

SpaceWire Intelligent Camera

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University of Dundee

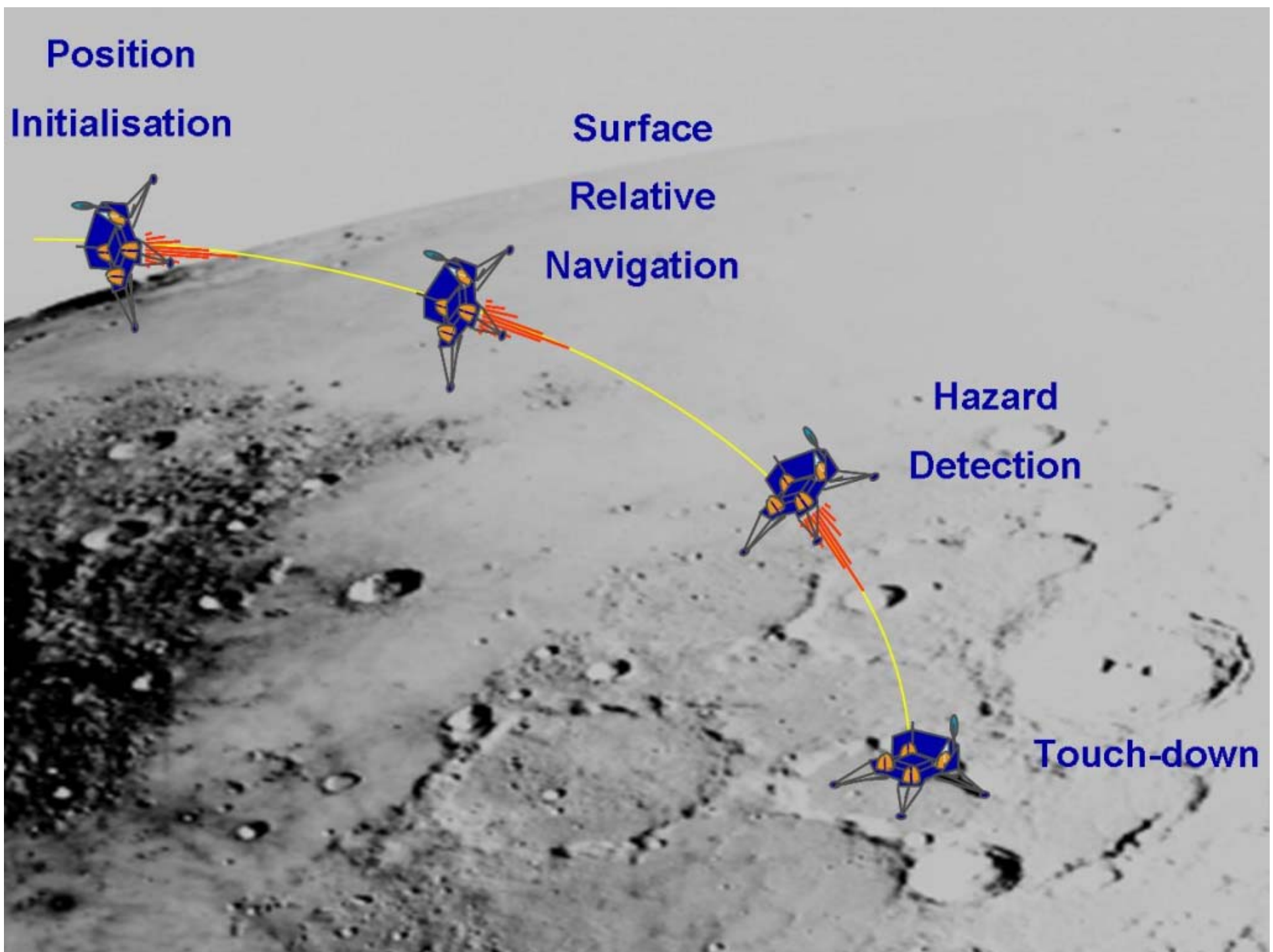
Position

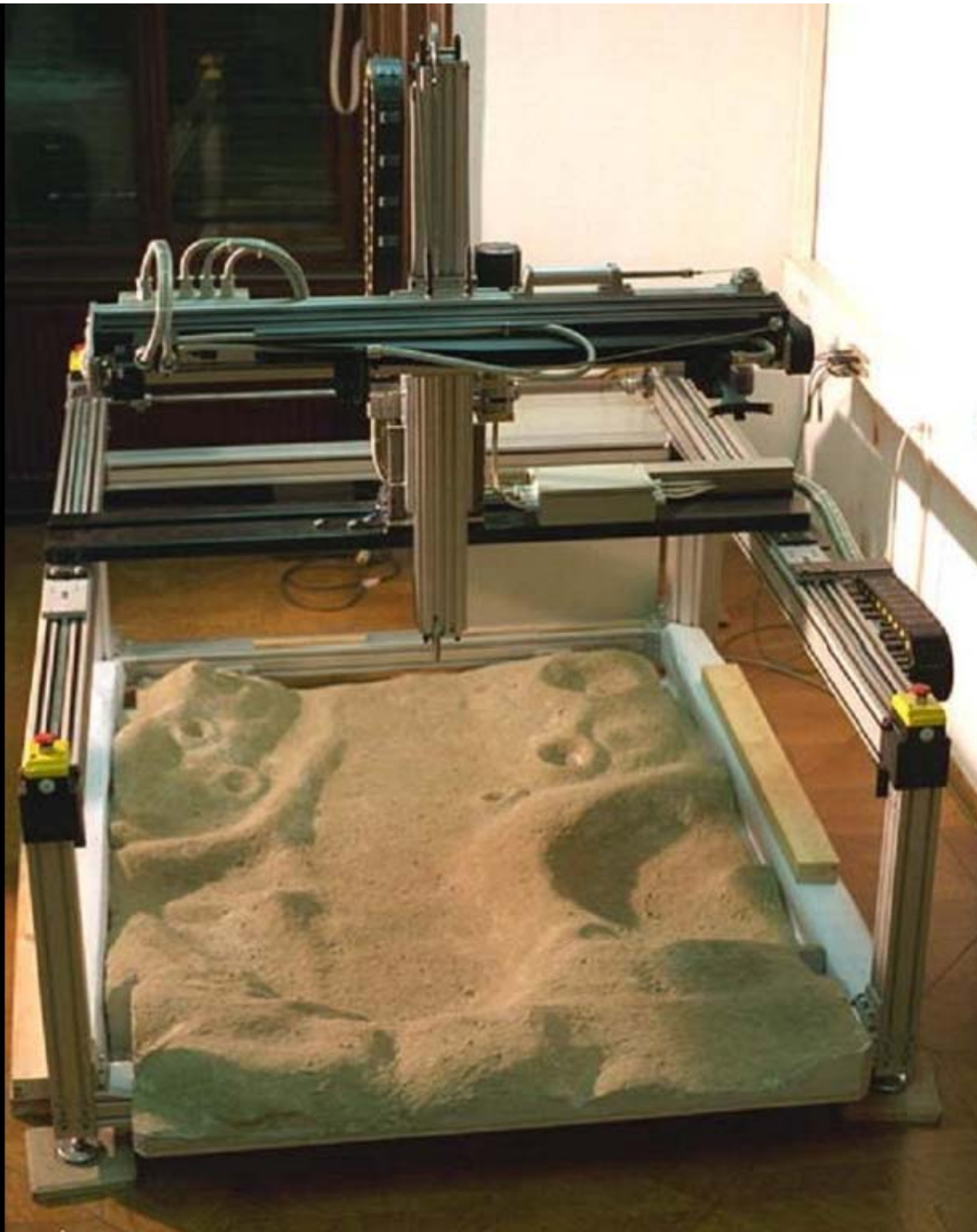
Initialisation

**Surface
Relative
Navigation**

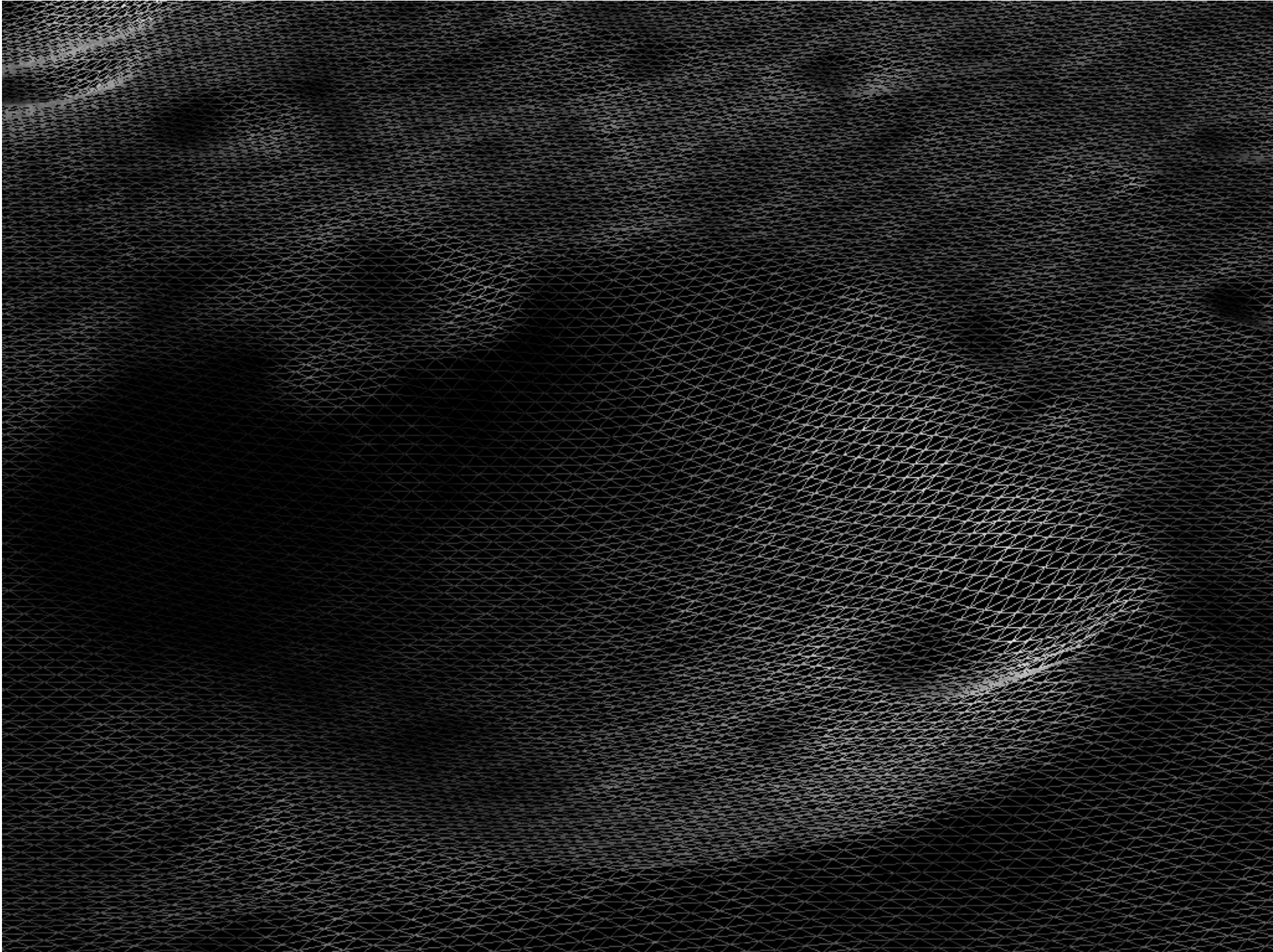
**Hazard
Detection**

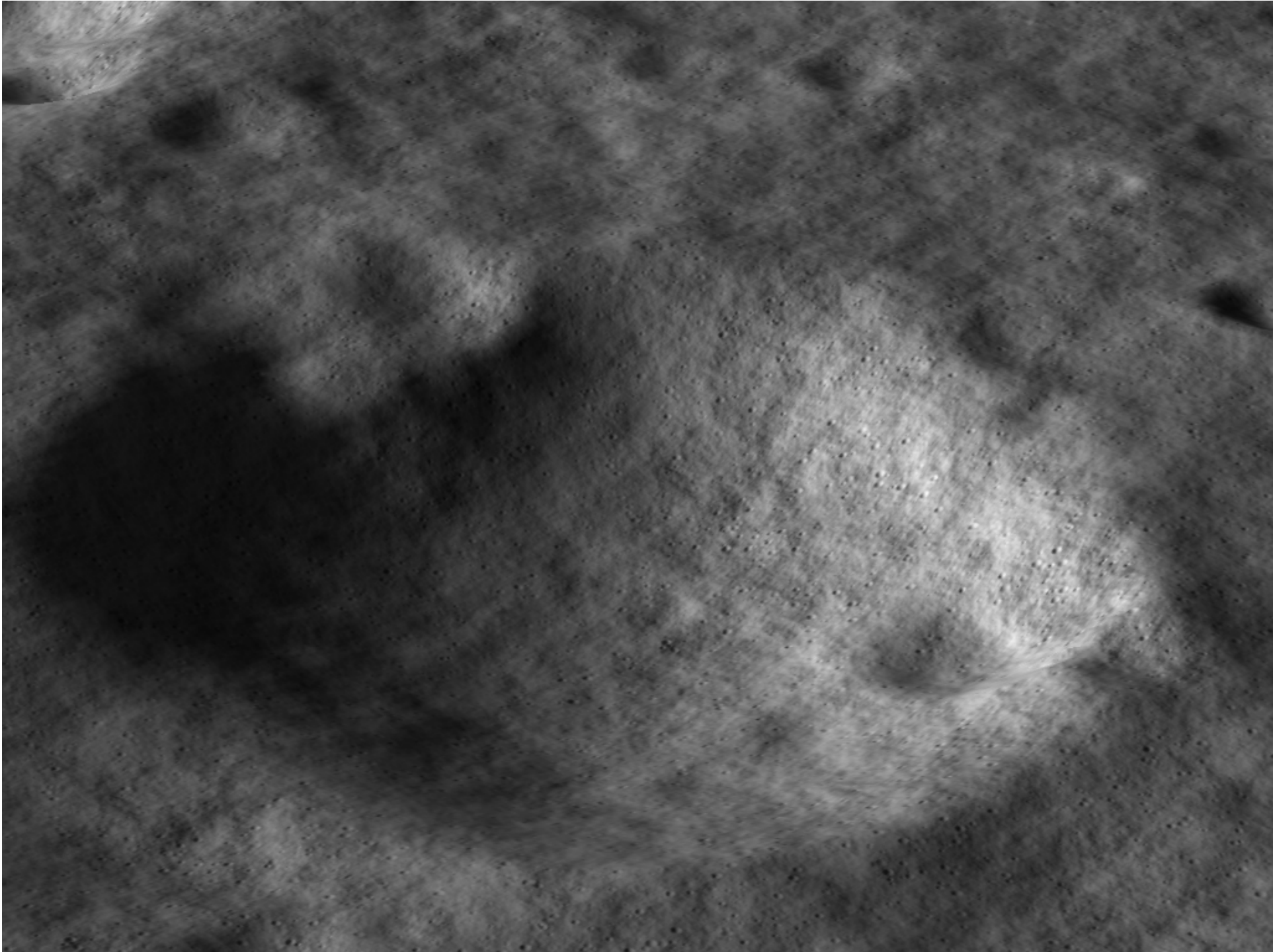
Touch-down

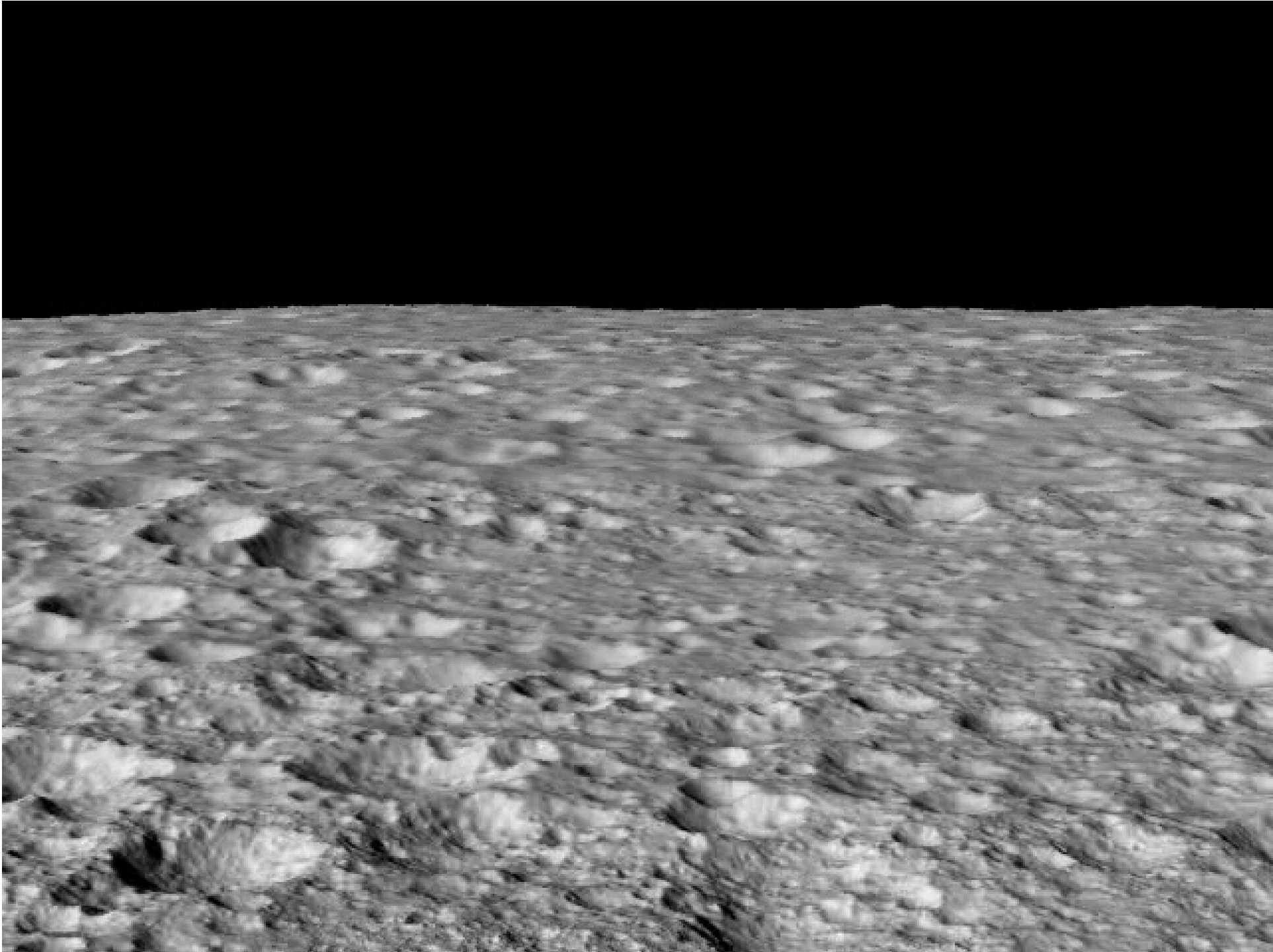














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Image Processing Chip

- Images from camera chip
 - Via ping-pong memory
- Detect features on surface
 - 100 features extracted each frame
 - Harris operator
 - Ensure points spread across image
- Track features from one frame to next
 - 100 features tracked each frame
 - Correlation based tracking
 - Search window predicted by GNC
- Manage list of tracked features
 - Tracked points
 - Failed to track points
- Send tracked points to GNC computer



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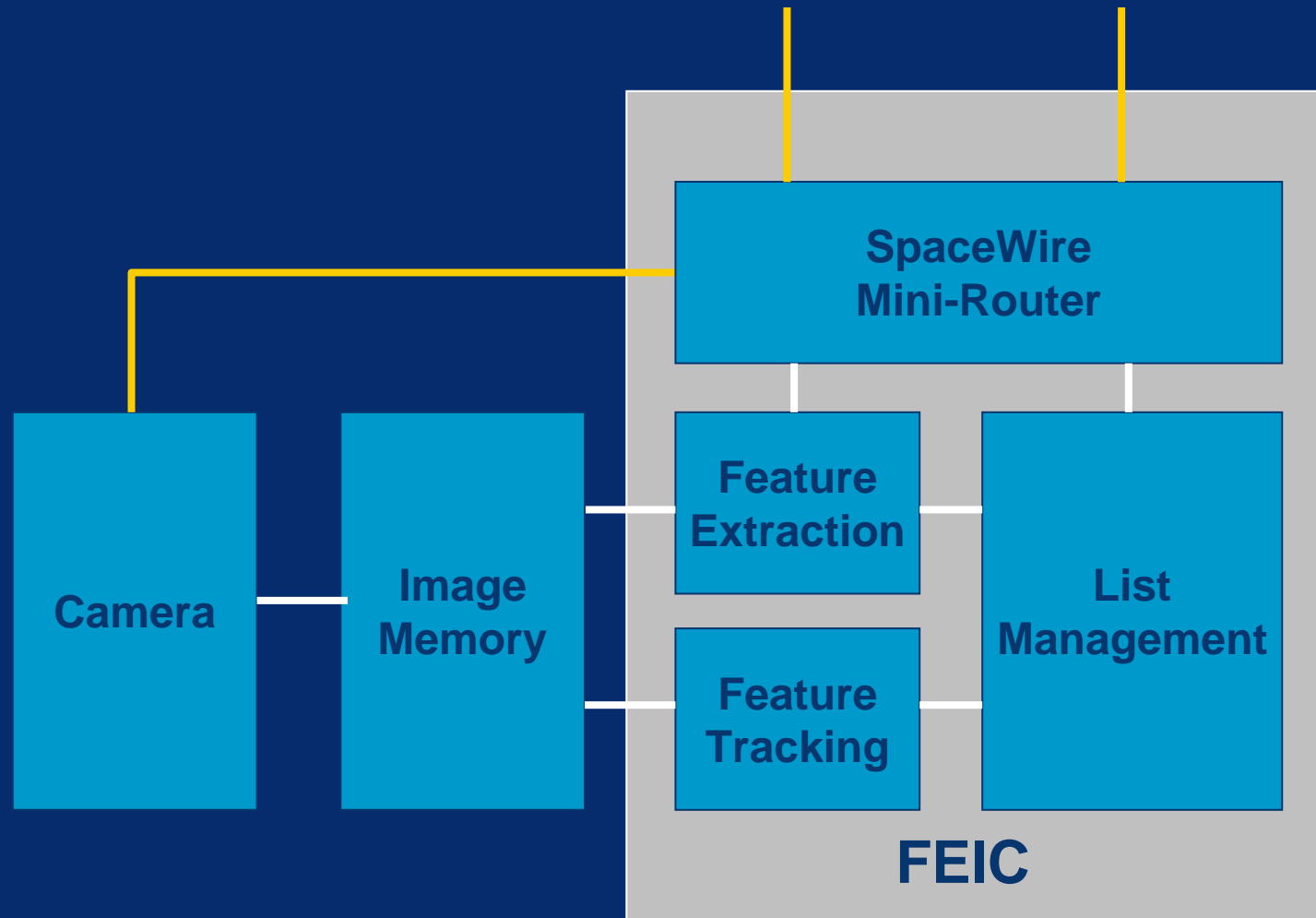
Image Processing Chip

- Interface to GNC computer
 - Originally PCI
 - Dual redundant interface required
 - Large pin count
 - Short distance
- SpaceWire a solution
 - SpaceWire mini-router
 - Two SpaceWire links to GNC computer
 - One SpaceWire link to Camera for control
 - Parallel ports into image processing chip



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Image Processing Chip



WARNING !
Do not connect external power
if board is in PCI Slot

PMCMB-SRAM
EADS ASTRIUM
CI 208038E-00

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The main area of the PCB is densely packed with components. Key components include:

- Two Intel 48LC1608 SRAM chips (U26, U27) with part numbers 031A90 and 0210551A.
- Two Texas Instruments DSP chips (U47, U48) with part number 2002.
- Various resistors (R1 through R199) and capacitors (C1 through C50).
- Microprocessors (U30, U31) with part number 0326.
- Other integrated circuits (U40, U41, U42, U43, U44, U45, U46).

Labels for components are scattered across the board, often with values like 10k, 100k, 1k, 100n, 100p, etc. There are also labels for test points (TP1-TP5) and jumpers (J1, J2, J3, J4).

A PCI connector is located on the left side of the board, with a metal shield. Labels for pins and components are visible near the connector, including R165, C43, C44, C45, C46, C47, C48, C49, C50, R164, R163, R162, R161, R160, R159, R158, R157, R156, R155, R154, R153, R152, R151, R150, R149, R148, R147, R146, R145, R144, R143, R142, R141, R140, R139, R138, R137, R136, R135, R134, R133, R132, R131, R130, R129, R128, R127, R126, R125, R124, R123, R122, R121, R120, R119, R118, R117, R116, R115, R114, R113, R112, R111, R110, R109, R108, R107, R106, R105, R104, R103, R102, R101, R100, R99, R98, R97, R96, R95, R94, R93, R92, R91, R90, R89, R88, R87, R86, R85, R84, R83, R82, R81, R80, R79, R78, R77, R76, R75, R74, R73, R72, R71, R70, R69, R68, R67, R66, R65, R64, R63, R62, R61, R60, R59, R58, R57, R56, R55, R54, R53, R52, R51, R50, R49, R48, R47, R46, R45, R44, R43, R42, R41, R40, R39, R38, R37, R36, R35, R34, R33, R32, R31, R30, R29, R28, R27, R26, R25, R24, R23, R22, R21, R20, R19, R18, R17, R16, R15, R14, R13, R12, R11, R10, R9, R8, R7, R6, R5, R4, R3, R2, R1, R0.

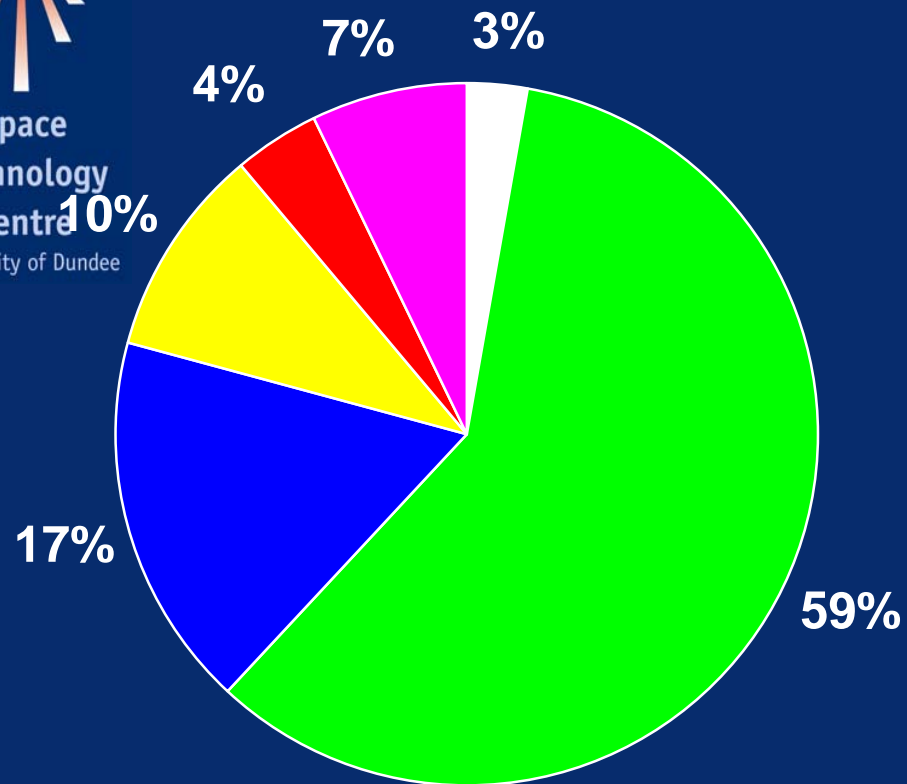
CC8 must not be soldered if board is in PCI Slot

01140E0101-0045
TRANSTECH
COPYRIGHT
STECH DSP 2002
U47 GPC 0326
U48

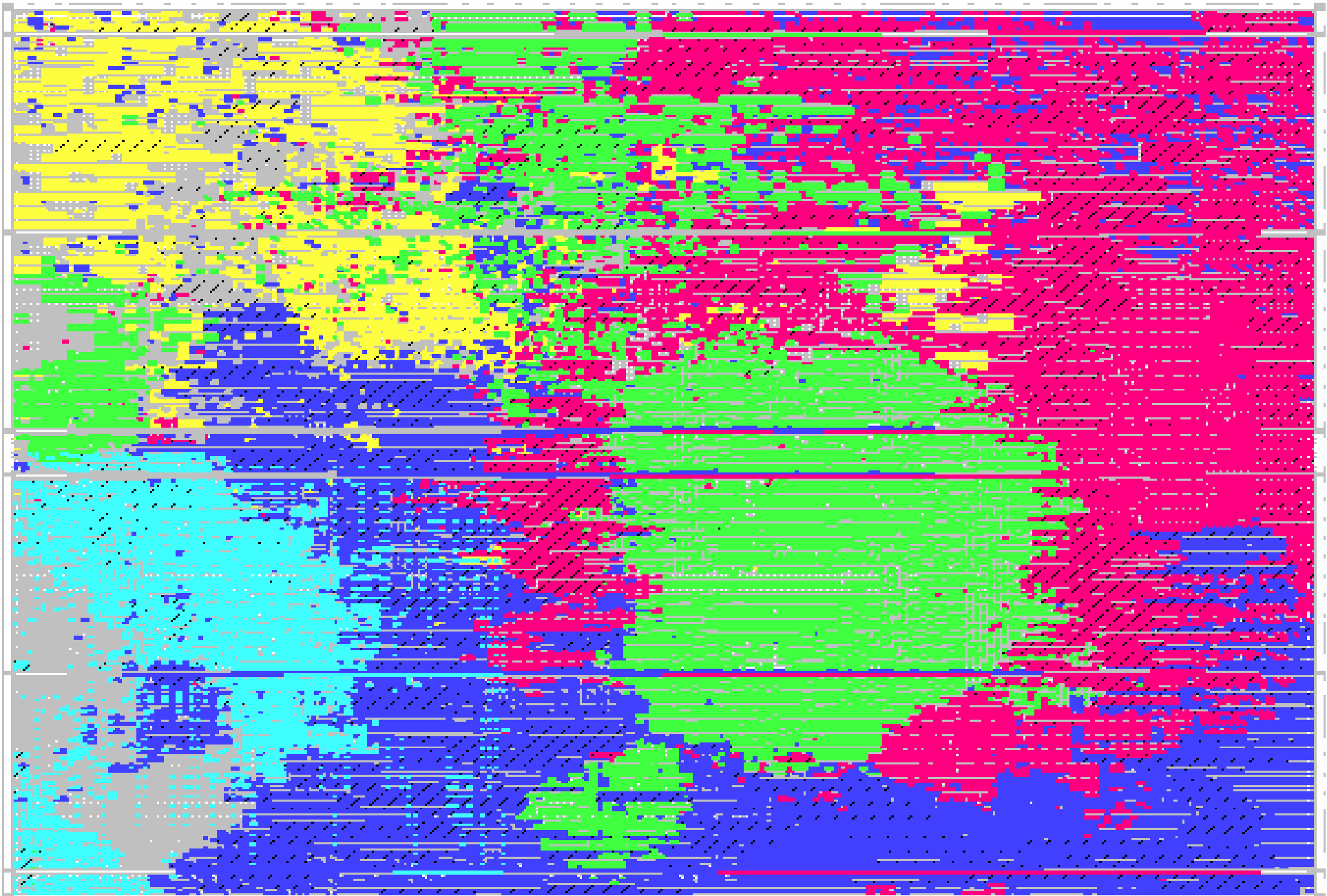
Xilinx V6000 Usage



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- MemoryInterface
- ImageProcessing
- ListManager
- SpaceWire
- Registers
- TextureStore



Extractor



Tracker



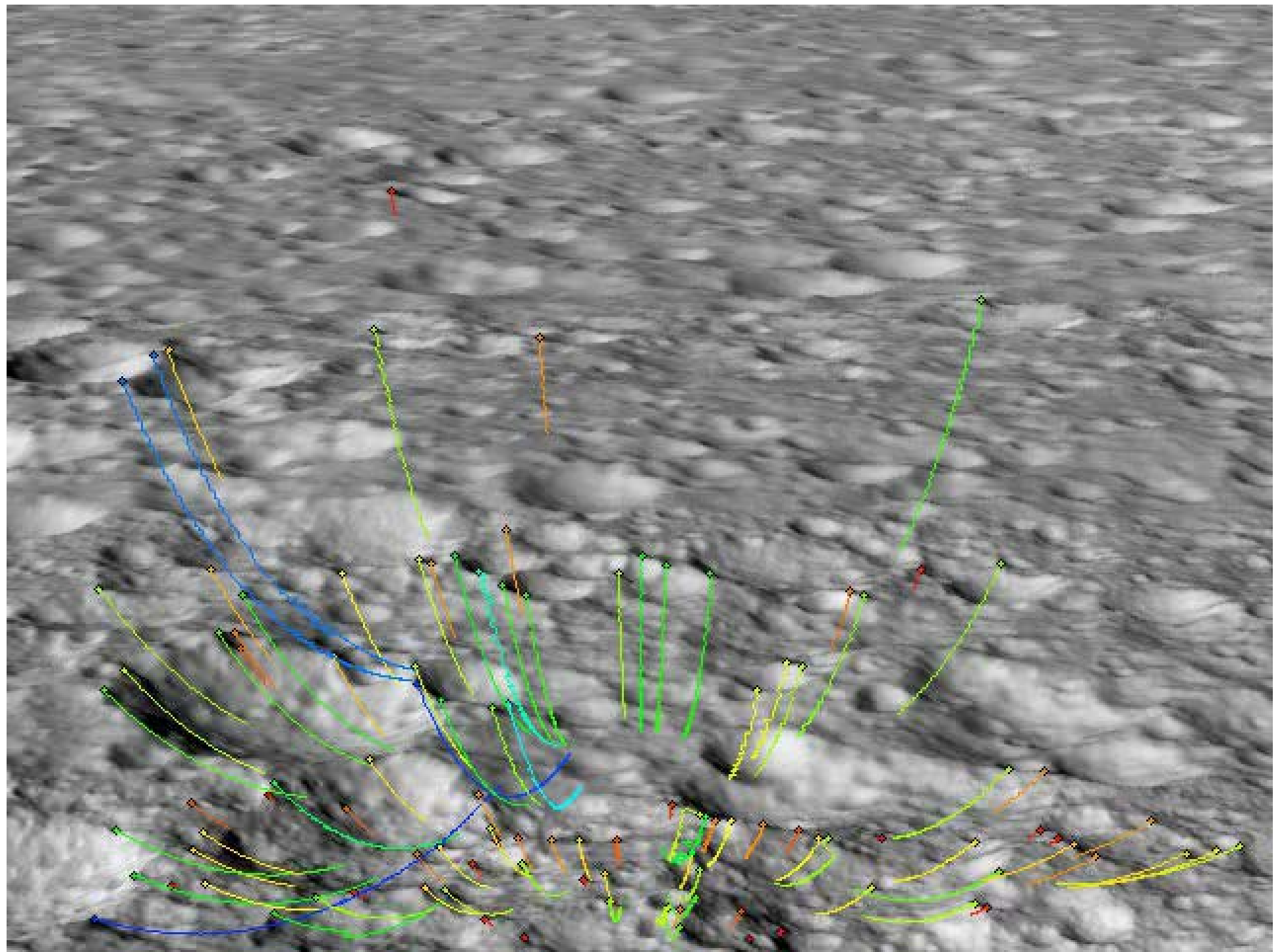
List Manager

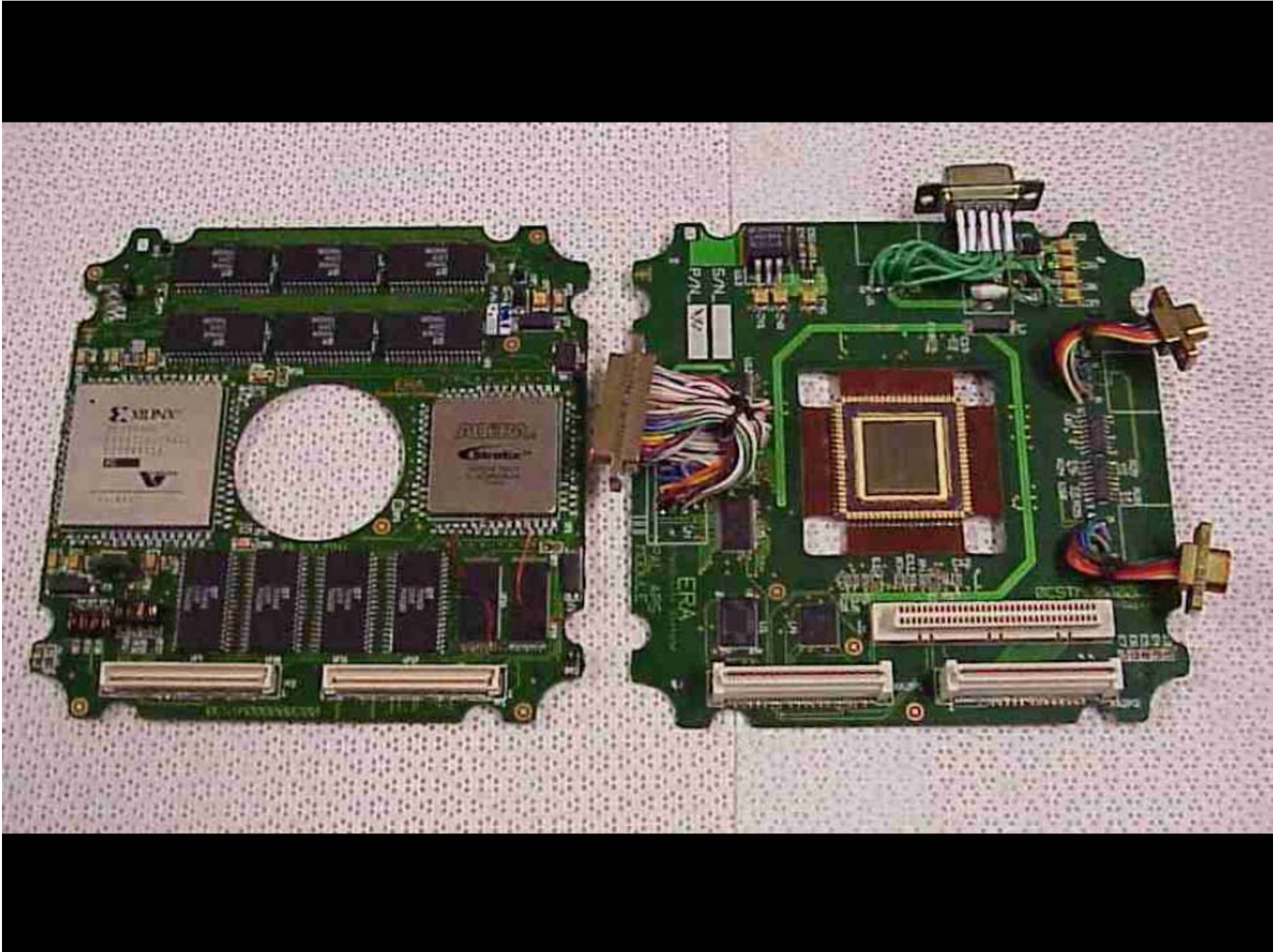


Router



Registers











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SpaceWire Intelligent Camera

- Use of SpaceWire
 - Reduced pin count
 - Reduced power consumption
 - Enabled remote GNC
 - Loosely coupled, highly cohesive
 - Readily available SpaceWire test and development equipment
 - Proven SpaceWire Router IP
- Overall camera project
 - Very successful
 - Testing using helicopter planned
 - High state of technology readiness
 - Hope to see it fly to Mars
 - An enabling technology for future targeted landings

