Build Your Own or Buy Off The Shelf?

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Overview

- The Three Constraints (plus One)
- A Quantitative Approach
- What to Expect
- What Not to Expect
- Thoughts for Third Party Developers
The Three Constraints

- Performance; Schedule; Budget
- Only two of these can be constrained

All decisions must take into account the effect they will have on these constraints; particularly on the how the unconstrained must change.
…plus One

What kind of experience should/must be gained?

- For the Program
  - Increase In-House Knowledge
  - Avoid Single String Suppliers
  - Gain Industry Partners

- For the Participant
  - Increase Individual Knowledge
  - Work With Third Parties
  - Integrate/Troubleshoot a Black Box Design
Performance

- In House
  - Customizable
  - Knowledge Base Required

- Third Party
  - Leverage Existing Knowledge
  - Limits to Customizability
Example – StenSat Radio

- ConOps required a relatively high powered transmitter
- Lack of RF building experience led to an off-the-shelf solution
- Solution lacked the ability to adjust power output
- Inability to customize led to a negative power budget
Schedule

- Third Party
  - Off the Shelf/Instant Gratification
  - Unforeseen delays due to integration/troubleshooting

- In House
  - Designed with integration in mind
  - Allows for easier troubleshooting
  - Lack of experience can cause gross underestimation
Example – Vibration Facility

- On-site testing facilities is a goal of Kentucky Space
- Facilities included custom fixturing and custom control software
- Lack of experience led to gross underestimation of the time necessary
- ~10 months behind schedule the shaker is still not fully operational
Budget

- Development costs are low in academia; much higher in industry
- Third party designs are generally much more costly
- When looking strictly at dollars; it almost always makes sense to design in-house
A Quantitative Approach

- How to deal with the interplay between all the constraints?
- Attempt to quantify and look for relationships
  - Cost Benefit Analysis
  - Risk Benefit Analysis
  - Risk Value Analysis
Risk Value Analysis

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\text{Value} = \frac{\text{Performance} \times \text{Good Feeling}}{\text{Cost} \times \text{Hassle}}
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\text{Risk} = \frac{\text{Complexity} \times \text{Significance}}{\text{Experience} \times \text{Heritage}}
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- Performance – How well does the technology fit the requirements
- Good Feeling – On time, good communication, education
- Cost – Total opportunity cost
- Hassle – Red tape, failed parts
- Complexity – How much does this technology have to do
- Significance – What is the potential impact from failure
- Experience – How much experience does the developer have with working with this technology
- Heritage – TRL
Expectations

- What to Expect
  - Accurate Specs
  - Full Disclosure of Bugs/Design Changes
  - Easy Communication
  - Troubleshooting Help

- What Not to Expect
  - Plug and Play
  - Full Disclosure of Design
  - Instant Communication
  - Automatic Credulity
Third Party Developers

- Everyone makes mistakes; disclose problems
- Don’t overstate specs
- Don’t promise what can’t be delivered
- Disclose design changes and update specs
- Straightforward Communication