

Accelerated Marine Vehicle Autonomy, Sensing, and Communications

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Introduction to the IvP Helm

(LAB DISCUSSION)

Web <http://oceanai.mit.edu/2.680>

Email:

Mike Benjamin mikerb@mit.edu

Henrik Schmidt henrik@mit.edu

Accelerated Marine Autonomy – "Introduction to the IvP Helm"



Today's Material

From your Browser:

- <http://oceanai.mit.edu/ntu/lecture03.pdf>
- http://oceanai.mit.edu/ntu/lecture03_lab.pdf
- <http://oceanai.mit.edu/ntu/lab03.pdf>
- <http://oceanai.mit.edu/ntu/lecture04.pdf>
- http://oceanai.mit.edu/ntu/lecture04_lab.pdf
- <http://oceanai.mit.edu/ntu/lab04.pdf>

Overview

S2_alpha
Exercise

S3_alpha
Exercise

S4_alpha
Exercise

S5_alpha
exercise

S6_alpha
Exercise

S7_alpha
Exercise

Michael Benjamin 2017

Overview



In this lab we exercise our knowledge in:

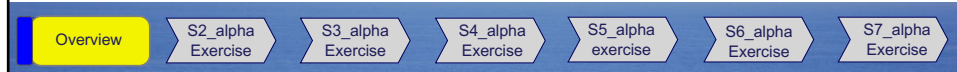
- MOOS and Helm configurations, by extending the Alpha mission
- Behavior Logic Conditions, Behavior runtime flags.

A few new topics we touch, and learn on the fly:

- uTimerScript
- iSay MOOS application
- The StationKeep Behavior
- Behavior durations

Lab Exercises

- **s2_alpha**: Add a second survey behavior before returning home
- **s3_alpha**: Add command and control for switching East/West
- **s4_alpha**: Use uTimerScript for switching East/West
- **s5_alpha**: Post iSay events with the waypoint behavior
- **s6_alpha**: Station-Keep at waypoints, user commands to continue
- **s7_alpha**: Station-Keep at waypoints, use behavior duration to continue



The s2_alpha Exercise

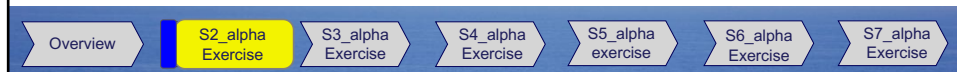


Copy the s1_alpha mission, calling it the s2_alpha

Add another survey behavior, executed after the first survey behavior

- Call it the name:
"west_wpt_survey"
- Give it a survey pattern of:
`points = -35,-65 : -35,-125 : 20,-125 : 20, -65`

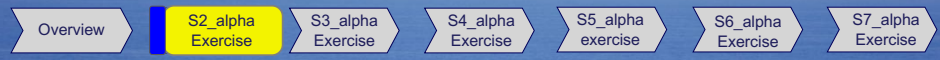
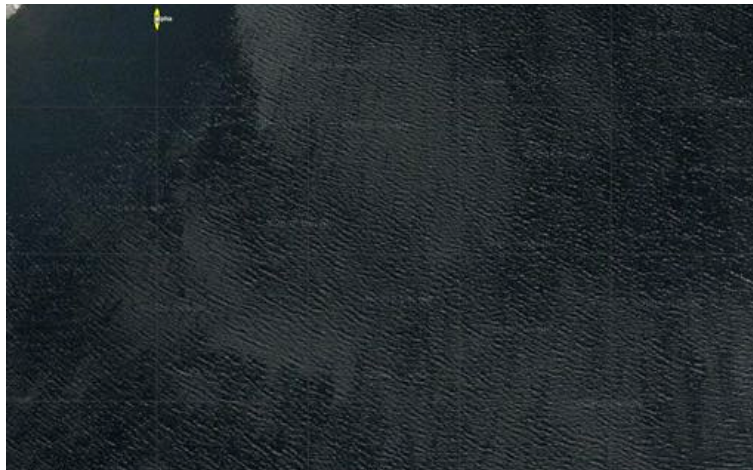
The second survey behavior runs after the first one. Then returns.



The s2_alpha Exercise



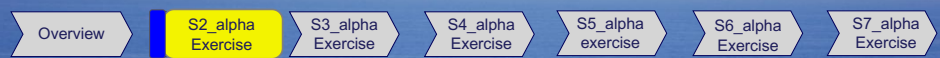
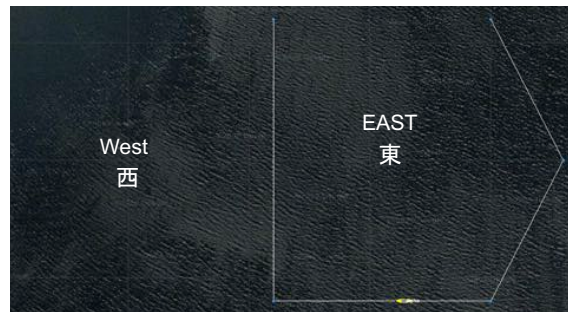
A working solution to the s2_alpha exercise:



Requirements of the s2_alpha Exercise



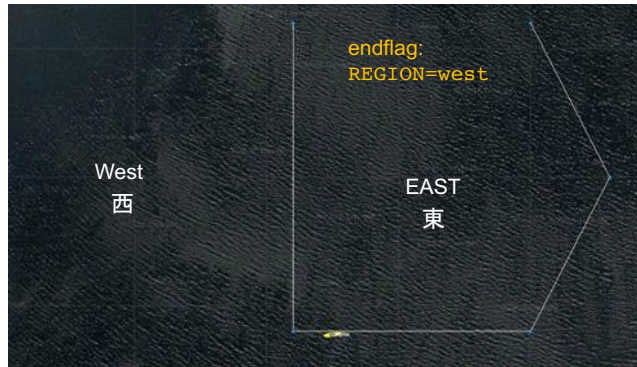
1. Add another survey behavior, executed after the first survey behavior
 - Call it the name: "west_wpt_survey"
 - Pattern of: points = -35,-65 : -35,-125 : 20,-125 : 20, -65
2. Condition the new behavior such that it only runs when
`condition = REGION = west`
3. Make sure the first survey behavior only runs when
`condition = REGION = east`
4. Initialize upon helm startup:
`initialize = REGION = east`



Requirements of the s2_alpha Exercise

5. Make sure the end flag for the first behavior now triggers the second waypoint behavior, and not a return home

```
endflag = REGION = west
```



Overview

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S4_alpha
Exercise

S5_alpha
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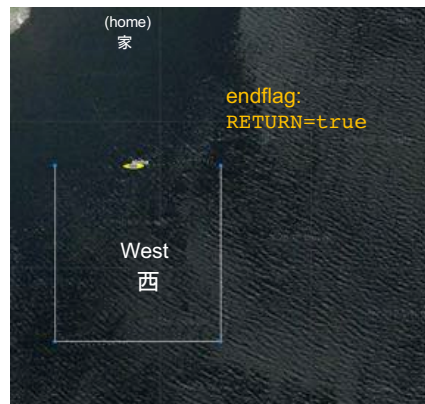
S6_alpha
Exercise

S7_alpha
Exercise

Requirements of the s2_alpha Exercise

6. Make sure the end flag for the second survey behavior now triggers the return home behavior

```
endflag = RETURN = true
```



Overview

S2_alpha
Exercise

S3_alpha
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S4_alpha
Exercise

S5_alpha
exercise

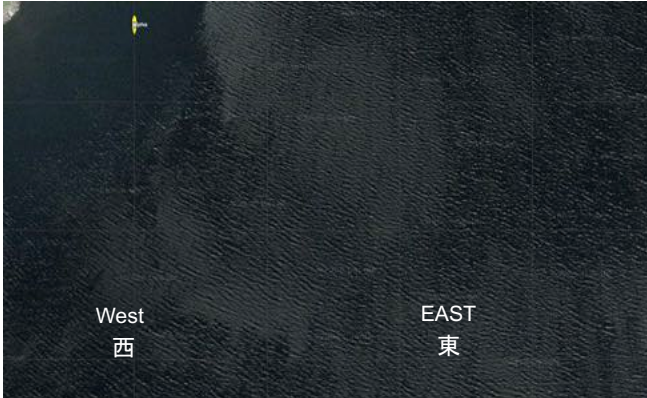
S6_alpha
Exercise

S7_alpha
Exercise

Requirements of the s2_alpha Exercise

7. The East survey is executed **ONE time** (repeat = 0)

8. The West survey is executed **THREE times** (repeat = 2)



West
西

EAST
東

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The s3_alpha Exercise

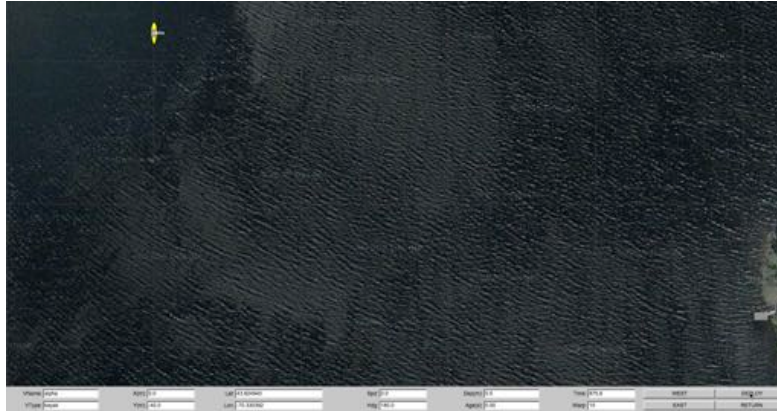
Overview S2_alpha Exercise S3_alpha Exercise S4_alpha Exercise S5_alpha exercise S6_alpha Exercise S7_alpha Exercise

The s3_alpha Exercise



To Start: Copy the s2_alpha mission, calling it s3_alpha

- Modify the Waypoint Survey behaviors to repeat forever
- Add Command and Control for switching between East and West, and Returning



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S2_alpha
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S3_alpha
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S5_alpha
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S6_alpha
Exercise

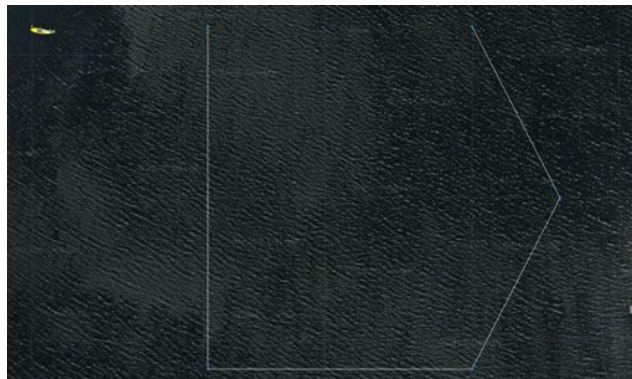
S7_alpha
Exercise

Requirements of the s3_alpha Exercise



1. Modify each behavior to transit indefinitely

```
repeat = forever
```



Overview

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exercise

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Exercise

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Requirements of the s3_alpha Exercise

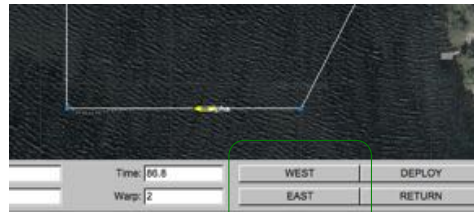
1. Add Command buttons to pMarineViewer

```
button_three = WEST # REGION=west
button_four = EAST # REGION=east
```

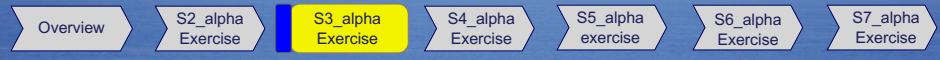
 Button
name
 MOOS
Variable
 Variable
Value

Note: the variable values published to the MOODB, are the same ones as the endflags in the previous mission:

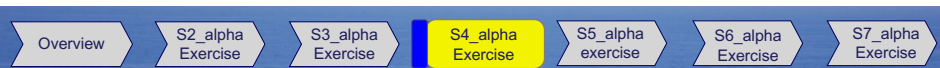
`endflag = REGION=west`



New
Buttons



The s4_alpha Exercise



The s4_alpha Exercise

To Start: Copy the s3_alpha mission, calling it s4_alpha

- Add the uTimerScript MOOS application to the Antler launch list
- Use the uTimerScript to periodically switch between East and West



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S2_alpha
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S5_alpha
exercise

S6_alpha
Exercise

S7_alpha
Exercise

Requirements of the s4_alpha Exercise

1. Add uTimerScript to the alpha.moos Antler configuration block

```
//-----
// Antler configuration block
ProcessConfig = ANTLER
{
  MSBetweenLaunches = 200

  Run = MOOSDB           @ NewConsole = false
  Run = pLogger           @ NewConsole = false
  Run = uSimMarine        @ NewConsole = false
  Run = pMarinePID        @ NewConsole = false
  Run = pHelmIvP          @ NewConsole = false
  Run = pMarineViewer     @ NewConsole = false
  Run = uProcessWatch     @ NewConsole = false
  Run = pNodeReporter     @ NewConsole = false
  Run = uTimerScript      @ NewConsole = false
}
```

← Add this line

Overview

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Exercise

Requirements of the s4_alpha Exercise

2. Add the uTimerScript configuration block

```
//-----
// uTimerScript config block
ProcessConfig = uTimerScript
{
  AppTick    = 4
  CommsTick  = 4

  condition  = DEPLOY = true
  event      = var=REGION, val="west", time=90
  event      = var=REGION, val="east", time=180
  reset_max  = nolimit
  reset_time = all-posted
}
```

Note: the variable values published to the MOODB, are the same ones as the endflags in the previous mission:

endflag = REGION=west

The uTimerScript Documentation:

<http://oceanai.mit.edu/ivpman/apps/uTimerScript>

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The s5_alpha Exercise

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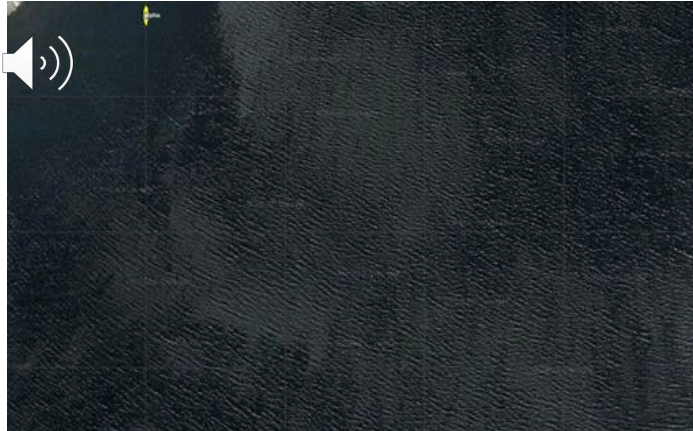
S6_alpha
Exercise

S7_alpha
Exercise

The s5_alpha Exercise

To Start: Copy the s2_alpha mission, calling it s5_alpha

- Add the iSay MOOS application to the Antler launch list
- Use iSay to audibly inform the user when switching between East and West



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Exercise

S5_alpha
Exercise

S6_alpha
Exercise

S7_alpha
Exercise

Requirements of the s5_alpha Exercise

1. Add iSay to the alpha.moos Antler configuration block

```
//-----
// Antler configuration block
ProcessConfig = ANTLER
{
  MSBetweenLaunches = 200

  Run = MOOSDB           @ NewConsole = false
  Run = pLogger           @ NewConsole = false
  Run = uSimMarine        @ NewConsole = false
  Run = pMarinePID        @ NewConsole = false
  Run = pHelmIvP          @ NewConsole = false
  Run = pMarineViewer     @ NewConsole = false
  Run = uProcessWatch     @ NewConsole = false
  Run = pNodeReporter     @ NewConsole = false
  Run = iSay              @ NewConsole = false
}
```

Add this line

2. Download two sound files

```
$ cd s5_alpha
$ wget http://oceanai.mit.edu/ntu/shipbell.wav
$ wget http://oceanai.mit.edu/ntu/buzzer.wav
```

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Requirements of the s5_alpha Exercise

3. Add the iSay configuration block

```
//-----
// iSay config block
ProcessConfig = iSay
{
  AppTick    = 4
  CommsTick  = 4

  default_voice    = alex      // iSay --voices for others
  default_rate     = 200
  interval_policy  = from_end  // or from_start
  min_utter_interval = 1
}
```

Text: SAY_MOOS = say={Would you like to play a game?}, rate=200

Audio: SAY_MOOS = file=file.wav

The iSay Documentation: <http://oceanai.mit.edu/ivpman/apps/iSay>

rate是說話的速度，
越大越快

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S6_alpha
Exercise

S7_alpha
Exercise

Requirements of the s5_alpha Exercise

4. Add the iSay events as behavior endflags

```
//-----
Behavior = BHV_Waypoint
{
  name      = east_waypt_survey
  pwt       = 100
  condition = RETURN = false
  condition = DEPLOY = true
  condition = REGION = east
  endflag   = REGION = west
  endflag   = SAY_MOOS = file=shipbell.wav
}
```

Add this line

```
//-----
Behavior = BHV_Waypoint
{
  name      = west_waypt_survey
  pwt       = 100
  condition = RETURN = false
  condition = DEPLOY = true
  condition = REGION = east
  endflag   = REGION = west
  endflag   = SAY_MOOS = file=buzer.wav
}
```

Add this line

要結束！才會響，所以用按鈕切換無法

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S3_alpha
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S4_alpha
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S5_alpha
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S6_alpha
Exercise

S7_alpha
Exercise



The s6_alpha Exercise

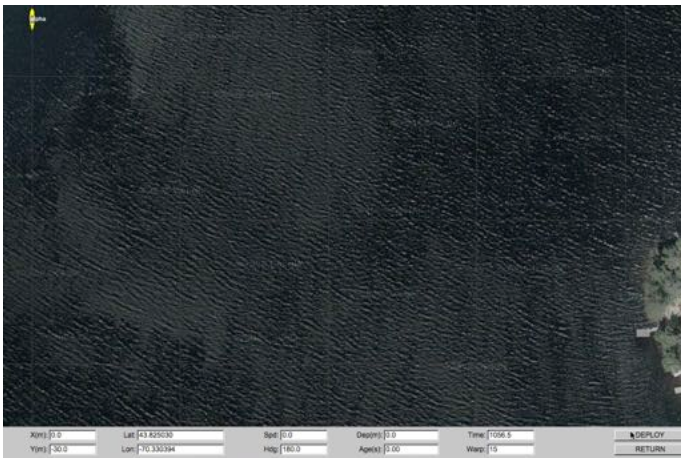
Overview
S2_alpha Exercise
S3_alpha Exercise
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S6_alpha Exercise
S7_alpha Exercise



The s6_alpha Exercise

To Start: Copy the s1_alpha mission, calling it s6_alpha

- Add a StationKeep Behavior to hold station at each waypoint
- The user then simply re-deploys with the DEPLOY button



Alt: 0.0
Lat: 43.82533
Long: 140.0
Depth: 0.0
Time: 1000.0
DEPLOY

Yaws: 0.0
Lon: 140.00000
Height: 100.0
Age: 0.0
Winds: 0.0
RETURN

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S2_alpha Exercise
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S7_alpha Exercise

Requirements of the s6_alpha Exercise



1. Add StationKeep behavior to the alpha.bhv file

```
//-----
Behavior = BHV_StationKeep
{
  name = station-keep
  pwt = 100
  condition = DEPLOY = true
  condition = STATION = true
  center_activate = true
  inner_radius = 8
  outer_radius = 15
  swing_time = 6
}
```

Note its conditions

StationKeep Documentation:

<http://oceanai.mit.edu/ivpman/bhvs/StationKeep>

(covered in more detail in the next lecture)

Overview

S2_alpha
Exercise

S3_alpha
Exercise

S4_alpha
Exercise

S5_alpha
exercise

S6_alpha
Exercise

S7_alpha
Exercise

Requirements of the s6_alpha Exercise



2. Invoke StationKeeping after each waypoint, with the wptflag parameter

```
//-----
Behavior = BHV_Waypoint
{
  name = waypt_survey
  pwt = 100
  condition = STATION != true
  condition = RETURN = false
  condition = DEPLOY = true
  endflag = RETURN = true
  wptflag = STATION = true
  . . .
}
```

Note the new condition

每次waypoint被觸發就會觸發

- Note the flag published as each waypoint is achieved.
- This is unique to the Waypoint Behavior.
- Unlike the other flag types which are defined in the IvP Behavior superclass

Waypoint Behavior Documentation:

<http://oceanai.mit.edu/ivpman/bhvs/Waypoint>

(covered in more detail in the next lecture)

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exercise

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Exercise

S7_alpha
Exercise

Requirements of the s6_alpha Exercise



3. Make sure the waypoint return behavior also respects StationKeeping

```
//-----
Behavior = BHV_Waypoint
{
  name      = waypt_return
  pwt      = 100
  condition = STATION != true
  condition = RETURN = true
  condition = DEPLOY = true
  endflag   = RETURN = false
  . . .
}
```



Note the new condition

4. Edit pMarineViewer configuration in alpha.moos, so DEPLOY button also turns off StationKeeping

```
button_one = DEPLOY # DEPLOY=true
button_one = STATION=false
button_one = MOOS_MANUAL_OVERRIDE=false
button_one = RETURN=false
button_two = RETURN # RETURN=true
```



here



Overview

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S6_alpha
Exercise

S7_alpha
Exercise

The s7_alpha Exercise



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S4_alpha
Exercise

S5_alpha
exercise

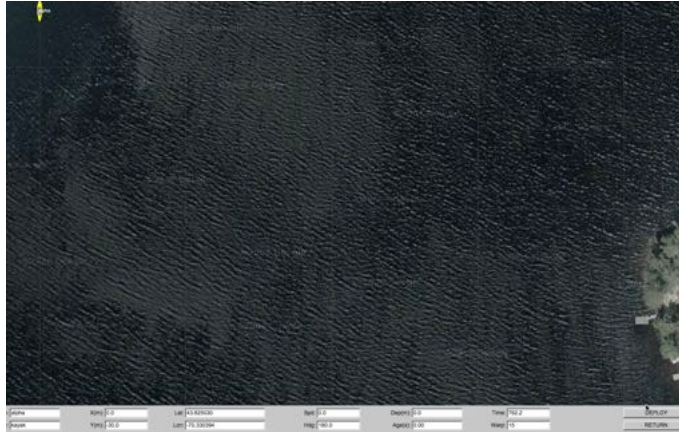
S6_alpha
Exercise

S7_alpha
Exercise

The s7_alpha Exercise

To Start: Copy the s6_alpha mission, calling it s7_alpha

- Add a **duration** to the StationKeep Behavior
- Vehicle automatically resumes mission after period of StationKeeping



Overview

S2_alpha
Exercise

S3_alpha
Exercise

S4_alpha
Exercise

S5_alpha
exercise

S6_alpha
Exercise

S7_alpha
Exercise

Requirements of the s7_alpha Exercise

1. Add a **duration** to the StationKeep behavior in the **alpha.bhv** file

```
//-----
Behavior = BHV_StationKeep
{
  name = station-keep
  pwt = 100
  condition = DEPLOY = true
  condition = STATION = true

  duration = 60

  center_activate = true
  inner_radius = 8
  outer_radius = 15
  swing_time = 6
}
```

The behavior will complete after 60 second and post its endflags

The IVP Behavior duration parameter is documented here:

http://oceanai.mit.edu/ivpman/pmwiki/pmwiki.php?n=Helm.HelmBehaviors#sec_duration

Overview

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Exercise

S4_alpha
Exercise

S5_alpha
exercise

S6_alpha
Exercise

S7_alpha
Exercise

Requirements of the s7_alpha Exercise

2. Further modify the StationKeep behavior to shut itself when it times out: using the `endflag`.
3. Declare the StationKeep behavior to be perpetual with the `perpetual=true` parameter. This allows the behavior to *not* be destroyed after it completes.

```
//-----
Behavior = BHV_StationKeep
{
  name = station-keep
  pwt = 100
  condition = DEPLOY = true
  condition = STATION = true

  duration = 60
  endflag = STATION = false

  perpetual = true

  duration_idle_decay = false

  center_activate = true
  inner_radius = 8
  outer_radius = 15
  swing_time = 6
}
```

This will force its own condition to fail.

Behavior will not die after completion.

Set to false so the duration timer is paused when the behavior is idle

讓這個程式不會執行玩一次就死掉
要重複利用的程式都要加

Overview

S2_alpha
Exercise

S3_alpha
Exercise

S4_alpha
Exercise

S5_alpha
exercise

S6_alpha
Exercise

S7_alpha
Exercise

END

Overview

S2_alpha
Exercise

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S4_alpha
Exercise

S5_alpha
exercise

S6_alpha
Exercise

S7_alpha
Exercise