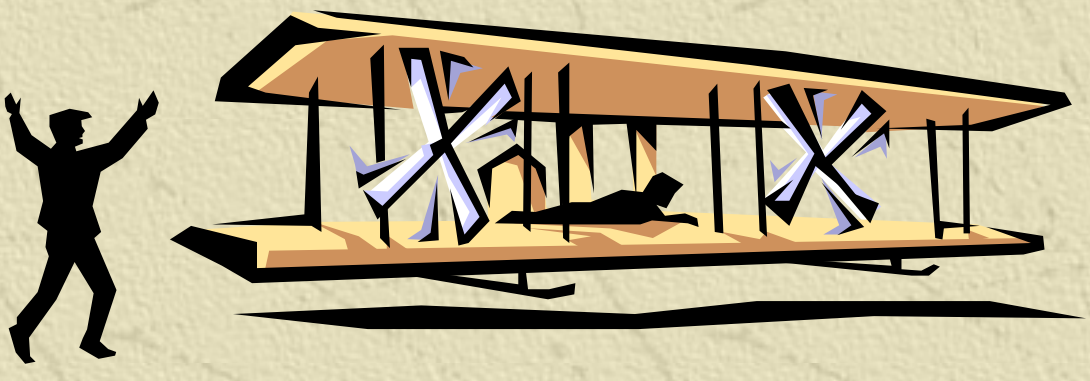


Learning to Fly

Techniques for getting Model-based Projects Airborne

Gary Marcos
Principal Consultant
Garym@smartproj.com

Smart Projects

Outline

- Brief history of model-based project outcomes in organization “X”
  - Successful pilot project
  - Full-scale disaster project
  - Three rapid development projects
- Failure factors for the disaster project
- Success factors for the 3 rapid projects
- Summary and Conclusions

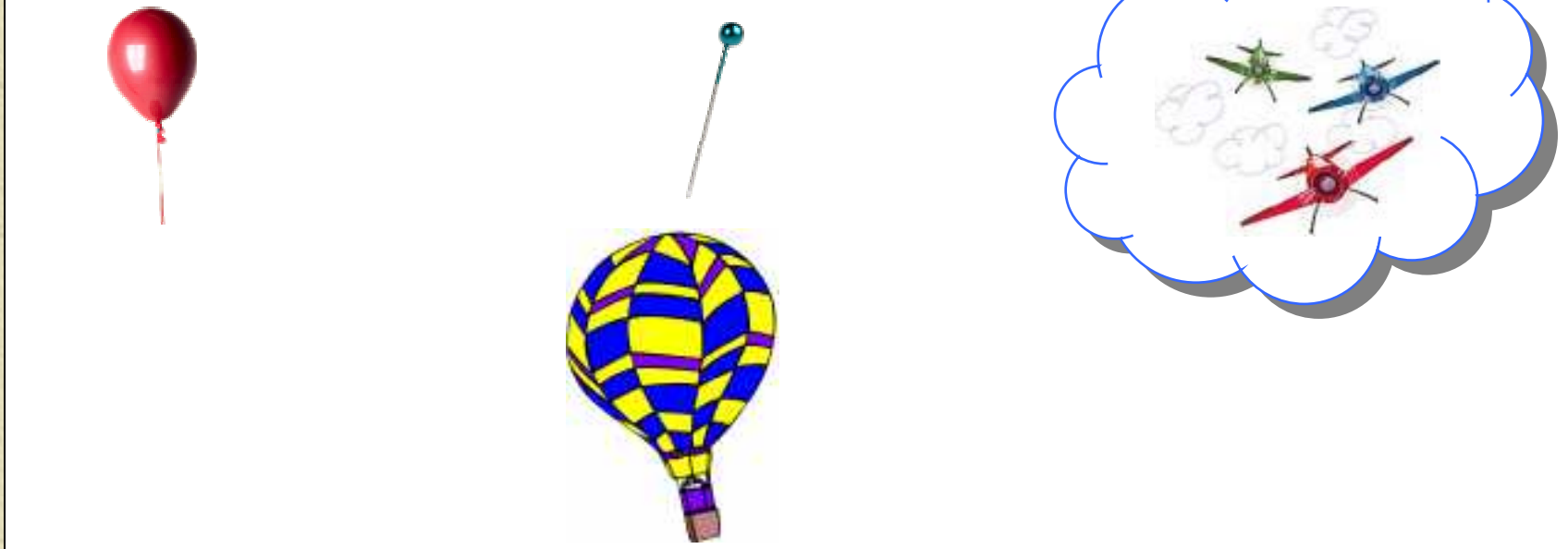


Organization “X”

- Leading manufacturer of scientific instruments
- Development activities on 3 different continents
- Software applications:
  - Real-time, embedded, and networked
  - Must interact with custom hardware



History of Model-based Projects in Organization "X"



Smart Projects

www.smartproj.com

Successful Pilot Project



- Project Attributes
- Project Outcome
- Success Factors

Pilot Project

1989



Smart Projects

www.smartproj.com

Successful Pilot Project

- Project Attributes:
  - Team size: 1.1
  - Project complexity: low
  - Application domain familiarity: high
  - CASE tool: paper and pencil
  - Programming language: C



Pilot Project

1989



Successful Pilot Project

- Project Outcome:
  - TTM: fast
  - Resource consumption: low
  - Reliability: good





Pilot Project

1989



Successful Pilot Project

- Success factors:
  - Small team size (single developer)
  - High caliber team
  - Limited new technology adoption (OOA/RD)
    - No new programming language…
    - Developer already familiar with pencil and paper



Pilot Project

1989



Management Opinion of Model-based Development, circa 1990

- Previous code-based software projects yielded poor results:
  - Slow and unpredictable TTM
  - Poor quality
- Model-based development appears to be a wonderful approach. We should try it out on our next full-scale project.



Full Development Disaster Project



Disaster Project

1991 - 1997

Smart Projects

www.smartproj.com

Development Disaster Project

- Project Attributes:
  - Team size: 12+
  - Project complexity: medium
  - App. domain familiarity: medium – high
  - CASE tool: Teamwork → BridgePoint
  - Architecture: hybrid
  - Programming language: C++

Disaster Project

1991 - 1997



Smart Projects

www.smartproj.com

Development Disaster Project

- Project Outcome:
  - TTM: incredibly slow
  - Resource consumption: excessive
  - Reliability: good
  - SW group reputation: mud
  - Punishment: several employees terminated



Disaster Project

1991 - 1997



Development Disaster Project

- Disaster factors:
  - Poor project management
  - Lousy systems engineering
  - Large team size
  - Reviews highly procedural, …yet worthless
  - Degree of specialization: too low
  - Learning curve: C++



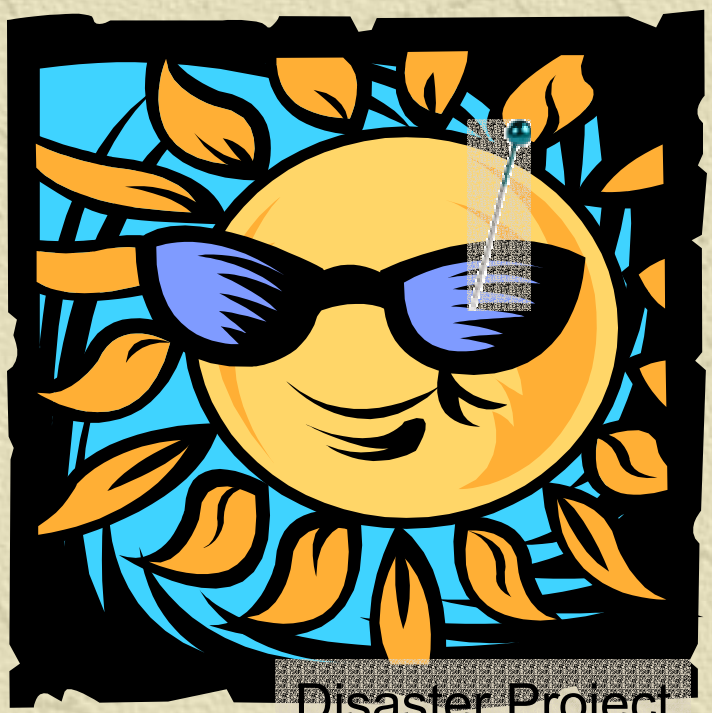
Disaster Project

1991 - 1997



Development Development Project

- Bright Side
  - Market Success!!!
  - Maintenance Success!!!



1991 - 1997



Smart Projects

www.smartproj.com

Management Opinion of Model-based Development, late 90s

- eXtreme pain during the development phase
- The resulting software was robust
- The maintenance phase was exemplary



New Market Forces

- Competition released smaller and less expensive product.



New Market Forces

- However, management was terrified at the prospect of a new software project

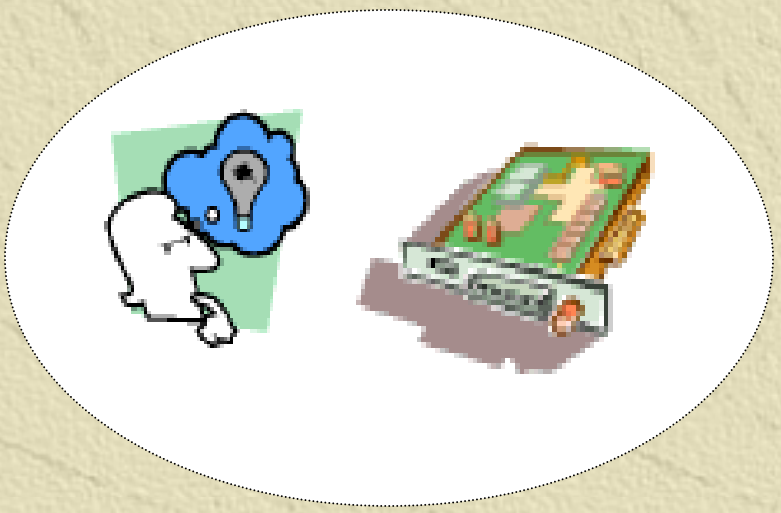






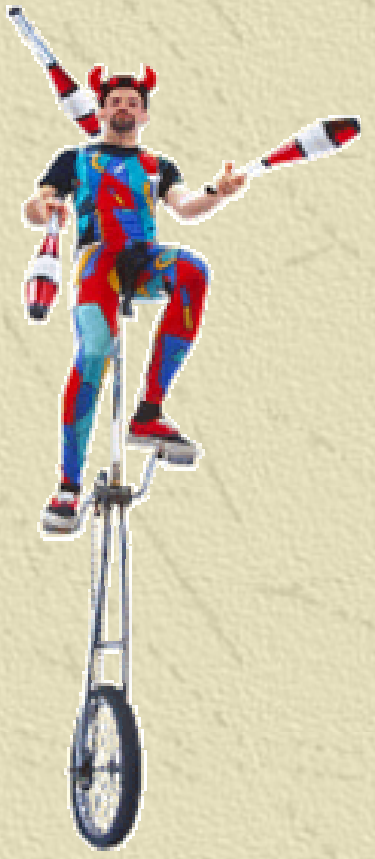
New Market Forces

- Due to fear of disaster…the electronics team was chartered to reduce the size and cost of the electronics…with no change to the software.
- Not feasible



Submitted Proposal for Rapid Development (1/99)

- Reactions to the proposal included disbelief and laughter



Proposal Approved



Project Completed in Record Time!!!



- A subset of the team members from the disaster project became heroes.



3 Rapid Projects

1999 - 2002



Smart Projects

www.smartproj.com

Three Rapid Development Projects



3 Rapid Projects

1999 - 2002



Smart Projects

www.smartproj.com

Three Rapid Development Projects



- Project Attributes:
  - Team size: 3 – 6
  - Project complexity: medium
  - App. Domain Familiarity: high → low
  - CASE tool: BridgePoint
  - Architecture: MC-3020
  - Programming language: C

3 Rapid Projects

1999 - 2002



Three Rapid Development Projects



- Project Outcome:
  - TTM: very fast
  - Resource consumption: reasonable
  - Reliability: very good
  - SW group reputation: excellent
  - Rewards: employees $, managers promoted

3 Rapid Projects

1999 - 2002



Smart Projects

www.smartproj.com

Three Rapid Development Projects



- Success factors:
  - Aggressive Project Management…
  - Great Systems Engineering…
  - Requirements Management…
  - Reuse…
  - Development Environment…
  - Reasonable Team Size

3 Rapid Projects

1999 - 2002



Success Factors: Project Management



- Early and frequent incremental releases
  - Establish visible progress
    - Gain political capital
    - Boost software team morale
    - Scare hardware team into meeting their milestones
  - Early evaluation of risk areas
  - Learn valuable information that feeds back into subsequent releases



Success Factors: Project Management



- Binary Micro-Milestones
  - No concept of 10% complete! Done, or not!
  - 1 week duration
  - Counteracts wildly optimistic developer estimates
    - No task can be 90% complete for the majority of the project



Success Factors: Project Management



- Critical Path Management
  - Identify and attack
  - Dynamic priorities and resource assignments
  - Throw strongest resources onto the CP



Success Factors: Project Management



- eXtreme Specialization

Outside-the-box protocol
Application Domain
Service Domains
Hardware Abstraction
Operating System +
In-the-box Protocol
Micro-controller SW
Physical Hardware



Success Factors: Project Management



- Agile Reviews:
  - High-frequency
  - Low-formality
  - Primarily one-on-one



Success Factors: Systems Engineering



- Great partitioning between software and hardware
  - Response Time Partitioning
    - SW responsible for timing >= 10 ms
    - HW (micro-controller) handled µsec response time
  - Able to control HW from host platform
    - Serial interface to HW
- Plug-in scaleable computing elements
  - 386, 486
- Test and debug facilities built into the production platform
  - Route OOA trace to VGA, telnet session, serial port



Success Factors: Requirements Management



- 2 projects with high application familiarity
  - Product Marketing representative did an excellent job:
    - Prioritizing the requirements
    - Negotiating schedule / requirement tradeoffs
    - Defined new UI w/o prototyping



Success Factors: Requirements Management



- Project with low application familiarity
  - All SMEs located in Europe
  - SW developers in California



  - SMEs produced SRS
    - Modeling easy in comparison to detailed SRS production
    - SRS development time > SW development time
    - Benefit: More requirements rework, less model churning



Success Factors: Reuse



- OTS SW Architecture: MC-3020
- Development environment
- UI Modeled Domain
- Communication Protocols
- Algorithms



Success Factors: Development Environment



- Geared for speed
  - Rapid Builds
  - Rapid Check-in & Check-out
- Portability
  - Replaced UNIX environment with NT
- Accessibility
  - VPN: Internet access to archive & build machine





Three Rapid Development Projects



- Summary of the success factors:
  - Aggressive Project Management…
  - Great Systems Engineering…
  - Requirements Management…
  - Reuse…
  - Development Environment…
  - Reasonable Team Size



Summary and Conclusions







Pilot Project

Disaster Project

3 Rapid Projects

1989

1991 - 1997

1999 - 2002



Smart Projects

www.smartproj.com

Summary and Conclusions

- Rapid development techniques can work with xtUML projects
- Significant time-to-market improvements can be achieved
- Resultant quality of a rapid development xtUML project can be very high



Questions?



Smart Projects

www.smartproj.com