The Bishop Report
Performance and Forecast of the World Connector Industry

Issue No. 356 | 3rd Quarter 2022 | July 2022

Sales Up +12.7% in June and +8.2% for 2Q22
Backlog Started Shrinking After 20 Months of Growth

Regional Performance:
World sales are up +9.8% YTD June.

In June, North America achieved the highest regional sales growth at +18.8% YTD.

North America also has the highest YTD growth in bookings at +12.6%.

Industry Results:
In 2Q22, the industry grew +8.2% equaling sales of $20,560 million. This was the eighth consecutive quarter of growth.

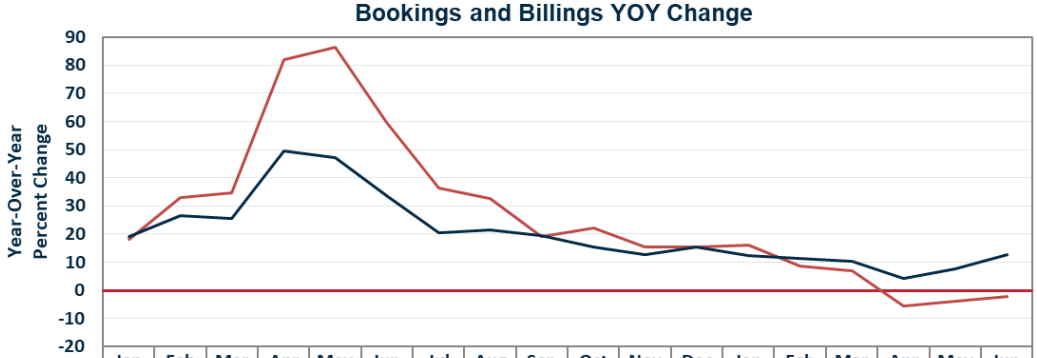
Industry Outlook:
Industry sales for 2022 are forecast to be $82,989 million, up +6.4%.

Industry Backlog:
June backlog decreased to $26,302 million equaling 16.4 weeks. This is a decrease of $314 million from May.

2022 Currency Impact:
The industry grew +9.8% YTD in June in USD and 3.1% in local currencies. Sales growth is 6.7 percentage points lower when stated in local currencies.

June bookings were down -2.1%. Billings were up +12.7%. Industry growth is slowing. Backlog decreased to $26,302 million in June, however, it still converts to 16.4 weeks.

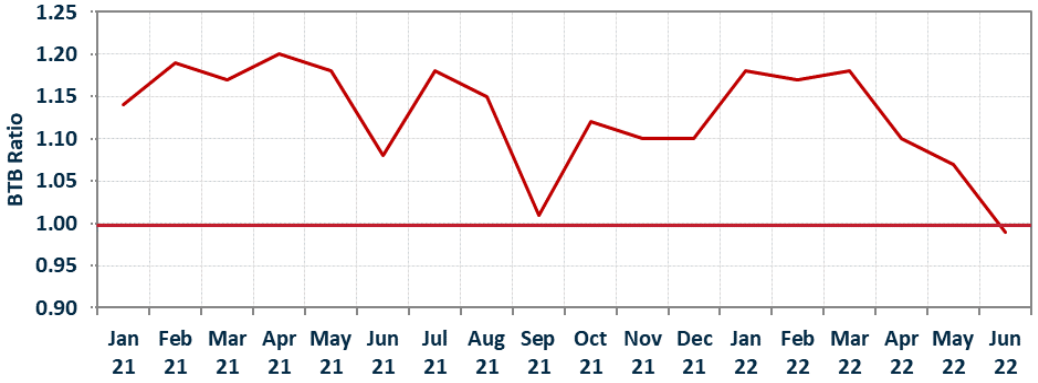
Bookings and Billings YOY Change



	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22
Bookings	18.0	32.8	34.5	81.9	86.4	59.7	36.4	32.5	19.1	22.1	15.3	15.5	15.9	8.7	7.1	-5.5	-3.9	-2.1
Billings	19.0	26.7	25.5	49.5	47.1	33.5	20.6	21.5	19.4	15.3	12.8	15.5	12.4	11.2	10.2	4.1	7.7	12.7

The book-to-bill ratio in June was 0.99 and YTD was 1.10.

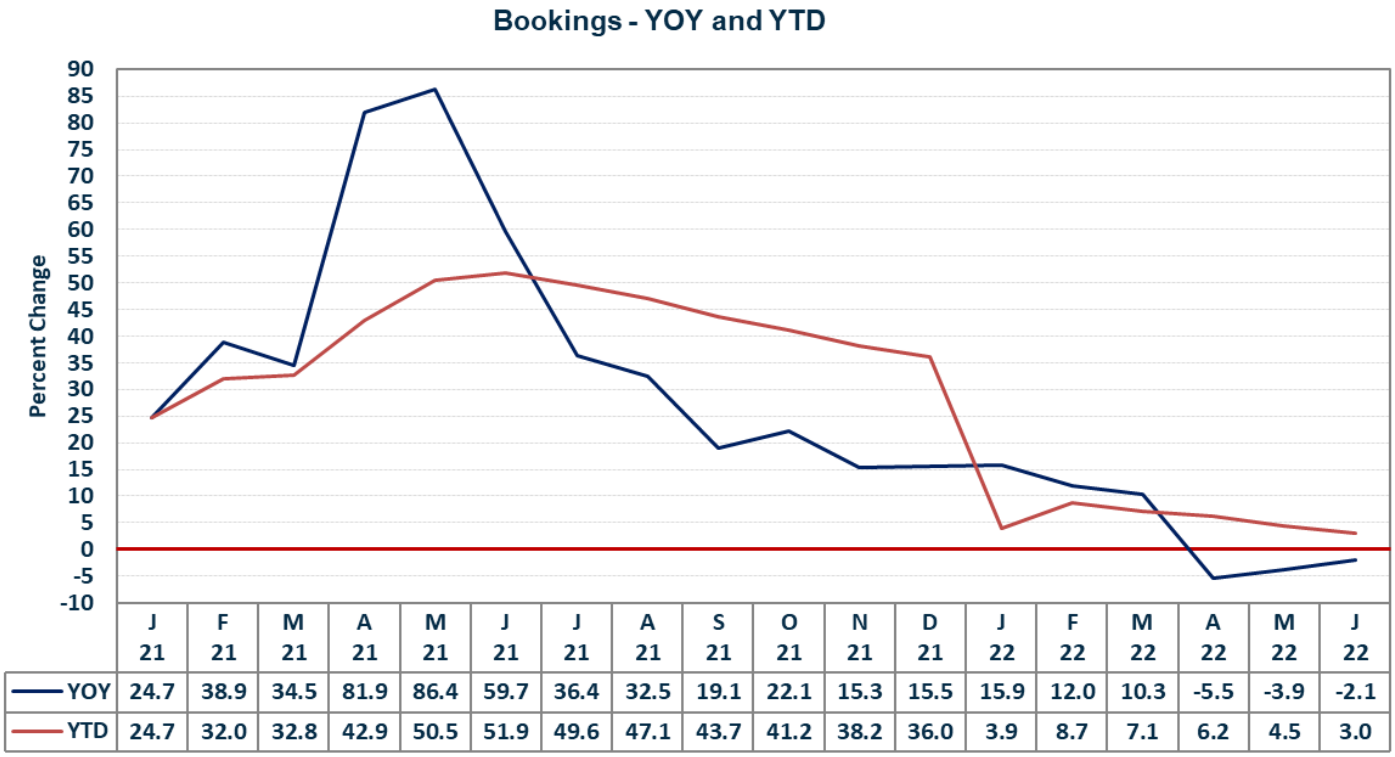
Connector Industry Book-to-Bill



Booking Highlights and Conclusions

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

	Sequential			Year-Over-Year			Year-To-Date		
Month	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%		-1.0%	36.4%		-7.0%	49.6%	
Aug	10.7%	6.6%		1.8%	32.5%		-5.8%	47.1%	
Sep	-0.9%	-11.9%		8.4%	19.1%		-4.3%	43.7%	
Oct	4.7%	6.8%		13.0%	22.1%		-2.6%	41.2%	
Nov	15.2%	9.3%		17.5%	15.3%		-0.6%	38.2%	
Dec	-7.2%	-7.0%		18.3%	15.5%		1.0%	36.0%	



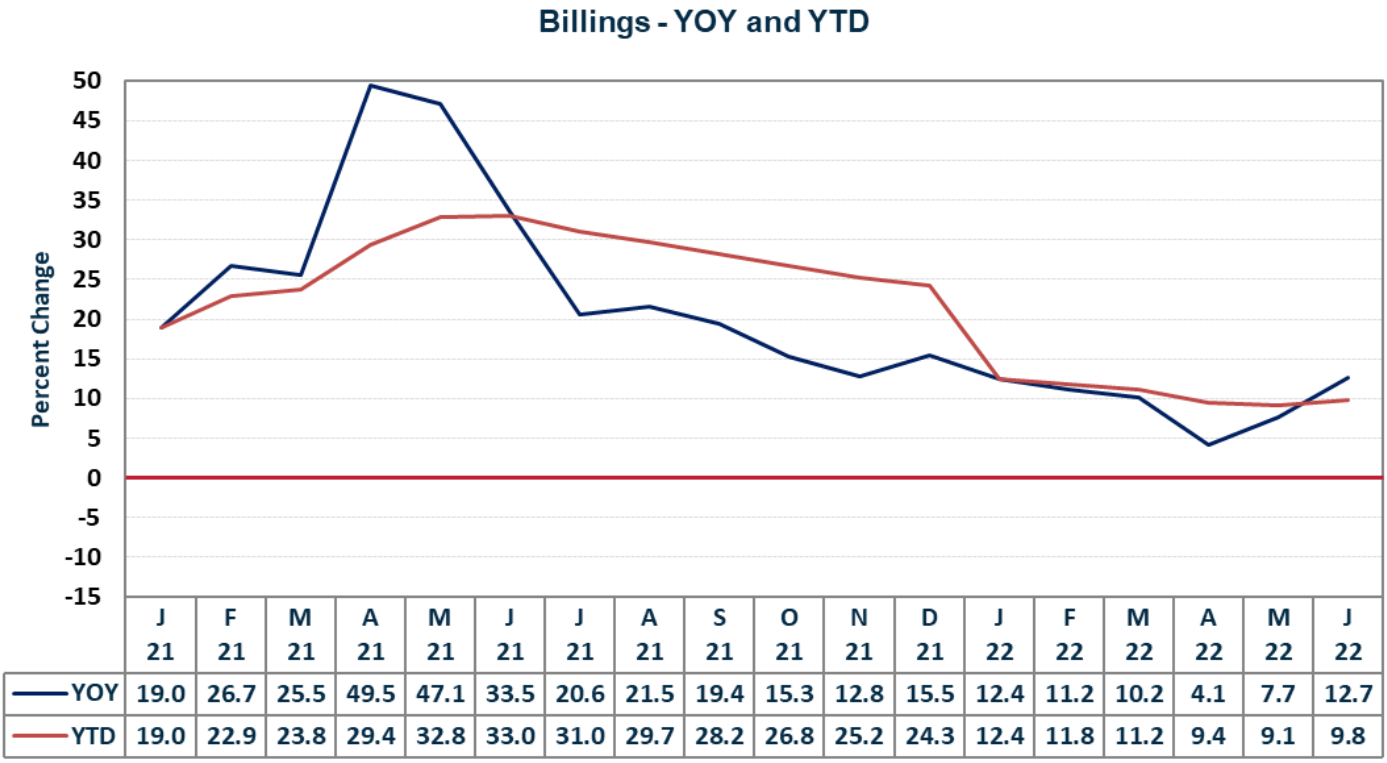
	J 21	F 21	M 21	A 21	M 21	J 21	J 21	A 21	S 21	O 21	N 21	D 21	J 22	F 22	M 22	A 22	M 22	J 22
YOY	24.7	38.9	34.5	81.9	86.4	59.7	36.4	32.5	19.1	22.1	15.3	15.5	15.9	12.0	10.3	-5.5	-3.9	-2.1
YTD	24.7	32.0	32.8	42.9	50.5	51.9	49.6	47.1	43.7	41.2	38.2	36.0	3.9	8.7	7.1	6.2	4.5	3.0

- June bookings declined -2.1% YOY. Bookings are up +3.0% YTD.
- Orders decreased -6.7% sequentially.
- The book-to-bill ratio for June was 0.99 going below 1.0 for the first time since September 2020. The YTD ratio is 1.10.

Billing Highlights and Conclusions

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

	Sequential			Year-Over-Year			Year-To-Date		
Month	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%		-1.6%	20.6%		-9.0%	31.0%	
Aug	9.0%	8.7%		-0.3%	21.5%		-7.8%	29.7%	
Sep	1.7%	-2.3%		5.0%	19.4%		-6.3%	28.2%	
Oct	-1.0%	-3.4%		7.6%	15.3%		-4.9%	26.8%	
Nov	11.4%	9.4%		9.1%	12.8%		-3.6%	25.2%	
Dec	-7.7%	-5.6%		13.4%	15.5%		-2.2%	24.3%	

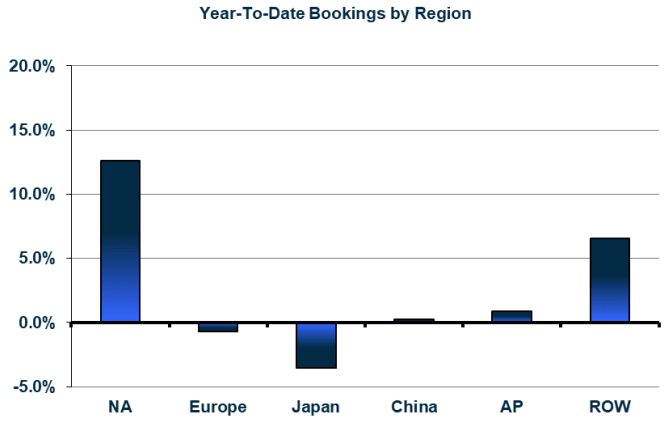


- June billings increased +12.7% YOY. YTD, billings are up +9.8%. 2Q22 sales were up +8.2%.
- Sequentially, billings increased +0.7% in June.

Regional Performance: BOOKINGS

June 2022 Bookings

Region	Sequential	YOY	YTD
NA	-8.4%	4.0%	12.6%
Europe	-6.4%	-1.5%	-0.7%
Japan	-1.0%	-9.1%	-3.6%
China	-1.7%	-4.0%	0.2%
AP	-14.3%	-7.9%	0.9%
ROW	-11.3%	-5.9%	6.6%
Total	-6.7%	-2.1%	3.0%

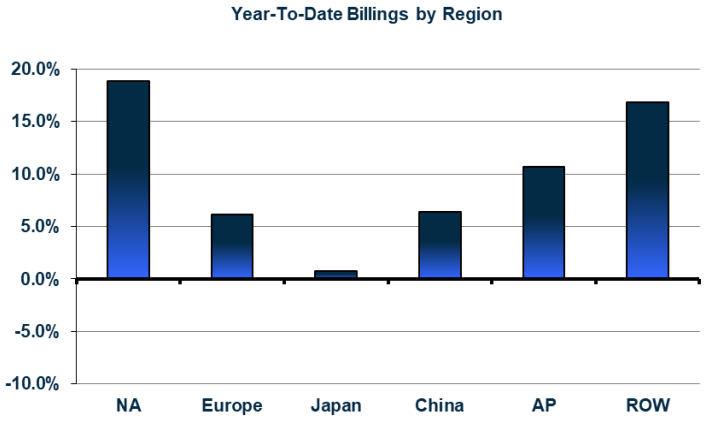


- June bookings decreased -2.1% YOY.
- North America was the only region that reported YOY growth in June.
- Japan's growth was down the most at -9.1%.
- At this point, the backlog is starting to shrink.

Regional Performance: BILLINGS

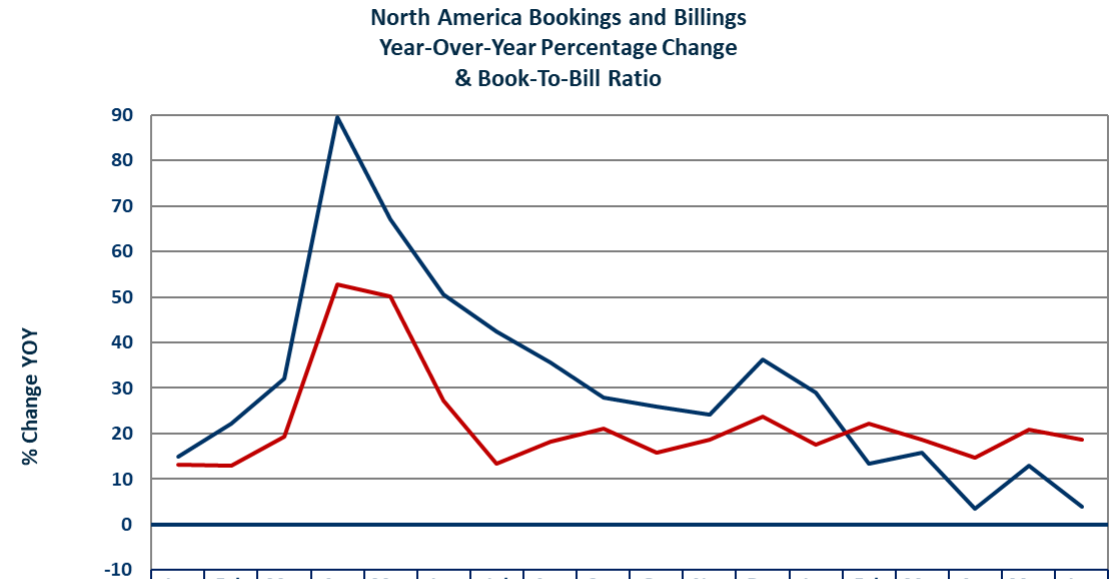
June 2022 Billings

Region	Sequential	YOY	YTD
NA	-6.6%	18.6%	18.8%
Europe	-2.9%	9.1%	6.2%
Japan	4.9%	0.9%	0.7%
China	12.5%	16.5%	6.4%
AP	-2.9%	7.3%	10.7%
ROW	-8.2%	13.3%	16.8%
Total	0.7%	12.7%	9.8%



- June connector sales increased +12.7% YOY. The industry is still up +9.8% YTD.
- YOY, all regions had growth in June.

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.



	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22
Bookings	15.0	22.1	32.1	89.5	67.0	50.5	42.4	35.5	28.0	26.0	24.2	36.2	29.1	13.3	15.8	3.5	13.0	4.0
Billings	13.2	13.0	19.4	52.7	50.1	27.2	13.4	18.2	21.1	15.8	18.7	23.7	17.6	22.2	18.6	14.8	20.8	18.6
Billing SEQ	-2.1	14.9	-1.7	0.4	8.2	23.7	-1.2	14.9	-5.3	-4.4	7.8	-1.9	-6.9	19.1	-4.6	-7.2	14.5	-6.6
BTB	1.14	1.18	1.18	1.23	1.13	1.18	1.16	1.13	1.01	1.14	1.11	1.07	1.25	1.10	1.16	1.11	1.06	1.04

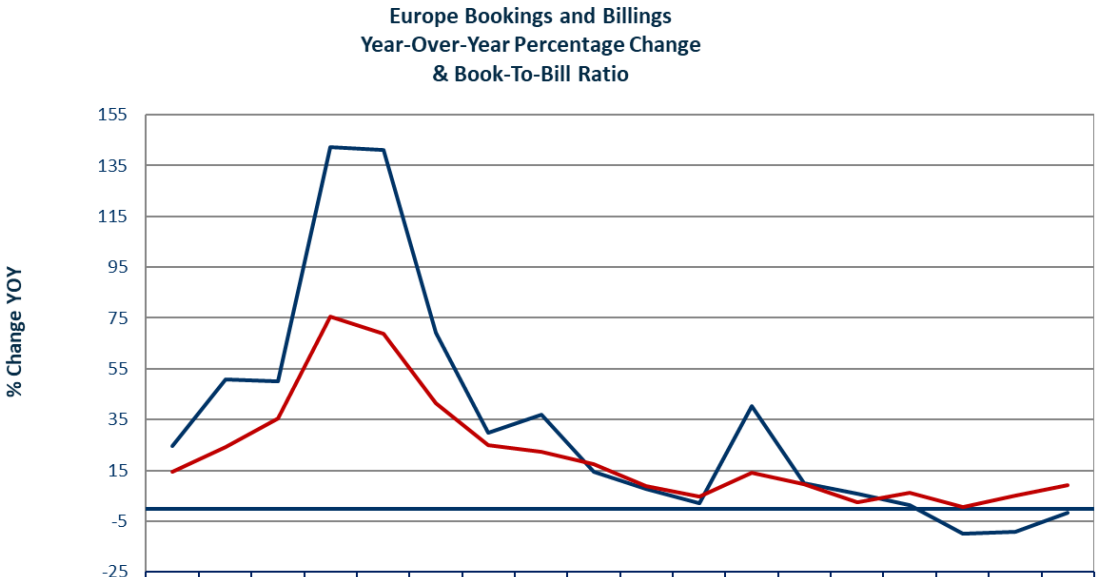
North America Performance

- Sales grew +18.6% and orders were up +4.0% YOY in June. North American billings were down sequentially -6.6%. The book-to-bill was 1.04.
- 2Q22 GDP contracted 0.9% YOY, so the US is technically in a recession.
- US inflation hit 9.1% in June, the highest rate since November 1981. Energy prices rose 41.6% and food costs were up 10.4%. The rate has been above 5% for 13 months.
- Industrial production increased 4.2% YOY in June.
- Manufacturing PMI was down to 52.3 in July.
- US unemployment remained at 3.6% in June for the fourth consecutive month.
- Retail sales were up 8.4% YOY in June.
- Housing starts were down 2.0% sequentially in June and existing home sales dropped 5.4%.
- US automotive sales in June decreased 20.7% YOY and truck/SUV sales were down 9.2%.

Conclusions

Higher prices/inflation, supply chain issues, rising interest rates, unstable financial markets, 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. The ports on the West Coast (and East Coast and Gulf) are still backed up. 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.



	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22
Bookings	24.5	50.8	49.9	142.2	141.2	69.2	29.9	36.8	14.5	7.6	2.1	40.4	9.9	6.0	1.5	-9.8	-9.0	-1.5
Billings	14.6	24.1	35.6	75.4	68.7	41.4	25.0	22.5	17.6	8.8	4.6	13.9	9.6	2.4	6.2	0.6	5.0	9.1
Billing SEQ	1.6	24.7	-3.6	-5.3	10.3	45.7	-5.5	8.6	-1.8	-7.4	12.5	-9.0	-2.3	21.7	-4.5	-13.1	15.9	-2.9
BTB	1.18	1.28	1.20	1.23	1.22	1.13	1.14	1.12	0.98	1.08	1.06	1.13	1.18	1.27	1.14	1.10	1.06	1.02

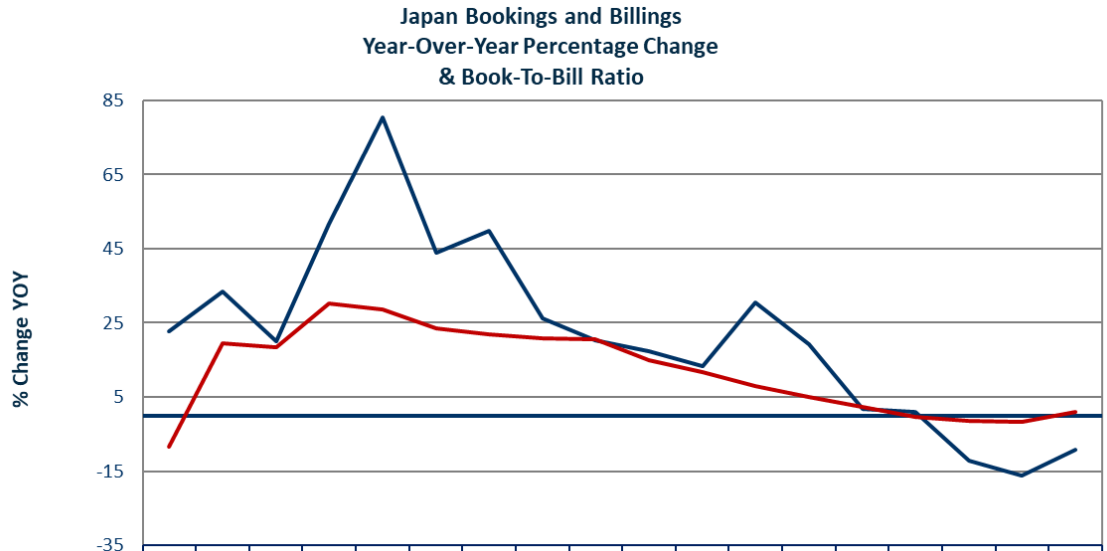
Europe Performance

- YOY billings were up +9.1% and orders were down -1.5%. The book-to-bill ratio was 1.02. Sequentially, sales were down -2.9%.
- Euro Area industrial production increased 1.6% YOY in May.
- The July manufacturing PMI dropped to 49.6 indicating the first contraction in factory activity since June 2020.
- May retail sales increased 0.2% YOY.
- The inflation rate increased to a record high 8.6% in June. The UK rate hit 9.4%, a 40-year high.
- Year-over-year, Euro area June new car registrations slipped 17.0% due to part shortages and the war in Ukraine.
- The unemployment rate decreased to 6.6% in May, a new record.

Conclusions

European new car registrations are down double-digits YTD due in large part to the war in Ukraine disrupting the supply chain. Automotive is the largest connector market in Europe. The connector industry appears to be headed for a difficult year in Europe given the ongoing shortages, high inflation, the situation in the Ukraine, and supply chain issues that will likely continue to dampen results.

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.



	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22
Bookings	22.6	33.5	20.1	51.6	80.4	43.9	49.7	26.3	20.4	17.4	13.3	30.5	19.2	1.8	1.0	-12.1	-16.3	-9.1
Billings	-8.5	19.6	18.5	30.3	28.7	23.6	21.8	20.8	20.4	15.0	11.6	8.0	4.9	2.4	-0.3	-1.4	-1.8	0.9
Billing SEQ	16.9	17.9	-4.3	-2.8	0.3	28.6	1.0	5.4	-3.4	-4.5	9.7	-4.5	-11.1	15.1	-5.0	-5.0	-0.2	4.9
BTB	1.03	1.13	1.06	1.22	1.23	1.10	1.17	1.10	1.08	1.14	1.13	1.14	1.17	1.12	1.38	1.09	1.05	0.99

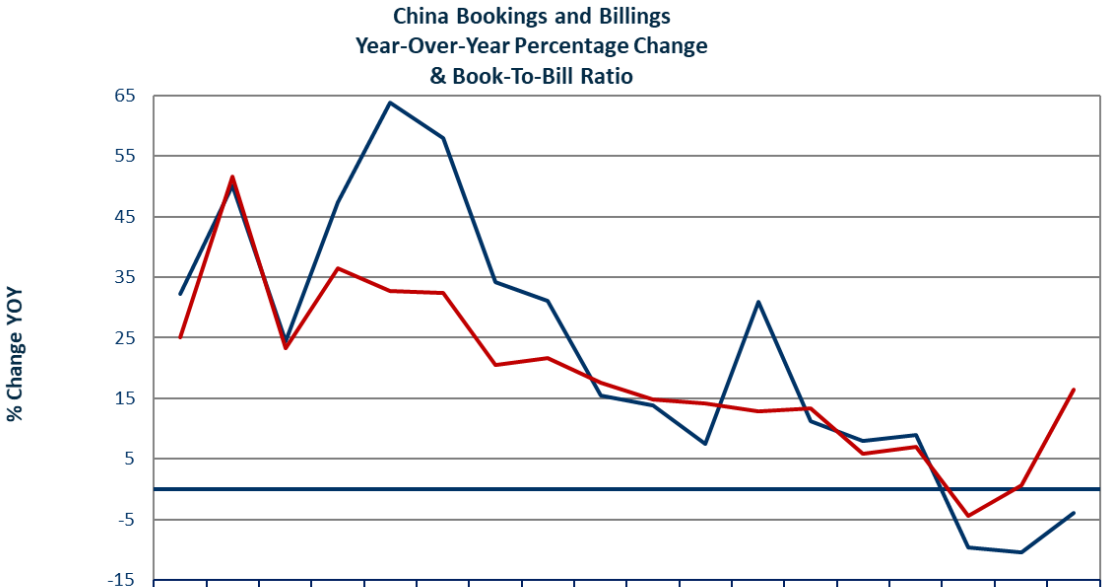
Japan Performance

- Bookings were down -9.1% in June. Sales increased +0.9%. Sequentially, sales increased +4.9%. Japan's book-to-bill ratio was 0.99.
- The inflation rate in June was 2.4%, down slightly from May.
- Industrial production decreased 3.1% YOY in May.
- May retail sales grew 3.6% YOY.
- Exports grew 18.9% sequentially in June.
- The July manufacturing PMI was to 52.2, a ten-month low.
- Housing starts declined 4.3% in May.

Conclusions

Until April, Japan's bookings performance primarily was reflective of easy comparisons to 2021 results. The shortage of semiconductors is holding back growth in automotive industry sales in 2022. Billings have been weak for the last four months.

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.



	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22
Bookings	32.3	50.2	24.5	47.3	63.8	58.0	34.2	31.1	15.5	13.9	7.5	30.9	11.2	7.9	9.0	-9.7	-10.4	-4.0
Billings	25.0	51.6	23.3	36.5	32.7	32.3	20.4	21.7	17.6	14.8	14.1	12.8	13.4	5.8	7.0	-4.4	0.6	16.5
Billing SEQ	-3.2	3.1	2.0	-0.4	4.2	28.6	0.3	5.6	0.9	-2.4	11.1	-5.2	-2.7	-3.9	3.2	-15.4	10.3	12.5
BTB	1.14	1.12	1.11	1.19	1.21	1.14	1.12	1.18	1.00	1.08	1.00	1.03	1.12	1.14	1.22	1.12	1.07	0.94

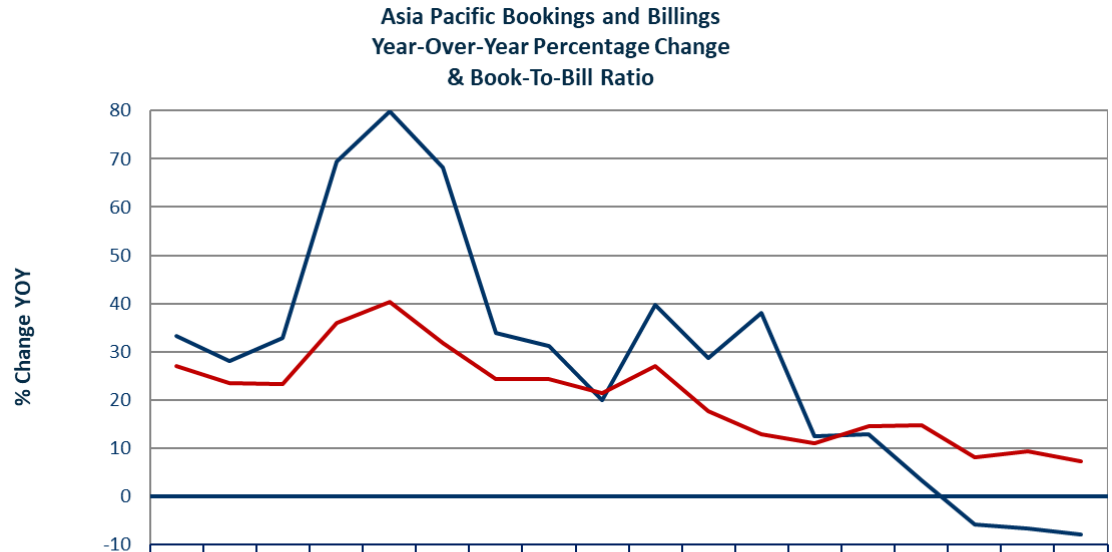
China Performance

- China's sales increased +16.5% YOY and orders decreased -4.0% YOY. The BTB was 0.94. Sequentially, sales increased +12.5% in June.
- Industrial production increased 3.9% YOY in June.
- China's manufacturing PMI rose to 51.7 in June from 48.1 in May.
- Retail sales increased 3.1% YOY in June.
- Exports from China were up 7.5% YOY to $331 billion in June. Electrical and electronic equipment comprised 27% of the exports.
- China's total vehicle sales rose 23.8% in June. YTD sales are down 6.6% from prior year.
- The inflation rate rose to 2.5% in June.

Conclusions

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. This is likely to impact the growth in the Chinese connector industry for 2022.

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.



	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22
Bookings	33.2	28.1	32.8	69.4	80.0	68.3	33.9	31.1	20.0	39.7	28.7	38.1	12.4	12.9	3.4	-5.9	-6.7	-7.9
Billings	27.1	23.5	23.2	36.1	40.3	31.8	24.3	24.3	21.4	27.0	17.6	12.9	11.0	14.5	14.7	8.1	9.4	7.3
Billing SEQ	-0.5	2.0	0.7	5.6	5.7	40.6	-2.6	4.4	-3.1	4.7	4.4	-7.1	-2.2	5.2	0.9	-5.0	7.3	-2.9
BTB	1.14	1.17	1.24	1.23	1.24	1.09	1.09	1.09	1.06	1.23	1.50	1.04	1.16	1.15	1.21	1.07	1.06	0.94

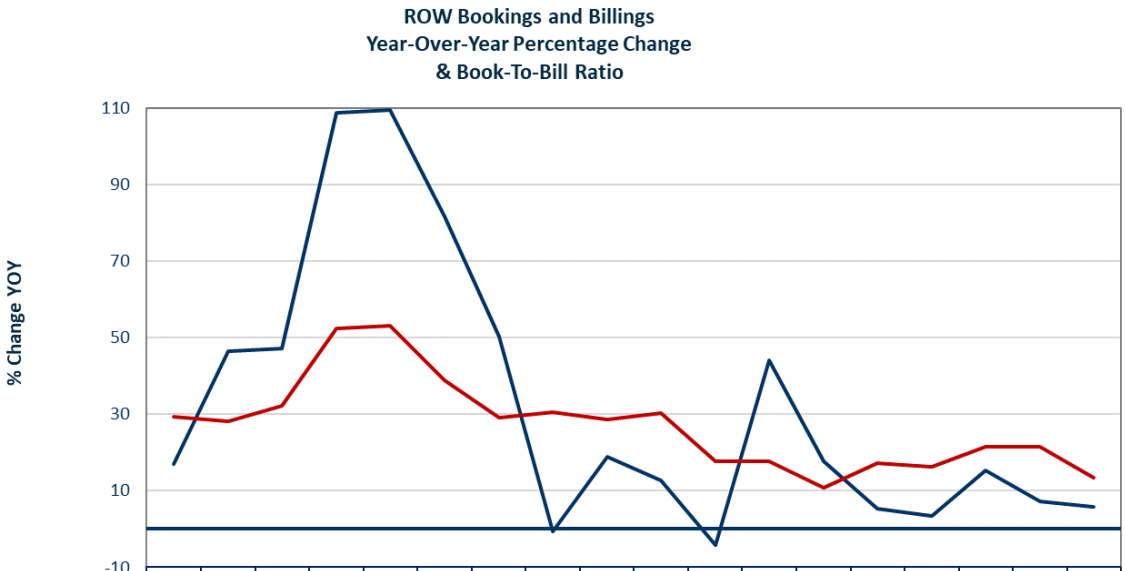
Asia Pacific Performance

- Orders were down -7.9% in June and sales increased +7.3% YOY. The book-to-bill ratio was 0.94. Sequentially, sales decreased -2.9%.
- India's industrial production grew 19.6% YOY in May. Exports increased 23.5% YOY in June driven primarily by petroleum products. Electrical and electronic equipment only represents 4.8% of the exports. The manufacturing PMI decreased slightly to 53.9 in June. Inflation in June decreased slightly to 7.01%.
- South Korea's industrial production rose 7.3% YOY in May. Exports decreased 6.2% sequentially in June. Electrical and electronic equipment comprise 31% of their exports. The manufacturing PMI decreased to 51.3 in June. Inflation rose to 6.0% in June, the fastest rate since November 1998.

Conclusions

India's and South Korea's economies continues to grow YOY and sequentially. South Korea's connector sales have a positive outlook with strong 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.



	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22
Bookings	17.0	46.5	47.1	108.7	109.6	81.6	50.2	-0.6	18.9	12.7	-4.3	44.0	17.6	5.3	3.5	15.2	7.2	5.9
Billings	29.3	28.2	32.3	52.5	53.1	38.9	29.1	30.6	28.6	30.2	17.6	17.6	10.7	17.2	16.2	21.5	21.6	13.3
Billing SEQ	0.0	12.3	-2.4	-4.0	12.2	41.5	-0.5	10.9	-4.3	1.3	1.9	-7.1	-5.8	18.5	-3.3	-5.3	13.1	-8.2
BTB	1.09	1.33	1.20	1.17	1.20	1.23	1.29	0.74	0.93	1.01	0.85	1.89	1.16	1.20	1.07	1.11	1.06	1.02

Rest of World Performance

- Orders increased +5.9% and sales increased +13.3% YOY in June. Sequentially, sales in the region decreased -8.2%. The book-to-bill ratio was 1.02.
- Brazil's industrial production increased 0.5% YOY in May, the first month of growth in the last 10 months. The inflation rate decreased to 11.82% in June from 11.73% in the prior month. The manufacturing PMI dropped to 54.1 in June from 54.2 in the previous month. The unemployment rate declined to 9.8% in May.
- Russia's economic data has been reported as unreliable at this point in time.

Conclusions

The region continues to experience growth within their connector industries. Sales have grown in the double-digit range since September 2020.

We anticipate that slowing economic growth in both countries will adversely affect connector growth in 2022. 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 drastic 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.

Second Quarter Industry Results

The connector industry achieved sales in 2Q22 of $20,560 million, up +8.2% in US dollars compared to 2Q21, and up +3.0% sequentially.

The following table shows industry sales by quarter for 2020, 2021, and 2022, actual and forecast. Our full year 2022 forecast is $82,989 million, up +6.4% from prior year.

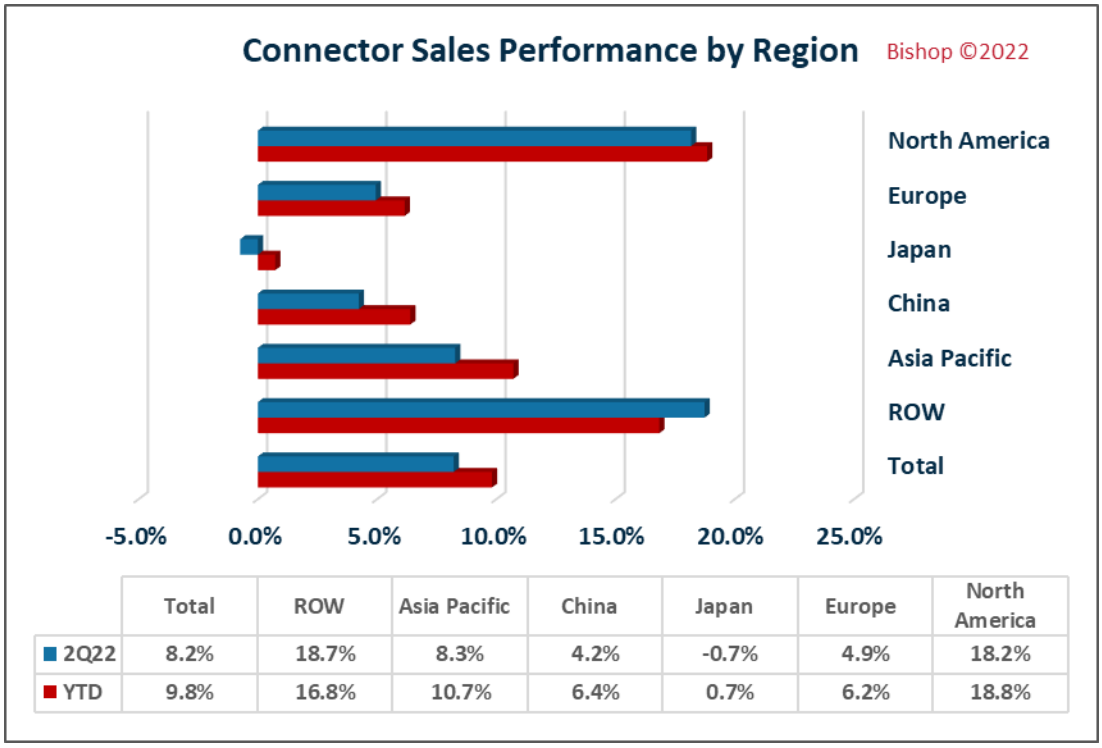
Connector Industry Quarterly Sales Results/Forecast

2020, 2021, and 2022

Quarter	2020 Actual	2021 Actual	YOY Change	2022 Forecast	YOY Change
1Q	$15,397	$19,061	23.8%	$21,200	11.2%
2Q	$13,333	$19,000	42.5%	$20,560	8.2%
3Q	$16,689	$20,150	20.7%	$20,770	3.1%
4Q	$17,308	$19,780	14.3%	$20,459	3.4%
Total	$62,727	$77,991	24.3%	$82,989	6.4%

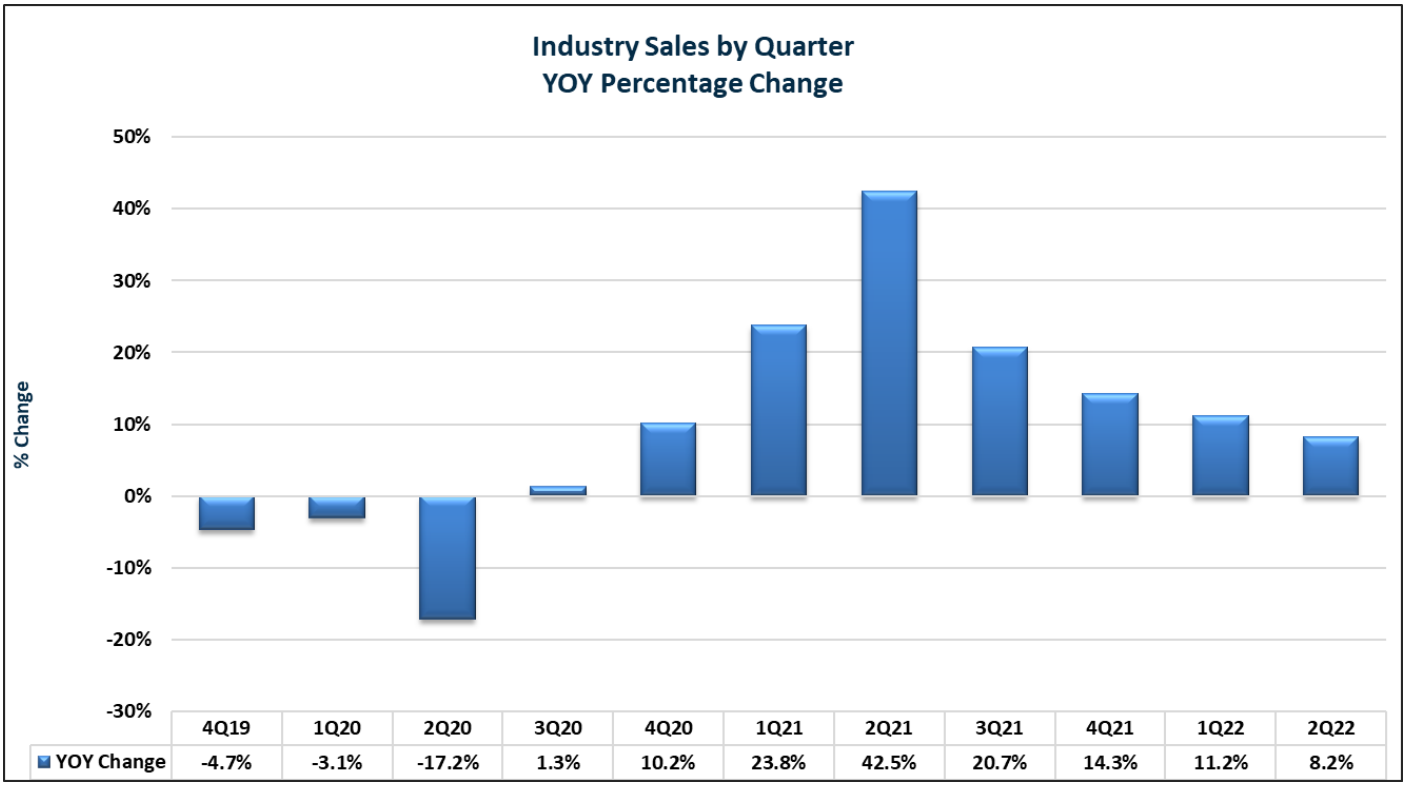
$ Million, Bishop ©2022, Red = Forecast

Year-to-date and YOY sales growth by region in the second quarter of 2022 can be seen in the following chart.



	Total	ROW	Asia Pacific	China	Japan	Europe	North America
2Q22	8.2%	18.7%	8.3%	4.2%	-0.7%	4.9%	18.2%
YTD	9.8%	16.8%	10.7%	6.4%	0.7%	6.2%	18.8%

Connector industry sales growth by quarter can be seen in the following chart. In the last contraction, the industry contracted for seven consecutive quarters. Prior to that, the industry achieved eleven consecutive quarters of growth. We have now achieved eight consecutive quarters of growth.



	4Q19	1Q20	2Q20	3Q20	4Q20	1Q21	2Q21	3Q21	4Q21	1Q22	2Q22
YOY Change	-4.7%	-3.1%	-17.2%	1.3%	10.2%	23.8%	42.5%	20.7%	14.3%	11.2%	8.2%

Industry Backlog Remains at 16.4 Weeks

The industry backlog decreased to $26,302 million in June. The industry is currently shipping $1,605 million per week. This converts to 16.4 weeks of backlog.

The following table displays the industry backlog year-to-date June 2022. To date, the industry has booked $46,543 million and achieved sales of $41,740 million.

Industry Backlog

	2021	YTD June 2022
BtB Ratio	1.14	0.99
Beginning Backlog	$10,530	$21,499
Bookings	$88,910	$46,543
Billings	$77,991	$41,740
Ending Backlog	$21,499	$26,302
Backlog in Weeks	14.3	16.4

$ Millions

Prior to June, the industry achieved 20 consecutive months with a book-to-bill ratio above 1.0. The last time the BTB was below 1.0 was September 2020. However, June 2022 resulted in a BTB ratio of 0.99.

We are projecting slower demand in the second half of 2022 and expect the backlog to continue to shrink.

2022 Industry Outlook

Over the past 12 years (2010-2021), sales through June averaged 48.9% of full year sales. Year-to-date, sales were $41,740 million. Assuming the historical average of 48.9% repeats, the industry will achieve sales of $85,358 million. This is a 9.4% increase over 2021 sales of $77,991 million.

The following table identifies the range of full year 2022 sales based on the 12-year averages for January through June combined.

2022 Forecast Range

	Historical Range		
	High	**Avg**	**Low**
YTD June Sales %	45.6%	48.9%	51.2%
YTD June Actual Sales	$41,740	$41,740	$41,740
Full Year Forecast	$91,535	$85,358	$81,523
2021 Actual Sales	$77,991	$77,991	$77,991
% Increase	**17.4%**	**9.4%**	**4.5%**

$ Millions

The following table summarizes this forecast analysis, including the Bishop forecast.

Category	2022 Sales	% Growth
12 Year High	$91,535	17.4%
12 Year Average	$85,358	9.4%
Bishop Forecast	$82,989	6.4%
12 Year Low	$81,523	4.5%

$ Millions

As the above demonstrates, a historical perspective (12 years) forecasts 2022 connector sales should grow approximately +9.4. We are forecasting a lower growth rate of +6.4%. This slightly more pessimistic outlook is based on tougher comparisons (2021 sales were up +24.3%) and some rather significant headwinds.

- Inflation and rising interest rates. The US Federal Reserve just increased interest rates 0.75 basis points.
- War in Europe and saber rattling over Taiwan.
- Shortages of semiconductors, particularly in the auto industry, is having a negative impact on Europe.
- Slower global GDP growth. The US just reported two quarters of contraction.

The following table displays the 2022 and 2023 Bishop forecast by geographic region of the world:

Bishop Forecast by Region

	2021 Results	Change	2022 Forecast	Change	2023 Forecast	Change
North America	$16,484	22.2%	$17,999	9.2%	$18,436	2.4%
Europe	$16,278	26.8%	$17,109	5.1%	$17,502	2.3%
Japan	$5,276	19.1%	$5,355	1.5%	$5,456	1.9%
China	$24,978	23.8%	$26,443	5.9%	$27,686	4.7%
Asia Pacific	$11,384	25.9%	$12,195	7.1%	$12,637	3.6%
ROW	$3,590	31.2%	$3,888	8.3%	$3,983	2.4%
Total	**$77,991**	**24.3%**	**$82,989**	**6.4%**	**$85,700**	**3.3%**

$ Million, Bishop ©2022

Growth of +6.4% in 2022 is above the historical average for industry growth and would be a significant achievement after the outstanding performance of 2021 when sales were up +24.3%. This would be two of the best back-to-back years in industry's history.

You will note that we are less positive of 2023 projecting sales up only +3.3%.

Strong U.S. Dollar Reduces Growth from 9.8% in USD to 3.1% in Local Currencies

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

Local Currency to One USD
June 2021 versus June 2022

Currency	2021	2022	% Change
Euro	0.8301	0.9457	13.9%
Yuan	6.4228	6.6940	4.2%
Yen	110.0957	133.8910	21.6%

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

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

Industry Sales Performance
YTD June 2022
USD-vs-Local Currencies

Region	U.S.$	Local Currency
North America	18.8%	18.8%
Europe	6.2%	-8.6%
Japan	0.7%	-21.0%
China	6.4%	1.9%
Asia Pacific	10.7%	10.7%
ROW	16.8%	16.8%
World	**9.8%**	**3.1%**

Connector sales are 6.7 percentage points lower when stated in local currencies rather than in US dollars, putting industry performance at +3.1% in June (versus +9.8% in US dollars). This is the result of a stronger US dollar, on average, compared to these three currencies.

Significant Events

Digi-Key Hires Mike Slater as VP of Global Business Development

Digi-Key Electronics has hired Mike Slater as its new vice president of global business development. In his new role, Slater will oversee the company's worldwide customer and supplier development strategy. Slater comes to Digi-Key with more than 25 years of sales, management, and business experience. Prior to joining Digi-Key, he served as the president of E-Switch Inc., where he was responsible for the company's global sales across North America, Asia, Europe, and Latin America. Slater also previously served as a general manager at Arrow Electronics, where he built, managed, and developed effective sales teams. "Mike's deep background in sales strategy and management aligns with our strategic growth initiatives as we continue to expand our markets around the globe and redefine what it means to be a high service distributor," said Dave Doherty, president of Digi-Key.

TTI Inc. promoted John Drabik to president, TTI Americas.

Drabik, who joined TTI in 2020, previously held the position of senior vice president, TTI Americas sales and product management. Prior to TTI, he served as president, Americas components at Arrow Electronics. Drabik began his career with KEMET working closely with TTI. In making the announcement, Mike Morton, TTI CEO, stated, "When we invited John to join the TTI leadership team we anticipated his progression into this role. Since joining us he has worked across multiple areas of our company, becoming familiar with our process and most importantly our people. John is a highly qualified, talented individual and well suited to serve all those invested in the continued growth and success of our company." Drabik succeeds TTI Americas president, Don Akery, who will be joining non-competitor, master distributor Waldom Electronics as CEO.

Andrew Dinsdale Named General Manager of SV Microwave

After 26 years, effective July 1, 2022, Subi Katragadda will step down as general manager of Amphenol SV Microwave. Under his stewardship, SV has experienced tremendous growth, diversification, and organizational development. Taking up the mantle, Andrew Dinsdale will become the next general manager of SV Microwave, effective on July 1. Dinsdale joined SV in 2008 as an application engineer, and since then has worked as a business development manager focused on diversification into the high frequency commercial market and most recently, as director of marketing and applications engineering. In his latest role, Dinsdale has been instrumental in driving SV's performance over the last several years. As GM, he will continue to push the entrepreneurial culture and people-focused approach that embodies SV Micro.

Inflation Spirals in the High-Tech Supply Chain

When judging the cost of electronics, it's about more than the price of an individual part. Supply chain considerations include the cost of getting parts through the door, and that price is skyrocketing.

Inflation is taking its toll on the electronics industry. The IPC's June Global Sentiment of the Electronics Supply Chain report found that nine in 10 electronics manufacturers surveyed are currently experiencing rising material costs, while 86 percent of electronics manufacturers are concerned about inflation – for good reason. IPC's June Economic Report points to three main forces exerting pressure on the economy: geopolitical uncertainties, inflationary pressure and China's Covid-related lockdowns.

"The three key themes we laid out last month continue to hold: geopolitical uncertainties remain high in the shadow of Russia's invasion of Ukraine, inflationary pressures are wreaking havoc on wide swaths of the

economy, and China's Covid lockdowns are exacerbating supply chain disruptions," said Shawn DuBravac, IPC chief economist.

Of course, these aren't the only supply chain disruptions increasing both confusion and costs. In June 2022, inflation hit a 40-year record, with consumer prices increasing 9.1 percent over the last 12 months, according to the U.S. Bureau of Labor Statistics.

Continued congestion in U.S. ports remains an ongoing concern. Although some reports say that issue has peaked, there's no indication that it will resolve itself any time soon. Prices on shipping containers has risen exponentially in the meantime. Prior to Covid, a 40-foot-high container cube cost about $4,000 to bring into a harbor. By February 2022, that price had gone to $24,000 (six times more). Now, the price is at $14,000, a seemingly large increase that still represents a price more than triple normal levels. That's a 40 percent decrease that's still a 200 percent increase prior to the problem.

From a manufacturer's perspective, some logistics problems seem to be improving. Ocean and air shipments are spending less time in transit, according to cargo marketplace Freightos. Rates are declining, although they remain high relative to prior year levels. However, these may be indications of softening demand rather than global logistics improvements. Gas prices have added to the cost equation. Fuel surcharges are appearing at every juncture of the supply chain.

For now, high prices and inflation are an unescapable reality. Several chipmakers – Intel, Qualcomm and Marvell – have announced price hikes related to inflation. Pundits predict that this new reality will be with us for the next 18 months. "The inflation rate is likely to stay close to 9 percent the rest of the year, then decline gradually after that, ending 2023 at about 3 percent," according to Kiplinger.

Gartner Forecasts Worldwide PC Shipments to Decline 9.5% in 2022

Worldwide PC shipments are on pace to decline 9.5% in 2022, according to the latest forecast from Gartner, Inc. The PC market is expected to experience the steepest decline of all device segments this year.

"A perfect storm of geopolitics upheaval, high inflation, currency fluctuations and supply chain disruptions have lowered business and consumer demand for devices across the world and is set to impact the PC market the hardest in 2022," said Ranjit Atwal, senior director analyst at Gartner. "Consumer PC demand is on pace to decline 13.1% in 2022 and will plummet much faster than business PC demand, which is expected to decline 7.2% year over year."

From a regional perspective, the EMEA PC market is forecast to record a 14% decline in 2022, driven by lack of consumer PC demand. The Russian Invasion of Ukraine, price increases and unavailability of products due to of lockdowns in China are significantly impacting consumer demand in the region.

Overall, global shipments of total devices (PCs, tablets and mobile phones) are on pace to decline 7.6% in 2022, with Greater China and Eastern Europe including Eurasia recording double-digit declines

North American PCB Industry Sales Up 17.1 Percent in June

IPC announced the June 2022 findings from its North American Printed Circuit Board (PCB) Statistical Program. The book-to-bill ratio stands at 1.03. Total North American PCB shipments in June 2022 were up 17.1 percent compared to the same month last year. Compared to the preceding month, June shipments rose 26.3 percent. PCB year-to-date bookings in June were down 4.1 percent compared to last year. Bookings in June increased 14.4 percent from the previous month.

Smartphone Shipments Fell 9% in Q2, But Apple iPhone Remains in High Demand Despite Inflation Pressure

Shipments of Apple's iPhone remain strong despite regional uncertainty and economic headwinds that dragged global phone shipments down 9% year over year in the second quarter, according to new data from research firm Canalys. Apple had a 17% share of global phone shipments in Q2, up from 14% in the year-earlier quarter, Canalys said, noting that the iPhone 13 remains in high demand. Samsung has the largest share with 21% of the market, according to Canalys, but that was largely on the strength of shipments of its low-end A series phones that cost less than the iPhone 13.

Gartner Says Worldwide PC Shipments Experienced the Sharpest Decline in 9 Years in Second Quarter of 2022

Worldwide PC shipments totaled 72 million units in the second quarter of 2022, a 12.6% decline from the second quarter of 2021, according to preliminary results by Gartner, Inc. This is the sharpest decline in nine years for the global PC market, brought on by geopolitical, economic and supply chain challenges impacting all regional markets. The top three vendors in the worldwide PC market experienced declines in PC shipments in the second quarter of 2022, but their ranking remained unchanged. The combination of HP declining 27.5% and Dell declining 5.2% allowed Dell to move to within 0.3 percentage points of HP in market share. Apple was the only vendor to experience growth in the second quarter of 2022, driven by the popularity of the M1 device.

Lenovo's worldwide PC shipments declined year-over-year, the third consecutive quarter of decline for the company. However, Lenovo grew 2% in the worldwide desktop PC market, partly because the company improved its supply chain in EMEA. HP experienced a decline of 27.5% in the second quarter of 2022, primarily due to a steep decrease in Chromebooks shipments.

Dell's shipments declined year-over-year for the first time since the third quarter of 2020. Shipments were down across all key regions except Latin America where Dell registered 6.5% growth. Despite the overall shipments decline, Dell's market share increased 1 percentage point compared to a year ago.

The U.S. PC market declined 17.5% in the second quarter of 2022. Although the market experienced shipment growth in both desktop PCs and laptops (excluding Chromebooks), this growth was offset by a 50% year-over-year decline in Chromebook shipments. Dell secured the top spot in the U.S. PC market based on shipments with 27.2% market share. Despite a decline of 43.5%, HP took the No. 2 position with 22.3% market share.

The EMEA PC market was the hardest hit in the second quarter of 2022 with a 18% decline in PC shipments, reaching only 17.8 million units. "This is a major setback in total volume after two years of very strong growth stimulated by COVID-19 and refreshed interest in PCs among consumers and the education segment," said Kitagawa. "Abandonment or complete relinquishment of operations in Russia due to war in the Ukraine had an even bigger impact on the PC market, as Russian PC shipments for leading PC vendors used to contribute between 5-10% the total EMEA PC volume."

EMEA also experienced a 20% decline in laptop shipments, while Chromebook shipments declined over 50% year-over-year. This is the result of overall sluggish demand from consumers across many countries in EMEA, struggling with price increases across many products, especially fuel and energy. A very high level of inflation will negatively impact consumer purchase power in the second half of 2022 and possibly into the first half of 2023.

The APAC (excluding Japan) PC market declined 5.2% in the second quarter of 2022, driven by a 16% decline in the China PC market. China's zero COVID-19 policy dramatically impacted the economy with lockdowns in Shanghai stopping carriers and logistics and any online orders and delivery in Shanghai during the time.

The Japanese PC market declined 10.8% in the second quarter of 2022. The decline was partly impacted by the steep depreciation of the Japanese Yen. PC prices increased steadily as a reflection of the weak currency value. Other influencing factors included rising fuel costs and temporary impact from the China lockdown, tightening IT spending in general.

Hon Hai Eyes Annual Growth After Surprise in Q2

Hon Hai Precision Industry Co said it looks to grow its revenue this year after reporting better-than-expected results for the second quarter thanks to double-digit percentage growth in sales of its cloud-based servers and computing products. In the April-to-June quarter, revenue from smart consumer electronics — mainly smartphones — surpassed the company's expectations, growing significantly from a year earlier.

Revenue expanded 7.26 percent quarter-on-quarter and 11.3 percent year-on-year to NT$1.51 trillion (US$50.8 billion) last quarter, beating the company's expectations of an almost flat quarter amid rising inflation that weighed on demand for smart consumer electronics.

Last quarter's results were the best second-quarter figures in the company's history, it said. Hon Hai in May predicted a slight annual decline in revenue this year, as sales of older-generation smartphones usually slow down ahead of new model launches in the fall. However, the product transition effect last month caused only a mild decline in revenue from smart consumer electronics, Hon Hai said.
Revenue last month soared 5.71 percent monthly and 31.2 percent annually to NT$526.2 billion, the company's best June result. Smart consumer electronics is the biggest revenue contributor to the company. Aside from market share gains, Hon Hai said resilient supply chain management last quarter helped it fend off logistics chaos and key component supply constraints due to China's COVID-19 restrictions. With strong sales figures for last month and last quarter, Hon Hai said that "visibility for this quarter is pretty much in line with market expectations, representing significant growth on a year-on-year basis." "The outlook for the full year has also improved, which should be better than the original flattish expectation," it said.

Hon Hai said all four major product categories performed better than expected. Cloud and networking products, primarily servers, and computing products outshone other products. Revenue from components also grew, benefiting from rising demand for electronic parts, the statement said.

US CHIPS Act Nears Approval After Senate Passage

The US CHIPS Act is close to approval. The Senate has voted in favor of a trimmer package of subsidy measures that's more focused on rebuilding the American semiconductor industry. On July 19, the Senate voted 64–34, demonstrating bipartisan support for the bill designed to provide more than $52 billion to boost U.S. semiconductor competition with China. The Senate is expected to vote on passage of a final version of the bill as early as this week. It still must pass the House of Representatives and go to President Joe Biden's desk for his signature before it becomes law. The Biden administration and the U.S. Department of Commerce (DOC) have strongly urged that the legislation must be approved as soon as possible because the European Union and governments in other parts of the world have offered more attractive stimulus measures that may slow investments, including Intel's $20 billion fab project in the U.S. state of Ohio.

American Chip Companies Spend Most on R&D

American chip companies spent more than half of the industry's total investment in research and development (R&D) in 2021, according to IC Insights. Despite political and national security concerns about US domestic semiconductor production, about 56% of global R&D spent in 2021 was by companies headquartered in the Americas region—essentially all of them in the US A large chunk of that came from Intel (19%, or $15.2 billion last year).

Worldwide, semiconductor companies spent 13.1% of combined sales on R&D in 2021 ($80.5 billion) versus 15.5% ($50.8 billion) in 2011, according to IC Insights' 2Q22 Update of The McClean Report. R&D spending covered by IC Insights' industry analysis include expenditures by wafer fab-operating IDMs, fabless chip suppliers, and pure-play foundries, but does not include other companies and organizations involved in semiconductor-related technologies, such as production equipment and materials suppliers, packaging and test service providers, universities, government-funded labs, and industry cooperatives.

R&D expenditures as a percent of semiconductor sales for companies headquartered in the Americas region averaged 16.9% in 2021. The R&D-to-sales ratio for semiconductor suppliers in the Asia-Pacific region was 9.8% in 2021, while European companies spent about 14.4% of their combined chip revenues on research and development last year. Japanese semiconductor companies had a combined R&D/sales ratio of 11.5% in 2021, according to IC Insights' current update report.

Why Taiwan's Foxconn Is Investing $800 Million In China's Chip Champion

Foxconn plans to invest about $800 million in Chinese chip conglomerate Tsinghua Unigroup, a move that will further expose the world's largest contract assembler of consumer electronics to the fast-growing electric vehicle market. Tsinghua Unigroup could offer Foxconn access to its mobile chipset or memory expertise, says Neil Mawston, executive director with market research firm Strategy Analytics. Battery-powered vehicles run on semiconductor chips, while memory modules help run other automotive applications. Tsinghua Unigroup reorganized earlier this month after defaulting on billions of dollars' worth of bonds and analysts say it still needs help. On the other side of the table, Foxconn is searching for new revenue Foxconn is stepping into semiconductors because the global semiconductor industry for smartphones, EVs and other products is greatly undersupplied and offers big opportunities for growth and supply-chain control.

The Taiwanese company also known as Hon Hai Precision and founded by billionaire Terry Gou has pushed into the production of EVs over the past two years. It made a merger-and-acquisition deal this year to develop EV semiconductors. Last year, Foxconn reached agreements with Los Angeles-based startup Fisker and global auto-making giant Stellantis. Fisker and Foxconn would make electric cars in the US, while Stellantis would co-develop automotive chips with Foxconn.

But this investment would not be a co-development partnership like Foxconn's other EV deals and may instead take shape as a traditional investment for purely financial gain, says Brady Wang, a Taipei-based analyst with market intelligence firm Counterpoint Research. "Of course, there are advantages, but in terms of using production capacity, that's an impossibility," he says.

GM Says It's Well on the Way to 1 million EVs by 2025

General Motors expects to produce 400,000 electric vehicles in 2022-24, on its way to its longstanding goal to reach 1 million by 2025, said CEO Mary Barra in a Tuesday investors' call following release of the automaker's second-quarter financial results. Meanwhile, its Cruise autonomous-vehicle subsidiary will expand coverage, hours of operation, and fleet size for its "ride hail" service, which launched in San Francisco last November.

Barra highlighted these EV models:

Chevrolet has more than 150,000 reservations for its 2024 Silverado EV, which goes on sale in spring 2023, with 65% conquest buyers and 70% on the East and West coasts. Ford said it closed off reservations for its F-150 Lightning EV early this year after hitting 200,000 reservations.

GMC has more than 80,000 reservations for its monster Hummer EV currently in production, “with momentum growing,” including 42% of those (about 33,600) new to GM and 75% new to GMC. Biggest markets for the GMC Hummer are California, Florida, and Texas.

No reservation numbers were released on the Cadillac Lyriq, now in production in the onetime Saturn assembly plant in Spring Hill, Tennessee, though Barra says 70% of its customers are new to Cadillac and 30% are from the Western region of the US. Barra says Lyriq’s production at Spring Hill will accelerate through the second half of 2022 and into ’23.

Chevrolet Blazer EV production begins in the summer of 2023, followed by the $30,000 base-price Equinox EV beginning production in the fall.

Cruise—an autonomous Chevy Bolt (pictured below) with no steering wheel or brake and throttle controls—has given more than 1,000 rides in San Francisco since driverless ride-hail service began last November. It will expand to “hundreds” of cars deployed in the City by the Bay by the end of this year. GM says Cruise has the potential for $50 billion in annualized revenue by decade’s end.

BrightDropZero electric delivery van production launches at GM’s CAMI plant in Ingersol, Ontario, late this year with annualized production of 30,000 vehicles “and the ability to double by mid-decade.” This all but confirms our recent story that Chevrolet Express and GMC Savana EV replacements will be built in the same plant as the larger delivery vans.

Google and Chevron Invest in Nuclear Fusion Startup That’s Raised $1.2 billion

Google and Chevron are part of a $250 million funding raise announced Tuesday for TAE Technologies, a nuclear fusion startup with an unconventional strategy that has now raised a total of $1.2 billion. Nuclear fusion is often referred to as the holy grail of clean energy because of its promise of generating nearly unlimited emission-free energy without the equivalent harmful, long-lasting radioactive waste that nuclear fission produces. TAE was founded in 1998 and aims to have a commercial scale fusion reactor delivering energy to the grid in the early 2030s.

Amazon Plans to Start Delivering Packages by Drone in Texas Later This Year

Amazon said it will begin delivering packages to shoppers by drone in College Station, Texas, later this year. The eastern Texas town is the second location to see the launch of Prime Air drone deliveries. Last month, Amazon announced it would deliver some packages by drone later this year in the Northern California town of Lockeford. Amazon said it will work with Texas A&M University, located in College Station, to deploy the drones. Amazon shoppers in Lockeford and College Station will be able to receive free drone delivery on thousands of everyday items, Amazon said. The company said its drones are capable of delivering packages up to five pounds in less than an hour. Prime Air drones can fly up to 50 miles per hour and up to an altitude of 400 feet, Amazon said. Its drones fly to a designated delivery location, descend to the shoppers’ backyard, and hover at a safe height, the company said. The device releases the package, rises back up to altitude, and returns to base, Amazon said. Amazon’s drone delivery program has been slow going since 2013 when founder and then-CEO Jeff Bezos said the company was testing the technology and promised that half-hour shipping with Prime Air drones would arrive as soon as 2018.

Starlink’s Space Speed-Up: A Battle for Internet Leadership

SpaceX’s Starlink microsatellite internet service now delivers downloads of around 90.55 Mbps in the United States, according to a recent analysis by Ookla. The speed test company reports that the median downlink speed in the first quarter of 2022 in the U.S. has “dramatically increased” by 38%, up from 65.72 Mbps in Q1, 2021. Indeed, Ookla finds that Starlink is delivering some of the fastest satellite–based internet download speeds across the countries it operates in worldwide. The analysts say that Starlink offers median downlink

transfers of 124.31 Mbps in Australia, 105.91 Mbps in Mexico, and 100 Mbps+ in all the European countries it offers service in. Specifically, this service is designed for rural users rather than city slickers. This means Starlink should deliver enough speed for streaming, gaming, and other tasks that rural users typically wish to perform. SpaceX still warns of service outages, though. On July 7, 53 new Starlink satellites lifted off from Cape Canaveral, Florida, adding to the more than 2,500 satellites SpaceX currently has in orbit.

Billionaire and SpaceX owner Elon Musk told the Federal Communications Commission (FCC) in mid–May that Starlink has over 400,000 subscribers globally. The satellite service currently operates in 36 countries worldwide and is planning to add new nations in Africa, Asia, and the Middle East in 2023.

The satellite download speeds aren't remotely as fast as the best cable services in major metro areas or even the fastest mobile 5G carrier in the U.S. As Ookla points out, however, this kind of service can prove a revelation for users in the boondocks, who haven't had access to speedy internet.

Apple Forecast to Ship 85m iPhone 14s by End of Year

Global shipments of iPhone 14-series smartphones are forecast to reach 85 million units by the end of the year after Apple Inc launches its next-generation models later this year. Shipments by Apple's major iPhone assemblers — Hon Hai Precision Industry Co, Pegatron Corp and Luxshare Precision Industry Co are expected to reach 22 million units by the end of this quarter and add another 63 million units next quarter. Despite no order cuts from Apple so far, the 85 million units forecast is lower than a market consensus forecast of 90 million to 92 million units. Apple is expected to launch four new models in the iPhone 14 series: the iPhone 14, iPhone 14 Max, iPhone 14 Pro and iPhone 14 Pro Max.

Apple has Applied for 248 Car-Related Patents Since 2000

Apple has filed for and published a total 248 automobile-related patents since 2000, according to research conducted by Japanese news site Nikkei and Tokyo analytics firm Intellectual Property Landscape. Patents cover self-driving technology, riding comfort, seats, suspensions, navigation, battery management, vehicle-to-everything (V2X) connectivity for car-to-car communication, and more. Apple has filed the most patents related to communication and navigation, followed by autonomous driving.

After Apple submits a patent application, it takes around 18 months for it to be published. Apple has so far had eight car-related patents published from 2021, but additional patents should be granted later this year, and the number of 2021 patents published is expected to exceed the number of patents Apple had published in 2020. Car-related patent filings began picking up in 2016 after fewer than 10 per year in the 2010s, with Apple filing for 44. Patent filings ticked up even further in 2017, when Apple filed for a record 66 applications.

News of Apple's work on some kind of self-driving vehicle first surfaced in 2014, and since then, we've heard regular rumors about Apple's progress. The work on the car has shifted several times and there were moments when it looked like a full car was not going to happen, but in recent years, changes to the project indicate Apple is indeed pushing for some kind of electric autonomous vehicle to be released by the end of the decade.

Recent rumors indicate that Apple has ambitious plans for its self-driving vehicle, with the aim of changing the car market the way the iPhone changed the smartphone market. Apple is exploring a design with four seats that face inward, with no steering wheel or brake pedal.

There is no word on when the Apple Car will be launching, but reliable sources like Bloomberg's Mark Gurman and Apple analyst Ming-Chi Kuo have suggested that Apple is aiming for a 2025 release.

Copper and Fiber Connectivity in the Data Center

The data center has grown from its original concept as a central location for computing and storage hardware to the data center of today that is at the epicenter of connection of nearly every aspect of our digitized lives. Data centers have evolved from single client on-premises facilities that were isolated from the world to multi-acre hyperscale facilities that contain thousands of servers and act as nodes in a globally connected high-speed network.

The past 30 years have seen massive adoption of new computing technologies including virtualization that enabled dynamic adaptation to support constantly changing resource demands. Widespread adoption of the Internet and the literally millions of subsequent applications together with the advent of streaming video has driven Internet traffic to incredible levels. The transition to software defined and managed data centers increased the efficiency of modern data center infrastructure and ushered in the cloud and edge computing revolution, but we are only at an early stage in what will be required to support the workload expected in the near future. Looming on the horizon are emerging technologies including artificial intelligence, fully autonomous transportation, 8K video, Industry 4.0, and artificial reality that will demand incredible computing power delivered with nearly zero latency. The potential demands that the metaverse could add to the level of data center traffic is unimaginable. The infrastructure of the global data center network will be tasked with efficiency supporting these demands while addressing challenges in power and heat reduction, and improved reliability, while assuring absolute security. High-speed data links, both copper and fiber optic will play critical roles in achieving each of these objectives.

Copper based circuits have been the primary media choice for high-speed electronic signals within the data center since its beginning years. Copper conductors in printed circuit boards (PCB), wire and cable assemblies have a proven track record of reliability over many years. The technology is well developed and supported with decades of manufacturing experience available from a universe of global vendors.

Fiber offers multiple technical advantages including, near unlimited bandwidth, low signal loss and distortion over long distances, reduced size and bulk, as well as isolation from electromagnetic interference (EMI) and electrostatic discharge (ESD). Early glass fiber was extremely fragile, difficult to terminate and costly. Components required to perform the electro-optic conversion process at both ends of a link added to the power and heat budget, consumed valuable space as well as added cost. Fiber optic links filled a limited niche in long-haul telecommunication applications that could extend for hundreds or thousands of miles. To use copper cables in lengths that long would require many expensive amplifiers, making copper impractical especially in undersea cables.

In addition to the data center, emerging applications of fiber will initially be concentrated in select industries including high performance computing (HPC), military and avionic. As experience is gained and component prices decline, commercialization will allow the migration of fiber into more mainstream equipment including embedded computers. Fiber to the home (FTTH) has already brought the advantages of increased bandwidth to millions of residents. It is possible in the future that as homes and offices in the past were wired with Ethernet cable, fiber will become a universal backbone of high-speed residential data distribution in the future.

This 275-page market research report identifies and compares the leading trends that are driving the consideration of fiber optic communication in an expanding range of applications that have traditionally been served by copper electrical circuits. Advances in optical hardware including connectors as well as transmission technology is discussed along with how future advances will enable support of evolving network traffic demands.

The long-predicted demise and replacement of copper circuitry by fiber optic alternatives, remains just that, but as bandwidth demands continue to rise, optical transmission will continue to offer a cost-effective alternative in a gradually increasing number of applications.

Copper and Fiber Connectivity in the Data Center

The following table of contents shows the detail provided in this new report.

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