



# PMDG 737NGX

## Software Developers Kit

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## PMDG 737NGX SOFTWARE DEVELOPMENT KIT

The purpose of the PMDG 737NGX SDK is to allow users a clean, simple methodology for creating third party applications that interface with the PMDG 737NGX series of software products.

This SDK is designed primarily with the intent to allow home-cockpit hardware manufacturers to create simple interfaces so that their hardware can be fully compatible with the PMDG 737NGX series of products without having to plumb the depths of memory in search of bits.

We anticipate that other uses for this SDK will come forward that we have not yet imagined, and we encourage creative parties to reach out to us if there are specific items that they feel would enhance their ability to provide after-market products to support the PMDG 737NGX line of products.

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The PMDG 737NGX SDK provides an interface which can be used by third party software to monitor the state of the PMDG 737NGX and to control certain cockpit functions.

The SDK provides read-only access to a data block containing the state of most PMDG 737NGX controls and indications. It also allows controlling the PMDG 737NGX by triggering control events that request operation of one or more items in the PMDG 737NGX.

The communication between the third party add-on application and the PMDG 737NGX is done using the Microsoft SimConnect library that comes standard with the Microsoft Flight Simulator X. Please refer to the SimConnect SDK documentation for advice on the creation of a SimConnect application.



The NGX SDK includes an example SimConnect application written in C++ that you may use as a starting point, but it is by no means a complete or final authority on the subject of interfacing with SimConnect.

## SDK CONTENTS

The PMDG 737NGX SDK includes the following files:

- **PMDG\_NGX\_SDK.h** is the SDK header file. It defines the data structures and events used to communicate with the PMDG 737NGX. You should `#include` this file in your application.
- **PMDG\_NGX\_ConnectionTest.cpp** is an example application. It demonstrates how to connect to the NGX via SimConnect, read the state of several PMDG 737NGX switches and use different methods to send control events to the PMDG 737NGX.

## ENABLING DATA OUTPUT

The PMDG 737NGX is already set up to listen for control events that may originate from an external application. However, since providing state data to third party applications does consume a small amount of processor attention, **we have disabled this communication output by default** since the vast majority of our users will not be using SDK driven applications.

To enable the data communication output, you will need to open the file **737NGX\_Options.ini** that is located in the folder <FSX ROOT>\PMDG\PMDG 737 NGX

Once this folder is open, add the following two lines to the bottom of the file:

```
[SDK]  
EnableDataBroadcast=1
```

When you release your product to customers, it will be necessary for your application installation to set this parameter on the customer's installation, else they will not see data connectivity between your application and the PMDG 737NGX.



## READING CONTROL AND INDICATOR STATES

The PMDG 737NGX keeps the state of most of its controls and indicators in a data block that can be read by external applications. (Provided that this capability is enabled, as described on the previous page.)

Your application will use SimConnect to request data from this block. The contents of this data block are defined by struct `PMDG_NGX_Data` in the `PMDG_NGX_SDK.h` file.

The members are self-explanatory and we have added comments to clarify wherever the variable is not a simple boolean.

The `PMDG_NGX_ConnectionTest.cpp` sample code demonstrates the access to the PMDG 737NGX.

For example, the following code from `testCommunication()` function requests data from the PMDG 737NGX data block. The data is sent *whenever it changes*:

```
// Associate an ID with the PMDG data area name
hr = SimConnect_MapClientDataNameToID (hSimConnect, PMDG_NGX_DATA_NAME,
PMDG_NGX_DATA_ID);

// Define the data area structure - this is a required step
hr = SimConnect_AddToClientDataDefinition (hSimConnect,
PMDG_NGX_DATA_DEFINITION,
    0, sizeof(PMDG_NGX_Data), 0, 0);

// Sign up for notification of data change.
// SIMCONNECT_CLIENT_DATA_REQUEST_FLAG_CHANGED flag asks for the data to
be sent
// only when some of the data is changed.
hr = SimConnect_RequestClientData(hSimConnect, PMDG_NGX_DATA_ID,
DATA_REQUEST, PMDG_NGX_DATA_DEFINITION,
    SIMCONNECT_CLIENT_DATA_PERIOD_ON_SET,
SIMCONNECT_CLIENT_DATA_REQUEST_FLAG_CHANGED, 0, 0, 0);
```





Then, the event dispatch procedure handles the PMDG 737NGX state data sent by SimConnect:

```
void CALLBACK MyDispatchProc(SIMCONNECT_RECV* pData, DWORD cbData, void
*pContext)
{
    // Receive and process the NGX data block
    switch(pData->dwID)
    {
        case SIMCONNECT_RECV_ID_CLIENT_DATA:
            {
                SIMCONNECT_RECV_CLIENT_DATA *pObjData =
                (SIMCONNECT_RECV_CLIENT_DATA*)pData;

                switch(pObjData->dwRequestID)
                {
                    case DATA_REQUEST:
                        {
                            PMDG NGX_Data *pS =
                            (PMDG NGX_Data*)&pObjData->dwData;
                            ProcessNGXData(pS);
                            break;
                        }
                    }
                }
            }
    }
}

// This function is called when NGX data changes
void ProcessNGXData (PMDG NGX_Data *pS)
{
    // test the data access:
    // get the state of switches and save it for later use
    if (pS->LTS_TaxiSw != NGX_TaxiLightSwitch)
    {
        NGX_TaxiLightSwitch = pS->LTS_TaxiSw;
        if (NGX_TaxiLightSwitch)
            printf("\nTAXI LIGHTS: [ON]");
        else
            printf("\nTAXI LIGHTS: [OFF]");
    }
}
```




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## CONTROLLING THE PMDG 737NGX

### Control Event Parameters:

Your application can operate the PMDG 737NGX controls by sending special commands. These commands contain both a **control event code** and a **numeric parameter**.

The **control event code** defines the aircraft control, switch, selector or knob that is to be operated. The control events are listed in the PMDG\_NGX\_SDK.h file.

The **numeric parameter** can be used to send a switch position, or a control parameter to the PMDG 737NGX.

Example 1: Sending a value via the **numeric parameter** will tell the simulation to place the switch/knob/lever/control into a specific position. All values below 8192 are treated as a numeric position to which the item being controlled should be placed.

You can determine the positions of various knobs by looking PMDG\_NGX\_SDK.h file. Boolean parameters have no position information listed, but non Boolean parameters will include position information in the comments following the variable declaration:

```
bool          CDU_annunOFST[ 2 ] ;
unsigned char CDU_BrtKnob[ 2 ] ; // Position 0...127
```

Example 2: Alternatively the parameter can be one of the following mouse actions:

- MOUSE\_FLAG\_RIGHTSINGLE
- MOUSE\_FLAG\_MIDDLESINGLE
- MOUSE\_FLAG\_LEFTSINGLE
- MOUSE\_FLAG\_RIGHTDOUBLE
- MOUSE\_FLAG\_MIDDLEDOUBLE
- MOUSE\_FLAG\_LEFTDOUBLE
- MOUSE\_FLAG\_RIGHTDRAG
- MOUSE\_FLAG\_MIDDLEDRAG
- MOUSE\_FLAG\_LEFTDRAG
- MOUSE\_FLAG\_MOVE
- MOUSE\_FLAG\_DOWN\_REPEAT
- MOUSE\_FLAG\_RIGHTRELEASE



- MOUSE\_FLAG\_MIDDLERELEASE
- MOUSE\_FLAG\_LEFTRELEASE
- MOUSE\_FLAG\_WHEEL\_FLIP
- MOUSE\_FLAG\_WHEEL\_SKIP
- MOUSE\_FLAG\_WHEEL\_UP
- MOUSE\_FLAG\_WHEEL\_DOWN

Sending one of these parameters will simulate the associated mouse action being acted upon the switch/knob/control. This technique can be used to rotate knobs or to toggle switches, move levers, etc.

### **Control Methods:**

There are two methods of sending control events to the PMDG 737NGX. One involves using the PMDG 737NGX data block, and the other involves sending FSX events to the simulation, where they are picked up and processed by the PMDG 737NGX.

Which method you choose will depend on your application and preferred methods. Both will yield the same results.

Method 1 uses the special control data area monitored by the PMDG 737NGX. (This area was described a few pages ago.) The data area is initially empty. To send an event, your application writes the event ID and parameter to this data area. The PMDG 737NGX detects non-zero data and processes the corresponding event, after which it zeroes the control data area in order to prepare it for future events.

*Note that your application should wait until the command area is zero before placing another command there.*

### **METHOD 1 EXAMPLE:**

The connection to the NGX control data area is set up like this:

```
PMDG NGX_Control Control;
...

Control.Event = 0;
Control.Parameter = 0;

// Associate an ID with the PMDG control area name
hr = SimConnect_MapClientDataNameToID (hSimConnect,
PMDG NGX_CONTROL_NAME, PMDG NGX_CONTROL_ID);

// Define the control area structure - this is a required step
hr = SimConnect_AddToClientDataDefinition (hSimConnect,
PMDG NGX_CONTROL_DEFINITION,
```



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```

    0, sizeof(PMDG NGX_Control), 0, 0);

// Sign up for notification of control change.
hr = SimConnect_RequestClientData(hSimConnect, PMDG NGX_CONTROL_ID,
    CONTROL_REQUEST, PMDG NGX_CONTROL_DEFINITION,
SIMCONNECT_CLIENT_DATA_PERIOD_ON_SET,
    SIMCONNECT_CLIENT_DATA_REQUEST_FLAG_CHANGED, 0, 0, 0);

```

A code in the dispatch procedure keeps the data synchronized to NGX:

```

case CONTROL_REQUEST:
{
    // keep the present state of Control area to know if the server
had received and reset the command
    PMDG NGX_Control *pS = (PMDG NGX_Control*)&pObjData->dwData;
    Control = *pS;
    break;
}

```

This sample code sets the TAXI lights switch:

```

// Send another command only if there is no active command request
// and previous command has been processed by the NGX
if (Control.Event == 0)
{
    Control.Event = EVT_OH_LIGHTS_TAXI;           // = 69749
    if (New_TaxiLightSwitch)
        Control.Parameter = 1;
    else
        Control.Parameter = 0;
    SimConnect_SetClientData (hSimConnect, PMDG NGX_CONTROL_ID,
    PMDG NGX_CONTROL_DEFINITION,
        0, 0, sizeof(PMDG NGX_Control), &Control);
}

```

In this case, the transmitted event is EVT\_OH\_LIGHTS\_TAXI. The available events are listed in the PMDG NGX\_SDK.h file. The control parameter in this case is either 0 or 1 and determines the position the switch should be placed into.

Note how the code checks that the NGX has no pending events to process by checking that Control.Event == 0.

Method 2 is to directly generate the corresponding FSX event, which will be processed by the PMDG 737NGX. The advantage to using this method is that it allows sending one or several events at once without waiting for previous events to be received and processed.

The catch, however, is that it involves defining IDs and using `SimConnect_MapClientEventToSimEvent` functions for each unique control before you can trigger corresponding events.

#### METHOD 2 EXAMPLE:

This is how the direct event triggering is set up:

```
static enum EVENT_ID {
    EVENT_LOGO_LIGHT_SWITCH,
    EVENT_FLIGHT_DIRECTOR_SWITCH,
    EVENT_HEADING_SELECTOR,
};

...

//EVT_OH_LIGHTS_LOGO
hr = SimConnect_MapClientEventToSimEvent(hSimConnect,
EVENT_LOGO_LIGHT_SWITCH, "#69754");

//EVT_MCP_FD_SWITCH_L
hr = SimConnect_MapClientEventToSimEvent(hSimConnect,
EVENT_FLIGHT_DIRECTOR_SWITCH, "#70010");

//EVT_MCP_HEADING_SELECTOR
hr = SimConnect_MapClientEventToSimEvent(hSimConnect,
EVENT_HEADING_SELECTOR, "#70022");
```

The "#69754" is the numerical value for `EVT_OH_LIGHTS_LOGO`, which is defined as

```
#define EVT_OH_LIGHTS_LOGO (THIRD_PARTY_EVENT_ID_MIN + 122)
```

and `THIRD_PARTY_EVENT_ID_MIN` is equal to 69632.

After this, the logo lights can be switched by triggering the FSX event:



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```
int parameter = 1; // new switch position
SimConnect_TransmitClientEvent(hSimConnect, 0, EVENT_LOGO_LIGHT_SWITCH,
parameter,
SIMCONNECT_GROUP_PRIORITY_HIGHEST,
SIMCONNECT_EVENT_FLAG_GROUPID_IS_PRIORITY);
```

Such a call moves the switch to a specified position.

It is also possible to send events that simulate mouse operations. This can be useful to control rotary knobs or to trigger a two position switch without checking its previous position. To do this, set the event parameter to one of `MOUSE_FLAG_LEFTSINGLE`, `MOUSE_FLAG_LEFTRELEASE`, etc. (These constants are defined in the `PMDG_NGX_SDK.h` file.)

The following examples send mouse operation events:

```
// use mouse simulation to toggle the switch
SimConnect_TransmitClientEvent(hSimConnect, 0,
EVENT_FLIGHT_DIRECTOR_SWITCH, MOUSE_FLAG_LEFTSINGLE,
SIMCONNECT_GROUP_PRIORITY_HIGHEST,
SIMCONNECT_EVENT_FLAG_GROUPID_IS_PRIORITY);

SimConnect_TransmitClientEvent(hSimConnect, 0,
EVENT_FLIGHT_DIRECTOR_SWITCH, MOUSE_FLAG_LEFTRELEASE,
SIMCONNECT_GROUP_PRIORITY_HIGHEST,
SIMCONNECT_EVENT_FLAG_GROUPID_IS_PRIORITY);

// use mouse simulation to slew a knob
SimConnect_TransmitClientEvent(hSimConnect, 0, EVENT_HEADING_SELECTOR,
MOUSE_FLAG_WHEEL_UP,
SIMCONNECT_GROUP_PRIORITY_HIGHEST,
SIMCONNECT_EVENT_FLAG_GROUPID_IS_PRIORITY);
```

## CONCLUSION

Using the information and tools provided by this SDK, a skilled developer should be able to control just about any switch, knob, lever or control.

In addition, the state of hundreds of other parameters including annunciators and handles can be determined using the same methods described above.

We have made available many more parameters than most developers will likely require, but if your company or organization would like to request that we make others available, please open a support ticket and let us know! We cannot promise we will comply, but we will keep your request on hand for future updates, and we'll see what we can do!



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## SDK DOCUMENTATION

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If PMDG designates the Software as a "Demo" or "Evaluation" version, you may use the Software solely for evaluation purposes for the designated 10-day period. Use of the Software and/or documentation beyond the 10-day evaluation period violates PMDG's rights, as described above, including but not limited to PMDG's rights under

the United States Copyright Act. You acknowledge that any Demo or Evaluation version is merely a technology demonstration that may not be at the level of performance or compatibility of generally available PMDG products. Demo or Evaluation versions are provided strictly on an "as is" basis and are subject to Section 2 above.

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If the Software is designated by PMDG as an Upgrade or Add-On product, you may only use the Software if you are also currently a licensed user of the base product to which the Upgrade or Add-On applies. Unless the PMDG documentation for an Upgrade or Add-On specifically provides, you shall not separate upgrade products from base products, nor transfer them separately. PMDG reserves the sole and exclusive right to set its policies and prices regarding updates, upgrades add-ons and enhancements. All other terms of this EULA apply with equal force to any such Upgrades.

## GENERAL/MISCELLANEOUS CLAUSES

This EULA shall be governed by and construed under the substantive laws applicable to the United States of America. If any provision of this EULA is held to be unenforceable, the remaining provisions shall remain in full force and effect.

The undersigned agrees that this EULA is entered into at Sparks, Nevada, and further agrees that any legal or equitable dispute brought or arising under this Agreement shall be brought in the State and Federal courts for the State of Nevada.

This Agreement constitutes the entire Agreement between the undersigned and PMDG about the Software and documentation, and shall not be modified except in a writing signed by PMDG.