

A large blue parallelogram shape on the left side of the slide, containing the Northrop Grumman logo.

THE VALUE OF PERFORMANCE.
NORTHROP GRUMMAN

Innovation within a large company / applications of big data

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Topics for today

- Northrop Grumman Information Systems
- Our technical fellow program
- Our view of “big data”
- Questions and discussion

Northrop Grumman Information Systems

- Our mission is to **support important decision-makers** in making important, timely, and accurate decisions
- Increasingly, these decision-makers are presented with **too much data** . . . so today's conference theme of "big data" is a great one!

Snapshot of our business

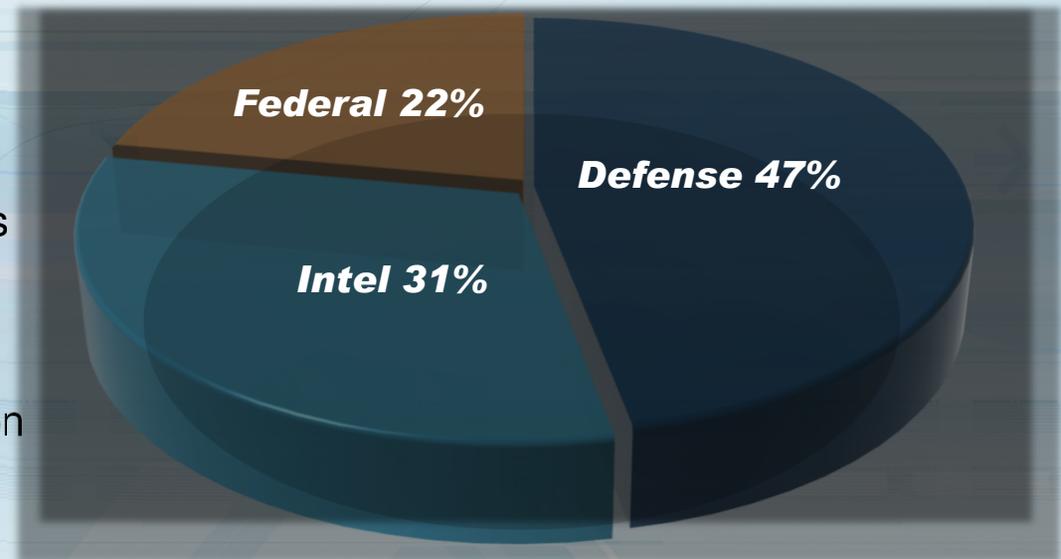
At a Glance

- ~\$7 billion business
- ~19k employees
- 49 states, 18 countries

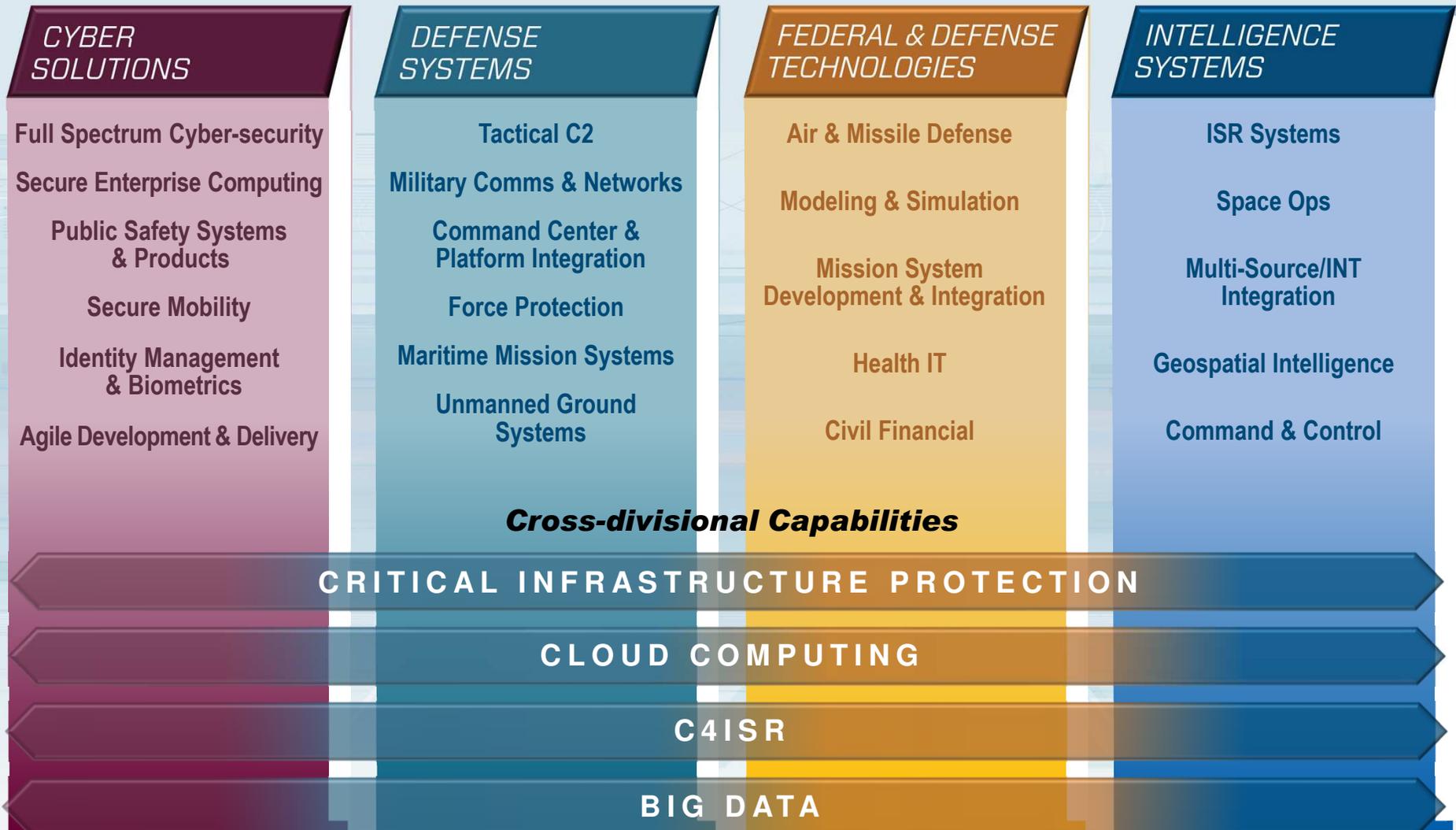
Core Areas

- Cyber-security
- Networking & communications
- Command & control
- Big data & analytics
- Critical infrastructure protection
- Intelligence, surveillance & reconnaissance

Market Breakout



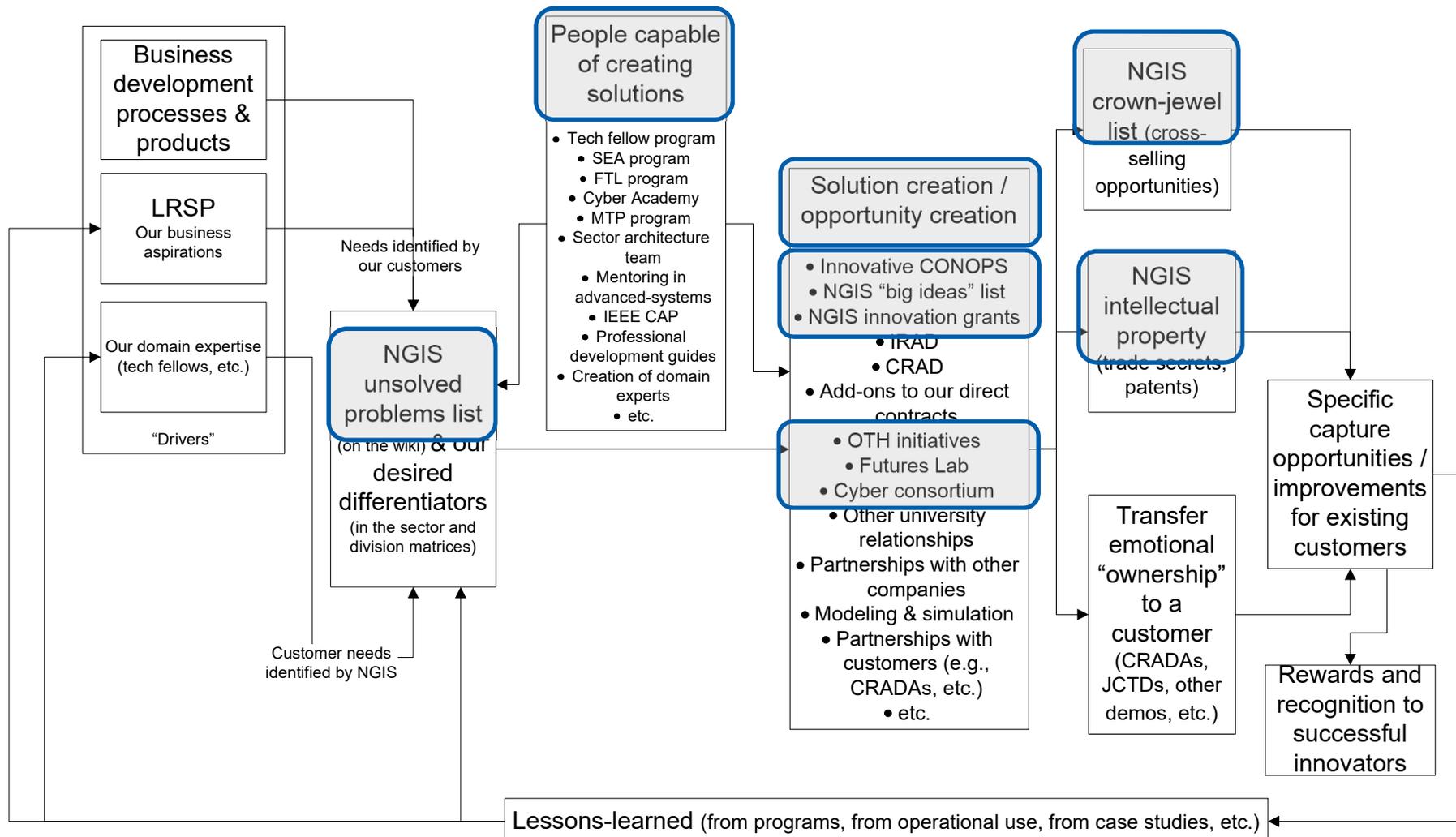
Divisions and capabilities



The NGIS technical fellows program

- I have ran the NGIS technical fellows program for more 12 years, so:
 - I have established most of the rules, processes, and criteria currently in effect
 - I have selected most of the current technical fellows
- ~100 out of 19,000 employees
 - 3-year renewable terms – you must **keep being excellent!**
 - Our (explicit) principal selection criteria: demonstrate the ability to **convert your technical prowess into differentiation and revenue** for the company
 - 3 consecutive selections, and you are eligible to become an NGIS distinguished technical fellow (~10 out of 19,000)
 - Technical fellows **must** serve as a mentor in our “mentoring the technical professional” program
 - Act on their own, but also as a group

Aligning our technology investments with our business strategy

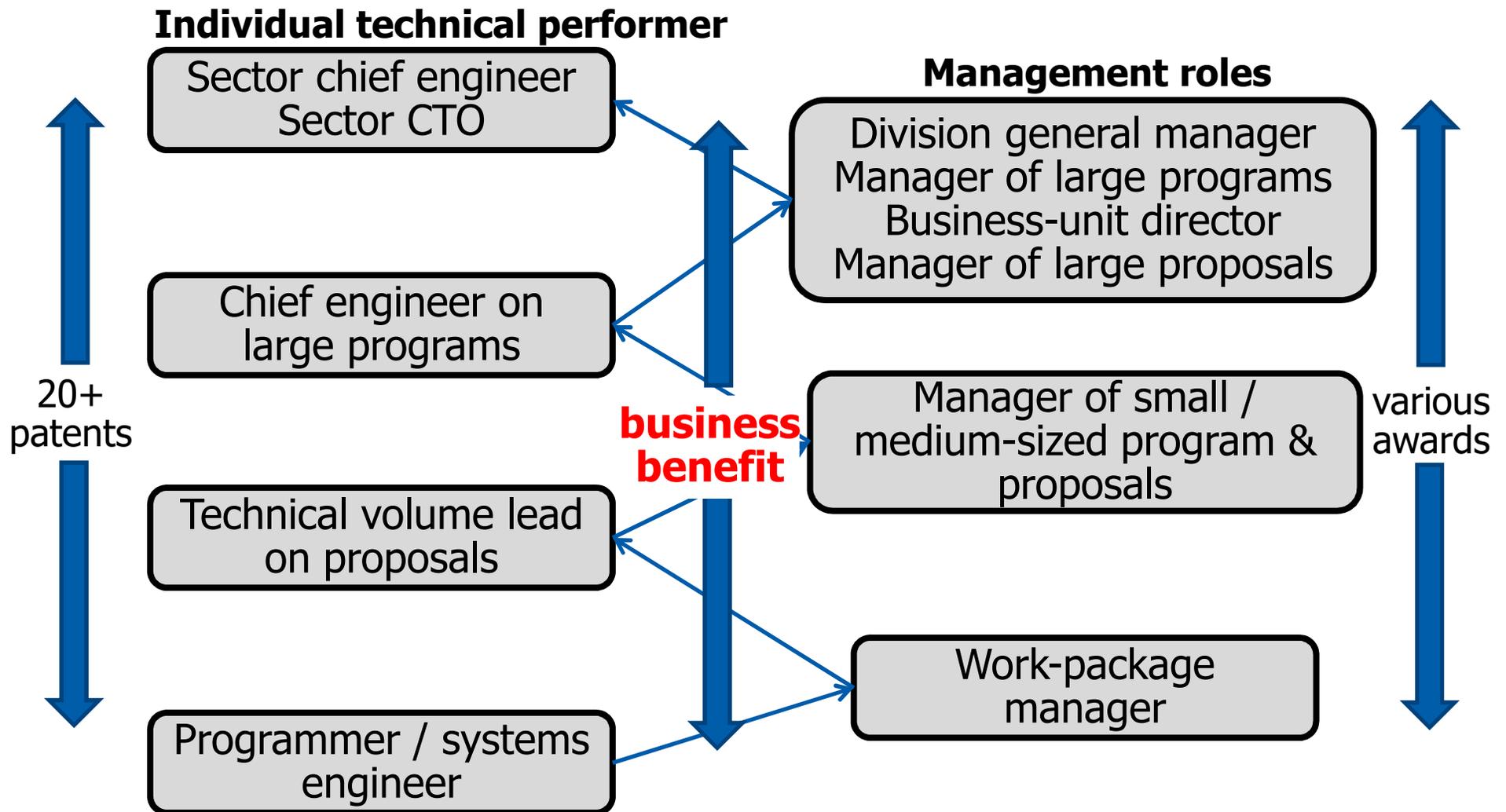


Technical career path options

- We support the opportunity for career growth and increased responsibility for individual technical performers
- Opportunities for leadership without having to take on management roles
- We do, however, appreciate and encourage multi-mode careers, e.g., some time as an individual technical performer, and some time as a manager



My career



Why is innovation important?

- Improve the requirements / satisfy the real “job to be done”
- Improve the design
- Create competitive differentiation
- The joy of creation

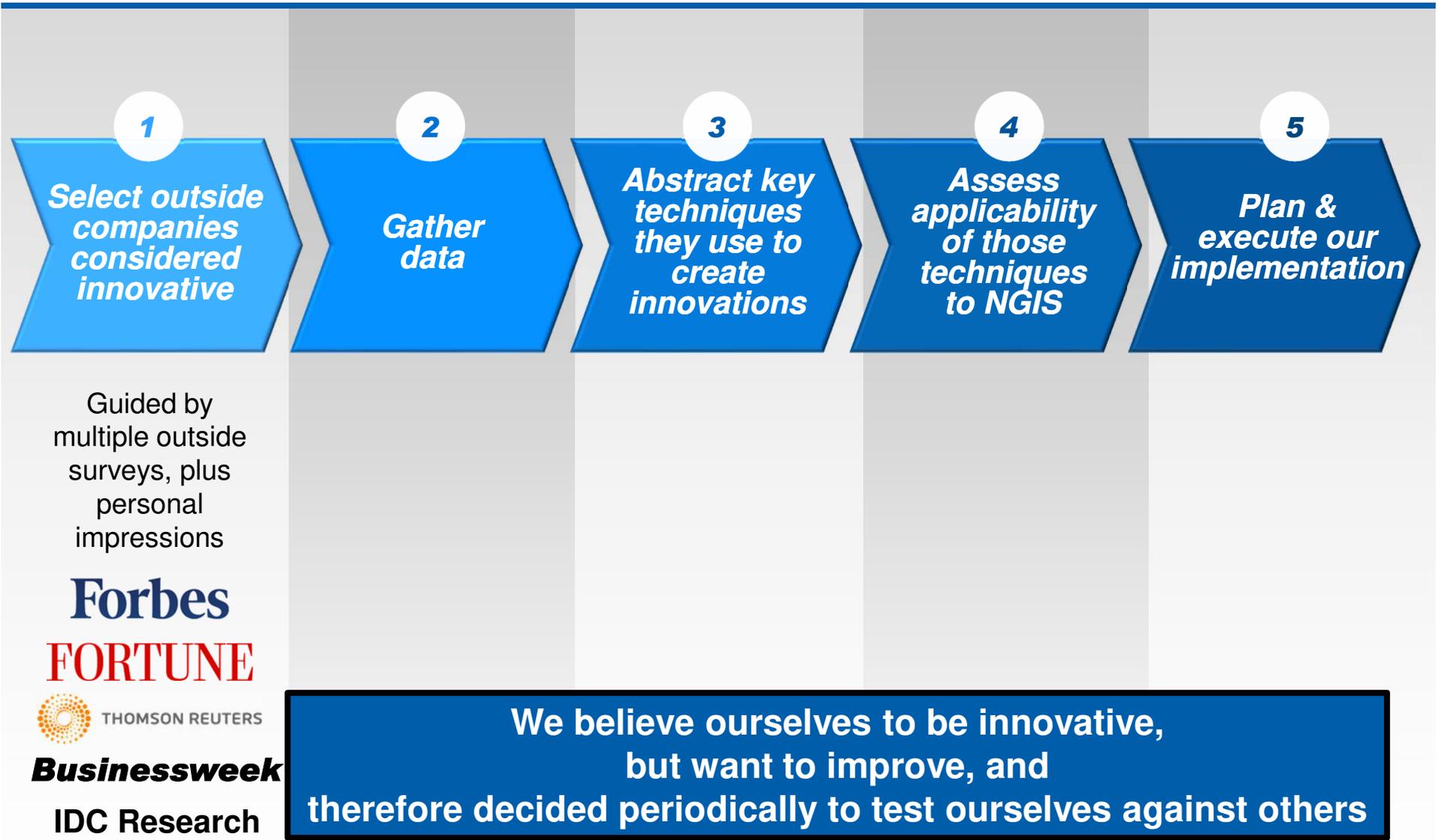
Innovation is valuable in all disciplines, not just engineering / technology

What do we do to support innovators?

- Rewards / recognition: IRAD, patents, “instant” cash rewards, promotion
- Motivation: NGIS innovation fund, unsolved problems list
- Collaboration: Crowd-sourcing (Brainstorm), internal company wiki, internal company social networking tool, NGIS “Crown Jewels”, TechFest
- Resources: communities of practice, NGIS innovation fund, Center for Innovative Solutions, NGIS engineering breathalyzer, Over-the-Horizon funding

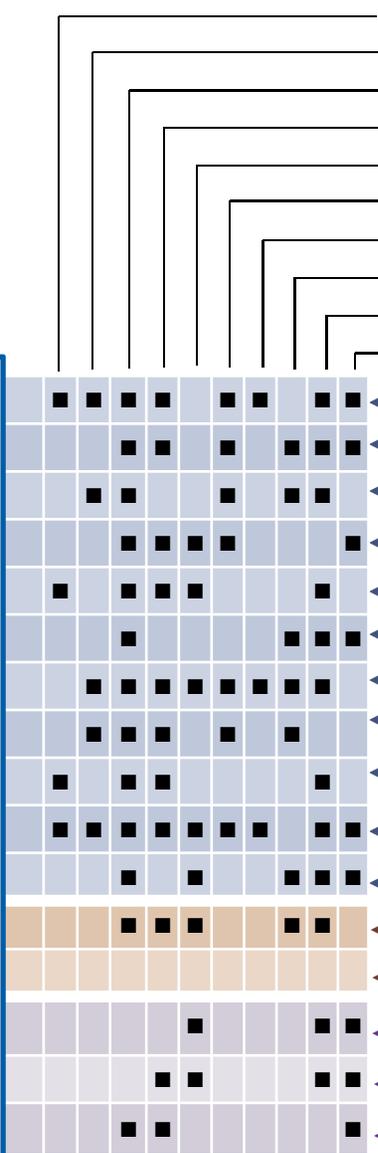
**Is it enough?
Training?**

Looking at other companies



What makes an organization innovative?

- Highly-structured process to guide innovation; metrics
- Certainty about how they create innovation
- Clear about what they consider own key innovations
- Leverages existing capabilities; “connects the dots”
- Long-term, disruptive, big-payoff goals
- Technology is only a *dependent* variable
- Belief that innovation is trainable
- Innovators promoted to all levels of the organization
- Time allocated to innovators; incentives
- Tolerates failure



- ◀ Structured processes; rapid product spins; endless derivatives
- ◀ The very best people; guide idea creation through concurrent visualization
- ◀ A small number of large bets; willingness to self-cannibalize; all demand is created – there are no pre-existing markets
- ◀ Long-term focus on relatively few objectives, in a single business
- ◀ Long-term focus on relatively few objectives, but spread across a diverse portfolio
- ◀ Freedom to innovate; lots of bets
- ◀ Scientific discoveries; research driven
- ◀ Build at full scale; relentless re-use
- ◀ Focus on achieving a high volume of innovations (40 inventions per working day); choose winners through their Technology-to-Business Center
- ◀ Focus on process excellence to achieve product characteristics meaningful to customers (e.g., highly reliable cars)
- ◀ The very best people
- ◀ Plant a lot of seeds, weed quickly
- ◀ Plant a lot of seeds, small niche companies, transition to acquisition programs quickly
- ◀ Broad range of technology; long-term research goals; little if any central direction
- ◀ An open-ended approach, but with unifying themes
- ◀ Customer chooses problems and makes long-term investments; accepting of many failures

Big data

Big data within NGIS

- “Velocity”:
 - Ingest rate
 - Query rate
- “Volume”:
 - Terabytes per day
 - Unusually large number of small instances
- “Variety”:
 - We grew up in a world where we built the sensors, so we owned the format and schema
 - No more – I see a transition to a world where “open data” is the bulk of our volume, and we build sensors primarily to fill in gaps in those data. So we no longer own the format and the schema.
- “Veracity”:
 - I have tweeted my counterpart at Google: “You can provide me with a lot of so-called ‘answers’, but you can’t tell me which – if any – are actually true!”
 - When we built most of our own sensors, we could usually characterize the uncertainty of each measurement. Now we have to create that characterization as meta-data for the open data we ingest. This is perhaps the biggest change!

Philosophical goals

- Much of the commercial world (thus far) has focused on “search”:
 - e.g., it is presumed that the “answer” exists as an atomic entity in the data set; we just have to find it
- Much of our world is different:
 - The “answer” does **not** exist as an atomic entity within the data set
 - We must discover relationships between the data, and thereby **create the answer** (“connect the dots”)
 - Due to volume, this must be done with little or (preferably) no human intervention
- I believe that all big data enterprises will increasingly face this challenge, too; defense / intel has just been a little ahead of other enterprises in this regard

My “unsolved problems” in big-data

1. Automatic creation of meta-data for unstructured data
2. What of all of this stuff is actually true? How can we characterize uncertainty, so as to enable us to combine factoids to decrease uncertainty?
3. How to translate relevant and true data into effective decision-support?

There is a lot of focus on **volume** and **velocity** . . . but I don't see those as the cardinal unsolved problems in big data

Questions / discussion



About the presenter: Neil Siegel, Ph.D., sector vice-president & chief technology officer at Northrop Grumman, has been responsible for several of the Nation's most successful military systems, including the Blue-Force Tracker, the Army's first unmanned air vehicle, and many others. He is a member of the National Academy of Engineering, a Fellow of the IEEE, the recipient of the prestigious Simon Ramo Medal for systems engineering, the Army's Order of Saint Barbara, and other awards and honors.