# EVLA Top Level Data Flow Diagram



NRAO e2e

**One Program**

EVLA
Observing
Heuristics

Default Program Block
(with 'suggestions' filled in)

Refinements

Astronomer

Observation Preparer

**Program Block**
(Set of Scheduling Blocks for one Program)

Observation Scheduler

Operator

Metadata

Execution
State

**Next Scheduling Block to Run**

Archive

Operator

Metadata

Phases & Pointing Solutions

Observation Executor

Properties

Equipment State

**Sequence of Configurations
Antenna Delays
Antenna Calibrations (VLA)**

Online Domain

Real-Time Domain

Archive

Operator

RF — VLA Antennas

IF

Old Correlator

Array Processor (Backend)

RF — EVLA Antennas

FOTS Rcvr

WIDAR

State Counts

CBE

Lag Frames

Master LO Wx., etc.

AMCS

CMCS

Old RTCAT (AntSol)

Hardware M & C

To Old Archive

**Spectra & Headers**

Environment
Data Addressing Info
Equipment State

Data Capture-Store-Format Confibulator

RTCAT

Metadata (Executor)

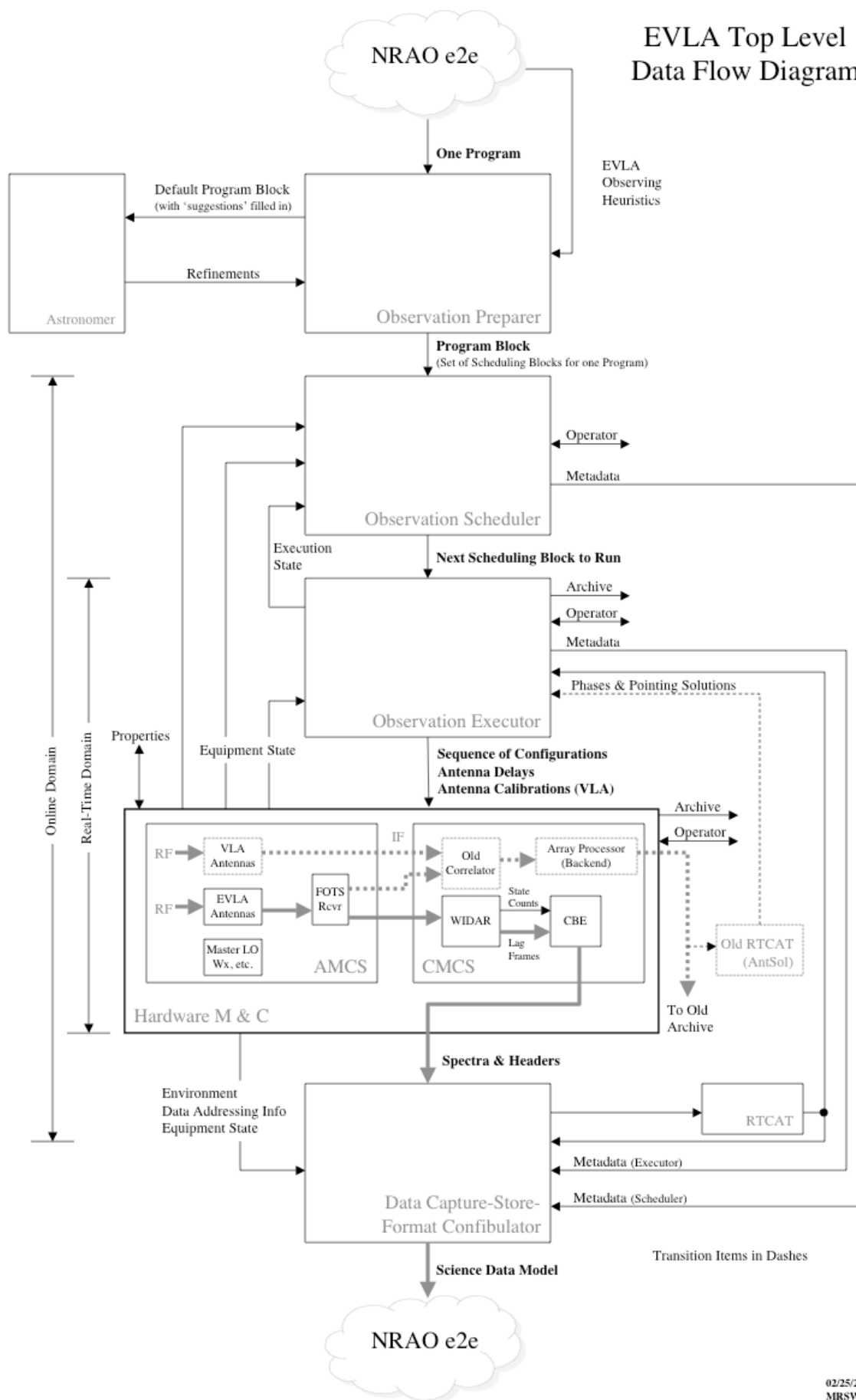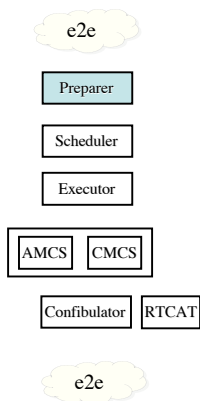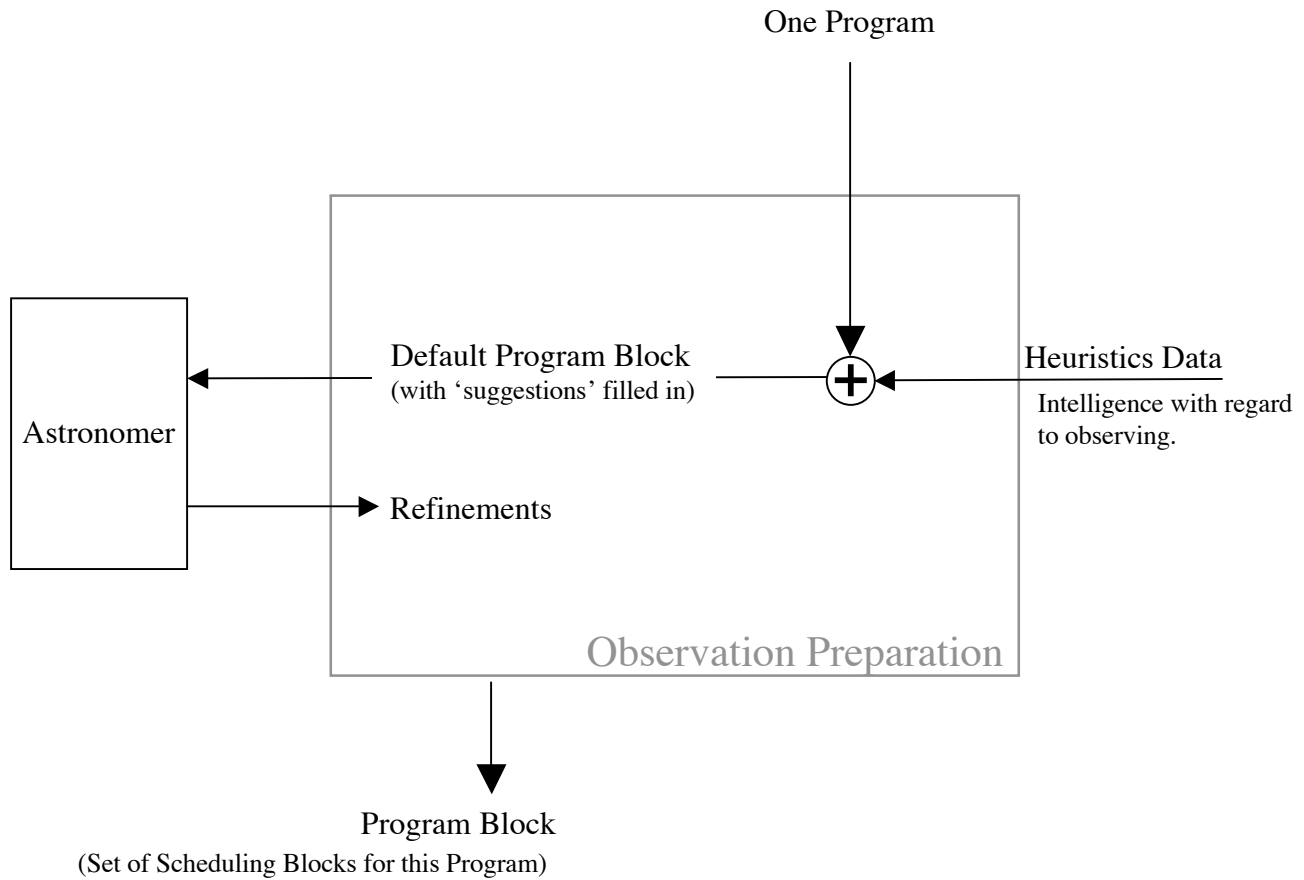Metadata (Scheduler)

**Science Data Model**

NRAO e2e

Transition Items in Dashes

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MRSW

For those that are selected, the Proposal Process generates a *Project* which consists of one or more *Programs*.

One Program

Default Program Block
(with 'suggestions' filled in)

Heuristics Data

Intelligence with regard to observing.

Astronomer

Refinements

Observation Preparation

Program Block
(Set of Scheduling Blocks for this Program)

e2e

Preparer

Scheduler

Executor

AMCS | CMCS

Confibulator | RTCAT

e2e

**Observation Preparation Tool**

**What it does:**
- Creates a Program Block for a Program

**Inputs:**
- Program Data (from Proposal Process)
- Observation Heuristics Data
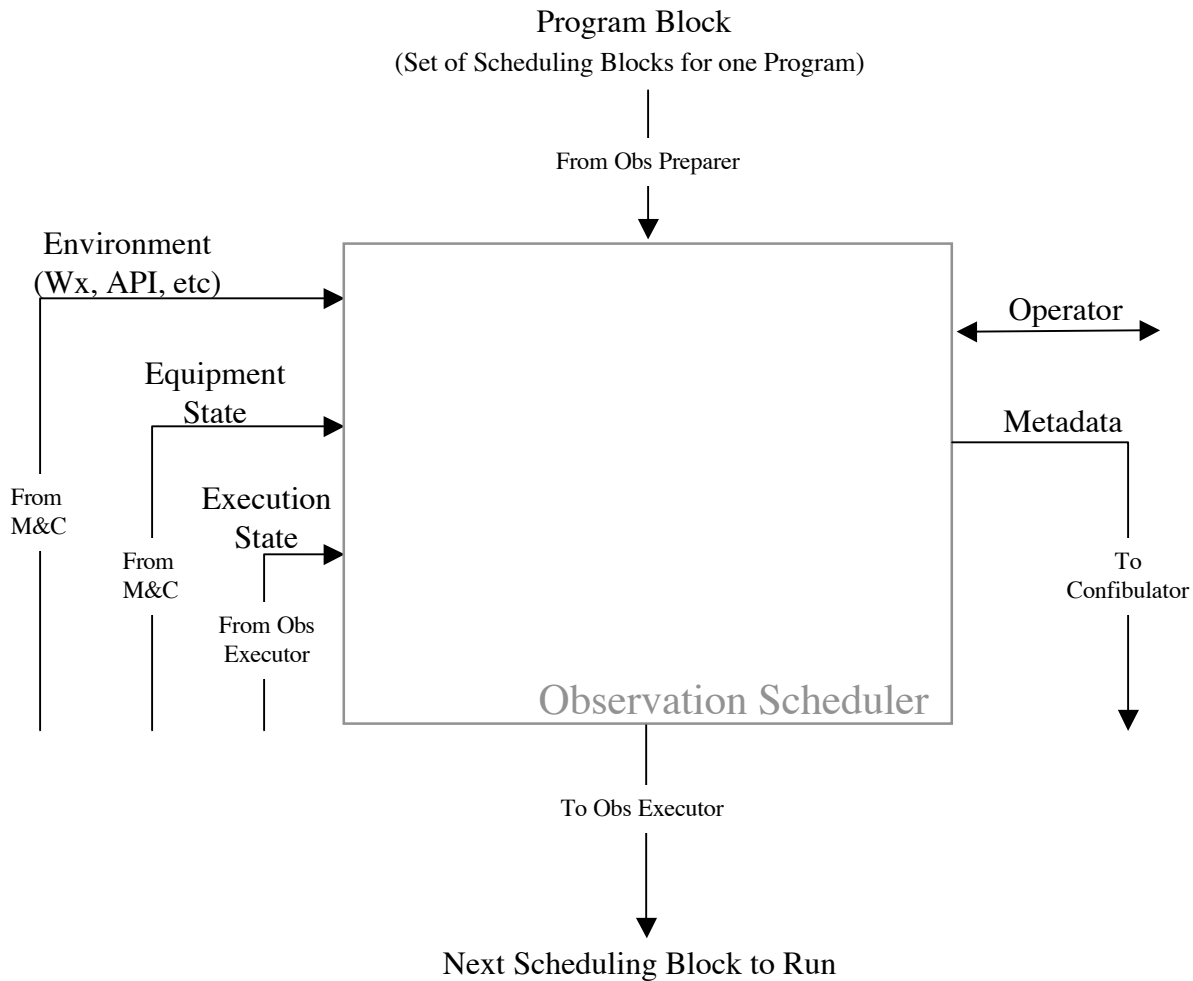- Astronomer Interaction (Editing/Validation Session)

**Processing:**
- Get Relevant *Program*
- Apply Heuristics
- Present Suggested *Program Block*
- Interact with Astronomer to fine-tune *Program Block*

**Outputs:**
- Program Block

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**Program Block**

(Set of Scheduling Blocks for one Program)

From Obs Preparer

Environment
(Wx, API, etc)

Operator

Equipment
State

Metadata

From
M&C

Execution
State

From
M&C

To
Confibulator

From Obs
Executor

Observation Scheduler

To Obs Executor

**Next Scheduling Block to Run**

e2e

Preparer

Scheduler

Executor

AMCS | CMCS

Confibulator | RTCAT

e2e

**Observation Scheduler**

**What it does:**
- Dynamically Selects the next Scheduling Block to Execute

**Inputs:**
- Program Block from Observation Preparation
- Operator - fill queue, override selection …
- Environment (weather, …, …?)
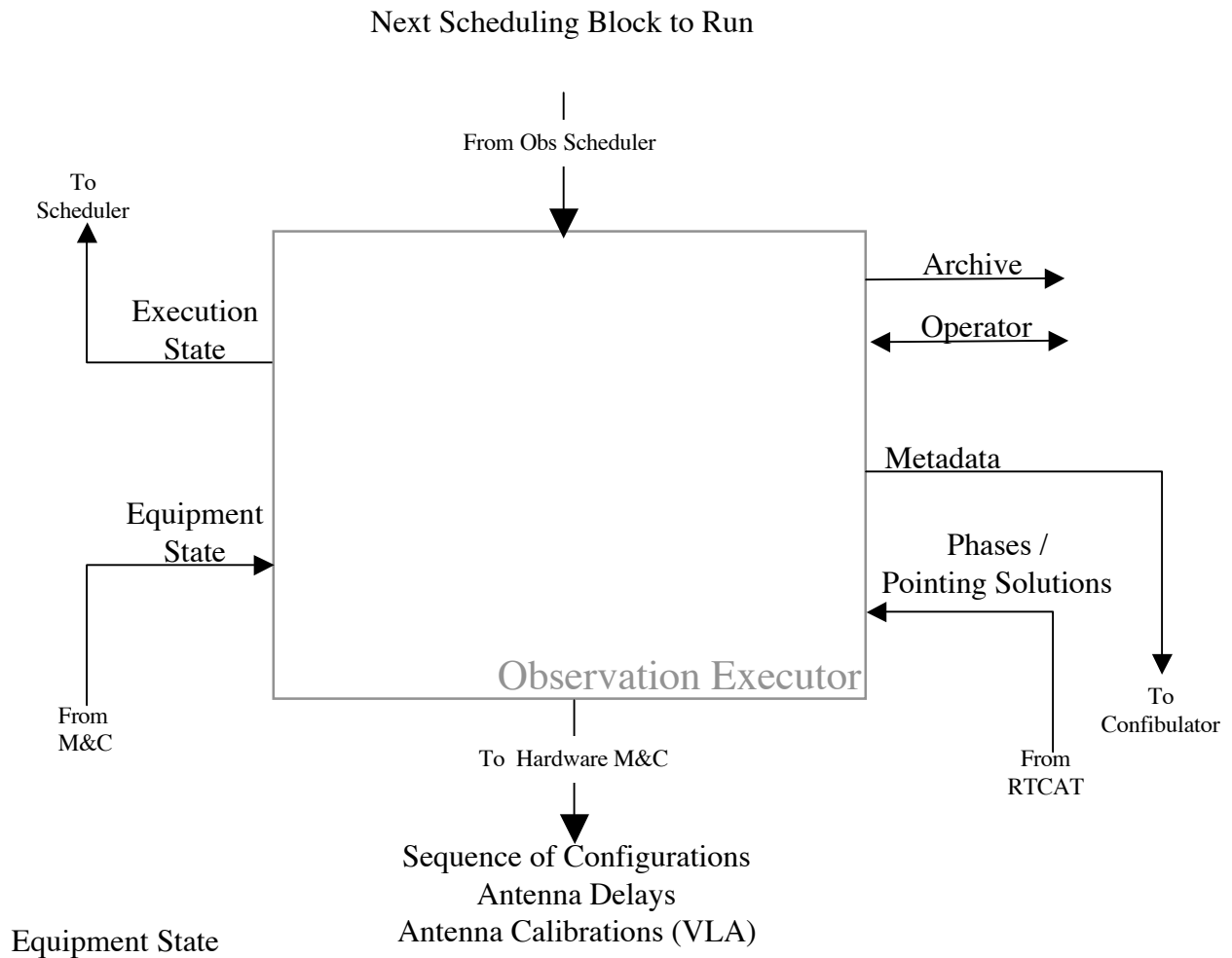- Execution State (from ?)

**Processing:**
- Get program blocks under consideration
- Apply environment variables
- Pick next scheduling block to be executed

**Outputs:**
- One Scheduling Block (to Observation Executor)

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Next Scheduling Block to Run

|

From Obs Scheduler

To
Scheduler

Archive

Operator

Execution
State

Metadata

Equipment
State

Phases /
Pointing Solutions

Observation Executor

To
Confibulator

From
M&C

To Hardware M&C

From
RTCAT

Sequence of Configurations
Antenna Delays
Antenna Calibrations (VLA)

Equipment State

e2e

Preparer

Scheduler

Executor

AMCS   CMCS

Confibulator   RTCAT

e2e

**Observation Executor**

**What it does:**
　　• Operate the Control Systems to Effect the
　　Execution of a Scheduling Block.
**Inputs:**
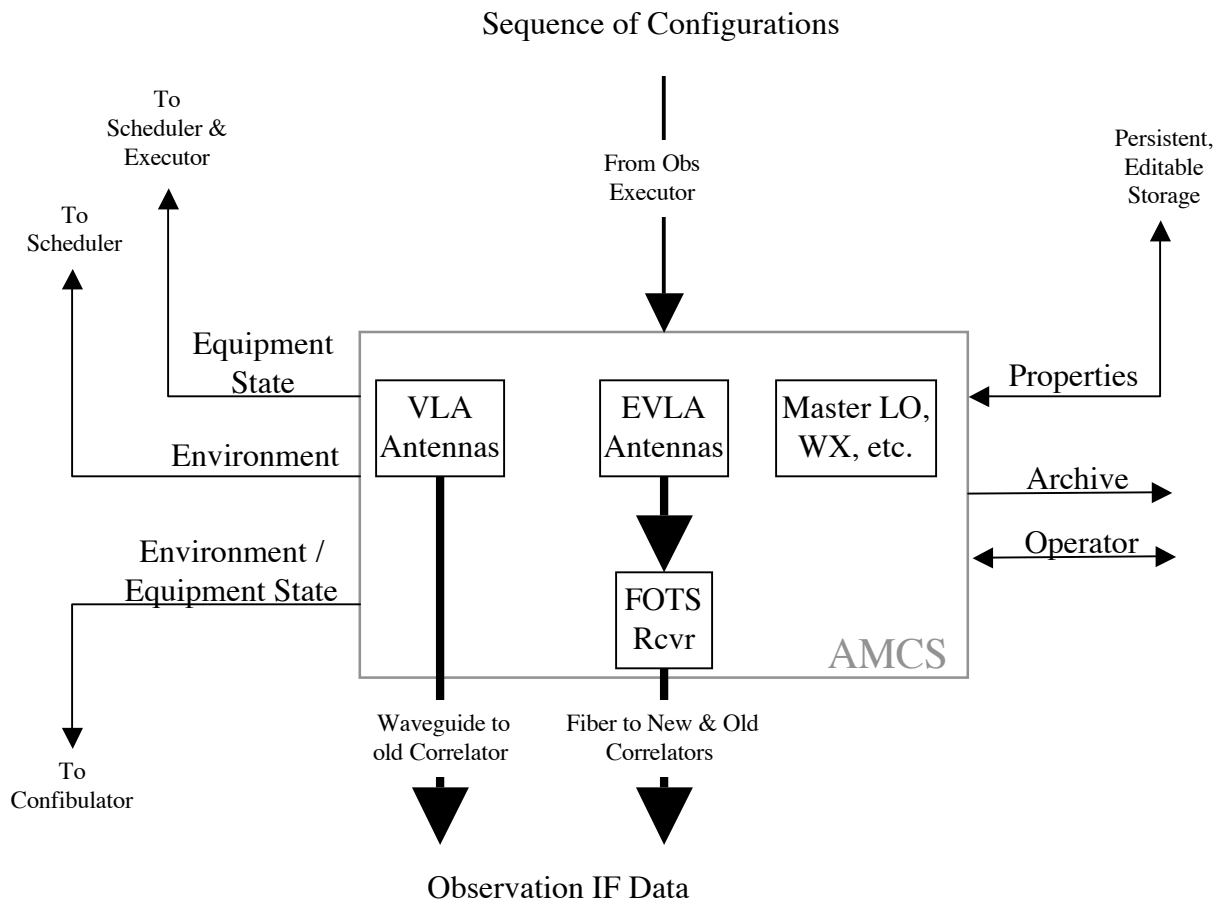　　• Scheduling Block from Obs Scheduler
**Processing:**
　　• Translate Scheduling Block (Science Context) to
　　Sequence of Configurations (Machine Context)
　　• Reference  Pointing
　　• Array Phasing
**Outputs:**
　　• Sequence of Configurations to Control Systems
　　• Real-time cal data, Proposal/Project Ancillary
　　data to Archive

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Sequence of Configurations

To
Scheduler &
Executor

To
Scheduler

From Obs
Executor

Persistent,
Editable
Storage

Equipment
State

Environment

Properties

VLA
Antennas

EVLA
Antennas

Master LO,
WX, etc.

Archive

Operator

Environment /
Equipment State

FOTS
Rcvr

AMCS

To
Confibulator

Waveguide to
old Correlator

Fiber to New & Old
Correlators

Observation IF Data

e2e

Preparer

Scheduler

Executor

AMCS  CMCS

Confibulator  RTCAT

e2e

**Antenna Monitor & Control Subsystem**

**What it does:**
- Control System for Antennas and Ancillary Equipment (Weather Station, Master LO, etc.)
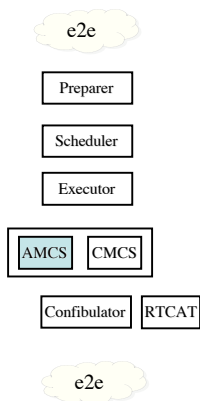
**Inputs:**
- Properties and Parameters (Device, CP, MP, etc)
- Sequence of Configurations
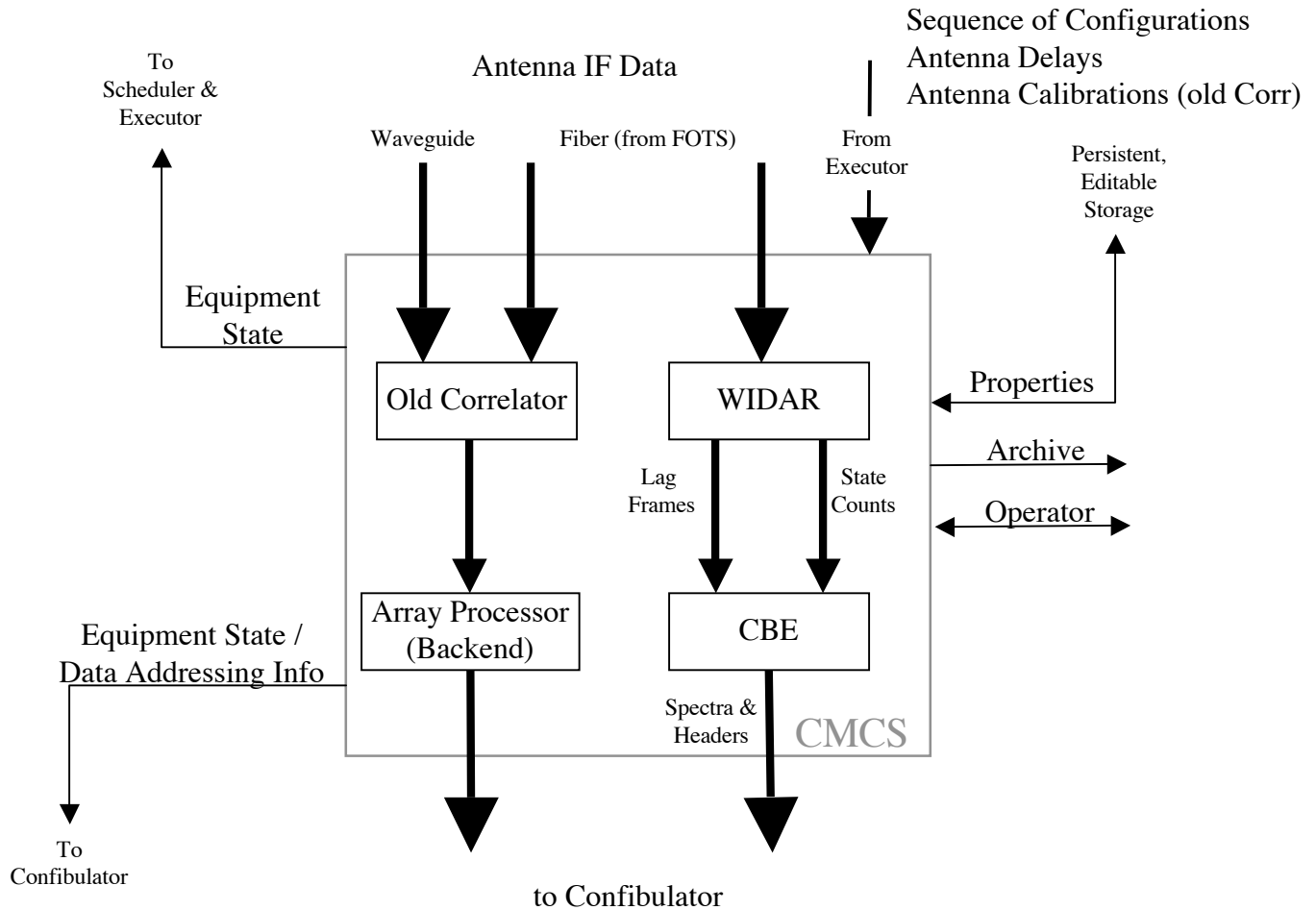- Individual 'Commands'
- RF (Observation)

**Processing:**
- Control Associated Hardware

**Outputs:**
- Archive Monitor Data
- Observation IF Data

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To
Scheduler &
Executor

Antenna IF Data

Sequence of Configurations
Antenna Delays
Antenna Calibrations (old Corr)

Waveguide          Fiber (from FOTS)          From
Executor

Persistent,
Editable
Storage

Equipment
State

Old Correlator

WIDAR

Properties

Lag
Frames

State
Counts

Archive

Operator

Equipment State /
Data Addressing Info

Array Processor
(Backend)

CBE

CMCS

Spectra &
Headers

To
Confibulator

to Confibulator

e2e

Preparer

Scheduler

Executor

AMCS   CMCS

Confibulator   RTCAT

e2e

**Correlator Monitor & Control Subsystem**

**What it does:**
 • Control System for Correlator
 **Inputs:**
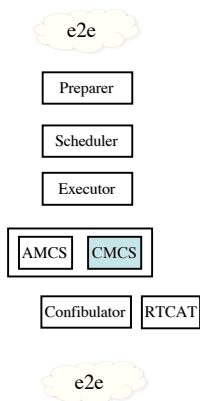 • Properties and Parameters (Device, CP, MP, etc)
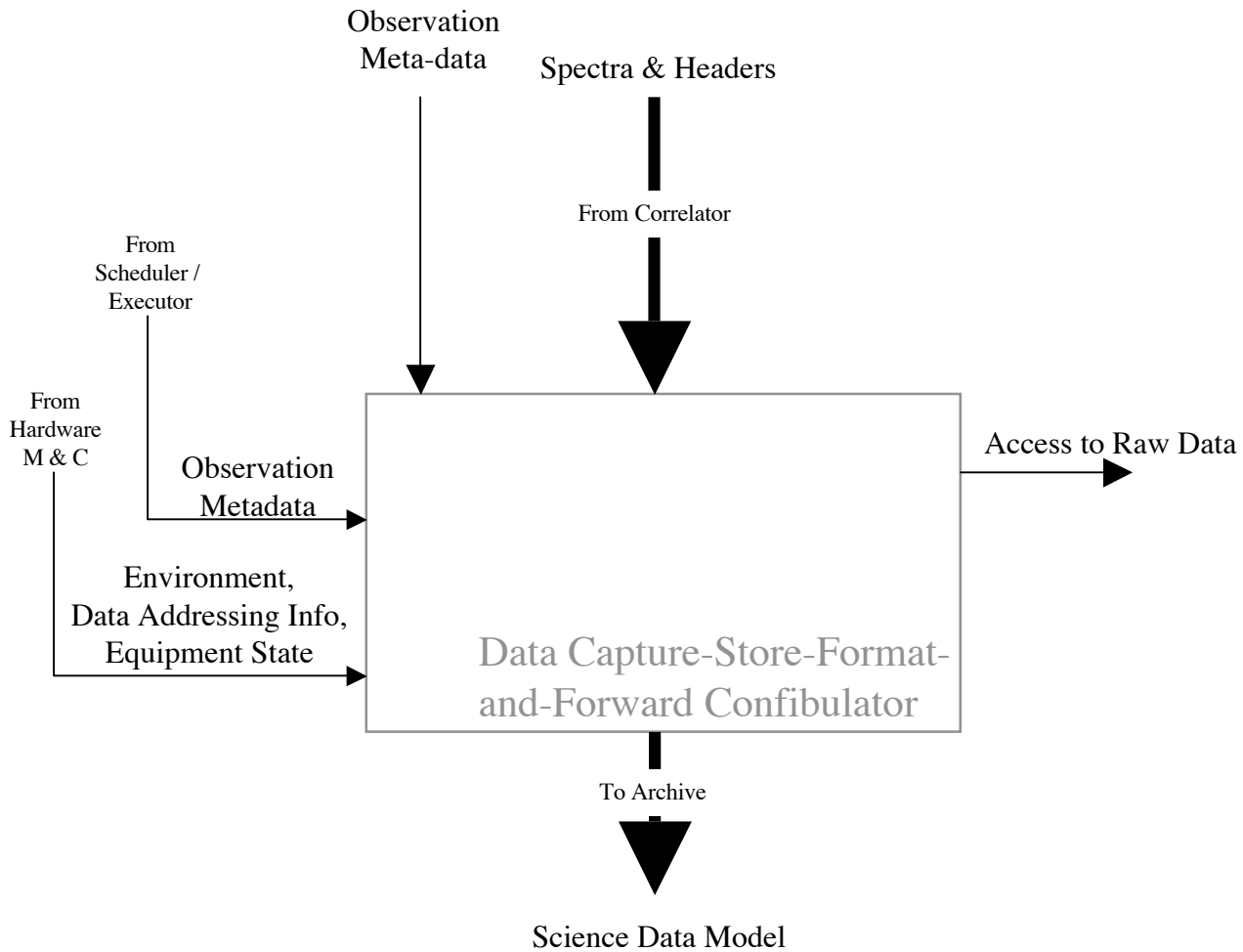 • IF Data from Antennas
 • Control Scripts / Commands
**Processing:**
 • Control Associated Hardware
**Outputs:**
 • Archive Monitor Data
 • Data Addressing
 • Correlated Data

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Observation
Meta-data

Spectra & Headers

From Correlator

From
Scheduler /
Executor

From
Hardware
M & C

Observation
Metadata

Access to Raw Data

Environment,
Data Addressing Info,
Equipment State

Data Capture-Store-Format-
and-Forward Confibulator

To Archive

Science Data Model

**Confibulator**

**What it does:**
- Buffers Real-Time Data
- Builds Science Data Model
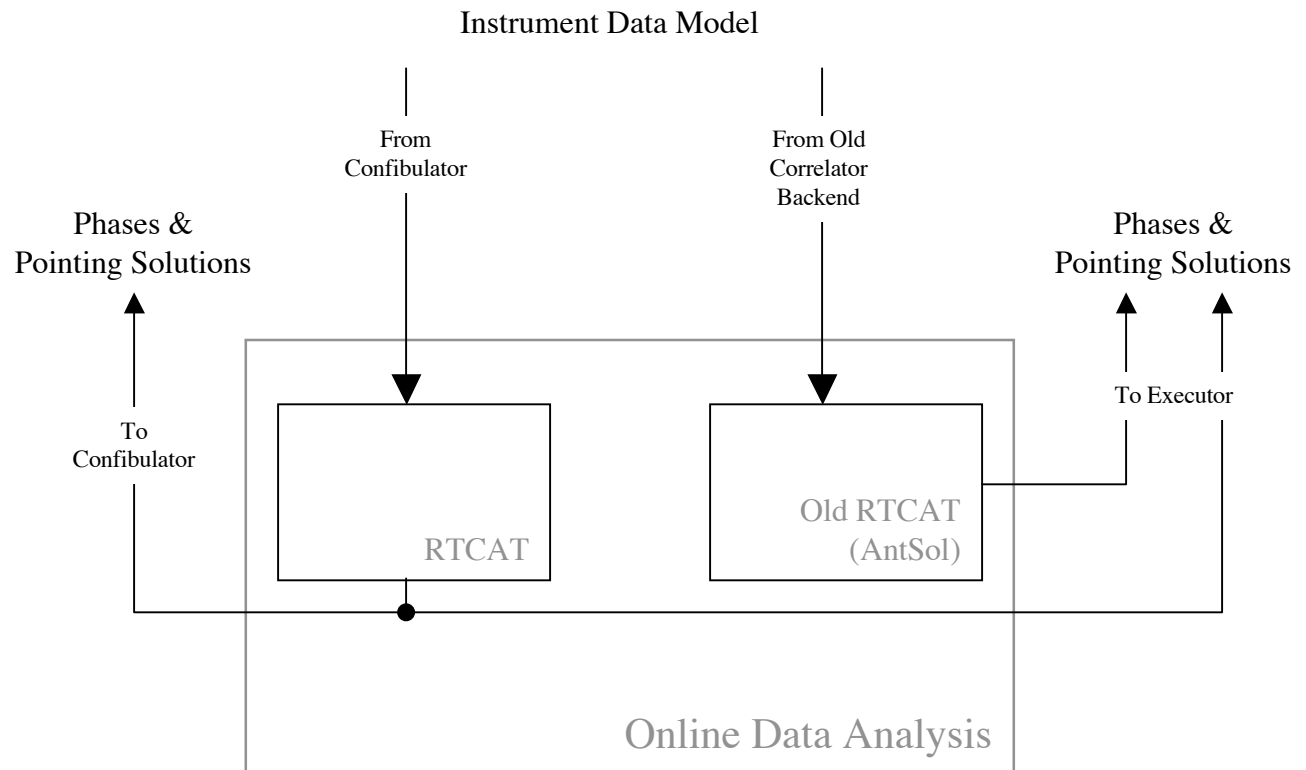
**Inputs:**
- Correlated Data
- Observation Meta-data

**Processing:**
- Collation of Data

**Outputs:**
- Science Data Model

e2e

Preparer

Scheduler

Executor

AMCS | CMCS

Confibulator | RTCAT

e2e

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Instrument Data Model

Phases &
Pointing Solutions

From
Confibulator

From Old
Correlator
Backend

Phases &
Pointing Solutions

To
Confibulator

To Executor

RTCAT

Old RTCAT
(AntSol)

Online Data Analysis
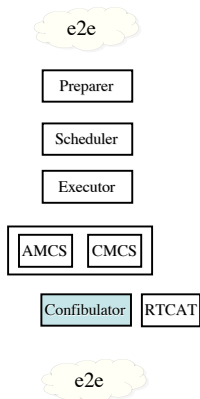
**Online Data Analysis**

**What it does:**
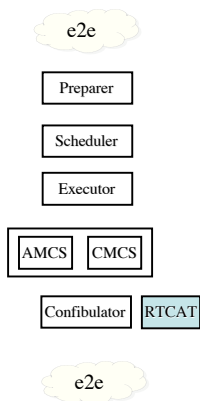> • Provide info for an array, in real-time, based on on-going calibration observations.

**Inputs:**
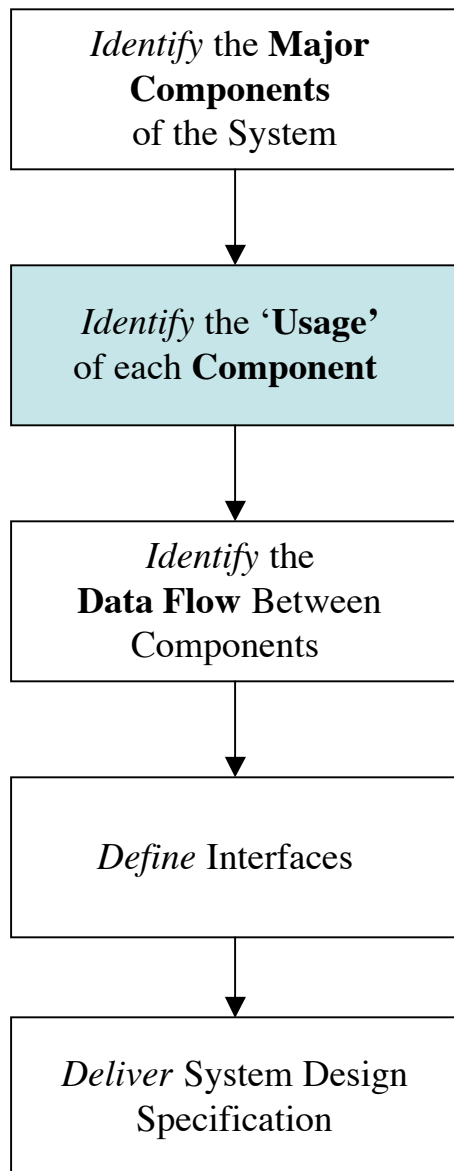> • Correlated data,
> • Metadata.

**Processing:**
> • AntSol & analysis of pointing scans.

**Outputs:**
> • Phases and Pointing Solutions.

e2e

Preparer

Scheduler

Executor

AMCS    CMCS

Confibulator    RTCAT

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# EVLA Design Team's Milestones

| | |
|---|---|
| *Identify* the **Major Components** of the System | |
| *Identify* the '**Usage**' of each **Component** | • Each component's functionality<br>• How components interact with each other<br>• How users interact with components |
| *Identify* the **Data Flow** Between Components | • What **type** of information is passed<br>• Order of Magnitude Size, bandwidth, speed, periodicity, etc.<br>We do not define specifics, instead we create a design capable of handling all specifics as they become available. |
| *Define* Interfaces | • For each Data Flow identified in previous step:<br>  • Data Protocols (XML, HTML, binary …)<br>  • Transmission Protocols (TCP/UDP …)<br>  • Schema Usage (but not schema contents)<br>This is where we do the first and only 'how' or implementation aspect of our job. |
| *Deliver* System Design Specification | • Final Product |