Air Taxi Operational Control Center

ENSE 626 Systems Life Cycle Cost Estimation
Spring 2004 José A. Faria

Course Project Presentation

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Abstract

Air taxi services are set to take off. Defining characteristics:

- Small aircraft & regional jets (4-30 seats)
- Direct flights serving both large & small airports
- Computer networks for dynamic scheduling

Due to some of the following conditions:

- Availability of relatively inexpensive small jets
- Congestion in traditional airlines & hub airports
- Improvements to & privatization of air traffic control towers for extra capacity.

Contents

- Project Estimation Schedule
- Design & Concept
- Scope of Work
- Work Breakdown Structure
- Spiral Development Scheduling
- Risk Identification & Mitigation
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http://world.honda.com/news/2003/c031216_2.html

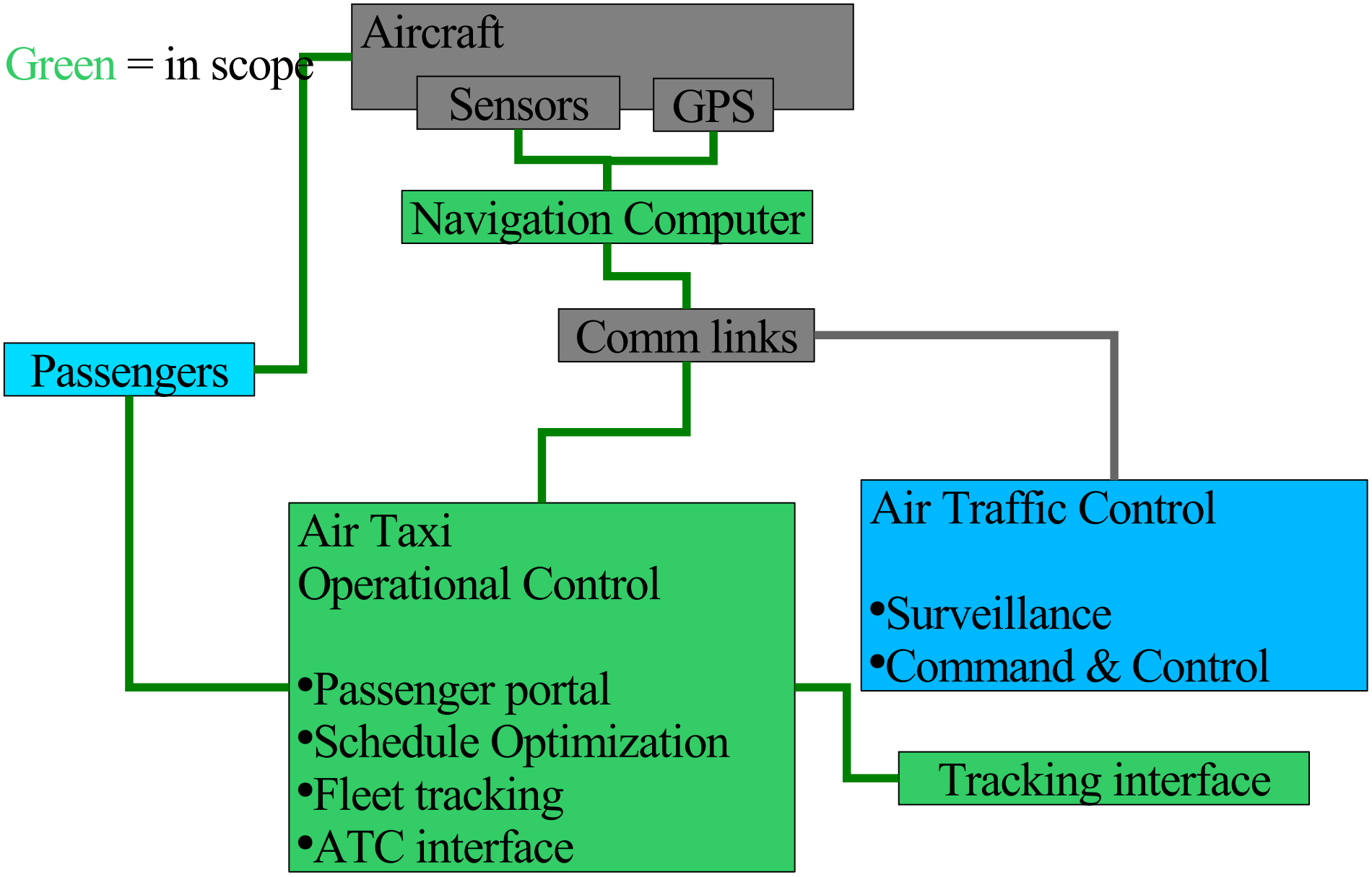
Estimation Schedule

Project Milestone	Week	Date	Events
	1	02/03/04	
Report Intro	2	02/10/04	
	3	02/17/04	Title Due
System Design / Architecture	4	02/24/04	
Work Breakdown Structure	5	03/02/04	
Spiral Development	6	03/09/04	Kickoff
Scheduling	7	03/16/04	Midterm
Risk Identification	8	03/23/04	Spring Break
Risk Mitigation	9	03/30/04	
	10	04/06/04	
Cost Estimation	11	04/13/04	
Graphs / Data Reduction	12	04/20/04	
Conclusion	13	04/27/04	Presentations
	14	05/04/04	Presentations
Report Document	15	05/11/04	Final

Concept

- Create an Airline Operational Control (AOC) center to coordinate passenger schedules with fleet schedules
- Define minimum equipage for aircraft fleet, provide “kits” to allow conversions of older aircraft
- Provide additional infrastructure necessary to allow increased air traffic control (ATC) service to smaller airports.

System Design



Scope

- Design, build, & operate control center
  - Passenger portal
  - Schedule optimization engine
  - Fleet tracking
- Provide minimal equipage for aircraft to operate as part of the fleet
- Develop & provide additional monitoring & communications software & equipment, training for controllers

Project Estimation Challenges

- Uncertainty / risk mitigation
  - Handle with parametric market analysis to attempt to put an upper bound on operating costs
  - Scale equipment costs relative to size of fleet

Estimation Tools & Techniques

- Spreadsheet WBS, bottom-up pricing
- Spiral development scheduling
- Risk analysis matrix

Work Breakdown Structure

Cat#	Sub#	Item#	Cat	Subcat
1			AOC Hardware	
1	1			Network
1	2			Servers
1	3			Operator station
2			Maintenance	
2	1			Comm Feeds
2	2			SW licensing
3			AOC SW Development	
3	1			Situational Awareness Display
3	2			Comm/Info Mgmt. Engine
3	3			Flow Mgmt.
3	4			Schedule Optimization
3	5			Passenger Portal
3	6			Maintenance Tracker
3	7			4D Traj Planner / Tracker
3	8			Data Interfaces
4			Aircraft Equipage Kit	
4	1			Nav PC
4	2			GPS
4	3			Comm link
4	4			Sensor package
4	5			SW Integration
5			ATC Equipage Kit	
5	1			Monitoring PC
5	2			Comm link
5	3			SW Integration

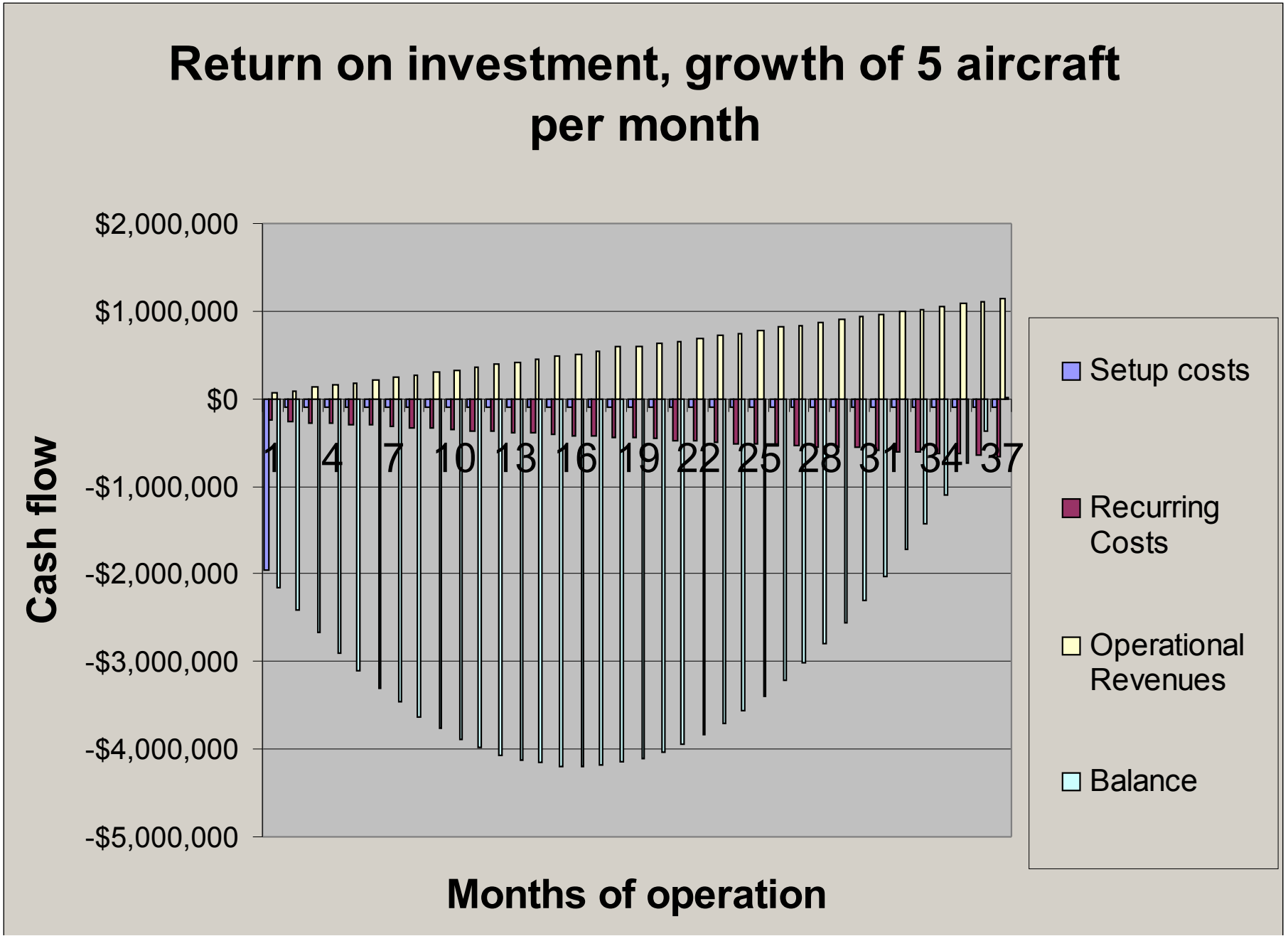
Parametric Estimation

- Relative to size of active fleet
- Airlines' performance usually based on operating cost per seat mile:
  - $0.12 Large airliners (economy of scale)
  - $0.07 Newer regional jets (point-to-point efficiencies)
  - $0.20 Small aircraft (~ $40/hr)
  - $1.00 Business jets (~ $2500/hr)
  - $0.40 Target

$10,000 in AOC operating costs per 1,000 passengers. Assumptions:

- AOC costs = 5% of operation
- 5 passengers / flight, traveling 500 miles on average

Revenue Projection



Risk Identification & Mitigation

Type	Risk Item	Mitigation	Contingencies
ATC Rejection			
	Rejection of AOC terminal		Operational efficiency at mercy of ATC
	Rejection of increased operations		Capacity lockout - inability to serve customers
Aircraft Equipment Certification Failure			
	Airborne Comm datalink		Use more expensive NEXCOM gear
	Nav equipment		Intermittent comm on ground only increased uncertainty in operations, use more expensive certified gear
Untenable Schedule Optimization			
	Insufficient compute time		Require longer lead time for schedule inputs, reduced flexibility in constrained capacity
	Unusable solutions		Use suboptimal human operator heuristics
Passenger Rejection			
	Safety concerns	Education, data, redundancy features, failure mode demonstrations	Change target market (private pilots, daredevils)
	Small airport inconvenience	Political push to improve infrastructure at small airports Partner with service providers	

Risk Matrix

Likelihood	Consequences	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
5	Almost Certain			4.1; 5.1; 6.2; 9.2	4.3	5.3
4	Likely		9.1	1.1; 2.1	3.2; 6.1	
3	Possible	9.3		3.1		1.2; 5.2; 8.1
2	Unlikely		4.2; 5.4; 7.2; 7.3	2.2		
1	Rare					

Spiral Development Scheduling

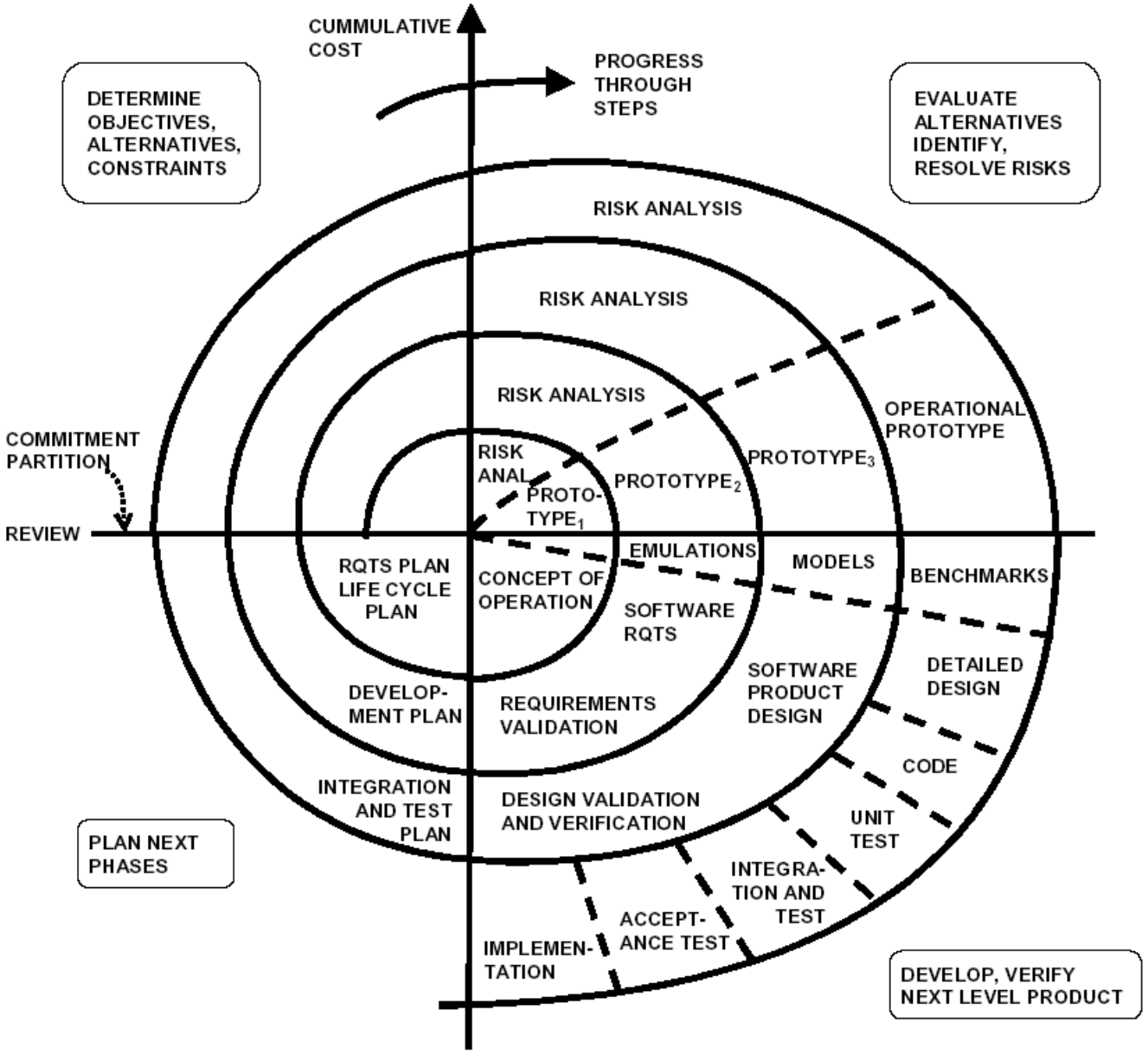


Figure 1: Original Diagram of Spiral Development

1. Operational Concept (1m)
2. Emulation Prototype (3m)
3. Modeling & Simulation (6m)
4. Proof-of-concept Demonstration (2m)
5. Deployment (6m)

http://www.sei.cmu.edu/pub/documents/00.reports/pdf/00sr008.pdf

Life Cycle Schedule Phases

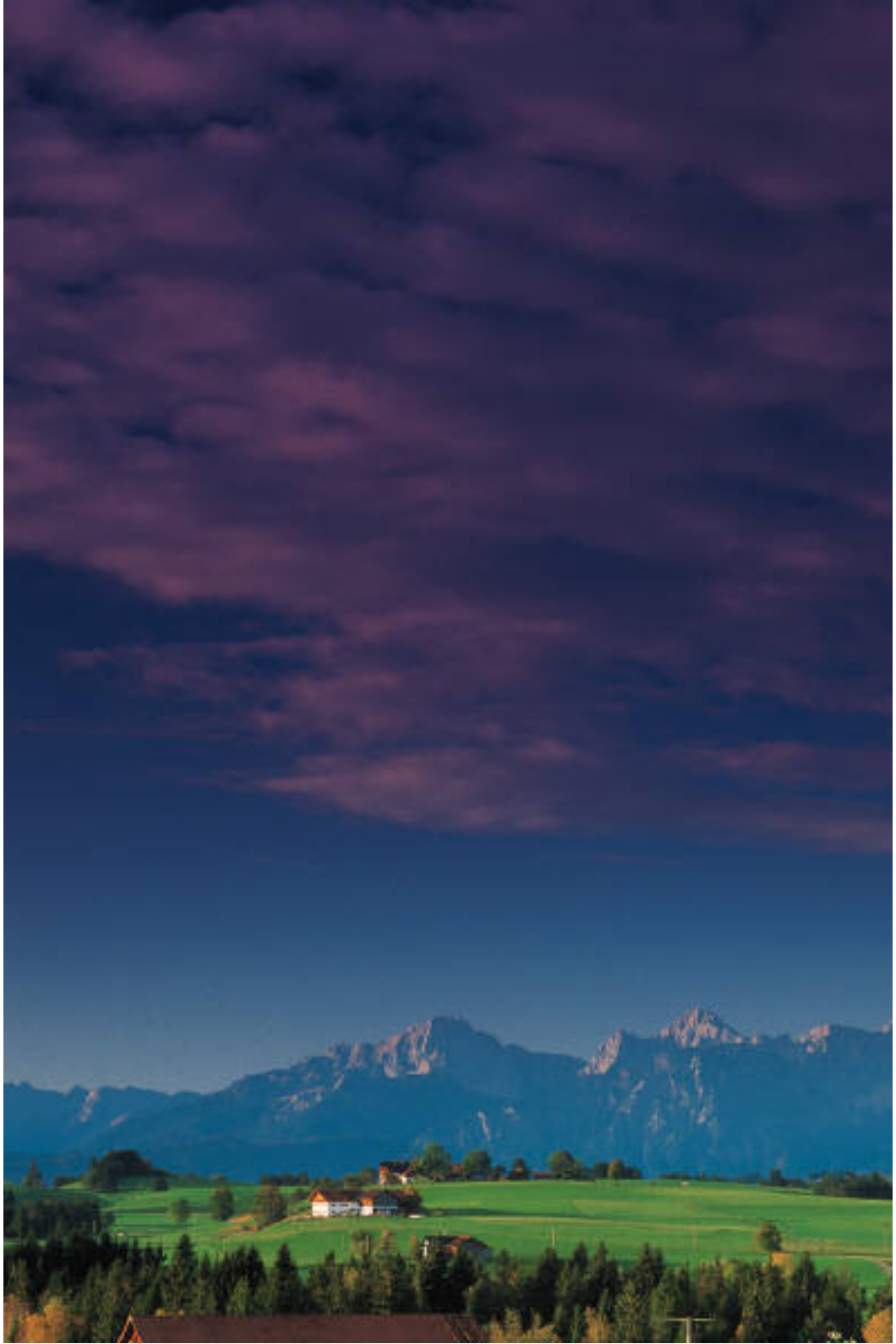
- 1 yr.: set up nominal initial operational capability

Future cycles (lower-priority design goals):

- Interoperability
  - open interfaces to other technologies & systems
- Incremental upgradability
  - incorporate new technologies
- Scaleable operations
  - distributed (decentralized) control center infrastructure
  - high availability

Next Steps

- Draw out resource-loaded project plan
- Justify Prototyping costs w/ decision tree
- Sensitivity analysis to design variables



Questions?