



## Resodyn Acoustic Mixer (RAM) Questionnaire

February 2015

Dear Sir/Madam,

The Munitions Safety Information Analysis Center (MSIAC) was requested by its steering committee to engage with its members to review work and research being carried out into resonant acoustic mixing; this was assigned the work element **KNO-UND-2**.

The use of energetic materials with any new technology requires robust safety cases. The sharing of experiences with other users can aid in this process. MSIAC has, therefore, developed a survey to aid the users in the community. The focus of the survey is to determine how each user has developed the safety case for using a resonant acoustic mixer with energetic material.

Should you require confirmation of the work plan or element please contact your country's National Focal Point Officer (NFPO). Details can be found on our website:

<http://www.msiac.nato.int/contact-us/national-focal-point-officers-nfpos>

### **Purpose**

The purpose of this survey is to share best practice, identify and highlight areas of interest to other users.

### **Input**

The completed questionnaire will be treated as 'MSIAC Nations Only'. Should you be able to share any other documents with MSIAC please inform us as to the distribution statement to be applied.

### **Output**

An MSIAC limit report consolidating best practice from the nations.

### **Timing**

Please complete and return the questionnaire by **24<sup>th</sup> April 2015**.

To: Dr Matthew Andrews

Email: [m.andrews@msiac.nato.int](mailto:m.andrews@msiac.nato.int)

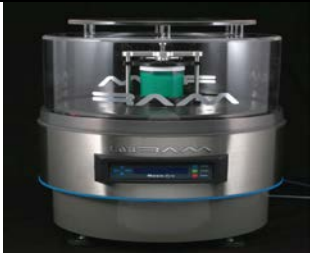


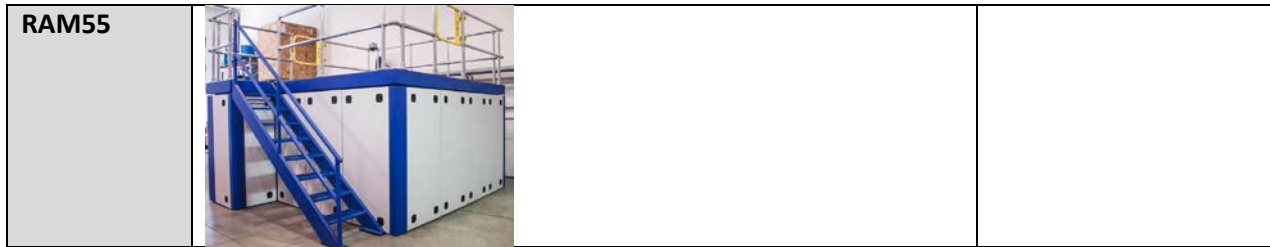
Post: MSIAC, S050, Building Z,  
NATO HQ,  
B-1110, Brussels,  
BELGIUM

Thank you for taking the time to complete this questionnaire.

## Resodyn Acoustic Mixer (RAM) Questionnaire

1. **RAM:** Of the following, which mixer(s) do you have within your facility?

		Quantity
LabRAM		
LabRAM II		
LabRAM II H		
RAM5		



2. Are you capable of resonant acoustic mixing on any other equipment? If so please describe.

3. **Software:** Which version of the RAM software are you currently running?

	RAMWare	RAMWare <sup>2</sup>
LabRAM		
LabRAM II		
LabRAM II H		
RAM5		
RAM55		
Other comments		

4. **Software:** Does the RAM software satisfy your safety requirements?



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5. **Other Mixers:** Do you operate other types of mixer(s) in your facility?

	Yes/No	Manufacturer(s)	Class of material mixed <sup>1</sup>
Planetary			
Horizontal			
Twin Screw Extruder			
Anchor			
Impeller			
Other			

6. **Accessories:** For your model of mixer which accessories, supplied by Resodyn™, do you have?

<b>Mixer type</b>	
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<sup>1</sup> E.g. propellant, pyrotechnic, high explosive formulation, inert material



<b>Vacuum attachment</b>	
<b>Heating/Cooling jacket</b>	
<b>Other</b>	

7. **Materials:** Which class(es) of energetic material are you using in your acoustic mixer? If possible could you give details of ingredients e.g. Secondary main charge; HTPB and RDX or Propellant; Al and AP?

<b>Mixer type</b>	
<b>Class of material (Propellant/ Pyrotechnic/ Secondary/ Primary/ Other/Inert)</b>	
<b>Ingredients</b>	

8. **Scale:** What scale have you or will you use your acoustic mixer with energetic materials?

	<b>Tick</b>	<b>Example (e.g. compatibility)</b>
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1-10mg		
100mg-10g		
10-100g		
100-500g		
500-1000g		
1kg+		

9. **Safety Assessment:** For your mixer did you carry out a Safety Assessment, Hazard Identification or similar hazard analysis?
- a. If so can you share any areas that required consideration?
  - b. Would you be willing to share a copy of the safety analysis?

10. **Guidance:** Did you follow any national guidance documents when carrying out your safety assessment? If so could you provide details e.g. Explosives Act, DSEAR?



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11. **Safety Case Trials:** Did you carry out any inert trials on the mixer?  
a. If so what hazard or mechanism were you testing e.g. generation of voids?

Mixer type	

12. **Modifications:** For your model of mixer have you made any modifications or adaptations?  
a. Were these changes a result of your Hazard Identification?  
b. Were these changes specific to the processing of the energetic material ?  
c. Please provide images, if possible, of any changes that will aid the community.

Changes to mixer based on Safety Assessment

Mixer type	
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	Yes/No	
<b>Earthing</b>		
<b>Mixing vessel</b>		<i>E.g. copper strip attached between vessel and base plate</i>
<i>Description</i>		
<b>Resonator</b>		
<i>Description</i>		
<b>Other</b>		<i>E.g. location</i>
<i>Description</i>		
<b>Vacuum</b>		<i>E.g. custom built vessel</i>
<i>Description</i>		
<b>Heating/Cooling</b>		<i>E.g. custom built jacket</i>
<i>Description</i>		
<b>Safety Interlocks</b>		<i>E.g. location and type</i>
<i>Description</i>		
<b>Location</b>		<i>E.g. separate building or blast cabinet</i>
<i>Description</i>		
<b>Other</b>		
<i>Description</i>		



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13. **Vessel design:** Could you provide details of the mixing vessel used?

<b>Mixer type</b>	
<b>Material</b> <i>e.g. 316 SS or velostat</i>	
<b>Dimensions</b> <i>(height x diameter)</i>	
<b>Shape</b> <i>e.g. rounded corners, RBF</i>	
<b>Image</b>	

14. **Data collection:** What data did you find important in assessing safety and did you add additional sensor(s) to either the mixer or vessel to obtain information about the mix/mixer?

<b>Mixer type</b>		
	<b>Location, type and reason</b>	<b>Importance (1 – low; 5 – high)</b>
<b>Intensity</b>		
<b>Acceleration</b>		



<b>Thermocouple(s)</b> <i>e.g. intra-vessel, wall</i>		
<b>Pressure transducer(s)</b> <i>e.g. overpressure in vessel, vacuum</i>		
<b>Other</b>		
<b>Comments</b>		

15. **Safety/systems checks:** Do you carry out additional safety checks before/during or after operation?

<b>Mixer type</b>	
<b>Checks</b> <i>e.g. check grounding, static charge post mixing</i>	



16. **Safety and Performance:** Was there any change in the safety, hazard, mechanical or performance properties for the material produced by the RAM, either energetic or inert, when compared to other production techniques? Did you consider this change to be positive or negative.

	Test	Results/Comments
<b>Test</b> <i>e.g. requirements from STANAG 4170: ESD, Impact, Friction, Shock, GAP, burn rate, DMA, VCCT</i>		

17. **Organisation:** Please select (tick) the type of organisation you work for?

<b>Government</b>	
<b>Industry</b>	
<b>Academia</b>	
<b>Other</b>	



18. **General Information:** Please note that personal information will not be included in the report.

Location		
	Country	
	Address	
	Name of Facility	
	Phone	
Point of Contact		
	Name	
	Phone	
	E-mail	
	Fax	
	Website	