

AX-TOOLBOX

Flight Analysis Scripting Language

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0 INTRODUCTION

0.1 Language basics

The flight analysis scripting language have two kind of instructions: settings and object constructors. The settings are used to set up some program options and variables and the constructors are used to define the flight tasks.

0.1.1 Settings

The setting instructions have the following syntax:

```
SET <key> = <one or more values>
```

The distinct values are separated by commas.

0.1.2 Constructors

The constructor instructions have the following syntax:

```
<class> <name> = <type>(<zero or more parameters>)
```

The distinct parameters are separated by commas.

0.1.3 Comments and blank characters

Any line whose first non space characters are double slashes '/' will be ignored. All blank lines are also ignored as well as all blank characters (spaces or tabs) before or after any symbol (instruction, name, key, type, value or parameter).

0.2 Notation Conventions

0.2.1 Names

Names can be any sequence of characters. All characters are allowed except commas ','. Names are case sensitive.

0.2.2 Distances and altitudes

Distance and altitude definitions are double precision floating point numbers with dot '.' decimal separator. The known units of measure are meters 'm', kilometers 'km', feet 'ft', miles 'mi' or nautical miles 'nm'.

Examples:

```
500m  
1640.42ft
```

0.2.3 Time definitions

Time definitions are in the format 'HH:MM:SS' (hours, minutes and seconds). The seconds part is optional.

Applies to absolute times (time of day) as well to relative times (time span).

Examples:

10:30:00

10:30

0.2.4 Colors

The following colors are allowed:

	AliceBlue	#FFF0F8FF		DarkTurquoise	#FF00CED1		LightSeaGreen	#FF20B2AA		PapayaWhip	#FFFFEFD5
	AntiqueWhite	#FFFAEBD7		DarkViolet	#FF9400D3		LightSkyBlue	#FF87CEFA		PeachPuff	#FFFFDAB9
	Aqua	#FF00FFFF		DeepPink	#FFFF1493		LightSlateGray	#FF778899		Peru	#FFCD853F
	Aquamarine	#FF7FFFD4		DeepSkyBlue	#FF00BFFF		LightSteelBlue	#FFB0C4DE		Pink	#FFFC0CB
	Azure	#FFF0FFFF		DimGray	#FF696969		LightYellow	#FFFFFFE0		Plum	#FFDDA0DD
	Beige	#FFF5F5DC		DodgerBlue	#FF1E90FF		Lime	#FF00FF00		PowderBlue	#FFB0E0E6
	Bisque	#FFFFE4C4		Firebrick	#FFB22222		LimeGreen	#FF32CD32		Purple	#FF800080
	Black	#FF000000		FloralWhite	#FFFFFFAF0		Linen	#FFFAF0E6		Red	#FFFF0000
	BlanchedAlmond	#FFFEBBCD		ForestGreen	#FF228B22		Magenta	#FFFF00FF		RosyBrown	#FFBC8F8F
	Blue	#FF0000FF		Fuchsia	#FFFF00FF		Maroon	#FF800000		RoyalBlue	#FF4169E1
	BlueViolet	#FF8A2BE2		Gainsboro	#FFDCDCDC		MediumAquamarine	#FF66CDAA		SaddleBrown	#FF8B4513
	Brown	#FFA52A2A		GhostWhite	#FFF8F8FF		MediumBlue	#FF0000CD		Salmon	#FFFA8072
	BurlyWood	#FFDEB887		Gold	#FFFD7000		MediumOrchid	#FFBA55D3		SandyBrown	#FFFA4A60
	CadetBlue	#FF5F9EA0		Goldenrod	#FFDAA520		MediumPurple	#FF9370DB		SeaGreen	#FF2E8B57
	Chartreuse	#FF7FFF00		Gray	#FF808080		MediumSeaGreen	#FF3CB371		SeaShell	#FFFFFFF5EE
	Chocolate	#FFD2691E		Green	#FF008000		MediumSlateBlue	#FF7B68EE		Sienna	#FFA0522D
	Coral	#FFF7F750		GreenYellow	#FFADFF2F		MediumSpringGreen	#FF00FA9A		Silver	#FFC0C0C0
	CornflowerBlue	#FF6495ED		Honeydew	#FFF0FFF0		MediumTurquoise	#FF48D1CC		SkyBlue	#FF87CEEB
	Cornsilk	#FFFFFFF8DC		HotPink	#FFFF69B4		MediumVioletRed	#FFC71585		SlateBlue	#FF6A5ACD
	Crimson	#FFDC143C		IndianRed	#FFCD5C5C		MidnightBlue	#FF191970		SlateGray	#FF708090
	Cyan	#FF00FFFF		Indigo	#FF4B0082		MintCream	#FFF5FFFA		Snow	#FFFFFFFAFA
	DarkBlue	#FF00008B		Ivory	#FFFFFFF0F0		MistyRose	#FFFFE4E1		SpringGreen	#FF00FF7F
	DarkCyan	#FF008B8B		Khaki	#FFF0E68C		Moccasin	#FFFFE4B5		SteelBlue	#FF4682B4
	DarkGoldenrod	#FFB8860B		Lavender	#FFE6E6FA		NavajoWhite	#FFFFDEAD		Tan	#FFD2B48C
	DarkGray	#FFA9A9A9		LavenderBlush	#FFF0F0F5		Navy	#FF000080		Teal	#FF008080
	DarkGreen	#FF006400		LawnGreen	#FF7CFC00		OldLace	#FFFD5E6		Thistle	#FFD8BFD8
	DarkKhaki	#FFBDB76B		LemonChiffon	#FFFFFACD		Olive	#FF808000		Tomato	#FFFF6347
	DarkMagenta	#FF8B008B		LightBlue	#FFADD8E6		OliveDrab	#FF6B8E23		Transparent	#00FFFFFF
	DarkOliveGreen	#FF556B2F		LightCoral	#FFF08080		Orange	#FFFA5000		Turquoise	#FF40E0D0
	DarkOrange	#FFFF8C00		LightCyan	#FFE0FFFF		OrangeRed	#FFFF4500		Violet	#FFEE82EE
	DarkOrchid	#FF9932CC		LightGoldenrodYellow	#FFFAFAD2		Orchid	#FFDA70D6		Wheat	#FFF5DEB3
	DarkRed	#FF8B0000		LightGray	#FFD3D3D3		PaleGoldenrod	#FFEE8AA		White	#FFFFFFF5F5
	DarkSalmon	#FFE9967A		LightGreen	#FF90EE90		PaleGreen	#FF98FB98		WhiteSmoke	#FFF5F5F5
	DarkSeaGreen	#FF8FBC8F		LightPink	#FFFFB6C1		PaleTurquoise	#FFAFEEEE		Yellow	#FFFFF000
	DarkSlateBlue	#FF483D8B		LightSalmon	#FFFA07A		PaleVioletRed	#FFDB7093		YellowGreen	#FF9ACD32
	DarkSlateGray	#FF2F4F4F									

Example: yellow

1 SET INSTRUCTION

```
SET <key> = <value>[, <value>...]
```

Allows to set different options.

1.1 Definition

1.1.1 Key TITLE: competition title

```
set TITLE = <title>
```

Sets the competition title (used in automatic flight report)

1.1.2 Key SUBTITLE: competition title

```
set SUBTITLE = <subtitle>
```

Sets the competition subtitle (used in automatic flight report)

1.1.3 Key LOGFILE: log file

```
set LOGFILE = <filename>
```

Sets the file where to log all scripting operations

<filename> is the name of the log file

1.1.4 Key ALTITUDECORRECTIONSFILE: logger altitude corrections file

```
set ALTITUDECORRECTIONSFILE = <filename>
```

Sets the file with the logger altitude corrections

<filename> is the name of the file

1.1.5 Key DATETIME: flight date and time

```
set DATETIME = <date>, <time>
```

Sets the flight date and time

<date> is the flight date in format yyyy/mm/dd

<time> is either AM or PM

1.1.6 Key UTCOFFSET

```
set UTCOFFSET = <time>
```

Sets the local timezone UTC Offset.

<time> is the difference from Universal Time Coordinate (UTC) from the local time zone in hh:mm. See

http://en.wikipedia.org/wiki/UTC_offset

1.1.7 Key DATUM

```
set DATUM = <datumName>
```

Sets the default datum.

<datumName> is the datum name

Supported datums: Corrego Alegre, European 1950, NAD27 CONUS, OSGB36, WGS72, WGS84.

1.1.8 Key UTMZONE

```
set UTMZONE = <zone>
```

Sets the default UTM zone.

<zone> is the UTM zone

1.1.9 Key TASKSINORDER

```
set TASKSINORDER = <value>
```

Sets whether the tasks must be flown in order or not. If this setting is not present it is assumed as true.

<value> is true or false

1.1.10 Key QNH

```
set QNH = <value>
```

Sets the QNH value

<value> is the qnh value

1.1.11 Key ALTITUDEUNITS

```
set ALTITUDEUNITS = <value>
```

Sets the altitude units to be used in all the program outputs. Allowed values are "meters" and "feet". If this setting is not specified, the default altitude units are "feet".

<value> is the units type

1.1.12 Key INTERPOLATION

```
set INTERPOLATION = <interval>[, <maxContiguousPoints>]
```

Inserts points in the track log by performing a cubic interpolation (Hermite spline).

If this setting is not specified, the default values are interval = 1 second, maxContiguousPoints = 10 points.

To turn off interpolation, set the interval to 0 seconds.

<interval> seconds between contiguous points

<maxContiguousPoints> maximum number of contiguous points to add. If a gap between points is greater, no interpolation will be performed.

1.1.13 Key SMOOTHNESS

```
set SMOOTHNESS = <value>
```

Sets the smoothness factor (moving average values) used in automatic launch and landing detection.

If undefined, 3 will be assumed.

<value> is the smoothness factor

1.1.14 Key MINSPEED

```
set MINSPEED = <speed>
```

Sets the minimum speed (in m/s) considered as movement in automatic launch and landing detection. If undefined, 0.5 will be assumed.

<speed> is the minimum speed

1.1.15 Key MAXACCELERATION

```
set MAXACCELERATION = <acceleration>
```

Sets the maximum acceleration (in m/s²) allowed in normal flight. Track points with greater acceleration will be discarded as bogus (spikes). If undefined, 0.3 will be assumed.

<acceleration> is the maximum acceleration

1.2 Examples

```
set DATETIME = 2010/09/19, AM
set DATUM = European 1950
set QNH = 1013
set MINSPEED = 0.3
set MAXDISTTOCROSSING = 300m
```

2 MAP CLASS

```
MAP <mapName> = <mapType>(<map params>)
```

There must be one and only one map file per script. If more than one is defined, only the last is used. The area covered by the map is assumed to be the competition area.

2.1 Constructors

```
<mapType>(<map params>)
```

2.1.1 Type BITMAP: Bitmap file

```
BITMAP(<fileName>)
```

<fileName> is a bitmap file name. Compatible bitmap types are bmp, gif, jpg, png, tif. A corresponding world file must exist. See http://en.wikipedia.org/wiki/World_file for more information.

2.1.2 Type BLANK: Blank map

```
BLANK(<topLeft>, <bottomRight>)
```

<topLeft> is a previously defined point name designing the top-left corner of the map.

<bottomRight> is a previously defined point name designing the bottom-right corner of the map.

2.2 Display modes

```
<displayMode>(<display params>)
```

2.2.1 Mode GRID

```
GRID(<width>)
```

<width> is the desired grid spacing between lines.

Draws a grid over the map.

2.3 Examples

```
MAP CompetitionMap = BITMAP(map.png) grid(1000)
MAP OfficialMap = BLANK(TopLeftPoint,BottomRightPoint)
```

3 TASK CLASS

TASK <taskName> = <taskType>(<number>)

<taskType> is one of the AXMER allowed task type.

<number> is the task number in the competition.

3.1 Constructors

<taskType>(<number>)

3.1.1 PDG - Pilot Declared Goal

PDG(<number>)

3.1.2 JDG - Judge Declared Goal

JDG(<number>)

3.1.3 HWZ - Hesitation Waltz

HWZ(<number>)

3.1.4 FIN - Fly In

FIN(<number>)

3.1.5 FON - Fly On

FON(<number>)

3.1.6 HNH - Hare And Hounds

HNH(<number>)

3.1.7 WSD - Watership Down

WSD(<number>)

3.1.8 GBM - Gordon Bennett Memorial

GBM(<number>)

3.1.9 CRT - Calculated Rate Of Approach

CRT(<number>)

3.1.10 RTA - Race To An Area

RTA (<number>)

3.1.11 ELB - Elbow

ELB (<number>)

3.1.12 LRN - Land Run

LRN (<number>)

3.1.13 MDT - Minimum Distance

MDT (<number>)

3.1.14 SFL - Shortest Flight

SFL (<number>)

3.1.15 MDD - Minimum Distance Double Drop

MDD (<number>)

3.1.16 XDT - Maximum Distance Time

XDT (<number>)

3.1.17 XDI - Maximum Distance

XDI (<number>)

3.1.18 XDD - Maximum Distance Double Drop

XDD (<number>)

3.1.19 ANG - Angle

ANG (<number>)

3.1.20 3DT - 3D Shape Task

3DT (<number>)

3.2 Examples

TASK Task3HWZ = HWZ (5)

TASK Task2 = JDG (3)

4 AREA CLASS

```
AREA <name> = <areaType>(<area params>) [<displayMode>(<display  
params>)]
```

4.1 Constructors

```
<areaType>(<area params>)
```

4.1.1 Type CYLINDER: Circular or cylindrical area

```
CYLINDER(<center>, <radius>[, <upperLimit>[, <lowerLimit>]])
```

<center> is a point name used as the circle center

<radius> is the circle radius

<upperLimit> is the upper altitude limit (above is outside)

<lowerLimit> is the lower altitude limit (below is outside)

4.1.2 Type SPHERE: Spherical area

```
SPHERE(<center>, <radius>)
```

<center> is a point name used as the sphere center

<radius> is the sphere radius

4.1.3 Type PRISM: Prismatic area

```
PRISM(<fileName>[, <upperLimit>[, <lowerLimit>]])
```

<fileName> is the name of a track file containing the polygon (trk, igc) used as base

<upperLimit> is the upper altitude limit (above is outside)

<lowerLimit> is the lower altitude limit (below is outside)

4.1.4 Type UNION: Union of various areas

```
UNION(<area1 name>, <area2 name>[, <area3name>, ...])
```

A union of two or more previously defined areas.

<area... name> name of a previously defined area

4.2 Display modes

```
<displayMode>(<display params>)
```

The display mode is optional. If it is not specified, DEFAULT(blue) is used.

4.2.1 Mode NONE

```
NONE()
```

The area will not be displayed.

4.2.2 Mode DEFAULT

```
DEFAULT([<color>])
```

Draws the area according to its type.

<color> is one of blue, brown, gray, green, orange, pink, red, violet, white, yellow. If no color is specified, blue will be used.

4.3 Examples

```
area Area1 = CYLINDER(P10, 100m) DEFAULT(green)
area Area2 = PRISM(area2.trk, 100m, 1000m)
area Area3 = SPHERE(P10, 500) NONE()
```

5 FILTER CLASS

Filter track points. Points filtered out are not considered in further computations. Successive filters are applied in definition order.

If the filter is defined before any task, it is considered as the competition area definition and applied automatically to all tasks.

```
FILTER <name> = <filterType>(<filter params>)
```

5.1 Constructors

5.1.1 INSIDE

```
INSIDE(<areaName>)
```

Selects all the track points inside the specified area.

<areaName> is the name of a previously defined area

5.1.2 OUTSIDE

```
OUTSIDE(<areaName>)
```

Selects all the track points outside the specified area.

<areaName> is the name of a previously defined area

5.1.3 BEFORETIME

```
BEFORETIME(<time>)
```

Selects all the track points earlier than specified time.

<time> desired time in hh:mm:ss

5.1.4 AFTERTIME

```
AFTERTIME(<time>)
```

Selects all the track points later than specified time.

<time> desired time in hh:mm:ss

5.1.5 BEFOREPOINT

```
BEFOREPOINT(<pointName>)
```

Selects all the track points earlier than specified point.

<pointName> is the name of a previously defined point

5.1.6 AFTERPOINT

`AFTERPOINT(<pointName>)`

Selects all the track points later than specified point.

`<pointName>` is the name of a previously defined point

5.1.7 ABOVE

`ABOVE(<altitude>)`

Selects all the track points above a given altitude

`<altitude>` is the desired altitude limit in feet

5.1.8 BELOW

`BELOW(<altitude>)`

Selects all the track points below a given altitude

`<altitude>` is the desired altitude limit in feet

5.1.9 NONE

`NONE()`

Clears all the active filters for the current task. Previous computations are not affected.

5.2 Examples

```
FILTER InArea = INSIDE(GBMArea)
FILTER Before10:00 = BEFORETIME(10:00:00)
```


6 POINT CLASS

```
POINT <name> = <pointType>(<point params>) [<displayMode>(<display  
params>)]
```

6.1 Static point (S) constructors

The S constructors return a statically defined point.

6.1.1 Type SLL: WGS84 lat/long

```
SLL(<lat>, <long>, <altitude>)
```

Returns a statically defined point using WGS lat/lon coordinates.

<lat> is the latitude coordinate

<long> is the longitude coordinate

<altitude> is the altitude (in feet)

6.1.2 Type SUTM: UTM

```
SUTM(<easting>, <northing>, <altitude>)
```

Returns a statically defined point using UTM coordinates in the default datum and zone.

<easting> is the easting coordinate

<northing> is the northing coordinate

<altitude> is the altitude (in feet)

6.2 Point from a list (L) constructors

The L constructors return a point chosen from a list of predefined points.

6.2.1 Type LNP: nearest to point

```
LNP(<desiredPoint>, <listPoint1>, <listPoint2>, ...,  
<altitudeThreshold>)
```

Returns the point closest to a desired one from a list of predefined points. It uses altitude dependent distance measurement (see DRAD result class).

<altitudeThreshold>: distance 2D measurement is used below this altitude difference. 3D otherwise.

6.2.2 Type LFT: first in time

```
LFT(<listPoint1>, <listPoint2>, ...)
```

Returns the earliest point from a list of points.

6.2.3 Type LLT: last in time

```
LLT(<listPoint1>, <listPoint2>, ...)
```

Returns the latest point from a list of points.

6.2.4 Type LFNN: first not null

```
LFNN(<listPoint1>, <listPoint2>, ...)
```

Returns the first non null point from a list of points.

6.2.5 Type LLNN: last not null

```
LLNN(<listPoint1>, <listPoint2>, ...)
```

Returns the last non null point from a list of points.

6.3 Logger mark (M) constructors

The M constructors return a point defined with a logger mark.

6.3.1 Type MVMD: virtual marker drop

```
MVMD(<number>)
```

Returns the first occurrence of the desired virtual marker drop. The filters applied to track points are enforced because virtual marker drops must coincide with a valid track point.

<number> desired marker number

6.3.2 Type MPDGD: pilot declared goal with default altitude

```
MPDGD(<number>[, <defaultAltitude>])
```

Returns the last occurrence of the desired pilot declared goal. If the pilot do not declare the altitude, a default altitude is applied.

<number> desired pilot declared goal number

<defaultAltitude> altitude to apply if not defined in the declaration. If it is not specified, the ground elevation is retrieved from a web service (<http://www.earthtools.org/webservices.htm#height>).

6.3.3 Type MPDGF: pilot declared goal with forced altitude

```
MPDGPF(<number>[, <forcedAltitude>])
```

Returns the last occurrence of the desired pilot declared goal. The declared altitude, if any, is ignored and a forced one is applied.

<number> desired pilot declared goal number

<forcedAltitude> altitude to apply. If it is not specified, the ground elevation is retrieved from a web service (<http://www.earthtools.org/webservices.htm#height>).

6.4 Track point (T) constructors

The T constructors return a point from the track log.

6.4.1 Type TLCH: launch

```
TLCH()
```

Returns the launch point.

6.4.2 Type TLND: landing

```
TLND()
```

Returns the landing point.

6.4.3 Type TPT: on point time

```
TPT(<pointName>)
```

Returns the track point with the same timestamp as a given point.

<pointName> is the name of a previously defined point

6.4.4 Type TNP: nearest to point

```
TNP(<pointName>, <altitudeThreshold>)
```

Returns the closest valid track point to the specified point.

<pointName> is the name of a previously defined point

<altitudeThreshold>: distance 2D measurement is used below this altitude difference. 3D otherwise.

6.4.5 Type TNL: nearest to point list

```
TNL(<listPoint1>, <listPoint2>, ..., <altitudeThreshold>)
```

Returns the closest valid track point to any the specified points.

<listPoint> is the name of another previously defined point

<altitudeThreshold>: distance 2D measurement is used below this altitude difference. 3D otherwise.

6.4.6 Type TDT: delayed in time

```
TDT(<pointName>, <timeDelay>[, <maxTime>])
```

If <maxTime> is not specified, returns the first valid track point after <timeDelay> minutes have elapsed over the desired point time.

If <maxTime> is specified, returns the last valid track point after <timeDelay> minutes have elapsed over the desired point time but before <maxTime>.

<pointName> is the name of another previously defined point

<timeDelay> desired time delay in minutes

<maxTime> desired time limit. This parameter is optional

6.4.7 Type TDD: delayed in distance

```
TDD(<pointName>, <distanceDelay>[, <maxTime>])
```

If <maxTime> is not specified, returns the first valid track point farther than <distanceDelay> from the desired point.

If <maxTime> is specified, returns the last valid track point before <maxTime> farther than <distanceDelay> from the desired point.

<pointName> is the name of another previously defined point

<distanceDelay> desired distance delay in meters

<maxTime> desired time limit. This parameter is optional

6.4.8 Type TAFI: area first in

```
TAFI(<areaName>)
```

Returns the first valid track point after entering the area for the first time.

<areaName> is the name of a previously defined area

6.4.9 Type TAFO: area first out

```
TAFO(<areaName>)
```

Returns the last valid track point before exiting the area for the first time.

<areaName> is the name of a previously defined area

6.4.10 Type TALI: area last in

```
TALI(<areaName>)
```

Returns the first valid track point after entering the area for the last time.

<areaName> is the name of a previously defined area

6.4.11 Type TALO: area last out

```
TALO(<areaName>)
```

Returns the last valid track point before exiting the area for the last time.

<areaName> is the name of a previously defined area

6.5 Display modes

```
<displayMode>(<display params>)
```

The display mode is optional. If it is not specified, WAYPOINT(blue) is used.

6.5.1 Mode NONE

`NONE()`

The point will not be displayed.

6.5.2 Mode WAYPOINT

`WAYPOINT([<color>])`

Displays a waypoint map overlay.

<color> is one of blue, brown, gray, green, orange, pink, red, violet, white, yellow. If no color is specified, blue will be used.

6.5.3 Mode TARGET

`TARGET(<radius>[, <color>])`

Displays a target map overlay with a circular area of given radius.

<radius> circular area radius in meters.

<color> is one of blue, brown, gray, green, orange, pink, red, violet, white, yellow. If no color is specified, blue will be used.

6.5.4 Mode MARKER

`MARKER([<color>])`

Displays a flag map overlay.

<color> is one of blue, brown, gray, green, orange, pink, red, violet, white, yellow. If no color is specified, blue will be used.

6.5.5 Mode CROSSHAIRS

`CROSSSHAIRS([<color>])`

Displays a crosshairs map overlay.

<color> is one of blue, brown, gray, green, orange, pink, red, violet, white, yellow. If no color is specified, blue will be used.

6.6 Examples

```
point LAUNCH = TLCH() WAYPOINT(green)
point LANDING = TLND() WAYPOINT(red)
point G12 = SLL(42.12, 3.23, 1500) TARGET(100, green)
point G13 = SUTM(31T, 235123, 4612153, 850) TARGET(100, green)
point Best = TNL(G12, G13) MARKER(green)
```

7 RESULT CLASS

```
RESULT <resultName> = <resultType>(<result params>)
```

Computes a task result. The results are assigned to the last defined task.

7.1 Constructors

```
<resultType>(<result params>)
```

7.1.1 Type D2D: distance in 2D

```
D2D(<pointNameA>, <pointNameB>[, <bestPerformance>])
```

Computes the projected distance (in 2D) between two points.

<bestPerformance>: best performance achievable with GPS (R12.22.4). If it's not specified, is assumed to be zero.

7.1.2 Type D3D: distance in 3D

```
D3D(<pointNameA>, <pointNameB>[, <bestPerformance>])
```

Computes the distance in 3D between two points.

<bestPerformance>: best performance achievable with GPS (R12.22.4). If it's not specified, is assumed to be zero.

7.1.3 Type DRAD: relative altitude dependent distance

```
DRAD(<pointNameA>, <pointNameB>, <2DThreshold>[, <bestPerformance>])
```

Computes the distance between two points. If the altitude difference between the two is less than the threshold , 2D distance will be computed (R12.22.3). Otherwise, 3D distance is used.

<bestPerformance>: best performance achievable with GPS (R12.22.4). If it's not specified, is assumed to be zero.

7.1.4 Type DRAD10: relative altitude dependent distance rounded down to decameter

```
DRAD10(<pointNameA>, <pointNameB>, <2DThreshold>[, <bestPerformance>])
```

Computes the distance, rounded down to the decameter, between two points. If the altitude difference between the two is less than the threshold , 2D distance will be computed (R12.22.3). Otherwise, 3D distance is used.

<bestPerformance>: best performance achievable with GPS (R12.22.4). If it's not specified, is assumed to be zero.

7.1.5 Type DACC: accumulated distance

```
DACC(<pointNameA>, <pointNameB>)
```

Computes the sum of the distances between consecutive valid track points from point 1 to point 2. In other words, It computes the total traveled distance between the two points.

7.1.6 Type TSEC: time in seconds

```
TSEC(<pointNameA>, <pointNameB>)
```

Computes the time elapsed in seconds between the two points.

7.1.7 Type TMIN: time in minutes

```
TMIN(<pointNameA>, <pointNameB>)
```

Computes the time elapsed in minutes between the two points.

7.1.8 Type ATRI: area of triangle

```
ATRI(<pointNameA>, <pointNameB>, <pointNameC>)
```

Computes the area in km² of the triangle delimited by the three points.

7.1.9 Type ANG3P: angle between 3 points

```
ANG3P(<pointNameA>, <pointNameB>, <pointNameC>)
```

Computes the direction change between AB and BC (180 - the angle ABC).

7.1.10 Type ANGN: angle to the north

```
ANGN(<pointNameA>, <pointNameB>)
```

Computes the angle between the line AB and the line north-south.

7.1.11 Type ANGSD: angle to a set direction

```
ANGSD(<pointNameA>, <pointNameB>, <setDirection>)
```

Computes the angle between the line AB and a set direction. 0 is north-south.

7.2 Examples

```
RESULT Task3Result=DRAD(Task3Marker,Task3Target,500)
```

8 RESTRICTION CLASS

```
RESTRICTION <restrictionName> = <restrictionType>(<restriction  
params>)
```

Computes a restriction. If a restriction is infringed, the pilot will not achieve a result for the task (group B).

8.1 Constructors

```
<restrictionType>(<restriction params>)
```

8.1.1 Type DMAX: maximum distance

```
DMAX(<pointNameA>, <pointNameB>, <distance>, <description>)
```

The 2D distance between point A and point B must not be greater than the specified distance.

<description> is the description of the infringement (rule number will be included automatically when known).

8.1.2 Type DMIN: minimum distance

```
DMIN(<pointNameA>, <pointNameB>, <distance>, <description>)
```

The 2D distance between point A and point B must not be lesser than the specified distance.

<description> is the description of the infringement (rule number will be included automatically when known).

8.1.3 Type DVMAX: maximum vertical distance

```
DVMAX(<pointNameA>, <pointNameB>, <height>, <description>)
```

The vertical distance between point A and point B must be greater than the specified height.

<description> is the description of the infringement (rule number will be included automatically when known).

8.1.4 Type DVMIN: minimum vertical distance

```
DVMIN(<pointNameA>, <pointNameB>, <height>, <description>)
```

The vertical distance between point A and point B must be lesser than the specified height.

<description> is the description of the infringement (rule number will be included automatically when known).

8.1.5 Type TMAX: maximum time

```
PBP(<pointNameA>, <pointNameB>, <time>, <description>)
```


The point B must not happen more than the the specified time in minutes later than point A.

<description> is the description of the infringement (rule number will be included automatically when known).

8.1.6 Type TMIN: minimum time

```
TMIN(<pointNameA>, <pointNameB>, <time>, <description>)
```

The point B must happen more than the the specified time in minutes later than point A.

<description> is the description of the infringement (rule number will be included automatically when known).

8.1.7 Type TBTOD: before time of day

```
TBTOD(<pointNameA>, <time>, <description>)
```

The point A must happen before the specified time of day.

<description> is the description of the infringement (rule number will be included automatically when known).

8.1.8 Type TATOD: after time of day

```
TATOD(<pointNameA>, <time>, <description>)
```

The point A must happen after the specified time of day.

<description> is the description of the infringement (rule number will be included automatically when known).

8.2 Examples

```
RESTRICTION t2_dmin = DMIN(launch, task02_target, 1000m, "launch too  
close to target")  
RESTRICTION t3_declTime = TATOD(declaration_point, 10:00:00, "late  
declaration")
```

9 PENALTY CLASS

```
PENALTY <penaltyName> = <penaltyType>(<penalty params>)
```

Computes a penalty. The penalty is applied to each affected task. The penalty definitions should be placed after the last task.

9.1 Constructors

```
<penaltyType>(< penalty params>)
```

9.1.1 Type BPZ: blue PZ

```
BPZ(<area>, <description>)
```

If the flight path enters an BPZ area, a penalty is applied to each affected task.

9.1.2 Type RPZ: red PZ

```
RPZ(<area>, <description>)
```

If the flight path enters an RPZ area, a penalty is applied to each affected task.

//TODO: explain better

9.1.3 Type VSMAX: maximum vertical speed

```
VSMAX(<verticalSpeed>, <sensitivity>)
```

This class actually does not apply any paramateres. It is intended for information purposes only.

It adds a remark when the vertical speed is over the given speed for over *sensitivity* seconds.

//TODO: check the value of the applied penalty

10 FULL TASK EXAMPLES

10.1 Judge Declared Goal (nearest track point)

```
TASK Task02JDG = JDG(2)
POINT Task02target=UTM(31T,325000,4612000,650)
FILTER Task02scoringPeriod1=AFTER(09:00:00)
FILTER Task02scoringPeriod2=BEFORE(10:00:00)
POINT Task02marker=TNP(Task02target)
RESULT Task02result=DRAD(Task02target,Task02marker,500)
```

The first line defines the task type, JDG. The second line defines the target. The next two lines define the scoring period from 9:00 to 10:00. The fifth line defines the nearest track point to the target. The last line computes the result, a relative altitude dependent distance with an altitude limit of 500ft.

10.2 Hesitation Waltz (logger marker drop)

```
TASK Task03HWZ=HWZ(3)
POINT Task03t1=UTM(31T,325000,4612000,650)
POINT Task03t2=UTM(31T,325500,4612000,650)
POINT Task03t3=UTM(31T,325000,4612500,650)
POINT Task03marker=MVMD(3)
POINT Target=LNP(Task03marker,Task03t1,Task03t2,Task03t3)
RESULT Result=D3D(Marker,Target)
```

The first line defines the task type, HWZ. The next three lines define the targets. The fifth line defines the logger marker drop #3. The sixth line defines the closest target to the marker. The last line computes the result, a distance in 3D.

10.3 Gordon Bennett Memorial (logger marker drop)

```
TASK Task1=GBM(1)
AREA T1area=Area(task1area.trk)
POINT T1goal=SUTM(31T,3166732,4613455,350)
FILTER T1scoringPeriod=BEFORE(10:00:00)
POINT T1marker=MVMD(1)
RESULT=DRAD(T1Goal,T1marker,500)
```

The first line defines a GBM task. The second line defines the scoring area from a track file. The third line defines the goal, a fixed UTM point. The next line defines a scoring period until 10:00. The next defines the logger marker #1 (note that the scoring period filter also applies to VMDs). The last line computes a relative altitude dependent distance with a threshold of 500ft.

10.4 Maximum Distance Double Drop (first in / last out)

```
TASK Task4=XDD(4)
AREA T4area=Area(task4area.trk)
FILTER T4scoringPeriod=BEFORE(10:00:00)
POINT T4A=TAFI(T4area)
POINT T4B=TALO(T4area)
RESULT t4result=D2D(T4A,T4B)
```

The first line defines the task type, XDD. The second line defines the task area from a track file. The third line applies a filter: the valid track points are those before 10:00:00 (task scoring period up to 10:00). The next line defines the first scoring point, the first-in point. The next defines the second scoring point, the last-out point. The last line computes the result, a distance in 2D.

11 BUGS AND IDEAS

The point constructors LNP, TNP and TNL do not specify what kind of distance should be used (d2d, d3d or drad). Consider constructors that specify the distance method.

Example: LNPd2D, LNPd3D, LNPdRAD, TNPD2D, TNPD3D, TNPD RAD, etc.

Think about a method to score a 3DS task allowing entering and exiting the area multiple times.