IBM Research Division

- ***1st Class Science and Engineering***
- ***Value to Shareholders***

Presentation to Snowbird

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IBM Research Worldwide

2000+ people in Comp. Science, Applied Mathematics, Comp. Eng, ...

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IBM Motivation to Innovate

- IBM isn’t a commodity provider; hence,
- We must provide ever-increasing *value* to customers; we depend on advances.
- IBM Research essential to IBM:
  - We tend to create a lot from within
  - The IBM culture greatly values the IBM Research Division so much innovation comes from within Research.

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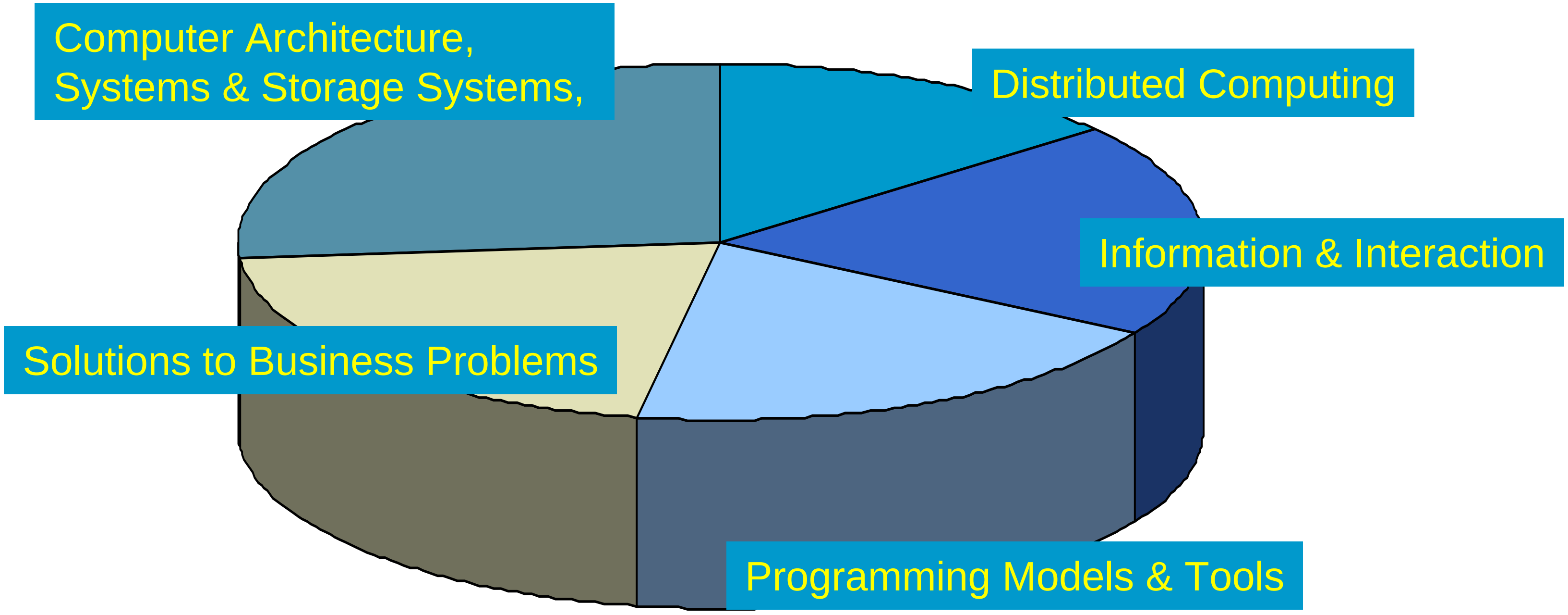
Computer Science-related Work



An equivalent quadrant of work in systems architecu

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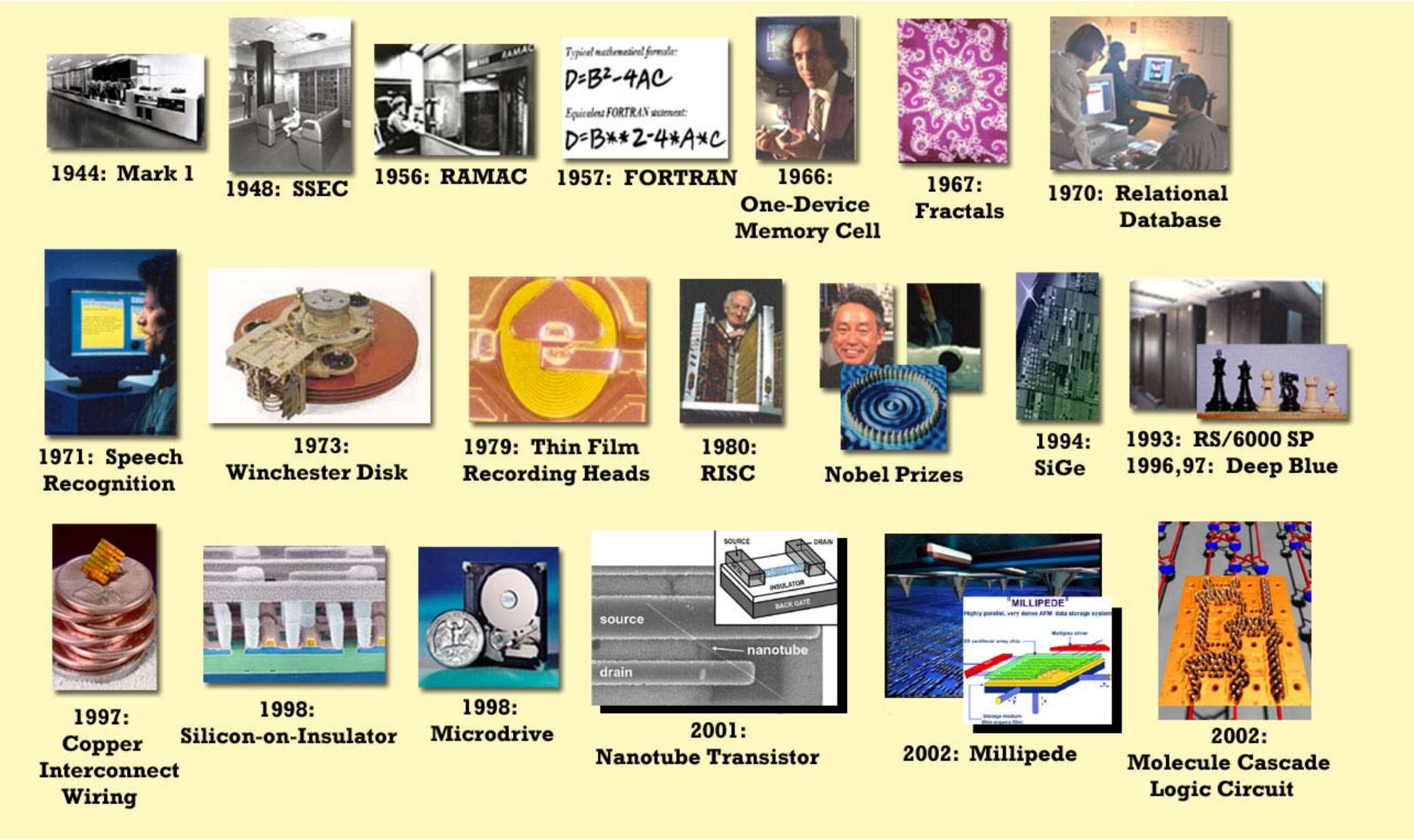
Value to Shareholders

- Technical and Strategic Breakthroughs
- Product Innovation
  - Features and Quality
  - Time-to-market
  - Near and long term
- Corporate consulting
  - Beneficial Corporate Dissonance
  - From Fire Fighting to Strategy
- Customer Interaction
- Talent Pool
- Funneling external innovation inside
- Intellectual Property, per se
- Public relations

1^{st} Class Sci./Eng. Results

- Industrial Research has some advantages
  - Size and geographical diversity
  - Greater ability to align strategically
  - Greater employee stability and more training than graduate students
  - Customer consultation, feedback
  - Product groups with code bases, routes to market, and customers
  - Technical support
- We have disadvantages, of course:
  - See above

History of Innovations



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Bottoms Up or Tops Down

- Both…
- Great results come in each domain
  - The late Ted Codd's contributions in Relational Databases were bottoms up
  - Gray's contributions req'd strategic leadership
- Balance is feasible:
  - E.g., Strategy Process and Adventurous Research program
- *In either case, we almost always know what the benefits will be to a successful line of research*

Re: Technology Push or Demand Pull

- I think the question relates to “time to value”
- Some projects of short-term value
- Some of long term value
- Strategically-led work can form the long term umbrella (e.g., like the grand challenge discussed yesterday)
  - *> Factorizable Research is a goal!*
- *We deliberately aim for a balance in our research portfolio, that meets corporate and researcher needs*

Speculation

- The integrative nature of research and products will grow
  - Decline in rate of frequency scaling
    - More parallelism
    - Specialized optimization
    - All, perhaps, reducing ability for “modular” industry
  - Many big challenges are integrative
    - E.g., NLP, Security, Autonomic Computing
- This may lead to more in-house innovation: “integrate-able” R&D

Organizational Alignment

- By:
  - Field
  - Strategy
  - Routes-to-market/Business, and/or
  - Geographical Facility
- The right balance is needed

Alignment!

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Blue Gene program

December 1999: IBM Research announced a 5 year, $100M US, effort to build a petaflop/s scale supercomputer

- *Advance the state of the art of scientific simulation.*
- *Advance the state of the art in computer design and software for extremely large scale systems: massive parallelism*

November 2002: Announced planned acquisition of a BG/L machine by LLNL as part of the ASCI Purple contract.

June 2003: First chips completed

November 2003: BG/L Half rack prototype (512 nodes) ranked #73 on 22nd Top500 List announced at SC2003 (1.435 TFlop/s).

32 node system folding proteins live on the demo floor at SC2003

February 2, 2004: Second pass BG/L chips delivered to Research

June/July, 2004: #4 and #8 on supercomputer list

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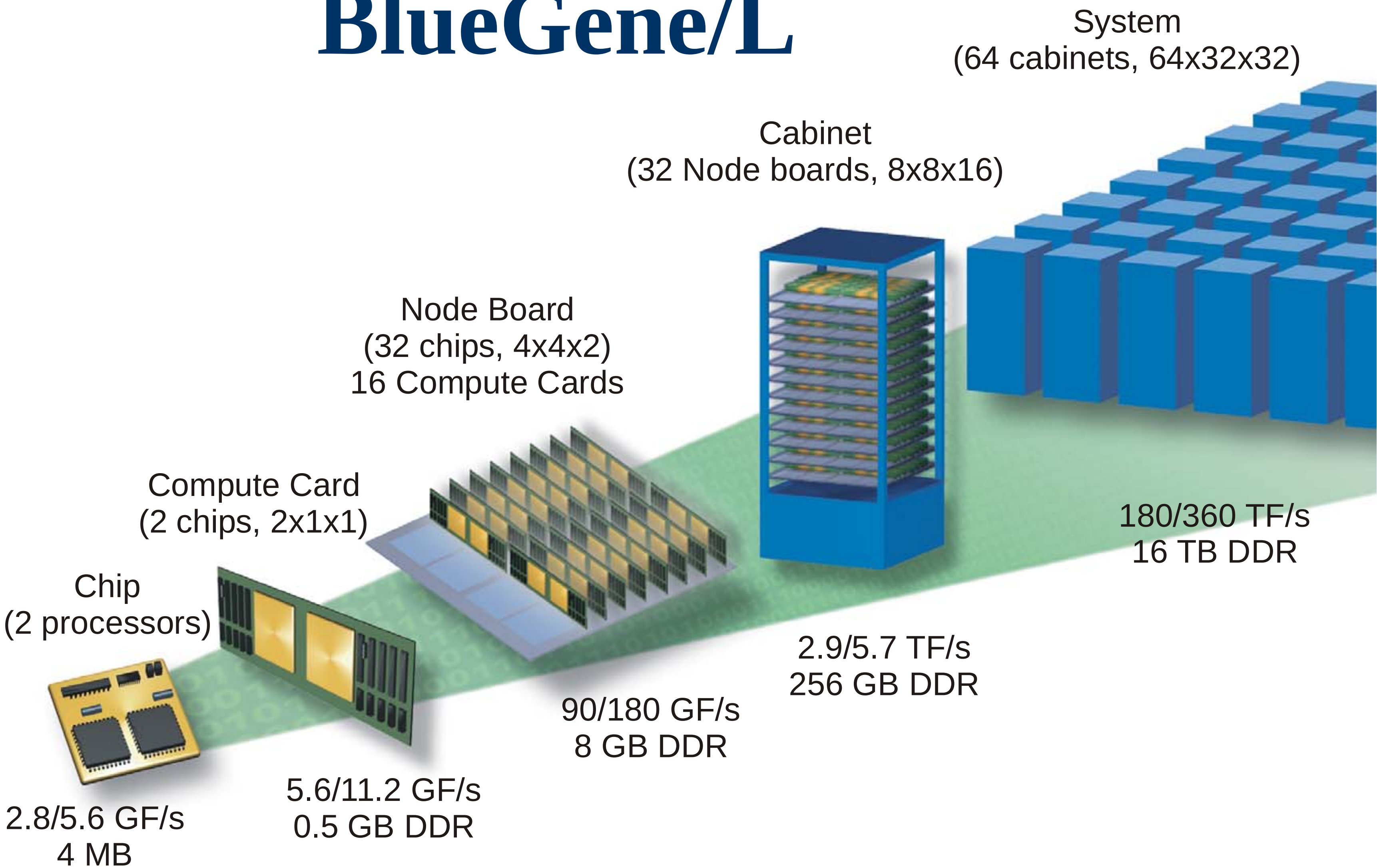
BlueGene/L



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Autonomic Vision

"Intelligent" open systems that:

- Manage complexity
- Know themselves
- Continuously tune themselves
- Adapt to unpredictable conditions
- Prevent and recover from failures
- Provide a safe environment

Increase Responsiveness

Adapt to dynamically changing environ-ments

Resiliency

Act/react to prevent disruptions

Operational Efficiency

Tune resources and balance workloads to maximize use of IT resources

Secure Information and Resources

Anticipate, detect, identify, and protect against attacks

Proactive security

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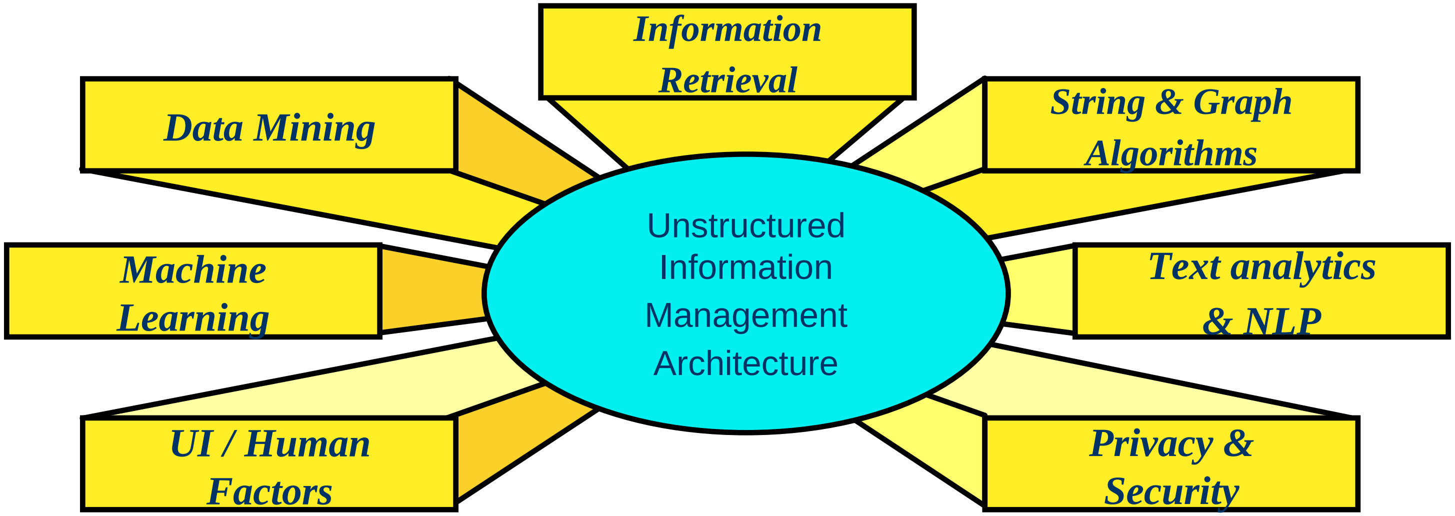
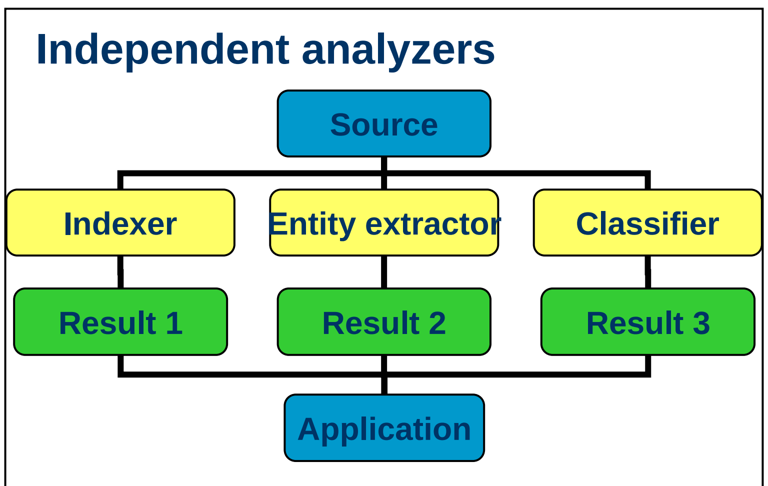
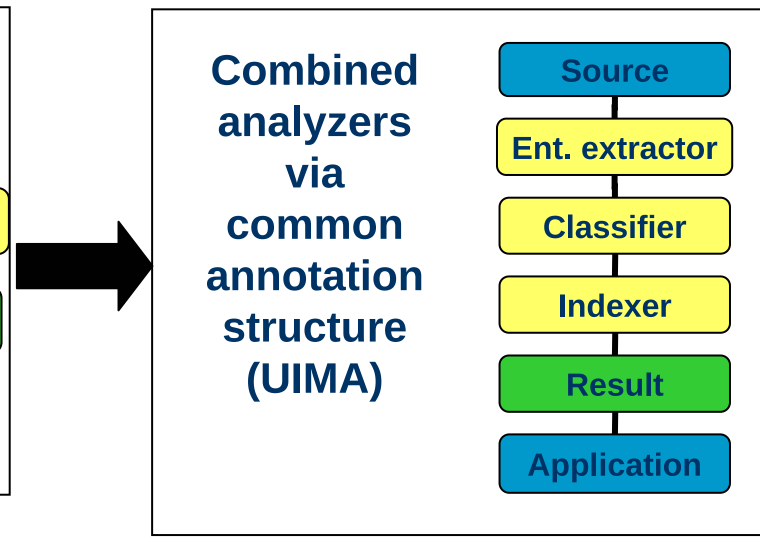
Unstructured Information Mgmt. Arch.







Key point: The combination hypothesis: If intimately integrated, various KM technologies will provide higher quality results (accuracy, recall, etc.)

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Continual Optimization

- One can argue that the first 50 years of I/T were primarily focused on transactional efficiency
- Premise: the next 50 years will be focused on optimization:
  - We can sense almost anything almost all the time.
  - We can effect transactional change at ever lower cost
  - We have the mathematics and computational capability to close the feedback loop
- This is a program that is going after the world's GDP.

On Demand Innovation Services

- Most innovation will be on the edge of the expanding sphere of Computer Science
- We are deliberately doing a modest amount of consulting on Business Consulting Service engagements with the goals of BCS win-rate, profitability, and new grist for our mill.

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Broader Conclusions

- Industrial research can work very well
- More opportunity in the field than ever before
- 10-years back, I thought much "systems" research was a bit "iffy“. I don't think so today
- There are many grand challenge problems are important and today tractable
  - Society wants and can benefit from our work
  - Building blocks abound
- Organization of Industrial Research requires great care and is not without overhead
- There is great work can be done by both the university and industrial research teams

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Thank you

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