# ICESat (GLAS) Science Processing Software Preliminary Design Review

**November 24, 1998**
**9:00 to 15:00**

**Goddard Space Flight Center, Building 16W Room N76**

# AGENDA

| TOPIC | PRESENTER | TIME |
|---|---|---|
| Introduction | Dr. Jay Zwally/David Hancock | 9:00-9:10 |
| Board | Richard Ullman | 9:10-9:20 |
| Science Goals | Dr. Bob Schutz | 9:20-9:35 |
| Instrument Description | Ron Follas | 9:35-9:45 |
| I-SIPS Software Description/ Requirements | David Hancock | 9:45-10:05 |
| Science Software Architectural Design | Anita Brenner | 10:05-10:30 |
| BREAK | | 10:30-10:45 |
| Detailed Design | | |
| I-SIPS Controller | John DiMarzio | 10:45-11:15 |
| Task Executive | Jeff Lee | 11:15-11:30 |
| Level 1 | Peggy Jester | 11:30-11:50 |
| LUNCH | | 11:50-13:00 |
| Detailed Design (continued) | | |
| Altimeter Waveform Analysis | Anita Brenner | 13:00-13:15 |
| Altimeter Elevation Computation | Suneel Bhardwaj | 13:15-13:30 |
| Lidar Processing | Kristine Barbieri | 13:30-13:50 |
| Requirements Trace | Gladstone Marcus | 13:50-14:05 |
| Schedule - Version Descriptions | Gladstone Marcus | 14:05-14:20 |
| Wrap-up | David Hancock | 14:20-14:25 |
| BREAK | | 14:25-14:35 |
| Caucus | Review Board | 14:35-…….. |

# ICESAT/GLAS
# SCIENCE SOFTWARE DEVELOPMENT

## KEY PERSONNEL

**Dr. Bob Schutz, GLAS Science Team Leader**

**Dr. Jay Zwally, ICESat Project Scientist, GLAS Team Member**

**Mr. David Hancock, Science Software Development Manager**

**Ms. Anita Brenner, Deputy Science Software Development Manager**

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# SCIENCE SOFTWARE DEVELOPMENT
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# GLAS STANDARD DATA SOFTWARE DEFINITIONS

- The GLAS Standard Data Software (SDS) is the system which provides data processing and mission support for the GLAS Investigation.

- The SDS is composed of the ICESat Science Investigator-led Processing System (I-SIPS) and the Instrument Support Terminal (IST) Software.

- The I-SIPS includes the software and operations which produce the GLAS standard data products and their metadata.

- The IST Software includes the GLAS instrument health assessment, instrument commanding, and other functions required for mission support.

# PDR PURPOSE

- To present the I-SIPS requirements and demonstrate that the I-SIPS Architectural Design satisfies those requirements
- To present the current design for peer review
- To allow suggested design improvements
- To identify any omissions
- Not intended to address the scientific aspects of the Algorithm Theoretical Basis Documents
- Not intended to address the IST

# SCIENCE GOALS

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# INSTRUMENT DESCRIPTION

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# I-SIPS SOFTWARE DESCRIPTION/REQUIREMENTS

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# PDR CONTENTS

- Present overview description and requirements
- Present completed architectural design
- Present detailed design work in progress

# DESIGN STATUS

- Requirements defined
- Architectural design defined
- Detailed design in progress

# I-SIPS SOFTWARE DEVELOPMENT DESCRIPTION

- Precision orbit and precision attitude software development at University of Texas at Austin (Ancillary process)
- Standard Data Software to be coded at GSFC under Science Team direction
  - Based on ATBDs
  - Standard Data Software implemented by one set of developers
  - Standard Data Software under configuration management (use ClearCase)
  - Deliver software to operations team
  - Software designed to handle processing, partial processing, and reprocessing
  - Final Level 2 products in HDF-EOS, others in HDF

# I-SIPS SOFTWARE DEVELOPMENT LIFE CYCLE

- Requirements Phase
  - Concept and Initiation
  - Requirements Development
- Design Phase
  - Prototyping
  - Architectural Design
  - Detailed Design
- Implementation and Testing Phase
  - Implementation/Coordination
  - Integration and Test
- Acceptance and Delivery Phase
  - Acceptance
  - Delivery
- Sustaining Engineering and Operations Phase
  - Operations
  - Maintenance

# I-SIPS DOCUMENTATION TREE

| GLAS Standard Data Software | |
|---|---|
| Management Plan Volume | GLAS Science Software Management Plan |
| | GLAS Science Data Management Plan |
| Product Specification Volume | GLAS Science Software Requirements |
| | GLAS Level 0 Instrument Data Product Specification |
| | GLAS Standard Data Products Specification – Level 1 |
| | GLAS Standard Data Products Specification – Level 2 |
| | GLAS Science Software Architectural Design |
| | GLAS Science Software Detailed Design |
| | GLAS Science Software User's Guide/Operational Procedures Manual |
| | GLAS Science Software Version Description |
| Assurance and Test Procedures Volume | GLAS Science Software Assurance and Test Procedures |
| Management, Engineering, and Assurance Reports | GLAS Science Software Performance/Status Report |
| | GLAS Science Software Discrepancy Reports |
| | GLAS Science Software Engineering Change Proposal |
| | GLAS Science Software Test Report |
| [based on the NASA Software Documentation Standard – Software Engineering Program, NASA-STD-2100-91, July 19, 1991] | |

# CURRENT DOCUMENTS PROVIDED ON http://glas.wff.nasa.gov

- GLAS Science Software Management Plan
- GLAS Data Management Plan
- GLAS Science Software Requirements Document
- GLAS Level 0 Instrument Data Product Specification
- GLAS Standard Data Products Specification - Level 1
- GLAS Standard Data Products Specification - Level 2
- GLAS I-SIPS Software Architectural Design Document
- GLAS Science Computing Facility (SCF) Plan
- I-SIPS Proposal

# I-SIPS SOFTWARE DEVELOPMENT TOOLS

- Development database - in-house developed Informix database for data product parameter tracking and documentation
- Action Item database - in-house developed Informix database for documenting and reporting action items
- ClearCase - COTS software configuration management tool
- Win/Mac A&D - COTS CASE tool for software design
- ANSI Fortran-90 and C
- ORACLE Database

# I-SIPS BASIC DESCRIPTION

**Performs:**

- **The I-SIPS processing performs the following functions:**
  - **ingest input data**
  - **execute algorithms to create the GLAS level 1 and 2 data products**
  - **assess data product for quality and content, and produce metadata**
  - **create processing reports/log**
  - **deliver data products to the NSIDC DAAC**

- **Perform reprocessing as required**

- **Create quick-look data for science team**

**Does Not Perform:**

- **All Level 3 and 4 GLAS data products are produced by the science team as special products**

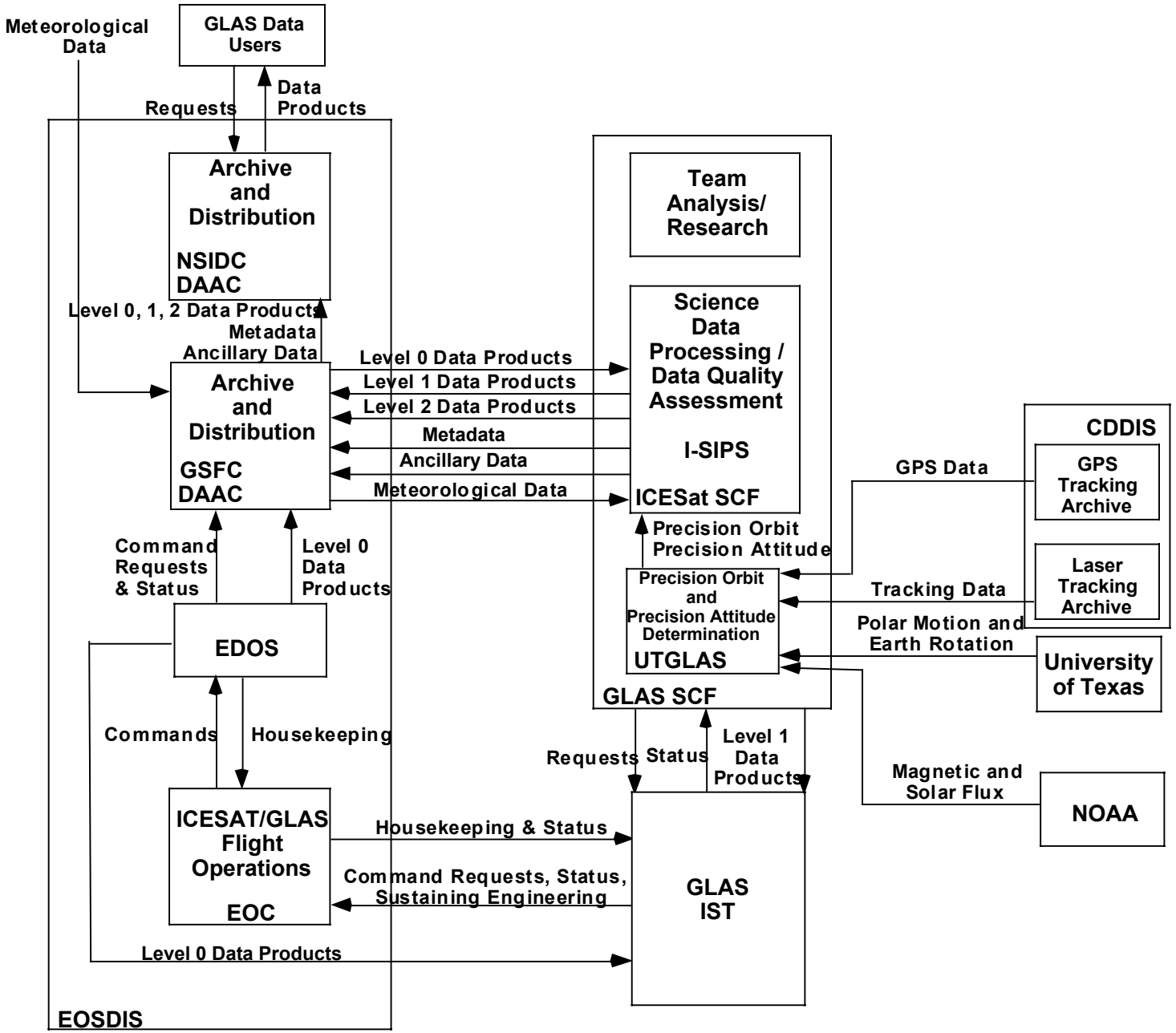
# I-SIPS PROCESSING BASIC REQUIREMENTS

- Process 24 hours of GLAS instrument data into standard data products within 4 hours of receipt of all required inputs
- Ability to distribute to the Science Team Level 1 and Level 2 data products within 24 hours of receipt of Level 0 data (uses predict ancillary data)
- Distribute fully processed Level 1 and Level 2 data products to NSIDC within 14 days of receipt of Level 0 data (after becoming operational and assuming proper ESDIS funding)
- Support reprocessing requirements without delaying regular processing assuming proper ESDIS funding

# I-SIPS DATA ARCHIVING REQUIREMENTS

- Archives internal data products for internal I-SIPS use, to End-of-Mission
- I-SIPS archives a log of products delivered
- I-SIPS does not perform permanent archive

# I-SIPS ARCHITECTURAL DIAGRAM



# GLAS DATA PRODUCTS

| Product ID (Identification) | Product Name | Product Level |
|---|---|---|
| GLA00 | GLAS Instrument Packet | 0 |
| GLA01 | Altimetry Data | 1A |
| GLA02 | Atmosphere Data | 1A |
| GLA03 | Engineering Data | 1A |
| GLA04 | SRS and GPS Data | 1A |
| GLA05 | Waveform-based Elevation Corrections | 1B |
| GLA06 | Elevation | 1B |
| GLA07 | Backscatter | 1B |
| GLA08 | Boundary Layer Height | 2 |
| GLA09 | Cloud Height for Multiple Layers | 2 |
| GLA10 | Aerosol Vertical Structure | 2 |
| GLA11 | Thin Cloud/Aerosol Optical Depth | 2 |
| GLA12 | Ice Sheet Elevation | 2 |
| GLA13 | Sea Ice Roughness | 2 |
| GLA14 | Land/Canopy Elevation | 2 |
| GLA15 | Ocean Elevation | 2 |

# SCIENCE SOFTWARE ARCHITECTURAL DESIGN

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# SCIENCE SOFTWARE REQUIREMENTS

- ISIPS software will create GLAS SDPs.
- ISIPS will ensure availability and integrity of all files necessary to produce GLAS SDPs.
- ISIPS will deliver all GLAS level 1 SDPs in HDF and level 2 SDPs in HDF-EOS format to the NSIDC DAAC.
- ISIPS will provide QA for each GLAS SDP and ancillary file delivered to the DAAC
- ISIPS will provide the science team with GLAS SDPs and quick look data

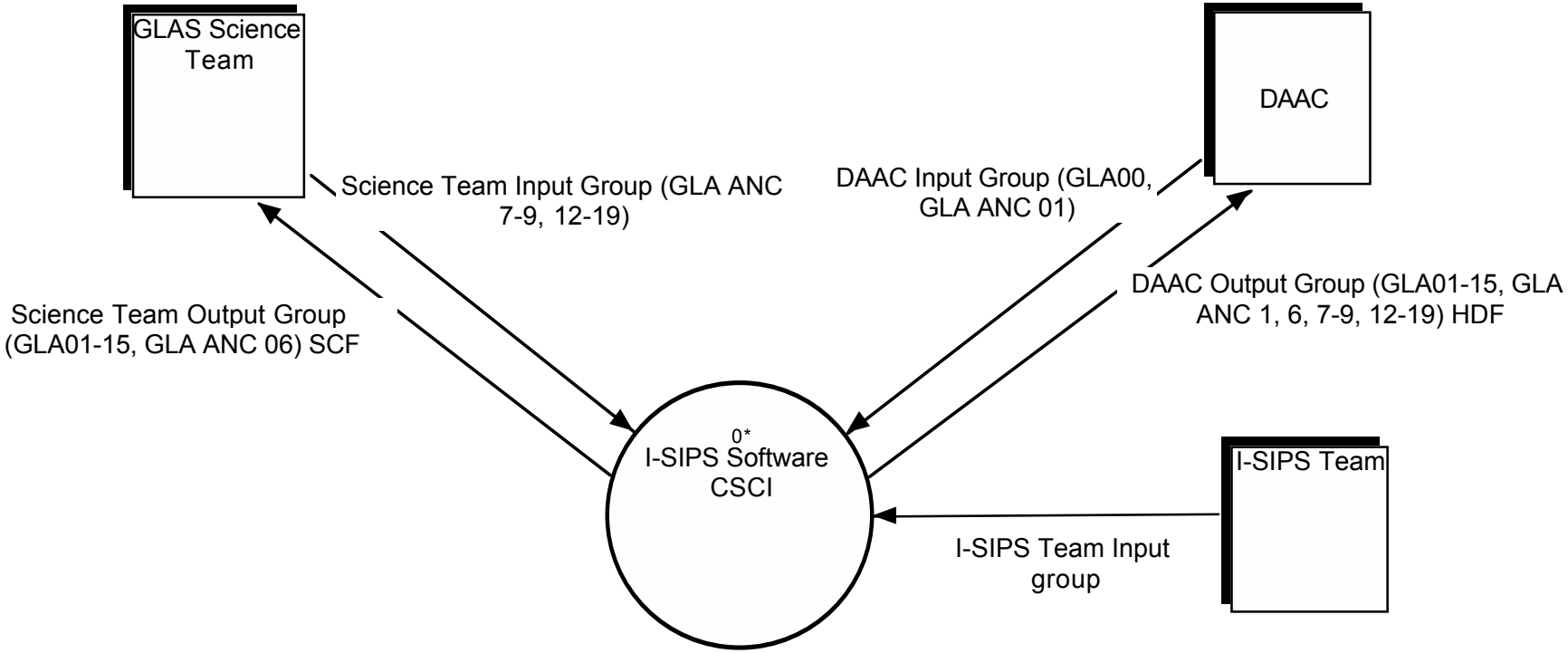
# SCIENCE SOFTWARE REQUIREMENTS (continued)

- ISIPS will consist of multiple independent subsystems to facilitate efficiency on multi-processor systems and reprocessing of selected products or portions of products

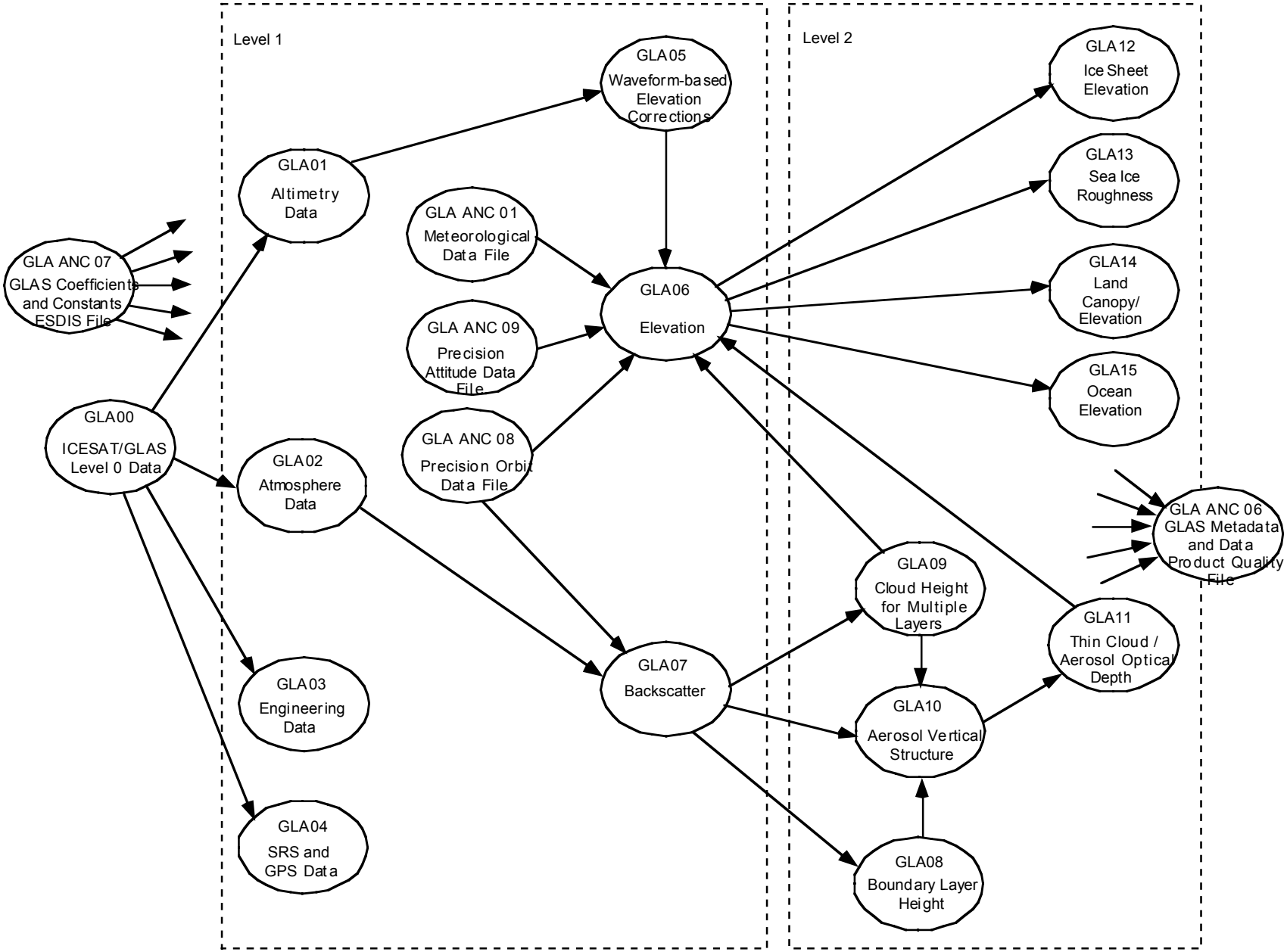
- ISIPS will be designed such that either LIDAR or altimetry data can be processed independently

- ISIPS will be designed for optimal portability by using ANSI standard options in compilers and keeping all host-dependent software in separate files.

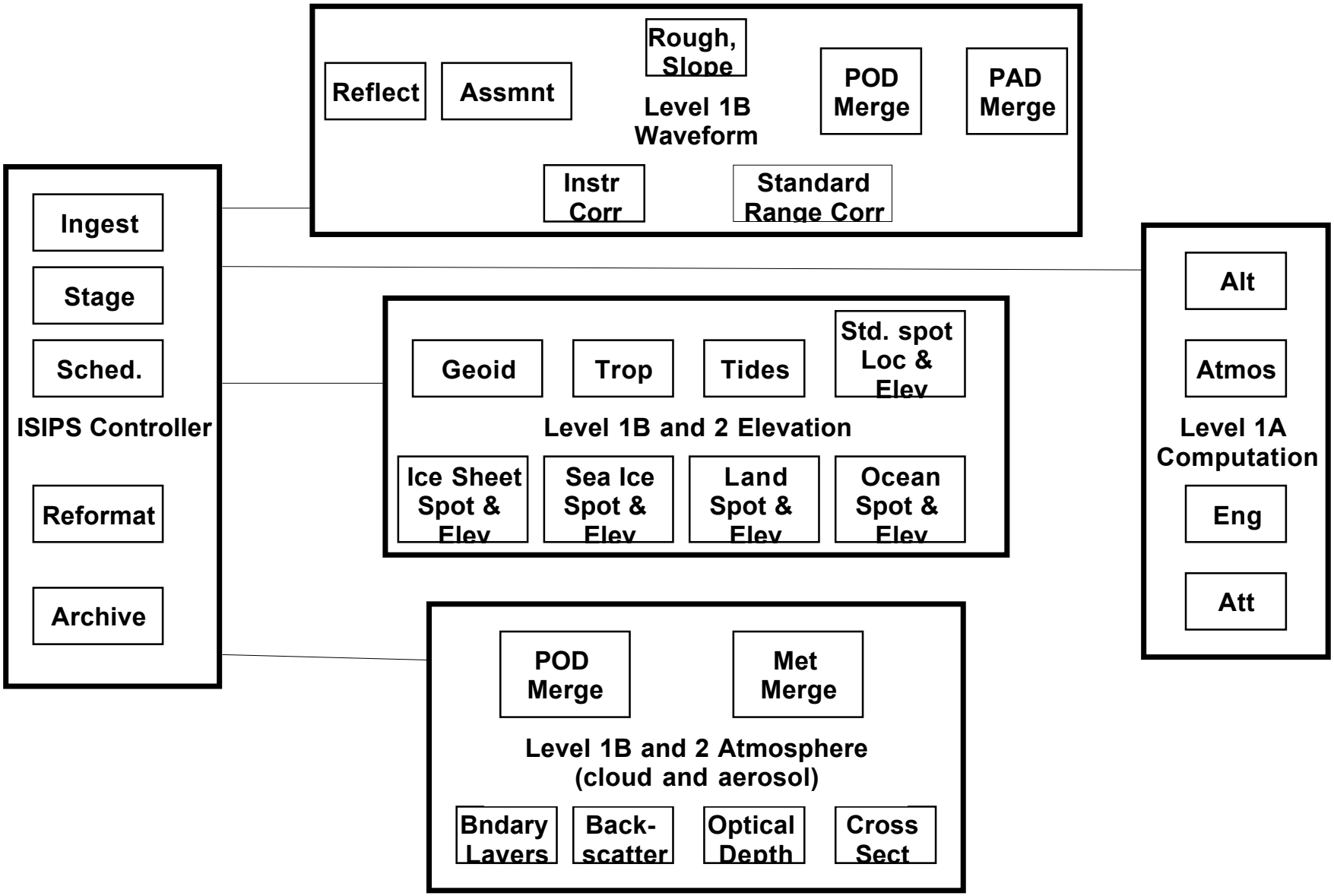
# I-SIPS SOFTWARE CONCEPTUAL ARCHITECTURE



# GLAS STANDARD DATA PRODUCT GENERATION DATA HIERARCHY AND FLOW



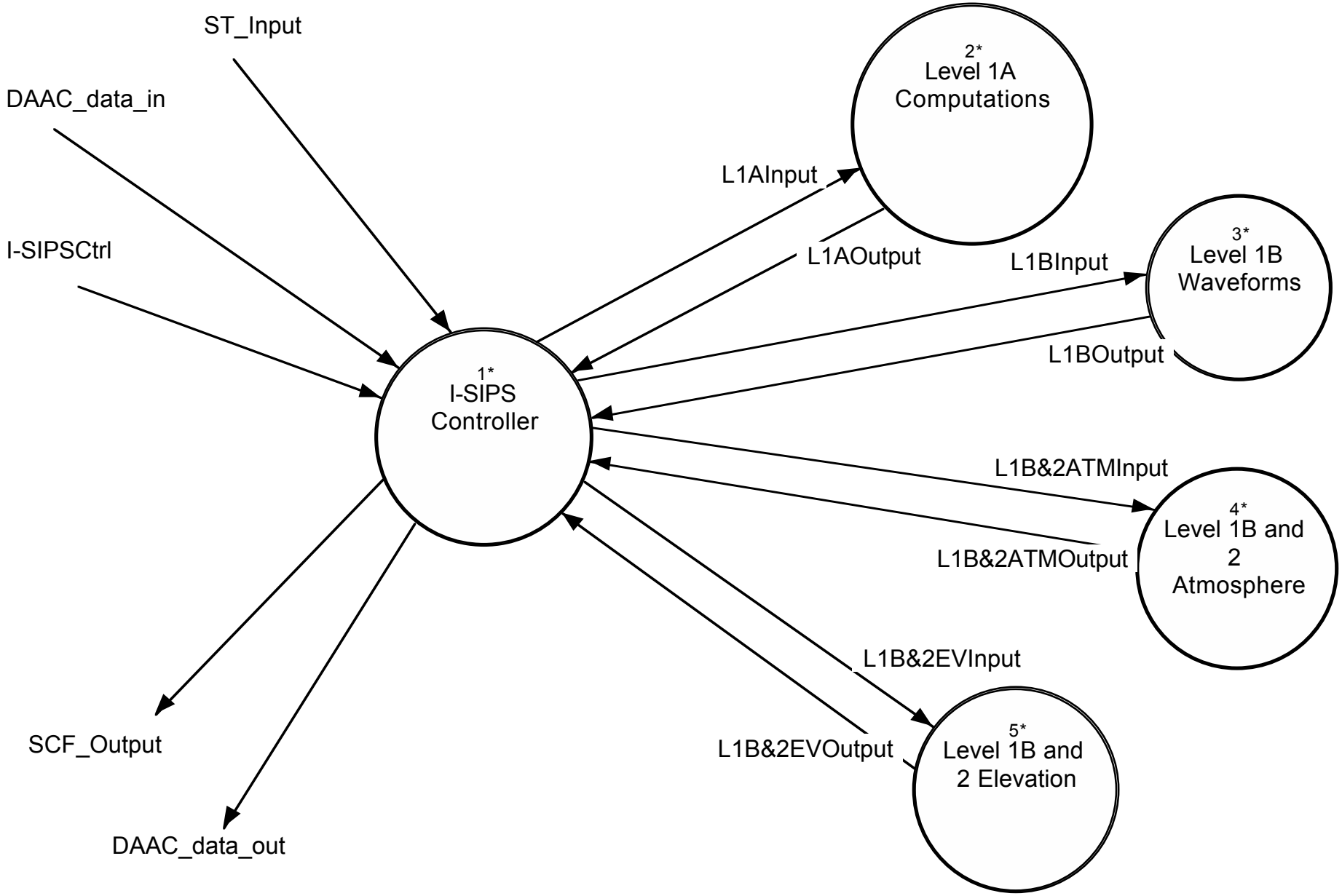
# I-SIPS SOFTWARE TOP LEVEL DECOMPOSITION



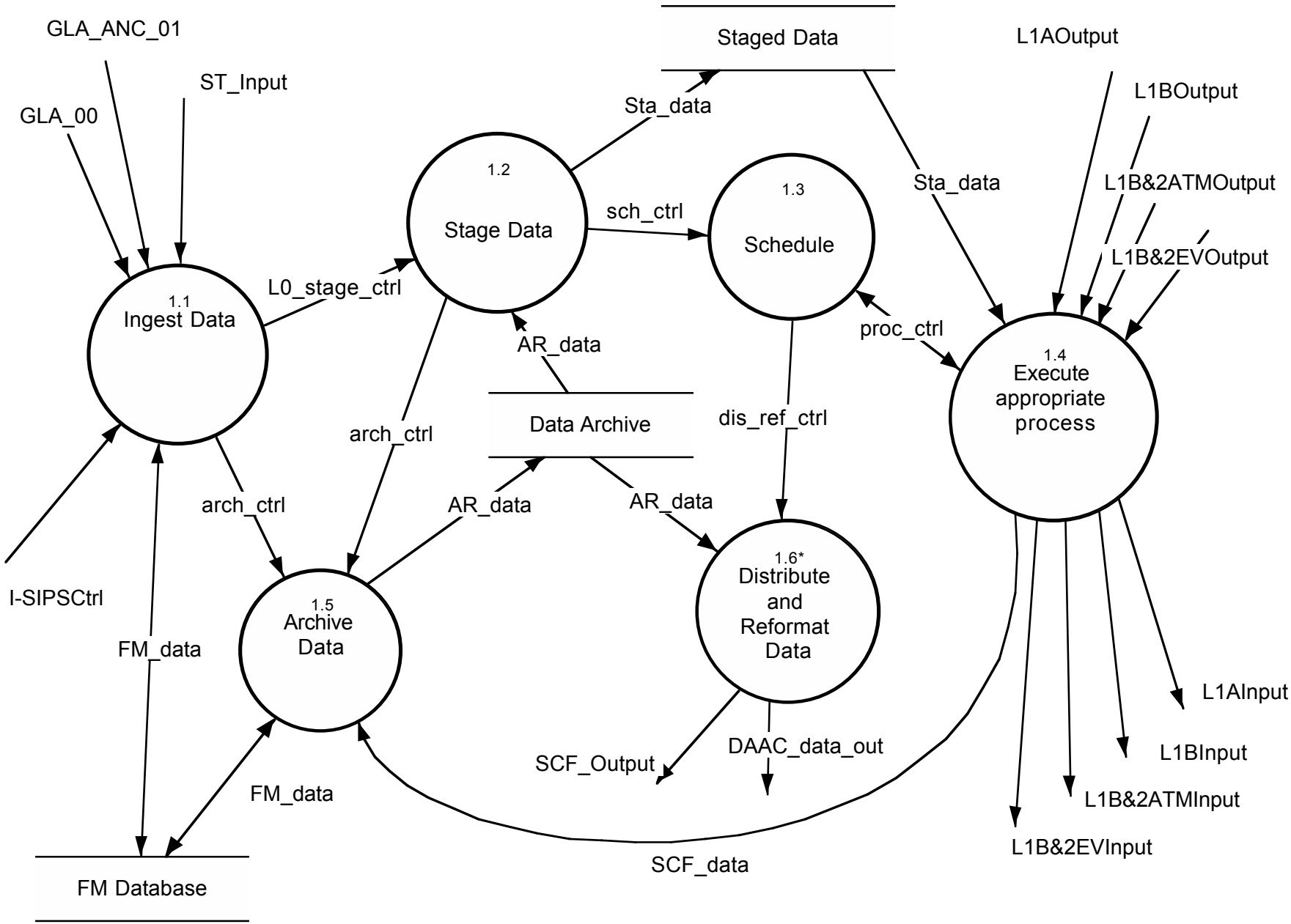
# NOMINAL PROCESSING FLOW

- Ingest level 0 data and some ancillary data from GSFC DAAC
- Validate and Archive level 0 and DAAC-received ancillary data
- Stage remaining ancillary data
- Schedule Processing
- Executors calculate all parameters for level 1 and 2 products in appropriate order
- Create 1 and 2 GLAS_SCF products
- Create GLAS_ANC 06 with QA and metadata
- Archive and distribute GLAS_SCF products
- Reformat data products to HDF or HDF-EOS and distribute to DAAC

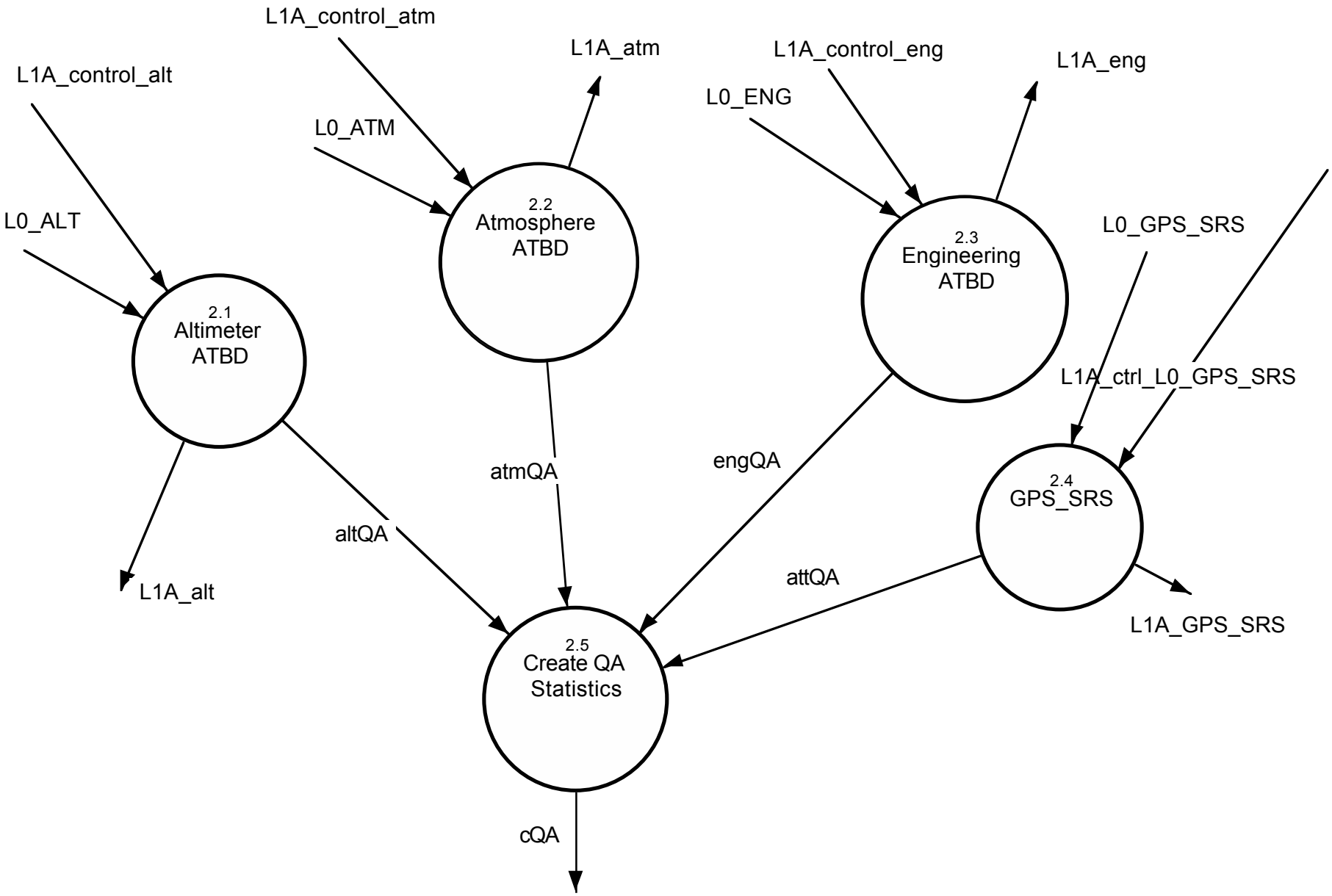
# I-SIPS SOFTWARE LEVEL 1 DFD



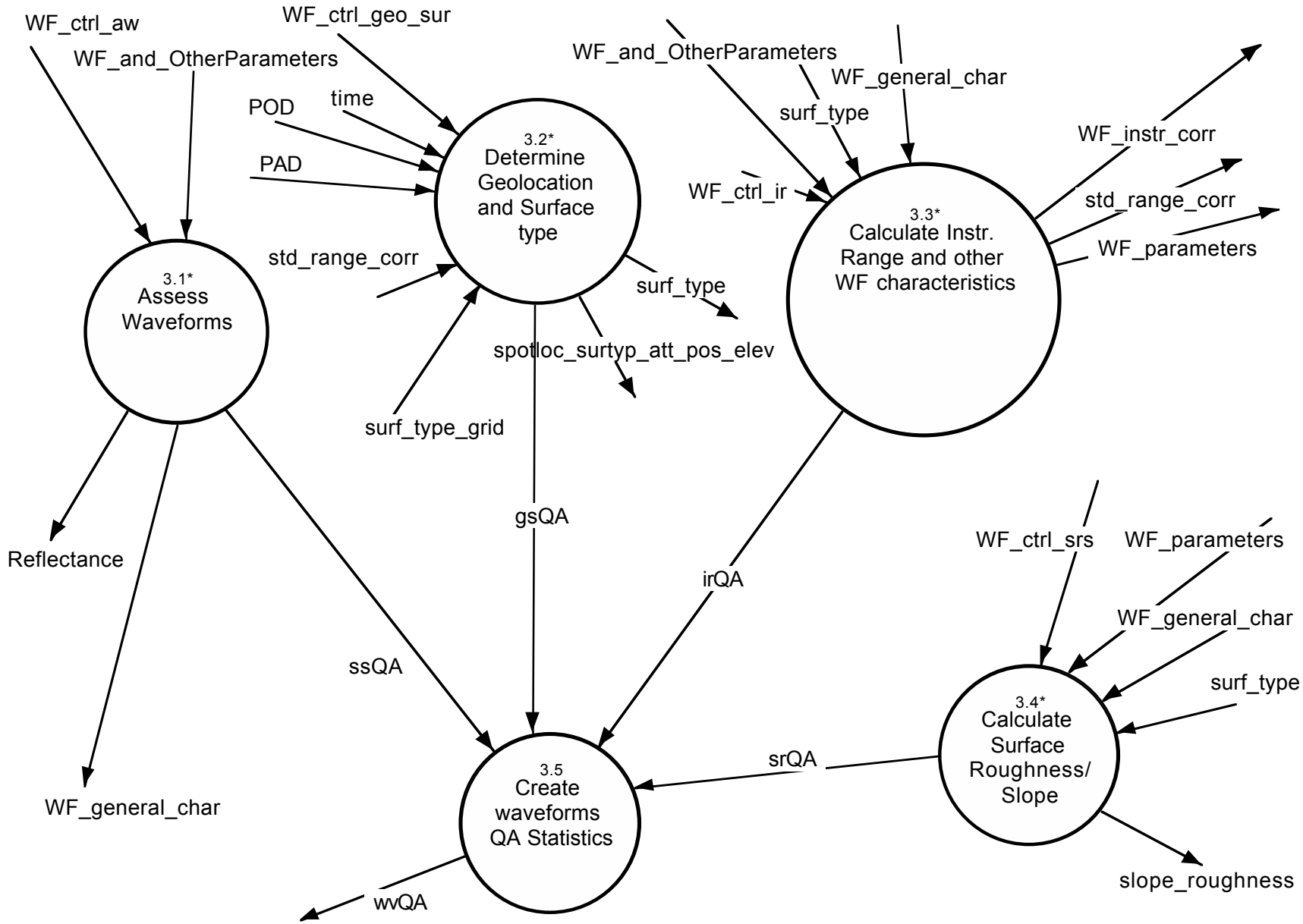
# I-SIPS CONTROLLER DFD



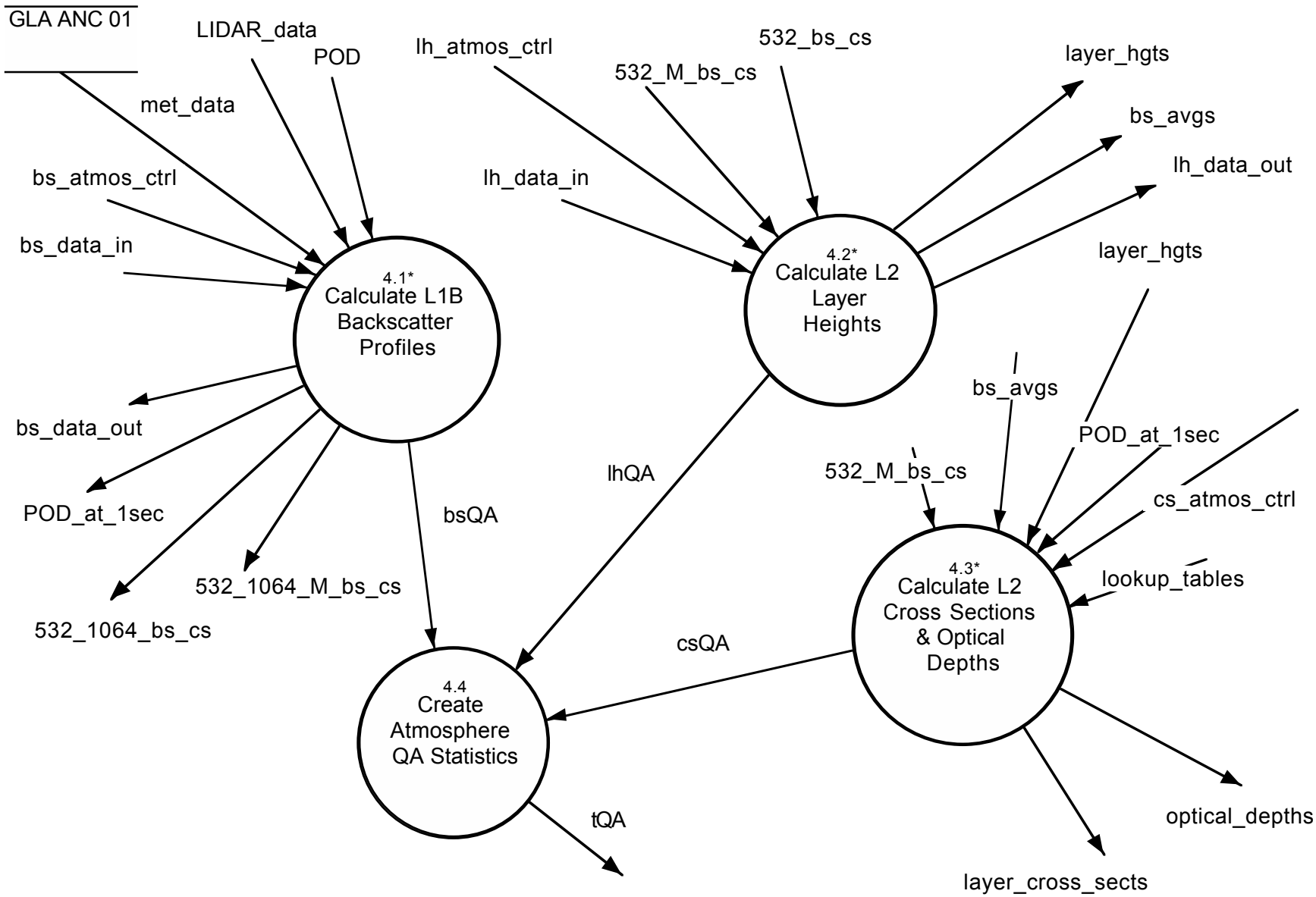
# LEVEL 1A COMPUTATIONS DFD



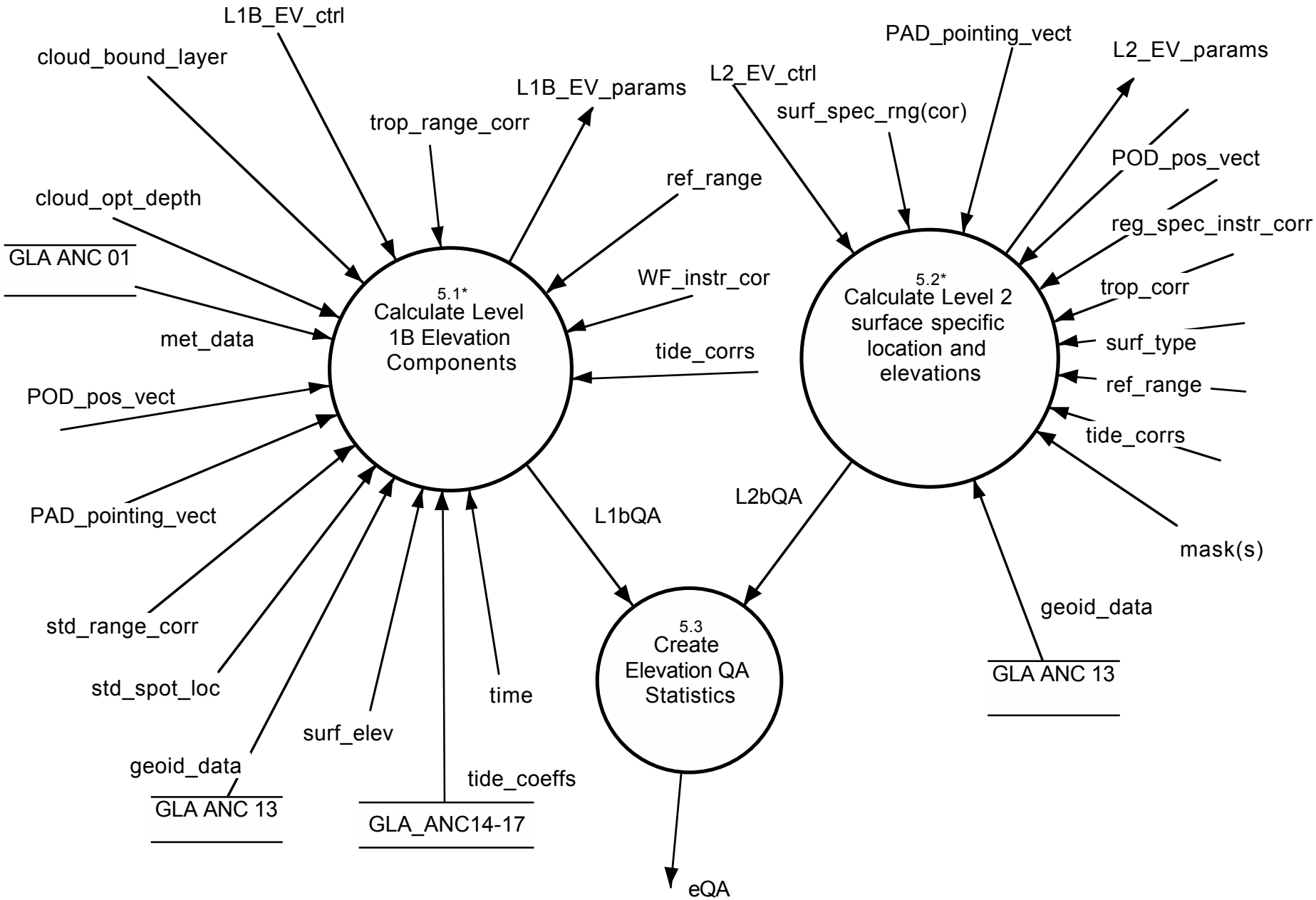
# LEVEL 1B WAVEFORMS DFD



# LEVEL 1B AND 2 ATMOSPHERE COMPUTATIONS DFD



# LEVEL 1B AND 2 ELEVATION DFD



# I-SIPS CONTROLLER

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# I-SIPS CONTROLLER REQUIREMENTS

- ICESat Science Investigator-led Processing System (I-SIPS) will be an automated system for processing and reprocessing of GLAS standard data products.
- The I-SIPS will be automated and “kick off” upon receipt of level 0 data from the GSFC DAAC.
- Level 0 data will be archived on near-line storage and cataloged as GLA00.
- GLA00 data will be staged to the processing area.
- All ancillary data needed for the time span to be processed will be staged to the processing area.
- All data products created during the processing will be archived and cataloged.
- Processed Level 1B, and 2 data will be distributed to the science team electronically.
- Level 0, and 1A data will be available to science team by request.
- All standard data products will be distributed to the NSIDC DAAC in HDF or HDF-EOS.

# I-SIPS CONTROLLER FUNCTIONS

- File Management
  - Ingest files
    - Level 0 data from the GSFC DAAC
    - Ancillary files from the GSFC DAAC
    - POD/PAD information from UTCSR
    - Ancillary files from science team locations
  - Archive files
    - Near-line archive on DLT library
    - Off-line archive to DLT
  - Catalog files
    - Date and time of receipt
    - Source
    - Time span of data
    - Location
    - Version

# I-SIPS CONTROLLER FUNCTIONS

- Resource Management
  - On-line staging area space availability.
  - Tape library space availability.
  - Export data from near-line to off-line.
  - Request tape mounts from operator for off-line data.
  - Error handling.
- Distribution
  - Routine delivery of requested data to science team members electronically.
  - Routine delivery of all standard data products to NSIDC.

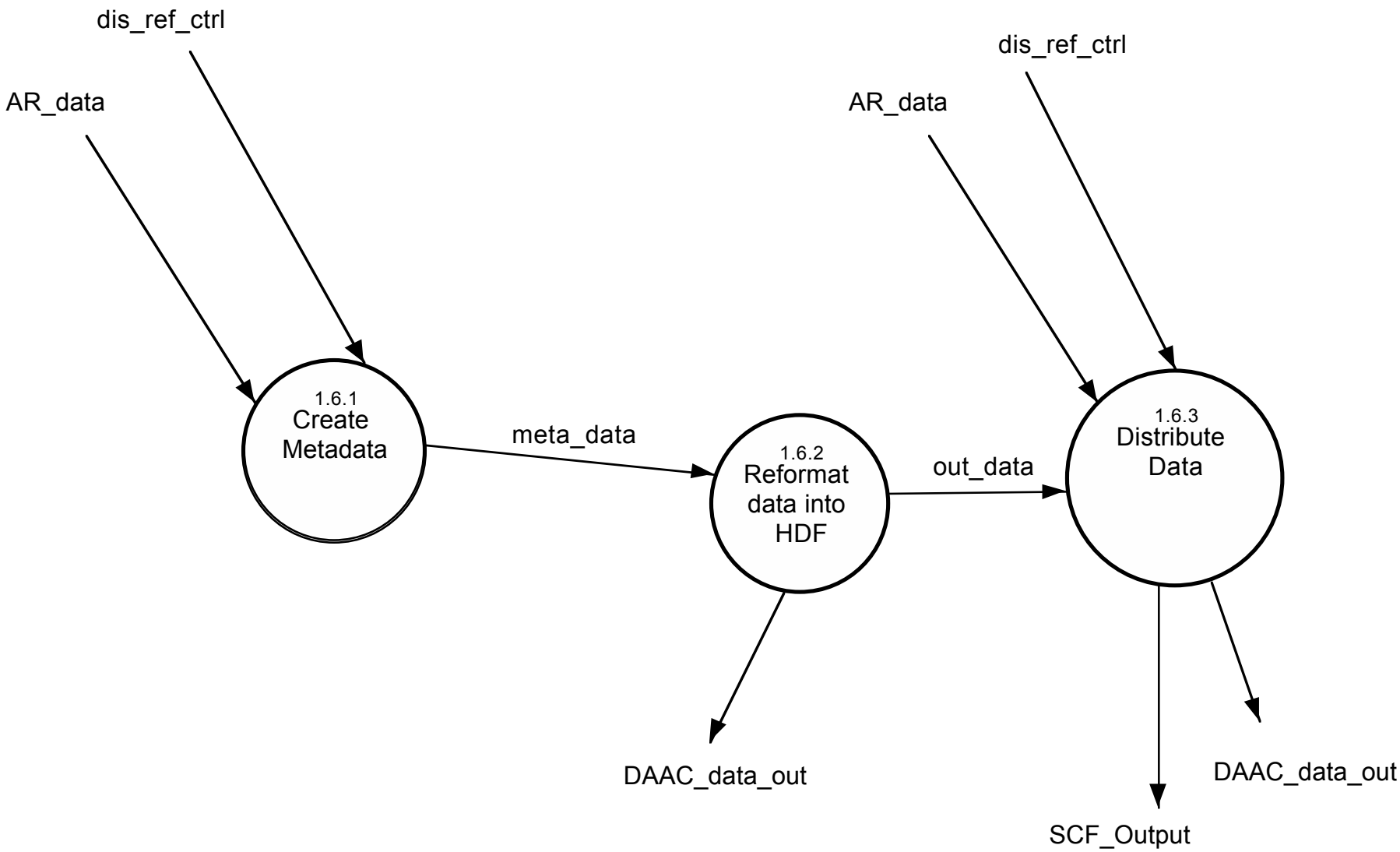
# I-SIPS CONTROLLER FUNCTIONS

- **Processing Control**
  - **Determine if required input data is available.**
  - **Stage data.**
  - **Schedule processing to begin when all data are staged.**
  - **Handle reprocessing scenarios.**
  - **Archive data.**
  - **Error handling.**
  - **Clean up.**

# DATA MANAGEMENT SYSTEM

- I-SIPS team will re-use the GSFC DAAC V0 software.
  - Requires porting to HP platform.
- Data archive and distribution, file management, and system resource functionality of the DAAC software will be adapted and integrated into the processing system.
- I-SIPS specific process scheduler will be written.
- I-SIPS ingest software will be written or modified as required.

# DATA MANAGEMENT DFD



# TASK EXECUTIVE

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# TASK EXECUTIVE FUNCTIONS

- Provides initialization
  - Variables
  - Most ancillary files
- Links ATBD subprocesses
- Provides standardized error handling
- Performs most data input/output
  - Design goal is to minimize input/output
- Allows partial processing and reprocessing scenarios
- Provides global wrap up

# THE EXECUTOR
## *A Layered Approach*

- **Layer 1: Executor - Top-level Control and Input**
- **Layer 2: Managers - Mid-Level Glue and Output**
- **Layer 3: Subsystems - ATBD Implementations**

<table>
<tr><td colspan="4">Executor</td></tr>
<tr><td>Level 1A<br>Manager</td><td>Level 1B and 2<br>Atmosphere Manager</td><td>Level 1B Waveforms<br>Manager</td><td>Level 1B and 2 Elevation<br>Manager</td></tr>
<tr><td>Level 1A Subsystem<br>Sub-Processes</td><td>Atmosphere Subsystem<br>Sub-Processes</td><td>Waveforms Subsystem<br>Sub-Processes</td><td>Elevation Subsystem<br>Sub-Processes</td></tr>
</table>

# LAYER 1 : EXECUTOR

- Global Initialization
  - Variable initialization
  - Global ancillary file initialization
  - Open all required files
- User Interface/Control Processing
- Global Metadata
- Data Input
  - Read and process record-by-record
- Data Buffering
- Global Error Handling
- Manager Execution Control
- Global Wrap-up
  - Close all open files
  - Write final metadata

# LAYER 2 : MANAGERS
## (L1A, Atmosphere, Waveforms, Elevation)

- Local Initialization
  - Variable initialization
- Local Metadata
  - Cumulative metadata
- Local Ancillary Data Input
  - Reads Ancillary data not kept in core
- Local Error Handling
- Sub-Process Execution Control
  - Handles fine level of reprocessing
- Data Output
- Local Wrap-up

# LAYER 3: SUBSYSTEMS

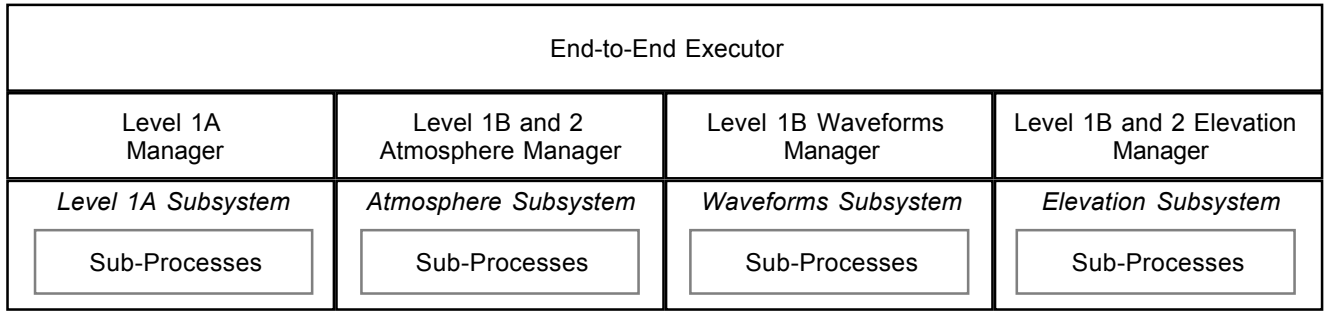
- **Actual implementation of ATBD computations**
- **Partitioned into processes designed for partial processing**

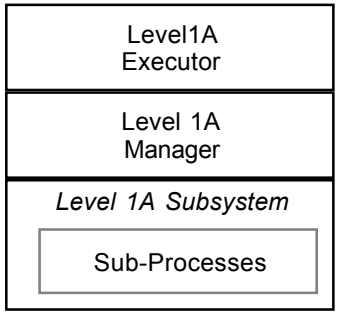
# PARTIAL PROCESSING AND RE-PROCESSING

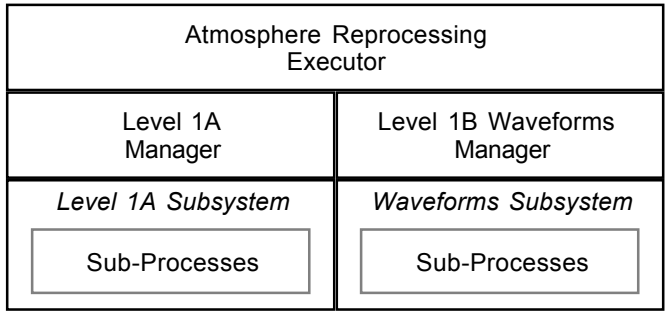
- **Solution to Partial Processing and Re-Processing complexity is Multiple Executives**
  - **Executives will be coded from a master "template"**
  - **Libraries of Subprocesses and Managers make code reuse easy**
- **Multiple Executives mean fewer states handled by each executive**

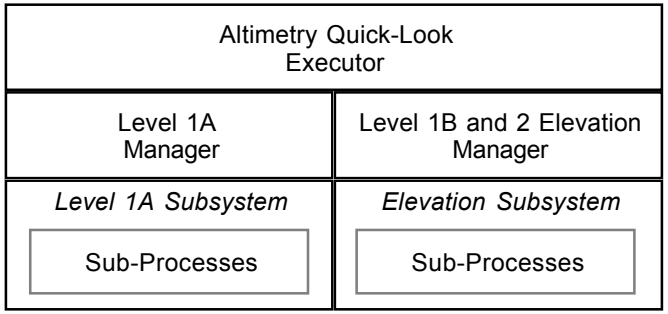
# PARTIAL PROCESSING AND RE-PROCESSING

## *Sample Executors*



# LEVEL 1

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# LEVEL 1A PROCESSING REQUIREMENTS

- Divide the Level 0 Data Among the Level 1A Data Products
- Engineering Unit Conversion
- Monitor Instrument Health / Performance
- Collect Performance Data for Trend Monitoring
- Perform Data Quality Checks
- Produce Data and Processing Metadata
- Perform all Data Operations Tied to Instrument State

## Inputs

- Level 0 Telemetry Data
  - Instrument
  - Spacecraft
- Conversion Coefficients, Constants, Limits
- Processing Control Data

## Outputs

- Level 1A Altimetry Data
- Level 1A Atmospheric Data
- Level 1A Engineering Data
- Level 1A Attitude Data
- Level 1A Metadata
- Trend Data
- Errors

## Level 1A Error States

- Missing APIDs
- Bad Checksums

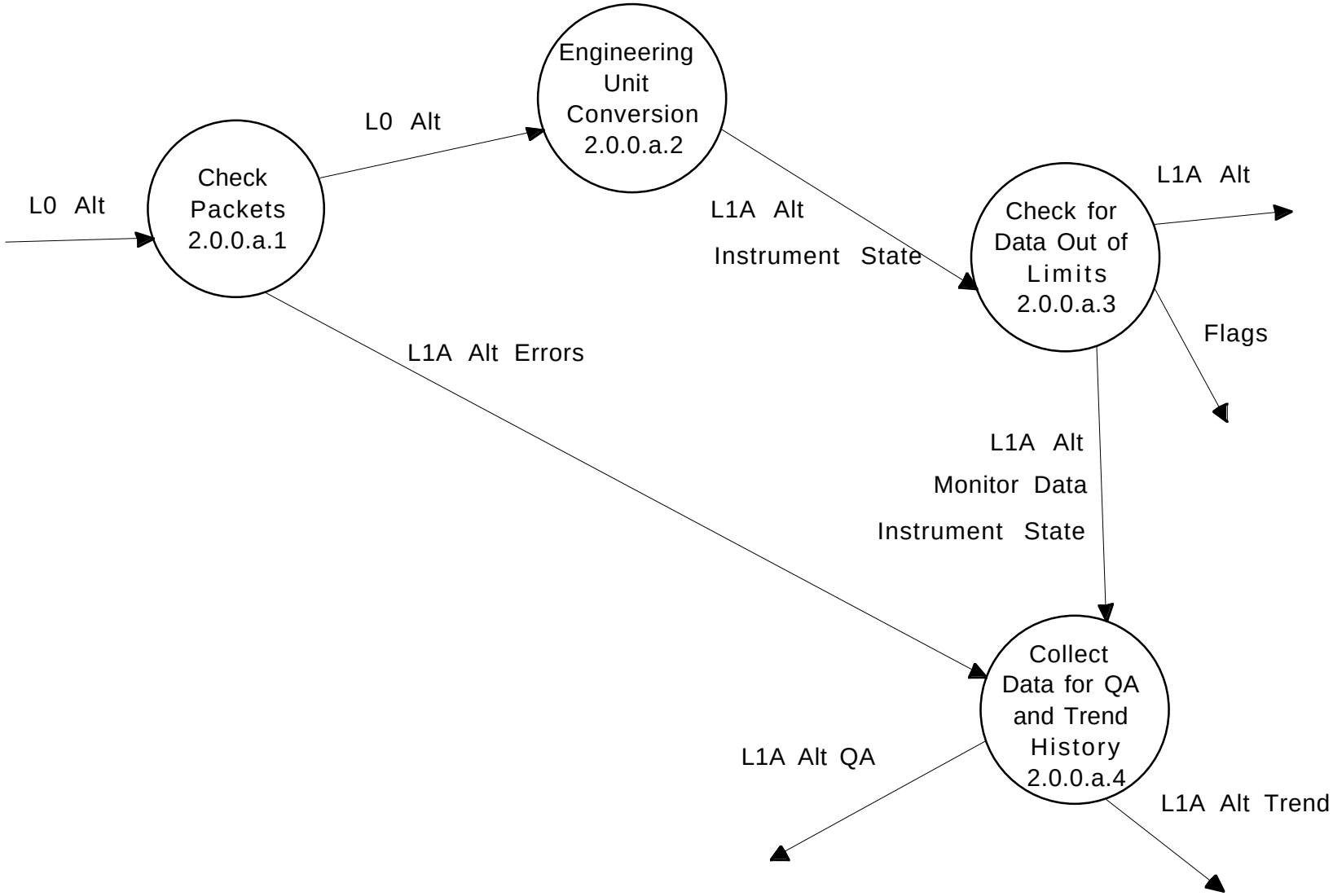
## Level 1A Reprocessing Scenarios

- Missing APIDs recovered
- Engineering Unit Conversion Updates
- Monitoring Updates
- Trend Data Collection Updates

## Unknowns

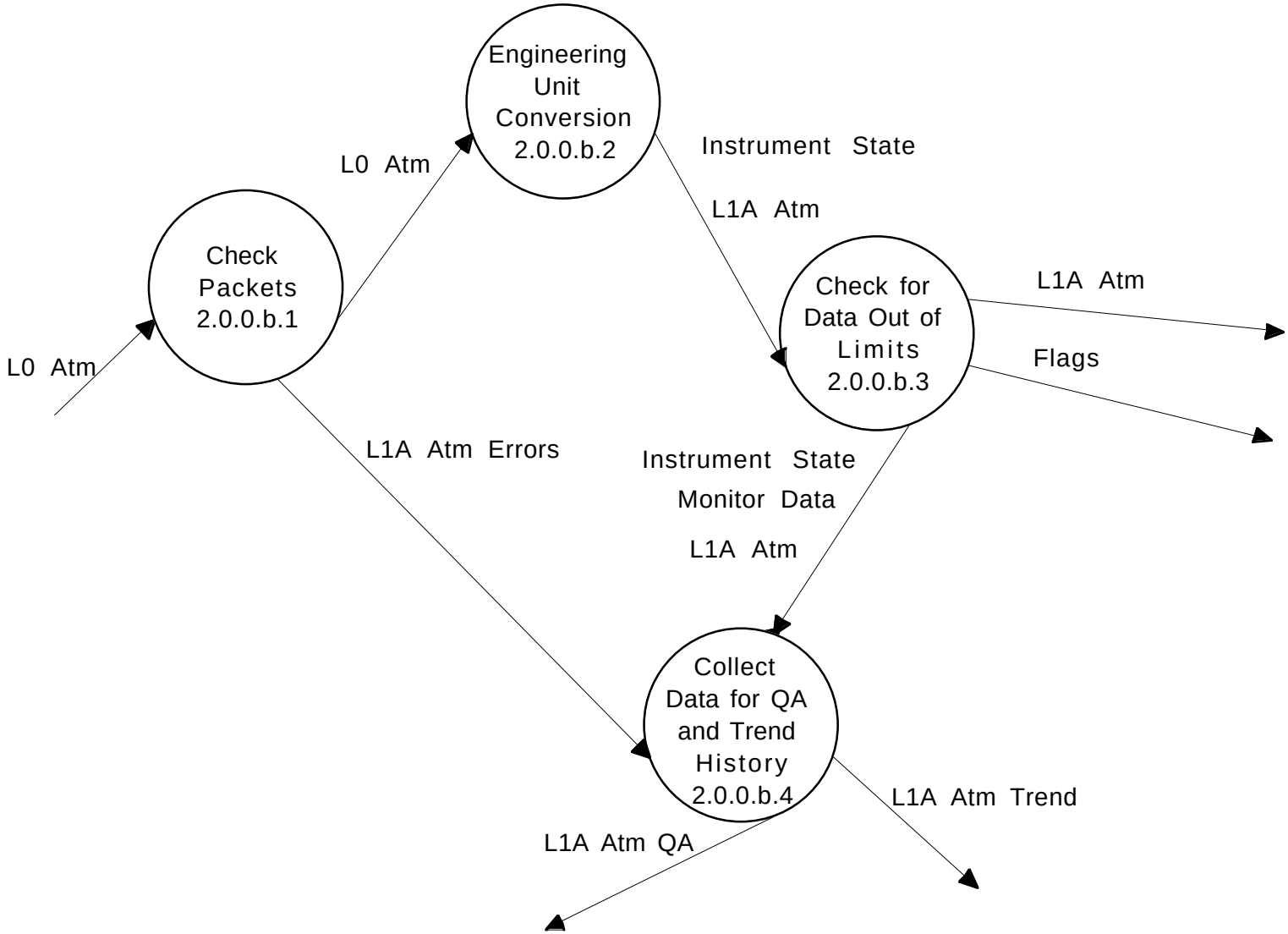
- Engineering Unit Conversions
- Monitoring Requirements
- Trend Data Requirements
- Processing Requirements for SRS and GPS Data

# DFD 2.0.0.a LEVEL 1A ALTIMETER ATBD



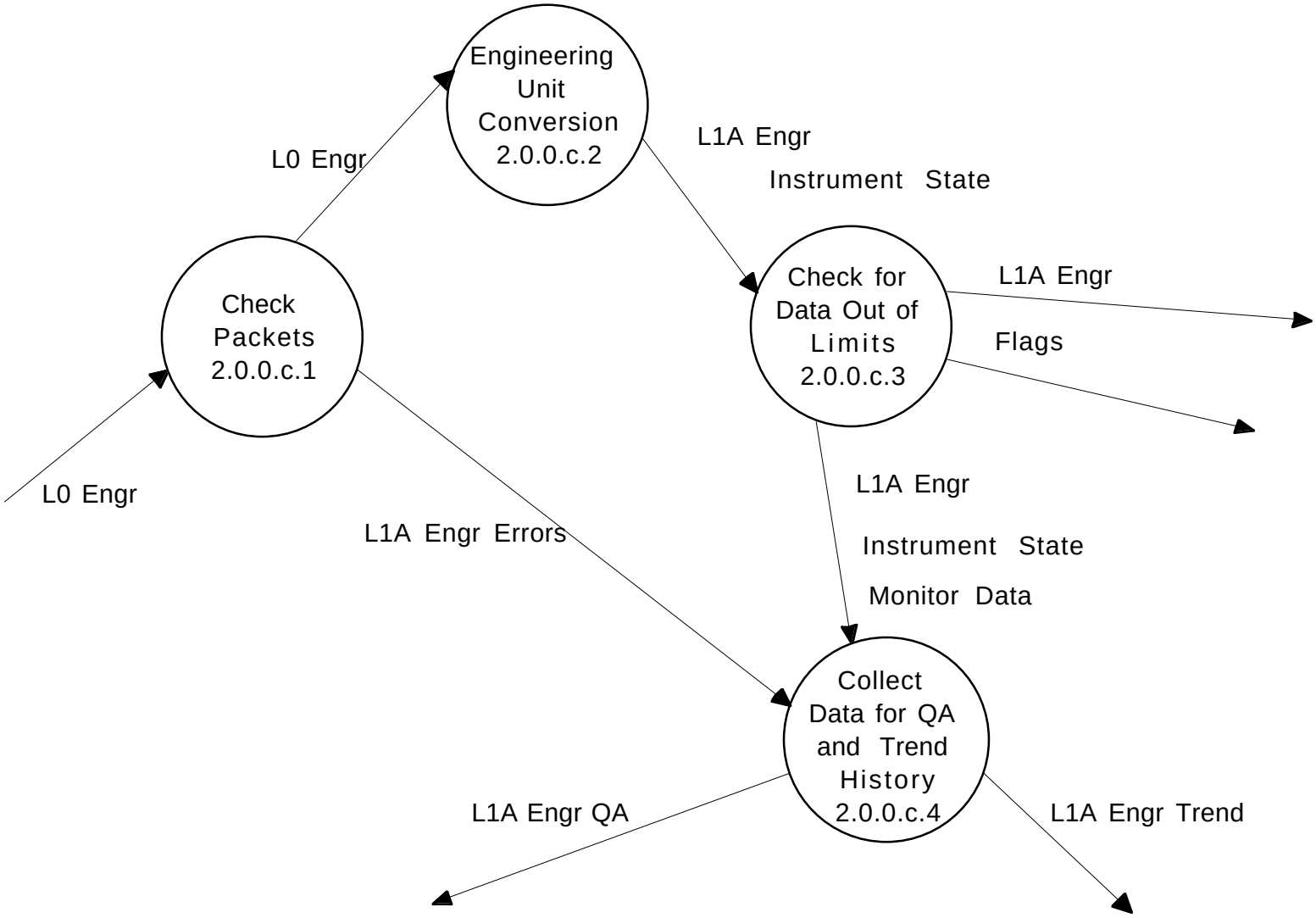

DFD 2.0.0.a Level 1A Altimeter ATBD

# DFD 2.0.0.b LEVEL 1A ATMOSPHERE ATBD



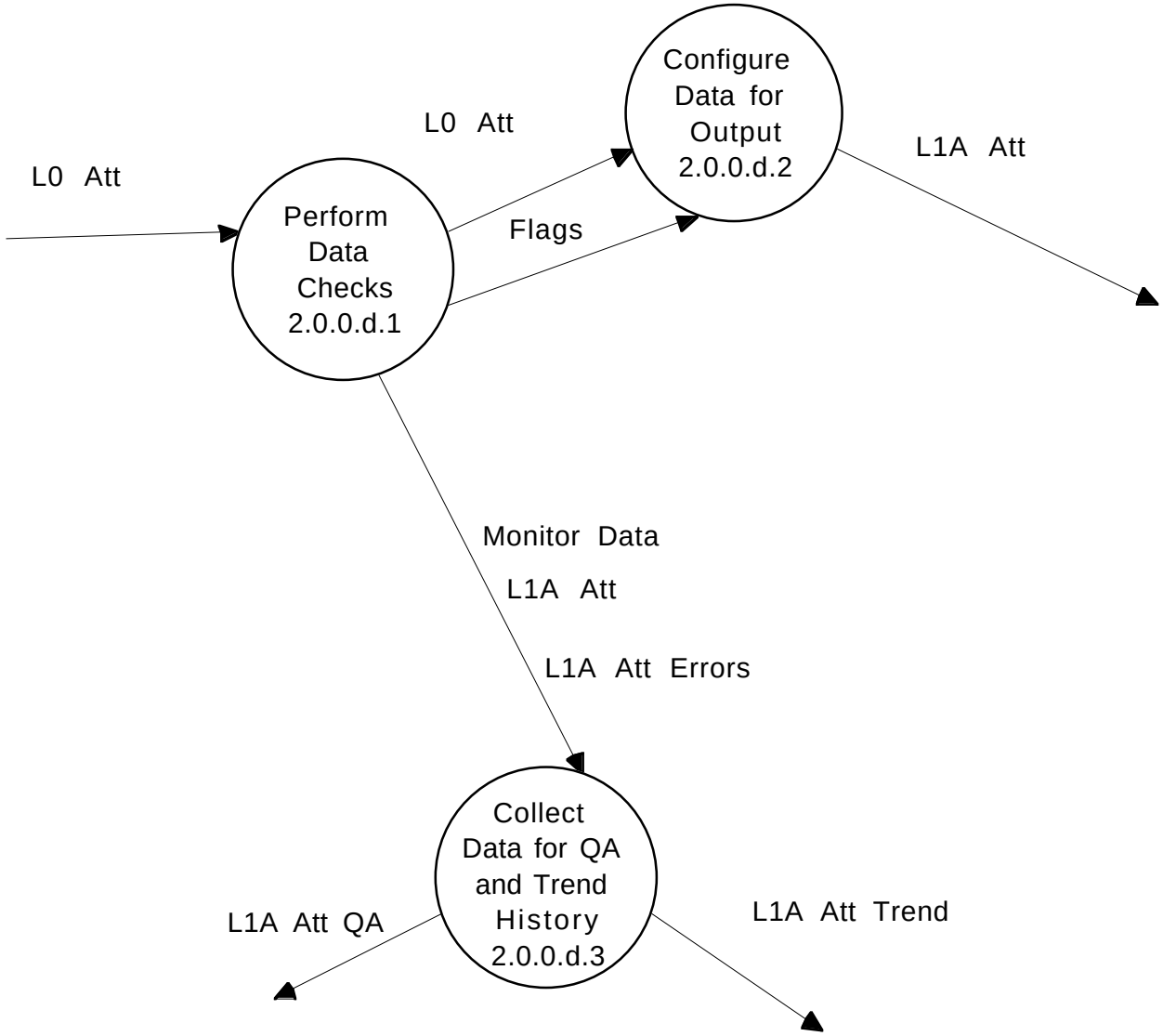

DFD 2.0.0.b Level 1A Atmosphere ATBD

# DFD 2.0.0.c LEVEL 1A ENGINEERING ATBD



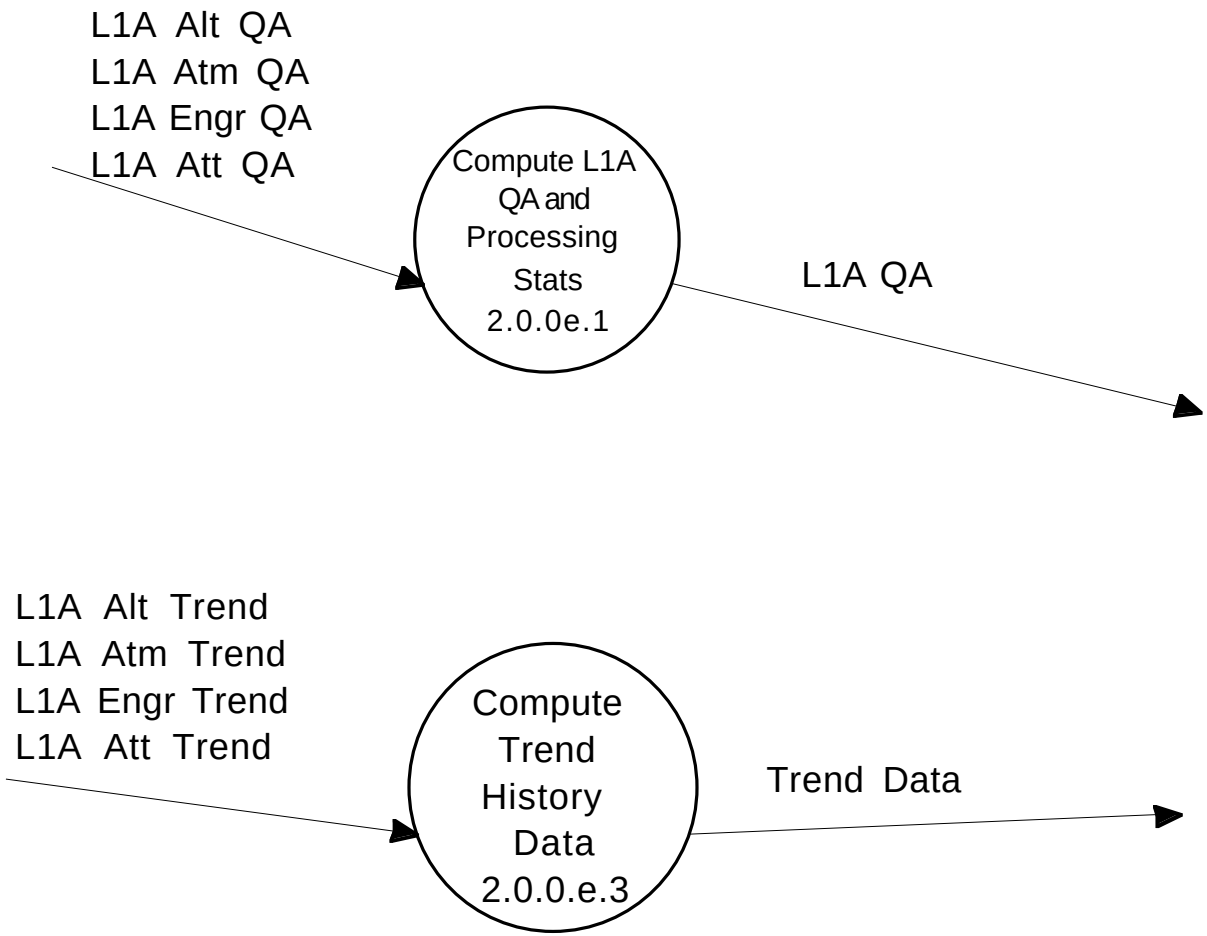

DFD 2.0.0.c Level 1A Engineering ATBD

# DFD 2.0.0.d LEVEL 1A ATTITUDE ATBD




DFD 2.0.0.d Level 1A Attitude ATBD

# DFD 2.0.0.e LEVEL 1A WRAP-UP




DFD 2.0.0.e Level 1A Wrap-up

# ALTIMETER WAVEFORM ANALYSIS

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**email: Anita.C.Brenner.1@gsfc.nasa.gov**

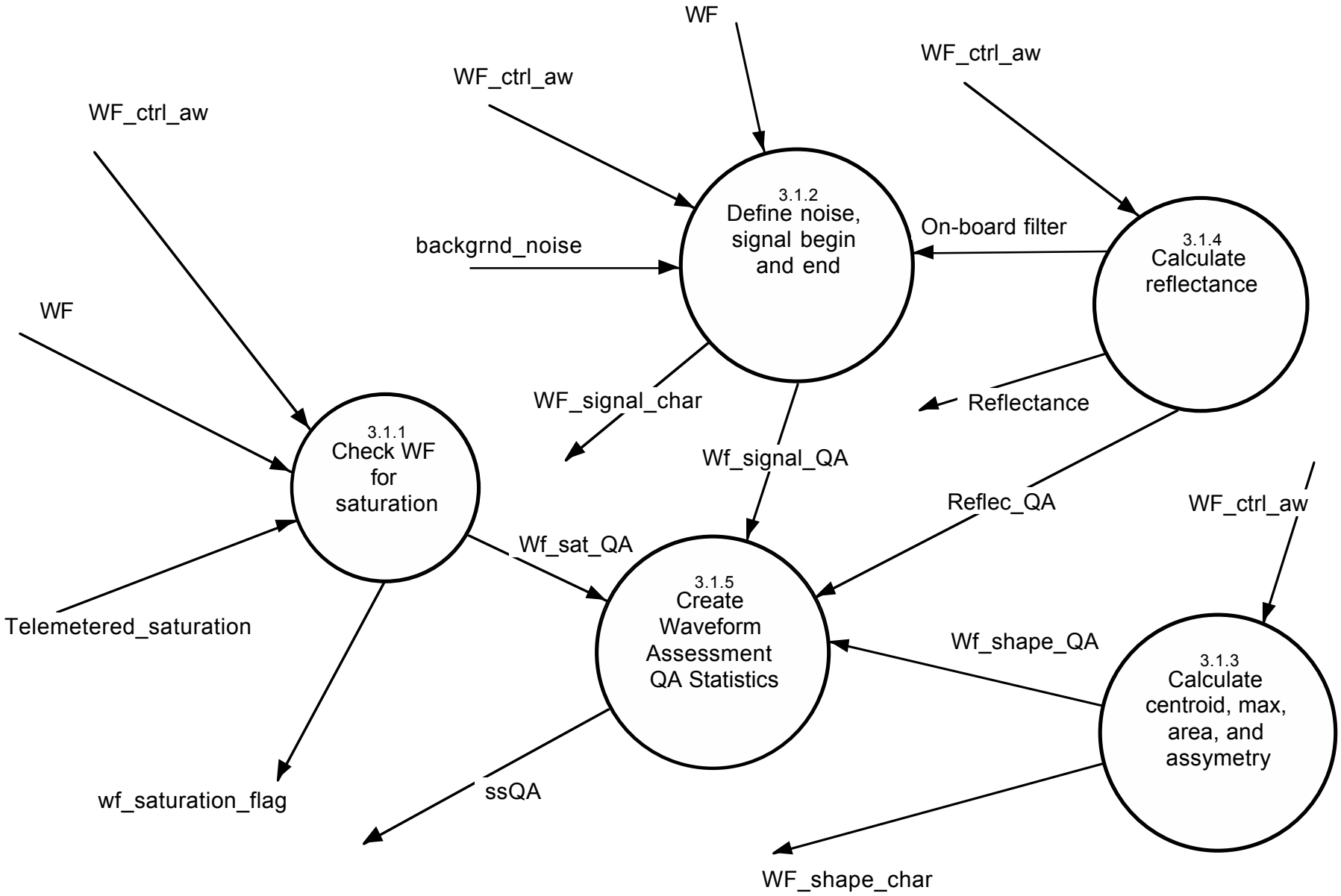
# LEVEL 1B ALTIMETER WAVEFORM PROCESSING FUNCTIONS

- General Assessment of waveform
- Calculate standard range correction
- Geolocate return and calculate possible region types for footprint
- Calculate instrument corrections for sea ice region type
- Calculate instrument corrections for ice sheet region type
- Calculate instrument corrections for land region type
- Calculate instrument corrections for ocean region type
- Calculate reflectance
- Calculate surface roughness and slope for sea ice region
- Calculate surface roughness and slope for ice sheet regions
- Calculate surface characteristics for land regions
- Create quality assurance statistics

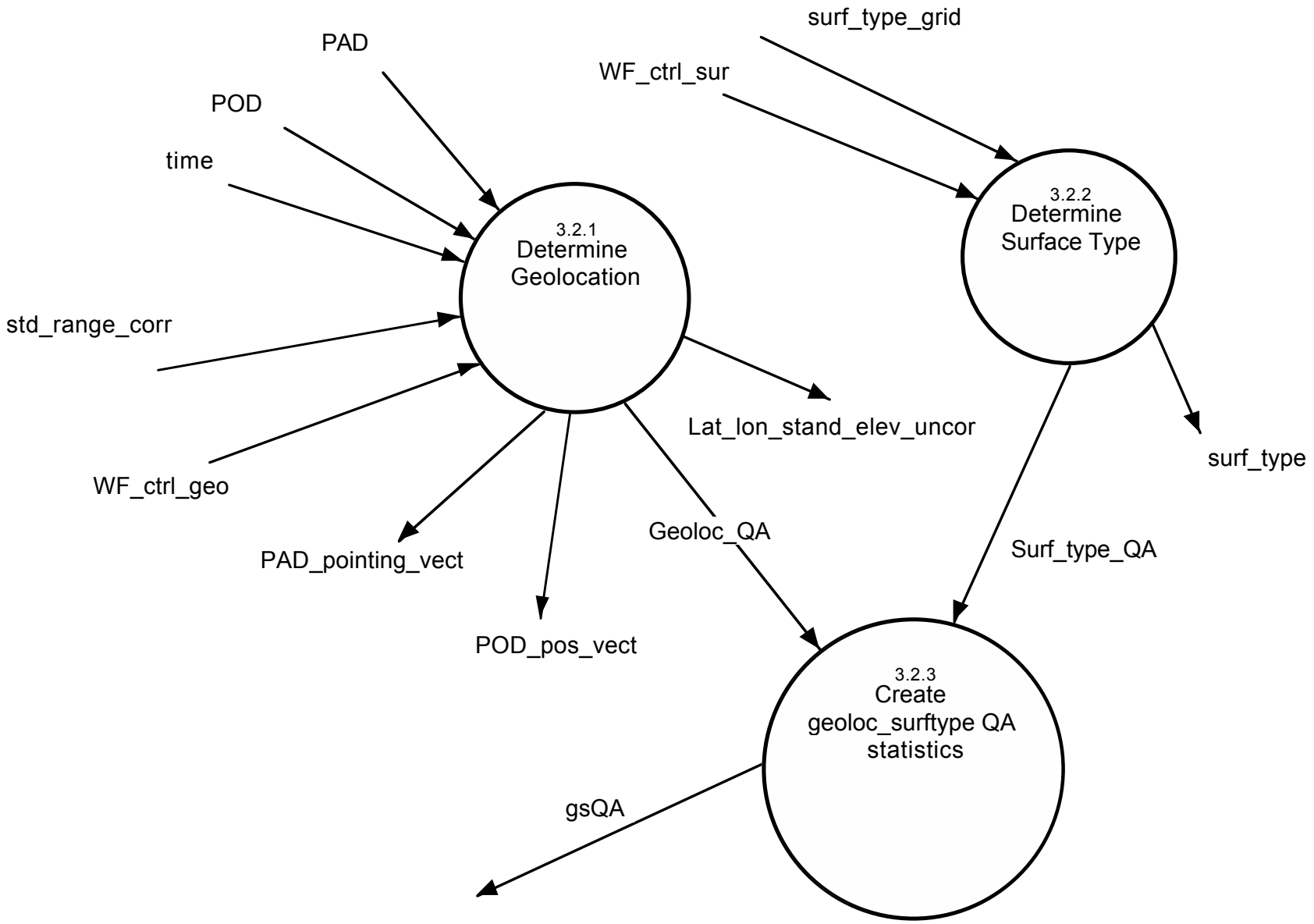
# LEVEL 1B WAVEFORM PROCESSING

- Inputs
  - Waveform after all calibration corrections have been applied
    - 544 samples for ice sheet and land
    - 207 samples for sea ice and ocean
  - Gain
  - Compression constants
  - Waveform processing control
  - Surface-type grid
  - POD and PAD
- Outputs
  - parameters for the level 1b waveform file - GLA05
  - level 1b waveform QA
  - level 1b waveform metadata

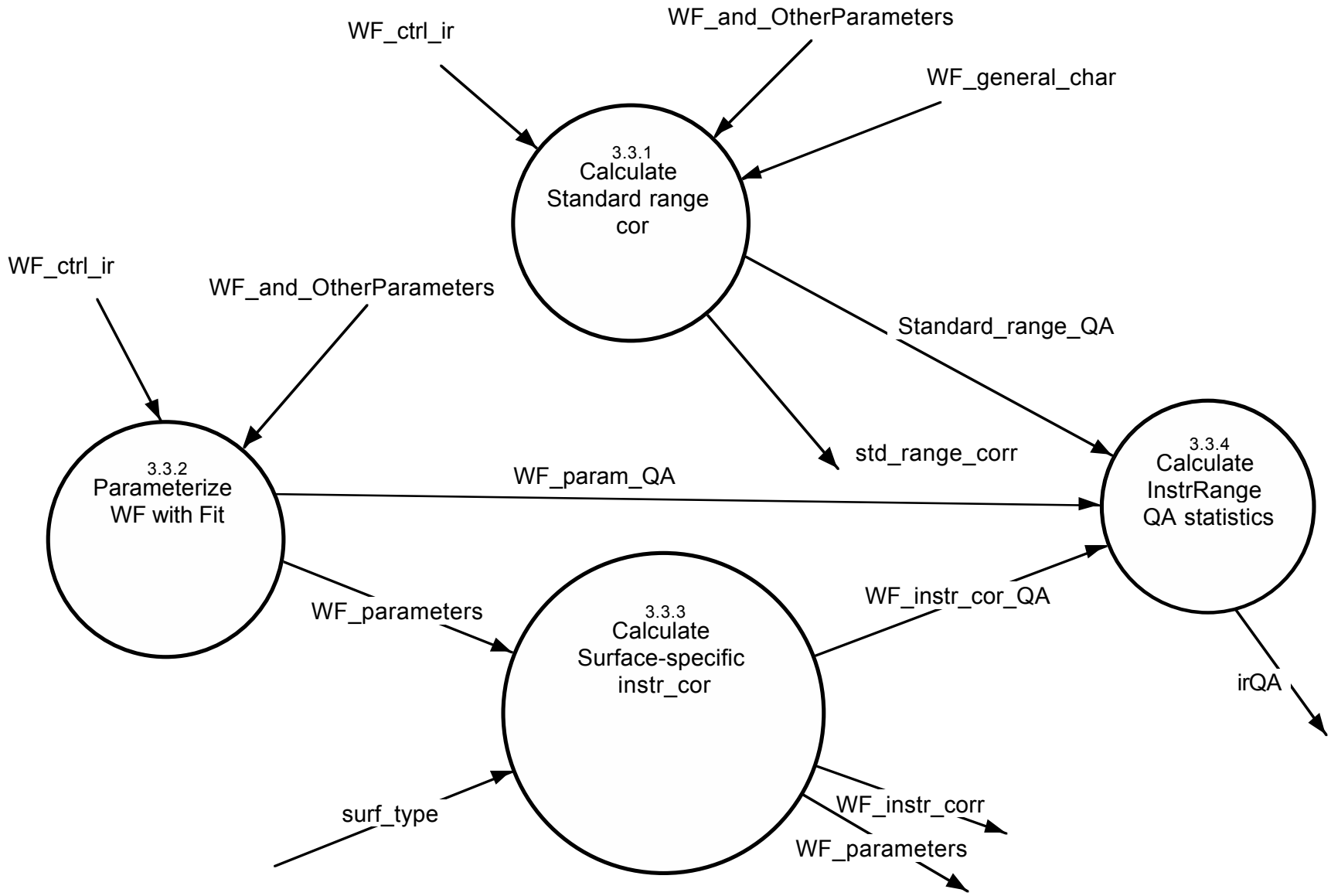
# ASSESS WAVEFORMS DFD



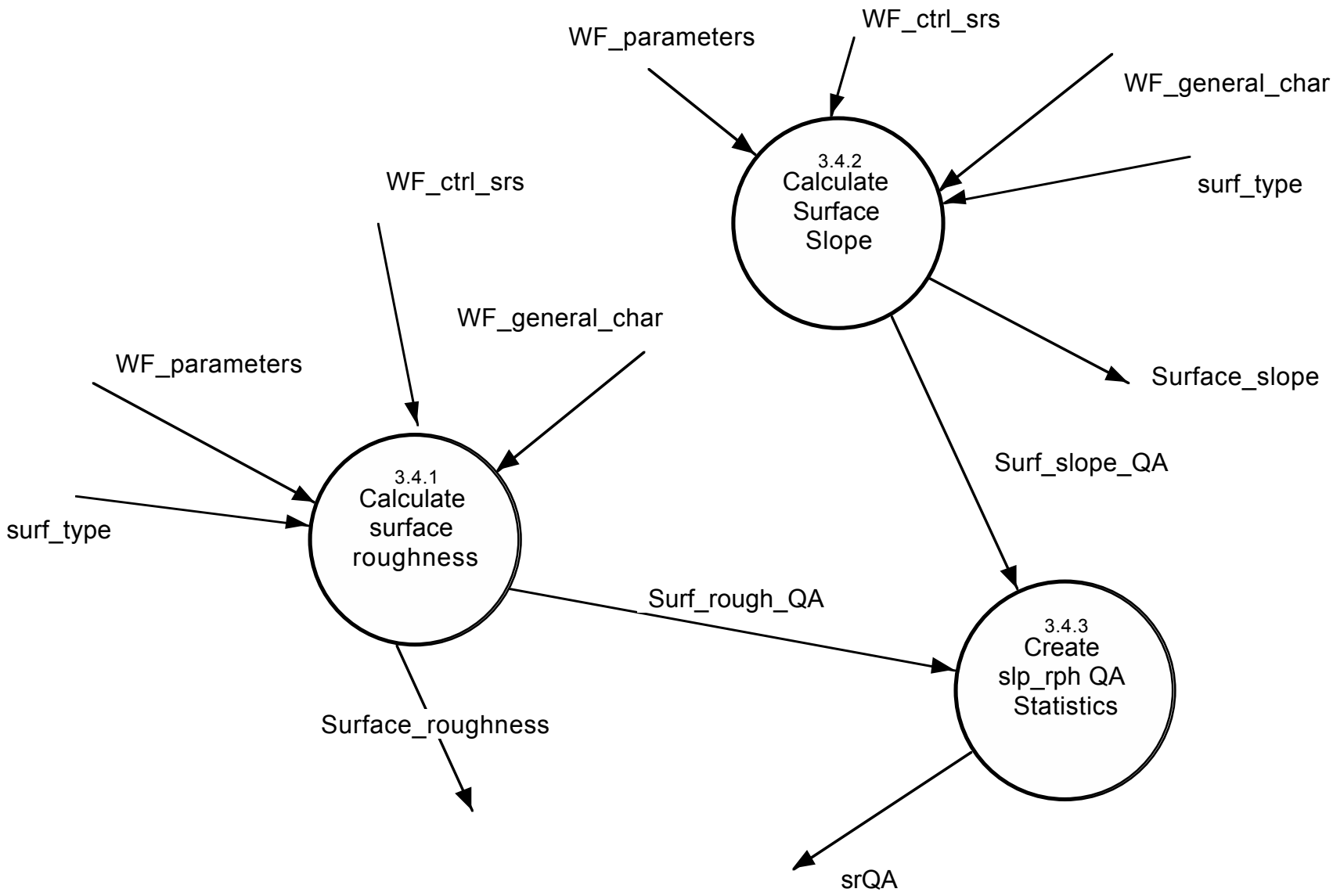
# DETERMINE GEOLOCATION AND SURFACE TYPE DFD



# CALCULATE INSTRUMENT RANGE AND OTHER WF CHARACTERISTICS DFD



# CALCULATE SURFACE ROUGHNESS/SLOPE DFD



# ALTIMETER ELEVATION COMPUTATION

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# LEVEL 1B ELEVATION COMPUTATION

**Functions:**

- Calculate Tide Corrections
- Calculate Geoid Height
- Calculate Tropospheric Delay Corrections
- Calculate Corrected Standard Surface Elevation and Spot Location

**Inputs:**

- Tide Coefficients
- Geoid Grid
- Met Data
- Spot Location
- Standard Range Correction
- Reference Range
- Time
- Position Vector

# LEVEL 1B ELEVATION COMPUTATION
## (continued)

**Inputs:**

- Attitude Vector
- Surface Type
- Processing Control Data

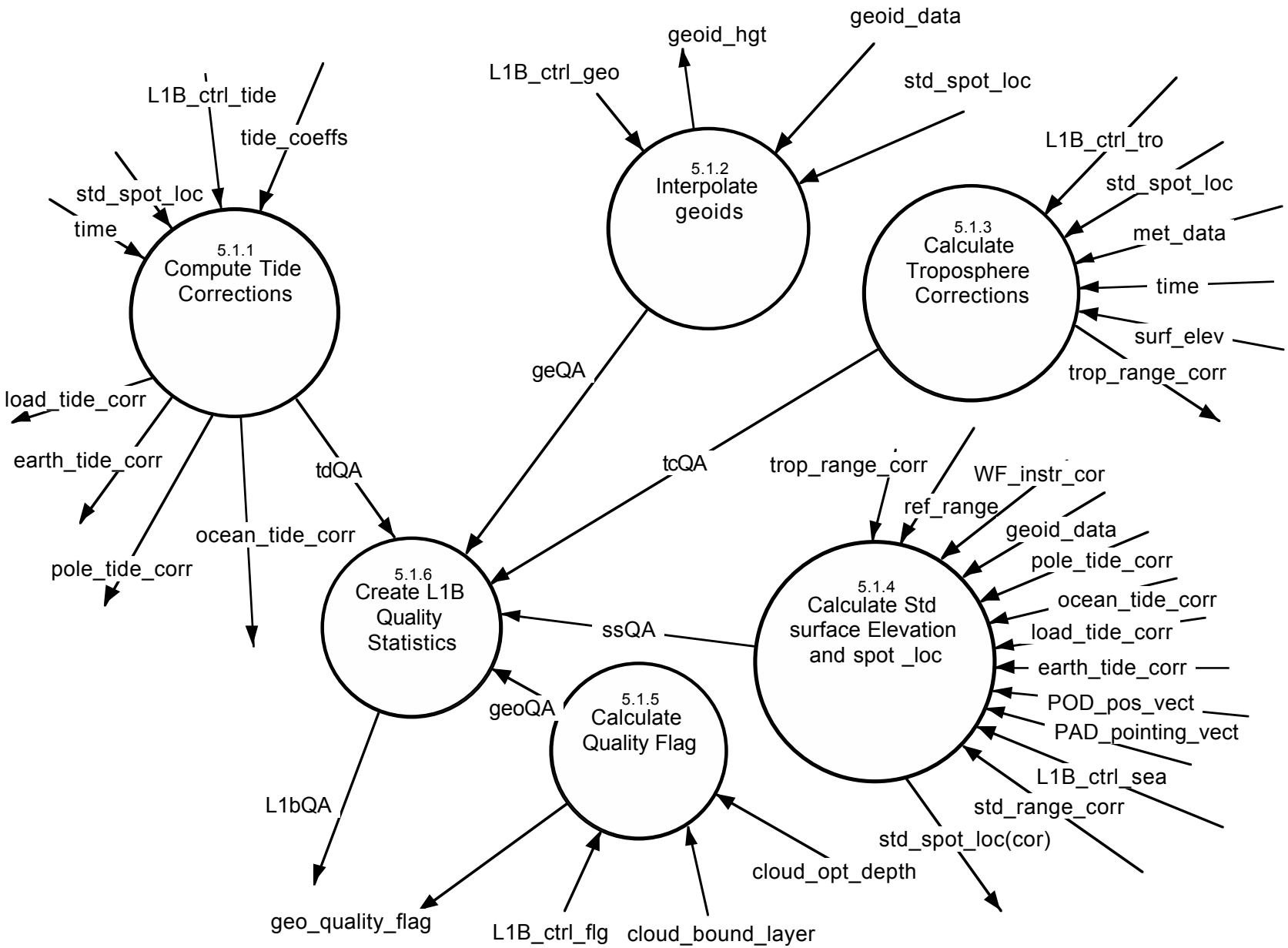
**Outputs:**

- Tide Corrections
- Geoid Height
- Tropospheric Delay Corrections
- Corrected Standard Surface Elevation and Spot Location
- Elevation Quality Flag
- Elevation QA

**NOTE:**

- The outputs will go towards the creation of GLA06 Standard Data Products

# LEVEL 1B ELEVATION COMPUTATION



# LEVEL 2 ELEVATION COMPUTATION

## Functions:

- Calculate Region Specific Range
- Calculate Region Specific Elevation and Spot Location
  (Sea Ice, Ice Sheet, Ocean, Land)

## Inputs:

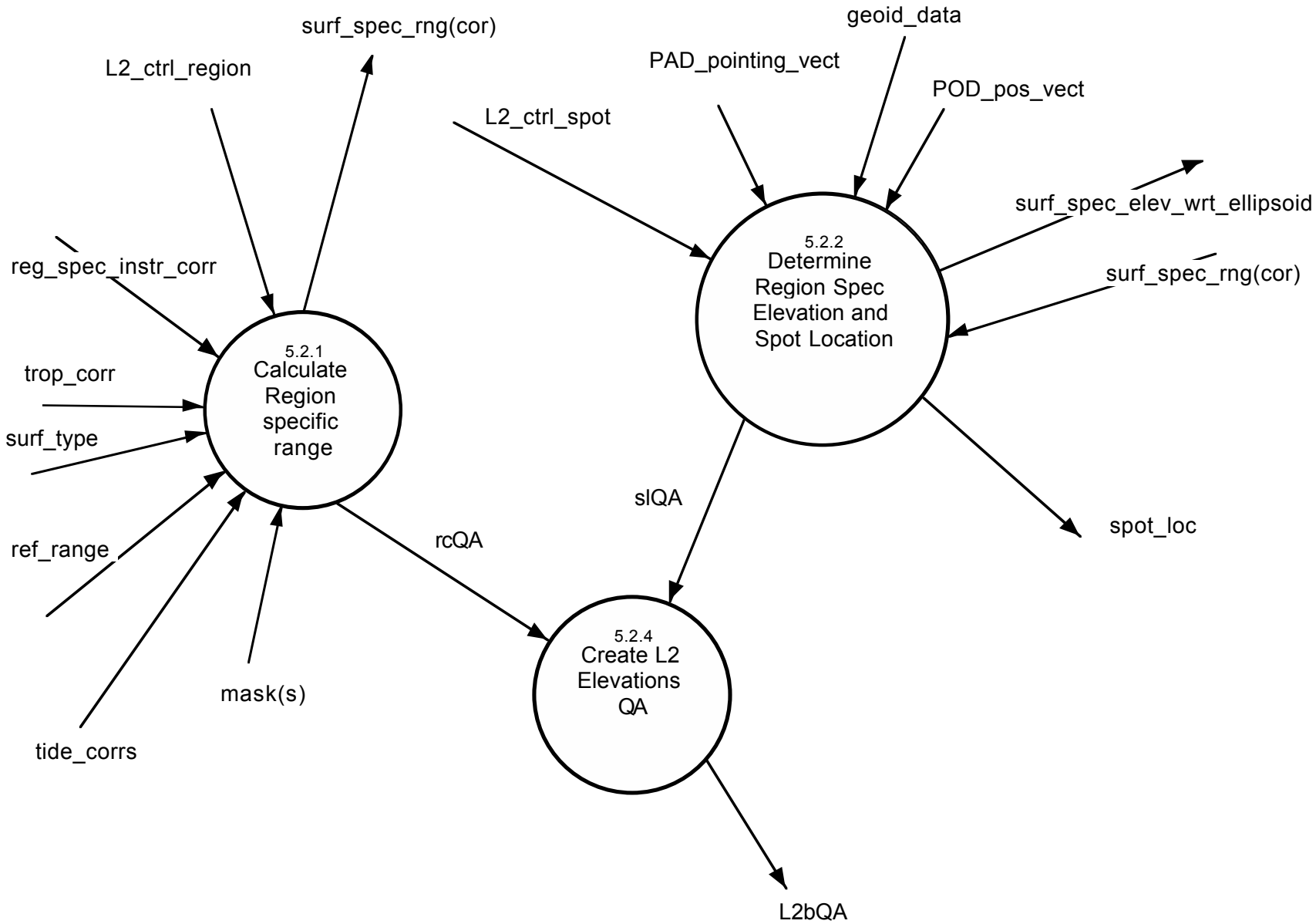
- Tide Corrections
- Tropospheric Delay Corrections
- Reference Range
- Region Specific Instrument Correction
- Position Vector
- Attitude Vector
- Surface Type & Masks
- Geoid Grid
- Processing Control Data

# LEVEL 2 ELEVATION COMPUTATION
## (continued)

**Outputs:**

- **Region Specific Elevation and Spot Location (Sea Ice, Ice Sheet, Ocean, Land) - used to create GLA12, GLA13, GLA14, and GLA15 Standard Data Products**
- **Level 2 Elevation QA**

# CALCULATE LEVEL 2 ELEVATIONS DFD



# LIDAR PROCESSING

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**(301) 614-5932(after 12/9)**
**email:Kristine.A.Barbieri.1@gsfc.nasa.gov**

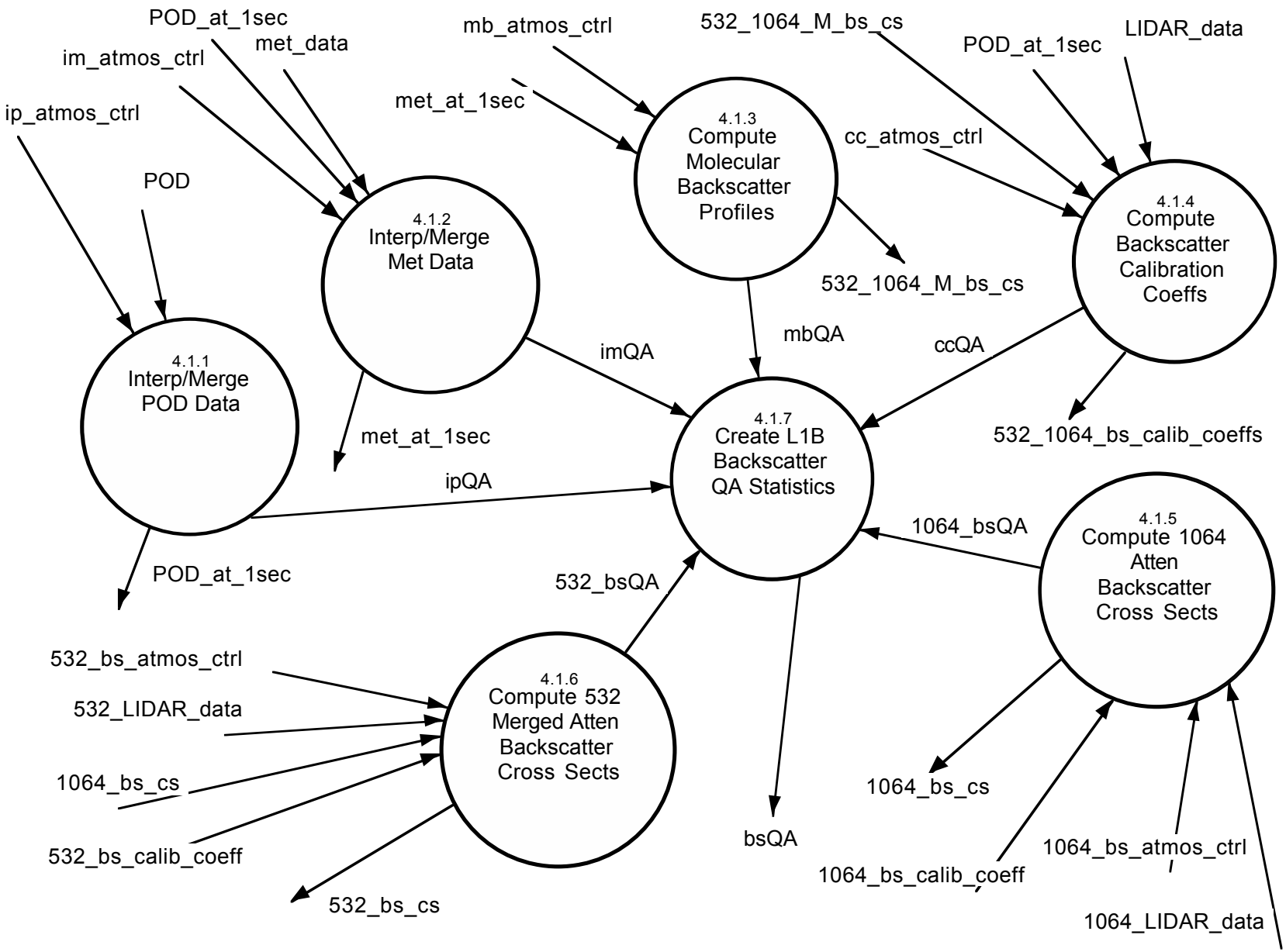
# LEVEL 1B AND 2 LIDAR PROCESSING FUNCTIONS

- Create level 1B attenuated backscatter cross section profiles
- Create level 2 cloud, aerosol, and PBL layer heights
- Create level 2 cloud, aerosol, and PBL attenuated backscatter cross section profiles
- Create level 2 cloud, aerosol, and PBL optical depths
- Create QA Statistics for level 1B and 2 data
- Inputs
  - POD
  - Met data
  - Normalized LIDAR signals from L1A
  - Atmosphere constants and lookup tables
  - Processing control data

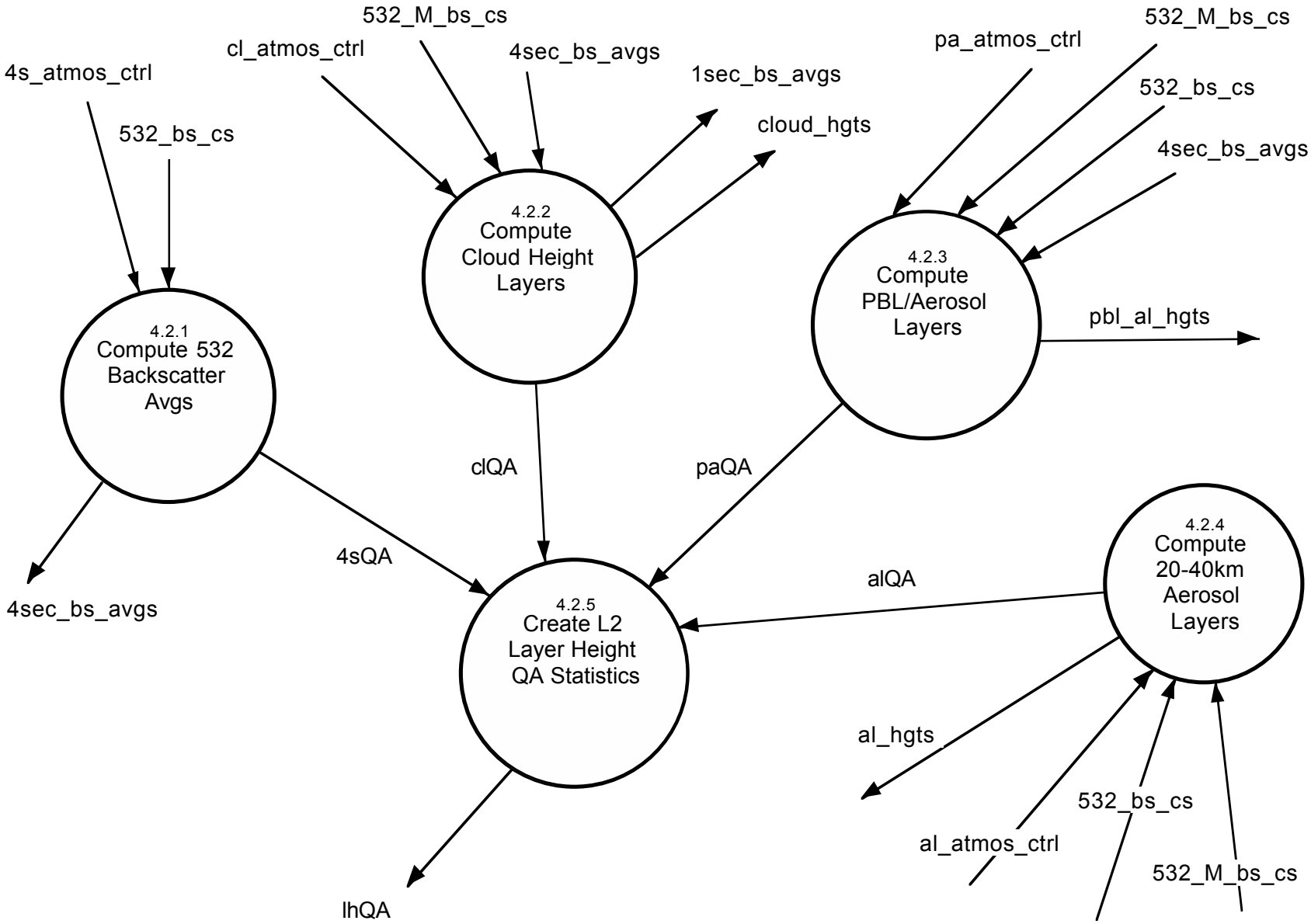
# LEVEL 1B AND 2 LIDAR PROCESSING FUNCTIONS
## (continued)

- Outputs
  - GLA07 parameters - level 1B attenuated backscatter cross section profiles
  - GLA08 parameters - level 2 aerosol and PBL layer heights
  - GLA09 parameters - level 2 cloud layer heights
  - GLA10 parameters - level 2 cloud, aerosol, and PBL attenuated backscatter cross section profiles
  - GLA11 parameters - level 2 cloud, aerosol, and PBL optical depths

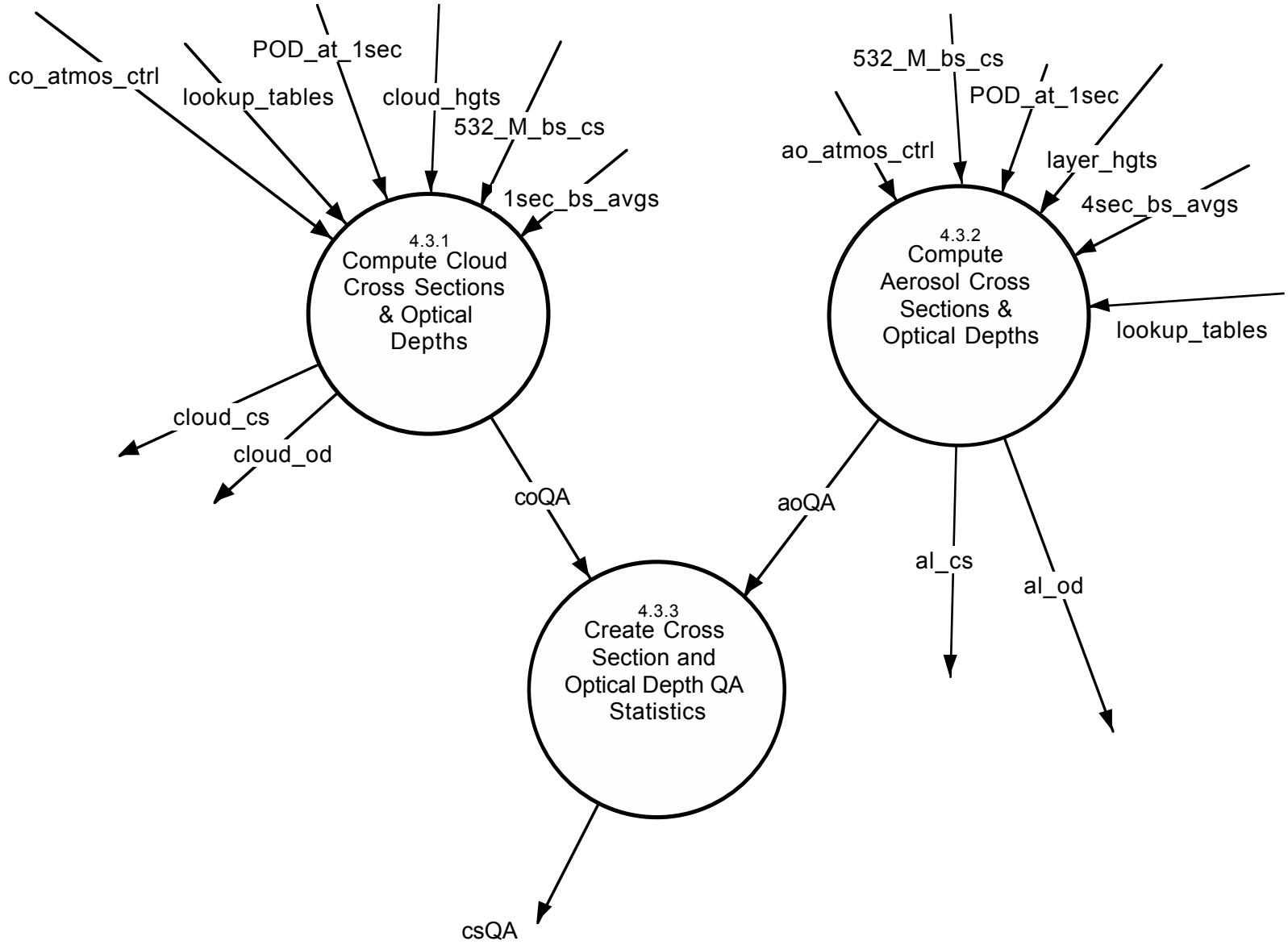
# CALCULATE L1B BACKSCATTER PROFILES



# CALCULATE LEVEL 2 LAYER HEIGHTS



# LEVEL 2 CROSS SECTION AND OPTICAL DEPTH ATBD



# REQUIREMENTS TRACE

**Gladstone Marcus**
**Raytheon ITSS**
**Greenbelt, MD 20770**
**email: marcus@serac.stx.com**
**phone: (301) 441- 4298**

# REQUIREMENTS TRACE

**Documents Referenced:**

- **GLAS Science Software Management Plan**
- **GLAS Science Software Requirements Document**
- **GLAS SDT Fortran 90 Programming Standards and Guidelines**

  **Web Page**

  **http://glas.wff.nasa.gov/docs/html**
- **GLAS I-SIPS Software Architectural Design Document - SSADD**

# REQUIREMENTS TRACE
# (continued)

- GLAS L0 data and ANC data files must be available prior to Standard Data Product generation.

  ∫ Concept Diagram

- Follow a well-defined software life cycle for reliable and maintainable software.

  ∫ Management Plan V3.0, Table 4-1

# REQUIREMENTS TRACE
# (continued)

- **Standard Data Software will interface with Science and I-SIPS Teams, DAAC, GLAS SDP.**

  ∫ **Concept Diagram**

- **Adhere to ESDIS requirements for delivery, retrieval**

  ∫ **Concept Diagram, DFD 1**

# REQUIREMENTS TRACE
# (continued)

- GLAS L1 products to DAAC in HDF
  - DFD 1, Concept Diagram
- GLAS L2 products to DAAC in HDF-EOS.
  - DFD 1, Concept diagram

# REQUIREMENTS TRACE
# (continued)

- EDOS L0 data to be provided from DAAC
  - ∫ Concept Diagram
- I-SIPS team to ensure availability, integrity of required ANC files.
  - ∫ I-SIPS Controller DFD. SSADD 5.2
- Software will create GLAS L1A data from L0 GLAS instrument data products.
  - ∫ Level 1A Computations DFD - 2

# REQUIREMENTS TRACE
# (continued)

- **Divide software into independent subsystems for multi-processing**
  - **DFD 1: I-SIPS Software Level 1**

# REQUIREMENTS TRACE
# (continued)

- **Produce metadata or prerequisite info. while generating data products and store for I-SIPS software access.**
  - **DFD 2-5, GLA ANC 06**
- **Implement science algorithms as defined in ATBDs.**
  - **Architectural Design Document Section 4.2**

# REQUIREMENTS TRACE
# (continued)

- **I-SIPS software to accept as input: GLAS instr. packet data, GLAS SDP, ANC.**
  - ∫ **Concept Diagram, DFD 1**
- **Produce metadata to describe data and quality.**
  - ∫ **DFD 1.6, DFD 2-5**

# REQUIREMENTS TRACE
# (continued)

- **Automatic handling of flight software, instr. hardware, mode changes during L1A processing.**
  - ∫ **Level 1A Computations DFD**
- **Create GLAS L1B data from L1A or L1B data and ANC data.**
  - ∫ **DFD 3, 4, 5**

# REQUIREMENTS TRACE
# (continued)

- **Create GLAS L2 data from L1A or 1B data and ANC data.**
  - **DFD 3, 4, 5**
- **Produce non-HDF intermediate files for efficiency.**
  - **Concept Diagram, DFD 1-5**

# REQUIREMENTS TRACE
# (continued)

| | |
|---|---|
| • Store time ordered global elevation data and corrections data. | ∫ Architectural Design Doc. Section 4 DFD 5. |
| • SDP will not be geolocated until POD data is available. | ∫ Architectural Design Doc. Section 4 |

# REQUIREMENTS TRACE
# (continued)

- **Automatic and Manual QA for each SDP and ANC file. Mark file status as valid/invalid.**
  - **DFD 2-5**
- **Minimum modifications for portability.**
  - **ANSI Fortran 90 and C used (Fortran 90 Coding Standards Document)**

# REQUIREMENTS TRACE
# (continued)

- Reprocessing entire or selected parameters on GLAS SDPs.
  - Architectural Design Doc . Section 4 DFD 1-5
- Group processes by ATBDs and related functions for selective reprocessing
  - Architectural Design Doc. Table 4.5 DFD 3,4,5
- I-SIPS software to control selected processes.
  - DFD 1, Architectural Design Doc. Section 4.4, DFD 1-5

# REQUIREMENTS TRACE
# (continued)

- Provide data and error handling.
  - ∫ SSADD 4.2.3.1
- Used constants and coefficients to be controlled and modifiable without code changes.
  - ∫ Architectural Design Doc. Table 4.3 - GLA ANC 07

# REQUIREMENTS TRACE
# (continued)

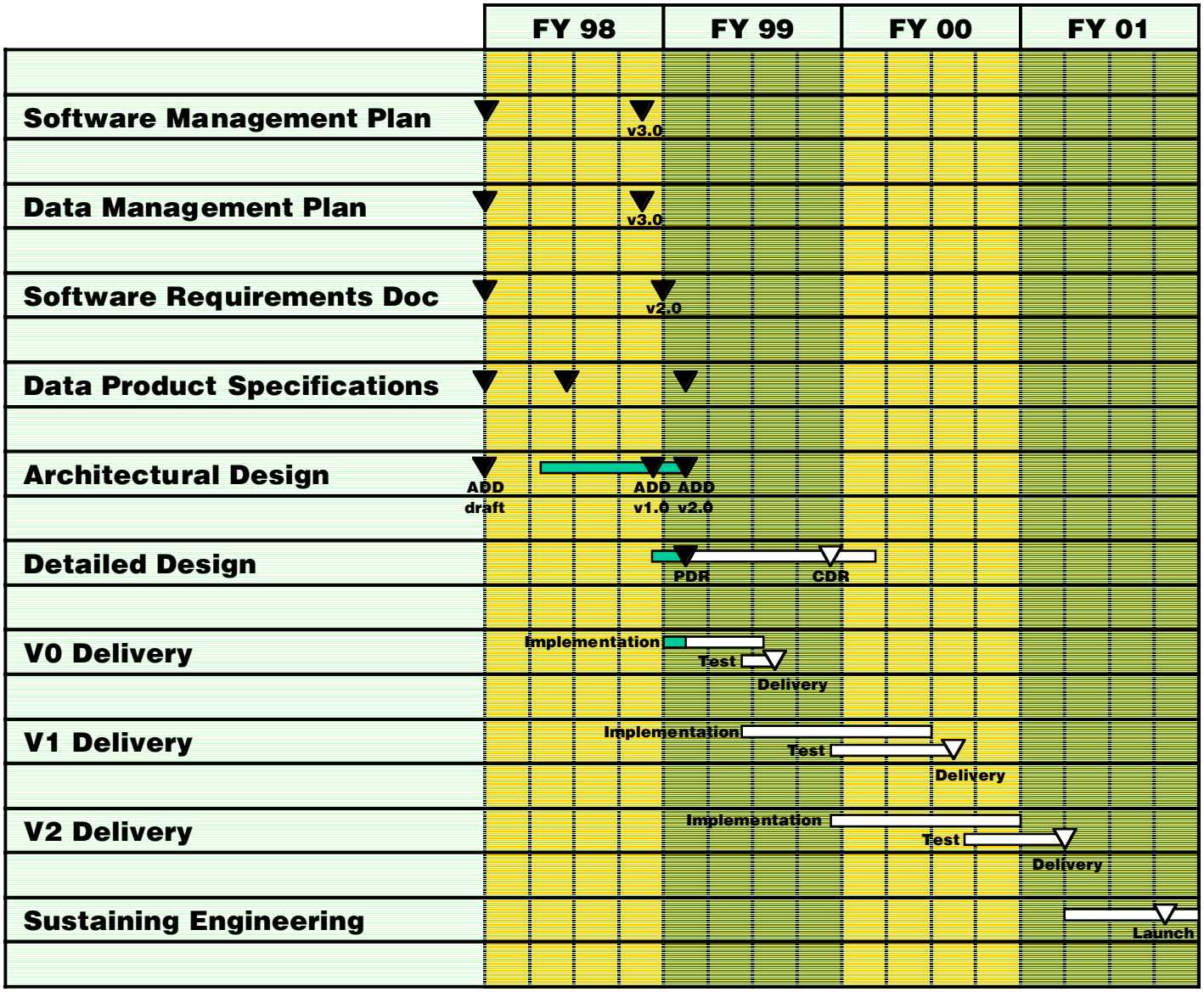
- **Define and document requirements and design for easy maintenance/mods.**

∫ **Architectural Design Document: Table 6.1, Detailed Design Document(in progress)**

# I-SIPS SOFTWARE DELIVERY SCHEDULE

- V0 (Beta) - May 1999
  - Framework in place, with interfaces for inputs/outputs
  - File formats defined
  - I/O routines written in C
  - F-90 file structures
  - F-90 modules to feed DFDs
  - Dummy calls to DFDs for standalone processing
- V1 – May 2000
  - All major functions and interfaces incorporated
  - Any fixes from V0 implemented
  - All ATBDs implemented
- V2 – December 2000
  - Complete verified operational I-SIPS software in place
  - Any fixes from V1 will have been implemented
  - Final pre-launch updates to calibration equations implemented

# STANDARD DATA SOFTWARE DEVELOPMENT SCHEDULE



# APPENDIX - DATA FLOW COMPOSITION (derived from Data Dictionary)

NAME: **532_1064_bs_cs**
COMPOSITION: 532_bs_cs + 1064_bs_cs

NAME: **bs_atmos_ctrl**
COMPOSITION:ip_atmos_ctrl + im_atmos_ctrl + mb_atmos_ctrl + cc_atmos_ctrl
+ 1064_bs_atmos_ctrl + 532_bs_atmos_ctrl

NAME: **bs_avgs**
COMPOSITION:1sec_bs_avgs + 4sec_bs_avgs

NAME: **bs_data_in**
COMPOSITION:met_at_1sec + 532_LIDAR_data + 1064_LIDAR_data + 1064_bs_cs +
532_bs_calib_coeff + 1064_bs_calib_coeff + POD_at_1sec +
532_1064_M_bs_cs

NAME: **bs_data_out**
COMPOSITION:met_at_1sec + 532_1064_bs_cs + 532_1064_bs_calib_coeffs + bsQA

NAME: **cs_atmos_ctrl**
COMPOSITION:co_atmos_ctrl + ao_atmos_ctrl

NAME: **DAACInputGroup**
COMPOSITION:DAAC_data_in

NAME: **DAAC_data_in**
COMPOSITION:GLA_00 + GLA_ANC_01

# APPENDIX - DATA FLOW COMPOSITION (derived from Data Dictionary)

NAME: **DAACOutputGroup**
COMPOSITION: DAAC_data_out

NAME: **DAAC_data_in**
COMPOSITION: GLA_00 + GLA_ANC_01

NAME: **I-SIPSTeamInputgroup**
COMPOSITION: I-SIPSCtrl

NAME: **L1AInput**
COMPOSITION: L0_ALT + L0_ATM + L0_ENG + L0_GPS_SRS + L1A_control_alt + L1A_control_atm + L1A_control_eng + L1A_ctrl_L0_GPS_SRS

NAME: **L1AOutput**
COMPOSITION: L1A_alt + L1A_atm + L1A_eng + L1A_GPS_SRS + cQA

NAME: **L1B2ATMInput**
COMPOSITION: bs_data_in + LIDAR_data + POD + lh_data_in + 532_M_bs_cs + 532_bs_cs + layer_hgts + bs_avgs + POD_at_1sec + lookup_tables + bs_atmos_ctrl + lh_atmos_ctrl + cs_atmos_ctrl

NAME: **layer_hgts**
COMPOSITION: cloud_hgts + al_hgts + pbl_al_hgts

NAME: **lh_atmos_ctrl**
COMPOSITION: 4s_atmos_ctrl + cl_atmos_ctrl + pa_atmos_ctrl + al_atmos_ctrl

# APPENDIX - DATA FLOW COMPOSITION (derived from Data Dictionary)

NAME: **L1B2ATMOutput**
COMPOSITION: bs_data_out + lh_data_out + 532_1064_M_bs_cs + 532_1064_bs_cs + layer_hgts + bs_avgs + POD_at_1sec + optical_depths + layer_cross_sects + tQA

NAME: **lh_data_out**
COMPOSITION: 4sec_bs_avgs + al_hgts + pbl_al_hgts + cloud_hgts + 1sec_bs_avgs **+ lhQA**

NAME: **optical_depths**
COMPOSITION: cloud_od + al_od

NAME: **layer_cross_sects**
COMPOSITION: cloud_cs + al_cs

NAME: **L1B2EVInput**
COMPOSITION: std_spot_loc + surf_type + PAD_pointing_vect + POD_pos_vect + cloud_opt_depth + cloud_bound_layer + L1B_EV_ctrl + L2_EV_ctrl + reg_spec_instr_corr + trop_corr + ref_range + tide_corrs + masks + time + WF_instr_cor + trop_range_corr + surf_elev + surf_spec_rngcor + std_range_corr

NAME: **L1B_EV_ctrl**
COMPOSITION: L1B_ctrl_tide + L1B_ctrl_geo + L1B_ctrl_tro + L1B_ctrl_sea + L1B_ctrl_flg

# APPENDIX - DATA FLOW COMPOSITION (derived from Data Dictionary)

NAME: **L2_EV_ctrl**
COMPOSITION: L2_ctrl_region + L2_ctrl_spot

NAME: **tide_corrs**
COMPOSITION: load_tide_corr + earth_tide_corr + pole_tide_corr + ocean_tide_corr

NAME: **L1B2EVOutput**
COMPOSITION: L1B_EV_params + L2_EV_params + eQA

NAME: **L1B_EV_params**
COMPOSITION: load_tide_corr + earth_tide_corr + pole_tide_corr + ocean_tide_corr + geo_quality_flag + std_spot_loccor + trop_range_corr + geoid_hgt

NAME: **L2_EV_params**
COMPOSITION: spot_loc + surf_spec_elev_wrt_ellipsoid + surf_spec_rngcor + L2bQA

NAME: **L1BInput**
COMPOSITION: WF_and_OtherParameters + WF_general_char + time + POD + PAD + surf_type_grid + std_range_corr + WF_parameters + WF_ctrl_aw + WF_ctrl_ir + WF_ctrl_geo_sur + WF_ctrl_srs + surf_type

NAME: **WF_and_OtherParameters**
COMPOSITION: WF + Telemetered_saturation + backgrnd_noise

# APPENDIX - DATA FLOW COMPOSITION (derived from Data Dictionary)

NAME: **WF_general_char**
COMPOSITION: WF_shape_char + wf_saturation_flag + WF_signal_char

NAME: **WF_ctrl_geo_sur**
COMPOSITION: WF_ctrl_geo + WF_ctrl_sur

NAME: **L1BOutput**
COMPOSITION: Reflectance + WF_parameters + WF_general_char + std_range_corr + WF_instr_corr + spotloc_surtyp_att_pos_elev + slope_roughness + surf_type + wvQA

NAME: **spotloc_surtyp_att_pos_elev**
COMPOSITION: POD_pos_vect + PAD_pointing_vect + Lat_lon_stand_elev_uncor

NAME: **slope_roughness**
COMPOSITION: Surface_slope + Surface_roughness

NAME: **ScienceTeamInputGroup**
COMPOSITION: ST_Input

NAME: **ScienceTeamOutputGroup**
COMPOSITION: SCF_Output