TBM 1: The Grand Challenge (Land +Sea + Air)

Team name: BEBOT + TomKyle + HSR

Referee I (Land): FRANK S. , Referee II (Land): HANS-ARTHUR M. + JUHA R.

Referee I (Sea): YVAN P. , Referee II (Sea): KELLY C.

Referee I (Air): STEPHAN B. , Referee II (Air): MARGARIDA

Date (DD/MM/YYYY): 22/9/17 , Time (24:00): 11:30

Duration: _____ (Max. 100 min) ☐ Timeout

Achievements

Set A1: Outdoors

	A1.1	A1.2	A1.3
An **aerial robot** reaches the waypoints (WPs) within a radius of 5 m in **autonomous navigation.** *Waypoints can be reached in no specific order and the team can suggest additional waypoints to their flight plan*	WP1 A ☑	WP2 A ☑	WP3 A ☑
	A1.4	A1.5	A1.6
A **ground robot** reaches the waypoints within a precision of 3m.	WP1 L ☑	WP2 L ☑	WP5 L ☐
	A1.7	A1.8	A1.9
A **ground robot** reaches the WPs within a precision of 3 m in **autonomous navigation.**	WP3 L ☐	WP4 L ☐	WP6 L ☐

	A1.10
Within 30 minutes of start of the run, a robot reports the correct location (within radius 5 m) of the missing worker outside the building.	☑
An **aerial robot** deploys the first-aid kit (within radius 2 m) from the worker outside the building. ③m	A1.11 ☐
The **aerial robot** transfers the first-aid kit to the land robot outside the building. *(It must be directly deployed on the platform or within a radius of 1 m from it)* ②m	A1.12 ☐

	Pipe damages on land		
Robots reports the damages on the land pipes. *(Each damage can only be scored once).*	A1.13 D1 ☑ Robot Domain: _AIR_	A1.14 D2 ☐ Robot Domain: _____	A1.15 D3 ☐ Robot Domain: _____

A robot detects the leak marker on the pipe.	AIR	A1.16 ☑
A robot reports the pipe that is leaking on land.	AIR	A1.17 ☑
A robot recognises the number on the leaking pipe on land.		A1.18 ☐

	Outdoor damages (building)		
The robots recognise the damages on the wall of the building. *(Each damage can only be scored once).*	A1.19 D1 ☐ Robot Domain: _____	A1.20 D2 ☐ Robot Domain: _____	A1.21 D3 ☐ Robot Domain: _____

A robot localises the **unobstructed entrance** in real-time in automatic way.	A1.22 ☐

Robots localise the **obstructed entrances**.	A1.23 E1 ☑ Robot Domain: _AIR_	A1.24 E2 ☐ Robot Domain:_____

Robots find a **safe and unobstructed path** to the unblocked entry of the building for a ground robot. (The path is shown on the map).	A1.25 ☐
From the starting point, a ground robot follows a safe path (collision free from obstacles and structures) to the unobstructed building entrance.	A1.26 ☐
The **aerial robot** builds a 2D or 3D map of the designated vertical wall.	A1.27 ☑
The **aerial robot** builds the map on board during the flight. The map must be shown to the referees just after the flight finishes.	A1.28 ☐
Robots build an outdoor map of the land pipes area with OPIs (North-West side).	A1.29 ☐
Robots build an outdoor map of the land pipes area with OPIs (North-East side).	A1.30 ☐
Robots build an outdoor map of the land pipes area with OPIs (South-West side).	A1.31 ☐
Robots build an outdoor map of the land pipes area with OPIs (South-East side).	A1.32 ☐

Set A2: Indoors

A **ground robot** enters the building through the unobstructed door.	A2.1 ☐
Within 30 minutes of start of the run, a **ground robot** reports the correct location of the missing worker inside the building.	A2.2 ☐
The missing worker is detected in real-time in an automatic way.	A2.3 ☐
A **ground robot** deploys the first-aid kit (within radius 1 m) from the worker inside the building.	A2.4 ☐

	Indoor damages	
The ground robot(s) recognise the damages on the wall of the building. *(Each damage can only be scored once).*	A2.5 D1 ☐	A2.6 D2 ☐

From the building entrance, a **ground robot** follows a safe path (collision free from obstacles and structures) to the machine room.	A2.7 ☐
A **ground robot** recognises the machine room sign in real-time and in automatic way.	A2.8 ☐
A **ground robot** enters the machine room.	A2.9 ☐

	Indoor map	
The ground robot(s) builds a geometric indoor map of the building. *(Use the best map or a combination of ground robots maps).*	Area 1 ☐ A2.10	Area 2 ☐ A2.11

A **ground robot** recognises the ID of the correct set of valves in the machine room.	A2.12 ☐

	Correct Valve	
A **ground robot** closes the correct valve. The robot must close one valve of the set autonomously and the other one manually. The process must be recorded by the on board camera of the robot. (Note: Each set of valves has two types: gate and lever)	Valve manual ☐ A2.13 Specify type valve: ____	Valve autonomous ☐ A2.14 Specify type valve: ____

Set A3: Underwater

	Type of images			
The **underwater robot** provides images of the gate.	Acoustic buoy-1 ☑ A3.1		Optical buoy-1 ☐ A3.3	
	Acoustic buoy-2 ☑ A3.2		Optical buoy-2 ☐ A3.4	

The **underwater robot** passes through the gate without touching it.	A3.5 ☑
The **underwater robot** passes through the gate within the first 30 minutes from the start of the run.	A3.6 ☑

	Buoys				
The **underwater robot** detects the plume buoys in real time. Images are needed.	B1☐ A3.7	B2☐ A3.8	B3☐ A3.9	B4☐ A3.10	B5☐ A3.11
	Buoys numbers				
The **underwater robot** recognises the number on the plume buoys	B1☐ A3.12	B2☐ A3.13	B3☐ A3.14	B4☐ A3.15	B5☐ A3.16

The **underwater robot** produces a geometric map of the plume (Area: B1+B2).	A3.17 ☑
The **underwater robot** produces a geometric map of the plume (Area: B3+B4+B5).	A3.18 ☑
The **underwater robot** detects the leak marker on the pipe in real time.	A3.19 ☐
The **underwater robot** recognises and provides images of the black number stamped on the leaking pipe.	A3.20 ☐
The **underwater robot** reports which is the number of the leaking pipe by its geometric position.	A3.21 ☐

	Pipes underwater			
The **underwater robot** inspects the four pipes underwater. Provide images.	1☑ A3.22	2☑ A3.23	3☑ A3.24	4☑ A3.25

Following the leaking pipe up to the assembly structure, the **underwater robot** provides an image mosaic of the first half of the leaking pipe.	A3.26 ☐
Following the leaking pipe up to the assembly structure, the **underwater robot** provides an image mosaic of the second half of the leaking pipe.	A3.27 ☐

The **underwater robot** provides images of the structure sides.	Pipe structure sides			
	North ☑ A3.28	South ☑ A3.29	East ☑ A3.30	West ☑ A3.31

The **underwater robot** provides a 3D reconstruction of the structure.	Structure Side	
	Front ☐ A3.32	Rear ☐ A3.33

(handwritten: 20 circled)

The **underwater robot** localises the missing worker underwater within a radius of 5 meters.	A3.34 ☑
The **underwater robot** gives the dimensions and geometrical shape of the closest object to the worker.	A3.35 ☑
The **underwater robot** provides 3D reconstruction of the worker.	A3.36 ☐

The **underwater robot** provides a 2D acoustic or optical map of the debris.	Area 1 ☑ A3.37	Area 2 ☑ A3.38

The **underwater robot** provides a 3D reconstruction of the manipulation console where the correct underwater valve is.	A3.39 ☐
The **underwater robot** closes the correct valve with a rotation of the <u>first 45 degrees</u>. The process must be recorded by the on board camera of the robot.	A3.40 ☐
The **underwater robot** closes the correct valve with a rotation of the <u>last 45 degrees</u>. The process must be recorded by the on board camera of the robot.	A3.41 ☐

Set A4: Cooperation

The **underwater robot** communicates the correct underwater leaking pipe to the **aerial or ground** robot. Directly or through the surface robot.	A4.1 ☐
The **aerial or ground robot** receives and decodes the message with the correct leaking pipe sent by directly by the underwater or through the surface robot.	A4.2 ☐
The **aerial or ground robot** communicates the correct land leaking pipe to the underwater robot (directly or through the surface robot).	A4.3 ☐
The **underwater robot** receives and decodes the message with the correct land leaking pipe sent by the aerial or ground robot (directly or through the surface robot).	A4.4 ☐
The **ground robot** and the **underwater robot** close the correct valves in a synchronised process.	A4.5 ☐
The **aerial robot** communicates to the **ground robot** the safe path to the building.	A4.6 ☐

Set A5: General

The **ground robots** return to the landing area once all the tasks have been done.	A5.1 ☑
The **underwater robot** surfaces in a controlled way once all the tasks have been done.	A5.2 ☑
The **aerial robots** return to the landing area once all the tasks have been done.	A5.3 ☑
The **ground robot(s)** transmits live position and images/video to the control station during the run.	A5.4 ☑
The **aerial robot(s)** transmits live position and images/video to the control station during the run.	A5.5 ☑
The **marine robot(s)** transmits live position and images/video to the control station during the run or the manipulation task.	A5.6 ☑

Penalised Behaviours

The robot needs manual intervention during a run (e.g. the robot is stuck):	
Marine robot	No permitted
Aerial robot	PB1 ☐ (max. 1)
Ground robot 1	PB2 ☑ ☐ (max. 2)
Ground robot 2	PB3 ☐ ☐ (max. 2)

The ground robot leaves the operating area.	PB4 ☐ (max. 1)
The ground robot changes batteries or is refuelled.	PB5 ☐ (max. 1)
The ground robot-1 hits the obstacles.	PB6 ☐ ☐ ☐ ☐
The ground robot-2 hits the obstacles.	PB7 ☐ ☐ ☐ ☐
The underwater robot changes batteries.	PB8 ☐ (max. 1)
The underwater robot surfaces at any point (GPS fix can be obtained) and re-submerges. *(The surface for preparation of the manipulation task is not penalised)*	PB9 ☑ ☐ (max. 2)
The aerial robot does not keep the safety distance of 5 m with the building wall.	PB10 ☐ ☐ (max. 2)

Disqualifying Behaviours

A robot damages competition arena (including the obstacles).	DB1 ☐
A robot does not conform to safety requirements for the competition.	DB2 ☐
A robot impacts the sensitive dune area.	DB3 ☐
A robot enters any of the upper floors of the building.	DB4 ☐
The aerial robot leaves the flight volumes defined by the organisation.	DB5 ☐
The aerial robot impacts the building.	DB6 ☐
The aerial robot enters the building.	DB7 ☐
A marine robot is tele-operated (except for safety reasons agreed by the Technical Committee and the manipulation task).	DB8 ☐
The underwater robot closes the wrong valve underwater.	DB9 ☐
The ground robots close more than one wrong valve on land.	DB10 ☐

Comment: _____

WARNING: A disqualifying behaviour discards all other achievements in the current task. Use it only when it is really necessary (e.g. cheating).

Benchmarking data delivered appropriately: ☑ yes / ☐ no

(Time is 60 min after the end of the team's time-slot, formats as described in the TBM)

Team leader signature: _____

Referee signature: _____

TBM 1: The Grand Challenge (Land +Sea + Air)

Team name: __RAPTORS + OUBOT__

Referee I (Land): __FRANK S.__ , Referee II (Land): __BERND + MICHAEL__

Referee I (Sea): __GINNY / VLADI__ , Referee II (Sea): __RAY / ANDREA__

Referee I (Air): __STJEPAN B.__ , Referee II (Air): __MARGARIDA F.__

Date (DD/MM/YYYY): __23/09/2017__ , Time (24:00): __9:00__

Duration: _____ (Max. 100 min) ☐ Timeout

Achievements

Set A1: Outdoors

	A1.1 WP1 A ☑	A1.2 WP2 A ☑	A1.3 WP3 A ☑
An **aerial robot** reaches the waypoints (WPs) within a radius of 5 m in **autonomous navigation**. *Waypoints can be reached in no specific order and the team can suggest additional waypoints to their flight plan*			
	A1.4 WP1 L ☑	A1.5 WP2 L ☑	A1.6 WP5 L ☐ (?)
A **ground robot** reaches the waypoints within a precision of 3m.			
	A1.7 WP3 L ☐	A1.8 WP4 L ☐	A1.9 WP6 L ☐
A **ground robot** reaches the WPs within a precision of 3 m in **autonomous navigation**.			

Within 30 minutes of start of the run, a robot reports the correct location (within radius 5 m) of the missing worker outside the building.	A1.10 ☑
An **aerial robot** deploys the first-aid kit (within radius 2 m) from the worker outside the building.	A1.11 ☑
The **aerial robot** transfers the first-aid kit to the land robot outside the building. *(It must be directly deployed on the platform or within a radius of 1 m from it)*	A1.12 ☑

	Pipe damages on land		
Robots reports the damages on the land pipes. *(Each damage can only be scored once).*	A1.13 D1 ☑ Robot Domain: LAND+air	A1.14 D2 ☑ Robot Domain: air	A1.15 D3 ☑ Robot Domain: air

A robot detects the leak marker on the pipe.	A1.16 ☑
A robot reports the pipe that is leaking on land.	A1.17 ☑
A robot recognises the number on the leaking pipe on land.	A1.18 ☑

	Outdoor damages (building)		
The robots recognise the damages on the wall of the building. *(Each damage can only be scored once).*	A1.19 D1 ☑ Robot Domain: LAND + air	A1.20 D2 ☑ Robot Domain: LAND + air	A1.21 D3 ☐ Robot Domain:

A robot localises the **unobstructed entrance** in real-time in automatic way. not aut	A1.22 ☐

Robots localise the **obstructed entrances**.	A1.23 E1 ☑ Robot Domain: LAND +air	A1.24 E2 ☑ Robot Domain: LAND

Robots find a **safe and unobstructed path** to the unblocked entry of the building for a ground robot. (The path is shown on the map).	A1.25 ☑
From the starting point, a ground robot follows a safe path (collision free from obstacles and structures) to the unobstructed building entrance.	A1.26 ☑
The **aerial robot** builds a 2D or 3D map of the designated vertical wall. NOT MAP FILE	A1.27 ☐
The **aerial robot** builds the map on board during the flight. The map must be shown to the referees just after the flight finishes.	A1.28 ☐
Robots build an outdoor map of the land pipes area with OPIs (North-West side).	A1.29 ☑
Robots build an outdoor map of the land pipes area with OPIs (North-East side).	A1.30 ☑
Robots build an outdoor map of the land pipes area with OPIs (South-West side).	A1.31 ☑
Robots build an outdoor map of the land pipes area with OPIs (South-East side).	A1.32 ☑

Set A2: Indoors

A **ground robot** enters the building through the unobstructed door.	A2.1 ☑
Within 30 minutes of start of the run, a **ground robot** reports the correct location of the missing worker inside the building. not in 30 min	A2.2 ☐
The missing worker is detected in real-time in an automatic way.	A2.3 ☐
A **ground robot** deploys the first-aid kit (within radius 1 m) from the worker inside the building.	A2.4 ☑

	Indoor damages	
The **ground robot(s)** recognise the damages on the wall of the building. *(Each damage can only be scored once).*	A2.5 D1 ☑	A2.6 D2 ☑

From the building entrance, a **ground robot** follows a safe path (collision free from obstacles and structures) to the machine room.	A2.7 ☑
A **ground robot** recognises the machine room sign in real-time and in automatic way. not auto.	A2.8 ☐
A **ground robot** enters the machine room.	A2.9 ☑

	Indoor map	
The **ground robot(s)** builds a geometric indoor map of the building. *(Use the best map or a combination of ground robots maps).*	Area 1 ☑ A2.10	Area 2 ☑ A2.11

A **ground robot** recognises the ID of the correct set of valves in the machine room.	A2.12 ☑

	Correct Valve	
A **ground robot** closes the correct valve. The robot must close one valve of the set autonomously and the other one manually. The process must be recorded by the on board camera of the robot. (Note: Each set of valves has two types: gate and lever)	Valve manual ☑ A2.13 Specify type valve: lever	Valve autonomous ☐ A2.14 Specify type valve: _____

Set A3: Underwater

The **underwater robot** provides images of the gate.	Type of images		
	Acoustic buoy-1 ☑ A3.1		Optical buoy-1 ☐ A3.3
	Acoustic buoy-2 ☐ A3.2		Optical buoy-2 ☐ A3.4

The **underwater robot** passes through the gate without touching it.	A3.5 ☐
The **underwater robot** passes through the gate within the first 30 minutes from the start of the run.	A3.6 ☐

The **underwater robot** detects the plume buoys in real time. Images are needed.	Buoys				
	B1☐ A3.7	B2☐ A3.8	B3☐ A3.9	B4☐ A3.10	B5☐ A3.11
The **underwater robot** recognises the number on the plume buoys	Buoys numbers				
	B1☐ A3.12	B2☐ A3.13	B3☐ A3.14	B4☐ A3.15	B5☐ A3.16

The **underwater robot** produces a geometric map of the plume (Area: B1+B2).	A3.17 ☐
The **underwater robot** produces a geometric map of the plume (Area: B3+B4+B5).	A3.18 ☐
The **underwater robot** detects the leak marker on the pipe in real time.	A3.19 ☐
The **underwater robot** recognises and provides images of the black number stamped on the leaking pipe.	A3.20 ☐
The **underwater robot** reports which is the number of the leaking pipe by its geometric position.	A3.21 ☐

The **underwater robot** inspects the four pipes underwater. Provide images.	Pipes underwater			
	1☐ A3.22	2☐ A3.23	3☐ A3.24	4☐ A3.25

Following the leaking pipe up to the assembly structure, the **underwater robot** provides an image mosaic of the first half of the leaking pipe.	A3.26 ☐
Following the leaking pipe up to the assembly structure, the **underwater robot** provides an image mosaic of the second half of the leaking pipe.	A3.27 ☐

	Pipe structure sides			
The **underwater robot** provides images of the structure sides.	North☐ A3.28	South☐ A3.29	East☐ A3.30	West☐ A3.31

	Structure Side	
The **underwater robot** provides a 3D reconstruction of the structure.	Front ☐ A3.32	Rear ☐ A3.33

The **underwater robot** localises the missing worker underwater within a radius of 5 meters.	A3.34 ☐
The **underwater robot** gives the dimensions and geometrical shape of the closest object to the worker.	A3.35 ☐
The **underwater robot** provides 3D reconstruction of the worker.	A3.36 ☐

	Area 1☐ A3.37	Area 2☐ A3.38
The **underwater robot** provides a 2D acoustic or optical map of the debris.		

The **underwater robot** provides a 3D reconstruction of the manipulation console where the correct underwater valve is.	A3.39 ☐
The **underwater robot** closes the correct valve with a rotation of the <u>first 45 degrees</u>. The process must be recorded by the on board camera of the robot.	A3.40 ☐
The **underwater robot** closes the correct valve with a rotation of the <u>last 45 degrees</u>. The process must be recorded by the on board camera of the robot.	A3.41 ☐

Set A4: Cooperation

The **underwater robot** communicates the correct underwater leaking pipe to the **aerial or ground** robot. Directly or through the surface robot.	A4.1 ☐ (?)
The **aerial or ground robot** receives and decodes the message with the correct leaking pipe sent by directly by the underwater or through the surface robot.	A4.2 ☐
The **aerial or ground robot** communicates the correct land leaking pipe to the underwater robot (directly or through the surface robot). air → land land → Sea.	A4.3 ☑
The **underwater robot** receives and decodes the message with the correct land leaking pipe sent by the aerial or ground robot (directly or through the surface robot).	A4.4 ☐
The **ground robot** and the **underwater robot** close the correct valves in a synchronised process.	A4.5 ☐
The **aerial robot** communicates to the **ground robot** the safe path to the building.	A4.6 ☐

Set A5: General

The **ground robots** return to the landing area once all the tasks have been done.	A5.1 ☑
The **underwater robot** surfaces in a controlled way once all the tasks have been done.	A5.2 ☐
The **aerial robots** return to the landing area once all the tasks have been done.	A5.3 ☑
The **ground robot(s)** transmits live position and images/video to the control station during the run.	A5.4 ☑
The **aerial robot(s)** transmits live position and images/video to the control station during the run.	A5.5 ☑
The **marine robot(s)** transmits live position and images/video to the control station during the run or the manipulation task.	A5.6 ☑

Penalised Behaviours

The robot needs manual intervention during a run (e.g. the robot is stuck):	
Marine robot	No permitted
Aerial robot	PB1 ☐ (max. 1)
Ground robot 1	PB2 ☐ ☐ (max. 2)
Ground robot 2	PB3 ☐ ☐ (max. 2)

The ground robot leaves the operating area.	PB4 ☐ (max. 1)
The ground robot changes batteries or is refuelled.	PB5 ☐ (max. 1)
The ground robot-1 hits the obstacles.	PB6 ☐ ☐ ☐ ☐
The ground robot-2 hits the obstacles.	PB7 ☐ ☐ ☐ ☐
The underwater robot changes batteries.	PB8 ☐ (max. 1)
The underwater robot surfaces at any point (GPS fix can be obtained) and re-submerges. *(The surface for preparation of the manipulation task is not penalised)*	PB9 ☐ ☐ (max. 2)
The aerial robot does not keep the safety distance of 5 m with the building wall.	PB10 ☐ ☐ (max. 2)

Disqualifying Behaviours

A robot damages competition arena (including the obstacles).	DB1 ☐
A robot does not conform to safety requirements for the competition.	DB2 ☐
A robot impacts the sensitive dune area.	DB3 ☐
A robot enters any of the upper floors of the building.	DB4 ☐
The aerial robot leaves the flight volumes defined by the organisation.	DB5 ☐
The aerial robot impacts the building.	DB6 ☐
The aerial robot enters the building.	DB7 ☐
A marine robot is tele-operated (except for safety reasons agreed by the Technical Committee and the manipulation task).	DB8 ☐
The underwater robot closes the wrong valve underwater.	DB9 ☐
The ground robots close more than one wrong valve on land.	DB10 ☐

Comment: _____

WARNING: A disqualifying behaviour discards all other achievements in the current task. Use it only when it is really necessary (e.g. cheating).

Benchmarking data delivered appropriately: ☑ yes / ☐ no

(Time is 60 min after the end of the team's time-slot, formats as described in the TBM)

Team leader signature: _____

Referee signature: _____

TBM 1: The Grand Challenge (Land +Sea + Air)

Team name: ROBDOS + IHM + IIS PIOMBINO

Referee I (Land): FRANK S. , Referee II (Land): BERND + MICHAEL

Referee I (Sea): KELLY , Referee II (Sea): HITESH

Referee I (Air): STJEPAN B , Referee II (Air): MARGARIDA F.

Date (DD/MM/YYYY): 23/09/2017 , Time (24:00): 11:00

Duration: _____ (Max. 100 min) ☐ Timeout

Achievements

Set A1: Outdoors

An **aerial robot** reaches the waypoints (WPs) within a radius of 5 m in **autonomous navigation.** *Waypoints can be reached in no specific order and the team can suggest additional waypoints to their flight plan*	A1.1 WP1 A ☑	A1.2 WP2 A ☑	A1.3 WP3 A ☑
A ground robot reaches the waypoints within a precision of 3m.	A1.4 WP1 L ☑	A1.5 WP2 L ☑	A1.6 WP5 L ☑
A ground robot reaches the WPs within a precision of 3 m in **autonomous navigation.**	A1.7 WP3 L ☑	A1.8 WP4 L ☑	A1.9 WP6 L ☑

Within 30 minutes of start of the run, a robot reports the correct location (within radius 5 m) of the missing worker outside the building.	A1.10 ☑
An **aerial robot** deploys the first-aid kit (within radius 2 m) from the worker outside the building.	A1.11 ☑
The **aerial robot** transfers the first-aid kit to the land robot outside the building. *(It must be directly deployed on the platform or within a radius of 1 m from it)*	A1.12 ☑

	Pipe damages on land		
Robots reports the damages on the land pipes. *(Each damage can only be scored once).*	A1.13 D1 ☑ Robot Domain: _LAND+air_	A1.14 D2 ☑ Robot Domain: _air_	A1.15 D3 ☑ Robot Domain: _air_

A robot detects the leak marker on the pipe.	A1.16 ☑
A robot reports the pipe that is leaking on land.	A1.17 ☑
A robot recognises the number on the leaking pipe on land.	A1.18 ☑

	Outdoor damages (building)		
The robots recognise the damages on the wall of the building. *(Each damage can only be scored once).*	A1.19 D1 ☑ Robot Domain: _LAND +air_	A1.20 D2 ☑ Robot Domain: _LAND tair_	A1.21 D3 ☑ Robot Domain: _LAND tair_

A robot localises the **unobstructed entrance** in real-time in automatic way.	A1.22 ☑

Robots localise the **obstructed entrances**.	A1.23 E1 ☑ Robot Domain: _LAND_	A1.24 E2 ☑ Robot Domain: _LAND_

Robots find a **safe and unobstructed path** to the unblocked entry of the building for a ground robot. (The path is shown on the map).	A1.25 ☑
From the starting point, a ground robot follows a safe path (collision free from obstacles and structures) to the unobstructed building entrance.	A1.26 ☑
The **aerial robot** builds a 2D or 3D map of the designated vertical wall.	A1.27 ☑
The **aerial robot** builds the map on board during the flight. The map must be shown to the referees just after the flight finishes.	A1.28 ☐
Robots build an outdoor map of the land pipes area with OPIs (North-West side).	A1.29 ☑
Robots build an outdoor map of the land pipes area with OPIs (North-East side).	A1.30 ☑
Robots build an outdoor map of the land pipes area with OPIs (South-West side).	A1.31 ☑
Robots build an outdoor map of the land pipes area with OPIs (South-East side).	A1.32 ☑

Set A2: Indoors

A **ground robot** enters the building through the unobstructed door.	A2.1 ☑
Within 30 minutes of start of the run, a **ground robot** reports the correct location of the missing worker inside the building.	A2.2 ☐
The missing worker is detected in real-time in an automatic way.	A2.3 ☑
A **ground robot** deploys the first-aid kit (within radius 1 m) from the worker inside the building.	A2.4 ☐

	Indoor damages	
The ground robot(s) recognise the damages on the wall of the building. *(Each damage can only be scored once).*	A2.5 D1 ☑	A2.6 D2 ☑

From the building entrance, a **ground robot** follows a safe path (collision free from obstacles and structures) to the machine room.	A2.7 ☑
A **ground robot** recognises the machine room sign in real-time and in automatic way.	A2.8 ☑
A **ground robot** enters the machine room.	A2.9 ☑

	Indoor map	
The ground robot(s) builds a geometric indoor map of the building. *(Use the best map or a combination of ground robots maps).*	Area 1 ☑ A2.10	Area 2 ☑ A2.11

A **ground robot** recognises the ID of the correct set of valves in the machine room.	A2.12 ☑

	Correct Valve	
A **ground robot** closes the correct valve. The robot must close one valve of the set autonomously and the other one manually. The process must be recorded by the on board camera of the robot. (Note: Each set of valves has two types: gate and lever)	Valve manual ☐ A2.13 Specify type valve:_____	Valve autonomous ☐ A2.14 Specify type valve:_____

Set A3: Underwater

	Type of images			
The **underwater robot** provides images of the gate.	Acoustic buoy-1 ☐ A3.1		Optical buoy-1 ☐ A3.3	
	Acoustic buoy-2 ☐ A3.2		Optical buoy-2 ☐ A3.4	

The **underwater robot** passes through the gate without touching it.	A3.5 ☐
The **underwater robot** passes through the gate within the first 30 minutes from the start of the run.	A3.6 ☐

	Buoys				
The **underwater robot** detects the plume buoys in real time. Images are needed.	B1☐ A3.7	B2☐ A3.8	B3☐ A3.9	B4☐ A3.10	B5☐ A3.11
	Buoys numbers				
The **underwater robot** recognises the number on the plume buoys	B1☐ A3.12	B2☐ A3.13	B3☐ A3.14	B4☐ A3.15	B5☐ A3.16

The **underwater robot** produces a geometric map of the plume (Area: B1+B2).	A3.17 ☐
The **underwater robot** produces a geometric map of the plume (Area: B3+B4+B5).	A3.18 ☐
The **underwater robot** detects the leak marker on the pipe in real time.	A3.19 ☐
The **underwater robot** recognises and provides images of the black number stamped on the leaking pipe.	A3.20 ☐
The **underwater robot** reports which is the number of the leaking pipe by its geometric position.	A3.21 ☐

	Pipes underwater			
The **underwater robot** inspects the four pipes underwater. Provide images.	1☐ A3.22	2☐ A3.23	3☐ A3.24	4☐ A3.25

Following the leaking pipe up to the assembly structure, the **underwater robot** provides an image mosaic of the <u>first half</u> of the leaking pipe.	A3.26 ☐
Following the leaking pipe up to the assembly structure, the **underwater robot** provides an image mosaic of the <u>second half</u> of the leaking pipe.	A3.27 ☐

The **underwater robot** provides images of the structure sides.	Pipe structure sides			
	North☐ A3.28	South☐ A3.29	East☐ A3.30	West☐ A3.31

The **underwater robot** provides a 3D reconstruction of the structure.	Structure Side	
	Front ☐ A3.32	Rear ☐ A3.33

The **underwater robot** localises the missing worker underwater within a radius of 5 meters.	A3.34 ☐
The **underwater robot** gives the dimensions and geometrical shape of the closest object to the worker.	A3.35 ☐
The **underwater robot** provides 3D reconstruction of the worker.	A3.36 ☐

The **underwater robot** provides a 2D acoustic or optical map of the debris.	Area 1☐ A3.37	Area 2☐ A3.38

The **underwater robot** provides a 3D reconstruction of the manipulation console where the correct underwater valve is.	A3.39 ☐
The **underwater robot** closes the correct valve with a rotation of the <u>first 45 degrees</u>. The process must be recorded by the on board camera of the robot.	A3.40 ☐
The **underwater robot** closes the correct valve with a rotation of the <u>last 45 degrees</u>. The process must be recorded by the on board camera of the robot.	A3.41 ☐

Set A4: Cooperation

The **underwater robot** communicates the correct underwater leaking pipe to the **aerial or ground** robot. Directly or through the surface robot.	A4.1 ☐
The **aerial or ground robot** receives and decodes the message with the correct leaking pipe sent by directly by the underwater or through the surface robot.	A4.2 ☐
The **aerial or ground robot** communicates the correct land leaking pipe to the underwater robot (directly or through the surface robot).	A4.3 ☑
The **underwater robot** receives and decodes the message with the correct land leaking pipe sent by the aerial or ground robot (directly or through the surface robot).	A4.4 ☐
The **ground robot** and the **underwater robot** close the correct valves in a synchronised process.	A4.5 ☐
The **aerial robot** communicates to the **ground robot** the safe path to the building.	A4.6 ☐

Set A5: General

The **ground robots** return to the landing area once all the tasks have been done.	A5.1 ☑
The **underwater robot** surfaces in a controlled way once all the tasks have been done.	A5.2 ☐
The **aerial robots** return to the landing area once all the tasks have been done.	A5.3 ☑
The **ground robot(s)** transmits live position and images/video to the control station during the run.	A5.4 ☑
The **aerial robot(s)** transmits live position and images/video to the control station during the run.	A5.5 ☑
The **marine robot(s)** transmits live position and images/video to the control station during the run or the manipulation task.	A5.6 ☐

Penalised Behaviours

The robot needs manual intervention during a run (e.g. the robot is stuck):	
Marine robot	No permitted
Aerial robot	PB1 ☐ (max. 1)
Ground robot 1	PB2 ☐ ☐ (max. 2)
Ground robot 2	PB3 ☐ ☐ (max. 2)

The ground robot leaves the operating area.	PB4 ☐ (max. 1)
The ground robot changes batteries or is refuelled.	PB5 ☐ (max. 1)
The ground robot-1 hits the obstacles.	PB6 ☐ ☐ ☐ ☐
The ground robot-2 hits the obstacles.	PB7 ☐ ☐ ☐ ☐
The underwater robot changes batteries.	PB8 ☐ (max. 1)
The underwater robot surfaces at any point (GPS fix can be obtained) and re-submerges. *(The surface for preparation of the manipulation task is not penalised)*	PB9 ☐ ☐ (max. 2)
The aerial robot does not keep the safety distance of 5 m with the building wall.	PB10 ☐ ☐ (max. 2)

Disqualifying Behaviours

A robot damages competition arena (including the obstacles).	DB1 ☐
A robot does not conform to safety requirements for the competition.	DB2 ☐
A robot impacts the sensitive dune area.	DB3 ☐
A robot enters any of the upper floors of the building.	DB4 ☐
The aerial robot leaves the flight volumes defined by the organisation.	DB5 ☐
The aerial robot impacts the building.	DB6 ☐
The aerial robot enters the building.	DB7 ☐
A marine robot is tele-operated (except for safety reasons agreed by the Technical Committee and the manipulation task).	DB8 ☐
The underwater robot closes the wrong valve underwater.	DB9 ☐
The ground robots close more than one wrong valve on land.	DB10 ☐

Comment: _____

WARNING: A disqualifying behaviour discards all other achievements in the current task. Use it only when it is really necessary (e.g. cheating).

Benchmarking data delivered appropriately: ☒ yes / ☐ no

(Time is 60 min after the end of the team's time-slot, formats as described in the TBM)

Team leader signature: _____

Referee signature: _____

TBM 1: The Grand Challenge (Land + Sea + Air)

Team name: __TELEROB + U. GIRONA + ISEP/INESC TEC__

Referee I (Land): __HANS ARTHUR M + MICHAL G.__, Referee II (Land): __BERND S + JUHA R.__

Referee I (Sea): __VLADI P.__, Referee II (Sea): __ANDREA__

Referee I (Air): __STJEPAN B.__, Referee II (Air): __MARGARIDA F.__

Date (DD/MM/YYYY): __22/09/2017__, Time (24:00): __14:05__

Duration: _____ (Max. 100 min) ☐ Timeout

Achievements

Set A1: Outdoors

	A1.1	A1.2	A1.3
An **aerial robot** reaches the waypoints (WPs) within a radius of 5 m in **autonomous navigation.** *Waypoints can be reached in no specific order and the team can suggest additional waypoints to their flight plan*	WP1 A ☒	WP2 A ☒	WP3 A ☒
	A1.4	**A1.5**	**A1.6**
A **ground robot** reaches the waypoints within a precision of 3m.	WP1 L ☑	WP2 L ☑	WP5 L ☑
	A1.7	**A1.8**	**A1.9**
A **ground robot** reaches the WPs within a precision of 3 m in (autonomous) navigation. Yes, but not ↗	WP3 L ☐	WP4 L ☐	WP6 L ☐

	A1.10
Within 30 minutes of start of the run, a robot reports the correct location (within radius 5 m) of the missing worker outside the building.	☒
An **aerial robot** deploys the first-aid kit (within radius 2 m) from the worker outside the building. WAY FAR	A1.11 ☐
The **aerial robot** transfers the first-aid kit to the land robot outside the building. *(It must be directly deployed on the platform or within a radius of 1 m from it)* 2m	A1.12 ☐

Pipe damages on land		
Robots reports the damages on the land pipes. *(Each damage can only be scored once).*	A1.13 D1 ☑ Robot Domain: LAND (1)	A1.14 D2 ☑ Robot Domain: LAND (2)	A1.15 D3 ☑ Robot Domain: (AIR) (3)

A robot detects the leak marker on the pipe.	A1.16 ☒
A robot reports the pipe that is leaking on land. air & land	A1.17 ☒
A robot recognises the number on the leaking pipe on land.	A1.18 ☒

Outdoor damages (building)		
The robots recognise the damages on the wall of the building. *(Each damage can only be scored once).*	A1.19 D1 ☑ Robot Domain: LAND + AIR	A1.20 D2 ☑ Robot Domain: LAND + AIR	A1.21 D3 ☑ Robot Domain: AIR

A robot localises the **unobstructed entrance** in real-time in automatic way. Not	A1.22 ☐

Robots localise the **obstructed entrances**.	A1.23 E1 ☑ Robot Domain: LAND	A1.24 E2 ☑ Robot Domain: LAND

Robots find a **safe and unobstructed path** to the unblocked entry of the building for a ground robot. (The path is shown on the map).	A1.25 ☒
From the starting point, a ground robot follows a safe path (collision free from obstacles and structures) to the unobstructed building entrance.	A1.26 ☑
The **aerial robot** builds a 2D or 3D map of the designated vertical wall. ? maybe	A1.27 ☑
The **aerial robot** builds the map on board during the flight. The map must be shown to the referees just after the flight finishes.	A1.28 ☑
Robots build an outdoor map of the land pipes area with OPIs (North-West side).	A1.29 ☒
Robots build an outdoor map of the land pipes area with OPIs (North-East side).	A1.30 ☒
Robots build an outdoor map of the land pipes area with OPIs (South-West side).	A1.31 ☒
Robots build an outdoor map of the land pipes area with OPIs (South-East side).	A1.32 ☒

Set A2: Indoors

A **ground robot** enters the building through the unobstructed door.	A2.1 ☑
Within 30 minutes of start of the run, a **ground robot** reports the correct location of the missing worker inside the building.	A2.2 ☑
The missing worker is detected in real-time in an automatic way.	A2.3 ☐
A **ground robot** deploys the first-aid kit (within radius 1 m) from the worker inside the building.	A2.4 ☑

	Indoor damages	
The ground robot(s) recognise the damages on the wall of the building. *(Each damage can only be scored once).*	A2.5 D1 ☑	A2.6 D2 ☑

From the building entrance, a **ground robot** follows a safe path (collision free from obstacles and structures) to the machine room.	A2.7 ☑
A **ground robot** recognises the machine room sign in real-time and in automatic way.	A2.8 ☐
A **ground robot** enters the machine room.	A2.9 ☑

	Indoor map	
The ground robot(s) builds a geometric indoor map of the building. *(Use the best map or a combination of ground robots maps).*	Area 1 ☑ A2.10	Area 2 ☑ A2.11

A **ground robot** recognises the ID of the correct set of valves in the machine room.	A2.12 ☑

	Correct Valve	
A **ground robot** closes the correct valve. The robot must close one valve of the set autonomously and the other one manually. The process must be recorded by the on board camera of the robot. (Note: Each set of valves has two types: gate and lever)	Valve manual ☑ A2.13 Specify type valve: bar	Valve autonomous ☐ A2.14 Specify type valve: wheel

Set A3: Underwater

The **underwater robot** provides images of the gate.	Type of images	
	Acoustic buoy-1 ☑ A3.1	Optical buoy-1 ☐ A3.3
	Acoustic buoy-2 ☑ A3.2	Optical buoy-2 ☐ A3.4

The **underwater robot** passes through the gate without touching it.	A3.5 ☑
The **underwater robot** passes through the gate within the first 30 minutes from the start of the run.	A3.6 ☑

	Buoys				
The **underwater robot** detects the plume buoys in real time. Images are needed.	B1☑ A3.7	B2☑ A3.8	B3☑ A3.9	B4☑ A3.10	B5☑ A3.11
	Buoys numbers				
The **underwater robot** recognises the number on the plume buoys	B1☐ A3.12	B2☐ A3.13	B3☐ A3.14	B4☐ A3.15	B5☐ A3.16

The **underwater robot** produces a geometric map of the plume (Area: B1+B2).	A3.17 ☑
The **underwater robot** produces a geometric map of the plume (Area: B3+B4+B5).	A3.18 ☑
The **underwater robot** detects the leak marker on the pipe in real time.	A3.19 ☐
The **underwater robot** recognises and provides images of the black number stamped on the leaking pipe.	A3.20 ☐
The **underwater robot** reports which is the number of the leaking pipe by its geometric position.	A3.21 ☐

	Pipes underwater			
The **underwater robot** inspects the four pipes underwater. Provide images.	1☑ A3.22	2☑ A3.23	3☑ A3.24 ?	4☑ A3.25 ?

Following the leaking pipe up to the assembly structure, the **underwater robot** provides an image mosaic of the <u>first half</u> of the leaking pipe.	A3.26 ☐
Following the leaking pipe up to the assembly structure, the **underwater robot** provides an image mosaic of the <u>second half</u> of the leaking pipe.	A3.27 ☐

	Pipe structure sides			
The **underwater robot** provides images of the structure sides.	North ☑ A3.28	South ☑ A3.29	East ☑ A3.30	West ☑ A3.31

	Structure Side	
The **underwater robot** provides a 3D reconstruction of the structure.	Front ☐ A3.32	Rear ☐ A3.33

The **underwater robot** localises the missing worker underwater within a radius of 5 meters.	A3.34 ☐
The **underwater robot** gives the dimensions and geometrical shape of the closest object to the worker.	A3.35 ☐
The **underwater robot** provides 3D reconstruction of the worker.	A3.36 ☐

The **underwater robot** provides a 2D acoustic or optical map of the debris.	Area 1 ☐ A3.37	Area 2 ☐ A3.38

The **underwater robot** provides a 3D reconstruction of the manipulation console where the correct underwater valve is.	A3.39 ☐
The **underwater robot** closes the correct valve with a rotation of the <u>first 45 degrees</u>. The process must be recorded by the on board camera of the robot.	A3.40 ☐
The **underwater robot** closes the correct valve with a rotation of the <u>last 45 degrees</u>. The process must be recorded by the on board camera of the robot.	A3.41 ☐

Set A4: Cooperation

The **underwater robot** communicates the correct underwater leaking pipe to the **aerial or ground** robot. Directly or through the surface robot.	A4.1 ☐
The **aerial or ground robot** receives and decodes the message with the correct leaking pipe sent by directly by the underwater or through the surface robot.	A4.2 ☒
The **aerial or ground robot** communicates the correct land leaking pipe to the underwater robot (directly or through the surface robot).	A4.3 ☒
The **underwater robot** receives and decodes the message with the correct land leaking pipe sent by the aerial or ground robot (directly or through the surface robot).	A4.4 ☑
The **ground robot** and the **underwater robot** close the correct valves in a synchronised process.	A4.5 ☐
The **aerial robot** communicates to the **ground robot** the safe path to the building.	A4.6 ☒

Set A5: General

The **ground robots** return to the landing area once all the tasks have been done.	A5.1 ☑
The **underwater robot** surfaces in a controlled way once all the tasks have been done.	A5.2 ☑
The **aerial robots** return to the landing area once all the tasks have been done.	A5.3 ☒
The **ground robot(s)** transmits live position and images/video to the control station during the run.	A5.4 ☑
The **aerial robot(s)** transmits live position and images/video to the control station during the run.	A5.5 ☒
The **marine robot(s)** transmits live position and images/video to the control station during the run or the manipulation task.	A5.6 ☑

Penalised Behaviours

The robot needs manual intervention during a run (e.g. the robot is stuck):	
Marine robot	No permitted
Aerial robot	PB1 ☐ (max. 1)
Ground robot 1	PB2 ☐ ☐ (max. 2)
Ground robot 2	PB3 ☐ ☐ (max. 2)

The ground robot leaves the operating area.	PB4 ☐ (max. 1)
The ground robot changes batteries or is refuelled.	PB5 ☐ (max. 1)
The ground robot-1 hits the obstacles.	PB6 ☐ ☐ ☐ ☐
The ground robot-2 hits the obstacles.	PB7 ☐ ☐ ☐ ☐
The underwater robot changes batteries.	PB8 ☐ (max. 1)
The underwater robot surfaces at any point (GPS fix can be obtained) and re-submerges. *(The surface for preparation of the manipulation task is not penalised)*	PB9 ☐ ☐ (max. 2)
The aerial robot does not keep the safety distance of 5 m with the building wall.	PB10 ☐ ☐ (max. 2)

Disqualifying Behaviours

A robot damages competition arena (including the obstacles).	DB1 ☐
A robot does not conform to safety requirements for the competition.	DB2 ☐
A robot impacts the sensitive dune area.	DB3 ☐
A robot enters any of the upper floors of the building.	DB4 ☐
The aerial robot leaves the flight volumes defined by the organisation.	DB5☐
The aerial robot impacts the building.	DB6 ☐
The aerial robot enters the building.	DB7 ☐
A marine robot is tele-operated (except for safety reasons agreed by the Technical Committee and the manipulation task).	DB8 ☐
The underwater robot closes the wrong valve underwater.	DB9 ☐
The ground robots close more than one wrong valve on land.	DB10 ☐

Comment: _____

WARNING: A disqualifying behaviour discards all other achievements in the current task. Use it only when it is really necessary (e.g. cheating).

Benchmarking data delivered appropriately: ☒ yes / ☐ no

(Time is 60 min after the end of the team's time-slot, formats as described in the TBM)

Team leader signature: _____

Referee signature: _____

TBM 1: The Grand Challenge (Land +Sea + Air)

Team name: _TUSCANY_

Referee I (Land): _FRANK S._ , Referee II (Land): _BERND B._

Referee I (Sea): _GINNY K_ , Referee II (Sea): _RAY S._

Referee I (Air): _STEPHAN B._ , Referee II (Air): _MARGALIDA F._

Date (DD/MM/YYYY): _22/9/17_ , Time (24:00): _09:30_

Duration: _____ (Max. 100 min) ☐ Timeout

Achievements

Set A1: Outdoors

	A1.1	A1.2	A1.3
An **aerial robot** reaches the waypoints (WPs) within a radius of 5 m in **autonomous navigation**. *Waypoints can be reached in no specific order and the team can suggest additional waypoints to their flight plan*	WP1 A ☑	WP2 A ☑	WP3 A ☑
	A1.4	A1.5	A1.6
A **ground robot** reaches the waypoints within a precision of 3m.	WP1 L ☑	WP2 L ☑	WP5 L ☑
	A1.7	A1.8	A1.9
A **ground robot** reaches the WPs within a precision of 3 m in **autonomous navigation**.	WP3 L ☐	WP4 L ☐	WP6 L ☐

Within 30 minutes of start of the run, a robot reports the correct location (within radius 5 m) of the missing worker outside the building.	A1.10 ☑
An **aerial robot** deploys the first-aid kit (within radius 2 m) from the worker outside the building.	A1.11 ☐
The **aerial robot** transfers the first-aid kit to the land robot outside the building. *(It must be directly deployed on the platform or within a radius of 1 m from it)*	A1.12 ☐

	Pipe damages on land		
Robots reports the damages on the land pipes. *(Each damage can only be scored once).*	A1.13 D1 ☑ Robot Domain: AiR	A1.14 D2 ☑ Robot Domain: AiR	A1.15 D3 ☑ Robot Domain: AiR

A robot detects the leak marker on the pipe.	A1.16 ☑
A robot reports the pipe that is leaking on land.	A1.17 ☑
A robot recognises the number on the leaking pipe on land.	A1.18 ☑

	Outdoor damages (building)		
The robots recognise the damages on the wall of the building. *(Each damage can only be scored once).*	A1.19 D1 ☑ Robot Domain: AiR	A1.20 D2 ☐ Robot Domain: ___	A1.21 D3 ☐ Robot Domain: ___

A robot localises the **unobstructed entrance** in real-time in automatic way.	A1.22 ☑

Robots localise the **obstructed entrances**.	A1.23 E1 ☑ Robot Domain: AiR/ LAND	A1.24 E2 ☑ Robot Domain: AiR/ LAND

Robots find a **safe and unobstructed path** to the unblocked entry of the building for a ground robot. (The path is shown on the map).	A1.25 ☑
From the starting point, a ground robot follows a safe path (collision free from obstacles and structures) to the unobstructed building entrance.	A1.26 ☑
The **aerial robot** builds a 2D or 3D map of the designated vertical wall.	A1.27 ☑
The **aerial robot** builds the map on board during the flight. The map must be shown to the referees just after the flight finishes.	A1.28 ☐
Robots build an outdoor map of the land pipes area with OPIs (North-West side).	A1.29 ☐
Robots build an outdoor map of the land pipes area with OPIs (North-East side).	A1.30 ☐
Robots build an outdoor map of the land pipes area with OPIs (South-West side). (AiR)	A1.31 ☑
Robots build an outdoor map of the land pipes area with OPIs (South-East side).	A1.32 ☐

Set A2: Indoors

A **ground robot** enters the building through the unobstructed door.	A2.1 ☑
Within 30 minutes of start of the run, a **ground robot** reports the correct location of the missing worker inside the building.	A2.2 ☐
The missing worker is detected in real-time in an automatic way.	A2.3 ☐
A **ground robot** deploys the first-aid kit (within radius 1 m) from the worker inside the building.	A2.4 ☐

	Indoor damages	
The **ground robot(s)** recognise the damages on the wall of the building. *(Each damage can only be scored once).*	A2.5 D1 ☑	A2.6 D2 ☑

From the building entrance, a **ground robot** follows a safe path (collision free from obstacles and structures) to the machine room.	A2.7 ☑
A **ground robot** recognises the machine room sign in real-time and in automatic way.	A2.8 ☐
A **ground robot** enters the machine room.	A2.9 ☑

	Indoor map	
The **ground robot(s)** builds a geometric indoor map of the building. *(Use the best map or a combination of ground robots maps).*	Area 1 ☐ A2.10	Area 2 ☐ A2.11

A **ground robot** recognises the ID of the correct set of valves in the machine room.	A2.12 ☐

	Correct Valve	
A **ground robot** closes the correct valve. The robot must close one valve of the set autonomously and the other one manually. The process must be recorded by the on board camera of the robot. (Note: Each set of valves has two types: gate and lever)	Valve manual ☐ A2.13 Specify type valve: ____	Valve autonomous ☐ A2.14 Specify type valve: ____

Set A3: Underwater

The **underwater robot** provides images of the gate.	Type of images	
	Acoustic buoy-1 ☑ A3.1	Optical buoy-1 ☐ A3.3
	Acoustic buoy-2 ☑ A3.2	Optical buoy-2 ☐ A3.4

The **underwater robot** passes through the gate without touching it.	A3.5 ☑
The **underwater robot** passes through the gate within the first 30 minutes from the start of the run.	A3.6 ☑

The **underwater robot** detects the plume buoys in real time. Images are needed.	Buoys				
	B1 ☑	B2 ☑	B3 ☐	B4 ☐	B5 ☑
	A3.7	A3.8	A3.9	A3.10	A3.11
The **underwater robot** recognises the number on the plume buoys	Buoys numbers				
	B1 ☐	B2 ☐	B3 ☐	B4 ☐	B5 ☐
	A3.12	A3.13	A3.14	A3.15	A3.16

The **underwater robot** produces a geometric map of the plume (Area: B1+B2).	A3.17 ☑
The **underwater robot** produces a geometric map of the plume (Area: B3+B4+B5).	A3.18 ☐
The **underwater robot** detects the leak marker on the pipe in real time.	A3.19 ☐
The **underwater robot** recognises and provides images of the black number stamped on the leaking pipe.	A3.20 ☐
The **underwater robot** reports which is the number of the leaking pipe by its geometric position.	A3.21 ☐

The **underwater robot** inspects the four pipes underwater. Provide images.	Pipes underwater			
	1 ☐	2 ☐	3 ☐	4 ☐
	A3.22	A3.23	A3.24	A3.25

Following the leaking pipe up to the assembly structure, the **underwater robot** provides an image mosaic of the <u>first half</u> of the leaking pipe.	A3.26 ☐
Following the leaking pipe up to the assembly structure, the **underwater robot** provides an image mosaic of the <u>second half</u> of the leaking pipe.	A3.27 ☐

	Pipe structure sides			
The **underwater robot** provides images of the structure sides.	North☐ A3.28	South☐ A3.29	East☐ A3.30	West☐ A3.31

	Structure Side	
The **underwater robot** provides a 3D reconstruction of the structure.	Front ☐ A3.32	Rear ☐ A3.33

The **underwater robot** localises the missing worker underwater within a radius of 5 meters.	A3.34 ☐
The **underwater robot** gives the dimensions and geometrical shape of the closest object to the worker.	A3.35 ☐
The **underwater robot** provides 3D reconstruction of the worker.	A3.36 ☐

The **underwater robot** provides a 2D acoustic or optical map of the debris.	Area 1☐ A3.37	Area 2☐ A3.38

The **underwater robot** provides a 3D reconstruction of the manipulation console where the correct underwater valve is.	A3.39 ☐
The **underwater robot** closes the correct valve with a rotation of the <u>first 45 degrees</u>. The process must be recorded by the on board camera of the robot.	A3.40 ☐
The **underwater robot** closes the correct valve with a rotation of the <u>last 45 degrees</u>. The process must be recorded by the on board camera of the robot.	A3.41 ☐

Set A4: Cooperation

The **underwater robot** communicates the correct underwater leaking pipe to the **aerial or ground** robot. Directly or through the surface robot.	A4.1 ☐
The **aerial or ground robot** receives and decodes the message with the correct leaking pipe sent by directly by the underwater or through the surface robot.	A4.2 ☐
The **aerial or ground robot** communicates the correct land leaking pipe to the underwater robot (directly or through the surface robot).	A4.3 ☐
The **underwater robot** receives and decodes the message with the correct land leaking pipe sent by the aerial or ground robot (directly or through the surface robot).	A4.4 ☐
The **ground robot** and the **underwater robot** close the correct valves in a synchronised process.	A4.5 ☐
The **aerial robot** communicates to the **ground robot** the safe path to the building.	A4.6 ☐

Set A5: General

The **ground robots** return to the landing area once all the tasks have been done.	A5.1 ☐
The **underwater robot** surfaces in a controlled way once all the tasks have been done.	A5.2 ☑
The **aerial robots** return to the landing area once all the tasks have been done.	A5.3 ☐
The **ground robot(s)** transmits live position and images/video to the control station during the run.	A5.4 ☑
The **aerial robot(s)** transmits live position and images/video to the control station during the run.	A5.5 ☑
The **marine robot(s)** transmits live position and images/video to the control station during the run or the manipulation task. ⟨?⟩	A5.6 ☑

Penalised Behaviours

The robot needs manual intervention during a run (e.g. the robot is stuck):	
Marine robot	No permitted
Aerial robot	PB1 ☑ (max. 1)
Ground robot 1	PB2 ☑ ☑ (max. 2)
Ground robot 2	PB3 ☐ ☐ (max. 2)

The ground robot leaves the operating area.	PB4 ☐ (max. 1)
The ground robot changes batteries or is refuelled.	PB5 ☐ (max. 1)
The ground robot-1 hits the obstacles.	PB6 ☐ ☐ ☐ ☐
The ground robot-2 hits the obstacles.	PB7 ☐ ☐ ☐ ☐
The underwater robot changes batteries.	PB8 ☐ (max. 1)
The underwater robot surfaces at any point (GPS fix can be obtained) and re-submerges. *(The surface for preparation of the manipulation task is not penalised)*	PB9 ☐ ☐ (max. 2)
The aerial robot does not keep the safety distance of 5 m with the building wall.	PB10 ☐ ☐ (max. 2)

Disqualifying Behaviours

A robot damages competition arena (including the obstacles).	DB1 ☐
A robot does not conform to safety requirements for the competition.	DB2 ☐
A robot impacts the sensitive dune area.	DB3 ☐
A robot enters any of the upper floors of the building.	DB4 ☐
The aerial robot leaves the flight volumes defined by the organisation.	DB5 ☐
The aerial robot impacts the building.	DB6 ☐
The aerial robot enters the building.	DB7 ☐
A marine robot is tele-operated (except for safety reasons agreed by the Technical Committee and the manipulation task).	DB8 ☐
The underwater robot closes the wrong valve underwater.	DB9 ☐
The ground robots close more than one wrong valve on land.	DB10 ☐

Comment: _____

WARNING: A disqualifying behaviour discards all other achievements in the current task. Use it only when it is really necessary (e.g. cheating).

Benchmarking data delivered appropriately: ☑ yes / ☐ no

(Time is 60 min after the end of the team's time-slot, formats as described in the TBM)

Team leader signature: _____

Referee signature: _____