



The case for unifying S&C and M&C work packages

Overview



- SPO has alternated on whether M&C and S&C belong together or not
- Rationales have changed over time
- S&C team opinion not solicited
- S&C team has commented repeatedly on the inadvisability of this split
- Current status: M&C and S&C are separate work packages
- S&C team proposes that the (externally reviewed) PEP structure be implemented i.e. S&C and M&C be unified

What makes SKA very challenging?



- Science capability
- Very large data flow
- Very large processing requirements
- Entirely automated science processing
- Very large archive requirements
- End-to-end data flow and processing
 - Requires suitable architecture across S&C and M&C

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Risks of split approach



- Disjoint development of architecture, designs, libraries, *etc.*
- Lack of commonality leads to long term maintenance and development costs
- Insufficient attention to running the telescope for science
- S&C work package bears risks from M&C work package but with no input or control

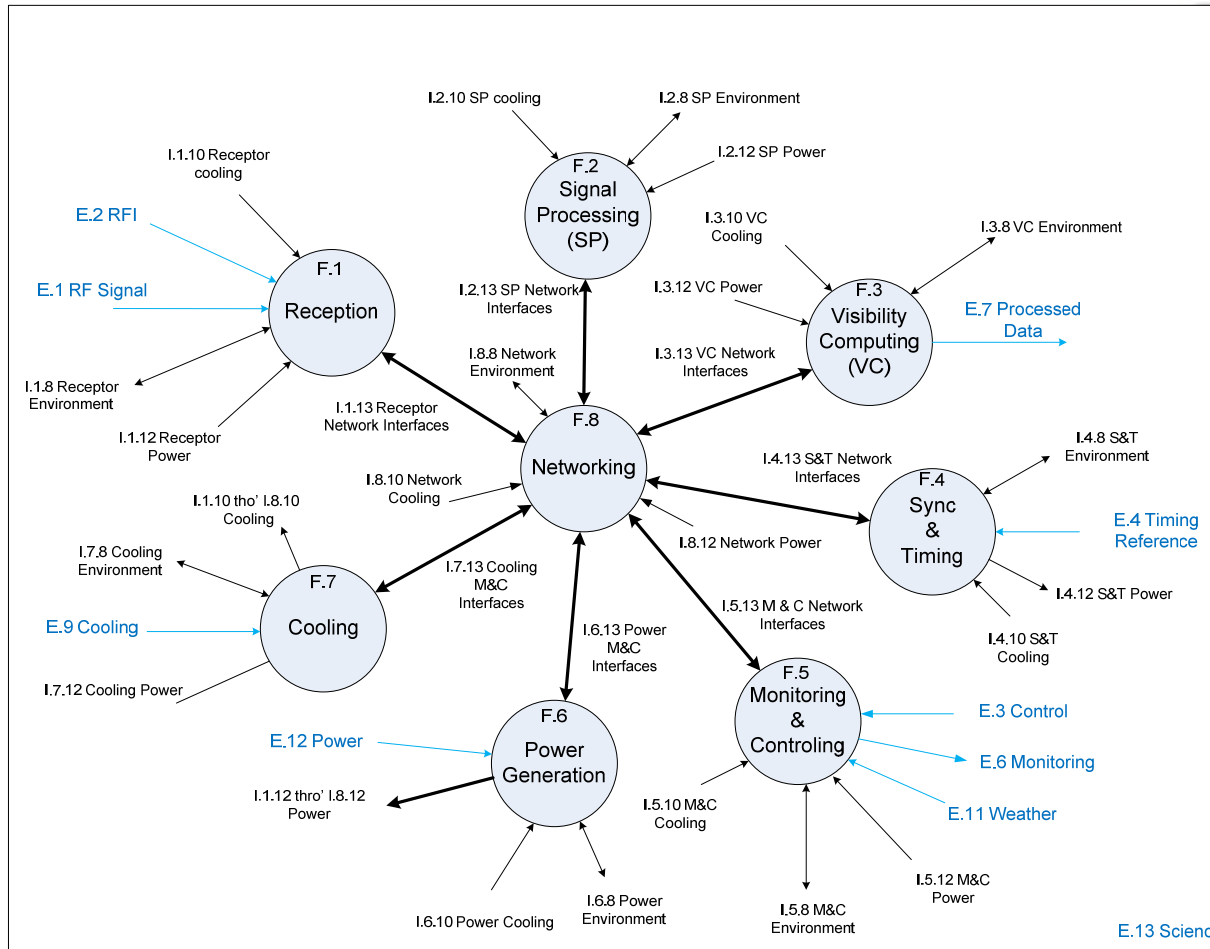
Externally reviewed PEP WBS



WP 9	Software and Computing		
9.1	Engineering and Management	9.2	Overall Design
9.3	Central Processing		
9.3.1	Analysis of data streams	9.3.2	Design and prototype data routing
9.3.3	UV-processor design, benchmarking and prototyping	9.3.4	Imaging processor design, benchmarking and prototyping
9.3.5	Data model design	9.3.6	Streaming framework design
9.3.7	Algorithm research	9.3.8	Application development
9.3.9	Local control software	9.3.10	Real-time databases
9.4	Science processing		
9.4.1	Data access software	9.4.2	Algorithm research and sky simulations
9.5	System Software		
9.5.1	Top-level architecture	9.5.2	Monitor and control
9.5.3	Scheduling and Observation handling	9.5.4	Observing proposal tool
9.5.5	System health management	9.5.6	Common Libraries

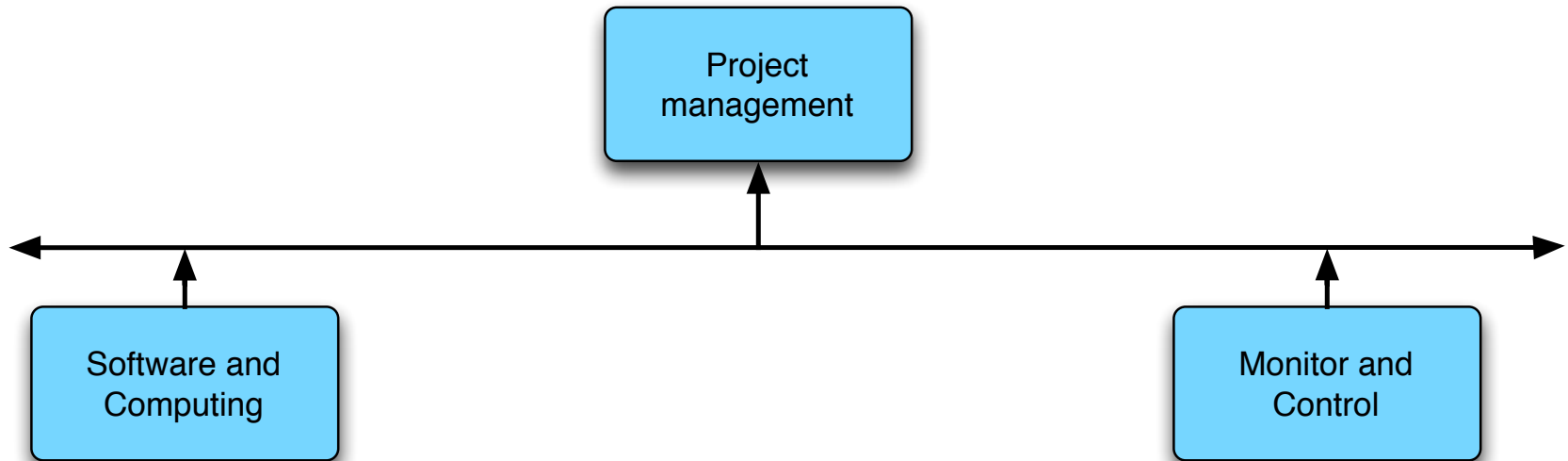
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delta CoDR



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Current split model



- Two independent software organisations with no strong alignment
- Dispute resolution only at project level
- Requires software engineering expertise at project level

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Outline of Telescope Manager WBS Level 3 Element:

3. SKA.TEL.MGR	Telescope Manager
4. SKA.TEL.MGR.MGT	Management
4. SKA.TEL.MGR.SE	System Engineering
4. SKA.TEL.MGR.TELMGT	Telescope management
5. SKA.TEL.MGR.TELMGT.MON	Monitoring data acquisition and handling
5. SKA.TEL.MGR.TELMGT.CTRL	Control
5. SKA.TEL.MGR.TELMGT.UIS	Operator and Engineer interfaces
5. SKA.TEL.MGR.TELMGT.LMCSTD	Local M&C Interface standardisation
5. SKA.TEL.MGR.TELMGT.IFS	Interfaces with other Elements
5. SKA.TEL.MGR.TELMGT.OPDBS	Operations Support databases
5. SKA.TEL.MGR.TELMGT.OPSUPP	Operations Support
5. SKA.TEL.MGR.TELMGT.ARCH	Monitoring data archive
5. SKA.TEL.MGR.TELMGT.FAULT	Fault detection and management
5. SKA.TEL.MGR.TELMGT.SAFE	Safety and equipment protection
5. SKA.TEL.MGR.TELMGT.SEC	Security
5. SKA.TEL.MGR.TELMGT.REL	Reliability, availability and integrity
5. SKA.TEL.MGR.TELMGT.ENGSIM	Engineering device simulators
4. SKA.TEL.MGR.STD	Standardisation
4. SKA.TEL.MGR.OBSMGT	Observation management
5. SKA.TEL.MGR.OBSMGT.PROPSUB	Proposal Submission
5. SKA.TEL.MGR.OBSMGT.OBSPREP	Observation preparation
5. SKA.TEL.MGR.OBSMGT.SCHED	Scheduling
5. SKA.TEL.MGR.OBSMGT.CFG	Instrument configuration
5. SKA.TEL.MGR.OBSMGT.EXEC	Observation execution
5. SKA.TEL.MGR.OBSMGT.ARCH	Observation management data archive
5. SKA.TEL.MGR.OBSMGT.UI	User interface
5. SKA.TEL.MGR.OBSMGT.SIM	Simulation
4. SKA.TEL.MGR.CSF	Common Software Framework
5. SKA.TEL.MGR.CSF.CDM	Common Data Models
5. SKA.TEL.MGR.CSF.PROTO	Common Protocols and Runtime
5. SKA.TEL.MGR.CSF.DEVTOOLS	Common tools
5. SKA.TELMGR.CSF.TEST	Common Testing Framework

- 4 SKA.TEL.SDP.MGT – Management (generic)
- 4 SKA.TEL.SDP.SE - System Engineering (mostly generic, some additions)
- 4 SKA.TEL.SDP.ARCH – Architecture
- 4 SKA.TEL.SDP.SSUP – Science Support
- 4 SKA.TEL.SDP.SIML - Simulation
 - 5 SKA.TEL.SDP.SIML.DQUAL – Simulation Exploring Data Quality
 - 5 SKA.TEL.SDP.SIML.PERF – Simulation Exploring Data Flow Performance
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 - 5 SKA.TEL.SDP.DHNDL.PP – Requirements of storing data processing provenance
 - 5 SKA.TEL.SDP.DHNDL.META – Requirements of metadata to be supplied by TM
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4 SKA.TEL.SDP.CS – Common Software

5 SKA.TEL.SDP.CS.REUSE – Survey opportunities to reuse

5 SKA.TEL.SDP.CS.RSRCH – Research developments in HPC industry

5 SKA.TEL.SDP.CS.IDG – Participation in Common Software IDG

4 SKA.TEL.SDP.EXTL – External Interfaces

5 SKA.TEL.SDP.EXTLEU – Interfaces for external users

5 SKA.TEL.SDP.EXTL.OP – Interfaces for operator users

5 SKA.TEL.SDP.EXTLENGR – Interfaces for engineering users

5 SKA.TEL.SDP.EXTL.SYS – Machine to machine interfaces

5 SKA.TEL.SDP.EXTL.IDG – Participation in interface IDG

4 SKA.TEL.SDP.SOA – System Operations and Administration

4 SKA.TEL.SDP.DEVS – Development Support

4 SKA.TEL.SDP.COMM – Commissioning Software

4 SKA.TEL.SDP.BDYA – Boundary Analyses

4 SKA.TEL.SDP.POWR – Power Management

4 SKA.TEL.SDP.INFRA - Infrastructure

4 SKA.TEL.SDP.LMC - Local Monitoring and Control

SPO rationales



M&C is system-wide and therefore belongs in System WP	True of many WP - e.g. Signals and Networks
M&C is very “large” and needs its own WP	“Size” not obviously coupled to project structure
M&C must be safety-focused	Always true of M&C. Not aware of any M&C system that violates this.
M&C may be bid for by industry	Not a conflict <i>e.g.</i> S&C consortium can include M&C and still have industry bid for it

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SPO rationales



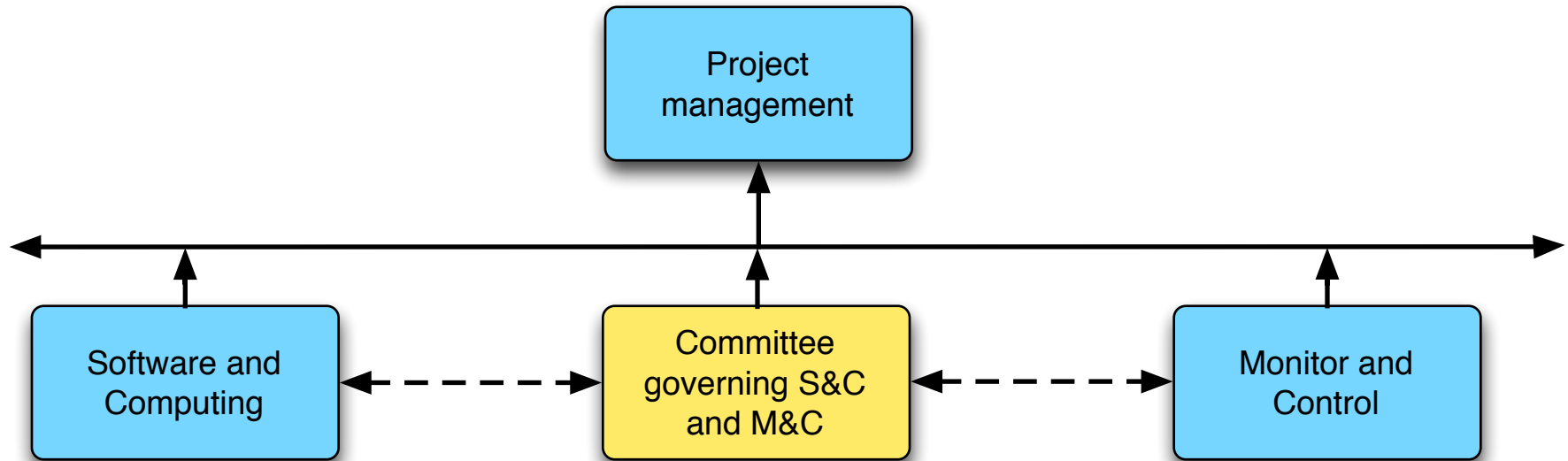
<p>M&C system must come up early in project timeline</p>	<p>Always true, other telescopes have demonstrated no conflict. A matter for project management.</p>
<p>All that's needed is excellent interface documentation</p>	<ul style="list-style-type: none">• Leaves out common architecture, design, libraries, <i>etc.</i>• Not efficient or appropriate for very closely related subsystems
<p>M&C cross cuts the project - lots of connections to other work packages</p>	<p>Always true but splitting it off doesn't help.</p>

M&C CoDR report



- Panel took project structure as out-of-scope
- Considered difficulties arising from split of M&C and S&C
- Proposed addition of “Computing Coordination Committee”

Committee model



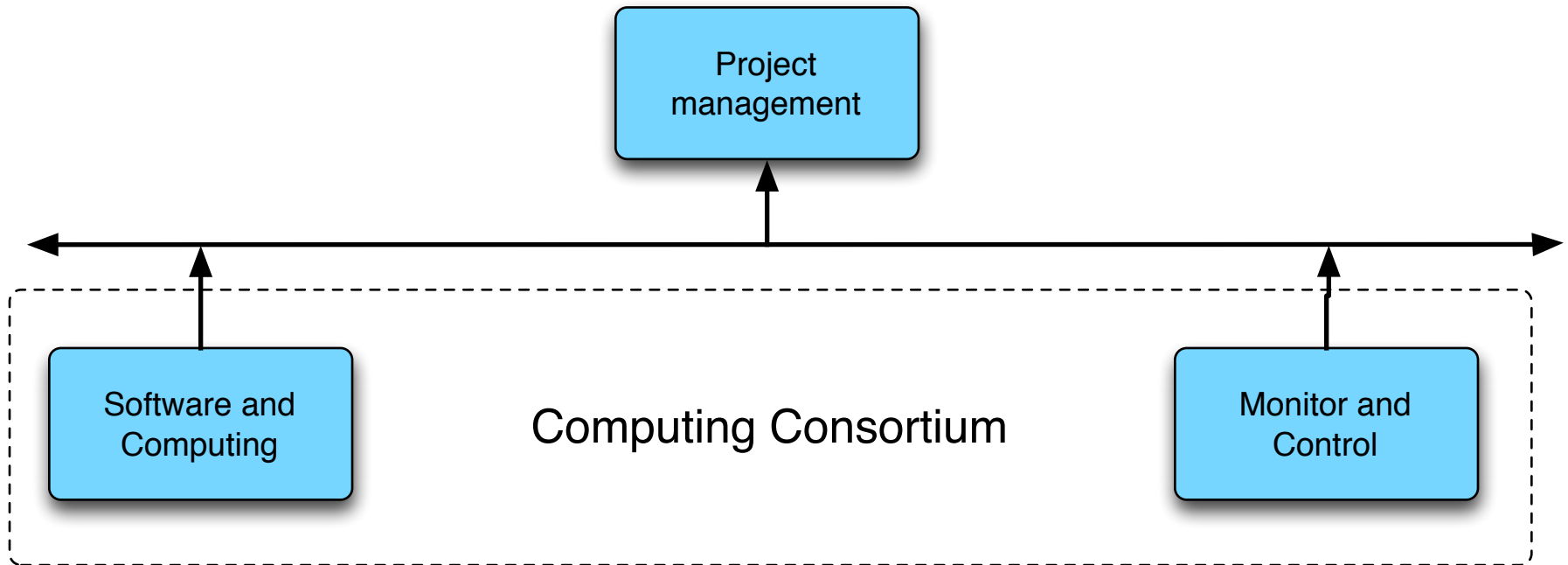
- Suggested by M&C review
- Same as status quo but with extra player
- Could be significantly worse than split model

Committee purview



- Oversees standards, frameworks, data model, databases, data formats, networks, computer hardware, archiving, operating systems, languages, HPC, tools, performance, science analysis tools, IT, testing, methodology, releases,...
- We understand architecture and design have been added to roles recently
- Governance? Membership? Accountability?

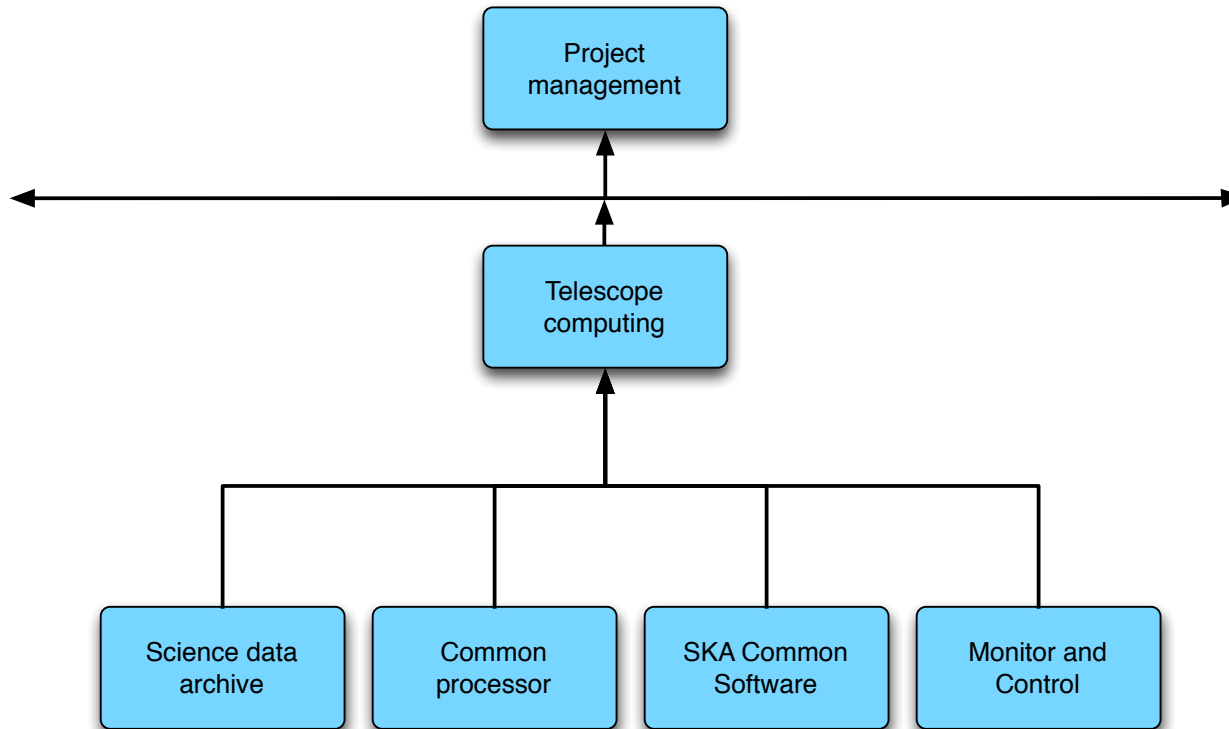
Consortium model



- Consortium bids for both work packages
- De-risks both areas
- Works to internal WBS, reports to external WBS

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Unified model



- All telescope computing integrated into one WP
- Governance, architecture, standards, policies all shared

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S&C team preferences



Combined	Easiest to manage, control fragmentation
Split + Consortium	Split essentially disappears
Split	Fragmentation of architecture, design, implementation
Split + C3	All the disadvantages of the Split PLUS an external non-accountable committee

Summary



- Over time, SPO has had multiple reasons for keeping M&C separate from S&C
- Without exception, S&C team believes S&C and M&C should be combined in a single level 3 WP
- ALMA, ASKAP, and LOFAR all have single team
- Decision due sometime after this CoDR
- S&C team has had no formal input to this decision
- Risk: **high likelihood, high consequence**