A Novel Concept of Thermally and Electrically Integrated 3-D Flexible Electronic Package

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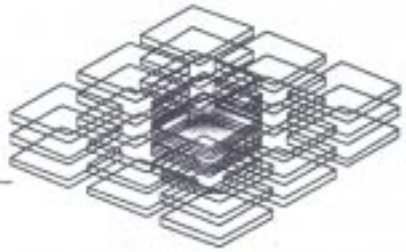
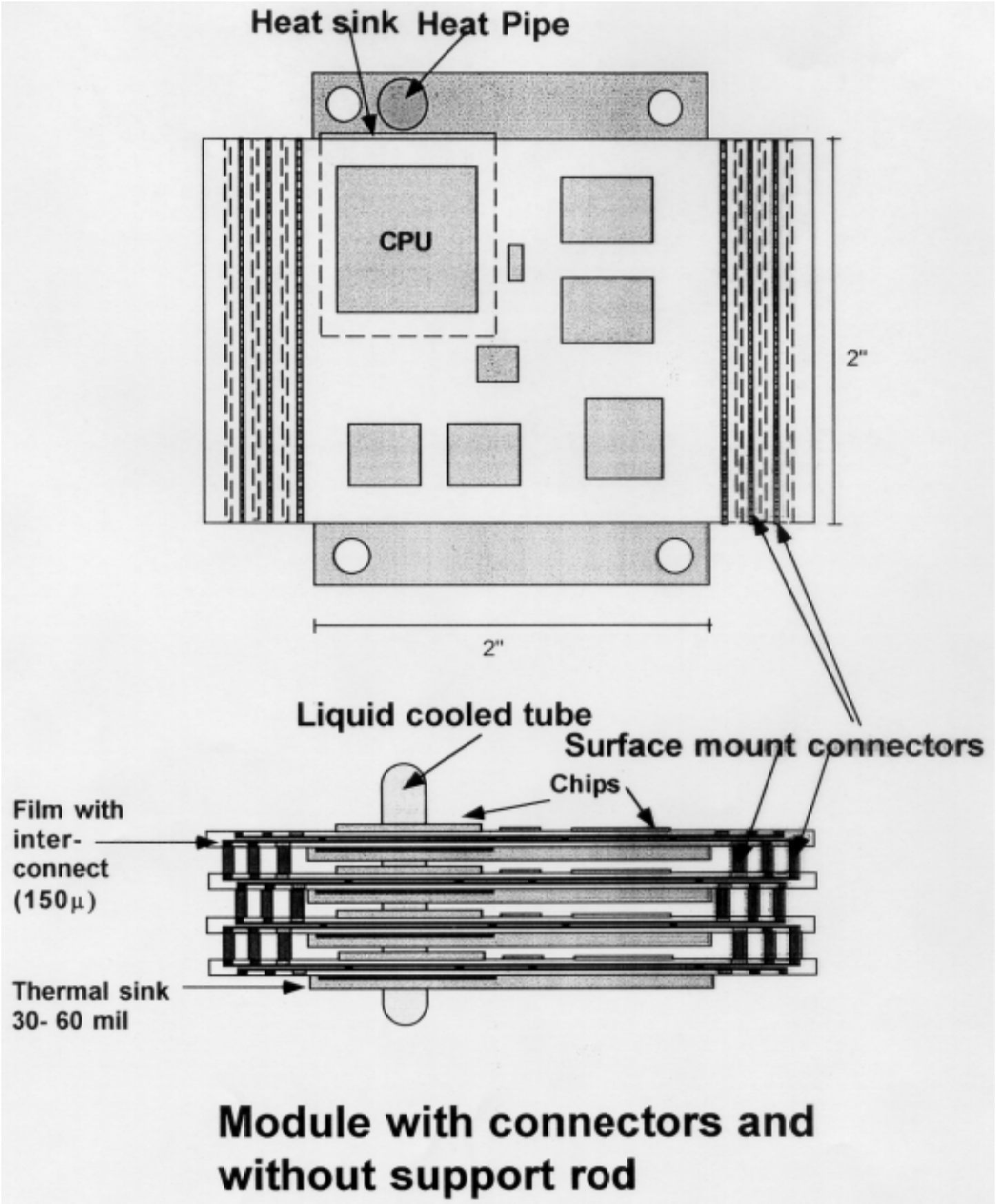
Outline :

- Introduction
- 3-D Flex MCM
- Current Status
- Future





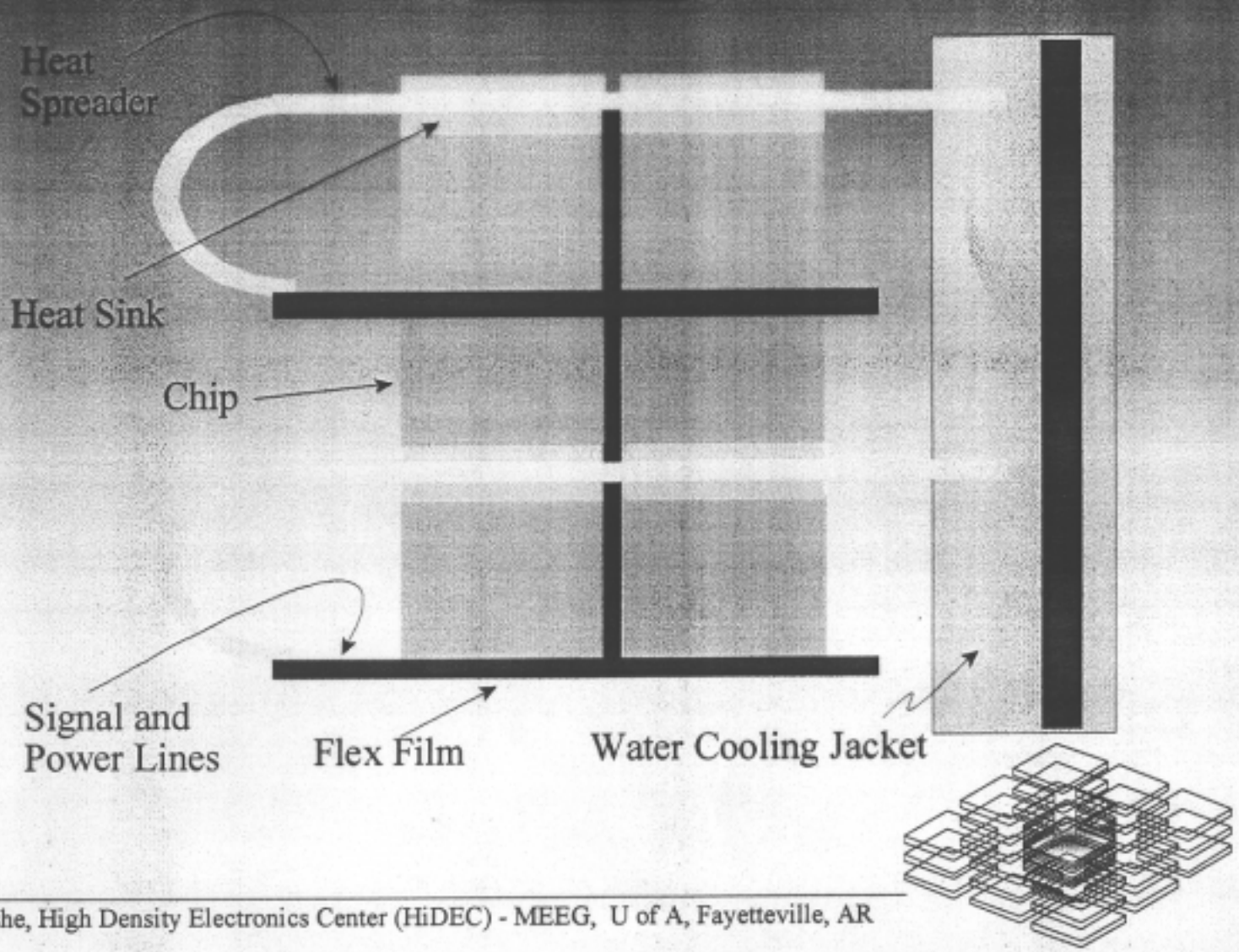
Module with connectors and without support rod

HiDEC's Integrated Passives Background (DARPA Consortium) :

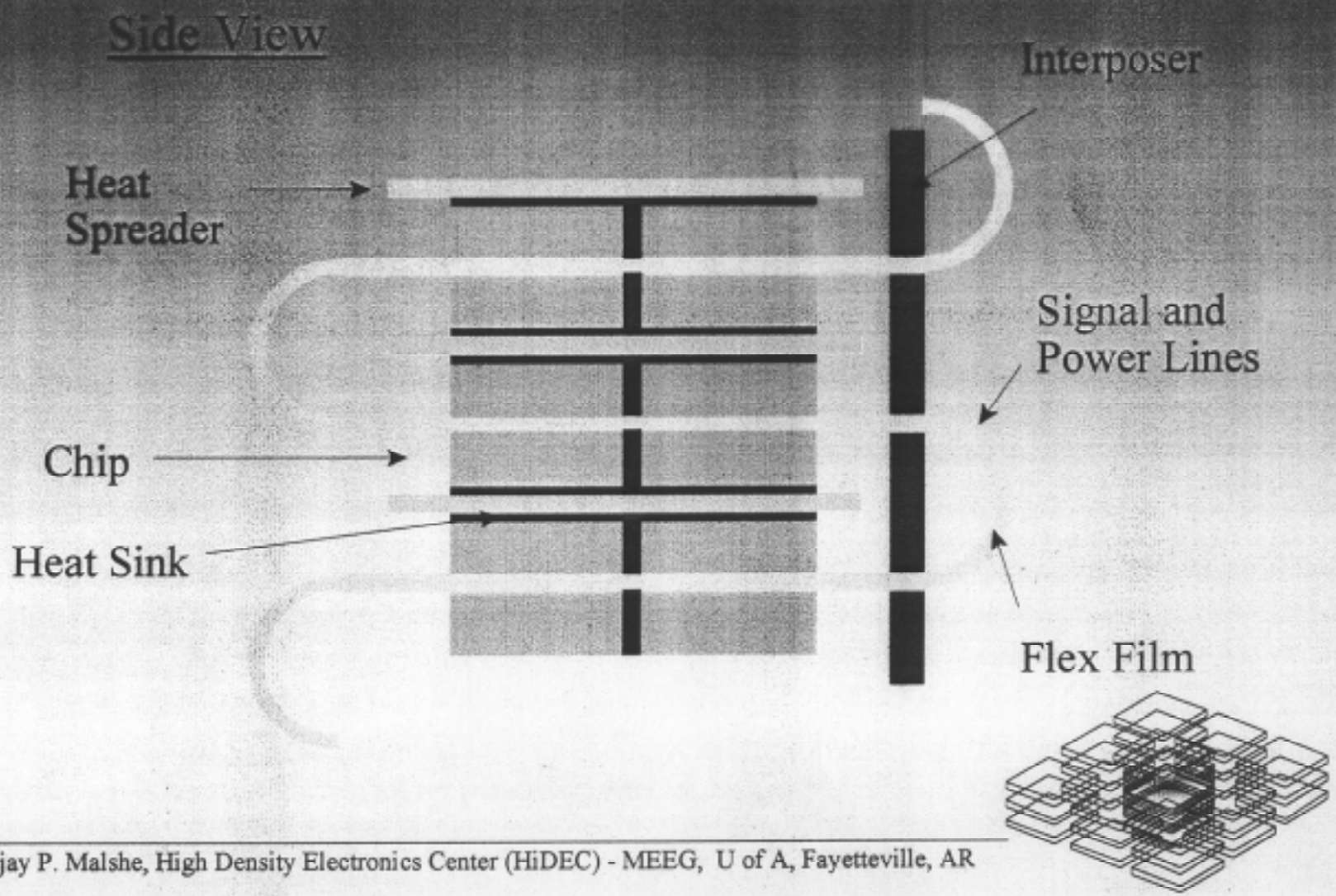
- Resistors
- Capacitors
- Inductors

2-D Package

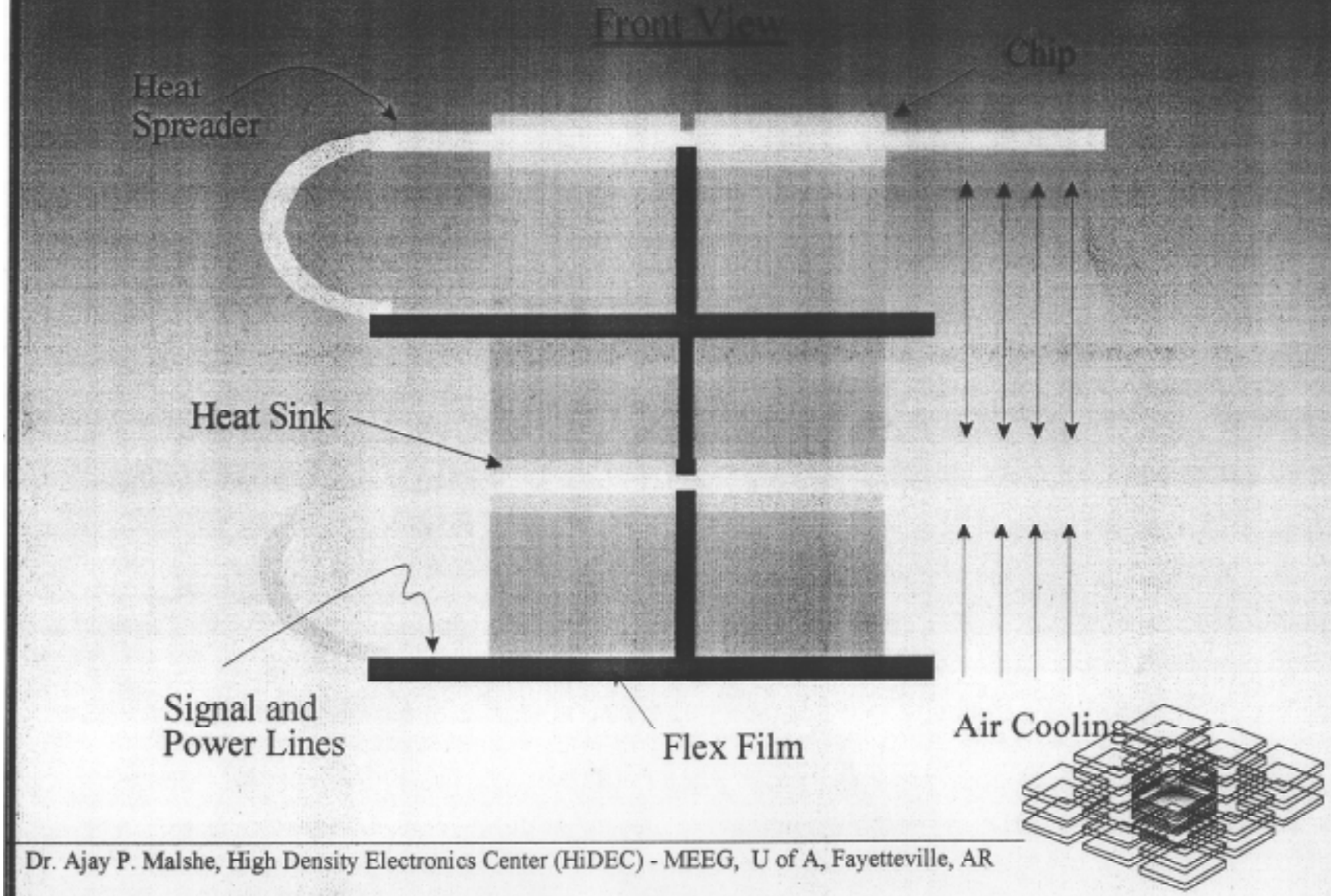
Front View



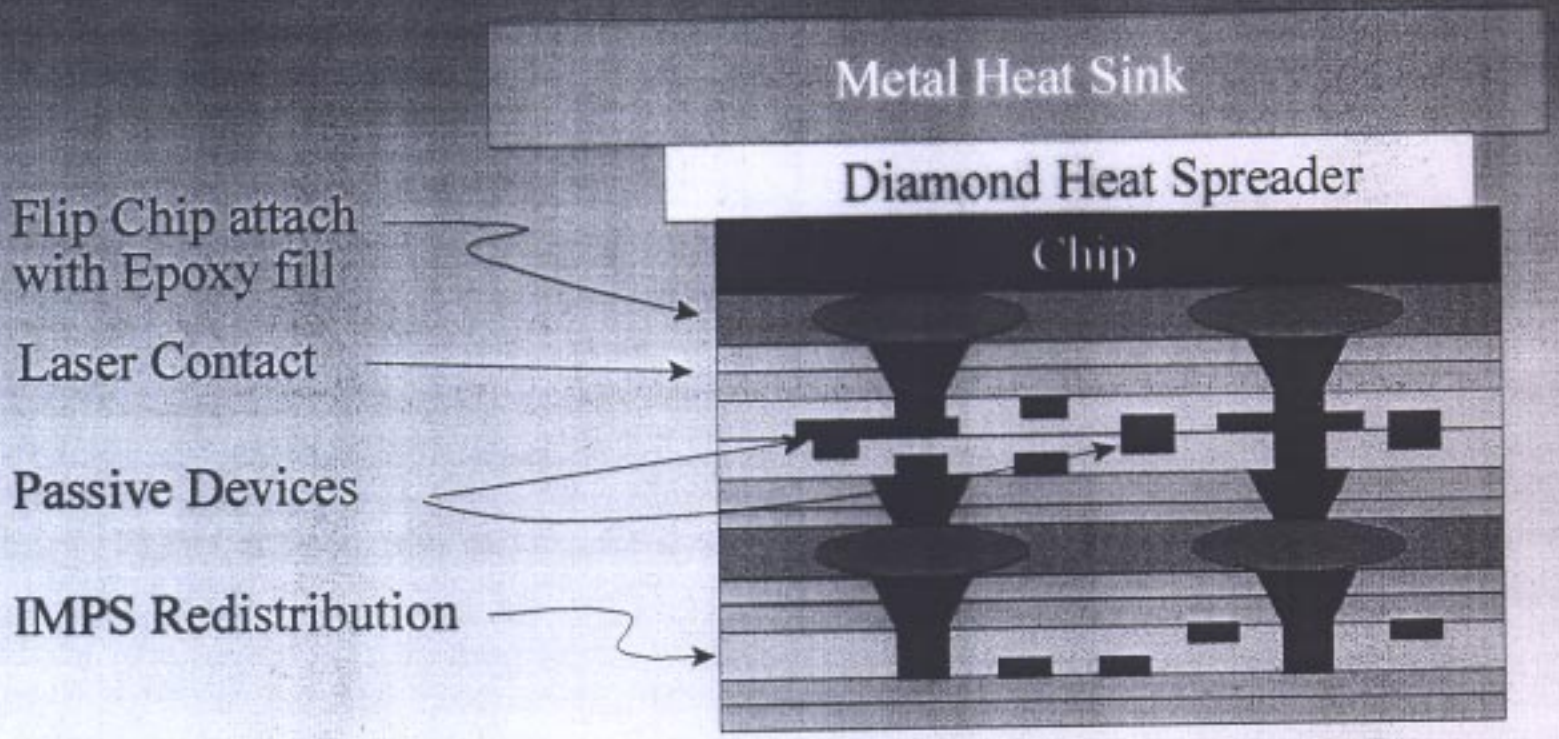
3-D Package : Chips Mounted on both sides of Film

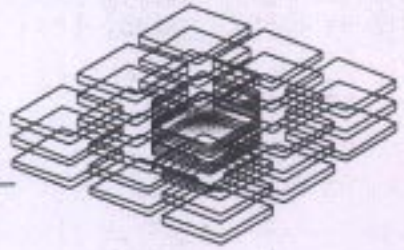


Air-cooled 3-D Configuration

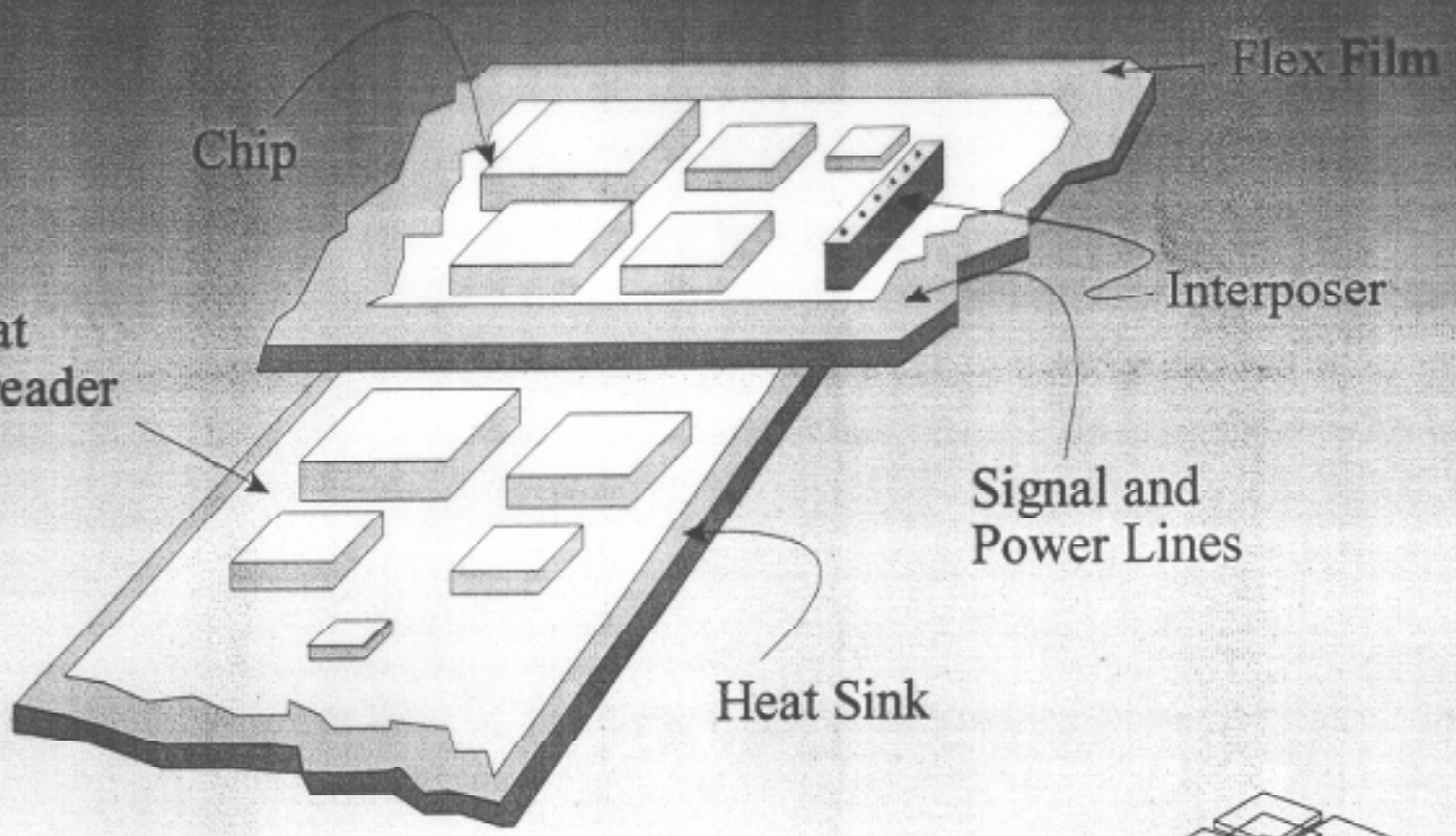


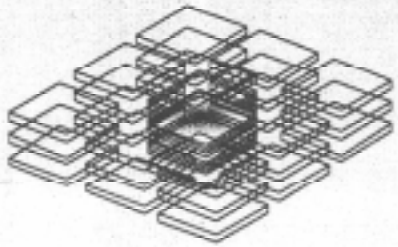
3-D Diamond Flex with Embedded Passives

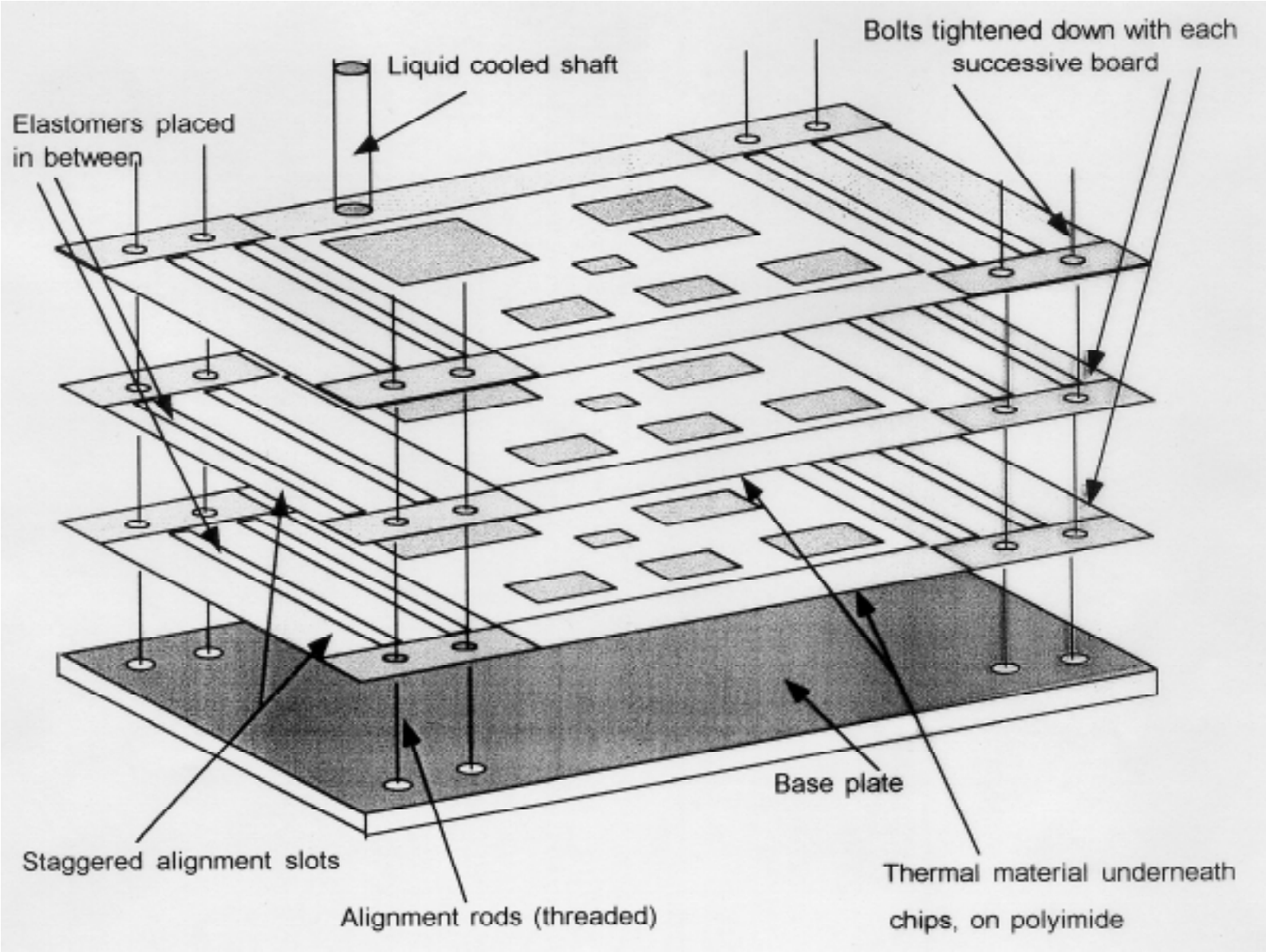




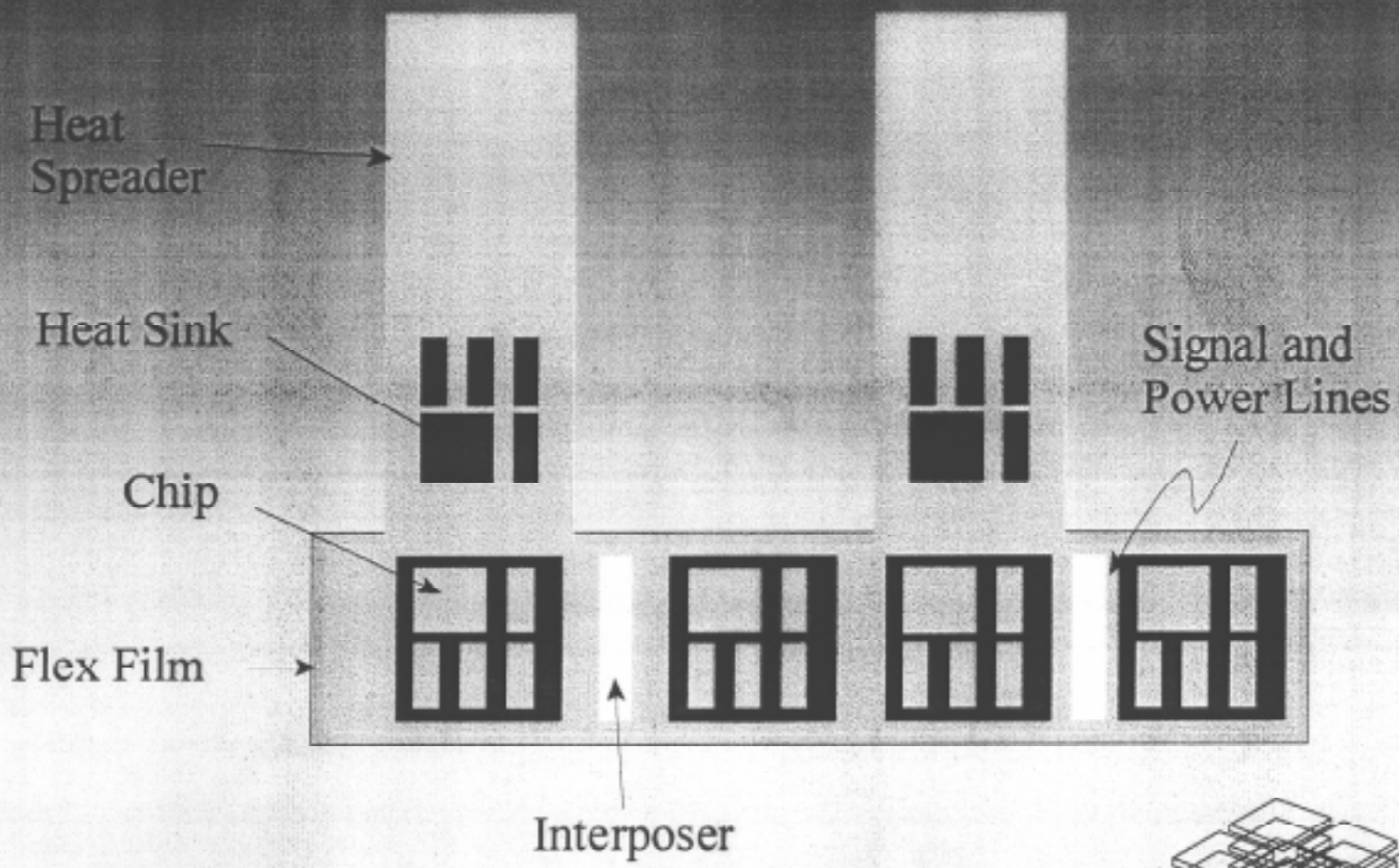
Layout of 3-D Flex Structures

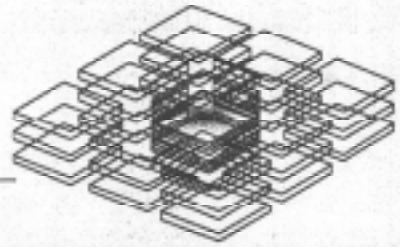




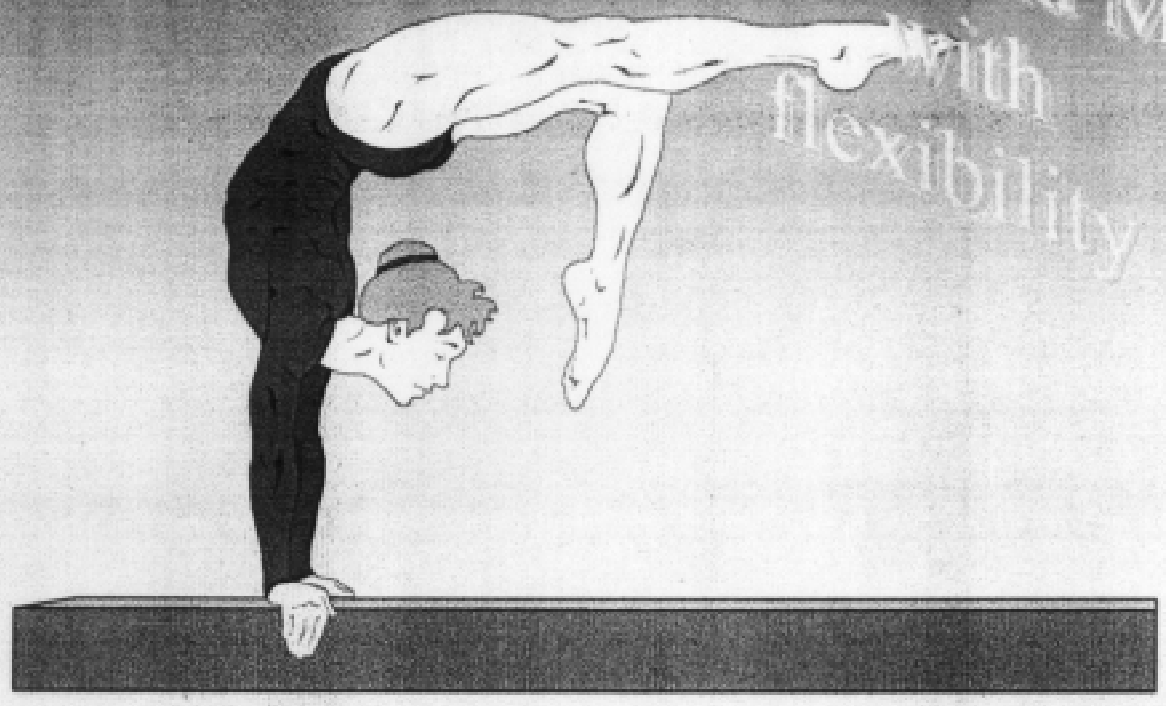

Bolts tightened down with each successive board
Liquid cooled shaft
Elastomers placed in between
Base plate
Staggered alignment slots
Thermal material underneath chips, on polyimide
Alignment rods (threaded)

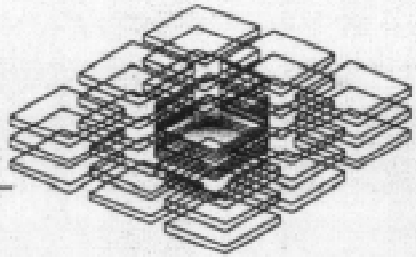
Manufacturing Layout :





Here's a concept that would mould multifunctionality of a high end MCM with flexibility





Desired Technologies :

- Electrical
- Thermal
- Mechanical
- Materials

Desired Technologies (contd...)

Electrical :

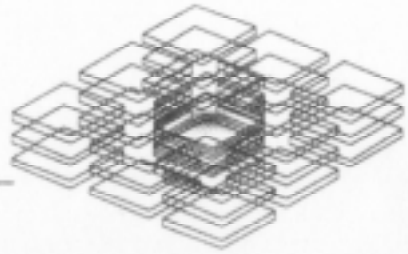
- Integrated passives
- Layer-to-layer connectivity
- Signal fidelity
- Speed of transmission

Desired Technologies (contd...)

Mechanical :

- Integration of electrical and thermal network into mechanically stable but reconfigurable "support" structure

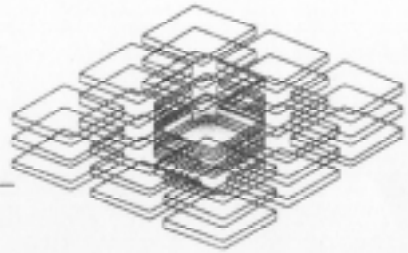
- Design flexibility



Desired Technologies (contd…)

Materials :

- Substrate anisotropy
- Strain-free chip-to-flex adhesion over the entire operating temperature range
- Flex-to-thermal spreader/sink contact
- Thermally conducting "flex laminate"



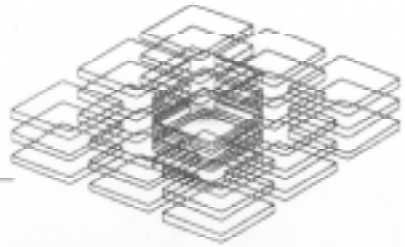
Desired Technologies (contd...)

Thermal :

Allow adequate power dissipation

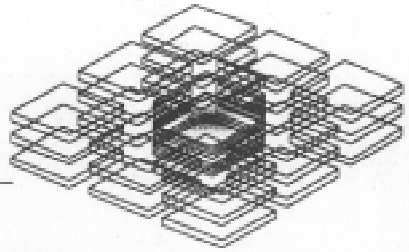
Efficient thermal management:

- Thermal spreader
- Coupled heat sink



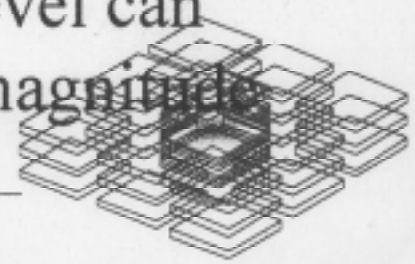
Advantages of 3-D Diamond-flex over 3-D Diamond MCM :

- Simple structure to manufacture compared to the state-of-the-art 3-D diamond MCM
- Lower material and manufacturing costs
- Smaller packaging volume
- Low weight and mechanically shock-proof
- Fewer restrictions on physical shape of the module
- Easily scalable



3-D Flex MCM :

- Novel packaging scheme
- Embedded electronic interconnects, passive devices and thermal spreaders
- Increased electrical reliability due to back-up *mosaic* chip network
- 3-D package at subsystem and system level can increase multifunctionality by orders of magnitude



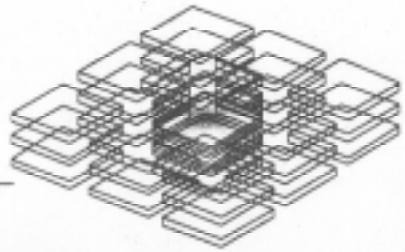
3-D Flex MCM's (contd...)

- Modular

  Repairable architecture for cable-free applications

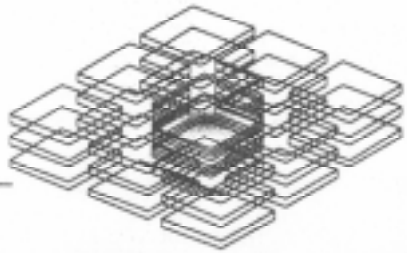
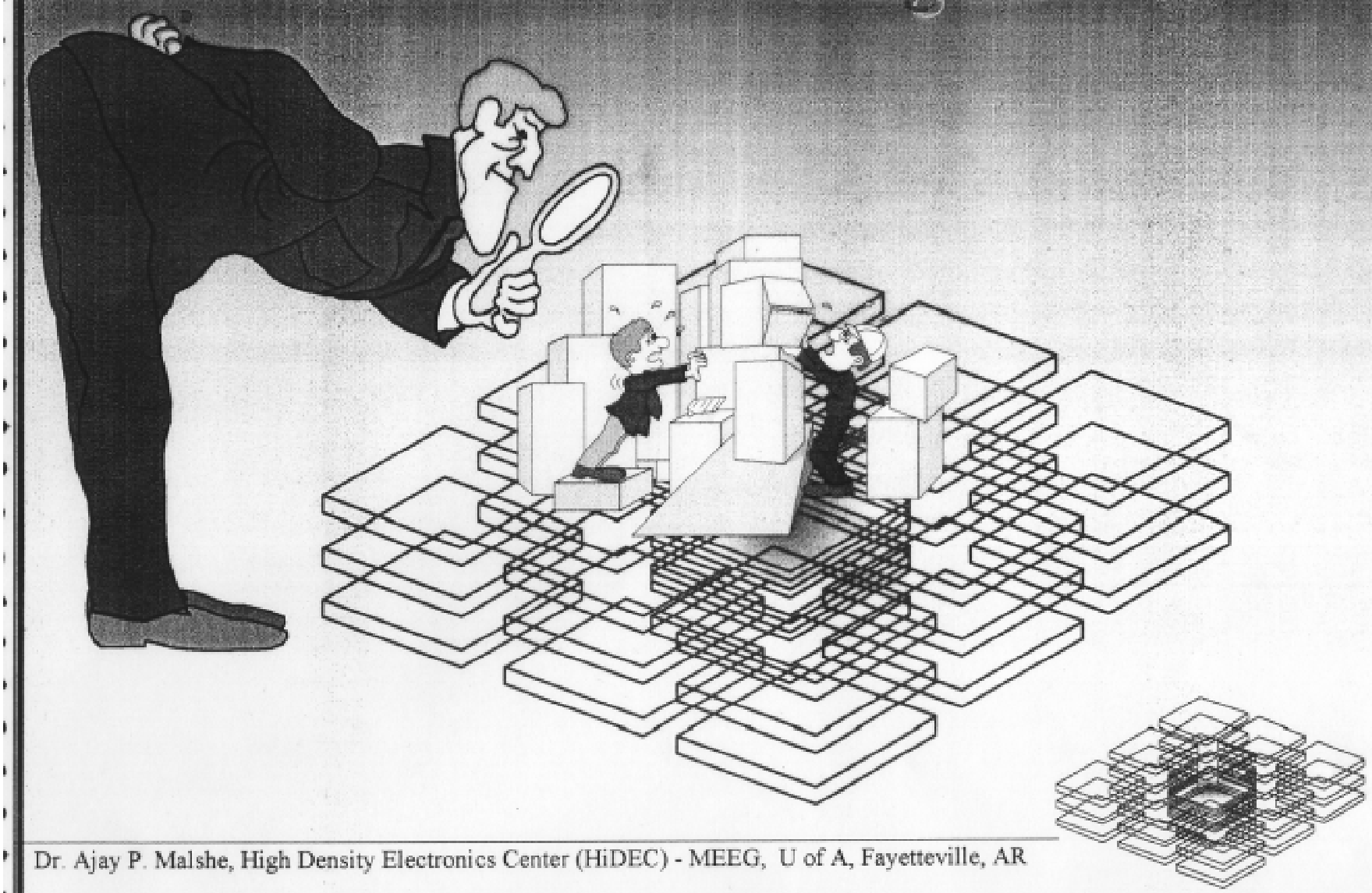
- Synergic integration of thermal management devices in flexible structures

- Geometrically reconfigurable



Potential Applications :

- Microsats
- Airborne electronics
- Global Positioning System (GPS) guidance packages
- Distributed simulation workstation
- Real time satellite data / image editing
- Ground stationed high traffic mobile telephone station
- Note-books and table-top workstation



Future - build a working module