Design Engineering Heuristics

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A copy of these slides will be found at gilb.com/downloads

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Gilb London 2011 Seminar on Solution Engineering
Solving multi-objective problems with logic rather than intuition

Heuristic, Koen

Signatures of the Heuristic

Although difficult to define, a heuristic has four signatures that make it easy to recognize:

- A heuristic does not guarantee a solution;
- It may contradict other heuristics;
- It reduces the search time in solving a problem; and
- Its acceptance depends on the immediate context instead of on an absolute standard.

http://www.cse.hcmut.edu.vn/~minhle/congtackysu_2008/Engineering_Method.pdf

Engineering Method Defined: Koen see next slide for central definition

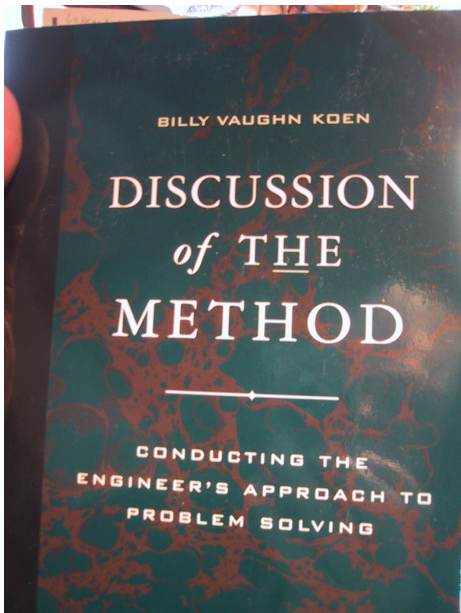
What is original in our discussion is the definition of the engineering method as the use of engineering heuristics to cause the best change in a poorly understood situation within the available resources. This definition is not meant to imply that the engineer just uses heuristics from time to time to aid in his work, as might be said of the mathematician. Instead my thesis is that the *engineering strategy for causing desirable change in an unknown situation within the available resources* and the *use of heuristics* is an absolute identity. In other words, everything the engineer does in his role as engineer is under the control of a heuristic. Engineering has no hint of the absolute, the deterministic, the guaranteed, the true. Instead it fairly reeks of the uncertain, the provisional and the doubtful. The engineer instinctively recognizes this and calls his ad hoc method "doing the best you can with what you've got," "finding a seat-of-the-

Koen: Engineering is

- The use of engineering heuristics
  - to cause the best change
  - in a poorly understood situation
  - within the available resources

Koen on Risk Control

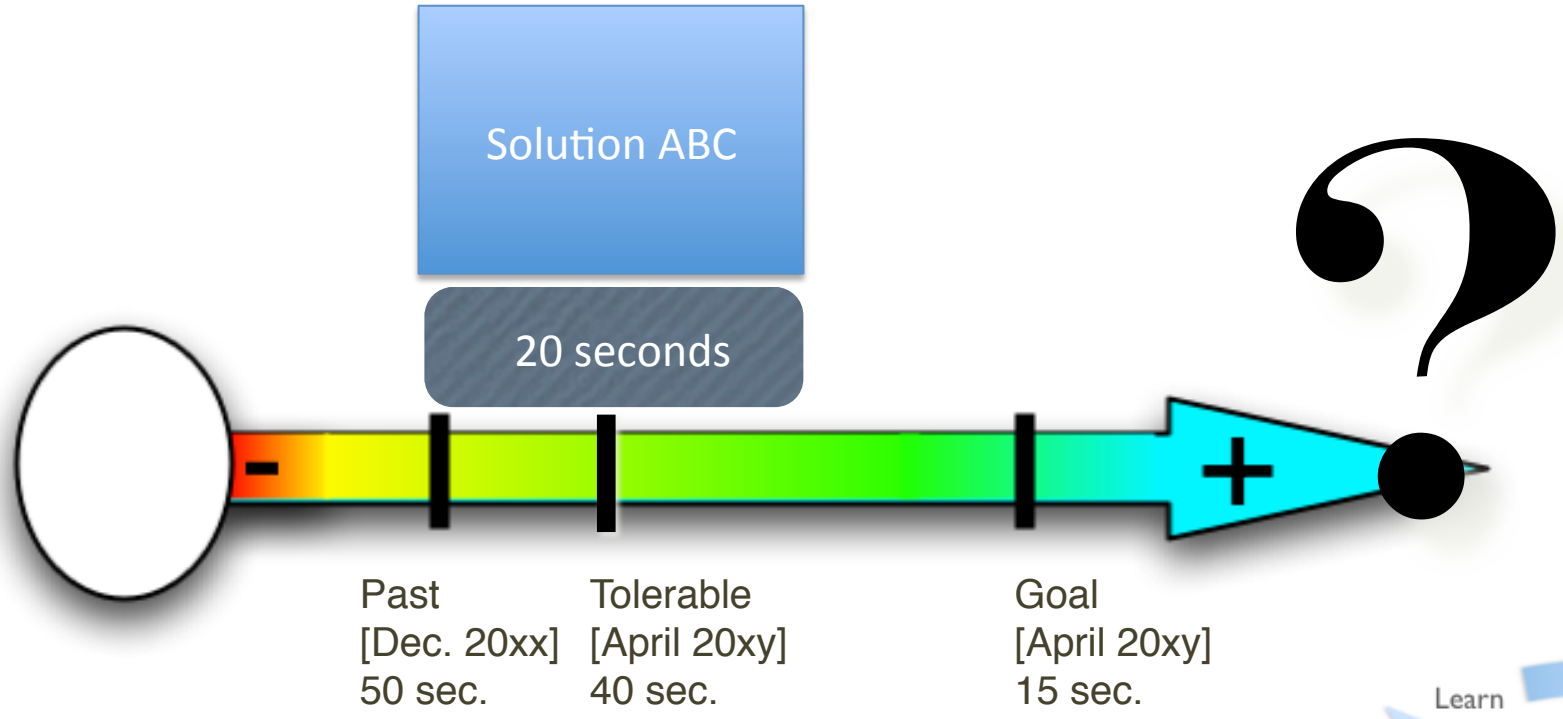
- Make small changes in the sota:
  - 'Sota' = Engineering State Of The Art Heuristics <-Koen, Discussion, p. 48
- Always give yourself a chance to retreat; and
- Use feedback to stabilize the design process

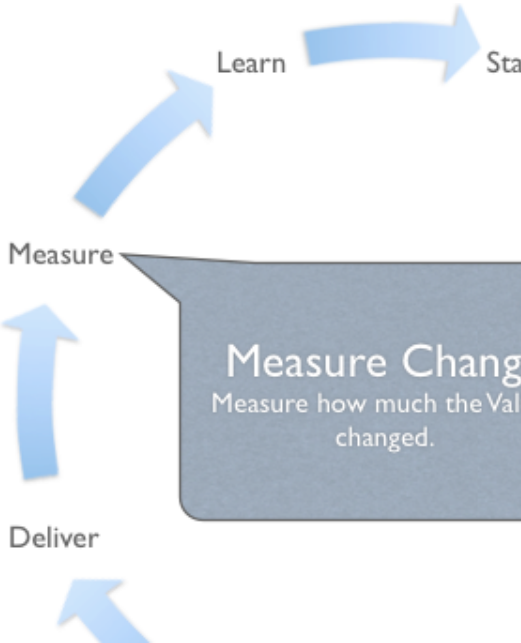


Design Intent Heuristic:

- A design *specification* is **intended** to
  - increment performance levels
  - in the direction of requirement levels,
  - within constraints.

The real-scale impact of a solution on a single improvement objective goal



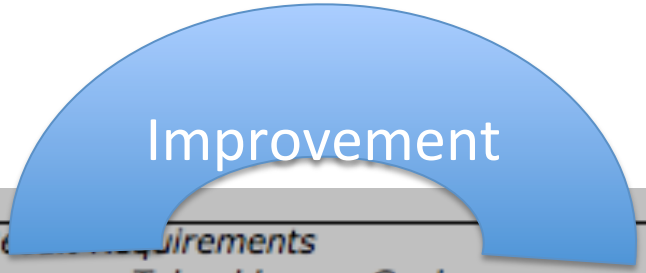


Design Attributes Heuristic:

- All design ideas have **multiple attributes**, related to system *performance,* and to development and maintenance *resources*.

Impact Estimation

Tables



Value Requirements Status when	Tolerable when	Goal when	Operating Model Consistency units	% of Goal
P&L-Consistency&T P&L			**-20**	**44%**
60	0	15	-10	22%
0	0	0	0.1	4%
Speed-To-Deliver			**-20**	**29%**
75	30	5	-7	10%
0	0	0	0.1	3%
Operational-Control.Accurate			**5**	**50%**
90	99	100	5	50%
0	0	0	0.1	5%
Operational-Control.Consistent			**1**	**50%**
97	0	99	0.2	10%
0	0	0	0.2	10%
Operational-Control.Timely.End&Overnigh			**-1**	**200%**
1	1	0.5	-0.5	100%
0	0	0	0.2	40%
Operational-Control.Timely.IntradayP&L				
1	2	3		
0	0	0		
Operational-Control.Timely.Trade-Booking			**-15**	**75%**

Estimate Units & %

± Uncertainty Worst Case range

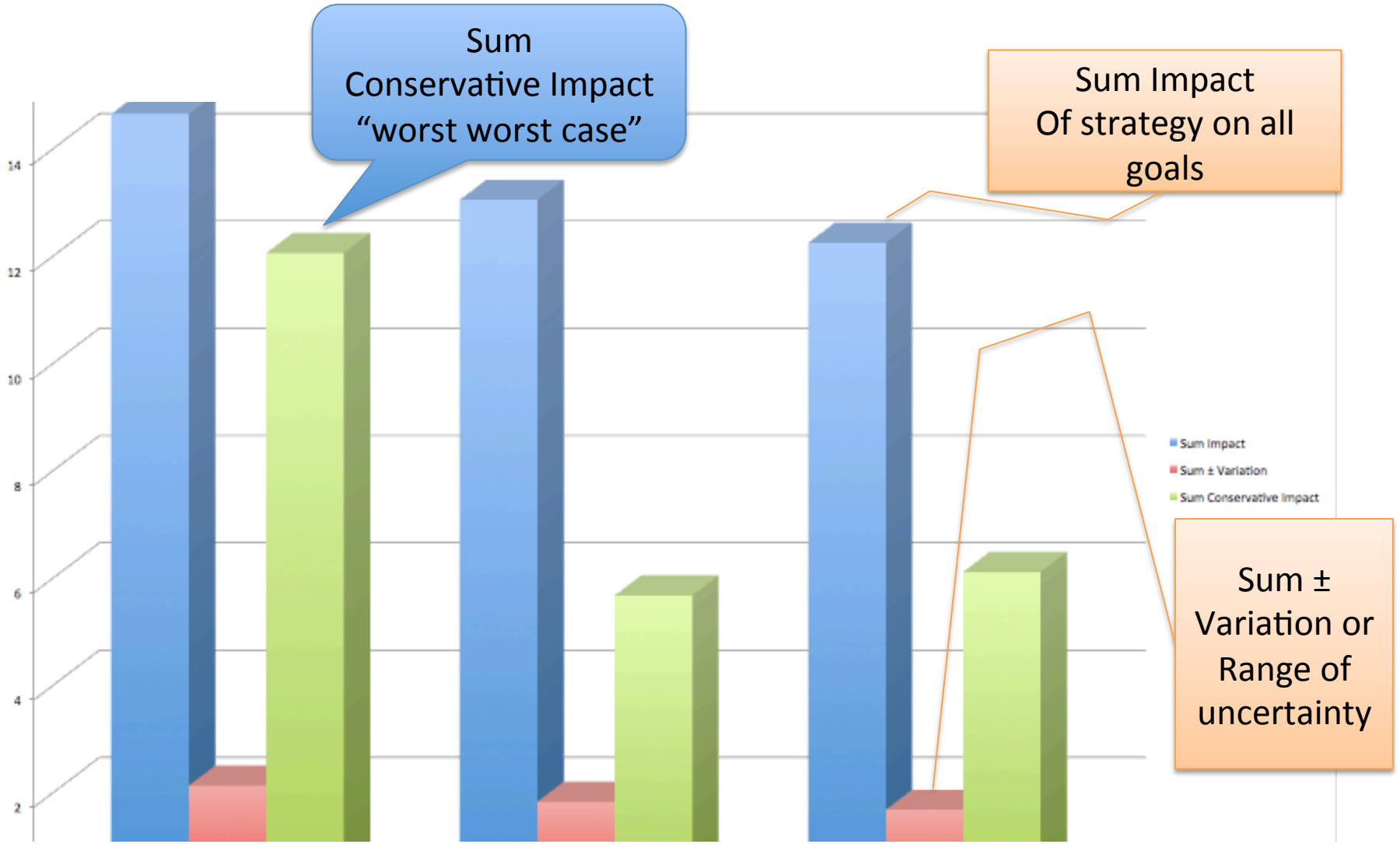
Credibility Adjustment 0.0 to 1.0

Based on tool built by Kai Gilb

Potential Attributes Heuristic:

- A design attribute level-range is a *potential* system attribute;
  - the *real* contribution of the design attribute will **vary** in time,
  - and will **depend** on a large number of mitigating factors –
    - *such as*
      - *exact implementation detail,*
      - *all other past, present and future design elements,*
      - *and system interaction with it's environment*

Summary of Options wrt Risk (20xx)



Based on work done by Kai Gilb

Design Attributes Inevitability Heuristic:

- the set of design attributes *delivered, and in place during system lifetime,*
  - is the inevitable consequence of
    - the *exact* real design implementation,
    - and its current environment.

See enlarged view of this slide in following slides. This is a 1-page overview

Defining a Design/Solution/Architecture/Strategy (Planguage, CE Design Template)

1. enough detail to estimate, 2. some impact assertion, 3. Assumptions, Risks, Issues

Orbit Application Base: (formal Cross reference Tag)

Type: Primary Architecture Option

========== Basic Information ==========

Version: Nov. 30 20xx 16:49, updated 2.Dec by telephone and in meeting. 14:34

Status: Draft

Owner: Brent Barclays

Expert: Raj Shell, London

Authority: for differentiating business environment characteristics, Raj Shell, Brent Barclays (for overview)

Source: <Source references for the information in this specification. Could include people>. Various, can be done later BB

Gist: risk and P/L aggregation service, which also provides work flow/adjustment and outbound and inbound feed support. Currently used by Rates ExtraBusiness, Front Office and Middle Office, USA & UK.

Description: <Describe the design idea in sufficient detail to support the estimated impacts and costs given below>.

D1: ETL Layer. Rules based highly configurable implementation of the ETL Pattern, which allows the data to be onboarded more quickly. Load and persist new data very quickly. With minimal development required. -> Business-Capability-Time-To-Market, Business Scalability

D2: high performance risk and P/L aggregation processing (Cube Building). -> Timeliness, P/L Explanation, Risk & P/L Understanding, Decision Support, Business Scalability, Responsiveness,

D3: Orbit supports BOTH Risk and P/L -> P/L Explanation, Risk & P/L Consistency, Risk & P/L Understanding, Decision Support,

D4: a flexible configurable workflow tool, which can be used to easily define new workflow processes -> Books/Records Consistency, Business Process Effectiveness, Business Capability Time to Market,

D5: a report definition language, which provides 90+% of the business logic contained with Orbit, allows a quick turnaround of new and enhanced reports with minimal regression testing and release procedure impact. -> P/L Explanation, Risk & P/L Understanding, Business Capability Time to Market, Business Scalability,

D6: Orbit GUI. Utilizes an Outlook Explorer metaphor for ease of use, and the Dxx Express Grid Control, to provide high performance Cube Interrogation Capability. -> Responsiveness, People Interchangeability, Decision Support, Risk & P/L Understanding,

D7: downstream feeds. A configurable event-driven data export service, which is used to generate feeds . -> Business Process Effectiveness, Business Capability Time to Market

========== **Priority and Risk Management** =======

Assumptions: <Any assumptions that have been made>.

A1: **FCCP is assumed to be a part of Orbit.** FCxx does not currently exist and is Dec 20xx 6 months into Requirements Spec. <- Picked up by TsG from dec 2 discussions AH MA JH EC.

Consequence: FCxx must be a part of the impact estimation and costs rating.

A2: **Costs**, the development costs will not be different. All will base on a budget of say $nn mm and 3 years. The o+

costs may differ slightly, like $n mm for hardware. MA AH 3 dec

A3:Boss X will continue to own Orbit. TSG DEC 2

A4: the schedule, 3 years, will constrained to a scope we can in fact deliver, OR we will be given additional budget. If not "I would have a problem" <- BB

A5: the cost of expanding Orbit will not be prohibitive. <- BB 2 dec

A6: we have made the assumption that we can integrate Oribit with PX+ in a sensible way, even in the short term <- BB

Dependencies: <State any dependencies for this design idea>.

D1: FCxx replaces Px+ in time. ? tsg 2.12

Risks: <Name or refer to tags of any factors, which could threaten your estimated impacts>.

R1. FCxx is delayed. Mitigation: continue to use Pxx <- tsg 2.12

R2: the technical **integration** of Px+ is not as easy as thought & we must redevelop Oribit

R3: the and or scalability and cost of **coherence** will not allow us to meet the delivery.

R4: **scalability** of Orbit team and infrastructure, first year especially <- BB. People, environments, etc.

R5: re Cross Desk reporting Requirement, major impact on technical design. **Solution not currently known**. Risk no solution allowing us to report all P/L

Issues: <Unresolved concerns or problems in the specification or the system>.

I1: Do we need to put the fact that we own Orbit into the objectives (Ownership). MA said, other agreed this is a huge differentiator. Dec 2.

I2: what are the time scales and scope now? Unclear now BB

I3: what will the success factors be? We don't know what we are actually being asked to do. BB 2 dec 20xx

I4: for the business other than flow options, there is still a lack of clarity as to what the requirements are and how they might differ from Extra and Flow Options. BB

I5: the degree to which this option will be seen to be useful without Intra Day. BB 2

Design Spec Enlarged 1 of 2

Spec Headers

Detailed Description and -> Impacted Objectives

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Design Spec Enlarged 2 of 2

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Design Attribute Quantification Heuristic:

- All design attributes vary,
- and can be quantified,
- estimated,
- measured,
- and managed –
- however poorly.

Real-istic Quantification of top 13 Objectives for Large Finance Project

P&L-Consistency&T P&L: **Scale:** total adjustments btw Flash/Predict and Actual (T+1) signed off P&L. per day. **Past 60 Goal**: **15**

Speed-To-Deliver: **Scale**: average Calendar days needed from New Idea Approved until Idea Operational, for given Tasks, on given Markets.
Past [2009, Market = EURex, Task =Bond Execution] **2-3 months** ?
Goal [Deadline =End 20xz, Market = EURex, Task =Bond Execution] **5 days**

Operational-Control: **Scale**: % of trades per day, where the calculated economic difference between OUR CO and Marketplace/Clients, is less than "1 Yen"(or equivalent).
Past [April 20xx] **10%** change this to 90% NH **Goal** [Dec. 20xy] **100%**

Operational-Control.Consistent: **Scale**: % of defined [Trades] failing full STP across the transaction cycle. **Past** [April 20xx, Trades=Voice Trades] **95%**
Past [April 20xx, Trades=eTrades] **93%**
Goal [April 20xz, Trades=Voice Trades] <**95 ± 2%**>
Goal [April 20xz, Trades=eTrades] **98.5 ± 0.5 %**

Operational-Control.Timely.End&OvernightP&L Scale: number of times, per quarter, the P&L information is not delivered timely to the defined [Bach-Run].
Past [April 20xx, Batch-Run=Overnight] 1 **Goal** [Dec. 20xy, Batch-Run=Overnight] <**0.5**> **Past** [April 20xx, Batch-Run= **T+1**] **1 Goal** [Dec. 20xy, Batch-Run=End-Of-Day, Delay<1hour] **1**

Operational-Control.Timely.IntradayP&L Scale: number of times per day the intraday P&L process is delayed more than 0.5 sec.

Operational-Control.Timely.Trade-Bookings Scale: number of trades per day that are not booked on trade date. **Past** [April 20xx] **20 ?**

Front-Office-Trade-Management-Efficiency Scale: Time from Ticket Launch to trade updating real-time risk view
Past [20xx, Function = Risk Mgt, Region = Global] **~ 80s** +/- **45s** ??
Goal [End 20xz, Function = Risk Mgt, Region = Global] **~ 50%** better?
Managing Risk – Accurate – Consolidated – Real Time

Risk.Cross-Product Scale: % of financial products that risk metrics can be displayed in a single position blotter in a way appropriate for the trader (i.e. – around a benchmark vs. across the curve).
Past [April 20xx] **0%** 95%. **Goal** [Dec. 20xy] **100%**

Risk.Low-latency Scale: number of times per day the intraday risk metrics is delayed by more than 0.5 sec. **Past** [April 20xx, NA] **1% Past** [April 20xx, EMEA] ??**% Past** [April 20xx, AP] 100**% Goal** [Dec. 20xy] **0%**
Risk.Accuracy

Risk. user-configurable Scale: ??? pretty binary – feature is there or not – how do we represent?
Past [April 20xx] **1% Goal** [Dec. 20xy] **0%**

Operational Cost Efficiency Scale: <Increased efficiency (Straight through processing STP Rates)>

Cost-Per-Trade Scale: % reduction in Cost-Per-Trade
Goal (EOY 20xy, cost type = I 1 – REGION = ALL) **Reduce cost by 60%** (BW)
Goal (EOY 20xy, cost type = I 2 – REGION = ALL) **Reduce cost by x %**
Goal (EOY 20xy, cost type = E1 – REGION = ALL) **Reduce cost by x %**
Goal (EOY 20xy, cost type = E 2 – REGION = ALL) **Reduce cost by 100%**
Goal (EOY 20xy, cost type = E 3 – REGION = ALL) **Reduce cost by x %**

Design Attribute Independence Heuristic:

- The various performance and cost attributes of a design
  - bear no correlation to each other.

Strategy Impact Estimation:
for a $100,000,000 Organizational Improvement Investment

Objectives

Technical Strategies

Defined In earlier slide

Business Objective	hardware adaptation	Telephony	Reference designs	IFace	Modularity	Defend vs Technology 66	Tools	User Experience	GUI & Graphics	Security	Defend vs OCD	Enterprise
	Viking Deliverables											
Time to market	20%	10%	30%	5%	10%	5%	15%	0%	0%	0%	5%	5%
Mid-range	15%	5%	10%	0%	5%	5%	5%	10%	5%	5%	0%	0%
Platformisation Technology	25%	10%	30%	0%	5%	10%	0%	5%	0%	10%	0%	5%
Interface	5%	15%	15%	0%	5%	0%	5%	0%	0%	10%	0%	10%
Operator preference	0%	0%	0%	0%	0%	20%	5%	10%	10%	20%	5%	10%
Get Torden	25%	10%	10%	-10%	0%	20%	0%	10%	-20%	10%	10%	5%
Commoditisation	20%	10%	20%	10%	-20%	25%	15%	0%	0%	5%	10%	5%
Duplication	15%	0%	10%	0%	0%	40%	0%	0%	0%	5%	20%	5%
Competitiveness	10%	15%	20%	0%	10%	20%	10%	10%	20%	10%	10%	10%
User experience	5%	0%	0%	0%	0%	0%	0%	30%	10%	0%	0%	0%
Downstream cost saving	15%	5%	0%	0%	10%	20%	5%	10%	0%	0%	10%	5%
Platformisation IFace	10%	10%	20%	40%	0%	20%	5%	0%	0%	0%	0%	5%
Japan	10%	5%	20%	0%	10%	0%	0%	10%	5%	0%	0%	0%
Contribution to overall result	15%	9%	17%	4%	7%	15%	6%	6%	1%	6%	6%	5%
Cost (£M)	£ 2.85	£ 0.49	£ 3.21	£ 2.54	£ 1.92	£ 2.31	£ 0.81	£ 1.21	£ 2.68	£ 0.79	£ 0.62	£ 0.60
ROI Index (100=average)	106	358	109	33	78	137	148	107	10	152	202	174

Strategy Impacts on Objectives

"Benefits"

Cost

358 !

Potential Attributes Corollary:

- Designs might not translate into
  - expected system properties,
  - depending on
    - unforeseen and unknown factors in the current system or its environment.

Design Attributes Inevitability Corollary:

- Ignoring side-effect attributes won't make them go away. It requires conscious design effort to understand, to exploit, or to mitigate the side-effect attributes of a design.

Design Attribute Quantification Corollary:

- All design quality attributes can be quantified, estimated, measured, and managed, and it might pay off to do so, or might not pay off.

Real Current Design Value Corollary:

- The value of a design can change depending on current requirements, current design set, and current system environment. It might not *be*, what it once *was*.

Design Attribute Independence Corollary:

- 1. A design that has *some* excellent attributes, might also have some others that are *poor*, and yet others that are *damaging* and *negative*.
- 2. The 'goodness' of a design is described by the 'fit' is has to all requirements. The 'fit' is based on *multiple* requirements, *multiple* design attributes, and the current *degree of satisfaction* of those requirements by other designs.

End Slide