SCP FOUNDATION

SECURE. CONTAIN. PROTECT.

SCRAMBLE GOGGLES MK2

PROJECT STATUS: ACTIVE
EQUIPMENT TYPE: Cognitohazard Mitigation (Optical)
CLEARANCE: LEVEL 3 - Secret /// NOGOV
CUSTODIAN: MTF Eta-10 ("See No Evil")
STORAGE: Site-19, Secure Vault 12
PROJECT LEAD: Dr. Dan / Dr. Oleksei

FILE OPENED:	14 SEP 1984
LAST REVISION:	06 JUL 2026
REVISION AUTH:	MTF Eta-10 Cmd. (SCRAMBLE)
DOC ID:	SCRAMBLE / 19.0096.00472
DISPOSAL:	Contact Site-19 Records on file closure

This page intentionally left blank

Table of Contents

1. Background

The SCRAMBLE project was initially designed for the recontainment of SCP-096. Due to SCP-096's anomalous properties, it was determined that recontainment could be expedited if the MTF agents involved were able to safely move around SCP-096. The SCRAMBLE goggles are headmounted goggles, which use an advanced image recognition model to expunge any instances of SCP-096 from the user's vision prior to the image reaching their eyes. Due to Incident 096-1-A the O5 council motioned a request for a redesign of the SCRAMBLE goggles. This document reviews the design and implementation of the SCRAMBLE MK2 goggles. The MK2 goggles use new mitigations and strategies to prevent future recontainment difficulties of SCP-096, and act as a platform for future cognitohazard containment methods. Despite the 096-1-A Incident, the SCRAMBLE goggles have been considered a tentative success, as they proved that theoretically, the dangers of cognitohazards can be mitigated by technology.

2. Requirements

The initial SCRAMBLE goggle request for design document had, among others, the following requirements (paraphrased):

- Prevent any possible light leakage from the user's eyes to the outside world
- All video presented to the user must be routed directly through the goggles
- The SCRAMBLE goggles should make use of an internal AI image recognition model to expunge SCP-096's face.
- Broadcasting scrambled realtime encrypted video feeds to nearby foundation sites for analysis.

The O5 council request for redesign highlighted several new project requirements:

- Increased processing power
- Enhanced peripheral vision and detection
- Removal of broadcasting capabilities, due to concerns over future cascading cognitohazard containment breaches (See: Incident 096-A-[redacted]).
- A dual AI system, where two image recognition models are ran and their results merged, to decrease likelihood of leakage.
- Custom molded face gaskets, to further prevent light leakage.
- Totally digital approach, camera feeds are always processed.
- Subframe processing and normalization: Detection results are aggregated and interpolated across subframes, to reduce chances of single frame leakages.
- Helmet mounted, powered by a high-capacity battery unit in MTF agents pack.

3. Architecture & Design

The SCRAMBLE MK2 goggles shift from using a single microprocessor to using a dedicated compute pack mounted to the back of the helmet. A diagram is shown in Figure 1, which demonstrates the path that data flows. The compute pack (mounted on the back of a standard tactical helmet) connects to the distribution block (mounted on the SCRAMBLE MK2 goggles) via dual USB-C Thunderbolt 5 cables. The data flow can be seen in in Figure 1. The full travel route of a single frame can be described by: Camera Module → Distribution Block → Bridge Processor ⇒ Computer Blocks ⇒ Bridge Processor → Distribution Board → Display. More info in Section 3.2.

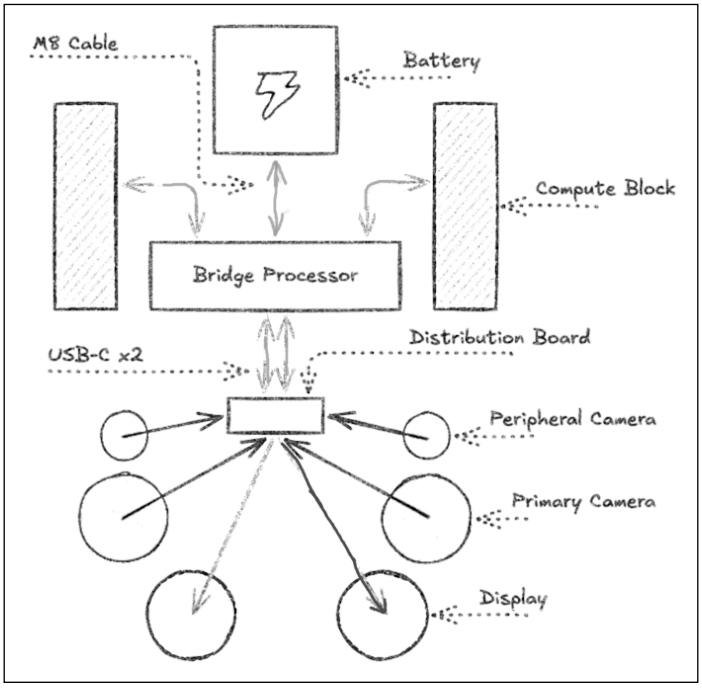

Figure 1: Diagram of data flow

3.1. SCRAMBLE Goggles MK2

The SCRAMBLE Goggles MK2 are built off on a AN/PVS-31A BNVD shell due to their reliability and MTF familiarity. The goggles operate fully digitally, and contain two cameras per tube. Each tube has a primary camera and a periphery camera, the primary camera feed being what's shown to the user (after being scrambled), and the periphery camera allowing for early warning and awareness when SCP-096 is outside of view of the user. The goggles contain a center mounted wide beam flashlight, while built on an Night Vision Goggle (NVG) platform, THE SYSTEM IS NOT NIGHTVISION. Due to dataset scarcity the decision was made to use existing image recognition datasets, and collected SCP-096 media to train the onboard AI models instead.

3.1.1. Cameras

The primary camera in each tube runs by default at 1080p/200fps. This decision was made primarily for subframe processing reasons, presenting the user with a fairly high resolution image, at a split 100fps, see: Section 3.3.1 for why. The primary cameras have a real Field Of View (FOV) of 140°, however due to the tube shape and required camera shielding, the real FOV per eye is 60°. This is considered a feature, as it allows the user to intentionally avoid accidental eye contact with SCP-096 and other cognitohazards from the corner of their eye, should the SCRAMBLE system momentarily fail. It's always worth stating that when handling cognitohazards, there are no solutions, only mitigations.

The SCRAMBLE MK2 system also has a peripheral camera for each tube. These are mounted on the outer shell of the tubes. These cameras have a lower data throughput, 720p at 120fps and are specifically placed to enhance situational awareness. They have a field of view of 180°, and allow for momentary advanced warning to the wearer when the cognitohazard is detected. The detection is communicated to the user via a warning arrow drawn on the inner display, pointing in the direction of the hazard.

3.1.2. Distribution Block

The distribution block acts as the on headset board that routes the incoming and outgoing video feeds between the tubes displays and cameras, and the main compute pack (Section 3.2). The distribution performs no compression, simply reading in camera feeds and finalized render frames, and passes them to the bridge processor, or the tube displays respectively. The distribution block connects to the compute pack via dual USB-C Thunderbolt 5 connectors, in regular operation the signals required for each eye go along their corresponding sides USB-C. In cases of disconnection or damage to the thunderbolt connectors, the distribution board can reroute all camera feeds through one USB-C line, however there are concerns of reduced framerate or resolution, as this approaches the limits of Thunderbolt 5 connections. Power to the displays and cameras are routed through these Thunderbolt 5 connections. The displays and cameras run through the inside of the mount, running through the hinge joint, and connect to the distribution board via a ribbon cable. The distribution block PCB has been treated with a water resistant coating.

3.2. Compute Pack

The compute pack makes use of dual Jetson Orin NX 16GB connected to a custom PCB board with a separate microprocessor. The compute pack has dual USB-C Thunderbolt 5 ports in its north position. These allow for two way communication between the compute pack and the distribution pack at rates of 80Gbps each. This results in a two way maximum throughput between the goggles and the compute pack 160Gbps. The compute pack is mounted on the back of the helmet and makes use of active cooling via two fans, see: Figure 9 The compute pack makes use of a large internal copper heatsink, designed to act as a large thermal mass. The compute pack may get hot when in use, the SCRAMBLE MK2 compute pack heatsinks or fans should not be touched. The compute pack PCB has been treated with a water resistant coating. The use of any non Thunderbolt 5 cables will result in an error that can be overriden.

3.2.1. Compute Modules

The computer modules used, as stated before, are Jetson Orin NX 16GBs. Each runs a slightly different AI model, with the goal being to decrease chances of edge cases in datasets or training resulting in momentary loss of SCRAMBLE functionality. The two compute modules send their data to the bridge processor, mounted on the PCB. The function of the bridge processor is to unify the two streams of detections, merge them into one, and composite the scramble graphics prior to the video feed being returned to the cameras.

3.2.2. Bridge Processor

The bridge processor is a specially designed FPGA that routes video data between the distribution board and the compute modules. It manages compositing of the finalized frames, receiving regions to scramble, and performing the scramble before pushing the frame to the distribution box. In cases where there are disagreements between the two onboard AIs the bridge processor always chooses the safest option, opting to cover more vision than may be necessary. This is done to mitigate the chances of slivers of cognitohazards being visible, but not fully covered. This situation is commonly referred to as binocular rivalry, where the two eyes disagree. As said before, in all cases, the safest option of SCRAMBLING all detected regions will be performed. This occurs even in cases where the hazard may not even be technically detectable through one of the eyes, due to the distance between them, i.e. around corners.

3.3. Software

The Software Cognitohazard Mitigation (SCM) stack is the software portion of the SCRAMBLE MK2 project. It is a series of programs and libraries designed to act as a framework for future cognitohazard mitigation strategies and devices. It runs on x64 Linux, and is lightweight, not containing a desktop environment, and is designed to run totally within RAM. The SCM Operating System (SCM-OS) portion of the SCM is built on an Linux installation, meaning system files cannot be changed at runtime. The SCM-OS does keep track of logs, and work is currently in development to allow for recording camera feeds to enhance future training, for both AI and MTF. The SCM-OS runs on both compute modules.

The SCM software module for SCRAMBLE MK2 is designated SCM-M-SCRAMBLE, it is paired with kernel module designed for inputting massive amounts of realtime video feeds. The data is passed to the AI processing module, SCM-M-DETECT, which uses trained AI models to detect the cognitohazards its trained to detect, and outputs regions of the frame that contain that hazard.

3.3.1. Subframe Processing

The largest innovation from the prior version of SCRAMBLE is the subframe processing. This is only possible with the enhanced hardware, and allows the computer to retain multiple prior frames and prevent flickering of SCRAMBLE detection regions, which caused Incident SCP-096-1-A. This is done by limiting the user framerate to 100fps, treating each subframe (every other frame), as a detection debouncing frame. Detections done in prior frames, or in subframes, can be interpolated, generating safe regions that can be scrambled, even if detection drops out for a few frames. This is done via a three frame delay, where the frame the camera is currently on is three frames ahead of the one actually being displayed. In testing this proved to be an added latency time of about 15ms, which is considered acceptable. The system compares the currently processed frame, and if it finds that its current frame has a significant disagreement with the incoming frames, the following frames will be scrambled, based on the current location of the detection. In cases where the detection resumes in one or two frames (referred to as a frame bounce), the detection can be applied to the in between frames, and the scrambles can be interpolated between the two. In cases of extremely fast motion this may appear as a black smear appearing for the smallest fraction of a second, this was determined to be highly effective in preventing single or double frame detection leaks.

4. Deployment Guidelines

The SCM stack is the Foundation’s attempt to modernize cognitohazard handling, containment, and recontainment. The SCM stack is being tested across several contained hazards, more advanced operational guidelines and more info can be found in DOC#19.0096.00440. The SCRAMBLE MK2 is the first hardware application of the new SCM system being distributed to MTF and scientists. In cases where failures or issues occur, follow the issue reporting guidelines in DOC#19.0096.00413.

4.1. Face Gaskets

The SCRAMBLE MK2 must be paired with a specially formed face gasket, this is not considered optional, except in the most extreme of scenarios. It is recommended that EVERY MTF agent in the following branches have face gaskets specially made and kept in retention:

- MTF Tau-1 (“Big Brother”)
- MTF Eta-10 (“See No Evil”)
- MTF Epsilon-11 (“Nine-Tailed Fox”)

We are awaiting an O5 mandate regarding this, but we will see fit to restrict access to SCRAMBLE MK2 in any way we can if it is found that gaskets are not being properly fitted. SCRAMBLE MK2 will *not* be considered a failure because of misuse.

4.2. Compute Pack

The compute pack is connected with an M8 power connector to the battery unit, the system is not designed to be hotswapped, and will shut off if the power cable is disconnected, however it will not damage the SCRAMBLE MK2 unit in any way. The battery unit will be placed in the agents backpack / pack. Ensure the connection is screwed on tightly prior to deployment. MTF branches should have their own protocols for battery changes.

4.3. Battery Management

Care should be taken to ensure that the battery pack is kept charged, each SCRAMBLE MK2 unit will be paired with two battery packs, 40,000mAh each. Any MTF agent using a SCRAMBLE MK2 should always have two battery packs with them at all times, one charged, and one backup. The entire SCRAMBLE MK2 system will run comfortably for four to five hours on one standard battery unit. These battery units are rated for 300 cycles, where their battery life may reach only four hours. Site maintenance should be contacted regarding acquiring new battery packs, this should be done every 300 cycles. The system will not function if power is not provided, there is no optical passthrough, power management is considered mission critical.

4.4. Environmental Considerations

The SCRAMBLE MK2 **IS NOT WATERPROOF**, it is *water resistant*. In cases of heavy rain, it is highly recommended that MTF agents use ponchos that cover the compute pack and the front of the headset. Waterproofing is a consderation for MK3. In cold environments the main heatsink may accumulate water droplets due to condensation, this is accounted for with the coatings present.

4.5. Fan Health

If the SCRAMBLE MK2 unit is turned on and active, the fan should be spinning. If the fan is spinning slowly this is considered acceptable, during prolonged use it should spin quickly. If the fan is not spinning in use it needs to be serviced, contact site maintenance for information on replacing your unit.

4.6. Part Replacement / Repairs

Users may be able to perform basic maintenance, such as fan replacement or distribution board swapping, however proper documentation must be done. In cases of unexpected behavior or failures, contact site maintenance and they will replace your unit so it can be repaired without compromising MTF capabilities.

4.7. Tactical Deployment

4.7.1. Shooting Considerations

Shooting with the SCRAMBLE MK2 goggles is similar to shooting under standard night vision, however it happens under the visible light spectrum. Guns used by MTF expected to use SCRAMBLE MK2 should be equipped with visible light lasers to allow for point shooting, as well as wide frame optics. Using the SCRAMBLE MK2 through a zoom scope is generally considered to be too difficult to be worth doing. SCRAMBLE MK2 for SCP-096 and any future cognitohazards is trained with data that includes reticles partially obscuring cognitohazards, obscuring a hazard via a reticle has not proven to prevent detection and scrambling by SCRAMBLE MK2. SCRAMBLE MK2 may make accurate shooting difficult or impossible, an agent's laser or reticle will necessarily be covered up by the scramble graphics. Work is currently in progress to overlay reticle / laser on top of the scramble graphics see: DOC#19.0096.00495.

4.7.2. Target Determination

In some cases, SCRAMBLE MK2 may scramble reflections or things that look similar to the target. This is considered ideal behavior, however MTF users should be aware that just because their teammate's face or arm has been scrambled, they should not necessarily be considered a target. For cases like SCP-096, identification can be confirmed via noise, in conjunction with context clues or partial views not considered cognitohazards in themselves. The risk of friendly fire remains high with the SCRAMBLE MK2 system. In test cases it was found that when a cognitohazard was partially obscured by an individual, the individual could sometimes also be scrambled, presenting a single scrambled mass to the operative. Use of callouts and other methods of communication is considered required, except in extreme scenarios.

5. SCRAMBLE MK2 Images

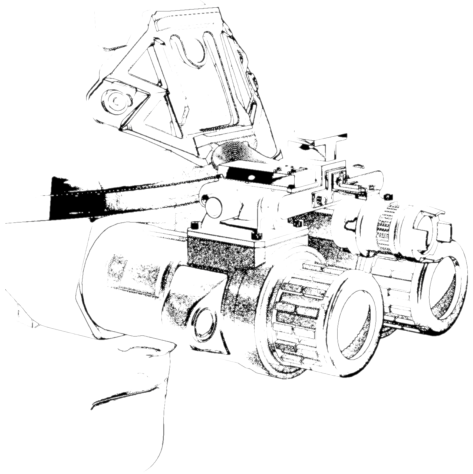

Figure 2: Exterior - frontal view.

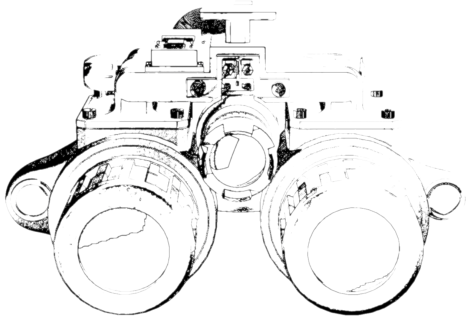

Figure 3: Exterior - frontal view.

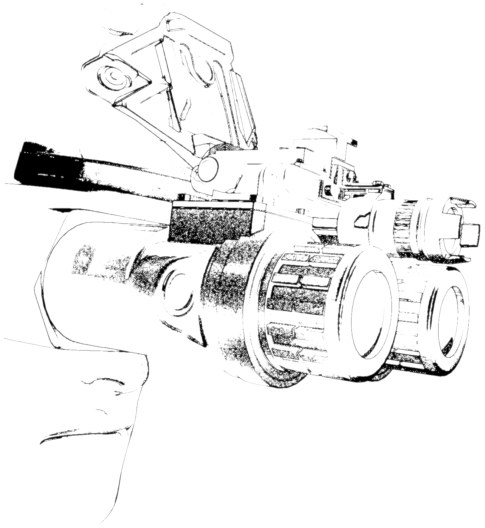

Figure 4: Exterior - lateral view.

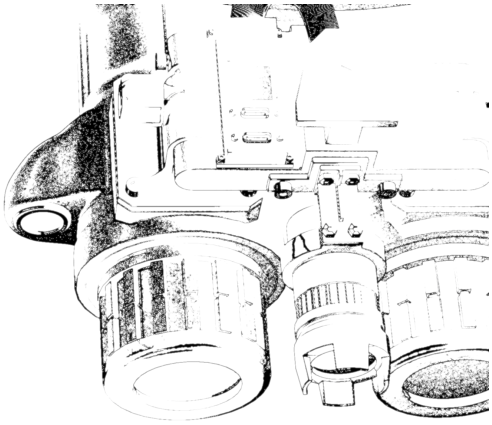

Figure 5: Exterior - dorsal aspect.

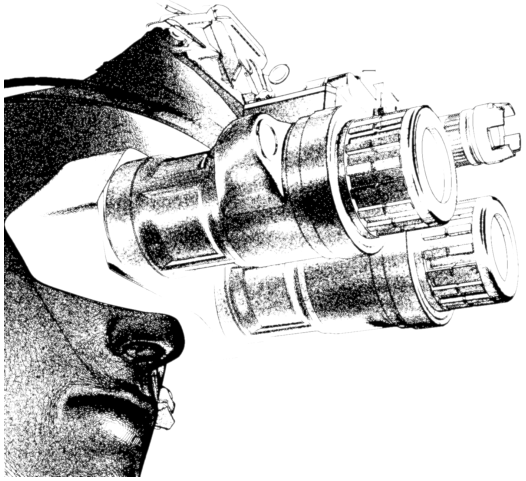

Figure 6: Exterior - ventral aspect.

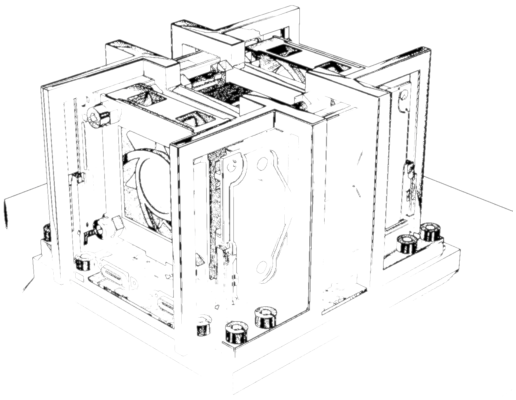

Figure 7: Compute module - oblique view.

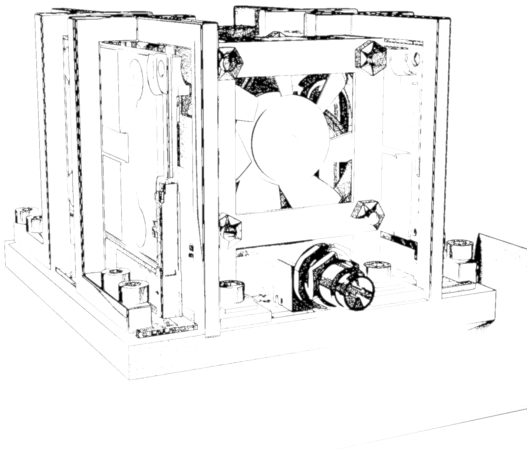

Figure 8: Compute module - power input.

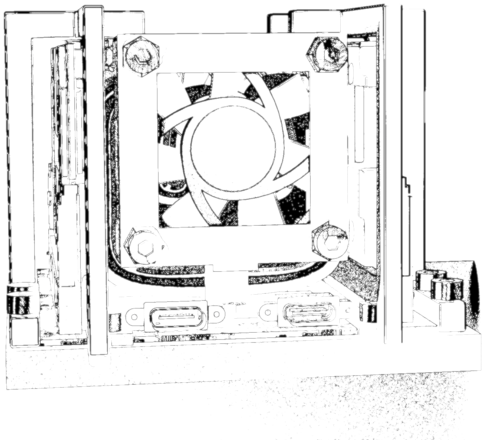

Figure 9: Compute module - USB-C ports.

6. Future Work

Work is currently be done on adapting the SCM and SCRAMBLE MK2 systems for the following cognitohazards:

- SCP-012
- SCP-1074
- [redacted]
- SCP-3007
- [redacted]
- SCP-023

The SCRAMBLE program has been renewed for further development. The foundation is excited about the future of the SCRAMBLE program and the mitigation of cognitohazards.