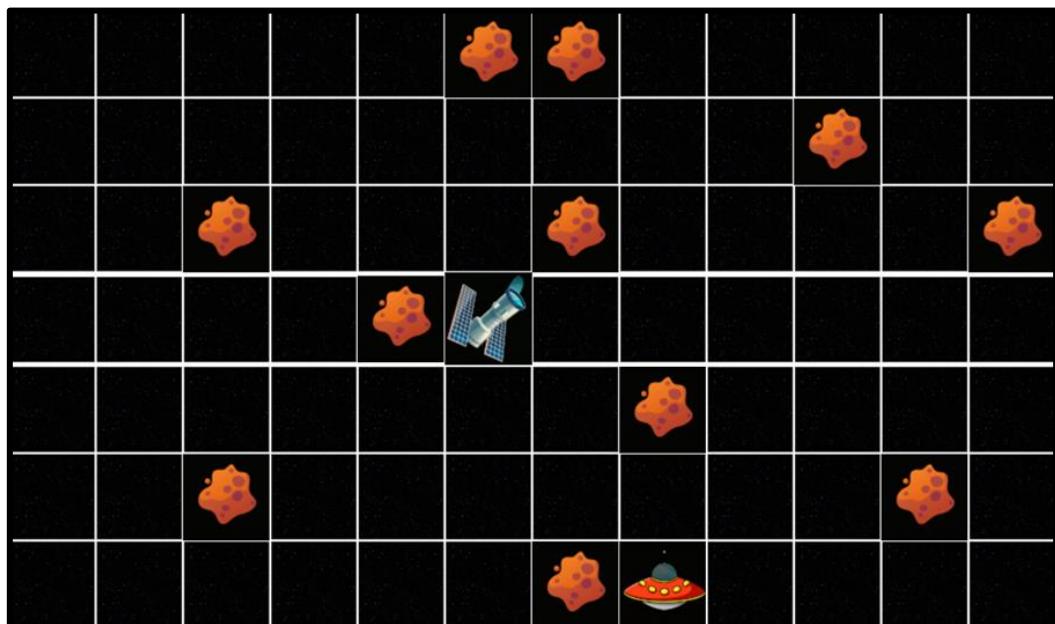




INFORMATICS
INSTITUTE OF
TECHNOLOGY

UNIVERSITY OF
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MODULE: 6SENG005C.1 Formal Methods



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1.0 Structure Diagram – B specification

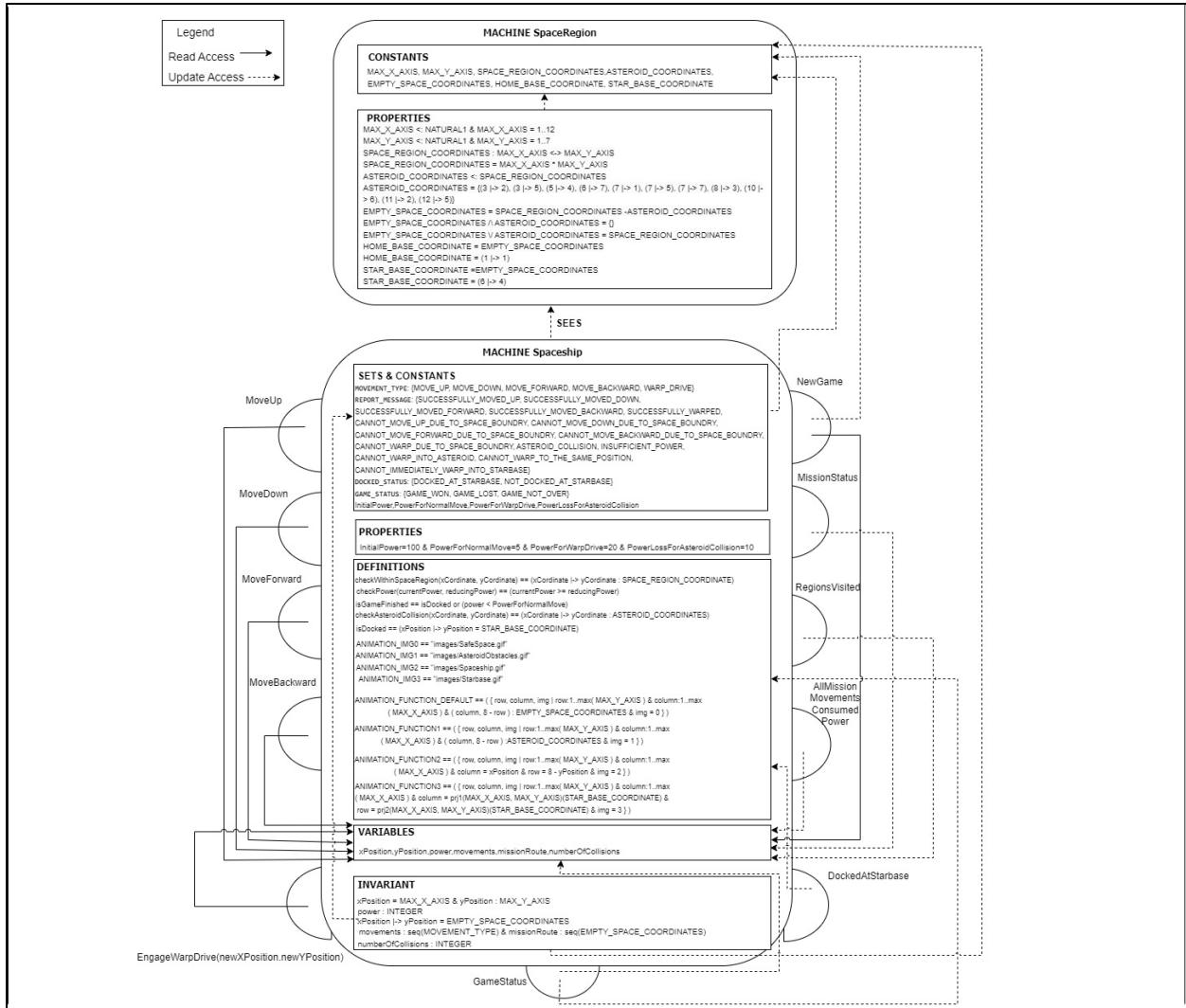


Figure 1 Structure Diagram

Visit <https://drive.google.com/file/d/1HS33AT6JUt8qlj2LLbcvWzhdIK1eMQzE/view?usp=sharing> to see the diagram more clearly

Model Type: Finite State Machine (FSM)

Model Overview:

- The model employs a finite state machine (FSM) to represent the spaceship's behavior within the game environment.
- The FSM is comprised of a finite set of states, interconnected by transitions triggered by specific events.
- The model's initial state is denoted as "Game_not_over."
- The model incorporates tables for sets, constants, properties, and variables, providing further context for its operation.

States:

- Game_not_over: The initial state, from which transitions to the following states can occur:
 - MoveUp
 - MoveDown
 - MoveForward
 - MoveReverse
 - EngageWarpDrive
- MoveUp: Represents the spaceship's upward movement. Transitions to:
 - Moved Successfully (upon successful movement)
 - Move Failed Unable to Visit Unknown Space (upon attempting to access an unknown area)
- MoveDown: Represents the spaceship's downward movement. Transitions to the same states as MoveUp.
- MoveForward: Represents the spaceship's forward movement. Transitions to:
 - Freespace (upon successful movement)
 - Asteroid Collision (upon collision with an asteroid)
- MoveReverse: Represents the spaceship's reverse movement. Transitions to the same states as MoveForward.
- EngageWarpDrive: Represents the spaceship's engagement of its warp drive. Transitions to:
 - Freespace (upon successful warp)
 - Warp Failed states (upon unsuccessful warp)
- Terminal States:
 - Moved Successfully
 - Freespace
 - DockedAtStarBase
 - These states signify the completion of a particular action or sequence, with no further transitions possible.

2.0 Rationale and Elaboration

This project entails the creation of a B specification for a simplified iteration of the Spaceship & Asteroids arcade game, utilizing B tools. A detailed exposition of the assigned and employed SETS, CONSTANTS, PROPERTIES, VARIABLES, and INVARIANTS is presented below.

2.1 SETS

The project involves two main machines: SpaceRegion and Spaceship. Each machine comprises several sets crucial for their functionality. The SpaceRegion machine sets define the spatial characteristics of the game, while the Spaceship machine sets are focused on the spaceship's movements, messages, and overall game status.

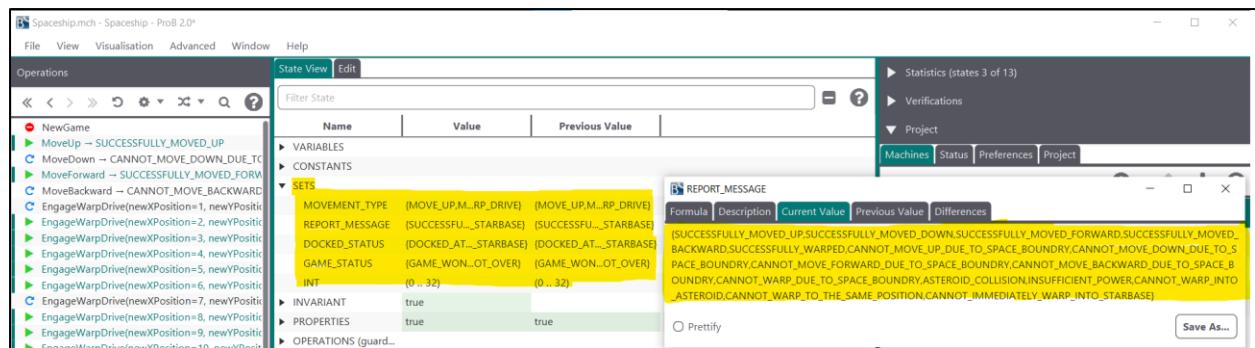


Figure 2 SETS

Machine	Set	Elements	Description
SpaceRegion	MAX_X_AXIS	1..12	Maximum value for the X-axis in the space region.
	MAX_Y_AXIS	1..7	Maximum value for the Y-axis in the space region.
	SPACE_REGION_COORDINATES	All pairs (x, y) where x is in MAX_X_AXIS and y is in MAX_Y_AXIS	Set of all coordinates in the space region.
	ASTEROID_COORDINATES	{(3,2), (3,5), (5,4), (6,7), (7,1), (7,5), (7,7), (8,3), (10,6), (11,2), (12,5)}	Set of coordinates occupied by asteroids.
	EMPTY_SPACE_COORDINATES	All coordinates in SPACE_REGION_COORDINATES not in ASTEROID_COORDINATES	Set of coordinates available for spaceship movement (excluding asteroid coordinates).

	HOME_BASE_COORDINATE	(1,1)	Coordinate of the home base.
	STAR_BASE_COORDINATE	(6,4)	Coordinate of the star base.
Spaceship	MOVEMENT_TYPE	{MOVE_UP, MOVE_DOWN, MOVE_FORWARD, MOVE_BACKWARD, WARP_DRIVE}	Movement types of spaceships
	REPORT_MESSAGE	{SUCCESSFULLY_MOVED_UP, SUCCESSFULLY_MOVED_DOWN, SUCCESSFULLY_MOVED_FORWARD, SUCCESSFULLY_MOVED_BACKWARD, SUCCESSFULLY_WARPED, CANNOT_MOVE_UP_DUE_TO_SPACE_BOUNDARY, CANNOT_MOVE_DOWN_DUE_TO_SPACE_BOUNDARY, CANNOT_MOVE_FORWARD_DUE_TO_SPACE_BOUNDARY, CANNOT_MOVE_BACKWARD_DUE_TO_SPACE_BOUNDARY, CANNOT_WARP_DUE_TO_SPACE_BOUNDARY, ASTEROID_COLLISION, INSUFFICIENT_POWER, CANNOT_WARP_INTO_ASTEROID, CANNOT_WARP_TO_THE_SAME_POSITION, CANNOT_IMMEDIATELY_WARP_INTO_STARBASE}	Appropriate report messages for various actions and conditions.
	DOCKED_STATUS	{DOCKED_AT_STARBASE, NOT_DOCKED_AT_STARBASE}	Spaceship docked status.
	GAME_STATUS	{GAME WON, GAME LOST, GAME NOT OVER}	Game status messages.
	InitialPower	100	Initial power for the spaceship.

	PowerForNormalMove	5	Power usage for a normal move.
	PowerForWarpDrive	20	Power usage for a warp drive.
	PowerLossForAsteroidCollision	10	Power loss for asteroid collision.

Table 1- SETS

2.2 CONSTANTS & PROPERTIES

CONSTANTS and PROPERTIES play a crucial role in defining the characteristics and behavior of the SpaceRegion and Spaceship machines.

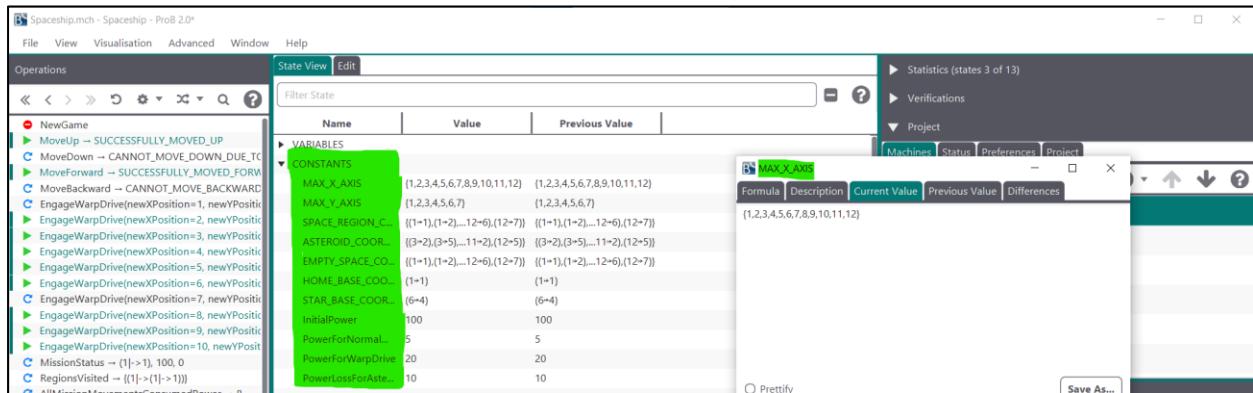


Figure3 CONSTANTS

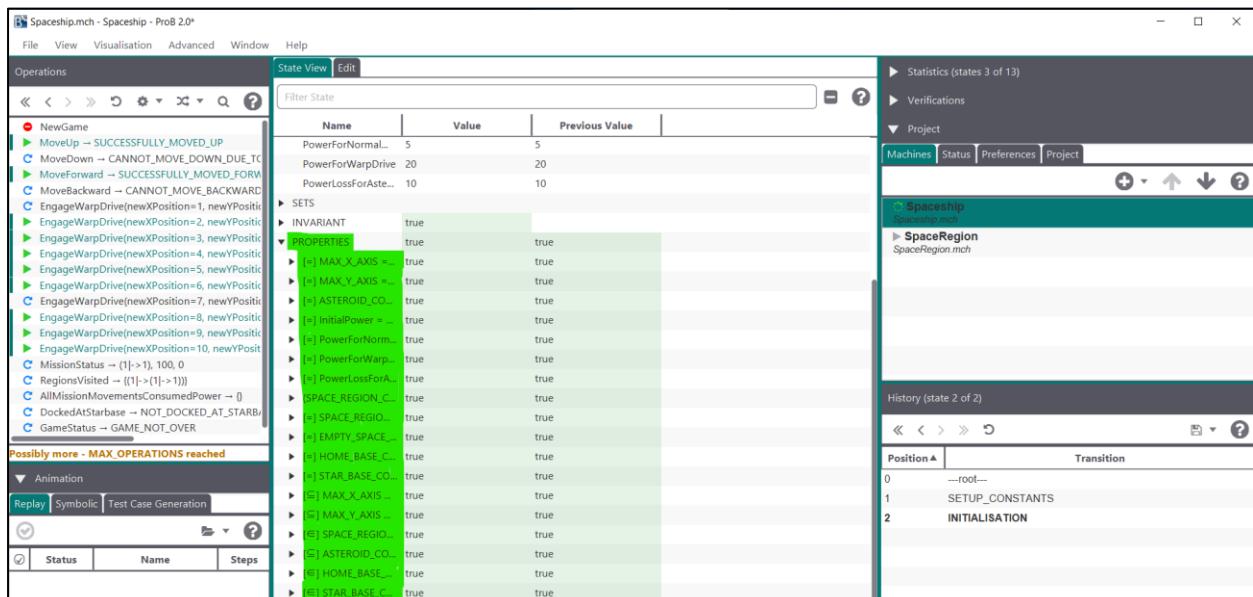


Figure4 PROPERTIES

Machine	CONSTANT	CONSTANT explanation	PROPERTY	PROPERTY explanation
SpaceRegion	MAX_X_AXIS, MAX_Y_AXIS	Maximum values for the X and Y axes in the space region.	MAX_X_AXIS <: NATURAL1 & MAX_X_AXIS = 1..12	Ensures that MAX_X_AXIS is a natural number between 1 and 12.
	SPACE_REGION_COORDINATES	Set of all coordinates in the space region based on MAX_X_AXIS and MAX_Y_AXIS.	MAX_Y_AXIS <: NATURAL1 & MAX_Y_AXIS = 1..7	Ensures that MAX_Y_AXIS is a natural number between 1 and 7.
	ASTEROID_COORDINATES	Set of coordinates occupied by asteroids in the space region.	SPACE_REGION_COORDINATES : MAX_X_AXIS <-> MAX_Y_AXIS	Establishes a relationship between SPACE_REGION_COORDINATES and the X and Y axes.
	EMPTY_SPACE_COORDINATES	Set of coordinates available for spaceship movement, excluding those occupied by asteroids.	ASTEROID_COORDINATES <: SPACE_REGION_COORDINATES	Specifies that ASTEROID_COORDINATES is a subset of SPACE_REGION_COORDINATES.
	HOME_BASE_COORDINATE, STAR_BASE_COORDINATE	Coordinates of the home base and star base within EMPTY_SPACE_COORDINATES.	EMPTY_SPACE_COORDINATES = SPACE_REGION_COORDINATES - ASTEROID_COORDINATES	Defines EMPTY_SPACE_COORDINATES as the set difference between SPACE_REGION_COORDINATES and ASTEROID_COORDINATES.
			HOME_BASE_COORDINATE : EMPTY_SPACE_COORDINATES & HOME_BASE_COORDINATE = (1	Specifies that HOME_BASE_COORDINATE is within EMPTY_SPACE_COORDINATES and defines its value.
			STAR_BASE_COORDINATE : EMPTY_SPACE_COORDINATES & STAR_BASE_COORDINATE = (6	Specifies that STAR_BASE_COORDINATE is within EMPTY_SPACE_COORDINATES and defines its value.
Spaceship	InitialPower, PowerForNormalMove, PowerForWarpDrive , PowerLossForAsteroidCollision	Constants for initial power, power usage for normal move, power usage for warp drive, and power loss for asteroid collision.	InitialPower = 100	Sets the initial power for the spaceship to 100.
			PowerForNormalMove = 5	Sets the power usage for a normal move to 5.
			PowerForWarpDrive = 20	Sets the power usage for a warp drive to 20.

			PowerLossForAsteroidCollision = 10	Sets the power loss for an asteroid collision to 10.
--	--	--	---	--

Table 2- CONSTANTS & PROPERTIES

2.3 VARIABLES & INVARIANTS

These VARIABLES and INVARIANTS are crucial for maintaining the consistency and correctness of the system's state and behavior during the execution of operations. They help define constraints on the allowed values and relationships between different components of the system.

Variables

Variables represent the dynamic state of a system. They are used to model values that can change during the execution of the system.

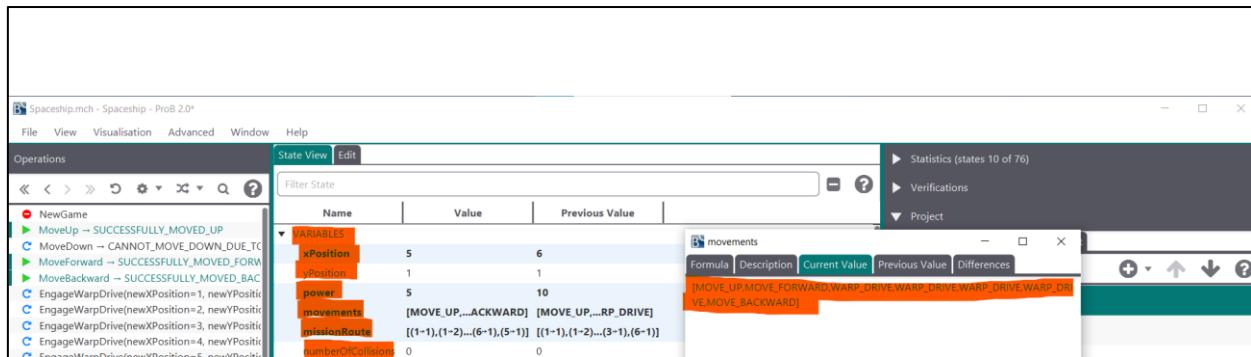


Figure4 VARIABLES

Variable	Number of Values
missionRoute	95
movements	39
numberOfCollisions	2
power	16
xPosition	9
yPosition	5

Figure VARIABLE Coverage

Table Visualisation		Variable	Read by	Written by
Machine Statistics		missionRoute	['MoveUp'; 'MoveDown'; 'MoveForward'; 'MoveBackward'; 'EngageWarpDrive'; 'RegionsVisited']	['NewGame', 'MoveUp', 'MoveDown', 'MoveForward', 'MoveBackward', 'EngageWarpDrive']
Expression Table...		movements	['MoveUp'; 'MoveDown'; 'MoveForward'; 'MoveBackward'; 'EngageWarpDrive'; 'AllMissionMov...']	['NewGame', 'MoveUp', 'MoveDown', 'MoveForward', 'MoveBackward', 'EngageWarpDrive']
Operation Coverage		numberOfCollisions	['MoveUp'; 'MoveDown'; 'MoveForward'; 'MoveBackward'; 'MissionStatus']	['NewGame', 'MoveUp', 'MoveDown', 'MoveForward', 'MoveBackward']
Operation Coverage and Feasibility		power	['NewGame', 'MoveUp', 'MoveDown', 'MoveForward', 'MoveBackward', 'EngageWarpDrive', 'Mi...']	['NewGame', 'MoveUp', 'MoveDown', 'MoveForward', 'MoveBackward', 'EngageWarpDrive']
Show Typing		xPosition	['NewGame', 'MoveUp', 'MoveDown', 'MoveForward', 'MoveBackward', 'EngageWarpDrive', 'Mi...']	['NewGame', 'MoveForward', 'MoveBackward', 'EngageWarpDrive']
Variable Coverage		yPosition	['NewGame', 'MoveUp', 'MoveDown', 'MoveForward', 'MoveBackward', 'EngageWarpDrive', 'Mi...']	['NewGame', 'MoveUp', 'MoveDown', 'EngageWarpDrive']
Constant Coverage				
Constant Analysis				
Min/Max Values				
Invariant Analysis				
Vacuous Invariants				
Specialized Invariants				
Vacuous Guards				
Operation Read/Write Matrix				
Variable Read/Write Matrix				
WD POs				
WD POs and Hyps				

Figure VARIABLE Read/Write matrix

Purpose of variables

Variables help track the changing aspects of a system over time. In the context of the provided machines (SpaceRegion and Spaceship), variables include elements such as the current position of a spaceship (xPosition and yPosition), the remaining power of the spaceship (power), the movements made by the spaceship (movements), the route taken by the spaceship (missionRoute), and the number of collisions the spaceship has encountered (numberOfCollisions).

Usage of variables

They are manipulated by operations in the machine. Operations can modify the values of variables based on certain conditions and constraints.

Invariant

Invariants are logical conditions that must hold true throughout the execution of the system. They provide constraints on the possible values of variables.

Name	Value	Previous Value
(INVARIANT)	true	true
xPosition	5	6
MAX_X_AXIS	{1,2,3,4,5,6,7,8,9,10,11,12}	{1,2,3,4,5,6,7,8,9,10,11,12}
movement	1	1
MAX_Y_AXIS	{1,2,3,4,5,6,7}	{1,2,3,4,5,6,7}
xPosition	(5=1)	(6=1)
EMPTY_SPACE	{(1=1),(1=2)...(12=6),(12=7)}	{(1=1),(1=2)...(12=6),(12=7)}
movement	[MOVE_UP,...ACKWARD] [MOVE_UP,...RP_DRIVE]	
seq	seq(MOVEMENT_TYPE)	seq(MOVEMENT_TYPE)
MOVEMENT	MOVEMENT_TYPE	MOVEMENT_TYPE
missionRoute	{(1=1),(1=2)...(6=1),(5=1)} {(1=1),(1=2)...(3=1),(6=1)}	
seq	seq{((1=1),(1=2)...(6=1),(5=1))} seq{((1=1),(1=2)...(3=1),(6=1))}	

Figure3 INVARIANTS

The screenshot shows a software interface with a sidebar containing navigation links such as Machine Statistics, Expression Table, Operation Coverage, etc. The main area displays a table titled "Specialized INvariants".

Operation	Unproven	Predicate
NewGame	INVARIANT (-)	not_simplified
MoveUp	INVARIANT (4)	yPosition : MAX_Y_AXIS & xPosition -> yPosition
MoveDown	INVARIANT (4)	yPosition : MAX_Y_AXIS & xPosition -> yPosition
MoveForward	INVARIANT (4)	xPosition : MAX_X_AXIS & xPosition -> yPosition
MoveBackward	INVARIANT (4)	xPosition : MAX_X_AXIS & xPosition -> yPosition
EngageWarpDrive	INVARIANT (-)	not_simplified
MissionStatus	INVARIANT (0)	btrue
RegionsVisited	INVARIANT (0)	btrue
AllMissionMovementsConsumedPower	INVARIANT (0)	btrue
DockedAtStarbase	INVARIANT (0)	btrue
GameStatus	INVARIANT (0)	btrue
\$Initialise_machine	INVARIANT (-)	not_simplified

Figure Specialized INvariants

The screenshot shows a software interface with a sidebar containing navigation links such as Machine Statistics, Expression Table, Operation Coverage, etc. The main area displays a table titled "INARIANT Analysis".

INARIANT	VALUE	State ID	Source
xPosition ∈ MAX_X_AXIS	TRUE	1	at line 67:4 - 67:26
yPosition ∈ MAX_Y_AXIS	TRUE	1	at line 67:29 - 67:52
xPosition ↳ yPosition ∈ EMPTY...	TRUE	1	at line 68:4 - 68:53
movements ∈ seq(MOVEMENT...	TRUE	1	at line 70:4 - 70:34
missionRoute ∈ seq(EMPTY_SP...	TRUE	1	at line 70:37 - 70:80

Figure INARIANT Analysis

Purpose of invariants

Invariants ensure that certain properties remain unchanged during the execution of the system. They help in specifying correctness conditions that should be preserved at all times.

Usage of Invariants

They are conditions that must be satisfied before and after the execution of any operation. In the provided machines, invariants include conditions such as the current position being within the bounds of the space region, the power being an integer, the movements being a sequence of predefined types, the mission route consisting of coordinates in empty space, and the number of collisions being an integer.

Machine	VARIABLE	VARIABLE description	INARIANT	INARIANT description
	(none)	No specific variables defined in	xPosition : MAX_X_AXIS	The xPosition variable, representing the current x-

SpaceRegion		the SpaceRegion machine	<p>coordinate of the spaceship, is within the bounds specified by the MAX_X_AXIS constant.</p> <p>This ensures that the x-coordinate of the spaceship is a valid value within the defined space region along the X-axis.</p>
		yPosition : MAX_Y_AXIS	<p>The yPosition variable, representing the current y-coordinate of the spaceship, is within the bounds specified by the MAX_Y_AXIS constant.</p> <p>Similar to the previous invariant, this ensures that the y-coordinate of the spaceship is a valid value within the defined space region along the Y-axis.</p>
		xPosition -> yPosition : EMPTY_SPACE_COORDINATES	<p>The pair (xPosition, yPosition) represents a coordinate in the empty space as defined by EMPTY_SPACE_COORDINATES.</p> <p>This ensures that the current position of the spaceship is within the set of coordinates available for movement, excluding positions occupied by asteroids.</p>
		power : INTEGER	<p>The power variable, representing the current power level of the spaceship, is an integer.</p> <p>This ensures that the power level is a whole number, conforming to the mathematical definition of integers.</p>
		movements : seq(MOVEMENT_TYPE)	The movements variable, representing the sequence of movements made by the

				<p>spaceship, is a sequence of elements from the MOVEMENT_TYPE set.</p> <p>This guarantees that the recorded movements are a valid sequence of predefined types, ensuring consistency in the recorded actions.</p>
			<code>missionRoute : seq(EMPTY_SPACE_COORDINATES)</code>	<p>The missionRoute variable, representing the sequence of coordinates in the spaceship's route, is a sequence of coordinates in empty space.</p> <p>This ensures that the recorded route consists only of coordinates in the empty space, excluding positions occupied by asteroids.</p>
			<code>numberOfCollisions : INTEGER</code>	<p>The numberOfCollisions variable, representing the count of collisions encountered by the spaceship, is an integer.</p> <p>This ensures that the count of collisions is a whole number, conforming to the mathematical definition of integers.</p>
Spaceship	xPosition	This variable represents the current x-coordinate of the spaceship in the space region.	xPosition : MAX_X_AXIS	This invariant ensures that the xPosition variable remains within the allowed bounds specified by MAX_X_AXIS.
	yPosition	This variable represents the current y-coordinate of the spaceship in the space region.	yPosition : MAX_Y_AXIS	This invariant ensures that the yPosition variable remains within the allowed bounds specified by MAX_Y_AXIS.

	power	This variable represents the current power level of the spaceship. It is used to model the available energy or resources that the spaceship has for its operations.	xPosition -> yPosition : EMPTY_SPACE_COORDINATES	This invariant ensures that the current position of the spaceship is within the set of empty space coordinates, meaning it is a valid position for the spaceship to occupy.
	movements	This variable is a sequence that stores all the movements performed by the spaceship. Each element in the sequence corresponds to a specific type of movement (e.g., MOVE_UP, MOVE_DOWN).	power : INTEGER	This invariant ensures that the power variable takes on integer values.
	missionRoute	This variable is a sequence that stores the coordinates representing the route taken by the spaceship. The coordinates are expected to be in empty space, as specified by the invariant.	movements : seq(MOVEMENT_TYPE)	This invariant ensures that the movements variable is a sequence composed of elements from the MOVEMENT_TYPE set, representing valid spaceship movements.
	numberOfCollisions	This variable keeps track of the total number of collisions encountered by the spaceship.	missionRoute : seq(EMPTY_SPACE_COORDINATES)	This invariant ensures that the missionRoute variable is a sequence of coordinates that are all within the set of empty space coordinates.
			numberOfCollisions : INTEGER	This invariant ensures that the numberOfCollisions variable takes on integer values.

Table 3- VARIABLES & INVARIANTS

2.4 INITIALISATION

The initializations provided for both the SpaceRegion and Spaceship machines are a set of instructions that define the starting state of the machines when a new instance of the game is initialized. These initializations ensure that the game starts with the spaceship positioned at the **home base, full power, no previous movements or collisions**, and with the **necessary data structures initialized** for tracking the spaceship's journey.

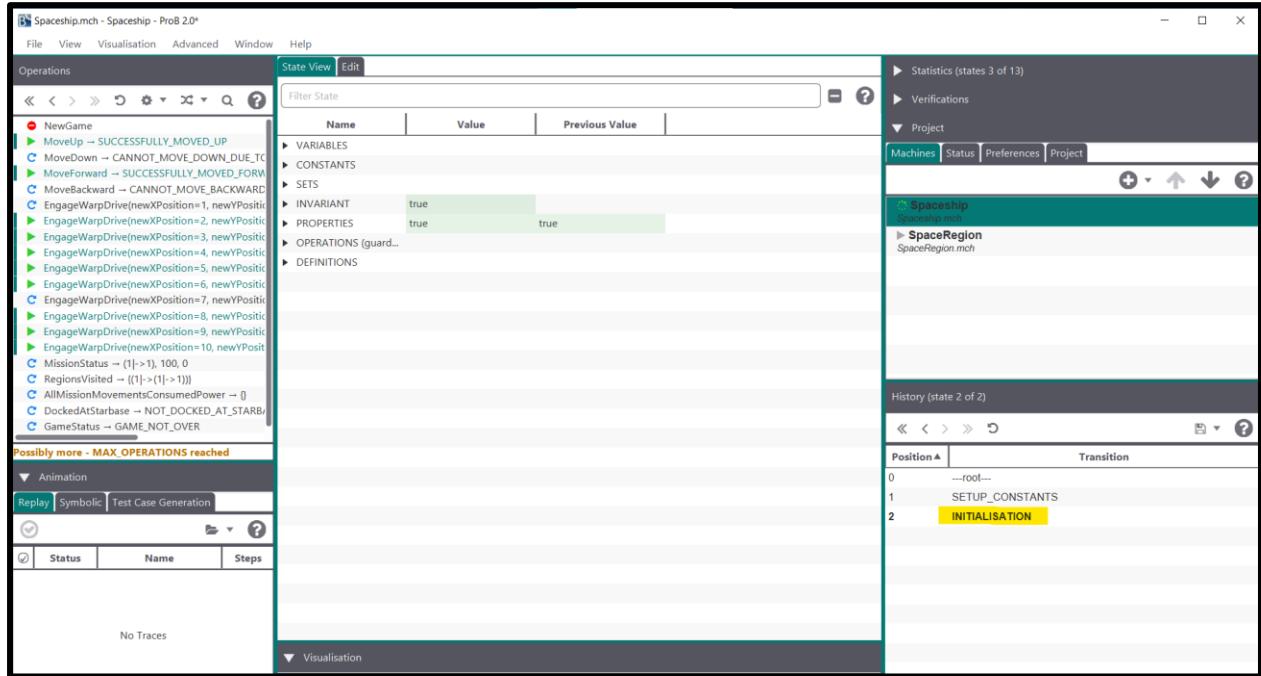
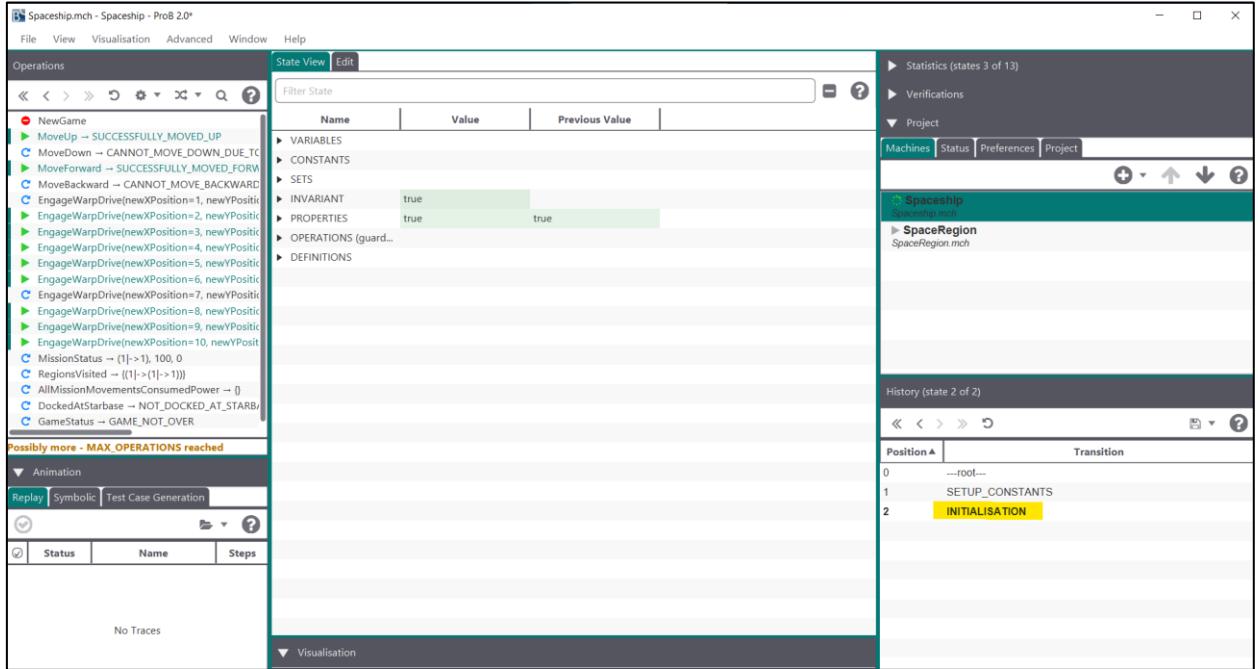


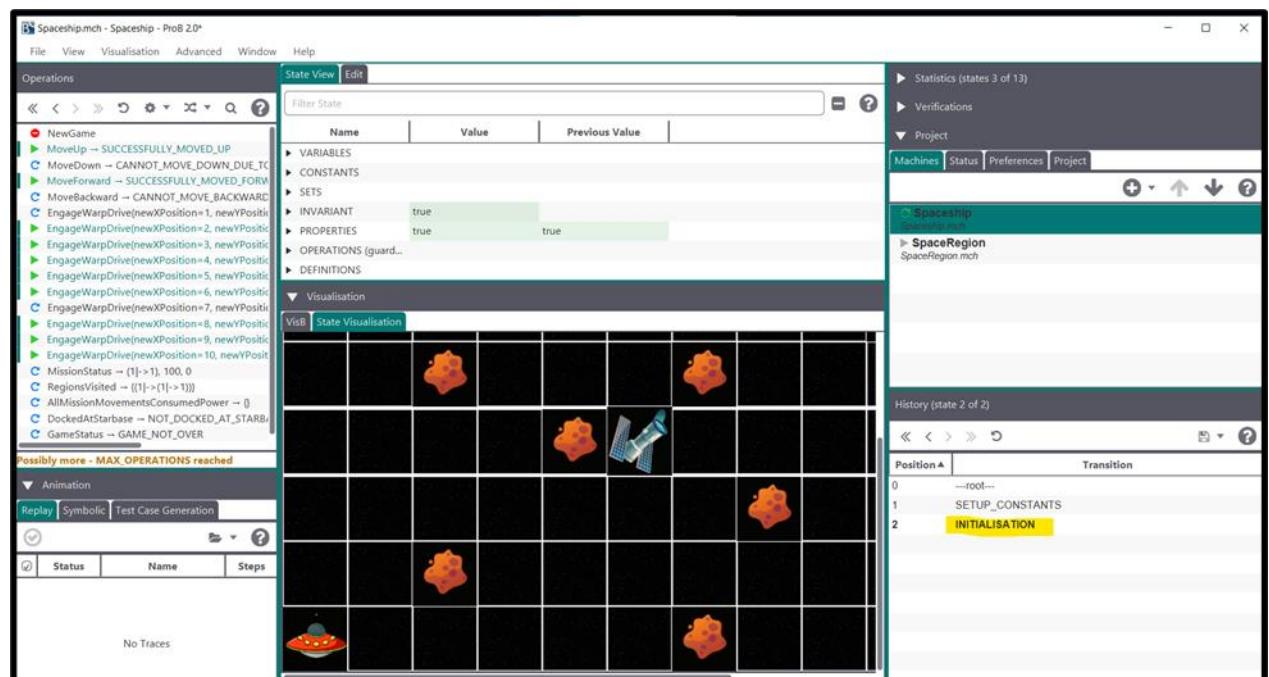
Figure 4 INITIALISATION

3.0 Implementation Screenshots

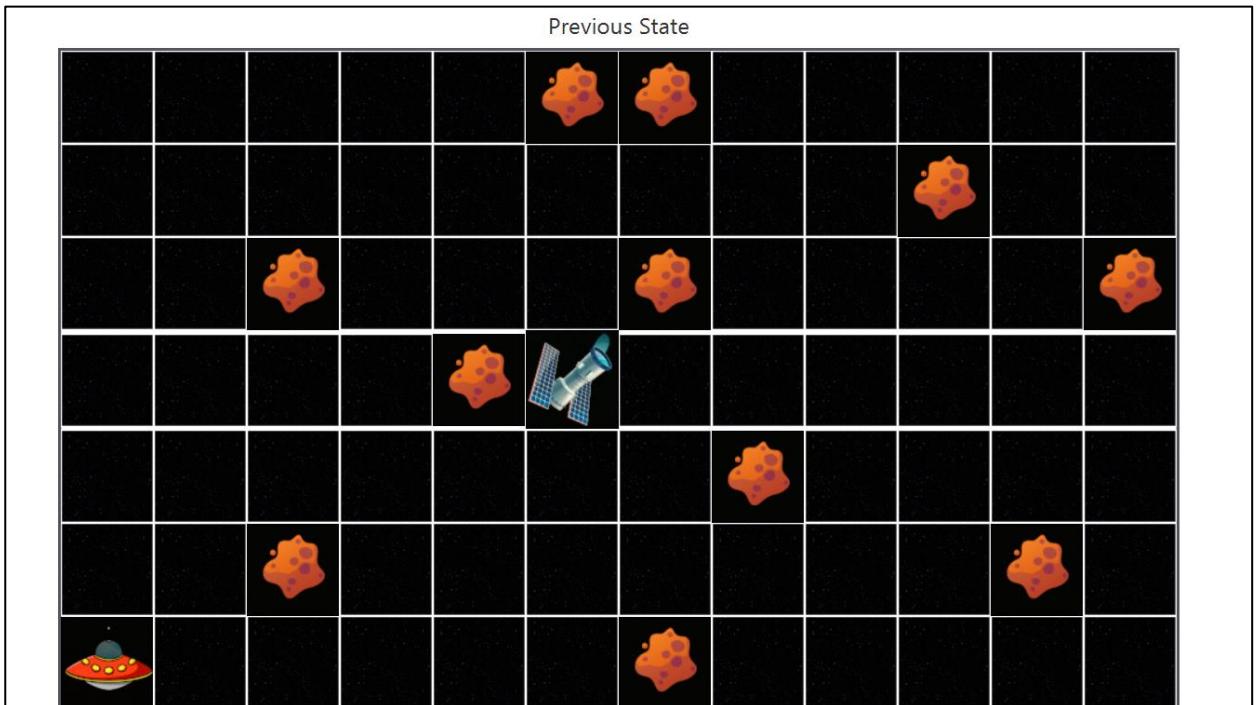
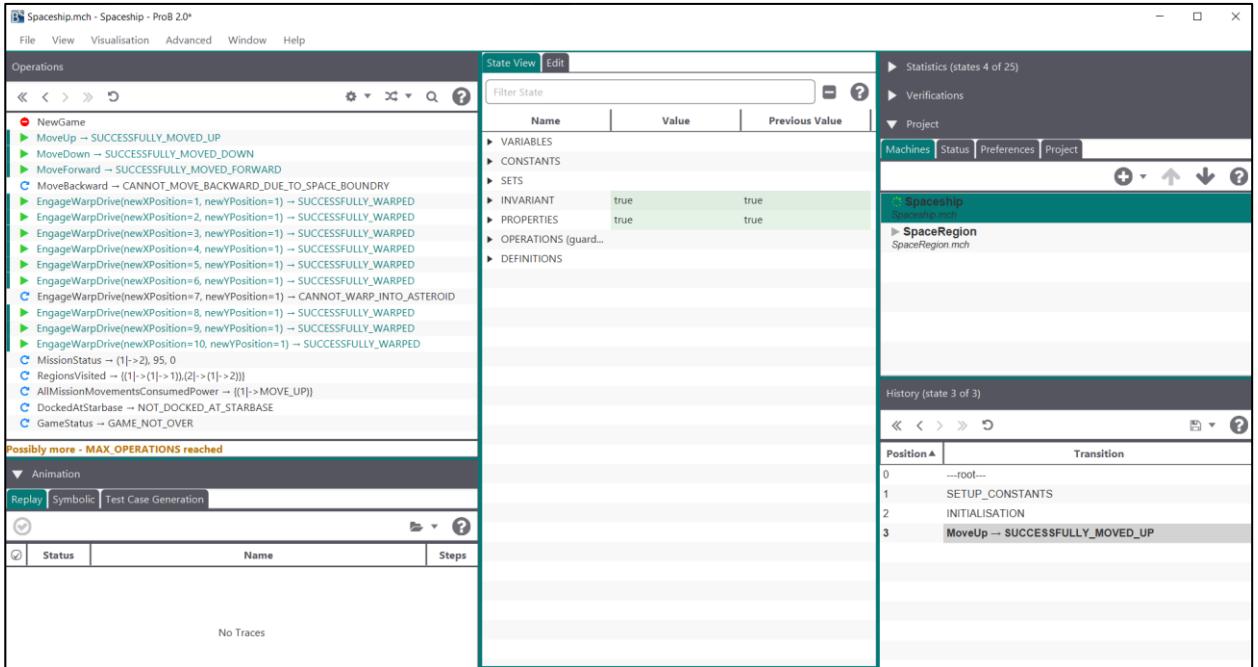
1. Initialising the Game

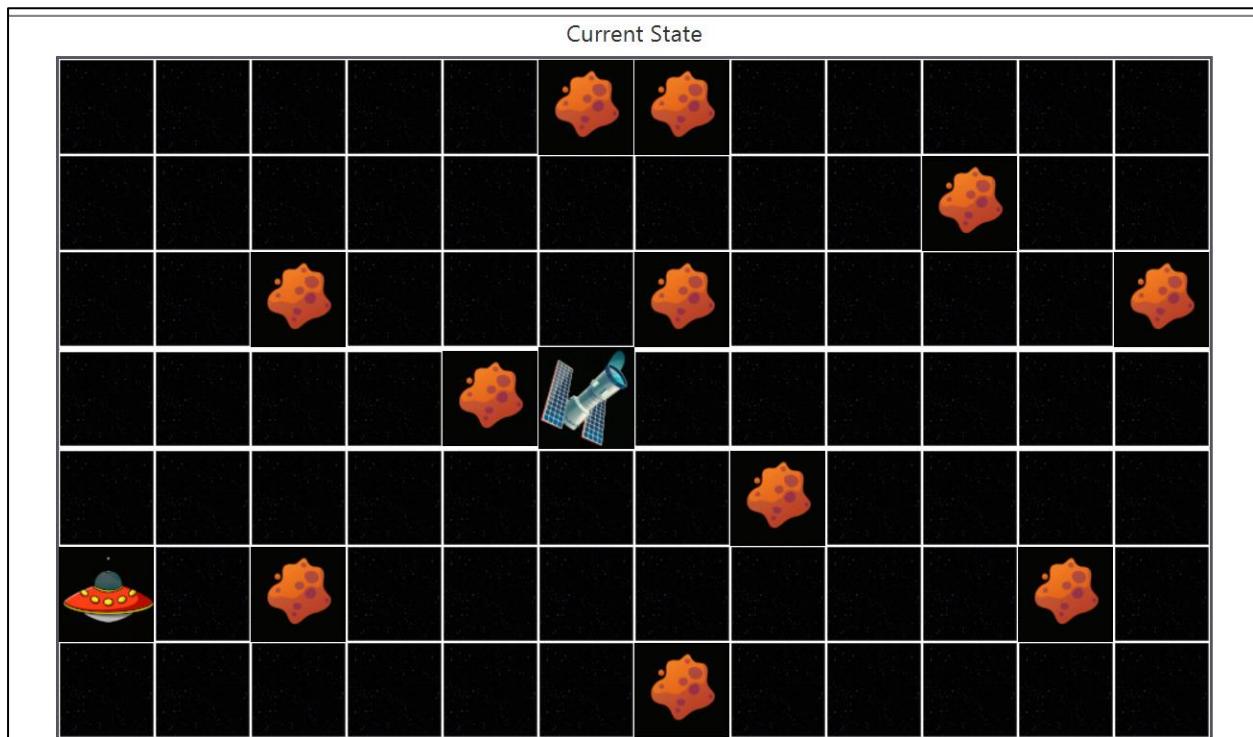


2. Start of the Game



3. Successful Normal Movement -MOVE_UP





4. Failed movement due to unknown space and asteroid collision

Screenshot of the ProB 2.0* tool interface showing a state trace for a Spaceship model.

Operations View:

- NewGame
- MoveUp → SUCCESSFULLY_MOVED_UP
- MoveDown → SUCCESSFULLY_MOVED_DOWN
- MoveForward → ASTEROID_COLLISION
- MoveBackward → SUCCESSFULLY_MOVED_BACKWARD
- EngageWarpDrive(newXPosition=1, newYPosition=1) → SUCCESSFULLY_WARPED
- EngageWarpDrive(newXPosition=2, newYPosition=1) → SUCCESSFULLY_WARPED
- EngageWarpDrive(newXPosition=3, newYPosition=1) → SUCCESSFULLY_WARPED
- EngageWarpDrive(newXPosition=4, newYPosition=1) → SUCCESSFULLY_WARPED
- EngageWarpDrive(newXPosition=5, newYPosition=1) → SUCCESSFULLY_WARPED
- EngageWarpDrive(newXPosition=6, newYPosition=1) → SUCCESSFULLY_WARPED
- EngageWarpDrive(newXPosition=7, newYPosition=1) → CANNOT_WARP_INTO_ASTEROID
- EngageWarpDrive(newXPosition=8, newYPosition=1) → SUCCESSFULLY_WARPED
- EngageWarpDrive(newXPosition=9, newYPosition=1) → SUCCESSFULLY_WARPED
- EngageWarpDrive(newXPosition=10, newYPosition=1) → SUCCESSFULLY_WARPED
- MissionStatus → (2|->2), 75, 1
- RegionsVisited → ((1|->(1|->1)),(2|->(1|->2)),(3|->(2|->2)))
- AllMissionMovementsConsumedPower → ((1|->MOVE_UP),(2|->MOVE_FORWARD),(3|->MOVE_BACKWARD))
- DockedAtStarbase → NOT_DOCKED_AT_STARBASE
- GameStatus → GAME_NOT_OVER

State View:

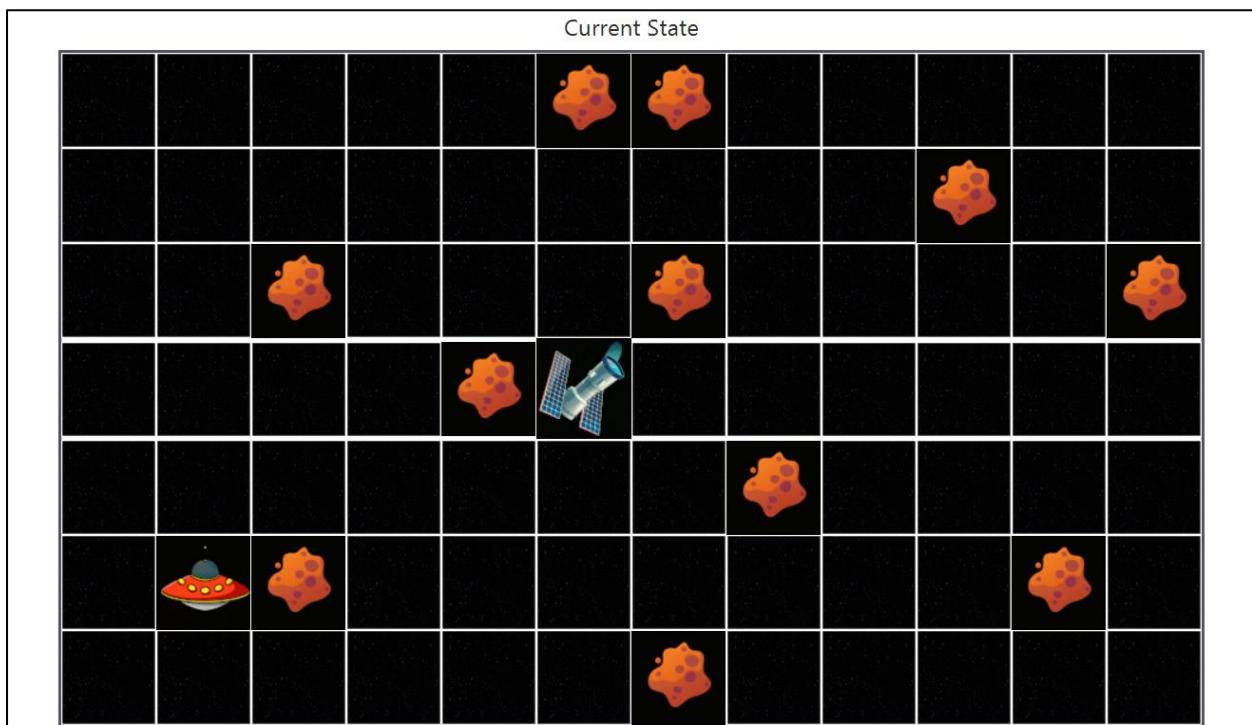
Name	Value	Previous Value
INVARIANT	true	true
PROPERTIES	true	true

Project View:

- Statistics (states 6 of 5)
- Verifications
- Project
- Machines Status Preferences Project
- Spaceship (Selected machine)
- SpaceRegion (Sub-machine)
- SpaceRegion.mch

History View:

Position	Transition
0	--root--
1	SETUP_CONSTANTS
2	INITIALISATION
3	MoveUp → SUCCESSFULLY_MOVED_UP
4	MoveForward → SUCCESSFULLY_MOVED_FORWARD
5	MoveForward → ASTEROID_COLLISION



5. Successful warp jump

Spaceship.mch - Spaceship - ProB 2.0*

File View Visualisation Advanced Window Help

Operations

- NewGame
- ▶ MoveUp → ASTEROID_COLLISION
- ◀ MoveDown → CANNOT_MOVE_DOWN_DUE_TO_SPACE_BOUNDARY
- ▶ MoveForward → SUCCESSFULLY_MOVED_FORWARD
- ▶ MoveBackward → SUCCESSFULLY_MOVED_BACKWARD
- ▶ EngageWarpDrive(newXPosition=1, newYPosition=1) → SUCCESSFULLY_WARPED
- ▶ EngageWarpDrive(newXPosition=2, newYPosition=1) → SUCCESSFULLY_WARPED
- ◀ EngageWarpDrive(newXPosition=3, newYPosition=1) → CANNOT_WARP_TO_THE_SAME_POSITION
- ▶ EngageWarpDrive(newXPosition=4, newYPosition=1) → SUCCESSFULLY_WARPED
- ▶ EngageWarpDrive(newXPosition=5, newYPosition=1) → SUCCESSFULLY_WARPED
- ▶ EngageWarpDrive(newXPosition=6, newYPosition=1) → SUCCESSFULLY_WARPED
- ▶ EngageWarpDrive(newXPosition=7, newYPosition=1) → SUCCESSFULLY_WARPED
- ▶ EngageWarpDrive(newXPosition=8, newYPosition=1) → SUCCESSFULLY_WARPED
- ▶ EngageWarpDrive(newXPosition=9, newYPosition=1) → SUCCESSFULLY_WARPED
- ▶ EngageWarpDrive(newXPosition=10, newYPosition=1) → SUCCESSFULLY_WARPED
- ◀ MissionStatus → (3|->1), 55, 1
- ◀ RegionsVisited → ((1|->(1|->1)),(2|->(1|->2)),(3|->(2|->2)),(4|->(3|->1)))
- ◀ AllMissionMovementsConsumedPower → ((1|->MOVE_UP),(2|->MOVE_FORWARD),(3|->MOVE_FORWARD),(4|->MOVE_UP))
- ◀ DockedAtStarbase → NOT_DOCKED_AT_STARBASE
- ◀ GameStatus → GAME_NOT_OVER

Possibly more - MAX_OPERATIONS reached

Animation

Replay Symbolic Test Case Generation

Status Name

No Traces

State View Edit

Name	Value	Prev
VARIABLES		
CONSTANTS		
SETS		
INVARIANT	true	true
PROPERTIES	true	true
OPERATIONS (guard...)		
DEFINITIONS		

Statistics (states 7 of 62)

Verifications

Project

Machines Status Preferences Project

Spaceship Spaceship.mch

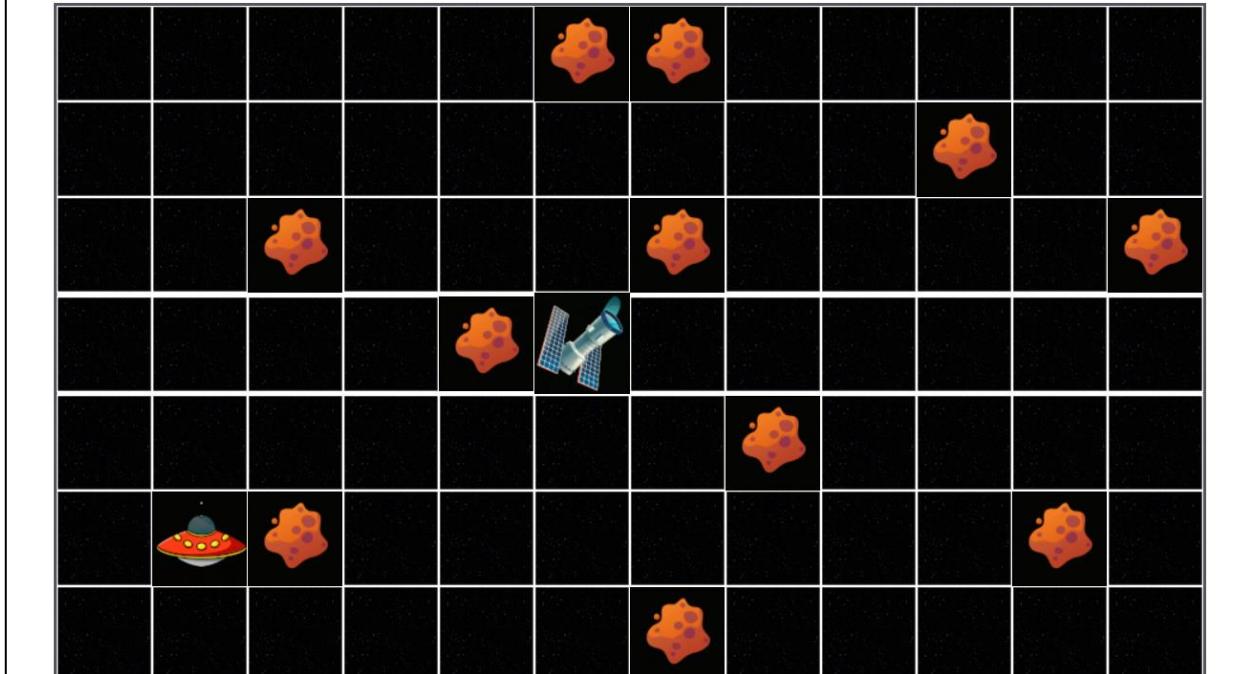
SpaceRegion SpaceRegion.mch

History (state 6 of 6)

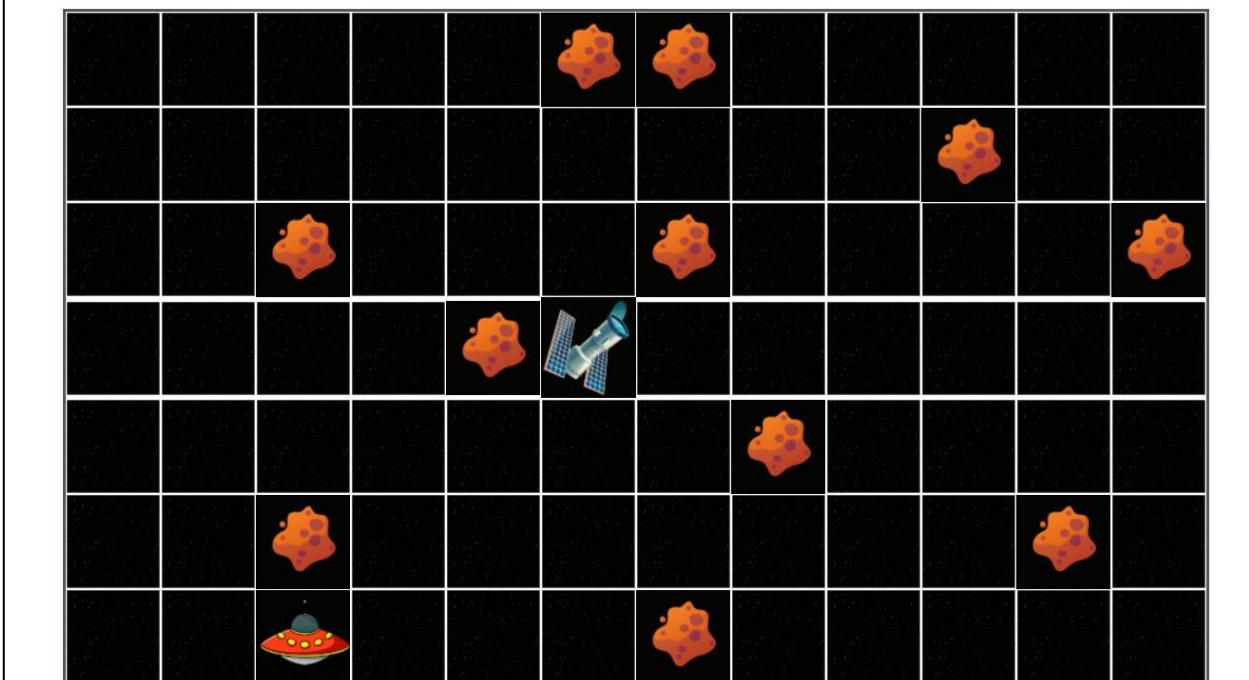
Position A	Transition
0	--root--
1	SETUP_CONSTANTS
2	INITIALISATION
3	MoveUp → SUCCESSFULLY_MOVED_UP
4	MoveForward → SUCCESSFULLY_MOVED_FORWARD
5	MoveForward → ASTEROID_COLLISION
6	EngageWarpDrive(newXPosition=3, newYPosition=1) → S...

Type here to search 78°F 5:50 AM 1/7/2024

Previous State



Current State



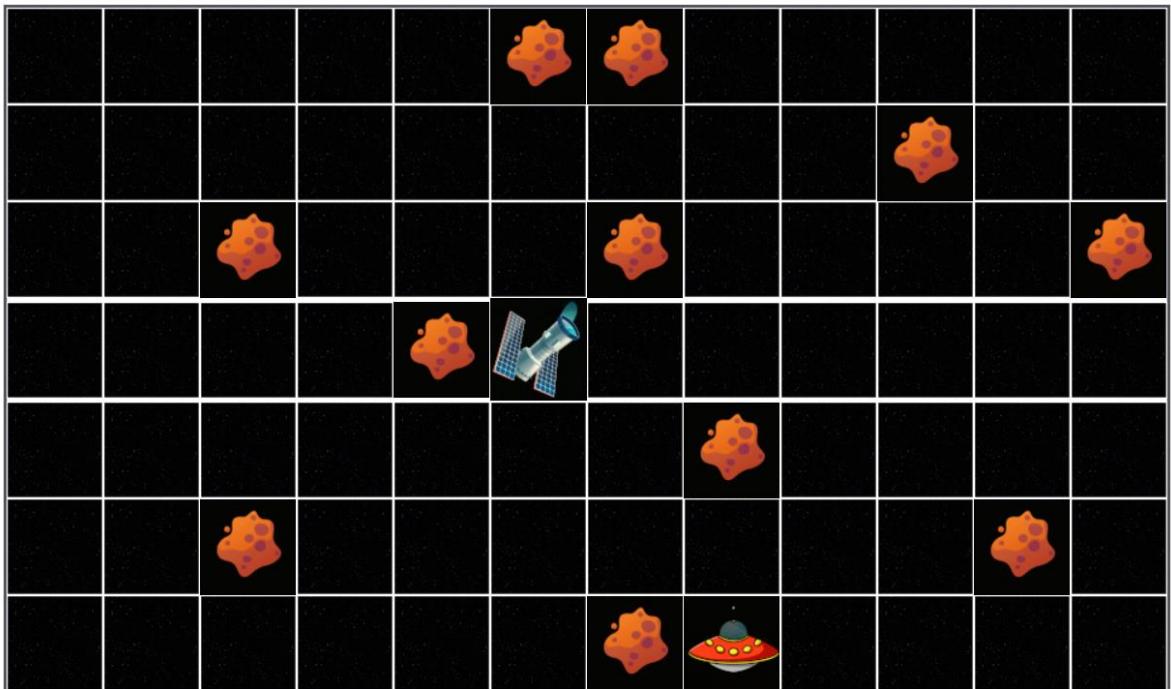
6. Failed warp jump due to same position, asteroid collision and unknown space errors

History (state 7 of 11)	
	Position ▲
0	--root--
1	SETUP_CONSTANTS
2	INITIALISATION
3	MoveUp → SUCCESSFULLY_MOVED_UP
4	MoveForward → SUCCESSFULLY_MOVED_FORWARD
5	MoveForward → ASTEROID_COLLISION
6	EngageWarpDrive(newXPosition=3, newYPosition=1) → SUCCESSFULLY_WARPED
7	EngageWarpDrive(newXPosition=7, newYPosition=1) → CANNOT_WARP_INTO_ASTEROID

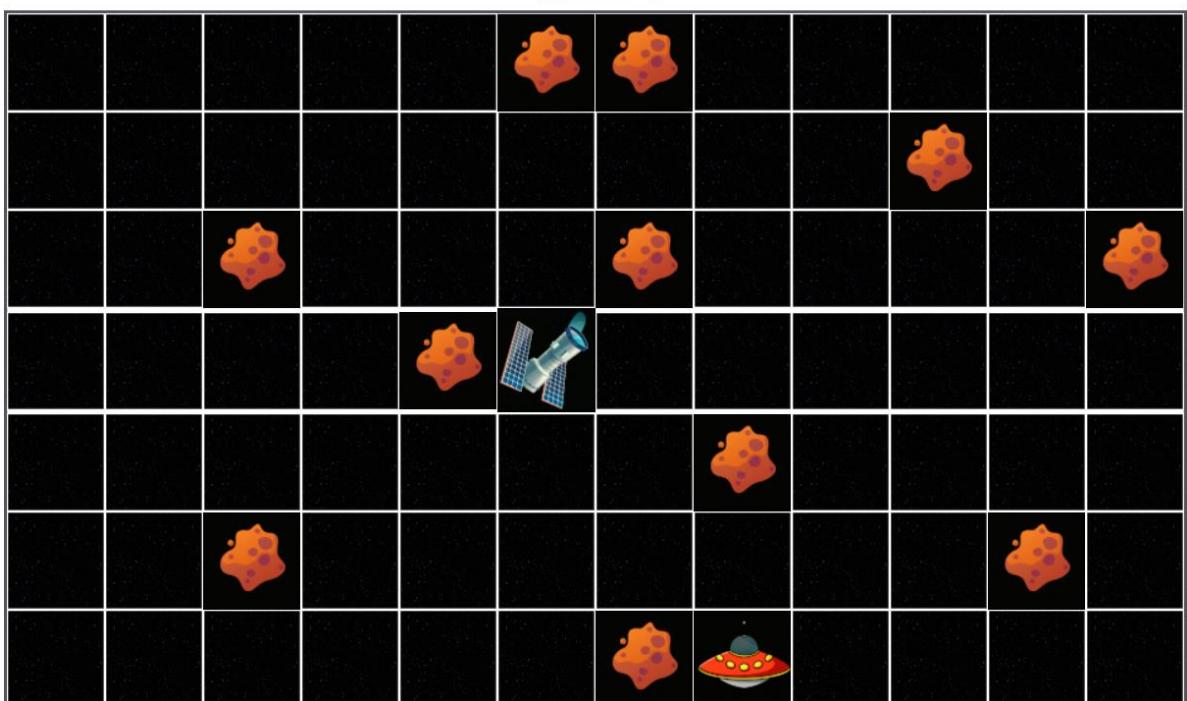
7. Failed warp jump due to insufficient power

History (state 21 of 21)	
	Position ▲
0	--root--
1	SETUP_CONSTANTS
2	INITIALISATION
3	MoveUp → SUCCESSFULLY_MOVED_UP
4	MoveForward → SUCCESSFULLY_MOVED_FORWARD
5	MoveForward → ASTEROID_COLLISION
6	EngageWarpDrive(newXPosition=3, newYPosition=1) → SUCCESSFULLY_WARPED
7	EngageWarpDrive(newXPosition=7, newYPosition=1) → CANNOT_WARP_INTO_ASTEROID
8	EngageWarpDrive(newXPosition=9, newYPosition=1) → SUCCESSFULLY_WARPED
9	EngageWarpDrive(newXPosition=9, newYPosition=1) → CANNOT_WARP_TO_THE_SAME_POSITION
10	EngageWarpDrive(newXPosition=8, newYPosition=1) → SUCCESSFULLY_WARPED
11	EngageWarpDrive(newXPosition=7, newYPosition=1) → INSUFFICIENT_POWER
12	EngageWarpDrive(newXPosition=5, newYPosition=1) → INSUFFICIENT_POWER
13	EngageWarpDrive(newXPosition=2, newYPosition=1) → INSUFFICIENT_POWER
14	EngageWarpDrive(newXPosition=3, newYPosition=1) → INSUFFICIENT_POWER
15	EngageWarpDrive(newXPosition=5, newYPosition=1) → INSUFFICIENT_POWER
16	EngageWarpDrive(newXPosition=6, newYPosition=1) → INSUFFICIENT_POWER
17	EngageWarpDrive(newXPosition=5, newYPosition=1) → INSUFFICIENT_POWER
18	EngageWarpDrive(newXPosition=7, newYPosition=1) → INSUFFICIENT_POWER
19	EngageWarpDrive(newXPosition=8, newYPosition=1) → INSUFFICIENT_POWER
20	EngageWarpDrive(newXPosition=6, newYPosition=1) → INSUFFICIENT_POWER
21	EngageWarpDrive(newXPosition=7, newYPosition=1) → INSUFFICIENT_POWER

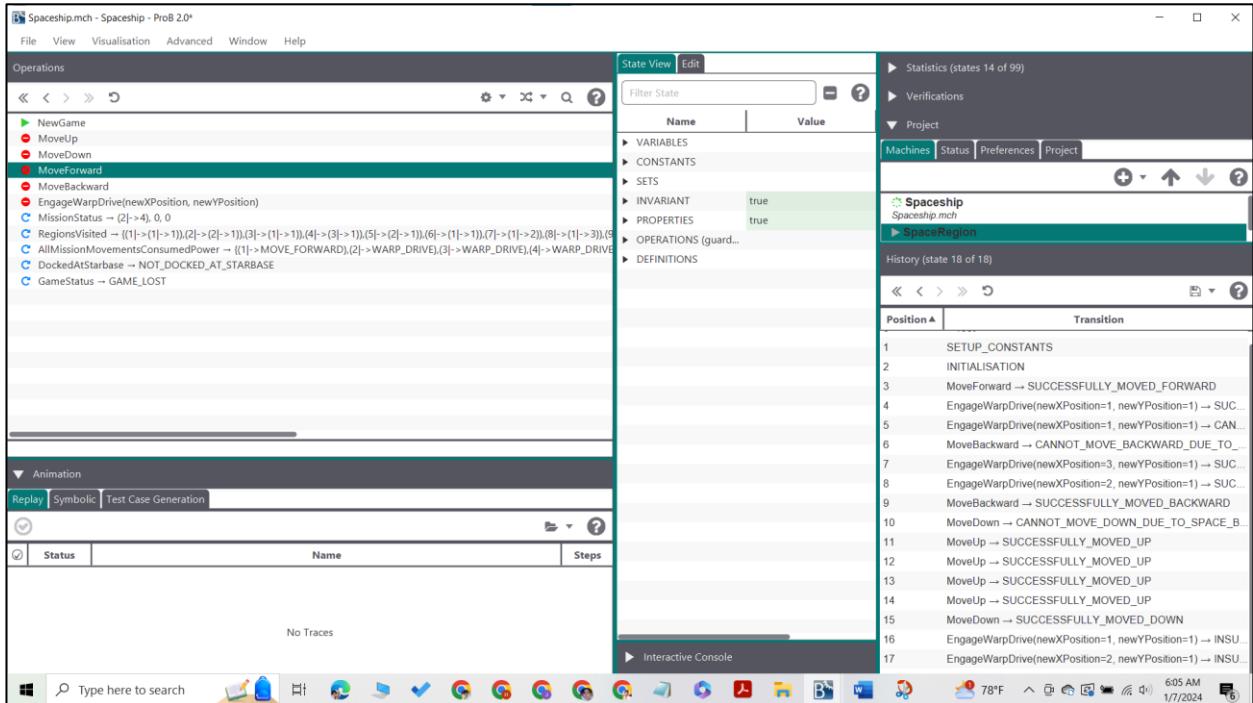
Previous State



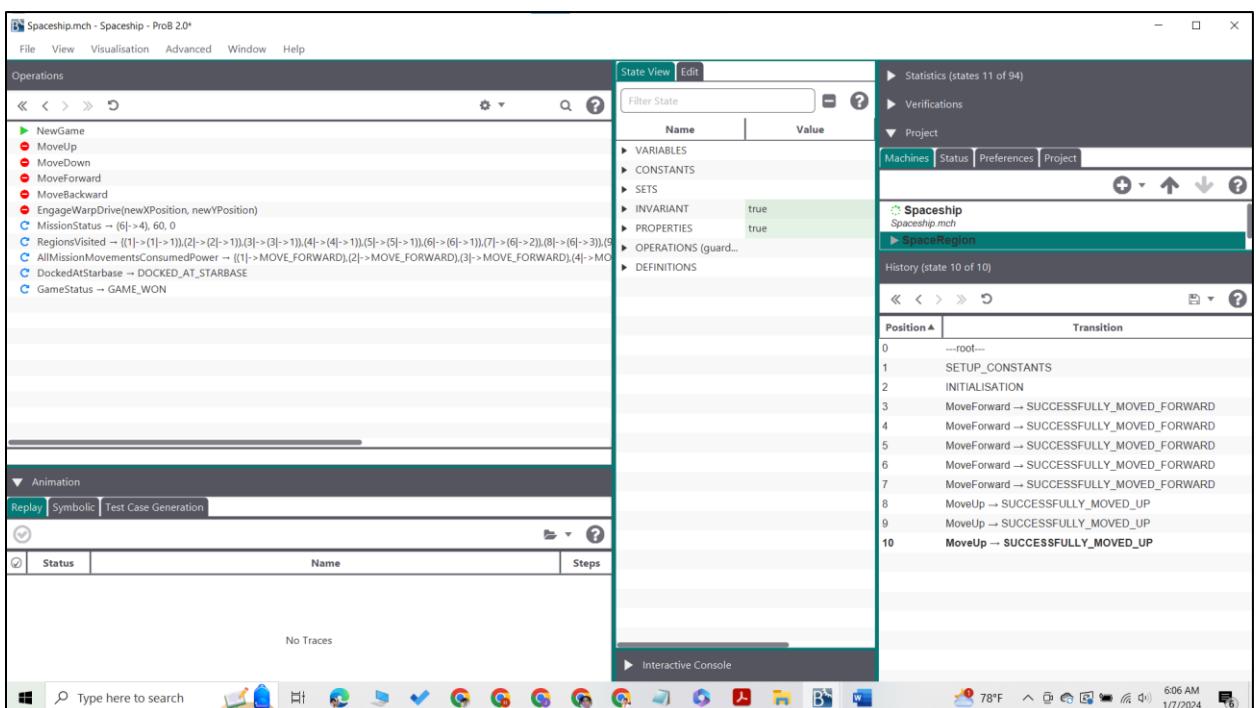
Current State

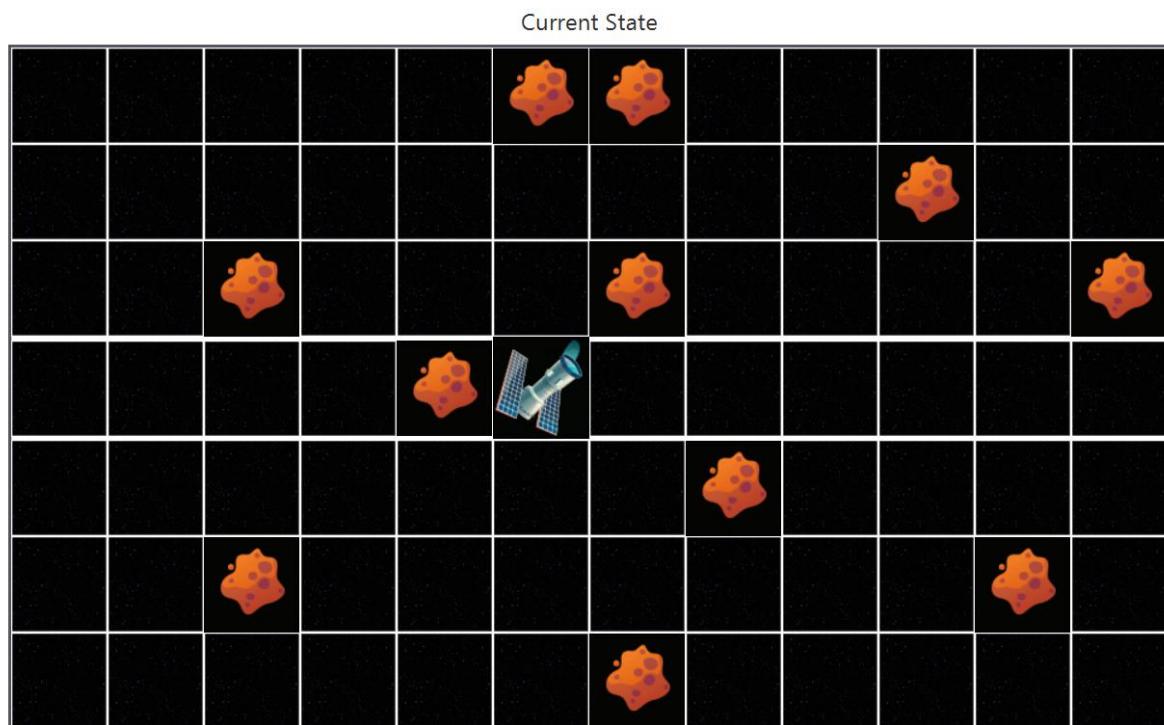
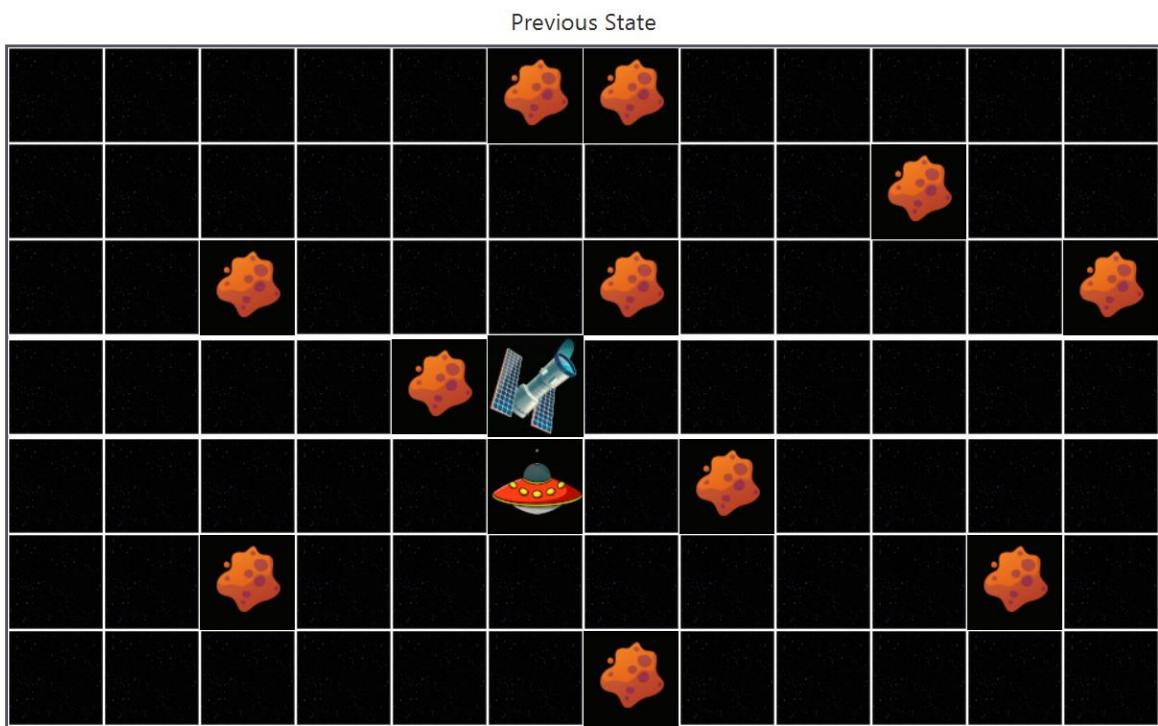


8. Game Lost

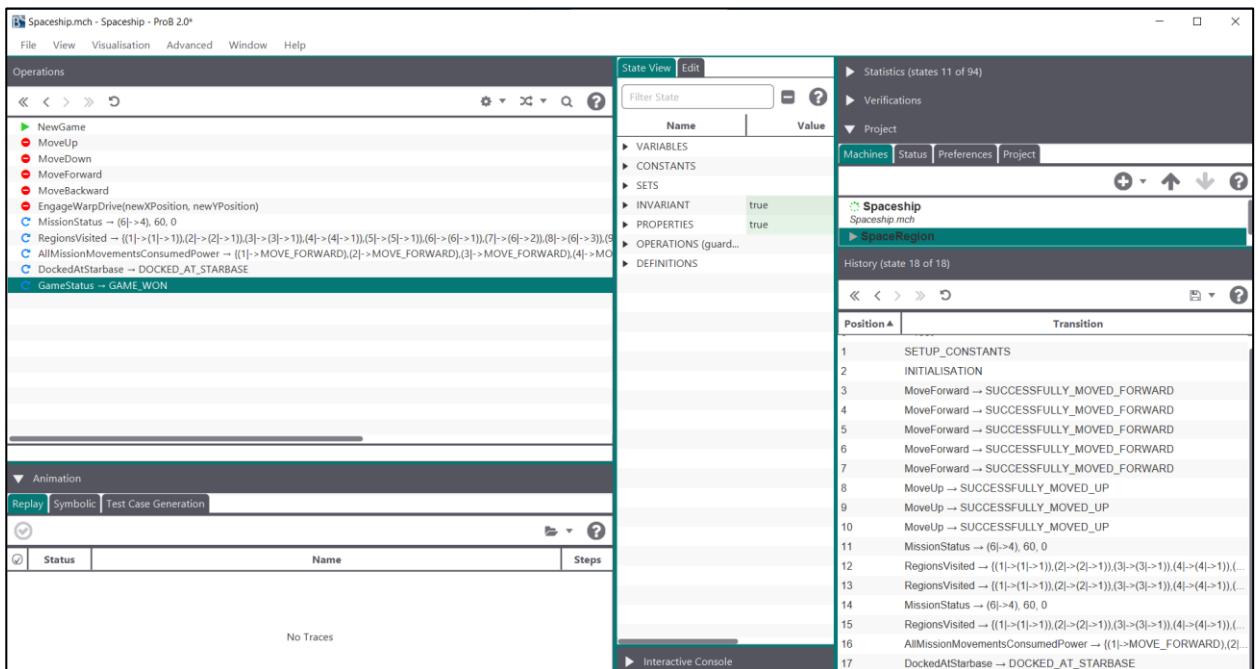


9. Game Won

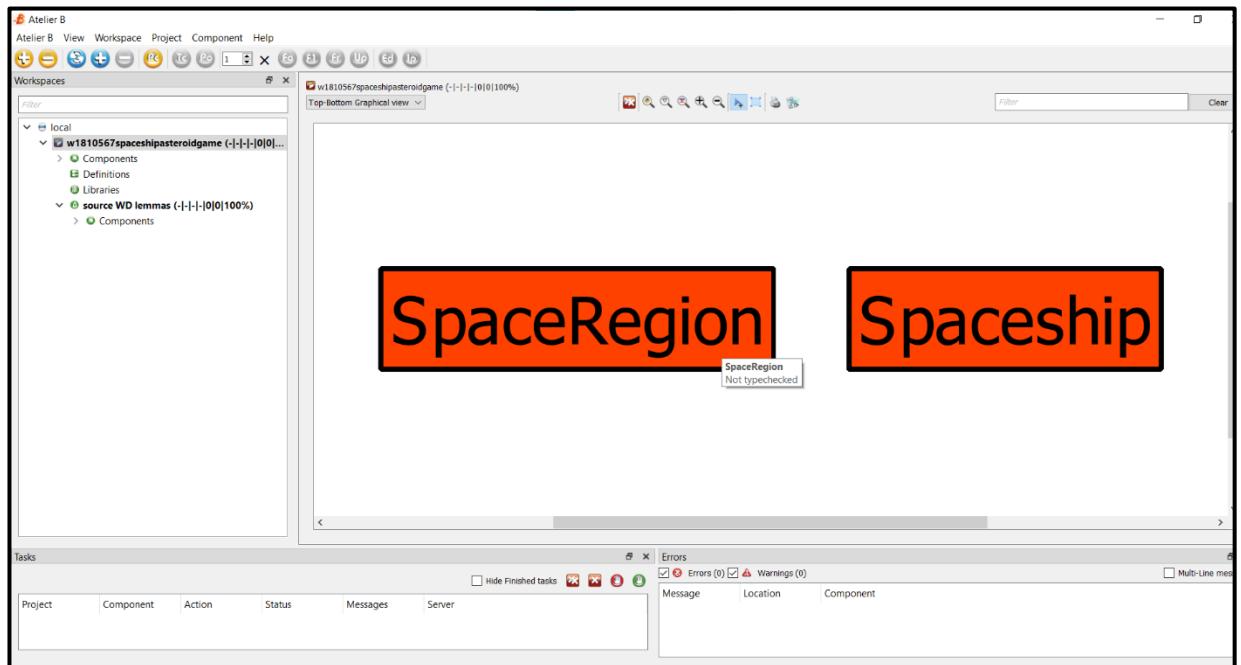




10. Status of the mission, Spaceship visited regions, Spaceship docked at starbase or not



11. Screenshot of the Atelier B before Type Check



12.Screenshot of the Atelier B after Type Check

