UNIT 1

Product Development Process and Organization

Product Development Process and Organization

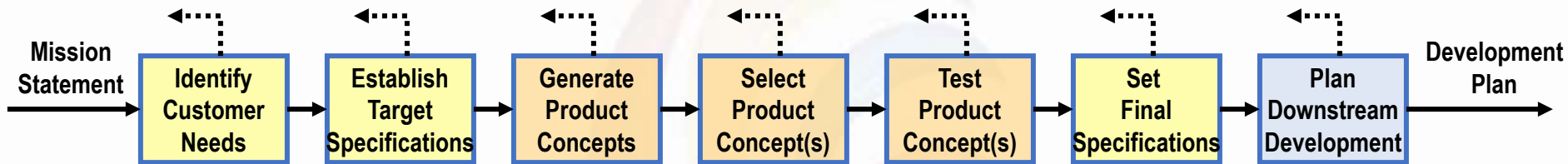# Generic Product Development Process
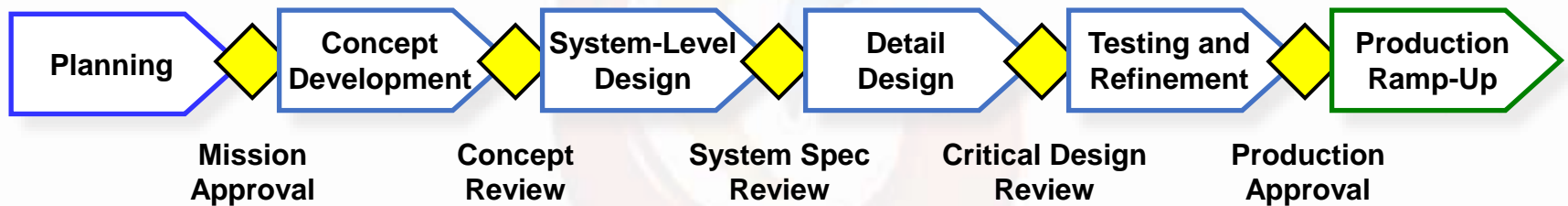
Concept Development Process

- Front-end of PD need not be a fuzzy process.
- Structured methods exist for each process step.
- This is not strictly sequential -- generally a parallel and iterative process.

Rapid Iteration PD Process

Staged Development Process

Planning

Concept Design

Reviews

System-Level Design

Detailed Design

Integration & Test

Launch

Cross-Phase Iterations (unplanned)

Within-Phase Iterations (planned)

Ref: Robert Cooper, *Winning at New Products 3rd ed.*, 2001.
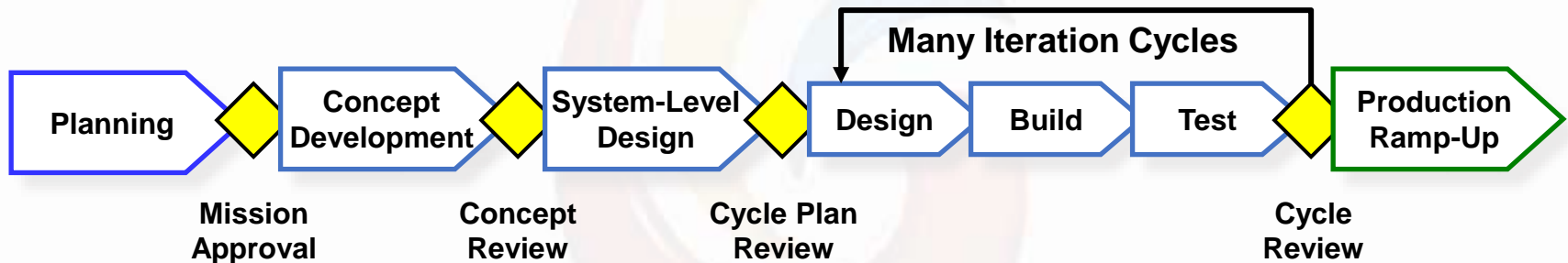
Spiral Development Process
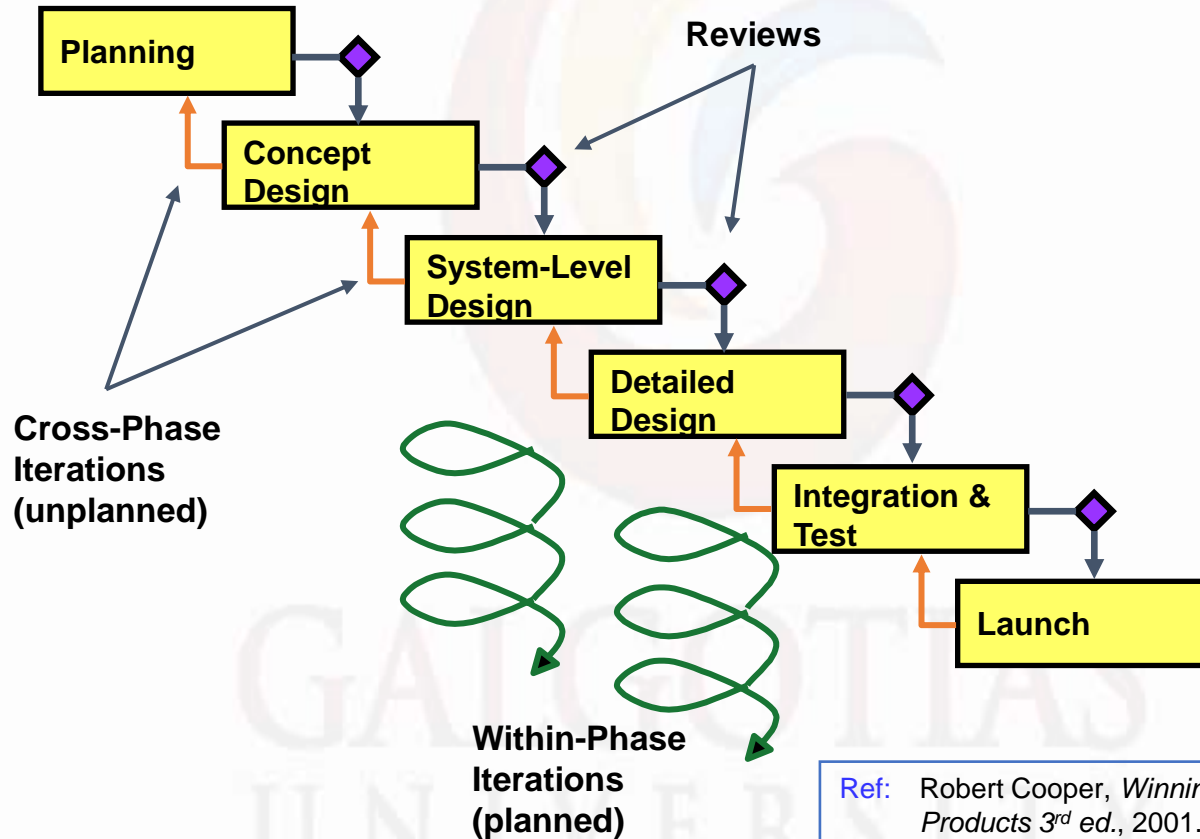
Spiral PD Process
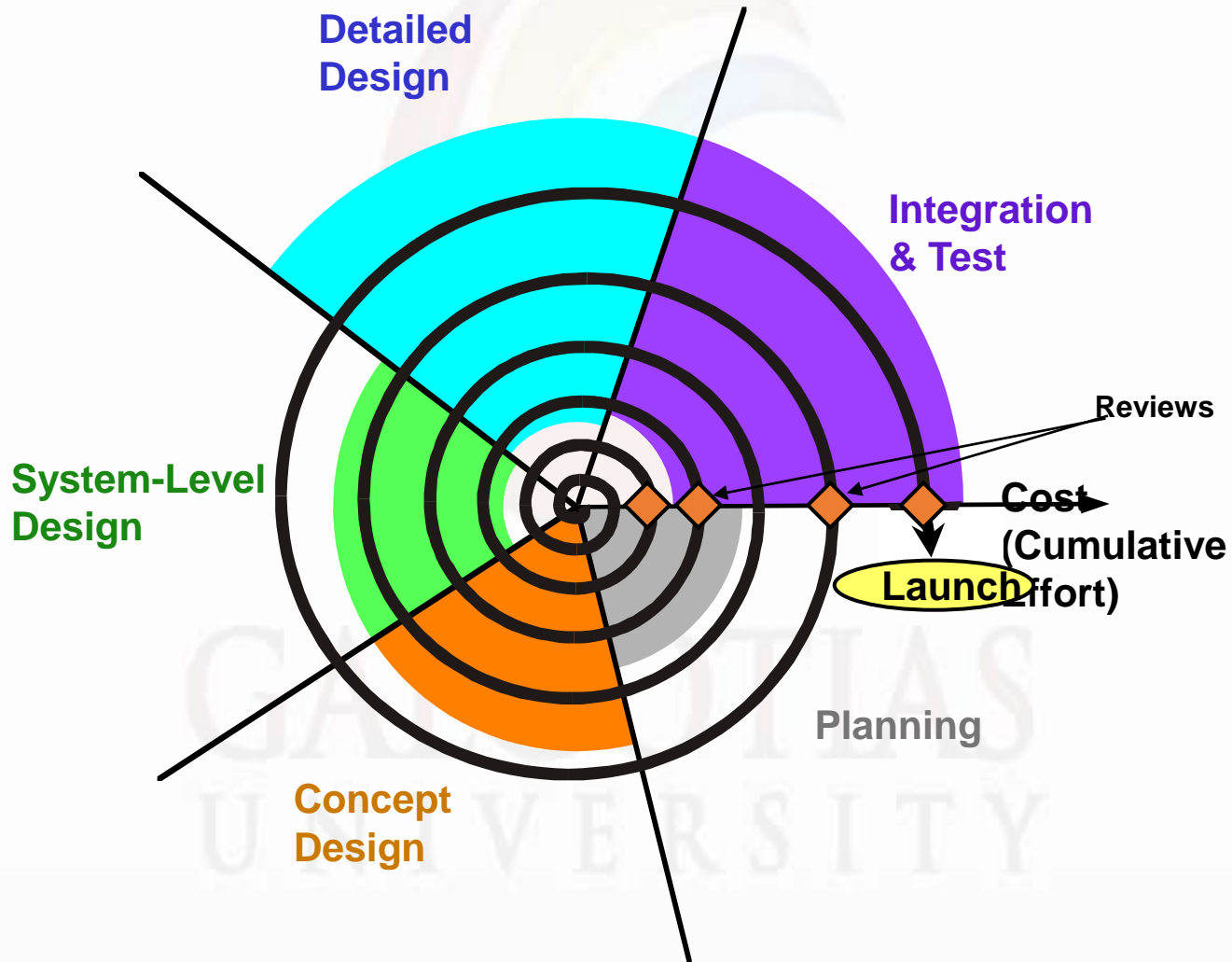
Complex System PD Process
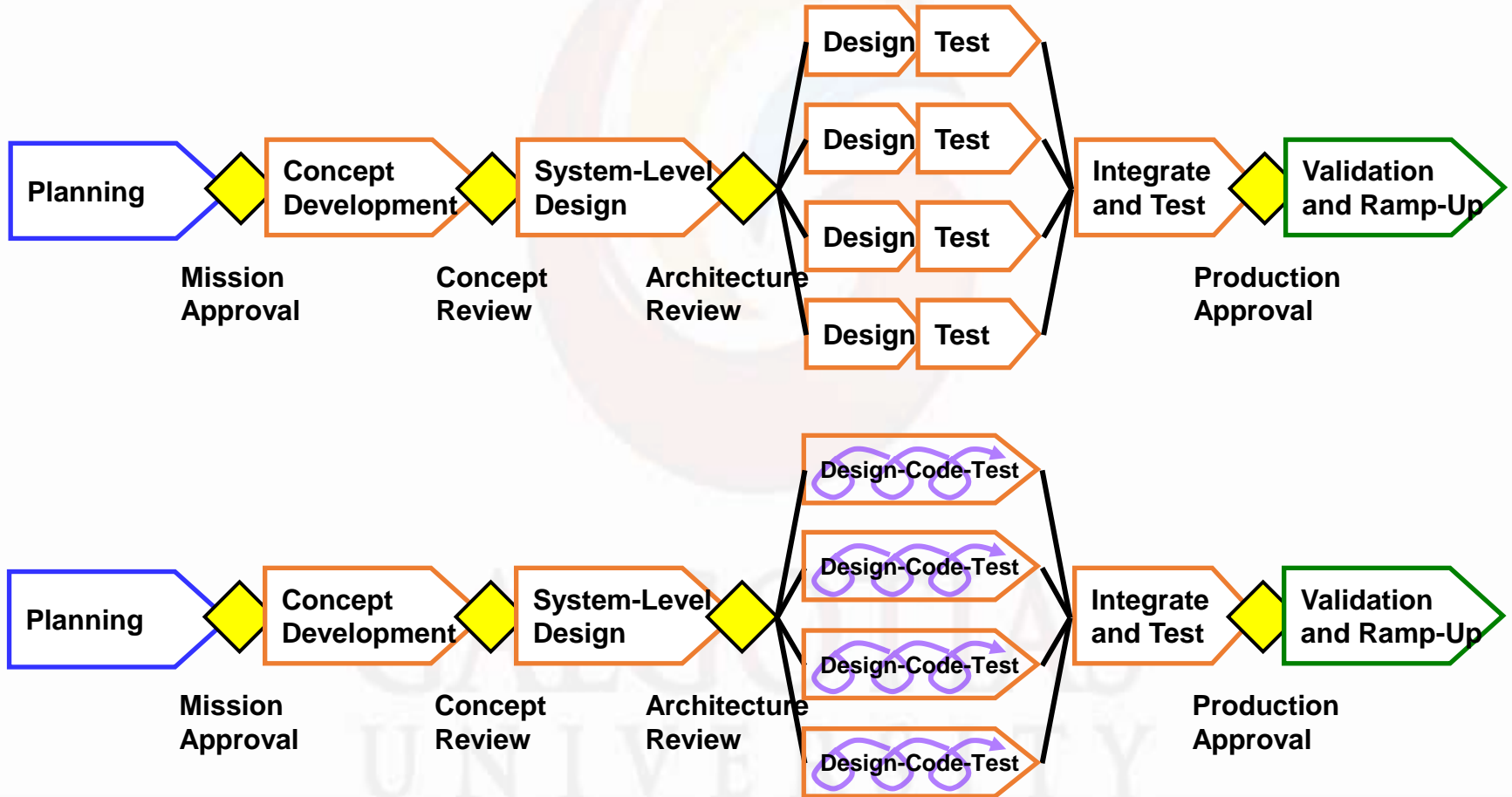
System Engineering V Model

Technology and Market Analysis

Feasibility Exploration

Operations and Maintenance

Changes and Upgrades

Concept Development

Customer Acceptance Requirements

System Deployment

System-Level Design

System Specifications and Test Plans

System Validation

Subsystem Design

Subsystem Specs and Test Plans

Subsystem Validation

Detail Design

Unit Specs and Tests

Component Testing

Decomposition

Integration

Component Development

Documentation and Review

Implementation

Adapted from U.S. Department of Transportation

Siemens Westinghouse *Stage Gate* PD Process

Tyco International *Rally Point* PD Process

DEFINE	CONCEPT	DESIGN	OPTIMIZE	VERIFY

Project Registration	Concept Definition	Feasibility and Planning	Preliminary Design	Final Design	Product Verification	Process Verification	Launch	Post-Launch Assessment

RP 0   RP 1   RP 2   RP 3   RP 4   RP 5   RP 6   RP 7   RP 8
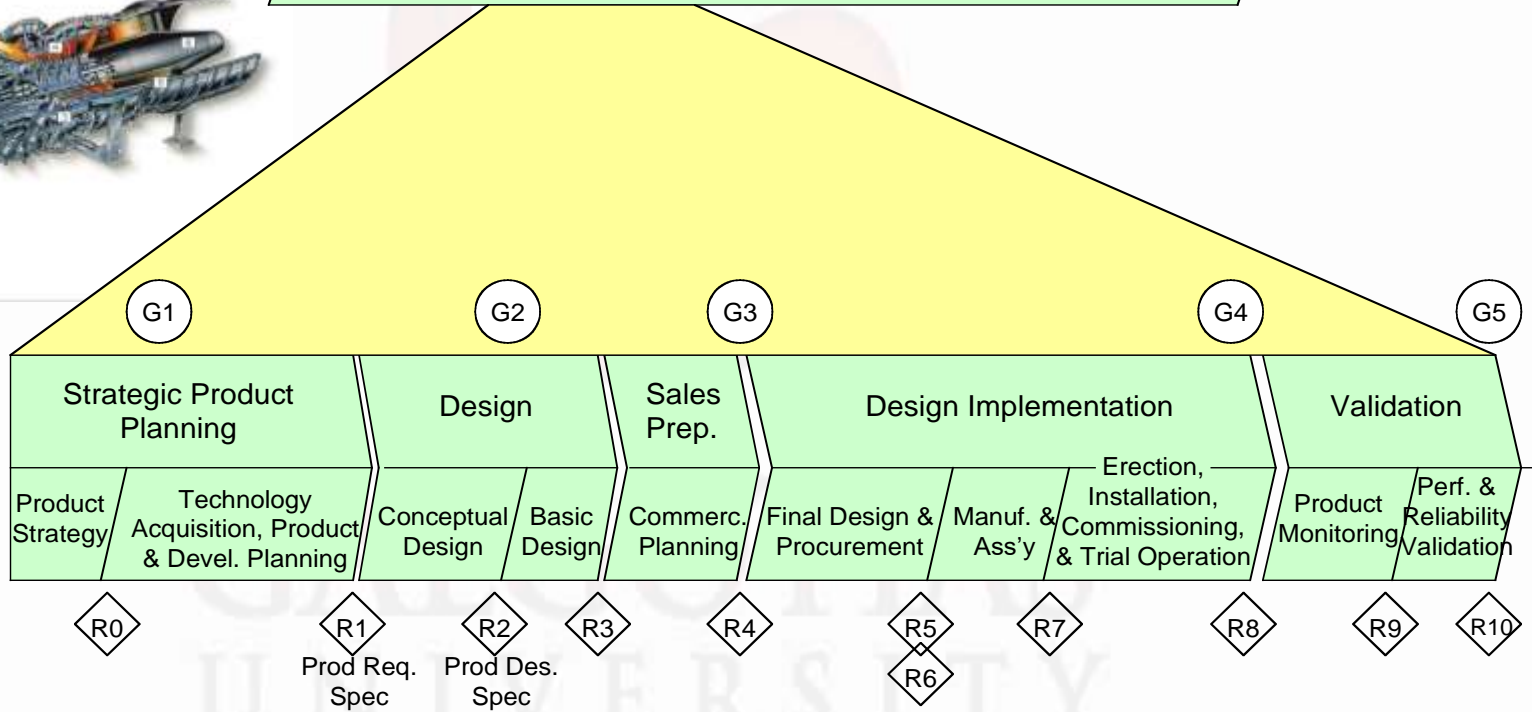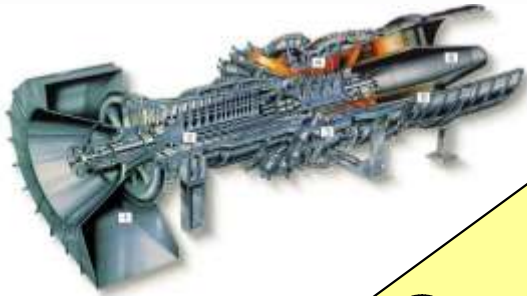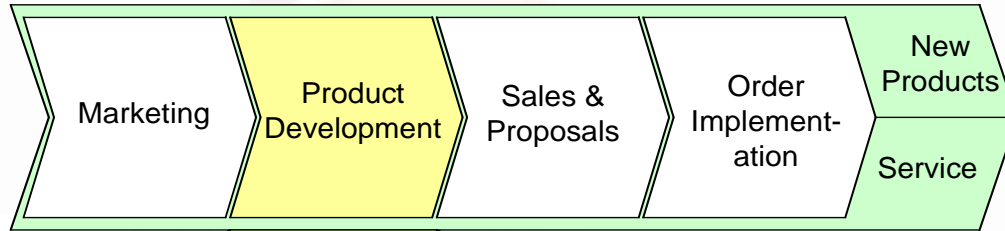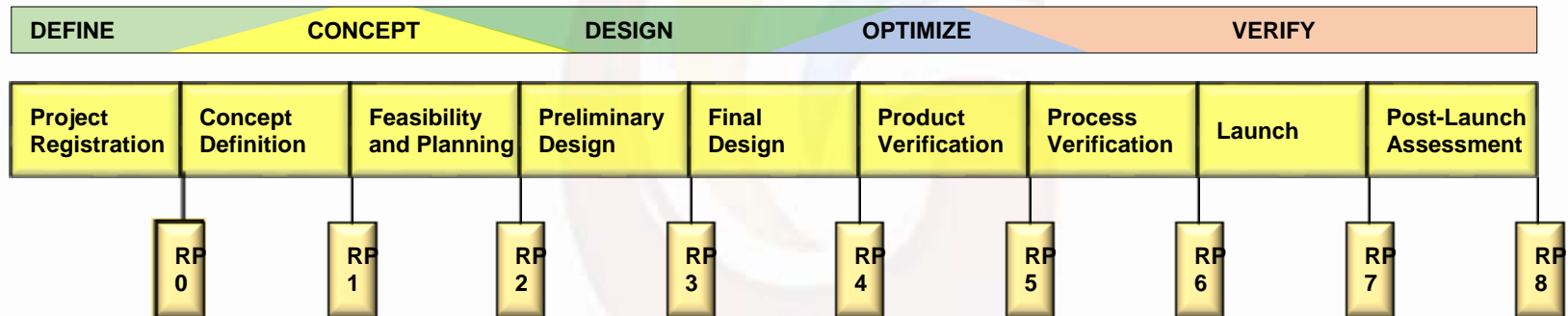
Source: Tyco International

Tyco International *Rally Point* PD Process

Rally Point Phase	0. Project Registration	1. Concept Definition	2. Feasibility and Planning	3. Preliminary Design	4. Final Design	5. Product Verification	6. Process Verification	7. Launch	8. Post-Launch Assessment
Primary Goal	Define project and business unit needs	Develop project concept and charter	Create product description	Create preliminary detailed design	Detail and optimize design	Demonstrate product performance	Demonstrate process performance	Launch product	Identify lessons learned
Marketing and Sales	Identify customers and market size	Capture voice of the customer	Develop marketing and sales plans	Review concepts with customer		Initialize field trials	Complete field trials	Finalize pricing and sales forecasts	Solicit customer feedback and satisfaction ratings
	Describe competitive features and benefits	Analyze customer needs	Create phase-in and phase-out plans				Finalize training plans	Complete sales and service training	Measure sales vs. forecast
	Identify target cost and price	Document customer needs							Complete phase-in and phase-out
Engineering	Identify project risks	Identify critical-to-quality specs	Create functional specification and performance metrics	Conduct a preliminary design review	Freeze hardware and software design	Finalize design documentation	Obtain regulatory approvals	Finalize product metrics	
		Develop and select concepts	Review concept selection	Build and test alpha prototypes	Complete engineering documentation	Complete beta prototype and field testing			
		Update project risks	Define product architecture	Assess product failure modes	Draft technical documentation	Apply for regulatory approvals			
			Assess technical failures modes		Secure beta prototypes				
Quality Assurance			Create preliminary test plan		Test beta prototypes for robustness	Complete quality assurance testing	Conduct process verification testing		
Manufacturing				Begin manufacturing process development	Finalize bill of materials (BOM)	Update manufacturing control plans	Run manufacturing pilots		Register obsolete and scrap products
				Conduct a preliminary manufacturing process review	Develop manufacturing control plans		Finalize manufacturing control plans		
Purchasing				Create a supplier participation matrix	Identify long lead-time items		Verify supply chain readiness		
				Assess suppliers for certification					
Legal		Search patents	Identify trade compliance issues	Identify potential patents	Prepare patent applications	Assure trade compliance			
Financial	Prepare preliminary business case	Refine business case	Complete financial package						Monitor return on investment
Project Management	Identify project timing, resources, and capital	Assess team capabilities/skills	Plan integrated product development schedule	Update RP1-2 deliverables	Update RP1-3 deliverables	Update RP1-4 deliverables	Update RP1-5 deliverables	Finalize all deliverables	Document best practices
	Prepare RP0 checklist & submit for approval	Identify development team members	Assign a project manager	Prepare RP3 checklist & submit for approval	Prepare RP4 checklist & submit for approval	Prepare RP5 checklist & submit for approval	Prepare RP6 checklist & submit for approval	Finalize launch plans and documentation	Prepare RP8 checklist & submit for approval
		Select a Rally Point process variant	Update RP1 deliverables					Update RP1-6 deliverables	
		Prepare RP1 checklist & submit for approval	Prepare RP2 checklist & submit for approval					Prepare RP7 checklist & submit for approval	

Xerox *Time-to-Market* (TTM) Process

| Define market attack plan & choose technology | Define product & deliver technology | Design product | Demonstrate product | Deliver product | Delight customers |

Software Development Sub-Process

XEROX

Microsoft *Milestone Build* Spiral Process

Planning

Development

Coding

Integration

Testing

Debugging

Stabilization
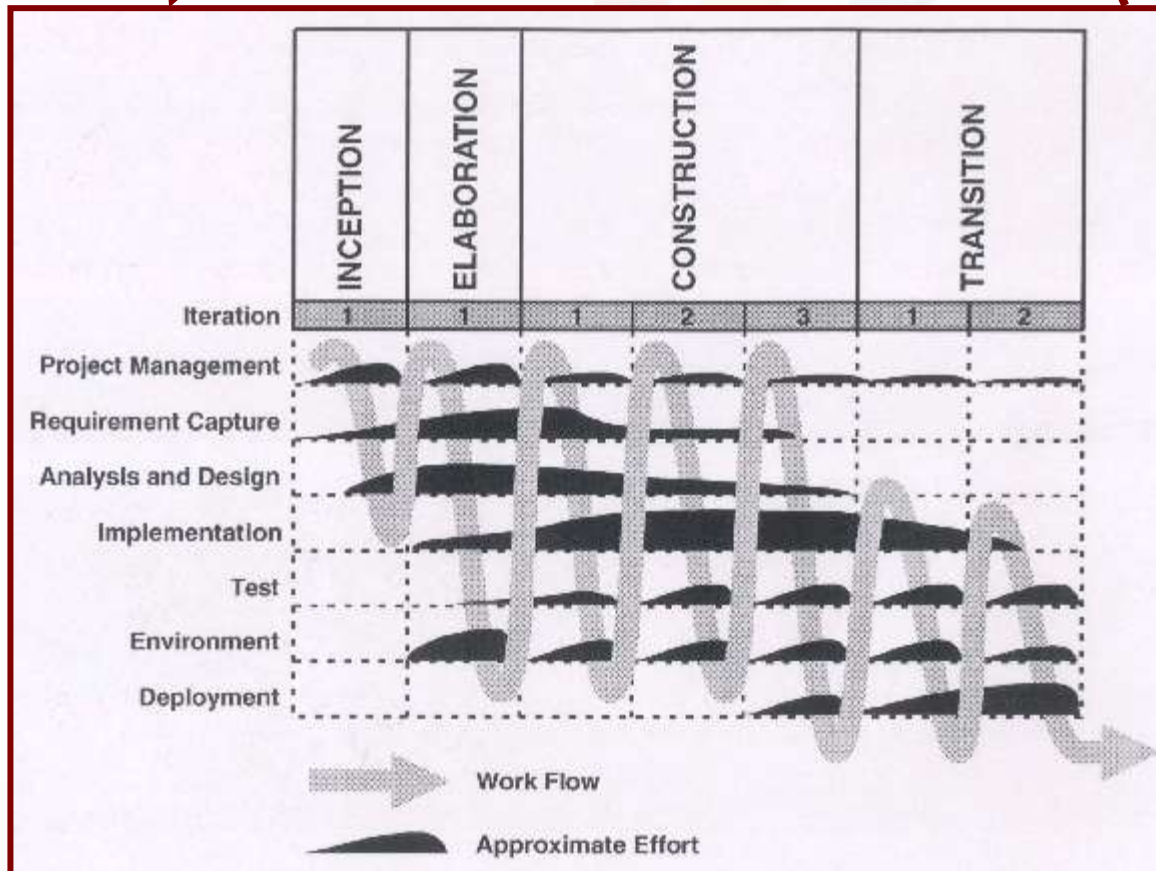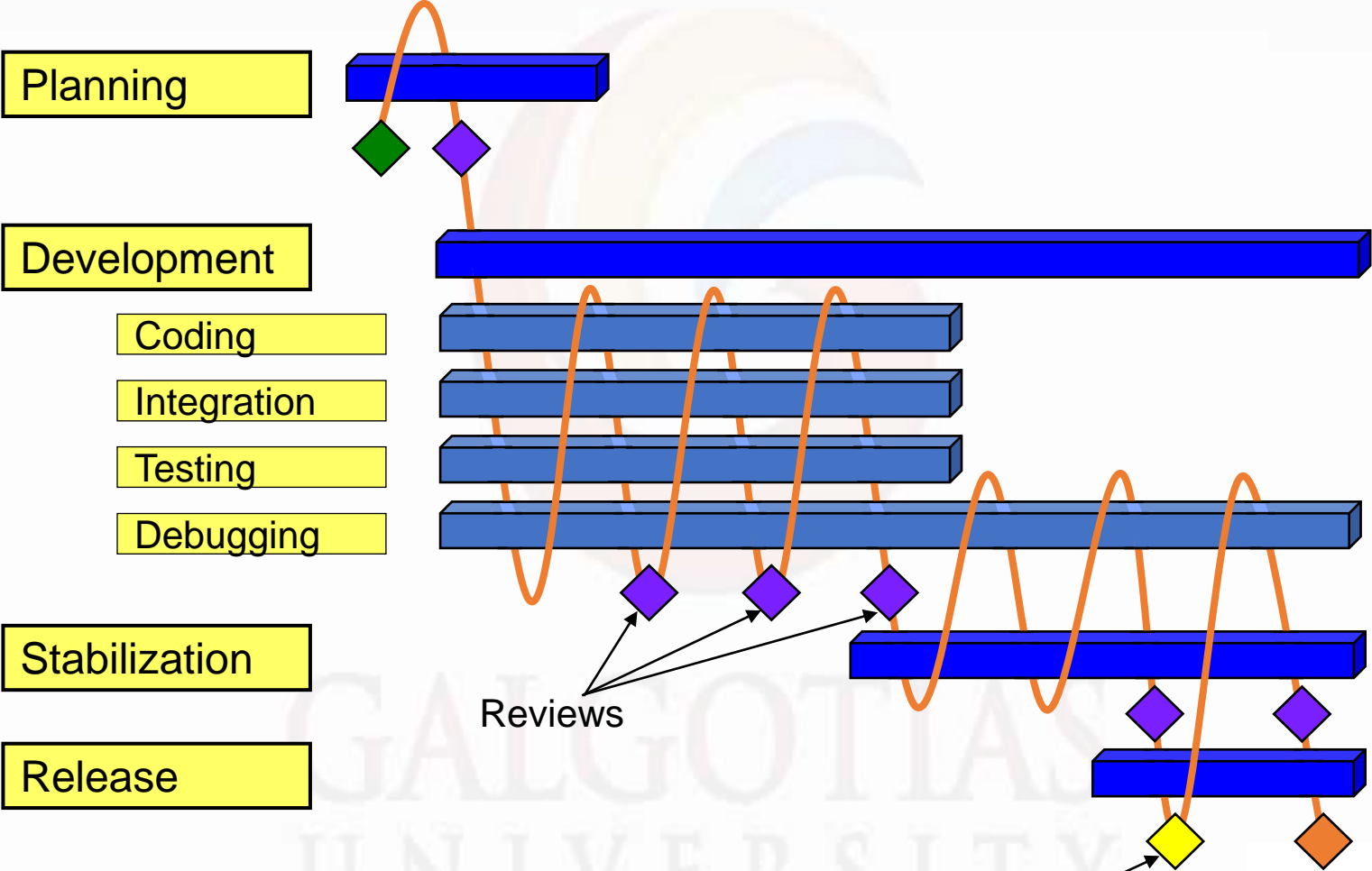
Reviews

Release

Beta

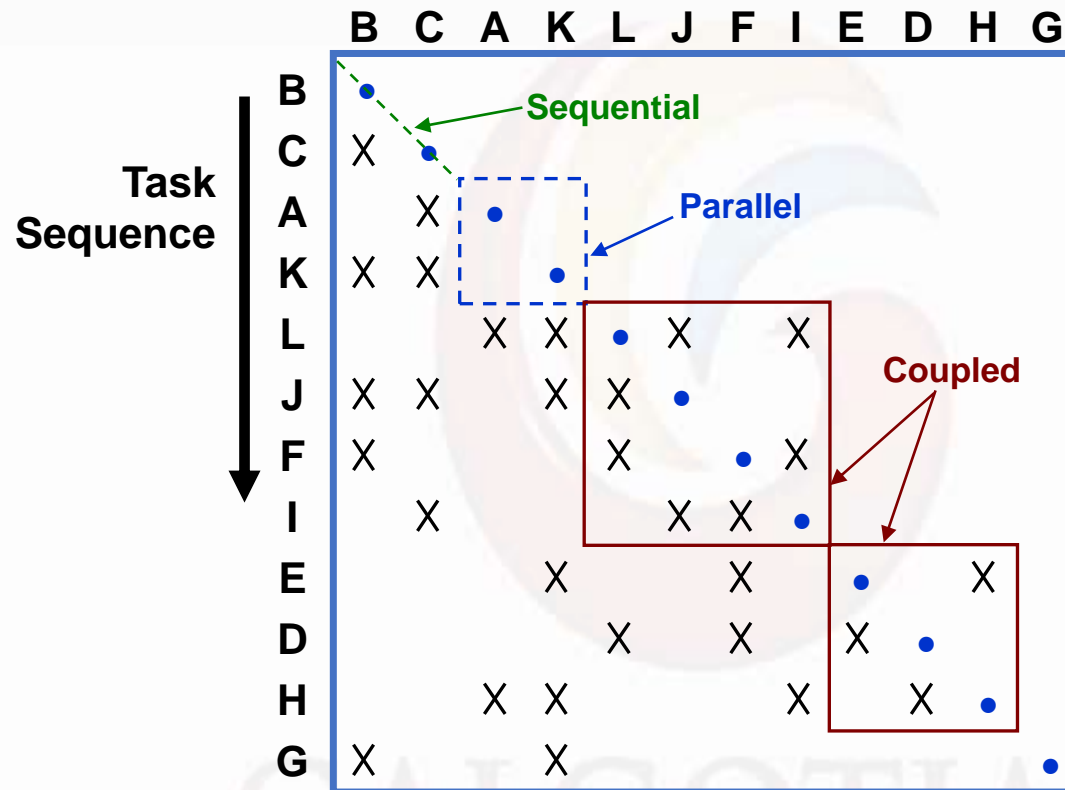Microsoft Office

Staged Development Process Example: ExxonMobil
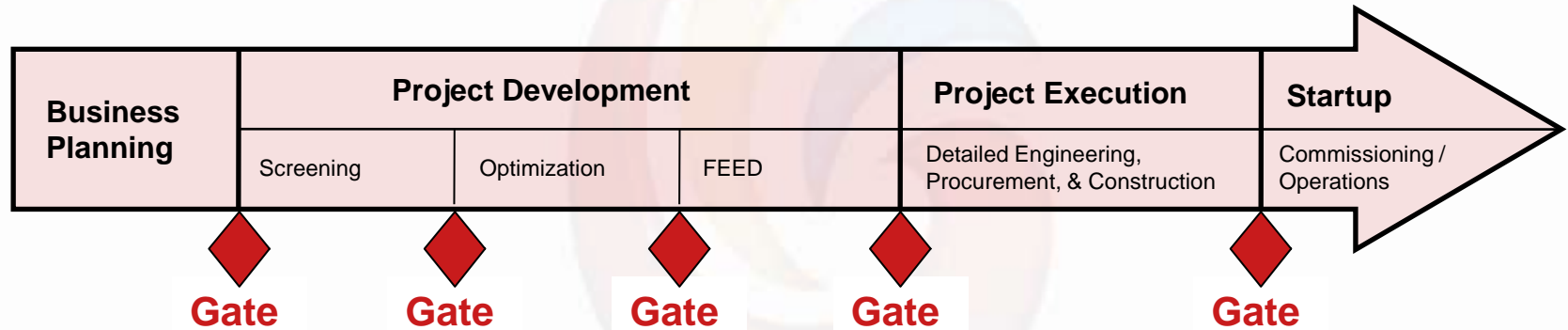
Source: ExxonMobil Research and Engineering

Design Structure Matrix:
A view of PD process architecture

Note:

- Coupled tasks can be identified uniquely.

- The display of the matrix can be manipulated to emphasize certain features of the process flow.

- DSM analysis software implements partitioning algorithms.

Ref: Eppinger and Browning, *Design Structure Matrix Methods and Applications*, MIT Press, 2012.
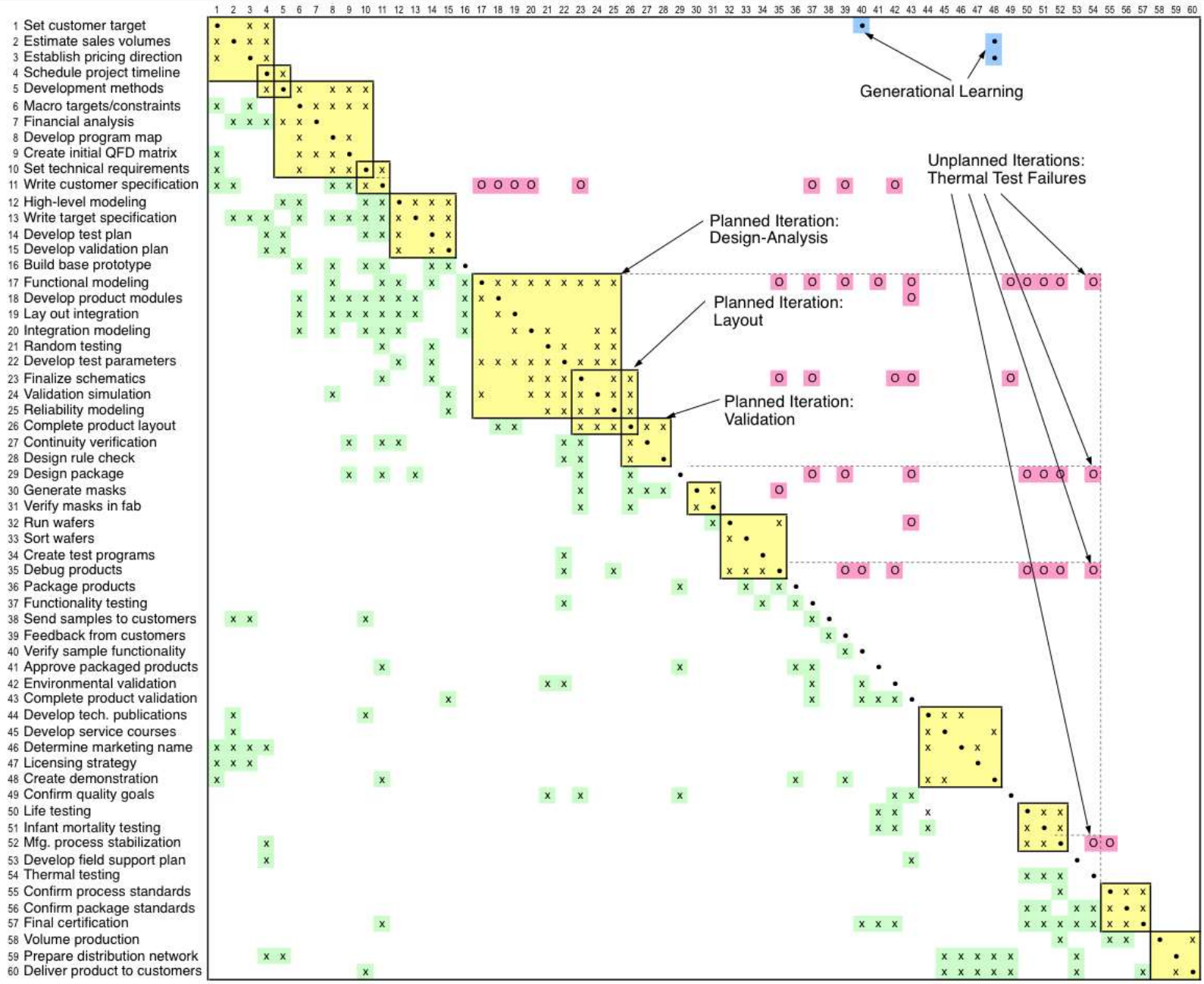
Legend: x = Information Flows | = Planned Iterations o = Unplanned Iterations · = Generational Learning

Recent Trends in PD Processes

- **Design Thinking**
  - user-centered approach to design, ideation, iteration, and testing
- **Development Speed**
  - using digital design, analysis, and collaboration tools to develop products faster
- **Platform Leverage**
  - open product architecture provides value by allowing multiple providers to use the platform
- **Complexity Management**
  - engineering complex systems through analysis of interaction networks
- **Outsourcing/Offshoring**
  - taking advantage of partner skills, operations, and access to global markets
- **Lean Principles**
  - improving efficiency by applying lean production, lean startup, and agile development methods
- **Open Innovation**
  - using the Internet to bring more people and their ideas into the process
- **Sustainability**
  - considering environment and social issues in responsible design of new products
- **Business Model Innovation**
  - new revenue models, e.g. multi-sided platforms, freemium, subscription, product-service systems

Apple *vs.* Google

Try it out.

Research and Development

| R	T	D
Basic Research	**Technology Development**	**Product/Service Development**

Basic Research
- Discovery process
- No set timing
- Unpredictable returns
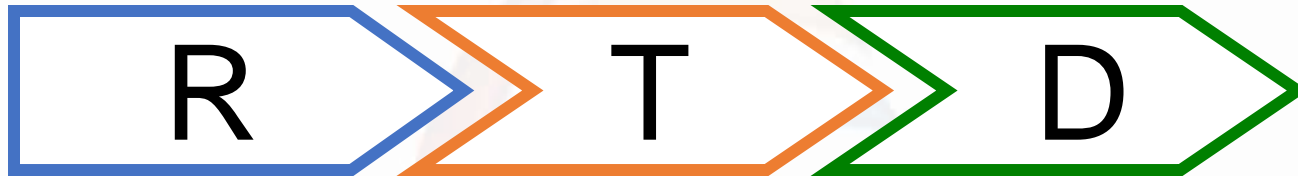- Long term

Technology Development
- Loosely structured
- Difficult to plan
- Less predictable
- Medium term

Product/Service Development
- Structured methods
- Planned timing
- Predictable outcome
- Short term

Increasingly systematic →
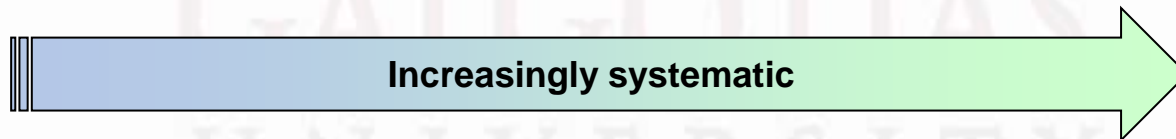
Linking R through T into D

R	T	D
Basic Research	**Technology Development**	**Product/Service Development**

Basic Research
- Acoustics
- Noise cancellation
- Vibration reduction

Technology Development
- Components
- Robustness
- Demonstration

Product/Service Development
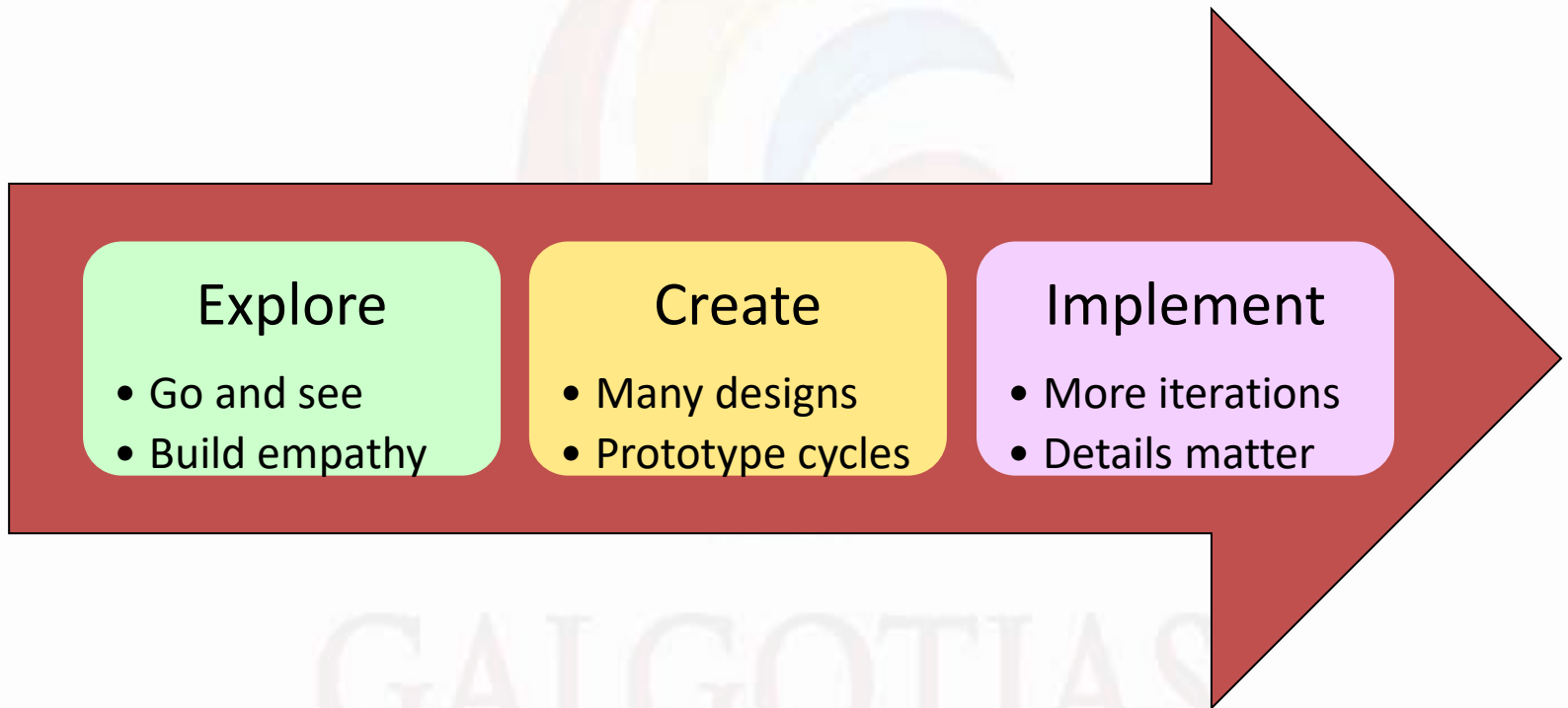- Headphones
- Home audio systems
- Auto OEM sound packages

BOSE
Better products through research

Design Thinking Skills

Explore
- Go and see
- Build empathy

Create
- Many designs
- Prototype cycles

Implement
- More iterations
- Details matter

Ref: Tim Brown, "Design Thinking", *Harvard Business Review*, June 2008.

The Agile Manifesto:

A statement of software project values

Individuals and interactions	over	Process and tools
Working software	over	Comprehensive documentation
Customer collaboration	over	Contract negotiation
Responding to change	over	Following a plan

www.agilemanifesto.org (2001)

Scrum Development Process

3. Project leader who enables the work of the team

6. Regular team check-in to report and coordinate

1. Product manager with responsibility for product success

Scrum Master

Daily Meeting

5. Full-time, self-organizing group doing the real work

Product Owner

Sprint Cycle 1-4 weeks

Project Team

Stakeholders

Product Backlog

Evaluation

Sprint Backlog

Incremental Delivery

Feedback

2. Prioritized list of project deliverables and milestones

4. Selected list of tasks to execute in the current sprint

7. Results reviewed by stakeholders at end of each sprint

Demonstration of a Scrum Meeting

How a PD team uses Scrum to:

- Focus on value to customers
- Stay informed of status and actions
- Understand project risks

… in a daily stand-up meeting

Demonstration of a Kanban Board

How a PD team uses Visual Management to:
- Prioritize the Product Backlog
- Keep track of tasks in the Sprint
- Know what everyone is doing
- See what is done!

… using Trello or Jira

Trello Boards for Inspiration

www.trello.com

- Scrum Project Management Board

  https://trello.com/b/0xzkRjTH/scrum-project-management-board

- Product Roadmap

  https://trello.com/b/kZsVVrc8/front-product-road

- Subnautica Development
  https://trello.com/b/yxoJrFgP/subnautica-development

- SaaS Development Board
  https://trello.com/b/jBSQMmXr/saas-development-board

- Agile Board

  https://trello.com/b/DnZvFigA/agile-board

References

1. Karl T. Ulrich and Steven D. Eppinger (2009), Product Design and Development, 4th Edition, Tata McGraw-Hill Publishing Company Limited, ISBN: 978-0-070-14679-2
2. Stephen C. Armstrong (2005), Engineering and Product development Management– The Holostic Approach, Cambridge University Press, ISBN: 978-0-521-01774-9.
3. IbrahimZeid (2006), Mastering CAD/CAM, 2nd Edition, Tata McGraw-Hill, ISBN: 978-0-070-63434-3.
4. Anoop Desai, Anil Mital and Anand Subramanian (2007), Product Development: A Structured Approach to Consumer Product Development, Design, and Manufacture, 1st Edition, Butterworth-Heinemann, ISBN: 978-0-750-68309-8.

Thank you