

Dealing with Estimation, Uncertainty, Risk, and Commitment :

An Outside-In Look at Agility and Risk Management



Todd Little
Sr. Development Manager
Landmark Software & Services

Agenda

- Introduction
- Exercise
- Estimation and Uncertainty
- Exercise
- Break
- Risk Management, Real Options and Commitment
- Exercise
- Summary



A Game?



Form into teams.
Pick a name...
Shout out the name.



- On a piece of paper, write
1. Your Name
 2. Your Team Name
 3. Team to complete task A first
 4. Team to complete task B first





task “A”...

Create a six sided random number generator.
Something like a dice like thingy.

Every member of the team needs to roll a double six.



task “B”...

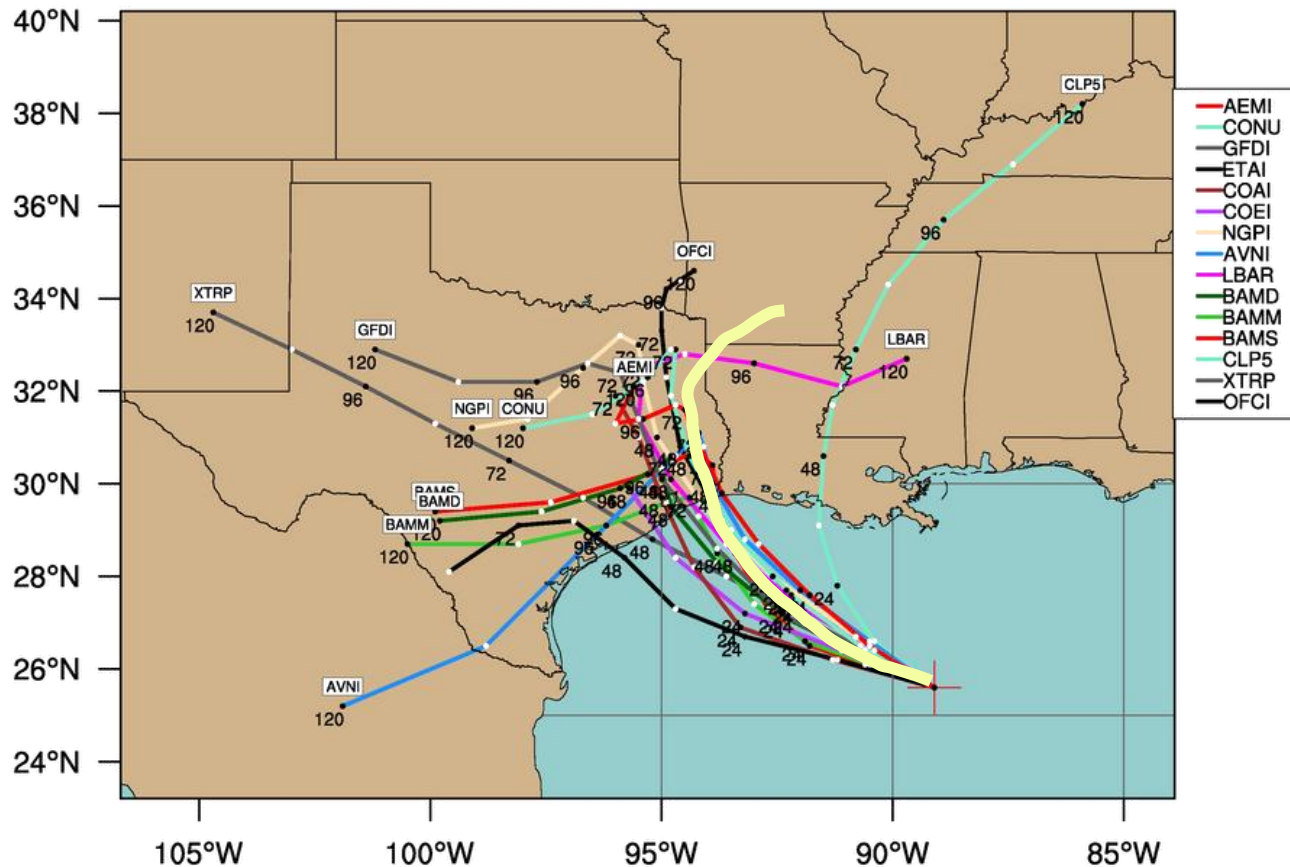
Create a four sided random number generator.
Something like a dice like thingy.

Every member of the team needs to roll a double six.

Hurricane Rita

AL18

Early-cycle track guidance valid 1800 UTC, 22 September 2005

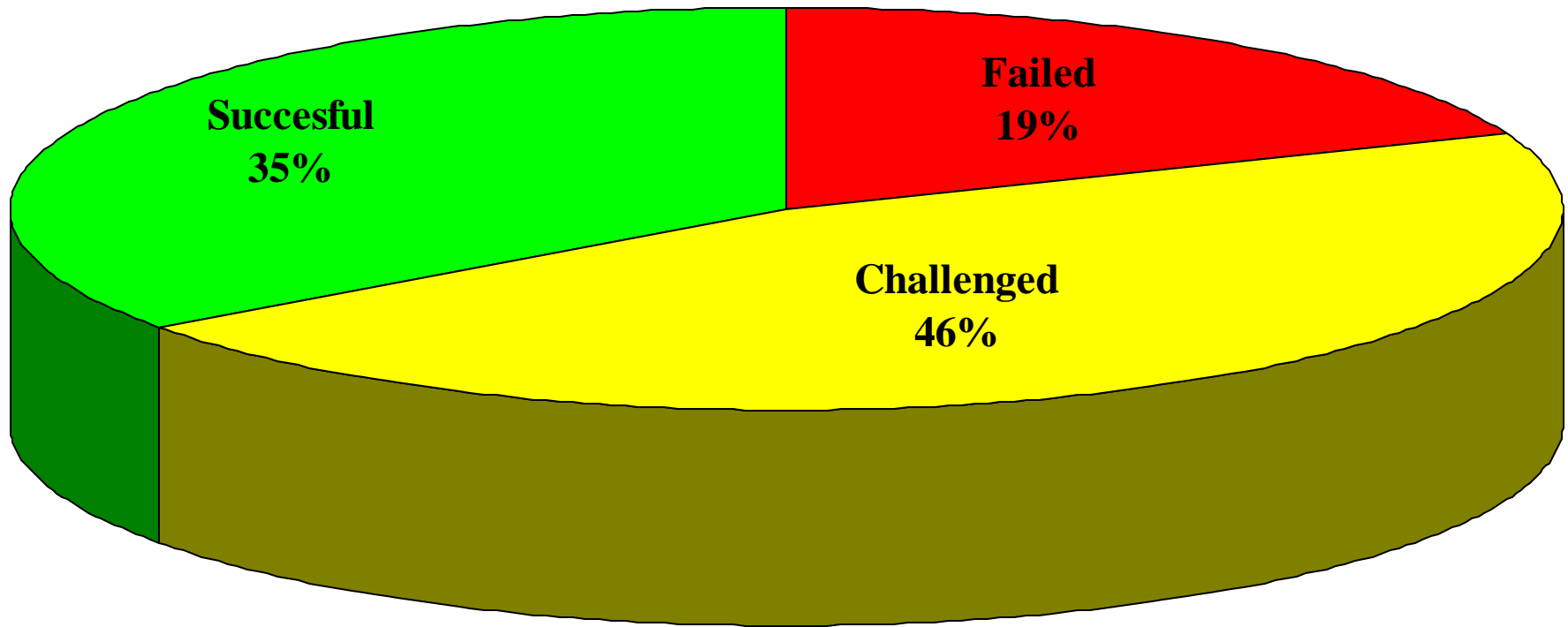


Risk and Uncertainty

	Risk	Uncertainty
Frank Knight	Immeasurable	Quantifiable
PMI	Risk can be positive or negative	???
English	A situation involving exposure to danger	The state of being uncertain Not known or established; questionable



Delivery Challenges/Failures



Managing the Coming Storm

Inside the Tornado

Project Kickoff

When will we get the requirements?

All in good time, my little pretty, all in good time

But I guess it doesn't matter anyway

Just give me your estimates by this afternoon

Team Unity

Not so fast! Not so fast! ... I'll have to give the matter a little thought. Go away and come back tomorrow

No, we need something today!

Ok then, it will take 2 years.

No, we need it sooner.

Doesn't anybody believe me?

I already promised the customer it will be out in 6 months

You're a very bad man!

We're not in Kansas Anymore

Developer Hero



I may not come out alive, but I'm goin' in there!

Reorg



The Great and Powerful Oz has got matters well in hand.



My! People come and go so quickly here!

Testing



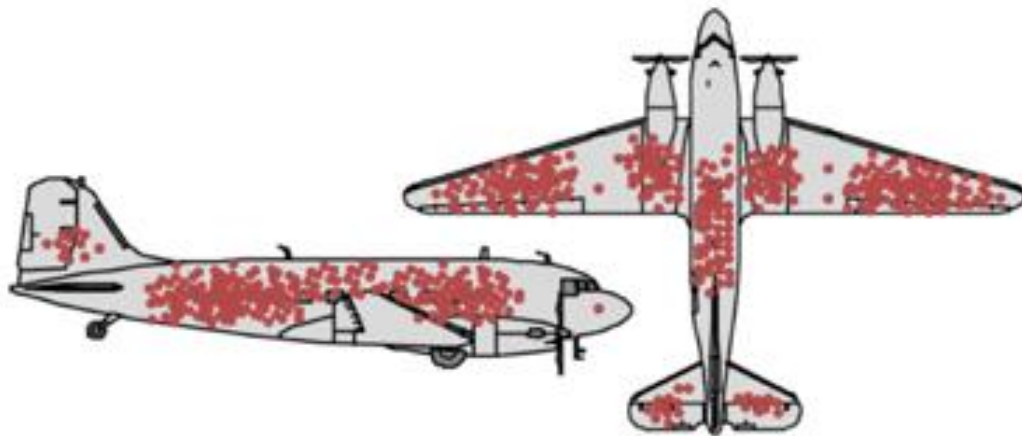
Hee hee hee ha ha! Going so soon? I wouldn't hear of it! Why, my little party's just beginning!

Why is Software Late?

Genuchten 1991 IEEE

General Manager	Project Manager	Item
1	10	Insufficient front end planning
2	3	Unrealistic project plan
3	8	Project scope underestimated
4	1	Customer/management changes
5	14	Insufficient contingency planning
6	13	Inability to track progress
7	5	Inability to track problems early
8	9	Insufficient Number of checkpoints
9	4	Staffing problems
10	2	Technical complexity
11	6	Priority Shifts
12	11	No commitment by personnel to plan
13	12	Uncooperative support groups
14	7	Sinking team spirit
15	15	Unqualified project personnel

The Context of Feedback



Why is Software Late?

Genuchten 1991 IEEE

General Manager	Project Manager	Item
4	1	Customer/management changes
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2	3	Unrealistic project plan
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15	15	Unqualified project personnel

Why is Software Late?

Genuchten 1991 IEEE

General Manager	Project Manager	Item
H	H	Customer/management changes
L	H	Overall complexity
H	H	Unrealistic project plan
M	H	Staffing problems
H	L	Insufficient front end planning

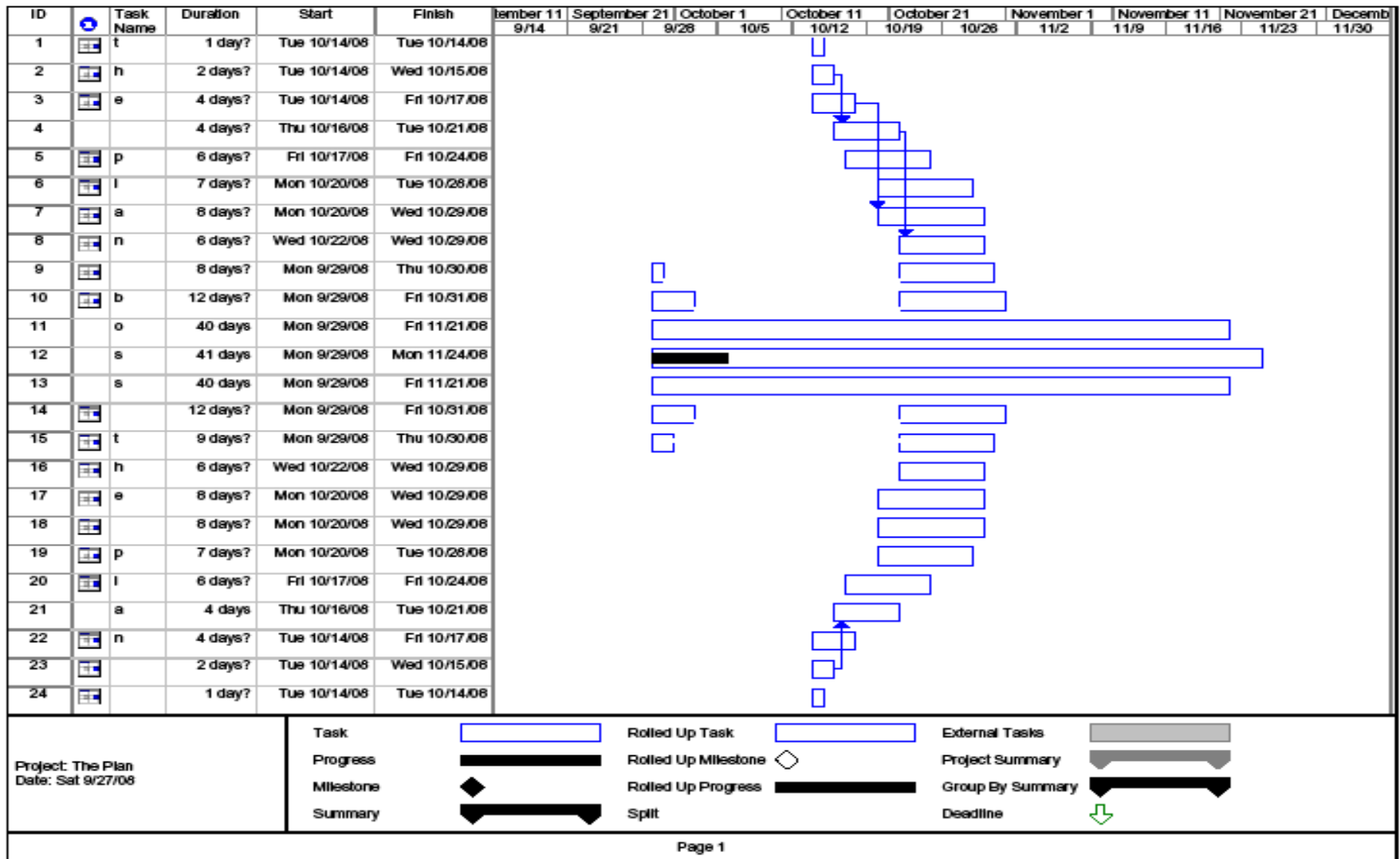
The Goal

On Time

To Spec

Within Budget

Da Plan, Boss – Da Plan



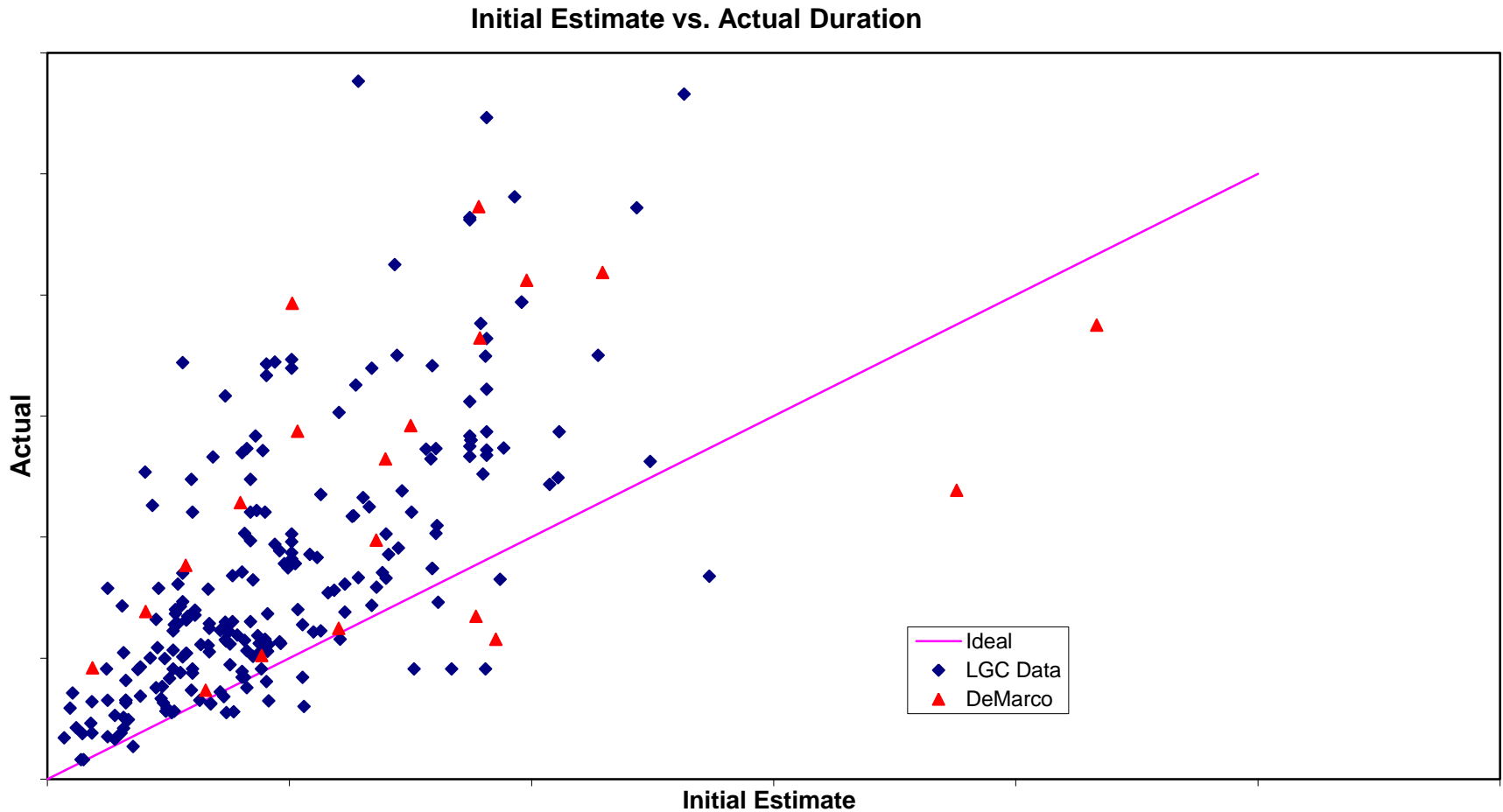
IEEE Software, May/June 2006

feature
project estimation

Schedule Estimation and Uncertainty Surrounding the Cone of Uncertainty

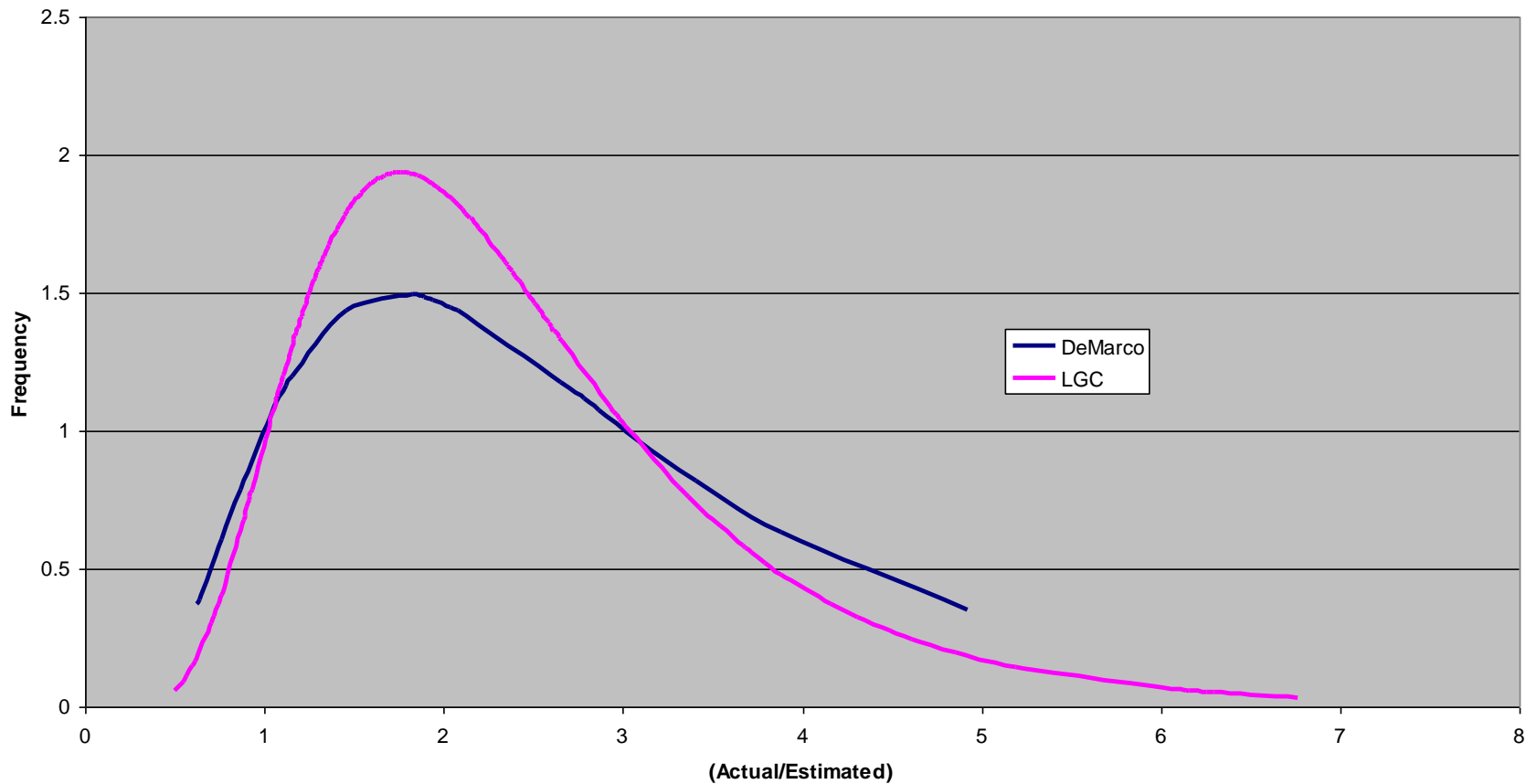
Todd Little, *Landmark Graphics*

Accuracy of Initial Estimate



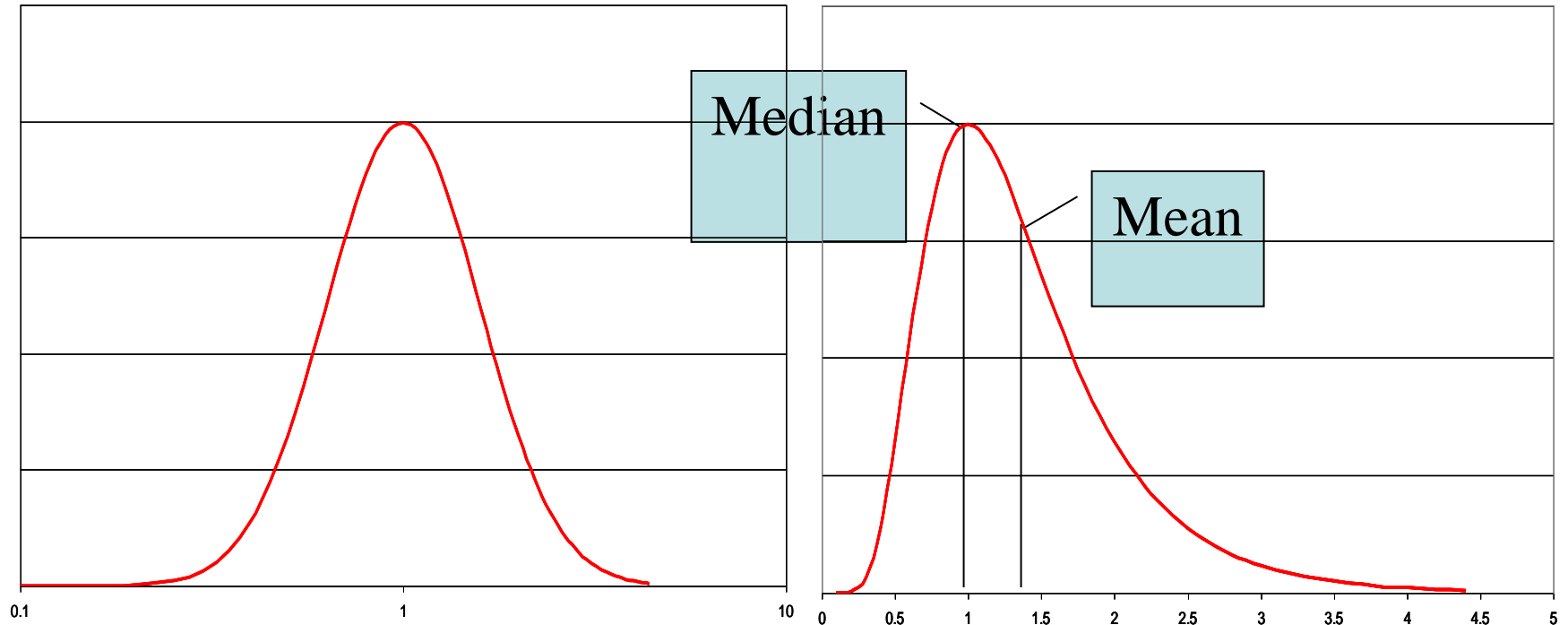
Probability Distribution Curve

Distribution Curve of Actual/Estimated (DeMarco data vs. LGC)
(Demarco data is Effort/Effort; LGC data is Duration/Duration)



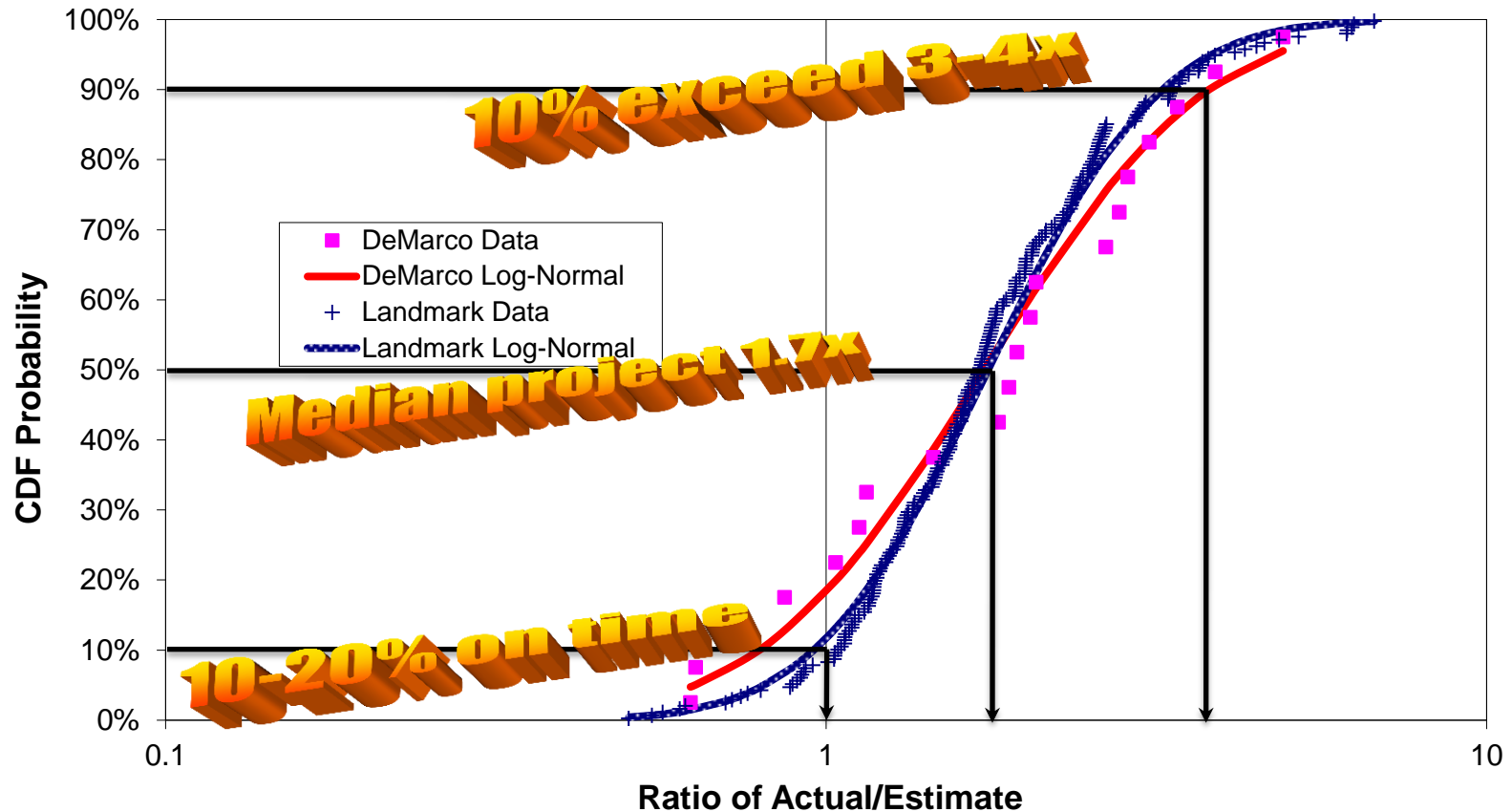
Log Normal Distribution

- Estimation Accuracy follows a Log Normal distribution



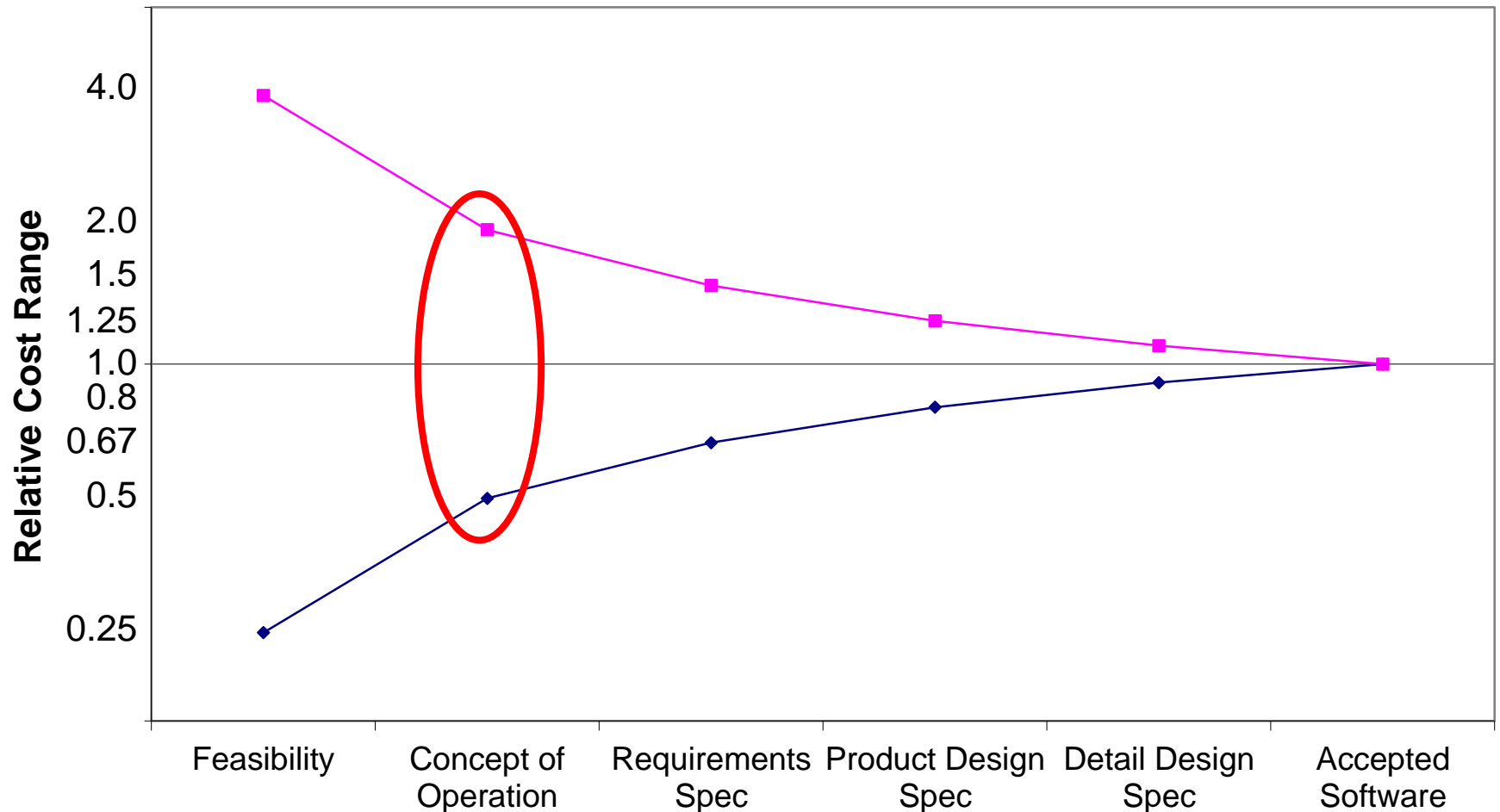
Uncertainty Bounds

Cumulative Distribution Function of Actual/Estimate Ratio



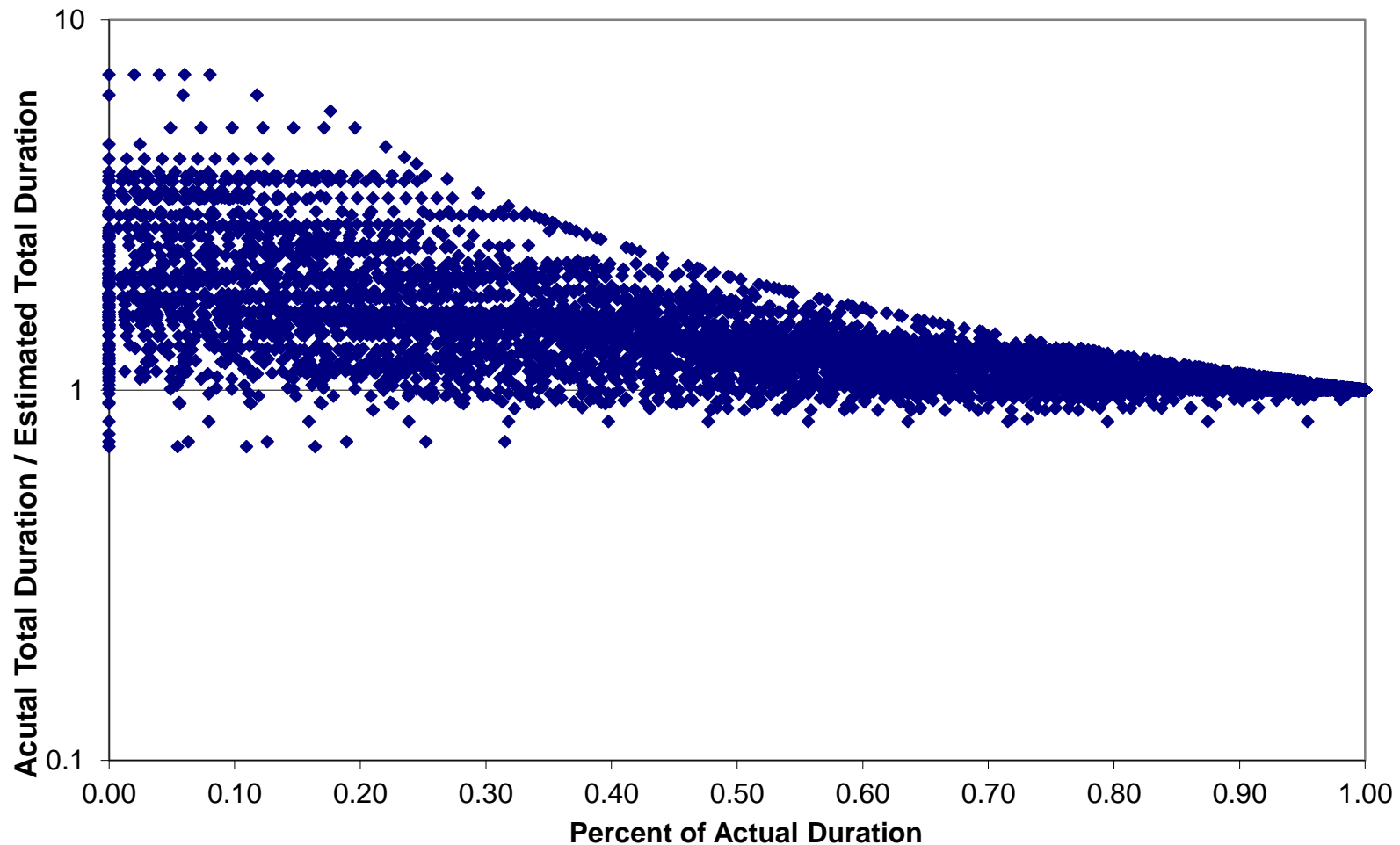
How does Estimation Accuracy Improve Over Time?

Cone of Uncertainty from Boehm



Landmark Cone of Uncertainty

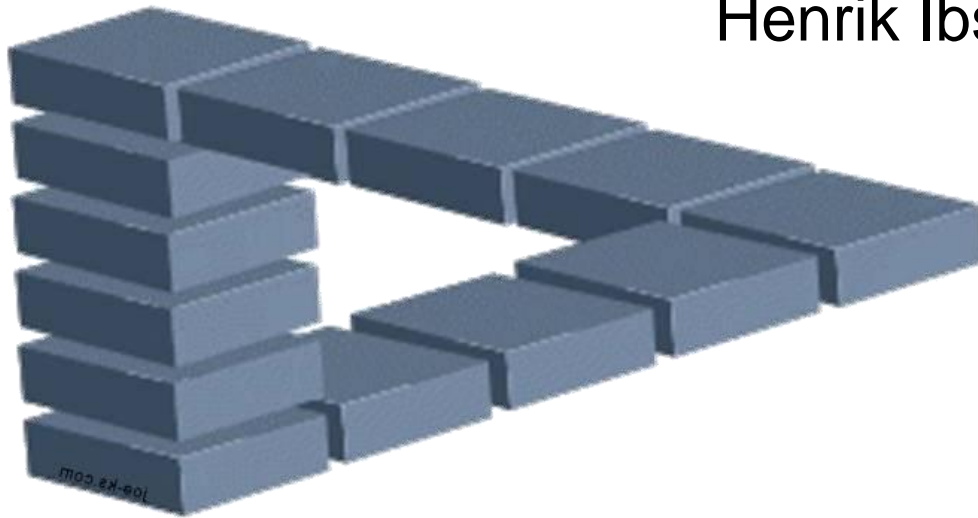
Estimation Error over Time



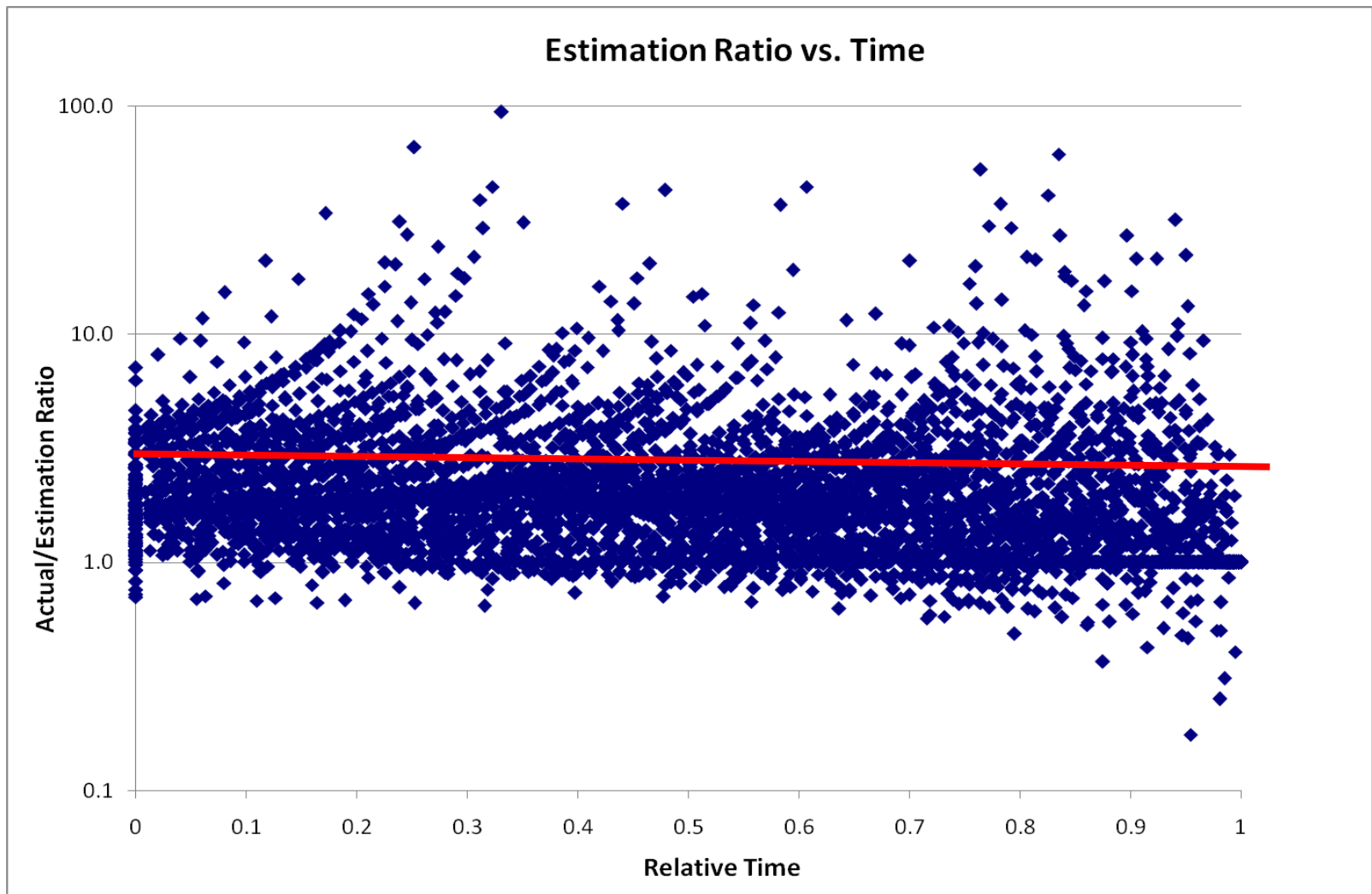
But is Uncertainty Really Reduced?

“Take away an ordinary person’s illusions and you take away happiness at the same time.”

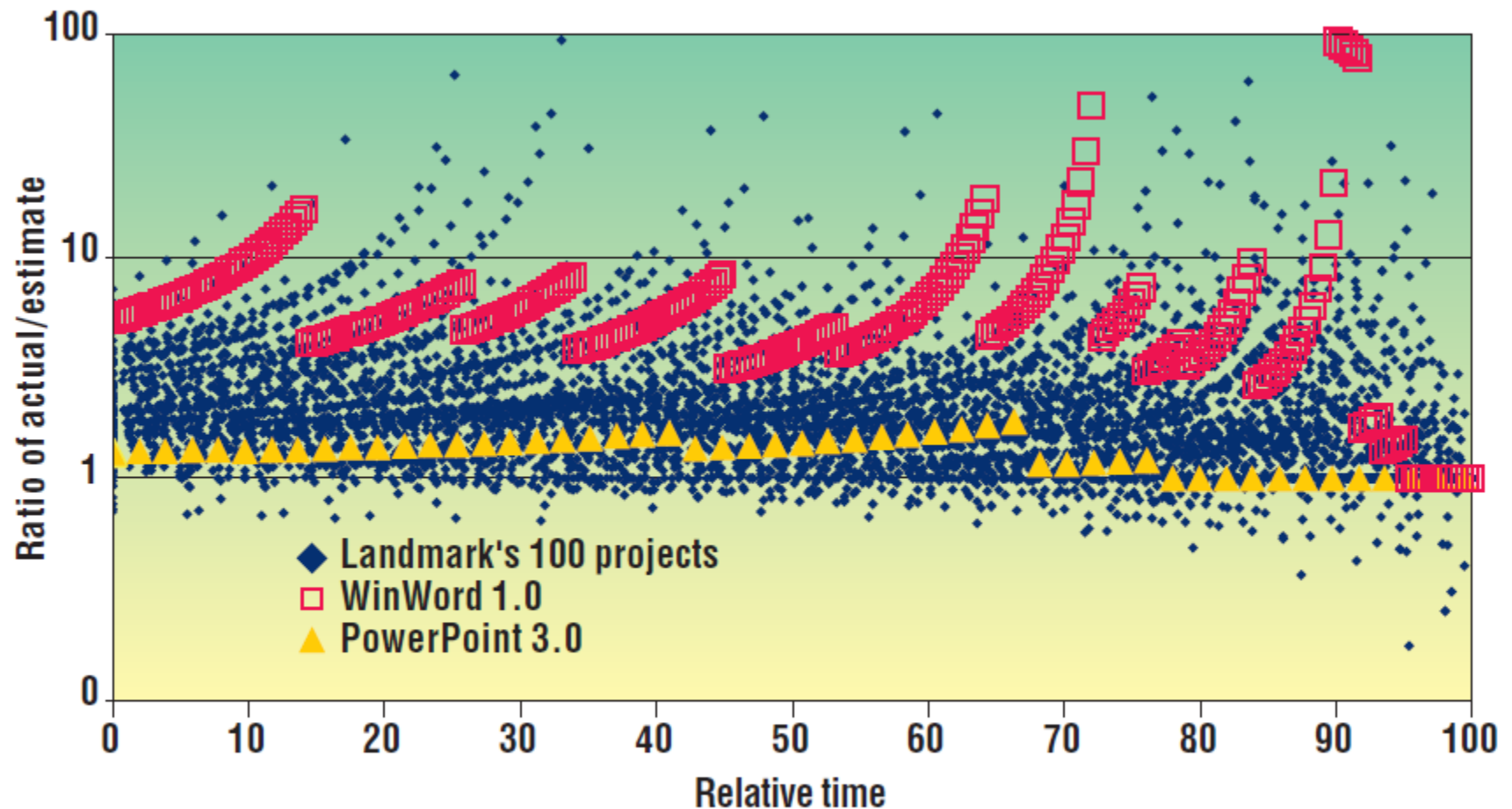
Henrik Ibsen-- *Villanden*



Remaining Uncertainty



Remaining Uncertainty

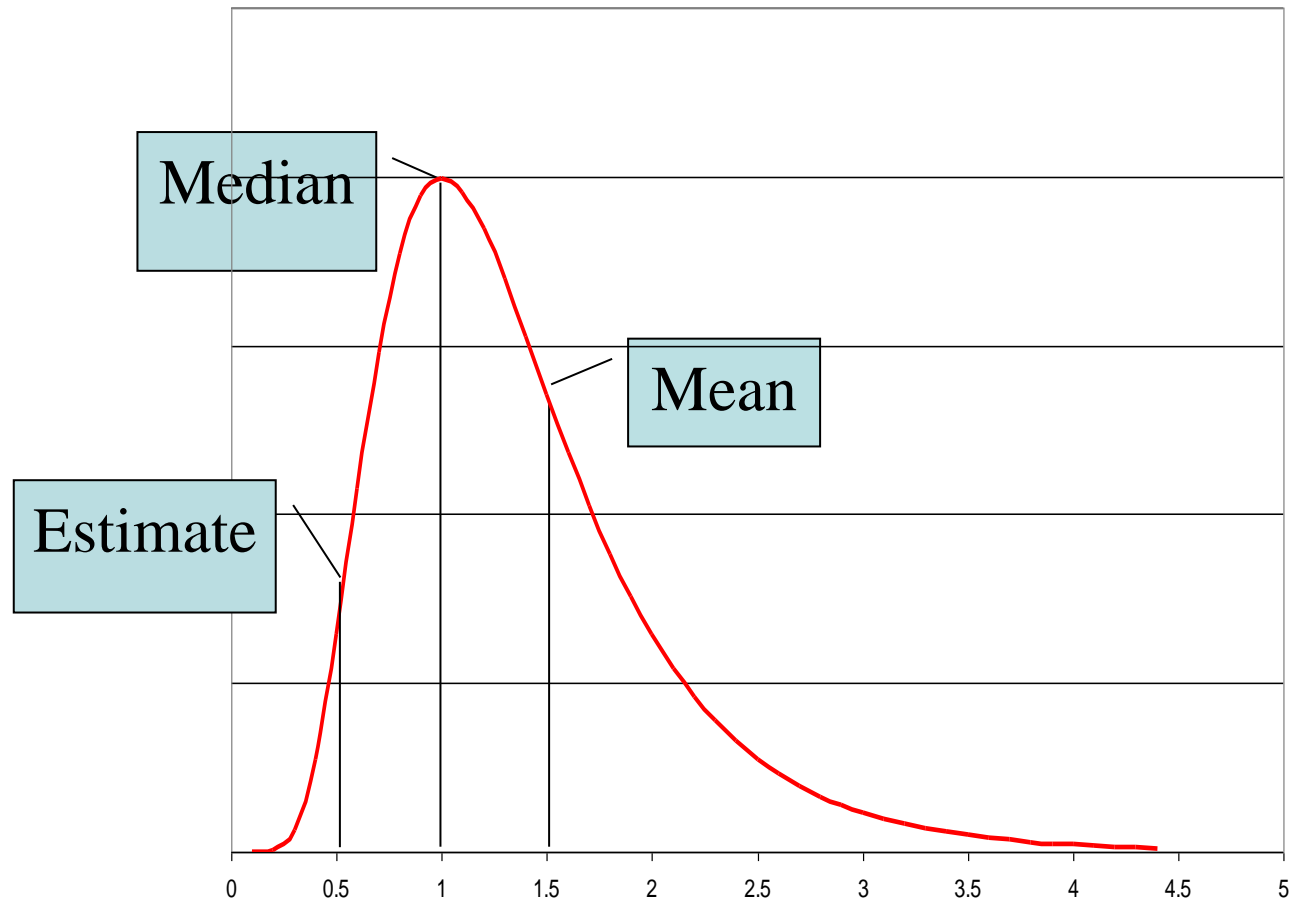


Sources of Error

- Bias
- Uncertainty Range
- Scope Creep

Sources of Error

- Bias



Negotiation Bias

- *"It is difficult to get a man to understand something when his salary depends upon his not understanding it."*

» *Upton Sinclair.*

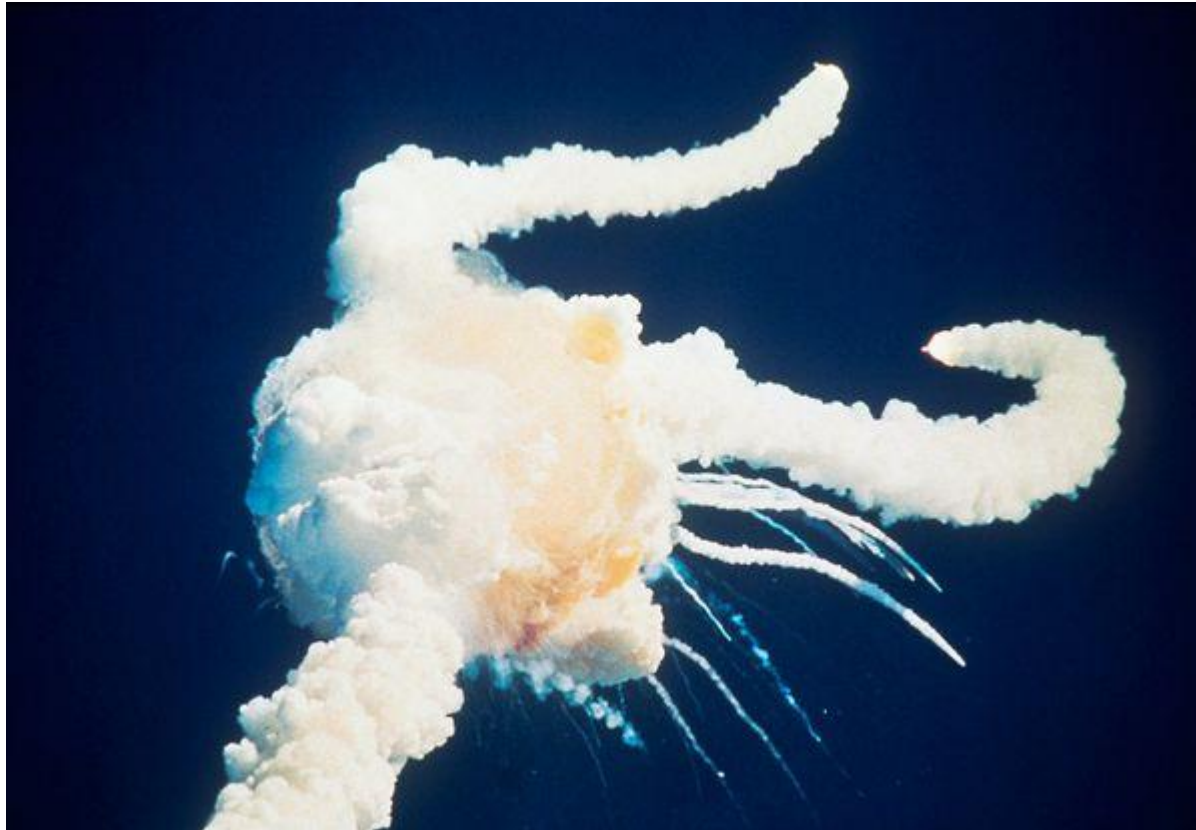
Politics and Schedule Estimation

- *Developers tend to be temperamentally opposed to the use of negotiating tricks. Such tricks offend their sense of technical accuracy and fair play. Developers don't want to offer lopsidedly high initial estimates even when they know that customers, marketers, or bosses will start with lopsidedly low bargaining positions.*

– *Steve McConnell*

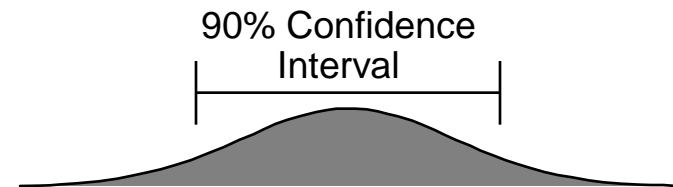
Space Shuttle Challenger

	Engineers	Management
Probability of loss of life	1 in 100	1 in 100,000



Overconfidence in Ranges

- Most people are significantly **overconfident** about their estimates, especially educated professionals



Group	Subject	% Correct (target 90%)
Harvard MBAs	General Trivia	40%
Chemical Co. Employees	General Industry	50%
Chemical Co. Employees	Company-Specific	48%
Computer Co. Managers	General Business	17%
Computer Co. Managers	Company-Specific	36%
AIE Seminar (before training)	General Trivia & IT	35%-50%
AIE Seminar (after training)	General Trivia & IT	~90%

Test 1 (Jørgensen IEEE Software 2008)

Group	Guidance	Result
A	800	
B	40	
C	4	
D	None	160

Test 1

Group	Guidance	Result
A	800	300
B	40	100
C	4	60
D	None	160

Test 2

Group	Guidance	Result
A	Minor Extension	
B	New Functionality	
C	Extension	50

Test 2

Group	Guidance	Result
A	Minor Extension	40
B	New Functionality	80
C	Extension	50

Test 3

Group	Guidance	Result
A	Future work at stake, efficiency will be measured	
B	Control	100

Test 3

Group	Guidance	Result
A	Future work at stake, efficiency will be measured	40
B	Control	100

Understand Bias

- *"What gets us into trouble is not what we don't know. It's what we know for sure that just ain't so."*

» *Mark Twain*



task “A”...

Create a six sided random number generator.
Something like a dice like thingy.

Every member of the team needs to roll a double six.

Relative Sizing

We're pretty good at
estimating relatively

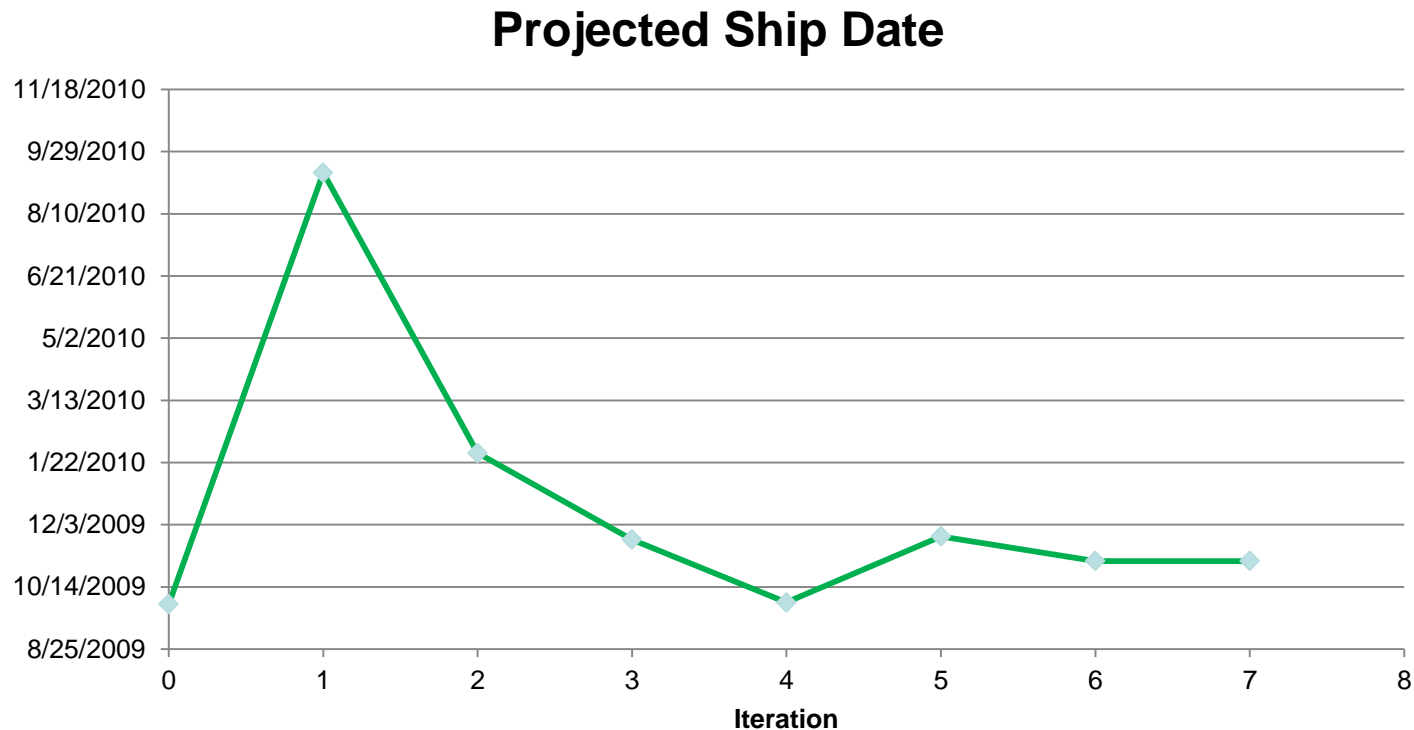


Did you know? (Jørgensen IEEE Software March 2013)

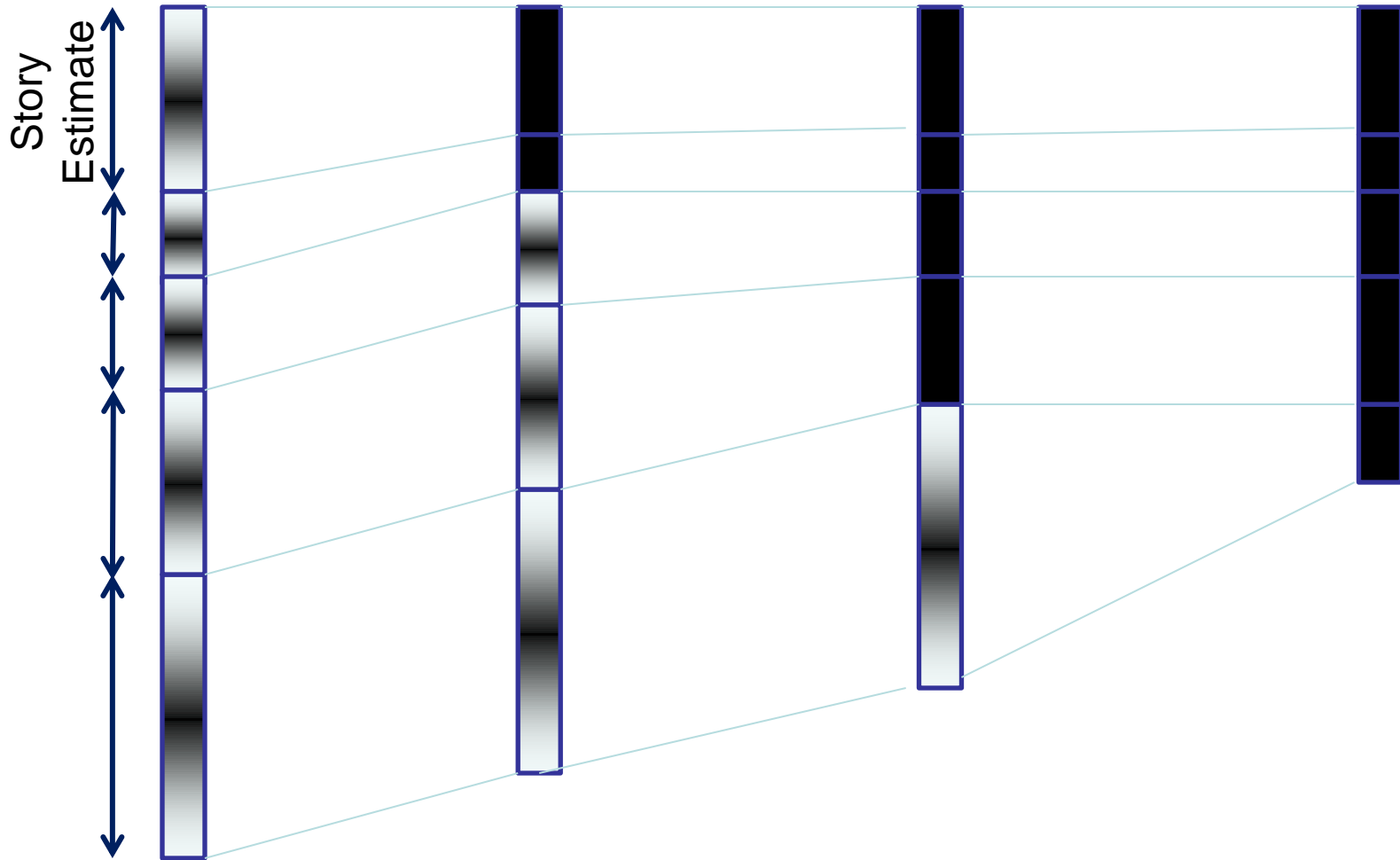
- The US has 155 million more inhabitants than Mexico, but Mexico has 100 million fewer inhabitants than the US.
- Poland has 10 million more inhabitants than Romania, but Romania has about the same number of inhabitants as Poland.
- Austria's population is 70% of Hungary's, while Hungary's population is 80% of Austria's.

Velocity Helps Remove Bias

- $\frac{\text{Story Points}}{\text{Story Points}} = \text{Iterations}$
Iteration



But Velocity is not a Silver Bullet



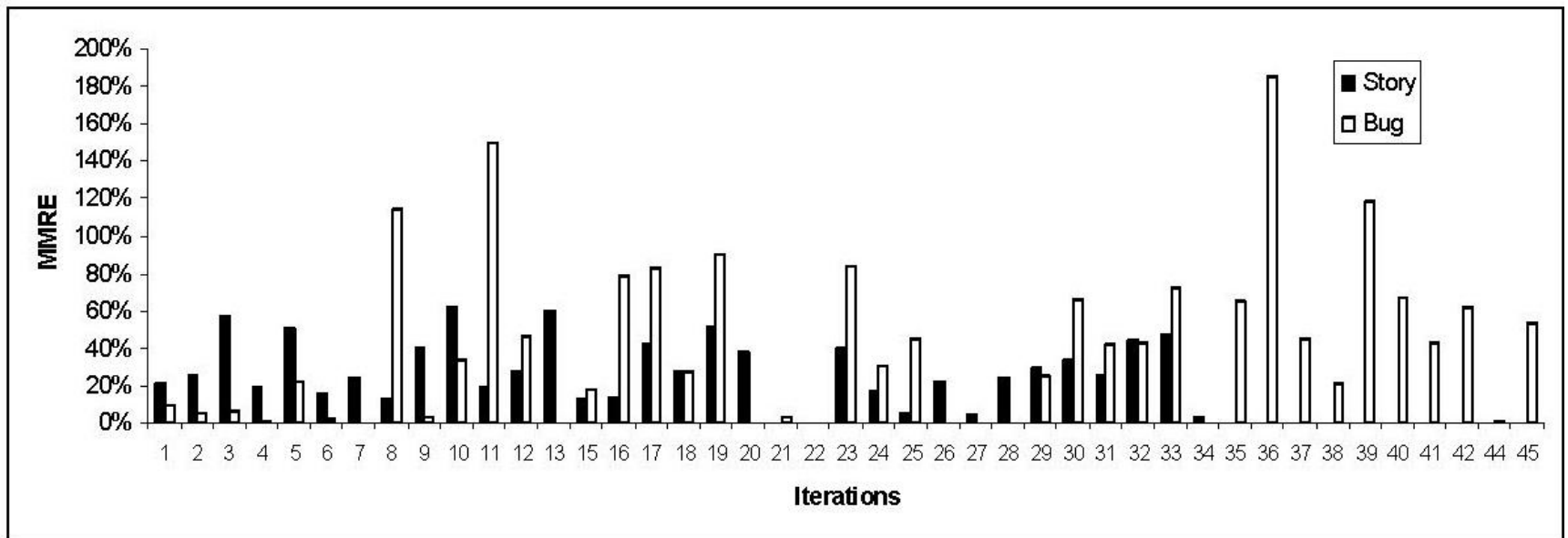
Sources of Error

- Range of Uncertainty



Estimation Errors

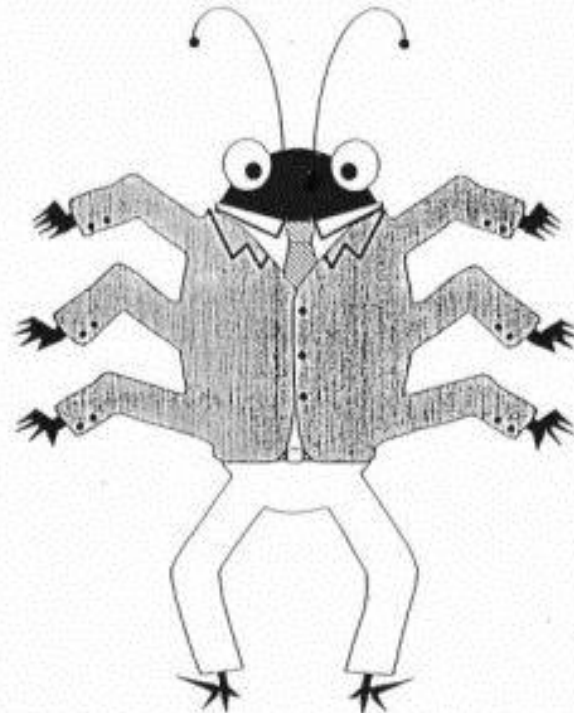
- Lan Cao - Estimating Agile Software Project Effort: An Empirical Study



Lan Cao - Estimating Agile Software Project Effort: An Empirical Study



BUG



FEATURE

Sources of Error

- Scope Creep



Scope Creep

- Capers Jones
 - 2% per month
 - 27% per year



Innovation

Revenue

Predictability

Efficiency

Late projects

Integration

Business Intelligence

BPM

CLOUD

Mobility

SOA

Agile

Uncertainty

<p>Know that we know</p>	<p>Know that we don't know</p>
<p>Don't know that we know</p>	<p>Knowable Don't know that we don't know Unknowable</p>

Uncertainty

Wishful Thinking p10	Discoverable Risks p50
Don't know that we know	Uncertainty Management p90

Estimation Exercise



Risky Business

REVIEWED AT NOBODIESRITYTHEATRE.COM

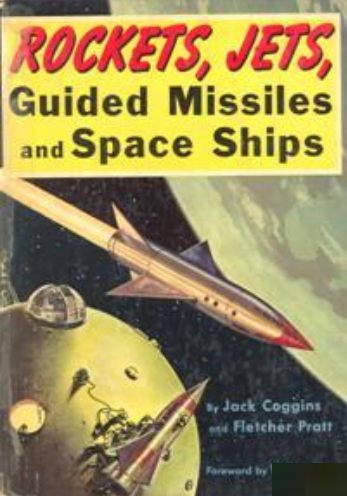


War

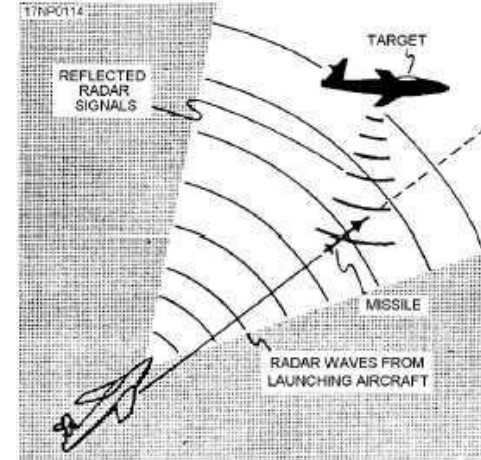
They couldn't hit an elephant at this dist...

General John B. Sedgwick, Union Army Civil War officer's last words, uttered during the Battle of Spotsylvania, 1864





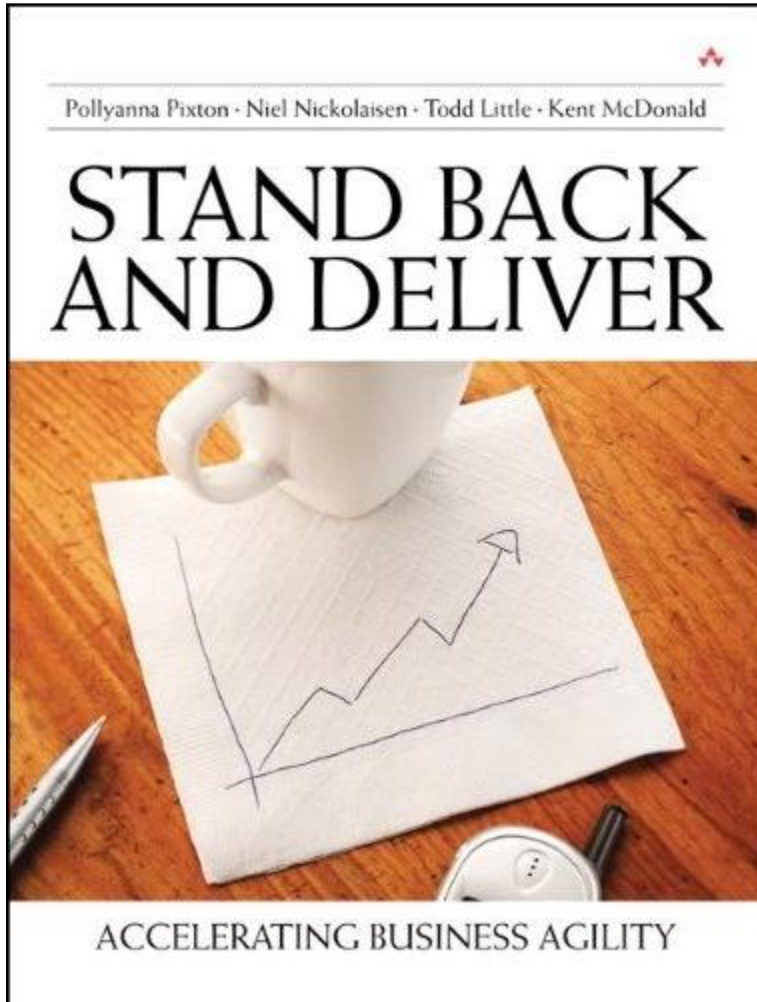
Gordon the Guided Missile



Movies



Books



300,000 in 2004,

**<25% sold more
Than 100 copies**

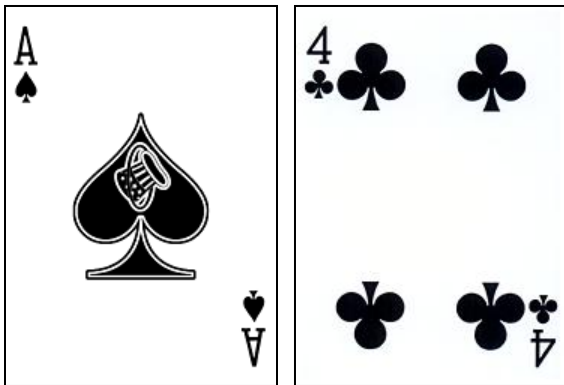
Poker



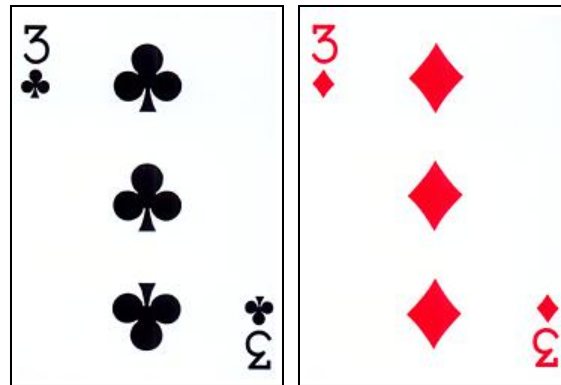
Texas Hold'em:

Which is the best hole hand?

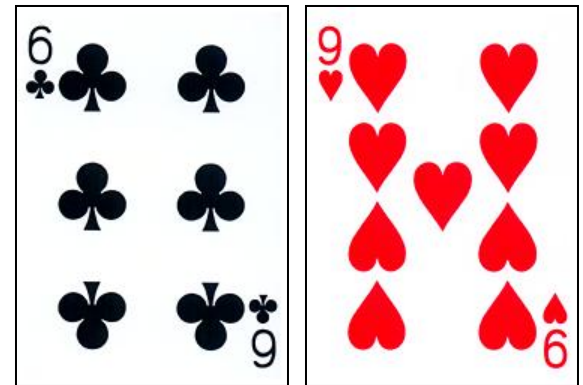
A



B



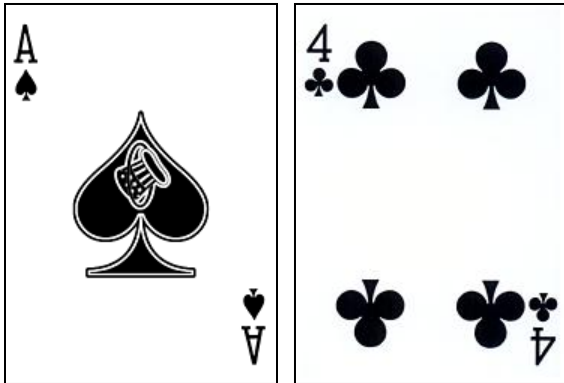
C



Texas Hold'em:

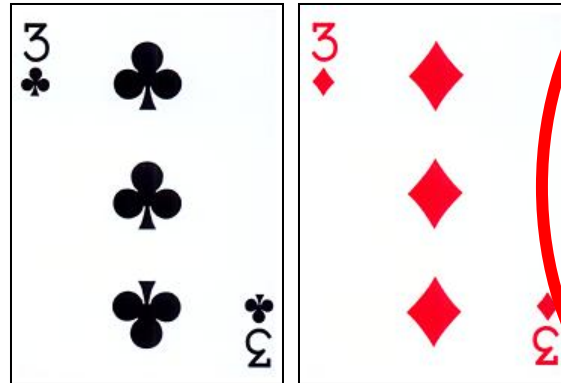
Which is the best hole hand?

A



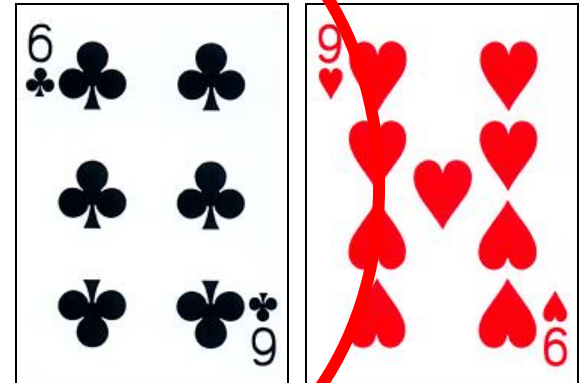
33.5%

B



29.6%

C



36.5%

Poker Metric: Percent of Hands Won



Oil & Gas Exploration



Oil & Gas Exploration



CAUTION

**THIS SIGN HAS
SHARP EDGES**

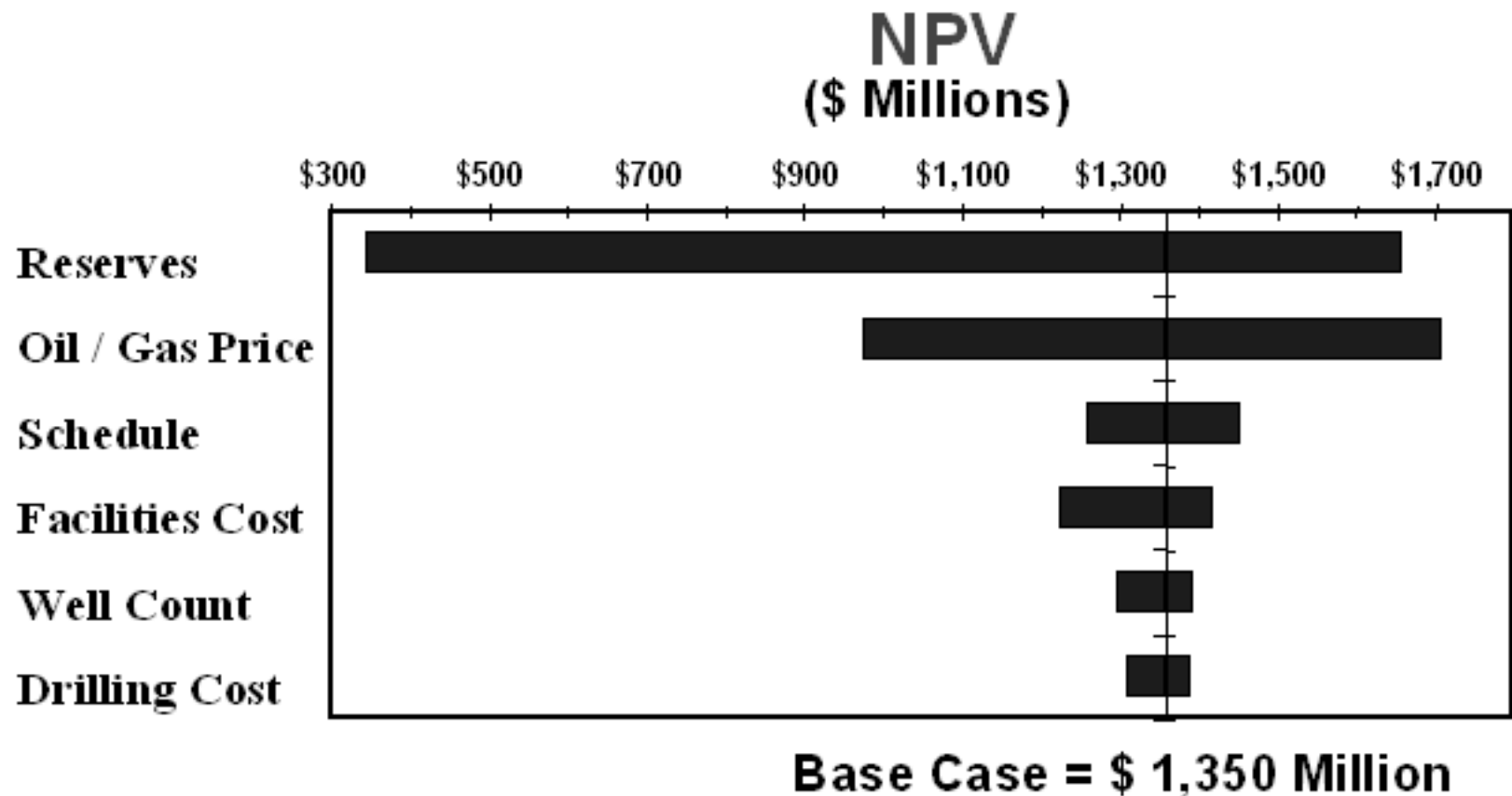
DO NOT TOUCH THE EDGES OF THIS SIGN



ALSO, THE BRIDGE IS OUT AHEAD



Which Risks Are Important



Real Options

- The right — but not the obligation — to undertake certain actions prior to an expiry date



Airline Tickets

06
PASSENGER TICKET AND BAGGAGE CHECK
SUBJECT TO CONDITIONS OF CONTRACT

ISSUED BY

Sample

FLIGHT COUPON 2 OF 2

BOARDING PASS

NORTHWEST AIRLINES

DATE OF ISSUE 09SEP06

ISS. OFF. CODE C16002000

ISS. AGT. ID TYN/HI

PLACE OF ISSUE

FULFILLMENT CENTER

NAME OF PASSENGER

FROM SAPPORO/CHITOSE

TO OKINAWA

CARRIER / FLIGHT JL 2703

CLASS / DATE D 31OCT1050

TIME

OK31OCT31OCT

PNR CODE ZVAC9D/NW

CONJ. TKT. NO.

NONENDORSABLE/FEES FOR CHANGE
MAY APPLY

ISSUED IN EXCHANGE FOR

FARE CALCULATION
TYO JL SPK 0.00 WP9500 JL OKA0.00 WP9500 NUC0.00 WP19000ENDROE0

FARE JPY 0.00

EQUIV. FARE PD.

FORM OF PAYMENT PKXSTYF478T3R725004LA1

STOCK CONTROL NUMBER TX 0120269201722

DOCUMENT NUMBER 012026914679 3

TOTAL JPY 0.00

NOT MARK OR WRITE IN THE WHITE AREA ABOVE

CHECK-IN REQUIRED

ADDITIONAL SEAT INFORMATION

BAGGAGE

Sample

Real Options

- The right, but not the obligation to take some action prior to an expiry date



Real Options

DEPARTURES				
Departing To	Time	Remarks	Flight	Gate
Boston	5:20p	On Time	4813	C3
Boston	7:20p	Cancelled	4815	
Chicago O'Hare	11:55a	Now 4:00p	337	
Chicago O'Hare	2:00p	Now 6:05p	333	D3
Chicago O'Hare	3:10p	Now 3:30p	335	D6
Chicago O'Hare	3:40p	Cancelled	337	
Chicago O'Hare	3:40p	Cancelled AS	1242	
Chicago O'Hare	4:40p	Now 6:00p	341	D7
Chicago O'Hare	5:29p	Now 6:30p	345	D6
Chicago O'Hare	6:25p	Cancelled	347	
Chicago O'Hare	7:20p	On Time	363	
Chicago O'Hare	9:00p	Cancelled	371	
Cleveland	8:29p	On Time	4891	
Columbus, OH	3:35p	Final Boarding	4919	C4
Columbus, OH	6:25p	Cancelled	4855	
Friday 3:34PM December 19				

Value of Information

Value of Flexibility

Value of Information



Value of Information

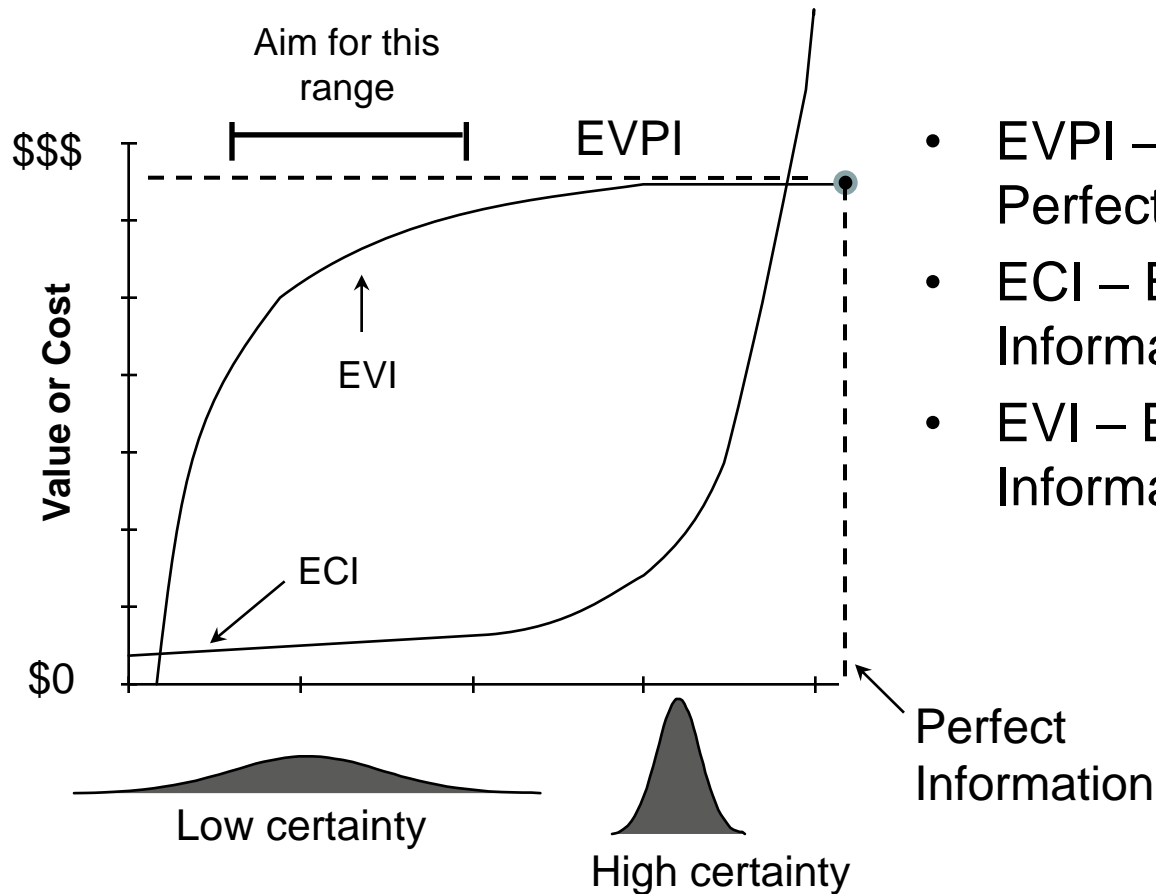


**Tooth looks fine
to the naked eye.**



**But an xRay
reveals the decay.**

Increasing Value & Cost of Info.



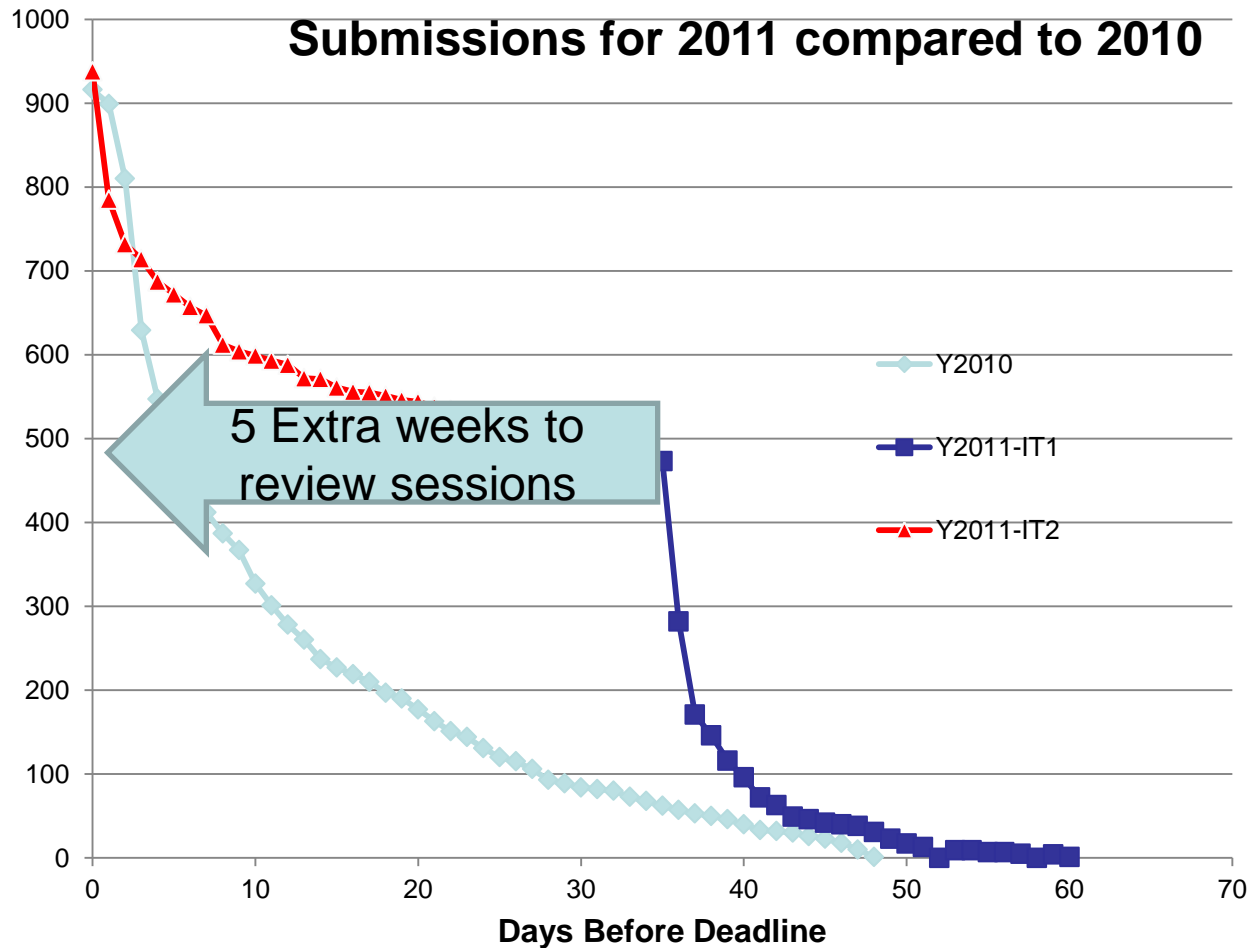
- EVPI – Expected Value of Perfect Information
- ECI – Expected Cost of Information
- EVI – Expected Value of Information

Value of Flexibility

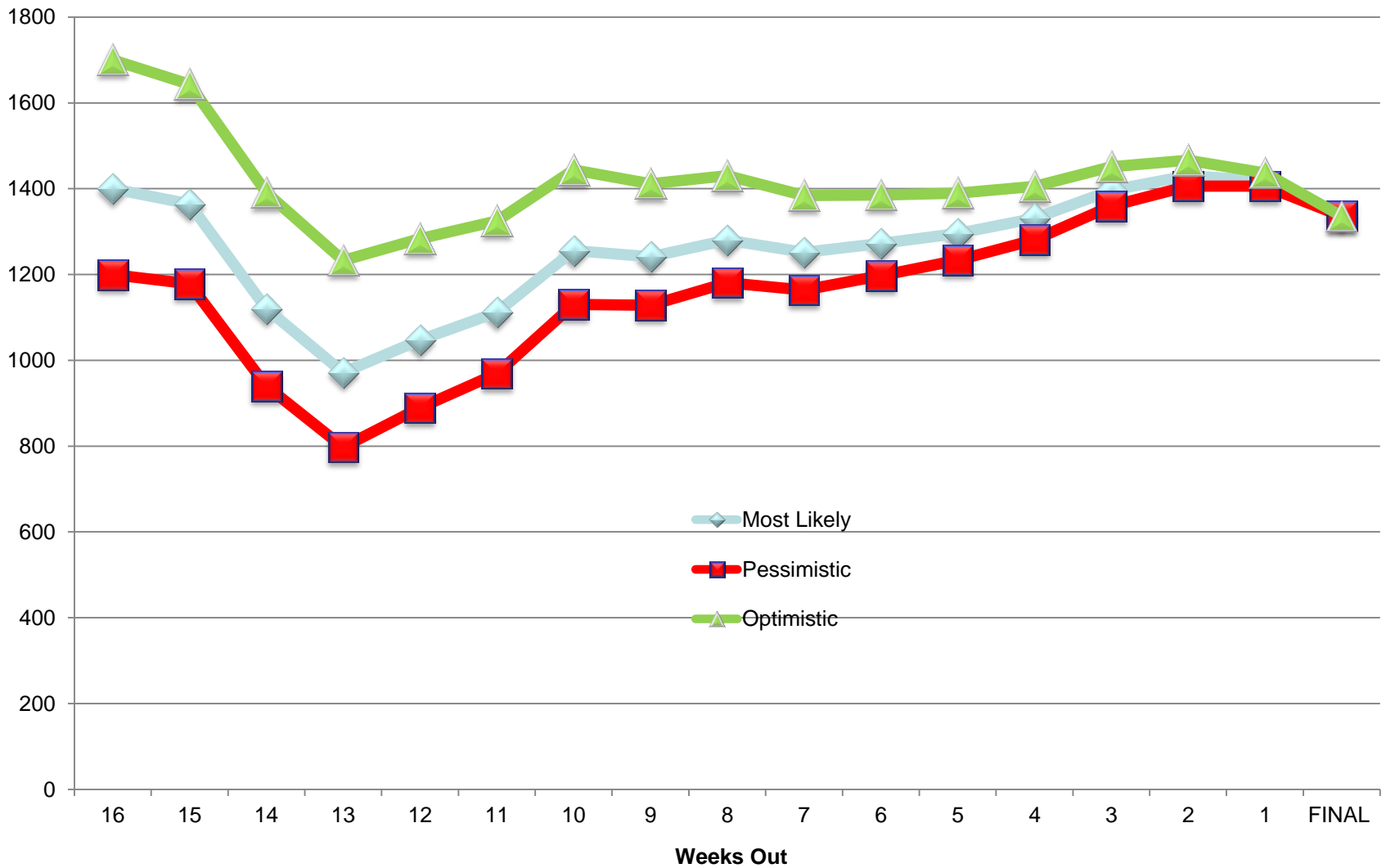


- The right — but not the obligation — to undertake certain actions prior to an expiry date

Making An Agile Conference Agile



Estimated Agile 2010 Attendance



Do you have a choice?

Option

Commitment

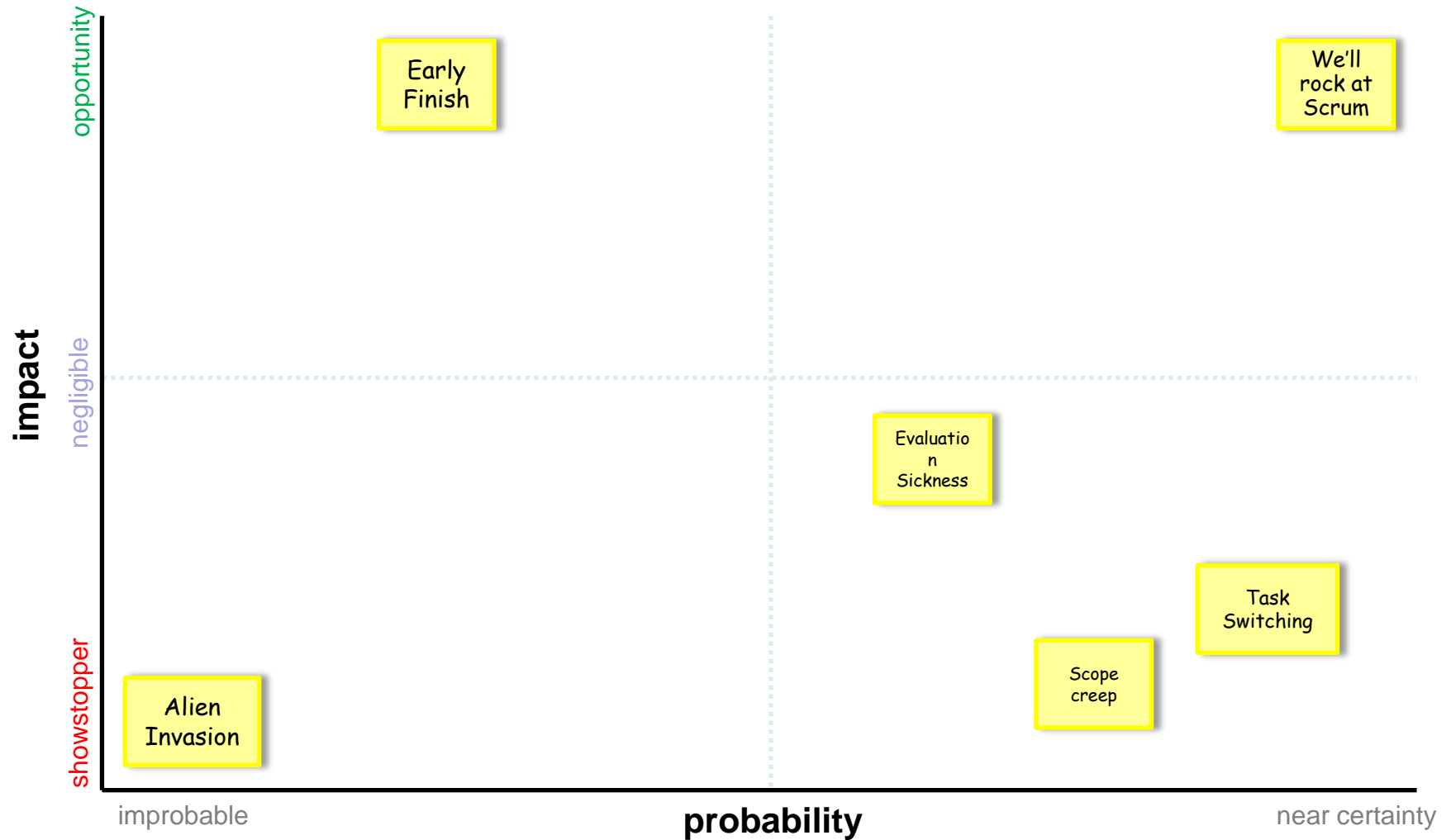
Decision



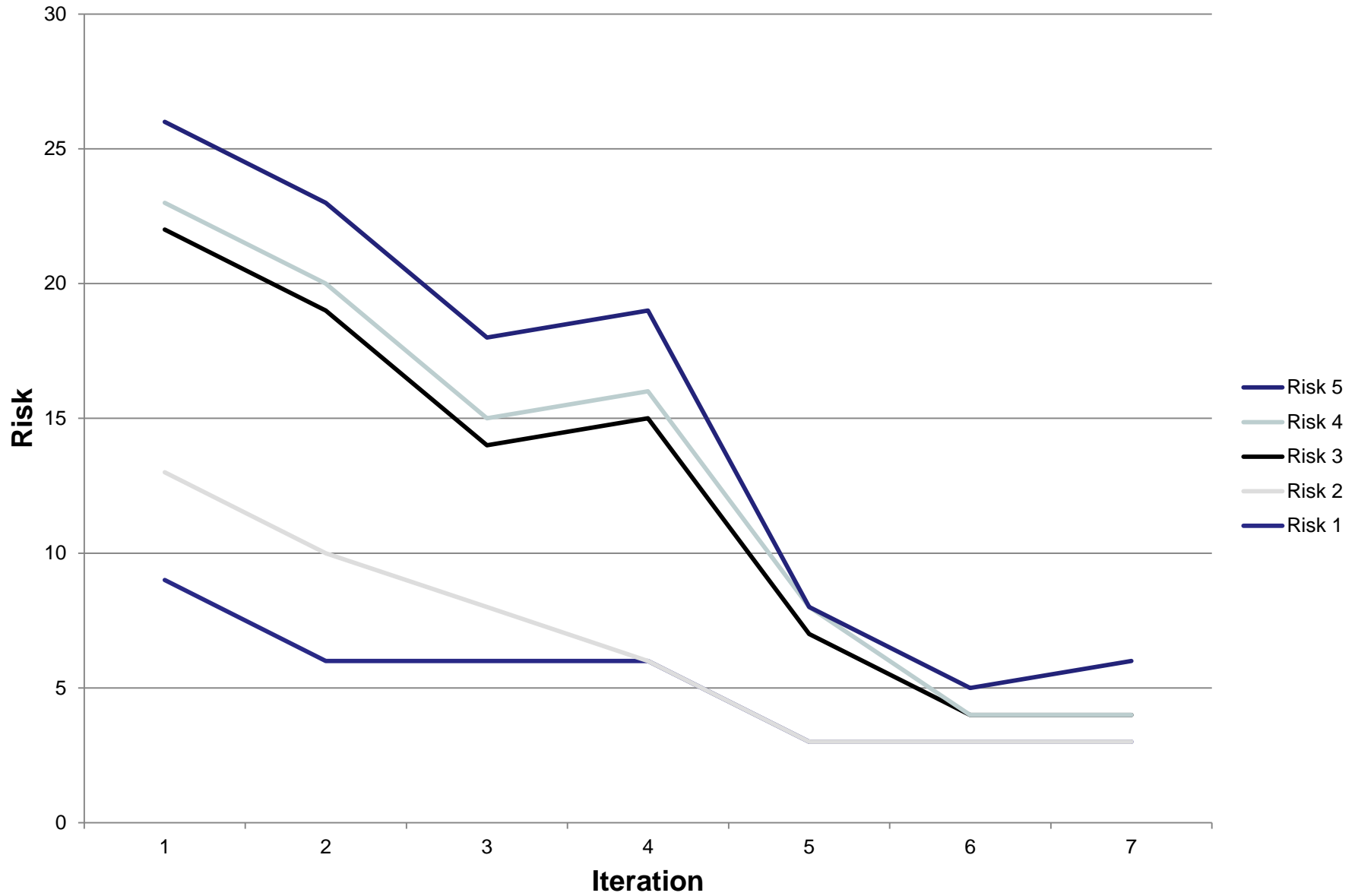
Agile projects need risk management too



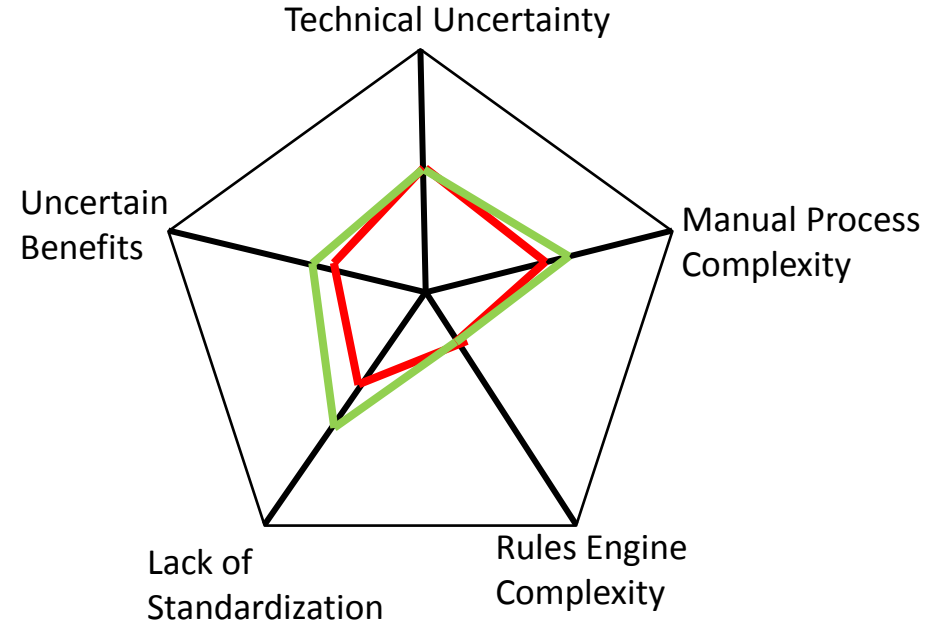
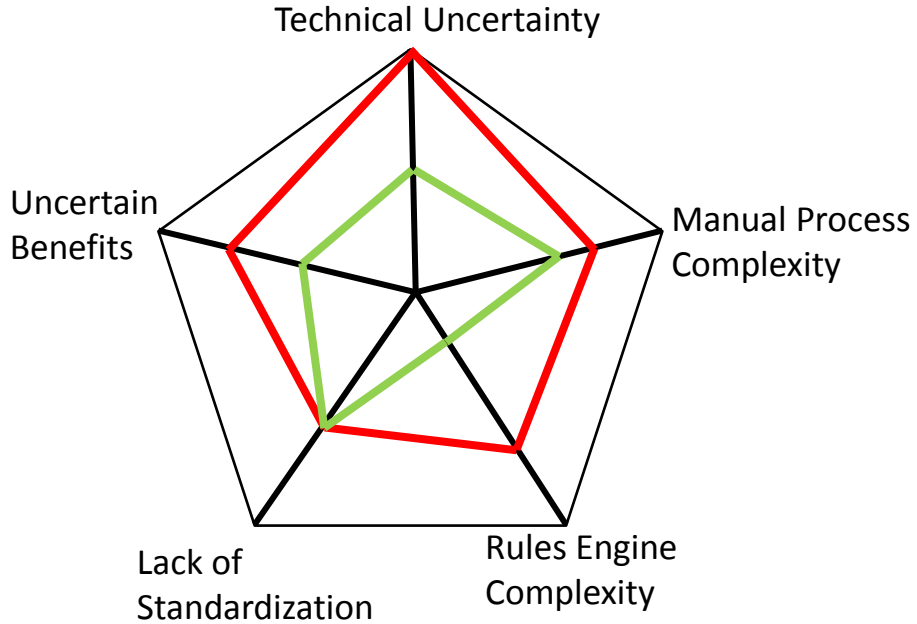
Analyze risks



Risk Burndown



Risk



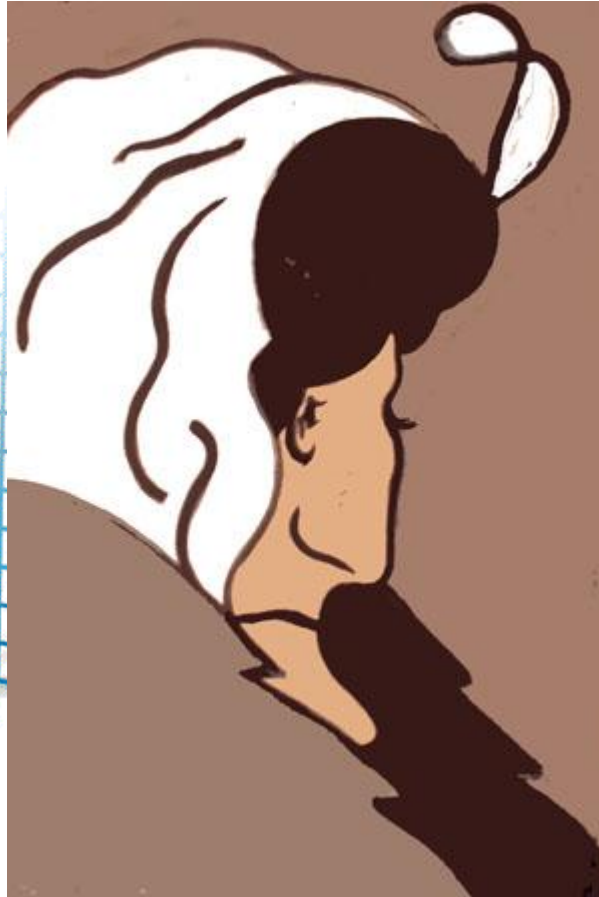
Categories of risk



Two Risk Perspectives



**Business
Perspective**



**Individual
Perspective**

Collateral Damage

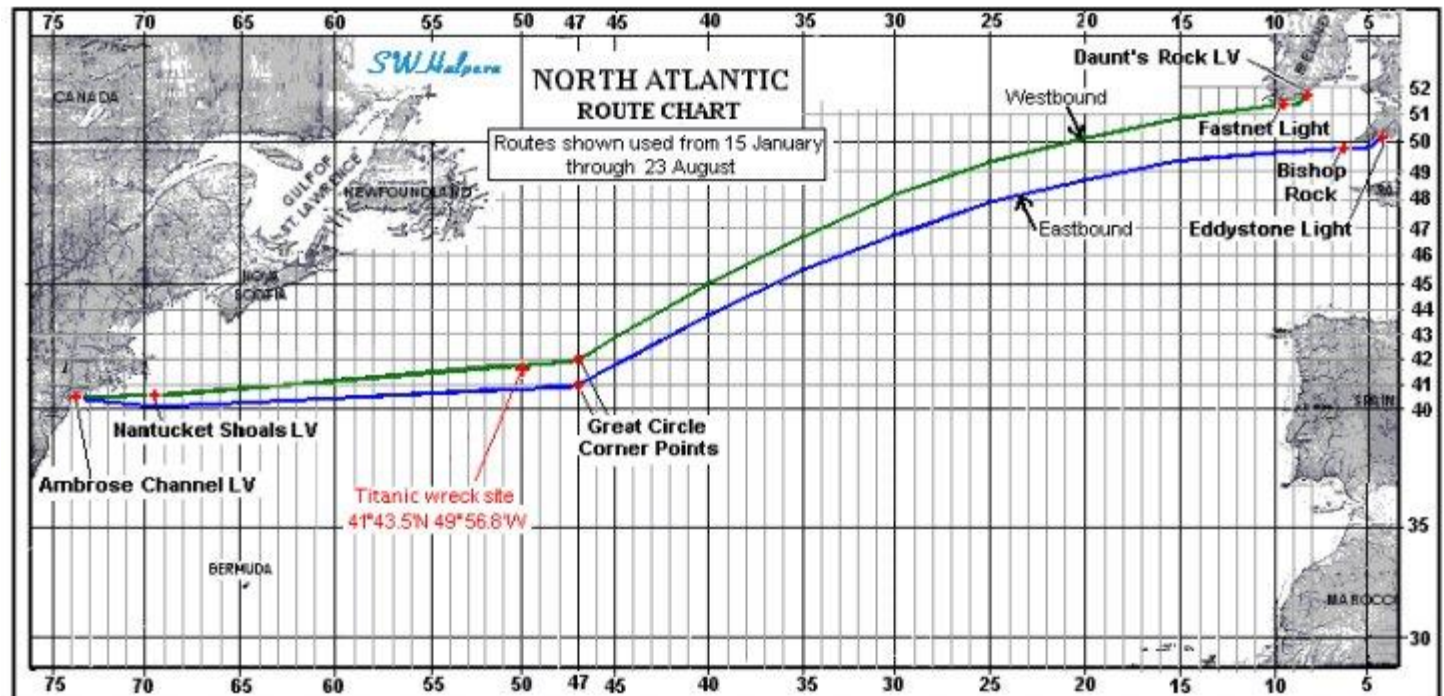
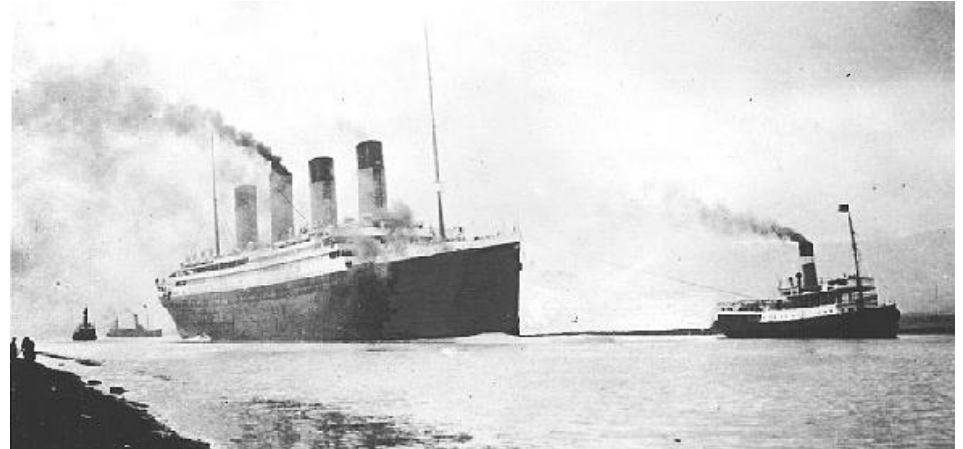



Delivery Failure results in Collateral Damage



Titanic

- Time pressure
- Feedback blocks
- Unsinkable



A large-scale volcanic eruption is shown, with a massive, billowing plume of fire and smoke rising into the sky. The fire is a mix of bright orange and yellow, with darker, charred rock visible within the plume. In the foreground, two people are standing on a grassy field, looking up at the eruption. The person on the left is wearing a light-colored shirt and dark pants, while the person on the right is wearing a dark shirt and light-colored pants. A speech bubble is positioned above them, containing text.

I'm beginning to
think it wasn't such
a good idea to turn
off those unit tests



Collateral Damage



Business Perspective

Could be catastrophic

Individual Perspective

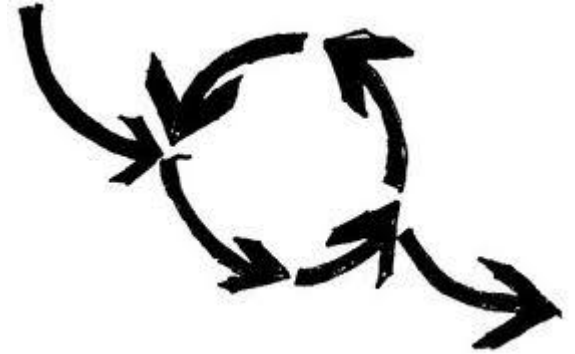
Some individuals may be willing to
take on more risk than desired



Collateral Damage Management



Inspect



Incremental Delivery



Honor feedback

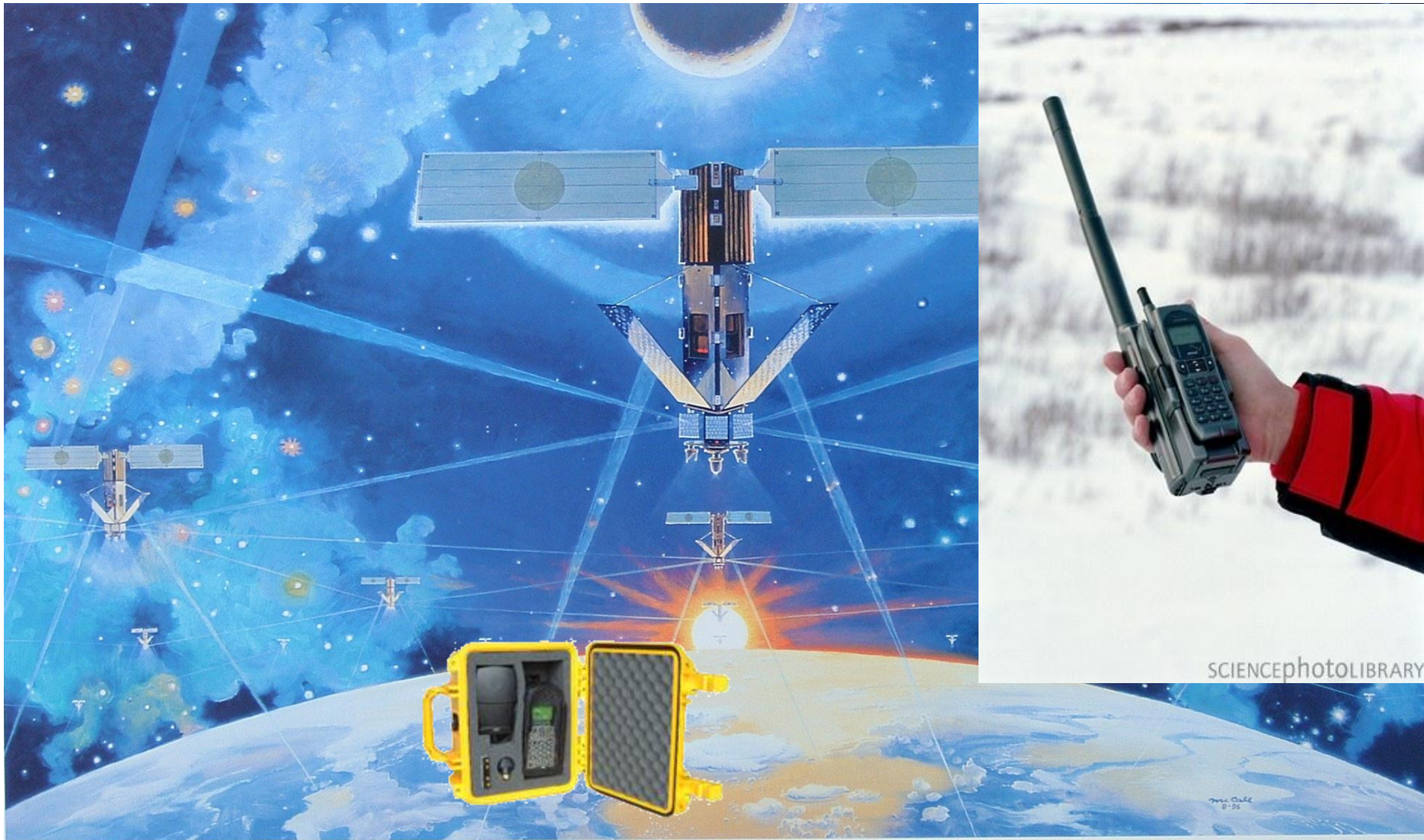


An effective roll-back strategy

Business Case Failure



Business Case Failure

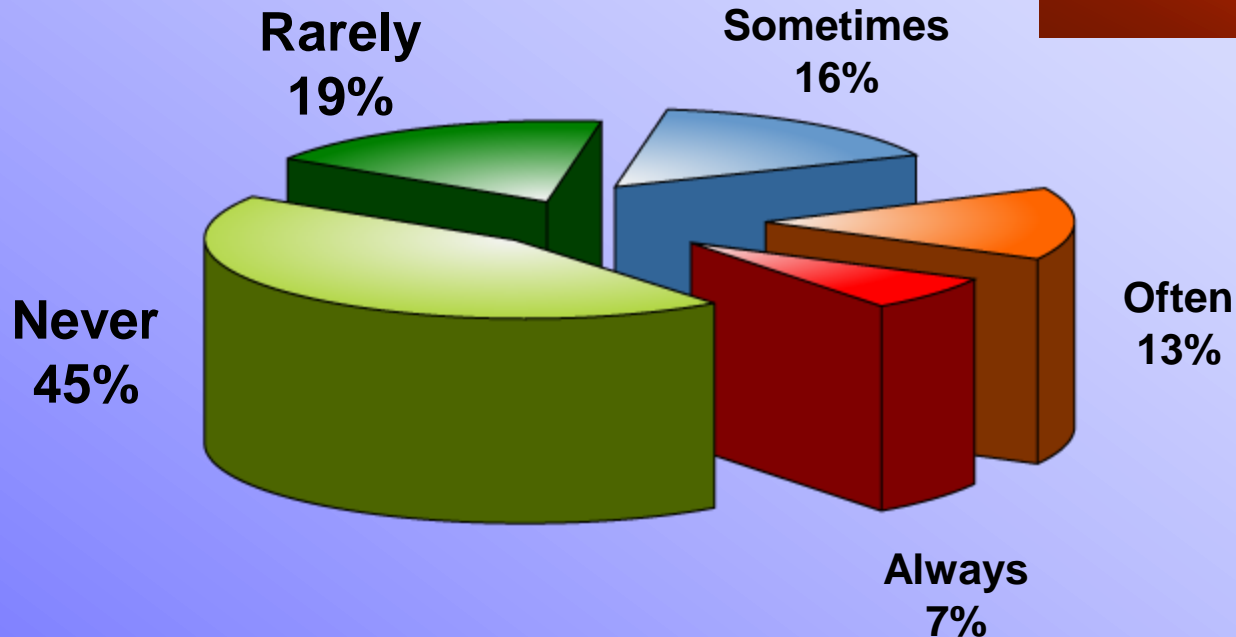


Spirit of IRIDIUM
by Robert T. McCall

Features and Functions

**Never or
Rarely Used:
64%**

**Always or
Often Used:
20%**



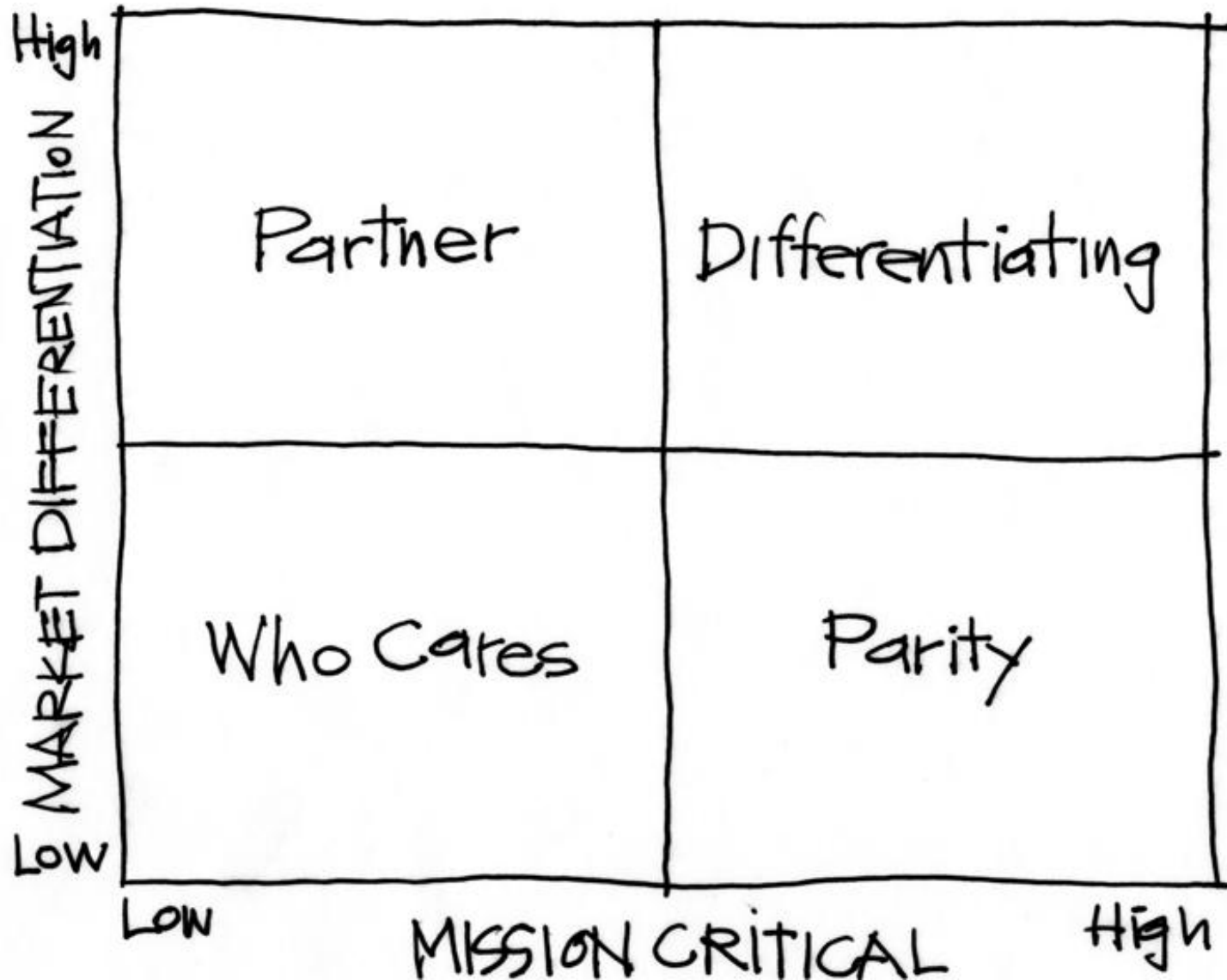
Powerful Questions are:
What are we building?
What Business are we in?



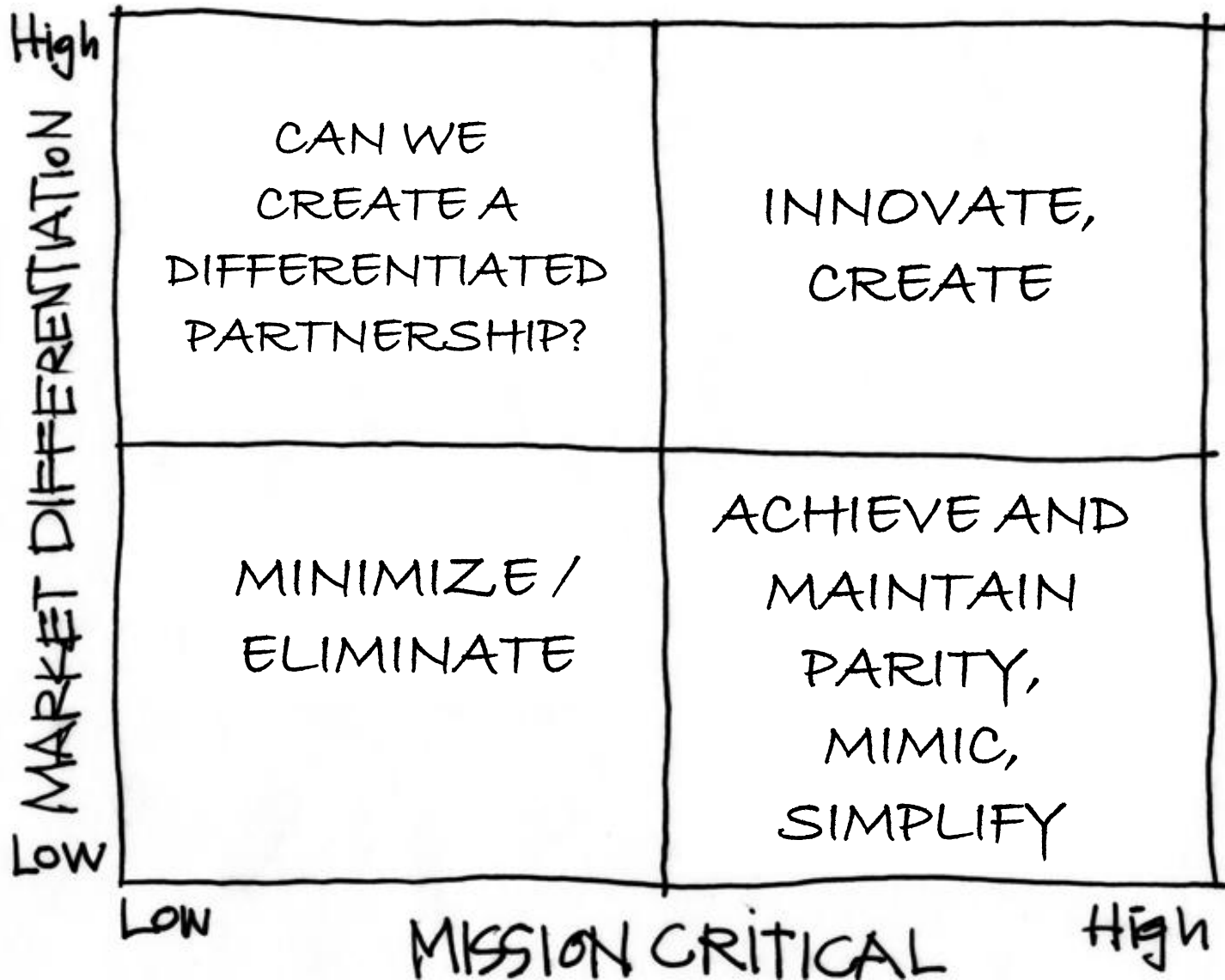
What
Building are
we in?



The Purpose Alignment Model



In Practice

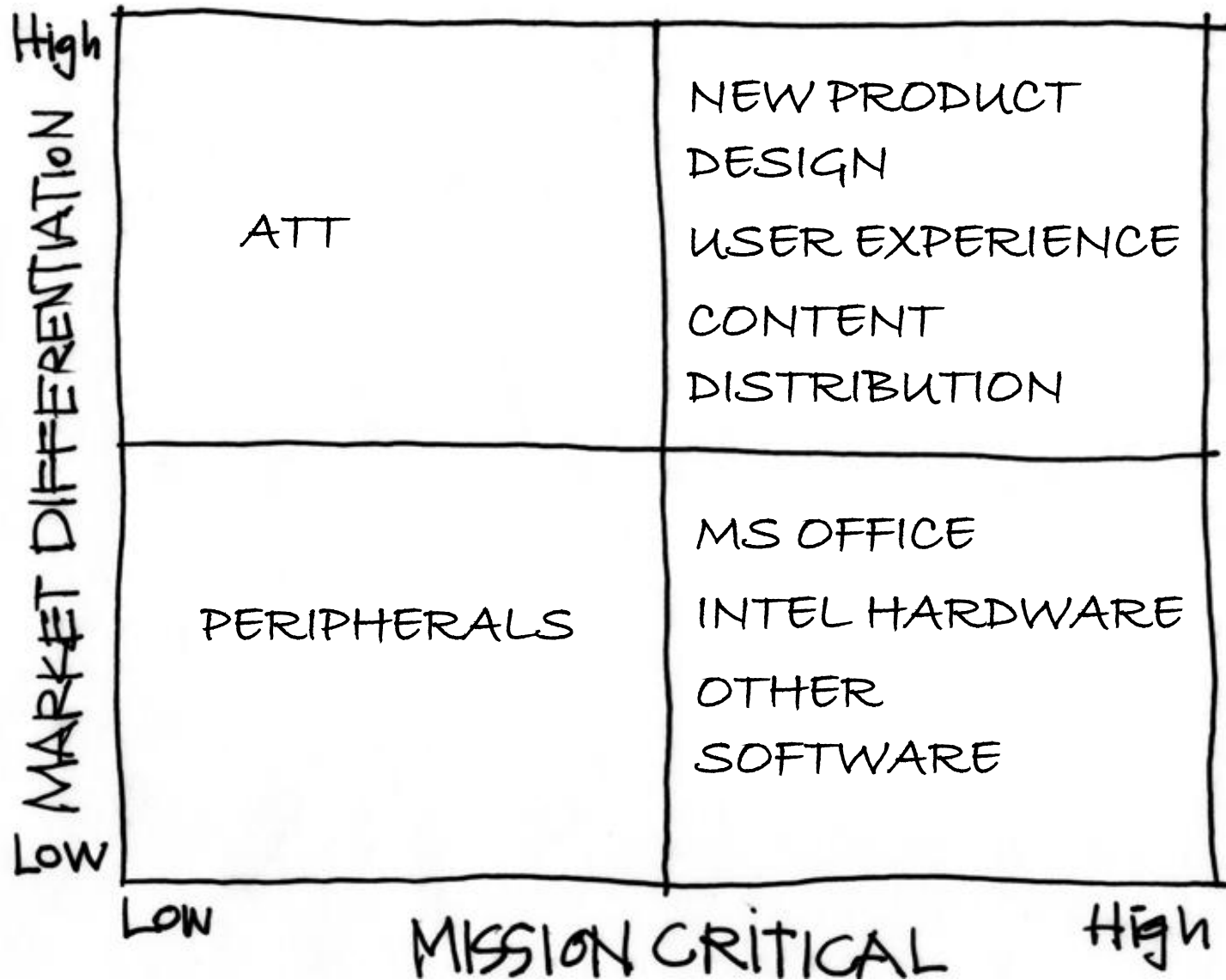


Applicable at all Levels

- Corporate Strategy
- Product Strategy



A View of Strategy - Apple





Business Case



Business Perspective

Sustainable competitive advantage



Individual Perspective

How can I sell this so that I can get more budget?



Delivery Failure



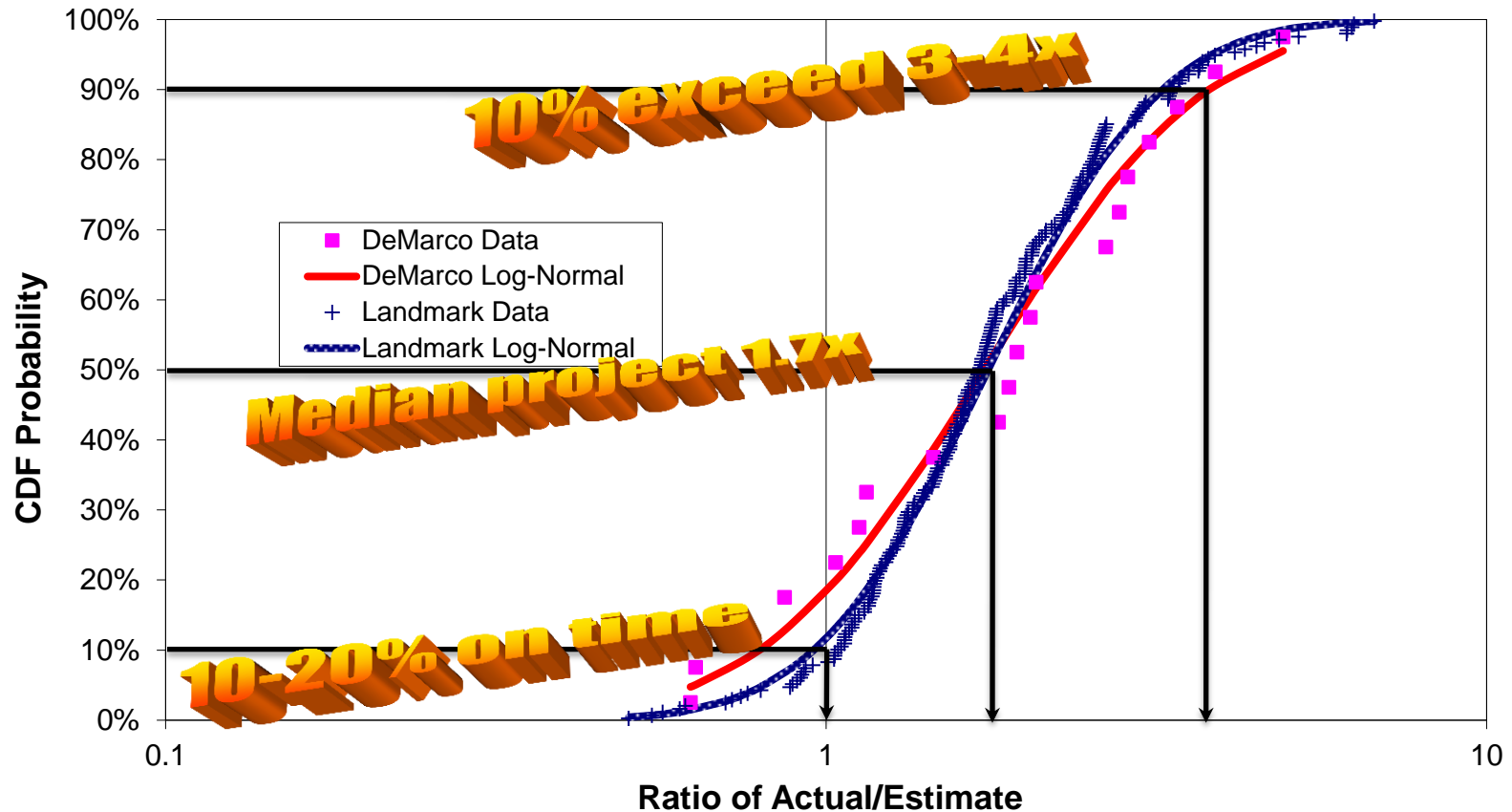
Late

Over Budget



Uncertainty Bounds

Cumulative Distribution Function of Actual/Estimate Ratio



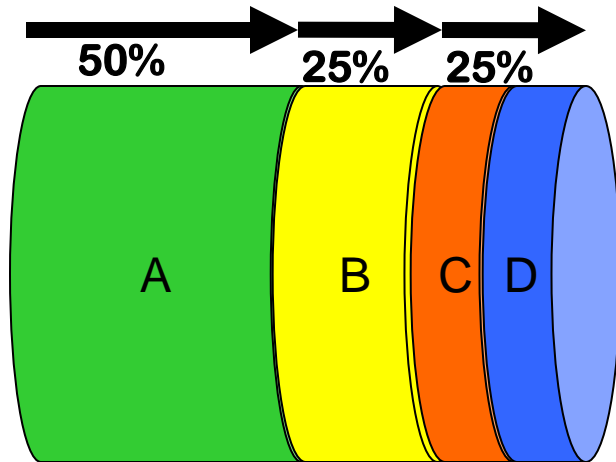
The A/B/C List sets proper expectations

A	MUST be completed in order to ship the product and the schedule will be slipped if necessary to make this commitment.
B	Is TARGETED to be completed in order to ship the product, but may be dropped without consequence.
C	Is NOT TARGETED to be completed prior to shipping, but might make it if time allows.

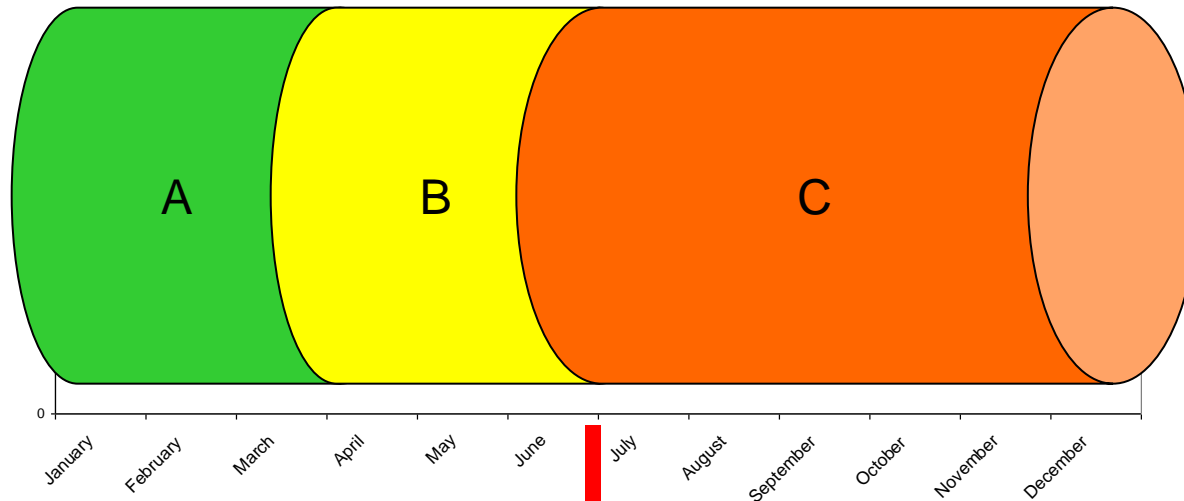
Only “A” features may be committed to customers.

If more than 50% of the planned effort is allocated to “A” items the project is at risk.

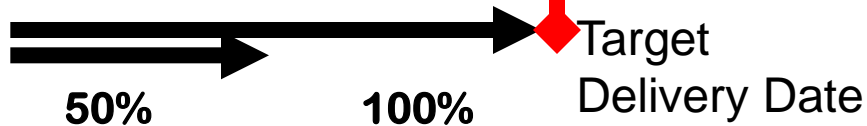
A/B/C List



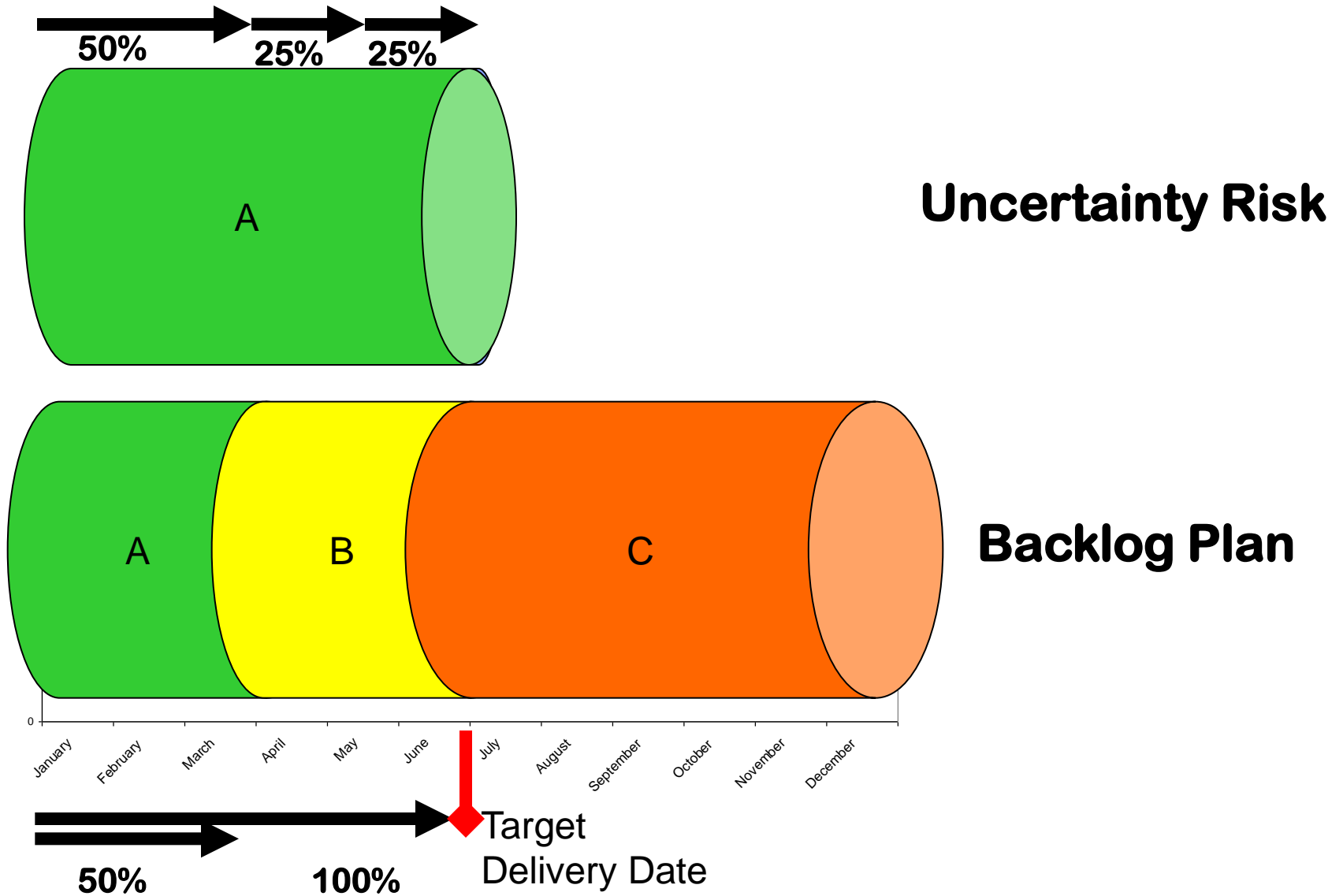
Typical Delivery



Backlog Plan



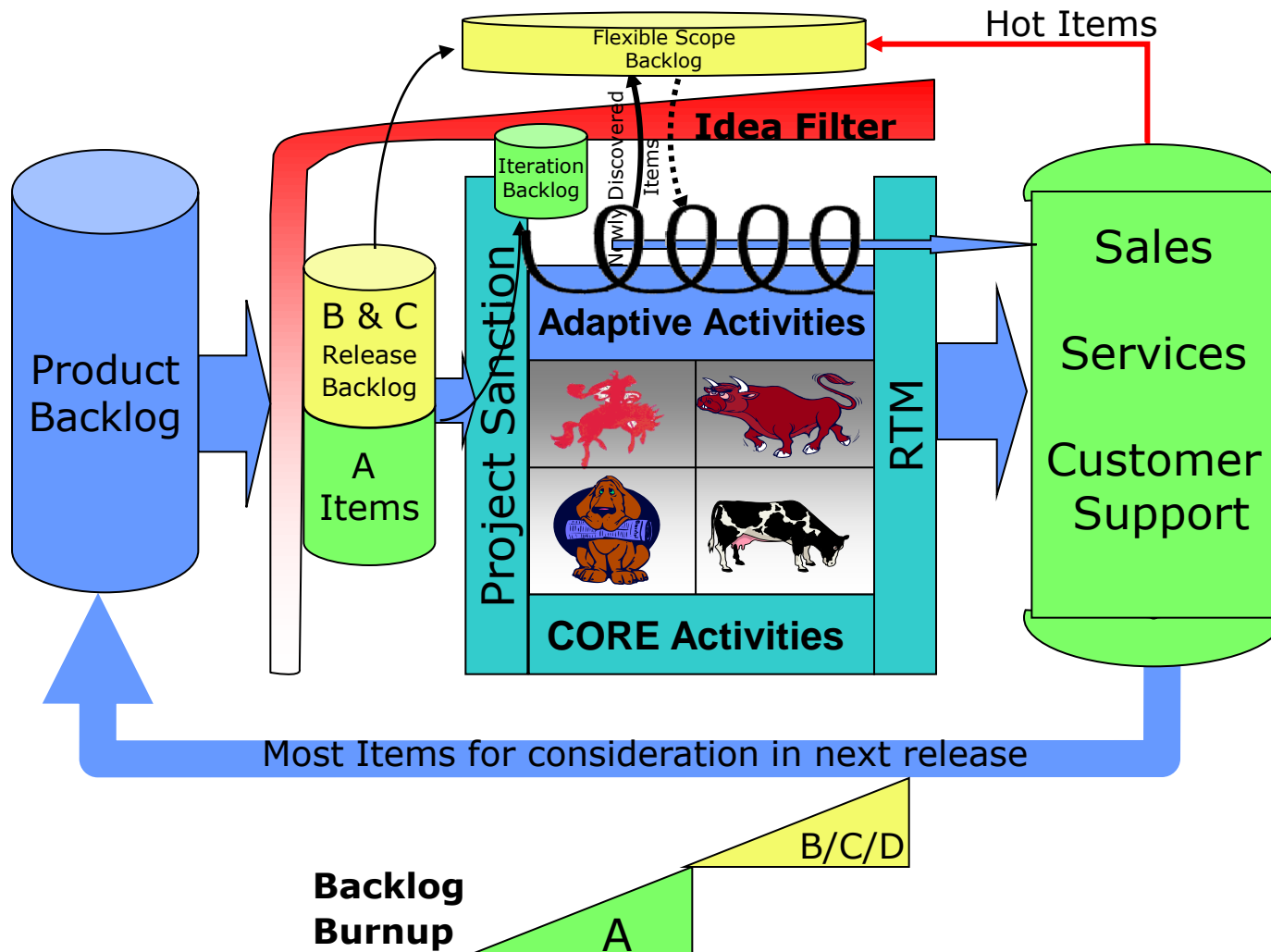
A/B/C List



Estimating Story Difficulty

Estimation				
XL				
L				
M				
S				
	S	M	L	XL
	Cost			

Product Innovation Flow



Risk Management = Expectation Management

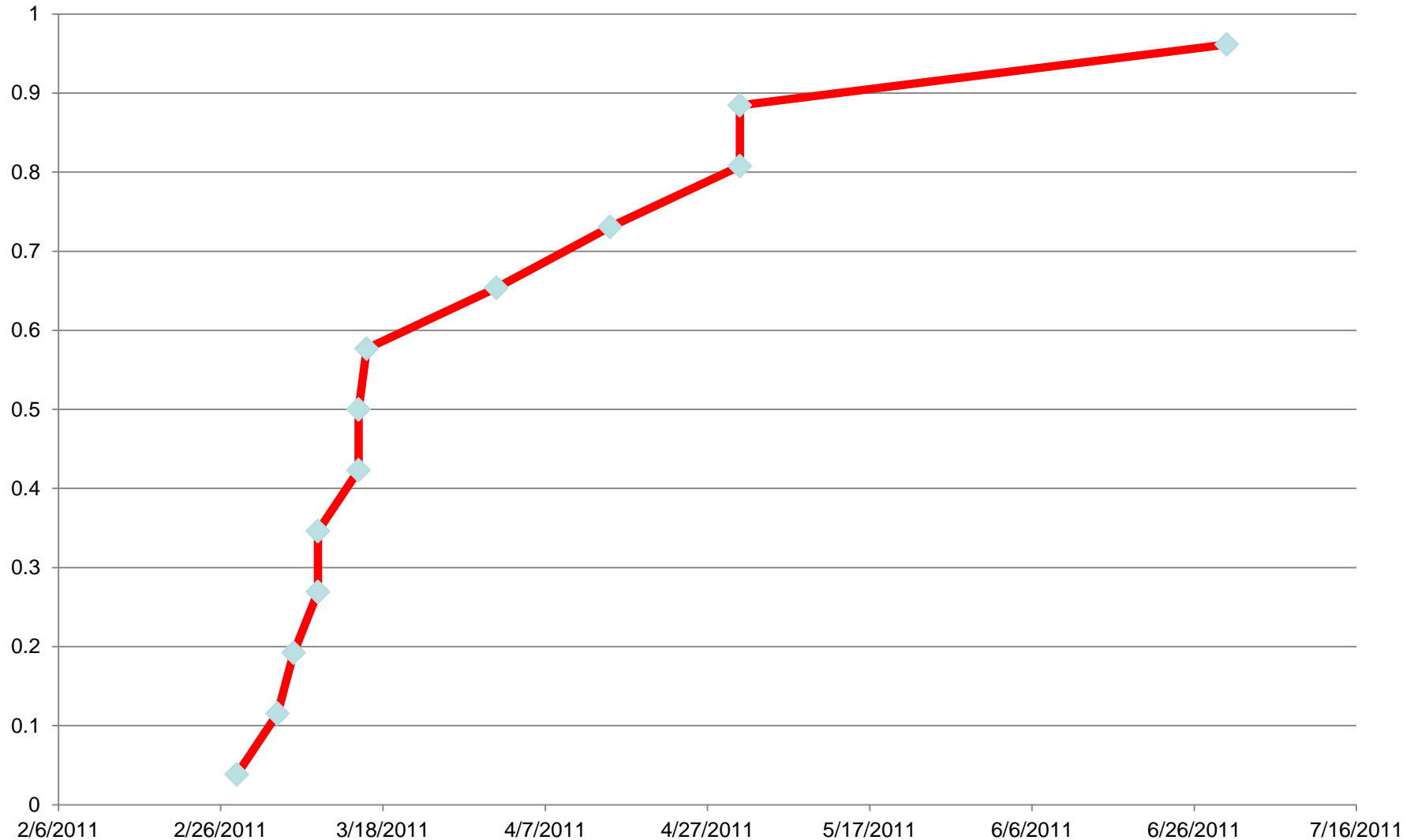
No
Surprises!



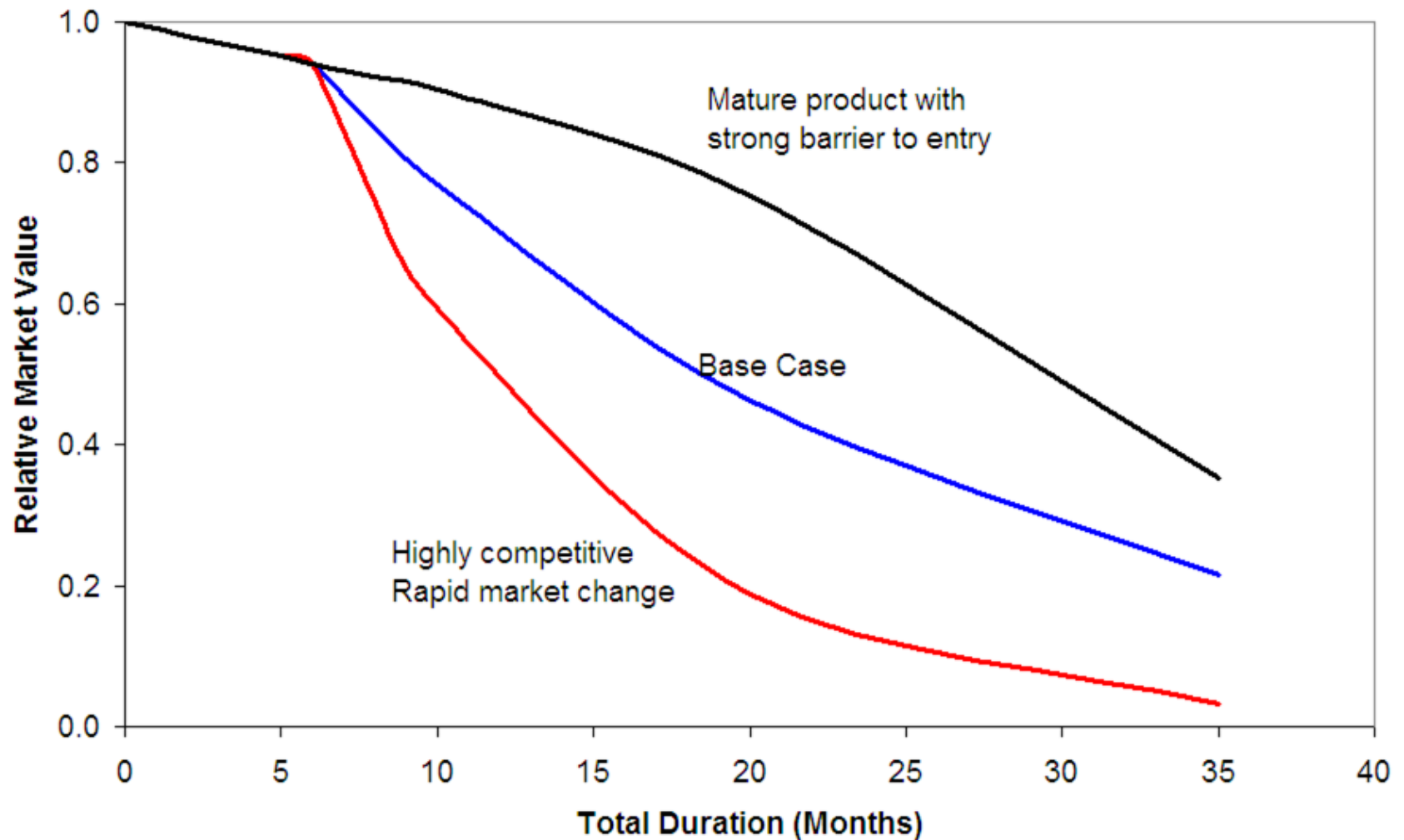
Iteration Review Questions

- What promises have been made, to whom were they made, and who made them?
- What key decisions or commitments might we have to make within the next 2 iterations?
- Questions to ask team anonymously
 - When will we be ready to ship?
 - Will we be able to keep our promises?
 - Is the team healthy and operating effectively?
 - Is the team on the right path?

Ask the Team



Cost of Delay



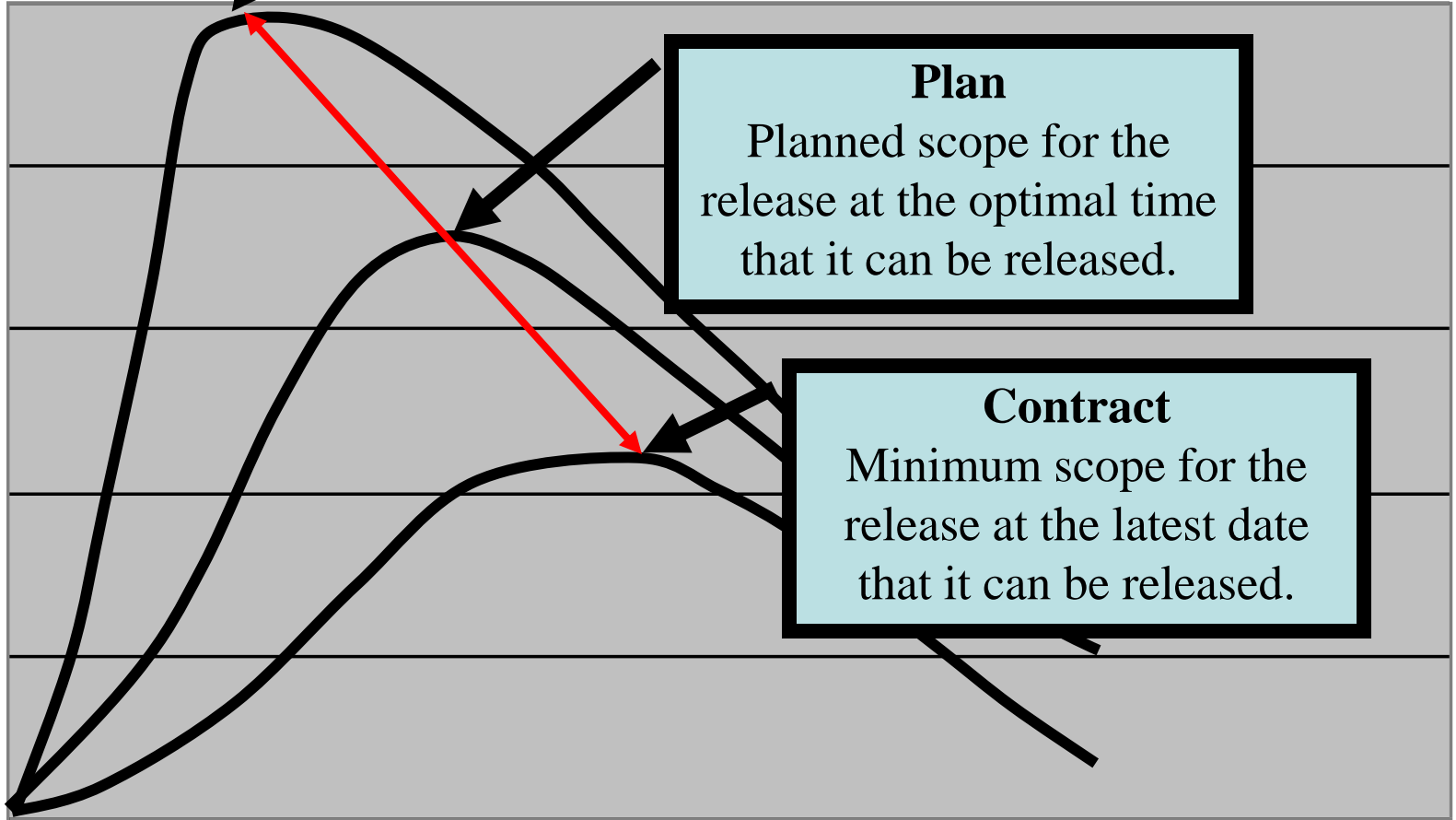
Target
Best possible scenario if everything went perfectly.

Plan
Planned scope for the release at the optimal time that it can be released.

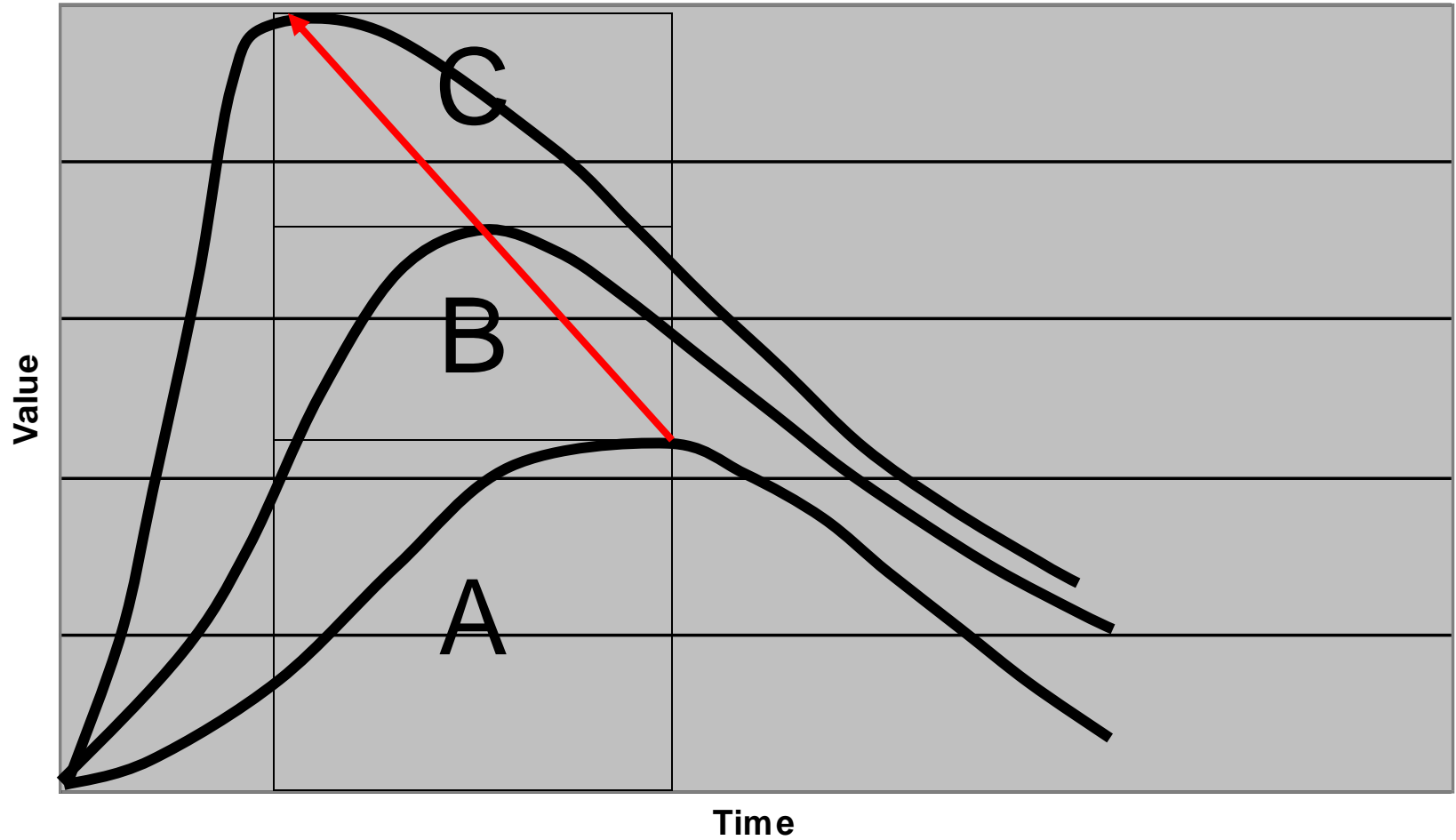
Contract
Minimum scope for the release at the latest date that it can be released.

Value

Time



Uncertainty



Tools for Delivery Risk

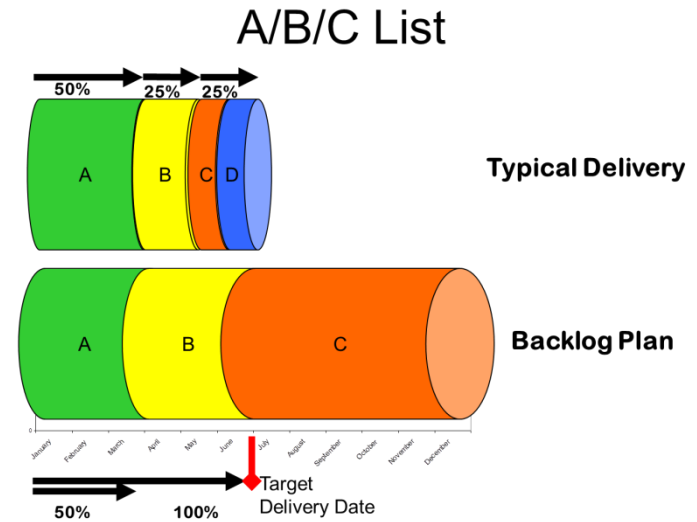
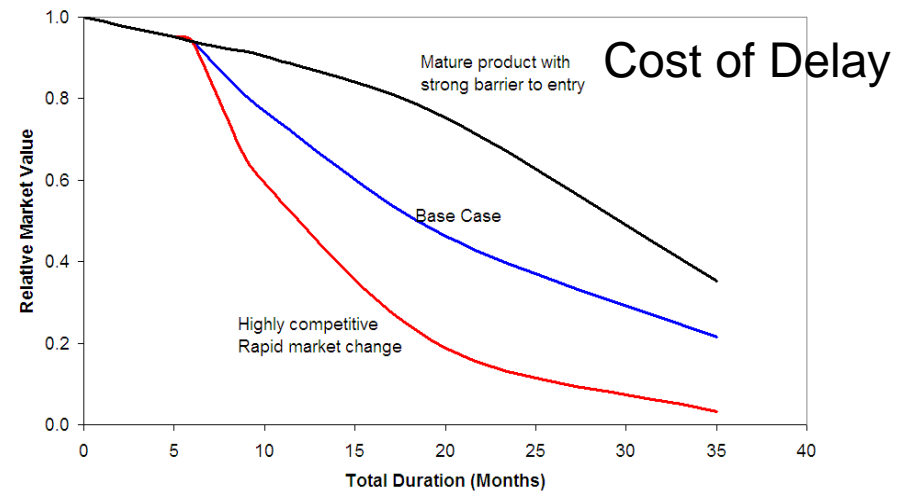
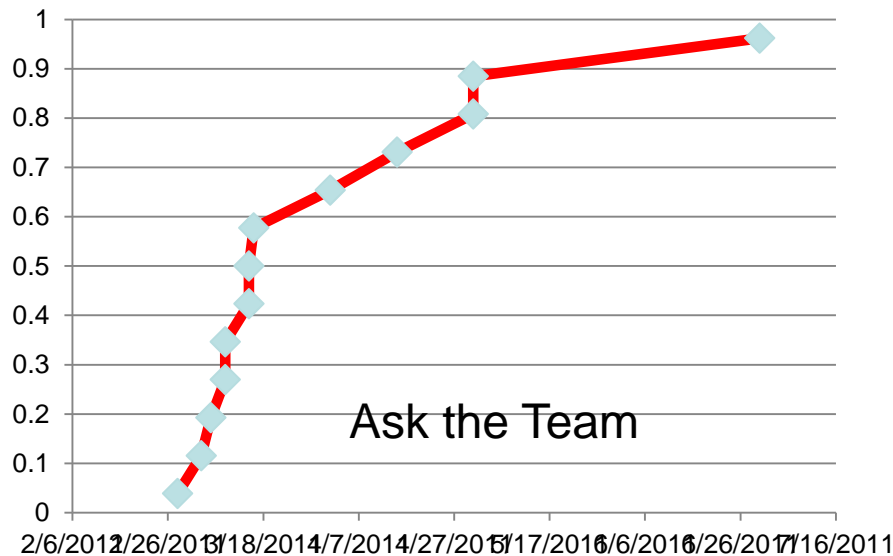


Figure 4: Relative Market Value Capture





Delivery Risk



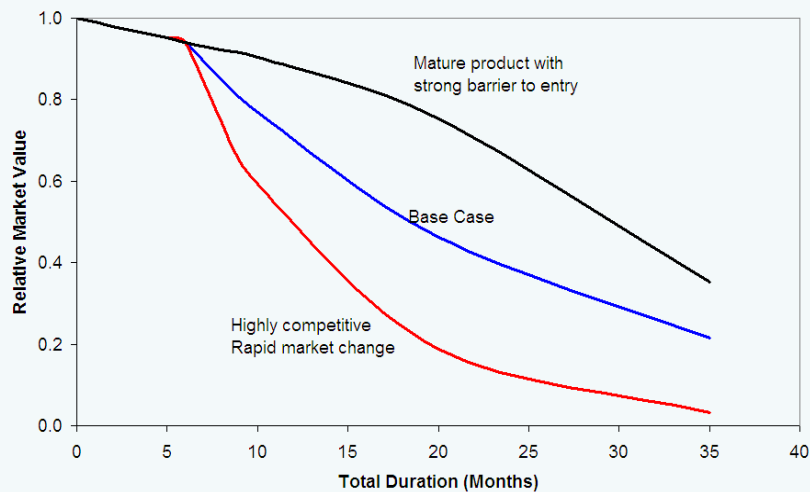
Business Perspective

Cost of Delay
Business Credibility

Individual Perspective

Personal Credibility

Figure 4: Relative Market Value Capture



Market Acceptance

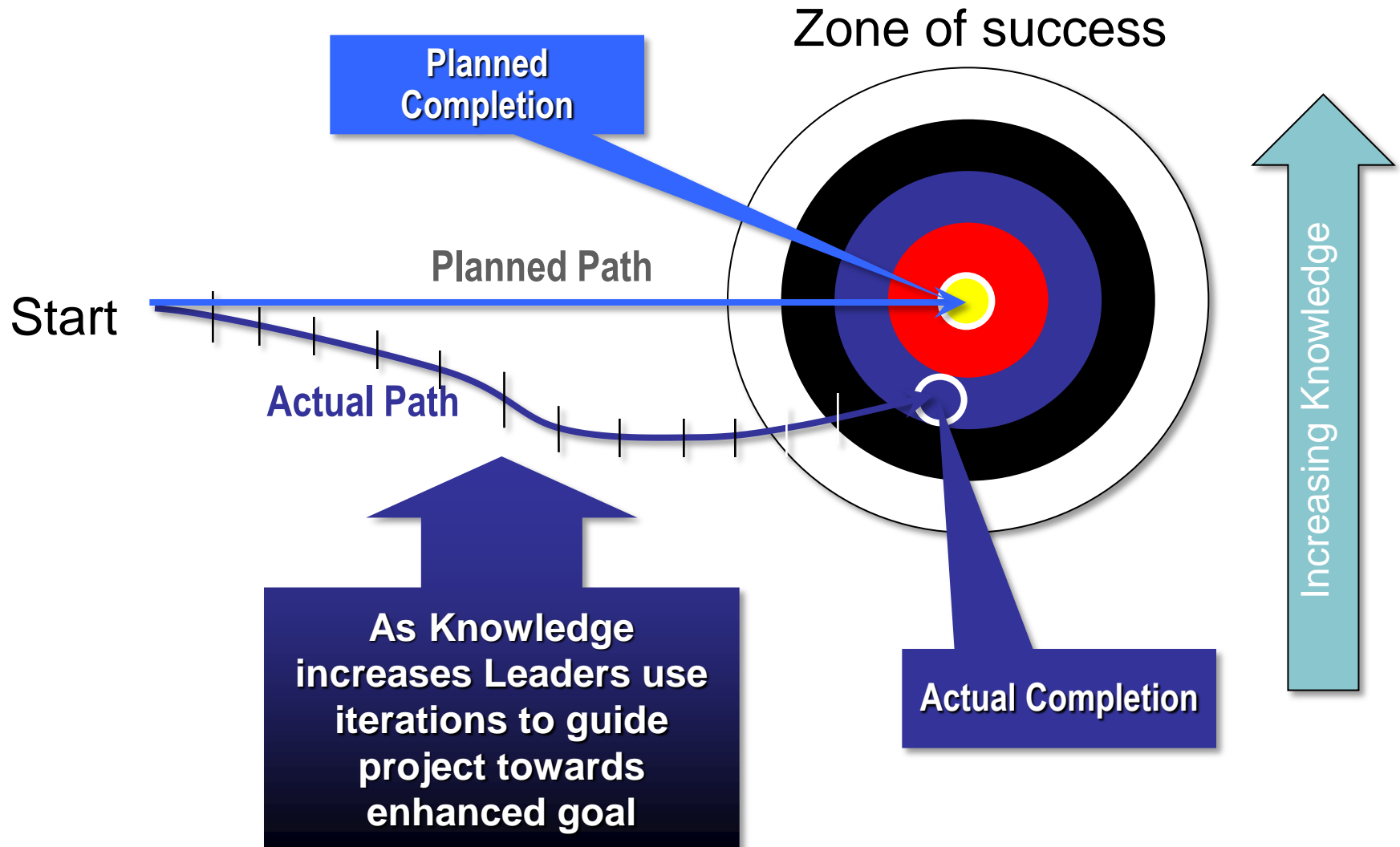


Features and Quality

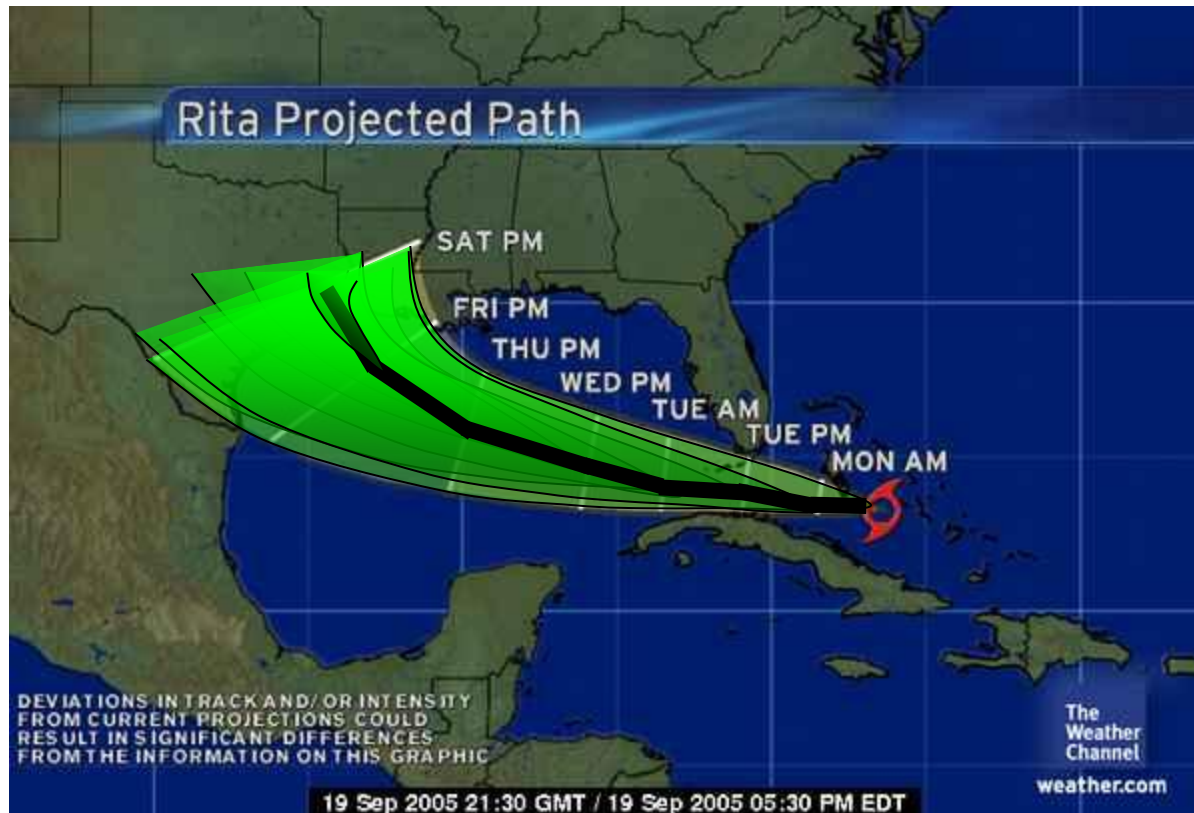


“I skate to where the puck is going to be, not where it has been.”

Allow Mid Course Corrections

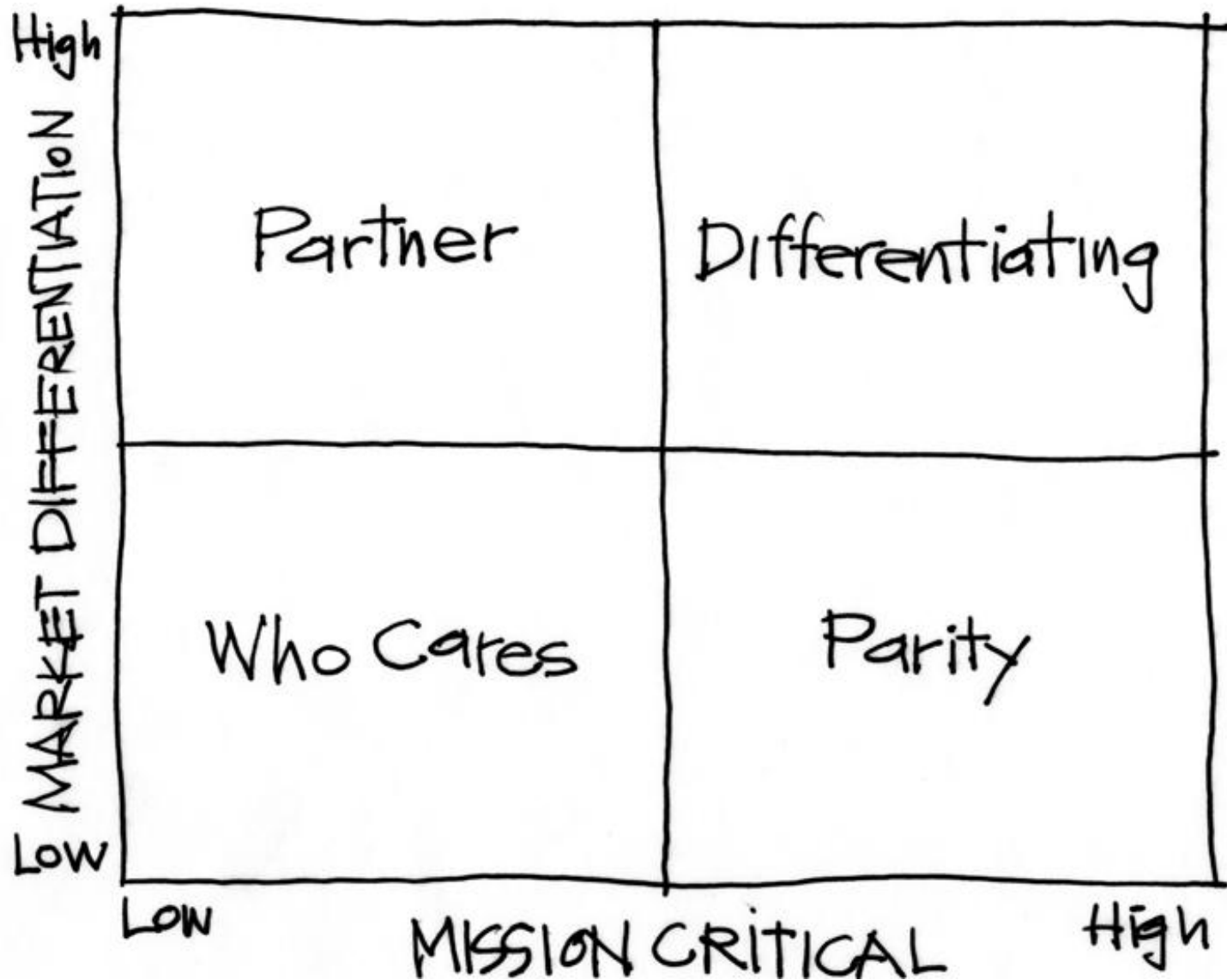


The Cone of Uncertainty



We expect **uncertainty** and manage for it through iterations, anticipation, and adaptation.

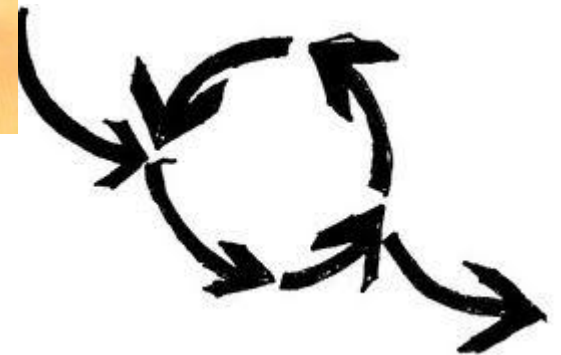
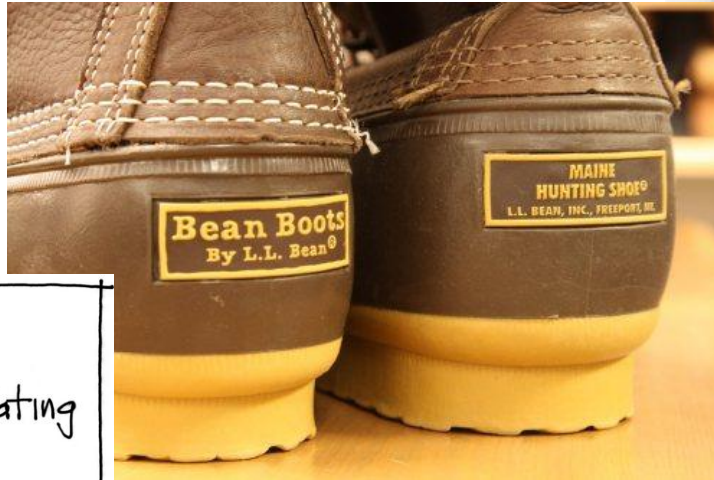
The Purpose Alignment Model



Quality and Market Acceptance Strategies



Seek and honor feedback



Incremental Delivery

CAUTION

**THIS SIGN HAS
SHARP EDGES**

DO NOT TOUCH THE EDGES OF THIS SIGN



ALSO, THE BRIDGE IS OUT AHEAD



Wrong Priorities



Compute This

"I recently asked a colleague [CIO] whether he would prefer to deliver a project somewhat late and over-budget but rich with business benefits or one that is on-time and underbudget but of scant value to the business. He thought it was a tough call, and then went for the on-time scenario. Delivering on-time and within budget is part of his IT department's performance metrics. Chasing after the elusive business value, over which he thought he had little control anyway, is not."

Cutter Sr. Consultant Helen Pukszta

Software Tornado Example

Item	-15M	0M	15M	30M	45M
Product Acceptance Uncertainty					
Schedule Uncertainty					
General Market Uncertainty					
Cost Uncertainty					

Software Tornado Example

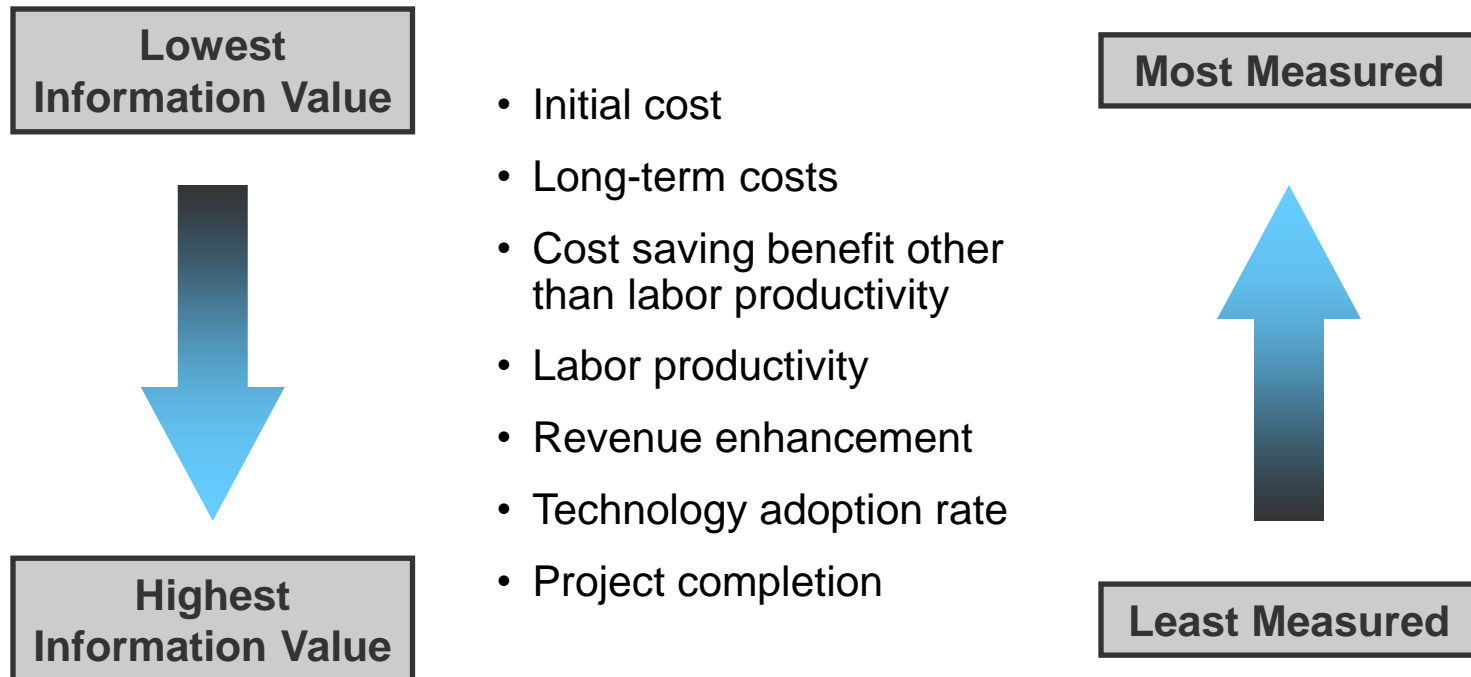
[illegible]

Software Tornado Example

Item	-15M		0M	15M	30M	45M
Product Acceptance Uncertainty						
Schedule Uncertainty						
General Market Uncertainty						
Cost Uncertainty						

The Measurement Inversion

In a business case, the economic value of measuring a variable is usually inversely proportional to the measurement attention it typically gets.





Market Acceptance

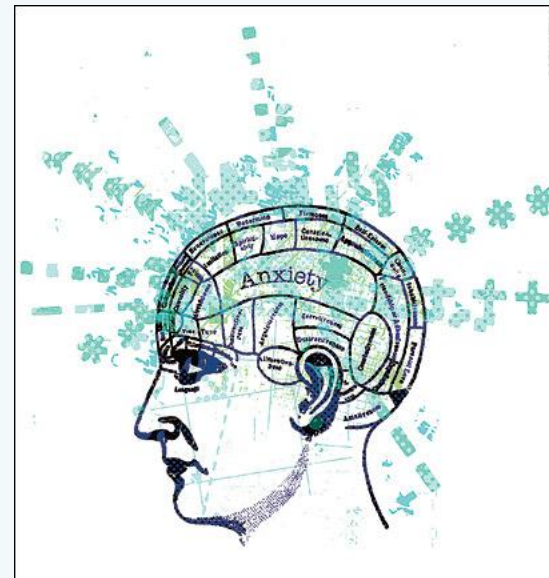


Business Perspective

Impact to revenue
Impact to credibility
Cost of rework

Individual Perspective

Priorities are often guided by other
perceived constraints



Political Risk



Change
or
Maintain

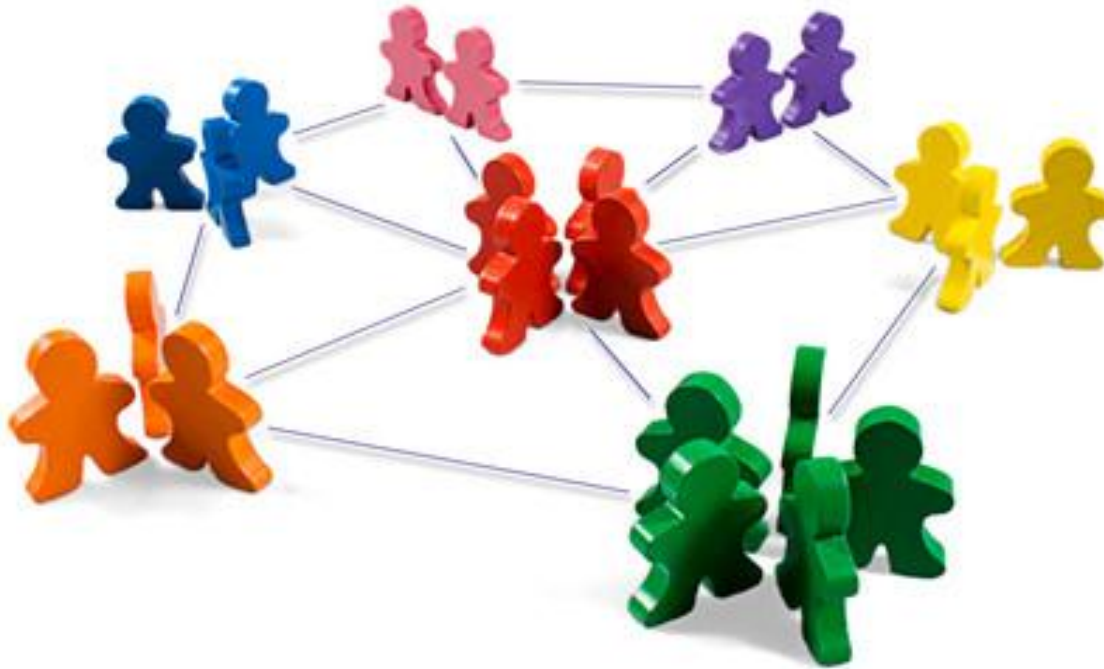


Political Challenges



Boss and above	Boss's Peers	Boss's Indirect Peers
You	Peers	Indirect Peers
Direct Reports	Peers' Reports	Indirect

Network



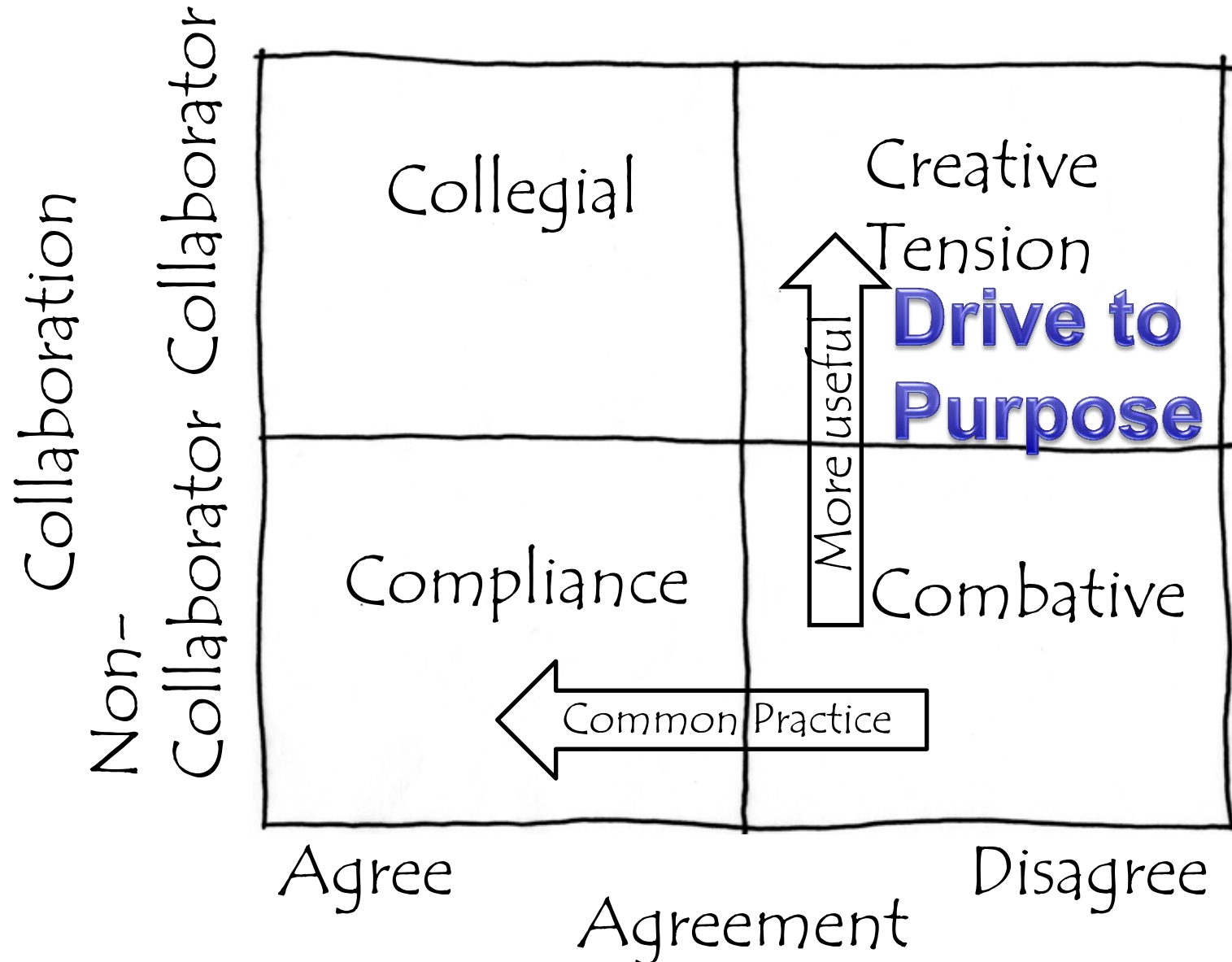
What's in it for them for everyone to succeed?
What do they worry about losing if you are successful?

Long Ago and Far, Far Away...

A group of people in military uniforms are standing in a hallway. The image is slightly blurred, and the text is overlaid on top. The text is in a white, serif font and reads "Management Project Review".

Management Project Review

Collaborating with Non-Collaborators



Agile Leadership





Politics



Business Perspective

Politics do not add to business value
other than by luck



Individual Perspective

Perception trumps Reality
Politics forms Perception



Final Summary

Risk	Business Perspective	Individual Perspective	Tools
Business Case	Strategic alignment with market need	Demonstrate Confidence	<ul style="list-style-type: none"> • Purpose Alignment Model
Collateral Damage	Could be catastrophic	Make or Break career. Individuals may be willing to take more risk than the organization	<ul style="list-style-type: none"> • Build quality in • Feedback loops
Delivery of Market/ Quality Need	Impact to revenue Impact to credibility Cost of rework	Depends on the individual - Priorities are often guided by other perceived constraints	<ul style="list-style-type: none"> • Customer Feedback
Delivery on Time or within Budget	Cost of Delay Reduction of ROI Business Credibility	Personal credibility	<ul style="list-style-type: none"> • Cost of Delay • Tornado Charts
Politics	Markets only care if politics influence external perception.	Perception trumps Reality Politics forms Perception	<ul style="list-style-type: none"> • Networking & Transparency • Collaborating with Non-Collaborators

Simulation Exercise



ID: 1 **Value: Sum of all dice**

Major feature

Test: Roll 3 dice - 2 or more dice are the same

Commit Points: 2

Stories and Scoring

We will run 3 iterations,
with 10 rolls of the dice per
iteration

WIP limit of one story in
progress

Must commit to 15 pts for
the release, and 5 pt per
iteration

ID: 1 Value: Sum of all dice

Major feature

Test: Roll 3 dice - 2 or more dice are the
same

Commit Points: 2

- Points (Value pts and Commit pts) are scored for accepted stories.
- Total points are $\text{Value} + 10 * \text{Commit Points Made}$.
- Value is just an estimate...the market will decide

Special Actions

- Information
 - At the cost of one roll, you may pre-roll your next turn prior to selecting the story to work on.
- Flexibility
 - At the cost of one roll, you may designate that the story that you will be working on can be refactored at a future date, i.e. you first accept the story, but if a future roll gives an improved result, you may use that roll for the new value
- It is ok abandon a story
- It is ok to redo a story

Estimating Story Difficulty

Estimation				
XL				
L				
M				
S				
	S	M	L	XL
Cost				

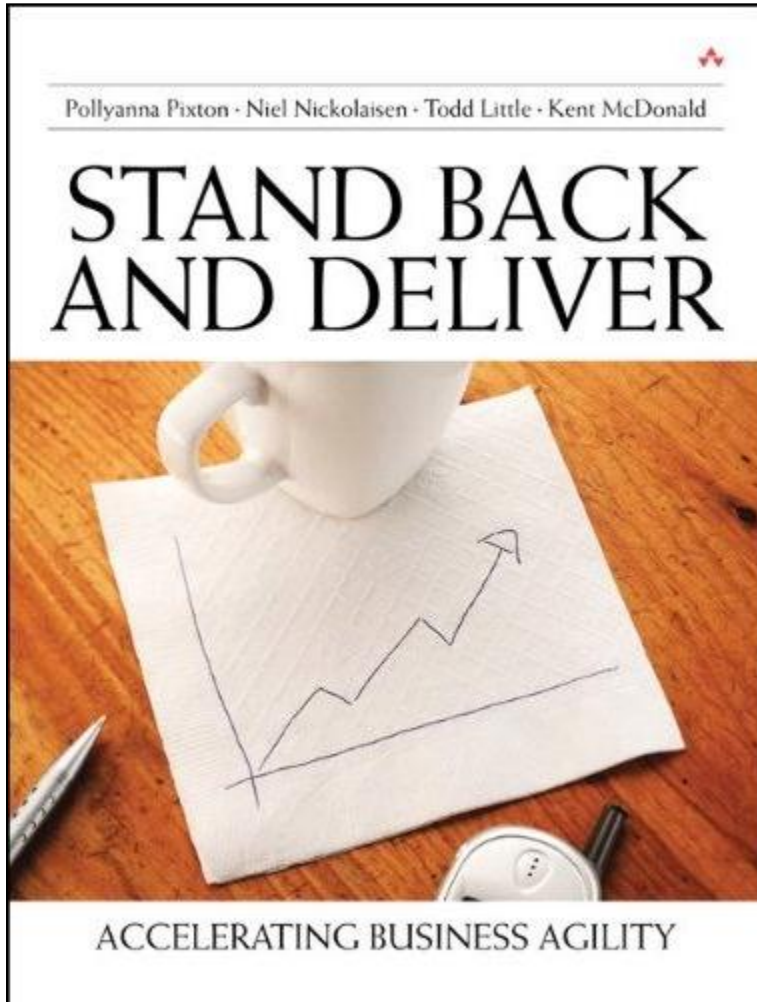
The Progress Board

Backlog	Committed	In Work	Accepted
Committed for this release (A) Cutline Potential stories	Committed for this iteration	In Development	Passes test criteria

Risk Management is not Risk Aversion



Contact



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www.toddlittleweb.com

www.accelinnova.com

Extra Slides

Why is
Software
Late?

From the home office in ~~Duncan, Oklahoma~~
Dubai, UAE

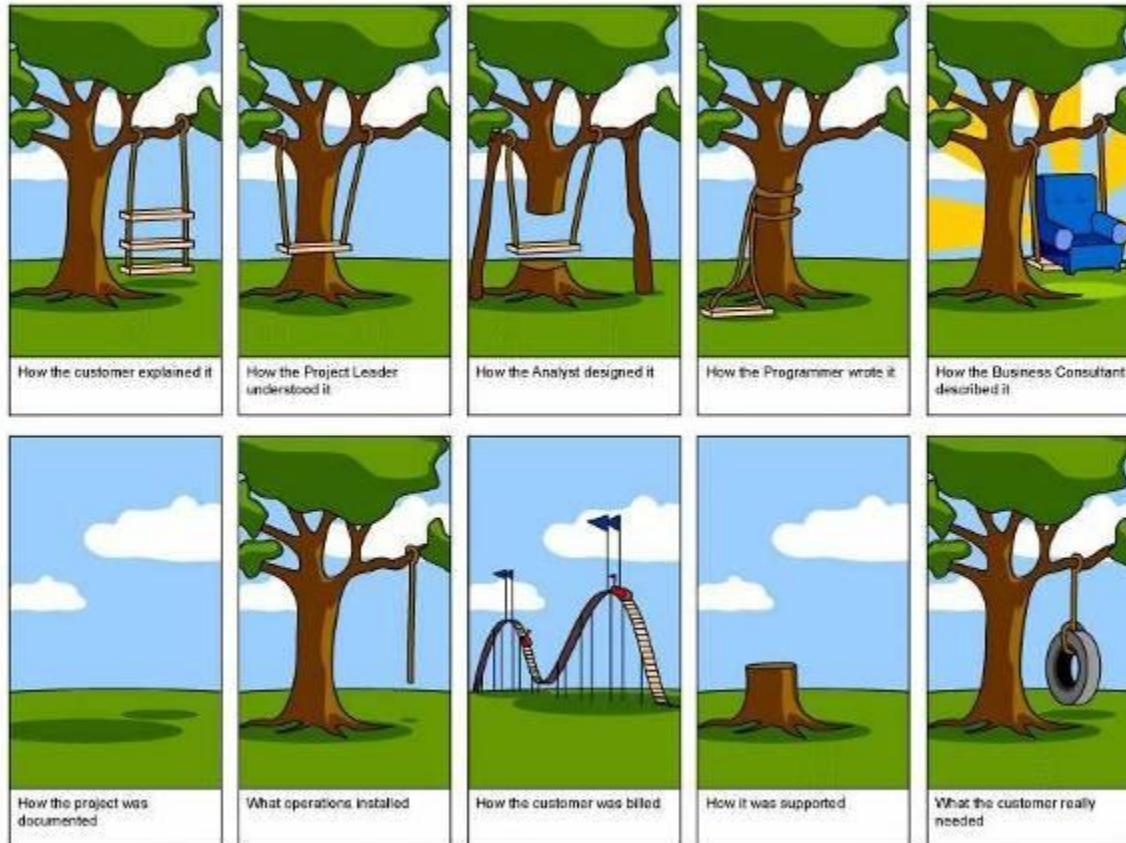
Top Ten reasons why software is late



Top 10 List

Top Ten reasons why software is late

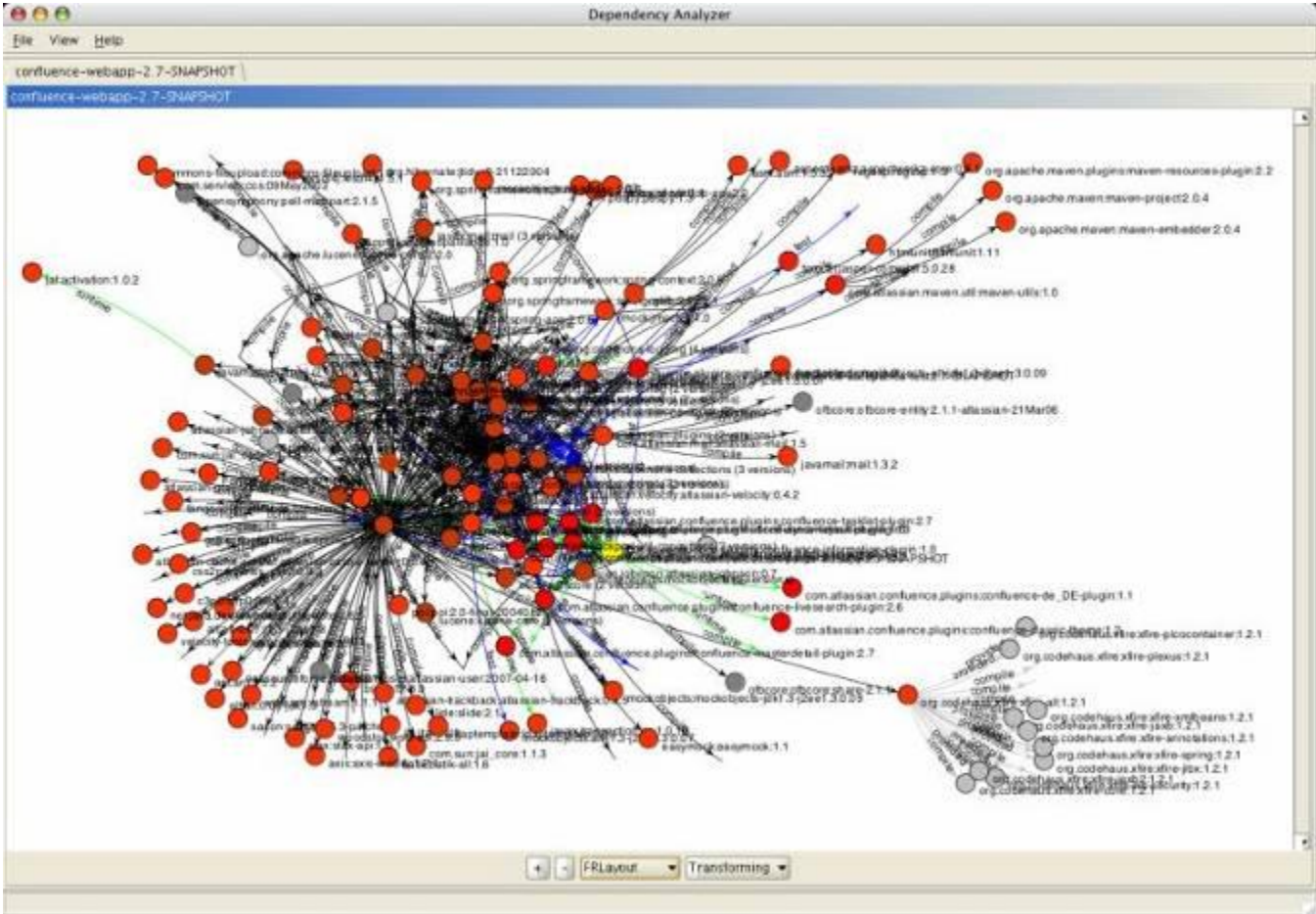
10: Requirements, what Requirements?



What you want, baby I got it

R-E-Q-U-I-R-E
Find out what it means to me

9: Dependencies on other groups that were late



Top Ten reasons why software is late

8: Over-optimistic Schedule Estimation



Always look on the bright side of code

.....

Always look on the bright side of code

.....

**The code's a piece of \$#!^,
when we look at it**

We can always overlook a minor kink . . .

It probably compiles, it might even link . .

Surely that must mean it doesn't stink

Top Ten reasons why software is late

7: Those weren't MY estimates

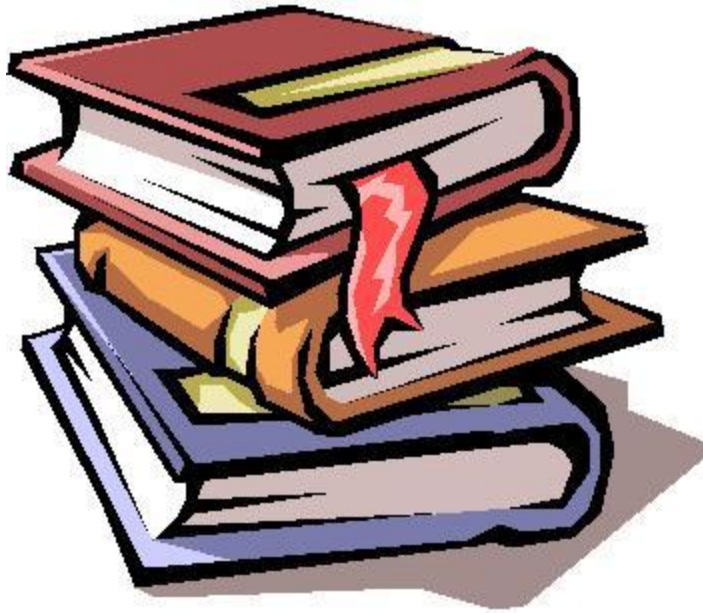
Scheduling Ritual



How low can you go!

Top Ten reasons why software is late

6: Not enough testers or documentation resources.



Who needs them anyway? We put those bugs--I mean features--in there on purpose. Besides, it was difficult to program, it should be difficult to use.

Top Ten reasons why software is late

5: Offshore and Outsourcing issues

My source code lies over the ocean,
My source code lies over the sea .
My source code lies over the ocean,
Oh bring back my source code to me

.....

Bring Back, Bring Back,
oh bring back my source code to me, to me
Bring Back, Bring Back,
oh bring back my source code to me

Top Ten reasons why software is late

4: One word, Ch-ch-ch-changes



Top Ten reasons why software is late

3: I can't get no, System Admin

- I can't get no, CM action
- 'cause I try,
- ..and I try,
-and I try,
-and I try....



Top Ten reasons why software is late

2: You didn't give me the headcount that
you promised



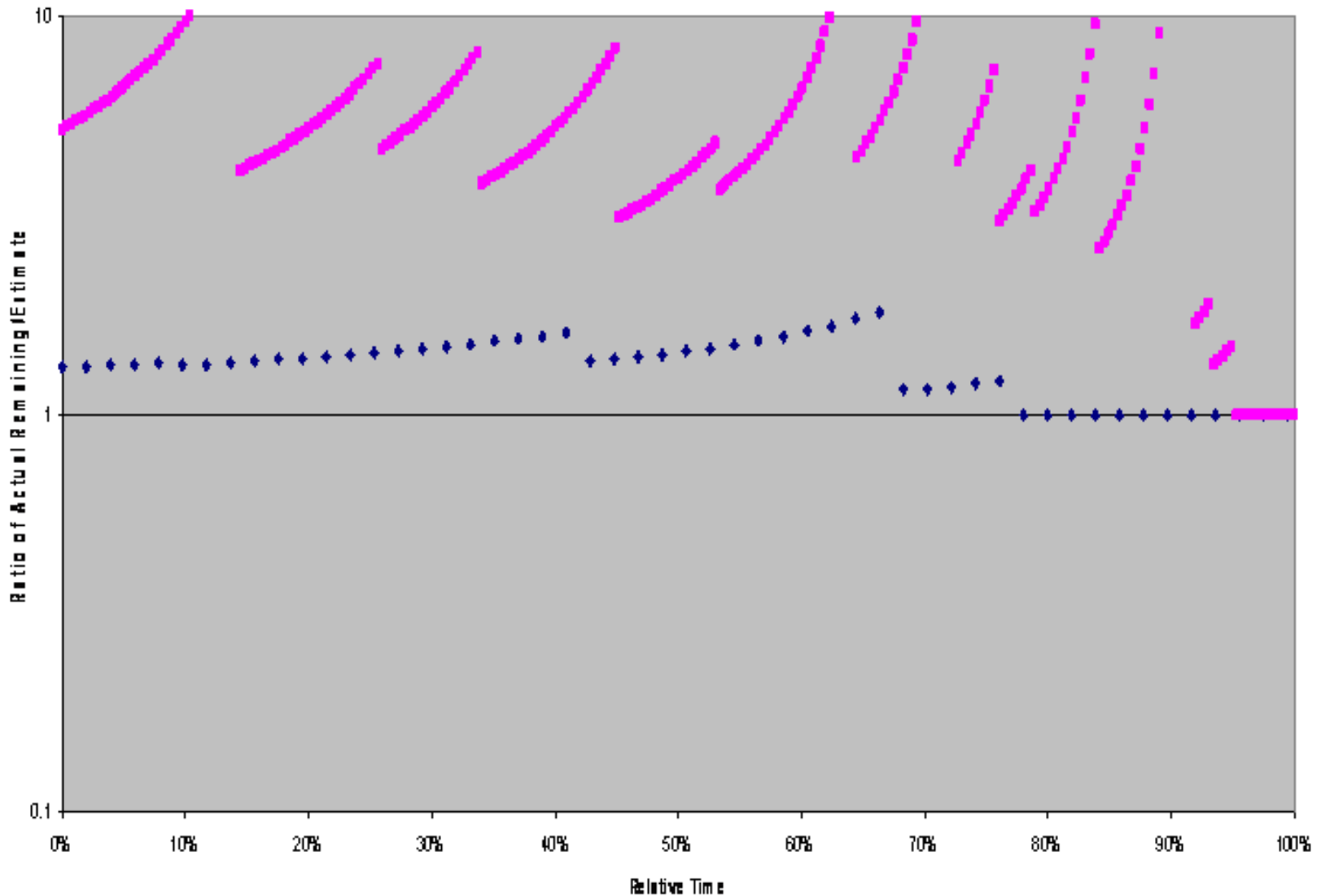
Top Ten reasons why software is late

1: Weren't you doing the backups!?



USAF File, 1952

Successful Projects?

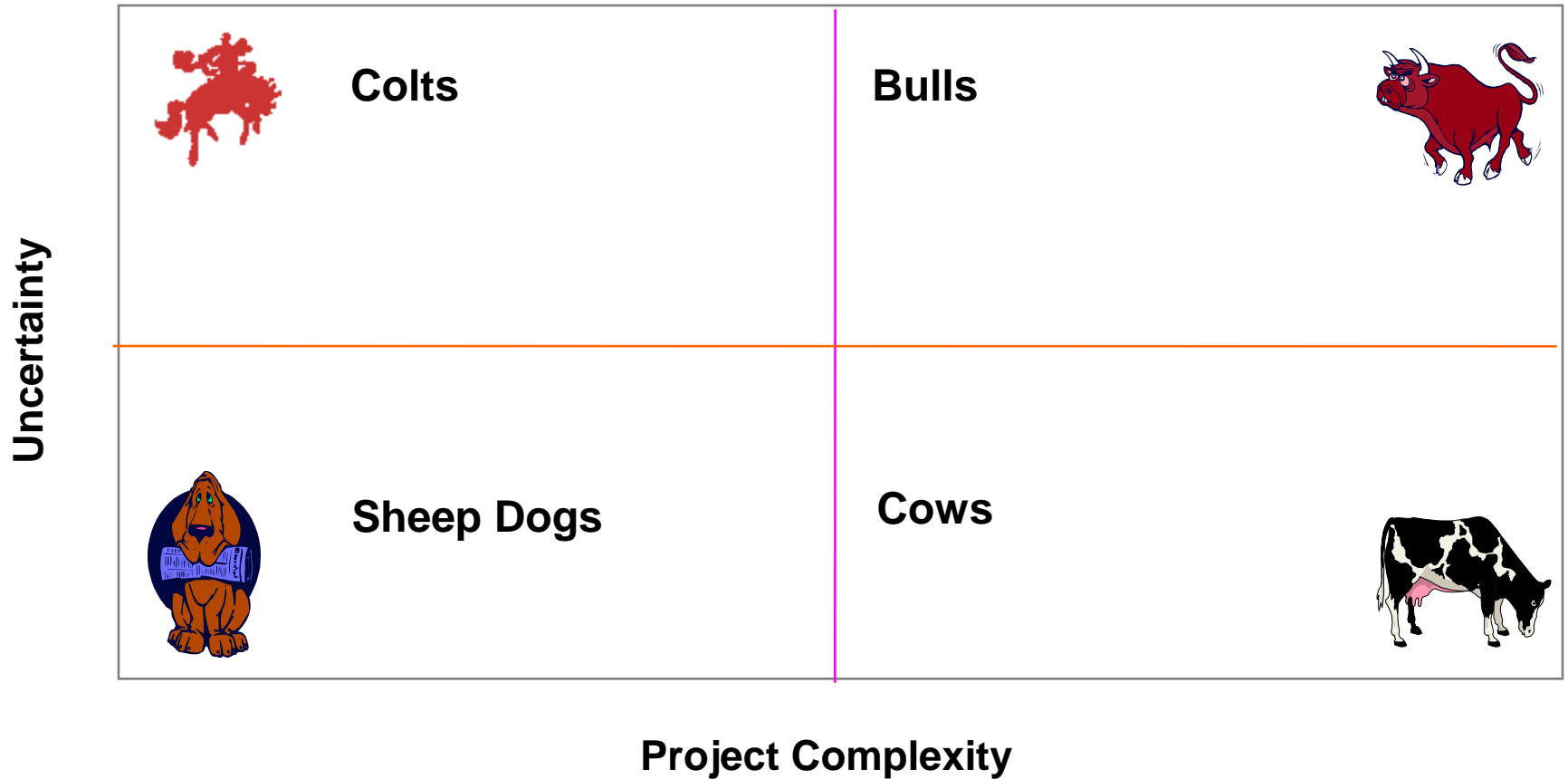


Risk and Context

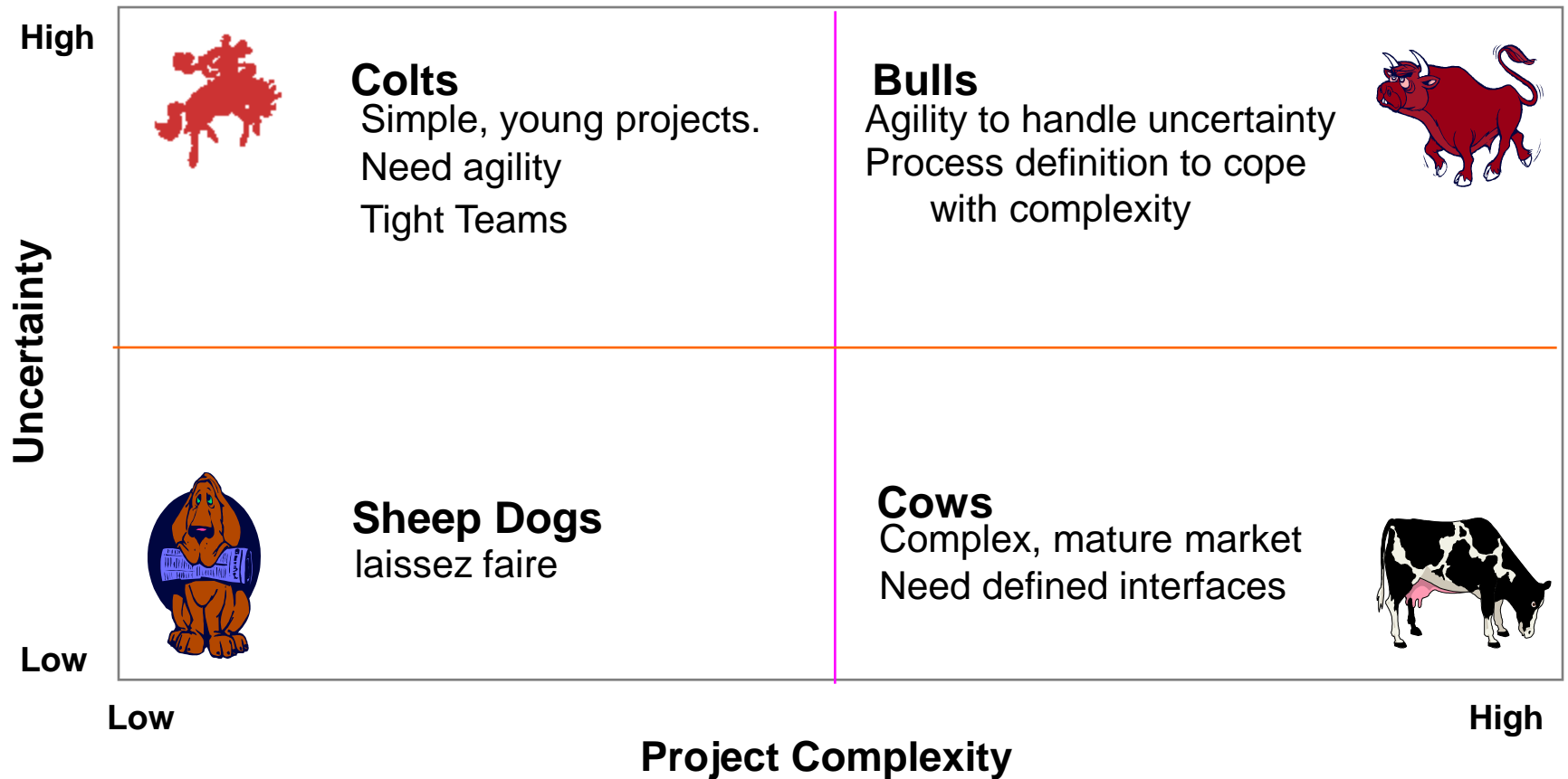
- One Size Doesn't Fit All



Context Leadership Model



Context Leadership Model



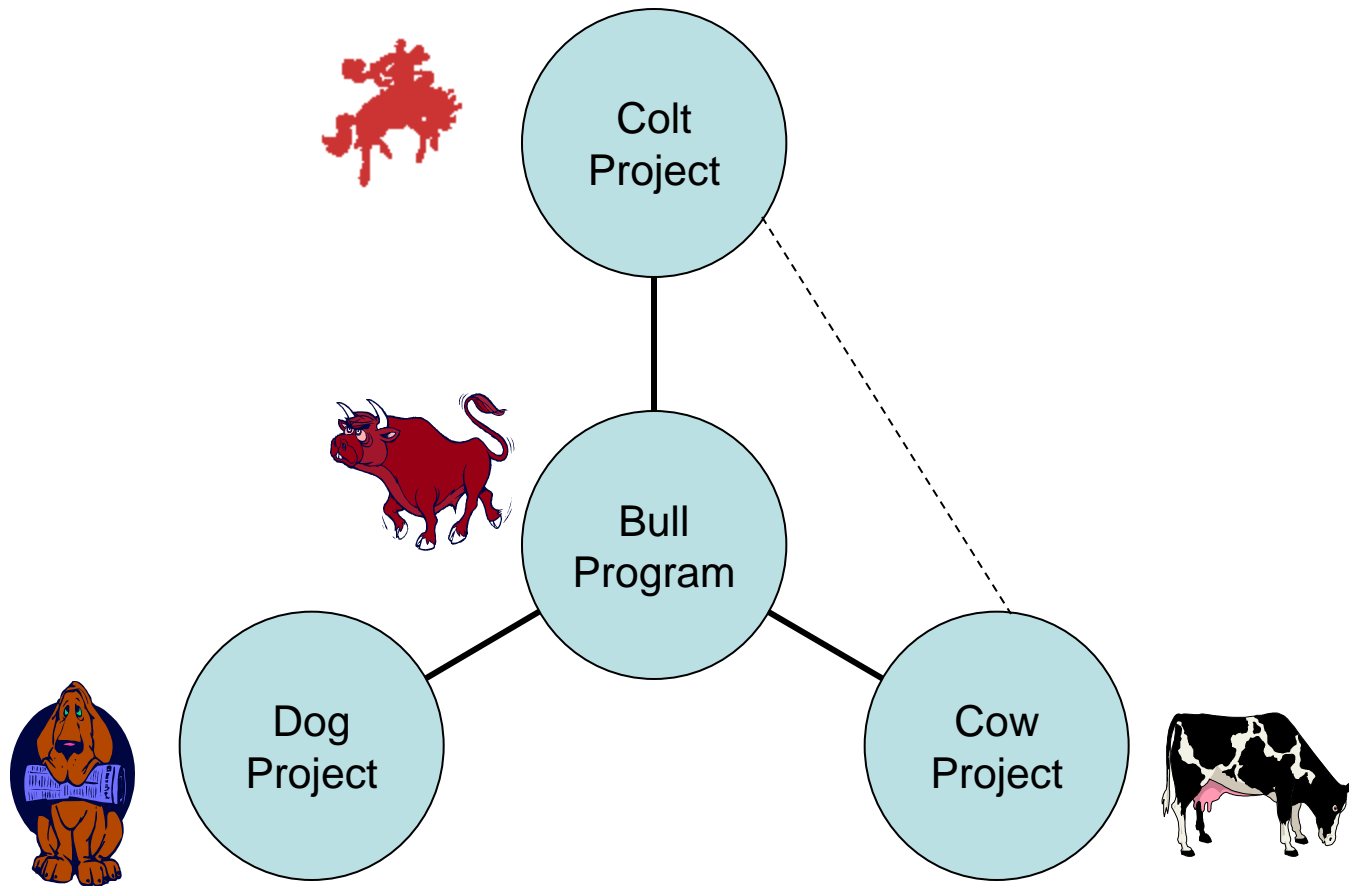
Bull Product Release



Reduce Uncertainty or Complexity

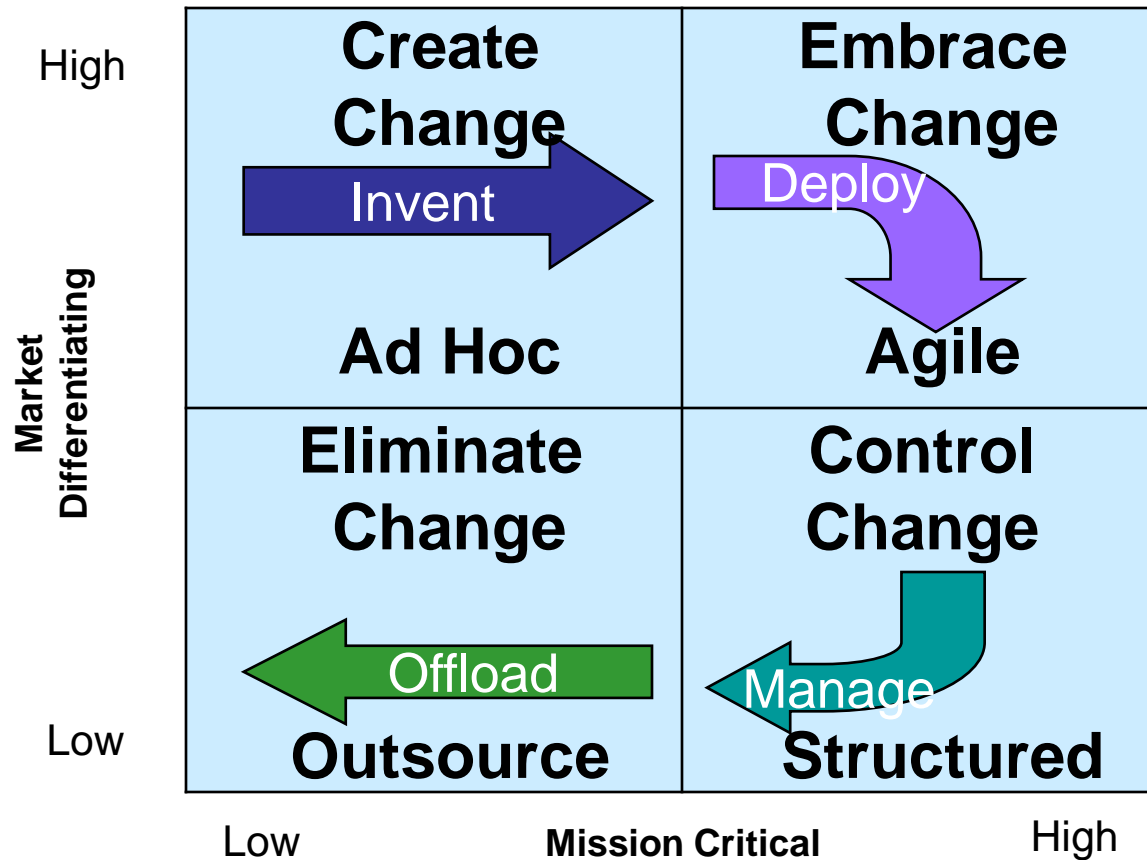
Uncertainty		Complexity	
Attribute	Score	Attribute	Score
Market	<div></div>	Team Size	<div></div>
Technical	<div></div>	Mission Critical	<div></div>
# Customers	<div></div>	Team Location	<div></div>
Duration	<div></div>	Team Maturity	<div></div>
Change	<div></div>	Domain Gaps	<div></div>
		Dependencies	<div></div>
Opportunities to Reduce Uncertainty: <ul style="list-style-type: none">• Use proven technologies• Reduce project duration		Opportunities to Reduce Complexity: <ul style="list-style-type: none">• Collocate the team• Break project into sub-projects	

Partitioning

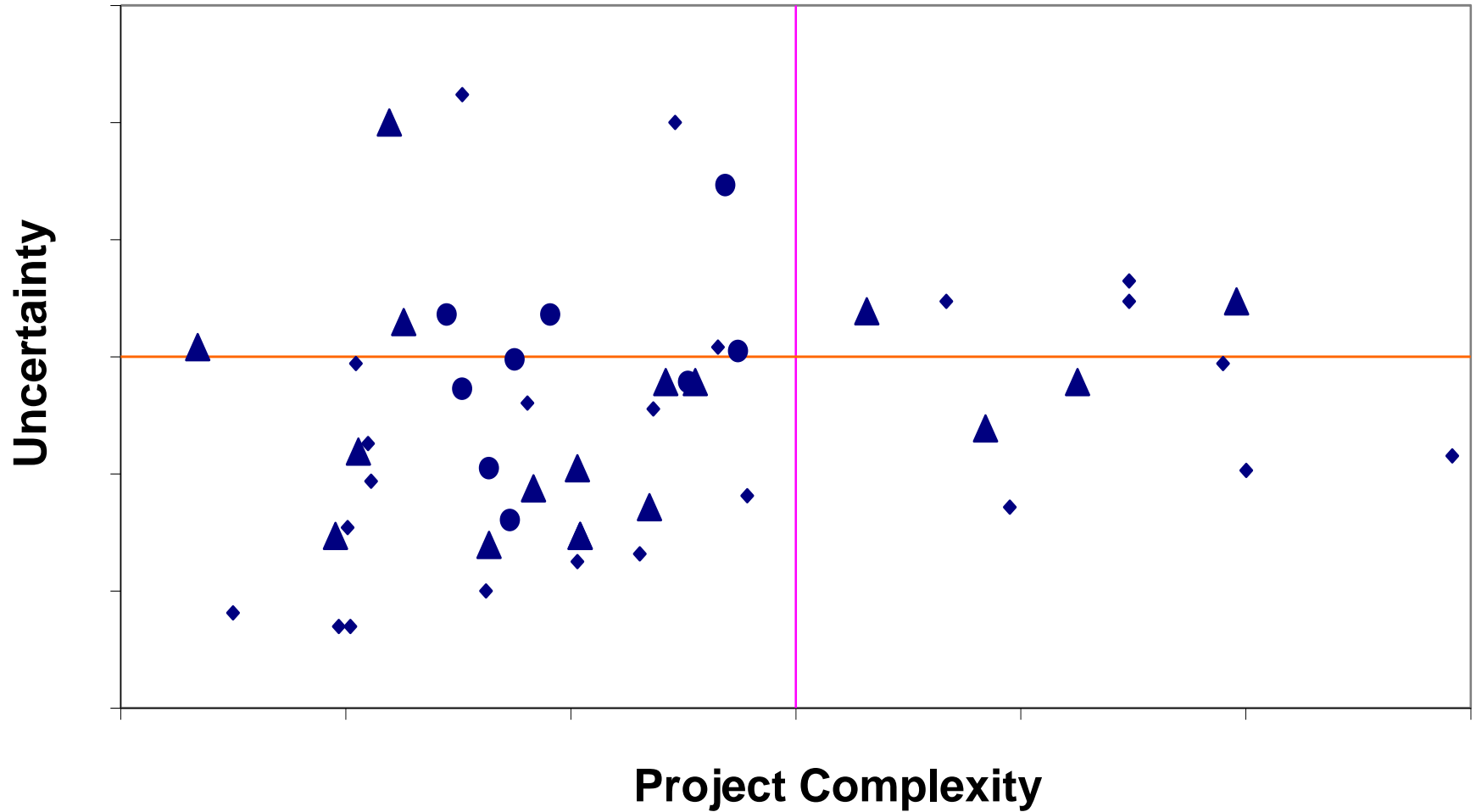


Remember: Loose Coupling and Strong Cohesion

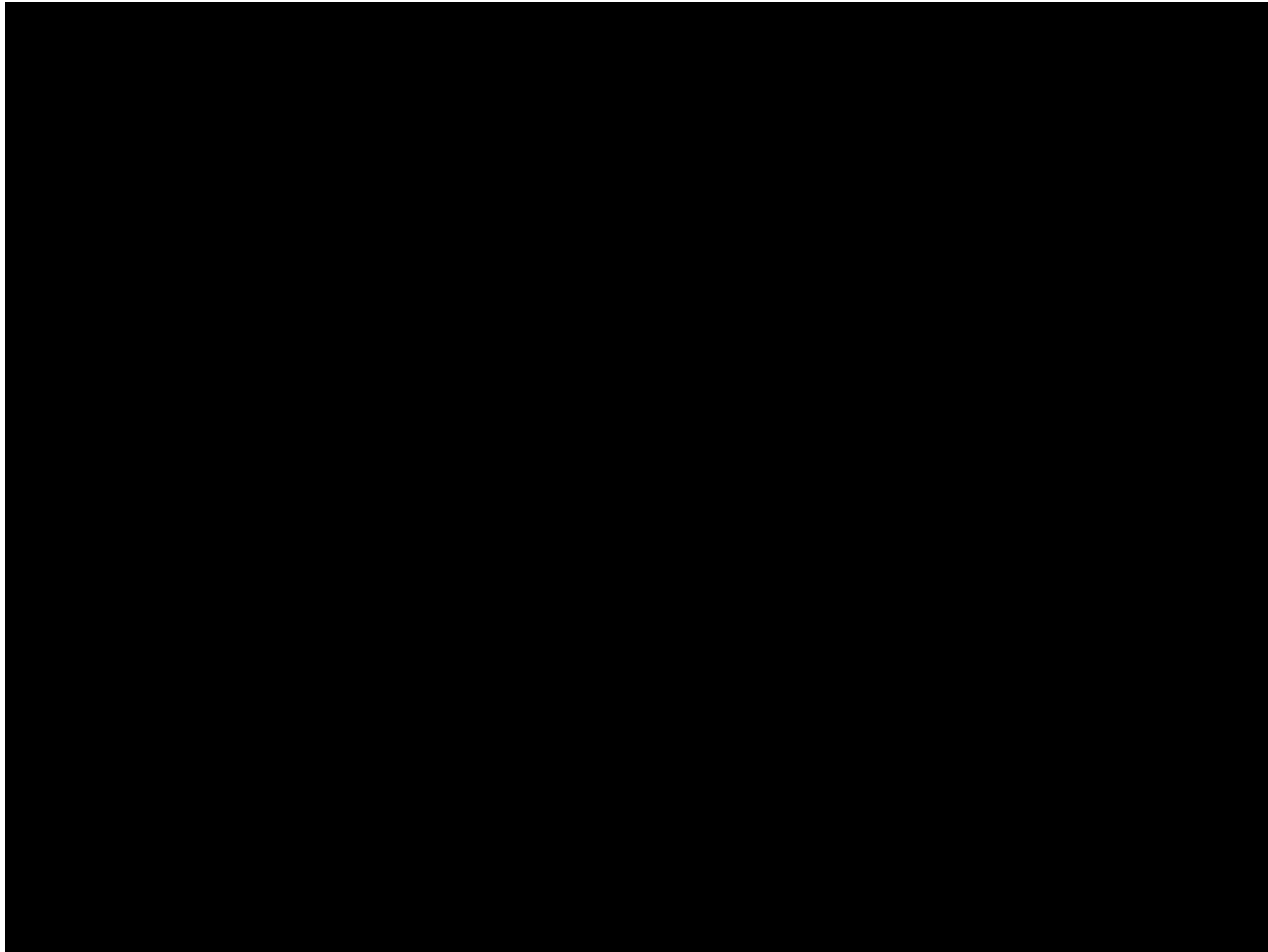
Project Leadership Guide



Portfolio Management



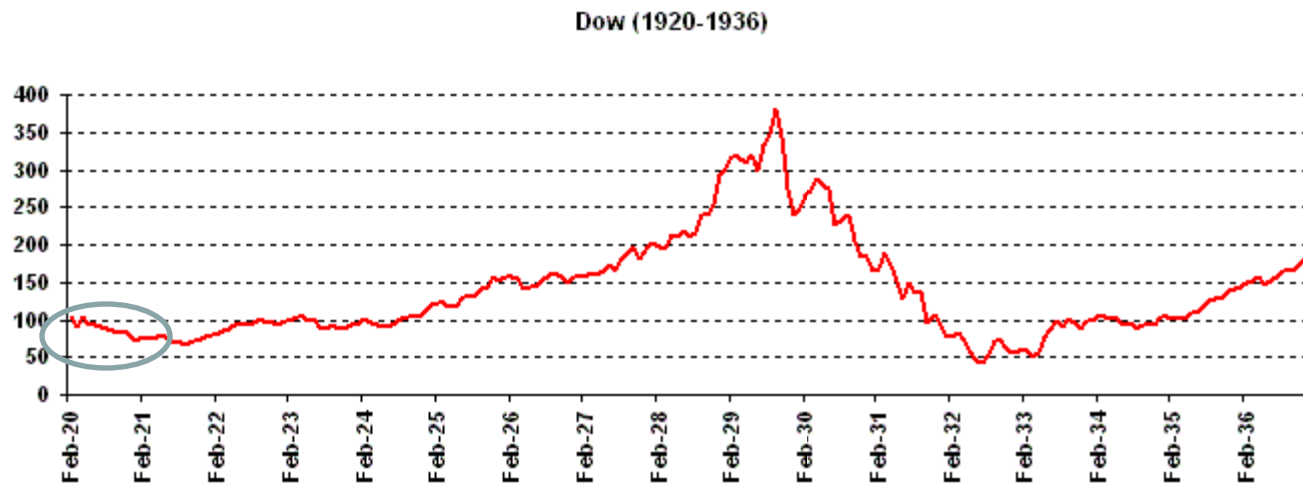
Not all dogs are the same



Financial Markets

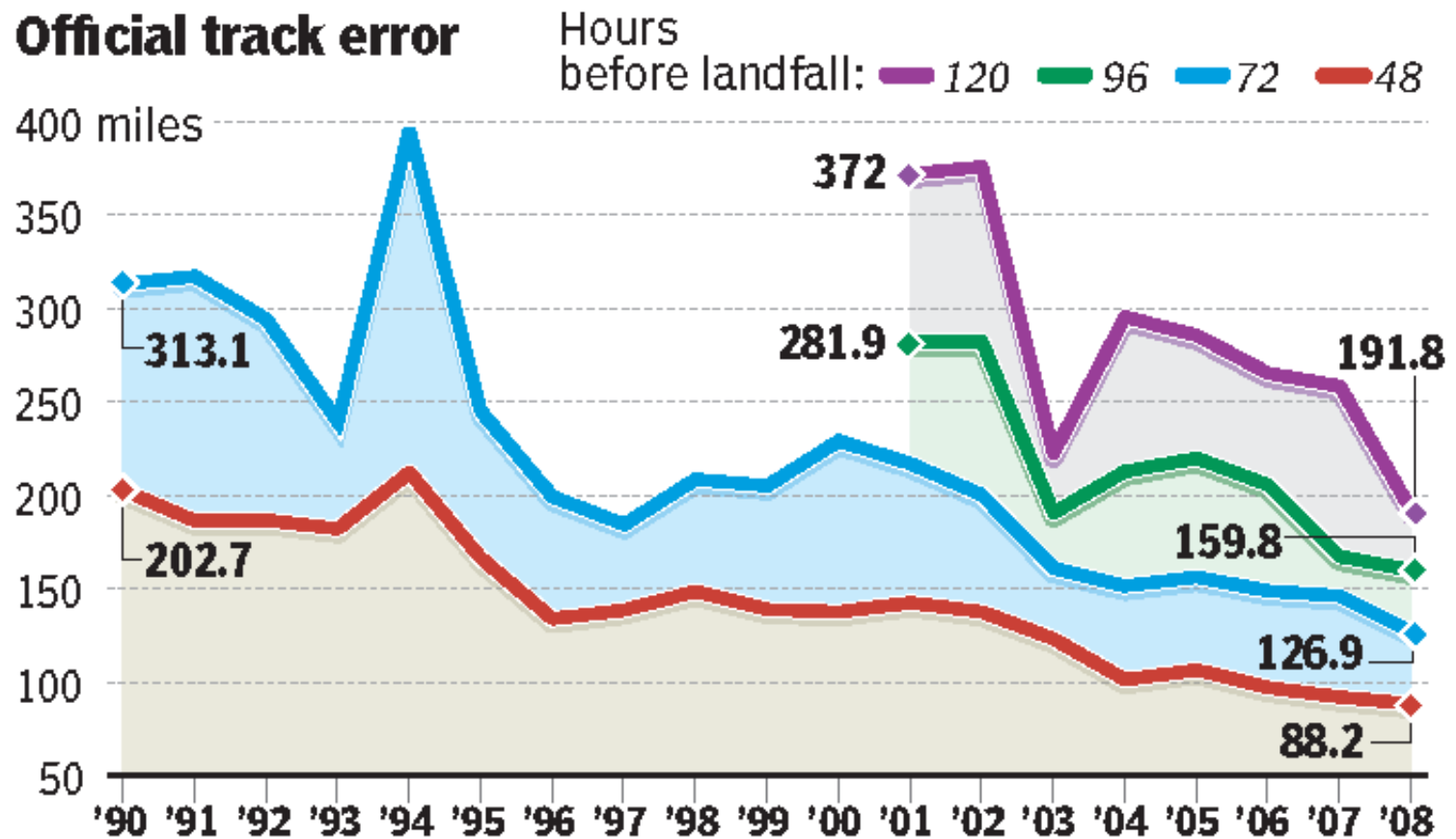
A severe depression like that of 1920-21 is outside the range of probability.

*Harvard Economic Society, Weekly Letter,
November 16, 1929.*



Getting Better

Official track error



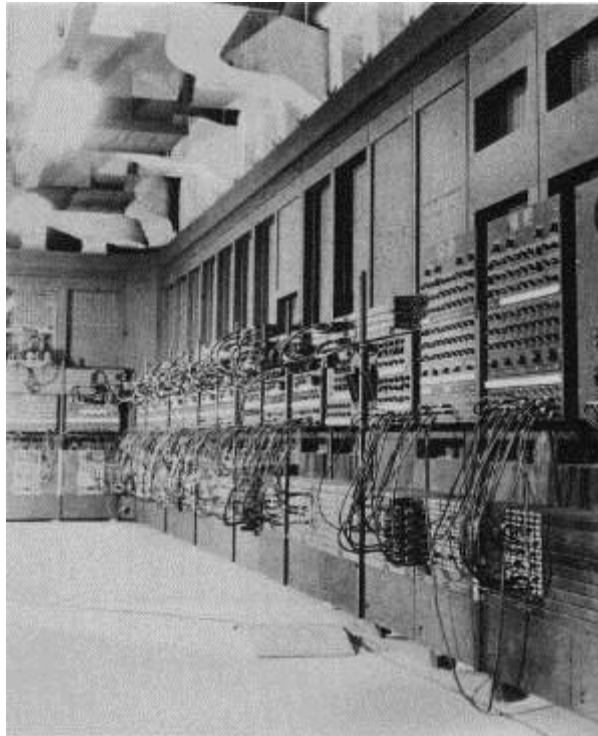
Sources: James Franklin,
National Hurricane Center

ALBERTO CUADRA : CHRONICLE

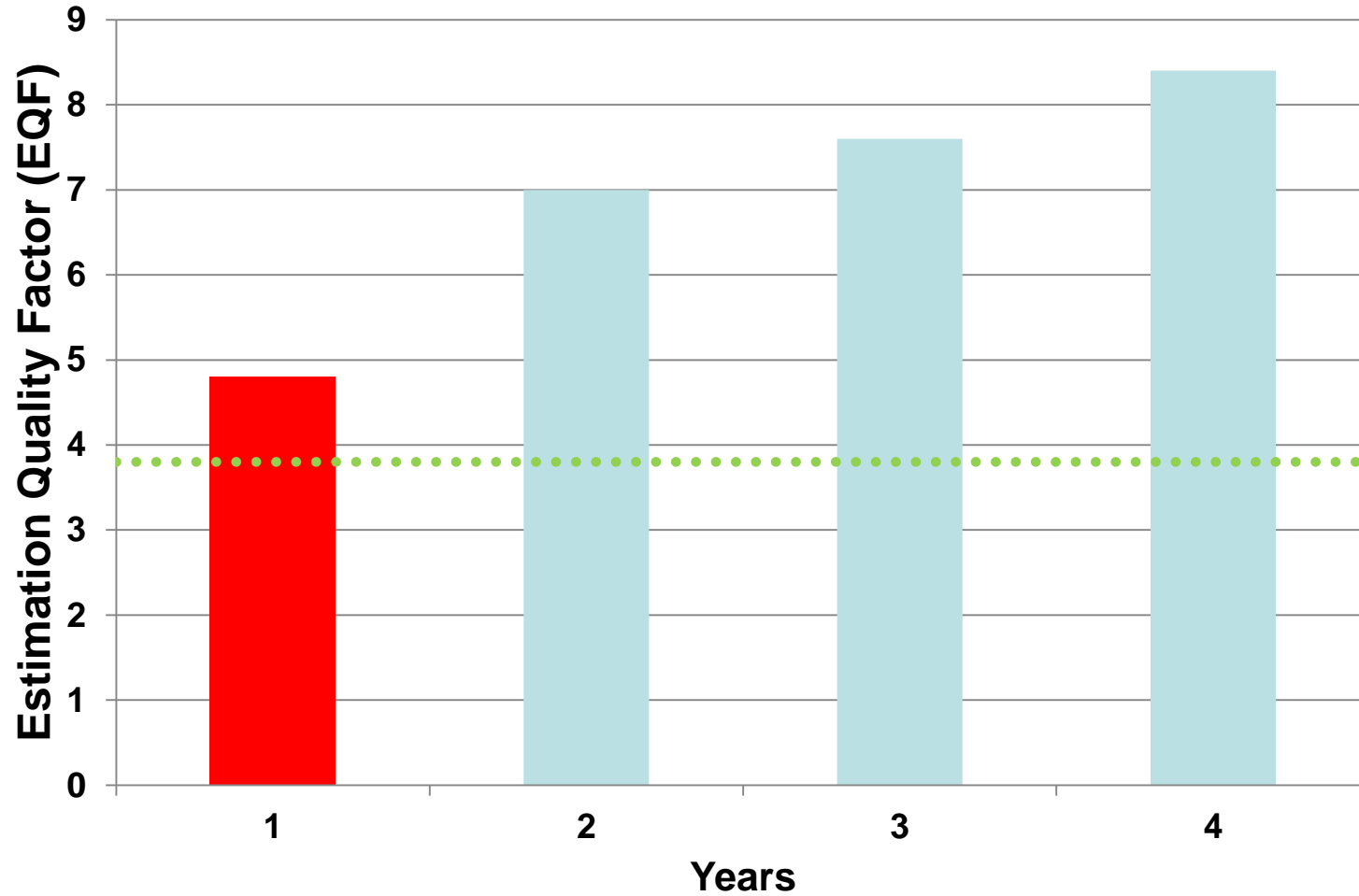
New Product Development

I think there is a world market for about five computers.

Thomas J. Watson, chairman of IBM, 1943.



Getting Better



How do “Risky Businesses” work



***“It’s tough to make predictions,
especially about the future.”***

Yogi Berra, Niels Bohr

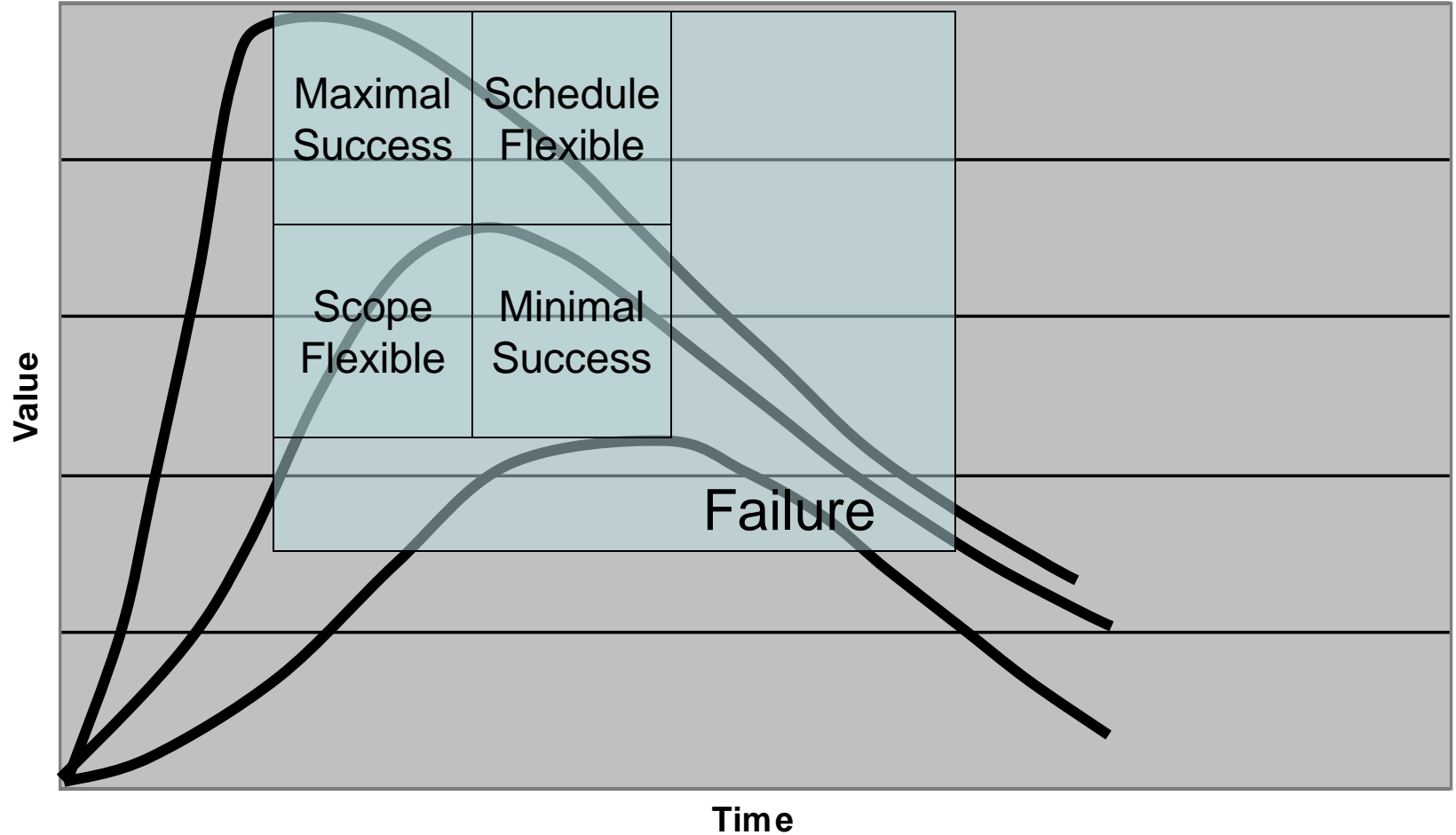
Exercise

	Low	Med	High
Distance from Las Vegas to Houston, Texas			
Height of the Empire State Building			
Population of Sweden			
U.S. Oil Consumption/day			
Water in a 100 gallon vat filled with sand			

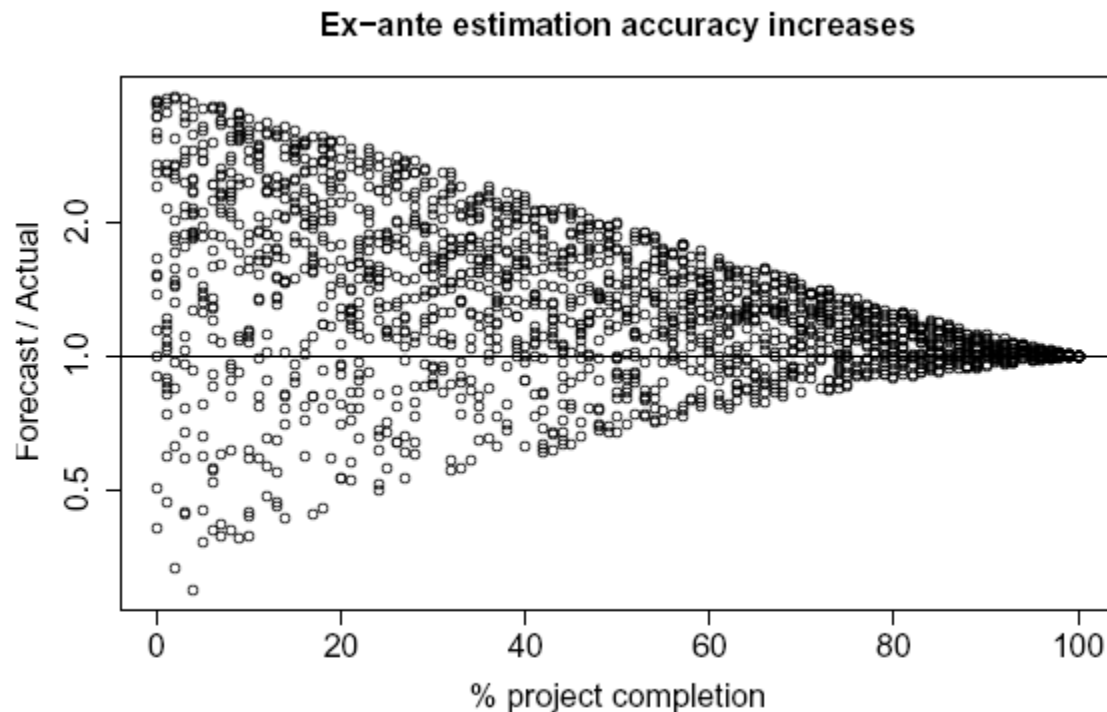
Exercise

	Low	Med	High
Distance from Las Vegas to Houston, Texas		1222	
Height of the Empire State Building		1453	
Population of Sweden		9MM	
U.S. Oil Consumption/day		20MM	
Water in a 100 gallon vat filled with sand		35	

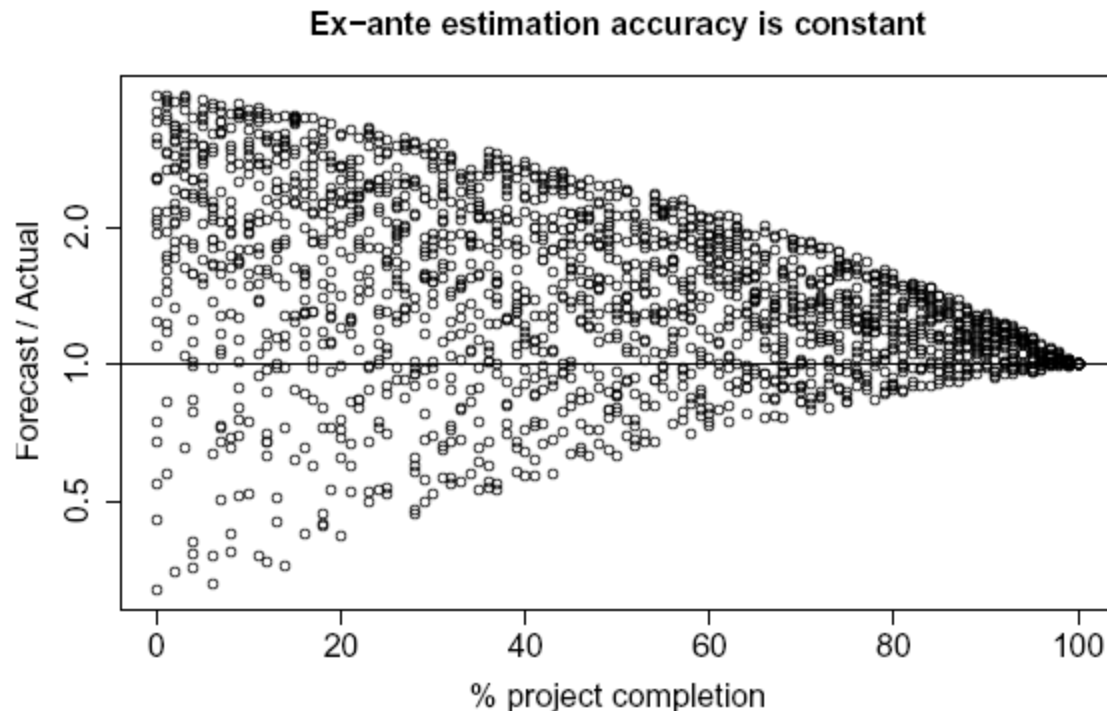
Uncertainty



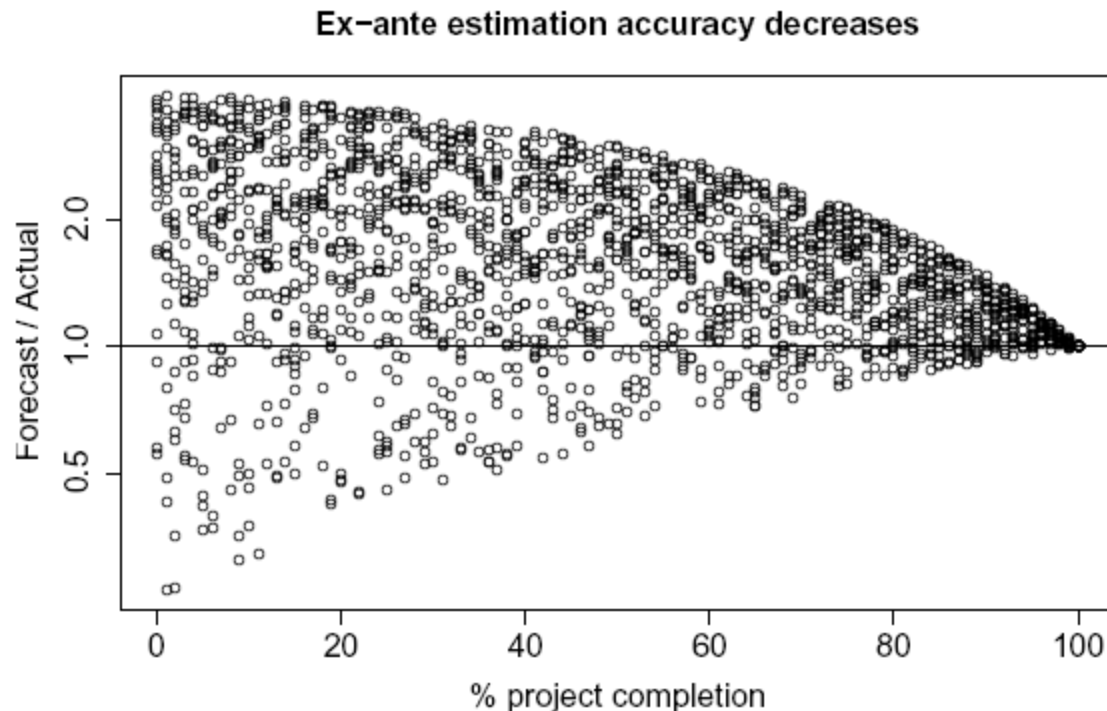
Estimation accuracy improves (Eveleens and Verhoef)



Estimation accuracy constant (Eveleens and Verhoef)



Estimation accuracy decreases (Eveleens and Verhoef)



Ex-ante estimation accuracy is constant
Ex-ante estimation accuracy decreases

