CHAPTER

SIX

JAVA

6.1 Java Client

This client provides a Java API for interacting with a kRPC server. A jar containing the `krpc.client` package can be downloaded from GitHub. It requires Java version 1.8.

6.1.1 Using the Library

The kRPC client library depends on the protobuf and javatuples libraries. A prebuilt jar for protobuf is available via Maven. Note that you need protobuf version 3. Version 2 is not compatible with kRPC.

The following example program connects to the server, queries it for its version and prints it out:

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.services.KRPC;

import java.io.IOException;

public class Basic {
  public static void main(String[] args) throws IOException, RPCException {
    try (Connection connection = Connection.newInstance()) {
      KRPC krpc = KRPC.newInstance(connection);
      System.out.println("Connected to kRPC version " + krpc.getStatus().
↪getVersion());
    }
  }
}
```

To compile this program using javac on the command line, save the source as `Example.java` and run the following:

```
javac -cp krpc-java-0.4.0.jar:protobuf-java-3.4.0.jar:javatuples-1.2.jar Example.java
```

You may need to change the paths to the JAR files.

6.1.2 Connecting to the Server

To connect to a server, call *`Connection.newInstance()`* which returns a connection object. All interaction with the server is done via this object. When constructed without any arguments, it will connect to the local machine on the default port numbers. You can specify different connection settings, and also a descriptive name for the connection, as follows:

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.services.KRPC;

import java.io.IOException;

public class Connecting {
  public static void main(String[] args) throws IOException, RPCException {
    try (Connection connection = Connection.newInstance("Remote example", "my.domain.
↪name", 1000, 1001)) {
      System.out.println(KRPC.newInstance(connection).getStatus().getVersion());
    }
  }
}
```

6.1.3 Calling Remote Procedures

The kRPC server provides *procedures* that a client can run. These procedures are arranged in groups called *services* to keep things organized. The functionality for the services are defined in the package `krpc.client.services`. For example, all of the functionality provided by the `SpaceCenter` service is contained in the class `krpc.client.services.SpaceCenter`.

To interact with a service, you must first instantiate it. You can then call its methods and properties to invoke remote procedures. The following example demonstrates how to do this. It instantiates the `SpaceCenter` service and calls *`krpc.client.services.SpaceCenter.SpaceCenter.getActiveVessel()`* to get an object representing the active vessel (of type *`krpc.client.services.SpaceCenter.Vessel`*). It sets the name of the vessel and then prints out its altitude:

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.Vessel;

import java.io.IOException;

public class RemoteProcedures {
  public static void main(String[] args) throws IOException, RPCException {
    try (Connection connection = Connection.newInstance("Vessel Name")) {
      SpaceCenter spaceCenter = SpaceCenter.newInstance(connection);
      Vessel vessel = spaceCenter.getActiveVessel();
      System.out.println(vessel.getName());
    }
  }
}
```

6.1.4 Streaming Data from the Server

A common use case for kRPC is to continuously extract data from the game. The naive approach to do this would be to repeatedly call a remote procedure, such as in the following which repeatedly prints the position of the active vessel:

```
import krpc.client.Connection;
import krpc.client.RPCException;
```

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```
import krpc.client.services.KRPC;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.ReferenceFrame;
import krpc.client.services.SpaceCenter.Vessel;

import java.io.IOException;

public class Streaming1 {
  public static void main(String[] args) throws IOException, RPCException {
    try (Connection connection = Connection.newInstance()) {
      SpaceCenter spaceCenter = SpaceCenter.newInstance(connection);
      Vessel vessel = spaceCenter.getActiveVessel();
      ReferenceFrame refframe = vessel.getOrbit().getBody().getReferenceFrame();
      while (true) {
        System.out.println(vessel.position(refframe));
      }
    }
  }
}
```

This approach requires significant communication overhead as request/response messages are repeatedly sent between the client and server. kRPC provides a more efficient mechanism to achieve this, called *streams*.

A stream repeatedly executes a procedure on the server (with a fixed set of argument values) and sends the result to the client. It only requires a single message to be sent to the server to establish the stream, which will then continuously send data to the client until the stream is closed.

The following example does the same thing as above using streams:

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.Stream;
import krpc.client.StreamException;
import krpc.client.services.KRPC;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.ReferenceFrame;
import krpc.client.services.SpaceCenter.Vessel;

import org.javatuples.Triplet;

import java.io.IOException;

public class Streaming2 {
  public static void main(String[] args) throws IOException, RPCException,␣
↪StreamException {
    try (Connection connection = Connection.newInstance()) {
      SpaceCenter spaceCenter = SpaceCenter.newInstance(connection);
      Vessel vessel = spaceCenter.getActiveVessel();
      ReferenceFrame refframe = vessel.getOrbit().getBody().getReferenceFrame();
      Stream<Triplet<Double,Double,Double>> vesselStream = connection.
↪addStream(vessel, "position", refframe);
      while (true) {
        System.out.println(vesselStream.get());
      }
    }
  }
}
```

It calls *Connection.addStream* once at the start of the program to create the stream, and then repeatedly prints the position returned by the stream. The stream is automatically closed when the client disconnects.

A stream can be created for any method call by calling *Connection.addStream* and passing it information about which method to stream. The example above passes a remote object, the name of the method to call, followed by the arguments to pass to the method (if any). *Connection.addStream* returns a stream object of type *Stream*. The most recent value of the stream can be obtained by calling *Stream.get*. A stream can be stopped and removed from the server by calling *Stream.remove* on the stream object. All of a clients streams are automatically stopped when it disconnects.

6.1.5 Synchronizing with Stream Updates

A common use case for kRPC is to wait until the value returned by a method or attribute changes, and then take some action. kRPC provides two mechanisms to do this efficiently: *condition variables* and *callbacks*.

Condition Variables

Each stream has a condition variable associated with it, that is notified whenever the value of the stream changes. These can be used to block the current thread of execution until the value of the stream changes.

The following example waits until the abort button is pressed in game, by waiting for the value of *krpc.client.services.SpaceCenter.Control.getAbort()* to change to true:

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.Stream;
import krpc.client.StreamException;
import krpc.client.services.KRPC;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.Control;

import java.io.IOException;

public class ConditionVariables {
  public static void main(String[] args) throws IOException, RPCException,␣
↪StreamException {
    try (Connection connection = Connection.newInstance()) {
      SpaceCenter spaceCenter = SpaceCenter.newInstance(connection);
      Control control = spaceCenter.getActiveVessel().getControl();
      Stream<Boolean> abort = connection.addStream(control, "getAbort");
      synchronized (abort.getCondition()) {
        while (!abort.get()) {
          abort.waitForUpdate();
        }
      }
    }
  }
}
```

This code creates a stream, acquires a lock on the streams condition variable (by using a `synchronized` block) and then repeatedly checks the value of `getAbort`. It leaves the loop when it changes to true.

The body of the loop calls `waitForUpdate` on the stream, which causes the program to block until the value changes. This prevents the loop from 'spinning' and so it does not consume processing resources whilst waiting.

Note: The stream does not start receiving updates until the first call to `waitForUpdate`. This means that the example code will not miss any updates to the streams value, as it will have already locked the condition variable before the first stream update is received.

Callbacks

Streams allow you to register callback functions that are called whenever the value of the stream changes. Callback functions should take a single argument, which is the new value of the stream, and should return nothing.

For example the following program registers two callbacks that are invoked when the value of *krpc.client.services.SpaceCenter.Control.getAbort()* changes:

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.Stream;
import krpc.client.StreamException;
import krpc.client.services.KRPC;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.Control;

import java.io.IOException;

public class Callbacks {
  public static void main(String[] args) throws IOException, RPCException,␣
↪StreamException {
    try (Connection connection = Connection.newInstance()) {
      SpaceCenter spaceCenter = SpaceCenter.newInstance(connection);
      Control control = spaceCenter.getActiveVessel().getControl();
      Stream<Boolean> abort = connection.addStream(control, "getAbort");
      abort.addCallback(
        (Boolean x) -> {
          System.out.println("Abort 1 called with a value of " + x);
        });
      abort.addCallback(
        (Boolean x) -> {
          System.out.println("Abort 2 called with a value of " + x);
        });
      abort.start();

      // Keep the program running...
      while (true) {
      }
    }
  }
}
```

Note: When a stream is created it does not start receiving updates until `start` is called. This is implicitly called when accessing the value of a stream, but as this example does not do this an explicit call to `start` is required.

Note: The callbacks are registered before the call to `start` so that stream updates are not missed.

Note: The callback function may be called from a different thread to that which created the stream. Any changes to shared state must therefore be protected with appropriate synchronization.

6.1.6 Custom Events

Some procedures return event objects of type *Event*. These allow you to wait until an event occurs, by calling *Event.waitFor*. Under the hood, these are implemented using streams and condition variables.

Custom events can also be created. An expression API allows you to create code that runs on the server and these can be used to build a custom event. For example, the following creates the expression `MeanAltitude > 1000` and then creates an event that will be triggered when the expression returns true:

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.Event;
import krpc.client.StreamException;
import krpc.client.services.KRPC;
import krpc.client.services.KRPC.Expression;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.Flight;
import krpc.schema.KRPC.ProcedureCall;

import java.io.IOException;

public class CustomEvent {
  public static void main(String[] args) throws IOException, RPCException,␣
↪StreamException {
    try (Connection connection = Connection.newInstance()) {
      KRPC krpc = KRPC.newInstance(connection);
      SpaceCenter spaceCenter = SpaceCenter.newInstance(connection);
      Flight flight = spaceCenter.getActiveVessel().flight(null);

      // Get the remote procedure call as a message object,
      // so it can be passed to the server
      ProcedureCall meanAltitude = connection.getCall(flight, "getMeanAltitude");

      // Create an expression on the server
      Expression expr = Expression.greaterThan(
        connection,
        Expression.call(connection, meanAltitude),
        Expression.constantDouble(connection, 1000));

      Event event = krpc.addEvent(expr);
      synchronized (event.getCondition()) {
        event.waitFor();
        System.out.println("Altitude reached 1000m");
      }
    }
  }
}
```

6.1.7 Client API Reference

class **Connection**

A connection to the kRPC server. All interaction with kRPC is performed via an instance of this class.

static *Connection* **newInstance**()

static *Connection* **newInstance**(String *name*)

static *Connection* **newInstance**(String *name*, String *address*)

static *Connection* **newInstance**(String *name*, String *address*, int *rpcPort*, int *streamPort*)

static *Connection* **newInstance**(String *name*, java.net.InetAddress *address*)

static *Connection* **newInstance**(String *name*, java.net.InetAddress *address*, int *rpcPort*, int *streamPort*)

Create a connection to the server, using the given connection details.

Parameters

- **name** (*String*) – A descriptive name for the connection. This is passed to the server and appears in the in-game server window.
- **address** (*String*) – The address of the server to connect to. Can either be a hostname, an IP address as a string or a `java.net.InetAddress` object. Defaults to 127.0.0.1.
- **rpc_port** (*int*) – The port number of the RPC Server. Defaults to 50000. This should match the RPC port number of the server you want to connect to.
- **stream_port** (*int*) – The port number of the Stream Server. Defaults to 50001. This should match the stream port number of the server you want to connect to.

Stream<T> **addStream**(Class<?> *clazz*, String *method*, Object... *args*)

Create a stream for a static method call to the given class.

Stream<T> **addStream**(*RemoteObject instance*, String *method*, Object... *args*)

Create a stream for a method call to the given remote object.

krpc.schema.KRPC.ProcedureCall **getCall**(Class<?> *clazz*, String *method*, Object... *args*)

Returns a procedure call message for the given static method call. This allows descriptions of procedure calls to be passed to the server, for example when constructing custom events. See *Custom Events*.

krpc.schema.KRPC.ProcedureCall **getCall**(*RemoteObject instance*, String *method*, Object... *args*)

Returns a procedure call message for the given method call. This allows descriptions of procedure calls to be passed to the server, for example when constructing custom events. See *Custom Events*.

void **close**()

Close the connection.

class **Stream**<T>

This class represents a stream. See *Streaming Data from the Server*.

Stream objects implement `hashCode` and `equals` such that two stream objects are equal if they are bound to the same stream on the server.

void **start**()

void **startAndWait**()

Starts the stream. When a stream is created it does not start sending updates to the client until this method is called.

The `startAndWait` method will block until at least one update has been received from the server.

The `start` method starts the stream and returns immediately. Subsequent calls to `get()` may throw a `StreamException`.

float **getRate**()

void **setRate**(float *rate*)
The update rate of the stream in Hertz. When set to zero, the rate is unlimited.

T **get**()
Returns the most recent value for the stream. If executing the remote procedure for the stream throws an exception, calling this method will rethrow the exception. Raises a `StreamException` if no update has been received from the server.

If the stream has not been started this method calls `startAndWait()` to start the stream and wait until at least one update has been received.

Object **getCondition**()
A condition variable that is notified (using `notifyAll`) whenever the value of the stream changes.

void **waitForUpdate**()

void **waitForUpdateWithTimeout**(double *timeout*)
These methods block until the value of the stream changes or the operation times out.

The streams condition variable must be locked before calling this method.

If *timeout* is specified it is the timeout in seconds for the operation.

If the stream has not been started this method calls `start` to start the stream (without waiting for at least one update to be received).

int **addCallback**(java.util.function.Consumer<T> *callback*)
Adds a callback function that is invoked whenever the value of the stream changes. The callback function should take one argument, which is passed the new value of the stream. Returns a unique identifier for the callback which can be used to remove it.

Note: The callback function may be called from a different thread to that which created the stream. Any changes to shared state must therefore be protected with appropriate synchronization.

---

void **removeCallback**(int *tag*)
Removes a callback function from the stream. The tag is the identifier returned when the callback was added.

void **remove**()
Remove the stream from the server.

class **Event**
This class represents an event. See *Custom Events*. It is wrapper around a `Stream` that indicates when the event occurs.

Event objects implement `hashCode` and `equals` such that two event objects are equal if they are bound to the same underlying stream on the server.

void **start**()
Starts the event. When an event is created, it will not receive updates from the server until this method is called.

Object **getCondition**()
The condition variable that is notified (using `notifyAll`) whenever the event occurs.

void **waitFor**()

void **waitForWithTimeout**(double *timeout*)
These methods block until the event occurs or the operation times out.

The events condition variable must be locked before calling this method.

If *timeout* is specified it is the timeout in seconds for the operation.

If the event has not been started this method calls `start()` to start the underlying stream.

int **addCallback**(java.lang.Callable *callback*)
Adds a callback function that is invoked whenever the event occurs. The callback function should be a function that takes zero arguments. Returns an integer tag identifying the callback which can be used to remove it later.

void **removeCallback**(int *tag*)
Removes a callback function from the event.

void **remove**()
Removes the event from the server.

Stream<Boolean> **getStream**()
Returns the underlying stream for the event.

abstract class **RemoteObject**
The abstract base class for all remote objects.

6.2 KRPC API

6.2.1 KRPC

None None None None None

public class **KRPC**
Main kRPC service, used by clients to interact with basic server functionality.

byte[] **getClientID**()
Returns the identifier for the current client.

Game Scenes All

String **getClientName**()
Returns the name of the current client. This is an empty string if the client has no name.

Game Scenes All

java.util.List<org.javatuples.Triplet<byte[], String, String>> **getClients**()
A list of RPC clients that are currently connected to the server. Each entry in the list is a clients identifier, name and address.

Game Scenes All

krpc.schema.KRPC.Status **getStatus**()
Returns some information about the server, such as the version.

Game Scenes All

krpc.schema.KRPC.Services **getServices**()
Returns information on all services, procedures, classes, properties etc. provided by the server. Can be used by client libraries to automatically create functionality such as stubs.

Game Scenes All

GameScene **getCurrentGameScene**()
Get the current game scene.

Game Scenes All

boolean **getPaused**()

void **setPaused**(boolean *value*)
Whether the game is paused.

Game Scenes All

public enum **GameScene**
The game scene. See *getCurrentGameScene()*.

public *GameScene* **SPACE_CENTER**
The game scene showing the Kerbal Space Center buildings.

public *GameScene* **FLIGHT**
The game scene showing a vessel in flight (or on the launchpad/runway).

public *GameScene* **TRACKING_STATION**
The tracking station.

public *GameScene* **EDITOR_VAB**
The Vehicle Assembly Building.

public *GameScene* **EDITOR_SPH**
The Space Plane Hangar.

public class **InvalidOperationException**
A method call was made to a method that is invalid given the current state of the object.

public class **ArgumentException**
A method was invoked where at least one of the passed arguments does not meet the parameter specification of the method.

public class **ArgumentNullException**
A null reference was passed to a method that does not accept it as a valid argument.

public class **ArgumentOutOfRangeException**
The value of an argument is outside the allowable range of values as defined by the invoked method.

6.2.2 Expressions

public class **Expression**
A server side expression.

static *Expression* **constantDouble**(*Connection connection*, double *value*)
A constant value of double precision floating point type.

Parameters

- **value** (*double*) –

Game Scenes All

static *Expression* **constantFloat**(*Connection connection*, float *value*)
A constant value of single precision floating point type.

Parameters

- **value** (*float*) –

Game Scenes All

static *Expression* **constantInt**(*Connection connection*, int *value*)
A constant value of integer type.

Parameters

- **value** (*int*) –

Game Scenes All

static *Expression* **constantBool** (*Connection connection*, boolean *value*)
A constant value of boolean type.

Parameters

- **value** (*boolean*) –

Game Scenes All

static *Expression* **constantString** (*Connection connection*, String *value*)
A constant value of string type.

Parameters

- **value** (*String*) –

Game Scenes All

static *Expression* **call** (*Connection connection*, krpc.schema.KRPC.ProcedureCall *call*)
An RPC call.

Parameters

- **call** (*krpc.schema.KRPC.ProcedureCall*) –

Game Scenes All

static *Expression* **equal** (*Connection connection*, *Expression arg0*, *Expression arg1*)
Equality comparison.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **notEqual** (*Connection connection*, *Expression arg0*, *Expression arg1*)
Inequality comparison.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **greaterThan** (*Connection connection*, *Expression arg0*, *Expression arg1*)
Greater than numerical comparison.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **greaterThanOrEqual** (*Connection connection*, *Expression arg0*, *Expression arg1*)
Greater than or equal numerical comparison.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **lessThan**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Less than numerical comparison.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **lessThanOrEqual**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Less than or equal numerical comparison.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **and**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Boolean and operator.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **or**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Boolean or operator.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **exclusiveOr**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Boolean exclusive-or operator.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **not**(*Connection connection*, *Expression arg*)
Boolean negation operator.

Parameters

- **arg** (Expression) –

Game Scenes All

static *Expression* **add**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Numerical addition.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **subtract**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Numerical subtraction.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **multiply**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Numerical multiplication.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **divide**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Numerical division.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **modulo**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Numerical modulo operator.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Returns The remainder of arg0 divided by arg1

Game Scenes All

static *Expression* **power**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Numerical power operator.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Returns arg0 raised to the power of arg1, with type of arg0

Game Scenes All

static *Expression* **leftShift**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Bitwise left shift.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **rightShift**(*Connection connection*, *Expression arg0*, *Expression arg1*)
Bitwise right shift.

Parameters

- **arg0** (Expression) –
- **arg1** (Expression) –

Game Scenes All

static *Expression* **cast**(*Connection connection*, *Expression arg*, *Type type*)
Perform a cast to the given type.

Parameters

- **arg** (Expression) –
- **type** (Type) – Type to cast the argument to.

Game Scenes All

static *Expression* **parameter**(*Connection connection*, String *name*, *Type type*)
A named parameter of type double.

Parameters

- **name** (*String*) – The name of the parameter.
- **type** (Type) – The type of the parameter.

Returns A named parameter.

Game Scenes All

static *Expression* **function**(*Connection connection*, java.util.List<*Expression*> *parameters*, *Expression body*)
A function.

Parameters

- **parameters** (*java.util.List<Expression>*) – The parameters of the function.
- **body** (Expression) – The body of the function.

Returns A function.

Game Scenes All

static *Expression* **invoke**(*Connection connection*, *Expression function*, java.util.Map<String, *Expression*> *args*)
A function call.

Parameters

- **function** (Expression) – The function to call.

- **args** (*java.util.Map<String,Expression>*) – The arguments to call the function with.

Returns A function call.

Game Scenes All

static *Expression* **createTuple**(*Connection connection*, java.util.List<*Expression*> *elements*)
Construct a tuple.

Parameters

- **elements** (*java.util.List<Expression>*) – The elements.

Returns The tuple.

Game Scenes All

static *Expression* **createList**(*Connection connection*, java.util.List<*Expression*> *values*)
Construct a list.

Parameters

- **values** (*java.util.List<Expression>*) – The value. Should all be of the same type.

Returns The list.

Game Scenes All

static *Expression* **createSet**(*Connection connection*, java.util.Set<*Expression*> *values*)
Construct a set.

Parameters

- **values** (*java.util.Set<Expression>*) – The values. Should all be of the same type.

Returns The set.

Game Scenes All

static *Expression* **createDictionary**(*Connection connection*, java.util.List<*Expression*> *keys*, java.util.List<*Expression*> *values*)
Construct a dictionary, from a list of corresponding keys and values.

Parameters

- **keys** (*java.util.List<Expression>*) – The keys. Should all be of the same type.
- **values** (*java.util.List<Expression>*) – The values. Should all be of the same type.

Returns The dictionary.

Game Scenes All

static *Expression* **toList**(*Connection connection*, *Expression arg*)
Convert a collection to a list.

Parameters

- **arg** (Expression) – The collection.

Returns The collection as a list.

Game Scenes All

static *Expression* **toSet**(*Connection connection*, *Expression arg*)
Convert a collection to a set.

Parameters

- **arg** (Expression) – The collection.

Returns The collection as a set.

Game Scenes All

static *Expression* **get**(*Connection connection*, *Expression arg*, *Expression index*)
Access an element in a tuple, list or dictionary.

Parameters

- **arg** (Expression) – The tuple, list or dictionary.
- **index** (Expression) – The index of the element to access. A zero indexed integer for a tuple or list, or a key for a dictionary.

Returns The element.

Game Scenes All

static *Expression* **count**(*Connection connection*, *Expression arg*)
Number of elements in a collection.

Parameters

- **arg** (Expression) – The list, set or dictionary.

Returns The number of elements in the collection.

Game Scenes All

static *Expression* **sum**(*Connection connection*, *Expression arg*)
Sum all elements of a collection.

Parameters

- **arg** (Expression) – The list or set.

Returns The sum of the elements in the collection.

Game Scenes All

static *Expression* **max**(*Connection connection*, *Expression arg*)
Maximum of all elements in a collection.

Parameters

- **arg** (Expression) – The list or set.

Returns The maximum elements in the collection.

Game Scenes All

static *Expression* **min**(*Connection connection*, *Expression arg*)
Minimum of all elements in a collection.

Parameters

- **arg** (Expression) – The list or set.

Returns The minimum elements in the collection.

Game Scenes All

static *Expression* **average**(*Connection connection*, *Expression arg*)
Minimum of all elements in a collection.

Parameters

- **arg** (Expression) – The list or set.

Returns The minimum elements in the collection.

Game Scenes All

static *Expression* **select**(*Connection connection*, *Expression arg*, *Expression func*)
Run a function on every element in the collection.

Parameters

- **arg** (Expression) – The list or set.
- **func** (Expression) – The function.

Returns The modified collection.

Game Scenes All

static *Expression* **where**(*Connection connection*, *Expression arg*, *Expression func*)
Run a function on every element in the collection.

Parameters

- **arg** (Expression) – The list or set.
- **func** (Expression) – The function.

Returns The modified collection.

Game Scenes All

static *Expression* **contains**(*Connection connection*, *Expression arg*, *Expression value*)
Determine if a collection contains a value.

Parameters

- **arg** (Expression) – The collection.
- **value** (Expression) – The value to look for.

Returns Whether the collection contains a value.

Game Scenes All

static *Expression* **aggregate**(*Connection connection*, *Expression arg*, *Expression func*)
Applies an accumulator function over a sequence.

Parameters

- **arg** (Expression) – The collection.
- **func** (Expression) – The accumulator function.

Returns The accumulated value.

Game Scenes All

static *Expression* **aggregateWithSeed**(*Connection connection*, *Expression arg*, *Expression seed*, *Expression func*)
Applies an accumulator function over a sequence, with a given seed.

Parameters

- **arg** (Expression) – The collection.

- **seed** (Expression) – The seed value.
- **func** (Expression) – The accumulator function.

Returns The accumulated value.

Game Scenes All

static *Expression* **concat**(*Connection connection*, *Expression arg1*, *Expression arg2*)
Concatenate two sequences.

Parameters

- **arg1** (Expression) – The first sequence.
- **arg2** (Expression) – The second sequence.

Returns The first sequence followed by the second sequence.

Game Scenes All

static *Expression* **orderBy**(*Connection connection*, *Expression arg*, *Expression key*)
Order a collection using a key function.

Parameters

- **arg** (Expression) – The collection to order.
- **key** (Expression) – A function that takes a value from the collection and generates a key to sort on.

Returns The ordered collection.

Game Scenes All

static *Expression* **all**(*Connection connection*, *Expression arg*, *Expression predicate*)
Determine whether all items in a collection satisfy a boolean predicate.

Parameters

- **arg** (Expression) – The collection.
- **predicate** (Expression) – The predicate function.

Returns Whether all items satisfy the predicate.

Game Scenes All

static *Expression* **any**(*Connection connection*, *Expression arg*, *Expression predicate*)
Determine whether any item in a collection satisfies a boolean predicate.

Parameters

- **arg** (Expression) – The collection.
- **predicate** (Expression) – The predicate function.

Returns Whether any item satisfies the predicate.

Game Scenes All

public class **Type**
A server side expression.

static *Type* **double_**(*Connection connection*)
Double type.

Game Scenes All

static *Type* **float_**(*Connection connection*)
Float type.

Game Scenes All

static *Type* **int_**(*Connection connection*)
Int type.

Game Scenes All

static *Type* **bool**(*Connection connection*)
Bool type.

Game Scenes All

static *Type* **string**(*Connection connection*)
String type.

Game Scenes All

6.3 SpaceCenter API

6.3.1 SpaceCenter

public class **SpaceCenter**
Provides functionality to interact with Kerbal Space Program. This includes controlling the active vessel, managing its resources, planning maneuver nodes and auto-piloting.

float **getScience**()
The current amount of science.

Game Scenes All

double **getFunds**()
The current amount of funds.

Game Scenes All

float **getReputation**()
The current amount of reputation.

Game Scenes All

Vessel **getActiveVessel**()

void **setActiveVessel**(*Vessel value*)
The currently active vessel.

Game Scenes Flight

java.util.List<*Vessel*> **getVessels**()
A list of all the vessels in the game.

Game Scenes All

java.util.Map<String, *CelestialBody*> **getBodies**()
A dictionary of all celestial bodies (planets, moons, etc.) in the game, keyed by the name of the body.

Game Scenes All

CelestialBody **getTargetBody**()

void **setTargetBody**(*CelestialBody value*)
The currently targeted celestial body.

Game Scenes Flight

Vessel **getTargetVessel**()

void **setTargetVessel**(*Vessel value*)
The currently targeted vessel.

Game Scenes Flight

DockingPort **getTargetDockingPort**()

void **setTargetDockingPort**(*DockingPort value*)
The currently targeted docking port.

Game Scenes Flight

void **clearTarget**()
Clears the current target.

Game Scenes Flight

java.util.List<String> **launchableVessels**(String *craftDirectory*)
Returns a list of vessels from the given *craftDirectory* that can be launched.

Parameters

- **craftDirectory** (*String*) – Name of the directory in the current saves "Ships" directory. For example `"VAB"` or `"SPH"`.

Game Scenes All

void **launchVessel**(String *craftDirectory*, String *name*, String *launchSite*, boolean *recover*)
Launch a vessel.

Parameters

- **craftDirectory** (*String*) – Name of the directory in the current saves "Ships" directory, that contains the craft file. For example `"VAB"` or `"SPH"`.
- **name** (*String*) – Name of the vessel to launch. This is the name of the ".craft" file in the save directory, without the ".craft" file extension.
- **launchSite** (*String*) – Name of the launch site. For example `"LaunchPad"` or `"Runway"`.
- **recover** (*boolean*) – If true and there is a vessel on the launch site, recover it before launching.

Game Scenes All

Note: Throws an exception if any of the games pre-flight checks fail.

---

void **launchVesselFromVAB**(String *name*, boolean *recover*)
Launch a new vessel from the VAB onto the launchpad.

Parameters

- **name** (*String*) – Name of the vessel to launch.
- **recover** (*boolean*) – If true and there is a vessel on the launch pad, recover it before launching.

Game Scenes All

Note: This is equivalent to calling *launchVessel(String, String, String, boolean)* with the craft directory set to "VAB" and the launch site set to "LaunchPad". Throws an exception if any of the games pre-flight checks fail.

---

void **launchVesselFromSPH**(String *name*, boolean *recover*)
Launch a new vessel from the SPH onto the runway.

Parameters

- **name** (*String*) – Name of the vessel to launch.
- **recover** (*boolean*) – If true and there is a vessel on the runway, recover it before launching.

Game Scenes All

Note: This is equivalent to calling *launchVessel(String, String, String, boolean)* with the craft directory set to "SPH" and the launch site set to "Runway". Throws an exception if any of the games pre-flight checks fail.

---

void **save**(String *name*)
Save the game with a given name. This will create a save file called `name.sfs` in the folder of the current save game.

Parameters

- **name** (*String*) –

Game Scenes All

void **load**(String *name*)
Load the game with the given name. This will create a load a save file called `name.sfs` from the folder of the current save game.

Parameters

- **name** (*String*) –

Game Scenes All

void **quicksave**()
Save a quicksave.

Game Scenes All

Note: This is the same as calling *save(String)* with the name "quicksave".

---

void **quickload**()
Load a quicksave.

Game Scenes All

Note: This is the same as calling *load(String)* with the name "quicksave".

---

boolean **getUIVisible**()

void **setUIVisible**(boolean *value*)
Whether the UI is visible.

Game Scenes Flight

boolean **getNavball**()

void **setNavball**(boolean *value*)
Whether the navball is visible.

Game Scenes Flight

double **getUT**()
The current universal time in seconds.

Game Scenes All

double **getG**()
The value of the gravitational constant G in $N(m/kg)^2$.

Game Scenes All

float **getWarpRate**()
The current warp rate. This is the rate at which time is passing for either on-rails or physical time warp. For example, a value of 10 means time is passing 10x faster than normal. Returns 1 if time warp is not active.

Game Scenes Flight

float **getWarpFactor**()
The current warp factor. This is the index of the rate at which time is passing for either regular "on-rails" or physical time warp. Returns 0 if time warp is not active. When in on-rails time warp, this is equal to *getRailsWarpFactor()*, and in physics time warp, this is equal to *getPhysicsWarpFactor()*.

Game Scenes Flight

int **getRailsWarpFactor**()

void **setRailsWarpFactor**(int *value*)
The time warp rate, using regular "on-rails" time warp. A value between 0 and 7 inclusive. 0 means no time warp. Returns 0 if physical time warp is active.

If requested time warp factor cannot be set, it will be set to the next lowest possible value. For example, if the vessel is too close to a planet. See the KSP wiki for details.

Game Scenes Flight

int **getPhysicsWarpFactor**()

void **setPhysicsWarpFactor**(int *value*)
The physical time warp rate. A value between 0 and 3 inclusive. 0 means no time warp. Returns 0 if regular "on-rails" time warp is active.

Game Scenes Flight

boolean **canRailsWarpAt**(int *factor*)
Returns `true` if regular "on-rails" time warp can be used, at the specified warp *factor*. The maximum time warp rate is limited by various things, including how close the active vessel is to a planet. See the KSP wiki for details.

Parameters

- **factor** (*int*) – The warp factor to check.

Game Scenes Flight

int **getMaximumRailsWarpFactor**()
The current maximum regular "on-rails" warp factor that can be set. A value between 0 and 7 inclusive. See the KSP wiki for details.

Game Scenes Flight

void **warpTo**(double *ut*, float *maxRailsRate*, float *maxPhysicsRate*)
Uses time acceleration to warp forward to a time in the future, specified by universal time *ut*. This call blocks until the desired time is reached. Uses regular "on-rails" or physical time warp as appropriate. For example, physical time warp is used when the active vessel is traveling through an atmosphere. When using regular "on-rails" time warp, the warp rate is limited by *maxRailsRate*, and when using physical time warp, the warp rate is limited by *maxPhysicsRate*.

Parameters

- **ut** (*double*) – The universal time to warp to, in seconds.
- **maxRailsRate** (*float*) – The maximum warp rate in regular "on-rails" time warp.
- **maxPhysicsRate** (*float*) – The maximum warp rate in physical time warp.

Returns When the time warp is complete.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **transformPosition**(org.javatuples.Triplet<Double, Double, Double> *position*, *ReferenceFrame from*, *ReferenceFrame to*)
Converts a position from one reference frame to another.

Parameters

- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – Position, as a vector, in reference frame *from*.
- **from** (ReferenceFrame) – The reference frame that the position is in.
- **to** (ReferenceFrame) – The reference frame to covert the position to.

Returns The corresponding position, as a vector, in reference frame *to*.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **transformDirection**(org.javatuples.Triplet<Double, Double, Double> *direction*, *ReferenceFrame from*, *ReferenceFrame to*)
Converts a direction from one reference frame to another.

Parameters

- **direction** (*org.javatuples.Triplet<Double,Double,Double>*) – Direction, as a vector, in reference frame *from*.
- **from** (ReferenceFrame) – The reference frame that the direction is in.
- **to** (ReferenceFrame) – The reference frame to covert the direction to.

Returns The corresponding direction, as a vector, in reference frame *to*.

Game Scenes All

org.javatuples.Quartet<Double, Double, Double, Double> **transformRotation**(org.javatuples.Quartet<Double, Double, Double, Double> *rotation*, *ReferenceFrame from*, *ReferenceFrame to*)

Converts a rotation from one reference frame to another.

Parameters

- **rotation** (*org.javatuples.Quartet<Double,Double,Double,Double>*) – Rotation, as a quaternion of the form (x, y, z, w), in reference frame *from*.
- **from** (ReferenceFrame) – The reference frame that the rotation is in.
- **to** (ReferenceFrame) – The reference frame to covert the rotation to.

Returns The corresponding rotation, as a quaternion of the form (x, y, z, w), in reference frame *to*.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **transformVelocity**(org.javatuples.Triplet<Double, Double, Double> *position*, org.javatuples.Triplet<Double, Double, Double> *velocity*, *ReferenceFrame from*, *ReferenceFrame to*)

Converts a velocity (acting at the specified position) from one reference frame to another. The position is required to take the relative angular velocity of the reference frames into account.

Parameters

- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – Position, as a vector, in reference frame *from*.
- **velocity** (*org.javatuples.Triplet<Double,Double,Double>*) – Velocity, as a vector that points in the direction of travel and whose magnitude is the speed in meters per second, in reference frame *from*.
- **from** (ReferenceFrame) – The reference frame that the position and velocity are in.
- **to** (ReferenceFrame) – The reference frame to covert the velocity to.

Returns The corresponding velocity, as a vector, in reference frame *to*.

Game Scenes All

double **raycastDistance**(org.javatuples.Triplet<Double, Double, Double> *position*, org.javatuples.Triplet<Double, Double, Double> *direction*, *ReferenceFrame referenceFrame*)

Cast a ray from a given position in a given direction, and return the distance to the hit point. If no hit occurs, returns infinity.

Parameters

- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – Position, as a vector, of the origin of the ray.
- **direction** (*org.javatuples.Triplet<Double,Double,Double>*) – Direction of the ray, as a unit vector.

- **referenceFrame** (ReferenceFrame) – The reference frame that the position and direction are in.

Returns The distance to the hit, in meters, or infinity if there was no hit.

Game Scenes All

Part **raycastPart**(org.javatuples.Triplet<Double, Double, Double> *position*, org.javatuples.Triplet<Double, Double, Double> *direction*, *ReferenceFrame referenceFrame*)

Cast a ray from a given position in a given direction, and return the part that it hits. If no hit occurs, returns `null`.

Parameters

- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – Position, as a vector, of the origin of the ray.
- **direction** (*org.javatuples.Triplet<Double,Double,Double>*) – Direction of the ray, as a unit vector.
- **referenceFrame** (ReferenceFrame) – The reference frame that the position and direction are in.

Returns The part that was hit or `null` if there was no hit.

Game Scenes Flight

boolean **getFARAvailable**()

Whether Ferram Aerospace Research is installed.

Game Scenes All

GameMode **getGameMode**()

The current mode the game is in.

Game Scenes All

WarpMode **getWarpMode**()

The current time warp mode. Returns *WarpMode.NONE* if time warp is not active, *WarpMode.RAILS* if regular "on-rails" time warp is active, or *WarpMode.PHYSICS* if physical time warp is active.

Game Scenes Flight

Camera **getCamera**()

An object that can be used to control the camera.

Game Scenes Flight

WaypointManager **getWaypointManager**()

The waypoint manager.

Game Scenes Flight

ContractManager **getContractManager**()

The contract manager.

Game Scenes All

public enum **GameMode**

The game mode. Returned by *GameMode*

public *GameMode* **SANDBOX**

Sandbox mode.

public *GameMode* **CAREER**
Career mode.

public *GameMode* **SCIENCE**
Science career mode.

public *GameMode* **SCIENCE_SANDBOX**
Science sandbox mode.

public *GameMode* **MISSION**
Mission mode.

public *GameMode* **MISSION_BUILDER**
Mission builder mode.

public *GameMode* **SCENARIO**
Scenario mode.

public *GameMode* **SCENARIO_NON_RESUMABLE**
Scenario mode that cannot be resumed.

public enum **WarpMode**
The time warp mode. Returned by *WarpMode*

public *WarpMode* **RAILS**
Time warp is active, and in regular "on-rails" mode.

public *WarpMode* **PHYSICS**
Time warp is active, and in physical time warp mode.

public *WarpMode* **NONE**
Time warp is not active.

6.3.2 Vessel

public class **Vessel**
These objects are used to interact with vessels in KSP. This includes getting orbital and flight data, manipulating control inputs and managing resources. Created using *getActiveVessel()* or *getVessels()*.

String **getName**()

void **setName**(String *value*)
The name of the vessel.

Game Scenes All

VesselType **getType**()

void **setType**(*VesselType value*)
The type of the vessel.

Game Scenes All

VesselSituation **getSituation**()
The situation the vessel is in.

Game Scenes All

boolean **getRecoverable**()
Whether the vessel is recoverable.

Game Scenes All

void **recover**()
Recover the vessel.

Game Scenes All

double **getMET**()
The mission elapsed time in seconds.

Game Scenes All

String **getBiome**()
The name of the biome the vessel is currently in.

Game Scenes All

Flight **flight**(*ReferenceFrame referenceFrame*)
Returns a *Flight* object that can be used to get flight telemetry for the vessel, in the specified reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – Reference frame. Defaults to the vessel's surface reference frame (*Vessel.getSurfaceReferenceFrame()*).

Game Scenes Flight

Note: When this is called with no arguments, the vessel's surface reference frame is used. This reference frame moves with the vessel, therefore velocities and speeds returned by the flight object will be zero. See the *reference frames tutorial* for examples of getting *the orbital and surface speeds of a vessel*.

Orbit **getOrbit**()
The current orbit of the vessel.

Game Scenes All

Control **getControl**()
Returns a *Control* object that can be used to manipulate the vessel's control inputs. For example, its pitch/yaw/roll controls, RCS and thrust.

Game Scenes Flight

Comms **getComms**()
Returns a *Comms* object that can be used to interact with CommNet for this vessel.

Game Scenes Flight

AutoPilot **getAutoPilot**()
An *AutoPilot* object, that can be used to perform simple auto-piloting of the vessel.

Game Scenes Flight

int **getCrewCapacity**()
The number of crew that can occupy the vessel.

Game Scenes All

int **getCrewCount**()
The number of crew that are occupying the vessel.

Game Scenes All

java.util.List<*CrewMember*> **getCrew**()
The crew in the vessel.

Game Scenes All

Resources **getResources**()
A *Resources* object, that can used to get information about resources stored in the vessel.

Game Scenes Flight

Resources **resourcesInDecoupleStage**(int *stage*, boolean *cumulative*)
Returns a *Resources* object, that can used to get information about resources stored in a given *stage*.

Parameters

- **stage** (*int*) – Get resources for parts that are decoupled in this stage.
- **cumulative** (*boolean*) – When `false`, returns the resources for parts decoupled in just the given stage. When `true` returns the resources decoupled in the given stage and all subsequent stages combined.

Game Scenes Flight

Note: For details on stage numbering, see the discussion on *Staging*.

Parts **getParts**()
A *Parts* object, that can used to interact with the parts that make up this vessel.

Game Scenes Flight

float **getMass**()
The total mass of the vessel, including resources, in kg.

Game Scenes Flight

float **getDryMass**()
The total mass of the vessel, excluding resources, in kg.

Game Scenes Flight

float **getThrust**()
The total thrust currently being produced by the vessel's engines, in Newtons. This is computed by summing *Engine.getThrust()* for every engine in the vessel.

Game Scenes Flight

float **getAvailableThrust**()
Gets the total available thrust that can be produced by the vessel's active engines, in Newtons. This is computed by summing *Engine.getAvailableThrust()* for every active engine in the vessel.

Game Scenes Flight

float **getMaxThrust**()
The total maximum thrust that can be produced by the vessel's active engines, in Newtons. This is computed by summing *Engine.getMaxThrust()* for every active engine.

Game Scenes Flight

float **getMaxVacuumThrust**()
The total maximum thrust that can be produced by the vessel's active engines when the vessel is in a vacuum, in Newtons. This is computed by summing *Engine.getMaxVacuumThrust()* for every active engine.

Game Scenes Flight

float **getSpecificImpulse**()
The combined specific impulse of all active engines, in seconds. This is computed using the formula described here.

Game Scenes Flight

float **getVacuumSpecificImpulse**()
The combined vacuum specific impulse of all active engines, in seconds. This is computed using the formula described here.

Game Scenes Flight

float **getKerbinSeaLevelSpecificImpulse**()
The combined specific impulse of all active engines at sea level on Kerbin, in seconds. This is computed using the formula described here.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getMomentOfInertia**()
The moment of inertia of the vessel around its center of mass in $kg.m^2$. The inertia values in the returned 3-tuple are around the pitch, roll and yaw directions respectively. This corresponds to the vessels reference frame (*ReferenceFrame*).

Game Scenes Flight

java.util.List<Double> **getInertiaTensor**()
The inertia tensor of the vessel around its center of mass, in the vessels reference frame (*ReferenceFrame*). Returns the 3x3 matrix as a list of elements, in row-major order.

Game Scenes All

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getAva**
The maximum torque that the vessel generates. Includes contributions from reaction wheels, RCS, gimballed engines and aerodynamic control surfaces. Returns the torques in $N.m$ around each of the coordinate axes of the vessels reference frame (*ReferenceFrame*). These axes are equivalent to the pitch, roll and yaw axes of the vessel.

Game Scenes Flight

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getAva**
The maximum torque that the currently active and powered reaction wheels can generate. Returns the torques in $N.m$ around each of the coordinate axes of the vessels reference frame (*ReferenceFrame*). These axes are equivalent to the pitch, roll and yaw axes of the vessel.

Game Scenes Flight

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getAva**
The maximum torque that the currently active RCS thrusters can generate. Returns the torques in $N.m$ around each of the coordinate axes of the vessels reference frame (*ReferenceFrame*). These axes are equivalent to the pitch, roll and yaw axes of the vessel.

Game Scenes Flight

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getAva**
The maximum torque that the currently active and gimballed engines can generate. Returns the torques in $N.m$ around each of the coordinate axes of the vessels reference frame (*ReferenceFrame*). These axes are equivalent to the pitch, roll and yaw axes of the vessel.

Game Scenes Flight

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getAva**
The maximum torque that the aerodynamic control surfaces can generate. Returns the torques in $N.m$

around each of the coordinate axes of the vessels reference frame (*ReferenceFrame*). These axes are equivalent to the pitch, roll and yaw axes of the vessel.

Game Scenes Flight

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getAva**

The maximum torque that parts (excluding reaction wheels, gimballed engines, RCS and control surfaces) can generate. Returns the torques in $N.m$ around each of the coordinate axes of the vessels reference frame (*ReferenceFrame*). These axes are equivalent to the pitch, roll and yaw axes of the vessel.

Game Scenes Flight

ReferenceFrame **getReferenceFrame**()

The reference frame that is fixed relative to the vessel, and orientated with the vessel.

- The origin is at the center of mass of the vessel.
- The axes rotate with the vessel.
- The x-axis points out to the right of the vessel.
- The y-axis points in the forward direction of the vessel.
- The z-axis points out of the bottom off the vessel.

Game Scenes Flight

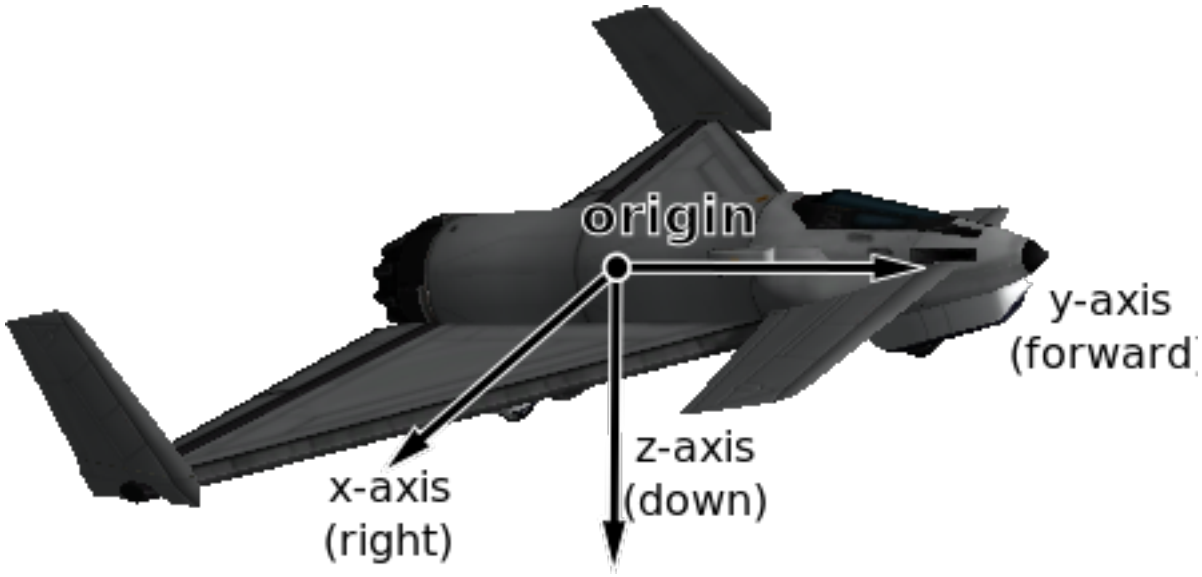

Fig. 1: Vessel reference frame origin and axes for the Aeris 3A aircraft

ReferenceFrame **getOrbitalReferenceFrame**()

The reference frame that is fixed relative to the vessel, and orientated with the vessels orbital prograde/normal/radial directions.

- The origin is at the center of mass of the vessel.
- The axes rotate with the orbital prograde/normal/radial directions.
- The x-axis points in the orbital anti-radial direction.
- The y-axis points in the orbital prograde direction.
- The z-axis points in the orbital normal direction.

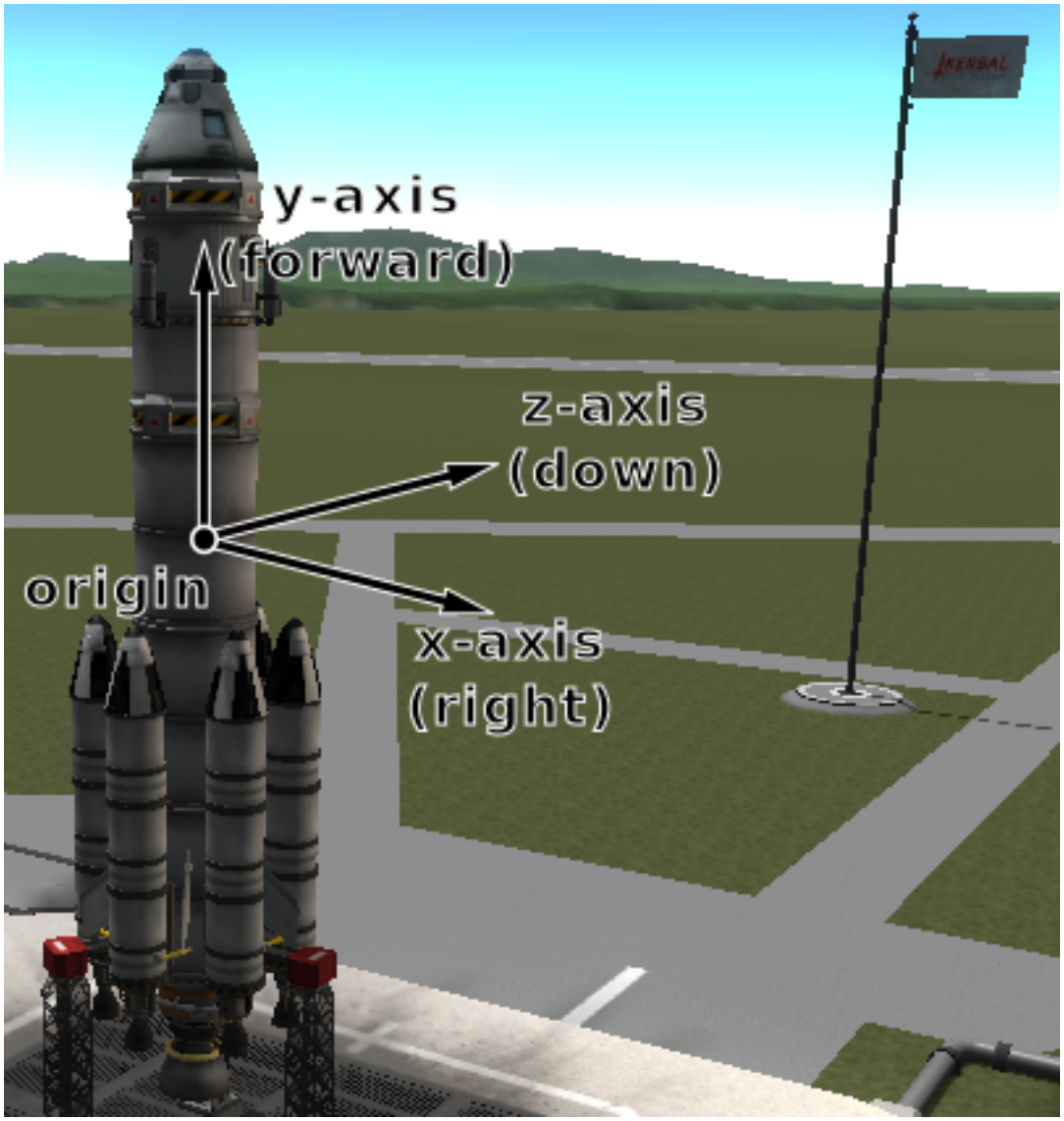

Fig. 2: Vessel reference frame origin and axes for the Kerbal-X rocket

Game Scenes Flight

Note: Be careful not to confuse this with 'orbit' mode on the navball.

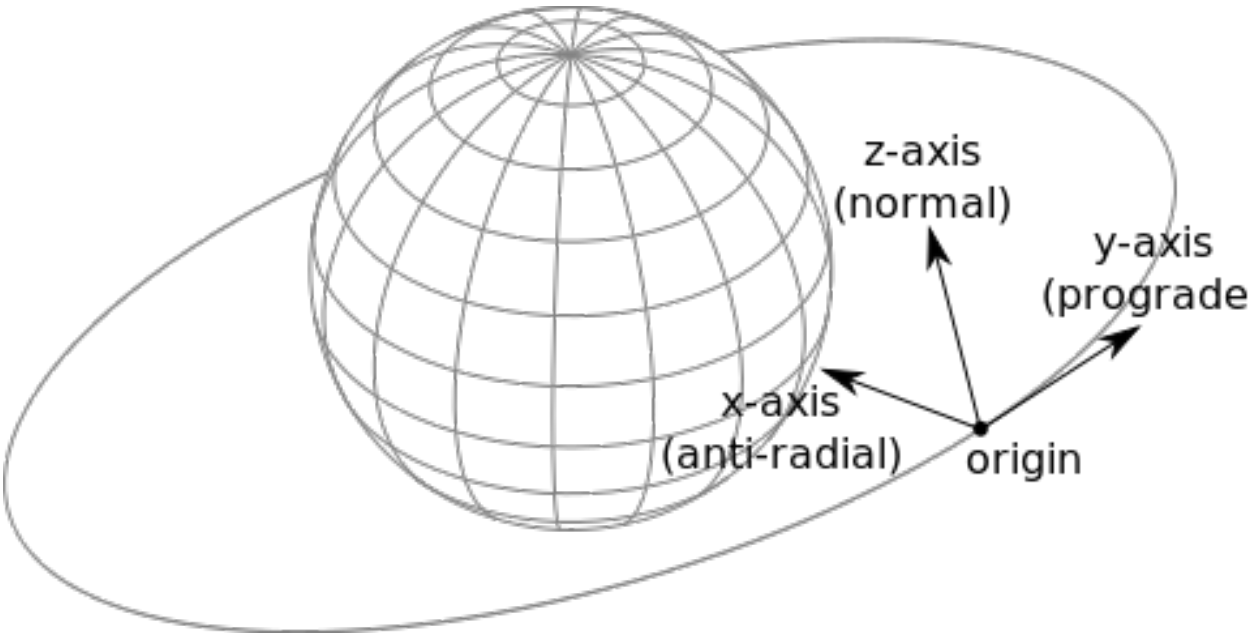

Fig. 3: Vessel orbital reference frame origin and axes

ReferenceFrame **getSurfaceReferenceFrame**()
The reference frame that is fixed relative to the vessel, and orientated with the surface of the body being orbited.

- The origin is at the center of mass of the vessel.
- The axes rotate with the north and up directions on the surface of the body.
- The x-axis points in the zenith direction (upwards, normal to the body being orbited, from the center of the body towards the center of mass of the vessel).
- The y-axis points northwards towards the astronomical horizon (north, and tangential to the surface of the body – the direction in which a compass would point when on the surface).
- The z-axis points eastwards towards the astronomical horizon (east, and tangential to the surface of the body – east on a compass when on the surface).

Game Scenes Flight

Note: Be careful not to confuse this with 'surface' mode on the navball.

ReferenceFrame **getSurfaceVelocityReferenceFrame**()
The reference frame that is fixed relative to the vessel, and orientated with the velocity vector of the vessel relative to the surface of the body being orbited.

- The origin is at the center of mass of the vessel.

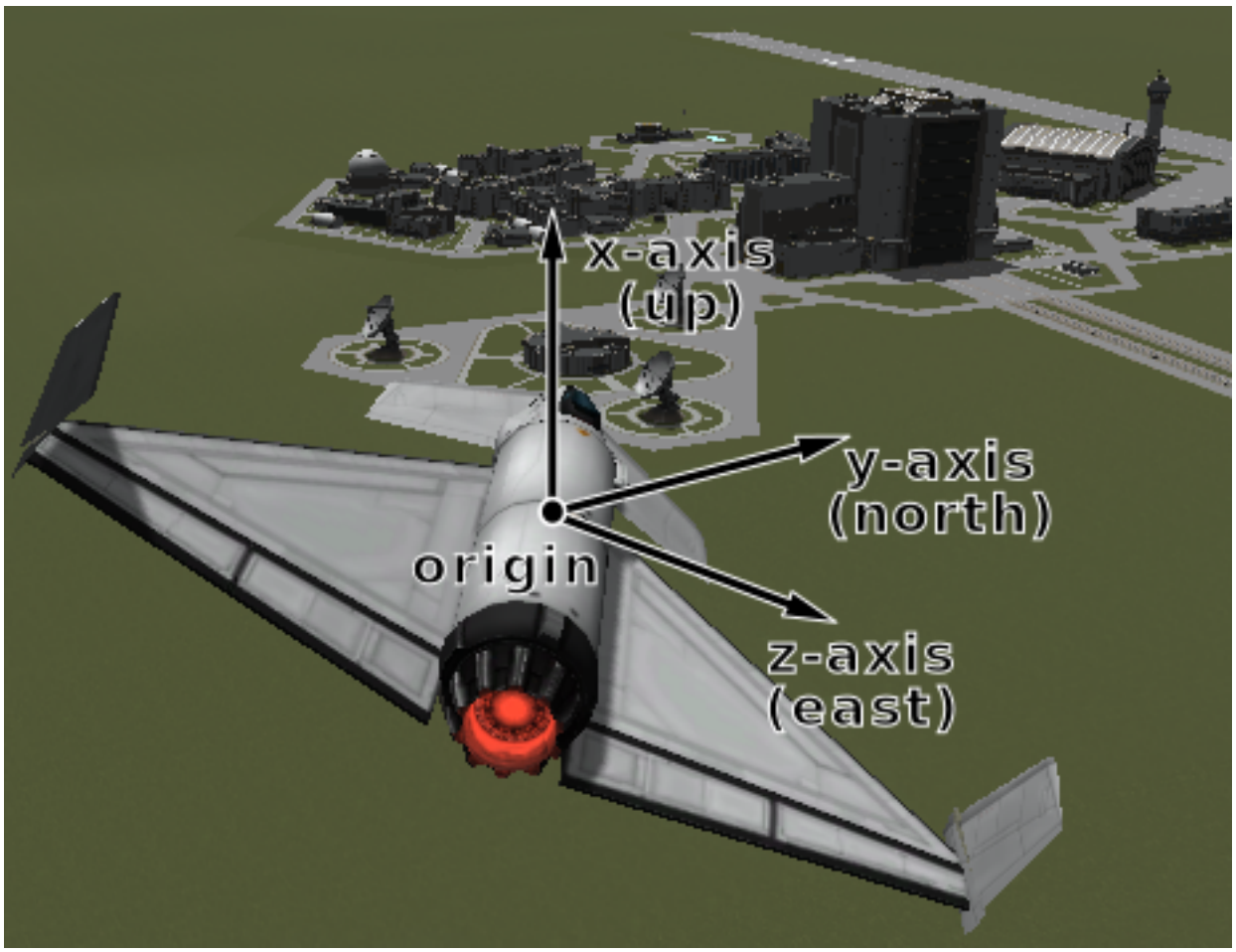

Fig. 4: Vessel surface reference frame origin and axes

- The axes rotate with the vessel's velocity vector.
- The y-axis points in the direction of the vessel's velocity vector, relative to the surface of the body being orbited.
- The z-axis is in the plane of the astronomical horizon.
- The x-axis is orthogonal to the other two axes.

Game Scenes Flight

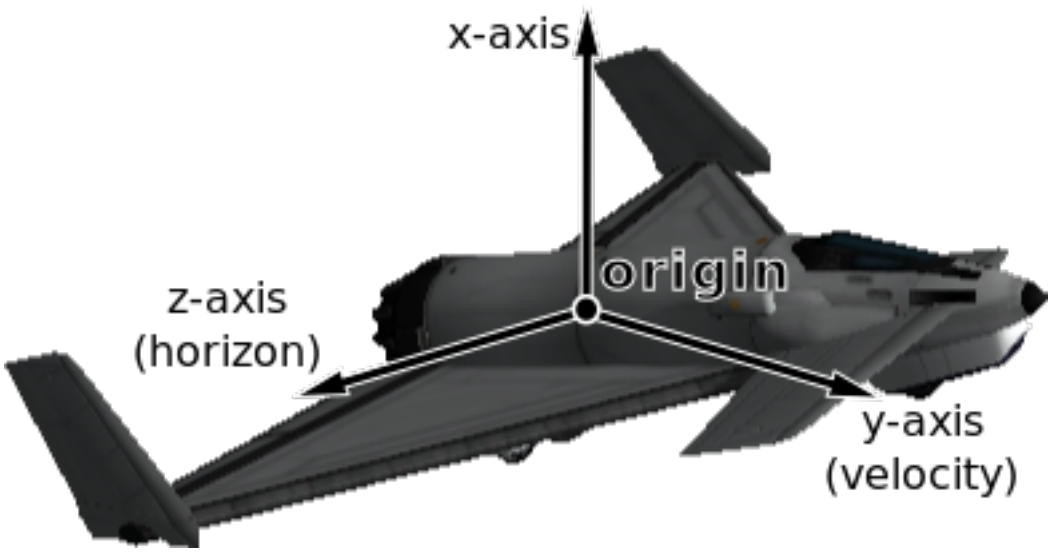

Fig. 5: Vessel surface velocity reference frame origin and axes

org.javatuples.Triplet<Double, Double, Double> **position** (*ReferenceFrame referenceFrame*)
The position of the center of mass of the vessel, in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned position vector is in.

Returns The position as a vector.

Game Scenes Flight

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **bound**

The axis-aligned bounding box of the vessel in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned position vectors are in.

Returns The positions of the minimum and maximum vertices of the box, as position vectors.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **velocity** (*ReferenceFrame referenceFrame*)
The velocity of the center of mass of the vessel, in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned velocity vector is in.

Returns The velocity as a vector. The vector points in the direction of travel, and its magnitude is the speed of the body in meters per second.

Game Scenes Flight

org.javatuples.Quartet<Double, Double, Double, Double> **rotation** (*ReferenceFrame referenceFrame*)
The rotation of the vessel, in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned rotation is in.

Returns The rotation as a quaternion of the form (x, y, z, w).

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **direction** (*ReferenceFrame referenceFrame*)
The direction in which the vessel is pointing, in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned direction is in.

Returns The direction as a unit vector.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **angularVelocity** (*ReferenceFrame referenceFrame*)
The angular velocity of the vessel, in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame the returned angular velocity is in.

Returns The angular velocity as a vector. The magnitude of the vector is the rotational speed of the vessel, in radians per second. The direction of the vector indicates the axis of rotation, using the right-hand rule.

Game Scenes Flight

public enum **VesselType**
The type of a vessel. See *Vessel.getType()*.

public *VesselType* **BASE**
Base.

public *VesselType* **DEBRIS**
Debris.

public *VesselType* **LANDER**
Lander.

public *VesselType* **PLANE**
Plane.

public *VesselType* **PROBE**
Probe.

public *VesselType* **RELAY**
Relay.

public *VesselType* **ROVER**
Rover.

public *VesselType* **SHIP**
Ship.

public *VesselType* **STATION**
Station.

public enum **VesselSituation**
The situation a vessel is in. See *Vessel.getSituation()*.

public *VesselSituation* **DOCKED**
Vessel is docked to another.

public *VesselSituation* **ESCAPING**
Escaping.

public *VesselSituation* **FLYING**
Vessel is flying through an atmosphere.

public *VesselSituation* **LANDED**
Vessel is landed on the surface of a body.

public *VesselSituation* **ORBITING**
Vessel is orbiting a body.

public *VesselSituation* **PRE_LAUNCH**
Vessel is awaiting launch.

public *VesselSituation* **Ssplashed**
Vessel has splashed down in an ocean.

public *VesselSituation* **SUB_ORBITAL**
Vessel is on a sub-orbital trajectory.

public class **CrewMember**
Represents crew in a vessel. Can be obtained using *Vessel.getCrew()*.

String **getName**()

void **setName**(String *value*)
The crew members name.

Game Scenes All

CrewMemberType **getType**()
The type of crew member.

Game Scenes All

boolean **getOnMission**()
Whether the crew member is on a mission.

Game Scenes All

float **getCourage**()

void **setCourage**(float *value*)
The crew members courage.

Game Scenes All

float **getStupidity**()

void **setStupidity**(float *value*)
The crew members stupidity.

Game Scenes All

float **getExperience**()

void **setExperience**(float *value*)
The crew members experience.

Game Scenes All

boolean **getBadass**()

void **setBadass**(boolean *value*)
Whether the crew member is a badass.

Game Scenes All

boolean **getVeteran**()

void **setVeteran**(boolean *value*)
Whether the crew member is a veteran.

Game Scenes All

public enum **CrewMemberType**
The type of a crew member. See *`CrewMember.getType()`*.

public *CrewMemberType* **APPLICANT**
An applicant for crew.

public *CrewMemberType* **CREW**
Rocket crew.

public *CrewMemberType* **TOURIST**
A tourist.

public *CrewMemberType* **UNOWNED**
An unowned crew member.

6.3.3 CelestialBody

public class **CelestialBody**
Represents a celestial body (such as a planet or moon). See *`getBodies()`*.

String **getName**()
The name of the body.

Game Scenes All

java.util.List<*CelestialBody*> **getSatellites**()
A list of celestial bodies that are in orbit around this celestial body.

Game Scenes All

Orbit **getOrbit**()
The orbit of the body.

Game Scenes All

float **getMass**()
The mass of the body, in kilograms.

Game Scenes All

float **getGravitationalParameter**()
The standard gravitational parameter of the body in $m^3 s^{-2}$.

Game Scenes All

float **getSurfaceGravity**()
The acceleration due to gravity at sea level (mean altitude) on the body, in m/s^2.

Game Scenes All

float **getRotationalPeriod**()
The sidereal rotational period of the body, in seconds.

Game Scenes All

float **getRotationalSpeed**()
The rotational speed of the body, in radians per second.

Game Scenes All

double **getRotationAngle**()
The current rotation angle of the body, in radians. A value between 0 and 2π

Game Scenes All

double **getInitialRotation**()
The initial rotation angle of the body (at UT 0), in radians. A value between 0 and 2π

Game Scenes All

float **getEquatorialRadius**()
The equatorial radius of the body, in meters.

Game Scenes All

double **surfaceHeight**(double *latitude*, double *longitude*)
The height of the surface relative to mean sea level, in meters, at the given position. When over water this is equal to 0.

Parameters

- **latitude** (*double*) – Latitude in degrees.
- **longitude** (*double*) – Longitude in degrees.

Game Scenes All

double **bedrockHeight**(double *latitude*, double *longitude*)
The height of the surface relative to mean sea level, in meters, at the given position. When over water, this is the height of the sea-bed and is therefore negative value.

Parameters

- **latitude** (*double*) – Latitude in degrees.
- **longitude** (*double*) – Longitude in degrees.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **mSLPosition**(double *latitude*, double *longitude*, *ReferenceFrame referenceFrame*)

The position at mean sea level at the given latitude and longitude, in the given reference frame.

Parameters

- **latitude** (*double*) – Latitude in degrees.
- **longitude** (*double*) – Longitude in degrees.
- **referenceFrame** (ReferenceFrame) – Reference frame for the returned position vector.

Returns Position as a vector.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **surfacePosition**(double *latitude*, double *longitude*, *ReferenceFrame referenceFrame*)

The position of the surface at the given latitude and longitude, in the given reference frame. When over water, this is the position of the surface of the water.

Parameters

- **latitude** (*double*) – Latitude in degrees.
- **longitude** (*double*) – Longitude in degrees.
- **referenceFrame** (ReferenceFrame) – Reference frame for the returned position vector.

Returns Position as a vector.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **bedrockPosition**(double *latitude*, double *longitude*, *ReferenceFrame referenceFrame*)

The position of the surface at the given latitude and longitude, in the given reference frame. When over water, this is the position at the bottom of the sea-bed.

Parameters

- **latitude** (*double*) – Latitude in degrees.
- **longitude** (*double*) – Longitude in degrees.
- **referenceFrame** (ReferenceFrame) – Reference frame for the returned position vector.

Returns Position as a vector.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **positionAtAltitude**(double *latitude*, double *longitude*, double *altitude*, *ReferenceFrame referenceFrame*)

The position at the given latitude, longitude and altitude, in the given reference frame.

Parameters

- **latitude** (*double*) – Latitude in degrees.

- **longitude** (*double*) – Longitude in degrees.
- **altitude** (*double*) – Altitude in meters above sea level.
- **referenceFrame** (ReferenceFrame) – Reference frame for the returned position vector.

Returns Position as a vector.

Game Scenes All

double **altitudeAtPosition**(org.javatuples.Triplet<Double, Double, Double> *position*, *ReferenceFrame referenceFrame*)

The altitude, in meters, of the given position in the given reference frame.

Parameters

- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – Position as a vector.
- **referenceFrame** (ReferenceFrame) – Reference frame for the position vector.

Game Scenes All

double **latitudeAtPosition**(org.javatuples.Triplet<Double, Double, Double> *position*, *ReferenceFrame referenceFrame*)

The latitude of the given position, in the given reference frame.

Parameters

- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – Position as a vector.
- **referenceFrame** (ReferenceFrame) – Reference frame for the position vector.

Game Scenes All

double **longitudeAtPosition**(org.javatuples.Triplet<Double, Double, Double> *position*, *ReferenceFrame referenceFrame*)

The longitude of the given position, in the given reference frame.

Parameters

- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – Position as a vector.
- **referenceFrame** (ReferenceFrame) – Reference frame for the position vector.

Game Scenes All

float **getSphereOfInfluence**()

The radius of the sphere of influence of the body, in meters.

Game Scenes All

boolean **getHasAtmosphere**()

`true` if the body has an atmosphere.

Game Scenes All

float **getAtmosphereDepth**()

The depth of the atmosphere, in meters.

Game Scenes All

double **atmosphericDensityAtPosition**(org.javatuples.Triplet<Double, Double, Double> *position*, *ReferenceFrame referenceFrame*)

The atmospheric density at the given position, in kg/m^3, in the given reference frame.

Parameters

- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – The position vector at which to measure the density.
- **referenceFrame** (ReferenceFrame) – Reference frame that the position vector is in.

Game Scenes All

boolean **getHasAtmosphericOxygen**()

`true` if there is oxygen in the atmosphere, required for air-breathing engines.

Game Scenes All

double **temperatureAt**(org.javatuples.Triplet<Double, Double, Double> *position*, *ReferenceFrame referenceFrame*)

The temperature on the body at the given position, in the given reference frame.

Parameters

- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – Position as a vector.
- **referenceFrame** (ReferenceFrame) – The reference frame that the position is in.

Game Scenes All

Note: This calculation is performed using the bodies current position, which means that the value could be wrong if you want to know the temperature in the far future.

---

double **densityAt**(double *altitude*)

Gets the air density, in kg/m^3, for the specified altitude above sea level, in meters.

Parameters

- **altitude** (*double*) –

Game Scenes All

Note: This is an approximation, because actual calculations, taking sun exposure into account to compute air temperature, require us to know the exact point on the body where the density is to be computed (knowing the altitude is not enough). However, the difference is small for high altitudes, so it makes very little difference for trajectory prediction.

---

double **pressureAt**(double *altitude*)

Gets the air pressure, in Pascals, for the specified altitude above sea level, in meters.

Parameters

- **altitude** (*double*) –

Game Scenes All

java.util.Set<String> **getBiomes**()

The biomes present on this body.

Game Scenes All

String **biomeAt**(double *latitude*, double *longitude*)
The biome at the given latitude and longitude, in degrees.

Parameters

- **latitude** (*double*) –
- **longitude** (*double*) –

Game Scenes All

float **getFlyingHighAltitudeThreshold**()
The altitude, in meters, above which a vessel is considered to be flying "high" when doing science.

Game Scenes All

float **getSpaceHighAltitudeThreshold**()
The altitude, in meters, above which a vessel is considered to be in "high" space when doing science.

Game Scenes All

ReferenceFrame **getReferenceFrame**()
The reference frame that is fixed relative to the celestial body.

- The origin is at the center of the body.
- The axes rotate with the body.
- The x-axis points from the center of the body towards the intersection of the prime meridian and equator (the position at 0° longitude, 0° latitude).
- The y-axis points from the center of the body towards the north pole.
- The z-axis points from the center of the body towards the equator at 90°E longitude.

Game Scenes All

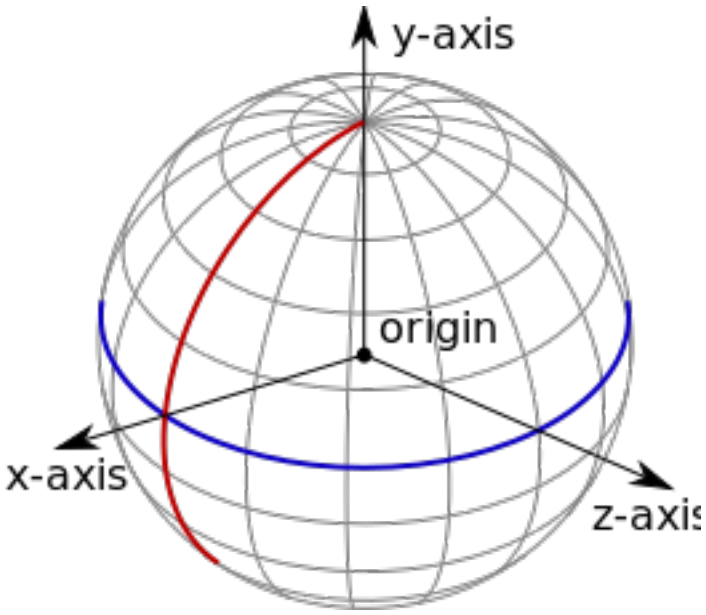

Fig. 6: Celestial body reference frame origin and axes. The equator is shown in blue, and the prime meridian in red.

ReferenceFrame **getNonRotatingReferenceFrame**()
The reference frame that is fixed relative to this celestial body, and orientated in a fixed direction (it does not rotate with the body).

- The origin is at the center of the body.
- The axes do not rotate.
- The x-axis points in an arbitrary direction through the equator.
- The y-axis points from the center of the body towards the north pole.
- The z-axis points in an arbitrary direction through the equator.

Game Scenes All

ReferenceFrame **getOrbitalReferenceFrame**()
The reference frame that is fixed relative to this celestial body, but orientated with the body's orbital prograde/normal/radial directions.

- The origin is at the center of the body.
- The axes rotate with the orbital prograde/normal/radial directions.
- The x-axis points in the orbital anti-radial direction.
- The y-axis points in the orbital prograde direction.
- The z-axis points in the orbital normal direction.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **position**(*ReferenceFrame referenceFrame*)
The position of the center of the body, in the specified reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned position vector is in.

Returns The position as a vector.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **velocity**(*ReferenceFrame referenceFrame*)
The linear velocity of the body, in the specified reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned velocity vector is in.

Returns The velocity as a vector. The vector points in the direction of travel, and its magnitude is the speed of the body in meters per second.

Game Scenes All

org.javatuples.Quartet<Double, Double, Double, Double> **rotation**(*ReferenceFrame referenceFrame*)
The rotation of the body, in the specified reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned rotation is in.

Returns The rotation as a quaternion of the form (x, y, z, w).

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **direction**(*ReferenceFrame referenceFrame*)
The direction in which the north pole of the celestial body is pointing, in the specified reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned direction is in.

Returns The direction as a unit vector.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **angularVelocity**(*ReferenceFrame referenceFrame*)
The angular velocity of the body in the specified reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame the returned angular velocity is in.

Returns The angular velocity as a vector. The magnitude of the vector is the rotational speed of the body, in radians per second. The direction of the vector indicates the axis of rotation, using the right-hand rule.

Game Scenes All

6.3.4 Flight

public class **Flight**
Used to get flight telemetry for a vessel, by calling *Vessel.flight(ReferenceFrame)*. All of the information returned by this class is given in the reference frame passed to that method. Obtained by calling *Vessel.flight(ReferenceFrame)*.

Note: To get orbital information, such as the apoapsis or inclination, see *Orbit*.

---

float **getGForce**()
The current G force acting on the vessel in g.

Game Scenes Flight

double **getMeanAltitude**()
The altitude above sea level, in meters. Measured from the center of mass of the vessel.

Game Scenes Flight

double **getSurfaceAltitude**()
The altitude above the surface of the body or sea level, whichever is closer, in meters. Measured from the center of mass of the vessel.

Game Scenes Flight

double **getBedrockAltitude**()
The altitude above the surface of the body, in meters. When over water, this is the altitude above the sea floor. Measured from the center of mass of the vessel.

Game Scenes Flight

double **getElevation**()
The elevation of the terrain under the vessel, in meters. This is the height of the terrain above sea level, and is negative when the vessel is over the sea.

Game Scenes Flight

double **getLatitude**()
The latitude of the vessel for the body being orbited, in degrees.

Game Scenes Flight

double **getLongitude**()
The longitude of the vessel for the body being orbited, in degrees.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getVelocity**()
The velocity of the vessel, in the reference frame *ReferenceFrame*.

Returns The velocity as a vector. The vector points in the direction of travel, and its magnitude is the speed of the vessel in meters per second.

Game Scenes Flight

double **getSpeed**()
The speed of the vessel in meters per second, in the reference frame *ReferenceFrame*.

Game Scenes Flight

double **getHorizontalSpeed**()
The horizontal speed of the vessel in meters per second, in the reference frame *ReferenceFrame*.

Game Scenes Flight

double **getVerticalSpeed**()
The vertical speed of the vessel in meters per second, in the reference frame *ReferenceFrame*.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getCenterOfMass**()
The position of the center of mass of the vessel, in the reference frame *ReferenceFrame*

Returns The position as a vector.

Game Scenes Flight

org.javatuples.Quartet<Double, Double, Double, Double> **getRotation**()
The rotation of the vessel, in the reference frame *ReferenceFrame*

Returns The rotation as a quaternion of the form (x, y, z, w).

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getDirection**()
The direction that the vessel is pointing in, in the reference frame *ReferenceFrame*.

Returns The direction as a unit vector.

Game Scenes Flight

float **getPitch**()
The pitch of the vessel relative to the horizon, in degrees. A value between -90° and +90°.

Game Scenes Flight

float **getHeading**()
The heading of the vessel (its angle relative to north), in degrees. A value between 0° and 360°.

Game Scenes Flight

float **getRoll**()
The roll of the vessel relative to the horizon, in degrees. A value between -180° and +180°.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getPrograde**()
The prograde direction of the vessels orbit, in the reference frame *ReferenceFrame*.

Returns The direction as a unit vector.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getRetrograde**()
The retrograde direction of the vessels orbit, in the reference frame *ReferenceFrame*.

Returns The direction as a unit vector.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getNormal**()
The direction normal to the vessels orbit, in the reference frame *ReferenceFrame*.

Returns The direction as a unit vector.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getAntiNormal**()
The direction opposite to the normal of the vessels orbit, in the reference frame *ReferenceFrame*.

Returns The direction as a unit vector.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getRadial**()
The radial direction of the vessels orbit, in the reference frame *ReferenceFrame*.

Returns The direction as a unit vector.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getAntiRadial**()
The direction opposite to the radial direction of the vessels orbit, in the reference frame *ReferenceFrame*.

Returns The direction as a unit vector.

Game Scenes Flight

float **getAtmosphereDensity**()
The current density of the atmosphere around the vessel, in kg/m^3.

Game Scenes Flight

float **getDynamicPressure**()
The dynamic pressure acting on the vessel, in Pascals. This is a measure of the strength of the aerodynamic forces. It is equal to $\frac{1}{2}$.air density.velocity^2. It is commonly denoted Q.

Game Scenes Flight

float **getStaticPressure**()
The static atmospheric pressure acting on the vessel, in Pascals.

Game Scenes Flight

float **getStaticPressureAtMSL**()
The static atmospheric pressure at mean sea level, in Pascals.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getAerodynamicForce**()
The total aerodynamic forces acting on the vessel, in reference frame *ReferenceFrame*.

Returns A vector pointing in the direction that the force acts, with its magnitude equal to the strength of the force in Newtons.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **simulateAerodynamicForceAt**(*CelestialBody body*, org.javatuples.Triplet<Double, Double, Double> *position*, org.javatuples.Triplet<Double, Double, Double> *velocity*)
Simulate and return the total aerodynamic forces acting on the vessel, if it where to be traveling with the given velocity at the given position in the atmosphere of the given celestial body.

Parameters

- **body** (CelestialBody) –
- **position** (*org.javatuples.Triplet<Double,Double,Double>*) –
- **velocity** (*org.javatuples.Triplet<Double,Double,Double>*) –

Returns A vector pointing in the direction that the force acts, with its magnitude equal to the strength of the force in Newtons.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getLift**()
The aerodynamic lift currently acting on the vessel.

Returns A vector pointing in the direction that the force acts, with its magnitude equal to the strength of the force in Newtons.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getDrag**()
The aerodynamic drag currently acting on the vessel.

Returns A vector pointing in the direction of the force, with its magnitude equal to the strength of the force in Newtons.

Game Scenes Flight

float **getSpeedOfSound**()
The speed of sound, in the atmosphere around the vessel, in m/s.

Game Scenes Flight

float **getMach**()
The speed of the vessel, in multiples of the speed of sound.

Game Scenes Flight

float **getReynoldsNumber**()
The vessels Reynolds number.

Game Scenes Flight

Note: Requires Ferram Aerospace Research.

float **getTrueAirSpeed**()
The true air speed of the vessel, in meters per second.

Game Scenes Flight

float **getEquivalentAirSpeed**()
The equivalent air speed of the vessel, in meters per second.

Game Scenes Flight

float **getTerminalVelocity**()
An estimate of the current terminal velocity of the vessel, in meters per second. This is the speed at which the drag forces cancel out the force of gravity.

Game Scenes Flight

float **getAngleOfAttack**()
The pitch angle between the orientation of the vessel and its velocity vector, in degrees.

Game Scenes Flight

float **getSideslipAngle**()
The yaw angle between the orientation of the vessel and its velocity vector, in degrees.

Game Scenes Flight

float **getTotalAirTemperature**()
The total air temperature of the atmosphere around the vessel, in Kelvin. This includes the *Flight.getStaticAirTemperature()* and the vessel's kinetic energy.

Game Scenes Flight

float **getStaticAirTemperature**()
The static (ambient) temperature of the atmosphere around the vessel, in Kelvin.

Game Scenes Flight

float **getStallFraction**()
The current amount of stall, between 0 and 1. A value greater than 0.005 indicates a minor stall and a value greater than 0.5 indicates a large-scale stall.

Game Scenes Flight

Note: Requires Ferram Aerospace Research.

float **getDragCoefficient**()
The coefficient of drag. This is the amount of drag produced by the vessel. It depends on air speed, air density and wing area.

Game Scenes Flight

Note: Requires Ferram Aerospace Research.

float **getLiftCoefficient**()
The coefficient of lift. This is the amount of lift produced by the vessel, and depends on air speed, air density and wing area.

Game Scenes Flight

Note: Requires Ferram Aerospace Research.

float **getBallisticCoefficient**()
The ballistic coefficient.

Game Scenes Flight

Note: Requires Ferram Aerospace Research.

float **getThrustSpecificFuelConsumption**()
The thrust specific fuel consumption for the jet engines on the vessel. This is a measure of the efficiency of the engines, with a lower value indicating a more efficient vessel. This value is the number of Newtons of fuel that are burned, per hour, to produce one newton of thrust.

Game Scenes Flight

Note: Requires Ferram Aerospace Research.

6.3.5 Orbit

public class **Orbit**
Describes an orbit. For example, the orbit of a vessel, obtained by calling *Vessel.getOrbit()*, or a celestial body, obtained by calling *CelestialBody.getOrbit()*.

CelestialBody **getBody**()
The celestial body (e.g. planet or moon) around which the object is orbiting.

Game Scenes All

double **getApoapsis**()
Gets the apoapsis of the orbit, in meters, from the center of mass of the body being orbited.

Game Scenes All

Note: For the apoapsis altitude reported on the in-game map view, use *Orbit.getApoapsisAltitude()*.

double **getPeriapsis**()
The periapsis of the orbit, in meters, from the center of mass of the body being orbited.

Game Scenes All

Note: For the periapsis altitude reported on the in-game map view, use *Orbit.getPeriapsisAltitude()*.

double **getApoapsisAltitude**()
The apoapsis of the orbit, in meters, above the sea level of the body being orbited.

Game Scenes All

Note: This is equal to *Orbit.getApoapsis()* minus the equatorial radius of the body.

double **getPeriapsisAltitude**()
The periapsis of the orbit, in meters, above the sea level of the body being orbited.

Game Scenes All

Note: This is equal to *Orbit.getPeriapsis()* minus the equatorial radius of the body.

double **getSemiMajorAxis**()
The semi-major axis of the orbit, in meters.

Game Scenes All

double **getSemiMinorAxis**()
The semi-minor axis of the orbit, in meters.

Game Scenes All

double **getRadius**()
The current radius of the orbit, in meters. This is the distance between the center of mass of the object in orbit, and the center of mass of the body around which it is orbiting.

Game Scenes All

Note: This value will change over time if the orbit is elliptical.

double **radiusAt**(double *ut*)
The orbital radius at the given time, in meters.

Parameters

- **ut** (*double*) – The universal time to measure the radius at.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **positionAt**(double *ut*, *ReferenceFrame referenceFrame*)
The position at a given time, in the specified reference frame.

Parameters

- **ut** (*double*) – The universal time to measure the position at.
- **referenceFrame** (ReferenceFrame) – The reference frame that the returned position vector is in.

Returns The position as a vector.

Game Scenes All

double **getSpeed**()
The current orbital speed of the object in meters per second.

Game Scenes All

Note: This value will change over time if the orbit is elliptical.

double **getPeriod**()
The orbital period, in seconds.

Game Scenes All

double **getTimeToApoapsis**()
The time until the object reaches apoapsis, in seconds.

Game Scenes All

double **getTimeToPeriapsis**()
The time until the object reaches periapsis, in seconds.

Game Scenes All

double **getEccentricity**()
The eccentricity of the orbit.

Game Scenes All

double **getInclination**()
The inclination of the orbit, in radians.

Game Scenes All

double **getLongitudeOfAscendingNode**()
The longitude of the ascending node, in radians.

Game Scenes All

double **getArgumentOfPeriapsis**()
The argument of periapsis, in radians.

Game Scenes All

double **getMeanAnomalyAtEpoch**()
The mean anomaly at epoch.

Game Scenes All

double **getEpoch**()
The time since the epoch (the point at which the mean anomaly at epoch was measured, in seconds.

Game Scenes All

double **getMeanAnomaly**()
The mean anomaly.

Game Scenes All

double **meanAnomalyAtUT**(double *ut*)
The mean anomaly at the given time.

Parameters

- **ut** (*double*) – The universal time in seconds.

Game Scenes All

double **getEccentricAnomaly**()
The eccentric anomaly.

Game Scenes All

double **eccentricAnomalyAtUT**(double *ut*)
The eccentric anomaly at the given universal time.

Parameters

- **ut** (*double*) – The universal time, in seconds.

Game Scenes All

double **getTrueAnomaly**()
The true anomaly.

Game Scenes All

double **trueAnomalyAtUT**(double *ut*)
The true anomaly at the given time.

Parameters

- **ut** (*double*) – The universal time in seconds.

Game Scenes All

double **trueAnomalyAtRadius**(double *radius*)
The true anomaly at the given orbital radius.

Parameters

- **radius** (*double*) – The orbital radius in meters.

Game Scenes All

double **uTAtTrueAnomaly**(double *trueAnomaly*)
The universal time, in seconds, corresponding to the given true anomaly.

Parameters

- **trueAnomaly** (*double*) – True anomaly.

Game Scenes All

double **radiusAtTrueAnomaly**(double *trueAnomaly*)
The orbital radius at the point in the orbit given by the true anomaly.

Parameters

- **trueAnomaly** (*double*) – The true anomaly.

Game Scenes All

double **trueAnomalyAtAN**(*Orbit target*)
The true anomaly of the ascending node with the given target orbit.

Parameters

- **target** (Orbit) – Target orbit.

Game Scenes All

double **trueAnomalyAtDN**(*Orbit target*)
The true anomaly of the descending node with the given target orbit.

Parameters

- **target** (Orbit) – Target orbit.

Game Scenes All

double **getOrbitalSpeed**()
The current orbital speed in meters per second.

Game Scenes All

double **orbitalSpeedAt**(double *time*)
The orbital speed at the given time, in meters per second.

Parameters

- **time** (*double*) – Time from now, in seconds.

Game Scenes All

static org.javatuples.Triplet<Double, Double, Double> **referencePlaneNormal**(*Connection connection*, *ReferenceFrame referenceFrame*)
The direction that is normal to the orbits reference plane, in the given reference frame. The reference plane is the plane from which the orbits inclination is measured.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned direction is in.

Returns The direction as a unit vector.

Game Scenes All

static org.javatuples.Triplet<Double, Double, Double> **referencePlaneDirection**(*Connection connection*, *ReferenceFrame referenceFrame*)
The direction from which the orbits longitude of ascending node is measured, in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned direction is in.

Returns The direction as a unit vector.

Game Scenes All

double **relativeInclination**(*Orbit target*)
Relative inclination of this orbit and the target orbit, in radians.

Parameters

- **target** (Orbit) – Target orbit.

Game Scenes All

double **getTimeToSOIChange**()
The time until the object changes sphere of influence, in seconds. Returns NaN if the object is not going to change sphere of influence.

Game Scenes All

Orbit **getNextOrbit**()
If the object is going to change sphere of influence in the future, returns the new orbit after the change. Otherwise returns null.

Game Scenes All

double **timeOfClosestApproach**(*Orbit target*)
Estimates and returns the time at closest approach to a target orbit.

Parameters

- **target** (`Orbit`) – Target orbit.

Returns The universal time at closest approach, in seconds.

Game Scenes All

double **distanceAtClosestApproach**(*Orbit target*)
Estimates and returns the distance at closest approach to a target orbit, in meters.

Parameters

- **target** (`Orbit`) – Target orbit.

Game Scenes All

java.util.List<java.util.List<Double>> **listClosestApproaches**(*Orbit target*, int *orbits*)
Returns the times at closest approach and corresponding distances, to a target orbit.

Parameters

- **target** (`Orbit`) – Target orbit.
- **orbits** (*int*) – The number of future orbits to search.

Returns A list of two lists. The first is a list of times at closest approach, as universal times in seconds. The second is a list of corresponding distances at closest approach, in meters.

Game Scenes All

6.3.6 Control

public class **Control**
Used to manipulate the controls of a vessel. This includes adjusting the throttle, enabling/disabling systems such as SAS and RCS, or altering the direction in which the vessel is pointing. Obtained by calling *Vessel.getControl()*.

Note: Control inputs (such as pitch, yaw and roll) are zeroed when all clients that have set one or more of these inputs are no longer connected.

ControlSource **getSource**()
The source of the vessels control, for example by a kerbal or a probe core.

Game Scenes Flight

ControlState **getState**()
The control state of the vessel.

Game Scenes Flight

boolean **getSAS**()

void **setSAS**(boolean *value*)
The state of SAS.

Game Scenes Flight

Note: Equivalent to `AutoPilot.getSAS()`

SASMode **getSASMode**()

void **setSASMode**(*SASMode value*)
The current `SASMode`. These modes are equivalent to the mode buttons to the left of the navball that appear when SAS is enabled.

Game Scenes Flight

Note: Equivalent to `AutoPilot.getSASMode()`

SpeedMode **getSpeedMode**()

void **setSpeedMode**(*SpeedMode value*)
The current `SpeedMode` of the navball. This is the mode displayed next to the speed at the top of the navball.

Game Scenes Flight

boolean **getRCS**()

void **setRCS**(boolean *value*)
The state of RCS.

Game Scenes Flight

boolean **getReactionWheels**()

void **setReactionWheels**(boolean *value*)
Returns whether all reactive wheels on the vessel are active, and sets the active state of all reaction wheels. See `ReactionWheel.getActive()`.

Game Scenes Flight

boolean **getGear**()

void **setGear**(boolean *value*)
The state of the landing gear/legs.

Game Scenes Flight

boolean **getLegs**()

void **setLegs**(boolean *value*)
Returns whether all landing legs on the vessel are deployed, and sets the deployment state of all landing legs. Does not include wheels (for example landing gear). See `Leg.getDeployed()`.

Game Scenes Flight

boolean **getWheels**()

void **setWheels**(boolean *value*)
Returns whether all wheels on the vessel are deployed, and sets the deployment state of all wheels. Does not include landing legs. See `Wheel.getDeployed()`.

Game Scenes Flight

boolean **getLights**()

void **setLights**(boolean *value*)
The state of the lights.

Game Scenes Flight

boolean **getBrakes**()

void **setBrakes**(boolean *value*)
The state of the wheel brakes.

Game Scenes Flight

boolean **getAntennas**()

void **setAntennas**(boolean *value*)
Returns whether all antennas on the vessel are deployed, and sets the deployment state of all antennas. See *Antenna.getDeployed()*.

Game Scenes Flight

boolean **getCargoBays**()

void **setCargoBays**(boolean *value*)
Returns whether any of the cargo bays on the vessel are open, and sets the open state of all cargo bays. See *CargoBay.getOpen()*.

Game Scenes Flight

boolean **getIntakes**()

void **setIntakes**(boolean *value*)
Returns whether all of the air intakes on the vessel are open, and sets the open state of all air intakes. See *Intake.getOpen()*.

Game Scenes Flight

boolean **getParachutes**()

void **setParachutes**(boolean *value*)
Returns whether all parachutes on the vessel are deployed, and sets the deployment state of all parachutes. Cannot be set to `false`. See *Parachute.getDeployed()*.

Game Scenes Flight

boolean **getRadiators**()

void **setRadiators**(boolean *value*)
Returns whether all radiators on the vessel are deployed, and sets the deployment state of all radiators. See *Radiator.getDeployed()*.

Game Scenes Flight

boolean **getResourceHarvesters**()

void **setResourceHarvesters**(boolean *value*)
Returns whether all of the resource harvesters on the vessel are deployed, and sets the deployment state of all resource harvesters. See *ResourceHarvester.getDeployed()*.

Game Scenes Flight

boolean **getResourceHarvestersActive**()

void **setResourceHarvestersActive**(boolean *value*)
Returns whether any of the resource harvesters on the vessel are active, and sets the active state of all resource harvesters. See *ResourceHarvester.getActive()*.

Game Scenes Flight

boolean **getSolarPanels**()

void **setSolarPanels**(boolean *value*)
Returns whether all solar panels on the vessel are deployed, and sets the deployment state of all solar panels. See *SolarPanel.getDeployed()*.

Game Scenes Flight

boolean **getAbort**()

void **setAbort**(boolean *value*)
The state of the abort action group.

Game Scenes Flight

float **getThrottle**()

void **setThrottle**(float *value*)
The state of the throttle. A value between 0 and 1.

Game Scenes Flight

ControlInputMode **getInputMode**()

void **setInputMode**(*ControlInputMode value*)
Sets the behavior of the pitch, yaw, roll and translation control inputs. When set to additive, these inputs are added to the vessels current inputs. This mode is the default. When set to override, these inputs (if non-zero) override the vessels inputs. This mode prevents keyboard control, or SAS, from interfering with the controls when they are set.

Game Scenes Flight

float **getPitch**()

void **setPitch**(float *value*)
The state of the pitch control. A value between -1 and 1. Equivalent to the w and s keys.

Game Scenes Flight

float **getYaw**()

void **setYaw**(float *value*)
The state of the yaw control. A value between -1 and 1. Equivalent to the a and d keys.

Game Scenes Flight

float **getRoll**()

void **setRoll**(float *value*)
The state of the roll control. A value between -1 and 1. Equivalent to the q and e keys.

Game Scenes Flight

float **getForward**()

void **setForward**(float *value*)
The state of the forward translational control. A value between -1 and 1. Equivalent to the h and n keys.

Game Scenes Flight

float **getUp**()

void **setUp**(float *value*)
The state of the up translational control. A value between -1 and 1. Equivalent to the i and k keys.

Game Scenes Flight

float **getRight**()

void **setRight**(float *value*)
The state of the right translational control. A value between -1 and 1. Equivalent to the j and l keys.

Game Scenes Flight

float **getWheelThrottle**()

void **setWheelThrottle**(float *value*)
The state of the wheel throttle. A value between -1 and 1. A value of 1 rotates the wheels forwards, a value of -1 rotates the wheels backwards.

Game Scenes Flight

float **getWheelSteering**()

void **setWheelSteering**(float *value*)
The state of the wheel steering. A value between -1 and 1. A value of 1 steers to the left, and a value of -1 steers to the right.

Game Scenes Flight

int **getCurrentStage**()
The current stage of the vessel. Corresponds to the stage number in the in-game UI.

Game Scenes Flight

java.util.List<*Vessel*> **activateNextStage**()
Activates the next stage. Equivalent to pressing the space bar in-game.

Returns A list of vessel objects that are jettisoned from the active vessel.

Game Scenes Flight

Note: When called, the active vessel may change. It is therefore possible that, after calling this function, the object(s) returned by previous call(s) to `getActiveVessel()` no longer refer to the active vessel.

---

boolean **getActionGroup**(int *group*)
Returns `true` if the given action group is enabled.

Parameters

- **group** (*int*) – A number between 0 and 9 inclusive, or between 0 and 250 inclusive when the Extended Action Groups mod is installed.

Game Scenes Flight

void **setActionGroup**(int *group*, boolean *state*)
Sets the state of the given action group.

Parameters

- **group** (*int*) – A number between 0 and 9 inclusive, or between 0 and 250 inclusive when the Extended Action Groups mod is installed.
- **state** (*boolean*) –

Game Scenes Flight

void **toggleActionGroup**(int *group*)
Toggles the state of the given action group.

Parameters

- **group** (*int*) – A number between 0 and 9 inclusive, or between 0 and 250 inclusive when the Extended Action Groups mod is installed.

Game Scenes Flight

Node **addNode** (double *ut*, float *prograde*, float *normal*, float *radial*)
Creates a maneuver node at the given universal time, and returns a *Node* object that can be used to modify it. Optionally sets the magnitude of the delta-v for the maneuver node in the prograde, normal and radial directions.

Parameters

- **ut** (*double*) – Universal time of the maneuver node.
- **prograde** (*float*) – Delta-v in the prograde direction.
- **normal** (*float*) – Delta-v in the normal direction.
- **radial** (*float*) – Delta-v in the radial direction.

Game Scenes Flight

java.util.List<*Node*> **getNodes** ()
Returns a list of all existing maneuver nodes, ordered by time from first to last.

Game Scenes Flight

void **removeNodes** ()
Remove all maneuver nodes.

Game Scenes Flight

public enum **ControlState**
The control state of a vessel. See *Control.getState()*.

public *ControlState* **FULL**
Full controllable.

public *ControlState* **PARTIAL**
Partially controllable.

public *ControlState* **NONE**
Not controllable.

public enum **ControlSource**
The control source of a vessel. See *Control.getSource()*.

public *ControlSource* **KERBAL**
Vessel is controlled by a Kerbal.

public *ControlSource* **PROBE**
Vessel is controlled by a probe core.

public *ControlSource* **NONE**
Vessel is not controlled.

public enum **SASMode**
The behavior of the SAS auto-pilot. See *AutoPilot.getSASMode()*.

public *SASMode* **STABILITY_ASSIST**
Stability assist mode. Dampen out any rotation.

public *SASMode* **MANEUVER**
Point in the burn direction of the next maneuver node.

public *SASMode* **PROGRADE**
Point in the prograde direction.

public *SASMode* **RETROGRADE**
Point in the retrograde direction.

public *SASMode* **NORMAL**
Point in the orbit normal direction.

public *SASMode* **ANTI_NORMAL**
Point in the orbit anti-normal direction.

public *SASMode* **RADIAL**
Point in the orbit radial direction.

public *SASMode* **ANTI_RADIAL**
Point in the orbit anti-radial direction.

public *SASMode* **TARGET**
Point in the direction of the current target.

public *SASMode* **ANTI_TARGET**
Point away from the current target.

public enum **SpeedMode**
The mode of the speed reported in the navball. See *Control.getSpeedMode()*.

public *SpeedMode* **ORBIT**
Speed is relative to the vessel's orbit.

public *SpeedMode* **SURFACE**
Speed is relative to the surface of the body being orbited.

public *SpeedMode* **TARGET**
Speed is relative to the current target.

public enum **ControlInputMode**
See *Control.getInputMode()*.

public *ControlInputMode* **ADDITIVE**
Control inputs are added to the vessels current control inputs.

public *ControlInputMode* **OVERRIDE**
Control inputs (when they are non-zero) override the vessels current control inputs.

6.3.7 Communications

public class **Comms**
Used to interact with CommNet for a given vessel. Obtained by calling *Vessel.getComms()*.

boolean **getCanCommunicate**()
Whether the vessel can communicate with KSC.

Game Scenes Flight

boolean **getCanTransmitScience**()
Whether the vessel can transmit science data to KSC.

Game Scenes Flight

double **getSignalStrength**()
Signal strength to KSC.

Game Scenes Flight

double **getSignalDelay**()
Signal delay to KSC in seconds.

Game Scenes Flight

double **getPower**()
The combined power of all active antennae on the vessel.

Game Scenes Flight

java.util.List<*CommLink*> **getControlPath**()
The communication path used to control the vessel.

Game Scenes Flight

public class **CommLink**
Represents a communication node in the network. For example, a vessel or the KSC.

CommLinkType **getType**()
The type of link.

Game Scenes All

double **getSignalStrength**()
Signal strength of the link.

Game Scenes All

CommNode **getStart**()
Start point of the link.

Game Scenes All

CommNode **getEnd**()
Start point of the link.

Game Scenes All

public enum **CommLinkType**
The type of a communication link. See *CommLink.getType()*.

public *CommLinkType* **HOME**
Link is to a base station on Kerbin.

public *CommLinkType* **CONTROL**
Link is to a control source, for example a manned spacecraft.

public *CommLinkType* **RELAY**
Link is to a relay satellite.

public class **CommNode**
Represents a communication node in the network. For example, a vessel or the KSC.

String **getName**()
Name of the communication node.

Game Scenes All

boolean **getIsHome**()
Whether the communication node is on Kerbin.

Game Scenes All

boolean **getIsControlPoint**()
Whether the communication node is a control point, for example a manned vessel.

Game Scenes All

boolean **getIsVessel**()
Whether the communication node is a vessel.

Game Scenes All

Vessel **getVessel**()
The vessel for this communication node.

Game Scenes All

6.3.8 Parts

The following classes allow interaction with a vessels individual parts.

- *Parts*
- *Part*
- *Module*
- *Specific Types of Part*
  - *Antenna*
  - *Cargo Bay*
  - *Control Surface*
  - *Decoupler*
  - *Docking Port*
  - *Engine*
  - *Experiment*
  - *Fairing*
  - *Intake*
  - *Leg*
  - *Launch Clamp*
  - *Light*
  - *Parachute*
  - *Radiator*
  - *Resource Converter*
  - *Resource Harvester*
  - *Reaction Wheel*
  - *RCS*
  - *Sensor*

  - *Solar Panel*
  - *Thruster*
  - *Wheel*
- *Trees of Parts*
  - *Traversing the Tree*
  - *Attachment Modes*
- *Fuel Lines*
- *Staging*

Parts

public class **Parts**

Instances of this class are used to interact with the parts of a vessel. An instance can be obtained by calling `Vessel.getParts()`.

java.util.List<*Part*> **getAll**()

A list of all of the vessels parts.

Game Scenes All

Part **getRoot**()

The vessels root part.

Game Scenes All

Note: See the discussion on *Trees of Parts*.

Part **getControlling**()

void **setControlling**(*Part value*)

The part from which the vessel is controlled.

Game Scenes All

java.util.List<*Part*> **withName**(String *name*)

A list of parts whose `Part.getName()` is *name*.

Parameters

- **name** (*String*) –

Game Scenes All

java.util.List<*Part*> **withTitle**(String *title*)

A list of all parts whose `Part.getTitle()` is *title*.

Parameters

- **title** (*String*) –

Game Scenes All

java.util.List<*Part*> **withTag**(String *tag*)

A list of all parts whose `Part.getTag()` is *tag*.

Parameters

- **tag** (*String*) –

Game Scenes All

java.util.List<*Part*> **withModule**(String *moduleName*)
A list of all parts that contain a *Module* whose *Module.getName()* is *moduleName*.

Parameters

- **moduleName** (*String*) –

Game Scenes All

java.util.List<*Part*> **inStage**(int *stage*)
A list of all parts that are activated in the given *stage*.

Parameters

- **stage** (*int*) –

Game Scenes All

Note: See the discussion on *Staging*.

---

java.util.List<*Part*> **inDecoupleStage**(int *stage*)
A list of all parts that are decoupled in the given *stage*.

Parameters

- **stage** (*int*) –

Game Scenes All

Note: See the discussion on *Staging*.

---

java.util.List<*Module*> **modulesWithName**(String *moduleName*)
A list of modules (combined across all parts in the vessel) whose *Module.getName()* is *moduleName*.

Parameters

- **moduleName** (*String*) –

Game Scenes All

java.util.List<*Antenna*> **getAntennas**()
A list of all antennas in the vessel.

Game Scenes All

java.util.List<*CargoBay*> **getCargoBays**()
A list of all cargo bays in the vessel.

Game Scenes All

java.util.List<*ControlSurface*> **getControlSurfaces**()
A list of all control surfaces in the vessel.

Game Scenes All

java.util.List<*Decoupler*> **getDecouplers**()
A list of all decouplers in the vessel.

Game Scenes All

java.util.List<*DockingPort*> **getDockingPorts**()
A list of all docking ports in the vessel.

Game Scenes All

java.util.List<*Engine*> **getEngines**()
A list of all engines in the vessel.

Game Scenes All

Note: This includes any part that generates thrust. This covers many different types of engine, including liquid fuel rockets, solid rocket boosters, jet engines and RCS thrusters.

---

java.util.List<*Experiment*> **getExperiments**()
A list of all science experiments in the vessel.

Game Scenes All

java.util.List<*Fairing*> **getFairings**()
A list of all fairings in the vessel.

Game Scenes All

java.util.List<*Intake*> **getIntakes**()
A list of all intakes in the vessel.

Game Scenes All

java.util.List<*Leg*> **getLegs**()
A list of all landing legs attached to the vessel.

Game Scenes All

java.util.List<*LaunchClamp*> **getLaunchClamps**()
A list of all launch clamps attached to the vessel.

Game Scenes All

java.util.List<*Light*> **getLights**()
A list of all lights in the vessel.

Game Scenes All

java.util.List<*Parachute*> **getParachutes**()
A list of all parachutes in the vessel.

Game Scenes All

java.util.List<*Radiator*> **getRadiators**()
A list of all radiators in the vessel.

Game Scenes All

java.util.List<*RCS*> **getRCS**()
A list of all RCS blocks/thrusters in the vessel.

Game Scenes All

java.util.List<*ReactionWheel*> **getReactionWheels**()
A list of all reaction wheels in the vessel.

Game Scenes All

java.util.List<*ResourceConverter*> **getResourceConverters**()
A list of all resource converters in the vessel.

Game Scenes All

java.util.List<*ResourceHarvester*> **getResourceHarvesters**()
A list of all resource harvesters in the vessel.

Game Scenes All

java.util.List<*Sensor*> **getSensors**()
A list of all sensors in the vessel.

Game Scenes All

java.util.List<*SolarPanel*> **getSolarPanels**()
A list of all solar panels in the vessel.

Game Scenes All

java.util.List<*Wheel*> **getWheels**()
A list of all wheels in the vessel.

Game Scenes All

Part

public class **Part**
Represents an individual part. Vessels are made up of multiple parts. Instances of this class can be obtained by several methods in `Parts`.

String **getName**()
Internal name of the part, as used in part cfg files. For example "Mark1-2Pod".

Game Scenes All

String **getTitle**()
Title of the part, as shown when the part is right clicked in-game. For example "Mk1-2 Command Pod".

Game Scenes All

String **getTag**()

void **setTag**(String *value*)
The name tag for the part. Can be set to a custom string using the in-game user interface.

Game Scenes All

Note: This string is shared with kOS if it is installed.

---

boolean **getHighlighted**()

void **setHighlighted**(boolean *value*)
Whether the part is highlighted.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **getHighlightColor**()

void **setHighlightColor**(org.javatuples.Triplet<Double, Double, Double> *value*)
The color used to highlight the part, as an RGB triple.

Game Scenes All

double **getCost**()
The cost of the part, in units of funds.

Game Scenes All

Vessel **getVessel**()
The vessel that contains this part.

Game Scenes All

Part **getParent**()
The parts parent. Returns `null` if the part does not have a parent. This, in combination with *`Part.getChildren()`*, can be used to traverse the vessels parts tree.

Game Scenes All

Note: See the discussion on *Trees of Parts*.

---

java.util.List<*Part*> **getChildren**()
The parts children. Returns an empty list if the part has no children. This, in combination with *`Part.getParent()`*, can be used to traverse the vessels parts tree.

Game Scenes All

Note: See the discussion on *Trees of Parts*.

---

boolean **getAxiallyAttached**()
Whether the part is axially attached to its parent, i.e. on the top or bottom of its parent. If the part has no parent, returns `false`.

Game Scenes All

Note: See the discussion on *Attachment Modes*.

---

boolean **getRadiallyAttached**()
Whether the part is radially attached to its parent, i.e. on the side of its parent. If the part has no parent, returns `false`.

Game Scenes All

Note: See the discussion on *Attachment Modes*.

---

int **getStage**()
The stage in which this part will be activated. Returns -1 if the part is not activated by staging.

Game Scenes All

Note: See the discussion on *Staging*.

---

int **getDecoupleStage**()
The stage in which this part will be decoupled. Returns -1 if the part is never decoupled from the vessel.

Game Scenes All

Note: See the discussion on *Staging*.

boolean **getMassless**()
Whether the part is massless.

Game Scenes All

double **getMass**()
The current mass of the part, including resources it contains, in kilograms. Returns zero if the part is massless.

Game Scenes All

double **getDryMass**()
The mass of the part, not including any resources it contains, in kilograms. Returns zero if the part is massless.

Game Scenes All

boolean **getShielded**()
Whether the part is shielded from the exterior of the vessel, for example by a fairing.

Game Scenes All

float **getDynamicPressure**()
The dynamic pressure acting on the part, in Pascals.

Game Scenes All

double **getImpactTolerance**()
The impact tolerance of the part, in meters per second.

Game Scenes All

double **getTemperature**()
Temperature of the part, in Kelvin.

Game Scenes All

double **getSkinTemperature**()
Temperature of the skin of the part, in Kelvin.

Game Scenes All

double **getMaxTemperature**()
Maximum temperature that the part can survive, in Kelvin.

Game Scenes All

double **getMaxSkinTemperature**()
Maximum temperature that the skin of the part can survive, in Kelvin.

Game Scenes All

float **getThermalMass**()
A measure of how much energy it takes to increase the internal temperature of the part, in Joules per Kelvin.

Game Scenes All

float **getThermalSkinMass**()
A measure of how much energy it takes to increase the skin temperature of the part, in Joules per Kelvin.

Game Scenes All

float **getThermalResourceMass**()
A measure of how much energy it takes to increase the temperature of the resources contained in the part, in Joules per Kelvin.

Game Scenes All

float **getThermalConductionFlux**()
The rate at which heat energy is conducting into or out of the part via contact with other parts. Measured in energy per unit time, or power, in Watts. A positive value means the part is gaining heat energy, and negative means it is losing heat energy.

Game Scenes All

float **getThermalConvectionFlux**()
The rate at which heat energy is convecting into or out of the part from the surrounding atmosphere. Measured in energy per unit time, or power, in Watts. A positive value means the part is gaining heat energy, and negative means it is losing heat energy.

Game Scenes All

float **getThermalRadiationFlux**()
The rate at which heat energy is radiating into or out of the part from the surrounding environment. Measured in energy per unit time, or power, in Watts. A positive value means the part is gaining heat energy, and negative means it is losing heat energy.

Game Scenes All

float **getThermalInternalFlux**()
The rate at which heat energy is begin generated by the part. For example, some engines generate heat by combusting fuel. Measured in energy per unit time, or power, in Watts. A positive value means the part is gaining heat energy, and negative means it is losing heat energy.

Game Scenes All

float **getThermalSkinToInternalFlux**()
The rate at which heat energy is transferring between the part's skin and its internals. Measured in energy per unit time, or power, in Watts. A positive value means the part's internals are gaining heat energy, and negative means its skin is gaining heat energy.

Game Scenes All

Resources **getResources**()
A *Resources* object for the part.

Game Scenes All

boolean **getCrossfeed**()
Whether this part is crossfeed capable.

Game Scenes All

boolean **getIsFuelLine**()
Whether this part is a fuel line.

Game Scenes All

java.util.List<*Part*> **getFuelLinesFrom**()
The parts that are connected to this part via fuel lines, where the direction of the fuel line is into this part.

Game Scenes All

Note: See the discussion on *Fuel Lines*.

---

java.util.List<*Part*> **getFuelLinesTo**()
The parts that are connected to this part via fuel lines, where the direction of the fuel line is out of this part.

Game Scenes All

Note: See the discussion on *Fuel Lines*.

---

java.util.List<*Module*> **getModules**()
The modules for this part.

Game Scenes All

Antenna **getAntenna**()
A *Antenna* if the part is an antenna, otherwise `null`.

Game Scenes All

CargoBay **getCargoBay**()
A *CargoBay* if the part is a cargo bay, otherwise `null`.

Game Scenes All

ControlSurface **getControlSurface**()
A *ControlSurface* if the part is an aerodynamic control surface, otherwise `null`.

Game Scenes All

Decoupler **getDecoupler**()
A *Decoupler* if the part is a decoupler, otherwise `null`.

Game Scenes All

DockingPort **getDockingPort**()
A *DockingPort* if the part is a docking port, otherwise `null`.

Game Scenes All

Engine **getEngine**()
An *Engine* if the part is an engine, otherwise `null`.

Game Scenes All

Experiment **getExperiment**()
An *Experiment* if the part is a science experiment, otherwise `null`.

Game Scenes All

Fairing **getFairing**()
A *Fairing* if the part is a fairing, otherwise `null`.

Game Scenes All

Intake **getIntake**()
An *Intake* if the part is an intake, otherwise `null`.

Game Scenes All

Note: This includes any part that generates thrust. This covers many different types of engine, including liquid fuel rockets, solid rocket boosters and jet engines. For RCS thrusters see *RCS*.

Leg **getLeg**()
A *Leg* if the part is a landing leg, otherwise `null`.

Game Scenes All

LaunchClamp **getLaunchClamp**()
A *LaunchClamp* if the part is a launch clamp, otherwise null.

Game Scenes All

Light **getLight**()
A *Light* if the part is a light, otherwise null.

Game Scenes All

Parachute **getParachute**()
A *Parachute* if the part is a parachute, otherwise null.

Game Scenes All

Radiator **getRadiator**()
A *Radiator* if the part is a radiator, otherwise null.

Game Scenes All

RCS **getRCS**()
A *RCS* if the part is an RCS block/thruster, otherwise null.

Game Scenes All

ReactionWheel **getReactionWheel**()
A *ReactionWheel* if the part is a reaction wheel, otherwise null.

Game Scenes All

ResourceConverter **getResourceConverter**()
A *ResourceConverter* if the part is a resource converter, otherwise null.

Game Scenes All

ResourceHarvester **getResourceHarvester**()
A *ResourceHarvester* if the part is a resource harvester, otherwise null.

Game Scenes All

Sensor **getSensor**()
A *Sensor* if the part is a sensor, otherwise null.

Game Scenes All

SolarPanel **getSolarPanel**()
A *SolarPanel* if the part is a solar panel, otherwise null.

Game Scenes All

Wheel **getWheel**()
A *Wheel* if the part is a wheel, otherwise null.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **position**(*ReferenceFrame referenceFrame*)
The position of the part in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned position vector is in.

Returns The position as a vector.

Game Scenes All

Note: This is a fixed position in the part, defined by the parts model. It s not necessarily the same as the parts center of mass. Use *`Part.centerOfMass(ReferenceFrame)`* to get the parts center of mass.

---

org.javatuples.Triplet<Double, Double, Double> **centerOfMass** (*ReferenceFrame referenceFrame*)

The position of the parts center of mass in the given reference frame. If the part is physicsless, this is equivalent to *`Part.position(ReferenceFrame)`*.

Parameters

- **referenceFrame** (`ReferenceFrame`) – The reference frame that the returned position vector is in.

Returns The position as a vector.

Game Scenes All

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **bound**

The axis-aligned bounding box of the part in the given reference frame.

Parameters

- **referenceFrame** (`ReferenceFrame`) – The reference frame that the returned position vectors are in.

Returns The positions of the minimum and maximum vertices of the box, as position vectors.

Game Scenes All

Note: This is computed from the collision mesh of the part. If the part is not collidable, the box has zero volume and is centered on the *`Part.position(ReferenceFrame)`* of the part.

---

org.javatuples.Triplet<Double, Double, Double> **direction** (*ReferenceFrame referenceFrame*)

The direction the part points in, in the given reference frame.

Parameters

- **referenceFrame** (`ReferenceFrame`) – The reference frame that the returned direction is in.

Returns The direction as a unit vector.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **velocity** (*ReferenceFrame referenceFrame*)

The linear velocity of the part in the given reference frame.

Parameters

- **referenceFrame** (`ReferenceFrame`) – The reference frame that the returned velocity vector is in.

Returns The velocity as a vector. The vector points in the direction of travel, and its magnitude is the speed of the body in meters per second.

Game Scenes All

org.javatuples.Quartet<Double, Double, Double, Double> **rotation**(*ReferenceFrame referenceFrame*)

The rotation of the part, in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned rotation is in.

Returns The rotation as a quaternion of the form (x, y, z, w).

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **getMomentOfInertia**()

The moment of inertia of the part in $kg.m^2$ around its center of mass in the parts reference frame (*ReferenceFrame*).

Game Scenes All

java.util.List<Double> **getInertiaTensor**()

The inertia tensor of the part in the parts reference frame (*ReferenceFrame*). Returns the 3x3 matrix as a list of elements, in row-major order.

Game Scenes All

ReferenceFrame **getReferenceFrame**()

The reference frame that is fixed relative to this part, and centered on a fixed position within the part, defined by the parts model.

- The origin is at the position of the part, as returned by *Part.position(ReferenceFrame)*.
- The axes rotate with the part.
- The x, y and z axis directions depend on the design of the part.

Game Scenes All

Note: For docking port parts, this reference frame is not necessarily equivalent to the reference frame for the docking port, returned by *DockingPort.getReferenceFrame()*.

ReferenceFrame **getCenterOfMassReferenceFrame**()

The reference frame that is fixed relative to this part, and centered on its center of mass.

- The origin is at the center of mass of the part, as returned by *Part.centerOfMass(ReferenceFrame)*.
- The axes rotate with the part.
- The x, y and z axis directions depend on the design of the part.

Game Scenes All

Note: For docking port parts, this reference frame is not necessarily equivalent to the reference frame for the docking port, returned by *DockingPort.getReferenceFrame()*.

Force **addForce**(org.javatuples.Triplet<Double, Double, Double> *force*, org.javatuples.Triplet<Double, Double, Double> *position*, *ReferenceFrame referenceFrame*)

Exert a constant force on the part, acting at the given position.

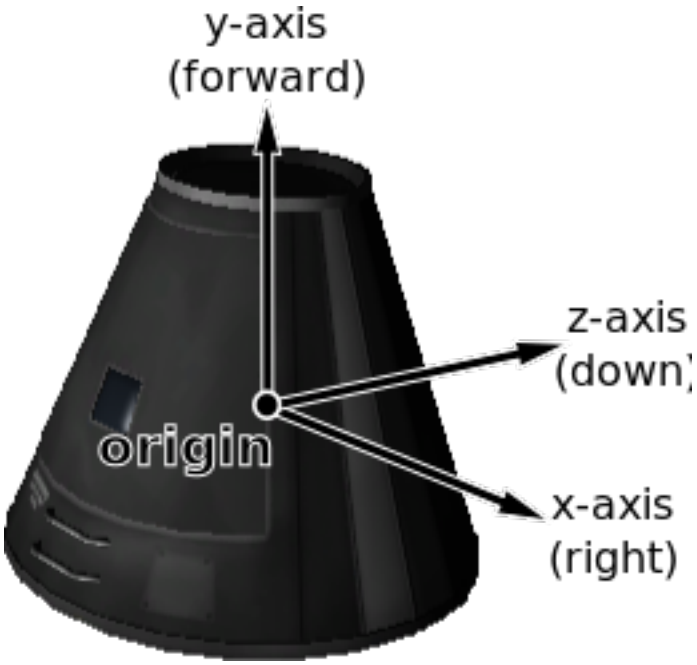

Fig. 7: Mk1 Command Pod reference frame origin and axes

Parameters

- **force** (*org.javatuples.Triplet<Double,Double,Double>*) – A vector pointing in the direction that the force acts, with its magnitude equal to the strength of the force in Newtons.
- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – The position at which the force acts, as a vector.
- **referenceFrame** (ReferenceFrame) – The reference frame that the force and position are in.

Returns An object that can be used to remove or modify the force.

Game Scenes All

void **instantaneousForce**(org.javatuples.Triplet<Double, Double, Double> *force*, org.javatuples.Triplet<Double, Double, Double> *position*, *ReferenceFrame referenceFrame*)

Exert an instantaneous force on the part, acting at the given position.

Parameters

- **force** (*org.javatuples.Triplet<Double,Double,Double>*) – A vector pointing in the direction that the force acts, with its magnitude equal to the strength of the force in Newtons.
- **position** (*org.javatuples.Triplet<Double,Double,Double>*) – The position at which the force acts, as a vector.
- **referenceFrame** (ReferenceFrame) – The reference frame that the force and position are in.

Game Scenes All

Note: The force is applied instantaneously in a single physics update.

public class **Force**

Obtained by calling *Part.addForce(org.javatuples.Triplet<Double,Double,Double>, org.javatuples.Triplet<Double,Double,Double>, ReferenceFrame)*.

Part **getPart**()

The part that this force is applied to.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **getForceVector**()

void **setForceVector**(org.javatuples.Triplet<Double, Double, Double> *value*)

The force vector, in Newtons.

Returns A vector pointing in the direction that the force acts, with its magnitude equal to the strength of the force in Newtons.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **getPosition**()

void **setPosition**(org.javatuples.Triplet<Double, Double, Double> *value*)

The position at which the force acts, in reference frame *ReferenceFrame*.

Returns The position as a vector.

Game Scenes All

ReferenceFrame **getReferenceFrame**()

void **setReferenceFrame**(*ReferenceFrame value*)

The reference frame of the force vector and position.

Game Scenes All

void **remove**()

Remove the force.

Game Scenes All

Module

public class **Module**

This can be used to interact with a specific part module. This includes part modules in stock KSP, and those added by mods.

In KSP, each part has zero or more PartModules associated with it. Each one contains some of the functionality of the part. For example, an engine has a "ModuleEngines" part module that contains all the functionality of an engine.

String **getName**()

Name of the PartModule. For example, "ModuleEngines".

Game Scenes All

Part **getPart**()

The part that contains this module.

Game Scenes All

java.util.Map<String, String> **getFields**()
The modules field names and their associated values, as a dictionary. These are the values visible in the right-click menu of the part.

Game Scenes All

boolean **hasField**(String *name*)
Returns `true` if the module has a field with the given name.

Parameters

- **name** (*String*) – Name of the field.

Game Scenes All

String **getField**(String *name*)
Returns the value of a field.

Parameters

- **name** (*String*) – Name of the field.

Game Scenes All

void **setFieldInt**(String *name*, int *value*)
Set the value of a field to the given integer number.

Parameters

- **name** (*String*) – Name of the field.
- **value** (*int*) – Value to set.

Game Scenes All

void **setFieldFloat**(String *name*, float *value*)
Set the value of a field to the given floating point number.

Parameters

- **name** (*String*) – Name of the field.
- **value** (*float*) – Value to set.

Game Scenes All

void **setFieldString**(String *name*, String *value*)
Set the value of a field to the given string.

Parameters

- **name** (*String*) – Name of the field.
- **value** (*String*) – Value to set.

Game Scenes All

void **resetField**(String *name*)
Set the value of a field to its original value.

Parameters

- **name** (*String*) – Name of the field.

Game Scenes All

java.util.List<String> **getEvents**()
A list of the names of all of the modules events. Events are the clickable buttons visible in the right-click menu of the part.

Game Scenes All

boolean **hasEvent**(String *name*)
`true` if the module has an event with the given name.

Parameters

- **name** (*String*) –

Game Scenes All

void **triggerEvent**(String *name*)
Trigger the named event. Equivalent to clicking the button in the right-click menu of the part.

Parameters

- **name** (*String*) –

Game Scenes All

java.util.List<String> **getActions**()
A list of all the names of the modules actions. These are the parts actions that can be assigned to action groups in the in-game editor.

Game Scenes All

boolean **hasAction**(String *name*)
`true` if the part has an action with the given name.

Parameters

- **name** (*String*) –

Game Scenes All

void **setAction**(String *name*, boolean *value*)
Set the value of an action with the given name.

Parameters

- **name** (*String*) –
- **value** (*boolean*) –

Game Scenes All

Specific Types of Part

The following classes provide functionality for specific types of part.

- *Antenna*
- *Cargo Bay*
- *Control Surface*
- *Decoupler*
- *Docking Port*

- *Engine*
- *Experiment*
- *Fairing*
- *Intake*
- *Leg*
- *Launch Clamp*
- *Light*
- *Parachute*
- *Radiator*
- *Resource Converter*
- *Resource Harvester*
- *Reaction Wheel*
- *RCS*
- *Sensor*
- *Solar Panel*
- *Thruster*
- *Wheel*

Antenna

public class **Antenna**

An antenna. Obtained by calling `Part.getAntenna()`.

Part **getPart**()

The part object for this antenna.

Game Scenes All

AntennaState **getState**()

The current state of the antenna.

Game Scenes All

boolean **getDeployable**()

Whether the antenna is deployable.

Game Scenes All

boolean **getDeployed**()

void **setDeployed**(boolean *value*)

Whether the antenna is deployed.

Game Scenes All

Note: Fixed antennas are always deployed. Returns an error if you try to deploy a fixed antenna.

boolean **getCanTransmit**()
Whether data can be transmitted by this antenna.

Game Scenes All

void **transmit**()
Transmit data.

Game Scenes All

void **cancel**()
Cancel current transmission of data.

Game Scenes All

boolean **getAllowPartial**()

void **setAllowPartial**(boolean *value*)
Whether partial data transmission is permitted.

Game Scenes All

double **getPower**()
The power of the antenna.

Game Scenes All

boolean **getCombinable**()
Whether the antenna can be combined with other antennae on the vessel to boost the power.

Game Scenes All

double **getCombinableExponent**()
Exponent used to calculate the combined power of multiple antennae on a vessel.

Game Scenes All

float **getPacketInterval**()
Interval between sending packets in seconds.

Game Scenes All

float **getPacketSize**()
Amount of data sent per packet in Mits.

Game Scenes All

double **getPacketResourceCost**()
Units of electric charge consumed per packet sent.

Game Scenes All

public enum **AntennaState**
The state of an antenna. See *`Antenna.getState()`*.

public *AntennaState* **DEPLOYED**
Antenna is fully deployed.

public *AntennaState* **RETRACTED**
Antenna is fully retracted.

public *AntennaState* **DEPLOYING**
Antenna is being deployed.

public *AntennaState* **RETRACTING**
Antenna is being retracted.

public *AntennaState* **BROKEN**
Antenna is broken.

Cargo Bay

public class **CargoBay**
A cargo bay. Obtained by calling `Part.getCargoBay()`.

Part **getPart**()
The part object for this cargo bay.

Game Scenes All

CargoBayState **getState**()
The state of the cargo bay.

Game Scenes All

boolean **getOpen**()

void **setOpen**(boolean *value*)
Whether the cargo bay is open.

Game Scenes All

public enum **CargoBayState**
The state of a cargo bay. See `CargoBay.getState()`.

public *CargoBayState* **OPEN**
Cargo bay is fully open.

public *CargoBayState* **CLOSED**
Cargo bay closed and locked.

public *CargoBayState* **OPENING**
Cargo bay is opening.

public *CargoBayState* **CLOSING**
Cargo bay is closing.

Control Surface

public class **ControlSurface**
An aerodynamic control surface. Obtained by calling `Part.getControlSurface()`.

Part **getPart**()
The part object for this control surface.

Game Scenes All

boolean **getPitchEnabled**()

void **setPitchEnabled**(boolean *value*)
Whether the control surface has pitch control enabled.

Game Scenes All

boolean **getYawEnabled**()

void **setYawEnabled**(boolean *value*)
Whether the control surface has yaw control enabled.

Game Scenes All

boolean **getRollEnabled**()

void **setRollEnabled**(boolean *value*)
Whether the control surface has roll control enabled.

Game Scenes All

float **getAuthorityLimiter**()

void **setAuthorityLimiter**(float *value*)
The authority limiter for the control surface, which controls how far the control surface will move.

Game Scenes All

boolean **getInverted**()

void **setInverted**(boolean *value*)
Whether the control surface movement is inverted.

Game Scenes All

boolean **getDeployed**()

void **setDeployed**(boolean *value*)
Whether the control surface has been fully deployed.

Game Scenes All

float **getSurfaceArea**()
Surface area of the control surface in m^2.

Game Scenes All

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getAva**
The available torque, in Newton meters, that can be produced by this control surface, in the positive and negative pitch, roll and yaw axes of the vessel. These axes correspond to the coordinate axes of the *Vessel.getReferenceFrame()*.

Game Scenes All

Decoupler

public class **Decoupler**
A decoupler. Obtained by calling *Part.getDecoupler()*

Part **getPart**()
The part object for this decoupler.

Game Scenes All

Vessel **decouple**()
Fires the decoupler. Returns the new vessel created when the decoupler fires. Throws an exception if the decoupler has already fired.

Game Scenes All

Note: When called, the active vessel may change. It is therefore possible that, after calling this function, the object(s) returned by previous call(s) to *getActiveVessel()* no longer refer to the active vessel.

---

boolean **getDecoupled**()
Whether the decoupler has fired.

Game Scenes All

boolean **getStaged**()
Whether the decoupler is enabled in the staging sequence.

Game Scenes All

float **getImpulse**()
The impulse that the decoupler imparts when it is fired, in Newton seconds.

Game Scenes All

Docking Port

public class **DockingPort**
A docking port. Obtained by calling *Part.getDockingPort()*

Part **getPart**()
The part object for this docking port.

Game Scenes All

DockingPortState **getState**()
The current state of the docking port.

Game Scenes All

Part **getDockedPart**()
The part that this docking port is docked to. Returns `null` if this docking port is not docked to anything.

Game Scenes All

Vessel **undock**()
Undocks the docking port and returns the new *Vessel* that is created. This method can be called for either docking port in a docked pair. Throws an exception if the docking port is not docked to anything.

Game Scenes All

Note: When called, the active vessel may change. It is therefore possible that, after calling this function, the object(s) returned by previous call(s) to *getActiveVessel()* no longer refer to the active vessel.

---

float **getReengageDistance**()
The distance a docking port must move away when it undocks before it becomes ready to dock with another port, in meters.

Game Scenes All

boolean **getHasShield**()
Whether the docking port has a shield.

Game Scenes All

boolean **getShielded**()

void **setShielded**(boolean *value*)
The state of the docking ports shield, if it has one.

Returns `true` if the docking port has a shield, and the shield is closed. Otherwise returns `false`. When set to `true`, the shield is closed, and when set to `false` the shield is opened. If the docking port does not have a shield, setting this attribute has no effect.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **`position`** (*ReferenceFrame referenceFrame*)
The position of the docking port, in the given reference frame.

Parameters

- **`referenceFrame`** (`ReferenceFrame`) – The reference frame that the returned position vector is in.

Returns The position as a vector.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **`direction`** (*ReferenceFrame referenceFrame*)
The direction that docking port points in, in the given reference frame.

Parameters

- **`referenceFrame`** (`ReferenceFrame`) – The reference frame that the returned direction is in.

Returns The direction as a unit vector.

Game Scenes All

org.javatuples.Quartet<Double, Double, Double, Double> **`rotation`** (*ReferenceFrame referenceFrame*)
The rotation of the docking port, in the given reference frame.

Parameters

- **`referenceFrame`** (`ReferenceFrame`) – The reference frame that the returned rotation is in.

Returns The rotation as a quaternion of the form (x, y, z, w).

Game Scenes All

ReferenceFrame **`getReferenceFrame`** ()
The reference frame that is fixed relative to this docking port, and oriented with the port.

- The origin is at the position of the docking port.
- The axes rotate with the docking port.
- The x-axis points out to the right side of the docking port.
- The y-axis points in the direction the docking port is facing.
- The z-axis points out of the bottom off the docking port.

Game Scenes All

Note: This reference frame is not necessarily equivalent to the reference frame for the part, returned by *`Part.getReferenceFrame()`*.

---

public enum **`DockingPortState`**
The state of a docking port. See *`DockingPort.getState()`*.

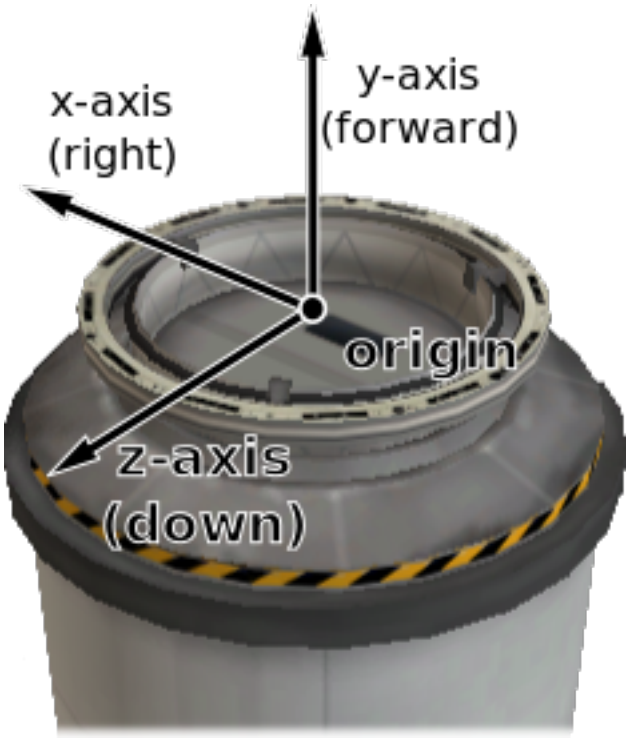

Fig. 8: Docking port reference frame origin and axes

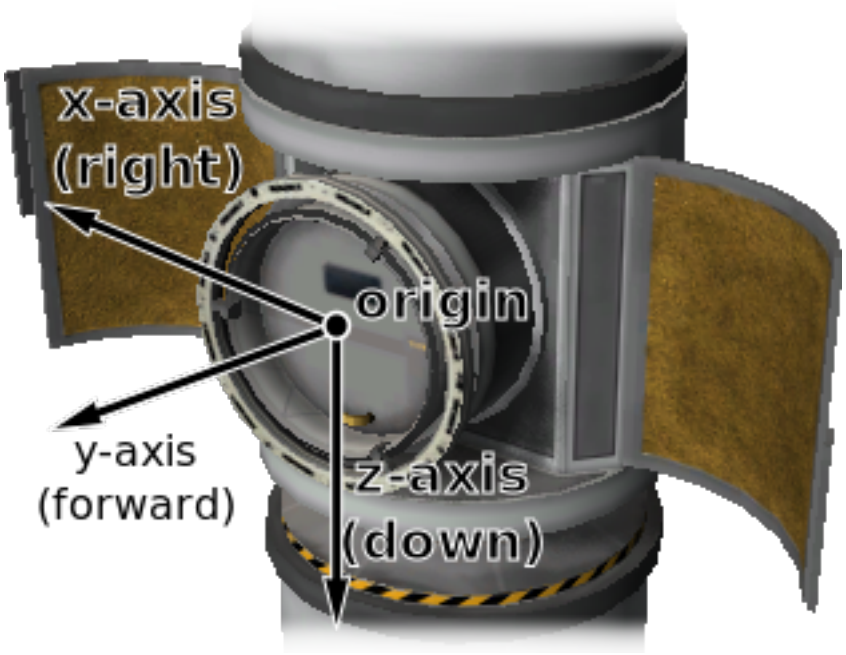

Fig. 9: Inline docking port reference frame origin and axes

public *DockingPortState* **READY**
The docking port is ready to dock to another docking port.

public *DockingPortState* **DOCKED**
The docking port is docked to another docking port, or docked to another part (from the VAB/SPH).

public *DockingPortState* **DOCKING**
The docking port is very close to another docking port, but has not docked. It is using magnetic force to acquire a solid dock.

public *DockingPortState* **UNDOCKING**
The docking port has just been undocked from another docking port, and is disabled until it moves away by a sufficient distance (*DockingPort.getReengageDistance()*).

public *DockingPortState* **SHIELDED**
The docking port has a shield, and the shield is closed.

public *DockingPortState* **MOVING**
The docking ports shield is currently opening/closing.

Engine

public class **Engine**
An engine, including ones of various types. For example liquid fuelled gimballed engines, solid rocket boosters and jet engines. Obtained by calling *Part.getEngine()*.

Note: For RCS thrusters *Part.getRCS()*.

Part **getPart**()
The part object for this engine.

Game Scenes All

boolean **getActive**()

void **setActive**(boolean *value*)
Whether the engine is active. Setting this attribute may have no effect, depending on *Engine.getCanShutdown()* and *Engine.getCanRestart()*.

Game Scenes All

float **getThrust**()
The current amount of thrust being produced by the engine, in Newtons.

Game Scenes All

float **getAvailableThrust**()
The amount of thrust, in Newtons, that would be produced by the engine when activated and with its throttle set to 100%. Returns zero if the engine does not have any fuel. Takes the engine's current *Engine.getThrustLimit()* and atmospheric conditions into account.

Game Scenes All

float **getMaxThrust**()
The amount of thrust, in Newtons, that would be produced by the engine when activated and fueled, with its throttle and throttle limiter set to 100%.

Game Scenes All

float **getMaxVacuumThrust**()
The maximum amount of thrust that can be produced by the engine in a vacuum, in Newtons. This is the amount of thrust produced by the engine when activated, *Engine.getThrustLimit()* is set to 100%, the main vessel's throttle is set to 100% and the engine is in a vacuum.

Game Scenes All

float **getThrustLimit**()

void **setThrustLimit**(float *value*)
The thrust limiter of the engine. A value between 0 and 1. Setting this attribute may have no effect, for example the thrust limit for a solid rocket booster cannot be changed in flight.

Game Scenes All

java.util.List<*Thruster*> **getThrusters**()
The components of the engine that generate thrust.

Game Scenes All

Note: For example, this corresponds to the rocket nozzel on a solid rocket booster, or the individual nozzels on a RAPIER engine. The overall thrust produced by the engine, as reported by *Engine.getAvailableThrust()*, *Engine.getMaxThrust()* and others, is the sum of the thrust generated by each thruster.

---

float **getSpecificImpulse**()
The current specific impulse of the engine, in seconds. Returns zero if the engine is not active.

Game Scenes All

float **getVacuumSpecificImpulse**()
The vacuum specific impulse of the engine, in seconds.

Game Scenes All

float **getKerbinSeaLevelSpecificImpulse**()
The specific impulse of the engine at sea level on Kerbin, in seconds.

Game Scenes All

java.util.List<String> **getPropellantNames**()
The names of the propellants that the engine consumes.

Game Scenes All

java.util.Map<String, Float> **getPropellantRatios**()
The ratio of resources that the engine consumes. A dictionary mapping resource names to the ratio at which they are consumed by the engine.

Game Scenes All

Note: For example, if the ratios are 0.6 for LiquidFuel and 0.4 for Oxidizer, then for every 0.6 units of LiquidFuel that the engine burns, it will burn 0.4 units of Oxidizer.

---

java.util.List<*Propellant*> **getPropellants**()
The propellants that the engine consumes.

Game Scenes All

boolean **getHasFuel**()
Whether the engine has any fuel available.

Game Scenes All

Note: The engine must be activated for this property to update correctly.

---

float **getThrottle**()
The current throttle setting for the engine. A value between 0 and 1. This is not necessarily the same as the vessel's main throttle setting, as some engines take time to adjust their throttle (such as jet engines).

Game Scenes All

boolean **getThrottleLocked**()
Whether the *Control.getThrottle()* affects the engine. For example, this is `true` for liquid fueled rockets, and `false` for solid rocket boosters.

Game Scenes All

boolean **getCanRestart**()
Whether the engine can be restarted once shutdown. If the engine cannot be shutdown, returns `false`. For example, this is `true` for liquid fueled rockets and `false` for solid rocket boosters.

Game Scenes All

boolean **getCanShutdown**()
Whether the engine can be shutdown once activated. For example, this is `true` for liquid fueled rockets and `false` for solid rocket boosters.

Game Scenes All

boolean **getHasModes**()
Whether the engine has multiple modes of operation.

Game Scenes All

String **getMode**()

void **setMode**(String *value*)
The name of the current engine mode.

Game Scenes All

java.util.Map<String, *Engine*> **getModes**()
The available modes for the engine. A dictionary mapping mode names to *Engine* objects.

Game Scenes All

void **toggleMode**()
Toggle the current engine mode.

Game Scenes All

boolean **getAutoModeSwitch**()

void **setAutoModeSwitch**(boolean *value*)
Whether the engine will automatically switch modes.

Game Scenes All

boolean **getGimballed**()
Whether the engine is gimballed.

Game Scenes All

float **getGimbalRange**()
The range over which the gimbal can move, in degrees. Returns 0 if the engine is not gimballed.

Game Scenes All

boolean **getGimbalLocked**()

void **setGimbalLocked**(boolean *value*)
Whether the engines gimbal is locked in place. Setting this attribute has no effect if the engine is not gimballed.

Game Scenes All

float **getGimbalLimit**()

void **setGimbalLimit**(float *value*)
The gimbal limiter of the engine. A value between 0 and 1. Returns 0 if the gimbal is locked.

Game Scenes All

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getAva**
The available torque, in Newton meters, that can be produced by this engine, in the positive and negative pitch, roll and yaw axes of the vessel. These axes correspond to the coordinate axes of the *Vessel.getReferenceFrame()*. Returns zero if the engine is inactive, or not gimballed.

Game Scenes All

public class **Propellant**
A propellant for an engine. Obtains by calling *Engine.getPropellants()*.

String **getName**()
The name of the propellant.

Game Scenes All

double **getCurrentAmount**()
The current amount of propellant.

Game Scenes All

double **getCurrentRequirement**()
The required amount of propellant.

Game Scenes All

double **getTotalResourceAvailable**()
The total amount of the underlying resource currently reachable given resource flow rules.

Game Scenes All

double **getTotalResourceCapacity**()
The total vehicle capacity for the underlying propellant resource, restricted by resource flow rules.

Game Scenes All

boolean **getIgnoreForIsp**()
If this propellant should be ignored when calculating required mass flow given specific impulse.

Game Scenes All

boolean **getIgnoreForThrustCurve**()
If this propellant should be ignored for thrust curve calculations.

Game Scenes All

boolean **getDrawStackGauge**()
If this propellant has a stack gauge or not.

Game Scenes All

boolean **getIsDeprived**()
If this propellant is deprived.

Game Scenes All

float **getRatio**()
The propellant ratio.

Game Scenes All

Experiment

public class **Experiment**
Obtained by calling *Part.getExperiment()*.

Part **getPart**()
The part object for this experiment.

Game Scenes All

void **run**()
Run the experiment.

Game Scenes All

void **transmit**()
Transmit all experimental data contained by this part.

Game Scenes All

void **dump**()
Dump the experimental data contained by the experiment.

Game Scenes All

void **reset**()
Reset the experiment.

Game Scenes All

boolean **getDeployed**()
Whether the experiment has been deployed.

Game Scenes All

boolean **getRerunnable**()
Whether the experiment can be re-run.

Game Scenes All

boolean **getInoperable**()
Whether the experiment is inoperable.

Game Scenes All

boolean **getHasData**()
Whether the experiment contains data.

Game Scenes All

java.util.List<*ScienceData*> **getData**()
The data contained in this experiment.

Game Scenes All

String **getBiome**()
The name of the biome the experiment is currently in.

Game Scenes All

boolean **getAvailable**()
Determines if the experiment is available given the current conditions.

Game Scenes All

ScienceSubject **getScienceSubject**()
Containing information on the corresponding specific science result for the current conditions. Returns `null` if the experiment is unavailable.

Game Scenes All

public class **ScienceData**
Obtained by calling *`Experiment.getData()`*.

float **getDataAmount**()
Data amount.

Game Scenes All

float **getScienceValue**()
Science value.

Game Scenes All

float **getTransmitValue**()
Transmit value.

Game Scenes All

public class **ScienceSubject**
Obtained by calling *`Experiment.getScienceSubject()`*.

String **getTitle**()
Title of science subject, displayed in science archives

Game Scenes All

boolean **getIsComplete**()
Whether the experiment has been completed.

Game Scenes All

float **getScience**()
Amount of science already earned from this subject, not updated until after transmission/recovery.

Game Scenes All

float **getScienceCap**()
Total science allowable for this subject.

Game Scenes All

float **getDataScale**()
Multiply science value by this to determine data amount in mits.

Game Scenes All

float **getSubjectValue**()
Multiplier for specific Celestial Body/Experiment Situation combination.

Game Scenes All

float **getScientificValue**()
Diminishing value multiplier for decreasing the science value returned from repeated experiments.

Game Scenes All

Fairing

public class **Fairing**
A fairing. Obtained by calling *Part.getFairing()*.

Part **getPart**()
The part object for this fairing.

Game Scenes All

void **jettison**()
Jettison the fairing. Has no effect if it has already been jettisoned.

Game Scenes All

boolean **getJettisoned**()
Whether the fairing has been jettisoned.

Game Scenes All

Intake

public class **Intake**
An air intake. Obtained by calling *Part.getIntake()*.

Part **getPart**()
The part object for this intake.

Game Scenes All

boolean **getOpen**()

void **setOpen**(boolean *value*)
Whether the intake is open.

Game Scenes All

float **getSpeed**()
Speed of the flow into the intake, in m/s.

Game Scenes All

float **getFlow**()
The rate of flow into the intake, in units of resource per second.

Game Scenes All

float **getArea**()
The area of the intake's opening, in square meters.

Game Scenes All

Leg

public class **Leg**
A landing leg. Obtained by calling *Part.getLeg()*.

Part **getPart**()
The part object for this landing leg.

Game Scenes All

LegState **getState**()
The current state of the landing leg.

Game Scenes All

boolean **getDeployable**()
Whether the leg is deployable.

Game Scenes All

boolean **getDeployed**()

void **setDeployed**(boolean *value*)
Whether the landing leg is deployed.

Game Scenes All

Note: Fixed landing legs are always deployed. Returns an error if you try to deploy fixed landing gear.

---

boolean **getIsGrounded**()
Returns whether the leg is touching the ground.

Game Scenes All

public enum **LegState**
The state of a landing leg. See *Leg.getState()*.

public *LegState* **DEPLOYED**
Landing leg is fully deployed.

public *LegState* **RETRACTED**
Landing leg is fully retracted.

public *LegState* **DEPLOYING**
Landing leg is being deployed.

public *LegState* **RETRACTING**
Landing leg is being retracted.

public *LegState* **BROKEN**
Landing leg is broken.

Launch Clamp

public class **LaunchClamp**
A launch clamp. Obtained by calling *Part.getLaunchClamp()*.

Part **getPart**()
The part object for this launch clamp.

Game Scenes All

void **release**()
Releases the docking clamp. Has no effect if the clamp has already been released.

Game Scenes All

Light

public class **Light**
A light. Obtained by calling *Part.getLight()*.

Part **getPart**()
The part object for this light.

Game Scenes All

boolean **getActive**()

void **setActive**(boolean *value*)
Whether the light is switched on.

Game Scenes All

org.javatuples.Triplet<Float, Float, Float> **getColor**()

void **setColor**(org.javatuples.Triplet<Float, Float, Float> *value*)
The color of the light, as an RGB triple.

Game Scenes All

float **getPowerUsage**()
The current power usage, in units of charge per second.

Game Scenes All

Parachute

public class **Parachute**
A parachute. Obtained by calling *Part.getParachute()*.

Part **getPart**()
The part object for this parachute.

Game Scenes All

void **deploy**()
Deploys the parachute. This has no effect if the parachute has already been deployed.

Game Scenes All

boolean **getDeployed**()
Whether the parachute has been deployed.

Game Scenes All

void **arm**()
Deploys the parachute. This has no effect if the parachute has already been armed or deployed. Only applicable to RealChutes parachutes.

Game Scenes All

boolean **getArmed**()
Whether the parachute has been armed or deployed. Only applicable to RealChutes parachutes.

Game Scenes All

ParachuteState **getState**()
The current state of the parachute.

Game Scenes All

float **getDeployAltitude**()

void **setDeployAltitude**(float *value*)
The altitude at which the parachute will full deploy, in meters. Only applicable to stock parachutes.

Game Scenes All

float **getDeployMinPressure**()

void **setDeployMinPressure**(float *value*)
The minimum pressure at which the parachute will semi-deploy, in atmospheres. Only applicable to stock parachutes.

Game Scenes All

public enum **ParachuteState**
The state of a parachute. See *Parachute.getState()*.

public *ParachuteState* **STOWED**
The parachute is safely tucked away inside its housing.

public *ParachuteState* **ARMED**
The parachute is armed for deployment. (RealChutes only)

public *ParachuteState* **ACTIVE**
The parachute is still stowed, but ready to semi-deploy. (Stock parachutes only)

public *ParachuteState* **SEMI_DEPLOYED**
The parachute has been deployed and is providing some drag, but is not fully deployed yet. (Stock parachutes only)

public *ParachuteState* **DEPLOYED**
The parachute is fully deployed.

public *ParachuteState* **CUT**
The parachute has been cut.

Radiator

public class **Radiator**
A radiator. Obtained by calling *Part.getRadiator()*.

Part **getPart**()
The part object for this radiator.

Game Scenes All

boolean **getDeployable**()
Whether the radiator is deployable.

Game Scenes All

boolean **getDeployed**()

void **setDeployed**(boolean *value*)
For a deployable radiator, `true` if the radiator is extended. If the radiator is not deployable, this is always `true`.

Game Scenes All

RadiatorState **getState**()
The current state of the radiator.

Game Scenes All

Note: A fixed radiator is always *`RadiatorState.EXTENDED`*.

---

public enum **RadiatorState**
The state of a radiator. *`RadiatorState`*

public *RadiatorState* **EXTENDED**
Radiator is fully extended.

public *RadiatorState* **RETRACTED**
Radiator is fully retracted.

public *RadiatorState* **EXTENDING**
Radiator is being extended.

public *RadiatorState* **RETRACTING**
Radiator is being retracted.

public *RadiatorState* **BROKEN**
Radiator is being broken.

Resource Converter

public class **ResourceConverter**
A resource converter. Obtained by calling *`Part.getResourceConverter()`*.

Part **getPart**()
The part object for this converter.

Game Scenes All

int **getCount**()
The number of converters in the part.

Game Scenes All

String **name**(int *index*)
The name of the specified converter.

Parameters

- **index** (*`int`*) – Index of the converter.

Game Scenes All

boolean **active**(int *index*)
True if the specified converter is active.

Parameters

- **index** (*`int`*) – Index of the converter.

Game Scenes All

void **start** (int *index*)
Start the specified converter.

Parameters

- **index** (*int*) – Index of the converter.

Game Scenes All

void **stop** (int *index*)
Stop the specified converter.

Parameters

- **index** (*int*) – Index of the converter.

Game Scenes All

ResourceConverterState **state** (int *index*)
The state of the specified converter.

Parameters

- **index** (*int*) – Index of the converter.

Game Scenes All

String **statusInfo** (int *index*)
Status information for the specified converter. This is the full status message shown in the in-game UI.

Parameters

- **index** (*int*) – Index of the converter.

Game Scenes All

java.util.List<String> **inputs** (int *index*)
List of the names of resources consumed by the specified converter.

Parameters

- **index** (*int*) – Index of the converter.

Game Scenes All

java.util.List<String> **outputs** (int *index*)
List of the names of resources produced by the specified converter.

Parameters

- **index** (*int*) – Index of the converter.

Game Scenes All

float **getOptimumCoreTemperature** ()
The core temperature at which the converter will operate with peak efficiency, in Kelvin.

Game Scenes All

float **getCoreTemperature** ()
The core temperature of the converter, in Kelvin.

Game Scenes All

float **getThermalEfficiency** ()
The thermal efficiency of the converter, as a percentage of its maximum.

Game Scenes All

public enum **ResourceConverterState**
The state of a resource converter. See *ResourceConverter.state(int)*.

public *ResourceConverterState* **RUNNING**
Converter is running.

public *ResourceConverterState* **IDLE**
Converter is idle.

public *ResourceConverterState* **MISSING_RESOURCE**
Converter is missing a required resource.

public *ResourceConverterState* **STORAGE_FULL**
No available storage for output resource.

public *ResourceConverterState* **CAPACITY**
At preset resource capacity.

public *ResourceConverterState* **UNKNOWN**
Unknown state. Possible with modified resource converters. In this case, check *ResourceConverter.statusInfo(int)* for more information.

Resource Harvester

public class **ResourceHarvester**
A resource harvester (drill). Obtained by calling *Part.getResourceHarvester()*.

Part **getPart**()
The part object for this harvester.

Game Scenes All

ResourceHarvesterState **getState**()
The state of the harvester.

Game Scenes All

boolean **getDeployed**()

void **setDeployed**(boolean *value*)
Whether the harvester is deployed.

Game Scenes All

boolean **getActive**()

void **setActive**(boolean *value*)
Whether the harvester is actively drilling.

Game Scenes All

float **getExtractionRate**()
The rate at which the drill is extracting ore, in units per second.

Game Scenes All

float **getThermalEfficiency**()
The thermal efficiency of the drill, as a percentage of its maximum.

Game Scenes All

float **getCoreTemperature**()
The core temperature of the drill, in Kelvin.

Game Scenes All

float **getOptimumCoreTemperature**()
The core temperature at which the drill will operate with peak efficiency, in Kelvin.

Game Scenes All

public enum **ResourceHarvesterState**
The state of a resource harvester. See *ResourceHarvester.getState()*.

public *ResourceHarvesterState* **DEPLOYING**
The drill is deploying.

public *ResourceHarvesterState* **DEPLOYED**
The drill is deployed and ready.

public *ResourceHarvesterState* **RETRACTING**
The drill is retracting.

public *ResourceHarvesterState* **RETRACTED**
The drill is retracted.

public *ResourceHarvesterState* **ACTIVE**
The drill is running.

Reaction Wheel

public class **ReactionWheel**
A reaction wheel. Obtained by calling *Part.getReactionWheel()*.

Part **getPart**()
The part object for this reaction wheel.

Game Scenes All

boolean **getActive**()

void **setActive**(boolean *value*)
Whether the reaction wheel is active.

Game Scenes All

boolean **getBroken**()
Whether the reaction wheel is broken.

Game Scenes All

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getAva**
The available torque, in Newton meters, that can be produced by this reaction wheel, in the positive and negative pitch, roll and yaw axes of the vessel. These axes correspond to the coordinate axes of the *Vessel.getReferenceFrame()*. Returns zero if the reaction wheel is inactive or broken.

Game Scenes All

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getMa**
The maximum torque, in Newton meters, that can be produced by this reaction wheel, when it is active, in the positive and negative pitch, roll and yaw axes of the vessel. These axes correspond to the coordinate axes of the *Vessel.getReferenceFrame()*.

Game Scenes All

RCS

public class **RCS**

An RCS block or thruster. Obtained by calling *Part.getRCS()*.

Part **getPart**()

The part object for this RCS.

Game Scenes All

boolean **getActive**()

Whether the RCS thrusters are active. An RCS thruster is inactive if the RCS action group is disabled (*Control.getRCS()*), the RCS thruster itself is not enabled (*RCS.getEnabled()*) or it is covered by a fairing (*Part.getShielded()*).

Game Scenes All

boolean **getEnabled**()

void **setEnabled**(boolean *value*)

Whether the RCS thrusters are enabled.

Game Scenes All

boolean **getPitchEnabled**()

void **setPitchEnabled**(boolean *value*)

Whether the RCS thruster will fire when pitch control input is given.

Game Scenes All

boolean **getYawEnabled**()

void **setYawEnabled**(boolean *value*)

Whether the RCS thruster will fire when yaw control input is given.

Game Scenes All

boolean **getRollEnabled**()

void **setRollEnabled**(boolean *value*)

Whether the RCS thruster will fire when roll control input is given.

Game Scenes All

boolean **getForwardEnabled**()

void **setForwardEnabled**(boolean *value*)

Whether the RCS thruster will fire when pitch control input is given.

Game Scenes All

boolean **getUpEnabled**()

void **setUpEnabled**(boolean *value*)

Whether the RCS thruster will fire when yaw control input is given.

Game Scenes All

boolean **getRightEnabled**()

void **setRightEnabled**(boolean *value*)

Whether the RCS thruster will fire when roll control input is given.

Game Scenes All

org.javatuples.Pair<org.javatuples.Triplet<Double, Double, Double>, org.javatuples.Triplet<Double, Double, Double>> **getAva**
The available torque, in Newton meters, that can be produced by this RCS, in the positive and negative pitch, roll and yaw axes of the vessel. These axes correspond to the coordinate axes of the *Vessel.getReferenceFrame()*. Returns zero if RCS is disable.

Game Scenes All

float **getMaxThrust**()
The maximum amount of thrust that can be produced by the RCS thrusters when active, in Newtons.

Game Scenes All

float **getMaxVacuumThrust**()
The maximum amount of thrust that can be produced by the RCS thrusters when active in a vacuum, in Newtons.

Game Scenes All

java.util.List<*Thruster*> **getThrusters**()
A list of thrusters, one of each nozzel in the RCS part.

Game Scenes All

float **getSpecificImpulse**()
The current specific impulse of the RCS, in seconds. Returns zero if the RCS is not active.

Game Scenes All

float **getVacuumSpecificImpulse**()
The vacuum specific impulse of the RCS, in seconds.

Game Scenes All

float **getKerbinSeaLevelSpecificImpulse**()
The specific impulse of the RCS at sea level on Kerbin, in seconds.

Game Scenes All

java.util.List<String> **getPropellants**()
The names of resources that the RCS consumes.

Game Scenes All

java.util.Map<String, Float> **getPropellantRatios**()
The ratios of resources that the RCS consumes. A dictionary mapping resource names to the ratios at which they are consumed by the RCS.

Game Scenes All

boolean **getHasFuel**()
Whether the RCS has fuel available.

Game Scenes All

Note: The RCS thruster must be activated for this property to update correctly.

Sensor

public class **Sensor**
A sensor, such as a thermometer. Obtained by calling *Part.getSensor()*.

Part **getPart**()
The part object for this sensor.

Game Scenes All

boolean **getActive**()

void **setActive**(boolean *value*)
Whether the sensor is active.

Game Scenes All

String **getValue**()
The current value of the sensor.

Game Scenes All

Solar Panel

public class **SolarPanel**
A solar panel. Obtained by calling *`Part.getSolarPanel()`*.

Part **getPart**()
The part object for this solar panel.

Game Scenes All

boolean **getDeployable**()
Whether the solar panel is deployable.

Game Scenes All

boolean **getDeployed**()

void **setDeployed**(boolean *value*)
Whether the solar panel is extended.

Game Scenes All

SolarPanelState **getState**()
The current state of the solar panel.

Game Scenes All

float **getEnergyFlow**()
The current amount of energy being generated by the solar panel, in units of charge per second.

Game Scenes All

float **getSunExposure**()
The current amount of sunlight that is incident on the solar panel, as a percentage. A value between 0 and 1.

Game Scenes All

public enum **SolarPanelState**
The state of a solar panel. See *`SolarPanel.getState()`*.

public *SolarPanelState* **EXTENDED**
Solar panel is fully extended.

public *SolarPanelState* **RETRACTED**
Solar panel is fully retracted.

public *SolarPanelState* **EXTENDING**
Solar panel is being extended.

public *SolarPanelState* **RETRACTING**
Solar panel is being retracted.

public *SolarPanelState* **BROKEN**
Solar panel is broken.

Thruster

public class **Thruster**
The component of an *Engine* or *RCS* part that generates thrust. Can obtained by calling *Engine.getThrusters()* or *RCS.getThrusters()*.

Note: Engines can consist of multiple thrusters. For example, the S3 KS-25x4 "Mammoth" has four rocket nozzels, and so consists of four thrusters.

Part **getPart**()
The *Part* that contains this thruster.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **thrustPosition**(*ReferenceFrame referenceFrame*)
The position at which the thruster generates thrust, in the given reference frame. For gimballed engines, this takes into account the current rotation of the gimbal.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned position vector is in.

Returns The position as a vector.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **thrustDirection**(*ReferenceFrame referenceFrame*)
The direction of the force generated by the thruster, in the given reference frame. This is opposite to the direction in which the thruster expels propellant. For gimballed engines, this takes into account the current rotation of the gimbal.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned direction is in.

Returns The direction as a unit vector.

Game Scenes All

ReferenceFrame **getThrustReferenceFrame**()
A reference frame that is fixed relative to the thruster and orientated with its thrust direction (*Thruster.thrustDirection(ReferenceFrame)*). For gimballed engines, this takes into account the current rotation of the gimbal.

- The origin is at the position of thrust for this thruster (*Thruster.thrustPosition(ReferenceFrame)*).

- The axes rotate with the thrust direction. This is the direction in which the thruster expels propellant, including any gimballing.
- The y-axis points along the thrust direction.
- The x-axis and z-axis are perpendicular to the thrust direction.

Game Scenes All

boolean **getGimballed**()
Whether the thruster is gimballed.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **gimbalPosition**(*ReferenceFrame referenceFrame*)
Position around which the gimbal pivots.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned position vector is in.

Returns The position as a vector.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **getGimbalAngle**()
The current gimbal angle in the pitch, roll and yaw axes, in degrees.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **initialThrustPosition**(*ReferenceFrame referenceFrame*)
The position at which the thruster generates thrust, when the engine is in its initial position (no gimballing), in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned position vector is in.

Returns The position as a vector.

Game Scenes All

Note: This position can move when the gimbal rotates. This is because the thrust position and gimbal position are not necessarily the same.

---

org.javatuples.Triplet<Double, Double, Double> **initialThrustDirection**(*ReferenceFrame referenceFrame*)
The direction of the force generated by the thruster, when the engine is in its initial position (no gimballing), in the given reference frame. This is opposite to the direction in which the thruster expels propellant.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned direction is in.

Returns The direction as a unit vector.

Game Scenes All

Wheel

public class **Wheel**

A wheel. Includes landing gear and rover wheels. Obtained by calling *Part.getWheel()*. Can be used to control the motors, steering and deployment of wheels, among other things.

Part **getPart**()
The part object for this wheel.

Game Scenes All

WheelState **getState**()
The current state of the wheel.

Game Scenes All

float **getRadius**()
Radius of the wheel, in meters.

Game Scenes All

boolean **getGrounded**()
Whether the wheel is touching the ground.

Game Scenes All

boolean **getHasBrakes**()
Whether the wheel has brakes.

Game Scenes All

float **getBrakes**()

void **setBrakes**(float *value*)
The braking force, as a percentage of maximum, when the brakes are applied.

Game Scenes All

boolean **getAutoFrictionControl**()

void **setAutoFrictionControl**(boolean *value*)
Whether automatic friction control is enabled.

Game Scenes All

float **getManualFrictionControl**()

void **setManualFrictionControl**(float *value*)
Manual friction control value. Only has an effect if automatic friction control is disabled. A value between 0 and 5 inclusive.

Game Scenes All

boolean **getDeployable**()
Whether the wheel is deployable.

Game Scenes All

boolean **getDeployed**()

void **setDeployed**(boolean *value*)
Whether the wheel is deployed.

Game Scenes All

boolean **getPowered**()
Whether the wheel is powered by a motor.

Game Scenes All

boolean **getMotorEnabled**()

void **setMotorEnabled**(boolean *value*)
Whether the motor is enabled.

Game Scenes All

boolean **getMotorInverted**()

void **setMotorInverted**(boolean *value*)
Whether the direction of the motor is inverted.

Game Scenes All

MotorState **getMotorState**()
Whether the direction of the motor is inverted.

Game Scenes All

float **getMotorOutput**()
The output of the motor. This is the torque currently being generated, in Newton meters.

Game Scenes All

boolean **getTractionControlEnabled**()

void **setTractionControlEnabled**(boolean *value*)
Whether automatic traction control is enabled. A wheel only has traction control if it is powered.

Game Scenes All

float **getTractionControl**()

void **setTractionControl**(float *value*)
Setting for the traction control. Only takes effect if the wheel has automatic traction control enabled. A value between 0 and 5 inclusive.

Game Scenes All

float **getDriveLimiter**()

void **setDriveLimiter**(float *value*)
Manual setting for the motor limiter. Only takes effect if the wheel has automatic traction control disabled. A value between 0 and 100 inclusive.

Game Scenes All

boolean **getSteerable**()
Whether the wheel has steering.

Game Scenes All

boolean **getSteeringEnabled**()

void **setSteeringEnabled**(boolean *value*)
Whether the wheel steering is enabled.

Game Scenes All

boolean **getSteeringInverted**()

void **setSteeringInverted**(boolean *value*)
Whether the wheel steering is inverted.

Game Scenes All

boolean **getHasSuspension**()
Whether the wheel has suspension.

Game Scenes All

float **getSuspensionSpringStrength**()
Suspension spring strength, as set in the editor.

Game Scenes All

float **getSuspensionDamperStrength**()
Suspension damper strength, as set in the editor.

Game Scenes All

boolean **getBroken**()
Whether the wheel is broken.

Game Scenes All

boolean **getRepairable**()
Whether the wheel is repairable.

Game Scenes All

float **getStress**()
Current stress on the wheel.

Game Scenes All

float **getStressTolerance**()
Stress tolerance of the wheel.

Game Scenes All

float **getStressPercentage**()
Current stress on the wheel as a percentage of its stress tolerance.

Game Scenes All

float **getDeflection**()
Current deflection of the wheel.

Game Scenes All

float **getSlip**()
Current slip of the wheel.

Game Scenes All

public enum **WheelState**
The state of a wheel. See *`Wheel.getState()`*.

public *WheelState* **DEPLOYED**
Wheel is fully deployed.

public *WheelState* **RETRACTED**
Wheel is fully retracted.

public *WheelState* **DEPLOYING**
Wheel is being deployed.

public *WheelState* **RETRACTING**
Wheel is being retracted.

public *WheelState* **BROKEN**
Wheel is broken.

public enum **MotorState**
The state of the motor on a powered wheel. See *Wheel.getMotorState()*.

public *MotorState* **IDLE**
The motor is idle.

public *MotorState* **RUNNING**
The motor is running.

public *MotorState* **DISABLED**
The motor is disabled.

public *MotorState* **INOPERABLE**
The motor is inoperable.

public *MotorState* **NOT_ENOUGH_RESOURCES**
The motor does not have enough resources to run.

Trees of Parts

Vessels in KSP are comprised of a number of parts, connected to one another in a *tree* structure. An example vessel is shown in Figure 1, and the corresponding tree of parts in Figure 2. The craft file for this example can also be downloaded here.

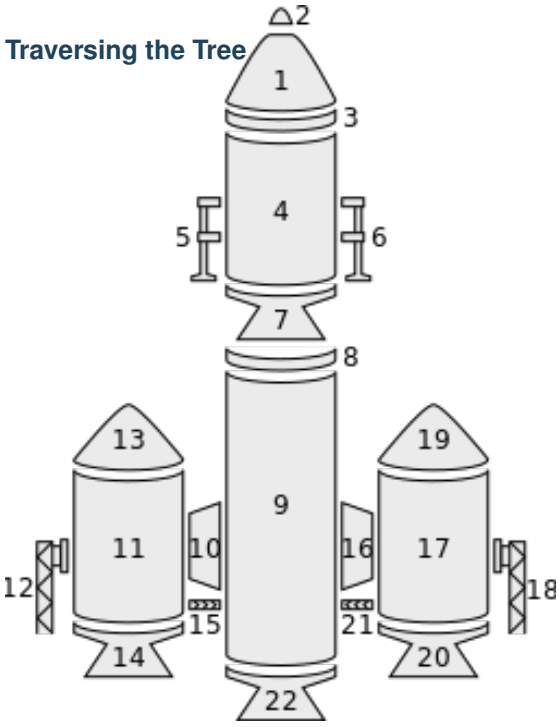

Fig. 10: **Figure 1** – Example parts making up a vessel.

Traversing the Tree

The tree of parts can be traversed using the attributes *Parts.getRoot()*, *Part.getParent()* and *Part.getChildren()*.

The root of the tree is the same as the vessels *root part* (part number 1 in the example above) and can be obtained by calling *Parts.getRoot()*. A parts children can be obtained by calling *Part.getChildren()*. If the part does not have any children, *Part.getChildren()* returns an empty list. A parts parent can be obtained by calling *Part.getParent()*. If the part does not have a parent (as is the case for the root part), *Part.getParent()* returns null.

The following Java example uses these attributes to perform a depth-first traversal over all of the parts in a vessel:

```
import krpc.client.C
import krpc.client.R
import krpc.client.s
import krpc.client.s
import
↪krpc.client.servic

import org.javatuple
```

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(continued from previous page)

```
import java.io.IOExc
import java.util.Arr
import java.util.Deq

public class TreeTra
    public static vo
↪args) throws IOExc
        Connection␣
↪connection = Conne
        Vessel vesse
↪newInstance(connec
    ␣
↪    Part root = ve
        Deque<Pair<P
↪= new ArrayDeque<P
        stack.
↪push(new Pair<Part
        while (stack
    ␣
↪    Pair<Part, In
            Part par
            int dept
            String p
            for (int
                pref
            }
            System.
↪out.println(prefix
    ␣
↪    for (Part chi
                stac
↪Pair<Part, Integer
            }
        }
        connection.c
    }
}
```

When this code is execute using the craft file for the example vessel pictured above, the following is printed out:

```
Command Pod Mk1
 TR-18A Stack Decoup
  FL-T400 Fuel Tank
   LV-909 Liquid Fue
    TR-18A Stack Dec
     FL-T800 Fuel Ta
      LV-909 Liquid
      TT-70 Radial D
       FL-T400 Fuel
        TT18-A Launc
        FTX-2 Extern
        LV-909 Liqui
        Aerodynamic
      TT-70 Radial D
```

(continues on next page)

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```
                                                                FL-T400 Fuel
                                                                 TT18-A Launc
                                                                 FTX-2 Extern
                                                                 LV-909 Liqui
                                                                 Aerodynamic
                                                          LT-1 Landing Stru
                                                          LT-1 Landing Stru
                                                        Mk16 Parachute
```

Attachment Modes

Parts can be attached to other parts either *radially* (on the side of the parent part) or *axially* (on the end of the parent part, to form a stack).

For example, in the vessel pictured above, the parachute (part 2) is *axially* connected to its parent (the command pod – part 1), and the landing leg (part 5) is *radially* connected to its parent (the fuel tank – part 4).

The root part of a vessel (for example the command pod – part 1) does not have a parent part, so does not have an attachment mode. However, the part is consider to be *axially* attached to nothing.

The following Java example does a depth-first traversal as before, but also prints out the attachment mode used by the part:

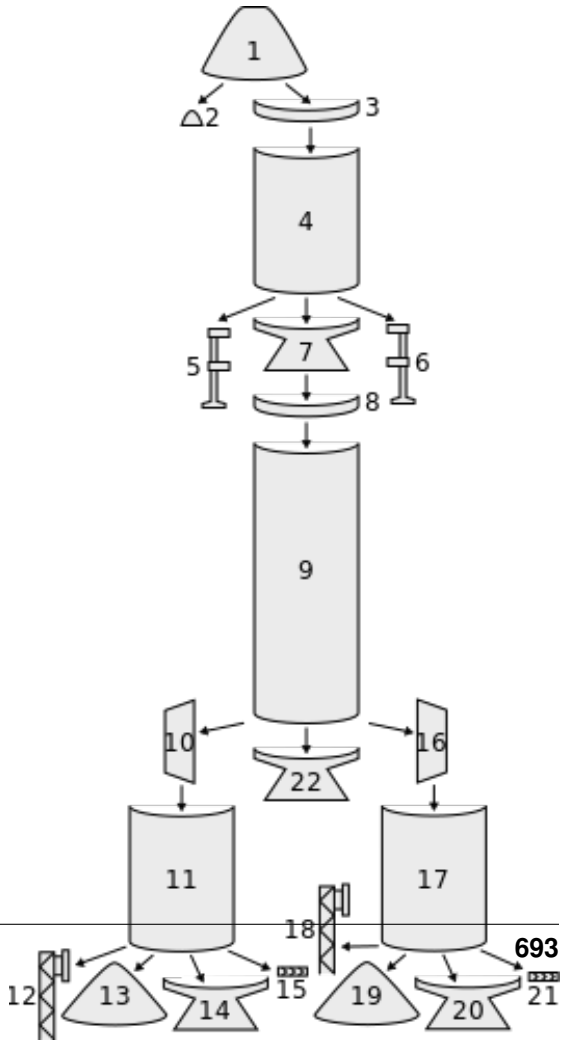
```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.Part;
import␣
↪krpc.client.services.SpaceCenter.Vessel;

import org.javatuples.Pair;

import java.io.IOException;
import java.util.ArrayDeque;
import java.util.Deque;

public class AttachmentModes {
    public static void main(String[]␣
↪args) throws IOException, RPCException {
        Connection␣
↪connection = Connection.newInstance();
        Vessel vessel = SpaceCenter.
↪newInstance(connection).getActiveVessel();
␣
↪    Part root = vessel.getParts().getRoot();
        Deque<Pair<Part, Integer>> stack␣
↪= new ArrayDeque<Pair<Part, Integer>>();
        stack.
↪push(new Pair<Part, Integer>(root, 0));
        while (stack.size() > 0) {
```

(continues on next page)



(continued from previous page)

```
↪     Pair<Part, Integer> item = stack.pop();
            Part part = item.getValue0();
            int depth = item.getValue1();
            String prefix = "";
            for (int i = 0; i < depth; i++) {
                prefix += " ";
            }
            String attachMode = part.
↪getAxiallyAttached() ? "axial" : "radial";
            System.out.println(prefix␣
↪+ part.getTitle() + " - " + attachMode);

↪     for (Part child : part.getChildren()) {
                stack.push(new␣
↪Pair<Part, Integer>(child, depth + 1));
            }
        }
        connection.close();
    }
}
```

When this code is execute using the craft file for the example vessel pictured above, the following is printed out:

```
Command Pod Mk1 - axial
 TR-18A Stack Decoupler - axial
  FL-T400 Fuel Tank - axial
   LV-909 Liquid Fuel Engine - axial
    TR-18A Stack Decoupler - axial
     FL-T800 Fuel Tank - axial
      LV-909 Liquid Fuel Engine - axial
      TT-70 Radial Decoupler - radial
       FL-T400 Fuel Tank - radial

↪    TT18-A Launch Stability Enhancer - radial
        FTX-2 External Fuel Duct - radial
        LV-909 Liquid Fuel Engine - axial
        Aerodynamic Nose Cone - axial
      TT-70 Radial Decoupler - radial
       FL-T400 Fuel Tank - radial

↪    TT18-A Launch Stability Enhancer - radial
        FTX-2 External Fuel Duct - radial
        LV-909 Liquid Fuel Engine - axial
        Aerodynamic Nose Cone - axial
   LT-1 Landing Struts - radial
   LT-1 Landing Struts - radial
 Mk16 Parachute - axial
```

Fuel Lines

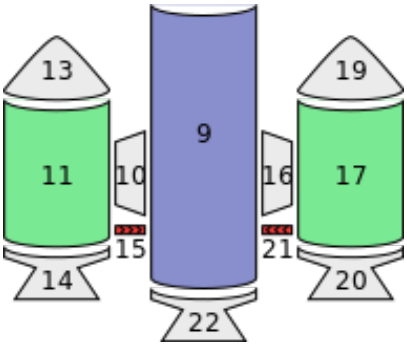


Fig. 12: **Figure 5** – Fuel lines from the example in Figure 1. Fuel flows from the parts highlighted in green, into the part highlighted in blue.

Fuel lines are considered parts, and are included in the parts tree (for example, as pictured in Figure 4). However, the parts tree does not contain information about which parts fuel lines connect to. The parent part of a fuel line is the part from which it will take fuel (as shown in Figure 4) however the part that it will send fuel to is not represented in the parts tree.

Figure 5 shows the fuel lines from the example vessel pictured earlier. Fuel line part 15 (in red) takes fuel from a fuel tank (part 11 – in green) and feeds it into another fuel tank (part 9 – in blue). The fuel line is therefore a child of part 11, but its connection to part 9 is not represented in the tree.

The attributes `Part.getFuelLinesFrom()` and `Part.getFuelLinesTo()` can be used to discover these connections. In the example in Figure 5, when `Part.getFuelLinesTo()` is called on fuel tank part 11, it will return a list of parts containing just fuel tank part 9 (the blue part). When `Part.getFuelLinesFrom()` is called on fuel tank part 9, it will return a list containing fuel tank parts 11 and 17 (the parts colored green).

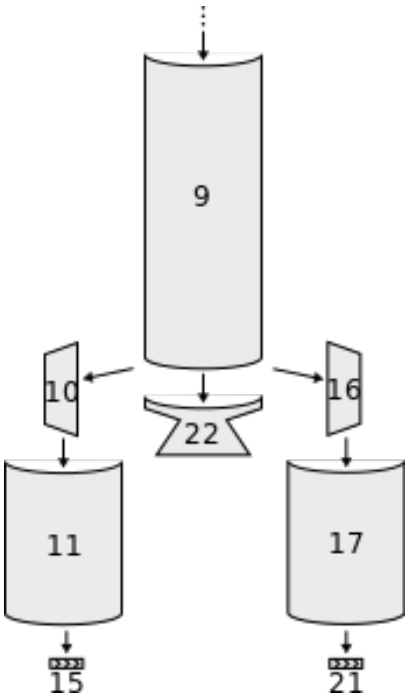


Fig. 13: **Figure 4** – A subset of the parts tree from Figure 2 above.

Staging

Each part has two staging numbers associated with it: the stage in which the part is *activated* and the stage in which the part is *decoupled*. These values can be obtained using `Part.getStage()` and `Part.getDecoupleStage()` respectively. For parts that are not activated by staging, `Part.getStage()` returns -1. For parts that are never decoupled, `Part.getDecoupleStage()` returns a value of -1.

Figure 6 shows an example staging sequence for a vessel. Figure 7 shows the stages in which each part of the vessel will be *activated*. Figure 8 shows the stages in which each part of the vessel will be *decoupled*.

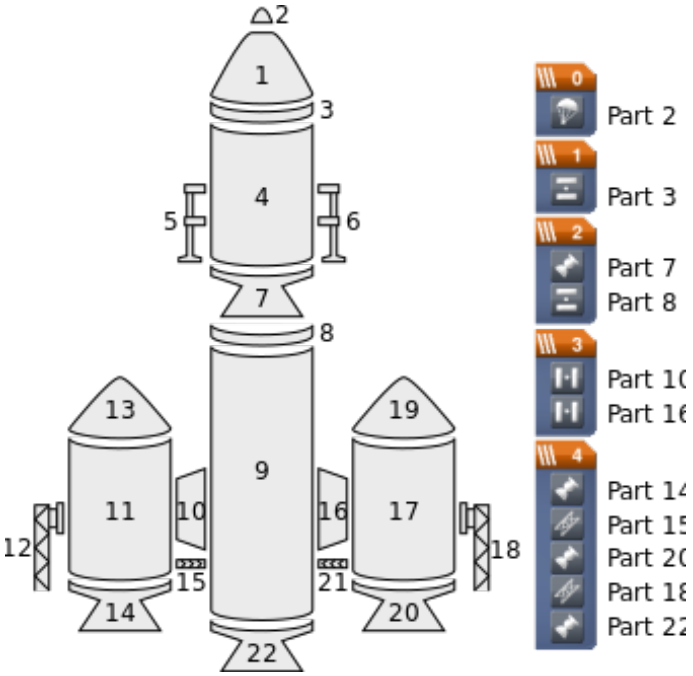


Fig. 14: **Figure 6** – Example vessel from Figure 1 with a staging sequence.

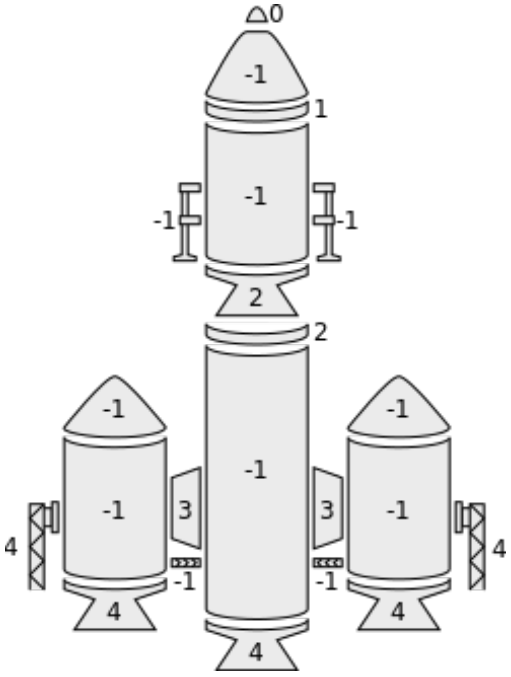


Fig. 15: **Figure 7** – The stage in which each part is *activated*.

6.3.9 Resources

public class **`Resources`**

Represents the collection of resources stored in a vessel, stage

or part. Created by calling *Vessel.getResources()*, *Vessel.resourcesInDecoupleStage(int, boolean)* or *Part.getResources()*.

java.util.List<*Resource*> **getAll**()
All the individual resources that can be stored.

Game Scenes Flight

java.util.List<*Resource*> **withResource**(String *name*)
All the individual resources with the given name that can be stored.

Parameters

- **name** (*String*) –

Game Scenes Flight

java.util.List<String> **getNames**()
A list of resource names that can be stored.

Game Scenes Flight

boolean **hasResource**(String *name*)
Check whether the named resource can be stored.

Parameters

- **name** (*String*) – The name of the resource.

Game Scenes Flight

float **amount**(String *name*)
Returns the amount of a resource that is currently stored.

Parameters

- **name** (*String*) – The name of the resource.

Game Scenes Flight

float **max**(String *name*)
Returns the amount of a resource that can be stored.

Parameters

- **name** (*String*) – The name of the resource.

Game Scenes Flight

static float **density**(*Connection connection*, String *name*)
Returns the density of a resource, in kg/l.

Parameters

- **name** (*String*) – The name of the resource.

Game Scenes Flight

static *ResourceFlowMode* **flowMode**(*Connection connection*, String *name*)
Returns the flow mode of a resource.

Parameters

- **name** (*String*) – The name of the resource.

Game Scenes Flight

boolean **getEnabled**()

void **setEnabled**(boolean *value*)
Whether use of all the resources are enabled.

Game Scenes Flight

Note: This is `true` if all of the resources are enabled. If any of the resources are not enabled, this is `false`.

---

public class **Resource**
An individual resource stored within a part. Created using methods in the *Resources* class.

String **getName**()
The name of the resource.

Game Scenes All

Part **getPart**()
The part containing the resource.

Game Scenes All

float **getAmount**()
The amount of the resource that is currently stored in the part.

Game Scenes All

float **getMax**()
The total amount of the resource that can be stored in the part.

Game Scenes All

float **getDensity**()
The density of the resource, in kg/l.

Game Scenes All

ResourceFlowMode **getFlowMode**()
The flow mode of the resource.

Game Scenes All

boolean **getEnabled**()

void **setEnabled**(boolean *value*)
Whether use of this resource is enabled.

Game Scenes All

public class **ResourceTransfer**
Transfer resources between parts.

static *ResourceTransfer* **start**(*Connection connection*, *Part fromPart*, *Part toPart*, String *resource*, float *maxAmount*)
Start transferring a resource transfer between a pair of parts. The transfer will move at most *maxAmount* units of the resource, depending on how much of the resource is available in the source part and how much storage is available in the destination part. Use *ResourceTransfer.getComplete()* to check if the transfer

is complete. Use *ResourceTransfer.getAmount()* to see how much of the resource has been transferred.

Parameters

- **fromPart** (Part) – The part to transfer to.
- **toPart** (Part) – The part to transfer from.
- **resource** (*String*) – The name of the resource to transfer.
- **maxAmount** (*float*) – The maximum amount of resource to transfer.

Game Scenes All

float **getAmount**()
The amount of the resource that has been transferred.

Game Scenes All

boolean **getComplete**()
Whether the transfer has completed.

Game Scenes All

public enum **ResourceFlowMode**
The way in which a resource flows between parts. See *Resources.flowMode(String)*.

public *ResourceFlowMode* **VESSEL**
The resource flows to any part in the vessel. For example, electric charge.

public *ResourceFlowMode* **STAGE**
The resource flows from parts in the first stage, followed by the second, and so on. For example, mono-propellant.

public *ResourceFlowMode* **ADJACENT**
The resource flows between adjacent parts within the vessel. For example, liquid fuel or oxidizer.

public *ResourceFlowMode* **NONE**
The resource does not flow. For example, solid fuel.

6.3.10 Node

public class **Node**
Represents a maneuver node. Can be created using *Control.addNode(double, float, float, float)*.

double **getPrograde**()

void **setPrograde**(double *value*)
The magnitude of the maneuver nodes delta-v in the prograde direction, in meters per second.

Game Scenes Flight

double **getNormal**()

void **setNormal**(double *value*)
The magnitude of the maneuver nodes delta-v in the normal direction, in meters per second.

Game Scenes Flight

double **getRadial**()

void **setRadial**(double *value*)
The magnitude of the maneuver nodes delta-v in the radial direction, in meters per second.

Game Scenes Flight

double **getDeltaV**()

void **setDeltaV**(double *value*)
The delta-v of the maneuver node, in meters per second.

Game Scenes Flight

Note: Does not change when executing the maneuver node. See *Node.getRemainingDeltaV()*.

---

double **getRemainingDeltaV**()
Gets the remaining delta-v of the maneuver node, in meters per second. Changes as the node is executed. This is equivalent to the delta-v reported in-game.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **burnVector**(*ReferenceFrame referenceFrame*)
Returns the burn vector for the maneuver node.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned vector is in. Defaults to *Vessel.getOrbitalReferenceFrame()*.

Returns A vector whose direction is the direction of the maneuver node burn, and magnitude is the delta-v of the burn in meters per second.

Game Scenes Flight

Note: Does not change when executing the maneuver node. See *Node.remainingBurnVector(ReferenceFrame)*.

---

org.javatuples.Triplet<Double, Double, Double> **remainingBurnVector**(*ReferenceFrame referenceFrame*)
Returns the remaining burn vector for the maneuver node.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned vector is in. Defaults to *Vessel.getOrbitalReferenceFrame()*.

Returns A vector whose direction is the direction of the maneuver node burn, and magnitude is the delta-v of the burn in meters per second.

Game Scenes Flight

Note: Changes as the maneuver node is executed. See *Node.burnVector(ReferenceFrame)*.

---

double **getUT**()

void **setUT**(double *value*)
The universal time at which the maneuver will occur, in seconds.

Game Scenes Flight

double **getTimeTo**()
The time until the maneuver node will be encountered, in seconds.

Game Scenes Flight

Orbit **getOrbit**()
The orbit that results from executing the maneuver node.

Game Scenes Flight

void **remove**()
Removes the maneuver node.

Game Scenes Flight

ReferenceFrame **getReferenceFrame**()
The reference frame that is fixed relative to the maneuver node's burn.

- The origin is at the position of the maneuver node.
- The y-axis points in the direction of the burn.
- The x-axis and z-axis point in arbitrary but fixed directions.

Game Scenes Flight

ReferenceFrame **getOrbitalReferenceFrame**()
The reference frame that is fixed relative to the maneuver node, and orientated with the orbital prograde/normal/radial directions of the original orbit at the maneuver node's position.

- The origin is at the position of the maneuver node.
- The x-axis points in the orbital anti-radial direction of the original orbit, at the position of the maneuver node.
- The y-axis points in the orbital prograde direction of the original orbit, at the position of the maneuver node.
- The z-axis points in the orbital normal direction of the original orbit, at the position of the maneuver node.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **position**(*ReferenceFrame referenceFrame*)
The position vector of the maneuver node in the given reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned position vector is in.

Returns The position as a vector.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **direction**(*ReferenceFrame referenceFrame*)
The direction of the maneuver nodes burn.

Parameters

- **referenceFrame** (ReferenceFrame) – The reference frame that the returned direction is in.

Returns The direction as a unit vector.

Game Scenes Flight

6.3.11 ReferenceFrame

public class **ReferenceFrame**
Represents a reference frame for positions, rotations and velocities. Contains:

- The position of the origin.
- The directions of the x, y and z axes.
- The linear velocity of the frame.
- The angular velocity of the frame.

Note: This class does not contain any properties or methods. It is only used as a parameter to other functions.

---

static *ReferenceFrame* **createRelative**(*Connection connection*, *ReferenceFrame referenceFrame*, org.javatuples.Triplet<Double, Double, Double> *position*, org.javatuples.Quartet<Double, Double, Double, Double> *rotation*, org.javatuples.Triplet<Double, Double, Double> *velocity*, org.javatuples.Triplet<Double, Double, Double> *angularVelocity*)
Create a relative reference frame. This is a custom reference frame whose components offset the components of a parent reference frame.

Parameters

- **referenceFrame** (ReferenceFrame) – The parent reference frame on which to base this reference frame.
- **position** (*org.javatuples.Triplet<Double, Double,Double>*) – The offset of the position of the origin, as a position vector. Defaults to $(0, 0, 0)$

- **rotation** (*org.javatuples.Quartet<Double, Double,Double,Double>*) – The rotation to apply to the parent frames rotation, as a quaternion of the form (x, y, z, w). Defaults to $(0, 0, 0, 1)$ (i.e. no rotation)
- **velocity** (*org.javatuples.Triplet<Double, Double,Double>*) – The linear velocity to offset the parent frame by, as a vector pointing in the direction of travel, whose magnitude is the speed in meters per second. Defaults to $(0, 0, 0)$.
- **angularVelocity** (*org.javatuples.Triplet<Double,Double,Double>*) – The angular velocity to offset the parent frame by, as a vector. This vector points in the direction of the axis of rotation, and its magnitude is the speed of the rotation in radians per second. Defaults to $(0, 0, 0)$.

Game Scenes All

static *ReferenceFrame* **createHybrid**(*Connection connection*, *ReferenceFrame position*, *ReferenceFrame rotation*, *ReferenceFrame velocity*, *ReferenceFrame angularVelocity*)

Create a hybrid reference frame. This is a custom reference frame whose components inherited from other reference frames.

Parameters

- **position** (`ReferenceFrame`) – The reference frame providing the position of the origin.
- **rotation** (`ReferenceFrame`) – The reference frame providing the rotation of the frame.
- **velocity** (`ReferenceFrame`) – The reference frame providing the linear velocity of the frame.
- **angularVelocity** (`ReferenceFrame`) – The reference frame providing the angular velocity of the frame.

Game Scenes All

Note: The *position* reference frame is required but all other reference frames are optional. If omitted, they are set to the *position* reference frame.

6.3.12 AutoPilot

public class **AutoPilot**

Provides basic auto-piloting utilities for a vessel. Created by calling *Vessel.getAutoPilot()*.

Note: If a client engages the auto-pilot and then closes its connection to the server, the auto-pilot will be disengaged and its target reference frame, direction and roll reset to default.

---

void **engage**()

Engage the auto-pilot.

Game Scenes Flight

void **disengage**()
Disengage the auto-pilot.

Game Scenes Flight

void **wait_**()
Blocks until the vessel is pointing in the target direction and has the target roll (if set). Throws an exception if the auto-pilot has not been engaged.

Game Scenes Flight

float **getError**()
The error, in degrees, between the direction the ship has been asked to point in and the direction it is pointing in. Throws an exception if the auto-pilot has not been engaged and SAS is not enabled or is in stability assist mode.

Game Scenes Flight

float **getPitchError**()
The error, in degrees, between the vessels current and target pitch. Throws an exception if the auto-pilot has not been engaged.

Game Scenes Flight

float **getHeadingError**()
The error, in degrees, between the vessels current and target heading. Throws an exception if the auto-pilot has not been engaged.

Game Scenes Flight

float **getRollError**()
The error, in degrees, between the vessels current and target roll. Throws an exception if the auto-pilot has not been engaged or no target roll is set.

Game Scenes Flight

ReferenceFrame **getReferenceFrame**()

void **setReferenceFrame**(*ReferenceFrame value*)
The reference frame for the target direction (*AutoPilot.getTargetDirection()*).

Game Scenes Flight

Note: An error will be thrown if this property is set to a reference frame that rotates with the vessel being controlled, as it is impossible to rotate the vessel in such a reference frame.

---

float **getTargetPitch**()

void **setTargetPitch**(float *value*)
The target pitch, in degrees, between -90° and +90°.

Game Scenes Flight

float **getTargetHeading**()

void **setTargetHeading**(float *value*)
The target heading, in degrees, between 0° and 360°.

Game Scenes Flight

float **getTargetRoll**()

void **setTargetRoll**(float *value*)
The target roll, in degrees. `NaN` if no target roll is set.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getTargetDirection**()

void **setTargetDirection**(org.javatuples.Triplet<Double, Double, Double> *value*)
Direction vector corresponding to the target pitch and heading. This is in the reference frame specified by *ReferenceFrame*.

Game Scenes Flight

void **targetPitchAndHeading**(float *pitch*, float *heading*)
Set target pitch and heading angles.

Parameters

- **pitch** (*float*) – Target pitch angle, in degrees between -90° and +90°.
- **heading** (*float*) – Target heading angle, in degrees between 0° and 360°.

Game Scenes Flight

boolean **getSAS**()

void **setSAS**(boolean *value*)
The state of SAS.

Game Scenes Flight

Note: Equivalent to *Control.getSAS()*

SASMode **getSASMode**()

void **setSASMode**(*SASMode value*)
The current *SASMode*. These modes are equivalent to the mode buttons to the left of the navball that appear when SAS is enabled.

Game Scenes Flight

Note: Equivalent to *Control.getSASMode()*

---

double **getRollThreshold**()

void **setRollThreshold**(double *value*)
The threshold at which the autopilot will try to match the target roll angle, if any. Defaults to 5 degrees.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getStoppingTime**()

void **setStoppingTime**(org.javatuples.Triplet<Double, Double, Double> *value*)
The maximum amount of time that the vessel should need to come to a complete stop. This determines the maximum angular velocity of the vessel. A vector of three stopping times, in seconds, one for each of the pitch, roll and yaw axes. Defaults to 0.5 seconds for each axis.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getDecelerationTime**()

void **setDecelerationTime**(org.javatuples.Triplet<Double, Double, Double> *value*)
The time the vessel should take to come to a stop pointing in the target direction. This determines the angular acceleration used to decelerate the vessel. A vector of three times, in seconds, one for each of the pitch, roll and yaw axes. Defaults to 5 seconds for each axis.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getAttenuationAngle**()

void **setAttenuationAngle**(org.javatuples.Triplet<Double, Double, Double> *value*)
The angle at which the autopilot considers the vessel to be pointing close to the target. This determines the midpoint of the target velocity attenuation function. A vector of three angles, in degrees, one for each of the pitch, roll and yaw axes. Defaults to 1° for each axis.

Game Scenes Flight

boolean **getAutoTune**()

void **setAutoTune**(boolean *value*)
Whether the rotation rate controllers PID parameters should be automatically tuned using the vessels moment of inertia and available torque. Defaults to `true`. See *`AutoPilot.getTimeToPeak()`* and *`AutoPilot.getOvershoot()`*.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getTimeToPeak**()

void **setTimeToPeak**(org.javatuples.Triplet<Double, Double, Double> *value*)
The target time to peak used to autotune the PID controllers. A vector of three times, in seconds, for each of the pitch, roll and yaw axes. Defaults to 3 seconds for each axis.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getOvershoot**()

void **setOvershoot**(org.javatuples.Triplet<Double, Double, Double> *value*)
The target overshoot percentage used to autotune the PID controllers. A vector of three values, between 0 and 1, for each of the pitch, roll and yaw axes. Defaults to 0.01 for each axis.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getPitchPIDGains**()

void **setPitchPIDGains**(org.javatuples.Triplet<Double, Double, Double> *value*)
Gains for the pitch PID controller.

Game Scenes Flight

Note: When *AutoPilot.getAutoTune()* is true, these values are updated automatically, which will overwrite any manual changes.

---

org.javatuples.Triplet<Double, Double, Double> **getRollPIDGains**()

void **setRollPIDGains**(org.javatuples.Triplet<Double, Double, Double> *value*)
Gains for the roll PID controller.

Game Scenes Flight

Note: When *AutoPilot.getAutoTune()* is true, these values are updated automatically, which will overwrite any manual changes.

---

org.javatuples.Triplet<Double, Double, Double> **getYawPIDGains**()

void **setYawPIDGains**(org.javatuples.Triplet<Double, Double, Double> *value*)
Gains for the yaw PID controller.

Game Scenes Flight

Note: When *AutoPilot.getAutoTune()* is true, these values are updated automatically, which will overwrite any manual changes.

6.3.13 Camera

public class **Camera**
Controls the game's camera. Obtained by calling *getCamera()*.

CameraMode **getMode**()

void **setMode**(*CameraMode value*)
The current mode of the camera.

Game Scenes Flight

float **getPitch**()

void **setPitch**(float *value*)
The pitch of the camera, in degrees. A value between *Camera.getMinPitch()* and *Camera.getMaxPitch()*

Game Scenes Flight

float **getHeading**()

void **setHeading**(float *value*)
The heading of the camera, in degrees.

Game Scenes Flight

float **getDistance**()

void **setDistance**(float *value*)
The distance from the camera to the subject, in meters. A value between *Camera.getMinDistance()* and *Camera.getMaxDistance()*.

Game Scenes Flight

float **getMinPitch**()
The minimum pitch of the camera.

Game Scenes Flight

float **getMaxPitch**()
The maximum pitch of the camera.

Game Scenes Flight

float **getMinDistance**()
Minimum distance from the camera to the subject, in meters.

Game Scenes Flight

float **getMaxDistance**()
Maximum distance from the camera to the subject, in meters.

Game Scenes Flight

float **getDefaultDistance**()
Default distance from the camera to the subject, in meters.

Game Scenes Flight

CelestialBody **getFocussedBody**()

void **setFocussedBody**(*CelestialBody value*)
In map mode, the celestial body that the camera is focussed on. Returns `null` if the camera is not focussed on a celestial body. Returns an error is the camera is not in map mode.

Game Scenes Flight

Vessel **getFocussedVessel**()

void **setFocussedVessel**(*Vessel value*)
In map mode, the vessel that the camera is focussed on. Returns `null` if the camera is not focussed on a vessel. Returns an error is the camera is not in map mode.

Game Scenes Flight

Node **getFocussedNode**()

void **setFocussedNode**(*Node value*)
In map mode, the maneuver node that the camera is focussed on. Returns `null` if the camera is not focussed on a maneuver node. Returns an error is the camera is not in map mode.

Game Scenes Flight

public enum **CameraMode**
See *`Camera.getMode()`*.

public *CameraMode* **AUTOMATIC**
The camera is showing the active vessel, in "auto" mode.

public *CameraMode* **FREE**
The camera is showing the active vessel, in "free" mode.

public *CameraMode* **CHASE**
The camera is showing the active vessel, in "chase" mode.

public *CameraMode* **LOCKED**
The camera is showing the active vessel, in "locked" mode.

public *CameraMode* **ORBITAL**
The camera is showing the active vessel, in "orbital" mode.

public *CameraMode* **IVA**
The Intra-Vehicular Activity view is being shown.

public *CameraMode* **MAP**
The map view is being shown.

6.3.14 Waypoints

public class **WaypointManager**
Waypoints are the location markers you can see on the map view showing you where contracts are targeted for. With this structure, you can obtain coordinate data for the locations of these waypoints. Obtained by calling *`getWaypointManager()`*.

java.util.List<*Waypoint*> **getWaypoints**()
A list of all existing waypoints.

Game Scenes All

Waypoint **addWaypoint**(double *latitude*, double *longitude*, *CelestialBody body*, String *name*)
Creates a waypoint at the given position at ground level, and returns a *`Waypoint`* object that can be used to modify it.

Parameters

- **latitude** (*double*) – Latitude of the waypoint.
- **longitude** (*double*) – Longitude of the waypoint.
- **body** (CelestialBody) – Celestial body the waypoint is attached to.
- **name** (*String*) – Name of the waypoint.

Game Scenes All

Waypoint **addWaypointAtAltitude**(double *latitude*, double *longitude*, double *altitude*, *CelestialBody body*, String *name*)

Creates a waypoint at the given position and altitude, and returns a *Waypoint* object that can be used to modify it.

Parameters

- **latitude** (*double*) – Latitude of the waypoint.
- **longitude** (*double*) – Longitude of the waypoint.
- **altitude** (*double*) – Altitude (above sea level) of the waypoint.
- **body** (CelestialBody) – Celestial body the waypoint is attached to.
- **name** (*String*) – Name of the waypoint.

Game Scenes All

java.util.Map<String, Integer> **getColors**()

An example map of known color - seed pairs. Any other integers may be used as seed.

Game Scenes All

java.util.List<String> **getIcons**()

Returns all available icons (from "GameData/Squad/Contracts/Icons/").

Game Scenes All

public class **Waypoint**

Represents a waypoint. Can be created using *WaypointManager.addWaypoint(double, double, CelestialBody, String)*.

CelestialBody **getBody**()

void **setBody**(*CelestialBody value*)

The celestial body the waypoint is attached to.

Game Scenes Flight

String **getName**()

void **setName**(String *value*)

The name of the waypoint as it appears on the map and the contract.

Game Scenes Flight

int **getColor**()

void **setColor**(int *value*)
The seed of the icon color. See *WaypointManager.getColors()* for example colors.

Game Scenes Flight

String **getIcon**()

void **setIcon**(String *value*)
The icon of the waypoint.

Game Scenes Flight

double **getLatitude**()

void **setLatitude**(double *value*)
The latitude of the waypoint.

Game Scenes Flight

double **getLongitude**()

void **setLongitude**(double *value*)
The longitude of the waypoint.

Game Scenes Flight

double **getMeanAltitude**()

void **setMeanAltitude**(double *value*)
The altitude of the waypoint above sea level, in meters.

Game Scenes Flight

double **getSurfaceAltitude**()

void **setSurfaceAltitude**(double *value*)
The altitude of the waypoint above the surface of the body or sea level, whichever is closer, in meters.

Game Scenes Flight

double **getBedrockAltitude**()

void **setBedrockAltitude**(double *value*)
The altitude of the waypoint above the surface of the body, in meters. When over water, this is the altitude above the sea floor.

Game Scenes Flight

boolean **getNearSurface**()
`true` if the waypoint is near to the surface of a body.

Game Scenes Flight

boolean **getGrounded**()
`true` if the waypoint is attached to the ground.

Game Scenes Flight

int **getIndex**()
The integer index of this waypoint within its cluster of sibling waypoints. In other words, when you have a cluster of waypoints called "Somewhere Alpha", "Somewhere Beta" and "Somewhere Gamma", the alpha site has index 0, the beta site has index 1 and the gamma site has index 2. When *`Waypoint.getClustered()`* is `false`, this is zero.

Game Scenes Flight

boolean **getClustered**()
`true` if this waypoint is part of a set of clustered waypoints with greek letter names appended (Alpha, Beta, Gamma, etc). If `true`, there is a one-to-one correspondence with the greek letter name and the *`Waypoint.getIndex()`*.

Game Scenes Flight

boolean **getHasContract**()
Whether the waypoint belongs to a contract.

Game Scenes Flight

Contract **getContract**()
The associated contract.

Game Scenes Flight

void **remove**()
Removes the waypoint.

Game Scenes Flight

6.3.15 Contracts

public class **ContractManager**
Contracts manager. Obtained by calling *`getContractManager()`*.

java.util.Set<String> **getTypes**()
A list of all contract types.

Game Scenes All

java.util.List<*Contract*> **getAllContracts**()
A list of all contracts.

Game Scenes All

java.util.List<*Contract*> **getActiveContracts**()
A list of all active contracts.

Game Scenes All

java.util.List<*Contract*> **getOfferedContracts**()
A list of all offered, but unaccepted, contracts.

Game Scenes All

java.util.List<*Contract*> **getCompletedContracts**()
A list of all completed contracts.

Game Scenes All

java.util.List<*Contract*> **getFailedContracts**()
A list of all failed contracts.

Game Scenes All

public class **Contract**
A contract. Can be accessed using *getContractManager()*.

String **getType**()
Type of the contract.

Game Scenes All

String **getTitle**()
Title of the contract.

Game Scenes All

String **getDescription**()
Description of the contract.

Game Scenes All

String **getNotes**()
Notes for the contract.

Game Scenes All

String **getSynopsis**()
Synopsis for the contract.

Game Scenes All

java.util.List<String> **getKeywords**()
Keywords for the contract.

Game Scenes All

ContractState **getState**()
State of the contract.

Game Scenes All

boolean **getSeen**()
Whether the contract has been seen.

Game Scenes All

boolean **getRead**()
Whether the contract has been read.

Game Scenes All

boolean **getActive**()
Whether the contract is active.

Game Scenes All

boolean **getFailed**()
Whether the contract has been failed.

Game Scenes All

boolean **getCanBeCanceled**()
Whether the contract can be canceled.

Game Scenes All

boolean **getCanBeDeclined**()
Whether the contract can be declined.

Game Scenes All

boolean **getCanBeFailed**()
Whether the contract can be failed.

Game Scenes All

void **accept**()
Accept an offered contract.

Game Scenes All

void **cancel**()
Cancel an active contract.

Game Scenes All

void **decline**()
Decline an offered contract.

Game Scenes All

double **getFundsAdvance**()
Funds received when accepting the contract.

Game Scenes All

double **getFundsCompletion**()
Funds received on completion of the contract.

Game Scenes All

double **getFundsFailure**()
Funds lost if the contract is failed.

Game Scenes All

double **getReputationCompletion**()
Reputation gained on completion of the contract.

Game Scenes All

double **getReputationFailure**()
Reputation lost if the contract is failed.

Game Scenes All

double **getScienceCompletion**()
Science gained on completion of the contract.

Game Scenes All

java.util.List<*ContractParameter*> **getParameters**()
Parameters for the contract.

Game Scenes All

public enum **ContractState**
The state of a contract. See *`Contract.getState()`*.

public *ContractState* **ACTIVE**
The contract is active.

public *ContractState* **CANCELED**
The contract has been canceled.

public *ContractState* **COMPLETED**
The contract has been completed.

public *ContractState* **DEADLINE_EXPIRED**
The deadline for the contract has expired.

public *ContractState* **DECLINED**
The contract has been declined.

public *ContractState* **FAILED**
The contract has been failed.

public *ContractState* **GENERATED**
The contract has been generated.

public *ContractState* **OFFERED**
The contract has been offered to the player.

public *ContractState* **OFFER_EXPIRED**
The contract was offered to the player, but the offer expired.

public *ContractState* **WITHDRAWN**
The contract has been withdrawn.

public class **ContractParameter**
A contract parameter. See *`Contract.getParameters()`*.

String **getTitle**()
Title of the parameter.

Game Scenes All

String **getNotes**()
Notes for the parameter.

Game Scenes All

java.util.List<*ContractParameter*> **getChildren**()
Child contract parameters.

Game Scenes All

boolean **getCompleted**()
Whether the parameter has been completed.

Game Scenes All

boolean **getFailed**()
Whether the parameter has been failed.

Game Scenes All

boolean **getOptional**()
Whether the contract parameter is optional.

Game Scenes All

double **getFundsCompletion**()
Funds received on completion of the contract parameter.

Game Scenes All

double **getFundsFailure**()
Funds lost if the contract parameter is failed.

Game Scenes All

double **getReputationCompletion**()
Reputation gained on completion of the contract parameter.

Game Scenes All

double **getReputationFailure**()
Reputation lost if the contract parameter is failed.

Game Scenes All

double **getScienceCompletion**()
Science gained on completion of the contract parameter.

Game Scenes All

6.3.16 Geometry Types

Vectors

3-dimensional vectors are represented as a 3-tuple. For example:

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.Vessel;

import org.javatuples.Triplet;

import java.io.IOException;

public class Vector3 {
    public static void main(String[]␣
↪args) throws IOException, RPCException {
        Connection␣
↪connection = Connection.newInstance();
        Vessel vessel = SpaceCenter.
↪newInstance(connection).getActiveVessel();
        Triplet<Double, Double,
↪ Double> v = vessel.flight(null).getPrograde();
        System.out.println(v.getValue0()␣
↪+ ", " + v.getValue1() + ", " + v.getValue2());
        connection.close();
    }
}
```

Quaternions

Quaternions (rotations in 3-dimensional space) are encoded as a 4-tuple containing the x, y, z and w components. For example:

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.Vessel;

import org.javatuples.Quartet;

import java.io.IOException;

public class Quaternion {
    public static void main(String[]␣
↪args) throws IOException, RPCException {
        Connection␣
↪connection = Connection.newInstance();
        Vessel vessel = SpaceCenter.
↪newInstance(connection).getActiveVessel();
        Quartet<Double, Double, Double,
↪ Double> q = vessel.flight(null).getRotation();
        System.out.
↪println(q.getValue0() + ", " + q.getValue1()␣
↪+ ", " + q.getValue2() + ", " + q.getValue3());
        connection.close();
    }
}
```

6.4 Drawing API

6.4.1 Drawing

public class **Drawing**

Provides functionality for drawing objects in the flight scene.

Line **addLine**(org.javatuples.Triplet<Double, Double, Double> *start*, org.javatuples.Triplet<Double, Double, Double> *end*, *SpaceCenter.ReferenceFrame referenceFrame*, boolean *visible*)

Draw a line in the scene.

Parameters

- **start** (*org.javatuples.Triplet<Double,Double, Double>*) – Position of the start of the line.
- **end** (*org.javatuples.Triplet<Double,Double, Double>*) – Position of the end of the line.
- **referenceFrame** (SpaceCenter.ReferenceFrame) – Reference frame that the positions are in.
- **visible** (*boolean*) – Whether the line is visible.

Game Scenes Flight

Line **addDirection**(org.javatuples.Triplet<Double, Double, Double> *direction*, *SpaceCenter.ReferenceFrame referenceFrame*, float *length*, boolean *visible*)

Draw a direction vector in the scene, from the center of mass of the active vessel.

Parameters

- **direction** (*org.javatuples.Triplet<Double, Double, Double>*) – Direction to draw the line in.
- **referenceFrame** (SpaceCenter.ReferenceFrame) – Reference frame that the direction is in.
- **length** (*float*) – The length of the line.
- **visible** (*boolean*) – Whether the line is visible.

Game Scenes Flight

Polygon **addPolygon** (java.util.List<org.javatuples.Triplet<Double, Double, Double>> *vertices*, *SpaceCenter.ReferenceFrame referenceFrame*, boolean *visible*)
Draw a polygon in the scene, defined by a list of vertices.

Parameters

- **vertices** (*java.util.List<org.javatuples.Triplet<Double, Double, Double>>*) – Vertices of the polygon.
- **referenceFrame** (SpaceCenter.ReferenceFrame) – Reference frame that the vertices are in.
- **visible** (*boolean*) – Whether the polygon is visible.

Game Scenes Flight

Text **addText** (String *text*, *SpaceCenter.ReferenceFrame referenceFrame*, org.javatuples.Triplet<Double, Double, Double> *position*, org.javatuples.Quartet<Double, Double, Double, Double> *rotation*, boolean *visible*)
Draw text in the scene.

Parameters

- **text** (*String*) – The string to draw.
- **referenceFrame** (SpaceCenter.ReferenceFrame) – Reference frame that the text position is in.
- **position** (*org.javatuples.Triplet<Double, Double, Double>*) – Position of the text.
- **rotation** (*org.javatuples.Quartet<Double, Double, Double, Double>*) – Rotation of the text, as a quaternion.
- **visible** (*boolean*) – Whether the text is visible.

Game Scenes Flight

void **clear** (boolean *clientOnly*)
Remove all objects being drawn.

Parameters

- **clientOnly** (*boolean*) – If true, only remove objects created by the calling client.

Game Scenes Flight

6.4.2 Line

public class **Line**

A line. Created using *addLine(org.javatuples.Triplet<Double,Double,Double>, org.javatuples.Triplet<Double,Double,Double>, SpaceCenter.ReferenceFrame, boolean)*.

org.javatuples.Triplet<Double, Double, Double> **getStart**()

void **setStart**(org.javatuples.Triplet<Double, Double, Double> *value*)

Start position of the line.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getEnd**()

void **setEnd**(org.javatuples.Triplet<Double, Double, Double> *value*)

End position of the line.

Game Scenes Flight

SpaceCenter.ReferenceFrame **getReferenceFrame**()

void **setReferenceFrame**(*SpaceCenter.ReferenceFrame value*)

Reference frame for the positions of the object.

Game Scenes Flight

boolean **getVisible**()

void **setVisible**(boolean *value*)

Whether the object is visible.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getColor**()

void **setColor**(org.javatuples.Triplet<Double, Double, Double> *value*)

Set the color

Game Scenes Flight

String **getMaterial**()

void **setMaterial**(String *value*)

Material used to render the object. Creates the material from a shader with the given name.

Game Scenes Flight

float **getThickness**()

void **setThickness**(float *value*)

Set the thickness

Game Scenes Flight

void **remove**()
Remove the object.

Game Scenes Flight

6.4.3 Polygon

public class **Polygon**
A polygon. Created using *addPolygon(java.util.List<org.javatuples.Triplet<Double,Double,Double>>, SpaceCenter.ReferenceFrame, boolean)*.

java.util.List<org.javatuples.Triplet<Double, Double, Double>> **getVertices**()

void **setVertices**(java.util.List<org.javatuples.Triplet<Double, Double, Double>> *value*)
Vertices for the polygon.

Game Scenes Flight

SpaceCenter.ReferenceFrame **getReferenceFrame**()

void **setReferenceFrame**(*SpaceCenter.ReferenceFrame value*)
Reference frame for the positions of the object.

Game Scenes Flight

boolean **getVisible**()

void **setVisible**(boolean *value*)
Whether the object is visible.

Game Scenes Flight

void **remove**()
Remove the object.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getColor**()

void **setColor**(org.javatuples.Triplet<Double, Double, Double> *value*)
Set the color

Game Scenes Flight

String **getMaterial**()

void **setMaterial**(String *value*)
Material used to render the object. Creates the material from a shader with the given name.

Game Scenes Flight

float **getThickness**()

void **setThickness**(float *value*)
Set the thickness

Game Scenes Flight

6.4.4 Text

public class **Text**
Text. Created using *addText(String, SpaceCenter.ReferenceFrame, org.javatuples.Triplet<Double,Double,Double>, org.javatuples.Quartet<Double,Double,Double,Double>, boolean)*.

org.javatuples.Triplet<Double, Double, Double> **getPosition**()

void **setPosition**(org.javatuples.Triplet<Double, Double, Double> *value*)
Position of the text.

Game Scenes Flight

org.javatuples.Quartet<Double, Double, Double, Double> **getRotation**()

void **setRotation**(org.javatuples.Quartet<Double, Double, Double, Double> *value*)
Rotation of the text as a quaternion.

Game Scenes Flight

SpaceCenter.ReferenceFrame **getReferenceFrame**()

void **setReferenceFrame**(*SpaceCenter.ReferenceFrame value*)
Reference frame for the positions of the object.

Game Scenes Flight

boolean **getVisible**()

void **setVisible**(boolean *value*)
Whether the object is visible.

Game Scenes Flight

void **remove**()
Remove the object.

Game Scenes Flight

String **getContent**()

void **setContent**(String *value*)
The text string

Game Scenes Flight

String **getFont**()

void **setFont**(String *value*)
Name of the font

Game Scenes Flight

static java.util.List<String> **availableFonts**(*Connection connection*)
A list of all available fonts.

Game Scenes Flight

int **getSize**()

void **setSize**(int *value*)
Font size.

Game Scenes Flight

float **getCharacterSize**()

void **setCharacterSize**(float *value*)
Character size.

Game Scenes Flight

UI.FontStyle **getStyle**()

void **setStyle**(*UI.FontStyle value*)
Font style.

Game Scenes Flight

org.javatuples.Triplet<Double, Double, Double> **getColor**()

void **setColor**(org.javatuples.Triplet<Double, Double, Double> *value*)
Set the color

Game Scenes Flight

String **getMaterial**()

void **setMaterial**(String *value*)
Material used to render the object. Creates the material from a shader with the given name.

Game Scenes Flight

UI.TextAlignment **getAlignment**()

void **setAlignment**(*UI.TextAlignment value*)
Alignment.

Game Scenes Flight

float **getLineSpacing**()

void **setLineSpacing**(float *value*)
Line spacing.

Game Scenes Flight

UI.TextAnchor **getAnchor**()

void **setAnchor**(*UI.TextAnchor value*)
Anchor.

Game Scenes Flight

6.5 InfernalRobotics API

Provides RPCs to interact with the InfernalRobotics mod. Both the original mod and Infernal Robotics Next are supported. Provides the following classes:

6.5.1 InfernalRobotics

public class **InfernalRobotics**
This service provides functionality to interact with Infernal Robotics.

boolean **getAvailable**()
Whether Infernal Robotics is installed.

Game Scenes Flight

boolean **getReady**()
Whether Infernal Robotics API is ready.

Game Scenes Flight

java.util.List<*ServoGroup*> **servoGroups**(*SpaceCenter.Vessel vessel*)
A list of all the servo groups in the given *vessel*.

Parameters

- **vessel** (SpaceCenter.Vessel) –

Game Scenes Flight

ServoGroup **servoGroupWithName**(*SpaceCenter.Vessel vessel*, String *name*)
Returns the servo group in the given *vessel* with the given *name*, or null if none exists. If multiple servo groups have the same name, only one of them is returned.

Parameters

- **vessel** (SpaceCenter.Vessel) – Vessel to check.
- **name** (*String*) – Name of servo group to find.

Game Scenes Flight

Servo **servoWithName**(*SpaceCenter.Vessel vessel*, String *name*)
Returns the servo in the given *vessel* with the given *name* or null if none exists. If multiple servos have the same name, only one of them is returned.

Parameters

- **vessel** (SpaceCenter.Vessel) – Vessel to check.

- **name** (*String*) – Name of the servo to find.

Game Scenes Flight

6.5.2 ServoGroup

public class **ServoGroup**
A group of servos, obtained by calling *servoGroups(SpaceCenter.Vessel)* or *servoGroupWithName(SpaceCenter.Vessel, String)*. Represents the "Servo Groups" in the InfernalRobotics UI.

String **getName**()

void **setName**(String *value*)
The name of the group.

Game Scenes Flight

String **getForwardKey**()

void **setForwardKey**(String *value*)
The key assigned to be the "forward" key for the group.

Game Scenes Flight

String **getReverseKey**()

void **setReverseKey**(String *value*)
The key assigned to be the "reverse" key for the group.

Game Scenes Flight

float **getSpeed**()

void **setSpeed**(float *value*)
The speed multiplier for the group.

Game Scenes Flight

boolean **getExpanded**()

void **setExpanded**(boolean *value*)
Whether the group is expanded in the InfernalRobotics UI.

Game Scenes Flight

java.util.List<*Servo*> **getServos**()
The servos that are in the group.

Game Scenes Flight

Servo **servoWithName**(String *name*)
Returns the servo with the given *name* from this group, or `null` if none exists.

Parameters

- **name** (*String*) – Name of servo to find.

Game Scenes Flight

java.util.List<*SpaceCenter.Part*> **getParts**()
The parts containing the servos in the group.

Game Scenes Flight

void **moveRight**()
Moves all of the servos in the group to the right.

Game Scenes Flight

void **moveLeft**()
Moves all of the servos in the group to the left.

Game Scenes Flight

void **moveCenter**()
Moves all of the servos in the group to the center.

Game Scenes Flight

void **moveNextPreset**()
Moves all of the servos in the group to the next preset.

Game Scenes Flight

void **movePrevPreset**()
Moves all of the servos in the group to the previous preset.

Game Scenes Flight

void **stop**()
Stops the servos in the group.

Game Scenes Flight

6.5.3 Servo

public class **Servo**
Represents a servo. Obtained using *ServoGroup.getServos()*, *ServoGroup.servoWithName(String)* or *servoWithName(SpaceCenter.Vessel, String)*.

String **getName**()

void **setName**(String *value*)
The name of the servo.

Game Scenes Flight

SpaceCenter.Part **getPart**()
The part containing the servo.

Game Scenes Flight

void **setHighlight**(boolean *value*)
Whether the servo should be highlighted in-game.

Game Scenes Flight

float **getPosition**()
The position of the servo.

Game Scenes Flight

float **getMinConfigPosition**()
The minimum position of the servo, specified by the part configuration.

Game Scenes Flight

float **getMaxConfigPosition**()
The maximum position of the servo, specified by the part configuration.

Game Scenes Flight

float **getMinPosition**()

void **setMinPosition**(float *value*)
The minimum position of the servo, specified by the in-game tweak menu.

Game Scenes Flight

float **getMaxPosition**()

void **setMaxPosition**(float *value*)
The maximum position of the servo, specified by the in-game tweak menu.

Game Scenes Flight

float **getConfigSpeed**()
The speed multiplier of the servo, specified by the part configuration.

Game Scenes Flight

float **getSpeed**()

void **setSpeed**(float *value*)
The speed multiplier of the servo, specified by the in-game tweak menu.

Game Scenes Flight

float **getCurrentSpeed**()

void **setCurrentSpeed**(float *value*)
The current speed at which the servo is moving.

Game Scenes Flight

float **getAcceleration**()

void **setAcceleration**(float *value*)
The current speed multiplier set in the UI.

Game Scenes Flight

boolean **getIsMoving**()
Whether the servo is moving.

Game Scenes Flight

boolean **getIsFreeMoving**()
Whether the servo is freely moving.

Game Scenes Flight

boolean **getIsLocked**()

void **setIsLocked**(boolean *value*)
Whether the servo is locked.

Game Scenes Flight

boolean **getIsAxisInverted**()

void **setIsAxisInverted**(boolean *value*)
Whether the servos axis is inverted.

Game Scenes Flight

void **moveRight**()
Moves the servo to the right.

Game Scenes Flight

void **moveLeft**()
Moves the servo to the left.

Game Scenes Flight

void **moveCenter**()
Moves the servo to the center.

Game Scenes Flight

void **moveNextPreset**()
Moves the servo to the next preset.

Game Scenes Flight

void **movePrevPreset**()
Moves the servo to the previous preset.

Game Scenes Flight

void **moveTo**(float *position*, float *speed*)
Moves the servo to *position* and sets the speed multiplier to *speed*.

Parameters

- **position** (*float*) – The position to move the servo to.
- **speed** (*float*) – Speed multiplier for the movement.

Game Scenes Flight

void **stop**()
Stops the servo.

Game Scenes Flight

6.5.4 Example

The following example gets the control group named "MyGroup", prints out the names and positions of all of the servos in the group, then moves all of the servos to the right for 1 second.

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.services.InfernalRobotics;
import␣
↪krpc.client.services.InfernalRobotics.Servo;
import krpc.
↪client.services.InfernalRobotics.ServoGroup;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.Vessel;

import java.io.IOException;

public class InfernalRoboticsExample {
    public static␣
↪void main(String[] args) throws IOException,
↪ RPCException, InterruptedException {
        Connection connection = Connection.
↪newInstance("InfernalRobotics Example");
        Vessel vessel = SpaceCenter.
↪newInstance(connection).getActiveVessel();
        InfernalRobotics␣
↪ir = InfernalRobotics.newInstance(connection);

        ServoGroup group␣
↪= ir.servoGroupWithName(vessel, "MyGroup");
        if (group == null) {
            System.out.println("Group not found");
            return;
        }

        for (Servo servo : group.getServos()) {
            System.out.println(servo.
↪getName() + " " + servo.getPosition());
        }

        group.moveRight();
        Thread.sleep(1000);
        group.stop();
        connection.close();
    }
}
```

6.6 Kerbal Alarm Clock API

Provides RPCs to interact with the Kerbal Alarm Clock mod. Provides the following classes:

6.6.1 KerbalAlarmClock

public class **KerbalAlarmClock**
This service provides functionality to interact with Kerbal Alarm Clock.

boolean **getAvailable**()
Whether Kerbal Alarm Clock is available.

Game Scenes All

java.util.List<*Alarm*> **getAlarms**()
A list of all the alarms.

Game Scenes All

Alarm **alarmWithName**(String *name*)
Get the alarm with the given *name*, or `null` if no alarms have that name. If more than one alarm has the name, only returns one of them.

Parameters

- **name** (*String*) – Name of the alarm to search for.

Game Scenes All

java.util.List<*Alarm*> **alarmsWithType**(*AlarmType type*)
Get a list of alarms of the specified *type*.

Parameters

- **type** (AlarmType) – Type of alarm to return.

Game Scenes All

Alarm **createAlarm**(*AlarmType type*, String *name*, double *ut*)
Create a new alarm and return it.

Parameters

- **type** (AlarmType) – Type of the new alarm.
- **name** (*String*) – Name of the new alarm.
- **ut** (*double*) – Time at which the new alarm should trigger.

Game Scenes All

6.6.2 Alarm

public class **Alarm**
Represents an alarm. Obtained by calling *getAlarms()*, *alarmWithName(String)* or *alarmsWithType(AlarmType)*.

AlarmAction **getAction**()

void **setAction**(*AlarmAction value*)
The action that the alarm triggers.

Game Scenes All

double **getMargin**()

void **setMargin**(double *value*)
The number of seconds before the event that the alarm will fire.

Game Scenes All

double **getTime**()

void **setTime**(double *value*)
The time at which the alarm will fire.

Game Scenes All

AlarmType **getType**()
The type of the alarm.

Game Scenes All

String **getID**()
The unique identifier for the alarm.

Game Scenes All

String **getName**()

void **setName**(String *value*)
The short name of the alarm.

Game Scenes All

String **getNotes**()

void **setNotes**(String *value*)
The long description of the alarm.

Game Scenes All

double **getRemaining**()
The number of seconds until the alarm will fire.

Game Scenes All

boolean **getRepeat**()

void **setRepeat**(boolean *value*)
Whether the alarm will be repeated after it has fired.

Game Scenes All

double **getRepeatPeriod**()

void **setRepeatPeriod**(double *value*)
The time delay to automatically create an alarm after it has fired.

Game Scenes All

SpaceCenter.Vessel **getVessel**()

void **setVessel**(*SpaceCenter.Vessel value*)
The vessel that the alarm is attached to.

Game Scenes All

SpaceCenter.CelestialBody **getXferOriginBody**()

void **setXferOriginBody**(*SpaceCenter.CelestialBody value*)
The celestial body the vessel is departing from.

Game Scenes All

SpaceCenter.CelestialBody **getXferTargetBody**()

void **setXferTargetBody**(*SpaceCenter.CelestialBody value*)
The celestial body the vessel is arriving at.

Game Scenes All

void **remove**()
Removes the alarm.

Game Scenes All

6.6.3 AlarmType

public enum **AlarmType**
The type of an alarm.

public *AlarmType* **RAW**
An alarm for a specific date/time or a specific period in the future.

public *AlarmType* **MANEUVER**
An alarm based on the next maneuver node on the current ships flight path. This node will be stored and can be restored when you come back to the ship.

public *AlarmType* **MANEUVER_AUTO**
See `AlarmType.MANEUVER`.

public *AlarmType* **APOAPSIS**
An alarm for furthest part of the orbit from the planet.

public *AlarmType* **PERIAPSIS**
An alarm for nearest part of the orbit from the planet.

public *AlarmType* **ASCENDING_NODE**
Ascending node for the targeted object, or equatorial ascending node.

public *AlarmType* **DESCENDING_NODE**
Descending node for the targeted object, or equatorial descending node.

public *AlarmType* **CLOSEST**
An alarm based on the closest approach of this vessel to the targeted vessel, some number of orbits into the future.

public *AlarmType* **CONTRACT**
An alarm based on the expiry or deadline of contracts in career modes.

public *AlarmType* **CONTRACT_AUTO**
See *AlarmType.CONTRACT*.

public *AlarmType* **CREW**
An alarm that is attached to a crew member.

public *AlarmType* **DISTANCE**
An alarm that is triggered when a selected target comes within a chosen distance.

public *AlarmType* **EARTH_TIME**
An alarm based on the time in the "Earth" alternative Universe (aka the Real World).

public *AlarmType* **LAUNCH_RENDEVOUS**
An alarm that fires as your landed craft passes under the orbit of your target.

public *AlarmType* **SOI_CHANGE**
An alarm manually based on when the next SOI point is on the flight path or set to continually monitor the active flight path and add alarms as it detects SOI changes.

public *AlarmType* **SOI_CHANGE_AUTO**
See *AlarmType.SOI_CHANGE*.

public *AlarmType* **TRANSFER**
An alarm based on Interplanetary Transfer Phase Angles, i.e. when should I launch to planet X? Based on Kosmo Not's post and used in Olex's Calculator.

public *AlarmType* **TRANSFER_MODELLED**
See *AlarmType.TRANSFER*.

6.6.4 AlarmAction

public enum **AlarmAction**
The action performed by an alarm when it fires.

public *AlarmAction* **DO_NOTHING**
Don't do anything at all...

public *AlarmAction* **DO_NOTHING_DELETE_WHEN_PASSED**
Don't do anything, and delete the alarm.

public *AlarmAction* **KILL_WARP**
Drop out of time warp.

public *AlarmAction* **KILL_WARP_ONLY**
Drop out of time warp.

public *AlarmAction* **MESSAGE_ONLY**
Display a message.

public *AlarmAction* **PAUSE_GAME**
Pause the game.

6.6.5 Example

The following example creates a new alarm for the active vessel. The alarm is set to trigger after 10 seconds have passed, and display a message.

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.services.KerbalAlarmClock;
import␣
↪krpc.client.services.KerbalAlarmClock.Alarm;
import krpc.
↪client.services.KerbalAlarmClock.AlarmAction;
import␣
↪krpc.client.services.KerbalAlarmClock.AlarmType;
import krpc.client.services.SpaceCenter;

import java.io.IOException;

public class KerbalAlarmClockExample {
    public static void main(String[]␣
↪args) throws IOException, RPCException {
        Connection connection = Connection.
↪newInstance("Kerbal Alarm Clock Example");
        KerbalAlarmClock␣
↪kac = KerbalAlarmClock.newInstance(connection);
        Alarm alarm = kac.createAlarm(AlarmType.
↪RAW, "My New Alarm", SpaceCenter.
↪newInstance(connection).getUT() + 10);
        alarm.setNotes("10 seconds␣
↪have now passed since the alarm was created.");
        alarm.setAction(AlarmAction.MESSAGE_ONLY);
        connection.close();
    }
}
```

6.7 RemoteTech API

Provides RPCs to interact with the RemoteTech mod. Provides the following classes:

6.7.1 RemoteTech

public class **RemoteTech**
This service provides functionality to interact with RemoteTech.

boolean **getAvailable**()
Whether RemoteTech is installed.

Game Scenes All

java.util.List<String> **getGroundStations**()
The names of the ground stations.

Game Scenes All

Antenna **antenna**(*SpaceCenter.Part part*)
Get the antenna object for a particular part.

Parameters

- **part** (SpaceCenter.Part) –

Game Scenes All

Comms **comms**(*SpaceCenter.Vessel vessel*)
Get a communications object, representing the communication capability of a particular vessel.

Parameters

- **vessel** (SpaceCenter.Vessel) –

Game Scenes All

6.7.2 Comms

public class **Comms**
Communications for a vessel.

SpaceCenter.Vessel **getVessel**()
Get the vessel.

Game Scenes All

boolean **getHasLocalControl**()
Whether the vessel can be controlled locally.

Game Scenes All

boolean **getHasFlightComputer**()
Whether the vessel has a flight computer on board.

Game Scenes All

boolean **getHasConnection**()
Whether the vessel has any connection.

Game Scenes All

boolean **getHasConnectionToGroundStation**()
Whether the vessel has a connection to a ground station.

Game Scenes All

double **getSignalDelay**()
The shortest signal delay to the vessel, in seconds.

Game Scenes All

double **getSignalDelayToGroundStation**()
The signal delay between the vessel and the closest ground station, in seconds.

Game Scenes All

double **signalDelayToVessel**(*SpaceCenter.Vessel other*)
The signal delay between the this vessel and another vessel, in seconds.

Parameters

- **other** (SpaceCenter.Vessel) –

Game Scenes All

java.util.List<*Antenna*> **getAntennas** ()
The antennas for this vessel.

Game Scenes All

6.7.3 Antenna

public class **Antenna**
A RemoteTech antenna. Obtained by calling *Comms.getAntennas()* or *antenna(SpaceCenter.Part)*.

SpaceCenter.Part **getPart** ()
Get the part containing this antenna.

Game Scenes All

boolean **getHasConnection** ()
Whether the antenna has a connection.

Game Scenes All

Target **getTarget** ()

void **setTarget** (*Target value*)
The object that the antenna is targetting. This property can be used to set the target to *Target.NONE* or *Target.ACTIVE_VESSEL*. To set the target to a celestial body, ground station or vessel see *Antenna.getTargetBody()*, *Antenna.getTargetGroundStation()* and *Antenna.getTargetVessel()*.

Game Scenes All

SpaceCenter.CelestialBody **getTargetBody** ()

void **setTargetBody** (*SpaceCenter.CelestialBody value*)
The celestial body the antenna is targetting.

Game Scenes All

String **getTargetGroundStation** ()

void **setTargetGroundStation** (String *value*)
The ground station the antenna is targetting.

Game Scenes All

SpaceCenter.Vessel **getTargetVessel** ()

void **setTargetVessel** (*SpaceCenter.Vessel value*)
The vessel the antenna is targetting.

Game Scenes All

public enum **Target**
The type of object an antenna is targetting. See *Antenna.getTarget()*.

public *Target* **ACTIVE_VESSEL**
The active vessel.

public *Target* **CELESTIAL_BODY**
A celestial body.

public *Target* **GROUND_STATION**
A ground station.

public *Target* **VESSEL**
A specific vessel.

public *Target* **NONE**
No target.

6.7.4 Example

The following example sets the target of a dish on the active vessel then prints out the signal delay to the active vessel.

```
import krpc.client.Connection;
import krpc.client.RPCException;
import krpc.client.services.RemoteTech;
import krpc.client.services.RemoteTech.Antenna;
import krpc.client.services.RemoteTech.Comms;
import krpc.client.services.SpaceCenter;
import krpc.client.services.SpaceCenter.Part;
import krpc.client.services.SpaceCenter.Vessel;

import java.io.IOException;

public class RemoteTechExample {
    public static void main(String[]␣
↪args) throws IOException, RPCException {
        Connection connection␣
↪= Connection.newInstance("RemoteTech Example");
        SpaceCenter␣
↪sc = SpaceCenter.newInstance(connection);
        RemoteTech␣
↪rt = RemoteTech.newInstance(connection);
        Vessel vessel = sc.getActiveVessel();

        // Set a dish target
        Part part = vessel.
↪getParts().withTitle("Reflectron KR-7").get(0);
        Antenna antenna = rt.antenna(part);
        antenna.
↪setTargetBody(sc.getBodies().get("Jool"));


↪    // Get info about the vessels communications
        Comms comms = rt.comms(vessel);
        System.out.printf("Signal delay␣
↪= %.1f seconds\n", comms.getSignalDelay());
```

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```
        connection.close();
    }
}
```

6.8 User Interface API

6.8.1 UI

public class **UI**

Provides functionality for drawing and interacting with in-game user interface elements.

Canvas **getStockCanvas**()

The stock UI canvas.

Game Scenes All

Canvas **addCanvas**()

Add a new canvas.

Game Scenes All

Note: If you want to add UI elements to KSPs stock UI canvas, use *getStockCanvas()*.

---

void **message**(String *content*, float *duration*, *MessagePosition position*, org.javatuples.Triplet<Double, Double, Double> *color*, float *size*)

Display a message on the screen.

Parameters

- **content** (*String*) – Message content.
- **duration** (*float*) – Duration before the message disappears, in seconds.
- **position** (MessagePosition) – Position to display the message.
- **color** (*org.javatuples.Triplet<Double,Double,Double>*) – The color of the message.
- **size** (*float*) – Size of the message, differs per position.

Game Scenes All

Note: The message appears just like a stock message, for example quicksave or quickload messages.

---

void **clear**(boolean *clientOnly*)

Remove all user interface elements.

Parameters

- **clientOnly** (*boolean*) – If true, only remove objects created by the calling client.

Game Scenes All

public enum **MessagePosition**
Message position.

public *MessagePosition* **TOP_LEFT**
Top left.

public *MessagePosition* **TOP_CENTER**
Top center.

public *MessagePosition* **TOP_RIGHT**
Top right.

public *MessagePosition* **BOTTOM_CENTER**
Bottom center.

6.8.2 Canvas

public class **Canvas**
A canvas for user interface elements. See *getStockCanvas()* and *addCanvas()*.

RectTransform **getRectTransform**()
The rect transform for the canvas.

Game Scenes All

boolean **getVisible**()

void **setVisible**(boolean *value*)
Whether the UI object is visible.

Game Scenes All

Panel **addPanel**(boolean *visible*)
Create a new container for user interface elements.

Parameters

- **visible** (*boolean*) – Whether the panel is visible.

Game Scenes All

Text **addText**(String *content*, boolean *visible*)
Add text to the canvas.

Parameters

- **content** (*String*) – The text.
- **visible** (*boolean*) – Whether the text is visible.

Game Scenes All

InputField **addInputField**(boolean *visible*)
Add an input field to the canvas.

Parameters

- **visible** (*boolean*) – Whether the input field is visible.

Game Scenes All

Button **addButton**(String *content*, boolean *visible*)
Add a button to the canvas.

Parameters

- **content** (*String*) – The label for the button.
- **visible** (*boolean*) – Whether the button is visible.

Game Scenes All

void **remove**()
Remove the UI object.

Game Scenes All

6.8.3 Panel

public class **Panel**
A container for user interface elements. See *Canvas.addPanel(boolean)*.

RectTransform **getRectTransform**()
The rect transform for the panel.

Game Scenes All

boolean **getVisible**()

void **setVisible**(boolean *value*)
Whether the UI object is visible.

Game Scenes All

Panel **addPanel**(boolean *visible*)
Create a panel within this panel.

Parameters

- **visible** (*boolean*) – Whether the new panel is visible.

Game Scenes All

Text **addText**(String *content*, boolean *visible*)
Add text to the panel.

Parameters

- **content** (*String*) – The text.
- **visible** (*boolean*) – Whether the text is visible.

Game Scenes All

InputField **addInputField**(boolean *visible*)
Add an input field to the panel.

Parameters

- **visible** (*boolean*) – Whether the input field is visible.

Game Scenes All

Button **addButton**(String *content*, boolean *visible*)
Add a button to the panel.

Parameters

- **content** (*String*) – The label for the button.
- **visible** (*boolean*) – Whether the button is visible.

Game Scenes All

void **remove**()
Remove the UI object.

Game Scenes All

6.8.4 Text

public class **Text**
A text label. See *Panel.addText(String, boolean)*.

RectTransform **getRectTransform**()
The rect transform for the text.

Game Scenes All

boolean **getVisible**()

void **setVisible**(boolean *value*)
Whether the UI object is visible.

Game Scenes All

String **getContent**()

void **setContent**(String *value*)
The text string

Game Scenes All

String **getFont**()

void **setFont**(String *value*)
Name of the font

Game Scenes All

java.util.List<String> **getAvailableFonts**()
A list of all available fonts.

Game Scenes All

int **getSize**()

void **setSize**(int *value*)
Font size.

Game Scenes All

FontStyle **getStyle**()

void **setStyle**(*FontStyle value*)
Font style.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **getColor**()

void **setColor**(org.javatuples.Triplet<Double, Double, Double> *value*)
Set the color

Game Scenes All

TextAnchor **getAlignment**()

void **setAlignment**(*TextAnchor value*)
Alignment.

Game Scenes All

float **getLineSpacing**()

void **setLineSpacing**(float *value*)
Line spacing.

Game Scenes All

void **remove**()
Remove the UI object.

Game Scenes All

public enum **FontStyle**
Font style.

public *FontStyle* **NORMAL**
Normal.

public *FontStyle* **BOLD**
Bold.

public *FontStyle* **ITALIC**
Italic.

public *FontStyle* **BOLD_AND_ITALIC**
Bold and italic.

public enum **TextAlignment**
Text alignment.

public *TextAlignment* **LEFT**
Left aligned.

public *TextAlignment* **RIGHT**
Right aligned.

public *TextAlignment* **CENTER**
Center aligned.

public enum **TextAnchor**
Text alignment.

public *TextAnchor* **LOWER_CENTER**
Lower center.

public *TextAnchor* **LOWER_LEFT**
Lower left.

public *TextAnchor* **LOWER_RIGHT**
Lower right.

public *TextAnchor* **MIDDLE_CENTER**
Middle center.

public *TextAnchor* **MIDDLE_LEFT**
Middle left.

public *TextAnchor* **MIDDLE_RIGHT**
Middle right.

public *TextAnchor* **UPPER_CENTER**
Upper center.

public *TextAnchor* **UPPER_LEFT**
Upper left.

public *TextAnchor* **UPPER_RIGHT**
Upper right.

6.8.5 Button

public class **Button**
A text label. See *Panel.addButton(String, boolean)*.

RectTransform **getRectTransform**()
The rect transform for the text.

Game Scenes All

boolean **getVisible**()

void **setVisible**(boolean *value*)
Whether the UI object is visible.

Game Scenes All

Text **getText**()
The text for the button.

Game Scenes All

boolean **getClicked**()

void **setClicked**(boolean *value*)
Whether the button has been clicked.

Game Scenes All

Note: This property is set to true when the user clicks the button. A client script should reset the property to false in order to detect subsequent button presses.

---

void **remove**()
Remove the UI object.

Game Scenes All

6.8.6 InputField

public class **InputField**
An input field. See *Panel.addInputField(boolean)*.

RectTransform **getRectTransform**()
The rect transform for the input field.

Game Scenes All

boolean **getVisible**()

void **setVisible**(boolean *value*)
Whether the UI object is visible.

Game Scenes All

String **getValue**()

void **setValue**(String *value*)
The value of the input field.

Game Scenes All

Text **getText**()
The text component of the input field.

Game Scenes All

Note: Use *InputField.getValue()* to get and set the value in the field. This object can be used to alter the style of the input field's text.

---

boolean **getChanged**()

void **setChanged**(boolean *value*)
Whether the input field has been changed.

Game Scenes All

Note: This property is set to true when the user modifies the value of the input field. A client script should reset the property to false in order to detect subsequent changes.

---

void **remove**()
Remove the UI object.

Game Scenes All

6.8.7 Rect Transform

public class **RectTransform**
A Unity engine Rect Transform for a UI object. See the Unity manual for more details.

org.javatuples.Pair<Double, Double> **getPosition**()

void **setPosition**(org.javatuples.Pair<Double, Double> *value*)
Position of the rectangles pivot point relative to the anchors.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **getLocalPosition**()

void **setLocalPosition**(org.javatuples.Triplet<Double, Double, Double> *value*)
Position of the rectangles pivot point relative to the anchors.

Game Scenes All

org.javatuples.Pair<Double, Double> **getSize**()

void **setSize**(org.javatuples.Pair<Double, Double> *value*)
Width and height of the rectangle.

Game Scenes All

org.javatuples.Pair<Double, Double> **getUpperRight**()

void **setUpperRight**(org.javatuples.Pair<Double, Double> *value*)
Position of the rectangles upper right corner relative to the anchors.

Game Scenes All

org.javatuples.Pair<Double, Double> **getLowerLeft**()

void **setLowerLeft**(org.javatuples.Pair<Double, Double> *value*)
Position of the rectangles lower left corner relative to the anchors.

Game Scenes All

void **setAnchor**(org.javatuples.Pair<Double, Double> *value*)
Set the minimum and maximum anchor points as a fraction of the size of the parent rectangle.

Game Scenes All

org.javatuples.Pair<Double, Double> **getAnchorMax**()

void **setAnchorMax**(org.javatuples.Pair<Double, Double> *value*)
The anchor point for the lower left corner of the rectangle defined as a fraction of the size of the parent rectangle.

Game Scenes All

org.javatuples.Pair<Double, Double> **getAnchorMin**()

void **setAnchorMin**(org.javatuples.Pair<Double, Double> *value*)
The anchor point for the upper right corner of the rectangle defined as a fraction of the size of the parent rectangle.

Game Scenes All

org.javatuples.Pair<Double, Double> **getPivot**()

void **setPivot**(org.javatuples.Pair<Double, Double> *value*)
Location of the pivot point around which the rectangle rotates, defined as a fraction of the size of the rectangle itself.

Game Scenes All

org.javatuples.Quartet<Double, Double, Double, Double> **getRotation**()

void **setRotation**(org.javatuples.Quartet<Double, Double, Double, Double> *value*)
Rotation, as a quaternion, of the object around its pivot point.

Game Scenes All

org.javatuples.Triplet<Double, Double, Double> **getScale**()

void **setScale**(org.javatuples.Triplet<Double, Double, Double> *value*)
Scale factor applied to the object in the x, y and z dimensions.

Game Scenes All