FAA Requirements Engineering Management Handbook

3. Develop the Operational Concepts

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Steps in the REMH

1. Develop the System Overview
2. Identify the System Boundary
3. **Develop the Operational Concepts**
4. Identify the Environmental Assumptions
5. Develop the Functional Architecture
6. Revise the Architecture to Meet Implementation Constraints
7. Identify System Modes
8. Develop the Detailed Behavior and Performance Requirements
9. Define the Software Requirements
10. Allocate System Requirements to Subsystems
11. Provide Rationale

Operational Concepts: Goals

We have previously identified the system contexts and system boundary. What are we trying to achieve with this step in the requirements engineering process?

- Define a black-box view of how the system will interact with its environment (operators and other systems)
  - Identifying the functions the operators or other systems expect the system to provide,
  - Identifying the orders in which those functions can be invoked, the values that can be provided as inputs, and the information needed from the system as feedback.
- Provide a step between the system overview and more detailed requirements
- Build consensus between stakeholders by letting them view “examples” of the system’s operational behavior

Operational Concepts: Artifacts

What artifacts should we produce as a result of this step?

- “Sunny day” use cases
  - Additional “alternate courses”
- Exception cases

3 Develop the Operational Concepts

3 Develop the Operational Concepts: For all contexts in which the system will be used, define a black-box view of how the system will interact with its environment. This includes identifying the functions the operators or other systems expect the system to provide, the orders in which those functions can be invoked, the values that can be provided as inputs, and the information needed from the system as feedback. Use cases are one popular way to do this.

- **3.1 Document the nominal "sunny day" behavior of the system first.** Later, as an extension of this nominal behavior, address failures and exceptions.
- **3.2 Include use cases** that describe how the system of interest is used within the larger context of its operating environment.
- **3.3 Use the goal of each use case as its title.**
- **3.4 Trace each use case back to the system goals it helps satisfy.**
- **3.5 Identify the primary actor that initiates each use case**, the preconditions that must hold before the use case starts, and the postconditions that must hold when the use case is finished.
- **3.6 Ensure each use case describes a dialogue** between the primary actor, the system of interest, and the other actors.
- **3.7 Link each step of a use case to any system function it calls out.**
- **3.8 Consolidate actions that are repeated** in several use cases into a single use case that can be called from multiple locations.
- **3.9 Describe exceptional situations** or ways in which a use case can fail to meet its goal or postconditions through the use of exception cases.
- **3.10 Describe alternate ways a use case can meet its goal** and postconditions though the use of alternate courses.
- **3.11** In a use case, **use the names of external entities for the actors** and the names of monitored and controlled variables in the precondition, postcondition, and steps of the use case.
- **3.12 Avoid specifying details of the operator interface** in the operational concepts. Instead, call out the system capabilities to be invoked by the operator.
- **3.13 Update the system boundary** with any new monitored and controlled variables identified during development of the use cases.
- **3.14** From the uses cases, **assemble a preliminary set of functions** to be provided by the system.

Use Case Terminology

"Use Cases" are a popular strategy for capturing operational concepts. We will use the following terminology when writing/discussing use cases.

- Actors – entities (not necessarily human) that act/react in our system context
  - Operators
  - System of Interest
  - Other systems that interact with systems of interest
- Use case -- describes a dialogue of requests and actions between actors
- Precondition – What must be true before starting
- Postcondition – What must be true after (successful) completion
- "Sunny Day" – Use case where nothing goes wrong

3.1 Document Sunny Day Behavior

Your first use case(s) should be the "Sunny Day" behaviors. For each Sunny Day behavior, create a use case and perform the following steps…

- Identify main success scenarios
  - Dialog between system context and system in which nothing goes wrong
- Identify "alternate courses"
  - Alternate Course – Different path to same goal
  - Introduce alternate courses if there is more than one way to achieve the use case goal
- Failure and exceptional conditions are extensions / modifications of "Sunny Day" scenarios
  - Are detailed later

Isolette "Sunny Day" Use Case

Use case A.2.1: Normal Operation of Isolette

This use case describes the normal operation of the Isolette by the Nurse.

Related System Goals: G1

Primary Actor: Nurse

Precondition:

Infant is ready to be placed in the Isolette.
Isolette and Thermostat are turned off.

Postcondition:

Infant is removed from the Isolette.
Isolette and Thermostat are turned off.

Main success scenario:

1. Nurse turns on the Isolette.
2. Isolette turns on the Thermostat.
3. Thermostat initializes and enters its normal mode of operation. [System Function A.5.1.2]
4. Nurse Configures the Isolette for the needs of the Infant. [UC A.2.2]
5. Nurse waits until the Current Temperature is within the Desired Temperature Range. [System Function A.5.1.1]
6. Nurse places the Infant in the Isolette.
7. Isolette maintains desired temperature. [UC A.2.3]
8. Nurse confirms that Current Temperature is in Desired Temperature Range during rounds. [System Function A.5.1.1]
9. Nurse removes the Infant.
10. Nurse turns off the Isolette.
11. Isolette turns off the Thermostat.

3.2 Include How the System is Used in its Environment

At what level of abstraction or at what level of the architecture should we capture the "dialogue"?

- System Level use cases should always capture dialogues with the principle actors in the environment (aka "external entities")

- Example: The operation of the thermostat is described within environment, i.e., the context of the *Nurse* operating the *Isolette*
  - This is more clear than simply describing an interface to the thermostat

3.3 Employ the Use Case Goal as the Title

A brief bit of advice…

- The title of the use case should describe the goal of the use case
- Example: "Normal Operation of Isolette"

Use case A.2.1: Normal Operation of Isolette

This use case describes the normal operation of the Isolette by the Nurse.

Related System Goals: G1

Primary Actor: Nurse

Precondition:
Infant is ready to be placed in the Isolette.
Isolette and Thermostat are turned off.

Postcondition:
Infant is removed from the Isolette.
Isolette and Thermostat are turned off.

Main success scenario:
1. Nurse turns on the Isolette.
2. Isolette turns on the Thermostat.
3. Thermostat initializes and enters its normal mode of operation. [System Function A.5.1.2]
4. Nurse Configures the Isolette for the needs of the Infant. [UC A.2.2]
5. Nurse waits until the Current Temperature is within the Desired Temperature Range. [System Function A.5.1.1]
6. Nurse places the Infant in the Isolette.
7. Isolette maintains desired temperature. [UC A.2.3]
8. Nurse confirms that Current Temperature is in Desired Temperature Range during rounds. [System Function A.5.1.1]
9. Nurse removes the Infant.
10. Nurse turns off the Isolette.
11. Isolette turns off the Thermostat.

3.4 Trace Each Use Case to System Goals

Why trace each use case to a system goal?

- Helps to satisfy / ensure that the use case describes a needed behavior
  - If a use case doesn't align with a goal, is the behavior needed? Or do we need to add another system goal?
- Helps to ensure that every system goal is illustrated with a use case
  - If a goal does not have a corresponding use case, is that goal needed? Or do we need to add use cases
- Facilitates maintenance if either the system goals or use case change
- The "Normal Operation of Isolette" use case traces directly to the first system goal.

Use case A.2.1: Normal Operation of Isolette

This use case describes the normal operation of the Isolette by the Nurse.

Related System Goals: G1

Primary Actor: Nurse

Precondition:
Infant is ready to be placed in the Isolette.
Isolette and Thermostat are turned off.

Postcondition:
Infant is removed from the Isolet
Isolette and Thermostat are turne

Main success scenario:
1. Nurse turns on the Isolette.
2. Isolette turns on the Thermost
3. Thermostat initializes and ent n A.5.1.2]
4. Nurse Configures the Isolette for the needs of the Infant. [UC A.2.2]
5. Nurse waits until the Current Temperature is within the Desired Temperature Range. [System Function A.5.1.1]
6. Nurse places the Infant in the Isolette.
7. Isolette maintains desired temperature. [UC A.2.3]
8. Nurse confirms that Current Temperature is in Desired Temperature Range during rounds. [System Function A.5.1.1]
9. Nurse removes the Infant.
10. Nurse turns off the Isolette.
11. Isolette turns off the Thermostat.

G1 -- The Infant should be kept at a safe and comfortable temperature.

3.5 Identify Actors and Pre/Postconditions

Identify actors…

- The primary actor is the actor that initiates the dialogue in the use case
- It is useful as well to explicitly document the other actors involved in the use case

Identify pre/post-conditions

- A precondition identifies all conditions that must be true at the start of a use case.
- A postcondition makes explicit what changes the use case will cause in the environment, and what state the system/ environment should be in upon completion of use case.

3.5 Identify Actors and Pre/Postconditions

Isolette example…

- In the Isolette use case, the primary actor is the nurse.
- The precondition is that the Isolette/Thermostat is turned off and the infant is ready to be put into the Isolette.
- The postcondition is that the Isolette/Thermostat is turned off and the infant has been removed from the Isolette
- Notes:
  - we might view the precondition and postcondition as describing the same state since the use case describes a complete cycle.
  - It is not always immediately clear where to "start" the use case
    - Should the Isolette be wheeled into the room, or the baby brought into the same room as the Isolette? Should the baby already be in the Isolette?
    - Generally we want to aim for a precondition that describes a state where next logical actions begin interaction with system

Actors and Pre/Postconditions

Use case A.2.1: Normal Operation of Isolette

This use case describes the normal operation of the Isolette by the Nurse.

Related System Goals: G1

Primary Actor: Nurse

Precondition:

Infant is ready to be placed in the Isolette.
Isolette and Thermostat are turned off.

Postcondition:

Infant is removed from the Isolette.
Isolette and Thermostat are turned off.

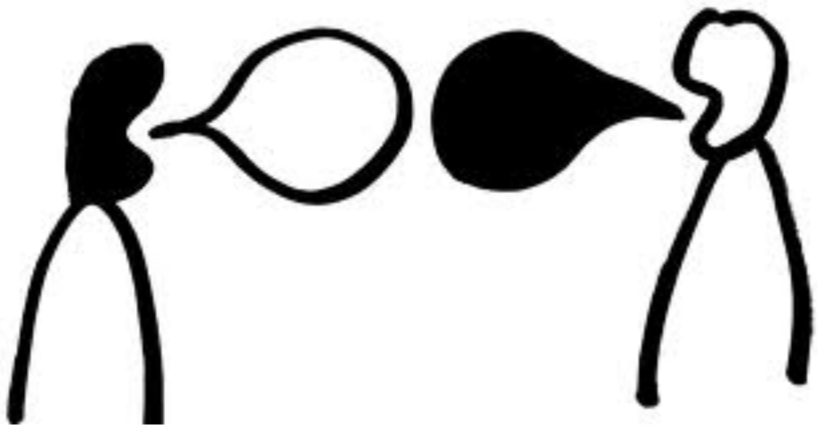
Main success scenario:

1. Nurse turns on the Isolette.
2. Isolette turns on the Thermostat.
3. Thermostat initializes and enters its normal mode of operation. [System Function A.5.1.2]
4. Nurse Configures the Isolette for the needs of the Infant. [UC A.2.2]
5. Nurse waits until the Current Temperature is within the Desired Temperature Range. [System Function A.5.1.1]
6. Nurse places the Infant in the Isolette.
7. Isolette maintains desired temperature. [UC A.2.3]
8. Nurse confirms that Current Temperature is in Desired Temperature Range during rounds. [System Function A.5.1.1]
9. Nurse removes the Infant.
10. Nurse turns off the Isolette.
11. Isolette turns off the Thermostat.

3.6 Make Each Case Describe a Dialog

Writing the Dialogs…

- Use cases should describe a dialog between:
  - The primary actor
  - The system of interest
  - Other actors
- Each line is an action
- Consider revising use cases dominated by one actor



3.6 Make Each Case Describe a Dialog

Hints from your instructor: consider the nouns in the dialog…

Each noun should correspond to an actor, monitored or controlled variable, mode, system function etc. (something explicitly identified in previous system context step, or (in some cases) to be identified in the future (e.g., mode))

Actor

1. Nurse turns on the Isolette.
2. Isolette turns on the Thermostat.
3. Thermostat initializes and enters its normal mode of operation. [System Function A.5.1.2]

Mode

4. Nurse Configures the Isolette for the needs of the Infant. [UC A.2.2]
5. Nurse waits until the Current Temperature is within the Desired Temperature Range. [System Function A.5.1.1]

Monitored (?) Variable

6. Nurse places the Inf
7. Isolette maintains desired temperature. [UC A.2.3]

Controlled Variable

8. Nurse confirms that Current Temperature is in Desired Temperature Range during rounds. [System Function A.5.1.1]
9. Nurse removes the Infant.
10. Nurse turns off the Isolette.
11. Isolette turns off the Thermostat.

3.6 Make Each Case Describe a Dialog

Hints from your instructor: consider the verbs in the dialog…

Each verb correspond to an interaction between an actor and the system, or a function that the actor/system performs. Should be able to classify interactions/functions as internal and external. All internal "verbs" must be accounted for (traceable) to some feature of the system. Remember, we often will turn use cases into test cases.

Interaction

1. Nurse turns on the Isolette.
2. Isolette turns on the Thermostat.
3. Thermostat initializes and enters its normal mode of operation. [System Function A.5.1.2]

Function

Function

4. Nurse Configures the Isolette for the needs of the Infant. [UC A.2.2]
5. Nurse waits until the Current Temperature is within the Desired Temperature Range. [A.5.1.1]

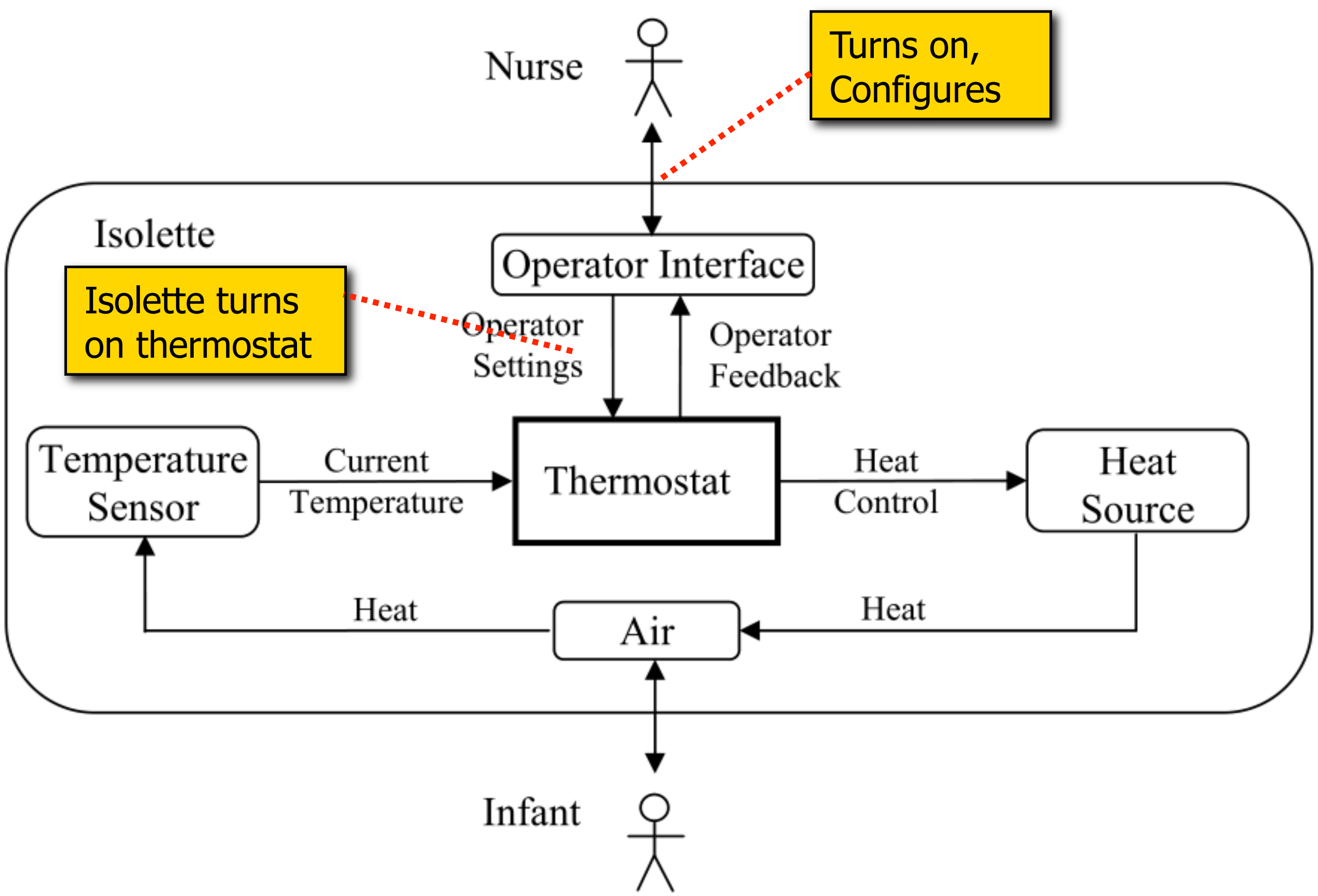
Interaction

6. Nurse places the Infant in the Isolette.
7. Isolette maintains desired temperature. [UC A.2.3]
8. Nurse confirms that Current Temperature is in Desired Temperature Range during rounds. [System Function A.5.1.1]
9. Nurse removes the Infant.
10. Nurse turns off the Isolette.
11. Isolette turns off the Thermostat.

Question: what's involved with the nurse "waiting"?

3.6 Make Each Case Describe a Dialog

Hints from your instructor: consider the nouns and verbs in the dialog…



3.7 Link Use Case Steps to System Functions

- Use cases help identify the functions the system will provide.
- If a system function is changed, it's easy to find and review all the ways the function was used.

Use case A.2.1: Normal Operation of Isolette

This use case describes the normal operation of the Isolette by the Nurse.

Related System Goals: G1

Primary Actor: Nurse

Precondition:
Infant is ready to be placed in the Isolette.
Isolette and Thermostat are turned off.

Postcondition:
Infant is removed from the Isolette.
Isolette and Thermostat are turned off.

Main success scenario:
1. Nurse turns on the Isolette.
2. Isolette turns on the Thermostat.
3. Thermostat initializes and enters its normal mode of operation. [System Function A.5.1.2]
4. Nurse Configures the Isolette for the needs of the Infant. [UC A.2.2]
5. Nurse waits until the Current Temperature is within the Desired Temperature Range. [System Function A.5.1.1]
6. Nurse places the Infant in the Isolette.

d Temperature Range during

A.5.1.1 Manage Regulator Interface Function.

The Manage Regulator Interface Function defines the interaction with the Operator Interface external entity. These include obtaining the Desired Range, reporting back the status of the Regulate Temperature Function, and reporting back the Display Temperature. The constants are shown in table A-8.

3.8 Consolidate Repeated Actions into a Single Use Case

A notion analogous to "subroutines" can be used in use cases to name/ abstract action sequences that appear in more than one place …

- Breaking use cases out allows actions that are used in several places to be consolidated and reused.
- This makes use cases more compact and readable.

Main use case "calls" a subroutine use case.

Use case A.2.1: Normal Operation of Isolette

This use case describes the normal operation of the Isolette by the Nurse.

Related System Goals: G1

Primary Actor: Nurse

Precondition:
Infant is ready to be placed in the Isolette.
Isolette and Thermostat are turned off.

Postcondition:
Infant is removed from the Isolette.
Isolette and Thermostat are turned off.

Main success scenario:
1. Nurse turns on the Isolette.
2. Isolette turns on the Thermostat.
3. Thermostat initializes and enters its normal mode of operation. [System Function A.5.1.2]
4. Nurse Configures the Isolette for the needs of the Infant. [UC A.2.2]
5. Nurse waits until the Current Temperature is within the Desired Temperature Range. [System Function A.5.1.1]
6. Nurse places the Infant in the Isolette.
7. Isolette maintains desired temperature. [UC A.2.3]
8. Nurse confirms that Current Temperature is in Desired Temperature Range during rounds. [System Function A.5.1.1]
9. Nurse removes the Infant.
10. Nurse turns off the Isolette.
11. Isolette turns off the Thermostat.

A.2.3 USE CASE: MAINTAIN DESIRED TEMPERATURE.

This use case describes how the Thermostat turns the Heat Source on and off to maintain the Current Temperature in the Isolette within the Desired Temperature Range.

- Related System Goals: G1
- Primary Actor: Thermostat
- Precondition: Isolette and Thermostat are turned on
- Postcondition:
  - Isolette and Thermostat are turned on
  - Current Temperature is in the Desired Temperature Range
- Main Success Scenario:

1. Current Temperature falls below the Desired Temperature Range
2. Thermostat turns the Heat Source on to warm up the Isolette (A.5.1.3)
3. … ired Temperature Range
4. … cool the Isolette (A.5.1.3)

"Subroutine use case"

3.9 Describe Exceptional Situations as Exception Cases

We need to consider not only the good/normal cases, but exception cases as well..

- Exception cases describe the behavior of the system and actors when an exception occurs.
- Exception cases do not ensure a use case's postcondition.
- Example exception cases in Isolette
  - Internal Failure Detected
  - Failure to Maintain Safe Temperature (Alarm)
  - Failure to Maintain Desired Temperature

3.9 Describe Exceptional Situations as Exception Cases

Example Exception Case

A.2.4 EXCEPTION CASE: FAILURE TO MAINTAIN SAFE TEMPERATURE.

This exception case describes how the Thermostat and Nurse respond when the Isolette is unable to maintain Current Temperature within the Alarm Temperature Range.

- Related System Goals: G2
- Primary Actor: Thermostat
- Precondition:
  - The Isolette and Thermostat are turned on
  - The Current Temperature is within the Alarm Temperature Range
  - The Alarm is off
- Postcondition:
  - The Isolette and Thermostat are turned on
  - The Current Temperature is within the Desired Temperature Range
  - The Alarm is off
- Main Success Scenario:
  1. Current Temperature falls below or rises above the Alarm Temperature Range
  2. Thermostat activates the Alarm (A.5.2.3)
  3. Nurse responds to the Alarm and sees that the Display Temperature is in the Alarm Temperature Range (A.5.1.1)
  4. Nurse removes Infant from the Isolette
  5. Nurse corrects the problem, e.g., closing an open door (alternate course 1)
  6. Nurse waits until the Display Temperature is within the Desired Temperature Range (A.2.6 and A.5.1.1)
  7. Nurse places Infant back in the Isolette

3.9 Describe Exceptional Situations as Exception Cases

Sometime Exception Cases can be initiated from any point; other times they only arise at specific points

- If the exception can only occur at a few points, a link should be made (i.e., an annotation should be added) from those steps in the use cases to the exception case.
- If the exception can occur at almost any time (such as a system failure), it is not reasonable to create a link from every use case step, but the precondition for the exception case should make it clear when the exception can occur.

5.	Nurse corrects the problem, e.g., closing an open door (alternate course 1)
6.	Nurse waits until the Display Temperature is within the Desired Temperature Range (A.2.6 and A.5.1.1)

Links to Exception Case "Failure to Maintain Desired Temperature"

3.10 Describe Alternate Ways to Satisfy Postconditions as Alternate Courses

- Other sequences that can be routinely taken to meet postconditions these can are alternate courses

- For example, if the isolette is having a problem, the nurse should try and solve the problem
  - If that fails, though, s/he can put the neonate in a different isolette

3.10 Describe Alternate Ways to Satisfy Postconditions as Alternate Courses

As an example, consider the alternate course in the "Failure to Maintain Safe Temperature" Exception Case (A.2.4)

Main Success Scenario:

1. Current Temperature falls below or rises above the Alarm Temperature Range
2. Thermostat activates the Alarm (A.5.2.3)
3. Nurse responds to the Alarm and sees that the Display Temperature is in the Alarm Temperature Range (A.5.1.1)
4. Nurse removes Infant from the Isolette
5. Nurse corrects the problem, e.g., closing an open door (alternate course 1)
6. Nurse waits until the Display Temperature is within the Desired Temperature Range (A.2.6 and A.5.1.1)
7. Nurse places Infant back in the Isolette

Alternate Course 1:

1. Nurse is unable to correct the problem
2. Nurse obtains another Isolette
3. Nurse starts normal operation of the new Isolette (A.2.1)

3.11 Use Names of External Entities or Environmental Variables

- A large proportion of the terms in the use case refer to:
  - External entities (lecture 1), and
  - Monitored and Controlled variables (lecture 2)
- This helps maintain consistency with the rest of the requirements specification.

Main idea: *We previously identified external entities (analogous to nouns) and **basic/atomic** actions that each can perform (analogous to verbs). Use cases identify possible **sequences** of actions performed by actors (analogous to a conversation or story).*

3.12 Avoid Operator Interface Details

- While physical operator interface details are important, they should be determined as part of the HMI process.
- It is still too early to commit to specific physical interfaces.
- This also makes use cases more widely applicable.

Isolette “Sunny Day” Use Case

Use case A.2.1: Normal Operation of Isolette

This use case describes the normal operation of the Isolette by the Nurse.

Related System Goals: G1

Primary Actor: Nurse

Precondition:

Infant is ready to be placed in the Isolette.
Isolette and Thermostat are turned off.

Postcondition:

Infant is removed from the Isolette.
Isolette and Thermostat are turned off.

Main success scenario:

1. Nurse turns on the Isolette.
2. Isolette turns on the Thermostat.
3. Thermostat initializes and enters its normal mode of operation. [System Function A.5.1.2]
4. Nurse Configures the Isolette for the needs of the Infant. [UC A.2.2]
5. Nurse waits until the Current Temperature is within the Desired Temperature Range. [System Function A.5.1.1]
6. Nurse places the Infant in the Isolette.
7. Isolette maintains desired temperature. [UC A.2.3]
8. Nurse confirms that Current Temperature is in Desired Temperature Range during rounds. [System Function A.5.1.1]
9. Nurse removes the Infant.
10. Nurse turns off the Isolette.
11. Isolette turns off the Thermostat.

3.13 Update the System Boundary

Writing use cases may cause us to identify flaws in results of earlier steps…

- Use cases enable…
  - Early validation of requirements
  - Early documentation of how actors interact with the system
  - Identification of inconsistencies and oversights
  - Identification of overlooked external entities as well as monitored and controlled variables
    - *See example on next slide*

Updated Monitored and Controlled Variables

3. Thermostat initializes and enters its normal mode of operation. [System Function A.5.1.2]

Table 5. Revised Thermostat Monitored and Controlled Variables

Name	Type	Physical Interpretation
Current Temperature	Monitored	Current air temperature inside Isolette
Operator Settings		Thermostat settings provided by operator
Desired Temperature Range		Desired range of Isolette temperature
Lower Desired Temperature	Monitored	Lower value of Desired Temperature Range
Upper Desired Temperature	Monitored	Upper value of Desired Temperature Range
Operator Feedback		Information provided back to the operator
Display Temperature	Controlled	Displayed temperature of air in Isolette
Thermostat Status	Controlled	Current operational status of the thermostat
Heat Control	Controlled	Command to turn heat source on or off

New, added per step 3

Example: Step 3 in the Main Success Scenario discusses the initialization of the Thermostat and its entry into normal operation. This implies that the nurse is able to determine when the thermostat enters normal operation so it can be configured, which in turn implies the need for an additional controlled variable to display the Thermostat Status.

3.14 Build a Preliminary Set of System Functions

- Create a preliminary list of system functions while creating use cases
  - These will be the basis of lecture 5 “Develop the Functional Architecture”

Links to identifiers for system functions

A.5.1.1 Manage Regulator Interface Function.
The Manage Regulator Interface Function defines the interaction with the Operator Interface external entity.

A.5.1.2 Manage Regulator Mode Function.
The Manage Regulator Mode Function determines the mode of the Regulate Temperature Function.

A.5.2.2 Manage Monitor Mode Function.
The Manage Monitor Mode Function determines the mode of the Monitor Temperature Function.

Main Success Scenario:

1. Nurse turns on the Isolette
2. Isolette turns on the Thermostat
3. Thermostat initializes and enters its normal mode of operation (exception case 1) (A.2.5, A.5.1.2 and A.5.2.2)
4. Nurse configures the Isolette for the needs of the Infant (A.2.2)
5. Nurse waits until the Current Temperature is within the Desired Temperature Range (A.2.6 and A.5.1.1)
6. Nurse places the Infant in the Isolette
7. Isolette maintains Desired Temperature (A.2.3)
8. Nurse confirms that the Current Temperature is in the Desired Temperature Range during rounds (A.2.6 and A.5.1.1)
9. Nurse removes Infant
10. Nurse turns off the Isolette
11. Isolette turns off the Thermostat

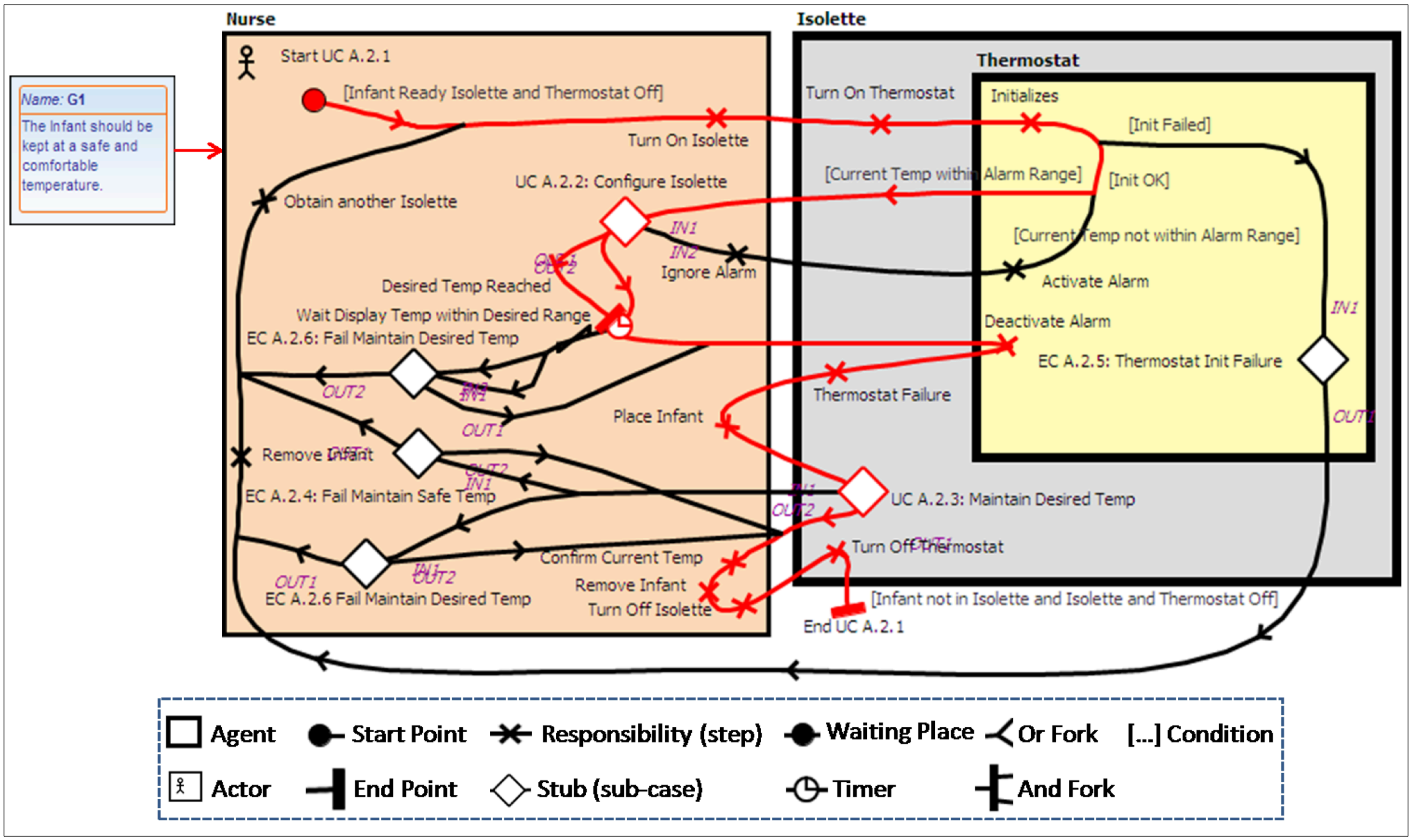
Example Early Isolette Function List

Table 6. Preliminary Set of Isolette Thermostat Functions

Turn the thermostat on and off	Indicate the thermostat status
Set the Desired Temperature	Turn heat source on and off
Display the current temperature	

Graphical Notation

Although we have focused on a textual notation for use cases, graphical views corresponding to our detailed treatment have been developed…



Use Case Maps – see http://www.usecasemaps.org/

Summary

To capture the users' understanding of the system and to provide a useful step from system overview to detailed requirements, we capture operational concepts in terms of *use cases* to describe how the system interacts with its operators and other systems in its environment.

- Use cases…
  - View the system as a block box
  - Help identify
    - What functions the operators expect the system to perform
    - The values the operators can provide as inputs,
    - The information that operators need as feedback
    - The sequence in which operators can invoke System Functions during normal operation
    - Response of the operators when the system behaves differently than expected.
- Operational concepts are written in a natural, intuitive style that all stakeholders can understand

For You To Do

- Be able to state the outline/format of a Use-Case
- Explain how the nouns/verbs used in use cases in this REMH stage trace to previous stages

Acknowledgements

- The material in this lecture is based almost entirely on
  - *FAA* DOT/FAA/AR-08/32*, Requirements Engineering Management Handbook.* David L. Lempia & Steven P. Miller.