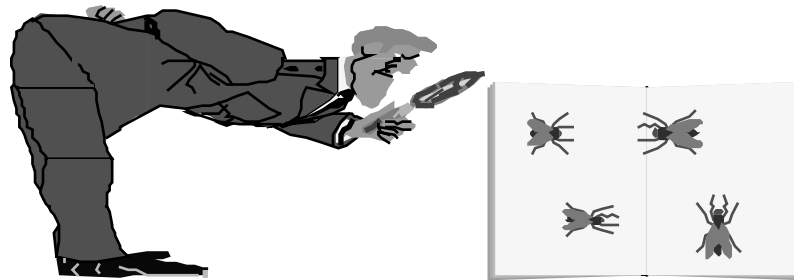


Fagan's Inspections For Documents



Lecture Outline

- **Fagan's Software Inspections**
- **Formal Process Definition**
- **Exit Criteria Examples**
- **Defects**
- **Seven Step Inspection Process Objectives**
- **Inspection Roles**
- **Step 1 - Planning**
- **Step 2 - Overview**
- **Step 3 - Preparation**
- **Step 4 - Inspection Meeting**
- **Step 5 - Inspection Analysis Meeting**
- **Step 6 - Rework**
- **Step 7 - Follow-Up**

Expectations

Motivate participants to:

- **Use these processes to produce defect-free products with a high degree of productivity**
- **Perform those processes repeatably and consistently**
- **Continually improve those processes in a controlled manner**

Provide participants with the knowledge and skills to:

- **Use the Fagan's Inspection processes**
- **Measure (participate in a Fagan's Inspection) and improve their work product**
- **Participate in developing improvements to work processes**

Objectives

- 1. To impart sufficient knowledge and skills to enable you to participate in productive document inspections. You will understand the objectives, principles and methods of Fagan's inspections.**
- 2. To develop skills/knowledge to enable you to participate in effective inspections fulfilling a moderator, author, reader or tester role:**
 - Planning & Organizing a Fagan's Inspection**
 - Preparing for a Fagan's Inspection Meeting**
 - Participating in a Fagan's Inspection**
- 3. To understand the basic concepts and approach of continuous process improvement as it relates to the software inspection process.**

Fagan's Inspection

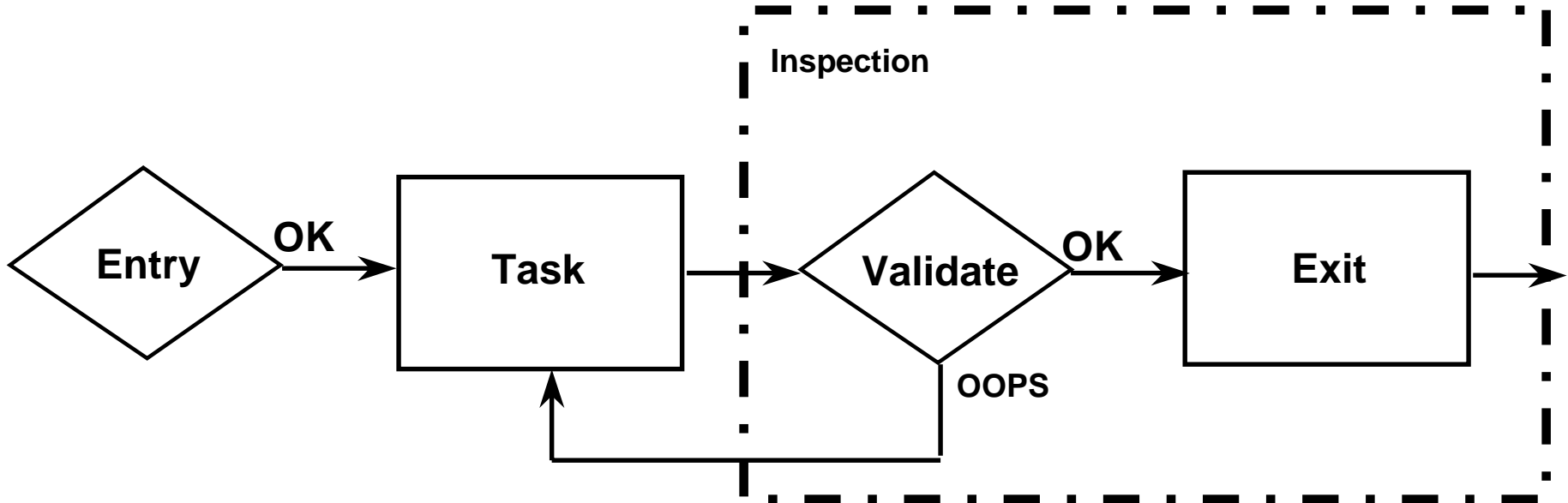
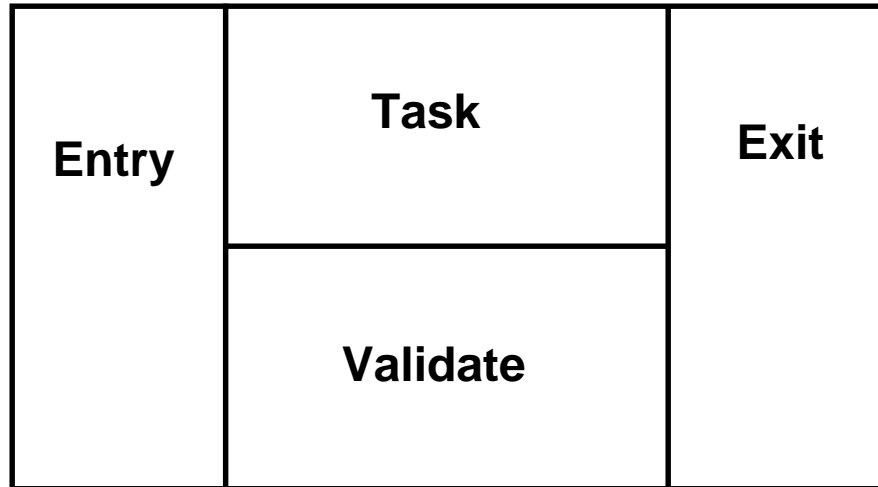
DEFINITION

A highly structured, clearly defined process by which software documents are reviewed in detail by a team including the author and, ideally, the customer.

GOAL

To identify defects as closely as possible to the point of occurrence in order to facilitate corrective action.

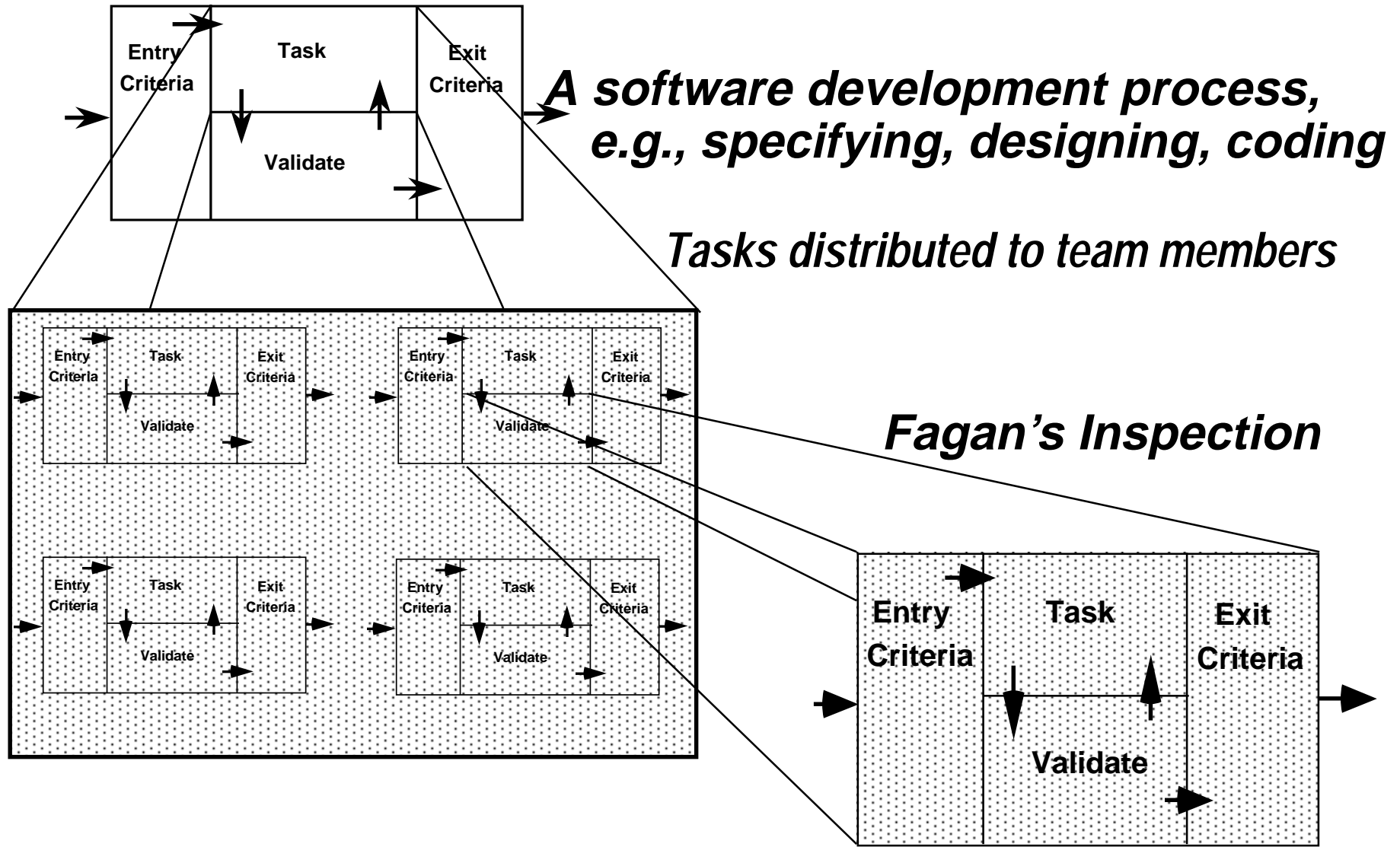
The ETVX Paradigm



ETVX Paradigm

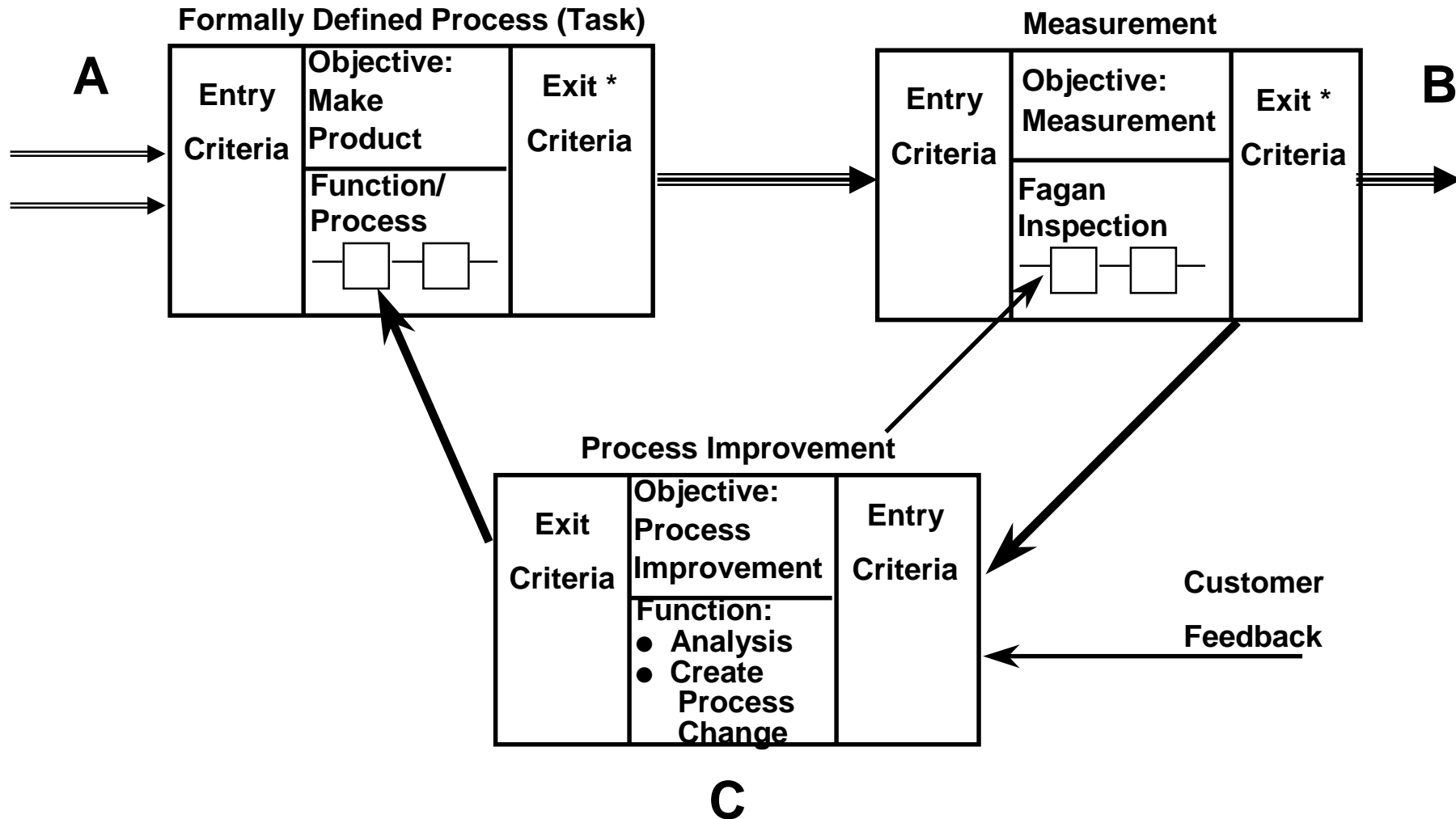
Relationships: Software Development Process

Fagan's Inspection



Michael Fagan's A-B-C Process

Continuous Incremental Process Improvement

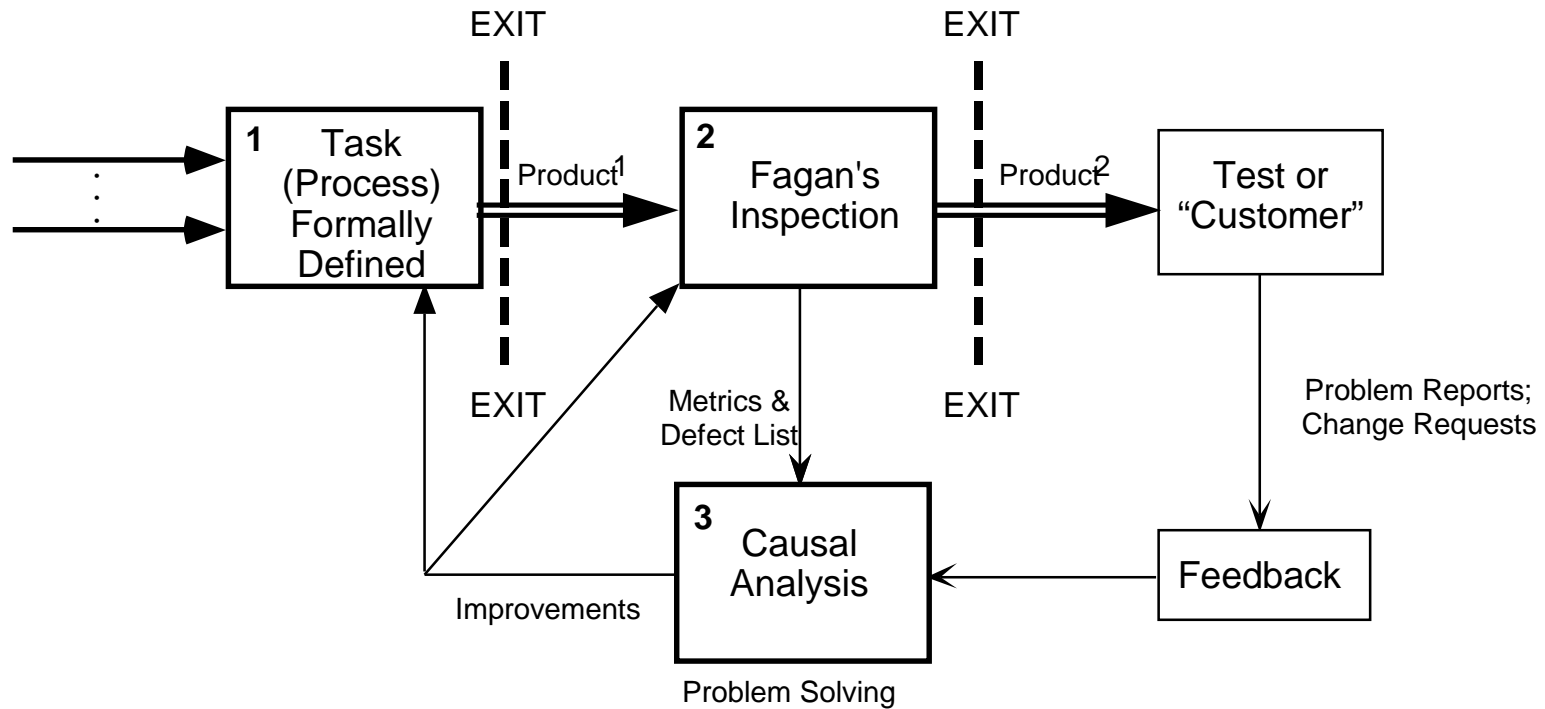


* Same Exit Criteria for product creation and validation

Relative Cost of Finding Defects

Who (Ref.)	In reqts	In design		In Coding			In Use
IBM			Prior to coding		Prior to test	During test	In field use
(Humphrey)		1.5	1	1.5	10	60	100
TRW					Develop. test (in)	Acceptance test (in)	Operation
(Boehm '81)	1	3-6		10	15-40	30-70	40-1000
IBM			Design reviews		Code Inspections	During machine test	
(Remus)			1		20	82	

Fagan Processes



* Same Exit Criteria for product creation and validation

Product¹: Product produced by process

Product²: Product with identified defects removed

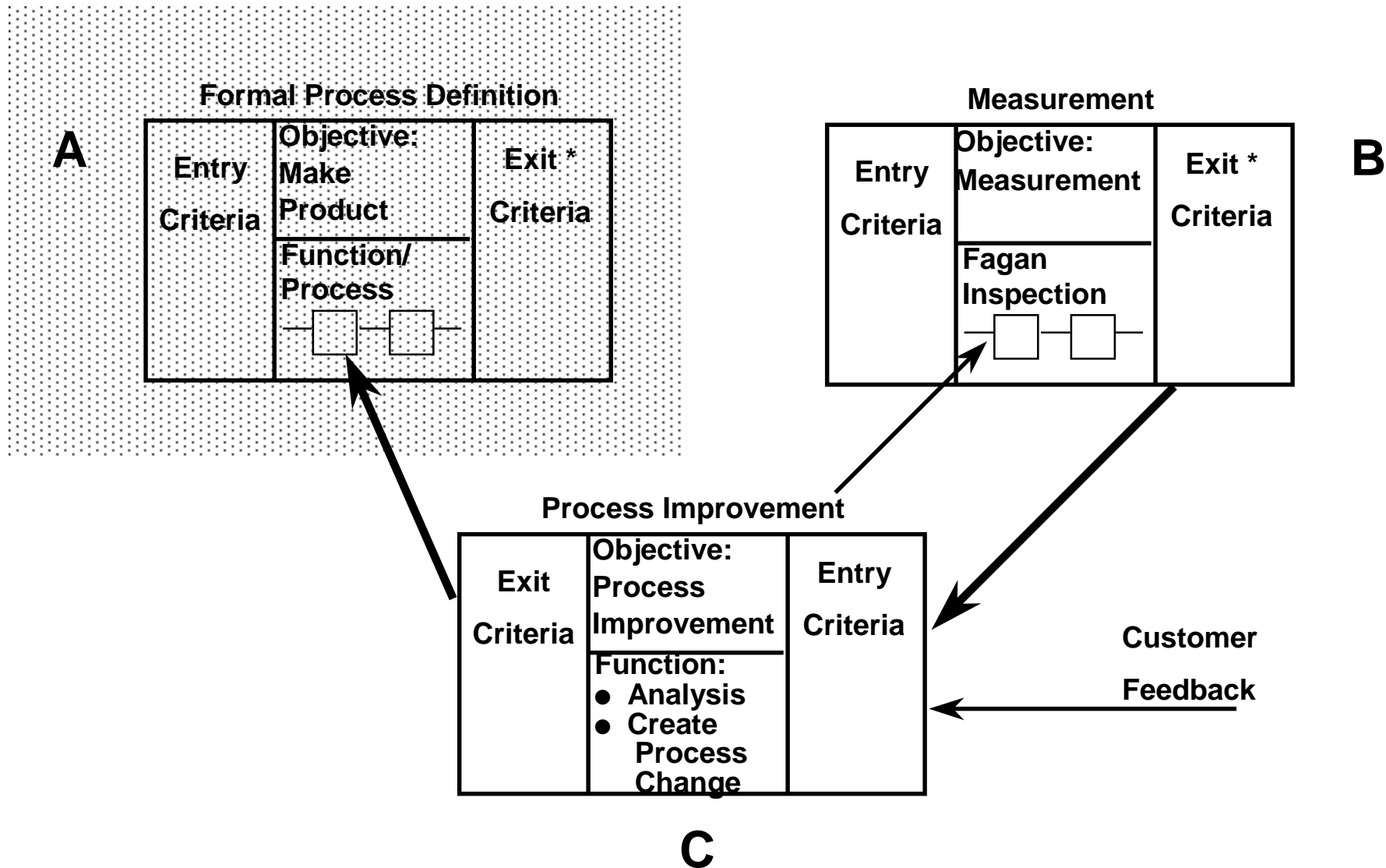
Software Inspection Methodology

This methodology has been found to work effectively in conjunction with all development techniques and languages with which it has been involved over the last 20 years.

You should expect it to work well with whatever techniques and languages you are now using.

The Software Inspection Process

Formal Process Definition



* Same Exit Criteria for product creation and validation

An Operational Definition of Entry/Exit Criteria

Operationally, Entry/Exit Criteria can be determined by asking about the *completeness* and accuracy of the process input/output.

Completeness is the set of statements defining *all* of the items that make up a finished document.

Accuracy, the standards of acceptance, is a combination of:

- the definitive source of information, conditions, or rules for data found in the document (content).
- how that information is to be formatted or depicted (form).

***The purpose of exit criteria is to define quality.
Without a definition of quality, quality cannot be measured.***

More Definitions of Exit Criteria

Exit criteria answers the questions:

"How do I know when I am finished with a task?"

"How can I show I've done it right?"

Characteristics of Exit Criteria

- A list of items that must be contained in a work product (SoA: one typed page).
- Each item has a "Standard of Acceptance (SoA)" associated with it.
 - An SoA states the attributes (properties) of each item.
 - An SoA states the acceptability of each item in a binary manner thereby allowing peers to objectively judge whether it has been met.
 - Each SoA must have an associated detailed reference so that someone could be shown that the standard was in fact met.
- Should be agreed to by the next step's workers [customer(s)].

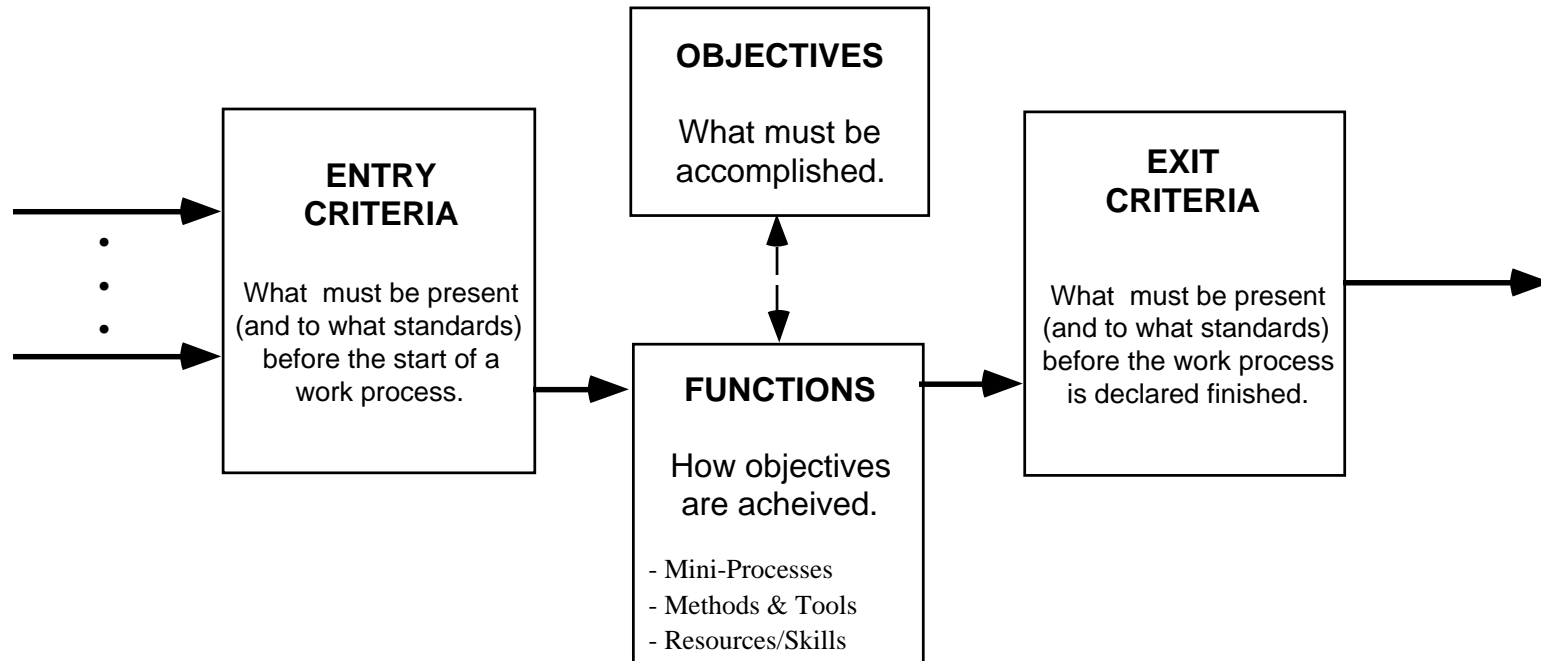
Exit Criteria

1. Items in Product, and Standards of Acceptance for each item
2. Product-requirements

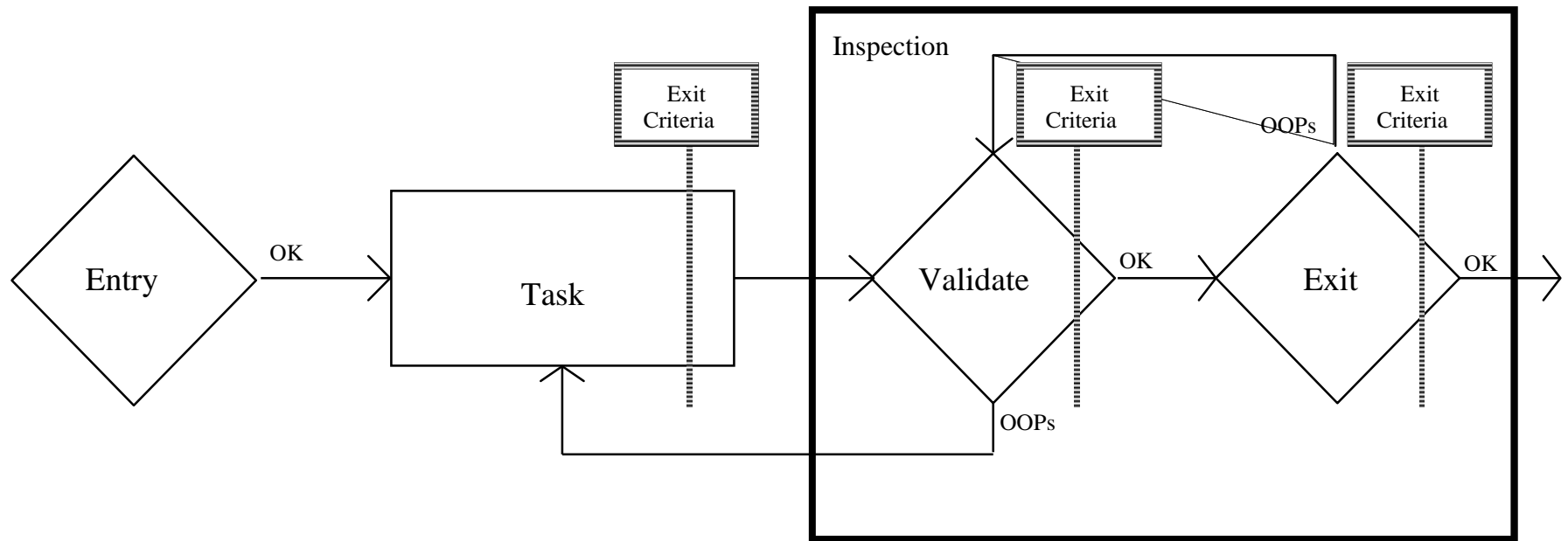
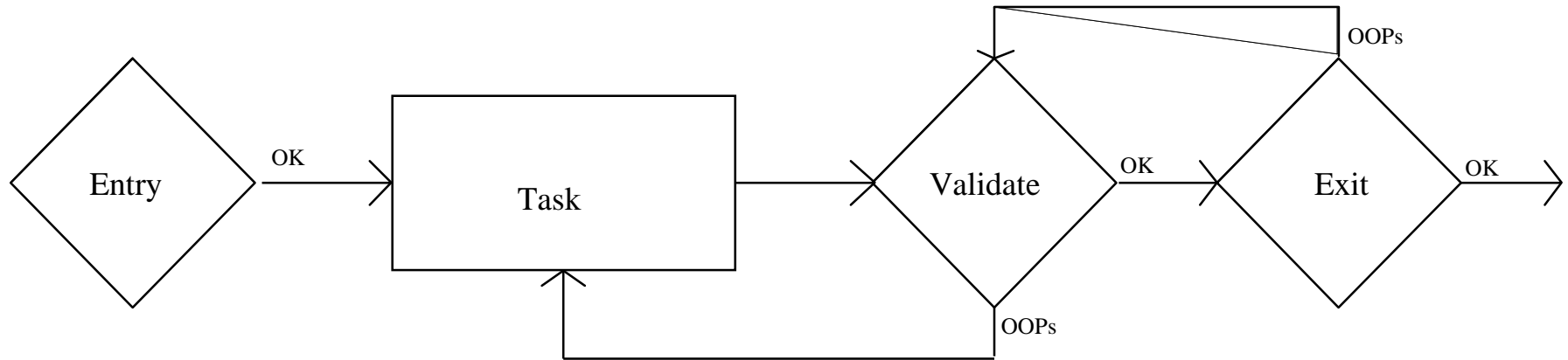
Example for Items in Product: My Presentations

1. **Copyright (SoA: Legally correct; in PowerPoint or Word template)**
2. **Version information: Version number & Date; “File name”-Page#**
3. **Title (SoA: one or two lines; 36 pt; centered)**
4. **Amount of material (SfA: max 18 lines of 24pt text with no graphics):**
 - - 2-5 Major topics (one line; No bullet)
 - - 2-5 Bullets on 3-4 major bullets with ●
 - - 2-5 Sub-bullets on 3-4 sub-bullets with dash lead-in
5. **One or two graphics (SoA: not interfering with text or replacing text lines)**
6. ...

Formal Process Definition

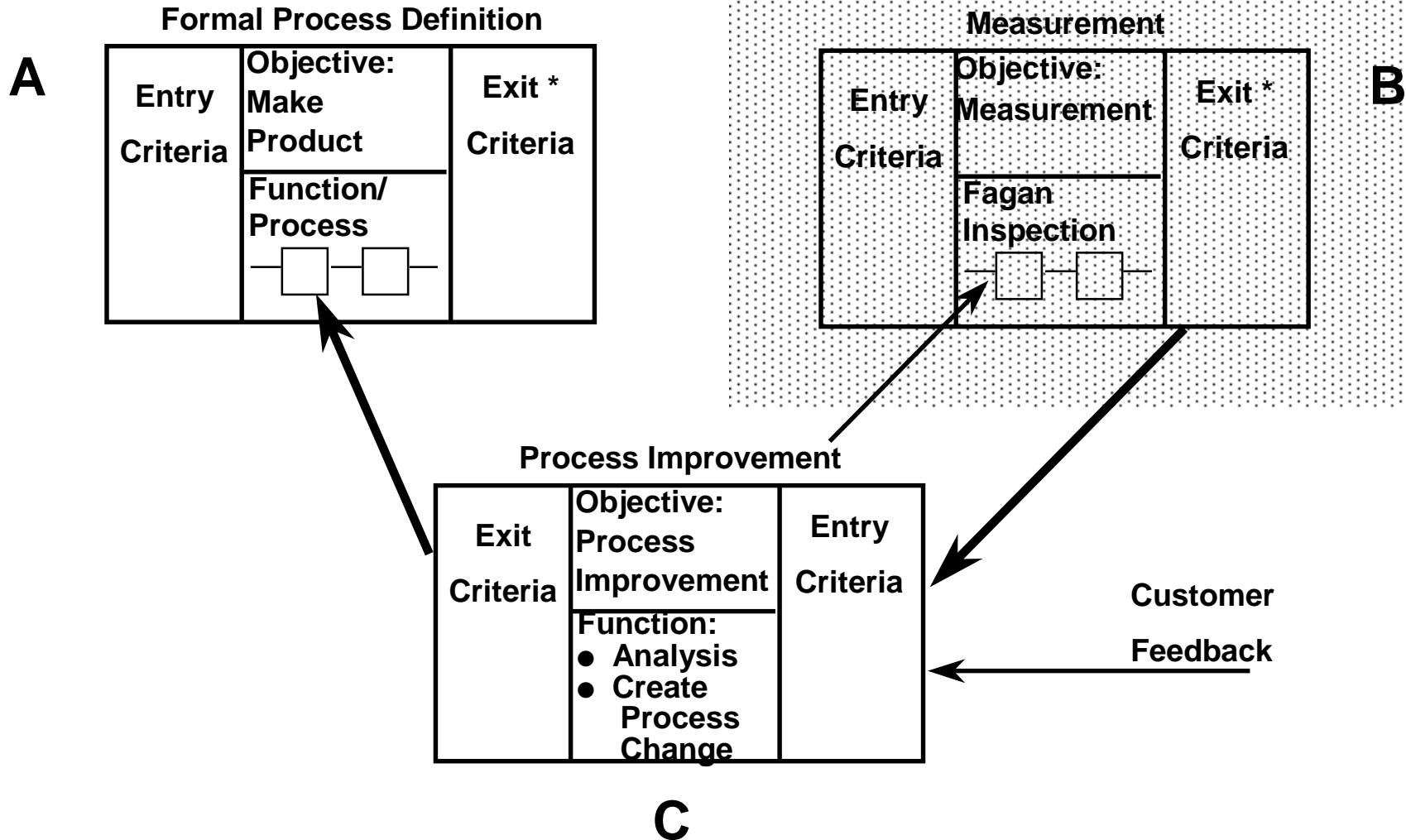


ETVX



Software Inspection

Measurement



* Same Exit Criteria for product creation and validation

Objective of Inspection

TO FIND EVERY DEVIATION FROM THE EXIT CRITERIA

- **Exit criteria are the work requirements of the process that the work product must meet**
- **Each deviation from requirements is a defect**

Purposes of Inspection

- Find defects immediately after they are caused
- Reduce total defect rework to a minimum
- Reduce the schedule impact of defect rework on subsequent life cycle processes
- Measure product quality (Exit Criteria)
- Determine whether a process has been completed
- Give real measurements against project management check points
- Provide early data for improvement of the software process
- Provide the software author with the quickest feedback on defects, how to recognize and avoid them in the future

What Is a Defect?

- **An instance of non-conformance with the initiating requirements, standards, or exit criteria**
- **Can exist in the accuracy/completeness of requirements, standards, and associated interface/reference documents**
- **Identified by team consensus during inspection meeting based on requirements/standards**

Defect Categories

■ Severity

a. Major

- A Condition that causes an operational failure, malfunction, or prevents attainment of an expected or specified result
- Information that would lead to an incorrect response or misinterpretation of the information by the user
- An instance of non-conformance that would lead to a discrepancy report if implemented as is

b. Minor

- A violation of standards, guidelines, or rules, but would not lead to a discrepancy report
- Information that is undesirable but would not cause a malfunction or unexpected results (bad workmanship)
- Information that, if left uncorrected, may decrease maintainability

Defect Categories (continued)

Class

a. Missing

- Information that is specified in the requirements or standard, but is not present in the document

b. Wrong

- Information that is specified in the requirements or standards and is present in the document, but the information is incorrect

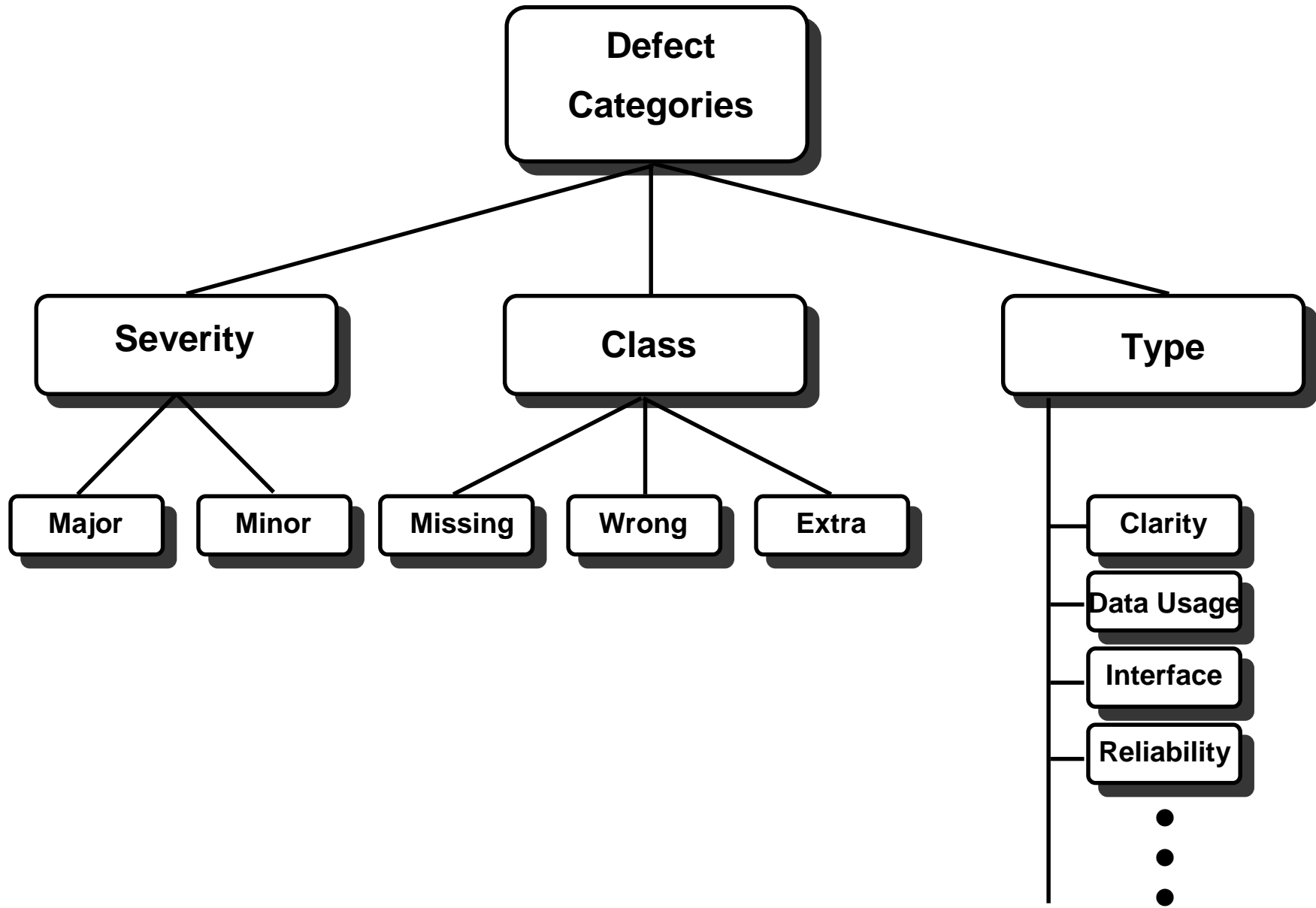
c. Extra

- Information that is not specified in the requirements or standards but is present in the document

Type

- Describes what kind of areas the inspection document has defects in (often an “-illity”; e.g. grammar, syntax)
- Inspection teams should define and tailor the classes to the work product

Defect Categories (continued)



Major Defect Definition

In Code: A condition in code or documentation that could cause a malfunction or a deviation from specified or expected results, i.e., operational failure.

Minor Defect Definition

In Code or Design: A design or coding instance that is a violation of standards or conventions that would not result in a test or user reported defect, if not corrected. It could cause difficulties in maintenance or clarity of purpose.

In Documents: A header, caption, prose or diagram instance that is a violation of standards or conventions that would not result in a test or user reported defect, if not corrected.

Inspectors and Their Roles

All roles have the common objective of verifying that the product satisfies the exit criteria (or, identifying defects)

Each role has a different function in inspections

- 1. Moderator**
- 2. Author (Writer, Analyst, Designer, Coder, etc.)**
- 3. Reader**
- 4. Tester**

Inspection Team Roles

■ Moderator

- Leads the inspection team

■ Author

- Originates/reworks the document

■ Reader (also an analyst, designer, coder, etc.)

- Paraphrases/interprets the document
 - ▲ expresses his/her understanding
 - ▲ does NOT actually read

■ Tester

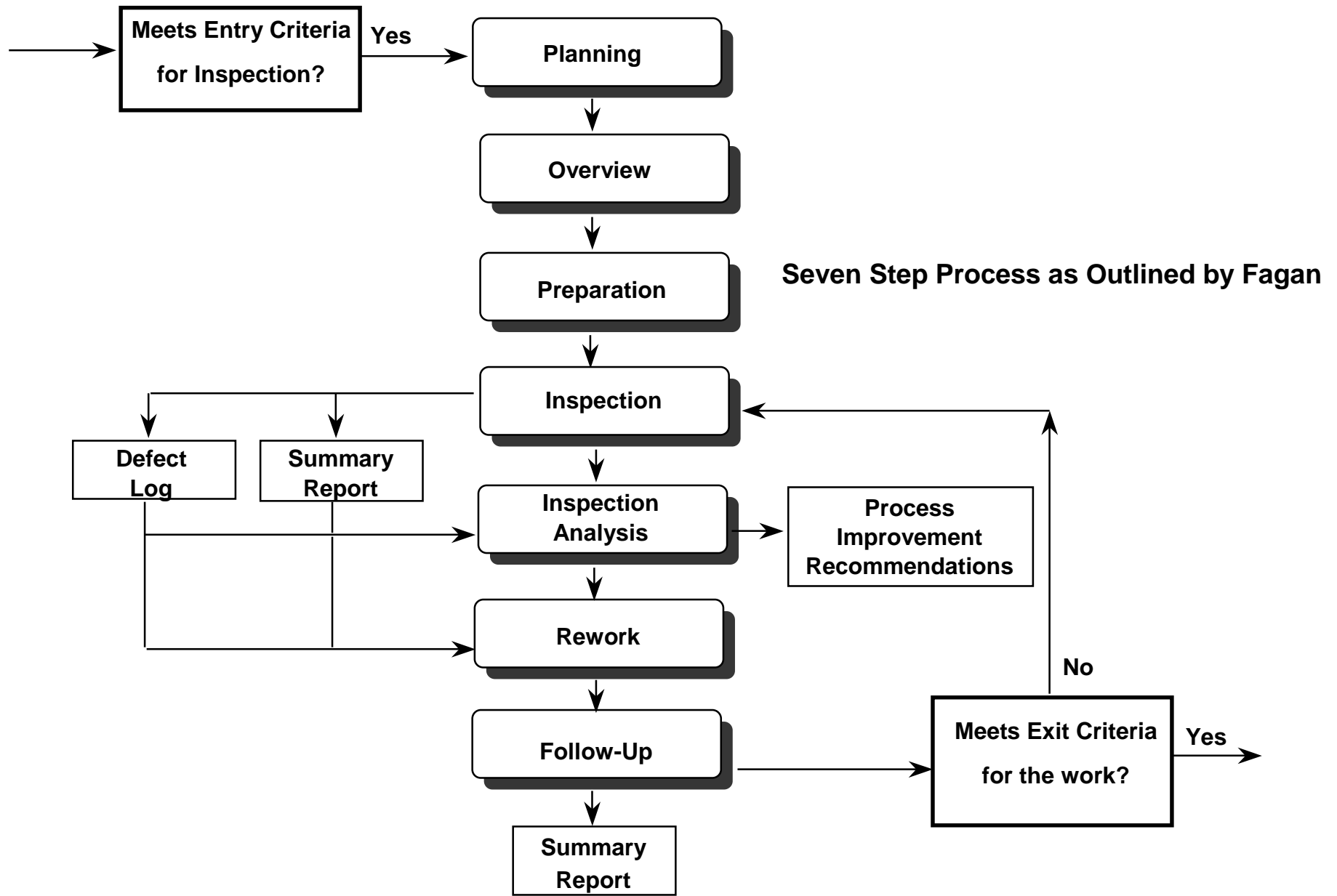
- Considers testability, traceability, requirements, standards and external interactions

All roles verify conformance with the exit criteria.

The Seven Step Inspection Process

STEP	OBJECTIVE
1. Planning	<ul style="list-style-type: none">- Materials meet inspection entry criteria- Assign Inspector roles- Schedule meeting time/place for steps 2, 4 & 5
2. Overview	<ul style="list-style-type: none">- Educate inspection team. Provide work product background, context, rationale, etc.
3. Preparation	<ul style="list-style-type: none">- Prepare to fulfill role- Completely understand document from role's perspective
4. Inspection	<ul style="list-style-type: none">- Identify, classify and record defects- No solutions or improvements
5. Inspection Analysis	<ul style="list-style-type: none">- Review/analyze inspection steps 1 - 5 for improvement- Identify defect causes- Recommend process improvements
6. Rework	<ul style="list-style-type: none">- Correct <u>ALL</u> defects
7. Follow-Up	<ul style="list-style-type: none">- Ensure all defects identified are corrected- Ensure no new defects are introduced

Software Inspection



Inspection Team - Moderator

■ Moderator

- **Manages the inspection meeting**
 - Discussion leader?
 - Facilitator?
 - Controls order of participation
 - Fills out the paperwork; “Holds the pen”
- **Is technically competent - Could have developed work product being inspected**
- **Stimulates participation of all team members**
- **Consensus driver (defect, and where, or ...)**
- **Ensures that team follows inspection process**

Inspection Team - Author

■ Author

- **Originator of work product being inspected**
- **Has vested interest in ensuring that all defects are found**
- **Provides inspection team with overview of work product**
- **Actively participates in Inspection Meeting**
- **Confirms reader and tester understanding**

Inspection Team - Reader

■ Reader

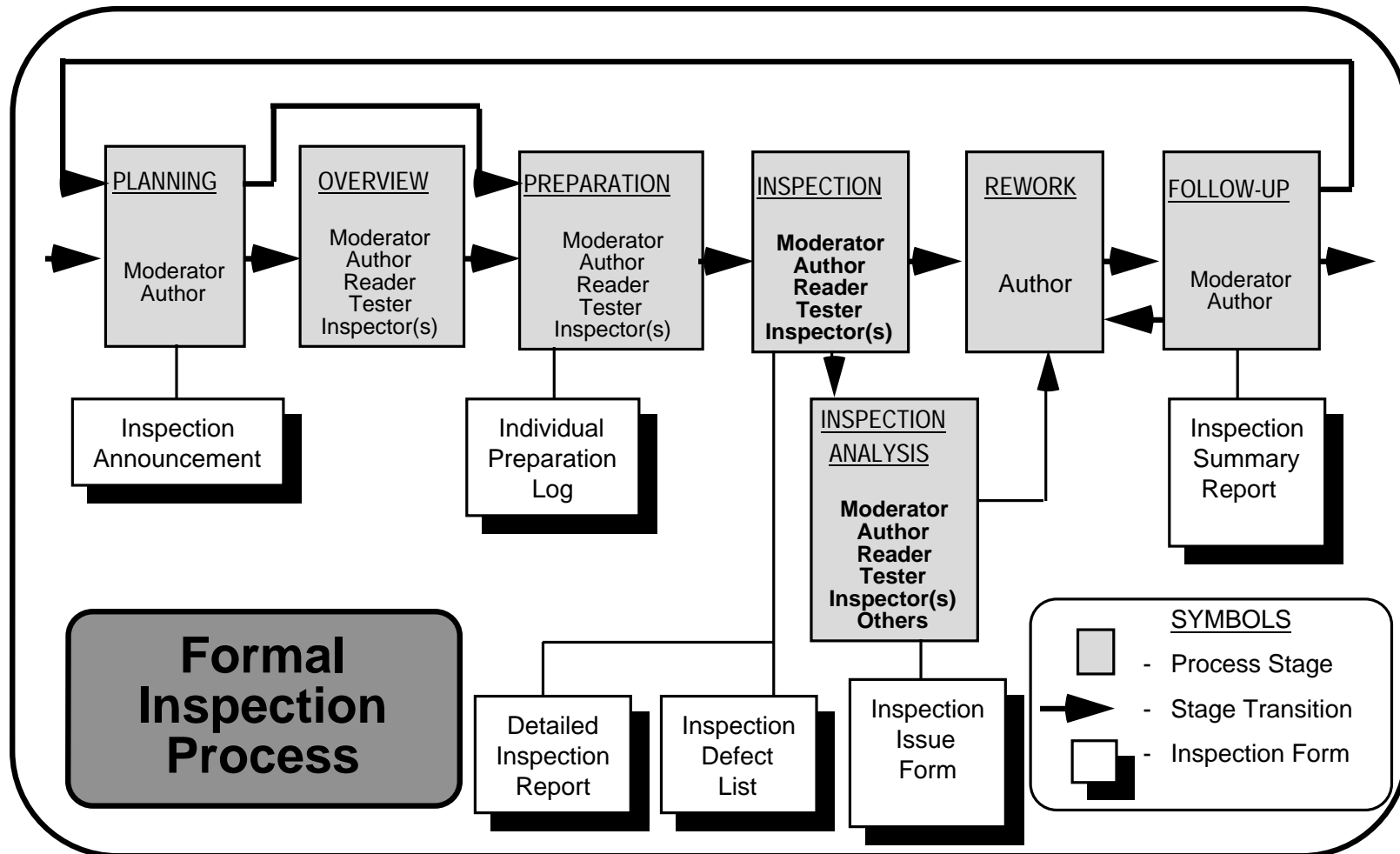
- Recipient of work product being inspected
- Obtains complete understanding of the document
- Determines the path to be followed through the document
- Paraphrases and interprets the document

Inspection Team - Tester

■ Tester

- **Completely understand the inspection document**
- **Considers testability**
- **Ensures that document complies with requirements and standards**
- **Describes test approaches**
- **Addresses all external interactions - control and data**

Formal Inspection Process Stages and People



Other Inspection Constraints

- **Maximum time allotted for the inspection meeting is 2 hours**
- **Over and above the four roles described, two additional "INSPECTORS" may participate; all must prepare and participate, usually as**
 - **Reader (perhaps diagram interpreter)**
 - **Tester (with special focus)**
- **Maximum of 6 participants allowed in inspection meeting**
- **Management is not invited**

The Seven Step Inspection Process

Step 1 Planning

Objective: Ensure document meets inspection entry criteria

Roles Involved: Author, Moderator

Responsibilities:

- **Moderator ensures that document meets the inspection entry criteria and that all supporting documentation is available**
- **Depending on the size of the document, the moderator may need to schedule several inspection meetings (chunking)**
- **Author and moderator select inspection team and determine roles**
- **Moderator schedules overview and inspection meetings and sends out meeting notices**

The Seven Step Inspection Process

Step 2 Overview

**Objective: Obtain shared understanding,
enable efficient preparation**

Roles Involved: Inspection Team

Responsibilities:

- **Moderator chairs the meeting and assigns roles**
- **Author gives presentation, briefing team on document background, purpose, design rationale, etc. (i.e. a fast walkthrough)**
- **Inspection team should understand their role and ask questions from the role's perspective to clarify and enhance understanding of the document**
- **Moderator distributes inspection materials and records overview hours**

The Seven Step Inspection Process

Step 3 Preparation

Objective: Enable effective participation in inspection meeting

Roles Involved: Entire Inspection Team

Responsibilities:

- **Team members become completely familiar with requirements, standards, exit criteria, and other relevant documentation**
- **Team members individually review, study, and understand document**
- **Note possible defects on the document and prepare for discussion at the inspection meeting (prepare to fulfill role)**
 - **Moderator must consider how to bring team into discussion in meeting**
 - **Reader makes notes about path taken through code, prose, or diagram so s/he can repeat it in the meeting**
 - **Tester makes notes about interfaces, source requirements, traceability, ..., and possible testing approaches, etc.**

The Seven Step Inspection Process

Step 4 Inspection - Establish Preparedness

Inspection

- **Objective: Identify, classify, and record document defects**
- **Roles Involved: Inspection Team**
- **Responsibilities:**
 - **Moderator records inspection start time**
 - **Moderator ensures adequacy of preparation time**
 - **If inadequate preparation by team, moderator cancels and reschedules inspection meeting**
 - **Moderator records team members preparation times**

The Seven Step Inspection Process

Step 4 Inspection - Inspecting the Product

- Reader proceeds through the document paraphrasing and interpreting the document's contents
- All team members participate in defect discovery and ensure document complies with project standards (meets exit criteria)
- Tester describes test approach, requirements trace, etc. and confirms external interface connections
- Author confirms the reader's and tester's understanding
- Moderator keeps team focused on the product (downplays interpersonal issues)
- Moderator maintains adequate iteration between reader/author/tester, not allowing reader to go too far too fast
- Moderator invites the phantom inspector (team synergy)
- Moderator allows only defect identification, not correction
- Moderator drives the defect identification to consensus
- All inspection team members agree on severity, type, class of defect
- Moderator records defect on defect list & issues on "action item" list

The Seven Step Inspection Process

Step 4 Inspection - Concluding the Meeting

- Document has been completed or 2 hours is up
- Moderator and inspection team determine product disposition
 - No defects identified, product deliverable to “customer”
 - Defects identified, some rework required (small amounts of change), product available to “customer” after author/moderator follow-up
 - Defects identified, rework required, partial reinspection required, reinspect rework only
 - Defects identified, major rework required, reinspect entire document
- Moderator records inspection meeting time on inspection summary
- Moderator requests inspection process improvement suggestions
- Moderator notes any software process improvement suggestions offered
- Moderator records estimated rework time (offered by author)

The Seven Step Inspection Process

Step 5 Inspection Analysis

Inspection Analysis

- Were preparation and inspection rates within limits of recommended rates?
- Was team synergy adequate?
- What would you do to improve your next inspection?
 - Planning
 - Overview
 - Preparation
 - Inspection
 - Inspection Analysis

Defect Analysis for Defect Cause Removal

- Were systemic problems in the software process identified? Issues noted? Recommendations noted?
- For each major defect:
 - Cause is systemic or mis-execution?
 - Process change recommended?
 - Action required?

The Seven Step Inspection Process

Step 6 Rework

REWORK

- **Objective:** Remove defects
- **Role Involved:** Author
- **Responsibilities:**
 - Author utilizes the defect list and any notes he recorded during the meeting
 - Author corrects ALL defects documented in the inspection meeting
 - Author determines if scope of rework increased sufficiently to justify reinspection
 - Author records actual rework time

The Seven Step Inspection Process

Step 7 Follow-Up

- **Objective:** Verify defect removal;
Ensure no new defects introduced
 - **Roles Involved:** Author/Moderator
 - **Responsibilities:**
 - Moderator reviews corrected defects with author, ensures all defects identified are corrected, conform to standards, meet exit criteria and product requirements
 - Moderator ensures that no new defects were introduced as the result of the rework
 - Moderator determines if scope of rework increased sufficiently to justify reinspection
 - Moderator signs off on reworked document
- Moderator publishes inspection summary report**

Software Inspection Perspectives

■ Inspectors Roles by Process Step

- Moderator's
- Author's
- Reader's
- Tester's

■ Seven-Step Inspection Method Process Map

Moderator's Role by Process Step

<u>STEP</u>	<u>RESPONSIBILITY</u>
Planning	<ul style="list-style-type: none">■ Inspection entry criteria have been met, the work product is complete and of a reasonable quality level■ Rework has been completed for a reinspection■ Inspection team selected and roles assigned■ Overview scheduled, if applicable■ Inspection meeting scheduled■ Inspection package compiled (work product, standards, requirements, exit criteria, defect type list, etc.)■ Inspection Announcement sent out

Moderator's Role by Process Step

STEP

RESPONSIBILITY

- Overview**
- **Planning (administrative) time recorded**
 - **Conduct overview meeting**
 - **Ensure inspection team obtains common understanding of the work product**
 - **Ensure each team member understands role and responsibility**
 - **Record overview time**

Moderator's Role by Process Step (cont.)

STEP

RESPONSIBILITY

Preparation

- Study and understand work product to guide/coach both reader and tester
- Complete individual preparation log
- Prepare for inspection moderator role (get the most from the team)
- Note preparation time

Moderator's Role by Process Step (cont.)

<u>STEP</u>	<u>RESPONSIBILITY</u>
-------------	-----------------------

- | | |
|---------------------------------|---|
| Inspection
[meeting] | <ul style="list-style-type: none">■ Lead inspection meeting■ Record inspection start time■ Record individual preparation time;
if inadequate, reschedule inspection meeting■ Ensure focus of meeting remains on
identifying defects■ Ensure that the reader proceeds at an
appropriate pace and all inspectors
participate■ Ensure each inspector fulfills the role
assigned■ Ensure defects identified are categorized
by severity, type, and class
based on team consensus |
|---------------------------------|---|

Moderator's Role by Process Step (cont.)

<u>STEP</u>	<u>RESPONSIBILITY</u>
-------------	-----------------------

**Inspection
(cont.)**

- Record work product issues where team consensus cannot be reached
- Record non-product issues as identified
- Ensure maximum meeting time is not exceeded (2 hours)
- Ensure the entire work product is inspected (or 2 hour limit reached)
- Ensure inspection defect list is complete and accurate
- Review all issues recorded and record any resolutions
- Assign action items for all unresolved issues
- Determine need for reinspection
- Record total inspection time

Moderator's Role by Process Step (cont.)

<u>STEP</u>	<u>RESPONSIBILITY</u>
Inspection (after)	<ul style="list-style-type: none">■ Obtain estimate for rework from author■ Complete detailed inspection report■ Collect all forms and maintain records of inspection

Moderator's Role by Process Step (cont.)

<u>STEP</u>	<u>RESPONSIBILITY</u>
-------------	-----------------------

- | | |
|---------------------|---|
| Inspection Analysis | <ul style="list-style-type: none">■ Schedule meeting as soon after inspection as possible
■ Invite appropriate inspection team members, subject matter experts, and individuals from the areas affected by issues (decision makers)
■ Conduct meeting
■ Seek group recommendations for improvement of the software inspection process based on analysis of the results of inspection steps 1 - 5 |
|---------------------|---|

Moderator's Role by Process Step (cont.)

STEP RESPONSIBILITY

- Inspection Analysis (cont.)**
- Review each unresolved issue, drive for resolution, assign action items for unresolved issues
 - Review each major defect recorded and attempt to determine its cause (systemic)
 - For systemic defects, seek recommendations for improvement of the software development process
 - For each change recommended, complete an inspection issue form for evaluation in the Process Improvement step.
 - Review action items assigned and changes recommended

Moderator's Role by Process Step (cont.)

STEP

RESPONSIBILITY

Rework

- Assure that work product issues/action items are resolved and communicated to the author in a timely manner

Follow-Up

- Meet with author
- Verify that all defects were corrected and no new defects were introduced as a result of the change
- Assure that corrections conform to project standards and product exit criteria
- Determine if the rework was significant enough to cause a need for a reinspection
- Complete and distribute the inspection summary report
- File completed inspection package

All Inspectors' Roles by Process Step

STEP

RESPONSIBILITY

- | | |
|--------------------|---|
| Planning | ■ Allocate time for inspection meeting(s) |
| Overview | ■ Attend overview meeting
■ Ask questions to clarify understanding of the work product |
| Preparation | ■ Study work product to gain understanding, and to fulfill role
■ Review work product against standards, exit criteria, requirements, and other documents provided in the inspection package
■ Complete individual preparation log noting questions and any possible defects
■ Record preparation time |

All Inspectors' Roles by Process Step (cont.)

<u>STEP</u>	<u>RESPONSIBILITY</u>
Inspection	<ul style="list-style-type: none">■ Attend inspection meeting■ Fulfill assigned role■ Ask questions to assure understanding of the work product■ Remain focused on finding defects■ Evaluate the work product, not the author■ Accept action items to resolve issues
Inspection Analysis	<ul style="list-style-type: none">■ Attend meeting as required by moderator■ Suggest solutions to correct defects■ Resolve issues, accept action items■ Recommend process changes
Rework	<ul style="list-style-type: none">■ None
Follow-up	<ul style="list-style-type: none">■ None

Author's Role by Process Step

STEP

RESPONSIBILITY

Planning

- Provide work product to be inspected, and all associated material for inspection package to the moderator
- Review material with moderator
- Work with moderator and team lead to select inspection team
- Prepare for overview, if applicable

Overview

- Present background information, design intent, problem, solution, etc., on the work product
- Answer questions presented by inspection team
- Provide moderator with time expended in preparation for overview

Preparation

- Prepare for inspection as a peer inspector
- Record preparation time

Author's Role by Process Step (cont.)

STEP

RESPONSIBILITY

- | | |
|----------------------------|---|
| Inspection | <ul style="list-style-type: none">■ Provide moderator with preparation time■ Confirm reader's paraphrasing, interpretation, or presentation of the work product■ Confirm tester's understanding of interfaces and approaches to testing■ Provide answers to inspector's questions■ Fulfill role of peer inspector |
| Inspection (after) | <ul style="list-style-type: none">■ Provide moderator with estimated time to correct defects |
| Inspection Analysis | <ul style="list-style-type: none">■ Participate in meeting when requested by moderator and provide clarification as required |
| Rework | <ul style="list-style-type: none">■ Correct all defects■ Ensure that all work product related issues/action items are resolved/closed■ Record actual rework time |

Author's Role by Process Step (continued)

STEP

RESPONSIBILITY

- Follow-Up**
- Meet with moderator
 - Confirm for each defect and that the changes correct the defect
 - Verify that changes do not introduce additional defects
 - Determine with the moderator if changes were significant enough to indicate a need for reinspection
 - Provide moderator with actual rework time

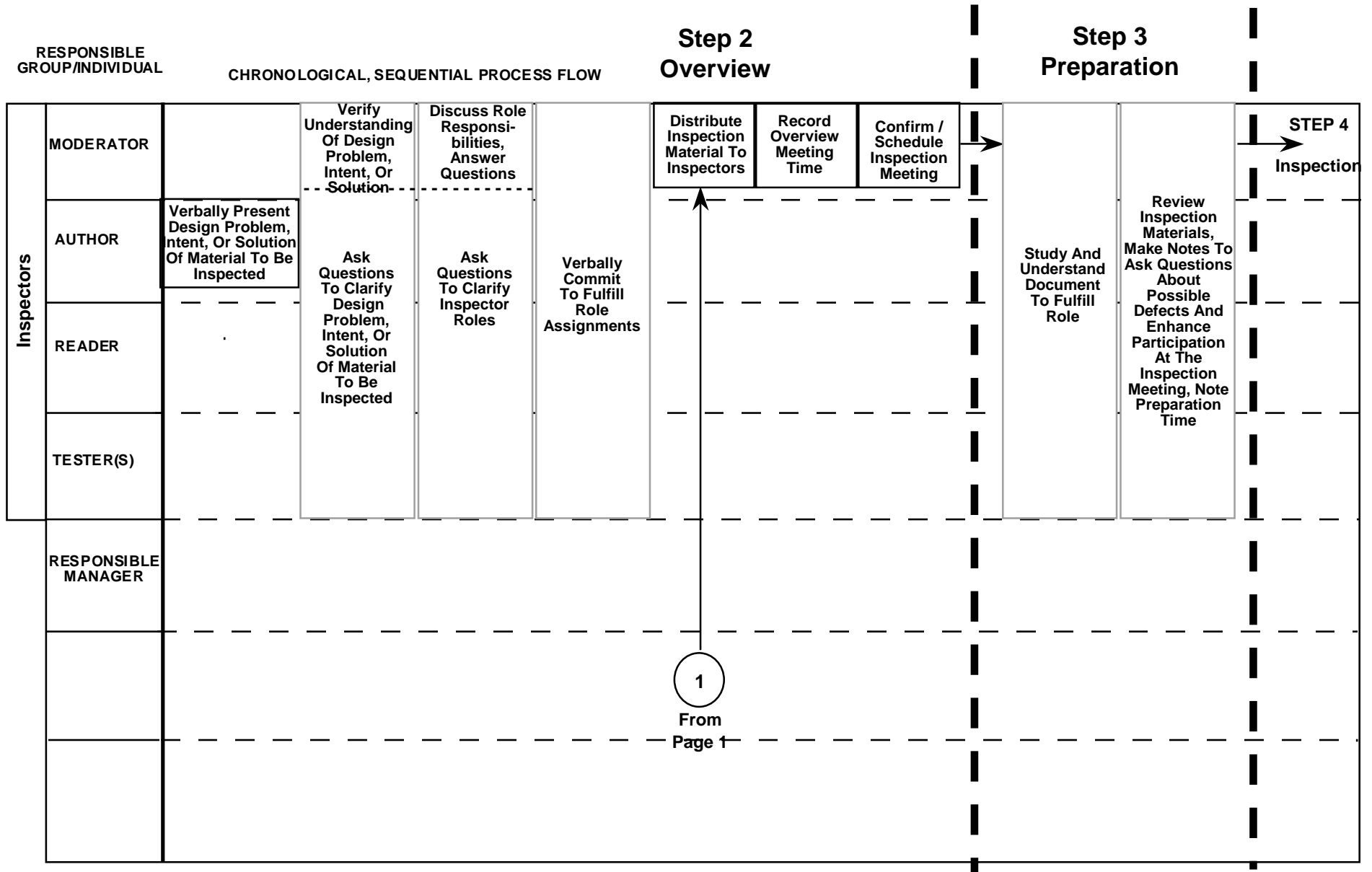
Reader's Role by Process Step

<u>STEP</u>	<u>RESPONSIBILITY</u>
Preparation	<ul style="list-style-type: none">■ Prepare to paraphrase/interpret the work product in the inspection meeting■ Determine path to be taken through the work product■ Perform duties required of all inspectors
Inspection	<ul style="list-style-type: none">■ Guide the inspection team through the work product■ Paraphrase, confirming understand with the author, tester, and other inspectors■ Point out areas of difficulty with understanding■ Relate back to higher level work product as required
All other steps	■ Fulfill responsibilities of inspector

Tester's Role by Process Step

<u>STEP</u>	<u>RESPONSIBILITY</u>
Preparation	<ul style="list-style-type: none">■ Study work product from testability aspect■ Confirm external interaction, both control and data■ Prepare to describe test approaches■ Fulfill responsibilities of inspector
Inspection	<ul style="list-style-type: none">■ Describe test approaches as required■ Confirm external linkages with reader and author■ Fulfill responsibilities of inspector
All other steps	<ul style="list-style-type: none">■ Fulfill responsibilities of inspector

SEVEN-STEP INSPECTION METHOD PROCESS MAP (2 of 7)

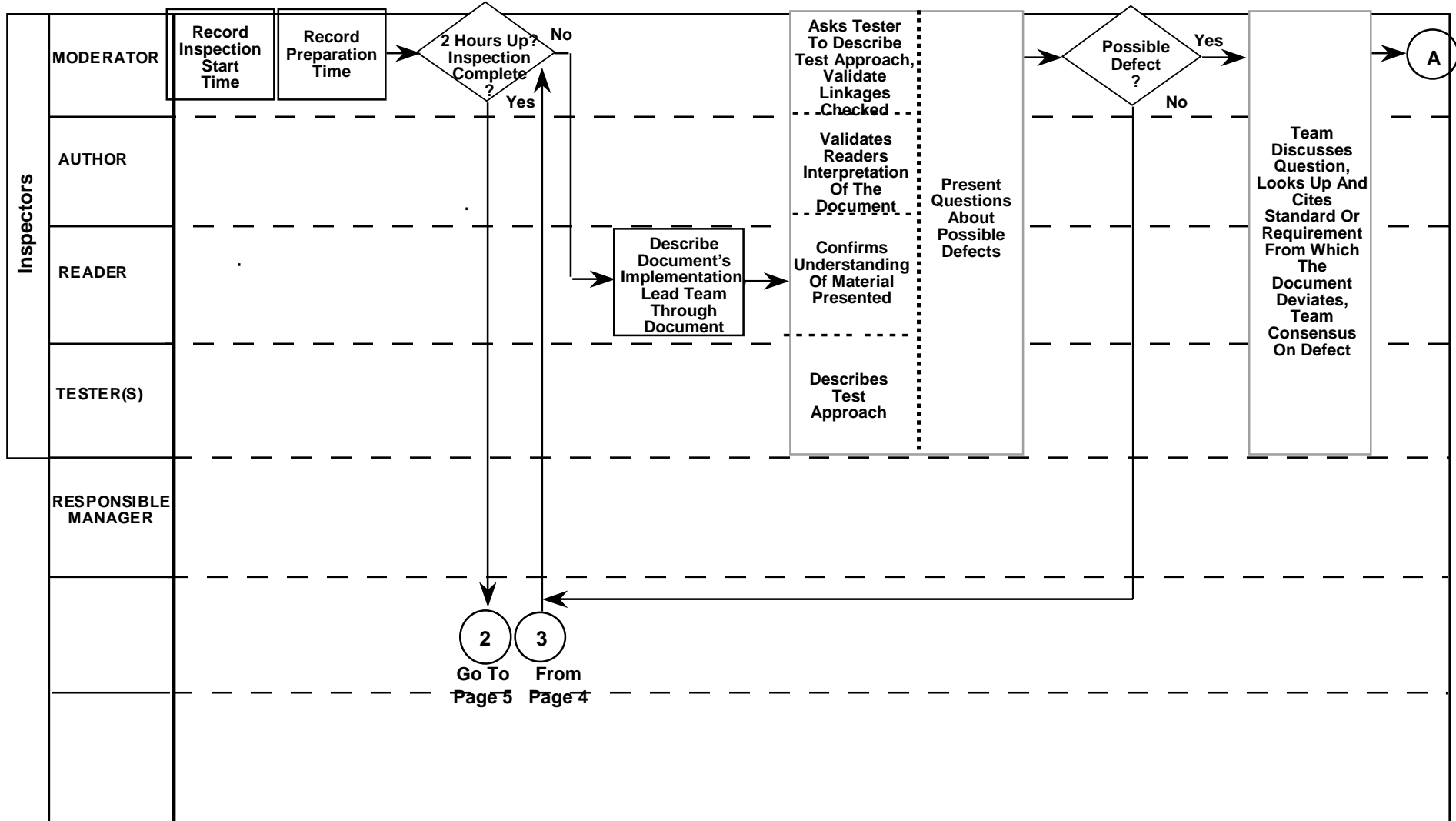


SEVEN-STEP INSPECTION METHOD PROCESS MAP (3 of 7)

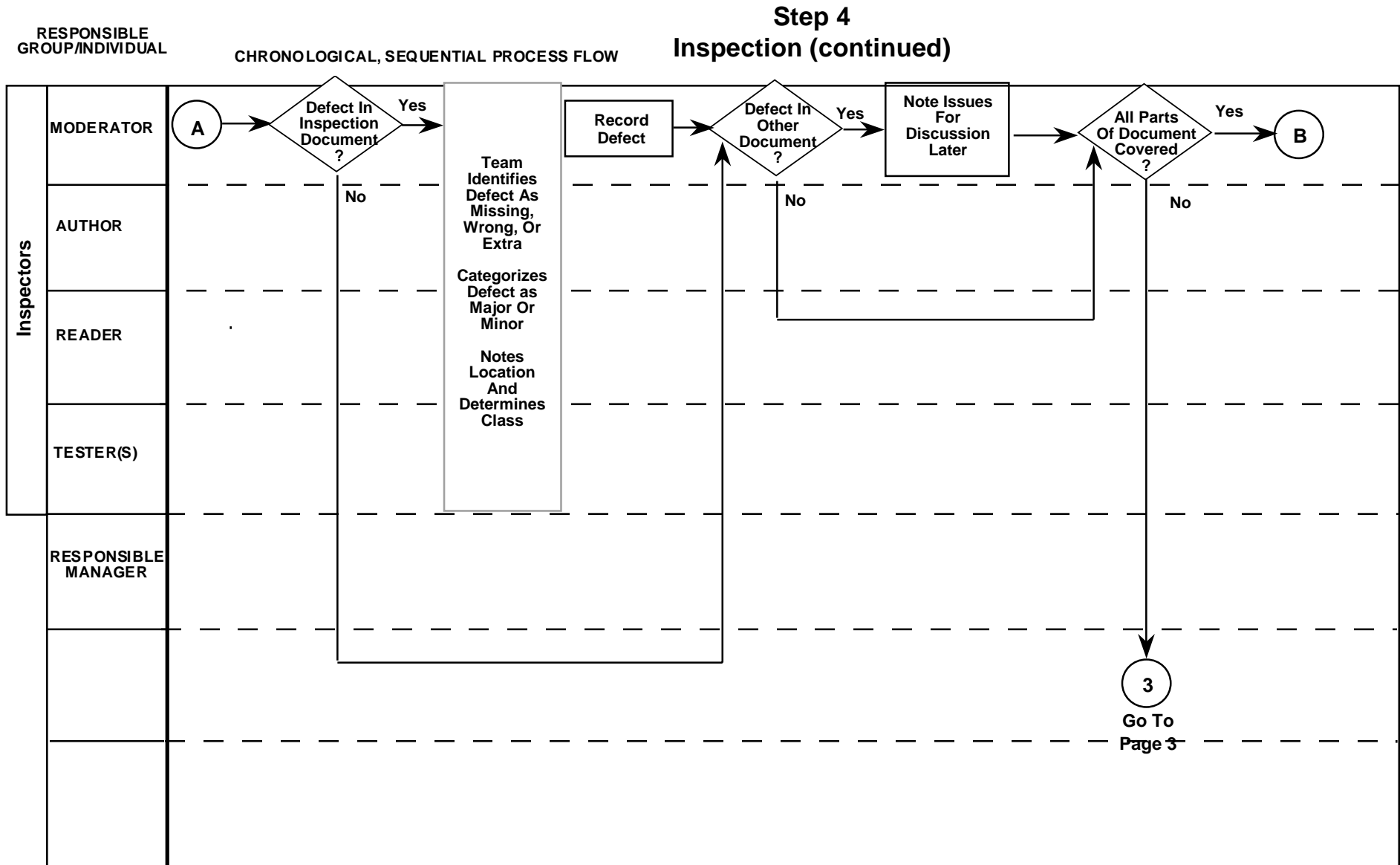
Step 4 Inspection

RESPONSIBLE GROUP/INDIVIDUAL

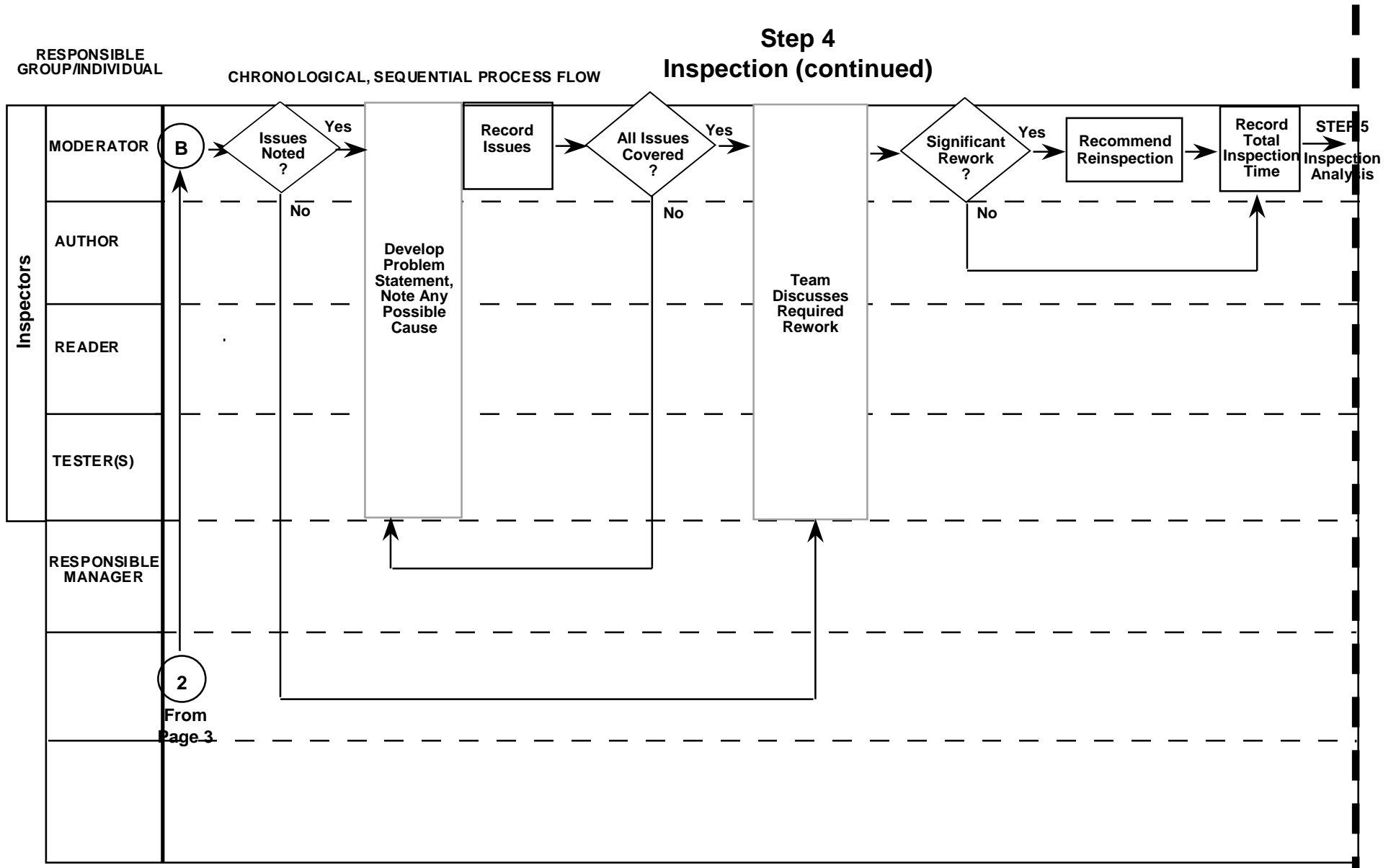
CHRONOLOGICAL, SEQUENTIAL PROCESS FLOW



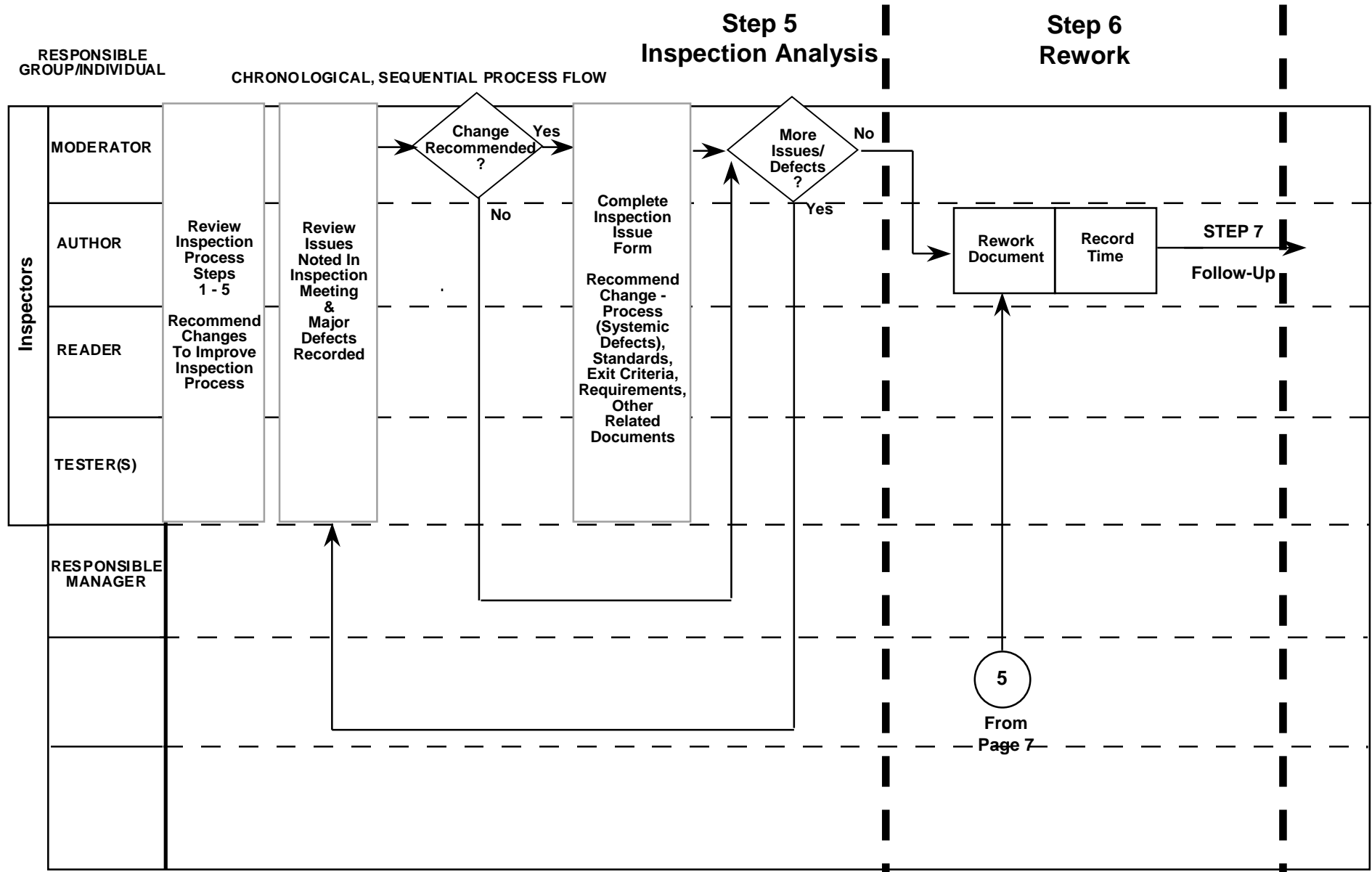
SEVEN-STEP INSPECTION METHOD PROCESS MAP (4 of 7)



SEVEN-STEP INSPECTION METHOD PROCESS MAP (5 of 7)



SEVEN-STEP INSPECTION METHOD PROCESS MAP (6 of 7)

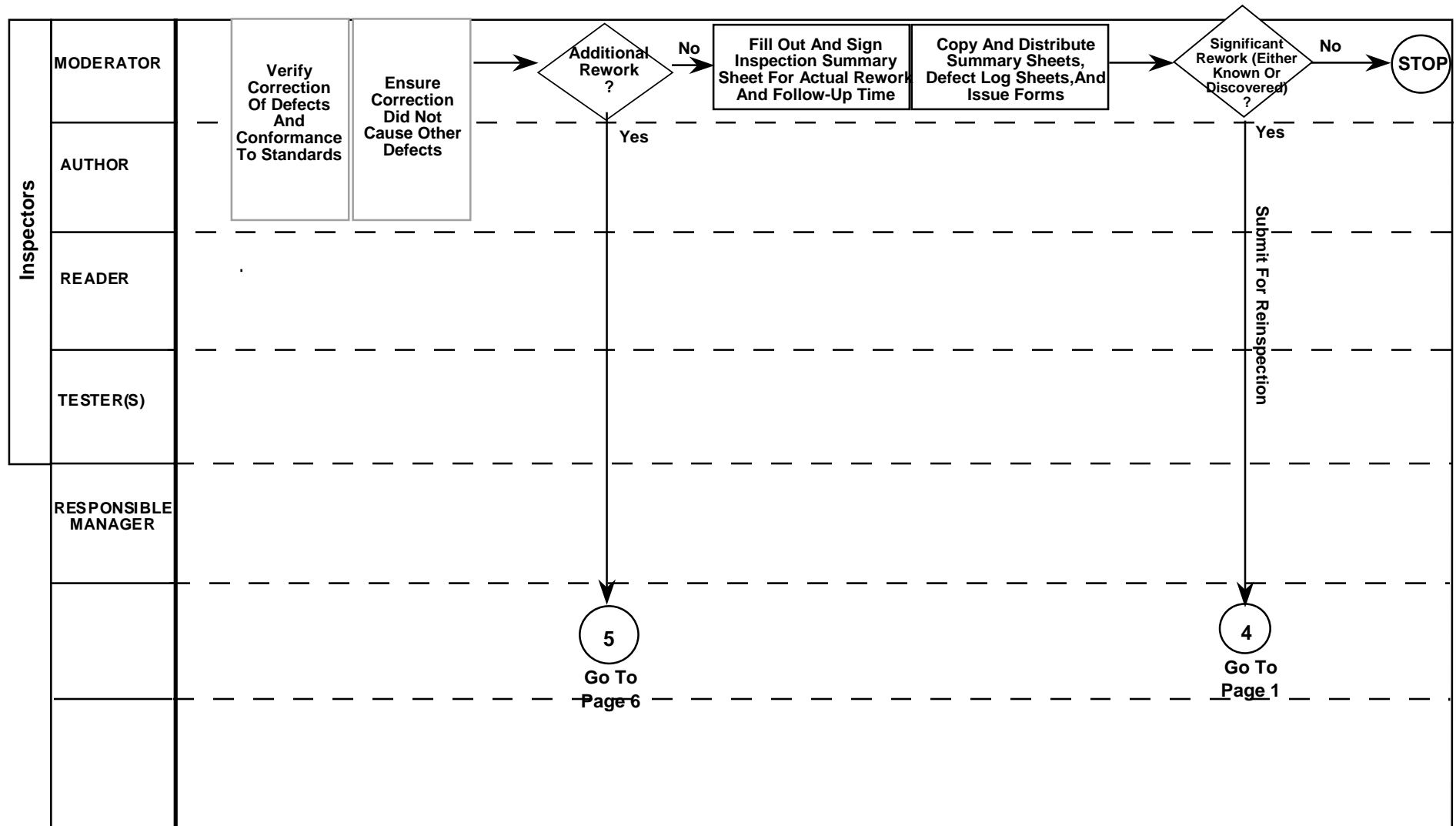


SEVEN-STEP INSPECTION METHOD PROCESS MAP (7 of 7)

Step 7 Follow-Up

RESPONSIBLE
GROUP/INDIVIDUAL

CHRONOLOGICAL, SEQUENTIAL PROCESS FLOW



Summary

Topics

- Fagan's continuous process improvement cycle
- Fagan's formal process definition including exit criteria
- Defect categories: Severity, class and type
- Fagan's inspection: Seven step process including roles, actions and responsibilities

Objectives

- Sufficient knowledge and skills to participate in productive software code inspections
- Understand the objectives, principles and methods of Fagan's inspections
- Skills/knowledge to fulfill an author, reader or tester role:
 - » Planning & Organizing a Fagan's Inspection
 - » Preparing for a Fagan's Inspection Meeting
 - » Participating in a Fagan's Inspection