StatusMFD Manual

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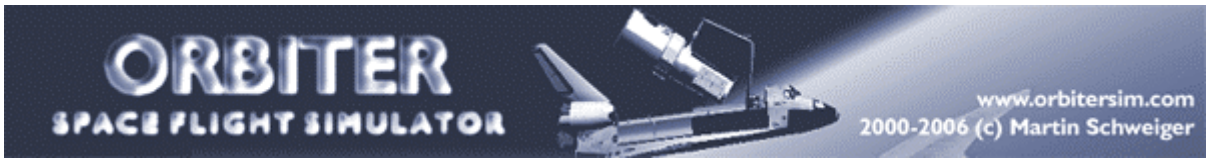
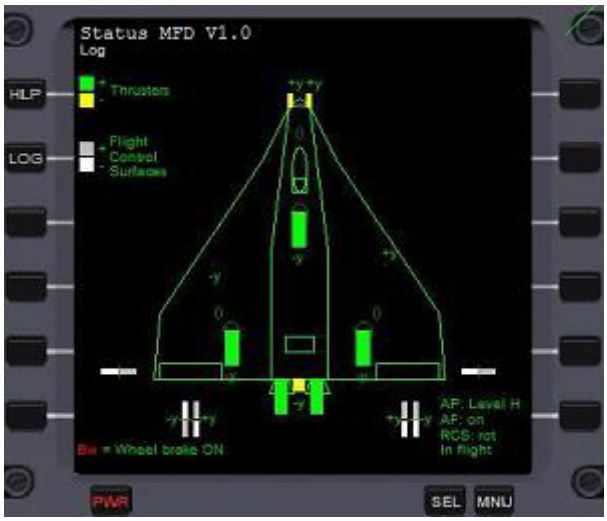




Contents

1 Introduction

The StatusMFD will depict thrusters, control surfaces and more, graphically on a generic spacecraft schematic with an optional help overlay.

2 Overview

This MFD is compatible with at least the following spacecrafts:
DG, **DG MkIV**, **DG-S**, **DG-R**, **DGIV**, **DG EX**, **DG-XR1**, **XR5 Vanguard**, **Space Shuttle Atlantis**

Shuttle rotations/translations in positive directions (*CW*, *Up*, *Forward*, *Right*) are in color green (thrusters) and color gray (control surfaces), in negative directions color yellow (thrusters) and color white (control surfaces).

The StatusMFD monitors the following functions:

Ÿ Main thrusters (*left*, *right*)
Ÿ Retro thrusters (*left*, *right*)
Ÿ Hover thrusters with *-y* notations (*forward*, *aft*)
Ÿ Attitude thrusters with *+y/-y/+z/-z* notations
Ÿ ROT: yaw, pitch, bank
Ÿ LIN: Moves transversal and along path, up and down
Ÿ Rudders (vertical needles on range bars)
Ÿ Elevators with *+y/-y* notations (horizontal needles on range bars)
Ÿ Ailerons with *+y/-y* notations (horizontal needles on range bars)
Ÿ Wheel brakes (flags *left*, *right*)
Ÿ Autopilot navigational sequences
Ÿ AF ctrl: *off*, *pitch*, *on*
Ÿ RCS mode: *off*, *rot*, *lin*
Ÿ Flight status: *Landed*, *In flight*, *Docked*

An help overlay can be activated through the button 

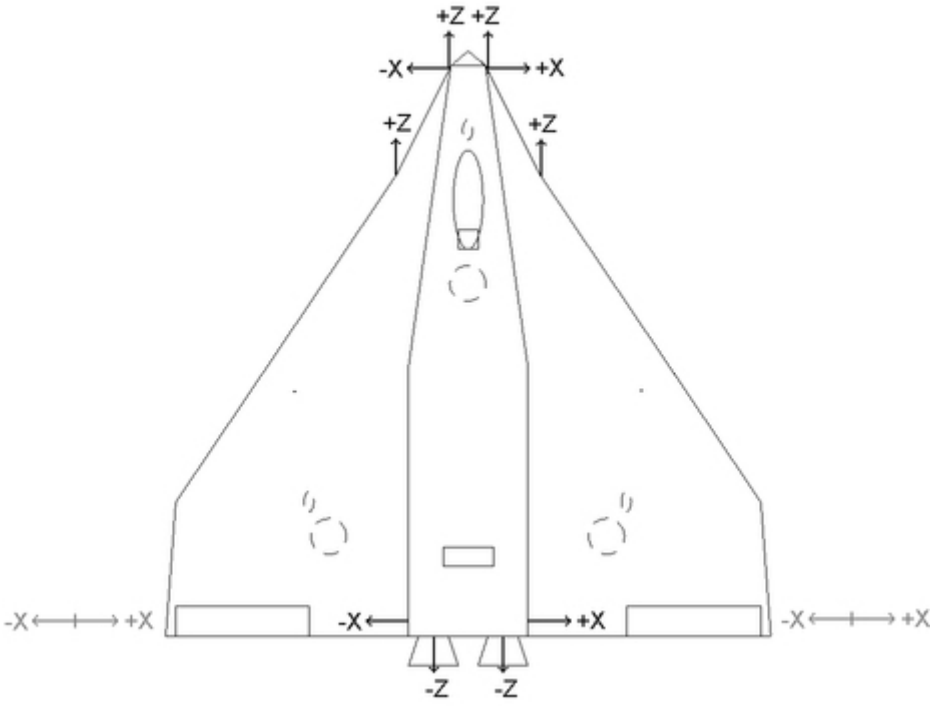
(toggle). The exhaust display for the attitude thrusters can be set to extend linearly or logarithmic (press toggle button 

). Logarithmic will make the exhaust display more sensitive to low thrusts. Particularly useful when using the AP.

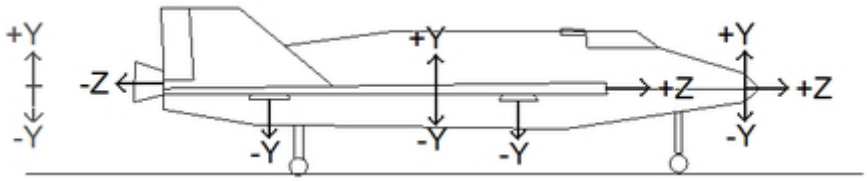
3 Keyboard interface

Shift F1	Open a menu for left/right MFD mode selection.
Shift F	Activate the StatusMFD mode.
Shift '	Open the help menu.
Shift H	Open the help overlay.
Shift L	Change to logarithmic extension of exhausts.

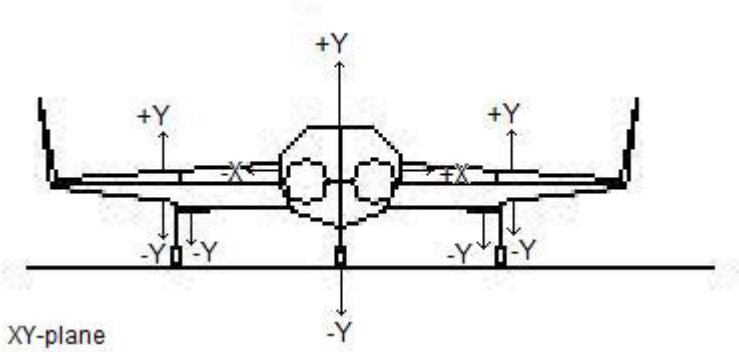
4 Coordinate Systems



XZ-plane



ZY-plane



XY-plane

The coordinate systems are local for each thruster (black) and control surfaces (gray), though they are all oriented in the same way. The first figure displays the *XZ-plane*, the second figure the *ZY-plane*, and the third figure the *XY-plane.*

Z-axis is along the fuselage and flight path, *X-axis* is transversal (lateral motion) to the *Z-axis*, and *Y-axis* is vertical (up & down motion) to the *Z-axis*.

The axes notations indicate in which directions the exhausts extend or the control surfaces move.

5 Thrusters

Thrusters consist of main thrusters, retro thrusters and attitude thrusters.

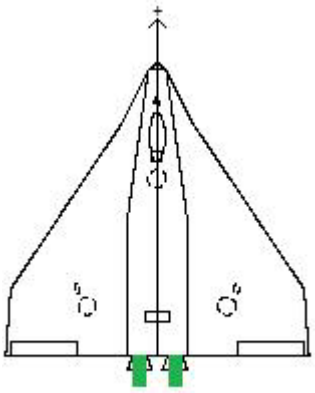
5.1 Main thrusters

StatusMFD can display none (e.g. **Dragonfly**), one (e.g. **Shuttle PB**), two (e.g. **DeltaGlider**) or three (e.g. **Space Shuttle** with **S**olid **R**ocket **B**oosters) thruster groups.

NOTE: When the main tank is separated (either automatically or jettisoned) from the **Space Shuttle**, the thrust is transferred from the three main thrusters (Main engine cluster) to the two OMS (Orbital Maneuvering System) pods.

The first (left) and second (right) main thruster group can be controlled separately.

The forward accelerating motion (**+** direction) of the spacecraft is represented through green exhausts.



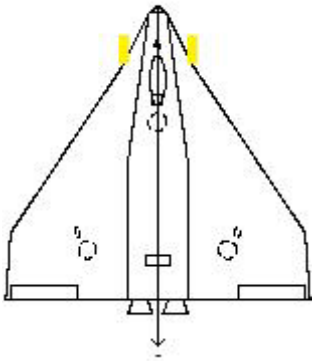
5.2 Retro thrusters

If the spacecraft is equipped with retro thrusters their exhausts will be displayed.

The first (left) and second (right) retro thruster group can be controlled separately.

NOTE: For some spacecrafts you have to open the retro doors first.

The backward accelerating motion (**-** direction) of the spacecraft is represented through yellow exhausts.



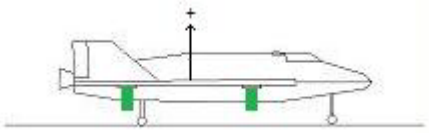
5.3 Hover thrusters

If the spacecraft is equipped with hover thrusters their exhausts will be displayed.

The first (forward) and second (aft) hover group can be controlled separately.

NOTE: For some spacecrafts you have to open the hover doors first.

The lifting accelerating motion (**+** direction) of the spacecraft is represented through green exhausts.



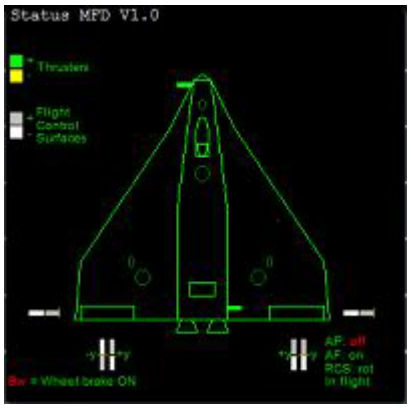
5.4 Attitude thrusters

The attitude thrusters are used for rotational motions (yaw, pitch, bank) and translational motions (forward & backward, left & right, up & down). The corresponding mode is selected through the RCS(*Reaction Control System*) switch.

NOTE: The right mode must be set even if using the Remote Vessel Control where the buttons for rotational and linear thrusters are separate from each other (I.e. no switch is used on the remote control).

NOTE2: The RCS must be set to normal configuration for **XR5 Vanguard**.

5.41 Yaw thrusters

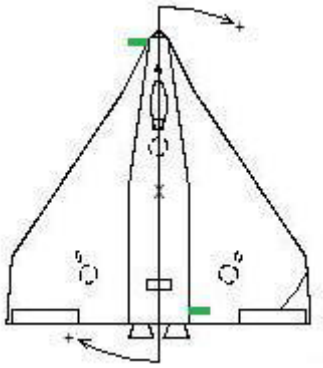


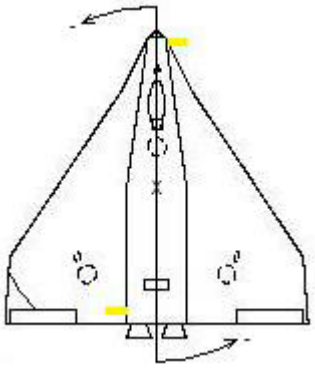
CW moment (+)

CCW moment (-)

The attitude thrusters used for yaw motions are cross linked on the fuselage.

The spacecraft rotates either CW (+ direction: green) or CCW (- direction: yellow) on the XZ-plane around the spacecraft's center.





If not using the autopilot navigational sequences the attitude thrusters must be set to work in rotational mode (RCS: rot)

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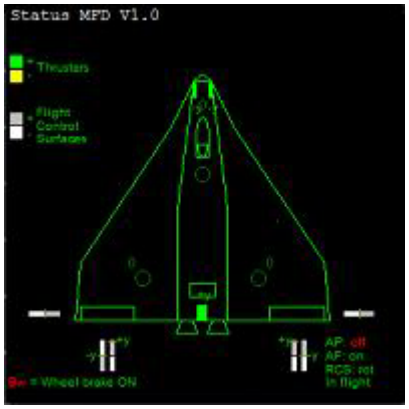
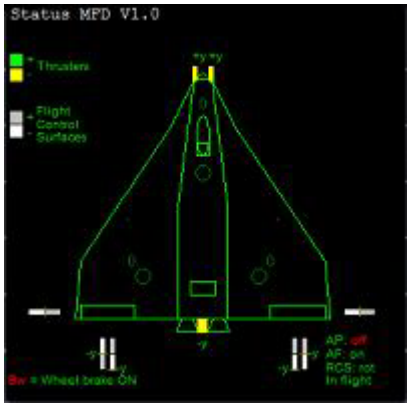
5.42 Pitch thrusters



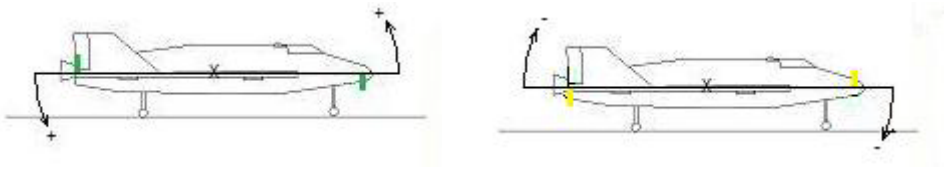
Up moment (+)



Down moment (-)

The pitch attitude thrusters are placed at the front and at the rear of the spacecraft.

The pitch thrusters rotates the nose up (**+** direction: green) or down (**-** direction: yellow) on the ZY-plane.



If not using the autopilot navigational sequences the attitude thrusters must be set to work in rotational mode (RCS: rot).

5.43 Bank thrusters

CW moment (+)

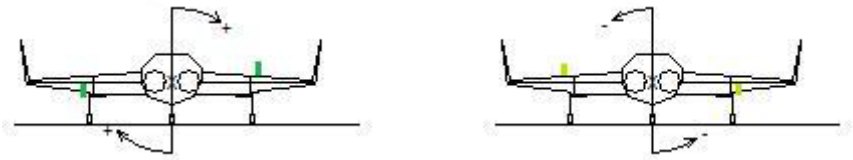
CCW moment (-)

The bank attitude thrusters are cross linked and positioned to the left and right of the spacecraft's center of gravity.

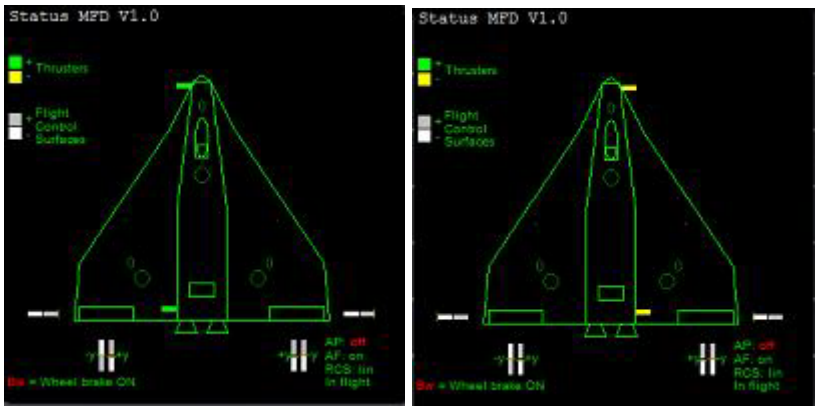
The bank thrusters tilt the spacecraft either CW (**+** direction: color green) or CCW (**-** direction: color yellow)

on the *XY- plane*.

If not using the autopilot navigational sequences the attitude thrusters must be set to work in rotational mode (RCS: rot).



5.44 Right/Left thrusters

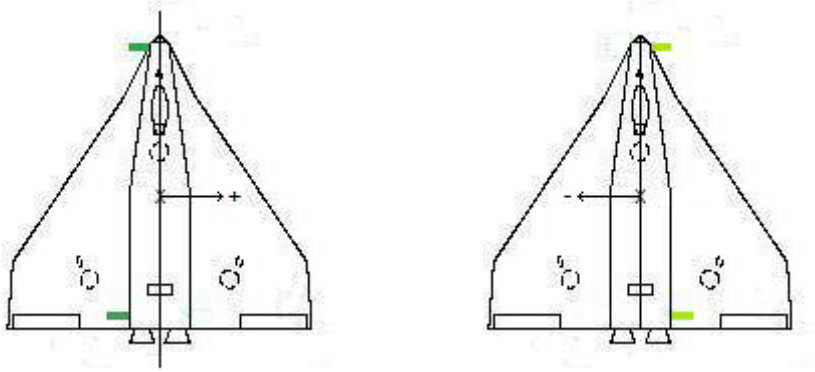


Right moment (+) Left moment (-)

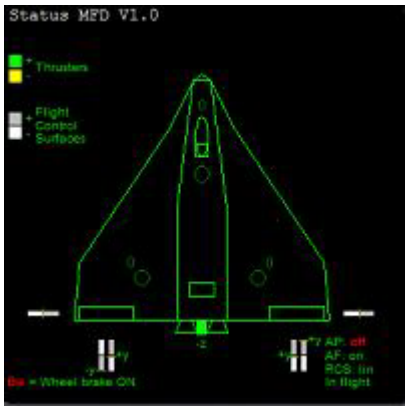
The right/left attitude thrusters are placed on the left and right side (forward, aft) in parallel pairs of the spacecraft's fuselage.

The right attitude thrusters move the spacecraft to the right (**+** direction: color green). The left attitude thrusters move the spacecraft to the left (**-** direction: color yellow).

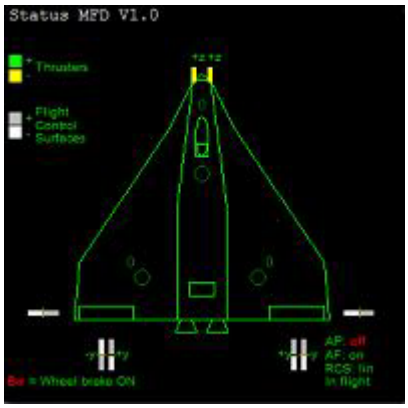
The attitude thrusters must be set to work in linear (translatorial) mode (RCS: lin).



5.45 Forward/Back thrusters



Forward moment (+)

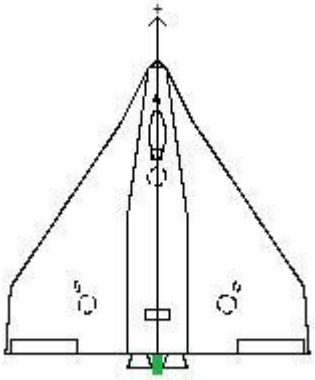


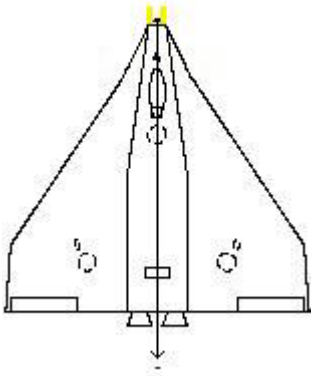
Back moment (-)

The forward/back attitude thrusters are placed at the front and at the rear respectively of the spacecraft.

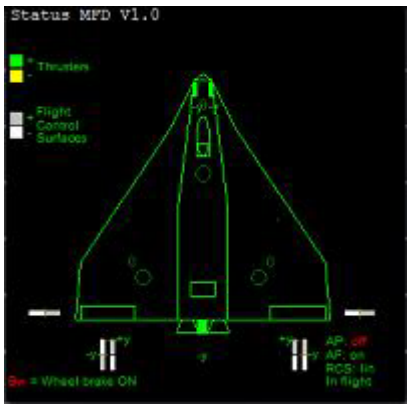
The forward attitude thrusters move the spacecraft forward (**+** direction: color green). The back attitude thrusters move the spacecraft backward (**-** direction: color yellow).

The attitude thrusters must be set to work in linear mode (RCS: lin).

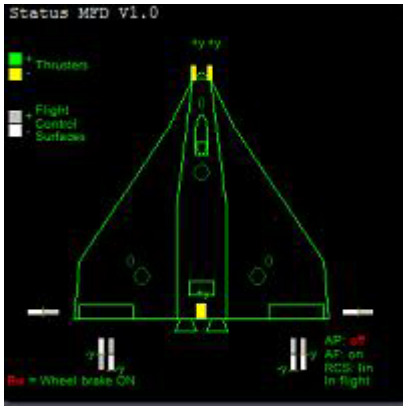




5.46 Up/Down thrusters



Up moment (+)

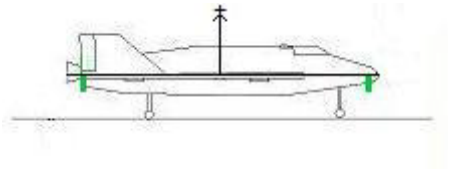


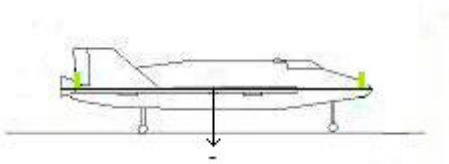
Down moment (-)

The up/down attitude thrusters are placed at the front and at the rear in parallel pairs of the spacecraft.

The up attitude thrusters move the spacecraft up (**+** direction: color green). The down attitude thrusters move the spacecraft down (**-** direction: color yellow).

The attitude thrusters must be set to work in linear mode (RCS: lin).

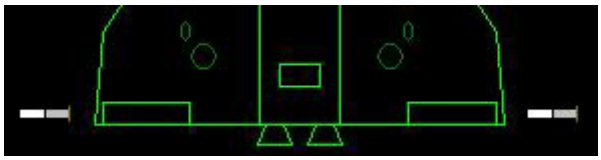


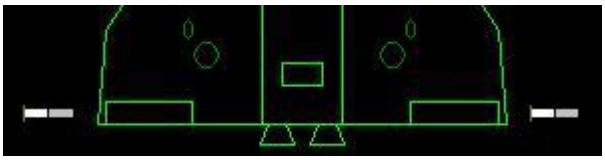


6 Control Surfaces

The aerodynamic control surfaces controls the spacecraft during atmospheric flights. They can slip the spacecraft sideways, pitch or bank it (through the rudders, elevators and ailerons). The applicable mode is selected via the AF(*Air Frame*) switch.

6.1 Rudders

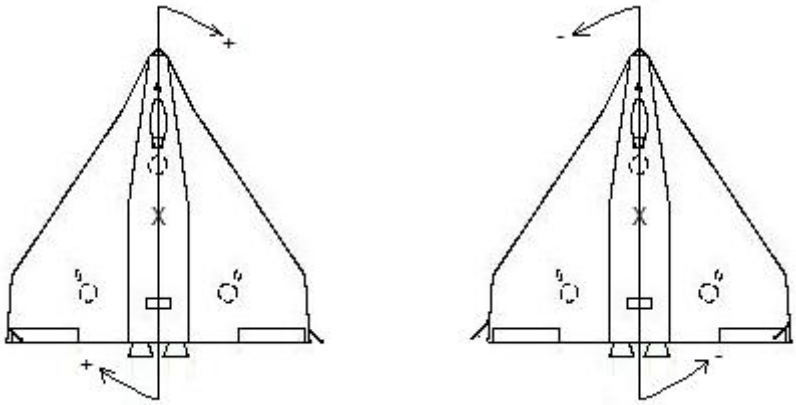

Rotate right (+)


Rotate left (-)

The rudders - represented through needles on two horizontal bars - are placed in the rear tail(s) of the spacecraft.

The rudders are in neutral position when the needles are at the center of the horizontal bars. When the needles move to the right (**+** direction: color gray), the spacecraft turns right. Correspondingly, it turns left if the needles move to the left (**-** direction: color white).

The rudders only work if the aerodynamic surface controls are activated (AF: on).



6.2 Elevators

Pitch up (+)

Pitch down (-)

The elevators - represented by needles on the two inner vertical bars - are placed at the left and right rear of the wings.

The elevators are in neutral position when the needles are at the center of the vertical bars. When the needles move up, the spacecraft pitch up (**+** direction: color gray). If they move down, the spacecraft pitch down (**-** direction: color white).

The elevators only work if the aerodynamic surface controls are set to pitch or on (AF: pitch, on).

6.3 Ailerons

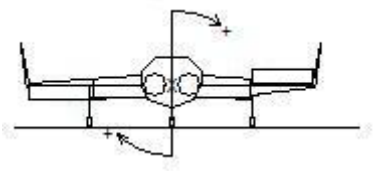
Bank right (+)

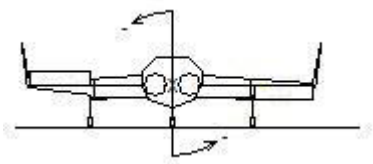
Bank left (-)

The ailerons - represented by needles on the two outer vertical bars - are placed at the left and right rear of the wings.

The ailerons are in neutral position when the needles are at the center of the vertical bars. When the left needle moves down and the right up, the spacecraft banks right (**+** direction: color gray). If the left needle moves up and the right down, the spacecraft banks left (**-** direction: color white).

The ailerons only work if the aerodynamic surface controls are set to on (AF: on).





7 Status area

The status area is in the bottom right of the display. It shows the functions which are currently in use, such as the autopilot (*AP*) navigational sequences (see below), if the air frame (*AF*) buttons are set to *off*, *pitch* or *on* and the mode of the reaction control system (*RCS*): *off*, *rot*(ation) or *lin*(ear). The schematic on the MFD will also respond accordingly.

The last line in the status area shows whether the spacecraft is *In flight*, *Docked* or has *Landed*.

7.1 Autopilot Navigational Sequences

The seven standard autopilot buttons will show the flight computer's mode on the first line in the status area: *Kill Rot*(ation), *Prograde*, *Retrograde*, *OrbN(+)* (Orbit normal), *OrbN(-)* (Orbit antinormal), *Level H*(orizon)

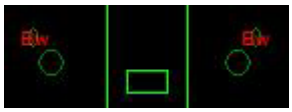
and *Hold Alt* (itude).

When the AP is used the MFD works independent of the mode setting for the attitude thrusters. For example, if the RCS-switch is set to rotational or linear mode. *Hold Alt*, however, uses hovers which are not attitude thrusters, therefore the attitude thrusters can be used freely and set to the mode that fit.

NOTE: Additional AP-functions will not be recognized.

8 Other

8.1 Wheel brakes

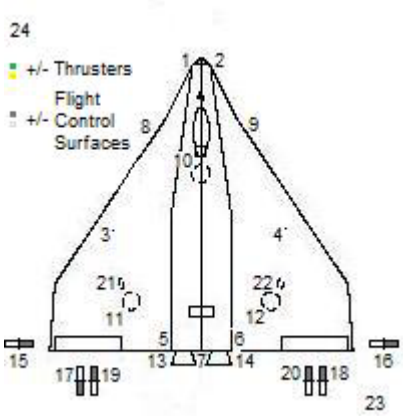


When the wheel brakes are applied, it will be noted above the spacecraft schematic's wheels (left and right wheel's brake status).

8.2 Help overlay

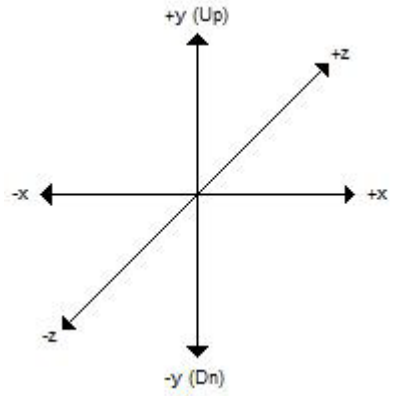
A help overlay can be activated through the HLP button or by pressing Shift H.

All parts of the MFD are identified and explained as below:

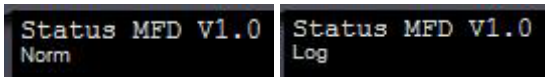


1. Yaw right/Pitch up/dn/Move up/dn/bck/right
2. Yaw left/Pitch up/dn/Move up/dn/bck/left
3. Bank right/left
4. Bank left/right
5. Yaw left/Move right
6. Yaw right/Move left
7. Pitch dn/up/Move up/dn/fwd

8. Retro thrust left
9. Retro thrust right
10. Hover thrust fwd
11. Hover thrust aft
12. Hover thrust aft
13. Main thrust left
14. Main thrust right
15. Rudder
16. Rudder
17. Aileron
18. Aileron
19. Elevator
20. Elevator
21. Wheel brake left
22. Wheel brake right
23. Autopilot/AF ctrl/RCS mode/Flight Status
24. Normal/Logarithmic exhaust extension



8.3 Logarithmic/Linear exhaust extension

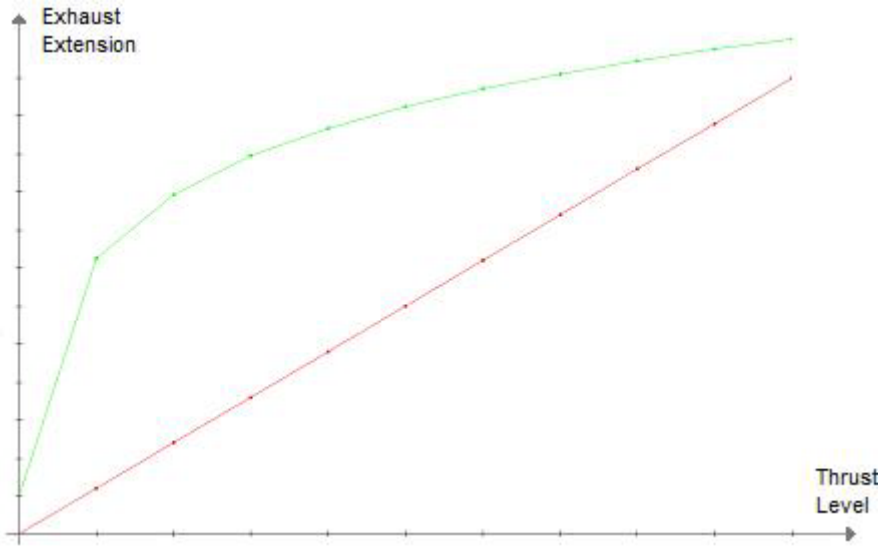


The length of the exhausts from attitude thrusters can be changed through the button 

. The actual setting is showed at the upper left of the display.

In normal mode the exhausts extend linearly (*lin-lin*), in logarithmic mode the mapping to the exhausts is base-10th logarithmic (*lin-log*).

As the sensitivity to the thrust levels increase with the logarithmic setting, it is especially convenient when using the autopilot which typically gives low thrusts. Moreover, when the thrust levels are above zero, the exhausts are at least always noticeable.



(The diagram shows the number of exhaust extension pixels on the vertical axis, where each tick mark is one pixel's increase , and the horizontal axis represent the thrust levels in 1/10th unit's increase for each tick mark. The red curve is lin-lin (Norm), and the green curve is lin-log10 (Log))