



JOINT STOCK COMPANY  
«558 AIRCRAFT REPAIR PLANT»

# «SATELLITE-M2» ECM PROTECTION SYSTEM



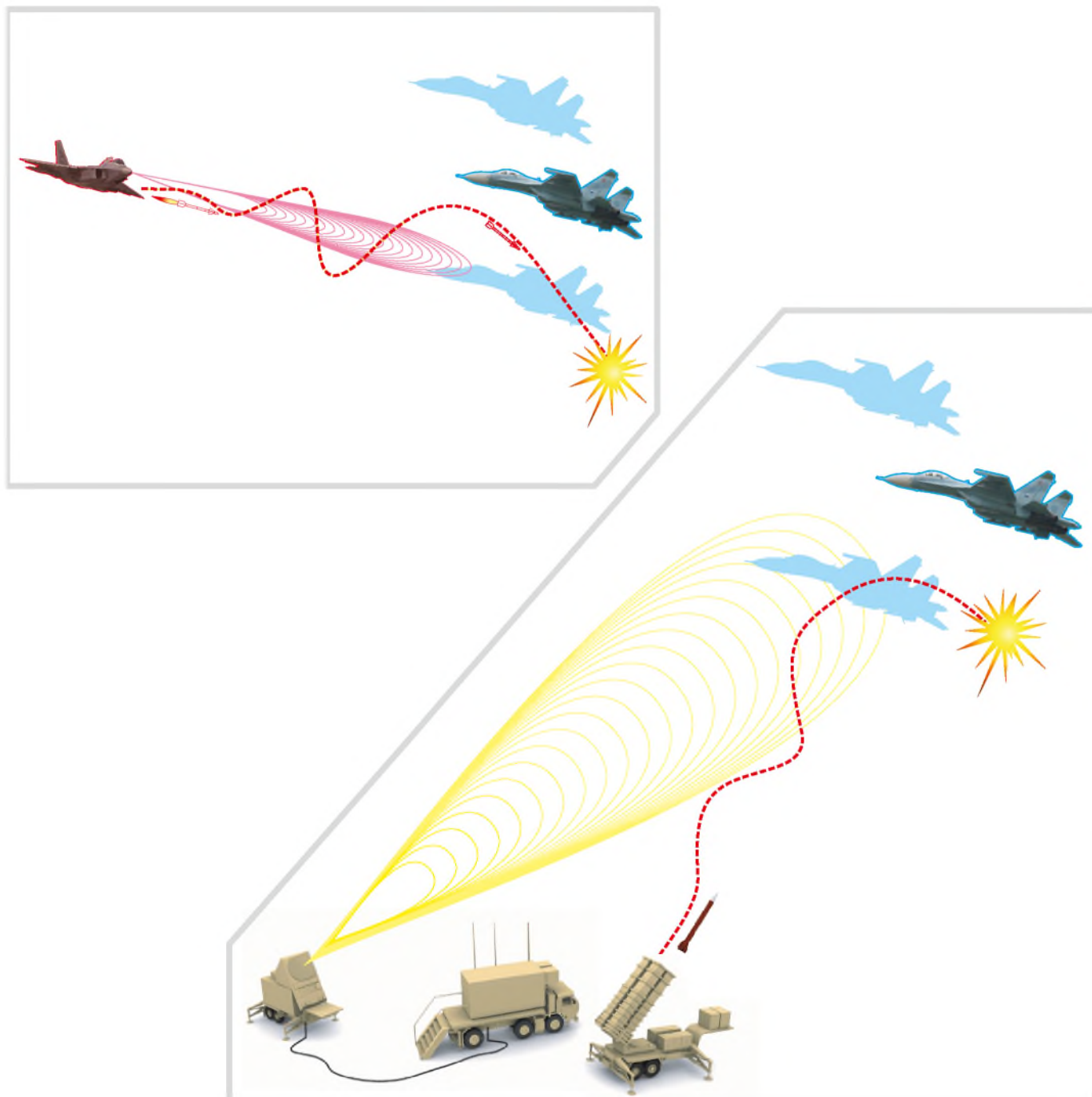
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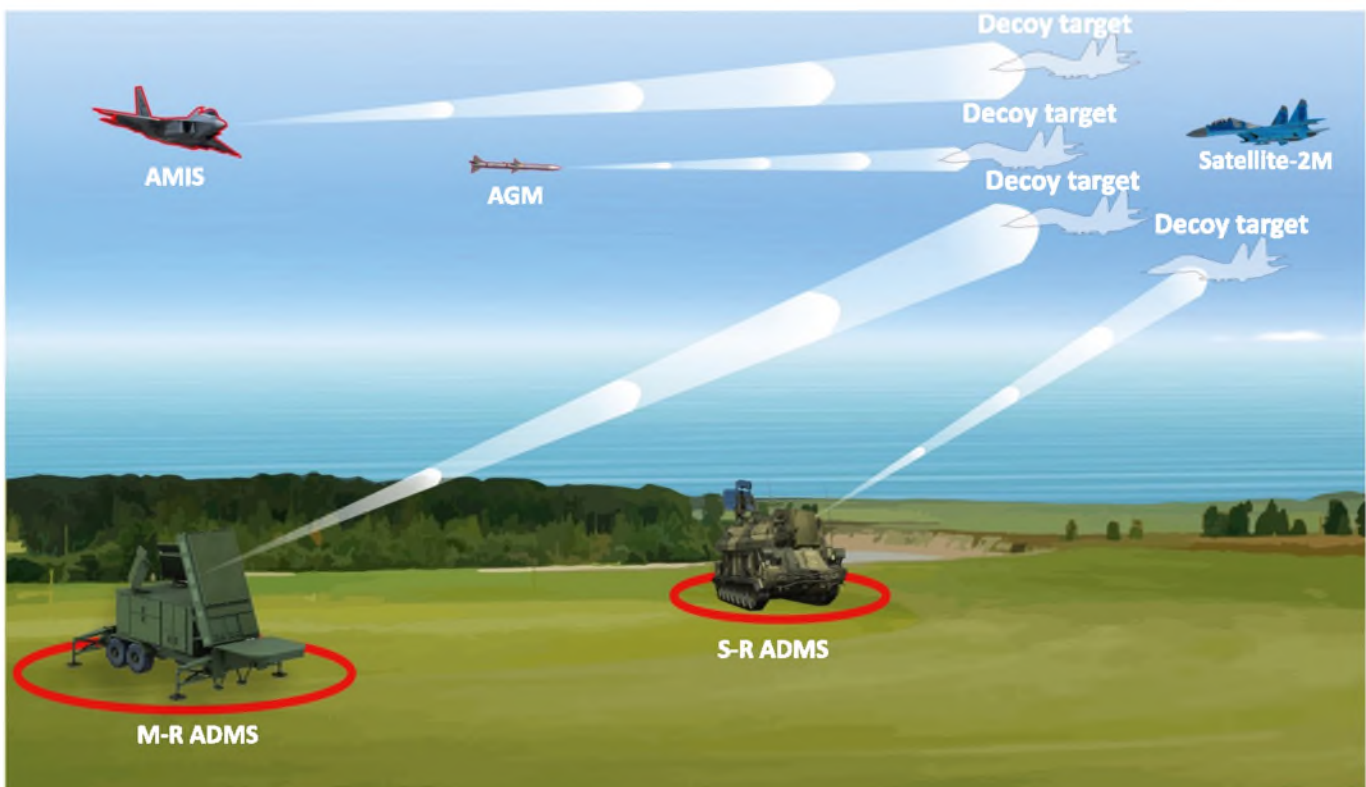
## DESIGNATION

"Satellite-M2" ECM equipment is intended for aircraft protection from the attacks of highly-precision radio-controlled weapons of adversary aviation missile interception systems (AMIS) and air defense missile systems (ADMS), operating in the 4.0 ... .18.0 GHz frequency range in the attack FHS and RHS.



# ADVANTAGES

- High likelihood of elimination of the probability of protected object hitting by highly-precision radio guided missiles.
- Provision of radar stealthiness: adversary force does not perceive interferences generation.
- Deterioration of attack combat means' capabilities (shrinkage of hitting areas etc.)
- Jamming impact is generated through all combat operation stages for avionic systems with composite signals, swift parameter's agility, incl. avionic systems with rotary (elliptic) polarization of probing signals.
- Provision of comprehensive EM compatibility with the carrier's avionic systems.
- The equipment is entirely self-contained, does not distract pilot's attention during combat mission performance.
- Employs the updated electronic and digital base, that broadens combat options and enables weight and equipment power consumption reduction.
- Made up as per unit-module principal, that allows customer-tailored arrangement of the equipment in respect to the airborne environment of the battle ground.
- light-weighted and small-sized



# HARDWARE CONFIGURATION

In terms of design ECM equipment represents two pods with the hardware being attached to the armament hardpoints. The hardware cut-in is enabled by the button on MFI. ECM equipment comprises two sets of units for self-sufficient operation into attack FHS and RHS.

Composition of each set:

- Cross-polarized interferences generation hardware for AMIS and ADMS of mono-pulse type with rotary and linear polarization with any type of probing signals;
- Adaptive and distractive interferences generations hardware on the basis of DRFM for ADMS avionic systems with raw and composite pulse signals;
- Hardware of airborne environment analysis and monitoring, avionics systems selection for suppression and information deception;
- Control central processor.



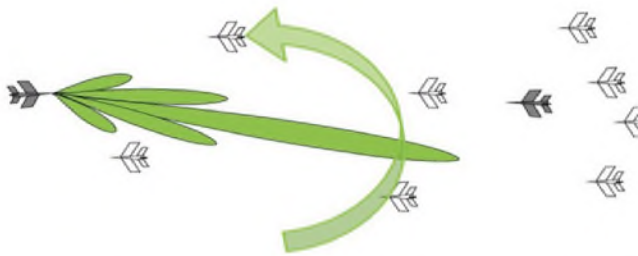
MFI display in the aircraft cockpit.

Variants of Hardware arrangement on various carriers' types.

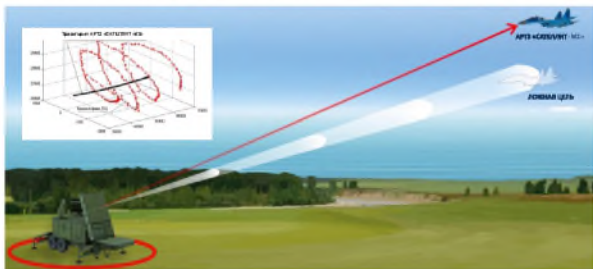
# OPERATION PRINCIPLE

With a view to secure aircraft-carrier's highly effective radiotechnical protection, jamming retransmitting principle is applied. It features reception of the adversary avionic means' probing signal, its' assessment, amplification, providing with special jamming modulation types and its' radiation into the space towards the enemy. Types of generated jamming impacts:

- Mock interferences of AMIS (ADMS) target detection channels;



- Cross-polarized interferences of tracking channels of AMIS (ADMS) and AGM with active seekers with rotary and linear polarization;



- Misleading, redirecting and adaptive interferences on the basis of DRFM for M-R and S-R ADMS with raw and composite probing signals.



**Procedure for jamming generation of pulse-type simple ADMS**

Inverse jamming of S-R ADMS target detection a vionics means on the basis of DRFM

Jamming array of M-R ADMS on the basis of DRFM



# ECM TARGETS

- **Mono-pulse AMIS and ADMS radio stations.**

**Aviation missile interception systems**

F-15

X-band AN/APG-70 Pulse-Doppler radio station



Saab JAS 39

X-band Pulse-Doppler radio station



F-16

X-band AN/APG-68 (V) Pulse-Doppler radio station



J-20

X-band Pulse-Doppler radio station



FA-18

X-band AN/APG-82 Pulse-Doppler radio station



Rafale

X-band Pulse-Doppler radio station



F-35A

X-band AN/APG-77 MF radio station

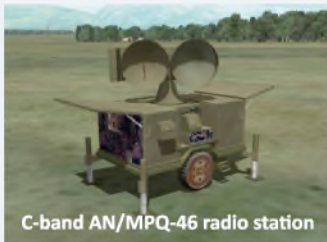


Cy-35

X-band Pulse-Doppler radio station



**Radio station of M-R ADMS weapon control**



C-band AN/MPQ-46 radio station



C-band Mono-pulse radio station



C-band P-D radio station



C-band AN/MPQ-53 P-D radio station



C-125 ADMS radio station



C-band P-D radio station



C-300 band P-D radio station



X-band Y-200 P-D radio station

- **Radio station of S-R ADMS weapon control**



CX-band P-D radio station



C-band P-D radio station



Ku, C band radio station



Ku, C-band radio station



Ku, C-band radio station



Ku, X-band P-D radio station



Ku-band P-D radio station

- **AVIATION MISSILES WITH ACTIVE RADAR SEEKERS**



AIM-120 AMRAAM (USA)



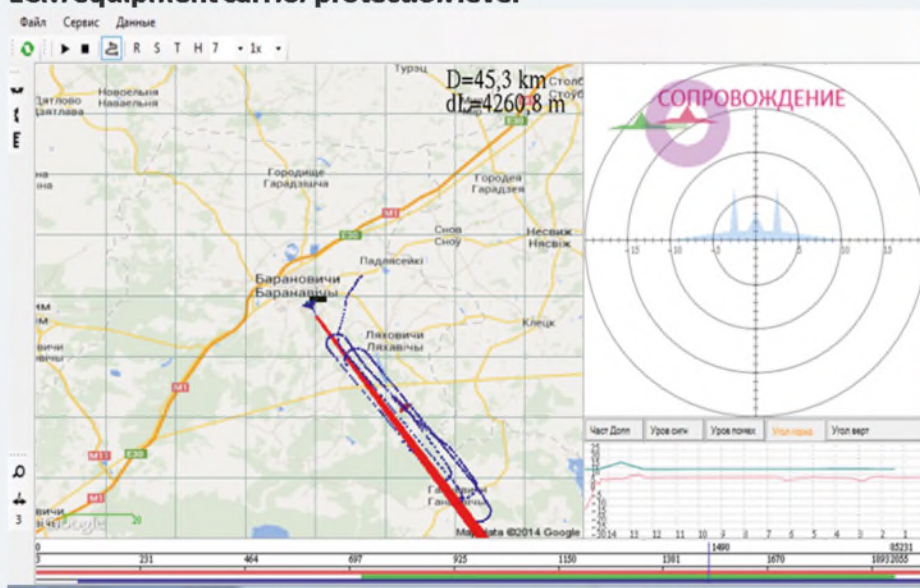
MBDA METEOR (EUROPE)



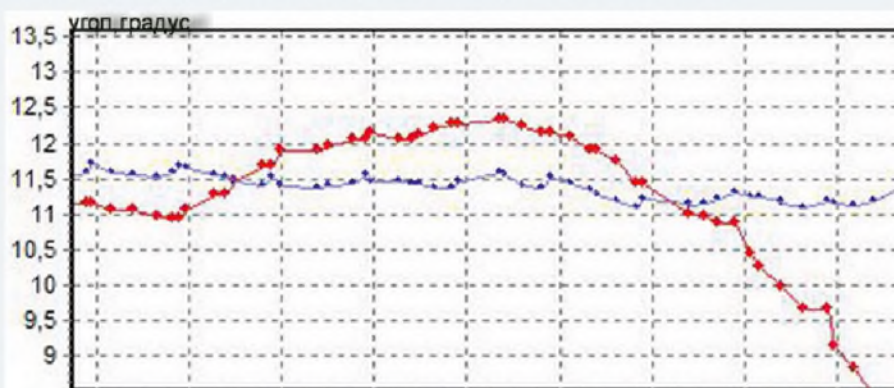
P-77 PBB-AE (RUSSIAN FEDERATION)

# DEMO FLIGHT TRIALS AT THE CUSTOMER'S TERRITORY

- Specialized program of flight trials' outcomes processing that enables obtainment of reliable evaluation of "Satellite-M2" ECM equipment carrier protection level



- Blue – "Satellite-M2" ECM equipment carrier flight pattern as per GPS data.
- Red – Maneuvering target flight pattern as per Interceptor localizer data.



## KEY TECHNICAL SPECIFICATIONS

- Frequency band ..... 4,0...18,0 GHz;
- Output power ..... 10...20 Watt;
- FHS and RHS protection area
  - In azimuth plane ..... $\pm 60^\circ$ ;
  - In elevation plane ..... $\pm 45^\circ$ ;
- Readiness for operation ..... 5 sec;
- Power voltage ..... +27 V;
- Total consumed power ..... 800 Watt;
- Weight of each pod's hardware ..... 15...20 Kg;
- Range of impact on adversary avionic means ..... not less than 1,5 of avionic means range.

# VARIANTS OF ECM EQUIPMENT LAYOUT ONBOARD FLIGHT VEHICLES



**"Satellite-M2" ECM equipment onboard Su-27 and Su-30**



**"Satellite-M2" ECM equipment onboard MiG-29**





**“Satellite-M2” ECM equipment onboard Su-25**



**“Satellite-M2” ECM equipment onboard Mi-8 helicopter**

## **“SATELLITE-M2” ECM EQUIPMENT HALLMARKS**

**"Satellite-M2" ECM equipment employs the existing shortcomings of modern mono-pulse avionic means and forms cross-polarization interference, disturbing their operation of angular, high-speed and range-tracking channels. Impact effectiveness is based on the fact that the protection systems of suppressed avionic means do not perceive the fact of jamming. The principle of generation of such interferences is fundamentally different from the existing method of creation of interference to a single-pulse avionic means on the basis of digital stations with DRFM (as, for example, in AN / ALQ-167, SAP-418, SAP-518, "Khibiny" jamming station etc).**

**"Satellit-M2" ECM equipment in order to disrupt the operability of the weapons control system of the M-R and S-R ADMS that employs raw and composite pulse signals, uses the hardware based on DRFM technology, generating multiple response-pulse range jamming and high-frequency noise interference such as "white noise", making it difficult to determine the targets' true position in space. For the target detection radar, repeatedly pulsed inverse interferences are generated.**

**The "Satellit-M2" ECM equipment creates special highly stable coherent cross polarized interferences, disturbing the operation of the ADMS weapons' sighting avionic means with rotary (elliptic) polarization.**

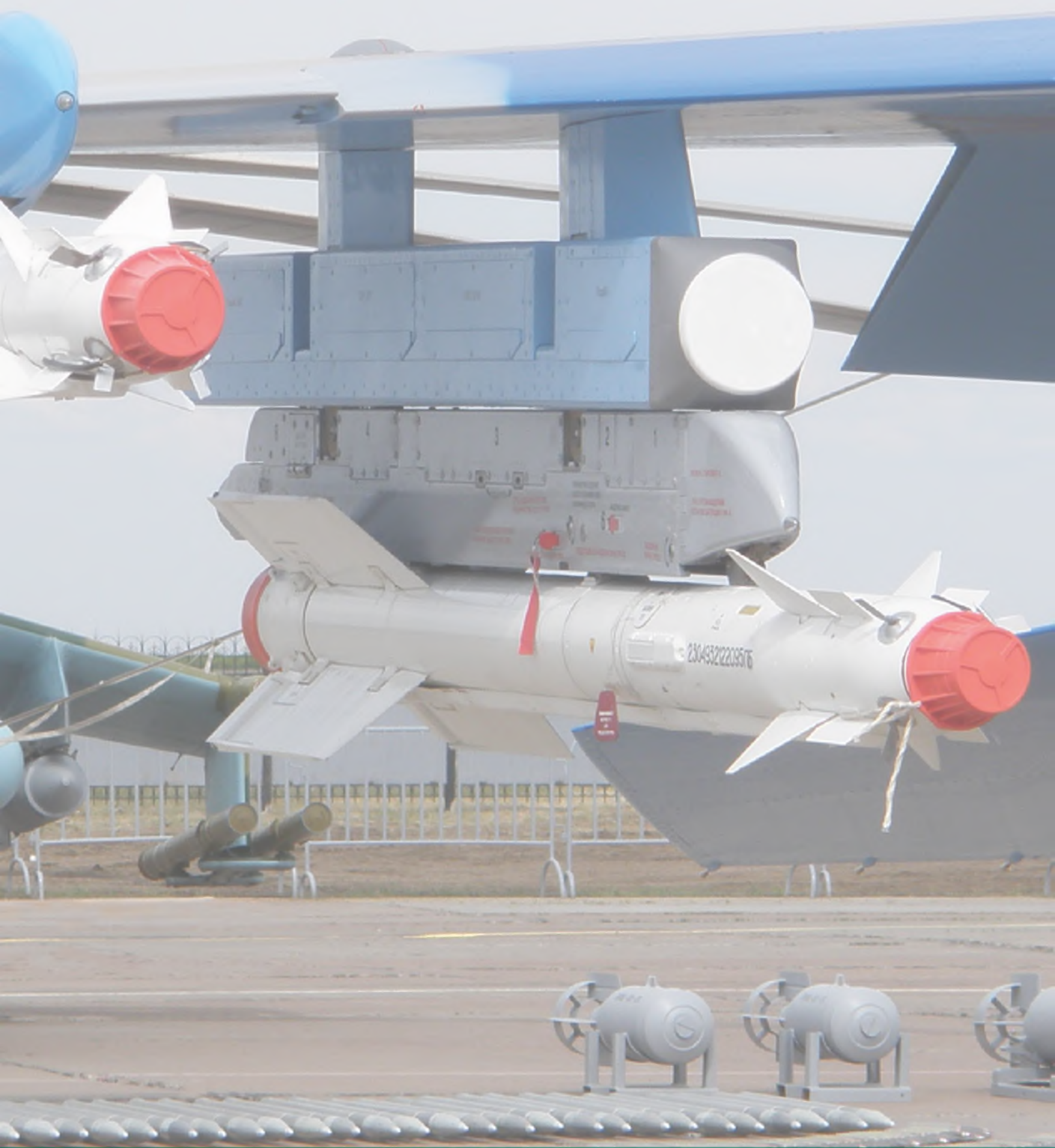
**"Satellite-M2" ECM equipment operates in automatic mode, is capable simultaneously to make impact on AMIS and ADMS radiating avionic means. It has protection from unauthorized access and copying.**

## **HARDWARE CONTROL IN THE COMBAT ENVIRONMENT**

**Engagement of ECM equipment can be performed either before the take-off of the aircraft or during the flight by the "Satellite" toggle switch located on the power panel in the cockpit. The monitoring of ECM equipment operability is displayed on the MFI. Determination of the type of threats (operating adversary AMIS and ADMS), selection of response impact on each type of means is generated automatically. At the same time it is possible to make impact on both the AMIS of enemy aircraft and on all operating adversary ADMS, including the ones with rotary (elliptic) polarization.**

## **GROUND MAINTENANCE**

**The operability is checked with employment of BIT (built-in monitoring system) from the control and monitoring unit located in the LH pod. Information about readiness for operation is displayed on the MFI, documented by the registration system, which also allows post-flight analysis of the operation and effectiveness of "Satellite-M2" ECM equipment combat employment.**





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