



Onboard CORBA Studies Project Review

Kevin Rice

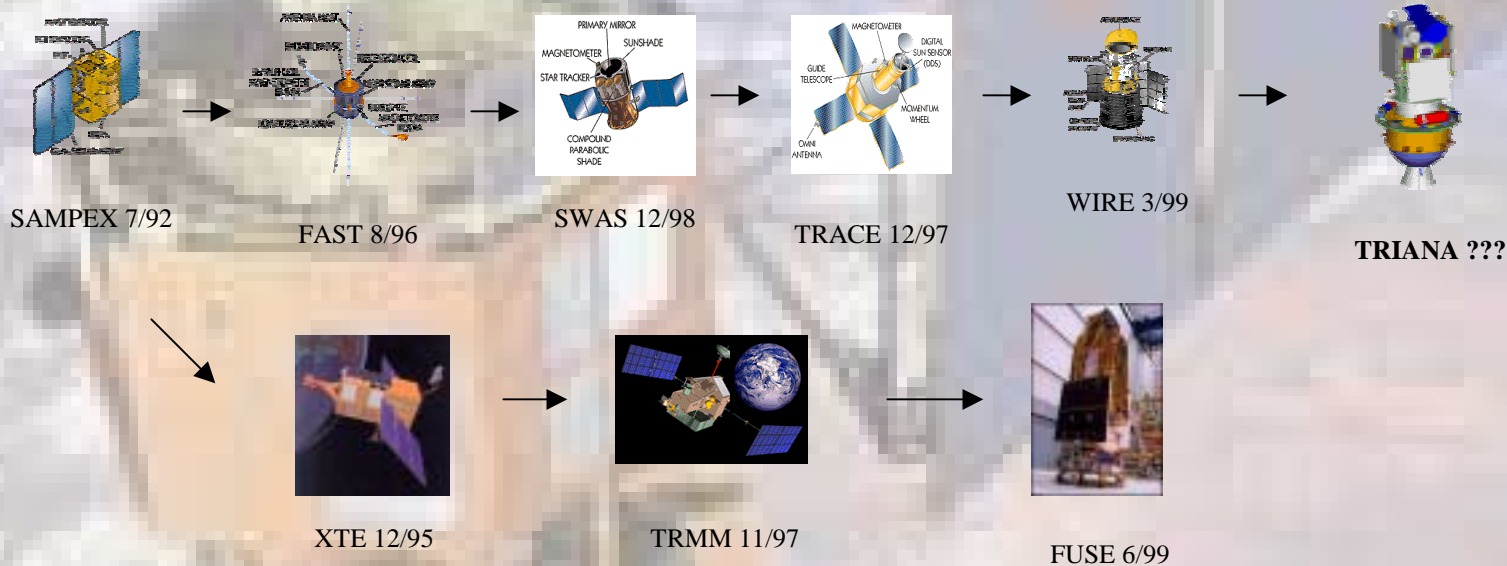
GST/NASA-GSFC Code 588

April 2001

Project Phases

- Phase 1
 - Port satellite flight software to CORBA
- Phase 2
 - Port “micro” CORBA to flight u-controllers
 - Connect u-controllers & main CPUs via PPP over MUX-1553 bus, using CORBA
- Phase 3
 - Develop “ground to space” CORBA experiment in lab environment
 - Possibly team with Science System Ltd (Plc) for flight experiments on UoSat-12

GSFC Flight Software Heritage



Architecture:

- C++
- 1 main flight computer
- VxWorks

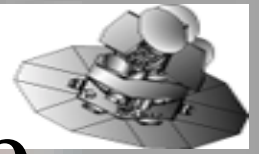
MAP 6/01?

Architecture:

- ANSIC
- 1 main flight computer
- several *u*-controller sub-systems
- 1553/1773 'network'
- VxWorks

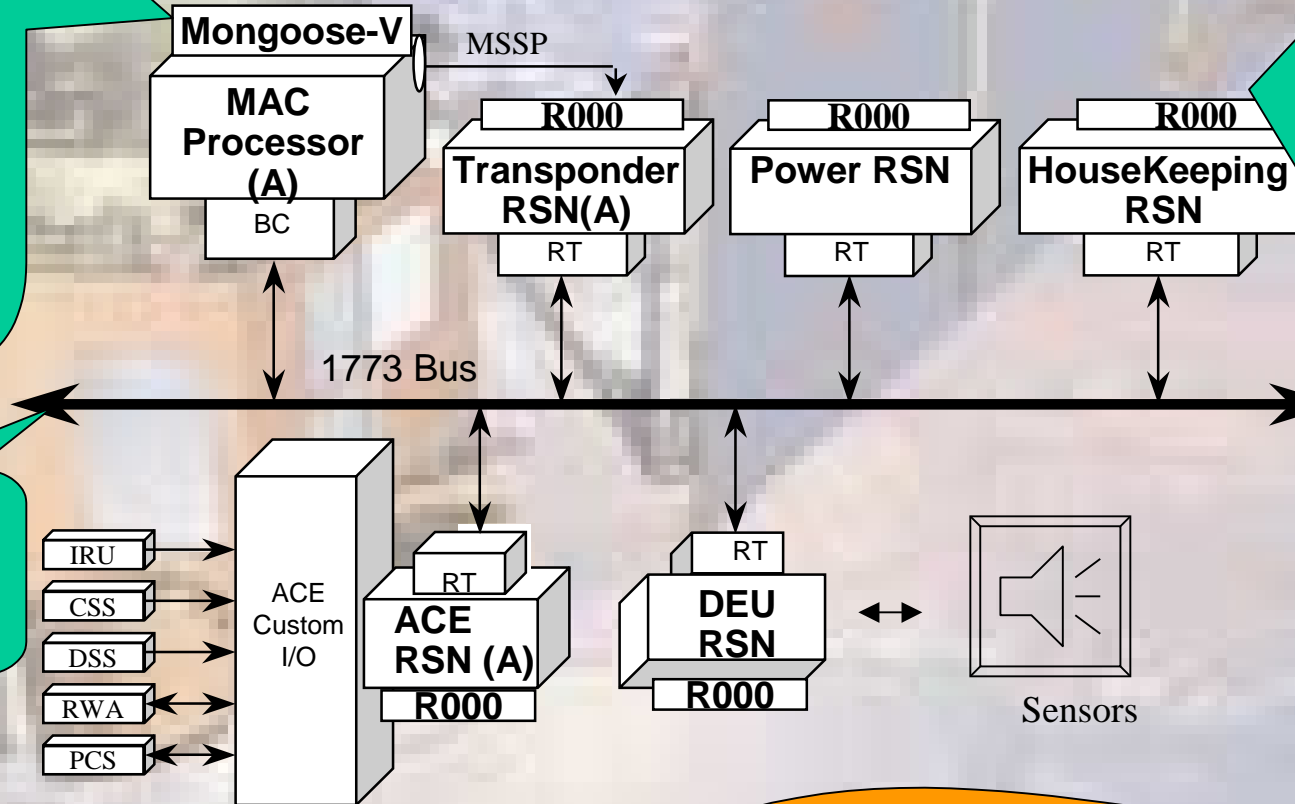
Use MAP Flight Software

- **Microwave Anisotropy Probe**
- Follow on to COBE
- Measures the cosmic micro-wave background radiation in the Universe
- Will launch in early summer 2001
- Well understood by GSFC flight software branch & largely finished...
- Written in ANSI C



MAP Hardware Architecture Diagram (Simplified)

- ~12-14Mhz
- 32MB of “program memory”
- 256 MB recorder storage,
- VxWorks



- Harvard Architecture
- 64K IRAM
- 64KDRAM
- Custom RSN-OS
- (160k, 1MB of IRAM possible)

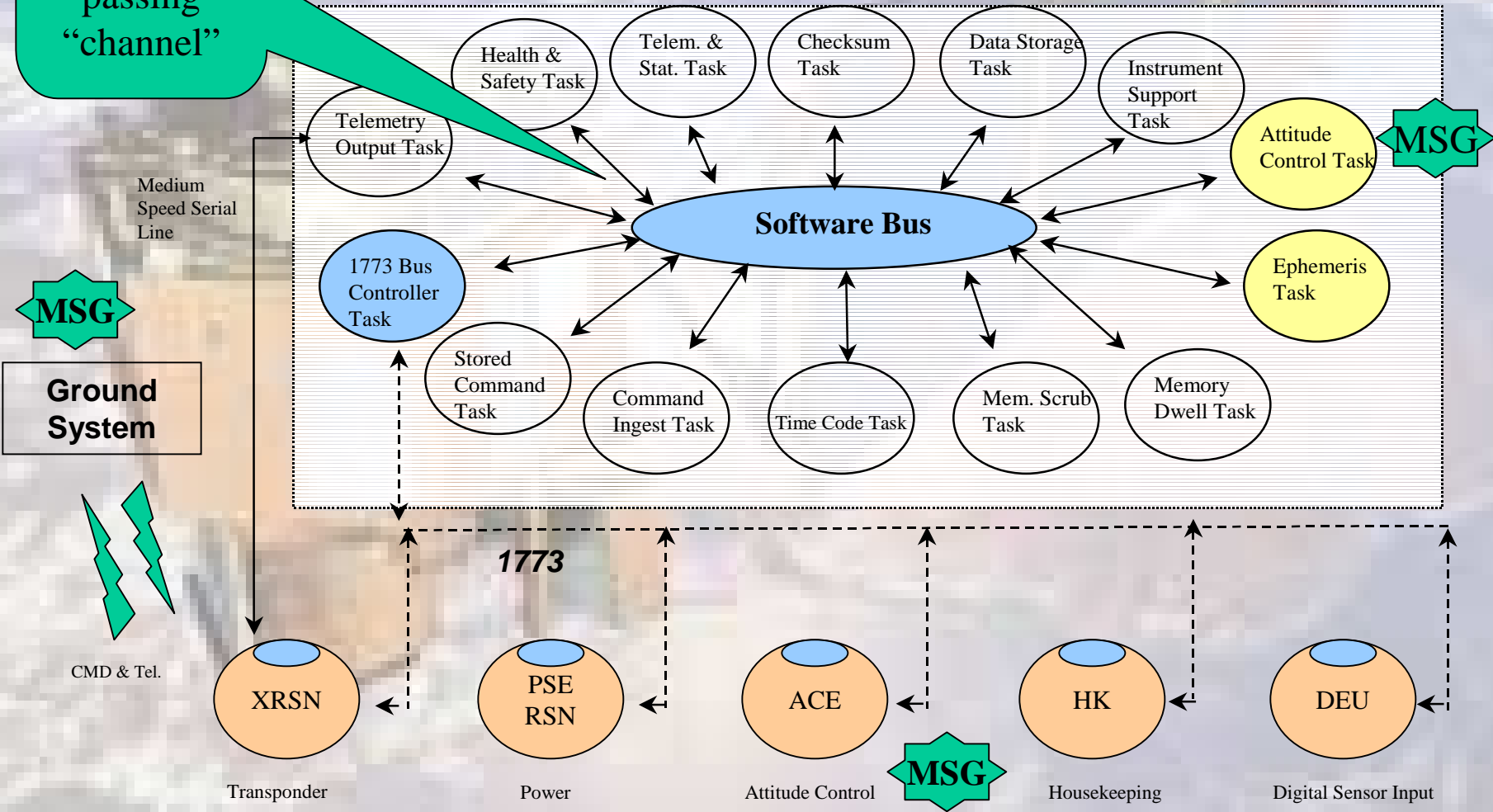
1553/1773 MUX Bus Interconnect

Basically a Distributed Architecture

Phase 1: MAP Software Architecture Overview

MAC Processor

The SBUS is used as the message passing "channel"

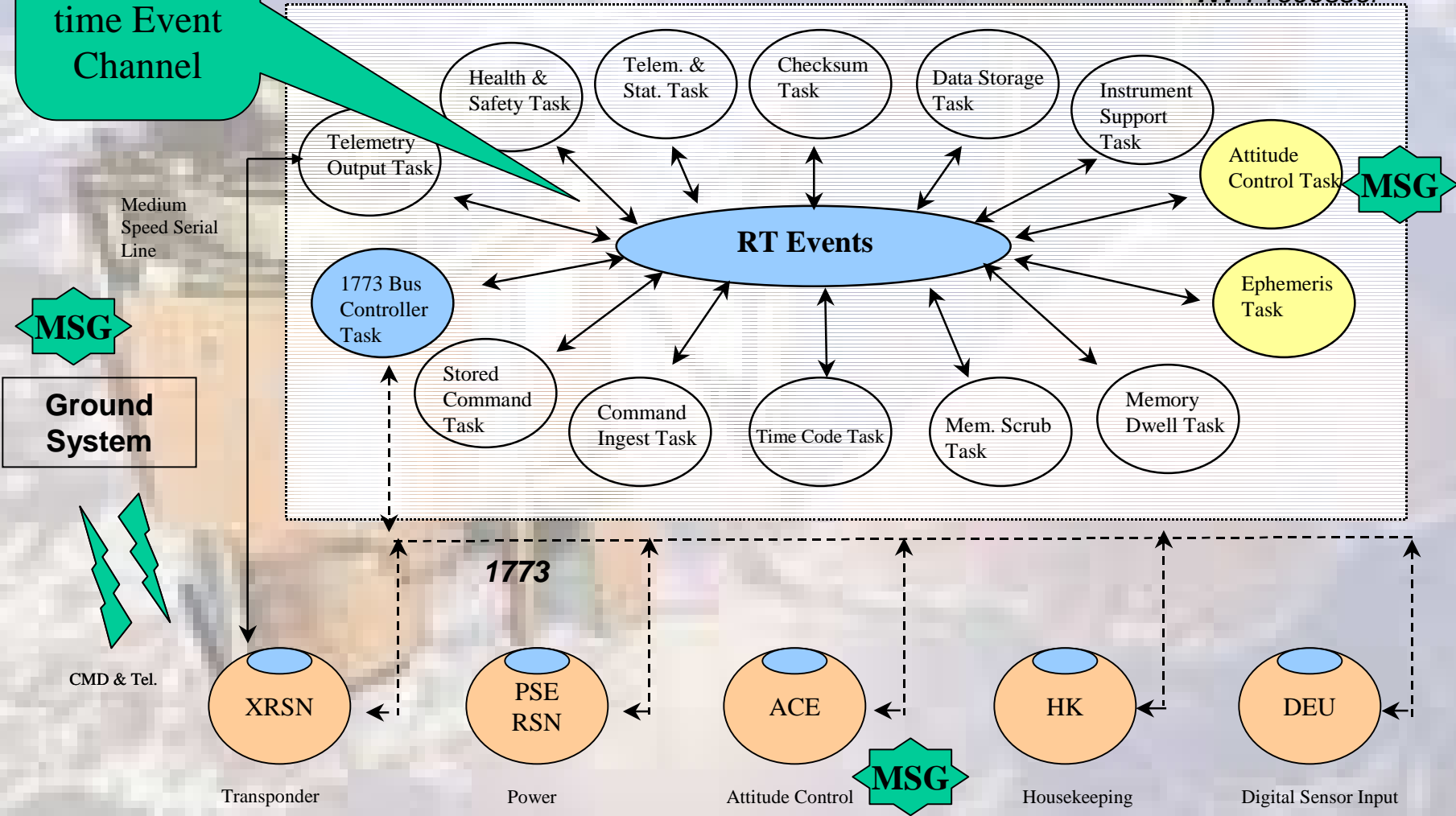


Phase 1: CORBA PORT

Actually ported
Linux PORT of
MAP to
CORBA, on NT

Replaced
SBUS with
TAO Real-
time Event
Channel

NT Processor



Phase 2: Use Micro-CORBA ORB

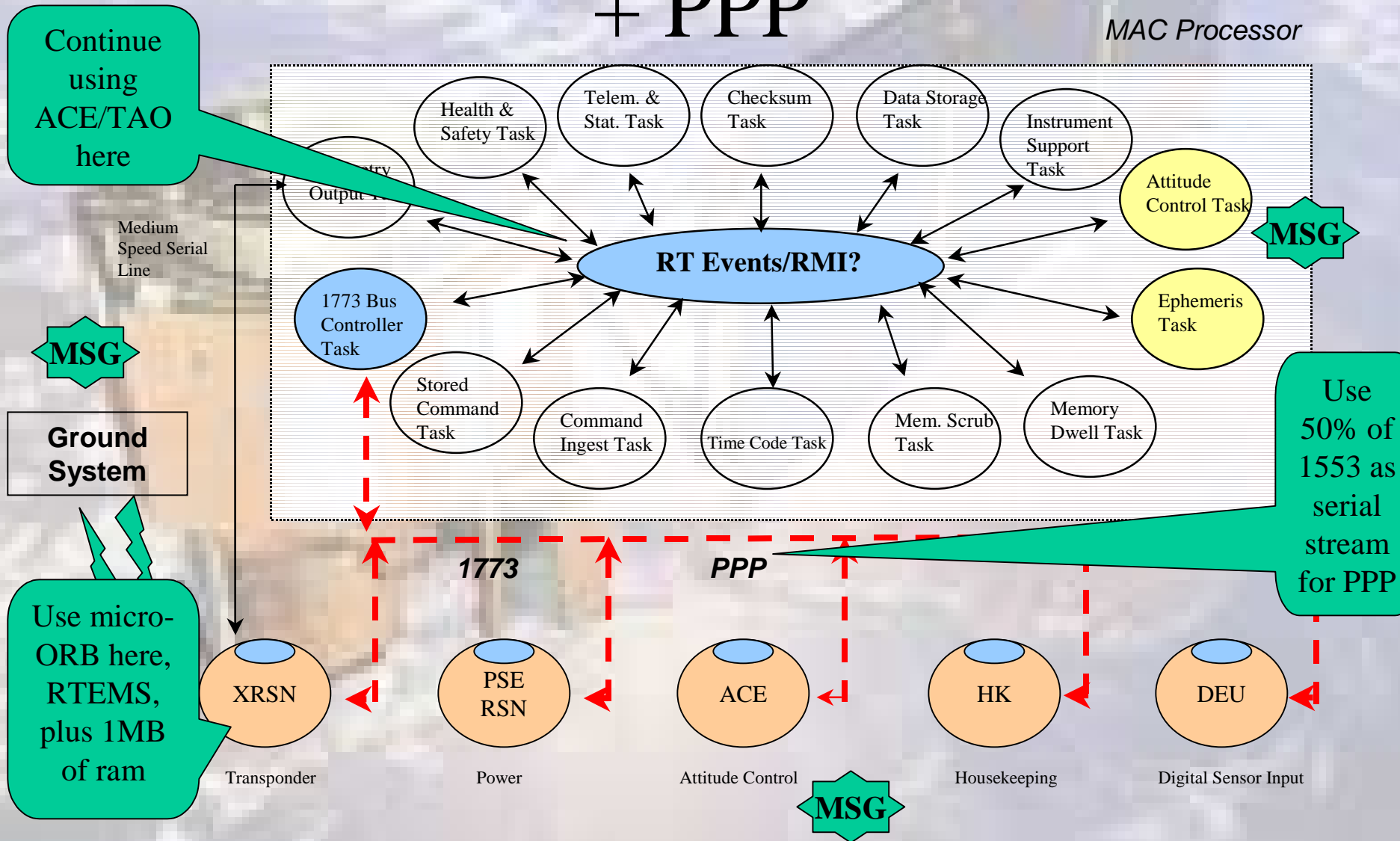
- Science Systems Ltd (Plc) developed a small flight ORB for their RATE experiment
- RATE flew on the STRV-1b satellite last fall with goal of testing CORBA “calls” ground to space...
- Unfortunately, the STRV-1b failed shortly after launch...
- The RATE ORB can be configured to 5-20k depending on desired functionality.
- BUT it is NOT a full featured ORB, or necessarily 100% CORBA compliant...

Phase 2: Port Micro-CORBA to RSNs

- Science System agreed to provide binary version of CORBA using our cross-compilers
- Run PPP over 1553/1773 bus to provide “network” link...
- Map GIOP over PPP, or use GIOP+TCP+PPP if limited address space permits (easiest)

Phase 2: Micro-CORBA + GIOP

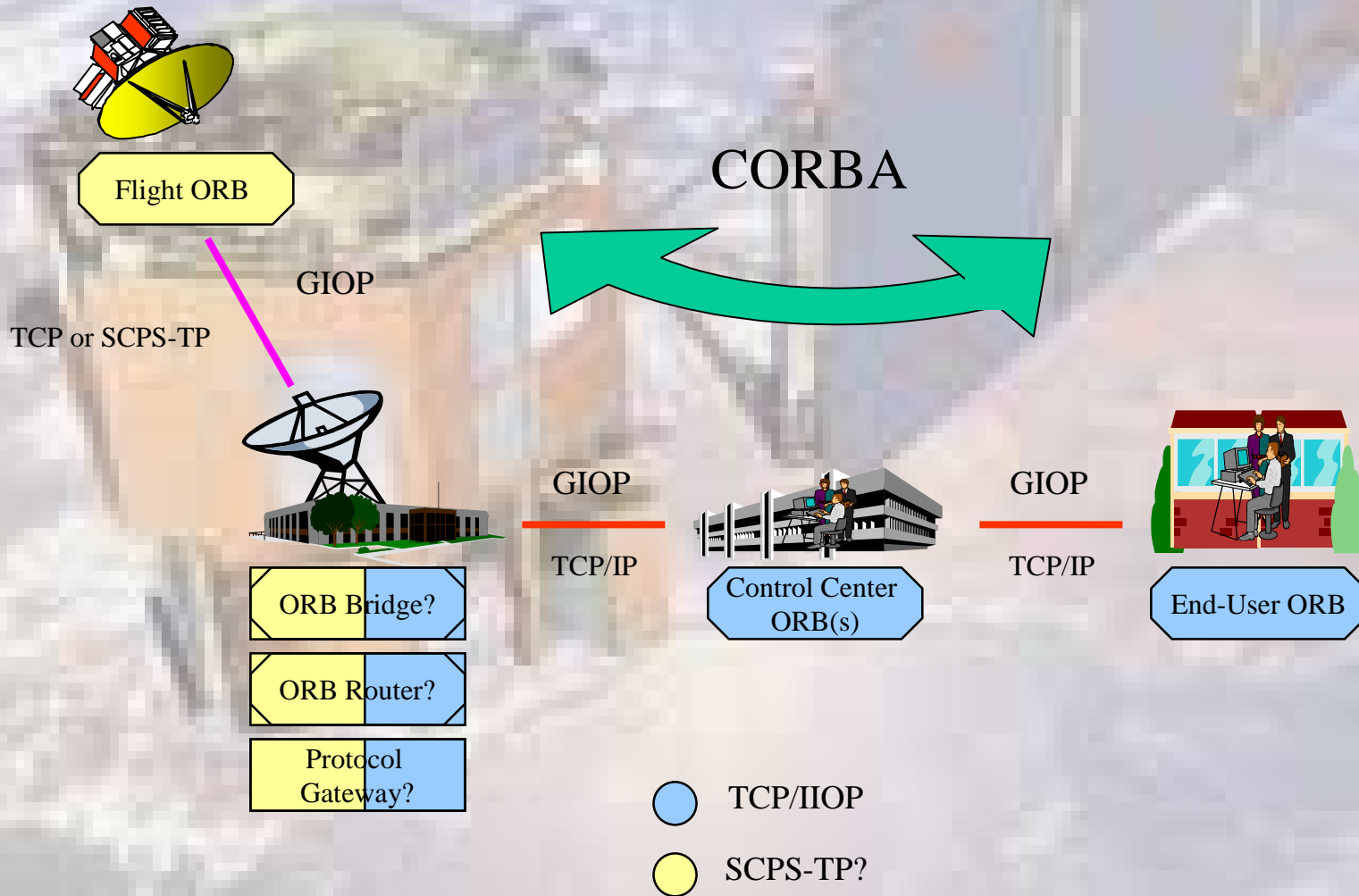
+ PPP



Phase 3: CORBA Ground to Space

- Develop in lab “flat sat” test bed to simulate ground to space CORBA
- Possibly experiment with simulated link delays and alternative protocol suites
 - TCP, SCPS-TP, CCSDS (using ORB level re-transmission of GIOP?)
- Team with Science Systems Ltd on RATE “2”, using UoSAT-12

Phase 3: CORBA Ground to Space Concept



Phase Status

- Phase 1:
 - Complete, but limited testing...
- Phase 2:
 - Currently working w/OAR Inc, to port RTEMS-OS to *u*-controller, RTEMS can be configured to 32-120K with TCP stack (An RSN 160KB, or 1MB will need to be used...)
 - July '01 to start work w/SSL to port micro-ORB
- Phase 3:
 - SSL secured funding with BNSC for UoSat-12 experiments
 - NASA-GSFC seeking funding...

Conclusion

- CORBA not quite ready for space environment, footprint is too large, performance is suspect...
- But functionally, it's just what we need, and could be applied in a variety of ways from ground system design, to flight software, to more esoteric ideas like "CORBA ground to space..."