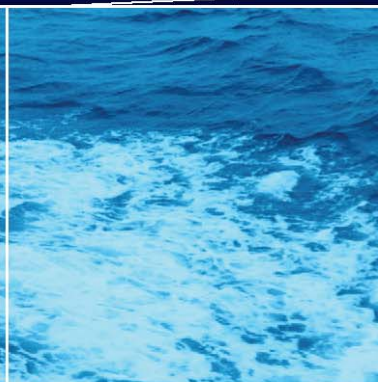


USERS MANUAL



# Tron SART



[www.jotron.com](http://www.jotron.com)



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**EC Declaration of Conformity, available at [www.jotron.com](http://www.jotron.com)**

## **Abbreviations and definitions**

### **C O S P A S**

COsmicheskaya Sistyema Poiska Avaryynich Sudov  
(Space System for the Search of Vessels in Distress)

### **GPS**

Global Position System

**EPIRB** Emergency Position Indicating Radio Beacon

### **km**

kilometer

**LUT** Local User Terminal (Ground Station)

**MCC** Mission Control Center

### **MHz**

Mega-Hertz ( $10^6$  Hertz)

**RCC** Rescue Coordination Center

### **S A R S A T**

Search and Rescue Satellite-Aided Tracking System

### **SOFTWARE**

Values programmed and preloaded into memory. The values represent a permanent set of instructions for running the automatic functions (computations) of the unit.

### **VCO**

Voltage Controlled Oscillator

### **VHF**

Very High Frequency -A set of frequencies in the MHz region



**VSWR**

Voltage standing wave ratio

**PROCESSOR**

The processor circuit card in the console that controls system operations and computes the positioning/navigation solutions.

**RCC**

Rescue Coordination Centre.

**SARSAT**



## Amendment Record

AMENDMENT NO.	INCORP. BY	DATE	PAGE(S)	VERSION	REASON FOR CHANGE
1				A	EM3829
2			Chapt. 5	B	EM 3903
3				C	
4	ES	14.03.07	Total 24	D	New version
5	ES	14.05.07	10 Total:24	E	Removed storage bracket. New company name
6	ES	26.03.08	12 and 15	F	Added text
7					
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The information in this book has been carefully checked and is believed to be accurate. However, no responsibility is assumed for inaccuracies.



This equipment contains CMOS integrated circuits. Observe handling precautions to avoid static discharges which may damage these devices. Jotron AS reserves the right to make changes without further notice to any products or modules described herein to improve reliability, function or design. Jotron AS does not assume any liability arising out of the application or use of the described product.

## WARNING / IMPORTANT

Jotron AS. is a prime manufacturer of safety equipment designed for rescue of human lives and their property. For safety equipment to be effective in line with the design parameters it is important that they are handled, stowed and maintained in compliance with the manufacturers instructions. Jotron AS. can not be held responsible for any damage caused due to incorrect use of the equipment or breach of laid down procedures or for failure of any specific component or other parts of the equipment.

The chapter covering battery replacement (6.2.1) is added for information only. Jotron AS. does not take any responsibility for improper disassembling/assembling of the beacon. We strongly recommend all service to be done by authorized Jotron agents. In addition to normal service, Jotron agents have the necessary equipment and education to test the operational functions of the beacon. Non-original maintenance and/or service parts may destroy the equipment function and performance.



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## **BATTERY SAFETY DATA SHEET**

(Form: EEC directive 91/155)

### **(2) SAFETY ADVICE**

- S2 Keep out of reach of children.
- S8 Keep container dry.
- S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
- S43 In case of fire, use D type extinguishers. Never use water.
- S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

### **(3) FIRST AID MEASURES**

In case of contact of cell contents with eyes, flush immediately with water for 15 min. With skin, wash with plenty of water and take off contaminated clothes. If inhaled, remove from exposure, give oxygen, and seek medical advice.

### **(4) FIRE-FIGHTING MEASURES**

#### **Extinguishing media**

Suitable: Type D fire extinguishers

Not to be used: Water - CO<sub>2</sub> - Halon, dry chemical or foam extinguishers

#### **Special exposure hazards**

Generation of chlorine, sulphur dioxide, disulphur dichloride during thermal decomposition.

#### **Special protective equipment**

Use protective working boots, rubber apron and safety glasses with side shields.



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## **INSTRUCTIONS FOR KEEPING THE RADIO LOG AND THE RADIO OPERATORS OBLIGATION ACCORDING TO NATIONAL AND INTERNATIONAL REGULATION.**

1. The radio log shall be kept in accordance with requirements in the Radio Regulations, SOLAS Convention, national regulations regarding radio installations and the STCW Convention (STCW 95 including the STCW Code) including the relevant regulation regarding watch keeping on board passenger and cargo ships.
2. Unauthorized transmissions and incidents of harmful interference should, if possible, be identified, recorded in the radio log and brought to the attention of the Administration in compliance with the Radio Regulations, together with an appropriate extract from the radio log. (STCW Code B-VIII/2 No.32)

### **TEST OF RADIO EQUIPMENT AND RESERVE SOURCE OF ENERGY**

#### **Weekly:**

GMDSS handheld VHF transceivers to be tested without using the mandatory required emergency batteries.

#### **Monthly:**

Float-free and manual EPIRBs to be checked using the means provided for testing on the equipment. Check data for periodical maintenance requirement for float-free EPIRB search and rescue radar transponders (SART) to be checked against 9 GHz radar.

#### **False alerts transmitted by EPIRB**

False alerts are a serious problem for the rescue service. Nearly 90% of EPIRB initiated distress alerts turn out to be false alarms.

If for any reason, your EPIRB should cause a false alarm, it is most important that you contact the nearest search and rescue authority and tell them it was a false alarm. They can then stand down any rescue service (coast radio station or appropriate CES or RCC). Use any means at your disposal to make contact. Switch off the distress alarm by deactivating your EPIRB, as soon as possible.





## TEST AND MAINTENANCE RECORD

DATE	N/T/B	SIGN	INSP

**N=NEW EPIRB INSTALLED, T=TEST, B=NEW BATTERY**



## 1 GENERAL DESCRIPTION

Tron SART is emergency equipment consisting of:

1. Tron SART radar transponder.
2. Mounting bracket for life rafts / life boats.
3. Mounting rope for life rafts / life boats.

The 9 GHz radar transponder type Tron SART is developed by Jotron AS to meet the regulations and rules for use on vessels and life rafts in the maritime service.

Tron SART meets the specifications for 9 GHz radar transponders for use in search and rescue operations at sea.

The operating range of the Tron SART is up to 30 nautical miles, depending on the height of the electronic unit and the radar height of the search and rescue unit (sea or airborne).

With a radar height of 20m and the Tron SART placed at 1m above sea level, the range will be up to 10 nautical miles.

Tron SART is buoyant, however to obtain maximum performance the transponder should be placed in a vertical position and as high up as possible in order to achieve maximum coverage.

Several mounting brackets and mounting aids are developed to ease a correct mounting and use of the radar transponder.

The purpose of the Tron SART is to perform a secondary alarm when search and rescue units are searching for a life raft / lifeboat in distress. The Tron SART will help the units to pinpoint exactly where the distressed boat is located in a larger area. This is done with the help of the radar on the searching ship or helicopter.

When the Tron SART is interrogated (hit) by a radar signal, it will immediately start to transmit a number of sweeps covering the complete maritime 3 cm radar band.

These sweeps are detected on the radar screen and are used to navigate directly towards the distressed life raft, for details on radar display see chapter 5.3.

Maximum distance to a ship will normally be about 10 nm and approximately 30nm to a helicopter, dependent on the helicopters altitude. The transponder will not give any alarms further away than this.

The primary alarm will usually be an Emergency Position Indicating Radio Beacon (EPIRB) or distress call on VHF / HF - manual or via digital selcall.

The Tron SART should be activated immediately after the EPIRB has been started or by instructions from the rescue control centre.

The batteries of the Tron SART will last at least 96 hours in standby after activation and then minimum 8 hours of continuous operation.



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Although the transponder does not send any alarm via satellite, VHF or other radio communication, the use should be limited to short tests and emergency situations. This is to save battery capacity in case a situation where the transponder is needed.

## **1.1 Tron SART features**

### **Watertight:**

Tron SART is watertight to a depth of minimum 1 meter.

### **Buoyant:**

Tron SART is buoyant in case the transponder is accidentally dropped into the water. To increase coverage the Tron SART should always be held or mounted as high as possible.

### **Rugged design:**

The Tron SART will withstand a drop from 30 meters into the water. It is resistant to seawater, oil and sunlight.

### **Handling:**

The Tron SART is made for easy operation, with a brief operating instruction printed on the unit. It comes standard with a 1 meter rope and a shackle hook to be used for hanging the Tron SART on the inside of a life raft.

### **Indicators:**

The Tron SART is equipped with a LED and a built in speaker to show operation of the SART. The LED will normally flash with a frequency of 1 per second to show that the SART is activated. When a search and rescue unit is approaching the internal speaker will sound each time the SART is hit by the radar. A continuous sound in the loudspeaker means that the ship or helicopter is close to the SART and the radar is hitting the SART continuously.

### **Battery unit.**

The battery unit consists of the complete lower half of the Tron SART and is to be replaced every 4. year. The marking on the battery unit show the expire date. A new battery comes complete with switch and indicators and is easily replaced by opening the screw ring between the top and bottom of the SART.



---

## 2 TECHNICAL SPECIFICATIONS

### 2.1 ELECTRICAL SPECIFICATIONS

Frequency:	X-band (3 cm) (9.2 - 9.5 GHz)
Temperature range:	Operating: -20 to +55°C
Storage:	-30 to +65°C
Radiated power:	> 400 mW e.i.r.p (+26 dBm)
Sweep type:	12 sweep sawtooth type Forward 7.5 us $\pm$ 1 ms Return 0.4 us $\pm$ 0.1 ms Starts with return sweep.
Receive sensitivity:	Better than -50 dBm e.r.s.
Response delay:	Max 0.5 ms
Antenna pattern:	Horizontal polarization. Omni directional radiation in the horizontal plane. Greater than $\pm$ 12.5 degrees elevation angle in the vertical plane.
Battery:	4PCs SAFT LSH20, lithium, 4 years service life
Battery capacity:	96 hours standby +8 hours continuous operating when activated by a radar with 1 kHz prf at -20°C. 4 years storage.



## 2.2 MECHANICAL SPECIFICATION

### **Materials used:**

Transponder housing: Polycarbonate with 10% glass.

Bracket: Anodized aluminum.

### **Transponder dimensions:**

Max diameter: 85 mm

Length: 370 mm

Weight: 1050 g

### **Transponder with standard storage bracket:**

Max diameter: 96 mm

Length: 376 mm



### 3 FUNCTIONAL DESCRIPTION

#### 3.1 GENERAL

The Tron SART consists of upper and lower house mounted together with an O- ring and screw ring. Tron SART may be split into the following main parts:

1. Upper module with transponder and antenna
2. Battery module with batteries, main switch, LED indicator and buzzer.
3. O- ring and screw ring.

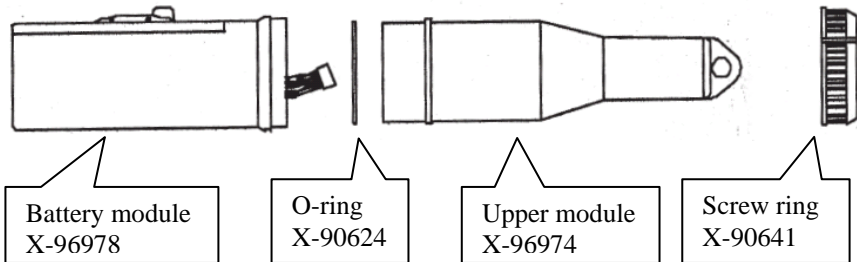


Figure 3.1, Tron SART disconnected

##### 3.1.1 Upper module with transponder and antenna

The Upper module consists of one printed circuit boards, a VCO and antenna, which are mounted in the upper housing:

1. The main board.
2. VCO.
3. Antenna (9GHz).

The housing is made of polycarbonate.

##### 3.1.2 Battery module

The battery module consists of the complete lower half of the Tron SART and is to be replaced every 4. year. The marking on the battery unit show the expire date.

A new battery module comes complete with switch and indicators and is easily replaced by opening the screw ring between the top and bottom of the SART.

##### 3.1.3 O-ring and screw ring

The two parts of the housing are put together with the O-ring gasket, and is locked with a screw ring.



## 4 INSTALLATION

The Tron SART can be mounted several ways, depending on the options available. As a general rule, the transponder should be mounted as high as possible to increase line of sight to the search and rescue units. Metal objects close to the transponder should be avoided, these will limit the performance in the directions they are located.

### 4.1 BRACKETS

There are three different mounting brackets available.

1. Storage bracket., X-92422
2. Outdoor bracket, X-93494
3. Lifeboat bracket, X-92424

#### 4.1.1 Storage bracket

A storage bracket is delivered with the Tron SART and should be used for storage of the transponder. The storage bracket should preferably be mounted in a vertical position and in a place where the Tron SART is easily available in case of an emergency.

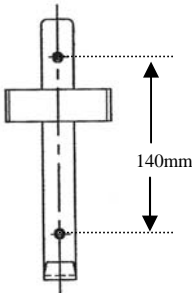


Figure 4.1.1a, storage bracket.

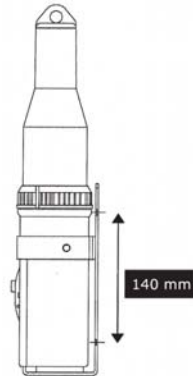


Figure 4.1.1b, SART mounted in storage bracket.

The bracket should be mounted with two screws ( $\varnothing$  4 mm) at a vertical distance of 140 mm.

#### 4.1.2 Outdoor lifeboat bracket

The outdoor lifeboat bracket should be mounted vertically on the roof of the lifeboat (as high as possible). To use the bracket activate the transponder and put it inside the bracket. To secure the transponder from falling out, the 1m rope should be attached to the hook in the bracket.

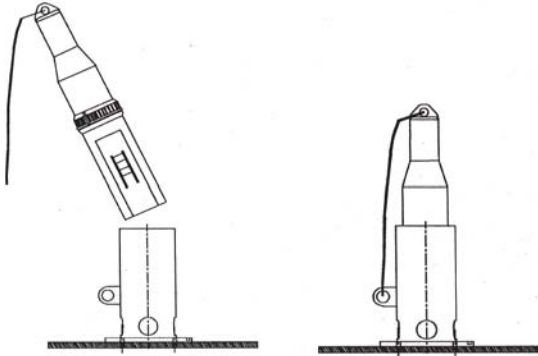


Figure 4.1.2 outdoor lifeboat bracket.

#### 4.1.3 Fixed lifeboat bracket

The fixed lifeboat bracket consists of a mounting bracket that is fixed on the lifeboat from the inside. Usually a blind cover is mounted in the place for the bracket. The blind cover must be removed and the mounting bracket with the Tron SART top unit attached is mounted. The removal of the blind cover and mounting of the mounting bracket is done using two wing nuts. In addition to the bracket, there is a cover to be mounted on the battery unit, and a cable connecting the two parts.

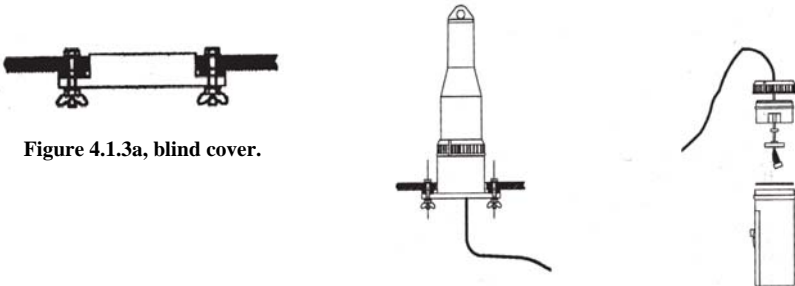


Figure 4.1.3a, blind cover.

Figure 4.1.3b, SART mounted in fixed bracket.





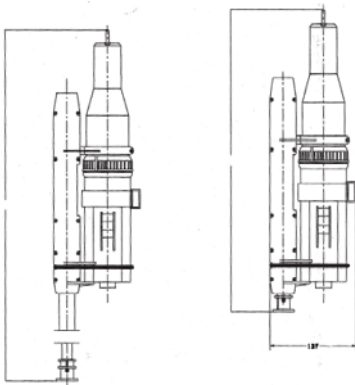
#### 4.2 Using the 1m rope



**Figure 4.2, Tron SART with 1m rope attached.**

The 1m. rope is meant to hang the Tron SART inside a life raft. Any objects that the rope can be attached to can be used. As long as the transponder is kept away from any metal objects, the performance will not be notable degraded because of the canvas of the life raft.

#### 4.3 Using the 1m pole



**Figure 4.3, Tron SART with 1m optional pole attached.**

The 1m pole can be used to extend the height of the Tron SART, inside or outside the life raft/boat. Simply extend the attached pole to the full length (app. 1,15m from the top of the Tron SART). Make sure that the rod is locked by pulling hard when it is fully extended. The rod can now be fastened or held by a person. Make sure to hold the rod as vertical as possible when activating the Tron SART.



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## 5 OPERATION INSTRUCTIONS

### 5.1 Activating the Tron SART

1. Break seal at switch.
2. Pull locking pin and make sure that the switch enters the "ON" position. An audible "BEEP" will be heard and the indicator led will start to flash.
3. Place (or hold) the transponder in a vertical position as high as possible. When the Tron SART is within range of an active 3 cm radar, the internal loudspeaker will be activated. A handheld VHF radio should now be used to establish contact with the approaching boat or helicopter.

### 5.2 Deactivating the Tron SART

1. Move the switch to the "OFF" position.
2. Replace the locking pin.

### 5.3 Test of the Tron SART

Test of the Tron SART is done using the ships own 3 cm radar. The radar display will show different patterns depending on the range to the transponder.

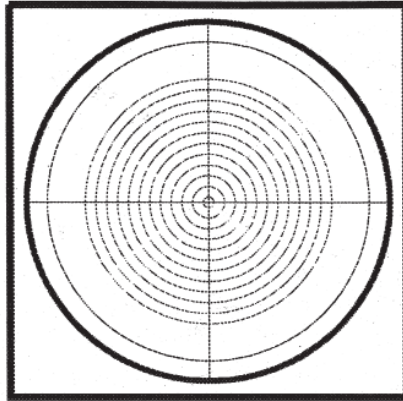
See Figure 2, Figure 3, and Figure 4 for details of the radar display. Note that the examples shown are typical and will vary with the radar performance (height, power output and sensitivity).

With the transponder located close to the radar the signals will appear as rings on the radar display.

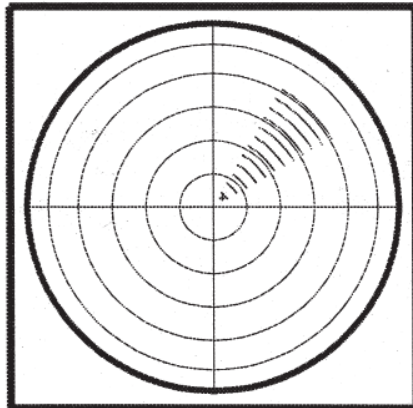
The rings may be broken in some sectors, depending on ship construction and other obstacles, and does not indicate an error in the transponder.

Placing it further away will reduce the signals to 12 dots on the radar display, showing the direction to the transponder.

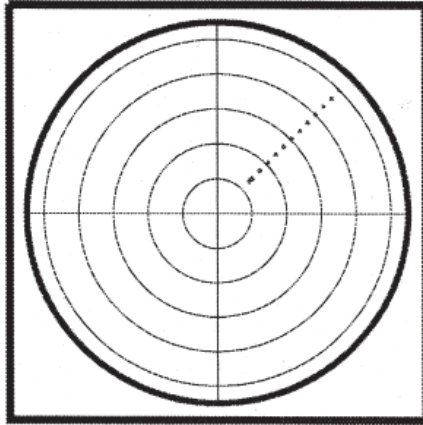
1. Hold the switch on the Tron SART in the "TEST" position.
2. Simultaneously a person should observe the radar display to check for correct pattern. The radar should be set for a 10 nm range.
3. The test should preferably be done in open sea to avoid interference on the radar display from land echoes.
4. Alternatively, a radar of a nearby ship can be used to test the transponder. A ship to ship vhf channel should then be used to confirm operation.



**Figure 5.3a**  
Typical display when Tron SART is located near ( $<0.2$  nm) the radar.  
Radar range is 10 nm. Rings are off.



**Figure 5.3b**  
Typical display when Tron SART is located close (1 nm) to the radar.  
Radar range is 10 nm. Rings are at 2 nm.



**Figure 5.3c**

Typical display when Tron SART is located away ( $>2$  nm) from the radar.  
Radar range is 10 nm. Rings are at 2 nm.

**CAUTION!**

While the Tron SART is activated it will respond to any 3 cm radars within range. Tests must be made as short as possible (5 min) to avoid interference and to avoid wasting battery capacity.



## 6 MAINTENANCE AND TROUBLESHOOTING

### 6.1 MAINTENANCE

The Tron SART requires the following maintenance:

#### Every 6. month.

The transponder should be taken out of its bracket and tested against a radar, using the procedure in chapter 5.3. Either the ships own radar could be used or the radar of a nearby ship.

#### Every 4. year.

The battery unit must be replaced every 4. year. Storage of batteries over a long period of time will reduce their capacity. To ensure long and reliable operation the battery unit must be replaced every 4. year. The battery replacement can be performed on board using the procedure in chapter 6.2.1.

### 6.2 SERVICE

#### Warranty Service

The warranty of the equipment is not valid if the customer has tried to repair, modify or rebuilt the unit, deliberate or accidental damage, failure to follow Jotron instructions with respect to approved service agents or if the unit has been exposed to environmental conditions outside the specifications for the unit. As a standard Jotron AS warrants that this product will be free from defects in materials and workmanship for a period of 12 months from the date received by end user, limited to 18 months from purchase from Jotron AS.

If necessary to have the nit repaired, please return it carriage pre-paid to the agent where you did your purchase. Provided that the unit(s) returned for repair is found to be under warranty, man-hour cost and material cost will be covered by Jotron AS.

Additional costs not related to repair/replacement of the unit will not be covered.

#### Out of Warranty Service

For defects arising from normal wear and tear after 12 months of operation, limited to 18 months from Jotron AS, normal service conditions will apply. For details see: [www.jotron.com](http://www.jotron.com)

#### 6.2.1 REPLACING THE BATTERY MODULE

Refer to Figure 3.1 and do the following steps:

1. Open the transponder by turning the screw ring counter clockwise.
2. Remove the battery unit (lower half) of the transponder, by disconnecting the
3. battery plug.
4. Make sure the o-ring is in place at the upper part of the transponder.
5. Please make sure that the enclosed silicagel bag is placed inside the Tron SART.
6. Please also fit the enclosed inti corrosion adhesive tape to the inside of the battery before assembly of the unit.
7. Connect the new battery unit and attach it to the upper part.
8. Tighten the screw ring by turning it clockwise.
9. Test the transponder according to procedure in chapter 5.3.



### 6.2.2 BATTERY DISPOSAL

Dispose in accordance with applicable regulations, which vary from country to country. (In most countries, the thrashing of used batteries is forbidden and the end-users are invited to dispose of them properly, eventually through non-profit organizations, mandated by local governments or organized on a voluntary basis by professionals). Lithium batteries should have their terminals insulated prior to disposal.

### 6.2.3 INCINERATION

Incineration should never be performed by battery users but eventually by trained professionals in authorized facilities with proper gas and fumes treatment.

### 6.2.4 LAND FILLING

Leachability regulations (mg/l)

Component	Leachability	EC limit	EPA	Other*
Iron	100			5
Nickel	100	500	2	0,5

\* Applicable to France

### 6.2.5 RECYCLING

Send to authorized recycling facilities, eventually through a licensed waste carrier.



## 7 SERVICE AGENTS

**Please look at [www.jotron.com](http://www.jotron.com) for Marine Service Agents.**

Jotron Group subsidiary companies:

Jotron UK Ltd.  
Crosland Park, Off Crowhall Road  
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Northumberland NE23 1LA  
United Kingdom

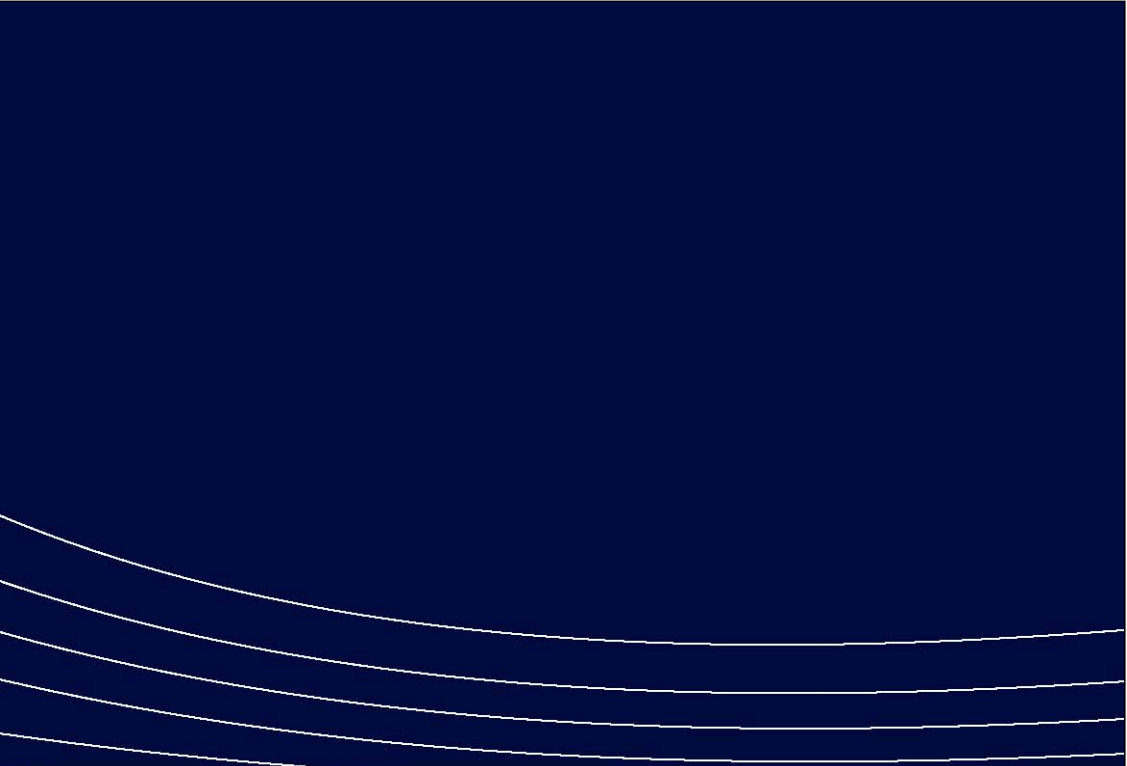
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