This tutorial goes through the safety practices required by the MATE ROV Competition. It covers:

- Initial Safety Inspection (if required)
- Onsite Safety Inspection
- Examples and photographs of what will and will not pass safety inspection
SCOUT & NAVIGATOR Class Safety Inspection Sheet Tutorial

DOCUMENTATION REQUIRED

DOC-001: Companies must provide a system interconnection diagram (SID) of their vehicle control system. An SID is an electrical diagram of their wiring, including their control box, motors, and any other electrical systems on their vehicle. The SID should separate and show what systems are on the surface and what systems are on the vehicle.

The SID is the starting point for Scout & Navigator Safety.

Companies should be aware of safety and everyone is required to submit a SID, if not early by the regional, it must be present for the on-site safety inspection.

DOC-002: Any electrical diagram should use ANSI, NEMA, or IEC symbols. They should be neatly hand drawn or created using a CAD software program.

DOC-003: Companies using fluid power must submit a fluid interconnection diagram (Fluid SID) of their system. Companies using syringe hydraulics only need a simple diagram, and could include it on their electrical SID. NAVIGATOR companies using powered pumps or compressors MUST include a full fluid SID.
**Initial Safety Review**

**Simple Check Points**
- Turned in on time?
- Documentation correct format and size?
- SID neatly done and includes industry standard fuse symbol?
- Any Fluid Power?
- Any issues seen will be listed.

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*The Initial Safety Inspection and Documentation Review score sheets will only be used if your regional requires prior submission of documents. Check your regional website’s Competition Information document or contact your regional coordinator to determine whether documentation must be submitted prior to competition day.*
Onsite Safety Inspection

Safety is the competition’s primary concern and guiding principle. Any system that is considered unsafe by competition officials will not be allowed to compete.

If a concern is found during the first safety inspection, companies are permitted to attempt to correct it and have their ROV re-inspected. However, the competition schedule will NOT change to allow companies more time.

Companies are allowed to have their vehicle re-inspected twice. If a company fails to pass its third and final safety inspection, it is disqualified from the underwater competition portion of the event. There are NO APPEALS once your ROV has been disqualified.
Onsite Safety Inspection

Examples of safety violations from previous ROV competitions include:

- The ROV does not use Anderson Powerpole connectors to attach to main power.
- No SID was provided at the safety check.
- The SID did not show a main fuse.
- The ROV used pneumatics, but the technical documentation did not include a pneumatics diagram (fluid SID).
- Sharp items, or potentially sharp items, (fishing hooks, glass bottles) were included on the vehicle.
- The vehicle motors were not waterproofed.
- Propellers were not protected inside the framework or not shrouded.
- Camera did not operate off the 12 volt MATE power supply.
Onsite Safety Inspection

Competition staff will conduct a safety inspection of the vehicle using the safety inspection rubric.

If the safety inspector(s) identify a safety violation, companies will have the opportunity to address it. The pool practice or product demonstration run schedule will NOT change to allow companies more time.

If during the second safety review the
   a. violation has not been properly addressed or
   b. another violation is revealed
companies will have ONE additional opportunity to address the issue.
# 2019 SCOUT SAFETY INSPECTION SHEET

**COMPANY NAME:**

**COMPANY NUMBER:**

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**2019 MATE ROV COMPETITION**

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**Innovations for Inshore: ROV Operations in Rivers, Lakes, and Dams**

**SCOUT CLASS SAFETY CHECK LIST**

Companies must bring this checklist to the ROV, tether, surface control, and any other item used in the deployment and operation of the ROV. They will all be inspected as part of the safety check. In addition, the SID, Technical Report and any additional documentation needed to verify compliance must be made available to Safety Inspectors during the inspection.

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### 1.0 Initial Inspection Results

**Fluid Power**

- Appropriate fluid is used for class (e.g., hydraulic, pneumatic, etc.)

**2.0 ROV (Phyiscal)**

- All parts of the ROV are clean and free of debris.

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### 3.0 ROV (Electrical)

- **Other:** Items are properly sealed.

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### 4.0 Pneumatic / Hydraulic (If applicable)

- Pneumatic / hydraulic systems properly pressurized?

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### 5.0 Electrical

- No exposed conductors.

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### 5.1 Surface Control Electrical / Physical

- Single attachment point to power source.

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### 5.2 Surface Control Electrical / Physical

- Power source mounted securely.

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### 5.3 Surface Control Electrical / Physical

- Tether not damaged by abrasion or other means.

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### 5.4 Surface Control Electrical / Physical

- Tether not damaged by abrasion or other means.

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### 5.5 Surface Control Electrical / Physical

- All electrical components are properly marked and connected.

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### 5.6 Surface Control Electrical / Physical

- All electrical components are properly marked and connected.

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### 5.7 Surface Control Electrical / Physical

- All electrical components are properly marked and connected.

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### 5.8 Surface Control Electrical / Physical

- All electrical components are properly marked and connected.

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**Inspection #1:** Items to address

- Judge: 

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**Inspection #2:** Items to address

- Judge: 

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**Inspection #3:** Reason

- Judge: 

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**Total Safety Points:**

- On Site Inspection (0 to 10)
2019 NAVIGATOR SAFETY INSPECTION SHEET

COMPANY NAME: ____________________________  COMPANY NUMBER: ______________

2019 MATE ROV COMPETITION
Innovations for Inlets: ROV Operations in Rivers, Lakes, and Dams

NAVIGATOR CLASS SAFETY CHECK LIST

Companies must bring this check list, the ROV, tether, surface controls, and any other item used in the deployment and operation of the ROV; they will all be inspected as part of the safety check. In addition, the SSD, technical documentation, and any additional documentation needed to verify compliance must be made available to Safety Inspectors during the inspection process.

1. Initial Inspection Results:

1.1 Fluid Power: in good & approved. If powered pumps are being used, see section 1.6. Pneumatic & Hydraulic - if any manual pumps are used, section 1.5 is not used.

1.2 ROV Physical:

All items attached to ROV are secure.

Thermoplastic 2-3 and 4-6 protection provided.

ALL Propellers are completely inspected or are replaced inside the fabric of the ROV.

No sharp edges or elements of ROV design that could cause injury to personnel or damage to pool surfaces.

3.6 ROV Electrical.

Tether is properly secured or the ROV.

No exposed sectors.

Brakelocks present and secured and inspected and properly secured.

All wires are properly secured or bare wire.

Wires are properly fished and properly secured.

3.1 Surface Controls Electronic & Physical

Final deployment point to secure source.

Amplifier Power Plant for deployment attachment.

12 deep or less single vines that within 30cm of power supply attachment point.

Surface control station is held to a neat and workmanship like manner. No Loose components or unwanted wires. All electrical components covered inside an enclosure.

Tether is properly secured or the surface control.

All exposed copper or bare wire.

All wires entering and leaving the surface control station must have adequate strain relief and vibration protection as the wires pass through the enclosure. Tape, zip ties, string and similar methods are not acceptable.

If used, 120VAC wiring is separated from the DC wiring (used for AC powered motors).

If used, 120VAC wiring must be clearly identified from the DC and control voltages with signage and/or color schemes. If color schemes, key provided for identification.

Cables operate all the MATE D/AC power supply through the single attachment point to power source.

All connectors utilized are properly type rated for their application. AC only rated connectors not be used for DC.

4.0 Pneumatic / Hydraulic (if applicable)

Pastall-pneumatic hydraulic test.

Pneumatic or hydraulic diagrams expected.

All pressure lines have minimum pressure rating:

150psi (pneumatic) or

200 psi (hydraulic)

Inspected for leaking or wall damage.

Valves meet the minimum pressure of:

100 psi pneumatic or 300 psi hydraulic.

Attachment to pressure source is secure.

Pressure is regulated to:

40 psi max for pneumatics and

150 psi max for hydraulics.

Pressure vessels have a stamped pressure rating or certification by specifications.

Pressure vessels have current inspection stickers.

Pressure vessel must be secured on pool deck.

Company fabricated pressure accumulator test results are provided (if used).

No hydrostatic fluids are leaking.

Pneumatics without compressed air or inert gas.

5.0 Lasers

No Lasers - Not permitted for NAVIGATOR.

INSPECTION #1  PASSED: 10 POINTS

FALL: Items to correct (see rear of this sheet)

INSPECTION #2  PASSED: 10 POINTS

FALL: Items to correct (see rear of this sheet)

INSPECTION #3  PASSED: 10 POINTS

FALL: Reason (see rear for details)

Total Safety Points

On Site Inspection [0 to 10]  ________

Judge: ____________________________
2.0 Physical

*All items attached to ROV are secure and will not fall off.*

Examples:

- loose camera
- securely attached camera
2.0 Physical

*No sharp edges or elements of ROV design that could cause injury to personnel or damage to pool surface.*

Examples:
The points on the front of this ROV may look cool, but the inspector failed the company during safety inspection for putting something that could be a danger to the divers.
2.0 Physical

**Hazardous items are identified and protection provided.**

Examples:
Sharp edges on the scoop are painted red; yellow and black safety warning colors are used elsewhere. The company successfully passed their safety inspection because potentially hazardous items that are needed to complete a task are identified and protected.
2.0 Physical

ALL Propellers must be shrouded or completely enclosed inside the frame of the ROV

If your ROV bumps up against the wall of the pool, turning propellers should not impact the side of the pool or other objects.
3.0 Electrical

Single attachment point to power source.

Anderson powerpole connectors are required to connect to the MATE power source.

A single inline fuse (not shown) must be within 30cm of attachment point (power connectors). Fuses in each line are acceptable.

NAVIGATOR and SCOUT class utilize the RED & BLACK powerpole connectors. Looking at the end of the connectors, you will see a small A on the end of each. With the tip of the A pointing up, black should be on the left and red on the right.
3.0 Electrical

Problems with the Anderson powerpoles have developed when teams do NOT use the proper crimper for these connectors.

Standard Electricians Crimpers will NOT work!

The crimp must be a roll crimp not a “squish” crimp.
3.0 Electrical System Interconnection Diagram (SID)

- **System Interconnection Diagram (SID)** A SID is a system-level, connection diagram that includes electrical and, if applicable, fluid power wiring information. Board-level and component-level schematics should not be included; however, these may be brought to the engineering evaluation for reference purposes. The intent is to provide the competition judges with a one-line diagram showing how the various systems are interconnected without the detail of each and every wire.

See the Competition Manual or the next two slides for examples of a SID. However, you must create your own SID for your vehicle. Do not directly copy the SID from a MATE resource, even if it is a proper SID for your vehicle.
Example SID 1
Fuse should be labeled and denoted by a proper symbol IEC, NEMA or ANSI symbol.
3.0 Electrical

*Single inline fuse within 30cm of attachment point.*

Examples:
This is an example of multiple attachments ahead of the fuse that **WILL NOT PASS**. In addition, MATE no longer uses banana plugs for power attachment.
3.0 Electrical

*No exposed copper or bare wire. No exposed motors.*

Examples:
These **WILL NOT** PASS. The motor on the left is both exposed and has bare wire. The motor on the right is exposed and not sealed.
3.0 Electrical

No exposed copper or bare wire.

Examples:
This WILL NOT PASS. Using banana plugs at both ends of the wire to route power from one section to another violates MATE’s safety rules. It is possible for the hot end of the wire to become unplugged and create a safety hazard.
3.0 Electrical

*Tether is properly secured at surface control point and at ROV.*

Example:
The wires on the ROV are loose or could get caught in a propeller when moving around the pool. Use tape, cable ties, or other methods to secure the wires away from any moving or potentially dangerous parts.

Wires entering into the control box should also be secured. If you accidentally walk the controller away from the ROV, you want any strain to be contained. You do not want to pull wires inside the control box.
3.0 Electrical

*Surface controls: All wiring and devices properly secured.*

Examples:
The two pictures below are examples of loose wiring. There is no strain relief and the wires can easily pull loose from their connections. Hot melt glue and tape are not acceptable strain relief items.
3.0 Electrical

*Surface controls: All wiring and devices properly secured.*

Example: both the red/black power wires and the tether wires going into the control box are properly secured by tight strain relief.
3.0 Electrical

Surface controls: All control elements are mounted with wiring inside an enclosure.

There are multiple FAILS in the picture below!

- Exposed wiring
- Multiple fuses instead of single point fuse for power.
- Loose wires.
- Alligator clips used for connections.
- No strain relief provided for wires coming from power or going to ROV.
4.0 Pneumatic / Hydraulic Checklist

- Pneumatic or hydraulic diagrams present?
- **Hand or Foot pump only?**
- Uses water or air only?
- No Pressure Accumulators?
- Any container that air is being pumped into is vented to the pool with vent holes at least ¼” (6.35mm) in diameter?
Fluid Power
NAVIGATOR class (only) if using pressurized fluid power.

4.0 Pneumatic / Hydraulic Checklist

◆ Did you PASS the pneumatics/hydraulics test?
◆ Do you have your pneumatic or hydraulic SID(s) present?
◆ Are pneumatic and/or hydraulic component specifications provided?
◆ Are you using pressure rated lines and fittings?
◆ Is your attachment to pressure source is secure?
◆ Is your pressure regulated to 40psi max for pneumatics and 150 psi max for hydraulics? **COMPANIES MUST PROVIDE THE REGULATOR.**
◆ Do your pressure vessels have a stamped pressure rating or verification by specification and do the pressure vessels have current inspection sticker?
◆ Are your pressure vessels secured on pool deck and not rolling around?
◆ If a company fabricated pressure accumulator is used, are pressure test results provided?
◆ Are hydraulic fluids leaking?
◆ Do your pneumatics utilize compressed air or inert gas?
SCOUT & NAVIGATOR Class Safety Inspection Sheet Tutorial

Fluid Power
NAVIGATOR class (only) if using pressurized fluid power.

4.0 Pneumatic / Hydraulic
Examples of Tank Certifications and Inspection Stickers

The tank must have a current visual inspection certificate (above) AND current hydrostatic test stamp (on the right).
5.0 Laser Checklist

LASERS ARE NOT PERMITTED IN SCOUT OR NAVIGATOR CLASS
SAFETY FIRST!

Our goal is not to fail teams and keep them from competing, but rather to run a fair and **SAFE** competition for all.

If you have a question or concern, You can ask your question on the MATE forum boards at: [https://www.marinetech.org/forums/](https://www.marinetech.org/forums/) or contact that MATE ROV Competition Technical Manager at mgardner@marinetech.org. In this case it is better to ask for permission, not forgiveness. Remember, it is better to be **SAFE** than sorry!