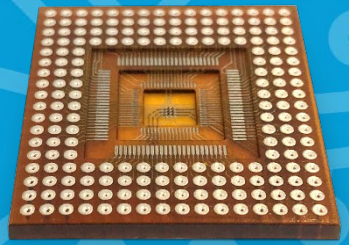
NANODIMENSION

Electrifying Additive Manufacturing®

# 3D-PRINTED ELECTRONICS
# ADDITIVELY MANUFACTURED ELECTRONICS (AME)

Corporate Presentation I Nasdaq: NNDM I December 17th, 2020



Intelligent Machines, Consumable Conductive & Dielectric Ink Materials

## *Forward Looking Statements*

*This presentation of Nano Dimension Ltd. (the "Company") contains "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act and other securities laws. Words such as "expects," "anticipates," "intends," "plans," "believes," "seeks," "estimates" and similar expressions or variations of such words are intended to identify forward-looking statements. For example, the Company is using forward-looking statements when it discuss the potential of its products, strategic growth plan, its business plan and investment plans, the size of its addressable market, market growth, and expected recurring revenue growth. Forward-looking statements are not historical facts, and are based upon management's current expectations, beliefs and projections, many of which, by their nature, are inherently uncertain. Such expectations, beliefs and projections are expressed in good faith. However, there can be no assurance that management's expectations, beliefs and projections will be achieved, and actual results may differ materially from what is expressed in or indicated by the forward-looking statements. Forward-looking statements are subject to risks and uncertainties that could cause actual performance or results to differ materially from those expressed in the forward-looking statements. For a more detailed description of the risks and uncertainties affecting the Company, reference is made to the Company's reports filed from time to time with the Securities and Exchange Commission ("SEC"), including, but not limited to, the risks detailed in the Company's annual report for the year ended December 31, 2019, filed with the SEC. Forward-looking statements speak only as of the date the statements are made. The Company assumes no obligation to update forward-looking statements to reflect actual results, subsequent events or circumstances, changes in assumptions or changes in other factors affecting forward-looking information except to the extent required by applicable securities laws. If the Company does update one or more forward-looking statements, no inference should be drawn that the Company will make additional updates with respect thereto or with respect to other forward-looking statements.*

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NANODIMENSION
Electrifying Additive Manufacturing®

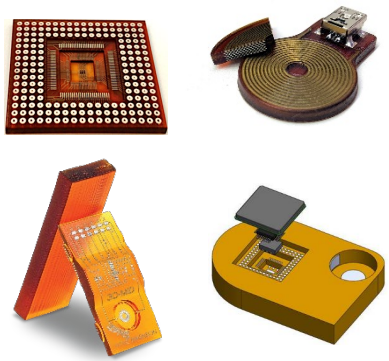
# NANO DIMENSION OFFERING

## AME 3D-PRINTING SYSTEMS

DRAGONFLY LDM, DRAGONFLY PIK

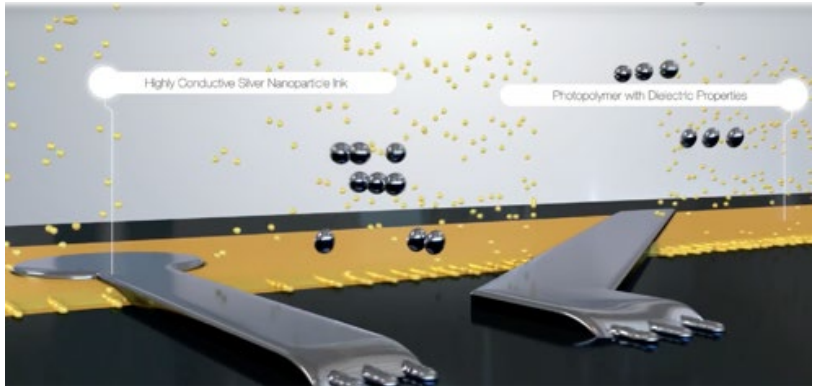
- System
- Training and Support
- Leasing Options

## NaNoS℠ – 3D FABRICATION SERVICE FOR THE PRODUCTION OF Hi-PEDs™



- Co-creation / Design
- Prototyping
- Low Volume Production

# HOW DOES IT WORK?





Just one manufacturing step: No need for etching, pressing, electroplating!

## TWO PRINTHEADS INKJET BOTH MATERIALS SIMULTANEOUSLY:

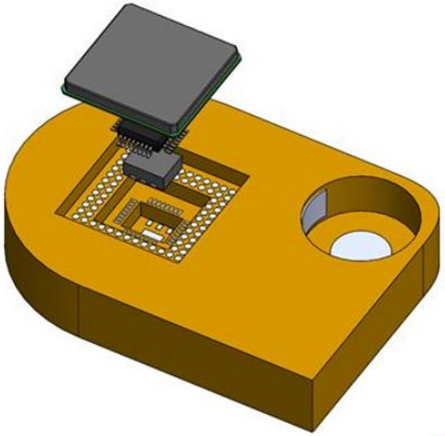
- Both conductor & insulator substrates are printed
- Both materials are activated in real – time on-the-fly
- 100% fully additive process!

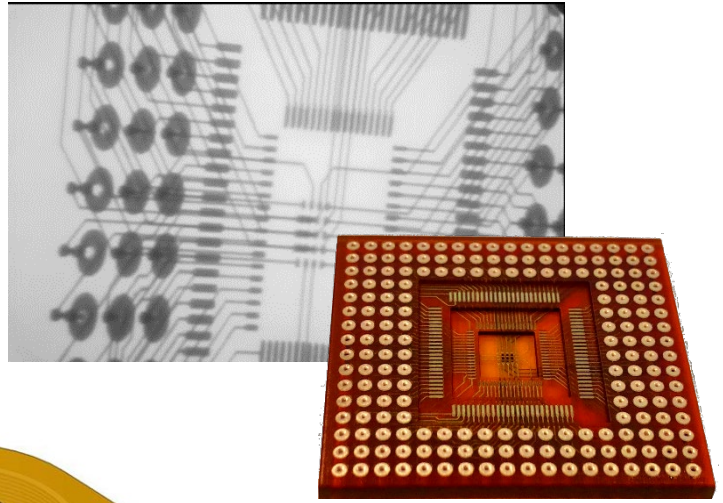
## THE OBJECT IS BUILT UP, LAYER BY LAYER, THROUGH FULL STACK THICKNESS:

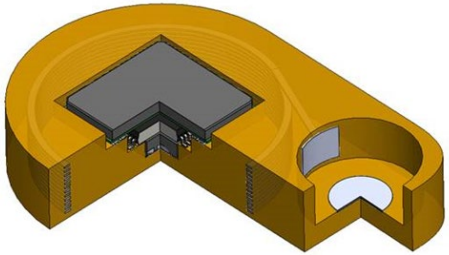
- Conductive layers & dielectric layers
- Drills and vias bottom up printed
- Soldermask & annotation

# EXAMPLE OF Hi-PEDs™: VERTICALLY STACKED INTEGRATED CIRCUITS (ICS)

Stacked ICs have a higher circuitry density than traditional PCBs by allowing ICs to be mounted and interconnected on top of each other.







# PRODUCE COMPLEX PCB AND Hi-PEDS™

## Hi-PEDs™

HIGH PERFORMANCE ELECTRONIC DEVICES

AME Circuit with Capacitors

IOT Access Point

AME with Side Mounted Components

Vertically Stacked Integrated Circuits

Low Pass Filter

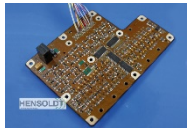
Coils & Inductors

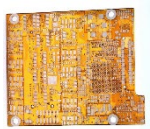
3D MID

RF Antenna

- Fast prototyping, hours vs weeks
- Tens of layers in a 3mm board
- Printed embedded components
- Expand 3D scales

## COMPLEX MULTILAYER PCB (50 LAYERS)





- Filled Vias: No need for drilling

# OUR MISSION

Our **DragonFly™ AME Machines** (controlled by AI algorithms) produce electronic devices by simultaneous 3D-injection of dielectric and conductive materials to fabricate, within hours:

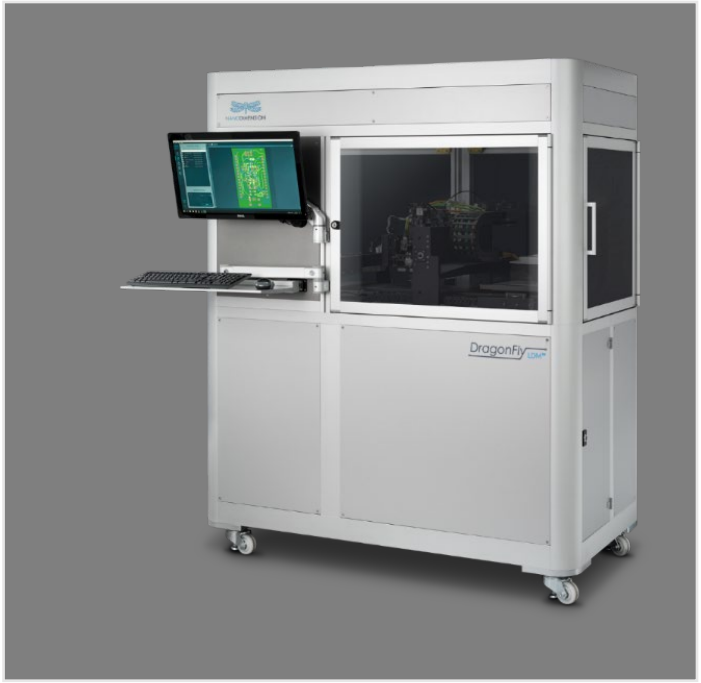
**High Performance Electronic Devices: Hi-PEDs™**

Sensors, Antennas, Capacitators, Convertors for unique geometries and complex devices

We develop and produce proprietary consumables chemical inks in our AME machines. All are **mission critical** and **economical** for our customers.

# DRAGONFLY LDM: A DIGITAL FACTORY IN A BOX

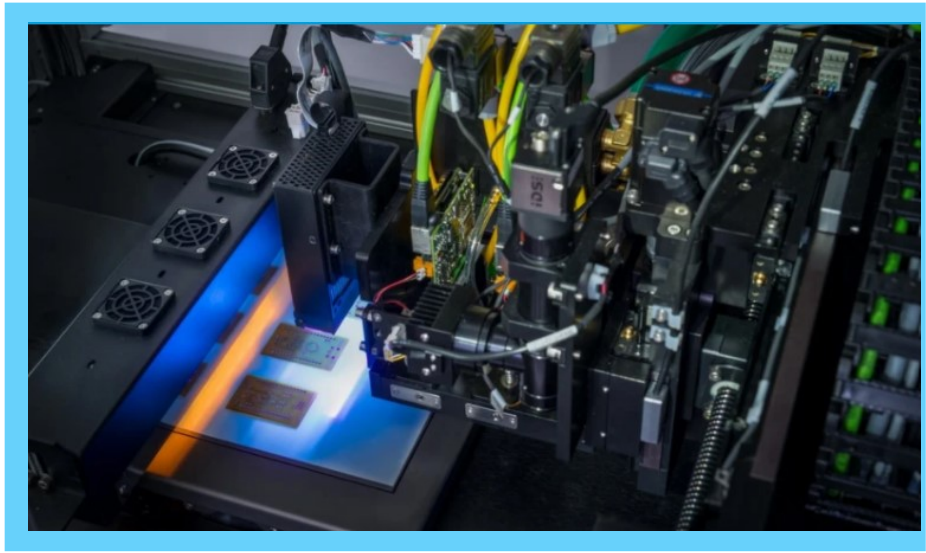
**ALL OF THIS …**




**…REPLACED WITH THIS!**

# NANO DIMENSION

- **Additive Manufacturing Electronics (AME) industry leader**
- **More than a dozen granted patents, and more than three dozen patent applications**
- **First-to-Market** advantage
- The **only** technology that converts digitally electronics circuits into functional high performance devices
- **Approx. 60 systems** sold worldwide
- Increasing **recurring revenue** of proprietary conductive and dielectric materials (3D-printing inks)
- **Strong cash-position** ($430.9 as of Dec 12, 2020)
  **Including short- and long-term bank deposits**



# NANO DIMENSION: FINANCIAL DATA

NASDAQ
**NNDM**
ADS ratio: 1:1

Shares Outstanding:
**~138,700,000 ***

**~$80M** invested mostly in R&D, over 6 years

- **Cash: $430.9M / No debt ***
  **Including short- and long-term bank deposits**

**As of December 12th, 2020*

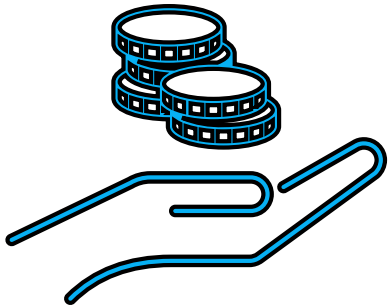
**Since 01-01-2018:**

# of 3D Printing machines sold:

- DragonFly Pro: 49
- DragonFly LDM machines ***(since Q3/2019)*** 11
- DragonFly Pro upgrades to LDM ***(since Q3/2019)*** 29
- DragonFly service contracts 34

Total Revenues (***from 01-01-2018 to 09-30-2020***): $13.598M

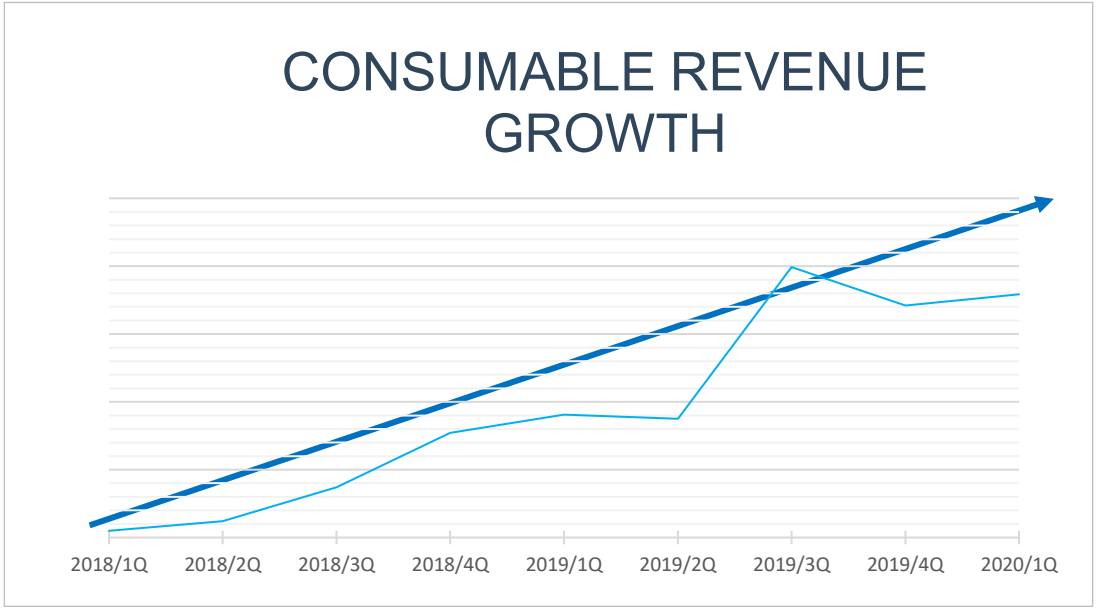
- **Revenue growth** of **~39%** in 2019 compared to previous year
- Significant trend of **Gross Margin improvements**



# BUSINESS MODEL: RECURRING REVENUE MODEL THAT SCALES

**Razor-Razorblade Model:**

- As the installed base of systems grows, the recurring revenues from consumables increases.
- Positive trend of increased ink consumption by customers is a validation to our recurring-revenue business model.
- Printed Electronics (“PE” or “AME”) and Consumable Materials:
  **Recurring & High GM Revenue**



# NANO DIMENSION'S 3D FABRICATION SERVICES: NaNoS℠

- Nano Services (NaNoS℠) is an offering for customers who need to get their hands-on complex, multilayered high-performance electronics with a quick turnaround time.
- Provide services to customers around the globe with its fabrication labs in the US, Israel and Hong Kong.
- Guaranteed quick turnaround for complex Hi-PEDs™.

## How it works

Chat With an expert regarding the most efficient way of printing your model

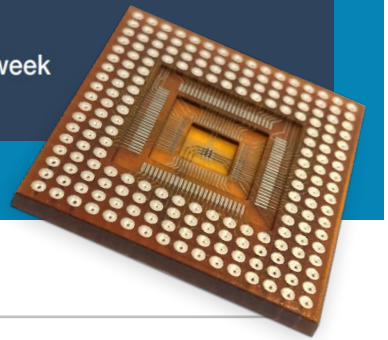
→

Send your CAD or SolidWorks files to optimize the printing

→

Your parts are printed cost effectively and shipped to you in the shortest competitive time

The entire process would take up to a week

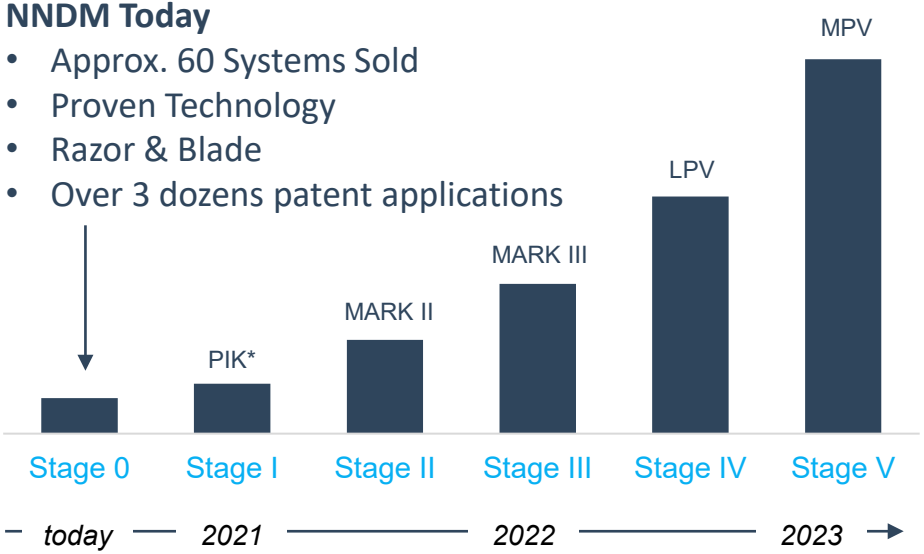


# FAIL SAFE "BIOTECH-LIKE" INVESTMENT MODEL

Upside like BioTech, **but**, **contrary** to BioTech **downside in case of failure at any stage is protected** as a sale of the existing business at improving multiples (as per stages I-V below, is a valid and doable financial exit through a sale to strategic buyers)

**NNDM Today**

- Approx. 60 Systems Sold
- Proven Technology
- Razor & Blade
- Over 3 dozens patent applications




- Stage I — Materials Commercial-Specs
- Stage II — Materials Industrial-Specs
- Stage III — Materials Mil-Specs
- Stage IV — LPV: Low Production Volume System
- Stage V — MPV: Medium Production Volume System

*Performance Improvement Kit

# NEW MANUFACTURING POSSIBILITIES WITH THE DRAGONFLY LDM

## High-Performance Electronic Devices™ : Hi-PEDs™

### RF AMPLIFIER FOR SPACE

- Light weight
- Integrated design
- < 1db gain difference

### RAPID PROTOTYPING INHOUSE

- Months > days
- Dozens of layers, both sides populated


DRAGONFLY LDM

"Lights Out" Digital Manufacturing

### PRINTED CAPACITORS

- High Accuracy Capacitors Integrated in the board
- 50 layers

### INNOVATIVE MEMS PACKAGING

- Embed piezoelectric transducers
- Compact, lightweight and robust package

# VISION: BRIDGING THE GAP

**DragonFly LDM & Ink Materials**

Design → Proof of Concepts → Prototype & Early Fabrication of HiPEDs™(High Performance Electronic Devices)

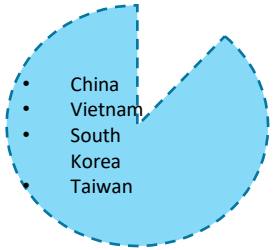
## AME TECHNOLOGY

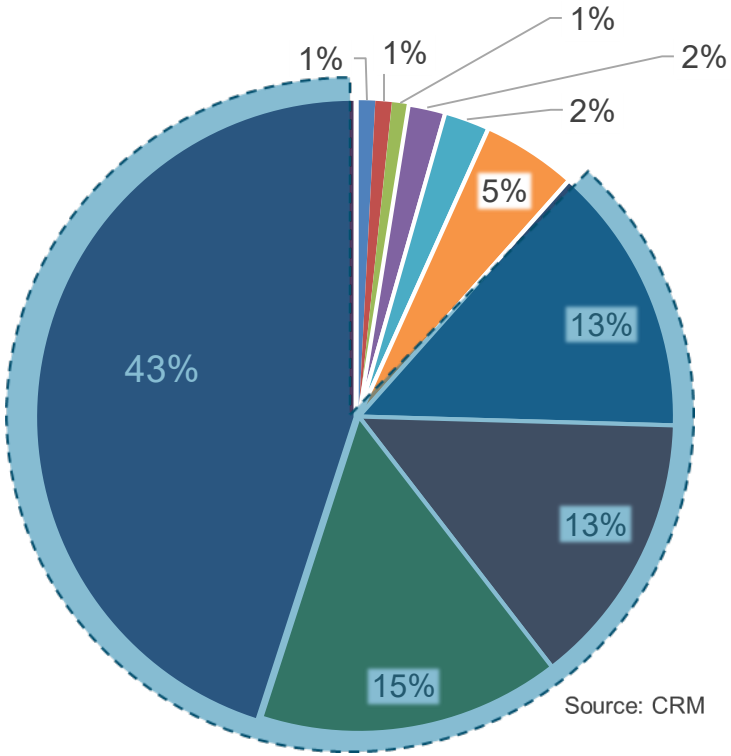
**TRADITIONAL INTEGRATED CIRCUITS**

*(IC, Chips, CPU, ASICs)*

**TRADITIONAL PRINTED CIRCUIT BOARDS** (PCB)

# TRADITIONAL PCBs: GEOGRAPHY




- Singapore
- Philippines
- Vietnam
- Germany
- Thailand
- USA
- Taiwan
- South Korea
- Japan
- China

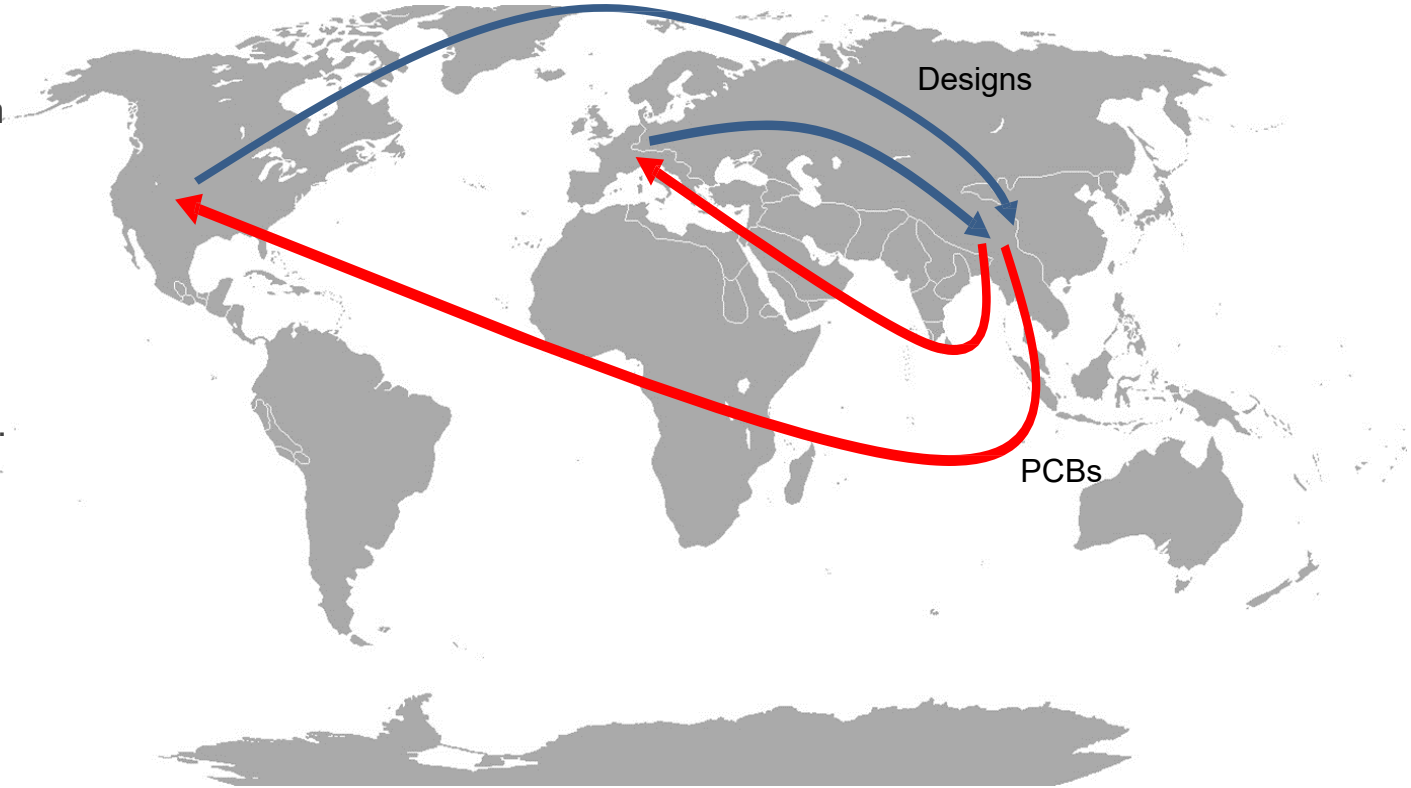
Around 90% of all PCBs are manufactured in the APAC region. China are the largest producer with around 43% market share followed by Japan and South Korea with 15% and 13%, respectively.

Intellectual Property (IP) is cited as a major cause for concern. Hardware design companies regard their PCB designs as core IP and some are reluctant to send them to Asia for prototyping.

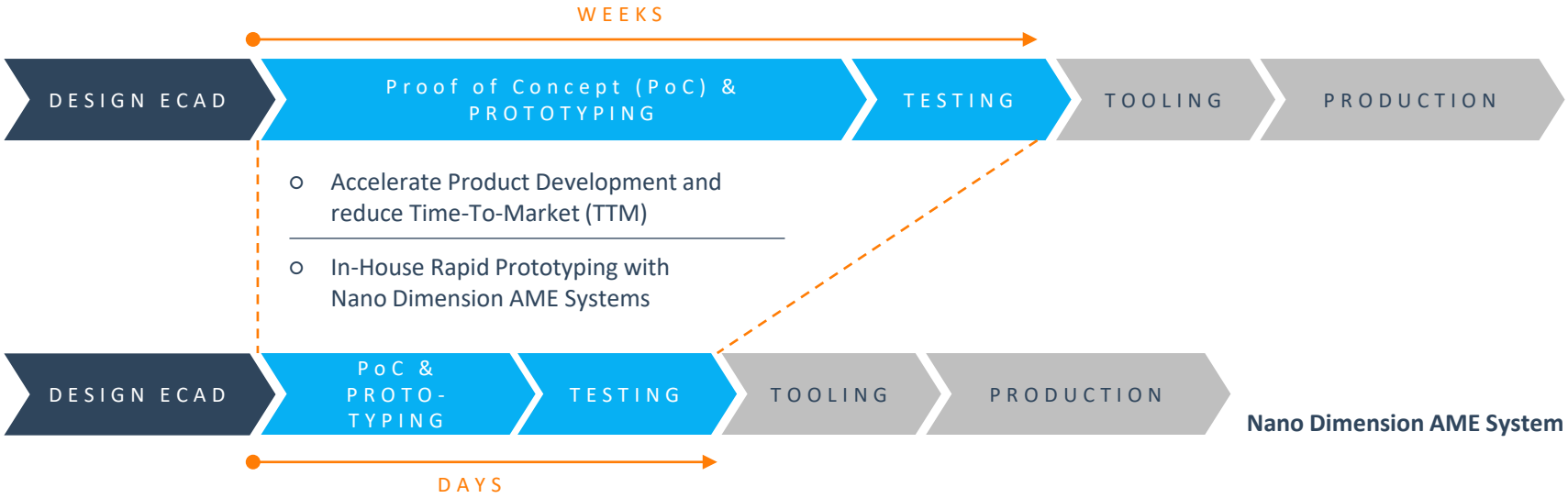
# TRADITIONAL PCBs: PROTOTYPING

Prototypes are often created by sending digital designs (typically from the US or Europe to China) and waiting 7 to 21 days to receive a PCB back.

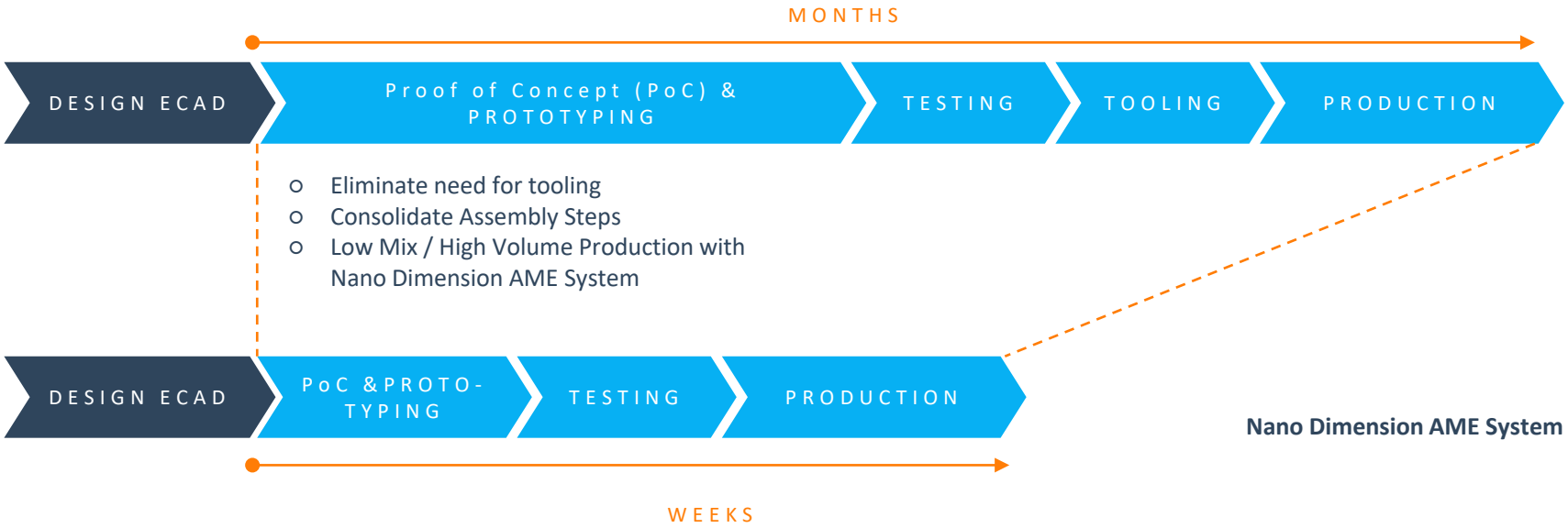
This is slow, costly and puts core intellectual property at risk.



# RETURN ON INVESTMENT: PROTOTYPING



# RETURN ON INVESTMENT: PRODUCTION



# AME / 3D PRINTED ELECTRONICS MARKET

**IDTechEX (2019)**

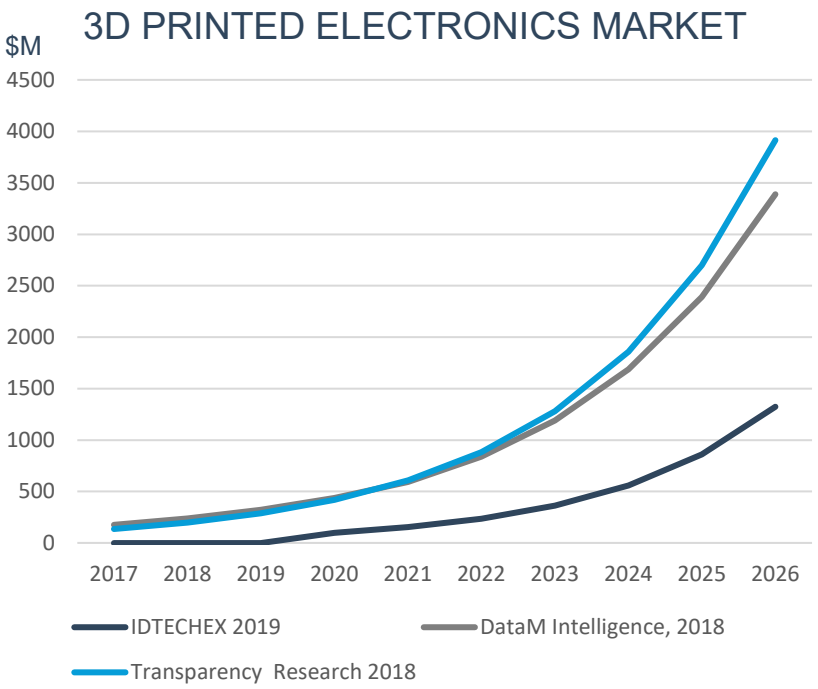
- The total market for 3D printed electronics will be worth $2.3 billion by 2029 and will be dominated by the professional PCB prototyping market segment. The educational and industrial production market segments will continue to grow steadily.
- The market for professional PCB prototyping is currently growing very rapidly, almost entirely due to market leader Nano Dimension, and has already overtaken the consumer and education. This growth will slow but this market segment will become the largest by 2020.

**DataM Intelligence (2018)**

- Analysts predict 3D printed electronics will be the next high-growth application for product innovation: 2017 3D printed electronics market size is estimated at $176 million, expected to reach $592 million in 2021 and up to $2.4 billion by 2025.

**Transparency Market Research (2018)**

- The global 3D printed electronics market was valued at US$ 137.1 million in 2017 and is expected to expand at a CAGR of 44.46% from 2018 to 2026, reaching US$ 3,915.0 million by the end of the forecast period.



# PRESENT **INVESTMENT THESIS** IS **NEW**

## PLAN FOR 2021-22: RIDING THE ELEPHANT

### "Fail-safe-BioTech Investment Model" – Stages I>>II>>III>>IV>>V

Since Covid-19 eruption – it is not about quarterly Revenue curve. We are focused on upside through accelerating Product Technological Edge (Upside like Biotech) ***BUT we have sold approx. 60 machines already.*** Contrary to Biotech downsides, a failure at any Stage is protected (as a sale of the existing business at improving multiples, as per stage, is a viable alternative)-For all HiPED™ printed by DragonFly 3D Electronic 3D-Printing Machines:

Stage I DragonFly PIK – (Performance Improvement Kit)

Stage II DragonFly MARK (Manufacturing And Reliability Kit) with **new** materials that reach specifications of " Industrial" standard (environmental tolerance: temperature, vibrations etc.). Repeatability and reliability of printing process – at "industrial level"

Stage III Next-Gen Machine ("NG") with **new** materials which fit mil-specs: Multiple Inks; Support Material

Stage IV New Machine, production-runs capability and throughput for such

Stage V Large Chuck, highest throughput and lose-loop real-time quality inspection and assurance modular-configurable machine

# THERE IS AN ELEPHANT IN THE ROOM

## CORONA IS AFFECTING BUSINESSES IN 2020

### WORKING ASSUMPTION: AT LEAST UNTIL Q3/2021

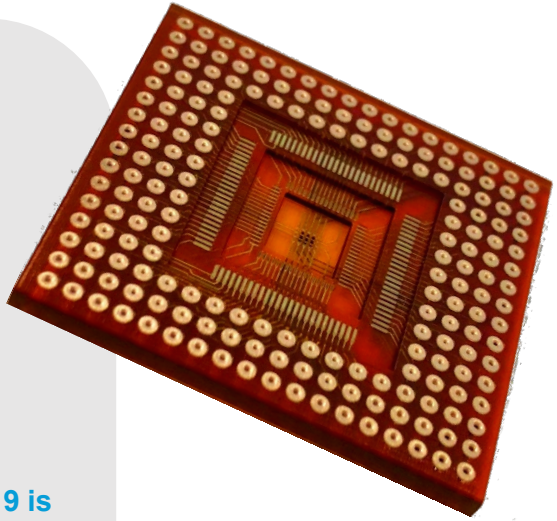
All present customers were out-of-office until July 2020.
Some until now. (Mostly USA)

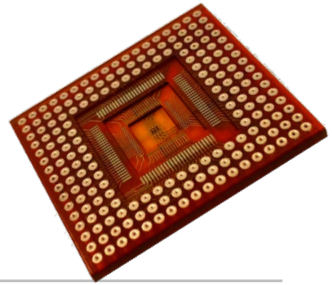
- Chinese companies returned on 5/2020 **but** still delaying all purchases of Capital Equipment.
- European business in June-July **but** delayed most CapEx deployments.
- USA corporations projected June as “back-to-business” **but** changed to July, and then changed to “maybe later or early 2021”
- Most customers (especially in USA) are in discussions, **but** no suppliers’ visits for maintenance until further notice. Hence: No installations are possible.
- And: Many DragonFly labs were shut down until Corona subsides, with no confirmed date.
- Europe experiencing the second wave 10/2020.

# PRESENT **INVESTMENT THESIS** IS **NEW**

## PLAN FOR 2021: RIDING THE ELEPHANT

- Started a Prototyping/Fabrication Services Business:
  **NaNoS (Nano Services)**
- **Expand NaNoS as revenue generator**, but mainly as
  a route for DragonFly purchases once CapEx are released post Corona
- M&A search directed at targets that will enable to **leverage NaNoS**
- **INVEST HEAVILY to preempt seeds of competition: Product & technology leapfrog toward production machines (DragonFly PIK & NextGen)**
- **Minimal investments in sales & marketing (other then NaNoS) until COVID-19 is over!!!**
- **There is no reason to drill in a dry field. The rich grounds is expected to reopen in 2-4 quarters**.
- CONSERVE CASH>> ACCELRATE TECHNOLOGICAL EDGE to create “Industry 4.0” Tectonic Shift.





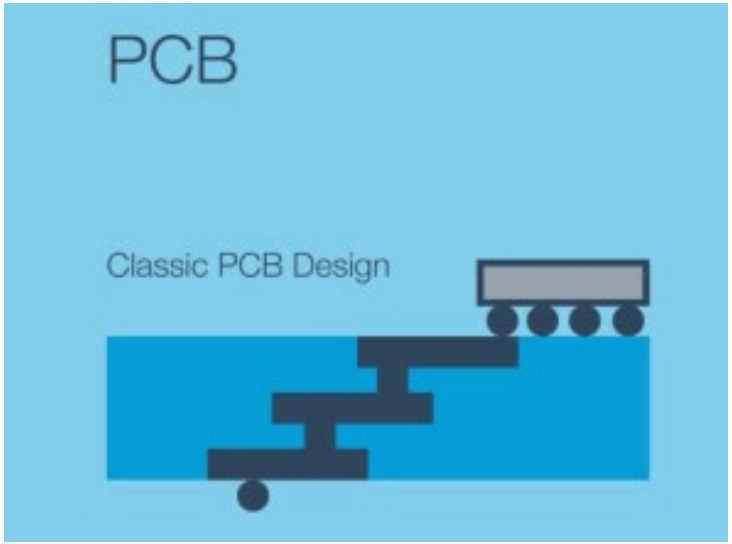
# NANO DIMENSION: APPROX. 60 SYSTEMS GLOBALLY

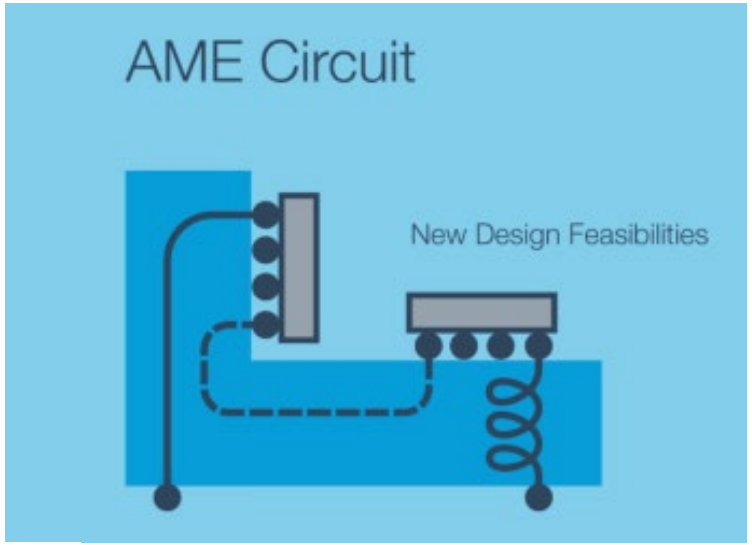
**Nano Dimension Customers:**

- 3 Multi-billion US$ defense manufacturers
- 2 European defense companies and multiple secret services
- 1 Multi-billion US$ valued technology conglomerate
- Multiple leading research institutions around the world

# ADDITIVE MANUFACTURING OF 3D ELECTRONICS

**High Performance Electronic Devices™:**
**Hi-PEDs™**



# CERTIFICATIONS

| | | |
|---|---|---|
| In-house DragonFly system manufacturing<br>FCC, CE, UL, CSA, EAC | In-house nano ink manufacturing<br>–<br>capacity to meet future demand | Top quality certified<br>ISO14001 and OHSAS18001<br>ISO 45001 and RoHS |

# WHY ADDITIVE MANUFACTURING FOR ELECTRONICS ?

## RAPID PROTOTYPING

**Benefits:** Shorten your Time-to-Market, reduce cost and increase innovation with agile prototyping and fast feedback cycles

- Reduce development time
- Reduce prototyping and R&D cost
- Inhouse, print designs over night
- Full confidentiality / IP protection
- Test many designs for more functions
- Reduce cost of error

## ADVANCED PRODUCTS: HiPED FABRICATION

**Benefits:** Produce better, lighter, cost-effective products by eliminating assemblies and improving the performance in 3D forms

- Produce complex 3D circuits and optimize form factor (SiP, Heterogeneous Integration)
- Reduce assembly steps by printing components
- Reduce size and weight of products
- Improve products performance

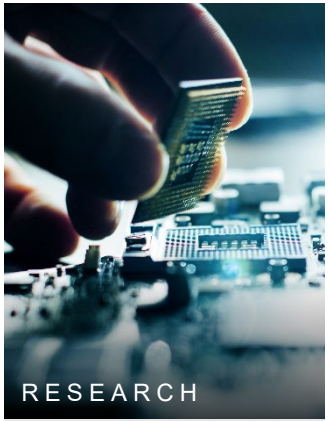
## DIGITAL INVENTORY

**Benefits:** The future will allow business models based on part licensing. Eliminate the need of sending physical parts

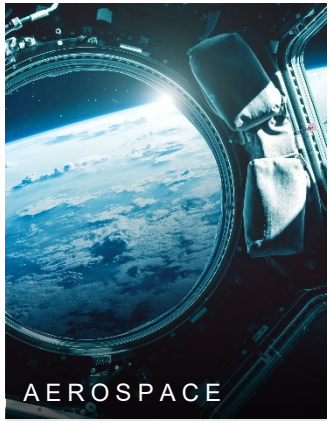
- On site per demand production of spare parts
- No tooling cost
- Eliminate stock and free up working capital
- Changing the paradigm of electronics production
- Reduce environmental waste

TODAY → TOMORROW

# OUR CUSTOMERS ARE INNOVATORS IN LEADING MARKETS

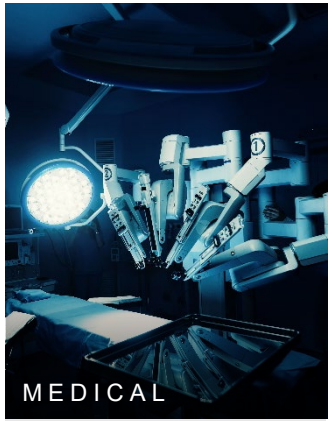



The DragonFly LDM System enables you to produce cutting edge electronics in your lab.

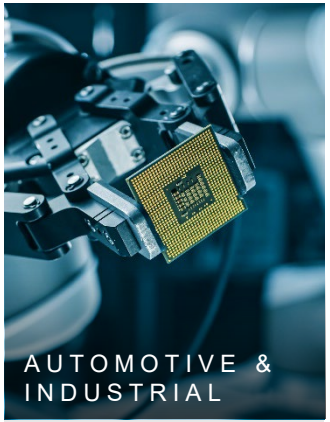



AME Technology enables you to reduce weight and to miniaturize electro-mechanical components like never before.


Keep your IP in your lab with the DragonFly LDM System and save time by eliminating the need for involving external parties.




Reduce time to market and optimize design for medical devices, biomedical sensors and in-vivo applications.




AME optimizes electromechanical parts for: smart products, IoT, sensors, autonomous driving, electric vehicles, 5G networks.

# NANO DIMENSION: CASE STUDIES & COOPERATION

I. Research Institutes: CBN-IIT

II. Aerospace: HARRIS

III. Defense: HENSOLDT

IV. Medical: PIEZOSKIN

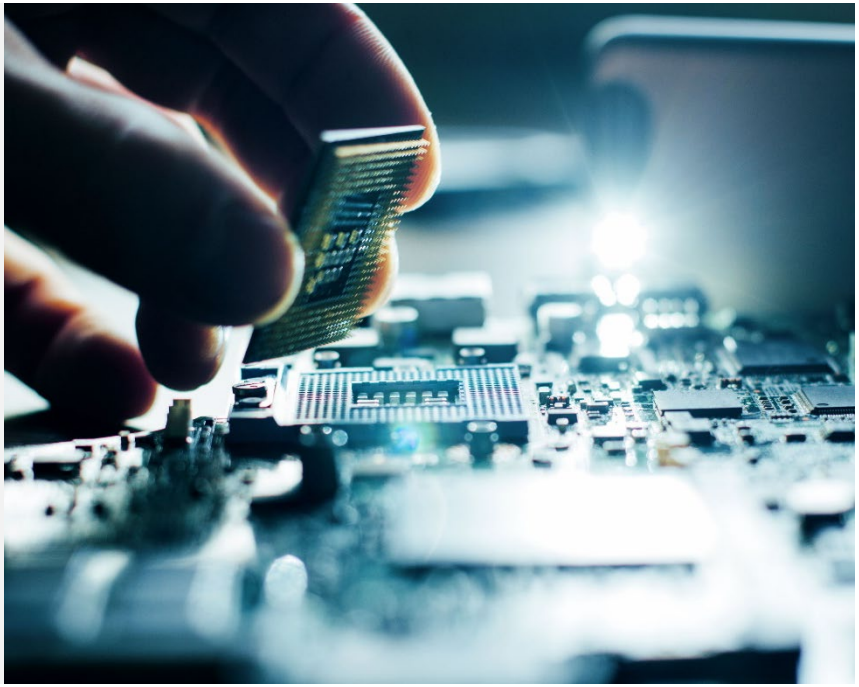
V. Automotive: REHAU

# CUSTOMER CASE I: CBN-IIT, ITALY

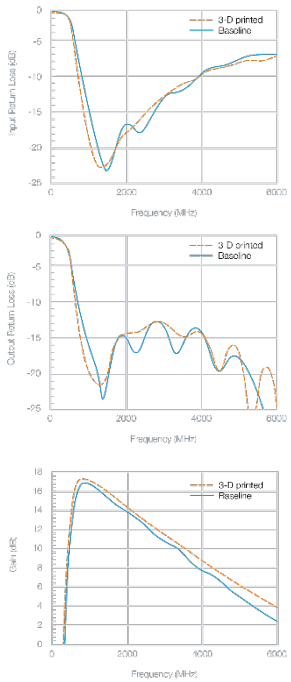
ISTITUTO ITALIANO DI TECNOLOGIA

*The suitability of the DragonFly system to rapidly and affordably manufacture functional prototypes, combined with the broad ecosystem of applications for health and energy harvesting, makes it an ideal choice for our team to achieve higher performance, quick development and print complex shapes not achievable using traditional manufacturing processes.*

**Prof. Massimo De Vittorio**
**CBN-IIT — Lecce — Italy**



# COOPERATION CASE II: HARRIS, USA




*"The ability to manufacture RF systems in-house offers an exciting new means for rapid and affordable prototyping and volume manufacturing. The results of the study provide substantial motivation to develop this technology further."*

**Dr. Arthur Paolella, Senior Scientist, Space and Intelligence Systems, Harris Corporation**

# CUSTOMER CASE III: HENSOLDT, GERMANY

**HENSOLDT and Nano Dimension Achieve Breakthrough in Electronics 3D Printing**

HENSOLDT succeeded in assembling the worlds first 3D printed 10-layer printed circuit board (PCB) which carries high-performance electronic structures soldered to both outer sides. This allows rapid prototyping inhouse of complex PCB.

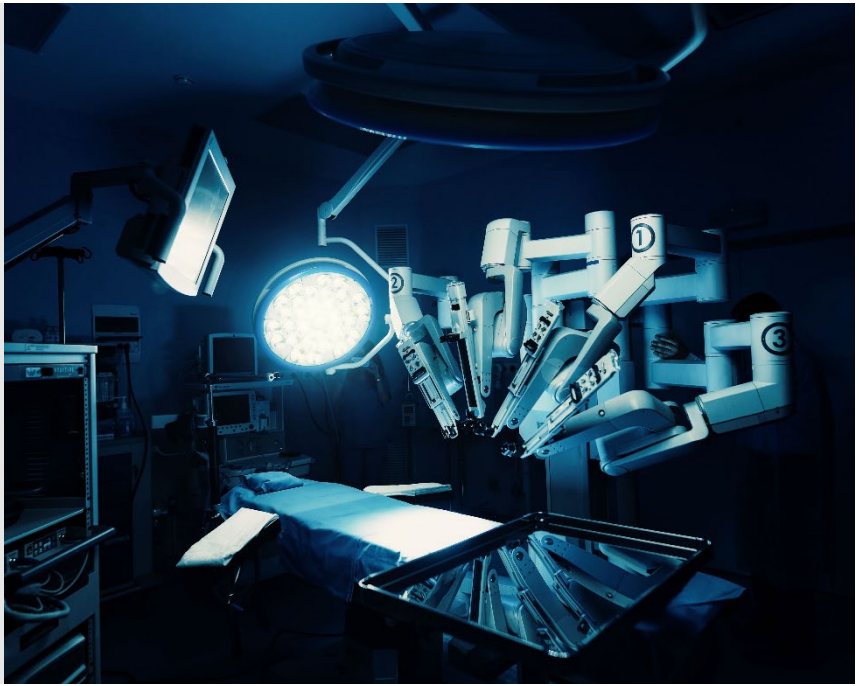
*Military sensor solutions require performance and reliability levels far above those of commercial components. To have high-density components quickly available with reduced effort by means of 3D printing gives us a competitive edge in the development process of such high-end electronic systems.*

**Thomas Müller,**
**CEO of HENSOLDT**

# CUSTOMER CASE IV: PIEZOSKIN, ITALY

*Nano Dimension's AME technology helped us to achieve an original product prototype, in which wires and connectors were eliminated and the package was minimized, to obtain an optimal user experience. It simplified the manufacturing process, as compared to traditional manufacturing methods.*

**Dr. Francesco Guido, CTO Piezoskin S.R.L**



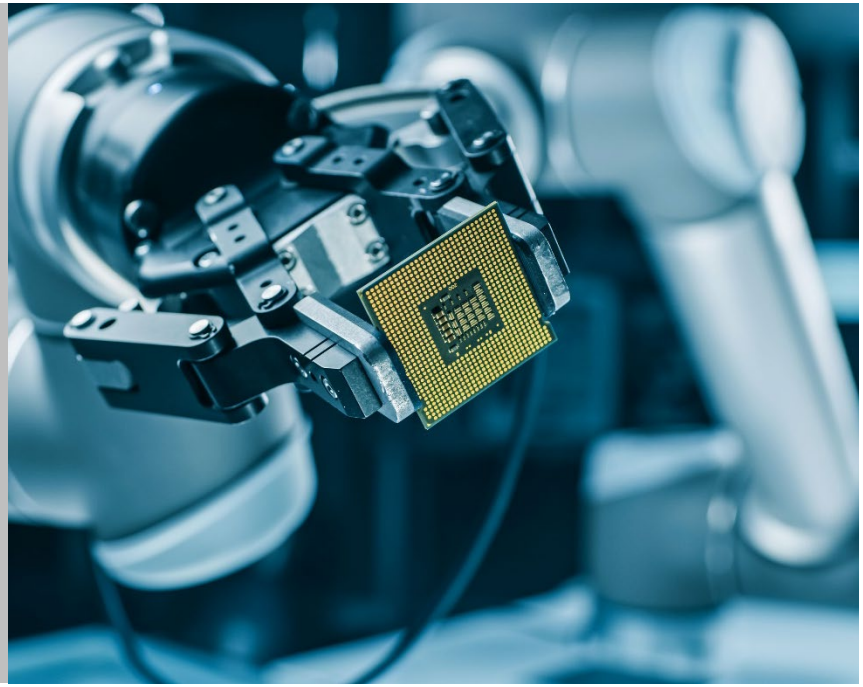
# CUSTOMER CASE V: REHAU, GERMANY

*With the DragonFly LDM we will drive forward REHAU's "Electronics into Polymers" strategy to speed up in-house electronics development and find new installation spaces and functions for our products.*

**Dr. Philipp Luchscheider, REHAU Engineer behind the 3D touch sensor design**

*Smartification is no longer just a vision for us. REHAU is developing improved products for the smart home and IoT environment, and Nano Dimension is providing important technology to help accelerate the availability of promising new applications.*

**Dr. Ansgar Niehoff, Head of Technology Platform "Electronics into Polymers" at REHAU**

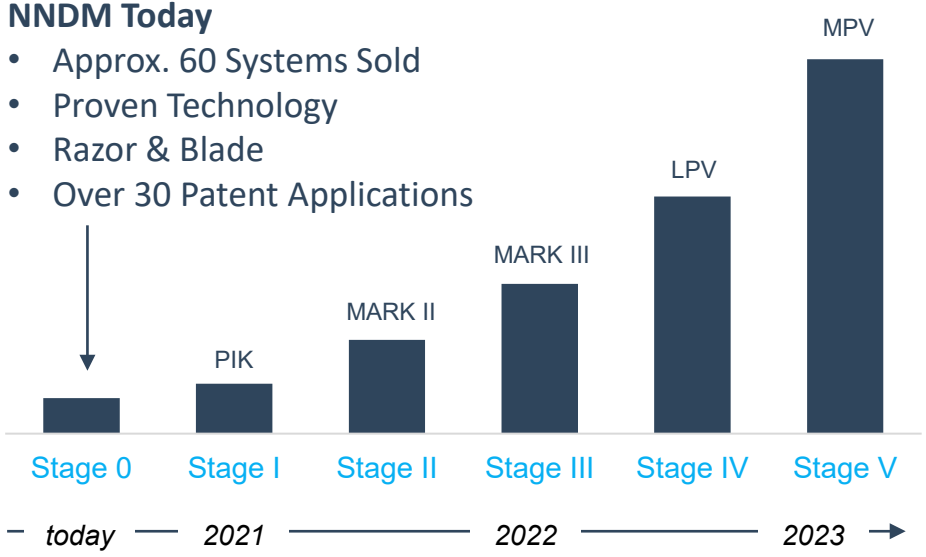


# FAIL SAFE "BIOTECH-LIKE" INVESTMENT MODEL

Since Covid-19's eruption – it is not about quarterly Revenue curve. We are focused on upside through accelerating Product Technological Edges (Upside like Biotech). BUT we have sold approx. 60 machines already. Contrary to Biotech downsides, a failure at any Stage is protected (as a sale of the existing business at improving multiples, as per stage, is a viable alternative)

**NNDM Today**

- Approx. 60 Systems Sold
- Proven Technology
- Razor & Blade
- Over 30 Patent Applications




- Stage I — Materials Commercial-Specs
- Stage II — Materials Industrial-Specs
- Stage III — Materials Mil-Specs
- Stage IV — LPV: Low Production Volume System
- Stage V — MPV: Medium Production Volume System

*Performance Improvement Kit

# NANO DIMENSION EVOLUTION

- **24/7 Print in a Compact System**
- **Integrated AI Software**

**DragonFly**

**First Prototype**
2013-17

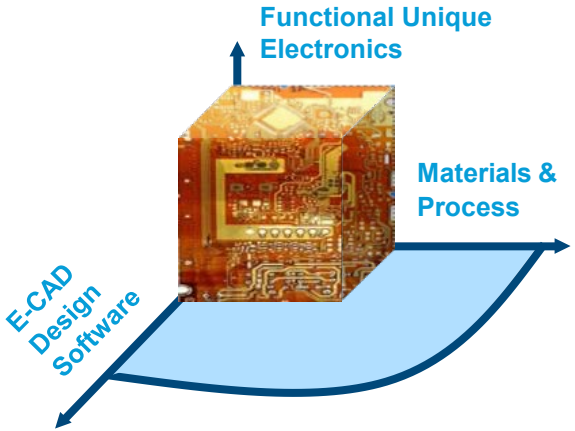
**DragonFly™ Pro**

**Industrial: Early Product**
2018-2019

**DragonFly™ LDM**

**Early Adopters: Fast Prototyping & Low Volume Production**
**Q3 2019**

**"The Secret Sauce"**
Competitive Edge & Barriers to Entry




**The Hardware is an Enabling Platform**

# WHY ADDITIVE MANUFACTURING FOR ELECTRONICS ?

Approx. **60 3D-Printing DragonFly** Machines were sold to leading blue-chip defense, research commercial & government organizations

**ACCELERATE**
**time to market**

**PROTECT**
**IP**

**INCREASE**
**design possibilities**

**IMPROVE**
**efficiency**

# NANO DIMENSION: REVENUE DRIVERS

## Emerging Technologies

- Communication 5G/RF
- Heterogeneous Integrations
- Aerospace (i.e. micro-satelites)
- Defense
- Medical (i.e. in-vivo devices)
- Automotive Revolution (electrical, autonomous)

## Hi-PEDs™ Necessitate

- Fast time-to-market
- IP safety → in-house rapid prototyping and production
- Interactive development
- Device performance gains
- Control of fabrication facilities → Defense & Homeland Security

**Hi-PEDs™ (High-Mix-Low-Volume) are produced at high quantitates that are constructed from high mix of designs and low volume per variety. This necessitates prototyping and low cost of production for low volumes.**

# POST CORONA WORLD: MOVING SUPPLY CHAIN 'IN HOUSE'

"Even as China comes back online, we are beginning to wonder if Covid-19 will impact other supply-oriented geographies…

…While China is improving, **the supply chain for the electronics industry** may yet **see substantial disruptions**….

*…Mass assembly is only one part of Apple's supply chain*. The company and its many partners spend months years sourcing individual components that are or assembled into final products. Any **disruptions** in this complex network could **slow the introduction of future devices**." (Bloomberg)[1]



*Sources:*

*1) Gurman, Mark, and Debbu Wu. "Https://Www.bloomberg.com/Amp/News/Articles/2020-03-19/Apple-s-Supply-Chain-Woes-Linger-Even-as-China-Recovers ." Bloomberg.com, Bloomberg, 19 Mar. 2020, www.bloomberg.com/amp/news/articles/2020-03-19/apple-s-supply-chain-woes-linger-even-as-china-recovers*

# POST CORONA WORLD: MOVING SUPPLY CHAIN 'IN HOUSE'

- "The global **supply chain right now is disrupted;** we are seeing disruptions across the board... the high-tech industry is heavily reliant on China and parts of Asia." (Bloomberg)[2]

- " ...heat from the Trump administration's 25% tariffs on many machinery parts from China, as well as rising political tide in America to bring industrial production of things such as **electronic circuit boards closer to home**…. Now with the coronavirus, he said, "there will be changes." (LA Times)[3]

- A recent **BofA survey**…wide…remapping of supply chains. 3,000 firms…in 10 out of 12 global industries, including **semiconductors, autos and medical equipment**…**shift,** at least **part of their supply chains from current locations**….

- Masterwork contracts with about 100 factories in China. Before the virus outbreak, the company could place an order and have it confirmed in two to four days. **Last month**…it was **taking two to three weeks — couldn't say when** the **products would be shipped**.

- "…industries will probably accelerate moves to **localize supply chains**, so they're more closely tied to final markets as opposed to extending them farther out."(LA Times)[3]

*Sources:*

*2) Chang, Emily. "Supply Chain Expert on Coronavirus Impact." Bloomberg, 17 Mar. 2020, www.bloomberg.com/news/videos/2020-03-17/supply-chain-expert-on-coronavirus-impact-video . Accessed 25 Mar. 2020.*

*3) Lee, Don. "As Coronavirus Cripples Global Supply Lines, More U.S. Firms Looking to Leave China." Los Angeles Times,*

*Los Angeles Times, 4 Mar. 2020, www.latimes.com/politics/story/2020-03-04/spreading-coronavirus-tears-apart-global-supply-chains.*

# POST CORONA WORLD: MOVING SUPPLY CHAIN 'IN HOUSE'

**OCTOBER 12th, 2020: The American Dream: Bringing Factories Back to the U.S.**(1)

A report from the McKinsey Global Institute found "180 products across value chains for which one country accounts for 70% or more of exports, creating the potential for bottlenecks." Worse, many of those products come from an increasingly hostile China, a circumstance with profound national-security implications for the U.S. and other democracies.

- Investors stand to benefit if reshoring means a longer-term revival in innovation and flexibility in production. And higher operating costs could be offset by higher revenues, whether that's through higher wages leading to greater consumer demand, government support, or some combination.
- Both presidential candidates want to bring manufacturing back, but their strategies differ. Democrat Joe Biden has unveiled a plan to boost federal spending on U.S.-made goods, support research and development, change the tax code to discourage offshoring, and close loopholes in rules that already require Uncle Sam to "Buy American."
- While Silicon Valley is now known for software, it originally prospered as a manufacturing center that supported fundamental scientific research in physics, electronics, and materials science. Many of the world's leading electronics hardware companies are still headquartered in Silicon Valley, but most don't manufacture anything there.
- Bringing manufacturing back to America isn't impossible by any means—especially in capital-intensive sectors such as electronics ….It may even benefit investors…
- "What's missing is the capability to pivot" to sudden changes in demand."(2)

*Sources:*

*1) Matthew C. Klein, Barrons, Updated October 12, 2020 / Original October 9, 2020, https://www.barrons.com/articles/the-american-dream-reshoring-manufacturing-51602270001*

*2) Erica Fuchs, professor of engineering and public policy at Carnegie Mellon, https://waysandmeans.house.gov/sites/democrats.waysandmeans.house.gov/files/documents/Erica%20Fuchs%20Testimony.pdf*

# NANO DIMENSION'S 3D FABRICATION SERVICES: NaNoS℠

- Nano Services (NaNoS℠) is an offering for customers who need to get their hands-on complex, multilayered high-performance electronics with a quick turnaround time.
- Provide services to customers around the globe with its fabrication labs in the US, Israel and Hong Kong.
- Guaranteed quick turnaround for complex Hi-PEDs™.

## How it works

Chat With an expert regarding the most efficient way of printing your model

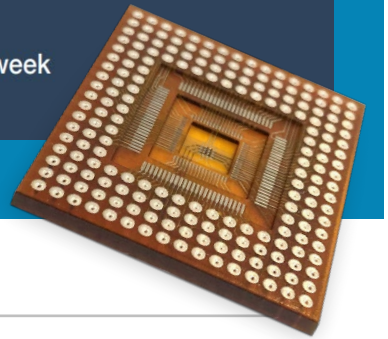
→

Send your CAD or SolidWorks files to optimize the printing

→

Your parts are printed cost effectively and shipped to you in the shortest competitive time

The entire process would take up to a week



# NANO DIMENSION: NEW CORPORATE AND US MANAGEMENT

- **Yoav Stern – President & CEO (Joined 01/2020) –** Investor and Chairman Cyber, Fintech and Mobile/Visual Tech *(USA).* President & CEO DVTEL Inc. *(Sold to FLIR Systems) (NJ, London, Tel Aviv, New Delhi, Adelaide, Singapore, Hong Kong, Taiwan).* A turn-around executive in the Homeland Security Industry. Co-Chairman Bogen Corporation *(New Jersey, Memphis, Florida, Germany),* one of its main investors and a member of its Executive Committee, Audit Committee and Compensation Committee. Managing Partner Helix Capital LLC, *(San Francisco, New York),* private M&A and Turn-Around Advisory Firm. Executive Chairman of the Board Kellstrom Industries Inc. *(Florida),* A $300M aerospace corporation. President of WordStar International, Inc. *(San Francisco),* a $50M publicly traded software company. Mr. Stern led the company's turnaround process and *structured the business combination* of WordStar with two other public companies, similar sizes. He was VP M&A & Business Development Elron Electronic (Nasdaq: ELRNF) a multinational industrial investment holding company with annual revenues in excess of $1.5 billion. Elron invested in companies active in the fields of Advanced defense electronics; Data communications; Internet-software products; Semiconductors equipment; Telecommunications. Mr. Stern is a Graduate of NYU, B.Sc. Degree, *Magna Cum Laude* in Mathematics and Computer Science, Engineering Diploma in Mechanics & Automation *Magna Cum Laude*. Graduate of the Air Force Academy. Air Force Service: Lt. Colonel (Ret.), Fighter Pilot, D. Squadron Commander, F-15.

- **Ziki Peled – COO, CRO (Joined 05/2020) –** Seasoned turn around executive from FLIR Systems, Inc. (Nasdaq: FLIR), which develops, manufactures, markets, and distributes thermal imaging systems, visible-light imaging systems, locator systems, measurement and diagnostic systems, and advanced threat detection systems. With annual turnover of $1.8 billion & a market cap of $7 billion. He was the CEO of Apollo Network Services Ltd. where he managed large projects in the field of Defense, Energy and Transportation for Finmeccanica, Multi-billion-euros Corporation, and one of the largest European organizations of its kind. Prior, CEO of as in Flash Networks Ltd. he led development and commercialization of NettGain™ Mobile Data Access Gateway. Peled was the CEO of Bogen Communication Int'l, NJ, USA in Ramsey, New Jersey, and Munich, Germany, which develops, manufactures, and markets telecommunication peripherals, sound processing equipment. Earlier, he was GM of Elbit Computers Ltd. Telecommunication Division, comprising various activities including CTV plant, Data Communication activity through the daughter company Fibronics and Telephony over Cable TV project in China. Earlier in Elbit he has led the merger of the R&D division and the Production division with over 1,000 people with a development budget of $30 million and production of over $100 million/year.

# NANO DIMENSION: NEW CORPORATE AND US MANAGEMENT

- **Dr. Jaim Nulman – EVP Products & CTO (Joined 2018)** – VP of Applied Materials, where he commercialized the Endura PVD system, the most successful semiconductor manufacturing product reaching market share from 0 to over 60% and a $1B in revenue in less than 5 years, with one of the highest gross margins in the company. While at Applied he also represented the company on the board of directors of some of the companies in which Applied invested as well as developed product commercialization methods that reduce the cost and time to market. Dr. Nulman served as research associate at the Submicron center at Cornell University where he pioneered rapid thermal processes for the semiconductor industry. He was an invited Lecturer at NATO Advanced Studies Institute and the University of Berkeley Extension. Dr. Nulman has published over 100 publications, and over 50 patents. He is an MSc and PhD from Cornell University all in electrical engineering, and an Executive MBA from Stanford University.

- **Dr. Joseph Kaplun VP R&D & CTO Materials (Joined 10/2020) –** Dr. Kaplun has spent 25 years with the IAI as the CTO, co-founder and Acting General Manager of Gal-El, unique GaAs, GaN, InP and MEMS devices and MMICs FAB. It is a partnership between the ELTA/IAI and the Weapon Development Authority (RAFAEL) in Israel. In the Technology Development Center of The Silicon FAB in USSR, Dr. Kaplun was the Head of Ion Processes Department. Dr. Kaplun earned his Ph.D. from NPO "Center of Sciences" in Moscow and B.Sc. & M.Sc. in Material Science in Microelectronics from the Moscow Institute of Electronic Technique, Zelenograd, Material Science Department. His publications include books about High Vacuum Technology, and Statistical Process Control as well as articles on BCB etching Process using High Density Plasma, Critical dimension improvement of plasma enhanced chemical vapor deposition silicon nitride thin films in GaAs devices, High Power Ka – Band PIN Diode Technology, Investigation of Contact Metal Stacks for Submicron GaN HEMT, Origin and elimination method of parasitic gate leakage current for AlGaN/GaN hetero-structure field effect transistor, Re-configurable MMIC: on-wafer fine tuning capabilities and Stepper-based integrated process on wafer pieces.

# AME / 3D PRINTED ELECTRONICS MARKET

**IDTechEX (2019)**

- The total market for 3D printed electronics will be worth $2.3 billion by 2029 and will be dominated by the professional PCB prototyping market segment. The educational and industrial production market segments will continue to grow steadily.
- The market for professional PCB prototyping is currently growing very rapidly, almost entirely due to market leader Nano Dimension, and has already overtaken the consumer and education. This growth will slow but this market segment will become the largest by 2020.

**DataM Intelligence (2018)**

- Analysts predict 3D printed electronics will be the next high-growth application for product innovation: 2017 3D printed electronics market size is estimated at $176 million, expected to reach $592 million in 2021 and up to $2.4 billion by 2025.

**Transparency Market Research (2018)**

- The global 3D printed electronics market was valued at US$ 137.1 million in 2017 and is expected to expand at a CAGR of 44.46% from 2018 to 2026, reaching US$ 3,915.0 million by the end of the forecast period.

The global **flexible circuit industry** recorded revenue of **$12.9 billion** in 2019

and is expected to grow at an **11.2% CAGR through 2025,**

outpacing the broader **global circuit board industry** which is **expected to grow at a 4.3% CAGR,**

as demand has increased for lighter, smaller devices with greater functionality.

*Source: Grand View Research*

# KEY HIGHLIGHTS:

- **Growth company** with significant technology and first mover advantage.
  - **Approx. 60 3D-Printing DragonFly Machines** with leading defense & research organizations **and Increasing recurring revenue of proprietary inks**
  - Shortening prototyping time while creating multi-layer **Hi-PEDs™** in house.
  - R&D of unique solutions, miniaturized, lower weight which can be fabricated in high mix/low volume almost only by 3D-printing.

- **New Investment Thesis:** Biotech investment model – with hedged downsides
  - Since Covid-19 eruption – **it is not about quarterly revenue curve.**
  - Focused on accelerating product technological edge (upside like Biotech). **Contrary** to Biotech downsides, a failure at any stage is protected (as a sale of the existing business at improving multiples, as per stage, is a viable alternative)

- **New NaNoS℠ = Prototyping Services Business Model** (fabrication labs on three continents).

- **Expected** to reach **inflection point upon conversion from prototyping to short production runs.**

- **Strong cash-position,** enough to advance the business plan towards commercial success, at minimal risk.

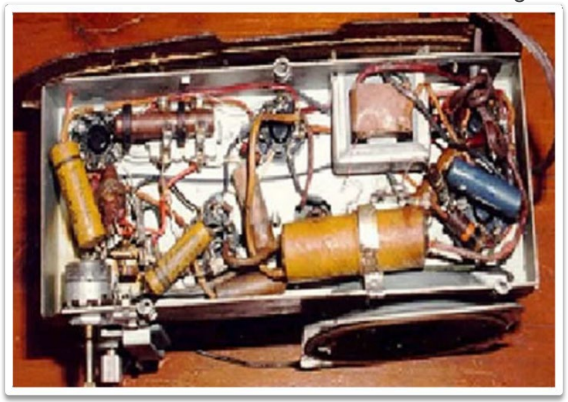
NANODIMENSION
Electrifying Additive Manufacturing®

# Appendix

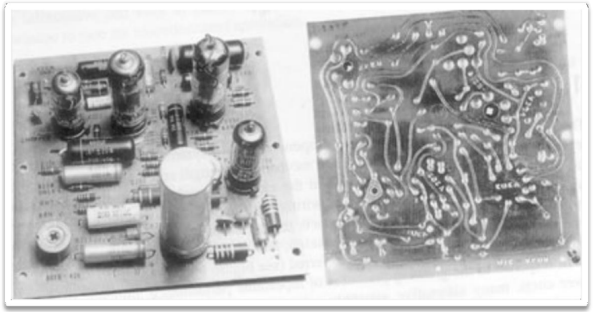
# Additive Manufacturing for Electronics

# TRADITIONAL PCBs: HISTORY

Pre-PCB electronic circuit with rat's nest wiring.



Early PCB



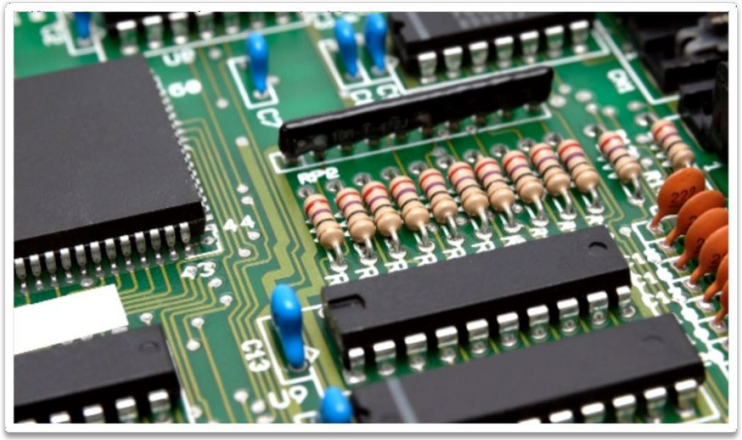
Before the 1950s, **electronic circuits were assembled using individual wires to connect** each of the components (Pic 1).

The components were then mounted on what were known as tag strips and sockets. The **first circuit boards were made by laminating an insulating material around 1.6mm thick with copper foil**. Holes were drilled for the components and the component leads were soldered onto the copper foil, using the copper to create an electrical connection between the components.

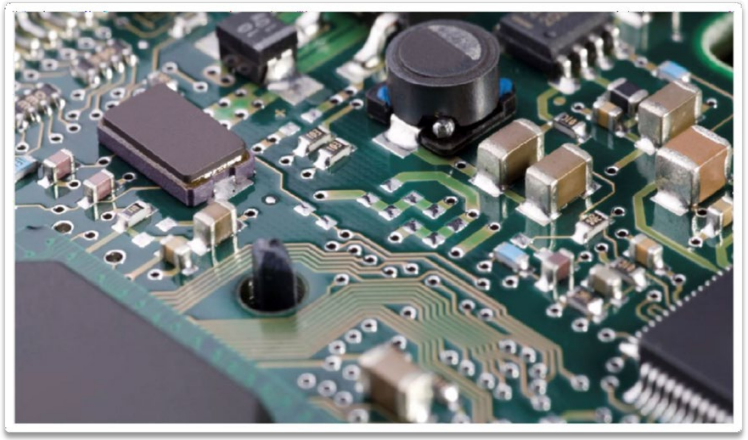
**Dr. Paul Eisle**r, an Austrian scientist working in England, is credited with **inventing the first single-sided PCB.** Based on Eisler's early work, single-sided boards were commercialized during the 1950s and 1960s, primarily in the United States.

# TRADITIONAL PCBs: MOUNTING COMPONENTS

Through-Hole Electronics

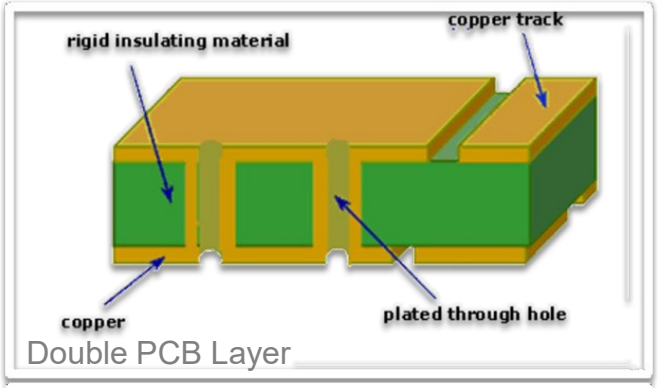


Surface Mount Electronics

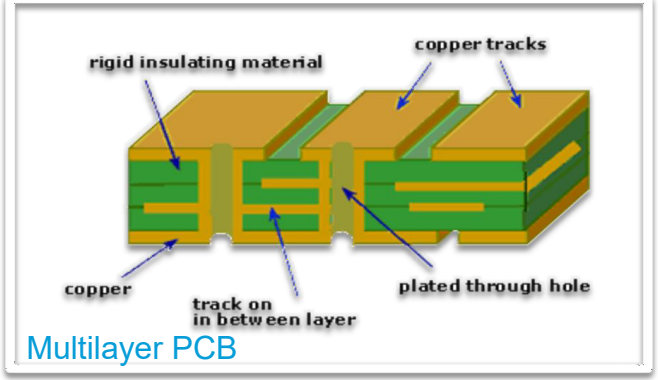


The vast majority of electronic circuits are now made using Printed Circuit Boards (PCBs). These are copper-clad fiberglass or epoxy boards that have the copper selectively etched away to leave conductive traces. Components can be mounted through drilled holes (left) or on the surfaces of the boards (right).

# NANO DIMENSION: PCB VS AME



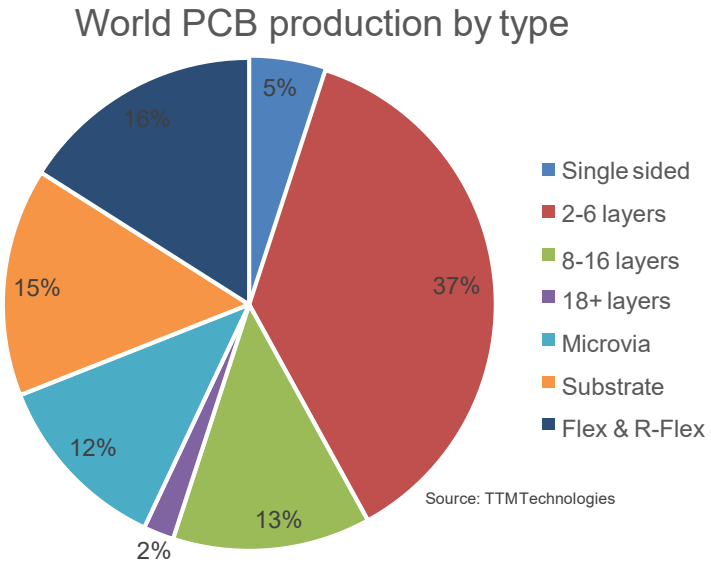
Double PCB Layer



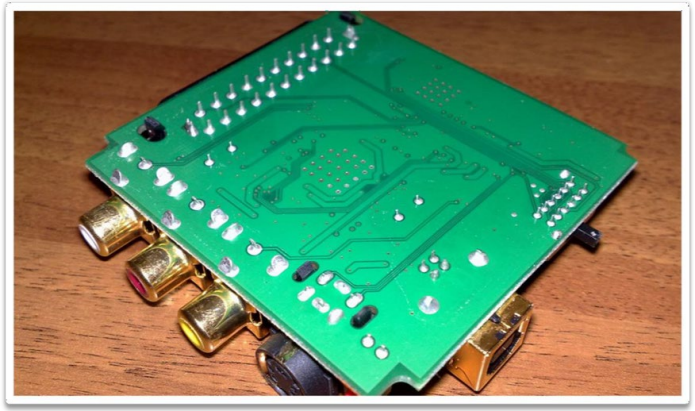
Multilayer PCB

- **Single-sided** PCBs are very limiting in terms of connection topology. With single-sided PCBs, most circuits require the ability to join two conductive tracks using a wire.
- **Double-sided** PCBs alleviate this problem by allowing connections through holes from one side of the PCB to another.
- **Multi-layer boards** take this further by providing up to 52 layers with connections between arbitrary layers. Such a large number of layers clearly represents a shift towards 3D printed electronics.

# TRADITIONAL PCBs: LAYERS



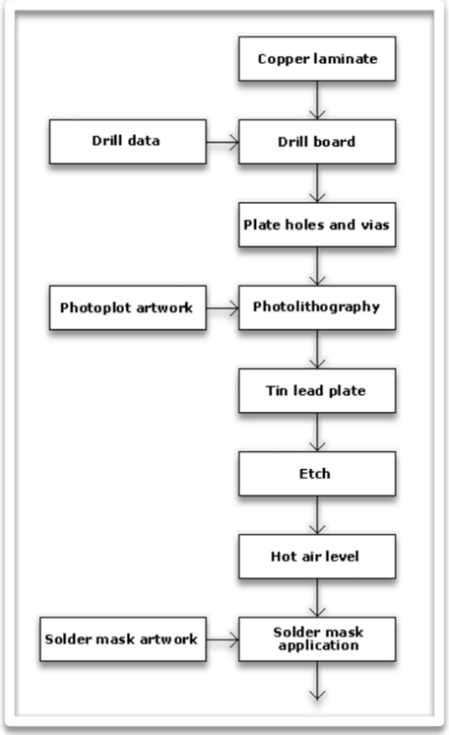

According to TTM Technologies, the most common PCB type is 2-6 layers with 37% share of the total market. Therefore, **multilayer boards will be the largest addressable market** for PCB rapid prototyping technologies such as 3D printed electronics.



Many PCB designs, particularly analog or high-frequency digital circuits, employ a ground plane. This is a **large area of copper foil** that provides a **low resistance connection** to a reliable ground voltage and some protection from EM interference.

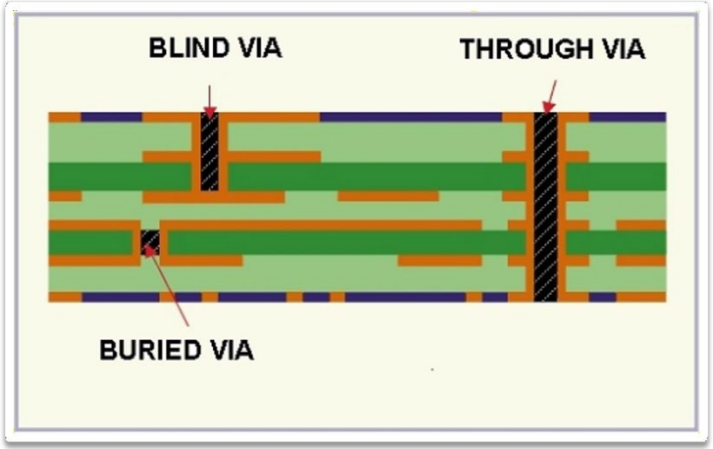
Consequently, PCB designs often employ more than one layer.

# TRADITIONAL PCBs: LAYERS

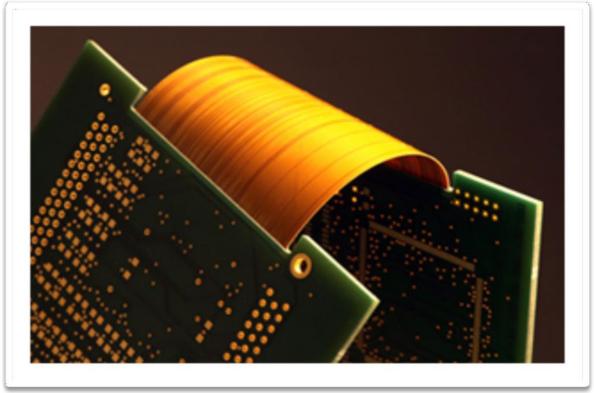



Traditional PCBs are a mature technology, and their limitations are well understood. High-end multilayer PCB manufacture is tricky and expensive, and prototypes are usually made externally and often off-shore. Traditional PCBs are both rigid and flat.

This imposes constraints on design that usually result in a traditional PCB being encapsulated in a housing typically made by injection molding thermoplastic



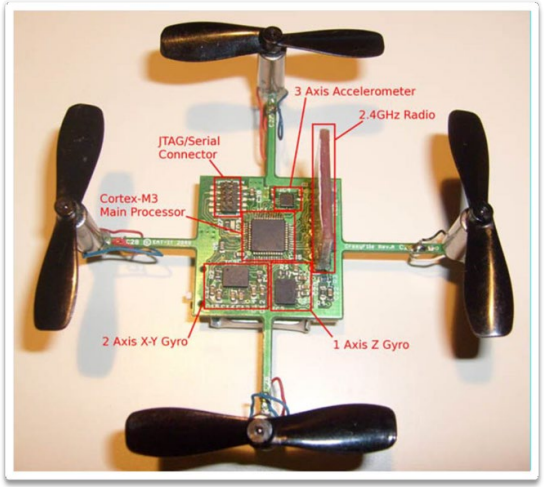
# TRADITIONAL PCBs: MECHANICS



Rigid PCBs can be connected together using flexible interconnects to offer a bit more design freedom but the physical limitations are obvious, particularly in the light of massive emerging markets like wearable technologies.

The physical strength of fiberglass board makes it possible to use a traditional PCB as a mechanical component in a device as well as an electrical one. This is a crude form of structural electronics.

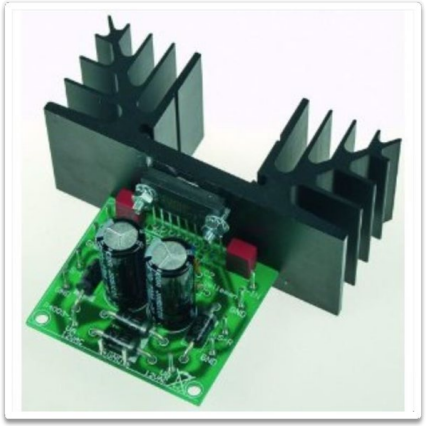
The CrazyFlie quadcopter shown above uses its traditional PCB as a chassis providing all of the power and control electronics as well as electrical and mechanical connections to each of the four motors.



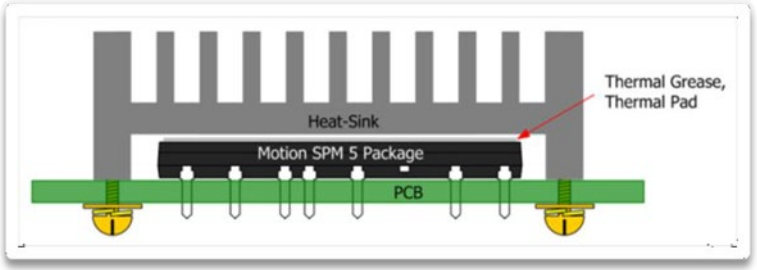
# TRADITIONAL PCBs: HEAT

Components such as power semiconductors can generate a lot of heat thatmust be dissipated in order to keep the device running within temperature tolerances. Temperature is responsible for 55% of all electronic circuit failures. Specifically, the failure rate of an electronic device doubles with every 10°C increase in chip junction temperature†. The ability to transfer and dissipate heat generated at the chip level directly dictates the system's reliability.

Heat dissipation is traditionally accomplished by using a thermal interface material to join the power semiconductor component to a heat sink, often on the opposite side to the PCB. In some cases, vias are used to help conduct heat through the PCB.



Fiberglass and epoxy are the standard substrates used in PCBs. These materials are thermal insulators and, therefore, do not help to conduct heat away from components. Ceramic fillers such as Beryllium Oxide (BeO) are used to improve thermal conductivity whilst retaining electrical insulation but the poor thermal conductivity of most PCBs is still a significant issue.




Heat management is one area where alternative technologies may be able to improve upon the traditional PCB.

# TRADITIONAL PCBs: SWOT ANALYSIS

## Strengths

- Established technology: ~$60bn industry.
- Physically strong.
- High electrical conductivity ($\sigma = 5.96 \times 10^7$ S/m) from solid copper traces typically 36µm deep facilitates analog and high-frequency digital circuits.
- Can withstand temperature extremes, humidity, mechanical shock and vibration, atmospheric variations, harmful chemicals, and electromagnetic radiation.
- Ground plates are cheap.
- Multilayer boards are commonplace.

## Weaknesses

- Either expensive to prototype locally or slow to prototype remotely (7 to 21 day turnaround from China).
- Cost single unit cost due to minimum batch size: ~$50 for a 6”x5” multilayer board.
- Poor thermal conductivity of the fiberglass or epoxy substrate creates heat management problems.
- Etching uses hazardous chemicals that are very bad for the environment to the extent that the world’s largest PCB manufacturer, China, have outlawed etching in coastal regions.

## Opportunities

- Some potential to include components like supercapacitors inside the PCB.

## Threats

- Flexible circuit boards.
- Printed conductive inks and pastes.
- 3D printed electronics.

# ADDITIVE MANUFACTURING OF 3D ELECTRONICS

Real 3D Embedded Electronics for Heterogenous Integration

Electronics integration (MEMS, Sensors, Transistors, ICs, Opto, Piezo, Chem-Electro, Magnetics, Motion)

3D Printed Electronics Components (Capacitor, Inductor, Transformer, Antenna)

**AME Hi-PEDs™**

*beyond traditional manufacturing*

Multi Stacking ICs, Packages, Side Mount & Contacts, Free Form of Vias

Non Planar Shape and 3D Structural Elements (Cavities, Special Shapes)

High Layer Count Circuits > 50

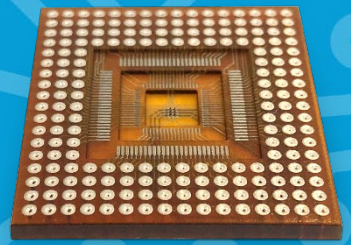
RF&MW Embedded Components

Converter and Chargers (DC, AC)

NANODIMENSION

Electrifying Additive Manufacturing®

# 3D-Printed Hi-PEDs™



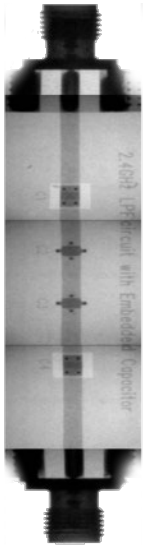
# NANO DIMENSION: 3D-PRINTED Hi-PEDs™

Example of Hi-PEDs™ :

- LOW PASS FILTER (LPF)
- VERTICALLY STACKED INTEGRATED CIRCUITS (ICS)
- RF ANTENNAS & AMPLIFIERS UP TO 6GHZ
- FUNCTIONAL CAPACITORS BY ADDITIVE MANUFACTURING
- IN PCB PLANAR DC-DC UP CONVERTER TRANSFORMER
- SIDE MOUNT/CONTACT AND INSERTED COMPONENTS
- BUILT IN POWER TRANSFORMERS

# EXAMPLE OF Hi-PEDs™: LOW PASS FILTER (LPF)


Printed LP

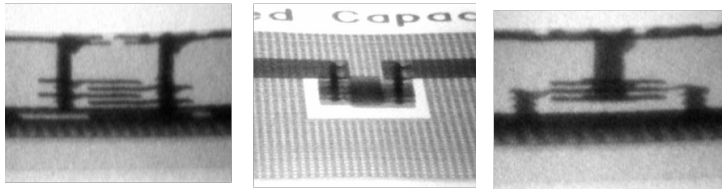


X-ray of Printed LP

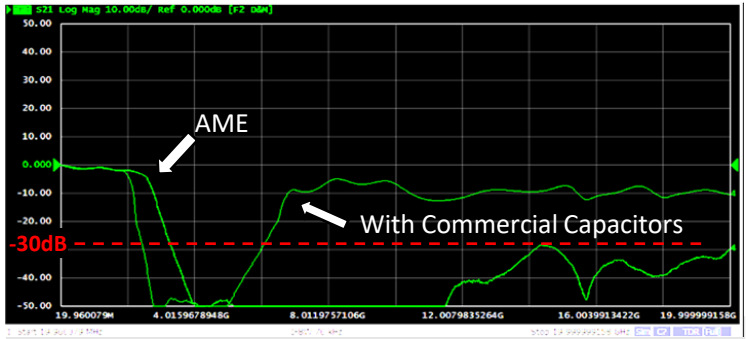
LPF uses AME capacitors fabricated simultaneously inside the AME board together with strip lines.

The AME capacitor and the strip line can be placed on any layer or on different layers in the AME board

**X-ray of LPF capacitors and transmission strip lines**



**S21 - AME transmission and capacitors vs AME transmission with SMT commercial capacitors**



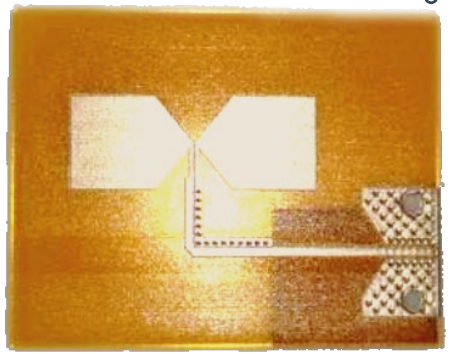

LPF with AME Capacitors filters the signal at least up to 20GHz. (less than -30db)

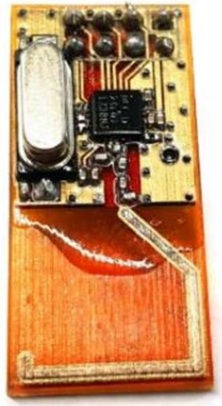
LPF with Commercial Capacitors stops filtering at 6GHz

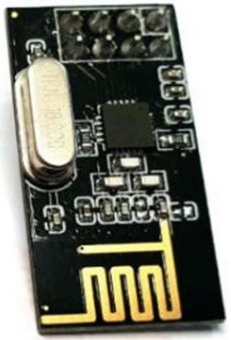
# EXAMPLE OF Hi-PEDs™: RF ANTENNAS & AMPLIFIERS UP TO 6GHZ

## NANO DIMENSION CAN DO IT

Our capability to print UHF & SHF RF signal transmission line and antennas. RF antennas & amplifier applications with up to 6GHz frequency.



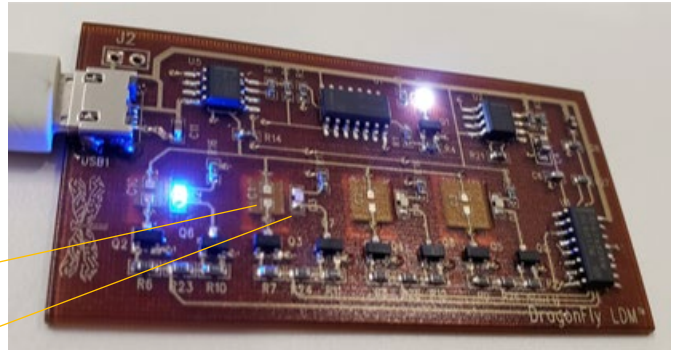


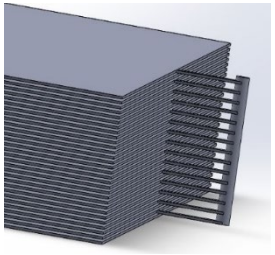


| Transmitter to receiver (173000 samplings) | Regular to Regular | Regular to printed | Printed to Regular | Printed to printed |
|---|---|---|---|---|
| 1m | 88.9% | 99.3% | 90.2% | 99.49% |
| 10m | 88% | 99% | 90.8% | 99.41% |
| 20m | 90% | 93.68% | 89% | 99.01% |

# EXAMPLE OF Hi-PEDs™: FUNCTIONAL CAPACITORS BY ADDITIVE MANUFACTURING

- Produced simultaneously during the additive manufacturing of PCBs
- Reduce the total size of the PCB
- Freeing surface area for mounting other PCB components



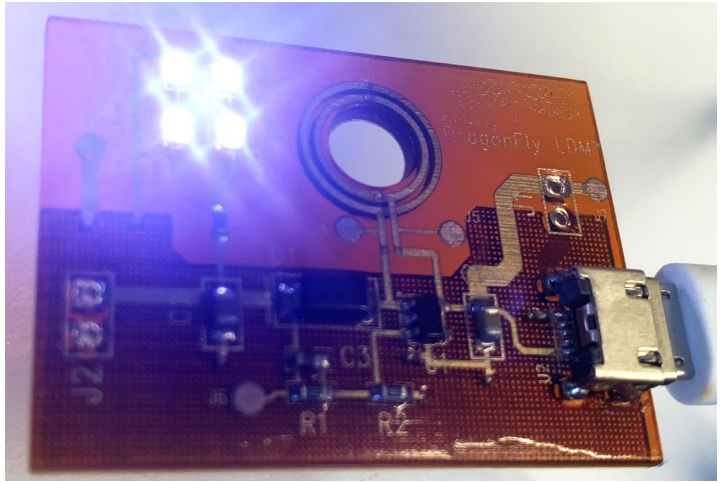



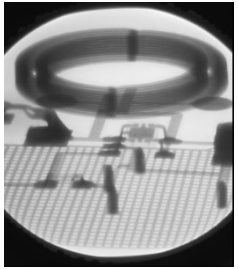
Design

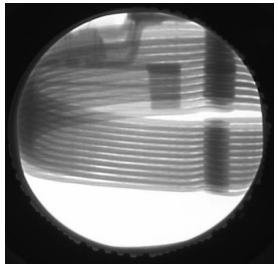
Actual

# EXAMPLE OF Hi-PEDs™: IN PCB PLANAR DC-DC UP CONVERTER TRANSFORMER

- The most common DC-DC Up Converters are units mounted on a PCB
- By producing the device as an integrated part of the PCB, surface area usage, assembly time, and other overhead costs are reduced.

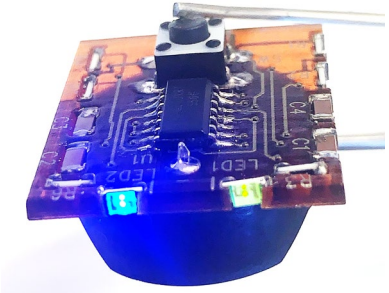


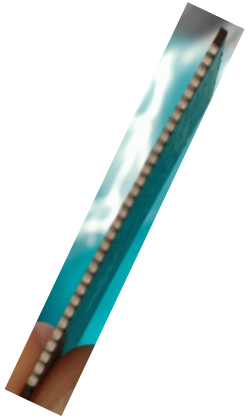



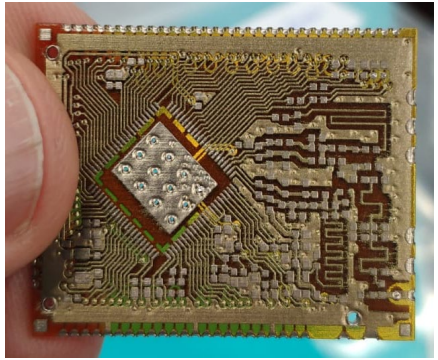


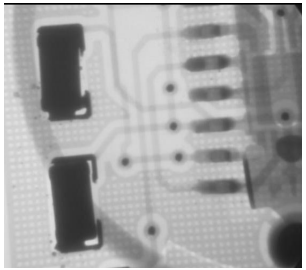
# EXAMPLE OF Hi-PEDs™: SIDE MOUNT/CONTACT AND INSERTED COMPONENTS

- Enables the use of an area not common for PCB components
- Enables the creation of customized small PCBs that can be inserted into a socket

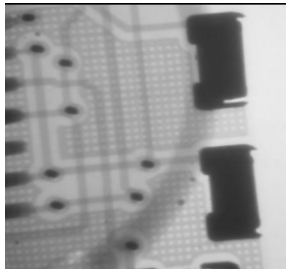








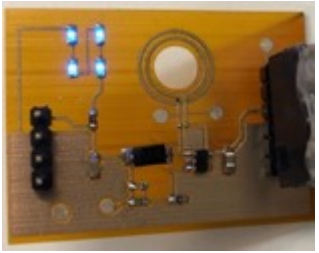
a)



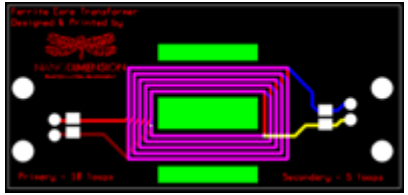
b)

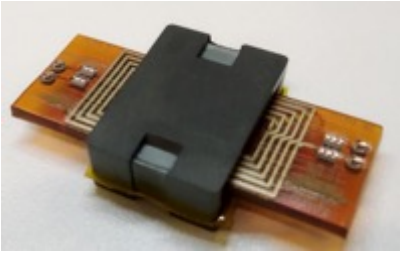
Figure 1 X-ray view of a) inserted, and b) side mounted components soldered to vertical contacts manufactured as part of the PCB additive manufacturing technology in the DragonFly LDM™

# EXAMPLE OF Hi-PEDs™: BUILT IN POWER TRANSFORMERS

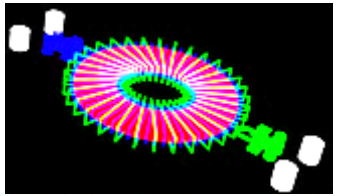


In Board Power
DC–DC Up
Voltage Converter





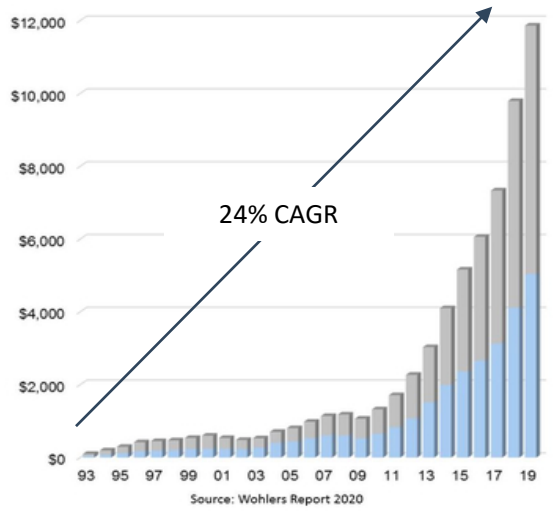
AC-AC
Transformer with
ferrite core



AC-AC Up
Converter (x10)

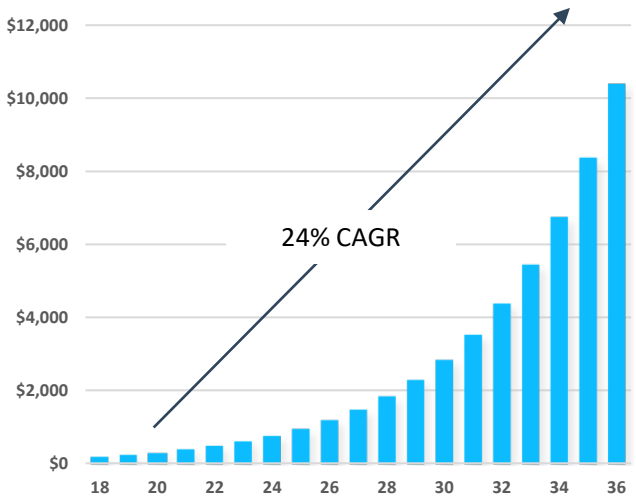
# NANO DIMENSION: LEADING THE AME REVOLUTION

## Additive Manufacturing **(Metal & Polymers)**




**Market Growth – Additive Manufacturing**
This chart provides revenues (in millions of dollars) for AM products and services worldwide. The lower (blue) segment of the bars represents products, while the upper (gray) segment represents services. Neither category includes secondary parts or processes, such as molded parts and castings.
Source: Wohlers Associates

## Additive Manufacturing of Electronics (AME)




**Market Growth – Additive Manufacturing of Electronics**
This chart provides revenues (in millions of dollars) for AME products and services worldwide. The projection is derived form various market studies projection is based on a CAGR of 24%

# THANK YOU

NASDAQ: NNDM

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