



Discover Space UK Limited

Machrihanish Airbase Launch Site Motor & Black Powder Risk Assessment

Document Number	DSUK_RA_005
Issue Date	20/01/2023
Status	V0.1



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CHANGE LOG

Number	Changes	Author	Date
V 0.1	Document created for Mach-23	Sara Lai	20/01/2022

Site Licence

This document is written with intent to mitigate risk and show competence when storing and handling both rocket motors and black powder. The mass of explosives being kept on site at Machrihanish Airbase requires a licence to store the explosives under the Explosive Regulations 2014. This licence allows up to 25kg of the applicable dangerous items (categorised by UN numbers) to be stored at site. For the rocket motor storage UN numbers 0186, 0272, 0349, 0351 and, 0471 are applicable dependent on the type of rocket motor, and for the black powder storage 0027 and 0028 are applicable.

The explosives stored on site are black powder and rocket motors (composite propellants made of ammonium perchlorate, aluminium powder, and a rubbery binder substance contained in a hard plastic case). The black powder is generally made from a mixture of charcoal, sulphur, and potassium nitrate. It is described as a low-explosive and can generally be ignited by sparks, heat, or friction. It burns violently when loose and may explode when confined. The rocket motors are generally ignited by an electric spark making contact with the ignition pellet. This will cause the motor to burn through and also trigger the delay grain, a timed burn pellet which will then ignite the ejection charge, a small measure of black powder.

To obtain the licence to store this quantity of explosives certain requirements must be met. This includes storing the explosives in a safe and secure location. The storage and handling of the rocket motors and black powder is on an active airfield and ex-military site with an accompanying business park located at Machrihanish on the west coast of Scotland, see the figures below. The storehouse for the explosive items is securely locked, alarmed, and has a camera monitoring the building. The building has a secure door, no electrical connections within the building and water does not get into the building. The explosive items are kept with a locked non-ferrous storage box that is securely fitted to the building structure. Each item is separated into its categorised UN number, more below, within the storage box and the box is designed to specifications set by the regulator.

When handling the explosives in preparation for the launch a sufficient level of competence is expected, avoiding obvious hazards, and applying common sense to handling the substances. Further detail below on handling the black powder. The explosive items will only be handled by DSUK staff. The location of the launch within the airbase will occur near Building 175 on a concreted area, far from other buildings and uninvolved people.

*Red circle  denotes Explosive store





Additional Information

Handling of Motors and Black Powder

Two certified Range Safety Officers (RSOs) will be on-site throughout the Mach-23 event. The RSOs will conduct the launches during the event, student teams must provide them with all launch information beforehand.

Handling of the motors and any black powder for ejection charges will be conducted either by the RSOs. Under no circumstances will students handle motors or black powder without supervision from the RSO's or DSUK team. Once ordered, motors can be sent direct to the site to be stored in the explosives housing mentioned above, using the following address:

Discover Space UK
Mach-23 Launch Competition
79 MACC Business Park
Campbeltown
PA28 6NU

Please note that the DSUK team need to be made aware of any incoming motors, by forwarding procurement confirmations and shipping updates to sara.lai@exotopic.com.

Risk Assessment

This risk assessment has been carried out in order to ensure the safe storage and handling of rocket motors and black powder at Machrihanish Airbase. The purpose of the risk assessment is to mitigate the risks that are a result of the storage and handling of the rocket motors and black powder. As such, the risk assessment will identify the key hazards, understand their consequences, provide a risk score, define the control measures in place to mitigate the risk, followed by an updated risk score with the controls in place.

Hazard	Consequence	Unmitigated Risk Probability	Unmitigated Risk Severity	Risk Score	Control Measures	Mitigated Risk Probability	Mitigated Risk Severity	Adjusted Risk Score
Motor Storage & Handling								
Inadvertent Ignition	Explosion, Fire/Chain reaction, Injuries: burn, impact	2	4	8	<ul style="list-style-type: none"> Store the motor in a safe and secure location within a secure box Ensure no sources of ignition are nearby Ensure motor is only handled by DSUK staff or, alternatively, by the RSOs Ensure firing system is disabled when setting up on launch pad If fire reaches explosives do not attempt to put out 	1	3	3
Motor Failure	Injuries: burn, impact, Explosion	2	4	8	<ul style="list-style-type: none"> Ensure safe distances are followed where appropriate Ensure firing system is disabled when setting up on launch pad 	1	3	3
After Use	Burns, Chemical waste	2	3	6	<ul style="list-style-type: none"> Ensure motor has time to cool (minimum 1 minute) Dispose of safely by soaking in water prior to putting in waste 	1	2	2

Black Powder Storage & Handling								
Inadvertent Ignition	Injuries: burns, impact Fire/Chain Reaction, Explosion	2	4	8	<ul style="list-style-type: none"> • Store the BP in a safe and secure location within a secure box • Ensure no sources of ignition are nearby (flame, spark, friction sources) • Ensure BP is only handled by DSUK staff or, alternatively, by RSOs • If fire reaches explosives do not attempt to put out 	1	4	4
Handling	Burn, Irritation	2	3	6	<ul style="list-style-type: none"> • Avoid prolonged contact • Avoid touching eyes when handling BP • Avoid sources of ignition • Store in safe containers (non-ferrous) 	1	3	3

Key:

Very low	1-5
Low	6-10
Medium	11-15
High	16-20
Very High	21-25