Mr. Pattison

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THE MERIT OF INDIVIDUAL SYSTEM PERFORMANCE CHARACTERISTICS FOR IFF-INTEROPERABILITY OF IFF SYSTEMS (MISPEC (IFF))

VOLUME 3

GUIDE FOR THE COLLECTION OF DATA

MARCH 1986

NATO INTERNATIONAL STAFF - DEFENCE SUPPORT DIVISION

THE MERIT OF INDIVIDUAL SYSTEM PERFORMANCE CHARACTERISTICS FOR IFF - INTEROPERABILITY OF IFF SYSTEMS (MISPEC (IFF))

VOLUME 3

GUIDE FOR THE COLLECTION OF DATA

MARCH 1986

ORIGINAL
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NORTH ATLANTIC TREATY ORGANIZATION

MILITARY AGENCY FOR STANDARDIZATION (MAS)

NATO LETTER OF PROMULGATION

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1. AEtP-5, Volume 3, The Merit of Individual System Performance Characteristics for IFF - Interoperability of IFF Systems (MISPEC (IFF)) - Guide for the Collection of Data is a NATO UNCLASSIFIED publication.

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M. KORKOLIS
Major-General, HEAR
Chairman

RECORD OF CHANGES

Change Date	Date Entered	Effective Date	By Whom Entered

CONTENTS PAGES

Associated Documents

1. Allied Electronic Publication n° 5 (AEtP-5) - The Merit of Individual System Performance Characteristics for IFF (MISPEC (IFF)) - Interoperability of IFF Systems

   Volume 1 - User Guide for Operational and Planning Staff

   Volume 2 - Technical Guide

   Volume 4 - Analysis of System Performance Characteristics (to be issued)

   Volume 5 - Computation Procedures

3. STANAG 5017 Edition 3

3. STANAG 4193

4. Allied Electronic Publication n° 6 (AEtP-6) - Standard Method of Measuring IFF System Performance

Contact for Further Information

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The Hague

Netherlands

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Section 1

General Introduction

MISPEC (IFF) Guide to Data Collection

Section 1 General

1.1 Introduction

The Merit of Individual System Performance Characteristics (MISPEC) is a system management method designed to examine the degree of interoperability between cooperating halves of a communications system. This management method determines, by calculation, the probability of interoperation by examining all characteristics likely to be encountered in a particular operation. As these characteristics vary widely in operational service, the computation is statistically based using in-service data as basic information.

In MISPEC terms, Interoperability is defined as the degree to which an interrogating platform and its target the transponding platform (a platform pair), can satisfactorily communicate with each other. In this context a platform may be a ship, a Manpad, a Shorad, an aircraft, an Air Defence Radar site or a stand alone identification interrogator system.

1.2 Scope of Guide

Although applicable to all cooperating communications systems, MISPEC is particularly applied to the electronic identification system IFF, employed as internationally agreed throughout NATO. However, a number of system variances will be encountered within the general terms of IFF (Identification Friend or Foe) and SSR (Secondary Surveillance Radar). The majority of differences are historical but variances are also those associated with modes of operation and reply capability. Within the context of this Data Collection Guide, equipments designed to conform to different agreements may be encountered and are described in general terms in the following paragraphs. The description does not, however, include systems of previous design that will not inter-operate with the systems to be examined.

1.2.1 IFF MK 10 (SIF)

IFF MK 10 (SIF) is described in STANAG 5017, dated 25 July 1969.

The IFF MK 10 (SIF) system operates on D band using a fixed carrier frequency pair. Interrogations are transmitted on 1030 MHz and replies on 1090 MHz, using pulse modulated signals.

Interrogations are made on Modes 1, 2 and 3, and replies are encoded pulse groups, the code capability being as follows:-

Mode 1	- 32 codes
Mode 2	- 4096 codes
Mode 3	- 64 codes

The system includes Identification of Position and Emergency reply features, and makes provision for Interrogation Sidelobe Suppression (ISLS).

New equipment will not be provided to this standard but it is in current NATO use, and the system is the basis for the subsequent improved systems, IFF MK 10A and IFF MK 12.

1.2.2 IFF MK 10A

The IFF MK 10A system is described in STANAG 4193.

Interrogation and reply signal formats are essentially the same as those for IFF MK 10 (SIF) and the two systems are, in principle, compatible.

The IFF MK 10A system provides extended Mode and Code capability as follows:-

Mode 1	- 32 Codes
Mode 2	- 4096 Codes
Mode 3/A	- 4096 Codes
Mode C	- Altitude reporting codes

Notes:

(1) For national purposes, some transponders have a capability of 4096 reply codes on Mode 1.

(2) The designation Mode 3/A is used since IFF Mode 3 is compatible with SSR Mode A.

1.2.3 IFF MK 12

The IFF MK 12 system is described in STANAG 4193.

The IFF MK 12 system is compatible with IFF MK 10A systems. It provides a further Mode and Code capability using separate cryptographic equipment, to give a total capability as follows:

Mode 1	- 32 Codes
Mode 2	- 4096 Codes
Mode 3/A	- 4096 Codes
Mode 4	- Cryptographic Codes
Mode C	- Altitude reporting Codes

1.2.4 Secondary Surveillance Radar

The civil Secondary Surveillance Radar (SSR) system is described in ICAO Annex 10 and is used for Air Traffic Control (ATC) purposes.

The system employs signal formats similar to those for IFF, and provides the defined civil Modes A, B, C and D.

The SSR Mode C facility may or may not be included in military equipments.

ICAO has also made provision for a further Mode, designated Mode S, which is intended for future use in the next generation of ATC systems.

1.2.5 Reduced Facility Systems

When special purpose equipments are provided that omit certain facilities, the facilities that are incorporated are required to meet the relevant requirements of the appropriate document. The operational use of these special purpose equipments shall not degrade the performance of other IFF equipment.

1.3 General System Operation

1.3.1 Principle of Operation

The IFF MK 10A, MK 12 and SSR systems are challenge/reply systems designed to assist in the rapid and positive identification of the friendly status of an aircraft, ship or other platform.

The challenge is generated by an interrogator system which transmits an interrogation in the form of pulse coded D Band RF signals to targets for which identification is required.

A transponder system installed in a target receives the interrogation and replies with another pulse coded D Band RF signal. Replies received by the interrogator are assessed for validity in order to determined the status of the target.

1.3.2 Association with Primary Sensors

IFF interrogators are intended to function in close association with primary sensors. In principle, IFF/SSR is a system for identification of radar detected targets, but other compatible sensors may be employed.

The IFF system itself provides the identification of friendly platforms, and enemy vehicles are determined, by implication, as being those targets detected by the primary sensor, but not identified by the IFF as friendly.

The IFF/SSR system and the primary system are harmonised in respect of the coverage provided and the capabilities for processing and display of the target information.

1.3.3 Self Interference

IFF/SSR is a multi-user and multi-access system and, as such, can be subject to interference generated by the system itself.

Such factors as reply garbling, fruit, over-interrogation and multipath propagation may impair overall system operation, and these factors must be taken into consideration when assessing the system capability.

1.3.4 Interrogation Sidelobe Suppression

Practical realisation of directional antennas will inevitably produce some undesirable sidelobe radiation, and the Interrogation Sidelobe Suppression (ISLS) technique is employed to suppress transponder replies to sidelobe signals and so reduce system self interference.

1.3.5 Mutual External Suppression

When IFF equipment is co-located with other systems that operate on the same frequency band, a suppression bus may be required to provide mutual suppression facilities whereby inter-system interference can be minimised.

1.3.6 Compatibility with SSR

Secondary Surveillance Radar (SSR) for Air Traffic Control (ATC) purposes is described in ICAO Annex 10. The IFF and SSR systems operate on the same basic principles and share certain features for which compatibility is required.

1.3.6.1 Mode 3/A

The IFF interrogation Mode 3 is compatible in operation with the SSR interrogation Mode A and the designation Mode 3/A is used to indicate the common Mode.

1.3.6.2 Mode C

The SSR Mode C is employed for automatic altitude reporting. When aircraft flight-level data are needed as an operational requirement, the IFF equipment provides Mode C facilities that comply with the appropriate provisions of ICAO Annex 10.

1.3.6.3 Mode S

Mode S is the ICAO designation assigned to the next generation ATC system for world-wide use. It is a selective address system that provides for ground based netted stations, and a data link capability.

1.3.7 Transponder System

A transponder system is installed in an aircraft, ship or other military platform for which identification of status is required.

The transponder responds to valid interrogation signals, received from an interrogator system, with coded replies which are dependent on the mode of operation.

The transponder system comprises a transponder, associated control facilities and an antenna system. The control facilities are sometimes incorporated into the transponder to form an integrated panel mounted unit.

In some installations, elements of the system are duplicated in order to improve operational availability of the system: for example, the dual antenna/diversity technique applied to airborne transponders, and the use of dual redundant transponders common in shipborne installations.

1.3.8 Interrogator Sub-Systems

Additional sub-systems are normally employed with the IFF interrogator to assist in the processing of target responses and determination of target position. Such systems include Defruiters, Evaluators and Plot Extractors, and consideration must be given to the performance of all the elements of an IFF facility when assessing overall system operation.

1.4 Purpose of Guide

The purpose of this guide is to describe methods and parameters of data collection together with guidance for the completion of data sheets necessary for the input to MISPEC (IFF) procedures for Stages 1, 2 and 3.

Each platform of a prospective operational "pair" will have a data sheet containing all information relevant to that platform. In turn those data sheets will be completed from information gathered by various authorities and collection agencies.

As a practical method of data collection, forms are provided to each agency to cover only that information for which they are responsible. This will provide for speedy collection, protection of information and updating where necessary. In some cases many forms must be completed (eg for equipment parameters) whereas in other cases, one form only will be provided.

Three forms will be transmitted via national data banks to NATO, SHAPE Technical Centre. Others will be held nationally.

The aim of this guide is to provide a recommended method and description of data collection, of each stage of collection, in order to establish common practices within NATO for the provision of MISPEC (IFF) reports.

Section 2

Data to be Collected

Section 2 General Information of Data to be Collected

IFF, like other communications systems, requires data from equipment installed on its host platforms. This is necessary to establish knowledge of the full operating performance of each half of the system. For IFF particularly, the interrogator system is designed or 'tailored' to its host platform and, therefore, the interrogating system in this guide is treated as an integral part of that host platform.

The transponder, however, is the constant element of the system conforming as it does to the appropriate NATO Standardisation Agreement (STANAG). Platform conditions are unlikely to create wide variations to transponder type although the characteristics will vary from one manufactured type to another. Data reporting for the transponder is conducted separately from its host platform. In this way, the many vehicles carrying the same transponder will not demand individual assessment of the transponder itself even though they will each require data on the individual platform installation.

In each case, whether it is for equipment or platform, the tolerances in service will vary at least over the allowable tolerances and in some cases to a greater extent. The data are therefore reported, where applicable, such that the discovered variables and averages can be used for the computation process. Data on defective equipment should not be included, unless degraded equipment remains in service. For instance, built-in test will often permit equipment below specification minima to remain in service. "Real" data should therefore be used.

In every case the use of actual data is extremely important. to use "minimum performance". characteristics as "nominal" may give an unnecessarily pessimistic prediction of performance. To use the mid-tolerance point may be equally misleading as pessimistic or optimistic depending on the direction of error. Equally, if equipment in service is below specification limits, the "real" data is particularly important.

For system reliability information, it is often important to establish the mode of failure.

For example, if one particular antenna (of two) on an aircraft is prone to failure, the Stage 2 MISPEC may compute the effect of that particular failure and its overall effect on the Probability of Identification.

For new equipment, assessments of performance will be necessary for first predictions or, as a means to determine allowable characteristics. However, with established systems and equipments, the use of experienced service data is paramount.

Section 3

Interrogator System Data Collection

Section 3 Interrogator System, Collection of Performance Data

3.1 General

Section 3 describes the rationale and requirements for interrogator system information required for the MISPEC (IFF) computation. Information falls into two categories, General Information and Performance Characteristics.

3.1.1 General Information

The general information will be readily available to the Technical Authority from service documents. It will describe the use of the interrogator system together with certain weapon information where that information may be pertinent to the MISPEC (IFF) procedure.

3.1.2 Performance Characteristics

The data completed in this section will be largely measured, but where such measurements are not possible, published data may be used. However, the importance of achieving "real" data cannot be overstressed and every endeavour should be made to conduct measurements on as many samples as possible.

Section 3.2

Interrogator System General Information

3.2 System General Information

Completion of this technical information will be the responsibility of the technical authority and may be obtained from technical documentation and specifications.

3.2.1 Type of Interrogation (Protocol)

(eg, Surveillance, target interrogation each scan, Operator Control etc.)

This item is provided on the data sheet in order that the "reasoning" behind IFF interrogation should be known. Examples are given as follows:

Surveillance	Where IFF operation is continuous
Target Interrogation	Where IFF is initiated as a result of primary detection of target. That target may be determined on every scan or, for more sophisticated systems with target memory, that target may be interrogated on one scan only.
Operator Control	Where IFF challenge is initiated by the operator.

(These examples are not exhaustive.)

3.2.1.1 PRF Characteristics

Data associated with the PRF control is to be entered in this section.

eg Fixed PRF at xxx per second
Staggered PRF etc.

3.2.2 Transmitter Power Control (if applicable)

Where systems are equipped with control of power for range adjustment, the method and levels should be stated.

3.2.3 Track Memory Capability

Certain systems are provided with track memory such that a target once identified as friendly will remain so for the duration of the track history. Where such systems are employed, details should be provided.

3.2.4 Scan Characteristics

Many systems employ methods for a reduction of the "area of interest". This may have considerable influence on the environment and therefore, details should be given.

3.2.5 Antenna Mounting Height above Ground or Sea (in metres)

This will permit calculation of the multipath effect on propagation, in association with target heights and range.

3.2.6 Modes of Operation

This information will be readily available from supporting documentation, but in addition to stating the modes themselves, an indication should be given of the total capability For example, the system may have a capability for a single mode of operation which may be selected in service, by the operator, from say Mode 1, Mode 3 or Mode 4. Equally a system may have an interlace capability changed every interrogation or every antenna rotation. The overall and the specific operational capability should be stated.

3.2.7 Decoding Capability

As with modes of operation, specific decoding capability is required and general information should be provided along the following lines, for example:

3.2.7.1 Passive Decoding recognising wanted code only

3.2.7.2 Mode 1 Decoding. Two digit decoding (32 Codes) but requiring C and D digits at zero.

3.2.7.3 Mode 2 Decoding. Four digit decoding (4096 Codes).

3.2.7.4 Mode 3A Decoding. Four digit decoding (4096 Codes).

3.2.7.5 Mode 4 Full Crypto facilities.

3.2.8 Code Validity Overlap Period (CVO)

When both the old code and the new code are valid and recognised. For example: CVO capability on this system to provide plus and minus x minutes overlap on the required code change, Modes 1 and 3.

3.2.9 Reply Evaluation Criteria

For example: Four valid 'friend' replies are required from a maximum of six interrogations for friend recognition in MK 10A.

For example: Reply evaluation using evaluator Algorithm xxx is utilized in Mode 4.

3.2.10 Azimuth Determination of Target

eg a) RSLS (artificially sharpened beam)

b) Monopulse

c) Sliding Window etc.

3.2.11 External Suppression Effects

For those systems coupled to other equipments, or to mutual suppression systems, data should be completed - (such systems are more likely to be applicable to airborne or shipborne interrogators).

eg a) Type of integrated system

b) Suppression periods

c) Protocol etc.

3.2.12 Swept Gain - Initial Depression and Recovery

Many systems employ swept gain (GTC) to improve the system dynamic range. The levels used should be stated, together with the recovery law.

3.2.13 System Reliability

Each nation and service authority has its own definition and equation for reliability. MISPEC calculations assess the probability of failure during interoperation of the platform pair, of which this subject interrogator is one half. The input data for the interrogator will be derived from the mean time between failures (MTBF) expressed in hours where that time is appropriate to operational deployment.

Where MTBF is normally expressed in total running hours, the reliability data should use that figure multiplied by the factor of running hours to operationally deployed hours.

Interrogator System Performance Data Sheet

CLASSIFY ACCORDING TO CONTENT

MISPEC (IFF) ASSESSMENT
INTERROGATOR SYSTEM TECHNICAL INFORMATION

GENERAL INFORMATION

(a) Host Platform (eg Ship, Shorad)	
(b) Interrogator Type	
(c) Country of Origin/Manufacturer	
(d) Type of Interrogation (Protocol) (eg Surveillance, target, interrogation each scan, operator control, number of interrogations, PRF rate and control)	
(e) Transmitter Power Control (if applicable)	
(f) Track Memory Capability (if applicable)	
(g) Scan Characteristics (Sector etc)	
(h) Antenna Height above ground or sea(metres)	
(i) Modes of Operation	
(j) Decoding Capability	
(k) Code Validity Overlap Facility	
(l) Reply Evaluation Criteria	
(m) Azimuth Determination Method	
(o) External Suppression Effects	
(p) Swept Gain Initial Depression/recovery	
(q) System Reliability (running hours)	

REMARKS - Note special features and/or STANAG deviation. Additional sheets may be attached but they are to contain form and reference numbers. Total sheets are to be noted.

Originator ______________________________

Date ...... Sheet 1 of ... sheets

Form No MIS 11a/2

Reference No ....

CLASSIFY ACCORDING TO CONTENT

Section 3.3

Interrogator System Measured Performance Characteristics

3.3 Measured Performance Characteristics

In gathering data for completion of performance characteristics, it is essential that as large a sample as possible is used. It is suggested that (with the possible exception of antenna radiation data), such a sample should be not less than six equipments.

3.3.1 Transmitter Power Output (P1 and P3)

Transmitter power (as measured at the equipment antenna terminal) for each equipment examined should be noted on the appropriate data collection sheet. Power should be described in terms of decibels above 1 watt (dBW). Where test systems provide data of power in terms of "watts", the figures may be tranposed using the following formula.

10 x log P dBW

where P = Power in Watts

3.3.2 Interrogator Receiver Sensitivity

Receiver sensitivity should be defined for 95 per cent decode capability (as measured at the interrogator unit antenna connector) in response to signals in terms of decibels below 1 milliwatt (-dBm). Where figures are described in other units they may be transferred as follows.

a) -dBW = -dBm + 30

eg -80 dBW = -50 dBm

(1 milliwatt is 30 dB below 1 watt)

b) -dBm = -dBv -13

eg -63 dBv = -50 dBm

Receiver sensitivity for each equipment examined should be noted on the appropriate data collection sheet.

3.3.3 Feeder Loss (L_T)

Unless included in antenna performance, the feeder loss data should be derived from service samples and recorded on the appropriate data sheet for each sample examined.

3.3.4 Interrogator System Antenna Performance

3.3.4.1 Azimuth Gain

Antenna radiation patterns showing azimuth performance, of the installed platform, should be appended to the overall data sheet. These patterns should include P1/P3 and P2 transmit and the receive performances. Where the radiation pattern is substantially different at different angles around the host platform, separate sheets should be provided. Ideally such patterns should describe the full 360° around the host platform with levels shown at elevation "peak of beam".

In the absence of radiation patterns, data for both gain and scan loss should be entered on to the performance data sheet.

3.3.4.2 Sidelobe Level

The peak sidelobe level should be stated as amplitude relative to the main beam maximum.

3.3.4.2 Elevation Gain

Antenna patterns showing elevation performance of the installed platform should be appended to the interrogator performance data sheet. Where the radiation pattern is substantialy different at different angles around the host platform, separate sheets should be provided. Ideally the sheets should describe the performance around the full 360° of the platform with elevation gain data between points 10dB down on peak. In the absence of any radiation patterns, the half power beamwidths and elevation angle of peak should be given. Any ability of the platform operator to alter the angle of peak should be stated, complete with the permitted circumstances.

3.3.5 Completion of Data Sheets

Attachment 1 at the end of this section contains sample sheets suggested for data collection of General Information and Performance characteristics. When completed with data and details of origination, the sheets should be despatched to the national IFF data collection agency for use in completing MISPEC platform information.

Interrogator System

Measured Performance Data Sheet

CLASSIFY ACCORDING TO CONTENT

MISPEC (IFF) ASSESSMENT

INTERROGATOR PERFORMANCE INFORMATION

Platform/Interrogator designation	
Interrogator Manufacturer/Country	
Interrogator serial number	
PERFORMANCE DATA	
(a) Transmitter output power	
(b) Receiver sensitivity for 95% decode (dBm)	
(c) Feeder loss (dB)	
*(d) Antenna Gain (dBi)	
*(e) Antenna beamwidth (Transmit) (Degrees) (measured at the 3dB points)	
*(f) Antenna beamwidth (Receive) (Degrees) (measured at the 3dB points)	
*(g) First sidelobe level (dB)	
*(h) Elevation beamwidth (degrees) (measured at 3dB points)	

REMARKS

(i) * Full patterns should be provided and only when not available should these sections be completed.
(ii) Note special features and/or STANAG deviation
(iii) Additional information sheets may be attached. Total sheets are to be noted on this front sheet and each sheet must contain the Form and reference numbers.

DATE ______________________

ORIGINATOR ______________________

____

Sheet 1 of ... sheets

Form MIS 11b/2 Reference.......

CLASSIFY ACCORDING TO CONTENT

Section 3.4

Weapon System Data Input

3.4 MISPEC IFF Data Input Sheet

Interrogator/Weapon System - General and Technical Information

3.4.1 Integrated Interrogator Systems - General Information

Completion of general information will be the responsibility of the operating authority. The completed data sheet despatched via the National Data bank will be retained in the NATO IFF library at SHAPE Technical Centre (STC). To assure correct allocation of data, particularly of systems used in different countries similar in general nomenclature but with alternative equipment types, it is essential to fully complete this general data. The technical and performance data will be extracted from the data sheets detailed in Sections 3.2. and 3.3.

3.4.1.1 Host Platform

eg, Rapier Short Range Air Defence Weapon, Air Defence Radar Site, Civil Aviation SSR site.

3.4.1.2 Interrogator Type

ie Type designation

3.4.1.3 Country of Origin

(of the interrogator system)

3.4.1.4 Manufacturer

(of the interrogator system)

3.4.1.5 Users

eg, US Army, RAF, Netherlands, Navy

3.4.1.6 Primary Sensor Detection Range

ie. The maximum detection range of the primary sensor. This would normally be the maximum range of required IFF. If this is not so, the maximum required IFF range should be so stated.

3.4.1.7 Weapon Performance (if applicable)

This would normally be the range at which identification of friend/foe must have been achieved. Failure to achieve friend identification at greater ranges may occupy the weapon needlessly, but would not put the target at risk. Failure to achieve identification at ranges closer than maximum firing range will put the target at risk. The three criteria of maximum optimum and minimum ranges, together with height, will provide "envelope" information to the MISPEC.

3.4.1.8 Weapon Height Bands

This section is to be completed to indicate the 'coverage' of the weapon. MISPEC calculations are conducted over all relative corresponding angles relevant to the system. The operational height bands are important in reducing unncessary computation.

3.4.1.9 Code Changing Capability versus time

From exercise data, this information will indicate the probability of the operator changing the required codes at the specified times. It may be provided in tabular form showing percentage of correctly set codes as time progresses.

3.4.2 Completion of General Data Sheet (Interrogator System)

From submitted data sheets of general information, and sufficient samples of performance sheets, the general data sheet should be completed. Where applicable, the mean and deviation should be calculated using the following formulas:

Mean = $\dfrac{\text{Sum of All Data Input}}{\text{Number of Samples}}$

Deviation =

$$\frac{\text{Sums of each Data input}^2 - \text{Mean}^2}{\text{Number of Samples}}$$

$$= \frac{D_1^2 + D_2^2 \cdot \cdot \cdot + D_n^2 - \text{Mean}^2}{n}$$

Interrogator and Weapon

General and Technical Information

MISPEC (IFF) ASSESSMENT
INTERROGATOR AND WEAPON
GENERAL AND TECHNICAL INFORMATION

1. GENERAL INFORMATION		
(a) Host Platform (eg Ship, Shored)		
(b) Interrogator Type		
(c) Country of Origin/Manufacturer		
(e) Users		
(f) Primary Sensor Detection Range		
(g) Weapon Performance(if applicable)	Range	Height
Maximum performance		
Optimum performance		
Minimum performance		
(h) Code Changing Capability with Time		
(i) Type of Interrogation (Protocol) (eg Surveillance, target, interrogation each scan, operator control, number of interrogations, PRF rate and control)		
(j) Transmitter Power Control (if applicable)		
(k) Track Memory Capability (if applicable)		
(l) Scan Characteristics (Sector etc)		
(m) Antenna Height above surface (metres)		
(n) Modes of Operation		
(p) Decoding Capability		
(q) Code Validity Overlap Facility		
(r) Reply Evaluation Criteria		
(s) Azimuth Determination Method		
(t) External Suppression Effects		
(u) Swept Gain Initial Depression/recovery		
(v) System Reliability (running Hours)		

2. PERFORMANCE	Mean	Deviation	No of Samples
(a) Transmitter output Power (dBW)			
(b) Receiver sensitivity (95% decode)(dBm)			
(c) Feeder loss (dB)			
*(d) Antenna Gain (dBi)			
*(e) Antenna beamwidth - Transmit (Degrees) (measured at 3dB points)			
*(f) Antenna beamwidth - Receive (Degrees) (measured at 3dB points)			
*(g) First sidelobe level (dB)			
*(h) Elevation beamwidth (Degrees) (measured at 3dB points)			
*(j) SLS Characteristics			

* Full patterns should be provided and only when not available should these sections be completed. All attachments are to contain form and reference numbers. Total sheets are to be noted.

Originator ______________________ Date ...... Sheet 1 of ... sheets

Form MIS 11/2 Reference.........

Section 4

Transponder Data Collection

Section 4 Transponder Data Collection

4.1 General

Completion of this general data will be undertaken by the engineering authority responsible in each nation or operating service. The completed document will be passed to the national or service data bank. Data should be completed as follows and on the appropriate sheet.

4.1.1 Transponder Type

This may include service designation, manufacturer's part number and generic title.

4.1.2 Country of Origin

As certain transponders may be manufactured in different countries, this section should be completed by all users.

4.1.3 Manufacturer

As with Country of Origin, equipment manufacture may be undertaken by different contractors and, where known, should be noted as appropriate.

4.1.4 Users

eg USN, USAF, Netherlands Navy etc

4.1.5 Aircraft or Ship Type

eg Phantom F4E, Tornado FRG, Mirage, Type 42 Frigate etc.

4.1.6 Transponder Technical Information

4.1.6.1 Number of Receiver Channels (single channel or dual channel)

4.1.6.2 Modes of Operation, eg 1, 2, 3, C and 4

Reply Code Capability, eg Mode	1	32 Codes
	2, 3A	4096 Codes
	C	Full Coding
	4	Full Coding

4.1.6.3 <u>System Reliability</u>

Each nation and service authority has its own definition and equation for reliability. MISPEC calculations assess the probability of failure during interoperation of the platform pair of which the transponder target is one half. The input data for the transponder will be derived from the mean time between failures (MTBF) expressed in hours where that time is appropriate to operational deployment or mission time.

Where MTBF is normally expressed in total running or flying hours, the reliability data should use that figure multiplied by the factor of running hours to operationally deployed or mission hours.

It is important that details are provided to indicate modes of failure in the IFF and its platform. For example, the lower antenna in aircraft XYZ is prone to failure due to excessive vibration, probability of failure 1%.

It is also important to note malfunctions which may be normally undetected. For example, BITE would accept transponder power of 21dBw, whereas the minimum acceptable performance by test equipment would be 24dBw. Real data, even if below performance criteria, is therefore important.

Transponder Performance Data

General and Technical Information Data Sheet

CLASSIFY ACCORDING TO CONTENT

MISPEC (IFF) ASSESSMENT

TRANSPONDER GENERAL & TECHNICAL INFORMATION

GENERAL INFORMATION

(a) Transponder Type	
(b) Country of Origin	
(c) Manufacturer	
(d) User	
(e) Aircraft or Ship Types	

TECHNICAL INFORMATION

(a) Number of Receiver Channels	
(b) Modes of Operation	
(c) Reply Code Capability	
(d) Equipment reliability (Flying hours)	

DATE ______________________

ORIGINATOR ______________________

Sheet 1 of ... sheets

Form No MIS 9/1a Reference No ....

CLASSIFY ACCORDING TO CONTENT

Section 4.2

Transponder Measured Performance Data

4.2 Transponder Measured Performance Data

4.2.1 General

The following characteristics are those obtained by measurement.

4.2.1.1 Receiver and Decoding Characteristics

The most fundamental of all transponder characteristics is the receiver sensitivity. This is expressed in terms of decoding capability and reply rate. By virtue of equipment design and the characteristics described in STANAG documents, the equipment will vary its capability to suit the number of interrogations it receives in order to provide suitable reply coding. The actual performance in service will therefore depend on the environment in which the equipment is operating and it is essential therefore, that the MISPEC recognise these changes in performance.

The Uplink characteristics will describe these changes at varying signal levels for interrogation and for interference.

4.2.1.2 Reply Power

This characteristic will describe the Downlink response signal levels.

4.2.1.3 Other Data

The system in operation will be influenced by a number of external effects. However, with the general exception of equipment reliability these influences will be aircraft or ship platform dependent.

4.2.2 Transponder Performance Data (measured)

Note: For measured data, a separate data report sheet will be provided for each equipment.

4.2.2.1 Transmitter Power Output

Transmitter power in terms of decibels above 1 watt (dBW) should be utilized in the data equations. If given in terms of 'watts', transfer of terms is given in the following formula.

$$10 \times \log P \text{ (dBW)}$$

where P = Power in watts

4.2.2.2 Typical Receiver Sensitivity (MTL)

Receiver sensitivity is given in terms of minimum triggering level for 90 per cent replies. This point is given for ease of reference only and should not be considered an indication of total system capability. The transponder is designed to adjust its sensitivity to the environment and the data are recorded at different levels to simulate scenario changes.

The maximum sensitivity is determined at low interrogation rates. A figure of 400 interrogations per second has been arbitrarily chosen as a 'low' rate and a level selected by test equipment manufacturers for flight line test sets. The test level may however, be varied over the range 150 to 900 interrogations per second.

Sensitivity levels are normally described in terms of decibels below one milliwatt (-dBm). However, this term may be converted from decibels below one watt (-dBW) by decreasing the number by 30.

For example -50 dBm = -80 dBW.

Likewise, data in terms of decibels below one volt (-dBv) may be converted by decreasing the number by 13.

For example, -63dBv = -50dBm.

4.2.2.3 Reduction of Sensitivity

Transponders are designed to reduce sensitivity as a means of controlling the transmitter reply rate. In normal operation, incoming signals are received at RF levels determined by interrogator power output and range. Signal levels from different interrogators at different ranges, will be at different levels. The transponder, by reducing sensitivity, will reject weaker signals thereby giving preference to the stronger. In order to test this condition it is necessary to simulate both the environment and the individual interrogator. A test set interconnection diagram is suggested in Figure 1. In this figure, test set 1 simulates the environment by setting the 'general' interrogation level at -50 dBm at a variable PRF.

Test Set 2 simulates the individual interrogator by fixing the interrogation rate at, for example, 400 Hz and by variation of the RF level is able to determine the effective sensitivity associated with the total interrogation environment (PRF Test Set 1 plus PRF Test Set 2).

As this test condition is not that used for 'normal sensitivity' examination, insertion losses incurred with the microwave coupling devices must be taken into account. It is suggested that with Test Set 1 set to zero PRF, 'normal sensitivity' is again determined to provide correlation with tests in paragraph 4.2.2.2 by establishing insertion loss adjustment for tests completed in this paragraph.

The characteristics may each be determined with this method at total interrogation rates of:

4.2.2.3.1	PRF 1 + PRF 2 = 1500 per sec
4.2.2.3.2	PRF 1 + PRF 2 = 3000 per sec
4.2.2.3.3	PRF 1 + PRF 2 = 5000 per sec

4.2.2.4 ECCM Capability

As with receiver sensitivity adjustment, the environment within which a transponder operates will be greatly affected by the level of interference. Electronic counter measures are intended to produce, within the environment, levels of interference that will significantly reduce the ability of a system to fulfil its task. The effect of interference on a transponder is to effectively reduce receiver sensitivity such that operational ranges are reduced. The ECCM capability of a transponder is described in terms of Signal to Jam (S/J) ratio. That is, the level of signal required to effectively overcome interference. The S/J ratio is simply determined from Signal level (S) required to overcome the interfering signals (J). The level is given as S - J (dB) for 50 per cent replies.

The S/J ratio or capability of a transponder is not a fixed figure but may vary over its dynamic range such that, for example, the signal difference necessary to overcome interference at long range may be greater than that required at short range, where both wanted and unwanted levels are stronger. In order to determine the full response, tests are required at various points throughout the transponder dynamic range. For convenience, these tests are conducted at 10dB intervals.

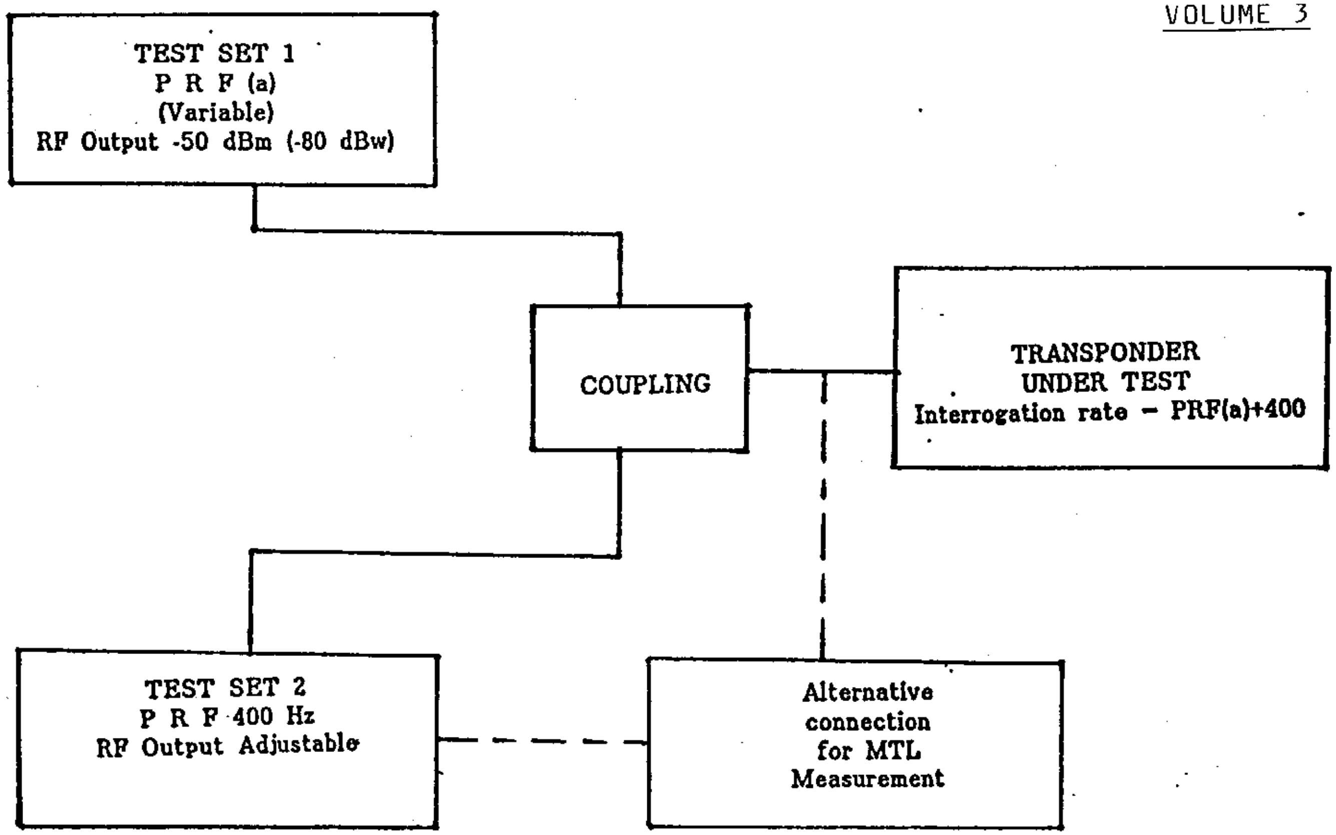
A test interconnection is shown in Figure 2. Using this method, performance measurements for determination of S/J ratio are conducted at the following levels.

4.2.2.4.1	-60 dBm interference level
4.2.2.4.2	-30 dBm signal level
4.2.2.4.3	-40 dBm signal level
4.2.2.4.4	-50 dBm signal level
4.2.2.4.5	-60 dBm signal level
4.2.2.4.6	-70 dBm signal level

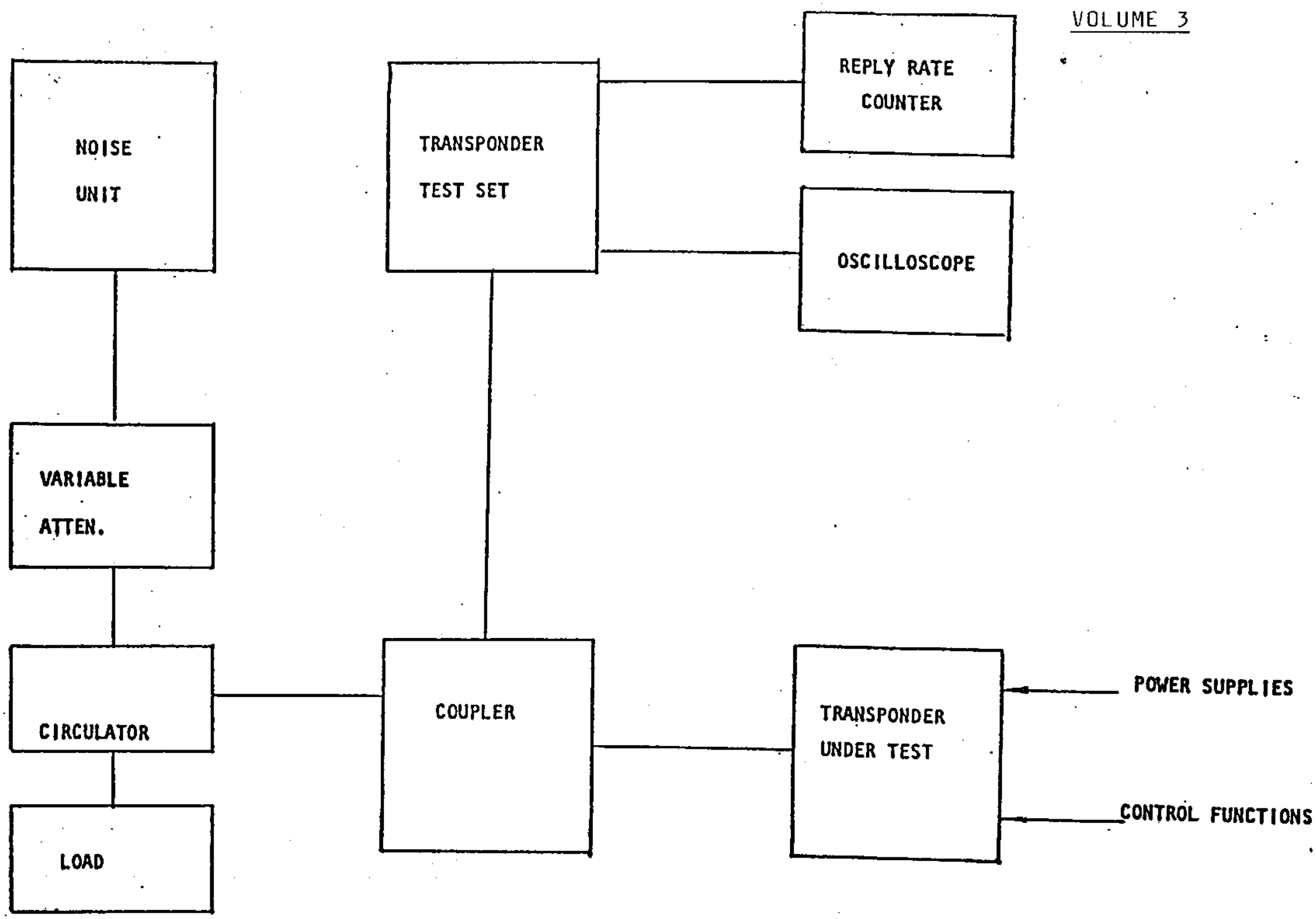
In each case the result is described in terms of difference between interfering signal and the wanted signal, eg with the interference signal less than the wanted signal, the S/J ratio is described as - dB (minus).

4.2.2.5 Completion of Data Sheets

A data sheet, shown at the end of this section, is provided for collection of transponder performance data. The sheet when completed should be annotated showing data origination and should include affiliation of the authority conducting the tests. The form is to be passed to the national IFF data bank.



TEST CONFIGURATION FOR RECEIVER SENSITIVITY MEASUREMENTS



TEST CONFIGURATION FOR INTERFERENCE
AND S/J MEASUREMENTS

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Transponder Performance Data Sheet

CLASSIFY ACCORDING TO CONTENT

MISPEC (IFF) ASSESSMENT

TRANSPONDER MEASURED PERFORMANCE DATA

Transponder Type		
Manufacturer		
Country of Origin		
Serial Number		
PERFORMANCE		
(a)	Transmitter Power (dBW)	
(b)	Receiver Sensitivity (90% Replies (dBm)) 400 Interrogations per second	
	1500 Interrogations per second	
	3000 Interrogations per second	
	5000 Interrogations per second	
(c)	S/J at -60dBm Interference 50% Replies (dB)	
(d)	False Reply rate at -60dBm Interference (no signal) (per sec)	
(e)	S/J (50% Replies)(dB)	
	-30dBm Signal level	
	-40dBm Signal level	
	-50dBm Signal level	
	-60dBm Signal level	
	-70dBm Signal level	

(Receiver checks in para (b) to (e) should be conducted on both channels where appropriate.)

REMARKS - Note special features and/or Stanag deviation.

(Additional information sheets may be attached but each sheet must contain the form and reference numbers. Total sheets are to be noted on this front sheet.)

DATE ____________________

ORIGINATOR ____________________ Sheet 1 of ... sheets

____________________ FORM No 9/ b Reference No ......

CLASSIFY ACCORDING TO CONTENT

Transponder General Data Completion

4.3 Completion of General Data Sheet (Transponder)

From submitted data sheets of general information and sufficient samples of performance sheets, the general data sheet should be completed and despatched to national and NATO data banks.

Where applicable, the mean and deviation should be calculated using the following formulas:

$$\text{Mean} = \frac{\text{Sum of all Data Input}}{\text{Number of Samples}}$$

$$\text{Deviation} = \frac{\text{Sums of each Data input}^2}{\text{Number of Samples}} - \text{Mean}^2$$

$$= \frac{D_1^2 + D_-^{\;2} \cdots + D_n^2}{n} - \text{Mean}^2$$

Transponder General and Performance Data Sheet

CLASSIFY ACCORDING TO CONTENT

MISPEC (IFF) ASSESSMENT

TRANSPONDER GENERAL AND TECHNICAL INFORMATION

1 **GENERAL INFORMATION**

(a) Transponder Type	
(b) Country of Origin	
(c) Manufacturer	
(d) User	
(e) Aircraft or Ship Types	
(f) Number of Receiver Channels	
(g) Modes of Operation	
(h) Reply Code Capability	
(j) Equipment Reliability (Flying Hours)	

2 **PERFORMANCE**

	Mean	Deviation	No of Samples
(a) Transmitter Power (dBw)			
(b) Receiver Sensitivity (400 ips) 90% Replies (dBm)			
(c) Receiver Sensitivity (90% Replies)(dBm)			
1500 interrogations per second			
3000 interrogations per second			
5000 interrogations per second			
(d) S/J at -60dBm Interference 50% Replies (dB)			
(e) False Reply rate at -60dBm Interference (no signal) (per sec)			
(f) S/J (50% Replies)(dB)			
-30dBm Signal level			
-40dBm Signal level			
-50dBm Signal level			
-60dBm Signal level			
-70dBm Signal level			

REMARKS - Note special features and/or Stanag deviation.Additional information sheets may be attached but they are to contain the form and reference numbers. Total sheets are to be noted on this front sheet.

ORIGINATOR ______________________ DATE ______________ Sheet 1 of ... sheets

____

____

Form MIS 9/2 Ref......

Section 5

Transponder Platform Measured Data

Section 5 Transponder Host Platform Data (Aircraft or Ship)

5.1 Host Platform Data - General

Completion of the general data will be undertaken in the first instance, by the engineering authority responsible for the platform type. Following completion of the appropriate form by the technical authorities, the completed data package will be passed via national or service data bank to the NATO IFF library at SHAPE Technical Centre (STC). Data should be completed as follows.

5.1.1 Designation

Such designation will include aircraft type or title or ship name.

5.1.2 Role

This description is more applicable to aircraft which should describe its primary duties, ie Air Defence, Ground Attack, Interdiction/Strike, Maritime reconnaisance etc.

5.1.3 Weapons Configuration - External Stores

The external configuration of the host vehicle, particularly an aircraft, greatly affects the propagation of the transponder antenna system. Descriptions, diagrams and sketches provide the most useful data, but in the absence of such formal information, technical narrative will serve a useful purpose. Of particular interest will be position of stores on the aircraft and the size of such material.

Several and alternative configurations may be described.

5.1.4 Transponder Type

This data should include the generic equipment type and if modified for this particular installation, should so state.

5.1.5 Antenna Types

Of particular interest is the style of antenna - for example flush mounted. However, the manufacturer's type and number will enable more definitive information to be obtained.

5.1.6 Antenna Selection Method

There are two fundamental methods of antenna selection, by lobing switch or space diversity. However, in addition to these methods, other variations are possible including single antenna without selection and the use of shared antennas with, for example, VHF Communications systems via microwave matching devices.

5.1.7 Code Changing

A number of possibilities exist for code changing, particularly in MK 10A. The variations may range from manual or crew alert to fully automatic code changing facilities. Alert facilities may be audio or visual. The method of timely code changing is a fundamental input to interoperability determination.

5.1.8 Code Changing Capability with Time

This data is required as a measure of timely code changing. Such data are derived in operational exercise and care should be exercised in detailing such results. The data may be provided with the number of correctly set codes tabulated against time.

5.1.9 IFF System MTBF

System MTBF will be related to mission reliability in association with the interrogator and transponder MTBFs collected during MISPEC (IFF) data collation.

5.1.10 Typical Mission Duration

This data is required for the assessment of mission success based solely on IFF reliability. The duration should be stated in terms of flying hours or, in the case of a ship, operating hours.

5.1.11 Mutual Suppression

Many systems supply mutual suppression interfaces to avoid interference from one system to another. Installations incorporating such suppression interconnection should be recorded on data sheets with particular emphasis placed upon any system suppressing the transponder from normal operation. For example, the TACAN system may be interconnected such that the TACAN will be suppressed on IFF transmissions, but it may also be so connected to suppress the IFF on TACAN transmissions. The data sheets should be completed with full description.

5.1.12 Antenna Performance

The antenna performance of the host vehicle is the most fundamental of all information pertaining to interoperability performance. The installed antenna performance has an exceptionally large influence as, for example, gain may vary between perhaps +4 dBi and -20 dBi. Given antenna installation details and the aircraft construction general data, the antenna performance may be determined with reasonable accuracy. However, changes to the outside of the aircraft will themselves vary the performance and it is therefore important to provide not only the base data, but also stores configurations for the subject platform.

Ships installations are also complicated due to the proximity of superstructure and the closeness to the antennas of other devices. Care in the provision of data is essential.

In collecting antenna performance, various methods are possible.

a) Full scale models

This is the most accurate method of performance prediction, but for the most part cannot be undertaken for practical reasons of size and range requirement.

b) Reduced scale models

This is an accurate method of performance prediction and is usually conducted during vehicle design and development. However, changes to configuration and stores often reduces the value of original data and further examination is necessary.

c) Computer modelling "Geometric theory of Defraction" (GTD)

This provides accurate performance information but, because of complexity, cost and timescale is considerable.

d) Computer modelling using "Simple Mathematical Modelling" (SM^2)

This provides slightly reduced accuracy of results when compared to GTD but is a recommended method where full or reduced scale modelling is not available.

e) Flight Trials

This method is expensive and does not provide sufficent accuracy and number of data points. Flight trials for systems proving is essential, but its use for data collection in this respect is not recommended.

Whichever method of determination is employed, it is essential that accurate and representative data is achieved.

For both shipborne and airborne transponder systems, the platform antenna gain should be expressed as polar gain plots (in dBi) in both azimuth and elevation. The azimuth and elevation steps should ensure that linear interpolation between steps does not produce errors in excess of 1dB. Separate plots should be provided for each platform stores configuration for which a MISPEC is to be calculated.

For MISPEC calculation, where appropriate to dual antenna installations, plots should be completed for both antenna installations. Where the utilization of each of the dual antenna systems is determined by time sharing or by signal amplitude diversity, a combined plot showing the highest gain achievement should be used in the MISPEC (IFF) calculation for Stage 1.

Section 5.2

Transponder Platform General and Technical Information

CLASSIFY ACCORDING TO CONTENT

MISPEC IFF ASSESSMENT
TRANSPONDER PLATFORM GENERAL INFORMATION

GENERAL INFORMATION

(a) Platform Designation		
(b) Role		
(c) Stores Configurations		
(d) Transponder Type Number and Capability (eg IFF Mark 10, SIF, 10A, 12)		
(e) Antenna Types		
(f) Antenna Selection Method		
(g) Code Changing	Mode 1/3	Mode 4
(i) Manual		
(ii) Auto		
(iii) Audio/Visual Alert		
(h) Code Changing Capability with time		
(j) IFF System MTBF & Mission Duration		
(k) Mutual Suppression effects (further details attached)		

Note: Attachments shall include:

i) Detailed scaled plans of Platform with antenna positions

ii) Installed platform polar diagrams of antenna performance (dBi) together with note on method of obtaining used in measuring those polar diagrams, if known.

(All attachments must include the Form and Reference numbers and the total number of sheets shall be shown on this front sheet.)

DATE ____________________

ORIGINATOR ____________________

____________________ Sheet 1 of ... sheets

Form MIS 10a/2 Reference No ....

CLASSIFY ACCORDING TO CONTENT

5.2 Performance Data

The information obtained in this section should be collected from a representative sample, if to be used as generic information, or measured data for individual installations such as ships. A sample should be as large as possible, but it is suggested that such a sample should be not less than six in order to provide sufficient statistical data.

5.2.1 Transponder System Dynamic Loss

Although the antenna performance has the largest effect on all-around coverage and interoperability, the installation itself has a significant effect. It is important that all coaxial devices, feeders, switches and antennas are carefully measured to provide the necessary data. The most important characteristic in this respect is the dynamic system loss (insertion loss) between the transponder and the antenna. This dynamic system loss will vary from measurement of individual devices because of phasing and VSWR components. As far as is possible, the system loss should be measured without reducing the installation into component parts. The total system loss figure is, therefore, most satisfactorily obtained by a dynamic measurement of the entire system. For a system with antenna probes this is accomplished by:

a) Measurement of performance at the transponder

b) Measurement of performance at the antenna probe.

Insertion loss is therefore: data of a - b + antenna probe coupling.

For systems without such test devices, care should be taken to ensure meaningful test results.

5.2.2 Antenna Switching Units (if fitted) (also known as lobing switches or ASU)

Certain systems include microwave switches for time sharing on each antenna to provide spatial coverage of the host platform. System losses will be experienced in the use of these devices and these have been included under para 5.2.1.

The largest effect of the use of these switches is associated with the evaluation criteria of the associated interrogator platform. In the event that one antenna only is "visible" to the interrogator platform (the condition for which the microwave switches were incorporated), replies are reduced to half. Within the calculation for MISPEC on the platform pair, the timing element of the performance is included. It is necessary to obtain, using a sufficient statistical sample, data related to switching period and mark space ratio. A switch period is defined as the time for a complete cycle: that is the time during which both the upper and the lower antennas have each been selected once. The switch period time unit will be Hertz (hz).

5.2.2.1 The mark/space ratio will be referenced to one (for example 1.1 to 1 or 1.1:1) indicating the first "half" period as greater by 0.1 than the second "half" period.

Transponder Platform Measured Data Sheet

CLASSIFY ACCORDING TO CONTENT

MISPEC (IFF) ASSESSMENT

TRANSPONDER PLATFORM MEASURED DATA

Platform Type and Identification ______________________________

MEASURED DATA

(a) Dynamic system loss transponder to Upper Antenna (dB)	
(b) Dynamic system loss transponder to Lower Antenna (dB)	
(c) Lobing Switch (ASU) - Rate (Hz)	
Mark Space Ratio	

DATE ______________________

ORIGINATOR ______________________

Sheet 1 of ... sheets

Form MIS 10b/2 Reference.......

5.3 Completion of Transponder Platform Data Sheets

Appendix 1 to this section describes a data sheet for collection of transponder host platform information. The sheet, with details of originator and affiliation and note of the total contents of the package, will be despatched via national data banks to SHAPE Technical Centre (STC) for use in the NATO IFF library for the production of MISPEC (IFF). The sheet will be completed using data provided by collection sheets described earlier in this publication. Where appropriate, statistical data of mean and deviation shall be derived as follows:

$$\text{Mean} = \frac{\text{Sum of all Data input}}{\text{Number of Samples}}$$

$$\text{Deviation} = \frac{\text{Sum of each Data input}^2}{\text{Number of Samples}} - \text{Mean}^2$$

$$= \frac{D_1^2 + D_2^2 \cdots D_n^2 - x^2}{n}$$

Transponder Platform Data Sheet

CLASSIFY ACCORDING TO CONTENT

MISPEC IFF ASSESSMENT
TRANSPONDER PLATFORM
GENERAL AND TECHNICAL INFORMATION

1. **GENERAL INFORMATION**

(a) Platform Designation		
(b) Role		
(c) Stores Configurations		
(d) Transponder Type and capability (eg IFF Mark (10, SIF, 10A, 12)		
(e) Antenna Types		
(f) Antenna Selection Method		
(g) Code Changing	Mode 1/3	Mode 4
(i) Manual		
(ii) Auto		
(iii) Audio/Visual Alert		
(h) Code changing capability versus time		
(j) IFF System MTBF & Mission time		
(k) External Suppression effects (specify scenario)		

2. **MEASURED DATA**

	Mean	Deviation	No Samples
(a) Dynamic system loss to Upper Antenna (dB)			
(b) Dynamic system loss to Lower Antenna (dB)			
(c) Lobing Switch (ASU) - Rate (Hz)			
Mark Space Ratio			

3. **REMARKS**

This sheet must be supported with detailed, scaled plans of the aircraft complete with antenna positioning and with antenna performance polar diagrams. Additional information relating to external stores configurations may also be added. All attached sheets must include the Form and Reference numbers. The total number of sheets are to be noted on this front sheet.

ORIGINATOR ________________________

DATE ....

Sheet 1 of .... sheets

____

Form MIS 10/2 Reference No ....

CLASSIFY ACCORDING TO CONTENT

ATTACHMENT 1

STANDARD INTERROGATION SIGNALS

(SIS)

STANDARD TEST SIGNAL CHARACTERISTICS

1. STANDARD INTERROGATION SIGNAL

A Standard Interrogation Signal (SIS) conforms to the following characteristics, unless otherwise stipulated:

1.1 Carrier Frequency

1030 ± MHz

1.2 Modulation

Pulse modulated, with an on/off keying ratio of not less than 60 dB.

1.3 Pulse Characteristics

Duration	: Modes 1, 2, 3/A and C	: 0.8 ± 0.05 µS
	Mode 4	: 0.5 ± 0.05 µS
Rise Time	: Within 0.05 to 0.1 µS	
Decay Time	: Within 0.05 to 0.2 µS	
Pulse Top Ripple	: Not greater than 1 dB peak to peak	
Amplitude Difference	: Not greater than 0.5 dB	

1.4 Interrogation Mode

1.4.1 Modes 1, 2, 3/A and C

Each interrogation shall consist of two pulses P1 and P3. The pulse interval shall correspond to the required Mode, as follows:

Mode 1	: 3 ± 0.05 µS
Mode 2	: 5 ± 0.05 µS
Mode 3/A	: 8 ± 0.05 µS
Mode C	: 21 ± 0.05 µS

2. STANDARD SIDELOBE INTERROGATION SIGNAL

A Standard Sidelobe Interrogation Signal (SSIS) conforms to the characteristics unless otherwise stipulated:

2.1 Modes 1, 2, 3/A, C

An additional pulse (P2) introduced with a P1 to P2 pulse interval of 2 ± 0.05 µS.

2.2 Mode 4

An additional pulse (P5) introduced with a P1 to P5 pulse interval of 8 ± 0.05 µS.

3. RANDOM PULSE

3.1 When it is required to simulate the effects on reception of interference due to random pulses, there is included in the Standard Interrogation Signal an additional pulse having the characteristics specified.

3.2 The position of the additional pulse is varied over the range from 25 µS in advance of P1 to 25 µS after P3, excluding all positions within 0.8 µS of a pulse position which could combine with any pulse of a Standard Interrogation Signal to form either a selected interrogation Mode of a ISLS pulse pair.

ATTACHMENT 2

TERMINOLOGY AND ABBREVIATIONS

TERMINOLOGY

1. DEFINITIONS

The following terms are defined for the purpose of this document:

1.1 Interrogator System

The equipment used to generate interrogating transmissions and to receive replies.

1.2 Transponder

The equipment necessary to perform all the functions of IFF or SSR as defined in the appropriate STANAG.

1.3 Signals in Space

The pulse characteristics of Radio Frequency (RF) signals in space are specified in terms of electric field strength.

1.4 Transponder Reply

The total RF transmission from the transponder, including the additional pulses associated with the identification of emergency replies where appropriate, in response to a valid interrogation.

1.5 Suppression Due to a Sidelobe Interrogation

The means by which, upon reception of a sidelobe interrogation signal, the transponder is rendered incapable of replying to the interrogation causing the suppression, and may be inhibited from processing further interrogations for a specified period.

1.6 Transponder Minimum Triggering Level

The RF level of a Standard Interrogation Signal required at the transponder input to generate transponder replies to 90 per cent of interrogations.

For practical convenience, the reply rate of 90 per cent has been chosen to determine the minimum trigger level (MTL). This is for measurement purposes only and should not be regarded as the maximum reply capability of the transponder.

1.7 Transponder Receiver Centre Frequency

The mean of the highest and lowest frequencies to which the carrier frequency of a Standard Interrogation Signal must be adjusted such that the RF level required to generate transponder replies to 90 per cent of the interrogations is MTL + 3 dB.

2. ABBREVIATIONS

ASU	Antenna (Aerial) Switch Unit
ATC	Air Traffic Control
BIT	Built-in Test
CVO	Code Validity Overlap
ERP	Effective Radiated Power
ERS	Effective Receiver Sensitivity
FRUIT	Friendly Replies Unsynchronised in Time
GTC	Gain Time Control
ICAO	International Civil Aviation Organisation
IFF	Identification, Friend or Foe
I/P	Identify Position
ISLS	Interrogation Sidelobe Suppression
MISPEC(IFF)	Merit of Individual System Performance Characteristics for IFF
MTBF	Mean Time Between Failures
MTL	Minimum Triggering Level
PI	Probability of Identification
PK	Probability of Kill
PRF	Pulse Repetition Frequency
PS	Probability of Survival
RSLS	Receiver Sidelobe Suppression
SIF	Selective Identification Feature
SIS	Standard Interrogation Signal
SPI	Special Identification Pulse
SRS	Standard Reply Signal
SSIS	Standard Sidelobe Interrogation Signal
SSR	Secondary Surveillance Radar