



# Software Integration and Test Techniques in a Large Distributed Project: Evolution, Process Improvement, Results

Paola Sivera - ESO



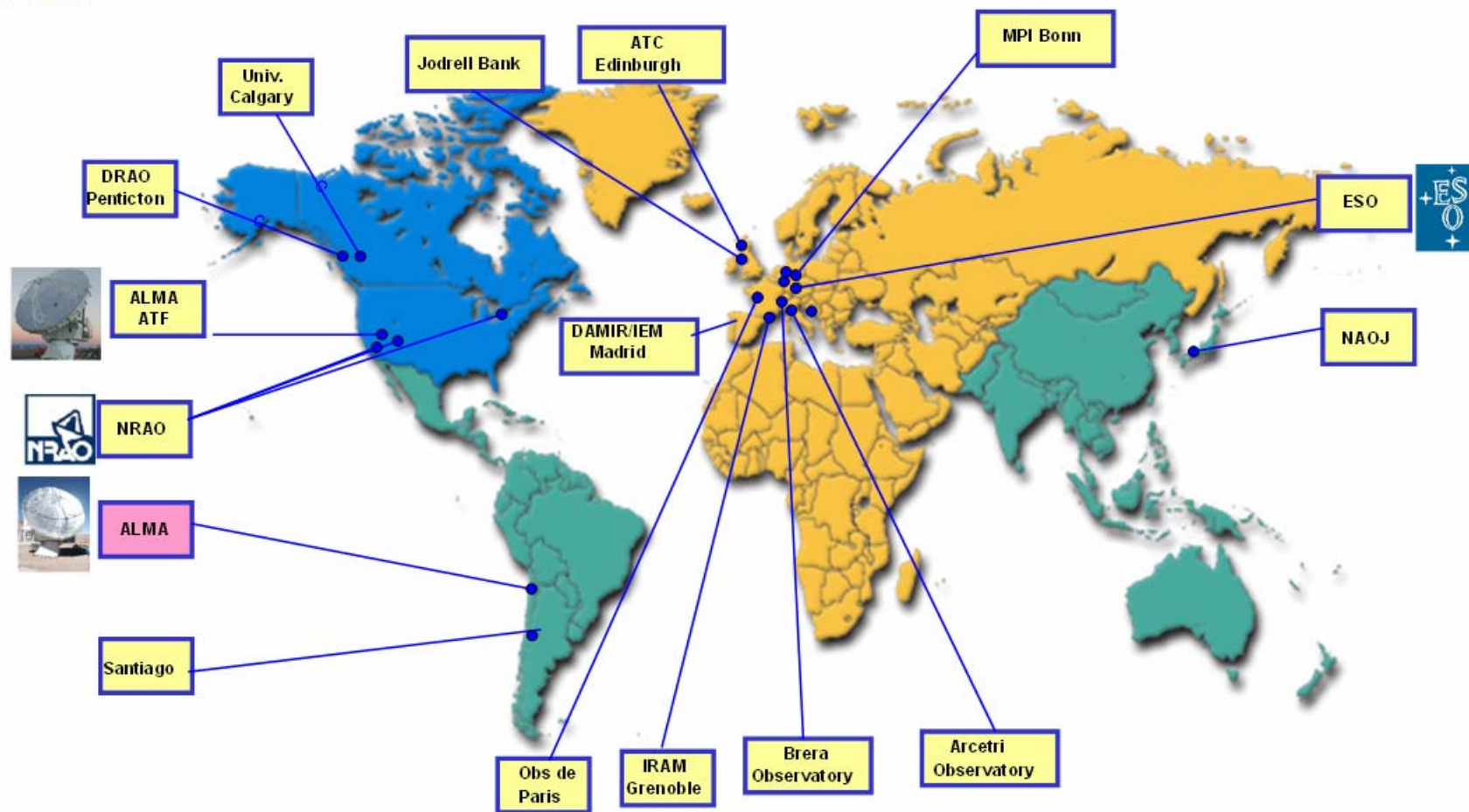
Antenna Prototypes at ALMA  
Test Facility: 2005







# ALMA Geographical distribution

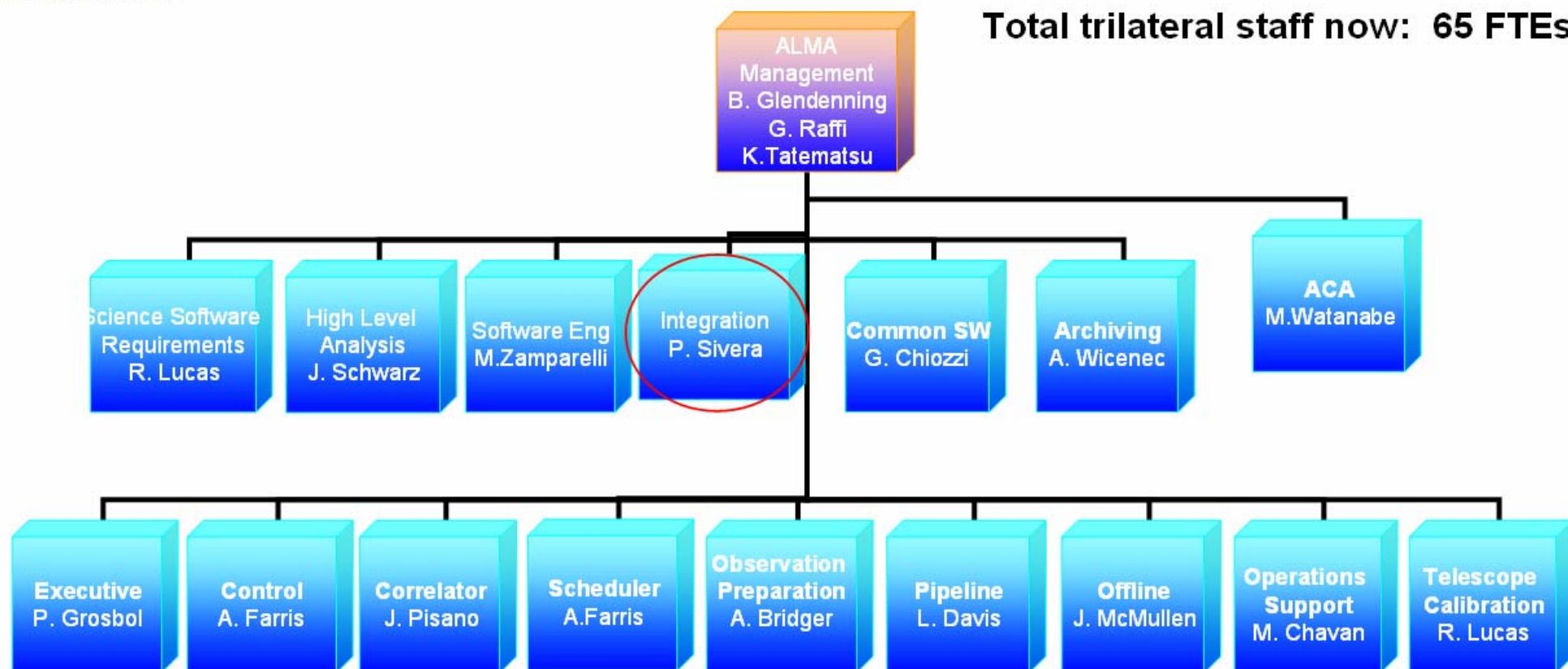




# Trilateral Computing IPT Organisation

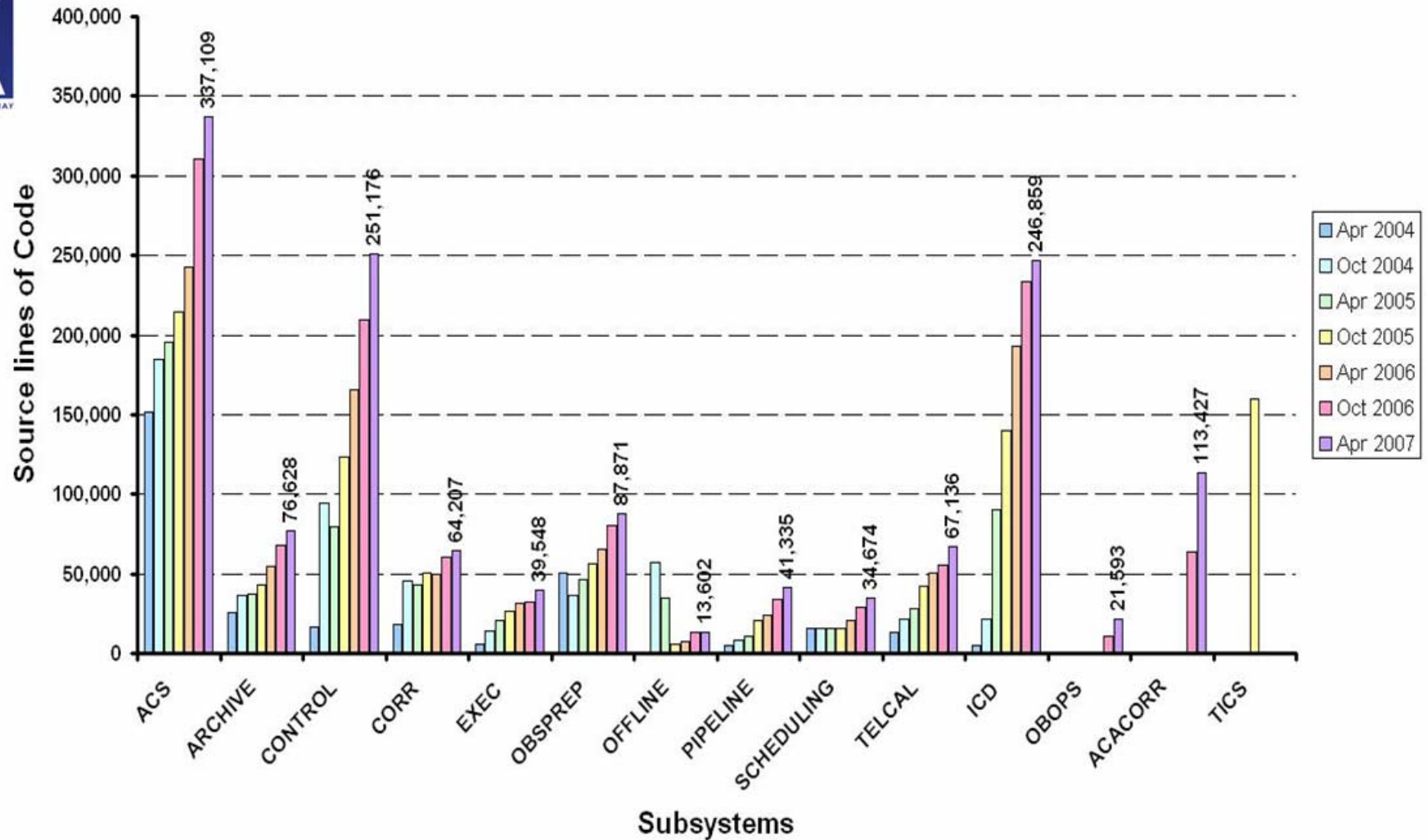
Total Bilateral staff now: 40 FTEs

Total trilateral staff now: 65 FTEs



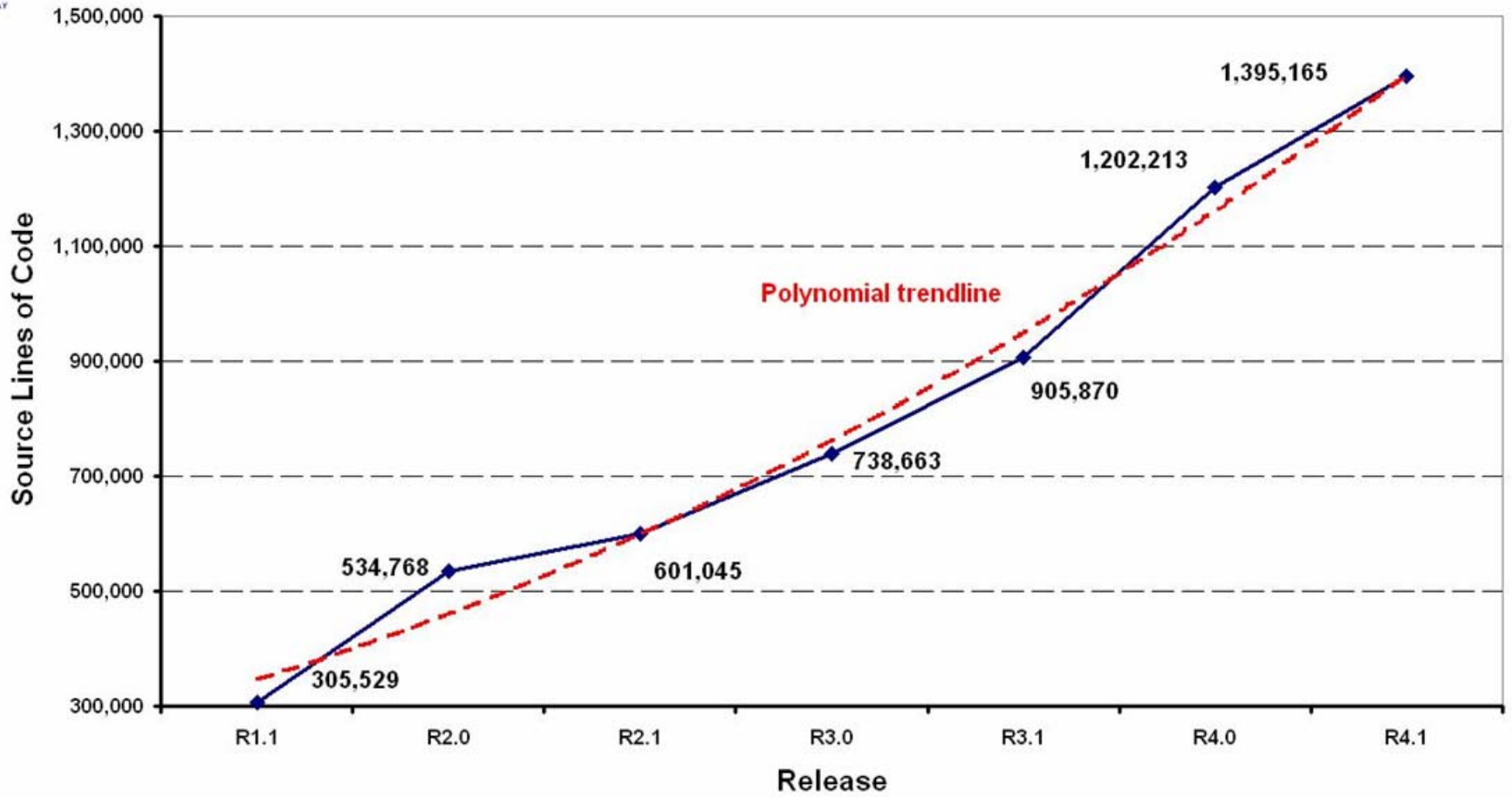


## SLOC per Subsystem over Releases





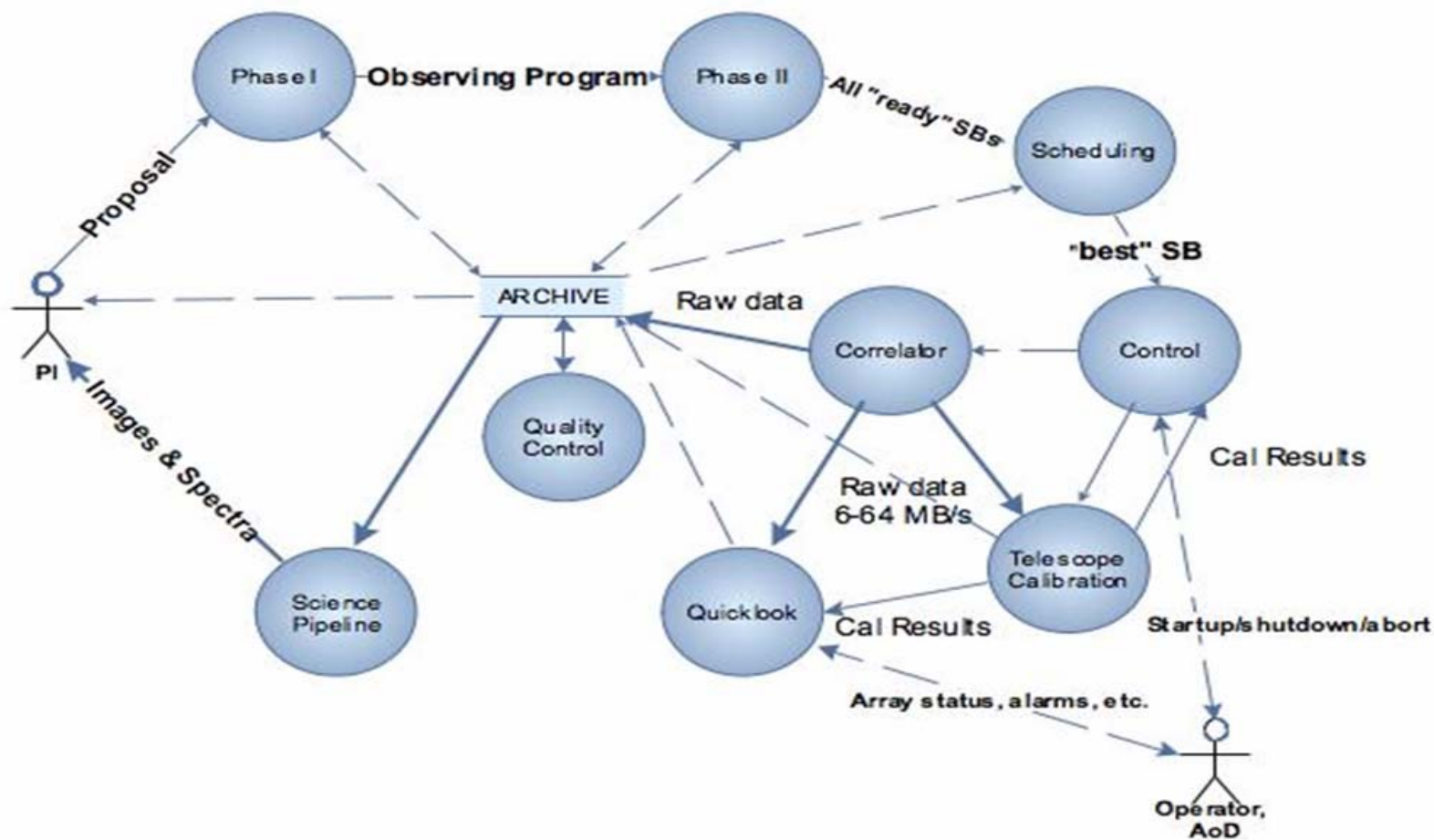
### SLOC per Release (No TICS)







# ALMA System Dataflow

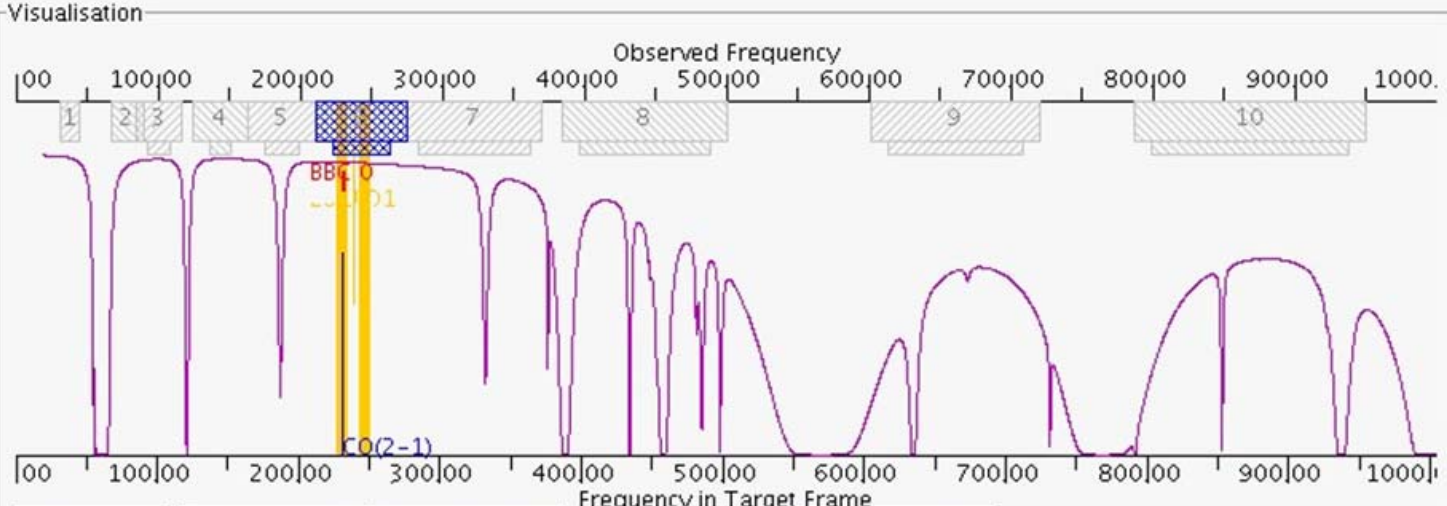






Editors

Visual Forms Catalog



Reset << >> Zoom To band Receiver Bands

+ - Pan to Line BBC Centre Frequencies

Best USB BBC 0 USB BBC 1 USB BBC 2 USB BBC 3 USB Basebands

Best LSB BBC 0 LSB BBC 1 LSB BBC 2 LSB BBC 3 LSB Other lines

Best BBC 0 BBC 1 BBC 2 BBC 3 Side Bands

Transmission

Frequency Setup

Rest Frequency  GHz

Transition

Receiver Band

LO<sub>1</sub> Frequency  GHz

BaseBand Configurations



# EXEC: Operator Master Client

**Operator MasterClient** [Session Extensions Debug]

---

### Scheduling

Queueing: **sub70**

Name	PI	Rank	Score	Proj Ref	OUS
sbName0	PI0	0.0	0.0	projectRef0	obs...
sbName1	PI1	1.0	1.0	projectRef1	obs...
sbName2	PI2	2.0	2.0	projectRef2	obs...
sbName3	PI3	3.0	3.0	projectRef3	obs...
sbName4	PI4	4.0	4.0	projectRef4	obs...

Choose Details...

Mode:  dynamic  interactive  stop

Status:  online  offline

### Connectivity

Alma: **Operational** (Error Shutdown Init Online)

Corba (Kill) Acs down **Acs up**

### Subsystems

- >> ARCHIVE: AVAILABLE/OPERATIONAL  Error Shutdown Init Online **Operational**
- >> SCHEDULING: AVAILABLE/OPERATIONAL  Error Shutdown Init Online **Operational**
- >> CONTROL: AVAILABLE/OPERATIONAL  Error Shutdown Init Online **Operational**
- >> TELCAL: AVAILABLE/OPERATIONAL  Error Shutdown Init Online **Operational**
- >> SCIENCE: AVAILABLE/OPERATIONAL  Error Shutdown Init Online **Operational**
- >> QL: AVAILABLE/OPERATIONAL  Error Shutdown Init Online **Operational**

---

### Tree Info

Deployment Info

- Manager on 10.30.1.2, port 3000
  - Containers (19)
  - Client Applications (2)
    - 'ExecOMC.ComponentClient' [id 43646977]
    - 'AcsCommandCenter.MaciSupervisor' [id 58130433]
  - Components (95)
    - 'CONTROL/ALMA002/IFProc1' [id 0]: 0 clients
    - 'CONTROL/ALMA002/HoloDSP' [id 0]: 0 clients
    - 'CONTROL/ALMA001/LORR' [id 0]: 0 clients

### Miscellany

Antennas Data Flow Plugins (AcsTree)

AntennaID	Status	Subarray
a-1	online	sub70
a-2	online	sub70

Total Unassigned sub70

---

### Consoles

Container(s)

```
ping received, container alive. Memory usage 14518 of 66112 kB (= 1.7% of
ping received, container alive. Memory usage 10537 of 56384 kB (= 1.2% of
ping received, container alive. Memory usage 10537 of 56384 kB (= 1.2% of
ping received, container alive. Memory usage 13248 of 65216 kB (= 1.6% of
```

Services & Manager Containers

### Feedback

Tasks Accumulated Events **Requests** Calendar Log Input

Urgency	Timestamp	Request	Time-out
2	2006-08-24 13:00:53.540	Activate Antenna a-0?	15s

No request chosen

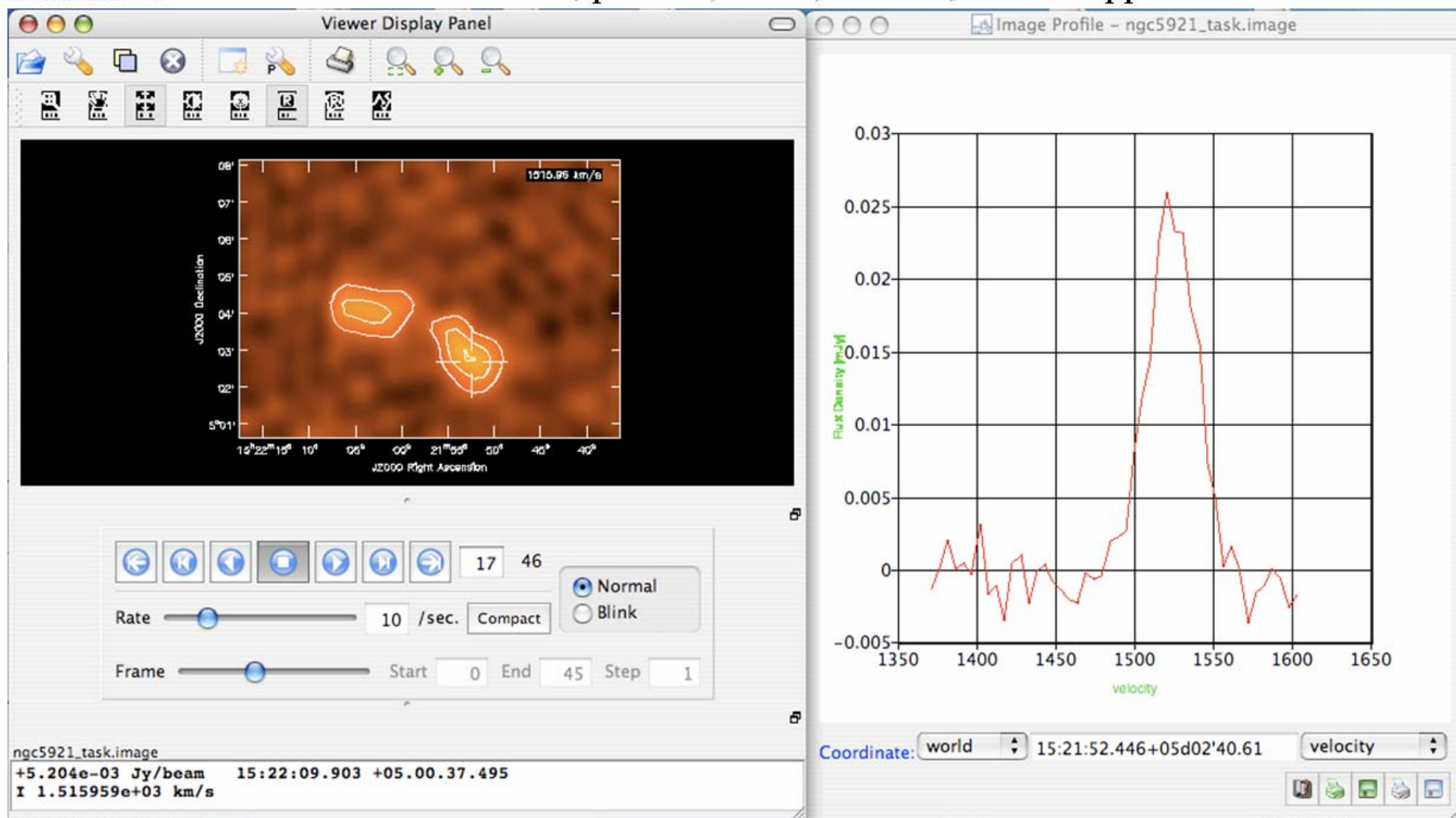
Alerts Questions **Confirm**





# CASA Viewer

- Visibility displays (raw, corrected data)
- Image, data cube displays
  - Statistics; profiles; raster, contour, vector support





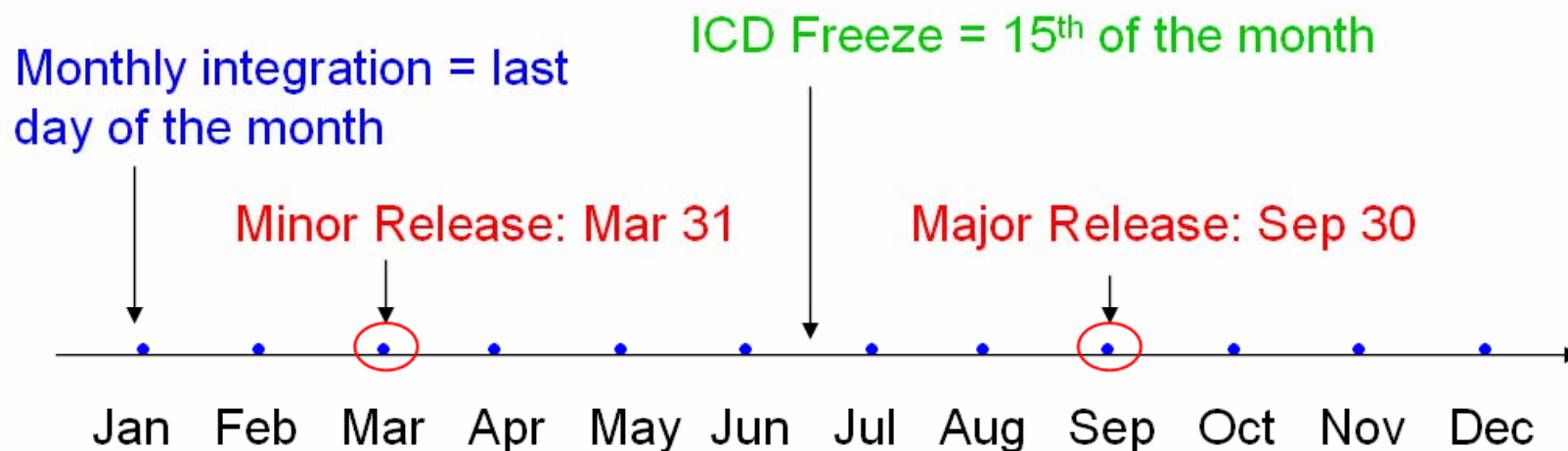
# Standards and Tools

- Alma Common Software
- Environment
- CVS organization
- Makefile
- Standard Test Environment (STE)
- Tool for automated testing
- Bug tracking tool (JIRA)





# ALMA Release Cycle





# Lessons learned

- Releases twice per year



# Lessons learned

- Releases twice per year

*but...*

- Subsystem developers working in isolation



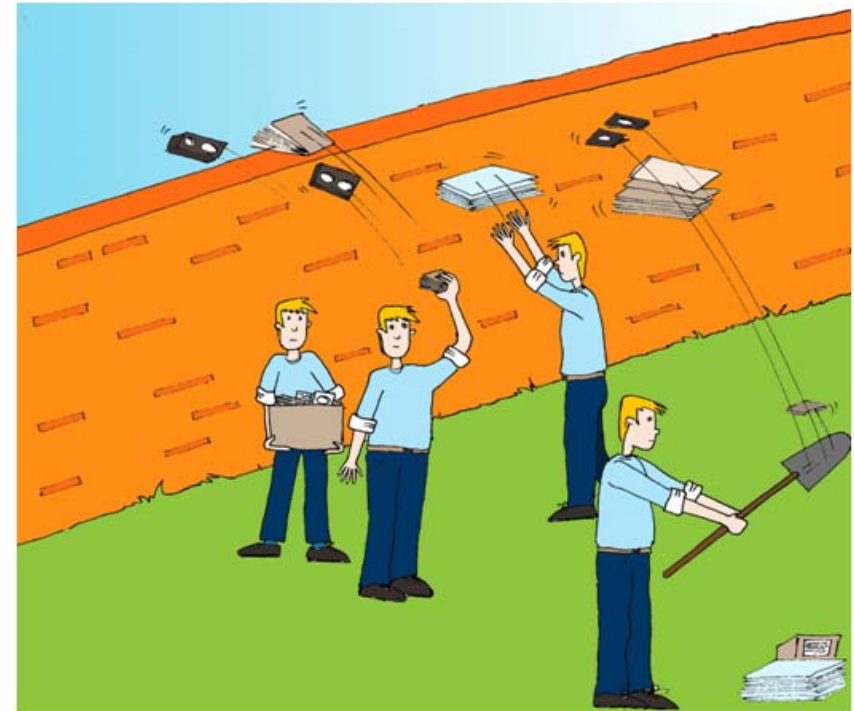


# Lessons learned

- Releases twice per year

*but...*

- Subsystem developers working in isolation
- Results thrown over the wall to ITS at release time







# Lessons learned

- Releases twice per year

*but...*

- Subsystem developers working in isolation
- Results thrown over the wall to ITS at release time
  - Each integration took ~2 months
  - At completion of integration code was already obsolete



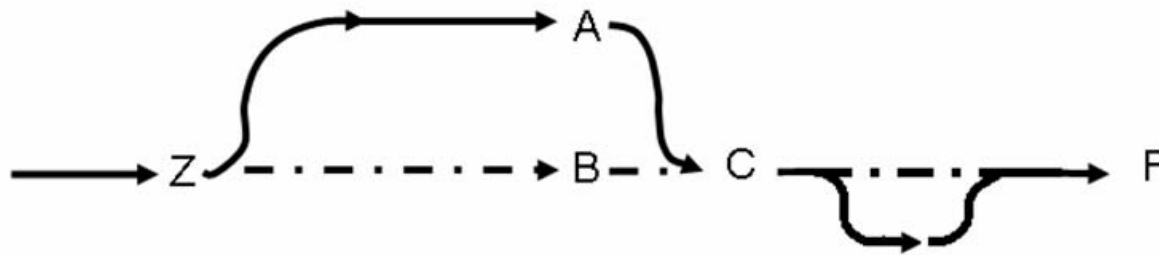


# Function-based Teams

ID	Task Name	Start	Finish	4th Quarter				1st Quarter			2nd Quarter			3rd Quarter		4th Quarter			1st Quarter			2nd Apr			
				Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb		Mar		
1	ACS 7.0	01 Nov '07	01 Nov '07																						
2	Stability Initiative # 2	02 Nov '07	10 Jan '08															■	■	■	■				
3	R5.0 (SFI with dynamic fringes)	03 Sep '07	30 Nov '07															■	■	■	■				
4	ACS 7.0 Porting	03 Dec '07	14 Dec '07																	■					
5	ACA Correlator #2	01 Nov '07	04 Jan '08																	■	■				
6	ITS validation	07 Jan '08	18 Jan '08																		■				
7	Schema Versioning	15 Oct '07	14 Dec '07																	■					
8	ITS validation	17 Dec '07	04 Jan '08																		■				
9	ASDM Finalization	07 Jan '08	29 Feb '08																		■	■			
10	ITS validation	03 Mar '08	14 Mar '08																			■			
11	Flagging and Blanking	07 Jan '08	14 Mar '08																			■	■		
12	ITS validation	17 Mar '08	28 Mar '08																				■		
13	R5.1 Validation at ATF	31 Mar '08	18 Apr '08																					■	



# FBTs organization



- Z      SharedSimulator-2006-02-B (branch)  
         SharedSimulator-2006-02-RootOfBranch (tag of the HEAD)
  
- A      SharedSimulator-2006-02-BeforeMerge
  
- B      TRUNK-SharedSimulator-2006-02-BeforeMerge
  
- C      TRUNK-SharedSimulator-2006-02-AfterMerge (tag of the HEAD)  
         SharedSimulator-2006-02-AfterMerge-B (branch)
  
- F      SharedSimulator-2006-02-FINAL



## Summing it up

- FBTs advantages:
  - Improve communication
  - More effective involvement of testers
- Testing end-to-end since the beginning
  - Good for object-oriented software
  - A lot of maintenance on the test cases
  - It is not enough -> user tests





## Future developments

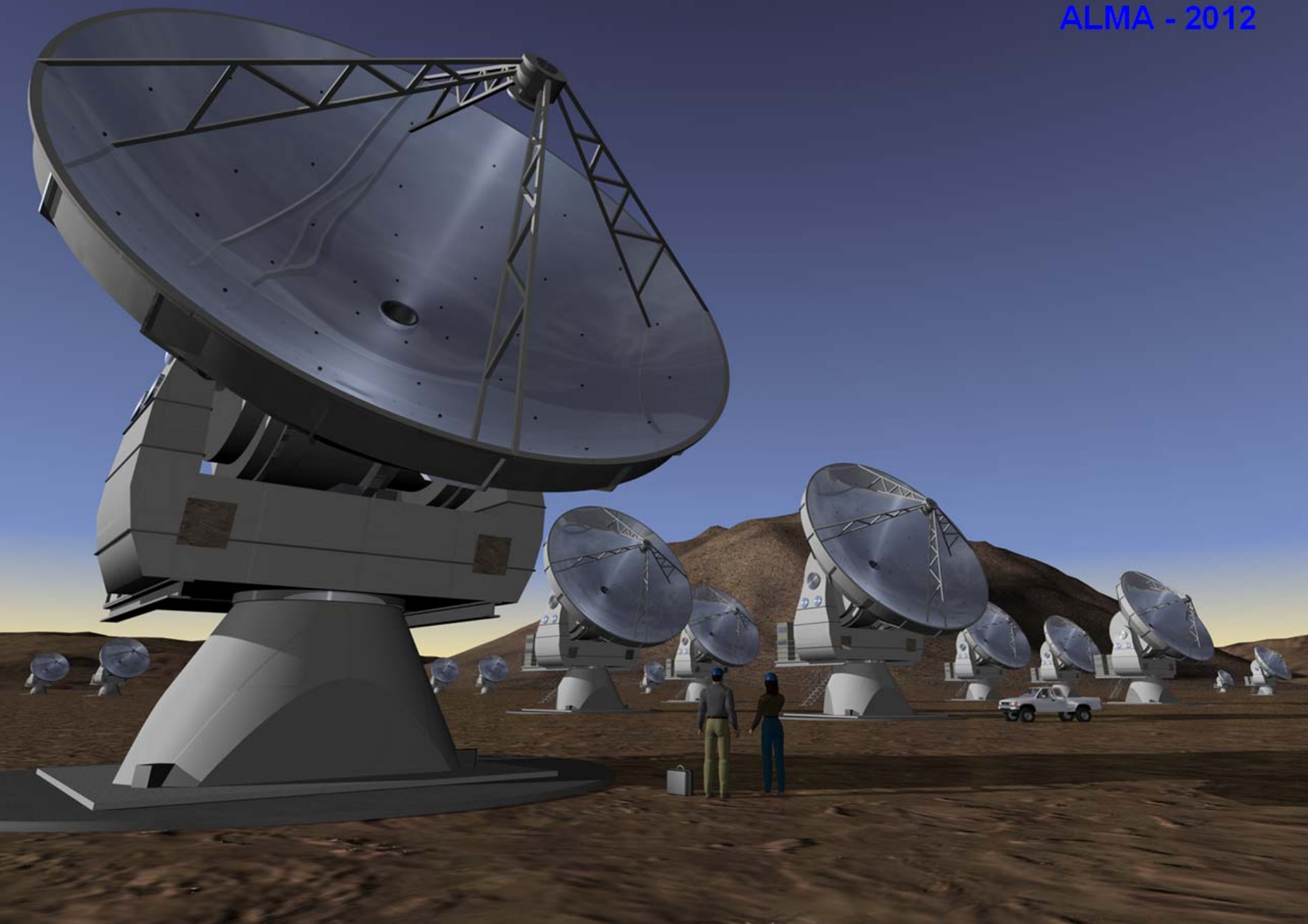
- ... the list can be very long ...

For the near future we want to focus on:

- Stability tests
- More automation



ALMA - 2012





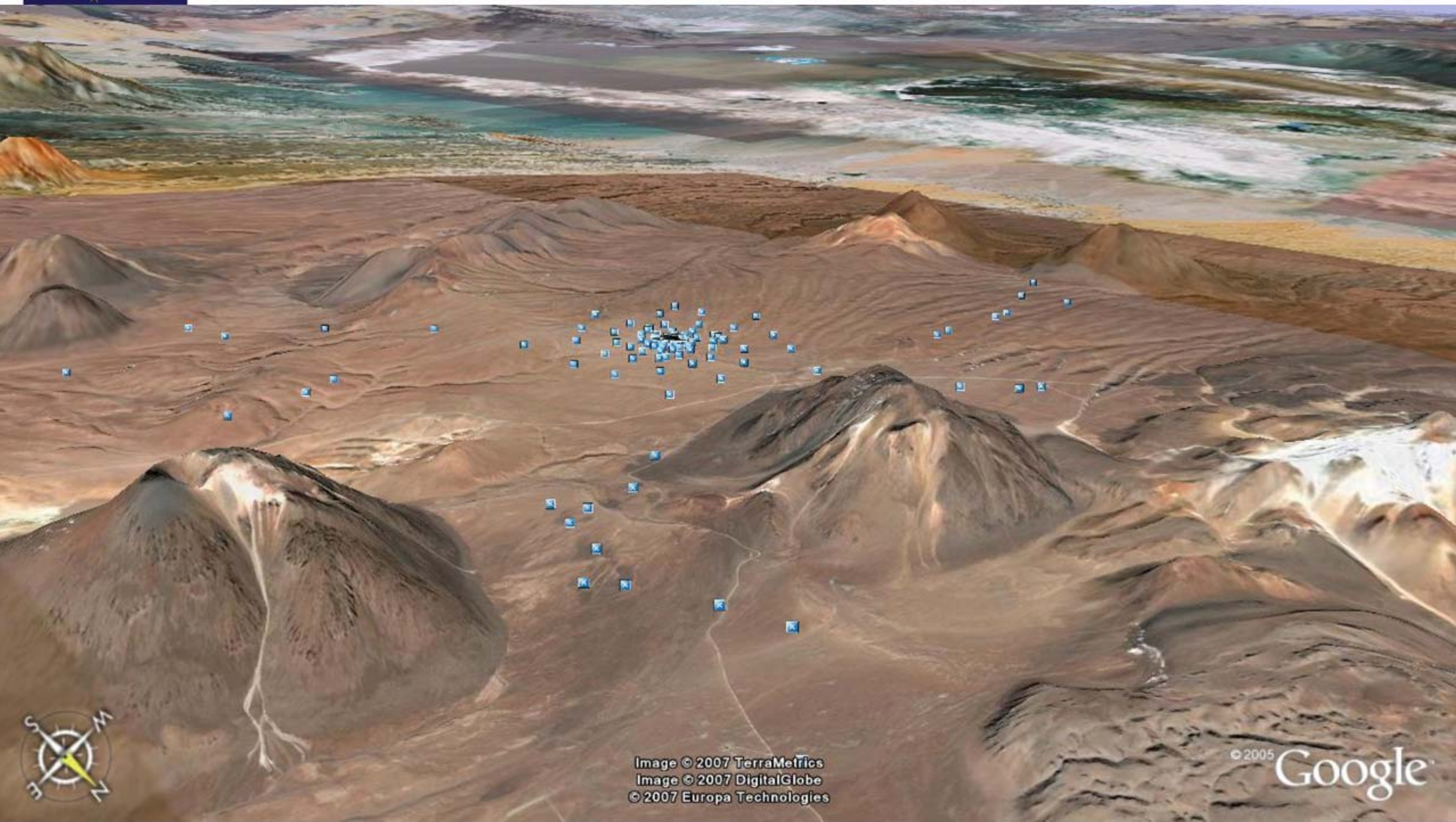
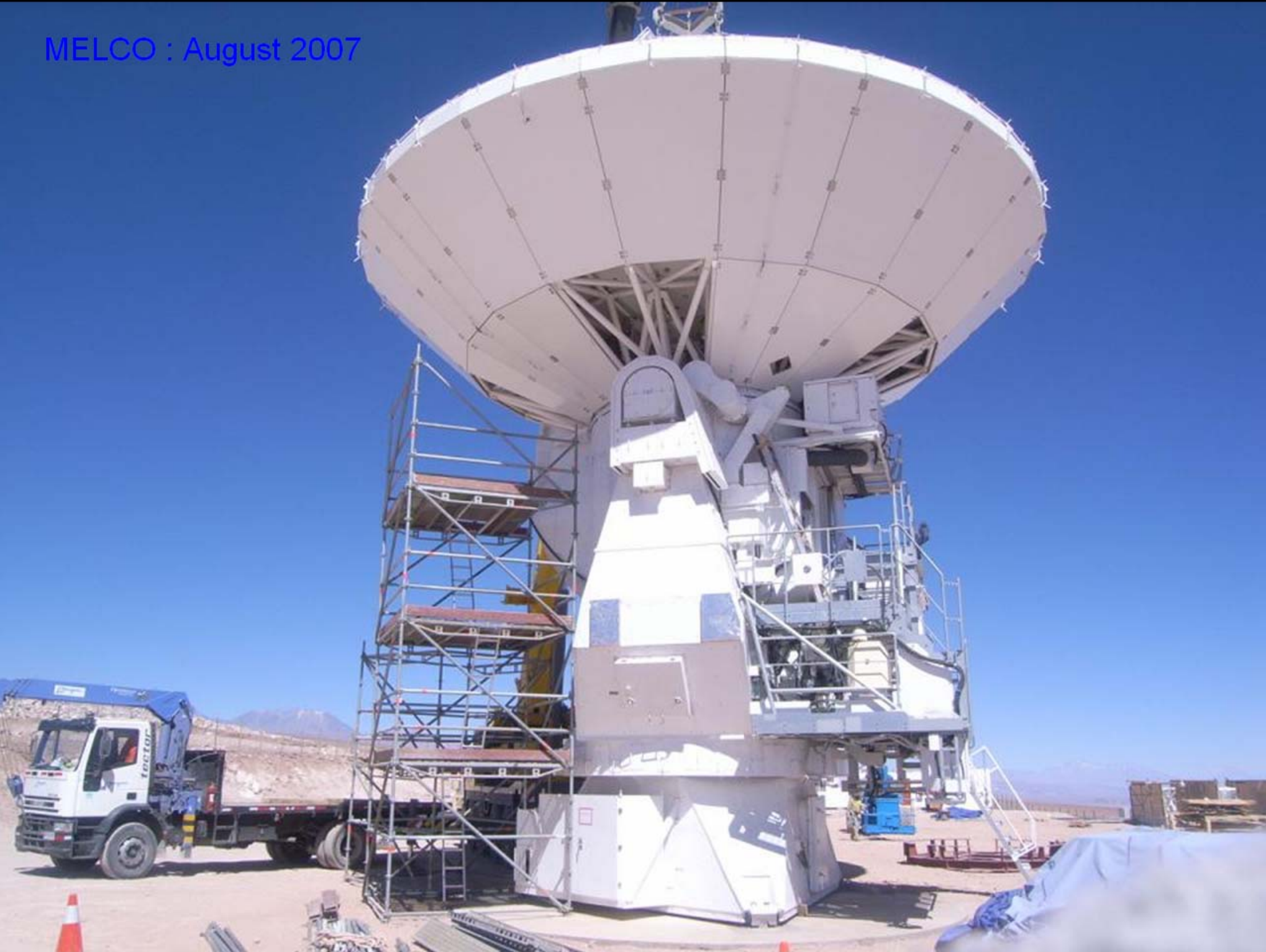


Image © 2007 TerraMetrics  
Image © 2007 DigitalGlobe  
© 2007 Europa Technologies

© 2005 Google



MELCO : August 2007



MELCO : August 2007

