

Drone Safety Kit

Introducing formalized safety
into your UAS operations.



Aviation
Manuals

In your safety kit

SMS 101

- What is it?
- Why does it matter?
- What should I do about it?

Safety Kit Tools

- Operational Risk Assessment
- Flight Risk Assessment
- Preflight Checklist



SMS 101

What is it?

Safety Management System (SMS)

SMS is a formalized program to proactively manage safety risks within an entire organization.

CONSISTS OF 4 COMPONENTS

Safety Policy	Safety Risk Management	Safety Assurance	Safety Promotion
Your formalized policies and procedures for how you manage risks.	The tools you use to find and manage those risks.	How you make sure your risk management tools are working.	The culture you create so the people you work with are trained and prepared to use your risk management tools. It is important to reinforce that these tools are used to only make improvements, not to punish.

HOW IT WORKS



Why does it matter?

Prevent injuries

Risk is a part of every operation. Having a system that can help you identify those risks will allow you to mitigate them and prevent incidents from happening.

Improve efficiency and save money

Don't make the same mistake twice. Close calls and incidents are bound to happen. When they do, follow a repeatable process to discover the root cause and put new procedures into place to prevent it from happening in the future.

Boost your professionalism

Constantly strive to improve. Periodically examine what you do to discover weaknesses and hidden "gotchas". Continuous improvement will always keep you at the top of your game.

Win contracts

Be more competitive when trying to win contracts. Having a formalized safety process demonstrates your commitment and follow through to being safe and efficient.



What should I do about it?

1. Use this kit

This safety kit includes safety forms and checklists to get you started on implementing formalized safety into your drone operations. The subsequent sections will give you an introduction to each tool and a description of how to use them.

2. Document your safety procedures

Write down the safety procedures you will follow when you operate. Your procedures should cover topics like:

- A statement of your commitment to safety (“Safety Policy”)
- A description of your safety system
- A listing of your safety tools, such as forms and assessments
- How you will track and resolve hazards and risks
- What you plan to do with safety data
- Your plan for mitigating, eliminating, and managing risks and fatigue

This may seem like a daunting task when you are staring at a blank page. To make getting started easier, try answering the questions below.

- How do you view the role of safety and safety management within your business?
- What are you doing to make safety a formal part of your operation?
- What elements are a part of your safety system?
- What will you do when you encounter risks and safety hazards?
- How will you keep a record of the risks and safety hazards you encounter?
- How will you use those records to improve your operation?



What should I do about it?

3. Start recording incidents

Use the forms contained within this kit along with additional forms you develop to start recording the risks and safety hazards you encounter as you operate. Record information such as:

- Risks that are present during all operations
- Any incidents that occur
- Risk associated with specific flights
- Details associated with risks and incidents such as when they occurred and specifics about what happened.

4. Regularly review your safety data

Once a quarter to twice a year review the data that you have recorded. Look for trends such as:

- Risks that often occur together
- Risks or incidents that have reoccurred more than once
- Additional incidents that occurred after implementing changes to mitigate a certain risk



Safety Kit Tools



Operational Risk Assessment

What is an Operational Risk Assessment (ORA)?

A tool used to identify each risk present, how likely they are to occur, how severe it would be if they did occur, and plan actions to prevent them from happening.

When do you use it?

The ORA is used primarily in two situations:

Operation-Specific ORA

Complete the Operation-Specific ORA during the mission planning process to evaluate the risks associated with a particular project.

Note: A mission may consist of multiple flights. This form does not need to be filled out prior to each flight of the mission, just once before the mission itself.

Master ORA

Annually, or anytime your business has a significant change, complete the Master ORA to evaluate the risks associated with your operation as a whole.



Operational Risk Assessment

Step 1: Identification of Risks and/or Hazards:

The goal of the Operational Risk Assessment is to identify the broad risks that may be present during operations and to develop mitigation measures in order to lower those risks. Risks could include the types of missions, location of operations, capabilities of equipment, available resources, etc.

In the text area below, please identify these Risks and/or Hazards:

- Master ORA (Overall Department Assessment)
- Operation-Specific ORA

Risks / Hazards Inherent to Operations:

Operational Risk Assessment

Step 2: Analyze Identified Hazards and/or Risks:

Risk assessments and analyses guide the Flight Department safety management. They need not be complex. However, plan so that the risk assessments and analyses can be accomplished without interruption.

Severity		Likelihood	
Descriptor	Description	Descriptor	Description
Catastrophic	Loss of life or property	Almost Always	Could be expected to occur in most circumstances
Major	Serious injuries or major damage	Likely	Could be probable to occur in most circumstances
Moderate	Moderate injury or damage	Possibly	Might occur at some time
Minor	Minor injury or damage	Unlikely	Could occur at some time
Negligible	Inconvenience	Rarely	May occur in only exceptional circumstances

	Rarely	Unlikely	Possibly	Likely	Almost Always
Catastrophic	Medium	High	High	High	High
Major	Low	Medium	High	High	High
Moderate	Low	Medium	Medium	High	High
Minor	Low	Low	Medium	Medium	High
Negligible	Low	Low	Low	Low	Medium

- Low: Some potential for injury to personnel or damage to equipment
- Medium: Likely potential for injury to personnel or damage to equipment or UAS
- High: Definite potential for injury or death to personnel, and damage to equipment or loss of UAS

Note: This risk level reflects the unmitigated risk value as it currently exists.

Risk / Hazard Examined:

Categorize the Risk / Hazard:

- Operational Technical Human Security Facilities

For example, Human Factors could be the number of pilots, currency, company culture, etc.

<p>Are there any underlying circumstances that may be causing the risk / hazard? Yes No</p>	<p><i>If yes, please describe the circumstances.</i></p>
----------------------------------------------------------------------------------------------------	----------------------------------------------------------

<p>Evaluate the Severity and Likelihood of occurrence: Severity: Likelihood: Risk Level:</p>	<p><i>Describe mitigating actions:</i></p>
----------------------------------------------------------------------------------------------------------	--------------------------------------------

Risk level after mitigations have been applied:

Mitigation Review Period:

Risk / Hazard Examined:

Categorize the Risk / Hazard:

- Operational Technical Human Security Facilities

For example, Human Factors could be the number of pilots, currency, company culture, etc.

<p>Are there any underlying circumstances that may be causing the risk / hazard? Yes No</p>	<p><i>If yes, please describe the circumstances.</i></p>
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<p>Evaluate the Severity and Likelihood of occurrence: Severity: Likelihood: Risk Level:</p>	<p><i>Describe mitigating actions:</i></p>
----------------------------------------------------------------------------------------------------------	--------------------------------------------

Risk level after mitigations have been applied:

Mitigation Review Period:

Operational Risk Assessment

EXAMPLE

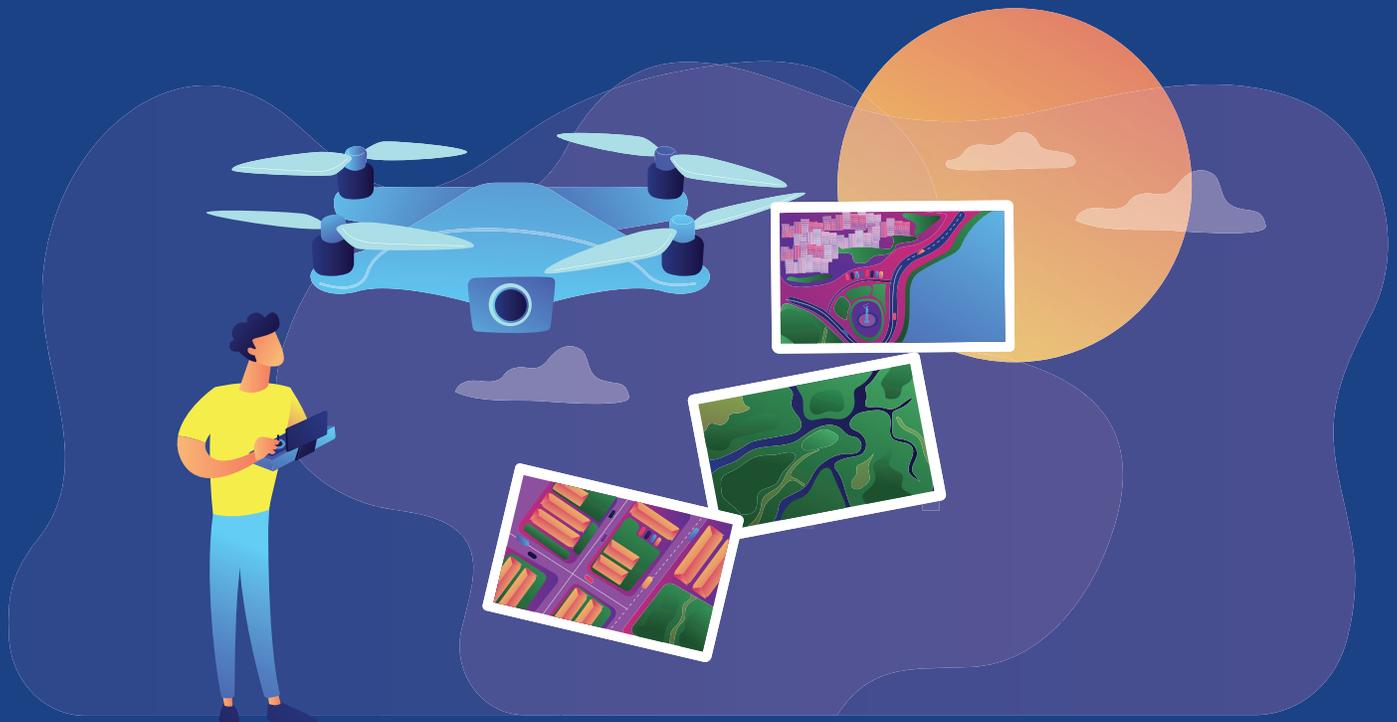
Let's look at an example of how you would use this form for an actual mission.

Scenario:

Kevin, who owns his own aerial imaging company, has been contracted to take aerial video and photography images during an upcoming summer festival. Kevin and his business partner haven't been flying a lot lately as the pandemic slowed job requests down, but with things opening back up the festival organizers, community, and Kevin are all looking forward to the event.

Everyone expects the summer festival will be very popular and a large crowd is expected. He will need to make multiple flights throughout the day to capture all the video footage and images he needs.

To ensure the operation is as safe as possible and increase the chances of everything going smoothly, Kevin fills out the ORA as follows.



EXAMPLE

Operational Risk Assessment

Step 1: Identification of Risks and/or Hazards:

The goal of the Operational Risk Assessment is to identify the broad risks that may be present during operations and to develop mitigation measures in order to lower those risks. Risks could include the types of missions, location of operations, capabilities of equipment, available resources, etc.

In the text area below, please identify these Risks and/or Hazards:

- Master ORA (Overall Department Assessment)
- Operation-Specific ORA

Risks / Hazards Inherent to Operations:

Aerial photography of XYZ Field for a summer festival. Risks identified include:

- Low recent flight activity for the Remote Pilot-in-Command (RPIC)
- 5 kt. winds
- Operations in the vicinity of bystanders
- Possible other UAS traffic in the area

EXAMPLE

Operational Risk Assessment

Step 2: Analyze Identified Hazards and/or Risks:

Risk assessments and analyses guide the Flight Department safety management. They need not be complex. However, plan so that the risk assessments and analyses can be accomplished without interruption.

Severity		Likelihood	
Descriptor	Description	Descriptor	Description
Catastrophic	Loss of life or property	Almost Always	Could be expected to occur in most circumstances
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	Rarely	Unlikely	Possibly	Likely	Almost Always
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Negligible	Low	Low	Low	Low	Medium

- Low: Some potential for injury to personnel or damage to equipment
- Medium: Likely potential for injury to personnel or damage to equipment or UAS
- High: Definite potential for injury or death to personnel, and damage to equipment or loss of UAS

Note: This risk level reflects the unmitigated risk value as it currently exists.

EXAMPLE

Risk / Hazard Examined: Low recent flight activity for the Remote Pilot-in-Command (RPIC)

Categorize the Risk / Hazard:

- Operational Technical Human Security Facilities

For example, Human Factors could be the number of pilots, currency, company culture, etc.

<p>Are there any underlying circumstances that may be causing the risk / hazard? <input checked="" type="radio"/> Yes <input type="radio"/> No</p>	<p><i>If yes, please describe the circumstances.</i> COVID-19 pandemic reduced operational opportunities leading to the lower recency. Refer to the Master ORA for an examination of the COVID-19 risks and mitigation strategies.</p>
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<p>Evaluate the Severity and Likelihood of occurrence: Severity: Moderate Likelihood: Unlikely Risk Level: Medium</p>	<p><i>Describe mitigating actions:</i> - Prior to the flight, the RPIC will conduct practice runs with a second qualified pilot. - The maximum tolerable Risk Assessment score will be lowered by 5 points.</p>
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Risk level after mitigations have been applied: Low.

Mitigation Review Period: Upon conclusion of the operation.

Risk / Hazard Examined: 5 kt. Winds

Categorize the Risk / Hazard:

- Operational Technical Human Security Facilities

For example, Human Factors could be the number of pilots, currency, company culture, etc.

<p>Are there any underlying circumstances that may be causing the risk / hazard? <input type="radio"/> Yes <input checked="" type="radio"/> No</p>	<p><i>If yes, please describe the circumstances.</i> COVID-19 pandemic reduced operational opportunities leading to the lower recency. Refer to the Master ORA for an examination of the COVID-19 risks and mitigation strategies.</p>
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<p>Evaluate the Severity and Likelihood of occurrence: Severity: Major Likelihood: Rarely Risk Level: Low</p>	<p><i>Describe mitigating actions:</i></p>
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Risk level after mitigations have been applied: Low.

Mitigation Review Period: 3 months.

EXAMPLE

Risk / Hazard Examined:

Operations in the vicinity of bystanders

Categorize the Risk / Hazard:

- Operational
- Technical
- Human
- Security
- Facilities

For example, Human Factors could be the number of pilots, currency, company culture, etc.

<p>Are there any underlying circumstances that may be causing the risk / hazard?</p> <p style="text-align: center;"><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	<p><i>If yes, please describe the circumstances.</i></p> <p>Summer festival will lead to increased presence in the area. The operational area is not open to the public; however, the increased number of attendees will increase the likelihood of incursion.</p>
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<p>Evaluate the Severity and Likelihood of occurrence:</p> <p>Severity: Moderate</p> <p>Likelihood: Unlikely</p> <p>Risk Level: Medium</p>	<p><i>Describe mitigating actions:</i></p> <ul style="list-style-type: none"> - Closely work with festival security to ensure the exclusion area is maintained. Portable Radio frequency will be exchanged with festival security to ensure security updates can be received. - Confirm that likely entry points to the exclusion area are clearly and vividly marked "Do not enter" - Send additional personnel to monitor the exclusion area.
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Risk level after mitigations have been applied:

Low.

Mitigation Review Period:

Upon conclusion of the operation.

Risk / Hazard Examined:

Possible other UAS traffic in the area

Categorize the Risk / Hazard:

- Operational
- Technical
- Human
- Security
- Facilities

For example, Human Factors could be the number of pilots, currency, company culture, etc.

<p>Are there any underlying circumstances that may be causing the risk / hazard?</p> <p style="text-align: center;"><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	<p><i>If yes, please describe the circumstances.</i></p> <p>Summer festival may lead to amateur UAS photography of the event. The operational area is not open to the public, and festival staff has reiterated that personal UASs are not permitted at the event.</p>
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<p>Evaluate the Severity and Likelihood of occurrence:</p> <p>Severity: Major</p> <p>Likelihood: Rarely</p> <p>Risk Level: Low</p>	<p><i>Describe mitigating actions:</i></p> <ul style="list-style-type: none"> - Work with festival staff to ensure the air-space remains secure. - Send a second Visual Observer to monitor for other air traffic.
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Risk level after mitigations have been applied:

Low.

Mitigation Review Period:

Upon conclusion of the operation.

Risk Assessment

What is a Risk Assessment?

The Risk Assessment allows you to benchmark your planned flight against pre-identified risks to help you evaluate how safe the operation will be and plan appropriate mitigations.

When do you use it?

It is recommended that you complete the Risk Assessment prior to each flight during the preflight planning process. If your flights for the day will happen in rapid succession, at the same location, and using the same equipment and teams, you can opt to only complete the assessment once prior to the first flight of the day.

Additionally, you should review the Risk Assessment shortly before flight to ensure circumstances have not changed since it was initially completed.



Date: UAS Registration: UAS Pilot: Risk Value Flight Value

Pilot Qualifications and Experience

1.	UAS Pilot with less than 50 hours in aircraft type	2
2.	UAS Pilot with less than 35 hours in last 90 days	3

Total Factor Score – Section 1

Crew Duty Day

3.	UAS Pilot duty day greater than 8 hours	4
4.	Visual Observer duty day greater than 10 hours	4
5.	UAS Pilot rest period less than 12 hours prior to the duty day	3
6.	Visual Observer rest period less than 12 hours prior to the duty day	3

Total Factor Score - Section 2

Area of Operation

7.	Operation planned in Class B, C, D, or E airspace (controlled airspace)	4
8.	Operation in the vicinity of an airport (within 5 NM)	4
9.	High obstacles (trees, buildings, etc.) that reduce clearance of altitude limits to less than 50'	5
10.	Operation in Special Use Airspace (Prohibited, Restricted, Warning, Alert, or MOA)	4
11.	Operation in proximity of fixed structures (e.g., power lines, trees, etc.)	3
12.	Operation in vicinity of the general public / non-participants	3
13.	Initial operation at that specific location	2
14.	Rugged, Remote, or Isolated Terrain	2

Total Factor Score - Section 3

Additional Considerations

15.	Weather: Visibility between 3-5 NM and/or cloud ceiling less than 1,000 ft	2
16.	Weather: Wind speed greater than 15 kts.	2
17.	Potential for Radio Frequency (RF) Interference	4
18.	High (>90 F) or low (<32 F) temperature operations	3
19.	Operations conducted under a waiver to specific 14 CFR Part 107 regulations	2
20.	First flight after UAS maintenance	2
21.		
22.		
23.		
24.		
25.		

Total Factor Score - Section 4

Date:

UAS Registration:

UAS Pilot:

Mitigation
Value

Mitigating Actions

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

Total Factor Score Reduction - Mitigations

Total

Preflight Checklist

Why it's important?

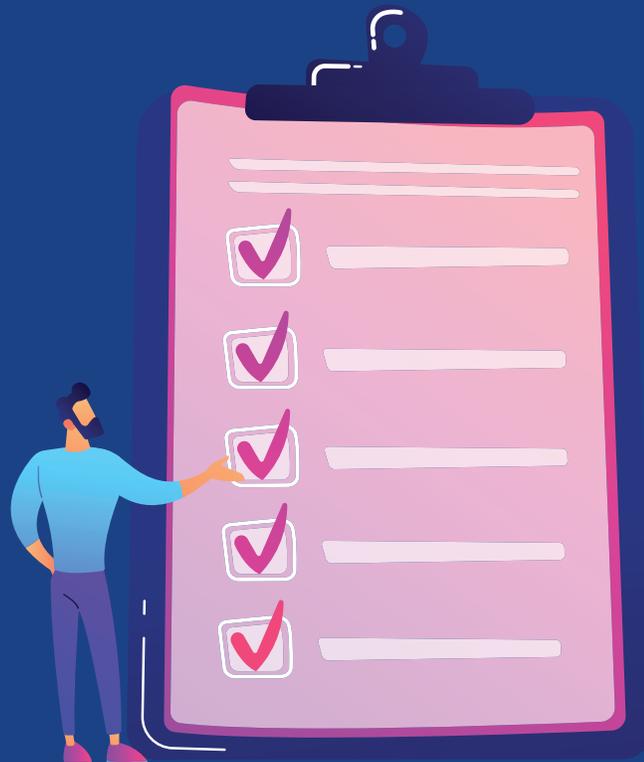
Have you ever gotten to the field, set everything up, and then realized you forgot that spare battery pack? Have you ever forgotten to disconnect the battery from the drone before you put it away?

A checklist will standardize what you do so you don't miss the little things.

When do you use it?

Before every flight.

After a while you may start to feel like you've done this so many times, you don't need to look at the checklist anymore because everything feels automatic; however, "going on autopilot" can lead to mistakes. We have seen in the manned aviation world that little distractions can disrupt your flow leading to errors and the same is true for unmanned aviation. Learn from the pioneers that have come before you and don't just rely on your memory for everything.



Preflight Checklist

1. Documentation Check (Physical or Electronic Copies)

1. UAS Pilot CertificatesPresent
2. Operational Feasibility AssessmentPresent
3. Risk Assessment ToolComplete and Present
4. Operational Permits, Waivers, Property Permissions (as appropriate).....Present
5. Aeronautical ChartsPresent
6. UAS User ManualPresent
7. UAS Manual and Standard Operating ProceduresPresent

2. Systems Check

1. UASPresent
 1. Rotor MountingFirm and Correct
 2. Rotor Condition..... Free of Damage
 3. Equipment Mounting Secure
 4. Control Surfaces Free of Damage
 5. Electrical Connections Connected and Secure
 6. Markings (Registration Number, Safety Placards).....Present and Visible
2. Batteries (UAS, Remote Controller, and Camera)
 1. ConnectionFirm
 2. Charge ≥90%
3. Route / Flight Plan:
 1. Review for Appropriateness Confirm
 2. Loaded Into Software Confirm
 3. Failsafe Return to Base (Emergency / Lost Link) Configured and Loaded
Note: Ensure the Failsafe Return to Base flight path provides for adequate clearance from persons, properties, obstacles, and does not intrude on airspace in which the UAS is not authorized to operate.
4. Sensors / Cameras:
 1. Manufacturer Checklists Complete
 2. Recording DeviceOperational / Free From Errors
 3. Recording Medium.....Has Sufficient Space
 4. SensorsOperating Normally in All Modes
5. Link Established
6. Interference Check..... Confirm no Interference
7. GPS Signal Coverage Checked / Adequate

3. Operational Area

1. Airspace Clear of Air Traffic
2. Non-Necessary Individuals (General Public) Clear of Area
3. Weather ConditionsSuitable
4. If Operating in Controlled Airspace:
 1. Air Traffic Control / Area Traffic..... Begin Communications

5. UAS Takeoff / Recovery Location:

1. Markings..... Clearly Marked
2. Clearance Provides 10' safety clearance
3. Foreign Objects or Debris (FOD) Assessment Free from FOD

4. Personnel

1. High-Visibility Identifying Vests..... Present and Worn
2. Preflight Briefing Complete
3. PositioningAt Designated Positions
4. Radio / Communications Check Complete

5. Safety Equipment:

1. Firefighting Equipment (metal bucket filled with water)Present
2. Personal Protective Equipment (PPE) Appropriate to Task and Present / Worn
3. First Aid Kit.....Present

About AviationManuals

Who we are

Whether you're checking powerlines, analyzing crops, inspecting rail lines, or simply trying to land a big contract, we help you make sure everyone knows their job and how to do it safely. Answering a growing need from the drone community since 2014, we support operators looking to run safer more professional drone operations by keeping you up to date on the latest standards, best practices and regulations all delivered through digital distribution and hosting software and apps.

Drone Operations Manual

Standardize your procedures, stay up to date on industry regulations, and implement a safety management system. You and your customers will know you're an operator who takes what they do seriously. Interested in becoming AUVSI TOP Certified? We make it easier.

ARC SMS Software

Take your operation to the next level. ARC is a comprehensive Safety Management Software and App that gives you secure cloud access to customizable modules, detailed analytics and automated documentation and communication tools.

Have questions? Looking to setup your own drone operation? Contact us anytime.

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