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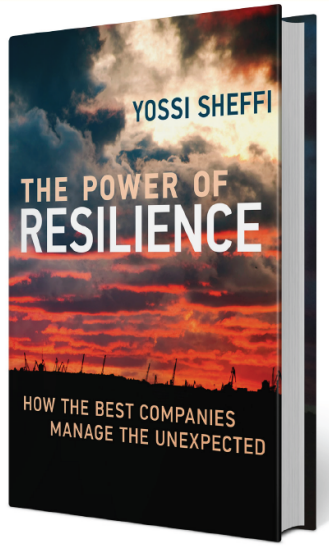

The Power of Resilience

How the best Companies manage the Unexpected

June 10, 2016
Cambridge, MA

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What Can Go Wrong?

- 2010 eruption of Eyjafjallajökulll
- 2011 Japan Tōhoku earthquake and tsunami
- 2011 Thailand floods
- 2012 Explosion at Evonik
- 2012 LA/LB port strike
- 2013 horsemeat fiasco

Dichotomy of Risks

Random Phenomena

Competition

Accidents

Economy

Governments & Politics

Social discontent

Non-Compliance

Intentional disruptions

Supplier Failure

Two Ways to Look at Disruptions

1. Thinking about causes

   Hurricanes, earthquakes, strikes, coup….

2. Thinking about effects

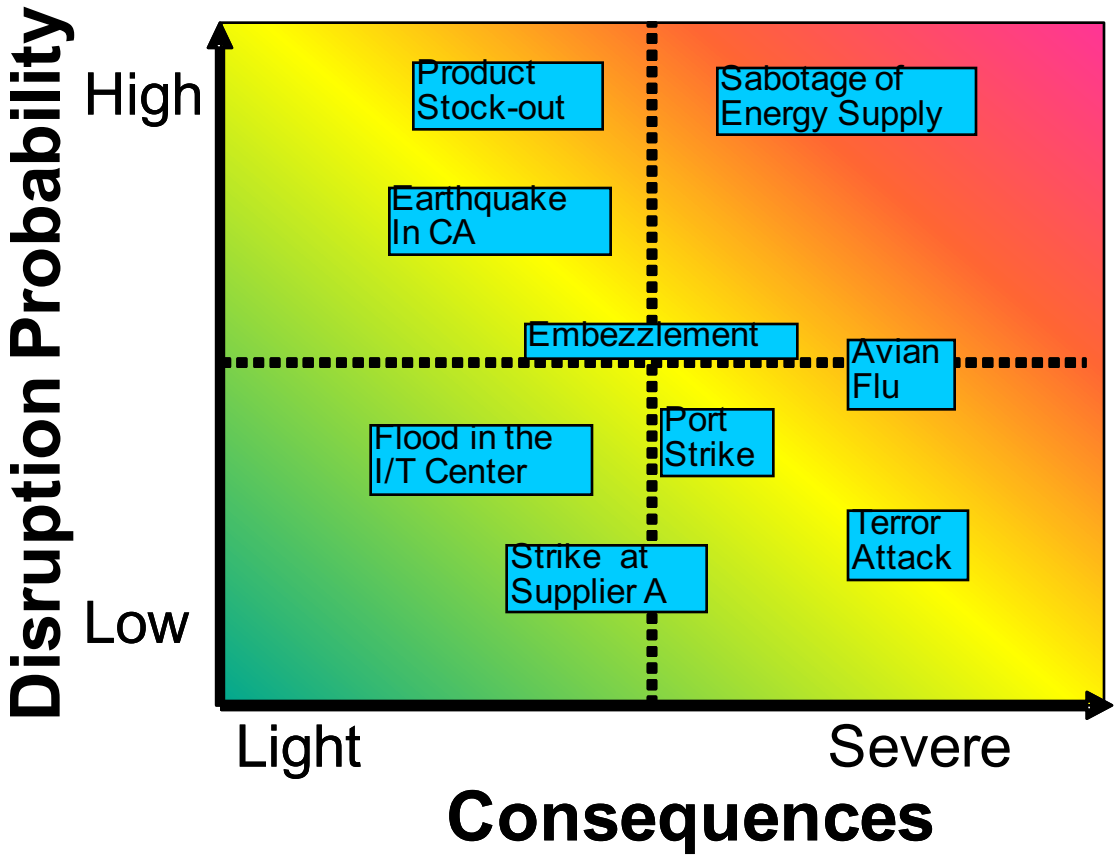
   Supplier down, shipping constrained…

3. Causes thinking helps estimate likelihoods

4. Effects thinking helps estimate impacts and consequences

Classification

- Categorize outcome
  - How likely?
  - How bad?



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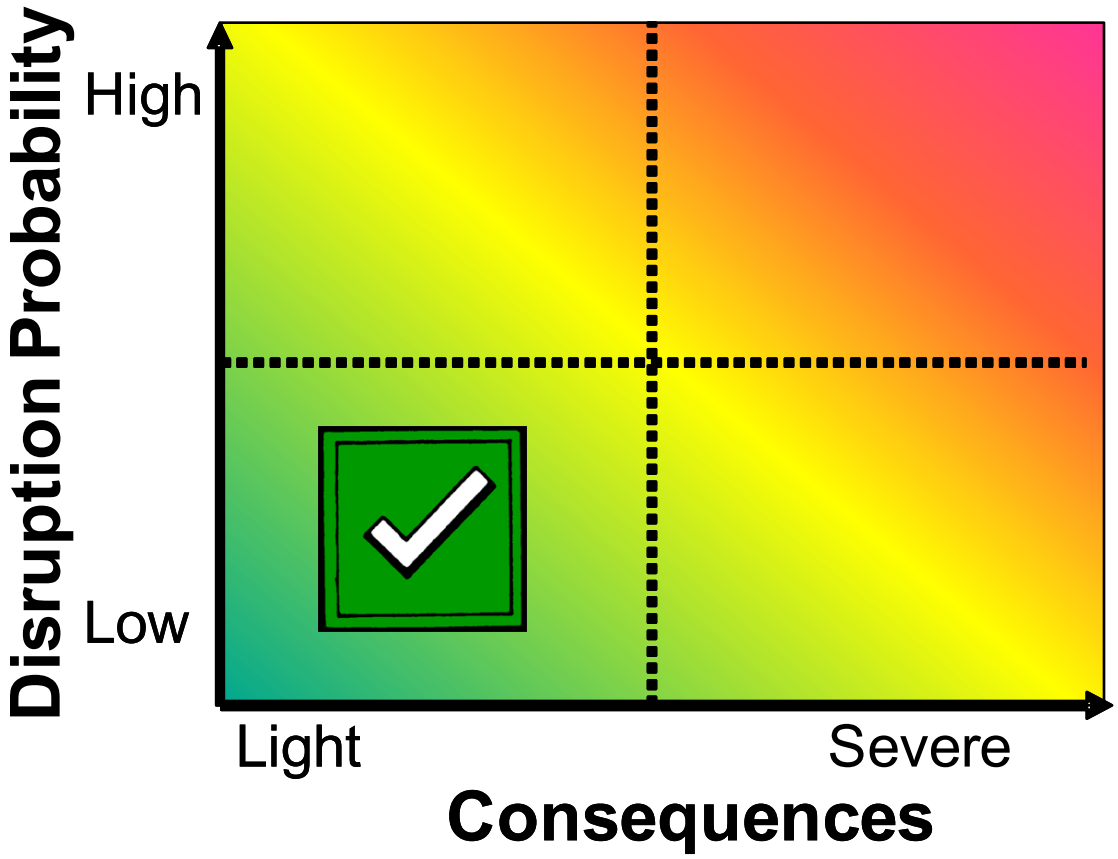

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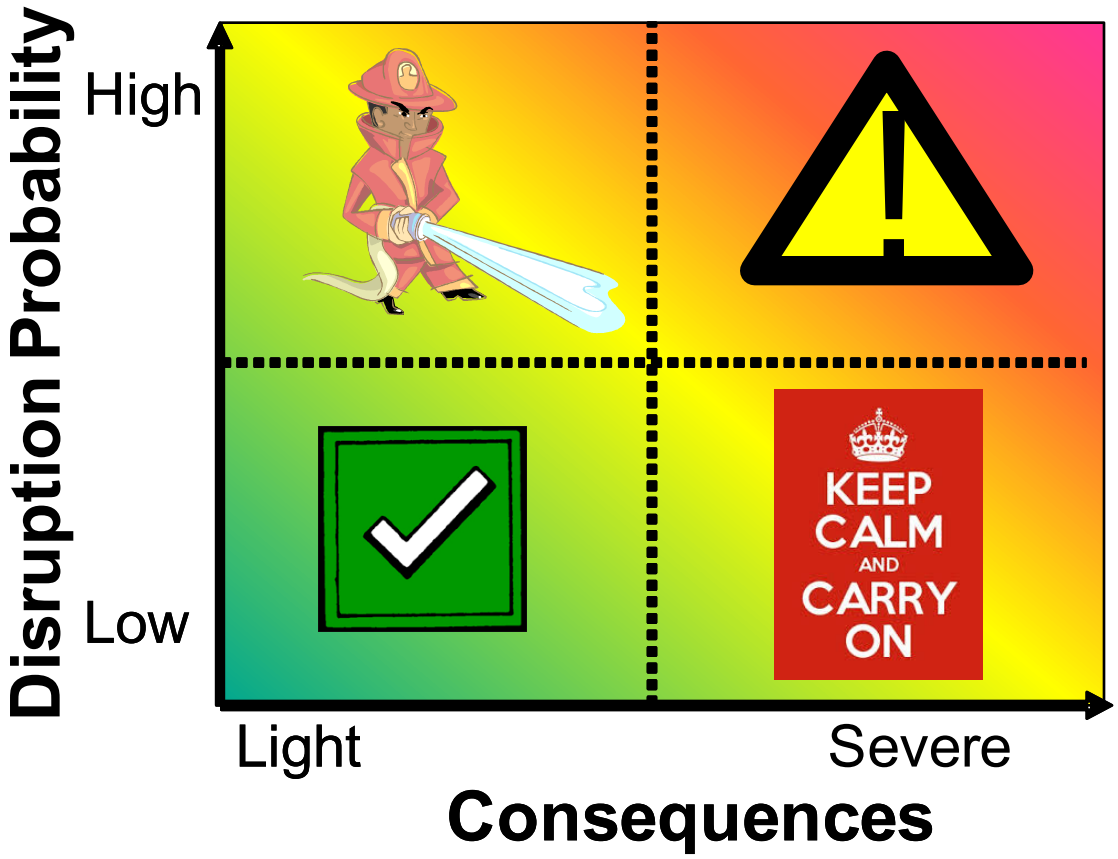

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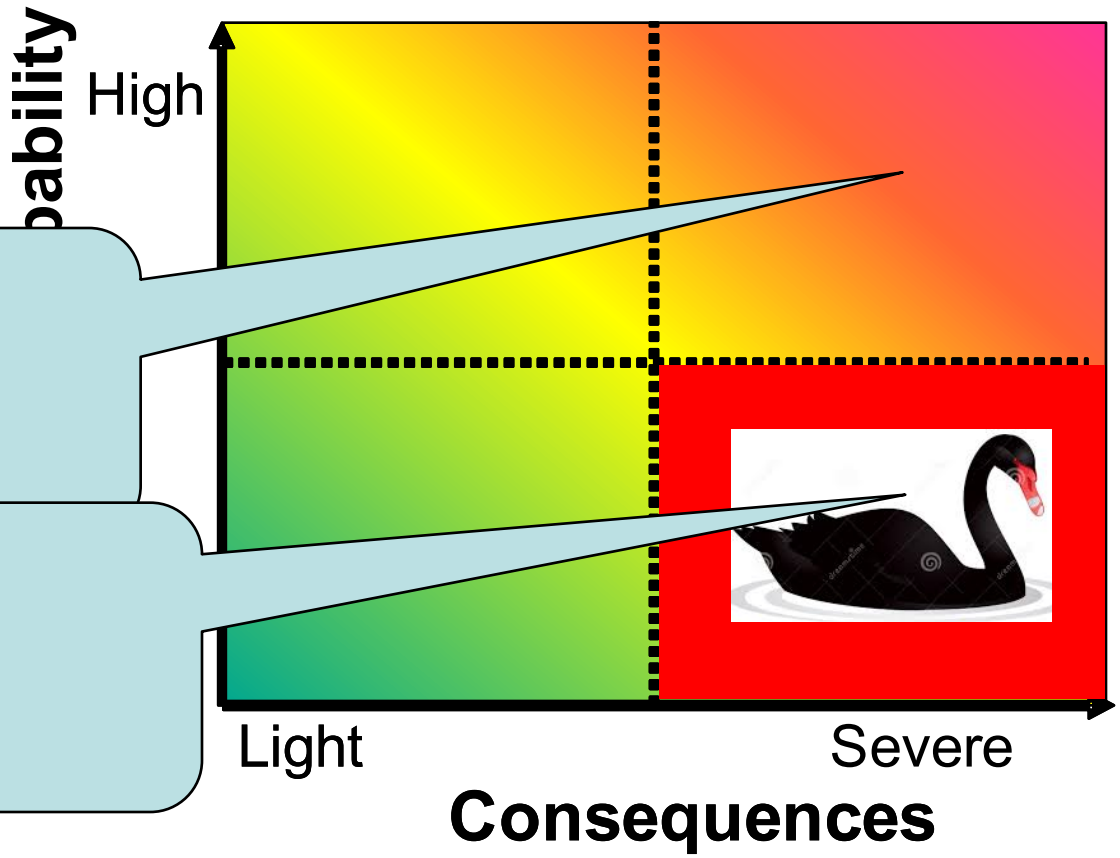

- Identify risks
- Prepare responses
- Drill

- Dream scenarios
- General response
- Resilience

Characteristics of Uncertain Disruptions

- Public fear
- Government “over-reaction”
- Institutional incompetence
- Unexpected connections and consequences
- Not very unlikely

Adding a Dimension

What is the probability that it will happen?

Some events can be realized only after the fact

If it happens, how bad is it going to be?

How long will it takes from sensing to impact?

Probability
High
Low
Detectability
Short Term
Long Term
Low
High
Consequences

The Detectability Axis

- After the fact
  - Industrial espionage
  - "Sleeping" pathogens
  - Cyber agent
- Immediate:
  - The missile is coming (alarm)
  - Tsunami sensor
- Short Term:
  - Weather forecast
- Medium Term:
  - Deteriorating labor relations
  - Superior competition
- Long Term:
  - Aging
  - Global warming
  - Deteriorating infrastructure







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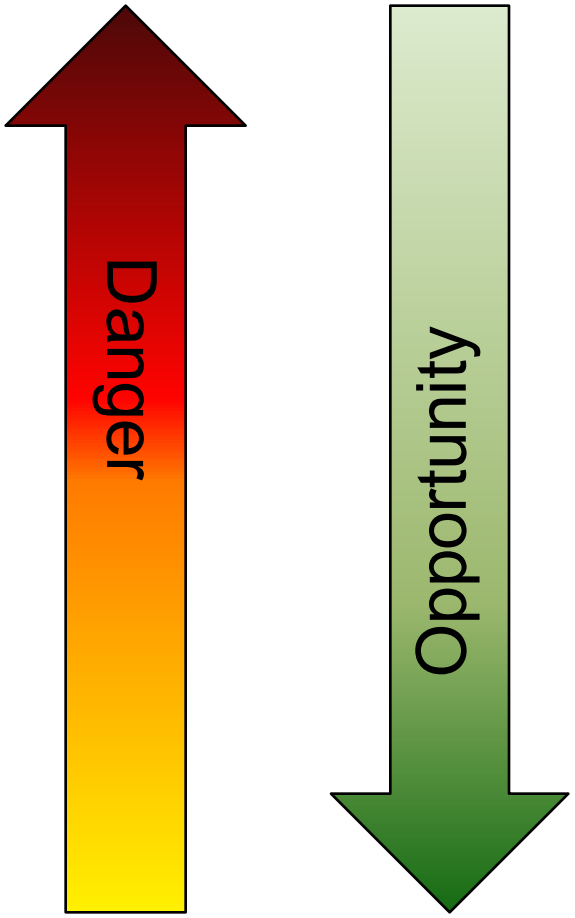


Alert applications

- IBM
- Impact Factors
- Resilinc
- SAP
- Razient
- Cisco

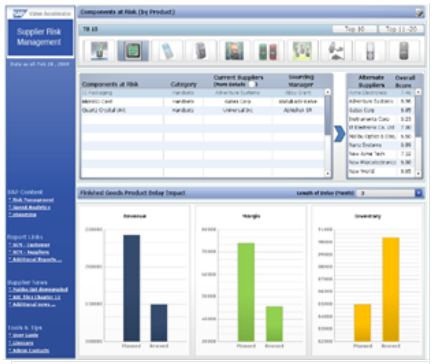


Figure 8 SAP Components at Risk Display

Figure 9 Razient Real Time Event Display

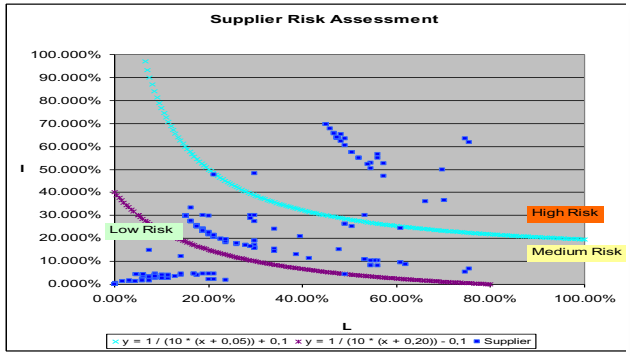


Figure 7 Resilinc Supplier Locations Map

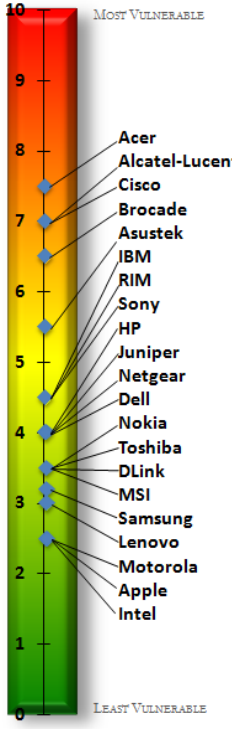


Figure 10 Cisco Network Nodes within Impact Area

Event alert systems:

NC4; Amerilert; Enera

Preparation and Response P&G

Preparation and Response P&G

- P&G facilities:
  - Gentilly plant (Half P&G coffee production - 20% of the US)
  - Also: Millstone coffee plant; Lancombe DC
- August 25th – P&G activates emergency preparations
  - Moving product out of the region (to Cincinnati)
  - Getting all backup tapes
  - Preparing for a possible shutdown
- August 27th: Storm turned North
  - Site was shut down
  - Told employees to evacuate
- August 29th: Katrina hit New Orleans
  - P&G priorities:
  - Support employees
  - Restore the plant

Preparation and Response P&G

- Command center (and staging area) in Baton Rouge
- Take air photos to assess the situation
  - Plant had limited damage
  - Road, rail and water down
- Help employees:
  - Find everybody
  - Continuity of pay
  - Counseling
- Restore the plant
  - Alternate sources of supply (port is down)
  - Housing (trailer village with 125 trailers and support facilities)
  - A new 700 ft. well
  - Supply brought in under police escort (local relationships)
- Plant started production September 17th


YOSSI SHEFFI
THE POWER OF
RESILIENCE
HOW THE BEST COMPANIES
MANAGE THE UNEXPECTED
YOSSI SHEFFI
THE
RESILIENT
ENTERPRISE

GM


DISASTER
IN JAPAN

0-80 Km Nuclear Zone

City: Shibata
Fujitsu - Microprocessors

City: Shibata
TDF – Crankshaf

City: Kakuda
Taian – Oil Jet Valve

City: Soma
Alps – Radio Asm

City: Soma
Hitachi Power Distribution
Hitachi Fukushima

City: Date-Gun
NPR – Valve sheet; camshaft

City: Fukushima
AISIN – Oil Seal
Jatco – Oil Seal
NOK – Oil Seal

City: Haranomachi
Fujikura – Rubber components for vaporizer

City: Nishonmatsu
NOK – Gasket, Boots

Fukushima Daichi
Nulcear Plant

City: Aizuwakamatsu
Fujitsu - Microprocessors

20-30 Km

30-80 Km

City: Tamura Gun
Ezaki – pipe, welding
Mitsuba – Wiper Module
Mitsuba – Wiper armature shaft

City: Iwaki
Merck – Xirallic additive
Nikki – Die Castings
Shinto – Chromizing for turbo – Fam Z
Kureha – Cell anode
Furukawa Battery - Battery

City: Ishikawa
TBK – Water Pump

City: Kitaibaraki
NOK – Synthetic Rubber
NOK – Special Lubricant
NOK – Plastic, urethane
I-Metal - Machining for Engine, Trans, Chassis

Initial Estimates (March 14)

- 30 suppliers down
- 390 parts affected
- First production halt: March 22
- Total GM shutdown (16 assembly plants): March 31

Actions

- Crisis suite:
  - Central coordination
  - Supply chain solutions
  - Engineering solutions
  - Smaller crisis rooms in international locations
- Tapping the team
  - Base on Project D
  - Leader: Bob Hurles, Exec. Dir. Of Global SC

The daily Cycle (7/24) (High Level)

- 6:00 - Call with senior leadership. All regions on the phone
  - Updates
  - Defining the day's priorities and activities
- 7:30 - Sub-team meetings (functional)
- 8:00 - Information roll-down to all teams
- 10:30 - Sales, service, marketing updates
- 16:00 – Follow-up: new information and daily progress

Timeline of Key Events

Shock - Discovery - Analysis – Reality - Hope – Creativity – Solutions - Execution

Leadership

	March 11	March 14	March 24	March 29	April 13	May 27
Key Event	•Earthquake and Tsunami hits Japan	•**Formation of GM Risk Mitigation Team** •Global Crisis Centers •Daily Senior Leadership calls	•**On site SQ Visits** •MAF, ECM, Fuel Pumps, switches, Paint, GID, Radio •**Formation of "Whitespace Chart"** •**Global Database Established**	•Supplier Restarts and Engineering solutions forming •**Program Management vs. Program Leadership**	•Clarity of Commodities and Supply Risk •Validation of Engineering Substitutions •Execution of Plans	•Continued Supply Base Support •Continued Execution of Engineering Substitutions and Validations
Part Numbers	Less than 25 Tier 1 Suppliers	390	1551	1889	5329 116 Commodities 11 R / 61 Y / 44 G	5850 118 Commodities **2 R / 34 Y / 82 G**
Mfg Risk	•Nearly all Japanese Suppliers shutdown	•All NA, E, SGM Plants out week of March 22. •All Remaining Plants out end of March •Force Majeure letters	•All 16 Global Platform Asm Plants down week of April 11 •**GMB ST build**	•All 16 Global Platform Asm down week of May 16 and return July 2011 •**GMB ST and Corvette build**	•5 of 16 Global Platforms forecast 100% build. •10 Global Platform Forecast building at 50% or greater thru 2011.	•**13 of 16 Global Platforms forecast to 100% build.** •**2 "Red" commodities driving reduced build schedules on 3 Global Platforms.**
Local Risk	•Food, Shelter, Clothing •Survival	•Food, Shelter, Clothing, Loss, •Nuclear Reactor Smoke, concern	•Nuclear reactor power used for cooling. •No fresh water	•Nuclear reactors stable and improving •Strong Aftershocks	•Radioactive water leakage, testing, clarity of local risk • Stable Power and water	•TEPCO announces highly radioactive water inundating reactor 1 basement •Heavy rain causes turbine water level to raise

Types of Solutions

- Supply chain – look for inventories anywhere
- Engineering – different parts
- Procurement/Engineering – find/qualify alternate suppliers
- Logistics – get the new parts in
- Allocation of common parts
  - Engine controllers, airflow sensors, brake control modules
  - Basis: financial contribution, field stock
  - Example: air flow sensors – Shreveport Colorado truck plant

White Space Projection – All Programs (May 27, 2011)

5/27/2011 11:30 AM

Week of:

Lead	Rank	Platform	March	April	2-May	9-May	16-May	23-May	30-May	6-Jun	13-Jun	20-Jun	27-Jun	4-Jul	11-Jul	18-Jul	25-Jul	Aug	Sept	Oct	Nov	Dec
Ferer	1	FS Truck	SD											SD						SD		SD
Quinn	2	Theta							Fam Z Diesel E20 (Renesas; C14x)					SD								SD
Heavener	3	Epsilon												SD				SD				SD
Quinn	4	Lambda																				SD
Nuno-Whelan	5	Gamma																				SD
Manzor	6	Delta							Fam Z Diesel E20 (Renesas; J30x)					SD				SD				SD
Groshek	7	Zeta												SD								SD
Knapp	8	MST												SD								SD
Groshek	9	Sigma		STS Build Out (4/21)						SD												SD
Quinn	10	TE							SD					SD								SD
Heavener	11	GMX211												SD								SD
Groshek	12	G/H Car					DTS Build Out (5/19)		Lucerne Build Out (6/3)					SD								
Groshek	13	Y Car												SD								SD
Ferer	14	G Van																				SD
Russell	15	Mini												SD								SD
Farah	16	EREV								SD					TPIM							SD
Medla	NR	GME Regional Programs																SD				SD
Cabral	NR	GMB Regional Programs																				SD
Hayes	NR	GMIO Regional Programs																SD				

Legend

- Significant Platform Production Reduction
- SD — Planned Shutdown

Lessons Learned

- Know whom to call! (Project "D", "J", "E", "S"…)
  - Trust (sharing all data; confront reality)
  - Expertise
  - Commitment
- Knowledge of the supply chain
- Good supplier relationships
- Leadership
  - Engagement; visible commitment
  - Articulate, commit and visualize
  - Structure without rigor: trust the team

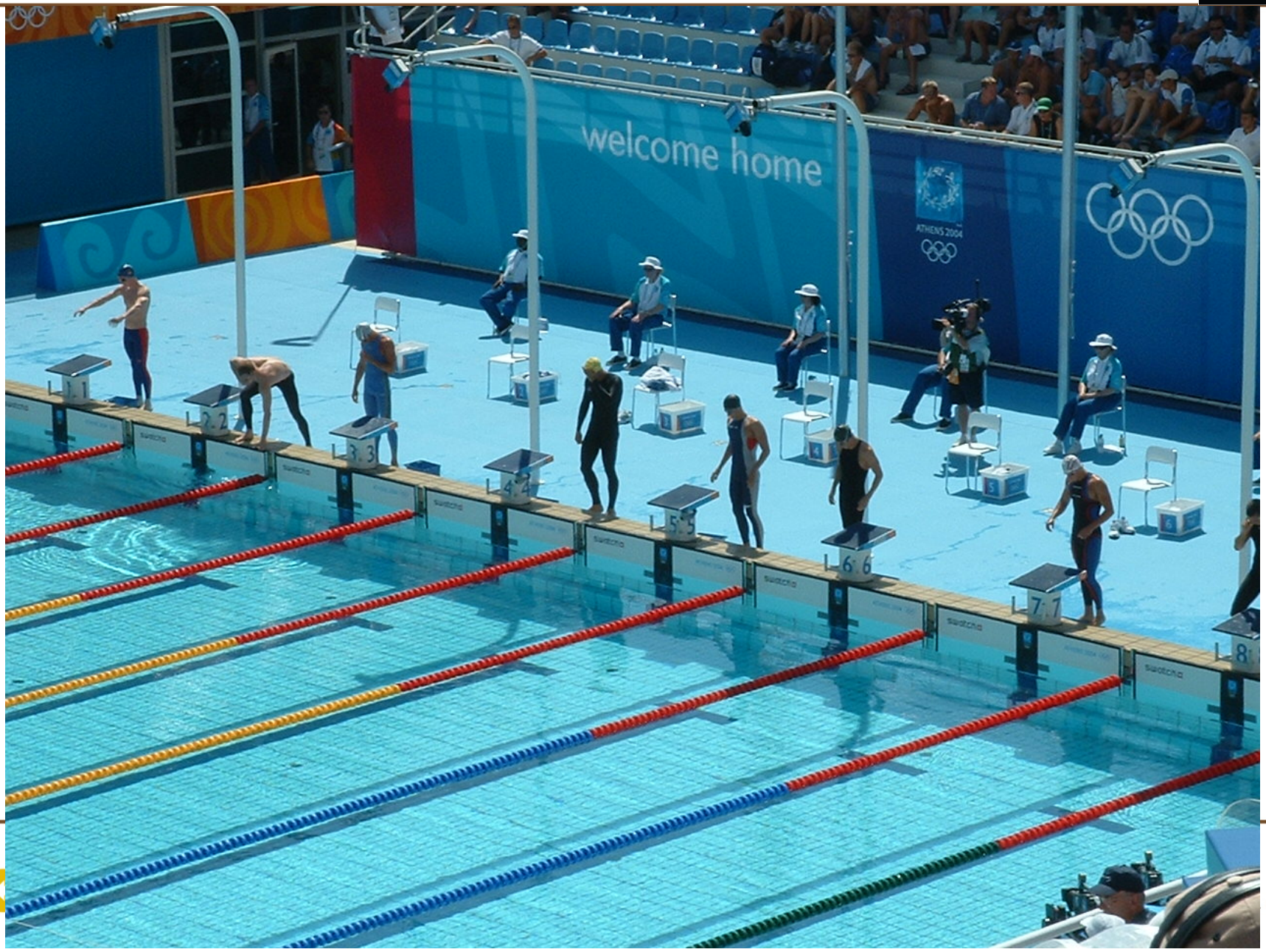
Swim in your lane!

Example:

- No seat heating module
- Build vehicles without heated seats

- Problems:
  - Heated seats go with leather => Build more cloth seats => Cloth/leather mix affects the basic/luxury model mix
  - Canceling leather seats means all subassemblies and components that went into these seats become stranded in the SC somewhere
  - Sales: dealers and end consumers want what they want.

Swim in your lane!



PREPARATIONS

Offering **options** to the responders

Reducing the Likelihood

- Detection
  - Baxter, 2001; The Spanish influenza
  - SPC
  - When do organizations "know"?
- Security
  - Layering
  - Balancing
  - Profiling
  - Collaboration
  - Culture
  - Drilling

Resilience through Redundancy

- System-wide (USPS and Anthrax)

UNITED STATES POSTAL SERVICE

- Inventory for redundancy (J&J, SOR)

Johnson & Johnson

- Redundant capacity (Boston Scientific, Intel)

Boston Scientific
Delivering what's next.

- Redundant IT systems (Merrill Lynch)

Merrill Lynch

Resilience through Flexibility

- Interchangeability
  - Plants
  - Part standardization
  - Product standardization
  - Pliable people
- Postponement
  - Late customization
  - Surge Response
  - Built to order

Flexibility DNA

- Culture
  - Continuous communications (informed employees, environment, status)
  - Distributed power (Toyota, US Navy, Zara, World, US Coast Guard)
  - Passion for work and the mission
  - Deference to expertise (Marines, FAA, Chemical plants)
  - Conditioning for disruptions
- Culture change
  - Safety
  - Quality
  - Many others (smoking, drinking-and-driving…)

Fundamental Lessons

- Lesson #1: Know who to call internally!
  - Intel: ERT; EOC/CEOC
  - GM: Based on experience. Project D,J, E, S
  - Cisco: Playbooks with lists
  - Intel Israel: a group of trained employee volunteers
  - Wal-Mart: On-going EOC
  - Also: external relationship

Best Practice: Separate employee care from business recovery

- Employees:
  - Contact
  - Continuity of pay, benefits
  - Take care of families
- Business recovery:
  - Inventories
  - Suppliers
  - Customers

Making Lemonade from Lemons

- Use security measures for process tightening
- Take advantage of flexibility to increase competitiveness
  - Disruptive marketing – from defense to offence
- Disruptions as opportunities
  - Opportunity to fix long-standing problems
  - Opportunity to increase market share

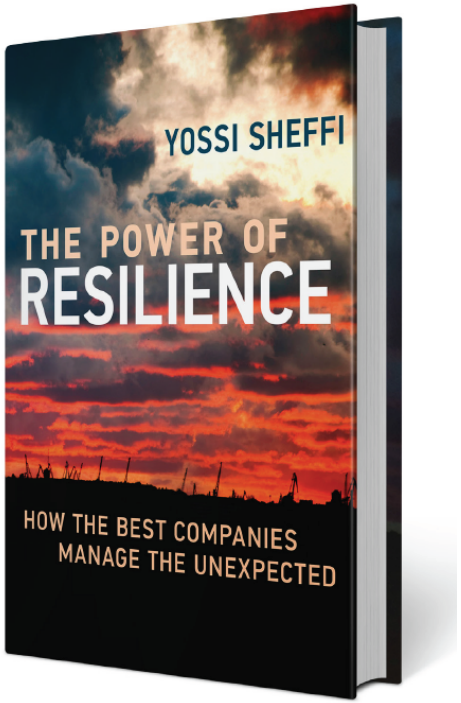
A Word of Caution

There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know.

Donald Rumsfeld

- Statistical reasoning is based on history
- Imagination is bounded by the largest past event.
- Complexity of the modern world increases the chance of unknown unknowns.
- Lack of evidence of disruption ≠ Evidence of lack of disruption

Questions?



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