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Description of SIS-AOP Result Format V1.0

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ABSTRACT

Single Image SICD-Based Automatic Object Processing (SIS-AOP) is an automatic object identification tool for SAR imagery. It ingests a SAR image in standard SICD format, and it will run a suite of algorithms to cue possible vehicle detections, cull those detections and then ultimately label them either as detections only or possible expound to give a class-level ID or a vehicle-type ID. The SIS-AOP results are given in an XML (Extensible Markup Language) output format. This document defines the elements in the SISAOPR XML output format.

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ACRONYMS AND DEFINITIONS

Abbreviation	Definition
SIS-AOP	Single Image SICD-Based Automatic Object Processing
SICD	Sensor Independent Complex Format (national data standard)
XML	Extensible Markup Language
DTD	Document Type Definition

1. INTRODUCTION

Single Image SICD-Based Automatic Object Processing (SIS-AOP) is an automatic object identification tool for SAR imagery. It ingests a SAR image in standard SICD format, and it will run a suite of algorithms to cue possible vehicle detections, cull those detections and then ultimately label them either as detections only or possible expound to give a class-level ID or a vehicle-type ID.

The SIS-AOP results are given in an XML (Extensible Markup Language) output format. As such, we have defined custom tags which are appropriate to the system. The tags will allow users to further process or display the results easily. A key virtue of the XML format is that it is extensible and flexible. In this way, the SIS-AOP XML format contains tags that allow for rotating antenna detector results to be included also, even though this is not a function of SIS-AOP. Another key benefit of using XML is that the output is human or machine readable, and it is self-documenting. In the following sections, we will define the elements in the SISAOPR XML. We do not plan on using a DTD (document type definition) or XML schema. The primary rationale is that using a defined schema can effectively limit the extensibility of the format, which we want to keep open at least while the prototype is being developed.

Each XML element contains an opening tag, a closing tag, and some content. The opening tag begins with a less than sign (<), followed by an element name that contains letters and numbers (but no spaces), and finishes with a greater than sign (>). Typically, the XML data is parsed character data. It could consist of plain text, other XML elements. Following the content is the closing tag, which exhibits the same spelling and capitalization as the opening tag, but with one change: a / appears right before the element name.

In our definition of the SIS-AOP result format, we are sticking to simple XML elements.
We concentrate in our definition to describe the hierarchy of our nested elements. We start with the SISAOPR as the root element (Level 1), and then continue down to Level 6. As this describes data from the SIS-AOP system, there are times when elements are required if certain higher-level elements exist or have certain values. We call these "result requirements." In the tables in the following sections that describe the various elements, "required" or "optional" does not refer to the XML schema, but rather the data that is required or optional as part of a meaningful SIS-AOP result that will be used or interpreted further downstream. Consider this a "requirement" of the result, not of the XML format.

2. SIS-AOP XML RESULT TREE

Figure 1 shows the logical structure of an example SISAOP XML result. Note the outline of the various elements indicates the level of the element using the ROYGBIV order: Red-Level 1, Orange-Level 2, Yellow-Level 3, Green-Level 4, Blue-Level 5, Violet-Level 6. In Figure 1, shading is used to help illustrate constrained values for certain elements or conditional result requirements, and outline glow is used to indicate when multiple elements are possible in the XML file.

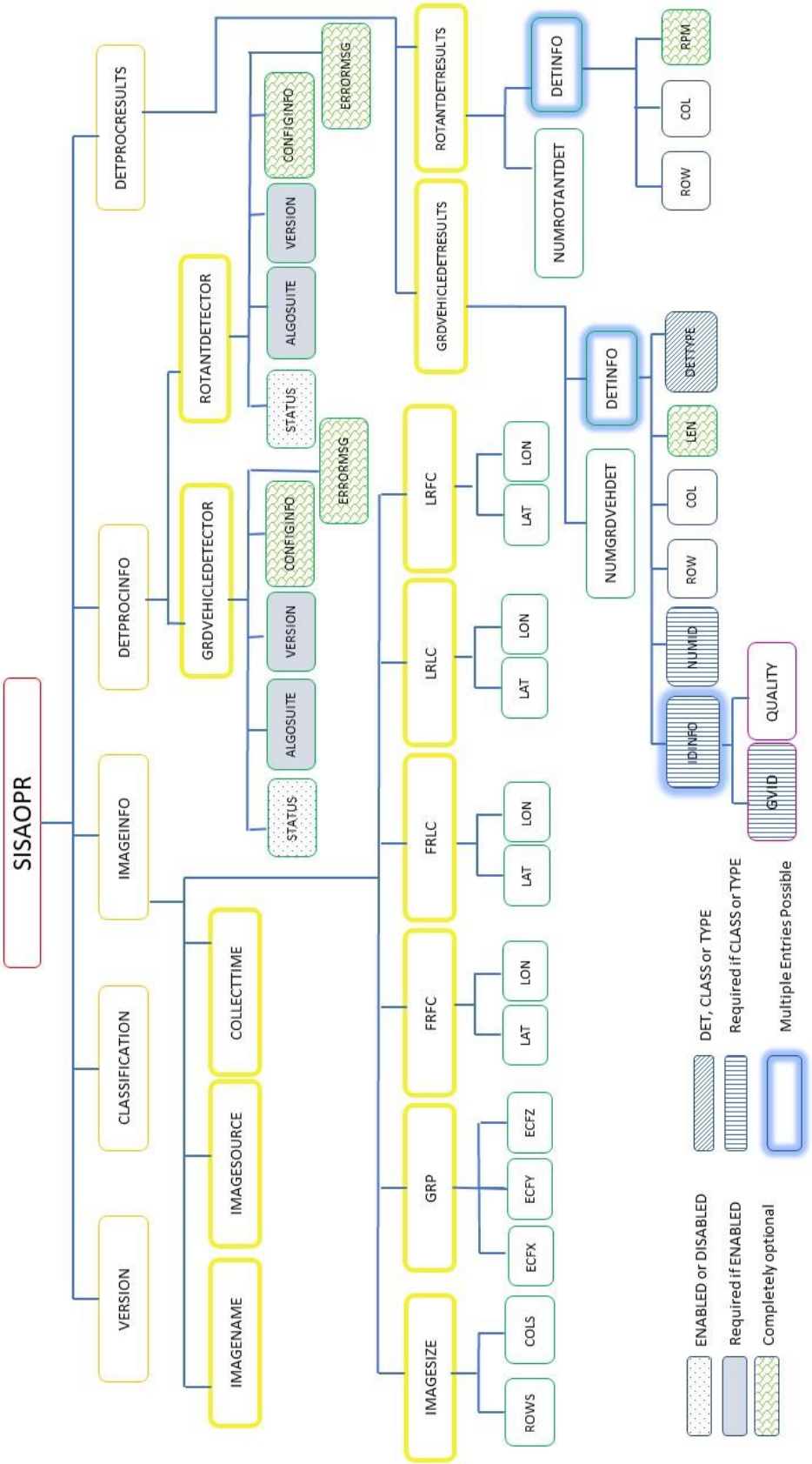

Figure 1: Logical Structure of XML SIS-AOP Result

3. DESCRIPTION OF XML ELEMENTS

3.1. Level 1 Element (Root): SISAOPR

From Figure 1, we can see that the root element name is SISAOPR. This is at Level 1. It is a result requirement. SISAOPR has five child elements, each of which is also a result requirement. These are described in the following table.

Element Name	Element level	Result Requirement	Description
SISAOPR	1	R	Root element of the SISAOPR file
VERSION	2	R	SISAOPR version information
CLASSIFICATION	2	R	classification information
IMAGEINFO	2	R	image information
DETPROCINFO	2	R	detection processing modules info
DETPROCRESULTS	2	R	detection processing results

Table 1: Level 1 and Level 2 Elements

3.2. Level 2 Element: VERSION

The first child element is VERSION. It holds a text string containing the version of the SISAOPR XML format version.

3.3. Level 2 Element: CLASSIFICATION

The second child element is CLASSIFICATION. It holds a text string that contains the classification of the SISAOPR XML file.

3.4. Level 2 Element: IMAGEINFO and Its Hierarchical Structure

The third child element is IMAGEINFO. This is basically just a label element to demarcate the SAR image information related to the image from which the SISAOP results are derived. The first child element at Level 3 is IMAGENAME, which is a text string containing the identifiable name of the image. The second child element at Level 3 is IMAGESOURCE, which is a text string to describe the system that collected the image. The third child element at Level 3 is COLLECTTIME, which is a text string that describes (in UTC format) when the input image was collected so that users can understand relevancy of the results. The remaining elements at Level 3 and Level 4 describe the geographical extent of image so that users can place detections in world coordinates, enabling the ability to display results without the need for the imagery. Note that a DEM would be useful to improve the HAE estimate at the various detection centers instead of using the GRP height information. See Table 2.

3.5. Level 2 Element: DETPROCINFO and Its Hierarchical Structure

The fourth child element at Level 2 is DETPROCINFO. This is basically just an element to demarcate information about the algorithms used to generate the results.

Element Name	Element level	Result Requirement		Description
IMAGEINFO	2	R		Element demarcating image details
IMAGENAME	3	R	txt string	image name
IMAGESOURCE	3	R	txt string	image source
COLLECTTIME	3	R	txt string	when image collected in UTC
IMAGESIZE	3	R		Element demarcating size of image in pixels
ROWS	4	R	int string	rows of image
COLS	4	R	int string	columns of image
GRP	3	R		Element demarcating center of image
ECFX	4	R	double string	ECEF x coordinate image center
ECFY	4	R	double string	ECEF y coordinate of image center
ECFZ	4	R	double string	ECEF z coordinate of image nominal center (ground reference point)
FRFC	3	R		Element demarcating location of first row first col corner of image
LAT	4	R	double string	latitude of image corner in decimal degrees
LON	4	R	double string	longitude of image corner in decimal degrees
FRLC	3	R		Element demarcating location of first row last col corner of image
LAT	4	R	double string	latitude of image corner in decimal degrees
LON	4	R	double string	longitude of image corner in decimal degrees
LRLC	3	R		Element demarcating location of last row last col corner of image
LAT	4	R	double string	latitude of image corner in decimal degrees
LON	4	R	double string	longitude of image corner in decimal degrees
LRFC	3	R		Element demarcating location of last row first col corner of image
LAT	4	R	double string	latitude of image corner in decimal degrees
LON	4	R	double string	longitude of image corner in decimal degrees

Table 2: Level 2 Element IMAGEINFO Hierarchy

The first child element under DETPROCINFO is GRDVEHICLEDETECTOR at Level 3, which is an element to demarcate information about the ground vehicle detection algorithm being used. The four elements under GRDVEHICLEDETECTOR are at Level 4. The first is STATUS, and it is a text string with value either "ENABLED" or "DISABLED", indicating if a ground vehicle detector was enabled to create results. The next element is ALGOSUITE, which is a text string to provide the name of the ground vehicle algorithm suite. It is a result requirement if GRDVEHICLEDETECTOR is ENABLED. The next element is VERSION, which is a text string to provide the version of the ground vehicle algorithm suite. It is a result requirement if GRDVEHICLEDETECTOR is ENABLED. The next element is CONFIGINFO. This gives any optional configuration information. It is a completely optional part of the results. The final element under GRDVEHICLEDETECTOR is ERRORMSG. It gives optional processing error information (e.g. no processing done because grazing angle out of range). It is a completely optional part of the results.

The next child element under DETPROCINFO is ROTANTDETECTOR at Level 3, which is an element to demarcate information about the rotating antenna detection algorithm being used. The four elements under ROTANTDETECTOR are at Level 4. The first is STATUS, and it is a text string either "ENABLED" or "DISABLED", indicating if the ground vehicle detector was used to create results. The next element is ALGOSUITE, which is a text string to provide the name of the ground vehicle algorithm suite. It is a result requirement if ROTANTDETECTOR is ENABLED. The next element is VERSION, which is a text string to provide the version of the ground vehicle algorithm suite. It is a result requirement if ROTANTDETECTOR is ENABLED. The next element is CONFIGINFO. This gives any optional configuration information. It is a completely optional part of the results. The final element under ROTANTDETECTOR is ERRORMSG. It gives optional processing error information (e.g. no processing done because resolution requirement is not met). It is a completely optional part of the results.

Element Name	**Element level**	**Result Requirement**		**Description**
DETPROCINFO	2	R		Element demarcating detection algorithm details
GRDVEHICLEDETECTOR	3	R		Element demarcating ground vehicle detection capability
STATUS	4	R	txt string	Value is either ENABLED or DISABLED
ALGOSUITE	4	R if sister element STATUS is ENABLED	txt string	name of ground vehicle algorithm suite
VERSION	4	R if sister element STATUS is ENABLED	txt string	version of ground vehicle algorithm suite

CONFIGINFO	4	O	txt string	optional configuration information
ERRORMSG	4	O	txt string	optional error message
ROTANTDETECTOR	3	R		rotating antenna detection capability
STATUS	4	R	txt string	Value is either ENABLED or DISABLED
ALGOSUITE	4	R if sister element STATUS is ENABLED	txt string	name of rotating antenna algorithm suite
VERSION	4	R if sister element STATUS is ENABLED	txt string	version of rotating antenna algorithm suite
CONFIGINFO	4	O	txt string	optional configuration information
ERRORMSG	4	O	txt string	optional error message

Table 3: Level 2 Element DETPROCINFO Hierarchy

3.6. Level 2 Element: DETPROCRESULTS and Its Hierarchical Structure

The fifth child element is DETPROCRESULTS. This is basically just a label child to demarcate the actual detection results.

Element Name		Element level	Result Requirement		Description
DETPROCRESULTS					Element demarcating processing detection results
GRDVEHICLEDETRESULTS		3	R if ENABLED		Element demarcating ground vehicle detection results
NUMGRDVEHDET		4	R if ENABLED	int string	number of ground vehicle detections (0 to n)
DETINFO		4	R if NUMGRDVEHDET > 0	int string	Element demarcating detection info (one for each detection)
ROW		5	R	int string	image row for center of detection

COL		5	R	int string	image column for center of detection
LEN		5	O	float string	estimated length (in meters) of detected ground vehicle
DETTYPE		5	R	txt string	ground vehicle detection type (DET, CLASS, or TYPE)
NUMID		5	R if DETTYPE is CLASS or TYPE	int string	number of vehicle classes or vehicle types reported
IDINFO		5	R if NUMID>0		Element demarcating ID info (one for each ID)
	GVID	6	R	text string	Class or type name
	QUALITY	6	O	float string	quality of score (0.0 to 1.0) (1.0 = strong match) Quality reflects how well the match criteria for that particular category was met.
ROTANTDETRESULTS		3	R if ENABLED		Element demarcating rotating antenna detection results
NUMROTANTDET		4	R if ENABLED	int string	number of rotating antenna detections (0 to n)
DETINFO		4	R if detections > 0		Element demarcating detection info (one for each detection)
ROW		5	R	int string	image row for center of detection
COL		5	R	int string	image column for center of detection
RPM		5	O	float string	estimated rpm of rotating antenna

Table 4: Level 2 Element DETPROCRESULTS Hierarchy

The first child element under DETPROCRESULTS is GRDVEHICLEDETRESULTS at Level 3, which is an element to demarcate information about the ground vehicle detection results. It is a required if GRDVEHICLEDETECTOR child STATUS is ENABLED. The two elements under GRDVEHICLEDETRESULTS are at Level 4. The first is NUMGRDVEHDET, and it is an int

string with the number of ground vehicle detections in the image. The next element is DETINFO, which is an element to demarcate information about each of the ground vehicle detections. It is a result requirement if NUMGRDVEHDET > 0. The six child elements at Level 5 under DETINFO are ROW, COL, LEN, DETTYPE, IDINFO and NUMID. ROW is an int string indicating the row corresponding to the center of the detection. COL is an int string indicating the column corresponding to the center of the detection. LEN is an optional float string indicating the estimated length (in meters) of the detected object. DETTYPE is a text string that indicates whether the detection is just a simple detection or if it has some level of identification with it. It has the value "DET" if it is a simple detection. It has the value "CLASS" if there is a class-level identification associated with the detection. It has the value "TYPE" if it has a type-level identification associated with the detection.

The last two Level 5 child elements: NUMID and IDINFO are result requirements if the Level 5 element DETTYPE is either "CLASS" or "TYPE". NUMID is an int string indicating the number of reported categories (classes or vehicle types) associated with that detection. IDINFO is an element to demarcate further information about each of the class or type level ground vehicle detections. IDINFO is a result requirement if at least one class or type is reported (NUMID > 0). The two child elements at Level 6 under IDINFO are GVID and QUALITY. GVID is a text string indicating the name for the vehicle class or vehicle type. QUALITY is a float string that indicates the quality of the identification score (class level or type level) associated with the call. It is not a result requirement. Quality ranges from 0.0 to 1.0. A value of 1.0 indicates a strong match. It is important to note that score quality is how well a detection matches the indicators associated with an individual class or type of vehicle. As such, a good match/ high quality score for a given object is not exclusive; it is possible to have multiple or no strong matches, depending on how generic or unique a target class or type is.

The second child element under element under DETPROCRESULTS is ROTANTDETRESULTS at Level 3, which is an element to demarcate information about the rotating antenna detection results. It is a required if ROTANTDETECTOR child STATUS is ENABLED. The two elements under ROTANTDETRESULTS are at Level 4. The first is NUMROTANTDET, and it is an int string with the number of rotating antenna detections in the image. The next element is DETINFO, which is an element to demarcate information about each of the rotating antenna detections. It is a result requirement if NUMROTANTDET > 0. The three child elements at Level 5 under DETINFO are ROW, COL and RPM. ROW is an int string indicating the row corresponding to the center of the detection. COL is an int string indicating the column corresponding to the center of the detection. RPM is an optional float string indicating the estimated revolutions per minute of the detected object.

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