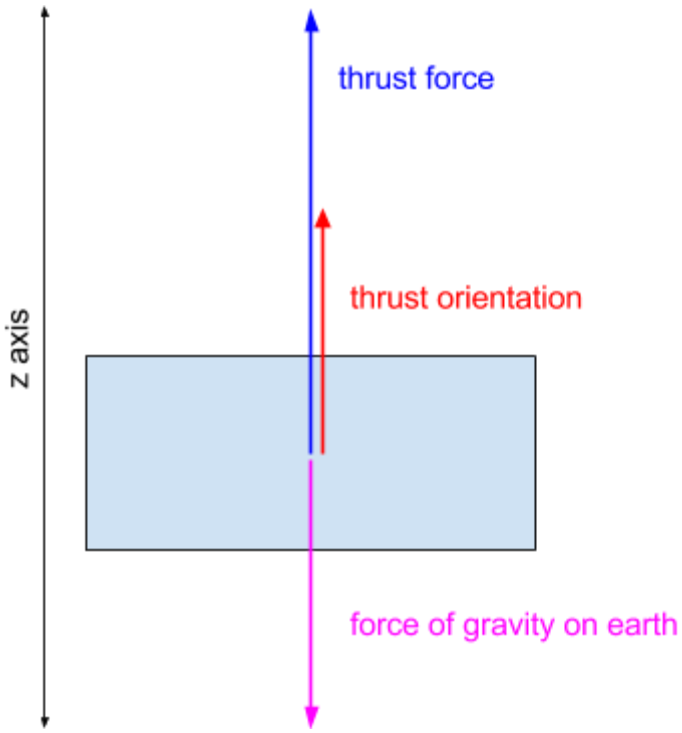
# Level 3

Now that you are officially a pilot, things get more interesting. You will have to **maneuver each of your drones to a different target**. A target is considered reached if your drone has landed closer than 2m to it.

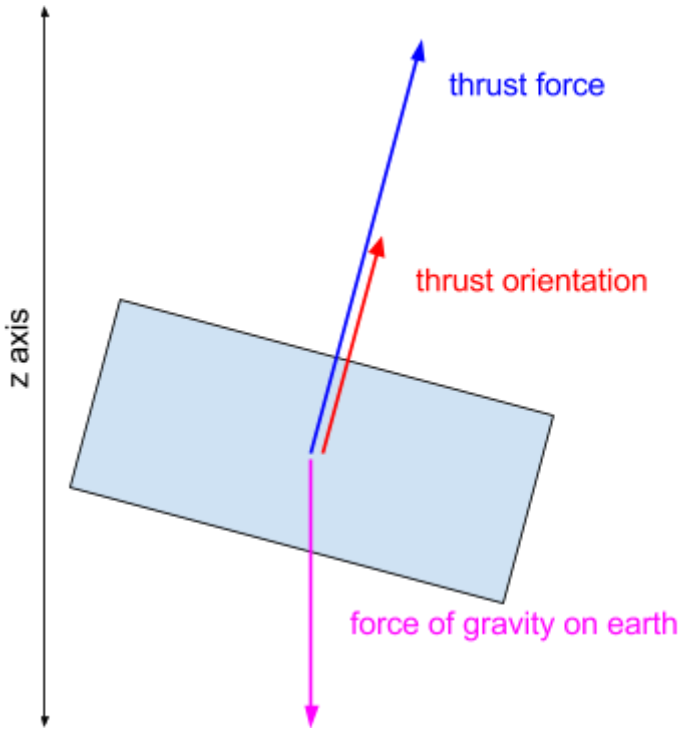
You will have to make sure that your drones do not collide with each other. Also, it is not guaranteed that a target is not blocked by other drones. Maybe you have to move them around.

## Physics

As your drones will now also have to move horizontally, you might want to consider the thrust orientation:




In this image you can see a projection of a drone that is climbing (increasing height). Its rotors spin to create a thrust force which works against gravity to lift the drone.




In order for your drone to move along the x or y axis, you need to “tilt” it. This can be done by changing the thrust orientation.

Remember that you can change the magnitude of the thrust force by adjusting the throttle.

## Model in the Simulator

1. Drone
    a. ID (integer)
    b. Position (3D, floating point)
    c. Velocity (3D, in m/s for every axis, floating point)
    d. Thrust orientation (3D, floating point)

## Initial Input Lines sent by the Simulator

| | |
|---|---|
| *N* | the number of drones available |
| *x y* | targets for the drones (each on a separate line, so you will get *N* lines). Targets are in order corresponding to drone IDs. |

| **Example** | |
|---|---|
| `1` | There is one drone to control. |
| `50.0 50.0` | The drone has to land in the center of the map to complete this level. |

# New Commands

In order to fly in a specific direction, you will need to tilt the drone so that it points in the right direction.

Note that the thrust vector is normalized before it is combined with the rotor power to calculate the thrust vector. Therefore increasing the magnitude of the thrust orientation vector makes no sense. Use a combination of thrust orientation vector and throttle to control your drone. Be also aware that the thrust orientation vector must always have a non-zero length.

| **Request** | **Response** | **Description** |
|---|---|---|
| `TURN` *`N x y z`* | | where *N* is drone ID, and *x*, *y*, *z* is the new thrust orientation vector. |
| | `OK` | the simulator will acknowledge that it handled your command. |

| **Example** | | |
|---|---|---|
| `TURN 0 1.0 1.0 0.0` | | Change the thrust orientation vector for diagonal movement (on the XY-plane) away from zero (affects only drone 0). |
| | `OK` | The thrust orientation vector was overwritten. |