# SCOPE OF THE EVALUATION

- **TEST THE TOOLSET WITH A SIGNIFICANT APPLICATION ( DATA HANDLING SW)**

- **PORTING THE APPLICATION FROM MIL-STD-3-1750 TECHNOLOGY INTO ERC32 TECHNOLOGY**

- **INVESTIGATE THE ERC32 Ada PROGRAMMING MODEL**

# EXERCISED ITEMS

- **ERC32 Ada Compilation System**
- **ERC32 Linker**
- **ERC32 Target Simulator**
- **HRT Development Model and HRT Tools**

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# EMPLOYED RESOURCES

- **Evaluation period :
from October to December 1997**

- **Partecipation to the "ERC32 Ada Technology Training" course held in ESTEC on October 1997**

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# SAMPLE APPLICATION

- **Data Handling SW** (an early version of XMM CDMU Standard Application SW)

- **language :
Ada and Assembly(2.5%)**

- **code size :
41000 word [16bit]** (33000 words of user code)

- **technology :
MIL-STD-3-1750 TLD (version 96T009) on Sun/Solaris 2.5**

- **Ada Programming Model :
Syngle-Process Cyclic Scheduling**

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# COMPILATION PHASE :
# REMARKS ON THE ACS COMPILER

- **the assembly parts were not converted in ERC32 assembly**

- **use of the Command Line Interface mode because faster than the Graphical User Interface**

- **some TLD warnings about UNCHECKED CONVERSION became compilation errors (the UCs were widely used in the application)**

- **many "type representation clauses" became no longer valid due to passing from 16 bit to 32 bit architecture (awaited)**

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## COMPILATION PHASE :
## REMARKS ON THE ACS COMPILER

- the "pragma PACK" was signalled as compilation error when used for record types

- the "renames" declarations were signalled as compilation error

- a workaround adopted to solve problems of TLD compiler revealed to be not necessary ( "if ..elsif" sequence to replace "case" Ada statement where the case expression was an enumerative type that had an enumeration clause applied to it )

# EXECUTABLE CODE PHASE : REMARKS

- **ABOUT THE TOOLSET**
  - **difficulties in using the Microtec Linker due to ESTEC Firewall access procedure**
  - **very low rate when working on ESTEC host via remote login**

- **ABOUT THE APPLICATION**
  - **size budget for the ERC32 and the MIL-STD-3-1750 TLD technologies**
    - » **code size incremented by 130%**
      - **code (RTS)      8177  -->  36475     [word 16bit]**
      - **code (user)     32377 -->  56816**
      - **constant(RTS)  708  -->   1543**

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# ERC32 Ada PROGRAMMING MODEL

- **guidelines for the new model construction**
  - the procedures which were set running by the Cyclic Scheduler were redefined as "cyclic task"
  - the procedures linked to the interrupt handlers were redefined as "interrupt sporadic task"
  - no element of the application were implemented as "software sporadic task"

- **some errors in the reference documentation**
  - Template for Interrupt Sporadic Task in Toolset User Manual

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## ERC32 Ada PROGRAMMING MODEL : COMPILATION PHASE

- **HRT options for the compiler for the Worst Case Execution Time Estimation (WCETE)**

- **Ada code restrictions requested by WCETE processing**

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# ERC32 Ada PROGRAMMING MODEL : COMPILATION PHASE

- **Restrictions on commonly used Ada statements**
  - assignment to array elements in slice mode
  - assignment to an array in block mode (i.e. not element by element)
  - assignment to a field of a variable of "record with discriminant" type
  - "if" statement  on a field of a variable of "record with discriminant" type
  - assignment to variable of "record" type

# ERC32 PROGRAMMING MODEL : EXECUTABLE CODE PHASE

- **SIZE BUDGET FOR THE TWO MODELS**
  - code size [16bit word] incremented by 32%
    - code (RTS)      36475  -->  62623
    - code (user)     56816  -->  60724
    - constant(RTS)  1543    -->  1540

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# ERC32 PROGRAMMING MODEL : SCHEDULABILITY ANALYSIS

- **ESF file :** **(obtained by the Binder)**

- **UCF file :** **(no-ATAC , priority range from 1 to 63 , clock frequency = 14 Mhz , no wait states)**

- **RTS characteristic file** **(included in the toolset)**

- **RESULTS AND REMARKS**

  - **the thread set was declared not schedulable**

  - **UCF : modification on the deadline data to obtain a schedulable thread set**

  - **SA terminated with **ERROR**:Thread.Response_Time(WCCT) not documented in the user manual**

  - **a bug in the SA tool uncovered !**

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# ERC32 PROGRAMMING MODEL : SCHEDULER SIMULATOR

- **BRIEFLY EXERCISED JUST TO FEEL THE USER INTERFACE**

- note :
  SS did not revealed any missed deadline for the thread set which SA was not able to process.

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# ERC32 ADA SYMBOLIC DEBUGGER

- **Ada Symbolic Debugger implemented by**
  - **AdaProbe**
  - **ERC32 Target Simulator configured as an extension of AdaProbe**

- **Installation problems in configuring the two packages (Aonix and Spacebel) to work properly. (Lack of details in the installation documentation)**

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# ERC32 ADA SYMBOLIC DEBUGGER

- **exercised on the application with no Ada-tasking**

- **exercised the typical debugger functions**
  - **breakpoint management**
  - **control of execution**
  - **manipulation of data objects**
  - **manipulation of memory at low level**
  - **use of command files for the debugging session setup**

- **not exercised**
  - **tasking display**
  - **observation of program execution through watchpoints**
  - **Runtime tracing of scheduling activity**

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# ERC32 ADA SYMBOLIC DEBUGGER : REMARKS

- the "STEP into" command does not work on the assembly code of an Ada statement expansion

- it is not possible to access a variable by directly input its name; it needs to open a file where the variable is referenced;

- there is no way to recall commands

- the following typical simulation
  "from a breakpoint, the user want to restart the application from the beginning of a parameterless subprogram in order to debug it without any care to restarting from the breakpoint"                                                    revealed long, tedious and trickly (setting of PC and NPC registers)

- in LOW.LEVEL TRANSPARENT the answer to low level TS commands were badly placed in the Adaprobe window

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## ERC32 TARGET SIMULATOR : REMARKS

- Very short activity on the standalone mode
  - exercised to verify the allocation in memory of some variable of record type to which representation clause had been applied

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# CONCLUSIONS

- **Toolset elements fairly exercised**

  - **Target Simulator**

  - **Ada Symbolic Debugger**

  - **Ada Program Library System**

  - **Schedulability Analyser**

  - **Scheduler Simulator**

- **Toolset elements not exercised**

  - **Aonix - batch tools (REFORMAT , XREF , MAKE)**

- **Comparision with the TLD technology inspired most of the remarks**

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# RECOMMENDATIONS

- Improve the user documentation

- Make available the Kernel and Runtime sources

- Improve the Ada Symbolic debugger user interface

- Improve WCETE functionality with respect to the Ada restrictions

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