



EM DIVISION

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SPECIFICATION FOR THE AIRBORNE
REAL TIME INSTRUMENTATION SYSTEM

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REVISION PAGE

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1	<ul style="list-style-type: none"> Add the data element of the user_command, recorded_files, data_displayed
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1 SCOPE

1.1 Identification

This Interfaces Requirements Specification (IRS) describes the specification of :

- interface 1: ACARD/ARTIS_t interfaces Airborne Real Time Instrumentation System (ARTIS_t) to ARTIS_t Card (ACARD)
- interface 2 : MMIMS/ARTIS_t interfaces Airborne Real Time Instrumentation System (ARTIS_t) to Man Machine Interface Management System (MMIMS)
- interface 3 : ARTIS_t/APRINTER interfaces Airborne Real Time Instrumentation System (ARTIS_t) to ARTIS_t Printer (APRINTER)
- interface 4 : ARTIS_t/DMS interfaces Airborne Real Time Instrumentation System (ARTIS_t) to Disk Management System (DMS).

All abbreviation/acronym can be seen in paragraph 6.

1.2 System Overview

Purpose of system :

ARTIS_t system is an instrumentation system based on Personal Computer (PC) which is installed on board the prototype aircraft to perform presentation of flight test data in real time. The presentation consists of display the data in table mode, display the data in graphic mode, display the data in mixed mode (table and graphic), and display the data in xplot mode (graphic between 2 parameters), and also print and record the data. The data which has been recorded by ARTIS_t, can be used by other software through the Disk Management System (DMS). The PC equipped with an interface for Pulse Code Modulation (PCM) decoder called ARTIS_t Card.

The following figure describes the system architecture of the ARTIS_t :

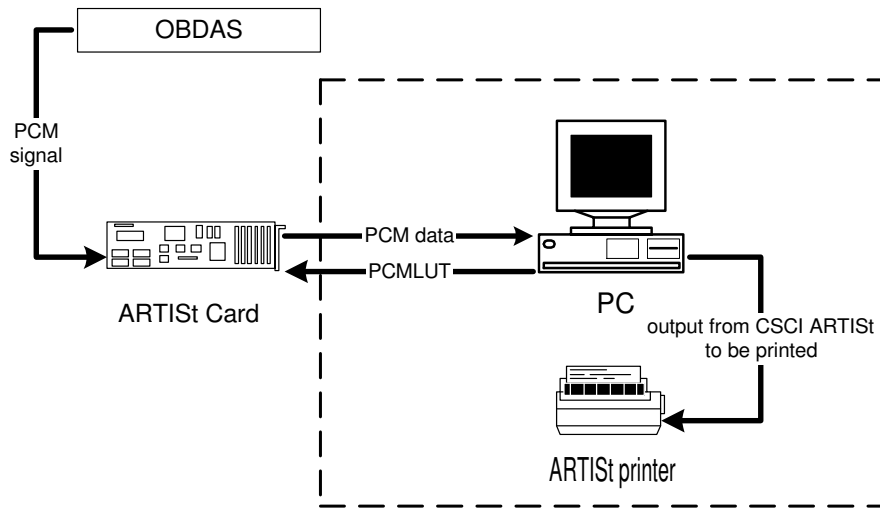


Figure 1 : "The ARTIS_t System Architecture"



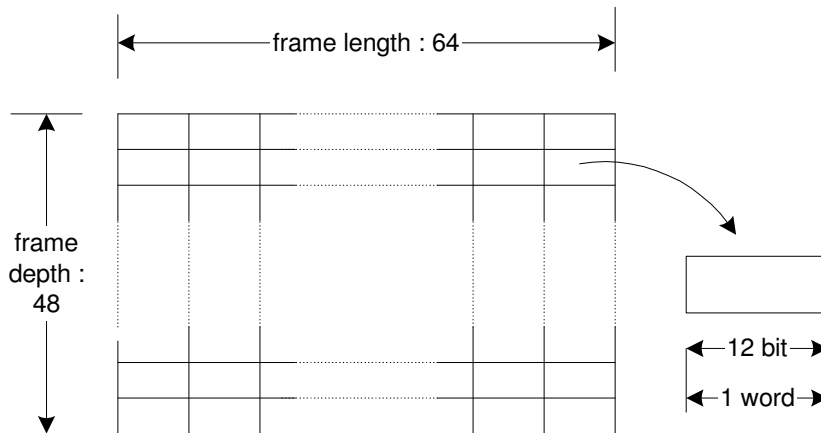
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On Board Data Acquisition System (OBDAS) is an instrumentation system which is installed on the prototype aircraft directly acquires analog and digital signals from various flight test sensors and other measurement sub system and convert them into a format suitable for real time display, telemetry and recording.

ARTIS_t card is an instrumentation system which is installed inside the PC which must receive a serial PCM bit stream output incoming from OBDAS, decoding it, and then transferring the data to the PC memory based on Pulse Code Modulation Look Up Table (PCMLUT). One PCM data is 12 bits (1 word) long. There are parameters which have 1 word data and Aeronautical Radio Incorporated (ARINC) parameters which has 3 words data. PCMLUT is array of PCM word position, means parameter position inside PCM data stream, which is arranged according to calibration file. PCM frame size is equal the size of PCM bit stream decoded by OBDAS which has specific frame length and frame depth, and position of frame number.

The following figure describes PCM data generated out from OBDAS and received by ARTIS_t.



Note :
frame size : frame depth x frame length

Figure 2 : "PCM Data Output from OBDAS to ARTIS_t "

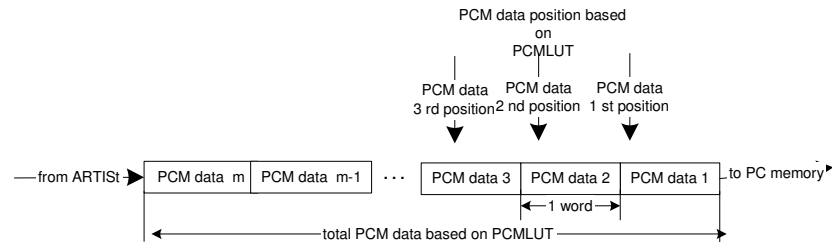
After passing through ARTIS_t card, the PCM data which goes out depending on PCMLUT. To regulate PCM data in PC memory, it is performed by the Non-Developmental Software (NDS) files. The NDS files are Artbuf and ISRPCM files.



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The following figure represents PCM data which goes to PC memory.



Note :

m : total pcm_data which goes out to PC memory based on PCMLUT.
(It can be said that **m** is sum pcm_data position)

Figure 3 : "PCM Data from ARTISr Card to The PC Memory"

Purpose of the CSCI :

ARTISr CSCI is a configuration item that is installed inside the PC and access the PCM data in the PC memory.

ARTISr CSCI should perform the following functions :

1. collect electrical data from ARTISr card
2. process the data : process to translate electrical data into engineering data and extended parameters calculation
3. present the data :
 - a. on-line displaying with status (displayed electrical data or engineering data in table mode or graphic mode or mixed mode or xplot mode),
 - b. on-line recording (electrical data and/or engineering data)
 - c. on-line printing (electrical data or engineering data)

ARTISr CSCI is able to process the all safety parameters used in prototype aircraft of IPTN. Total parameters which can be processed, will be described at calculation of memory and time allocation in the Software Design Document.

Electrical data is occurred because of a measurement device produce specific electrical voltage. PCM data is electrical data format. Then it is allocated in memory within hexadecimal value. Engineering data is readable data from engineering view. Actually, this engineering data will be got from calculation electrical data with specific formula based on calibration data (this data occurs from laboratory test).

Data collection is to select and to take electrical data which needed via ARTISr card. Data processing means that PCM data from ARTISr card will be translated from electrical data into engineering data and extended parameters calculation, based on calibration data which saved on calibration file with specific formula. Data presentation means, either electrical data or engineering data can be displayed on screen monitor (table mode and/or graphic mode), printed on printer and saved electrical data to the harddisk of PC.



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1.3 Document Overview

This Interface Requirements Specification (IRS) specifies the interface between the ARTIS_t Computer Software Configuration Item (CSCI) and its environment.

Analysis of the requirement applied to the ARTIS_t CSCI, rely on a SA/RT model. Certain elements resulting from this analysis are presented in this document (interface diagram and definition of external data).



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2 APPLICABLE DOCUMENT

2.1 International documents

- [1] DOD-STD-2167A Military standard,
Defense System Software Development,
(Issue dates 29 February 1988).
- [2] MIL-STD-1521B Military standard,
Technical Reviews and Audits for Systems, Equipment and Computer
Software.
(Issue dates 4 June 1985).

2.2 THOMSON-CSF documents

- [3] RDL-313 Thomson-CSF standard,
Drafting Guide for Interface Requirements Specification (IRS),
(Issue dates September 1993).

2.3 IPTN documents

- [4] PART 41 G – NCS 2001 IPTN Computational / Software Standard,
Airborne Software Standard,
(Issue dates 08 July 1998).
- [5] EM/000/PRO/AL/005 EM Division Procedures for Document and Data Control,
(Rev. 1, issues date November 1997).
- [6] EM/000/PRO/AL/026 EM Division Procedures for Software Design Control,
(Rev. 1, issues date November 1997).
- [7] EM/000/SRS/DD/003 Software Requirements Specification for Airborne Real Time Instrumenta-
tion System, rev. 2
(Issue dates December 2000).
- [8] TN/N250/DAS/12/97/004 Functional Test On Board Data Acquisition System,
(issue date December 20, 1997)



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3 INTERFACE SPECIFICATION

3.1 Interface diagrams

The interface diagram below gives the representation of interfaces between the Airborne Real Time Instrumentation System and its environment.

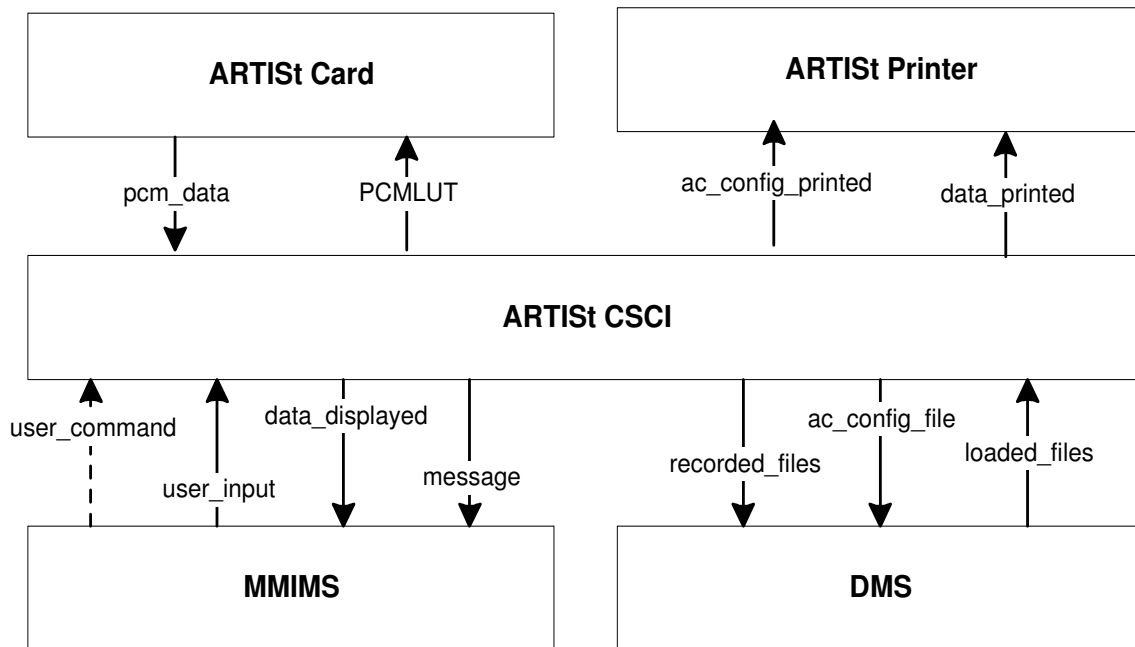


Figure 4: "Interface Diagram of ARTISt"

The interfaces described are:

- ACARD/ARTISt (ARTISt Card/Airborne Real Time Instrumentation System) linked to the "PCM data" and "PCMLUT" data flows.
- MMIMS/ARTISt (Man Machine Interface Management System/Airborne Real Time Instrumentation System), linked to the "user input", "data displayed", "message" data flows and "user command" control flow.
- ARTISt/APRINTER (Airborne Real Time Instrumentation System/ARTISt Printer) linked to the "data printed", and "ac config printed" data flows.
- ARTISt/DMS (Airborne Real Time Instrumentation System/Disk Management System) linked to the "loaded_files", "ac_config_file", and "recorded_files" data flows.

3.2 Overall specification

Not Applicable.



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3.3 ACARD/ARTIST Interface

3.3.1 Interfaces requirements

The Airborne Real Time Instrumentation System is interfaced to the ARTIST Card.
The ARTIST sends PCMLUT to the ARTIST Card.
The ARTIST receives PCM_data based on PCMLUT (**IRS_REQ_10000**).

3.3.2 Data requirements

PCM_data (**IRS_REQ_11000**)

Description :

The ARTIST Card sends PCM_data to the ARTIST CSCI in stream format.
PCM_data is 12 bits data (1 word) for each parameter, except for ARINC parameter has 3 words data.
PCM_data contains electrical data of parameters which will be changed into hexadecimal number. It is transmitted from ACARD to memory computer. ARTIST then access PCM_data in memory computer.

PCMLUT (**IRS_REQ_12000**)

Description :

The ARTIST CSCI requires PCM_data to the ARTIST Card by sending PCMLUT before.
PCMLUT is array of pcm_position of parameters required.
PCM position is always written in calibration file. It indicates address of electrical data of determined parameter.
The detail of each data element is listed in Tabel 1 below.

Data Requirement	Data Element	Value	Unit Of Value	Type Of Value	Description
PCM_data (IRS_REQ_11000)	--	0000..0FFF	DIGIT	integer 12 bits	12 bits data (1 word) transmitted by ACARD
PCMLUT (IRS_REQ_12000)	--	integer number	--	integer 16 bits	Set of data indicated PCM position in sequence in order to be PCM_data

Table 1 : “Data Requirement Of ACARD/ARTIST Interface”

3.3.3 Data Message Description

Not Applicable.



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3.4 MMIMS/ARTISt Interface

3.4.1 Interface Requirements

User controls the ARTISt CSCI through user_command. The CSCI shall receive input data launched by the user through keyboard and shall provide data displayed to the user according to the user input and user_command (IRS_REQ_20000).

3.4.2 Data Requirement

The value of each data/control flow is as follows :

- **user_command (IRS_REQ_21000)** =
[record_elect_command|record_eng_command|print_command|display_command|setting_command|
setting_ACConf_command|setting_global_command|setting_local_command|
setting_presentation_command|setting_finish|running_command|running_table_command|
running_graphic_command|running_mixed_command|running_xplot_command|running_finish|
print_acconfig_command|record_acconfig_command]
- **user_input (IRS_REQ_22000)** =
[calib_file_name|parameter_setup|graph_table_model|selected_parameters|record_file_name|lac_config|
ac_config_file_name|correct_formula]
- **data_displayed (IRS_REQ_23000)** =
[display_table|display_graphic|display_mixed|display_xplot]

The detail of each data element is listed in table below :

Data Requirement	Data Element	Value	Unit Of Value	Type Of Value	Description
user_command (IRS_REQ_21000)	record_elect_command (IRS_REQ_21100)	0 1	-	Boolean	command from user for start or stop record electrical data. 0=start recording; 1=stop recording
	record_eng_command (IRS_REQ_21110)	0 1	-	Boolean	command from user for start or stop record engineering data. 0=start recording; 1=stop recording
	print_command (IRS_REQ_21200)	0 1	-	Boolean	command from user for start or stop printing. 0=start printing; 1=stop printing
	display_command (IRS_REQ_21300)	0 1	-	Boolean	command from user for display elect or eng. 0=display elect; 1=display eng
	setting_command (IRS_REQ_21400)	Yes No	-	Boolean	command from user to set up program configuration
	setting_ACConf_command (IRS_REQ_21410)	Yes No	-	Boolean	command from user to set up Aircraft configuration



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Data Requirement	Data Element	Value	Unit Of Value	Type Of Value	Description
	setting_global_command (IRS_REQ_21420)	Yes No	-	Boolean	command from user to set up configuration of global parameter
	setting_local_command (IRS_REQ_21430)	Yes No	-	Boolean	command from user to set up configuration of local parameters
	setting_presentation_command (IRS_REQ_21440)	Yes No	-	Boolean	command from user to set up configuration of data presentation
	setting_finish (IRS_REQ_21500)	Yes No	-	Boolean	command from user to finish setting up
	running_command (IRS_REQ_21600)	Yes No	-	Boolean	command from user to activate the running state.
	running_table_command (IRS_REQ_21610)	Yes No	-	Boolean	command from user to display parameter on the table mode.
	running_graphic_command (IRS_REQ_21620)	Yes No	-	Boolean	command from user to display parameter on the graphic mode.
	running_mixed_command (IRS_REQ_21630)	Yes No	-	Boolean	command from user to display parameter on the mixed mode.
	running_xplot_command (IRS_REQ_21640)	Yes No	-	Boolean	command from user to display parameter on the xplot mode.
	running_finish (IRS_REQ_21700)	Yes No	-	Boolean	command from user to deactivate running state
	print_acconfig_command (IRS_REQ_21800)	Yes No	-	Boolean	command from user for print the ac_config
	record_acconfig_command (IRS_REQ_21900)	Yes No	-	Boolean	command from user for record the ac_config



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Data Requirement	Data Element	Value	Unit Of Value	Type Of Value	Description
User_input (IRS_REQ_22000)	calib_file_name (IRS_REQ_22100)	1{alpha numeric}8	--	string	This data flow carries selection of calib_file
	parameter_setup (IRS_REQ_22200)	dismod_par_setup framred_par_setup lirig_par_setup numsym_par_setup	--	--	parameters to setup presentation. more detail See "parameter_setup" (IRS_REQ_22200).
	selected_parameters (IRS_REQ_22400)	--	--	--	This data flow carries selection of parameters to be displayed, printed, or recorded. More detail, see "selected_parameters" (IRS_REQ_22400)
	record_file_name (IRS_REQ_22500)	1{alpha numeric}8	--	string	This data flow carries name of record_file
	ac_config (IRS_REQ_22600)	ac_reg+project+ mtow+cg+ test_subject+ ops_no+seq_no+ run_no+flap+lg	--	--	Configuration of aircraft. More detail See "ac_config" (IRS_REQ_22600)
	ac_config_file_name (IRS_REQ_22700)	1{alpha numeric}8	--	string	Name of aircraft configuration file to be recorded
	Correct_formula (IRS_REQ_22800)	(0-9), (A-Z), (+ - * / ^)	--	string	Arithmetic operation formula for determining derivative parameter
Parameter_setup (IRS_REQ_22200)	Dismod_par_setup (IRS_REQ_22210)	1 2	--	integer	The user selects display mode. Defined as : 1=elect; 2=eng
	Framred_par_setup (IRS_REQ_22220)	1 2	--	integer	The user selects framred mode. Defined as : 1=with framred; 2=without framed
	Irig_par_setup (IRS_REQ_22230)	1 2 3 4 5	--	integer	The user selects irigtime mode. Defined as : 1=Teledyne separated; 2=Teledyne compact; 3=Aydin Vector separated; 4=Aydin Vector compact; 5=Generated by computer
	Numsym_par_setup (IRS_REQ_22240)	1 2	--	integer	The user selects numsym mode. Defined as : 1=par_name;2=par_syn



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Data Requirement	Data Element	Value	Unit Of Value	Type Of Value	Description
Selected_parameters (IRS_REQ_22400)	Tab_selected_par (IRS_REQ_22410)	integer number	--	integer	This data flow carries pointer number of selected parameters to be displayed on tabel mode.
	gra_selected_par (IRS_REQ_22420)	integer number	--	integer	This data flow carries pointer number of selected parameters to be displayed on graphic mode.
	mixed_selected_par (IRS_REQ_22430)	integer number	--	integer	This data flow carries pointer number of selected parameters to be displayed on mixed mode.
	print_selected_par. (IRS_REQ_22440)	integer number	--	integer	This data flow carries pointer number of selected parameters to be printed.
	xplot_selected_par. (IRS_REQ_22450)	integer number	--	integer	This data flow carries pointer number of selected parameters to be displayed on xplot mode.
	rec_eng_selected_par. (IRS_REQ_22460)	integer number	--	integer	This data flow carries pointer number of selected parameters to be recorded of engineering data.



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Data Requirement	Data Element	Value	Unit Of Value	Type Of Value	Description
ac_config (IRS_REQ_22600)	ac_reg (IRS_REQ_22610)	1{alpha numeric}6	--	string	aircraft register
	project (IRS_REQ_22620)	1{alpha numeric}30	--	string	title of flight test project
	mtow (IRS_REQ_22630)	float number	kg	float	Maximum take-off weight
	cg (IRS_REQ_22640)	float number	%MAC	float	Center of gravity, center of mass of the aircraft
	test_subject (IRS_REQ_22650)	1{alpha numeric}30	--	string	subject of test
	ops_no (IRS_REQ_22660)	positive integer number	--	integer	Operation number, number of flight test operation
	seq_no (IRS_REQ_22670)	1..50	--	integer	sequence(maneuver) number. An operation number may contain any sequence numbers.
	run_no (IRS_REQ_22680)	1{alpha numeric}5	--	string	run number of defined sequence.
	flap (IRS_REQ_22690)	integer number	degree	integer	flap deflection
lg (IRS_REQ_22695)	0 1	--	integer	landing gear position, that is lg up (0), down (1)	
data_displayed (IRS_REQ_23000)	display_table (IRS_REQ_23100)	pa-ram_id+par_data	--	--	The table contains selected real time parameter data. More detail See "display_table" (IRS_REQ_23100)
	display_graphic (IRS_REQ_23200)	pa-ram_id+par_data	--	--	The graphic contains selected real time parameter data. More detail See "display_graphic" (IRS_REQ_23200)
	display_mixed (IRS_REQ_23300)	pa-ram_id+par_data	--	--	The mixed contains selected real time parameter data. More detail See "display_mixed" (IRS_REQ_23300)
	display_xplot (IRS_REQ_23400)	pa-ram_id+par_data	--	--	The xplot contains selected real time parameter data. More detail See "display_xplot" (IRS_REQ_23400)



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Data Requirement	Data Element	Value	Unit Of Value	Type Of Value	Description
display_table (IRS_REQ_23100)	param_id (IRS_REQ_23110)	--	--	--	set of parameter identification. More detail See "param_id" (IRS_REQ_23110)
	par_data (IRS_REQ_23120)	1{0..9}5	--	integer	data of parameter
param_id (IRS_REQ_23110)	par_name	1{alphanumeric}10	--	string	Name of parameter
	par_sym	1{alphanumeric}10	--	string	Symbol of parameter
	par_unit	1{alphanumeric}10	--	string	unit of parameter
	par_exp	0..9	--	integer	Exponen of parameter
display_graphic (IRS_REQ_23200)	param_id	--	--	--	set of parameter identification. all data elements idem [IRS_REQ_23110]
	par_data	1{0..9}5	--	integer	data of parameter
display_mixed (IRS_REQ_23300)	param_id	--	--	--	set of parameter identification. all data elements idem [IRS_REQ_23110]
	par_data	1{0..9}5	--	integer	data of parameter
display_xplot (IRS_REQ_23400)	param_id	--	--	--	set of parameter identification. all data elements idem [IRS_REQ_23110]
	par_data	1{0..9}5	--	integer	data of parameter
message (IRS_REQ_24000)	--	alpha numeric	--	string	This data flow carries message of system behavior.

Table 2 : "Data Requirement Of MMIMS/ARTIST Interface"

3.4.3 Data Message Description

Not Applicable



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3.5 ARTIST/APRINTER Interface

3.5.1 Interface Requirements

The CSCI shall provide data printed according to the user_inputs in table mode (**IRS_REQ_30000**).

3.5.2 Data Requirements

The value of each data/control flow is as follows :

- **data_printed (IRS_REQ_31000)=**
[param_id+par_data]
- **ac_config_printed (IRS_REQ_32000)=**
idem IRS_REQ_22600

The detail of each data element is listed in Tabel 3 below :

Data Requirement	Data Element	Value	Unit Of Value	Type Of Value	Description
data_printed (IRS_REQ_31000)	param_id	--	--	--	set of parameter identification. all data elements ider [IRS_REQ_23110]
	par_data	integer number	--	integer	data of parameter
ac_config_printed (IRS_REQ_32000)	--	--	--	--	aircraft configuration will be printed. All data element idem IRS_REQ_22600

Table 3 : “Data Requirement of ARTIST/APRINTER Interface”

3.5.3 Data Message Description

Not Applicable

3.6 ARTIST/ DMS Interface

3.6.1 Interface Requirements

The CSCI shall load config_file, and then load calib_file according to the user inputs (**IRS_REQ_40500**).

The CSCI shall provide recorded_files and ac_config_file if required (**IRS_REQ_41500**).

3.6.2 Data Requirements

The value of each data/control flow is as follows :

- **loaded_files (IRS_REQ_41000)=**
[config_file|calib_file|formula_file]



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- **recorded_files (IRS_REQ_42000)=**
[record_file_name+record_he_a_file+record_val_file|record_eng_file]
- **ac_config_file (IRS_REQ_43000)=**
[ac_config_file_name+ac_config_data]

The detail of each data element is listed in table below :

Data Requirement	Data Element	Value	Unit Of Value	Type Of Value	Description
Loaded_files (IRS_REQ_41000)	config_file (IRS_REQ_41100)	alpha numeric	--	string	File contains configuration setting for initialization program
	Calib_file (IRS_REQ_41200)	alpha numeric	--	string	File contains calibration of parameter identification, pcm position, and calibration data.
	Formula_file (IRS_REQ_41300)	alpha numeric	--	string	File contains formulas used for derivative parameter
recorded_files (IRS_REQ_42000)	record_file_name	1{alpha numeric}8	--	string	This data flow carries name of record_file
	record_he_a_file (IRS_REQ_42100)	--	--	--	Header file of data recorded. More detail See " record_he_a_file (IRS_REQ_42100) "
	record_val_file (IRS_REQ_42200)	integer number	--	integer	Data has been recorded
	record_eng_file (IRS_REQ_42300)	--	--	--	engineering data has been recorded. More detail See " record_eng_file (IRS_REQ_42300) "
record_he_a_file (IRS_REQ_42100)	file's_info_block (IRS_REQ_42110)	--	--	--	Block information of file. More detail See " file's_info_block (IRS_REQ_42110) "
	param's_info_block (IRS_REQ_42120)	--	--	--	Block information of parameter. all data elements idem " param (SRS_REQ_56000) " except par_elect_data (SRS_REQ_56850) and par_eng_data (SRS_REQ_56900)
	calib_data_block (IRS_REQ_42130)	float number	--	float	Block information of file.
	time_section_block (IRS_REQ_42140)	--	--	--	Block information of time section. See " time_section_block (IRS_REQ_42140) "



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Data Requirement	Data Element	Value	Unit Of Value	Type Of Value	Description
file's_info_block (IRS_REQ_42110)	date	struct date number	--	struct date	date of flight test
	num_of_parameter	--	--	--	total number of global parameter.
	number_of_data	integer number	--	integer	number of PCM data that be recorded.
	numcal	integer number	--	integer	total number of calibration data
time_section_block (IRS_REQ_42140)	time_section_num	integer number	--	integer	Time section number
	start_position	integer number	--	integer	first position of data on record_val_file.
	end_position	integer number	--	integer	last position of data on record_val_file.
	start_time	stuct time number	--	struct time	first time of data on record_val_file.
	end_time	stuct time number	--	struct time	last time of data on record_val_file.
record_eng_file (IRS_REQ_42300)	param_id	--	--	--	set of parameter identification. all data elements idem [IRS_REQ_23110]
	par_data	integer number	--	integer	data of parameter
ac_config_file (IRS_REQ_43000)	ac_config_file_name	1 {alpha numeric}8	--	string	Name of aircraft cofiguration file to be recorded
	ac_config_data				data of aircraft configuration to be recorded. all data elements idem "ac_config" (IRS_REQ_22600)

Table 4 : "Data Requirement of ARTISt/DMS Interface"

3.6.3 Data Message Description

Not Applicable



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4 QUALITY ASSURANCE

Not Applicable



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5 PREPARATION FOR DELIVERY

The CSCI documents will be delivered in hardcopy (paper format).
Executable files may be delivered within floppy disk 3.5".



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6 NOTES

Used acronyms and abbreviations:

- AC : Aircraft
- ACARD : ARTISt Card
- APRINTER : ARTISt Printer
- ARINC : Aeronautical Radio Incorporated
- ARTISt : Airborne Real Time Instrumentation System
- CCD : Control Context Diagram
- CSCI : Computer Software Configuration Item
- DCD : Data Context Diagram
- DOD : Department of Defense
- DMS : Disk Management System
- EM : Electronic Center and Measurements System
- FTC : Flight Test Center
- FTE : Flight Test Engineer
- IPTN : Industri Pesawat Terbang Nusantara
- IRS : Interface Requirement Specification
- MIL : Military
- MMIMS : Man Machine Interface Management System
- NDS : Non Developmental Software
- OB DAS : On Board Data Acquisition System
- PC : Personal Computer
- PCM : Pulse Code Modulation
- PCMLUT : PCM Look Up Table
- REQ : Requirement
- RTCA : Radio Telecommunication & Communication for Airborne
- RTSE : Real Time Software Engineering
- SA/RT : Structured Analysis for Real Time
- SRS : Software Requirement Specification
- STD : Standard