco distributors and rep network.

### **TE Connectivity Named to Dow Jones Sustainability Index for 11th Consecutive Year**

TE Connectivity has been recognized for the 11th consecutive year by the Dow Jones Sustainability Index for its corporate citizenship initiatives promoting positive environmental, social, and corporate governance (ESG) policies.



Each year, the Dow Jones Sustainability Index analyzes more than 8,000 companies around the world using their Corporate Sustainability Assessment submissions. TE's listing on the Dow Jones Sustainability Index places it in the top 10% of the largest 2,500 companies in the S&P Global Broad Market Index (BMI), based on long-term economic, environmental, and social criteria.

"TE's inclusion in the Dow Jones Sustainability Index is evidence of our global commitment to creating a safer, more sustainable, productive and connected world," said CEO Terrence Curtin. "I am proud of this accomplishment and look forward to further pursuing TE's One Connected World strategy, which will build upon our past successes."

In May, TE released its annual corporate responsibility report detailing the progress against the One Connected World sustainability strategy. The report also highlights how leaders across TE are innovating to meet the challenges of today and prepare for those of tomorrow. Highlights from the report include a 30% reduction of greenhouse gases from a 2021 baseline and the implementation of an enterprise-wide human rights policy.

## **PEI-Genesis Expands Footprint Across North America**

PEI-Genesis is expanding its footprint across North America to better serve local customers in the Eastern and Central regions of the territory. With the dedication to provide additional local support, PEI-Genesis is opening multiple new branch locations and hiring several sales representatives to drive customer engagement in key markets.

On the East Coast, PEI-Genesis has officially reopened its office located in Baltimore, Maryland. The company has appointed 22-year electronics industry veteran Emilie Bonds as the Maryland Branch Manager to lead the team, supporting the Mid-Atlantic and Southeast parts of the country, such as Florida and Alabama. Additionally, the company is in the process of opening a new branch office in New Hampshire to aid the New England territory. PEI has named 25-year electronics industry expert Joe Ashline as the New England Branch Manager to lead the sales force there.

"We're looking forward to establishing a local presence with our reps, suppliers, and, most importantly, our customers. Being local to our customers allows us to deliver a higher level of professional service and solutions," says Bob Maley, Eastern Regional Sales Manager at PEI-Genesis.

As for the Central Region, PEI-Genesis is also expanding its sale force to support the Dallas/Fort Worth, Texas area, with expert sales representatives spread throughout neighboring states such as Oklahoma, Louisiana, and Arkansas.

"We are excited to continue growing the Central Region team by adding Trusted Advisors to the TOLA Territory. We're committed to providing our customers and supplier partners heightened, localized attention in the Southern Central states," says Jennie Hampton, Central Regional Sales Manager at PEI-Genesis.

"PEI-Genesis will continue to aggressively expand its North American field and sales office presence over the next year. This will ensure that we continue to give our customers the Trusted Advisor support that PEI-Genesis is known for," says Richard Watt, VP of North American Sales at PEI-Genesis.

Now, PEI-Genesis has a larger sales representation, covering most of the United States and Canada to serve customers right down the street.

## **Electronics Limp to the End of 2022**

The close of 2022 looks undeniably grim for the electronics supply chain. Two US indices in November – the PMI and component sales trends – fell to their lowest levels since May of 2020. The ECIA's components survey collapsed to 58.1, well below the growth threshold of 100. The ISM's PMI declined to 49; readings below 50 indicate contraction.

The signals for Q1 2023 aren't encouraging either. ECIA's electronic component sales trend (ECST) index has been below 100 for six months and shows no sign of improvement in December. By contrast, the lowest index measurement in the early stages of the Covid pandemic was 69.4. Demand for manufactured goods is declining worldwide, according to the Institute for Supply Management, across many markets served by the electronics industry. ECIA's end-market index was 48.5 in November and drops to 43.1 in December.

## **Supply Chain Pressures Ease**

If there is any upside to year-end market trends, supply-chain pressures – such as prices, lead times and component availability — are easing. Forty-six percent of ECIA respondents saw component lead times decrease in November. Electronics distributor Sourcingengine reported semiconductor lead times dropped by 4 days in September, decreasing from 27 weeks on average to 26.3 weeks.

Along with decreased lead times, component inventory levels are on the rise. “Sudden demand drops have contributed to excess inventory within the consumer electronics market,” according to Sourcingengine. “Suppliers and OEMs alike are considering drastic price cuts throughout November and December of 2022 to digest inventory. The hope is to go into 2023 with far less excess stock to mitigate through the slow months of Q1 2023.”

As of the end of calendar Q3, distributors Arrow Electronics Inc. and Avnet Inc. had not seen a drastic increase in order cancellations or pushouts in orders. During periods of component shortages customers often place the same component order with several suppliers. This double ordering has created excess inventory levels in past cycles. Automotive components, on the other hand, continue to see rising lead times and price surges. US sanctions on China have led to panic-buying on behalf of automotive OEMs. Those that cannot buy through their normal partners have turned to gray marketers out of desperation. McKinsey and Co. reports suggest that the automotive component shortage might last until 2026 and, at worst, 2030.

## **Foxconn Reports Slump in Revenue After Unrest and Covid Outbreak at Key China Plant**

Foxconn, the world's largest contract electronics maker reported a sharp drop in November revenue after the company struggled with a Covid outbreak and worker unrest at the world's biggest iPhone factory in China. The Taiwanese firm said that revenue last month totaled 551.1 billion new Taiwan dollars (about \$18.05 billion), down more than 29% versus October and over 11% lower compared to November 2021.

## **Apple Could Lose Six Million iPhones**

The ongoing issues at Foxconn's Zhengzhou plant in China are impacting Apple's production plans. Protests against the extreme Covid restrictions that have seen many workers walk out of the factory are expected to result in a shortfall of almost 6 million iPhone 14 Pro handsets this year due to lost production. Apple warned earlier this month that Covid-19 restrictions at the factory would impact shipments of the two iPhone 14 Pro models. It's expected that six million units will be lost because of the disruption, though Apple and Foxconn hope to make up for the loss next year.

Apple isn't having the smoothest time with its iPhone 14 launch. Slumping demand for expensive tech products due to the global economic downturn saw Cupertino dial back plans to increase production of its newly released iPhone 14 in September to about 87 million units from an earlier estimate of 90 million units. In October, there

were reports that Apple had instructed two suppliers to lower production of the iPhone 14 Plus by 90%, less than two weeks after the phone debuted, on the back of weaker interest in the handset.

## **Tesla's Co-Founder Straubel Thinks He Has a \$3.5 Billion Solution to Our Battery Shortage**

Redwood Materials announced that it will break ground on a new EV battery recycling plant in the heart of the "Battery Belt," just outside Charleston, South Carolina. The \$3.5 billion campus, the company's second, will take old batteries, break them down to their basic metals (such as nickel, copper, cobalt, and lithium) and then rebuild them into cathode and anode products, the most critical and expensive components in an EV. The plant will sit on 600 acres and create more than 1,500 jobs, according to a statement from the company.

We need massive quantities of batteries to power a global energy transition, but to produce them at scale we need to mine more metals like lithium than the earth can supply. In addition, most anode and cathode components are not produced in the US, so battery cell manufacturers have to source them through 50,000+ mile global supply chain estimated to cost more than \$150 billion by 2030. In response to this demand, a new battery manufacturing corridor from Michigan to Georgia has sprung up over the last few years called the "Battery Belt." Companies such as BlueOval SK, which is owned by Ford and SK On of South Korea, and Ultium Cells, which is owned by General Motors and LG Energy Solutions of South Korea, recently opened plants.

Adding to the financial incentive, The Inflation Reduction Act of 2022 requires batteries to have at least 40 percent of materials sourced from North America or a US trading partner to be eligible for billions of dollars in federal loans and tax credits. US companies have started planning huge new battery factories, but Straubel thinks we won't have enough materials to supply them, not to mention that nearly all the world's facilities to process those materials are in Asia, meaning they will have travel 10,000 miles before we can use them. To that end, Redwood Materials is building a gargantuan facility outside Reno, which will process new minerals, recycled batteries, and manufacturing scrap into enough copper foil and powdery, mineral-rich cathode active material to build batteries for about 1 million electric cars a year by 2025. To completely transition the US to electric vehicles, we'll need about 10 facilities of that size, with mining operations on an unheard-of scale to supply them. But once more old batteries start being retired, the facilities will switch to pure recycling, creating a closed, clean system in which we reuse minerals in one battery generation after another, forever.

## **Tech Layoffs in 2022 Surpass Great Recession Levels**

The massive layoffs by the tech companies this year alone have surpassed the levels from the Great Recession the world went through 2008-2009 that began with Lehman Brothers collapse. In 2008, tech companies laid off about 65,000 employees, and a similar number of workers lost their livelihoods in 2009, according to data by global outplacement and career transitioning firm global outplacement & career transitioning firm Challenger, Gray & Christmas. By comparison, 965 tech companies have laid off more than 150,000 employees this year globally, surpassing the Great Recession levels of 2008-2009.

Led by companies like Meta, Amazon, Twitter, Microsoft, Salesforce and others, the tech layoffs are set to worsen early next year amid ongoing global macroeconomic conditions. According to a MarketWatch report, layoffs are part of a strategy by tech firms to maintain viability through 2023 and beyond. Data from layoffs.fyi, a crowdsourced database of tech layoffs, showed that 1,495 tech companies have sacked 246,267 employees since the onset of Covid-19, but 2022 has been the worst year for the tech sector and early 2023 can even be grimmer.

As of mid-November, more than 73,000 workers in the US tech sector have been laid off in mass-level job cuts led by companies like Meta, Twitter, Salesforce, Netflix, Cisco, Roku, and others. Over 17,000 tech employees have been shown the door in India too.

Big Tech companies like Amazon and PC and printer major HP Inc have joined the global layoff season and were set to lay off more than 20,000 and up to 6,000 employees in days to come, respectively. Networking giant Cisco has started slashing nearly 4,000 jobs globally. Google is reportedly bracing for a massive layoff early next year and Alphabet and Google CEO Sundar Pichai has reportedly offered no assurance to worried Google employees that it won't happen.

## **Growth for Smartphones Spearheaded by 5G and Supply Chain Diversification**

The smartphone sector in 2022 experienced a similar situation as the PC industry. The pandemic bonus in 2020 and 2021 created a high baseline, which in turn resulted in a double-digit shipment decline in 2022 for the sector. Fortunately, on one hand, the impact of negative factors like the Covid pandemic, the Russia-Ukraine war, and inflation has gradually lessened and will eventually be things of the past. On the other hand, the trends of 5G upgrades, foldable phones, and low-tier smartphone purchases in emerging markets have continued. This means that in 2023, the smartphone sector will be able to bounce back and see its shipment numbers increase again, albeit just slightly.

Global smartphone shipments are estimated to reach 1.176 billion units in 2022, a 10.7% YoY decrease compared to 1.317 billion units in 2021, according to data from DIGITIMES Research. This decline is largely caused by the decline in purchase power due to high inflation and a strong US dollar. Another major contributing factor to the sector's poor performance in 2022 is the struggling China market, which accounts for over 20% of global smartphone shipments. Already dealing with a bad economic outlook, demand in China took a further hit in 2022 with the lockdowns and zero-Covid policy. Smartphone shipments in China are estimated to see a YoY decrease of over 20% in 2022, much worse compared to non-China markets, which are estimated to see a YoY decrease of around 7.6%.

Looking forward to 2023, global smartphone shipment is expected to slightly increase to 1.2 billion units, a YoY growth of 2.3%. As with China, due to continued pressure from its biggest competitor, the US, and its own compromised economic structure due to policy changes, demand may not be strong. Shipment in China is predicted to go from 255.2 million units in 2022 to 260.1 million units in 2023, a slight YoY increase of 1.9%.

Overall, 2023 is shaping up to be a year of gradual recovery. Negative factors from 2022, like the high global inflation caused by the Russia-Ukraine war and a strong US dollar caused by the Fed's aggressive rate increases, have resulted in a significant decrease in purchase power, especially among emerging markets. The impact from them will still linger, which limits how much the smartphone market can bounce back. More major growth is likely only coming in 2024.

Amongst the overall bleak smartphone sector, one of the few positive trends is the rise of 5G smartphones. In 2022, approximately 611 million 5G smartphones will be shipped, a 14.8% YoY growth compared to 532.6 million in 2021. This figure is even more impressive considering that the Chinese market saw a major decline in 5G shipments, reporting a YoY decrease of over 16% for 2022. The non-China markets were able to compensate for China's weak performance, reporting a 43.2% YoY growth. According to DIGITIMES Research, in 2023, 5G smartphone shipments are estimated to grow by over 20% and will largely be fueled by the non-China markets as the China market slowly recovers from its current economic downturn. Markets outside of China are expected to account for more than 70% of the global 5G smartphone shipment in 2023.



The last trend to watch for 2023 is the diversification of the supply chain among major smartphone trends. The 2022 pandemic and China's shift in economic policy have resulted in many smartphone brands considering moving parts of their production outside of China, with India and Vietnam being the two primary locations brought up in discussions like this. In 2022, Apple's manufacturers still have around 80% of the iPhone's production capacity located in China, but Apple seems determined to diversify the risks of having so much production concentrated in China. It's estimated that starting in 2023, Apple OEMs like Foxconn, Pegatron, and Wistron will be expanding their production in India and continue to improve the usage rate of the local production lines.

## **US Import Volumes Decline but Freight Gets Cheaper**

Economic turmoil, reduction in retail transactions and high fuel costs are finally making an impact on US container imports, according to Descartes, a supply chain solutions provider. Total November 2022 volume experienced a significant 12 percent decline from October 2022, and a 11.1 percent decline in China imports from October 2022 was a major contributing factor. Costs are going down for businesses that rely on ocean freight. Lower rates benefit users but aren't great news for carriers. Early December's US West Coast average rate of about \$1,400/FEU is 4 percent lower than in 2019, according to cargo marketplace Freightos. East Coast prices have now decreased 80 percent since April, though some lingering congestion is one factor keeping rates 22 percent higher than in 2019.

Carriers continue to increase the number of blank sailings – globally 13 percent of all capacity will be canceled in the coming weeks, Freightos added. And though these steps do not seem to have slowed the rate decline much so far, there are reports of already fully booked vessels in January.

The US manufacturing index, the PMI, fell to contraction levels – below 50 — in November, according to the Institute for Supply Management (ISM). For example, global smartphone production totaled around 289 million units for 3Q22, showing a slight QoQ drop of 0.9 percent and a YoY drop of 11 percent, TrendForce reported. The smartphone market exhibited an extremely weak demand situation as the “iron law” of positive growth in the third quarter was broken after being in effect for years.

The latest National Retail Federation US ocean import data estimates volumes fell 7.5 percent in November to a level 12 percent lower than a year ago.

At the same time, pressures on the supply chain are easing. Port delays continue to improve, said Descartes, especially for West Coast ports as their import volumes are down significantly versus 2021. Prices paid by US manufacturers registered 43 percent, according to the ISM, down 3.6 percentage points compared with the October figure of 46.6 percent. This is the index's lowest reading since May 2020 when it stood at 40.8 percent.

Key economic indicators such as the growth of the economy, jobs, inflation, interest rates and fuel costs paint a conflicting picture of their impact on the future direction of US container import volumes. Chinese imports declined in November, but other countries such as Vietnam and Thailand experienced more significant drops. The December update of the logistics metrics Descartes is tracking shows more relief but continues to point to congested and challenging global supply chain performance going into 2023.

## **Chip Supplies Loosen as Fabs Face Q4 Correction**

Five foundries — TSMC, Samsung, UMC, GlobalFoundries and SMIC – led growth in Q3. Their collective global market share, in revenue, reached 89.6 percent. However, TrendForce noted that customers slowed their stock-up and new order activity during Q3. The world's 10 largest foundries will see revenue decline in Q4 as weak demand slows chip consumption and inventories build, according to TrendForce. Revenue for the top 10 foundries rose by 6 percent in Q3, to \$35.21 billion, fueled by the release of Apple's new iPhone.

China's zero-Covid policy, the weak global economy and high inflation continue to impact consumer confidence. As a result, peak-season demand in the second half of the year has been underwhelming, and inventory consumption is proceeding slower than anticipated. This situation has led to substantial downward corrections to foundry orders as well, and TrendForce sees the two-year boom in chip demand ending in Q4. There are still markets facing limited chip supplies, such as automotive. The auto industry's reliance on 90 nanometer chips will keep supply and demand out of balance for some time, McKinsey & Co. reported. But for buyers overall, what's bad for chip makers isn't necessarily bad for procurement. Manufacturers waiting for the "golden screw" that will complete their work-in-process will start to see semiconductor supplies loosen up.

To date, this grim forecast has had little impact on chip makers' plans to build new foundries. Passage of the US CHIPS Act has prompted TSMC to add a second fab in Arizona and Samsung to expand its investments in Texas. DRAM maker Micron announced plans for a \$100 million mega-fab in New York and new facilities in Boise.

TSMC made a notable gain due to Apple's strong stock-up demand for the SoCs deployed in this year's new iPhone models, and saw revenue rise by 11.1 percent QoQ to \$20.16 billion. The growth was mainly attributed to the  $\leq 7\text{nm}$  nodes, whose share in the foundry's revenue had kept climbing and reached 54 percent in Q3.

Samsung experienced a slight QoQ drop of 0.1 percent in foundry revenue even though it had also benefited from the component demand related to the new iPhone series. Partially impacted by the weakening of the Korean won, Samsung's market share fell to 15.5 percent.

UMC's revenue increased by 1.3 percent QoQ to around \$2.48 billion for 3Q22. UMC's performance was bolstered by the strengthening of the US dollar and the newly added 28nm production capacity that outputs higher-priced wafers.

GlobalFoundries posted a QoQ rise of 4.1 percent in revenue to around \$2.07 billion. The growth was attributed to a QoQ increase in wafer shipments as well as further optimization in wafer ASP and product mix. Furthermore, GlobalFoundries has been maintaining its capacity utilization rate above 90 percent.

SMIC posted a slight QoQ increase of 0.2 percent in revenue to around \$1.91 billion. SMIC has a product mix that is skewed toward consumer chips, so its QoQ performance was nominal. This was especially noticeable for chips used in smartphones and several kinds of consumer electronics. Nevertheless, SMIC's revenue kept climbing because the optimization of its wafer ASP offset the issue with its product mix and the slide in its wafer shipments.



Bishop & Associates has just released the 2022 **Connector Industry Forecast** update. This eight-chapter report provides an in-depth, and detailed forecast of the worldwide connector industry. In addition to the detailed forecasts for each region of the world (North America, Europe, Japan, China, Asia Pacific, and ROW), an industry overview is included which provides current market trends, currency fluctuation effects, and industry sales performance, as well as an outlook narrative.

Worldwide and each regional forecast includes:

#### **Computers & Peripherals**

- Mobile Computers
- Desktops
- Servers
- Storage Equipment
- Input/Output Equipment
- Communication LAN Devices
- Other Computer Equipment

#### **Business/Office Equipment**

- Retail/POS Equipment
- Imaging Systems
- Other Business/Office Equipment

#### **Instrumentation**

- Automatic Test Equipment
- Analytical/Scientific Instruments
- Other Instrumentation

#### **Medical Equipment**

- Diagnostic & Imaging Equipment
- Therapeutic Equipment
- Other Medical Equipment

#### **Industrial**

- Factory Automation and Machinery
- Construction and Civil Engineering
- Energy Markets
- Other Industrial Equipment

#### **Automotive**

- Body Wiring & Power Distribution
- Powertrain
- Comfort, Convenience & Entertainment
- Navigation & Instrumentation
- Safety & Security

#### **Transportation (non-auto)**

- Commercial Vehicles
- RVs & Power Sports
- Commercial Air
- Marine
- Rail
- Construction
- Farm & Garden

#### **Military/Aerospace**

#### **Telecom/Datacom**

- Carrier Network
- Enterprise Network
- Wireless Infrastructure
- Subscriber Equipment
- Other Telecommunications

#### **Consumer**

- Personal/Portable Consumer
- Home Video Equipment
- Home Audio Equipment
- Consumer White Goods

## 2022 – A Year of Challenges and Rewards!

After what we thought would be one of the most interesting years ever, 2022 has shaped up to be full of even more challenges and rewards than 2021. The connector industry entered 2022 with strong bookings and sales, following a year, where sales grew an astonishing 24.3%. Although, there have been a few hiccups and road bumps along the way, the industry has maintained a positive outcome year-to-date in 2022.

Bookings, although still very high, started to decline in April, dropping from double digit growth to a single-digit decline. Year-over-year bookings remained in negative territory through September, where they once again returned to low single-digit growth, only to experience a double-digit decline in October. On a year-to-date basis, bookings dropped from double-digit growth in 2021 to low and even negative single-digit growth in late 2022.

### Industry Sales Performance by Region

As indicated by the chart below, growth was not equal across all regions in 2021 nor will it be in 2022. The ROW region, which includes Central and South America, South Africa, and Russia saw the greatest growth at 31.2%. The ROW region was followed by Europe with growth of 26.8% and the Asia-Pacific region with growth of 25.9%. China, the largest region for electronic connector sales increased 23.8%. Japan, which has struggled for the past several years to bring sales back to their high of \$6.4 billion in 2012, showed the least growth, with sales only increasing 19.1%. North America, who had previously proved to the world that they could rapidly divert manufacturing capacity from one industry to another, saw connector sales increase a healthy 22.2%.

**2020 and 2021 Connector Sales by Region  
With Percent Change**

Region	2020	2021	Percent Change
North America	\$13,491.5	\$16,484.0	22.2%
Europe	\$12,837.5	\$16,278.4	26.8%
Japan	\$4,430.9	\$5,275.7	19.1%
China	\$20,184.3	\$24,978.3	23.8%
Asia-Pacific	\$9,045.0	\$11,383.9	25.9%
ROW	\$2,737.5	\$3,590.3	31.2%
<b>Total World</b>	<b>\$62,726.7</b>	<b>\$77,990.6</b>	<b>24.3%</b>

\$ Millions

Reviewing 2022, you see quickly that North America, which was ranked fifth out of six regions for percentage growth in 2021, is ranked number one in 2022 with double-digit growth of YY.6%. North America is followed by the ROW region, who drops from number one to number two in percentage growth, and who is anticipated to finish 2022 with double-digit growth of YY.2%. Japan, who as we previously mentioned, has struggled to bring sales past the \$5 billion mark, will show the lowest percentage increase, with sales declining -2.0%.



Unlike 2021, where the region with the greatest percentage increase in sales was not the same region that exhibited the greatest increase in total dollars, North America will also represent the region with the greatest overall growth in sales dollars. North America will see sales dollars increase \$X,XXX million, followed by China, where sales dollars will increase \$X,XXX million. As in 2021, Japan will show the least increase in sales dollars, increasing only \$XX million.

Please note currently we still are classifying economic information coming out of Russia as unreliable.

## 2021 and 2022F Sales by Region With Percent Change

Region	2021	2022F	Percent Change
North America	\$16,484.0	\$XX,XXX.X	X.X%
Europe	\$16,278.4	\$XX,XXX.X	X.X%
Japan	\$5,275.7	\$X,XXX.X	X.X%
China	\$24,978.3	\$XX,XXX.X	X.X%
Asia-Pacific	\$11,383.9	\$X,XXX.X	X.X%
ROW	\$3,590.3	\$X,XXX.X	X.X%
<b>Total World</b>	<b>\$77,990.6</b>	<b>\$8X,XXX.X</b>	<b>X.X%</b>

\$ Millions

In addition to connector sales results varying by region in 2021, electronic connector sales will also vary remarkably by market sector in 2022. As the table on the following page shows, in 2021, the industrial market, which encompasses a variety of equipment, including industrial automation and process control equipment, robotics, machine tools, and machinery, energy generation and distribution, and building and civil engineering saw the greatest percentage growth, at 29.3%. The industrial market was followed by the telecom/datacom market where sales grew a strong 26.4%. Naturally this growth was driven by the increase in internet activity and the continuing drive towards 5G. These two market sectors were followed by the medical equipment sector, where not only the need to increase or replace therapeutic equipment drove sales, but also the increase in diagnostic equipment. Surprisingly enough, these two market sectors were followed by the transportation sector, where increases in rail and commercial vehicles continued to drive the market.

## 2020 and 2021 Connector Sales by Market Sector With Percent Change

Equipment Sector	2020	2021	Percent Change
Computers & Peripherals	\$8,355.0	\$10,239.2	22.6%
Business/Office Equipment	\$724.2	\$879.2	21.4%
Instrumentation	\$1,811.7	\$2,257.3	24.6%
Medical	\$1,966.6	\$2,476.4	25.9%
Industrial	\$7,721.8	\$9,980.7	29.3%
Automotive	\$14,145.8	\$17,047.1	20.5%
Transportation	\$4,344.6	\$5,431.2	25.0%
Military/Aerospace	\$3,770.6	\$4,671.0	23.9%
Telecom/Datacom	\$14,479.4	\$18,301.3	26.4%
Consumer	\$3,038.4	\$3,757.8	23.7%
Other Equipment	\$2,368.6	\$2,949.4	24.5%
<b>Total World</b>	<b>\$62,726.7</b>	<b>\$77,990.6</b>	<b>24.3%</b>

\$ Millions

## 2022 Outlook

With industry backlog still exceedingly high, Bishop is forecasting 2022 sales to grow by Y.Y% to \$XX,821.7 million. We anticipate the greatest percentage increase will occur in North America, where sales will increase YY.Y%, followed by ROW where sales will increase YY.Y%. As seen in the past few years, in US dollars, the smallest growth will be seen in the Japanese region, where connector sales will decrease by \$XXX.9 million or 2.0%. The Japanese region will be followed by ROW, where although percentage wise sales will show low double-digit growth, sales in US dollars will only equate to growth of \$XXX.8 million.

## 2022F Connector Forecast by Geographic Region With Percent Change

Region	2021	2022F	Percent Change
North America	\$16,484.0	\$XX,XXX.X	Y.Y%
Europe	\$16,278.4	\$XX,XXX.X	Y.Y%
Japan	\$5,275.7	\$XX,XXX.X	Y.Y%
China	\$24,978.3	\$XX,XXX.X	Y.Y%
Asia-Pacific	\$11,383.9	\$XX,XXX.X	Y.Y%
ROW	\$3,590.3	\$XX,XXX.X	Y.Y%
<b>Total World</b>	<b>\$77,990.6</b>	<b>\$XX,XXX.X</b>	<b>Y.Y%</b>

\$ Millions

## Forecast Assumptions

Forecasting is always difficult, especially during challenging times. Projecting future business conditions in this environment is almost impossible. Consider the following economic headwinds, political challenges, and uncertainties.

- We have still not totally come out of a global pandemic. Although great strides have been made to bring things back to previous conditions, continued outbreaks of both old and new variants of COVID, have made that extremely difficult. In addition to COVID, greater attention is also being given to other diseases including Monkey Pox and RSV (Respiratory Syncytial Virus).
- Inflation is increasing, as are interest rates, leaving less discretionary income for consumers to use on non-necessary items, especially things like recreational vehicles, second homes, and personal watercraft.
- World GDPs are slowing in all economies.
- We have a semiconductor shortage that is predicted to last through the balance of 2022 and the beginning of 2023. This is affecting the automotive, computer, and consumer electronics/appliances industry extensively.
- We have a global supply chain backlog, with shipping containers gridlocked, a global shortage of truck and crane operators, and rising transportation costs (fuel and maintenance)
- Record high petroleum prices, sparking shortages and record high prices.
- An ongoing labor shortage, with studies showing that by 2030, we will be an estimated 85 million workers short globally!
- Increasing political tensions: War in Ukraine, deepening friction between China and Taiwan, North Korea's launching of eight ballistic missiles into the waters east of the Korean peninsula and China's announcement that they have equipped on their six nuclear -powered submarines, JL-3 intercontinental ballistic missiles capable of hitting the continental US.
- Iran is ramping up its nuclear program, after discussions with the Biden administration to rejoin the JCPOA stalled due to Russia's demand for more exemptions from sanctions.
- Although the Department of Homeland Security (DHS) announced that the secretary of Homeland Security designated Afghanistan Temporary Protected Status (TPS) for 18 months, effective May 20, 2022, through November 20, 2023, they are still being led by the Taliban, an organization that is notorious for cruelty and aggression.

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# Connector Industry Forecast

## Chapter 2 – World Connector Forecast (continued)

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Commercial Air  
Marine  
Rail  
Construction  
Farm & Garden  
Military  
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Carrier Network  
Enterprise Network  
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Other Office Equipment  
Instrumentation  
Automatic Test Equipment  
Analytical & Scientific Instruments  
Other Instruments  
Medical  
Diagnostic & Imaging Equipment  
Therapeutic Equipment  
Other Medical Equipment  
Industrial  
Factory Automation and Machinery  
Construction and Civil Engineering  
Energy Markets  
Other Industrial Equipment  
Automotive  
Body Wiring & Power Distribution  
Powertrain  
Comfort, Convenience & Entertainment  
Navigation & Instrumentation  
Safety & Security  
Transportation  
Commercial Vehicles  
RV's & Power Sports  
Commercial Air  
Marine  
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Telecom/Datacom  
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Enterprise Network  
Mobile & Wireless  
Wireless Infrastructure  
Subscriber Equipment  
Cable-Equipment-Infrastructure  
Other Telecommunications  
Consumer  
Personal/Portable Consumer Electronics  
Home Video Equipment  
Home Audio Equipment  
Consumer White Goods  
Other Consumer  
Other Equipment

## Chapters 4 Thru 8 Provide the Same Detail Level as Chapter 3

**Chapter 4 – European Connector Forecast**  
**Chapter 5 – Japanese Connector Forecast**  
**Chapter 6 – Chinese Connector Forecast**  
**Chapter 7 – Asia Pacific Connector Forecast**  
**Chapter 8 – ROW Connector Forecast**

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## What's New ?

Bishop & Associates has recently completed several new research reports about the worldwide connector industry. A table of contents for each report can be found at <https://store.bishopinc.com>.

- ❑ **Report F-2022-02**      **Connector Industry Forecast (November 2022) NEW**
- ❑ **Report M-1200-22**      **Military Ground Vehicle Market for Connectors (October 2022) NEW**
- ❑ **Report P-799-22**      **World Cable Assembly Market (September 2022) NEW**
- ❑ **Report M-121-22**      **2022 Top 100 Connector Manufacturers (August 2022) NEW**
- ❑ **Report P-675-22**      **Copper and Fiber Connectivity in the Data Center (July 2022) NEW**
- ❑ **Report C-122-22**      **2022 Connector Industry Yearbook (July 2022) NEW**
- ❑ **Report T-800-22**      **2022 North American Cable Assembly Manufacturers (May 2022) NEW**
- ❑ **Report M-1010-22**      **World Automotive Connector Market (April 2022) NEW**
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- ❑ **Report P-420-22**      **IC Sockets – Systems & Connector Forecast 2020-2030 (January 2022) NEW**
- ❑ **Report P-520-21**      **The World I/O Rectangular Connector Market 2021 (October 2021)**
- ❑ **Report P-430-21**      **World Circular Connector Market 2021 (September 2021)**
- ❑ **Report M-310-21**      **Instrumentation Market for Connectors (June 2021)**
- ❑ **Report P-410-21**      **Computer Server Market Trends and Connector Use 2020 – 2030 (May 2021)**
- ❑ **Report M-607-21**      **World Industrial Market for Connectors (April 2021)**
- ❑ **Report M-510-21**      **World Telecom Connector Market 2020-2025 (January 2021)**
- ❑ **Report M-1601-20**      **Top 50 Medical Interconnect Solutions Companies (December 2020)**

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