The European Institute for the PCB Community

# EIPC SPEeDNEWS

*The Weekly On-Line Newsletter*
*Issue 27 – September 2023*

## ARTIFICAL INTELLIGENCE NEWS

### Human-machine teams driven by AI are about to reshape warfare

By David Lague
SYDNEY, Sept 8 (Reuters) –

Some technology experts believe innovative commercial software developers now entering the arms market are challenging the dominance of the traditional defence industry, which produces big-ticket weapons, sometimes at glacial speed.

It is too early to say if big, human-crewed weapons like submarines or reconnaissance helicopters will go the way of the battleship, which was rendered obsolete with the rise of air power. But aerial, land and underwater robots, teamed with humans, are poised to play a major role in warfare.

Evidence of such change is already emerging from the war in Ukraine. There, even rudimentary teams of humans and machines operating without significant artificial-intelligence powered autonomy are reshaping the battlefield. Simple, remotely piloted drones have greatly improved the lethality of artillery, rockets and missiles in Ukraine, according to military analysts who study the conflict.

Kathleen Hicks, the U.S. deputy secretary of defence, said in an Aug. 28 speech at a conference on military technology in Washington that traditional military capabilities "remain essential." But she noted that the Ukraine conflict has shown that emerging technology developed by

commercial and non-traditional companies could be “decisive in defending against modern military aggression.”
A Reuters special report published today explores how automation powered by artificial intelligence is poised to revolutionise weapons, warfare and military power.

Both Russian and Ukrainian forces are integrating traditional weapons with AI, satellite imaging and communications, as well as smart and loitering munitions, according to a May report from the Special Competitive Studies Project, a non-partisan U.S. panel of experts. The battlefield is now a patchwork of deep trenches and bunkers where troops have been “forced to go underground or huddle in cellars to survive,” the report said.

Some military strategists have noted that in this conflict, attack and transport helicopters have become so vulnerable that they have been almost forced from the skies, their roles now increasingly handed over to drones.

“Uncrewed aerial systems have already taken crewed reconnaissance helicopters out of a lot of their missions,” said Mick Ryan, a former Australian army major general who publishes regular commentaries on the conflict. “We are starting to see ground-based artillery observers replaced by drones. So, we are already starting to see some replacement.”

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## MATERIAL NEWS

### The Glass Substrate Question: When Will It Replace Copper Clad Laminate?

Advanced IC substrates have facilitated a paradigm shift in packaging technology.

*SEPTEMBER 12TH, 2023*
*BY: KEITH BEST*
*Semiconductor Engineering*

"When will glass replace copper clad laminate on advanced IC substrates?" That's a question many on the heterogeneous integration (HI) side of the semiconductor industry are asking. Unfortunately, the answer is not straightforward.

But before we get to answering that, let's take an advanced IC substrate (AICS) refresher. In other words, how did we get to the point where glass substrates have become a topic of discussion?
AICS provides a means to connect chiplets and passives with extremely high I/O count to the printed circuit board (PCB). In the process, AICS has facilitated a paradigm shift in packaging technology with the introduction of HI. This revolutionary approach to packaging provides a significantly cheaper alternative to silicon interposer technology, which is limited in the package sizes it can support.

The AICS is built around a fibreglass resin core with copper on both sides. This is known as copper clad laminate (CCL). The CCL facilitates the creation of redistribution layers (RDL) that connect through the substrate core with plated through holes (PTH). The RDLs are separated by organic dielectric layers known as build-up films.

To be even more direct: the AICS is essentially the evolution of the PCB. In fact, many of the patterning techniques and materials are very similar but have been extended or replaced with more capable tooling. For instance, laser drilling replaces mechanical drilling to shrink via holes, and lithography steppers replace laser direct imaging (LDI) systems to reduce RDL dimensions and increase productivity.

Currently, the roadmap requirements for AICS have driven the CCL processing far beyond the capabilities of the PCB world. Today, new materials and processes are required to support the next generation of packages, where package sizes exceed 120mm x 120mm and interconnects (RDL) shrink below 5µm line/space (l/s).

As substrate manufacturers continue to push processing technology to match their customers' advanced packaging roadmaps, they face several technical challenges. The dilemma: how to lower manufacturing costs, while at the same time, not fall behind on next-generation product development.

This is where glass substrates enter the discussion.
Previously, it was thought the glass substrate transition would be when RDL shrinks below 5µm l/s. However, both equipment and processing solutions are readily available that can extend the life of CCL beyond 5µm line/space to potentially 2µm l/s. For instance, new substrate lithography steppers, with higher resolution lenses and advanced alignment algorithms, which can mitigate substrate distortion effects, enable overlay performance hitherto unknown. In addition, next-generation substrate inspection equipment that can detect RDL defects, currently limiting the yield of smaller RDL features, will soon become available.

To realize 2µm l/s with CCL, the process flow will need to be modified to support higher resolution RDL features and micro-via patterning (figure 1). Currently, the CCL via layer is defined by laser drilling through an organic dielectric build-up film. This process is limited to supporting vias >30µm l/s. To reach 2µm l/s roadmap requirements, vias will need to shrink to below 10µm; which will require lithographic patterning. The via lithography process will use either liquid or dry film photo-imageable dielectric (PID).

So, if CCL processing can reach the 2µm l/s node with good yield, then the glass core process will be pushed out to the next node, or overlap with it, depending on the final package requirements.

The glass core process has a number of advantages over CCL, but chief among them is the stability of glass to provide a flat and distortion-free surface on which to build the RDL and micro vias, enabling even smaller features to be defined.

Of course, glass comes with its own set of challenges; it's fragile, especially at the large panel sizes being employed today (510mm x 515mm and 600mm x 600mm). The glass substrate is also very thin, <100µm in some cases, which requires sophisticated handling equipment to process the substrate through the various steps without the risk of breakage.

One compromise of interest is a hybrid solution where the large RDL structures are built using the basic CCL process and the fine-line RDL is patterned on a glass substrate, which is affixed to the CCL through copper microbumps.

A question of time

The insatiable demand for increased RDL density and larger packages is going to continue for the foreseeable future. It is only a question of time before substrate manufacturers reach the 2µm l/s technology node. The only question that remains is will CCL or glass get there first and prevail?

Of course, CCL will eventually reach its physical limits. But as with most successful technologies, the process infrastructure inertia, coupled with next generation AICS equipment and software, will not be halted if there is a cost-effective solution that enables the technology roadmap to be achieved sooner, rather than later. If CCL substrates prove to be capable at the 2µm l/s technology node, they will inevitably overlap with glass substrates since the material properties of both lend themselves to different applications, enabling the two processes to coexist.

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## NEWS FROM FINLAND

### Aspocomp Group Plc: Composition of Shareholders' Nomination Board

The following members have been appointed to Aspocomp's Shareholders' Nomination Board:

Päivi Marttila, appointed by Etola Group and Erkki Etola
Kyösti Kakkonen, appointed by Joensuun Kauppa ja Kone Oy
Mikko Montonen, Aspocomp's third largest shareholder.

Aspocomp's Shareholders' Nomination Board consists of three members who represent the company's three largest shareholders. In addition, the Chairman of the company's Board of Directors shall serve as an expert member of the Nomination Board unless he or she is appointed as an ordinary member of the Board. The three largest shareholders are determined annually based on the ownership information registered with the company's shareholders' register on the first business day of September.

The Shareholder's Nomination Board is responsible for preparing and presenting to the Annual General Meeting and, where appropriate, to the Extraordinary General Meeting, proposals regarding the number and remuneration of the members of the Board of Directors as well as a proposal regarding its composition.

For further information, please contact Mikko Montonen, President and CEO tel. +358 20 775 6860, mikko.montonen(at)aspocomp.com.

ASPOCOMP GROUP PLC

Mikko Montonen
President and CEO

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## NEWS FROM GERMANY

### ICAPE GROUP steps up pace in Germany with the acquisition of PRINCITEC

ICAPE Group (ISIN code: FR001400A3Q3 - Ticker: ALICA), a global technology distributor of printed circuit boards ("PCB"), today announced the acquisition of 100% of the capital of PRINCITEC, a high value-added supplier of PCB.

Since 2004, PRINCITEC, located near Düsseldorf, has been providing the full range of technical, sourcing and quality services associated with the distribution of printed circuit boards. Backed by a network of 11 distributors in Asia and Europe, the company benefits from the commercial capacity to meet the needs of a wide variety of industries within very tight deadlines, thanks in particular to its wide range of products. With a base of 35 active customers, mainly located in Germany, PRINCITEC generated revenue of €6.5 million in 2022, with a gross margin of around 25.5%.

With this operation, ICAPE Group is unlocking a significant synergy potential while continuing to diversify its sourcing, thus reinforcing its unique logistical capacity to deliver on time, everywhere in the world and at the best cost. Following the acquisition of HLT announced at the end of May 2023, this new signature also strengthens ICAPE Group's positioning on the German market, Europe's leading printed circuit board market.

Yann DUIGOU, CEO of ICAPE Group, stated: "With the acquisition of PRINCITEC, we pursue the acceleration of our external growth strategy, focusing on supply and commercial synergies and cost optimization. PRINCITEC presents all the necessary assets to generate incremental organic growth following its integration into our Group. In addition, its seasoned team, solid supplier network and customer portfolio spanning a

wide variety of industries will strengthen our position in Germany, one of the world's leading markets. Our pipeline of potential acquisitions remains very strong, and we are in advanced discussions with targets covering all geographies, enabling us to reiterate our target of €30 million in additional revenue this year."

Bernhard TSCHAMPEL, Managing Director of PRINCITEC, added: " ICAPE Group, in addition to its position as a leading player in our market, has a set of values in line with our DNA, focused on product quality and customer relations. Thanks to this association, our customers will benefit fully from ICAPE's purchasing power and unique logistics platform, which will lead to a strengthening of the quality of service provided by our teams. We look forward to collaborating with the Group's German subsidiary to deploy the potential synergies between our two entities."

Like the recent acquisition of HLT, this transaction is carried out by the subsidiary ICAPE Deutschland Gmbh and is financed 100% in cash. PRINCITEC's 9 team members will also strengthen the Group's local subsidiary.

About ICAPE Group

Founded in 1999, ICAPE Group acts as a key technological expert in the PCB supply chain. With a global network of 35 subsidiaries and a major presence in China, where most of the world's PCB production is done, the Group is a one-stop-shop provider for the products and services which are essentials for customers. As of December 31, 2022, ICAPE Group recorded a consolidated revenue of nearly €220 million.

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## NEWS FROM TAIWAN

### Compeq diversifies target markets for HDI PCBs

HDI PCB specialist Compeq Manufacturing has expanded its target markets beyond handsets to include servers, automotive and low-Earth orbit (LEO) satellite products, with diversification efforts expected to yield fruit later this year and in 2024, according to industry sources.

HDI PCBs are in high demand in automotive and server applications, the sources said. For instance, the number of PCB layers required for servers has increased from eight to 12 on the Intel Purley platform, to 14 to 16 on the Whitley platform, and to 16 to 18 on the Eagle Stream platform.
As for LEO satellite applications, the availability of volume production in 2023 and 2024 will boost Compeq's offering for the segment to 5-10% as a proportion of company revenue, the sources indicated.

Compeq is also gearing up for a ramp-up in its output for the forthcoming iPhone models, the sources said. The HDI PCB supplier is already involved in the supply chains for upcoming smartphones from both US and Chinese brand manufacturers. Compeq with its any-layer HDI PCB offering has reportedly cut into the supply chain for Huawei's latest 5G smartphone.
Market sources expect Compeq to see its revenue hit peak for 2023 in the fourth quarter. The PCB company will also post a substantial revenue increase sequentially in the third quarter, according to the sources.
Compeq has reported August revenue increased 7.1% sequentially to NT$6.46 billion (US$201.4 million). Revenue for the first eight months of 2023 totalled NT$39.85 billion, down 16.9% on year.

Friday 8 September 2023
Janet Kang, Taipei; Jessie Shen, DIGITIMES Asia

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## NEWS FROM THE UK

### ZEISS/MCS WEBINAR FROM VIRTUAL TO REALITY

### TUESDAY 26 SEPTEMBER 2023 AT 12:00 (UK GMT TIME)

How to Target and Investigate Condition within Advanced Electronic Packages
By Stewart McCracken - MCS Group

The complexity of current electronics based systems make identifying the source of system malfunction a real challenge. A correlative workflow for physical analysis is particularly effective - find out why in this webinar. Our speaker will share their experience and tips for troubleshooting electronics packages.

Stewart McCracken (MCS Group) will discuss what it takes to identify and target specific features of components within its packaging. He will also share details of a forensic analysis case study, highlighting how information contained in the material microstructure can be used for failure diagnosis.
Registration for the Webinar is Free and is open below

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News from WECC members

WECC World Electronic Circuits Council

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## NEWSFROM THE IPC

### U.S. Economy Remains Resilient, but Headwinds Loom in Months Ahead; Growth in Eurozone Picked up in Second Quarter

*IPC releases August 2023 Economic Outlook report*

The forecast for U.S. economic growth, initially expected to be 0.5 percent at the beginning of 2023, is now expected to grow by 2 percent. While the U.S. economy has surpassed expectations, the Federal Reserve has raised rates significantly over the last year, signalling tremendous headwinds as those rates take effect. In Europe, growth in the Eurozone expanded by 0.3 percent compared to the previous quarter, marking the most substantial growth since the second quarter of 2022, according to IPC's August 2023 Economic Outlook report.

According to Shawn DuBravac, IPC chief economist, "The coming months will be crucial in determining the trajectory of the U.S. economy, with a keen eye on the Federal Reserve's strategies to balance growth and inflation concerns."

Additional data in the August IPC Economic Outlook show:

- In the U.S., infrastructure investments are poised to give a boost to the construction sector, potentially offsetting some of the slowdown in other areas of the economy.
- The U.S. manufacturing sector recorded a strong month, reporting output gains rose 0.5 percent in July, the first gain in three months. Auto and non-auto manufacturing both posted increases, rising 5.2 percent and 0.1 percent, respectively.
- The U.S. New Orders Index suggests orders remain soft, but manufacturers appear to be managing slower orders well.
- In Europe, the economies of France and Spain demonstrated positive growth, spurred by a surge in exports in France and a rebound in domestic demand in Spain.
- In the second quarter of 2023, employment rose by 0.2 percent in both the Eurozone and the EU. During the first quarter of 2023, both regions witnessed a more substantial increase in employment, with a growth rate of 0.5 percent.

View August 2023 IPC Economic Outlook. For more information on IPC's industry intelligence program including current research and reports, visit www.ipc.org/advocacy/industry-intelligence.

## NEWS FROM THE TPCA

### PCB will resume growth next year and carrier boards will be an important driving force

This year, the PCB market has experienced its biggest recession in several years. Almost all products, including multi-layer boards, HDI, soft boards, and soft-hard combined boards, have declined. After the inventory has been digested for many seasons, it seems that at present, all fields The inventory has returned to a relatively reasonable and healthy level. After two quarters of digestion in the second half of the year, as well as the support of related emerging high-end applications such as AI, HPC, and AIoT, growth will resume next year. According to research unit Industrial Research Institute IEK predicts that if we take an optimistic view, the PCB market will have an annual growth of approximately 8.1% next year, of which carrier boards are expected to be an important growth driver.

According to IEK estimates, the PCB output value will decline by approximately 16.8% in 2023. In terms of application, the automotive market has the greatest growth potential. This is also reflected in the fact that the PCB product with the smallest decline this year is multi-layer board, because of its multi-layer Boards are mainly used in the computer and automotive markets.

Looking forward to next year, with the terminal market expected to recover, the PCB market output value next year is expected to grow by 8.1%. Among them, the carrier board market will decline more than expected this year, mainly because BT carrier board is one of the main application markets. The recession in the memory market has been prolonged, coupled with the global economic downturn and shrinking demand for commercial high-end CPUs/computers/servers, this has also affected the decline in the ABF carrier board market this year. However, after adjustments, it will be an important growth driver for the industry next year.

It is estimated that the output value of BT carrier boards will decline by 23% this year, and that of ABF carrier boards will decline by 17%. However, as of the middle of the year, inventory reduction has been effective, and overall demand has bottomed out in the second quarter, and will continue to. As the peak season approaches, both ABF and BT are expected to gradually bottom out and rebound. Driven by the trend of small chips, 2.5D, and 3D advanced packaging, ABF carrier

boards will increase the number of layers and area of ABF carrier boards. Even if carrier board manufacturers increase their production capacity in 2023, carrier boards are still expected to return to a market situation where supply exceeds demand slightly in 2024.

## Taiwan's flexible PCB (FPCB) production value is estimated to slip 12.6% on year to US$17.2 billion in 2023, primarily due to high inventory and sluggish demand for consumer electronics

Taiwan's flexible PCB (FPCB) production value is estimated to slip 12.6% on year to US$17.2 billion in 2023, primarily due to high inventory and sluggish demand for consumer electronics, but is expected to return to a growth track in 2024, according to a global FPCB market outlook report jointly released by the Taiwan Printed Circuit Association (TPCA) and the Industry, Science and Technology International Strategy Center under the government-funded Industrial Technology Research Institute (ITRI). The report indicates that with the completion of terminal inventory adjustments, the recovery of major markets such as smartphones and computers, and the continuous growth in demand for automotive FPCBs, the global FPCB market could grow 5.4% on year in 2024.

Citing industry sources, the report also shows that most FPCB makers are actively shifting toward three major trends - high-frequency and high-speed applications, multi-layer specs and miniaturization, and automotive FPCBs - and are expanding production capacity and enhancing technology upgrades to cater for the changing market demands.

In other words, as electronic systems are becoming smaller, thinner and lighter with high-frequency/speed specifications, the development of FPCB is progressing towards high-density layouts, thin form factors, fine-line small holes, larger dimensions, and lower signal transmission losses, according to the report.

Currently, FPCBs see the largest application outlet in smartphones, but their penetration in new energy vehicles or electric vehicles and autonomous driving will be rising steadily, with Taiwan's top-2 FPCB suppliers Zhen Ding Technology and Flexium Interconnect benefiting significantly as a result.

Zhen Ding has reported its August revenue jumped 33.73% sequentially and slipped 16.65% on year reaching NT$13.785 billion (US$431.18 million), and January-August sales amounted to NT$79.176 billion, down 19.36% on year. Zhen Ding said the robust sequential revenue increase for August was mainly bolstered by customers increasing shipment pull-ins to support their new product offerings. With its capacity utilization gradually in high gear, the company is expecting mild revenue growth for the months ahead.

Flexium's August revenue rose 13.04% on month and plunged 36.2% on year to NT$2.643 billion, and sales for the first eight months of 2023 shrank 12% on year to

NT$21.20 billion. The company noted its increased FPCB shipments for notebooks, tablets and wearables in the months ahead can somewhat offset weak demand momentum from the global handset market.

Another FPCB maker Career Technology saw its August sales fall 5.05% sequentially and 46.8% on year to NT$970 million after logging a net loss of NT$1.45 billion in the first half of the year. The company, however, is confident that the loss will narrow and even swing into profit later in the year thanks to a gradual surge in demand for notebooks and wearable devices.


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## International Diary

### 2023

**EIPC @ FED Conference**
Augsburg, Germany
20 & 21 September

**22nd EIPC Technical Snapshot Webinar**
Registrations via www.eipc.org
October

**EIPC @ Productronica 2023**
Stand B3-529
14-17 November
München, Germany

**23rd EIPC Technical Snapshot Webinar**
Registrations via www.eipc.org
December

### 2024

**EIPC Winter Conference**
**Visit Schweizer Electronic AG**
Schramberg/Villingen-Schwenningen, Germany
Tuesday 30 & Wednesday 31 January

**EIPC Summer Conference**
Tuesday 4 & Wednesday 5 June
Location TBC