HI-TECH IN ACCIDENT INVESTIGATION
BEYOND CONVENTIONAL APPROACH

INTERSTATE AVIATION COMMITTEE

MENASASI SEMINAR-2023

Alexander Dyachenko

THE INTERSTATE AVIATION COMMITTEE

- WAS ESTABLISHED IN **1991**
- IAC HEADQUARTERS IS IN **MOSCOW**
- **SINGLE** MODEL
- RESPONSIBLE FOR **ACCIDENT** INVESTIGATIONS AS RAIO
- AREA OF RESPONSIBILITY – **MOST OF POST-SOVIET STATES**

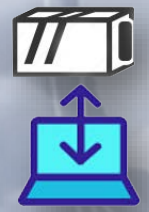
FLIGHT DATA SOURCES

CRASH SURVIVAL FLIGHT RECORDERS

MEANS TO RECOVER THE FLIGHT DATA

MEANS FOR FLIGHT DATA PROCESSING

Certified aviation equipment



Certified means to recover the flight data – AIK

Flight data processing software capable to decode the records

FLIGHT DATA SOURCES

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- MEANS TO RECOVER THE FLIGHT DATA
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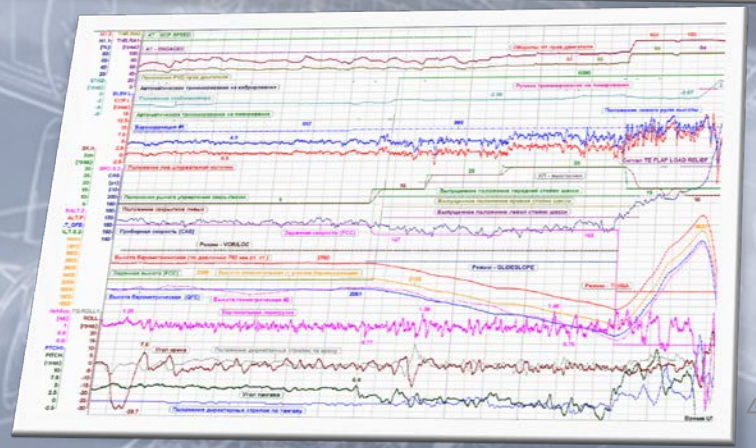

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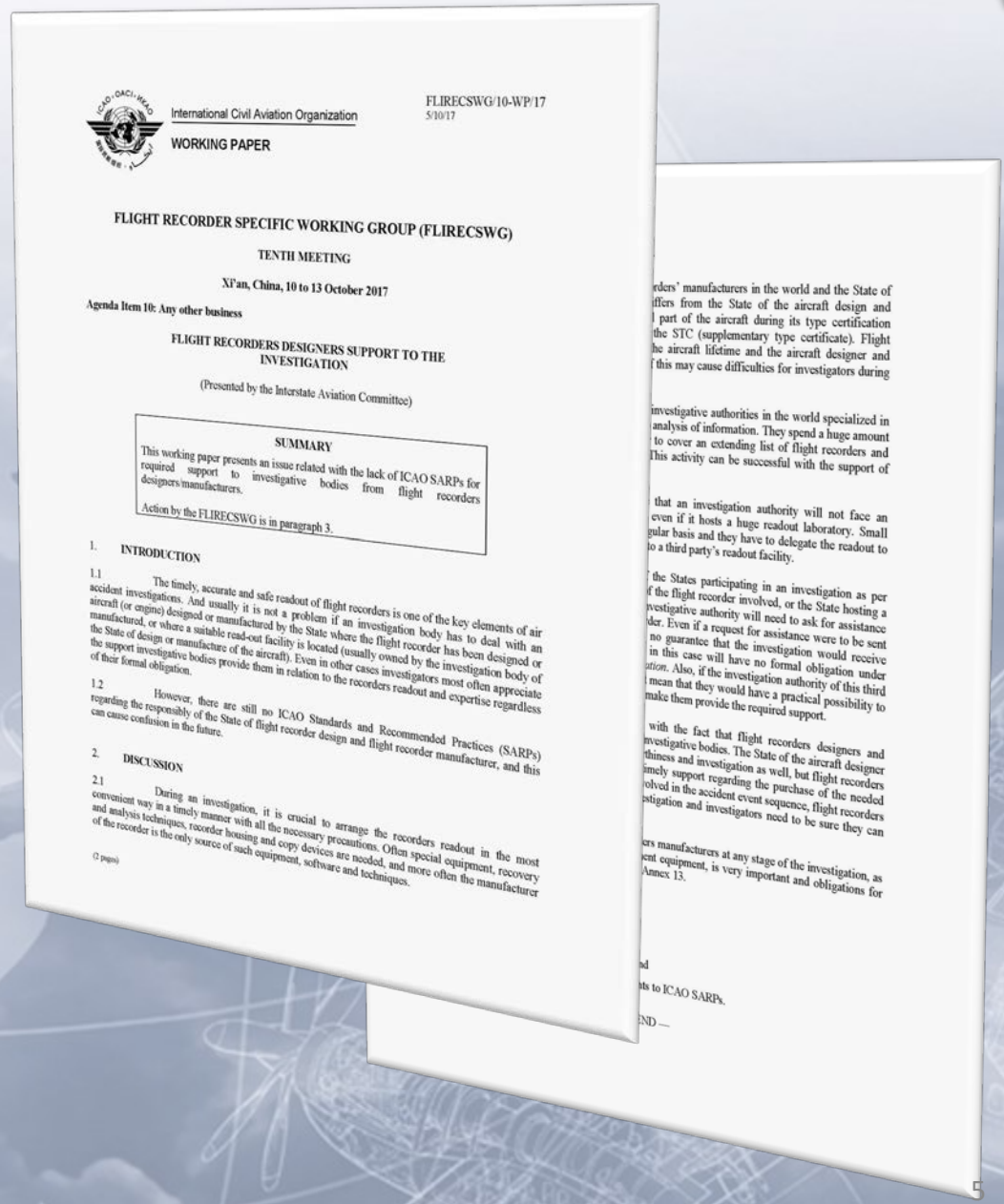

International Civil Aviation Organization

WORKING PAPER

FLIRECSWG/10-WP/17
5/10/17

FLIGHT RECORDER SPECIFIC WORKING GROUP (FLIRECSWG)

TENTH MEETING

Xi'an, China, 10 to 13 October 2017

Agenda Item 10: Any other business

FLIGHT RECORDERS DESIGNERS SUPPORT TO THE INVESTIGATION

(Presented by the Interstate Aviation Committee)

SUMMARY

This working paper presents an issue related with the lack of ICAO SARPs for required support to investigative bodies from flight recorders designers/manufacturers.

Action by the FLIRECSWG is in paragraph 3.

1. INTRODUCTION

1.1 The timely, accurate and safe readout of flight recorders is one of the key elements of air accident investigations. And usually it is not a problem if an investigation body has to deal with an aircraft (or engine) designed or manufactured by the State where the flight recorder has been designed or manufactured, or where a suitable read-out facility is located (usually owned by the investigation body of the State of design or manufacture of the aircraft). Even in other cases investigators most often appreciate the support investigative bodies provide them in relation to the recorders readout and expertise regardless of their formal obligation.

1.2 However, there are still no ICAO Standards and Recommended Practices (SARPs) regarding the responsibly of the State of flight recorder design and flight recorder manufacturer, and this can cause confusion in the future.

2. DISCUSSION

2.1 During an investigation, it is crucial to arrange the recorders readout in the most convenient way in a timely manner with all the necessary precautions. Often special equipment, recovery and analysis techniques, recorder housing and copy devices are needed, and more often the manufacturer of the recorder is the only source of such equipment, software and techniques.

(2 pages)

INVESTIGATION

(Presented by the Interstate Aviation Committee)

SUMMARY

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readout facility with the capability list desired, the investigative authority will need to ask for assistance from the designer or manufacturer of the flight recorder. Even if a request for assistance were to be sent via an investigative body of a third State, there is no guarantee that the investigation would receive adequate expected support because this third State in this case will have no formal obligation under Annex 13 — *Aircraft Accident and Incident Investigation*. Also, if the investigation authority of this third State would like to cooperate and to help, it does not mean that they would have a practical possibility to influence the manufacturer of the flight recorder and make them provide the required support.

2.6 The second problem is connected with the fact that flight recorders designers and manufacturers have no formal obligation to support investigative bodies. The State of the aircraft designer or manufacturer has obligations regarding the airworthiness and investigation as well, but flight recorders are not covered. It could be a problem to receive timely support regarding the purchase of the needed special hardware and software. Though not being involved in the accident event sequence, flight recorders nevertheless are one of the crucial parts of the investigation and investigators need to be sure they can benefit from their use.

2.7 Thus, support from the flight recorders manufacturers at any stage of the investigation, as well as while fitting the readout facility with pertinent equipment, is very important and obligations for such support should normally be an intrinsic part of Annex 13.

3. ACTION BY THE FLIRECSWG

3.1 The FLIRECSWG/10 is invited to:

a) note the content of the paper; and

b) consider appropriate amendments to ICAO SARPs.

— END —

FLIGHT DATA SOURCES

CRASH SURVIVAL FLIGHT RECORDERS

MEANS TO DOWNLOAD THE FLIGHT DATA

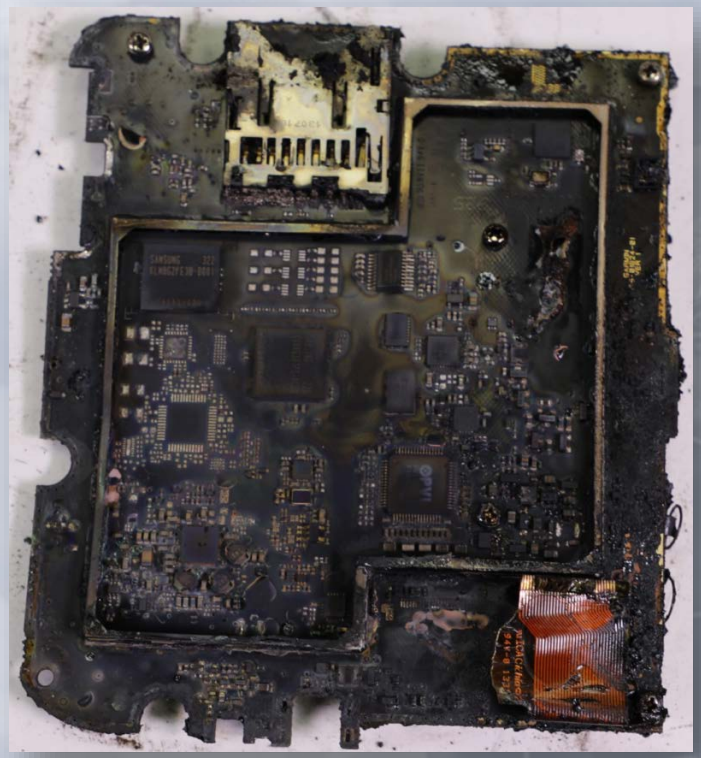
MEANS FOR FLIGHT DATA PROCESSING

NON-STANDARD SOURCES OF FLIGHT DATA

UNAVAILABLE MEANS TO RECOVER THE DATA

UNAVAILABLE MEANS FOR FLIGHT DATA PROCESSING

FLIGHT DATA SOURCES



NON-STANDARD SOURCES OF FLIGHT DATA

UNAVAILABLE MEANS TO RECOVER THE DATA

UNAVAILABLE MEANS FOR FLIGHT DATA PROCESSING

- ABSENCE OF STANDARD ON-BOARD FLIGHT DATA RECORDERS
- PRESENCE OF VARIOUS UNPROTECTED DAMAGED ELECTRONIC DEVICES ON SITE
- URGENT NEED TO DEVELOP APPROPRIATE **DATA RECOVERY TECHNOLOGY**

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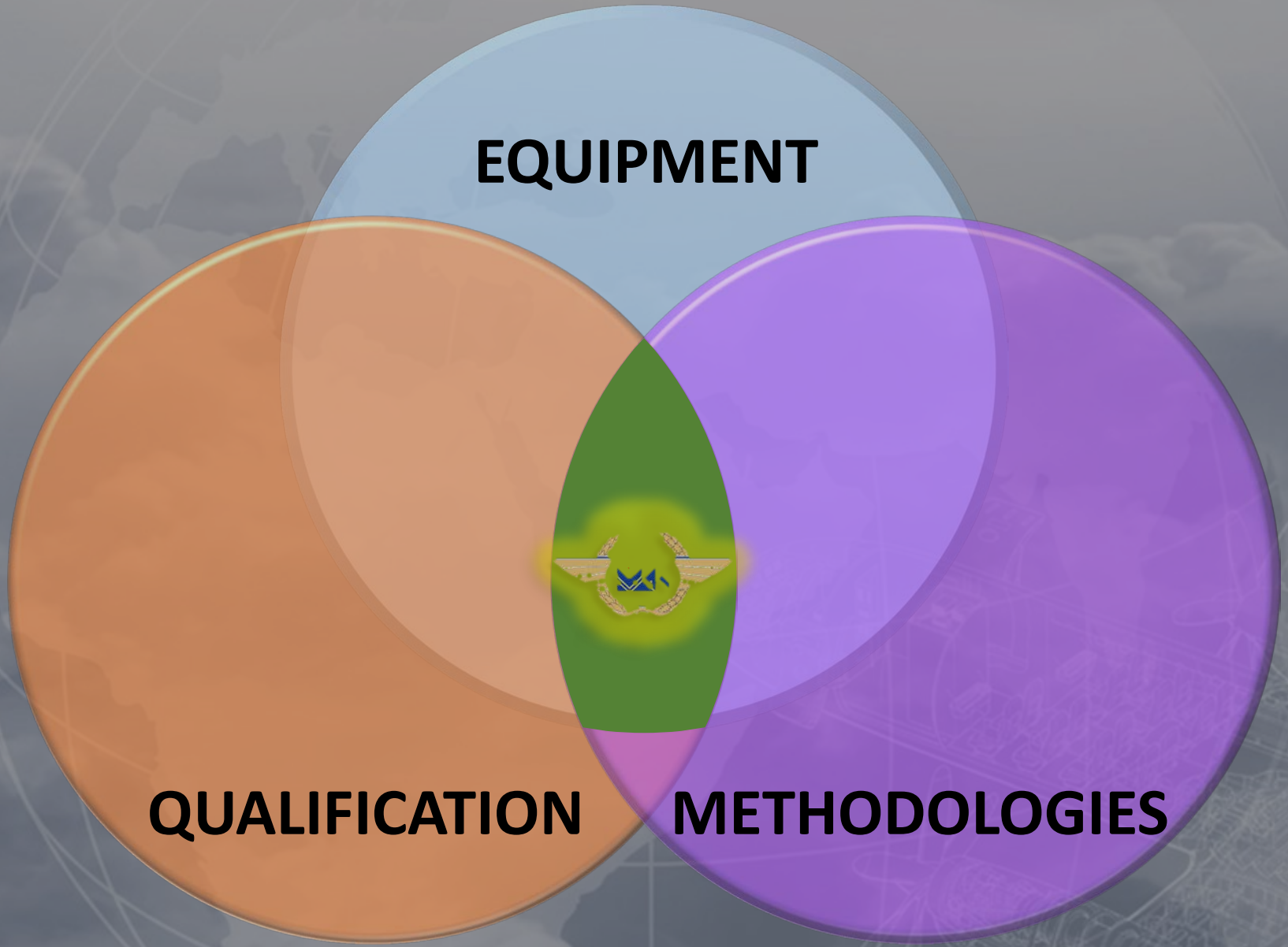
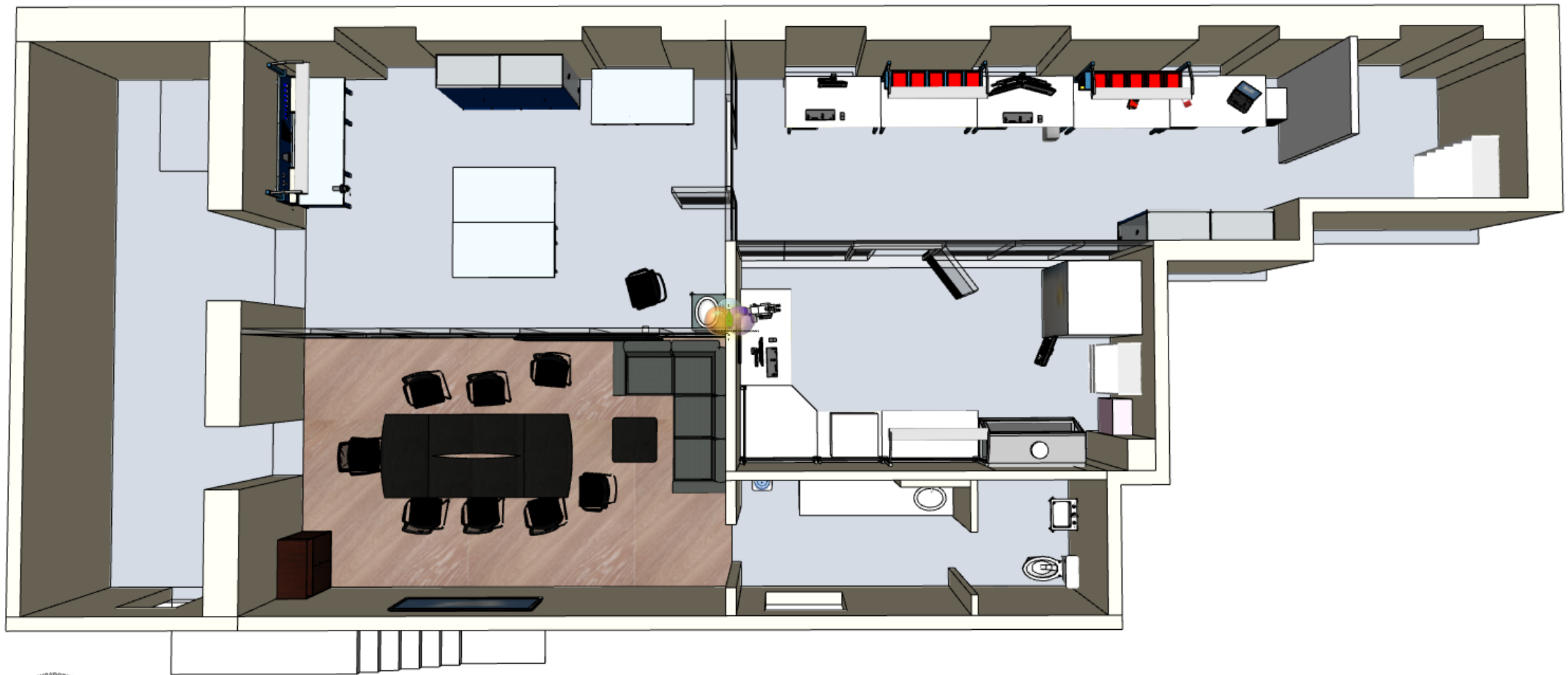
?


EQUIPMENT
QUALIFICATION
METHODOLOGIES

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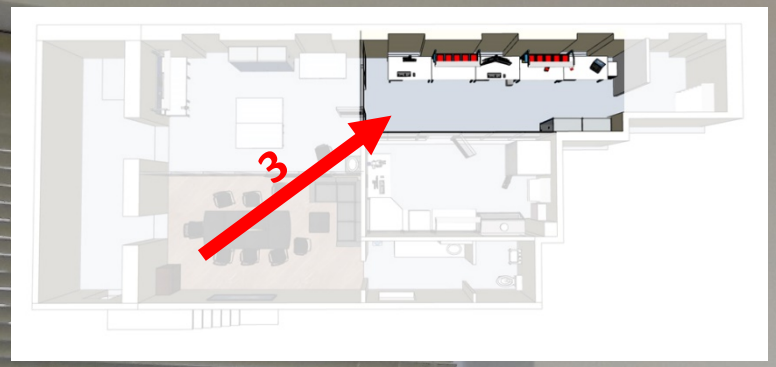
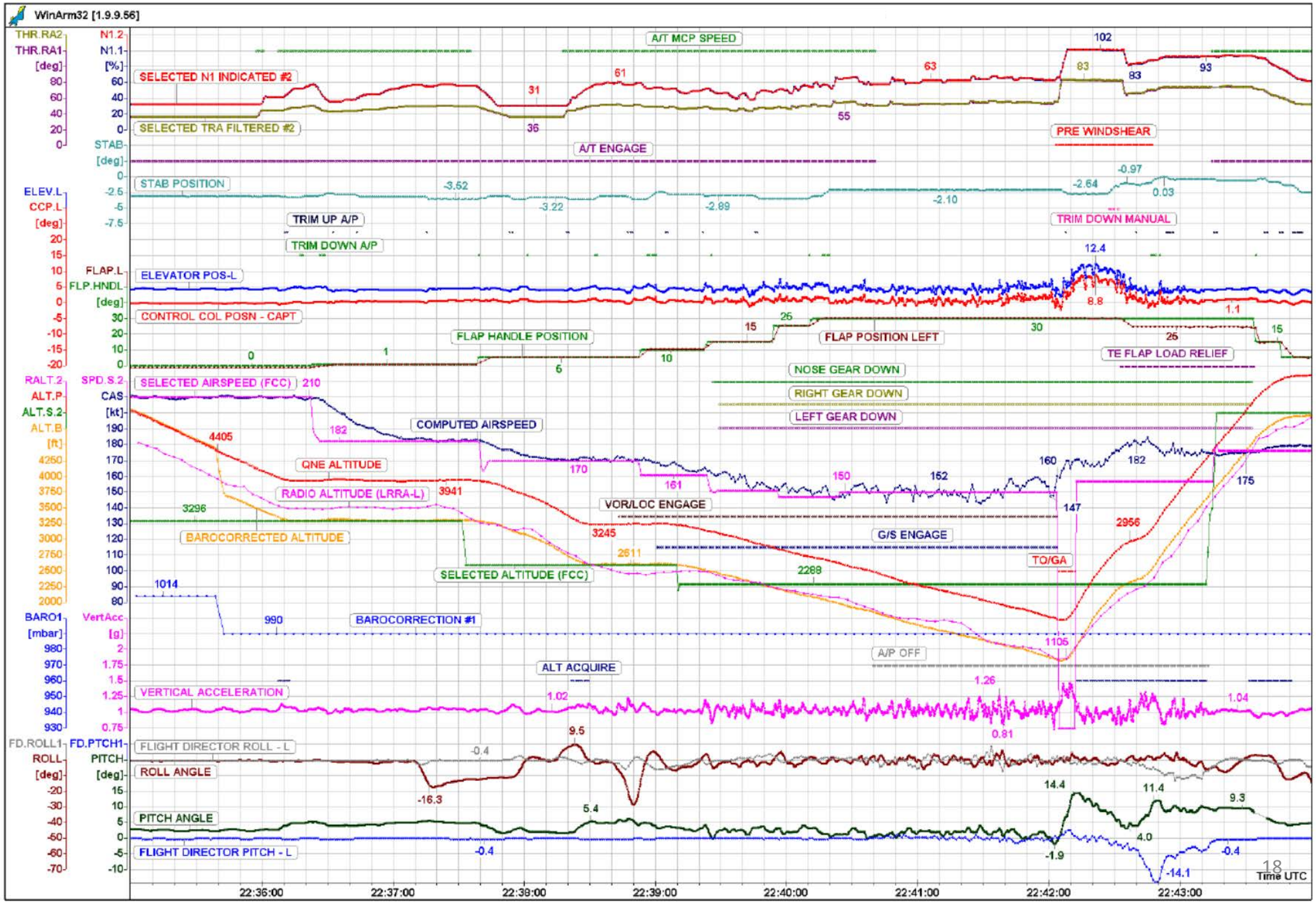
2



LABORATORY IS EQUIPPED WITH A WIDE RANGE OF
READOUT EQUIPMENT FOR UNDAMAGED AND DAMAGED **FLIGHT RECORDERS**

- ***L3 Communication***
- ***Honeywell***
- ***GE***
- ***Penny & Giles (Curtiss-Wright)***
- ***and many others***

IAC LAB FACILITIES ARE CONSTANTLY UPDATING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CCP.L
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FLP.HNDL
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CONTROL COL POSN - CAPT
FLAP HANDLE POSITION
FLAP POSITION LEFT
TE FLAP LOAD RELIEF
NOSE GEAR DOWN
RIGHT GEAR DOWN
LEFT GEAR DOWN
RALT.2
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BAROCORRECTED ALTITUDE
SELECTED ALTITUDE (FCC)
BARO1
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BAROCORRECTION #1
A/P OFF
ALT ACQUIRE
VERTICAL ACCELERATION
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ROLL
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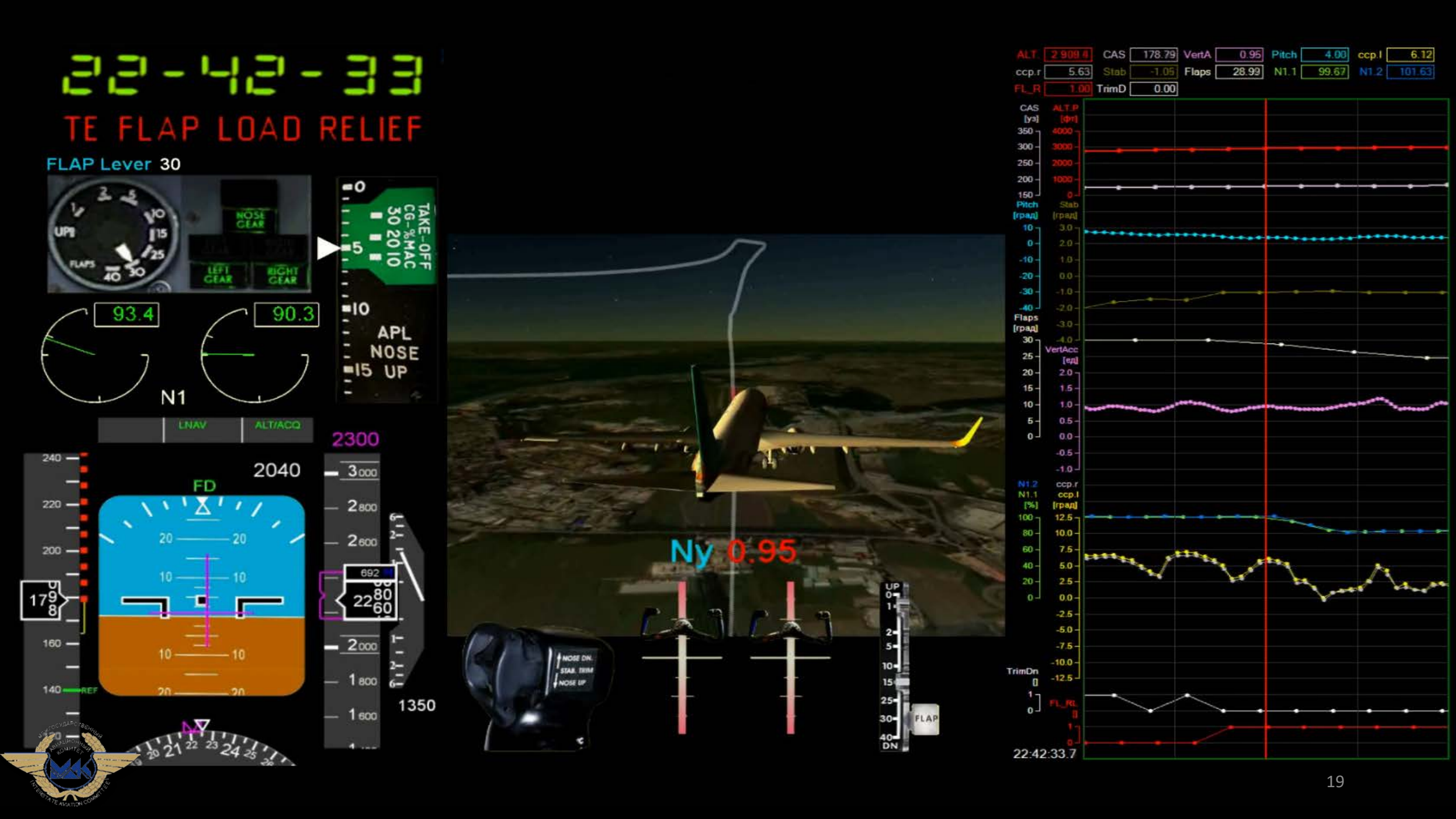
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TE FLAP LOAD RELIEF
FLAP Lever 30
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LEFT GEAR
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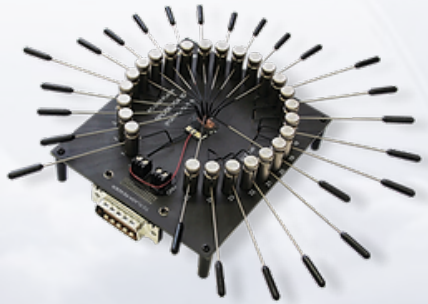
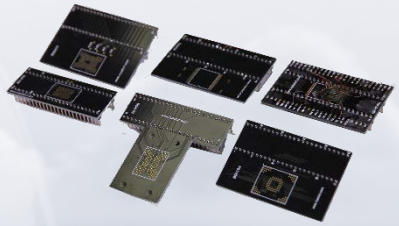
TAKE-OFF CG-%MAC 30 20 10
APL NOSE UP
93.4
90.3
N1
LNAV
ALT/ACQ
2300
2040
FD
1350
Ny 0.95
NOSE DN. STAB. TRIM NOSE UP
FLAP
ALT 2 909.8
CAS 178.79
VertA 0.95
Pitch 4.00
ccp.l 6.12
ccp.r 5.63
Stab -1.05
Flaps 28.99
N1.1 99.67
N1.2 101.63
FL_R 1.00
TrimD 0.00
22:42:33.7


YXLON
Y.Cougar SMT
CT
4

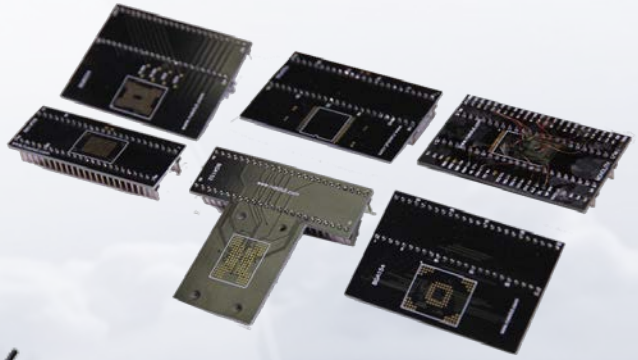

4

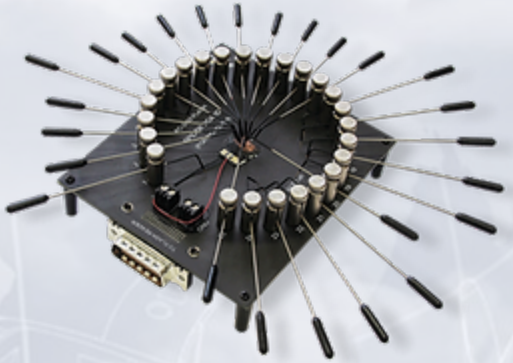
LABORATORY EQUIPMENT





LABORATORY EQUIPMENT



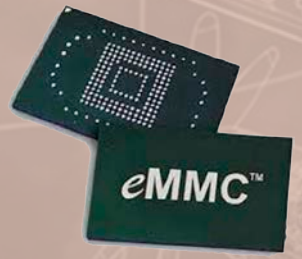


TYPICAL DATA RECOVERY CASES WITHIN THE AIR ACCIDENT INVESTIGATIONS

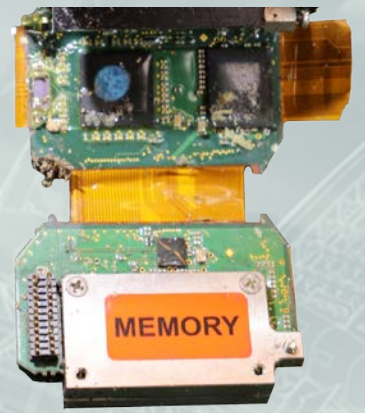
ACTION CAMERAS

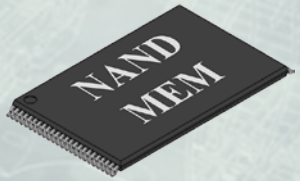
AVIONICS

GPS NAVIGATORS

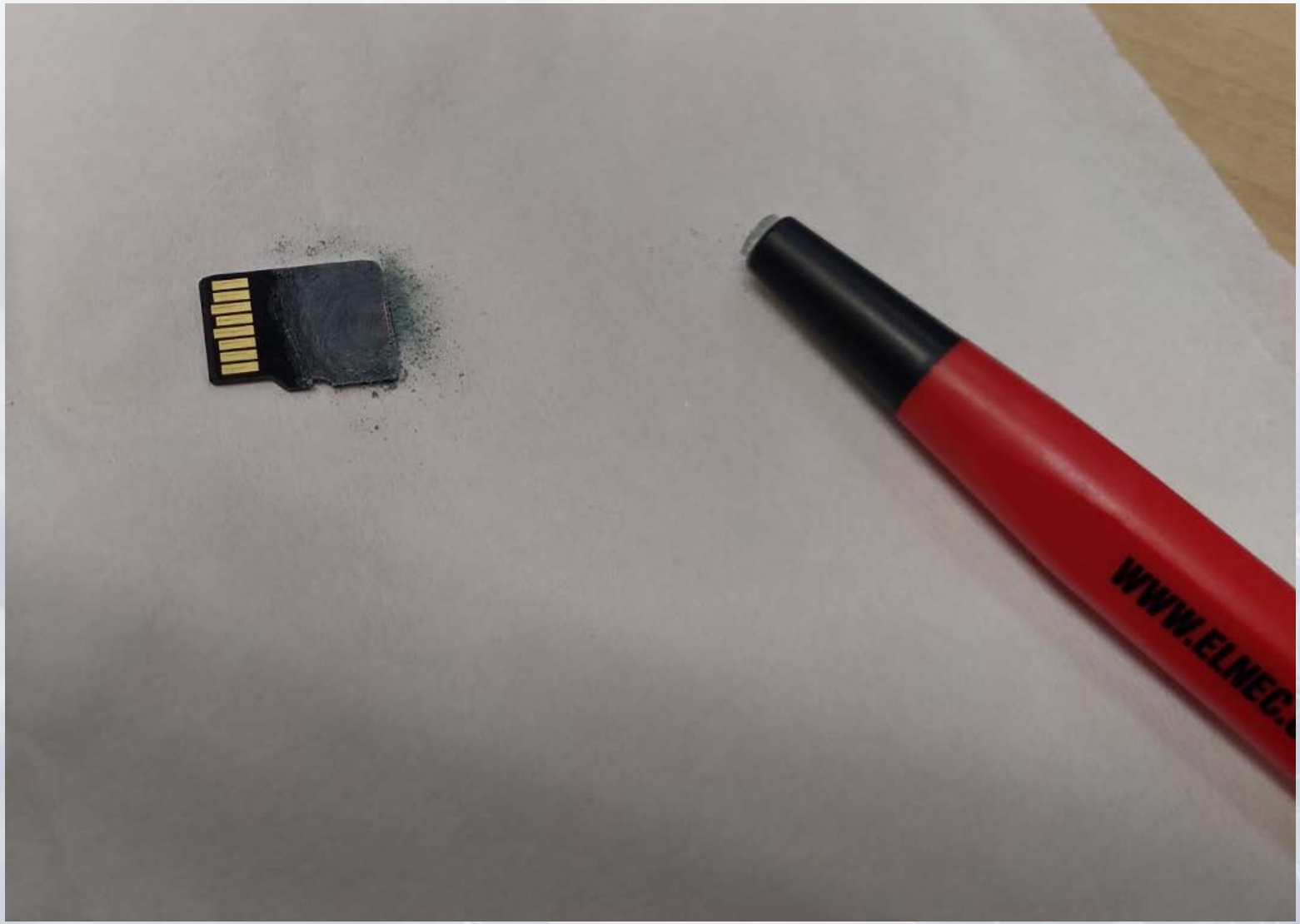


OPTIONAL EQUIPMENT

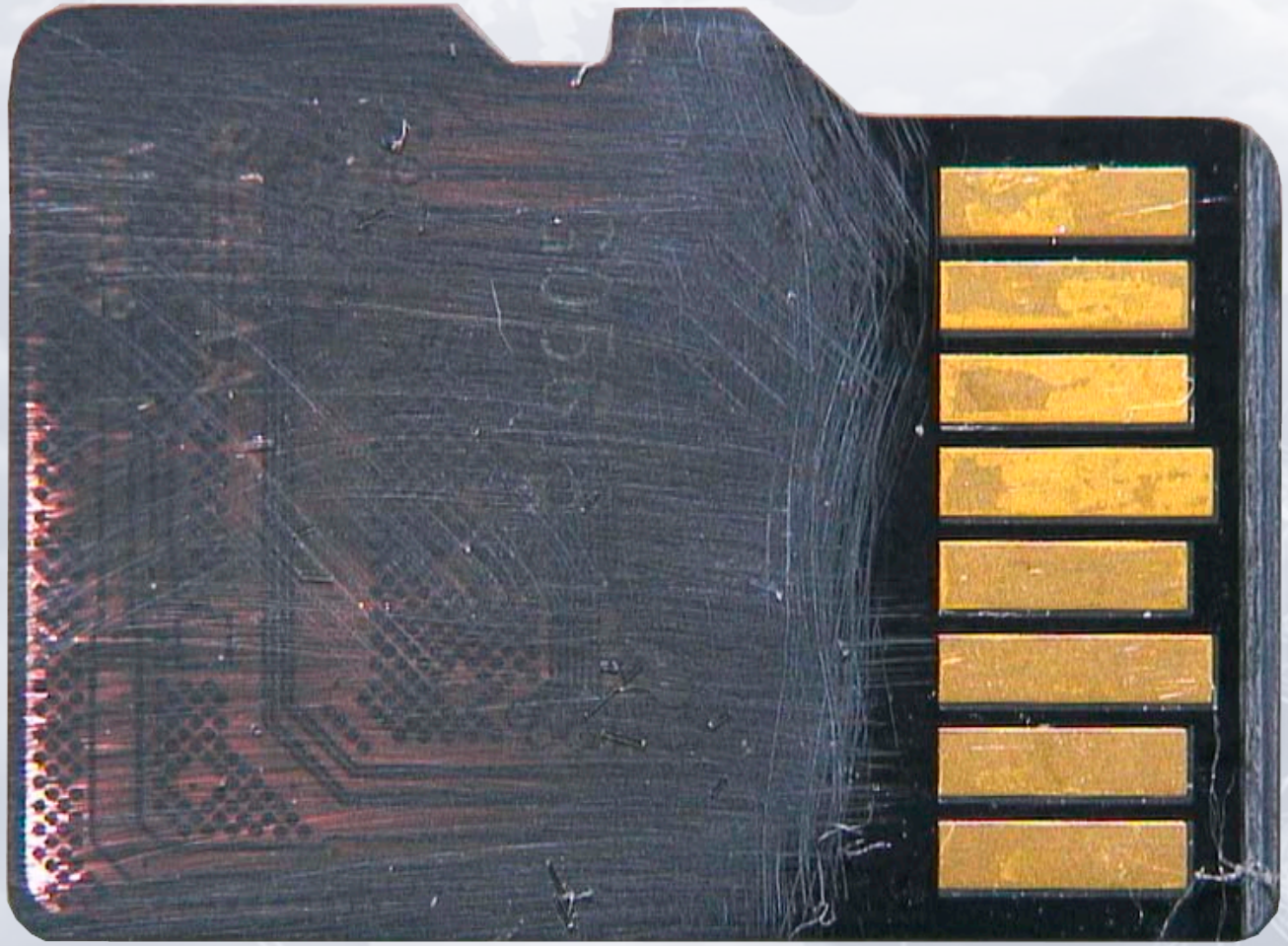




ACTION CAMERAS



ACTION CAMERAS



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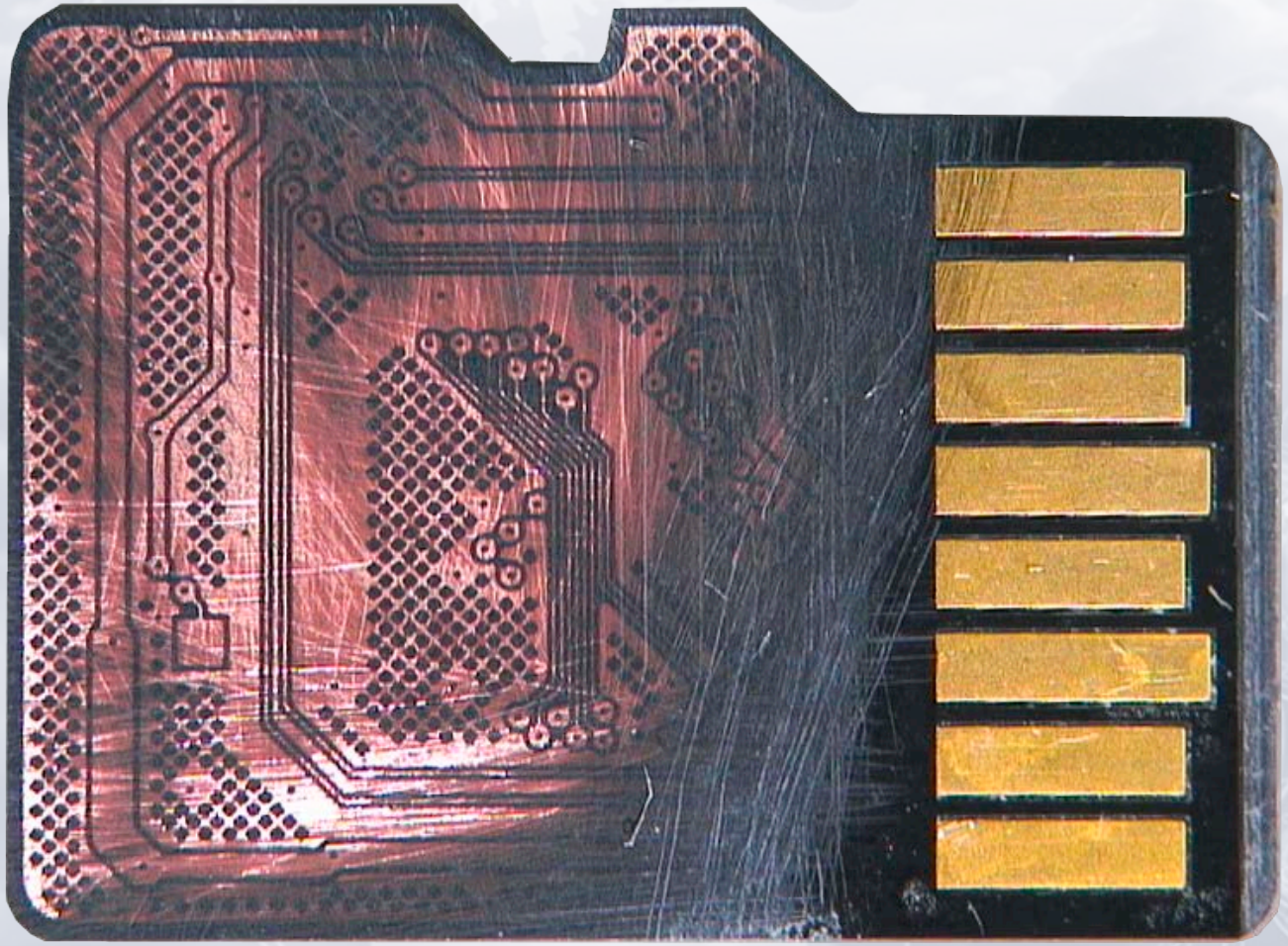

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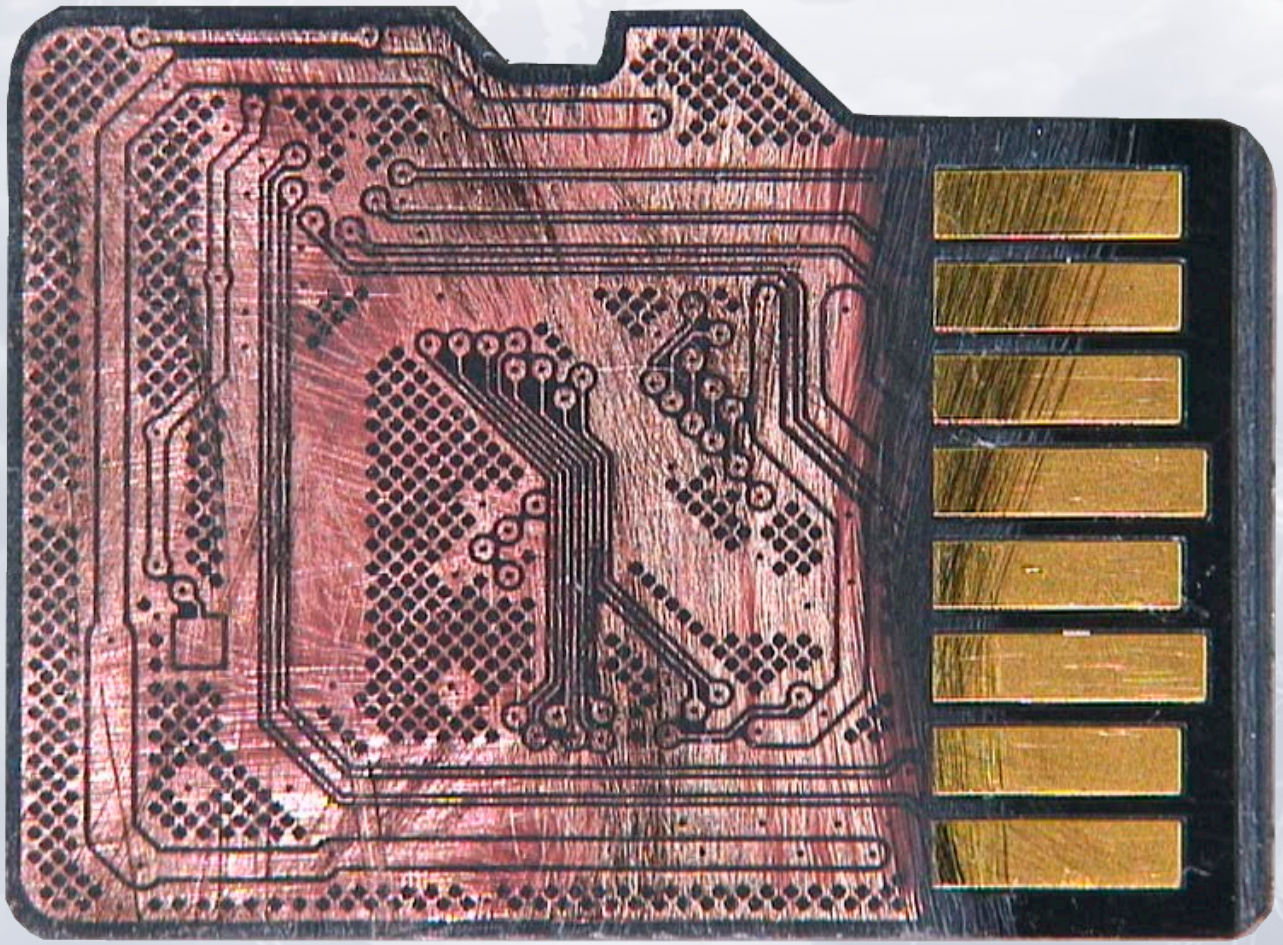

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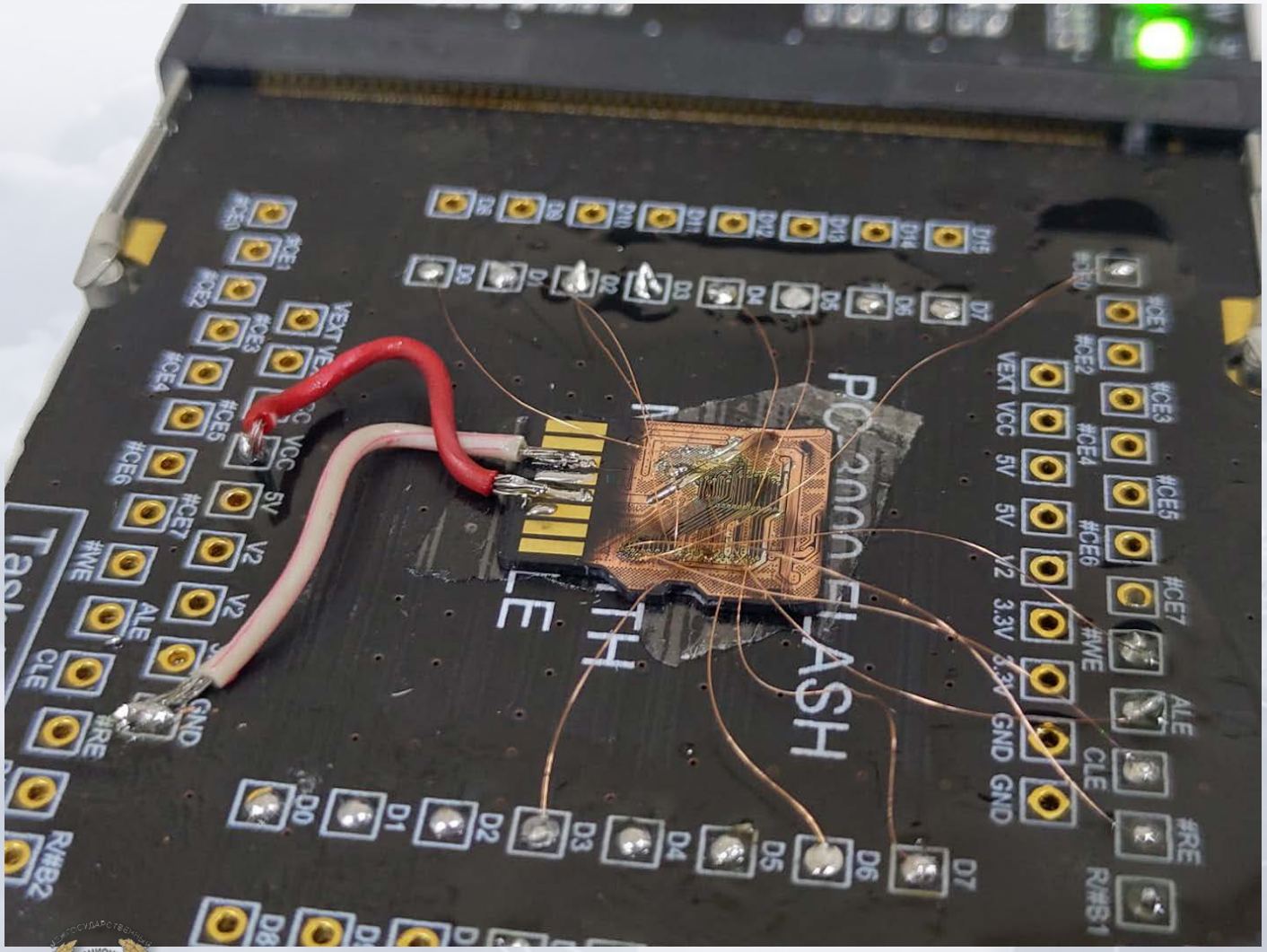
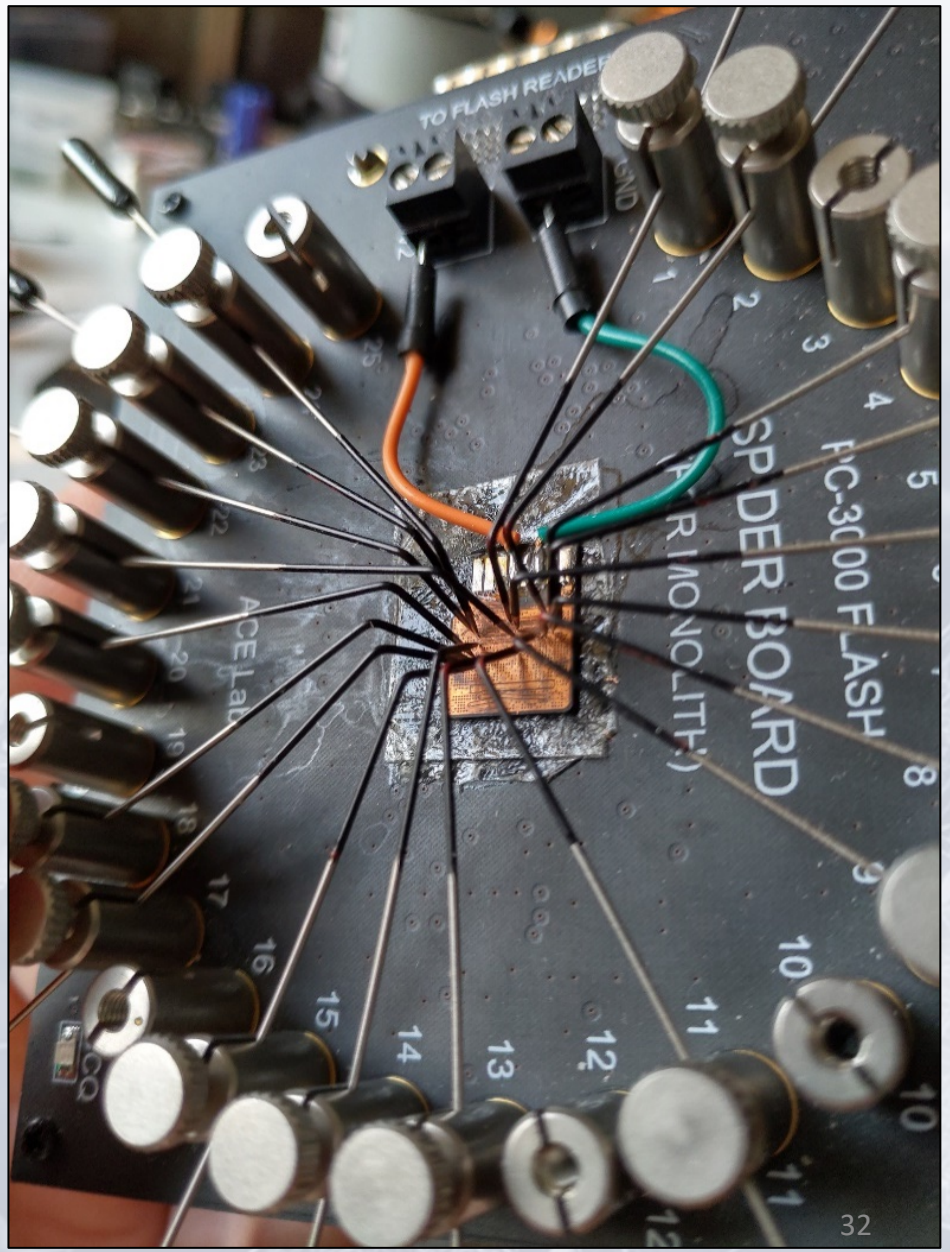




ACTION CAMERAS

PROBLEMS OF DATA RECOVERY WITHIN THE ACCIDENTS

- More often microSD occurs within the **action cameras** researches.
- Due to several reasons, **existing data recovery** software often **not capable to recover** the very last seconds of records, especially from damaged microSD.

SOLUTION

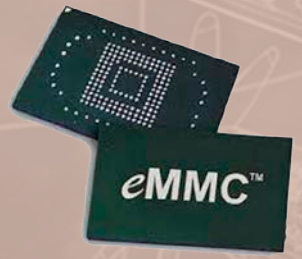
- IAC developed its **own technology** that allows to **restore** entire volume of **all data** that was recorded on a memory card.

TYPICAL DATA RECOVERY CASES WITHIN THE AIR ACCIDENT INVESTIGATIONS

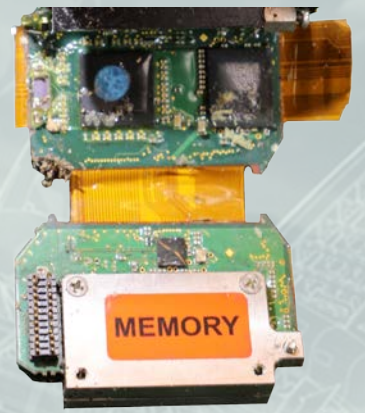
ACTION CAMERAS

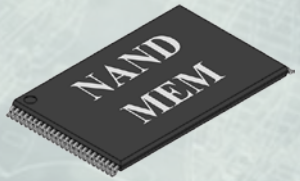
AVIONICS

GPS NAVIGATORS



OPTIONAL EQUIPMENT





PROBLEM

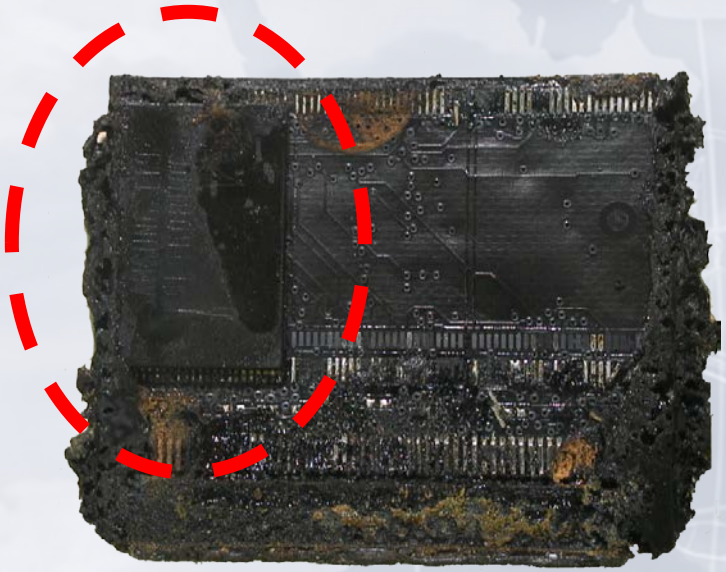
- **No data recovery technology** from damaged Engine Monitoring Units exists

SOLUTION

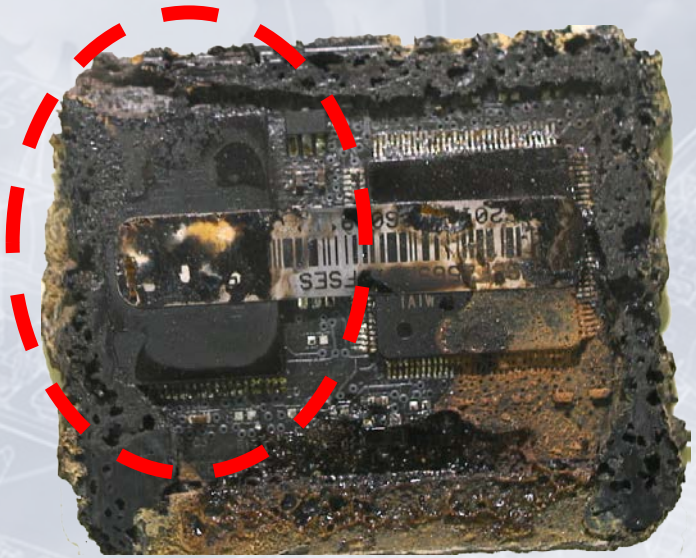
- **New** data recovery technology was developer and **successfully implemented**

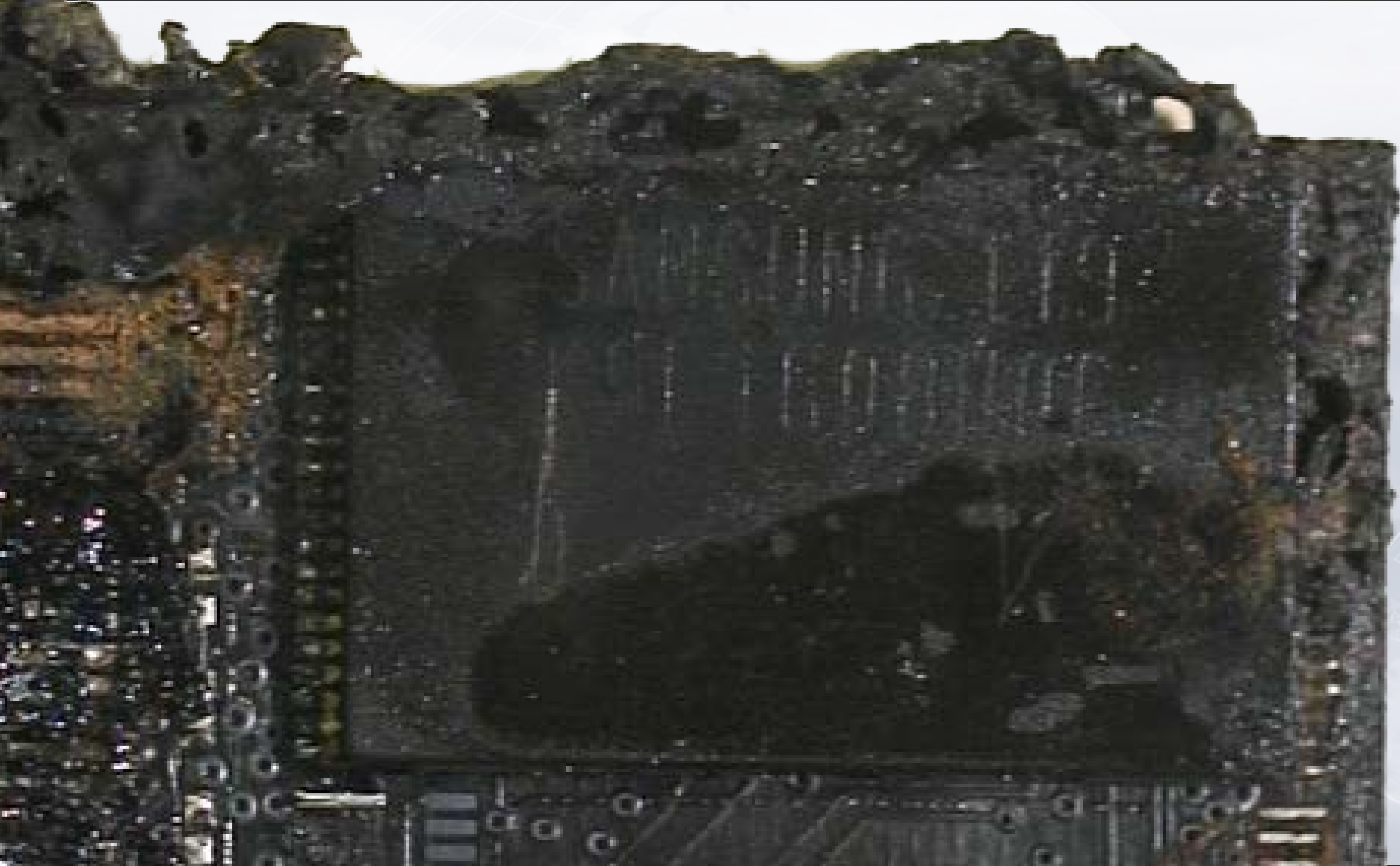
Compact FLASH

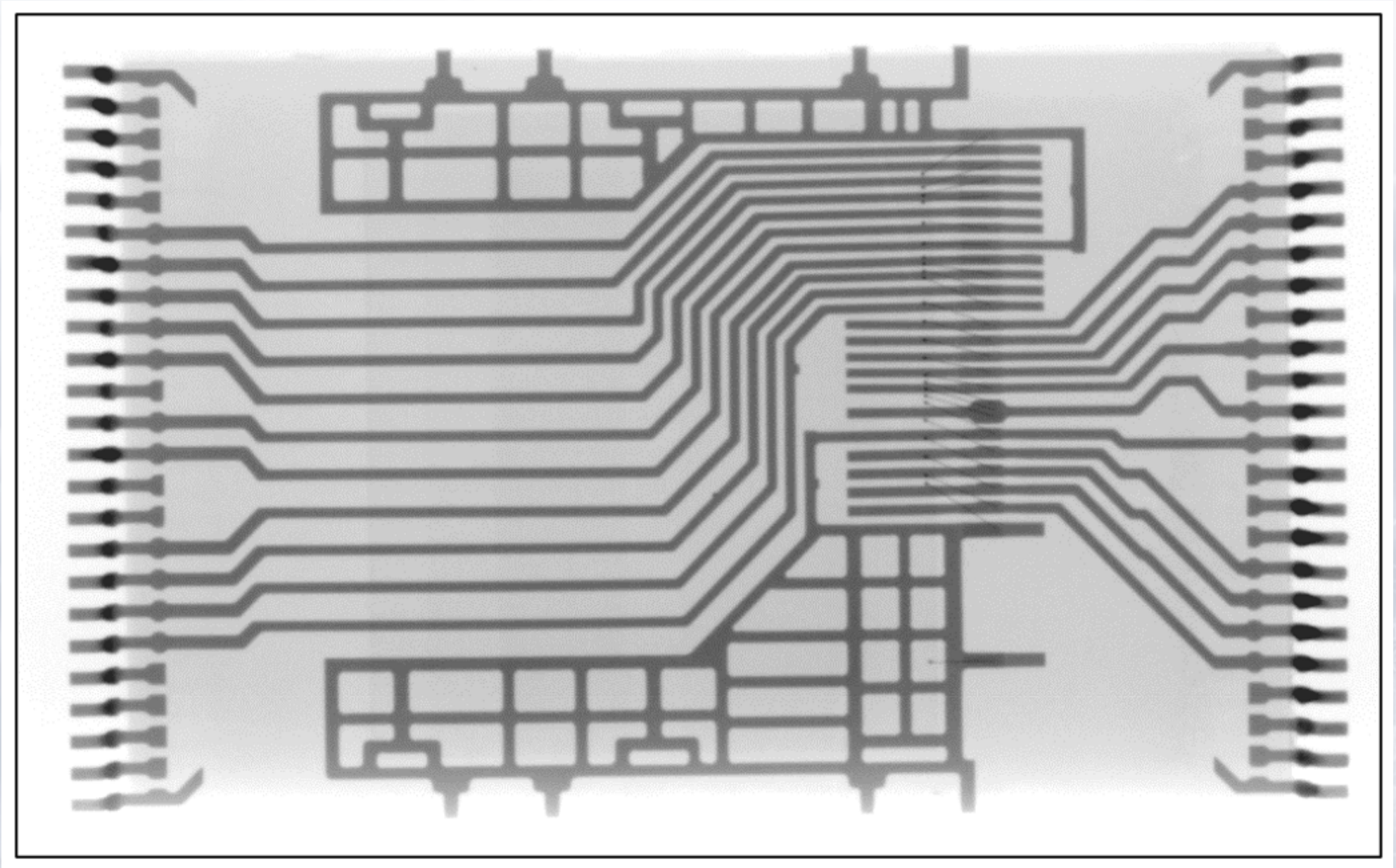
PCB top

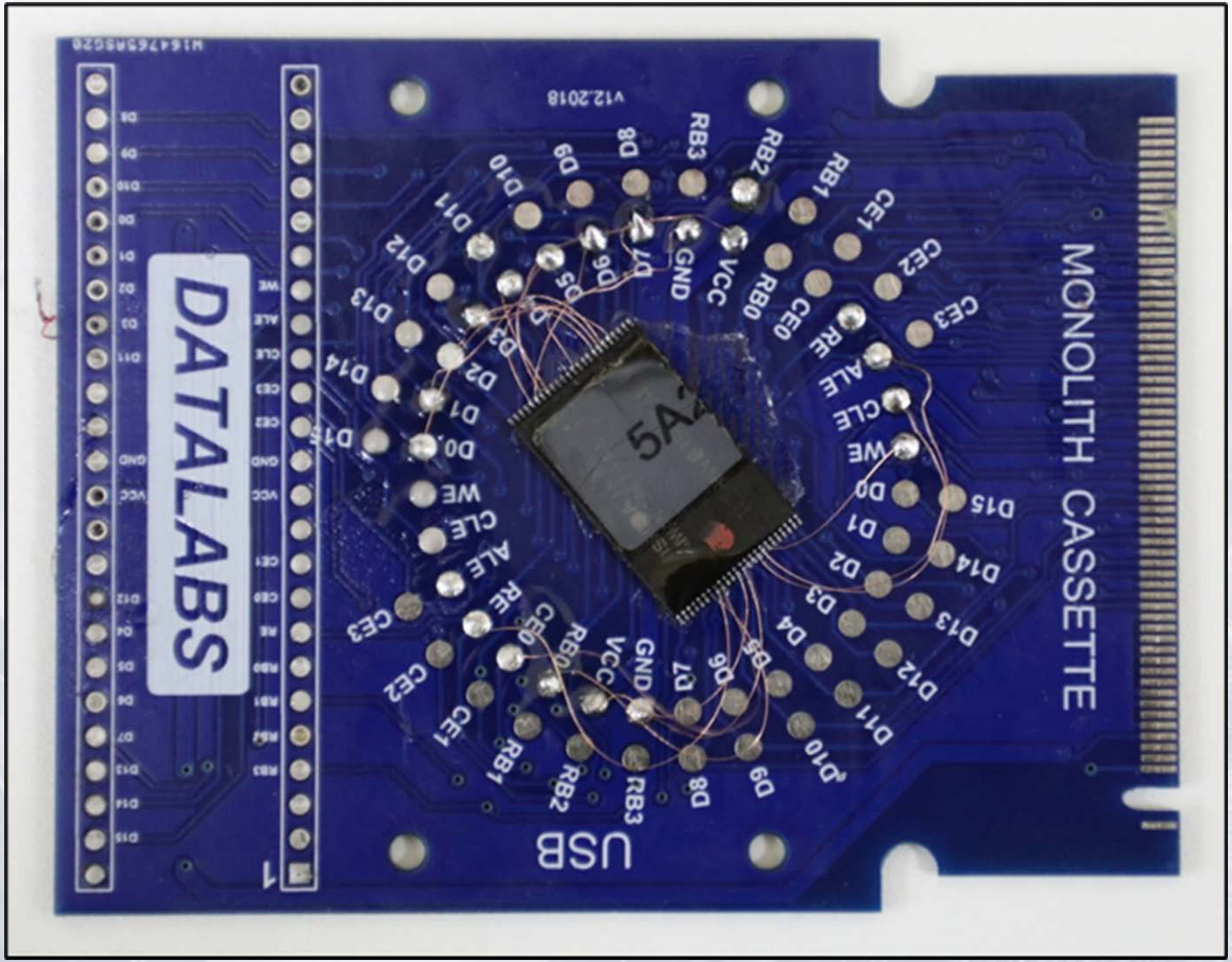


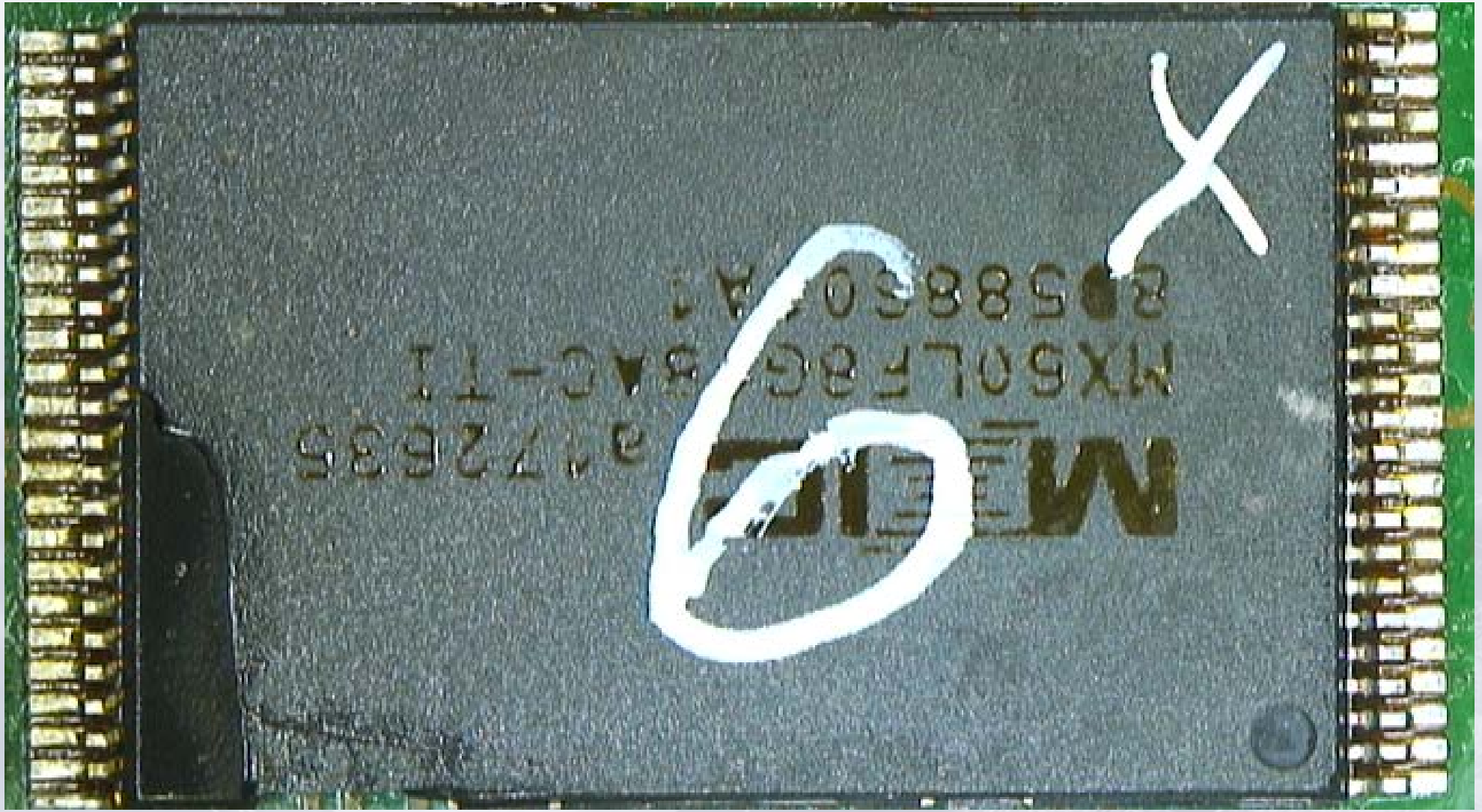
PCB bottom

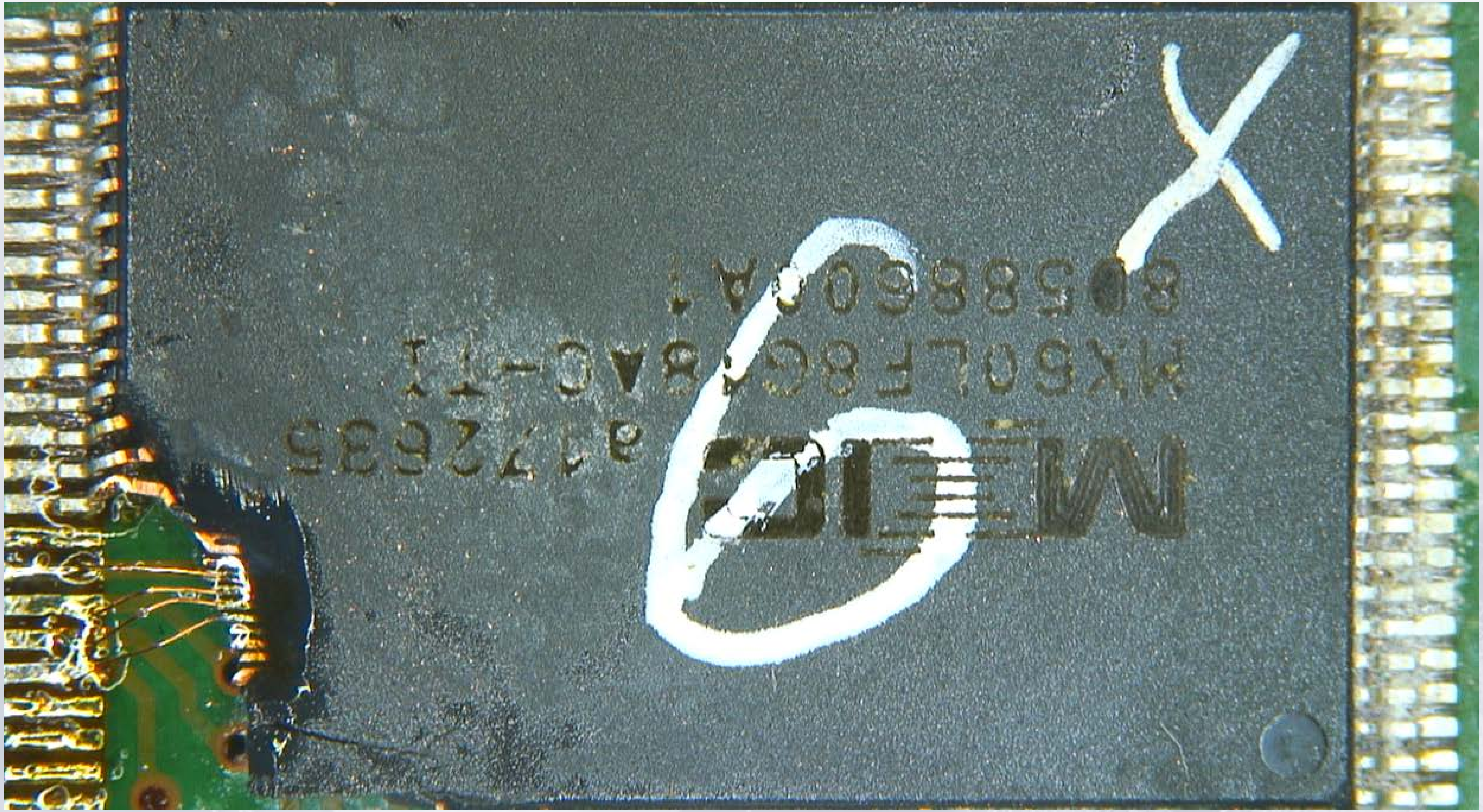






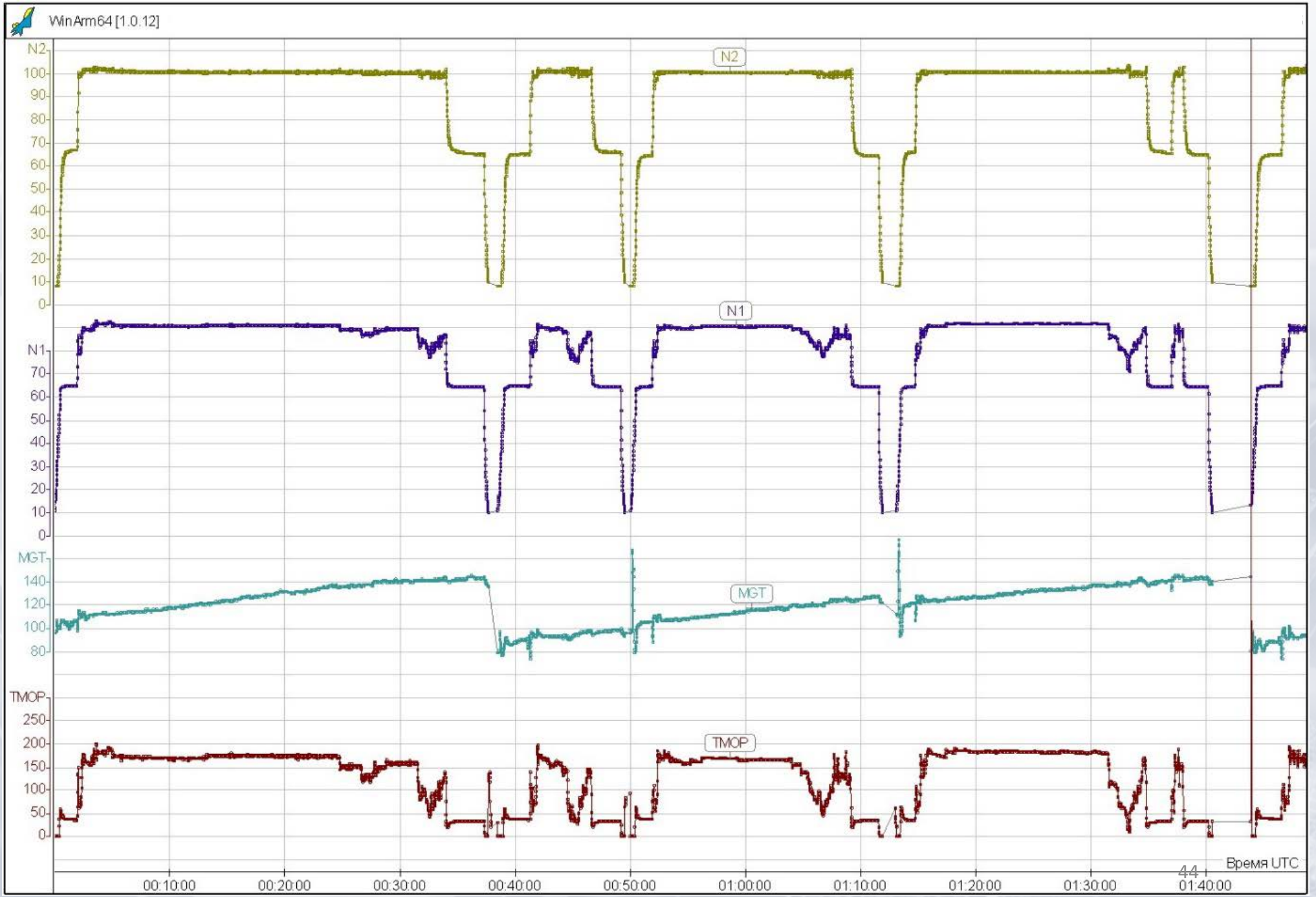

DATALABS
MONOLITH CASSETTE
USB
5A2





Engine data

- N1
- N2
- TORQUE
- MGT

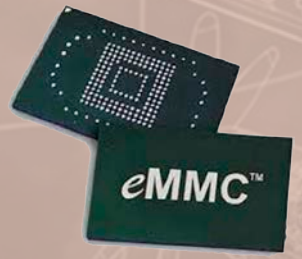


TYPICAL DATA RECOVERY CASES WITHIN THE AIR ACCIDENT INVESTIGATIONS

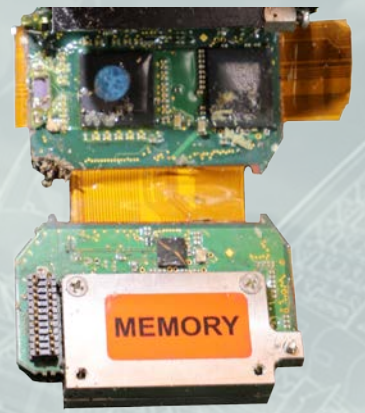
ACTION CAMERAS

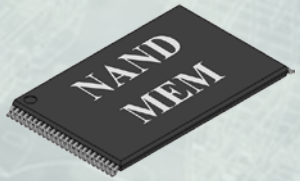
AVIONICS

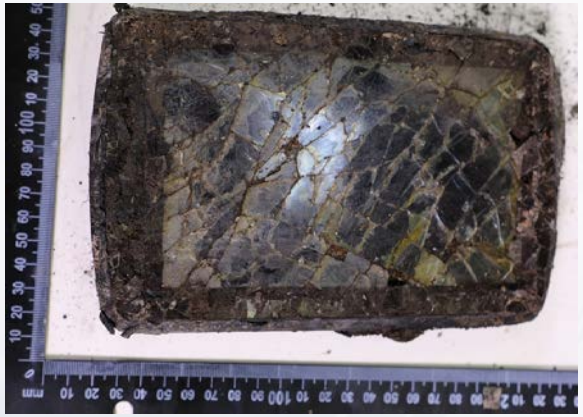
GPS NAVIGATORS

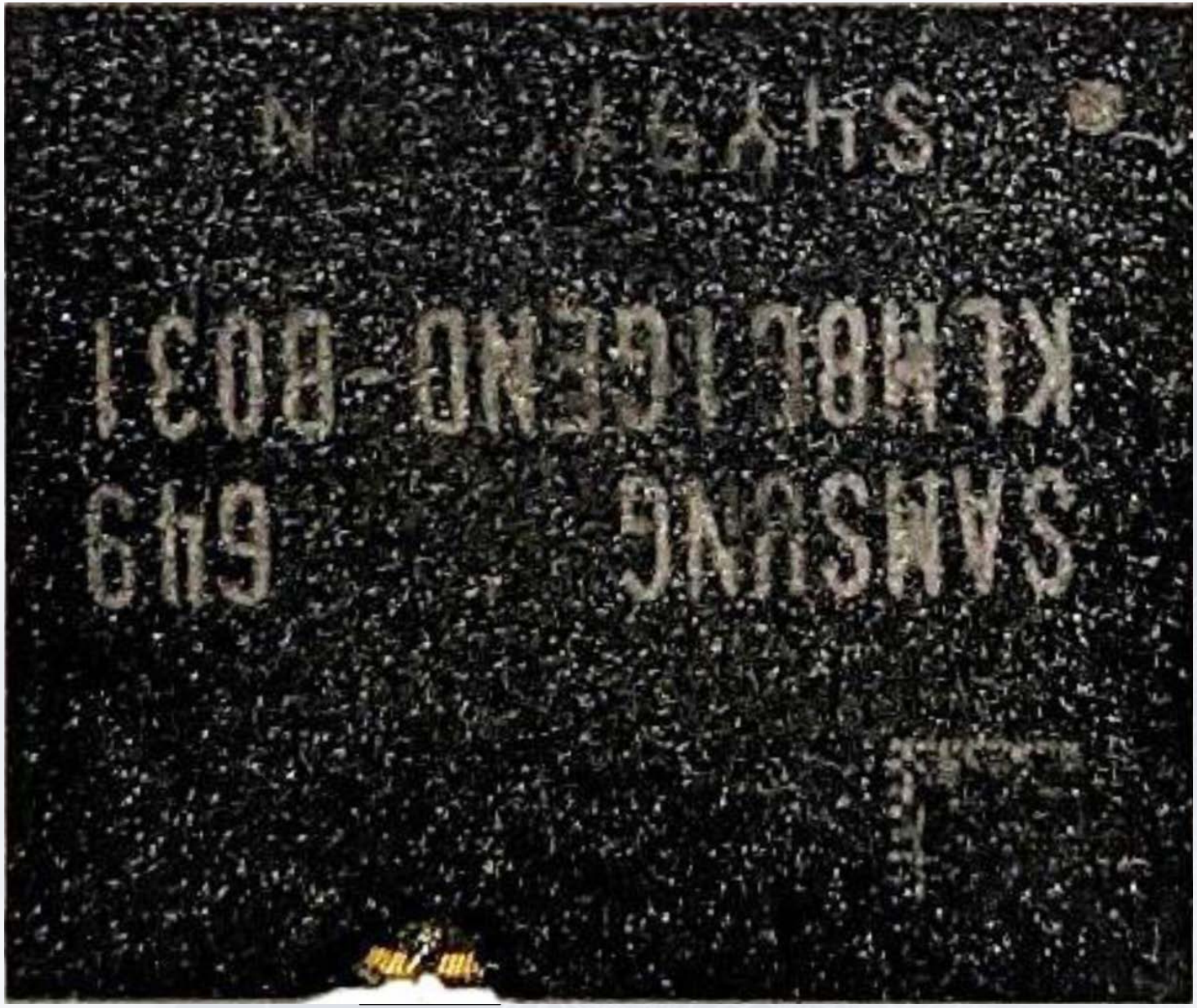


OPTIONAL EQUIPMENT







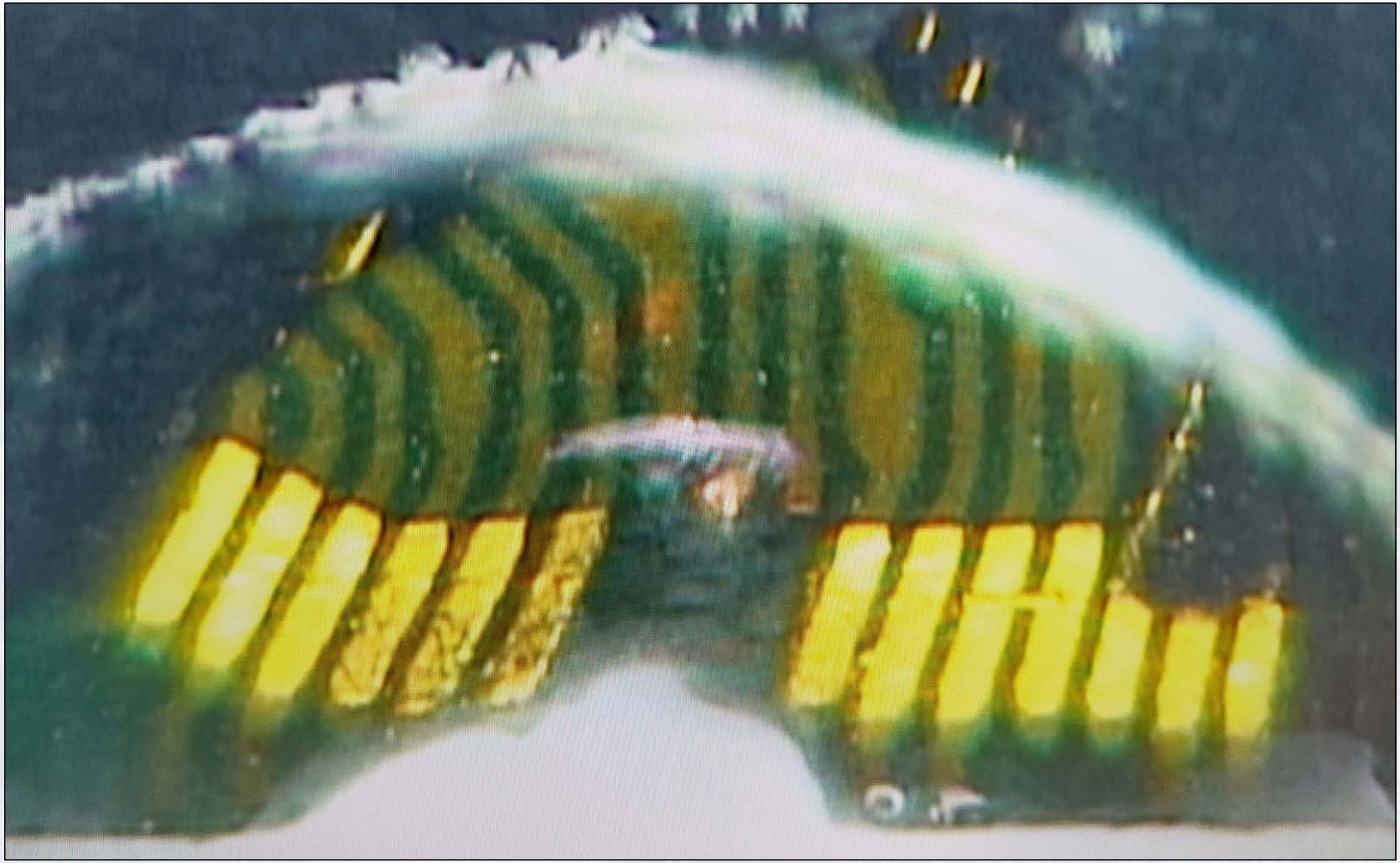


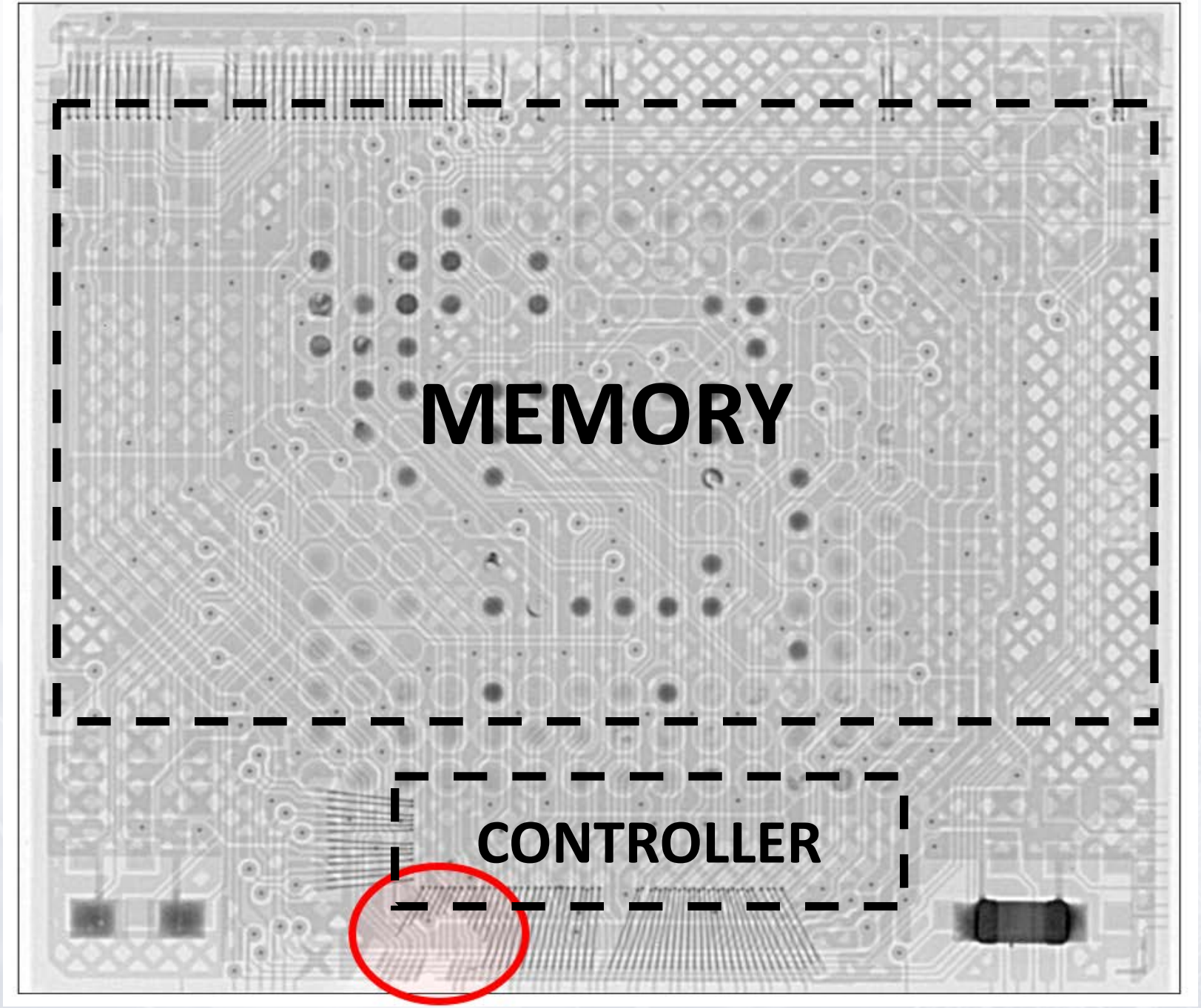
PROBLEM

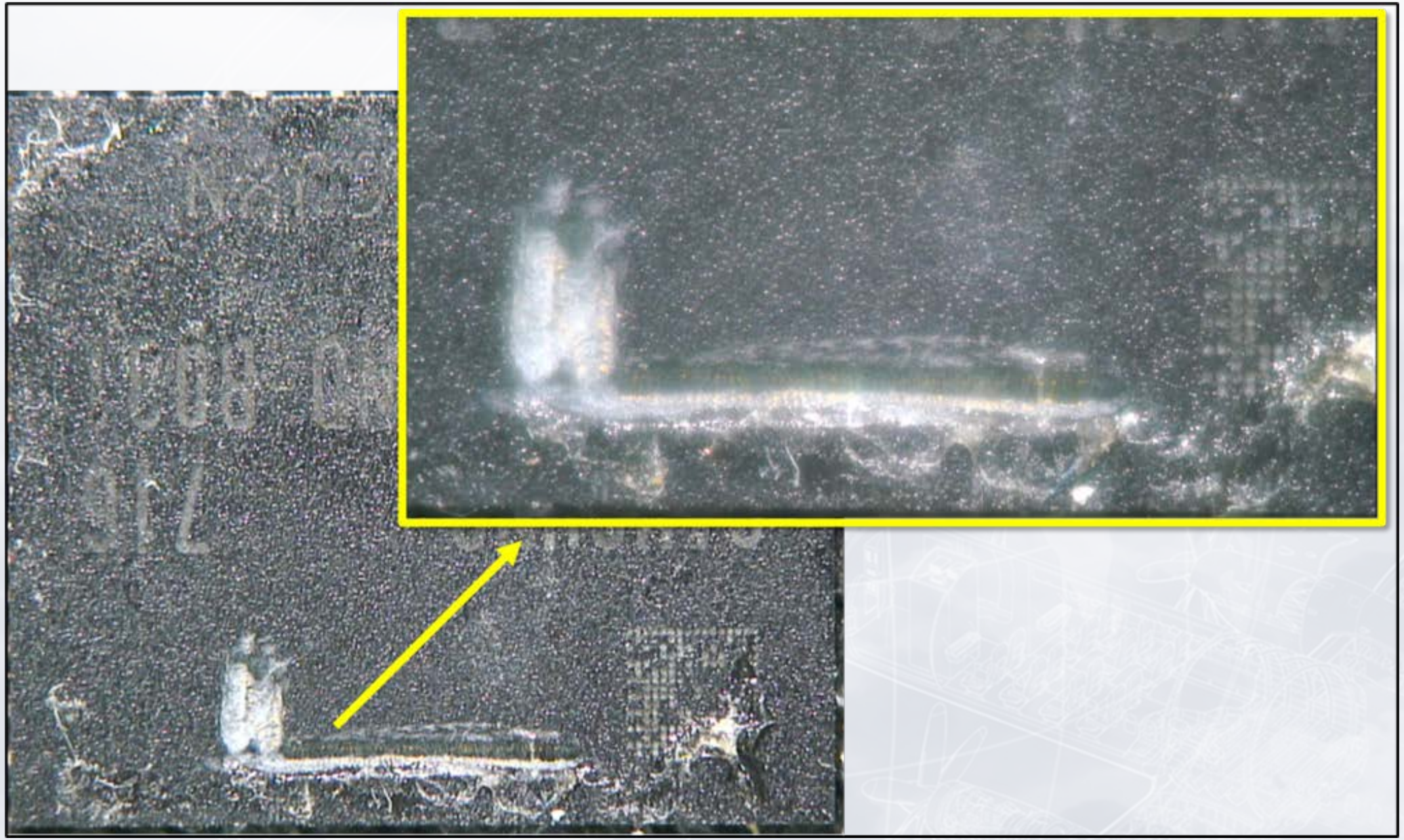
- Memory chip **damaged**
- **Short circuit** of power lines
- **Unavailable** data recovery technology

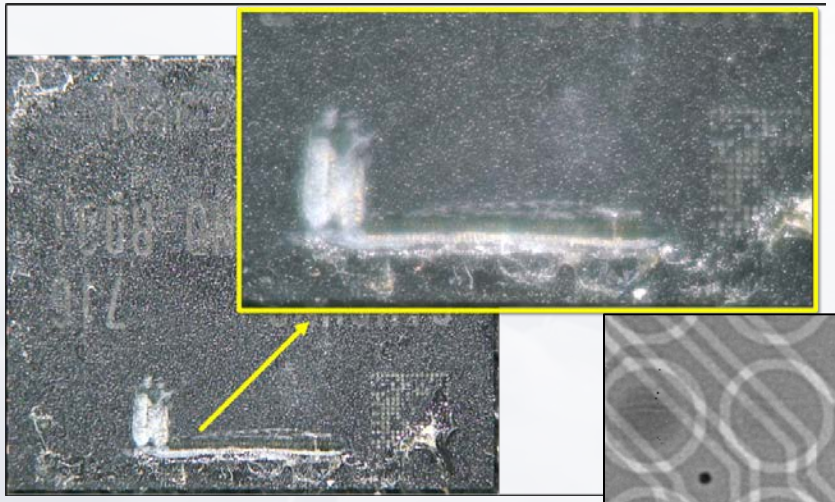
SOLUTION

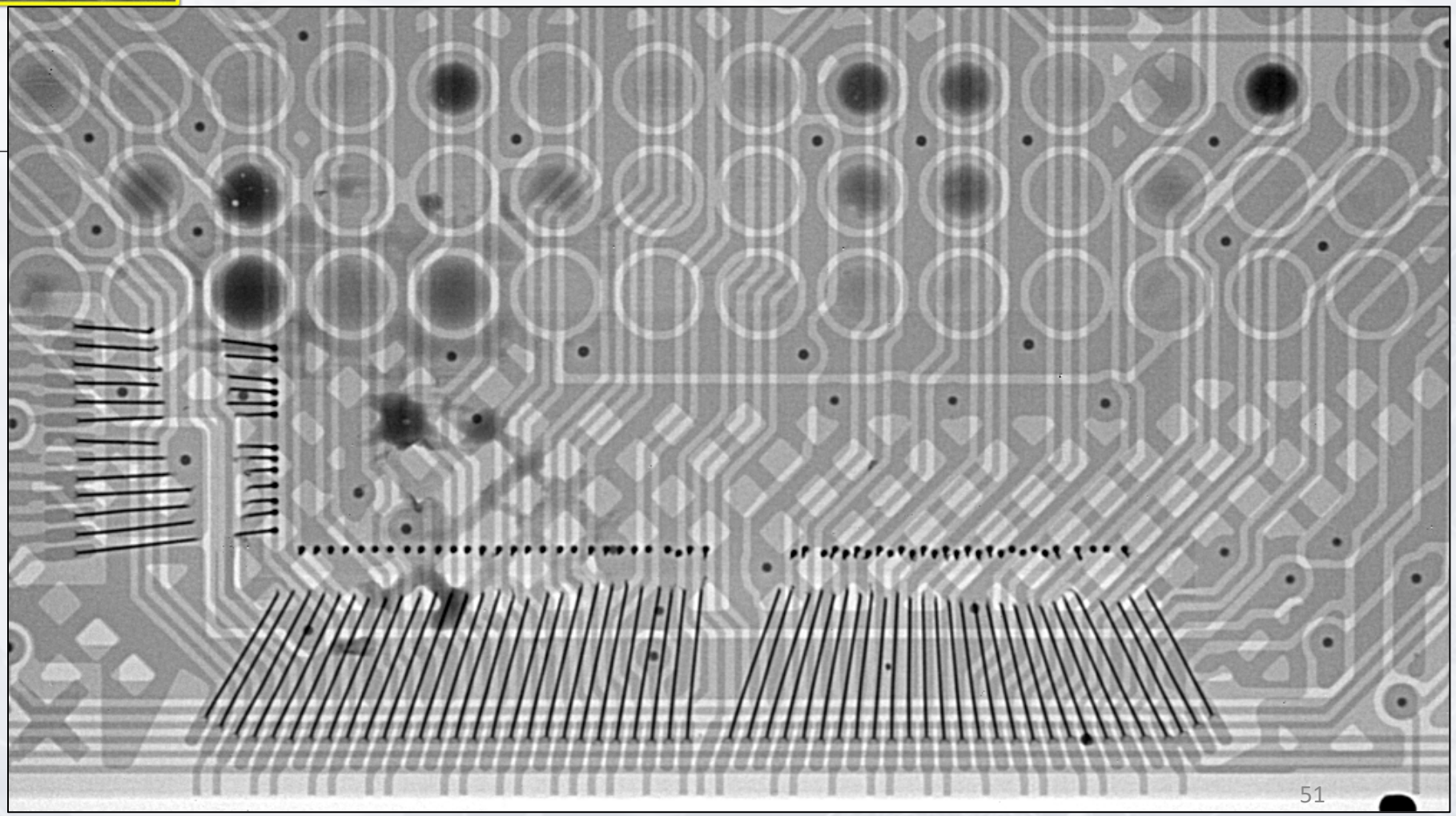
- **New** data recovery technology was developed and **successfully implemented**

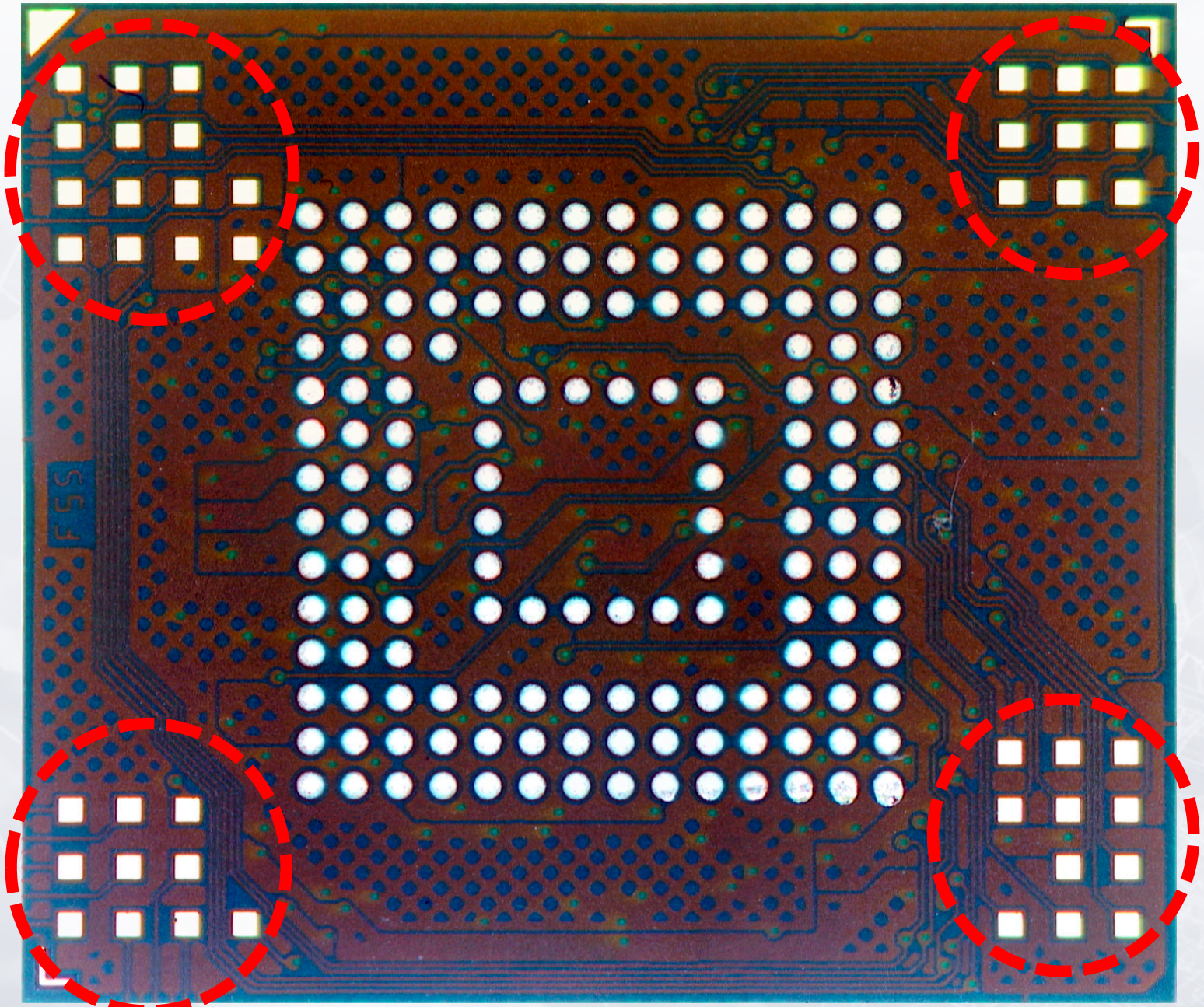


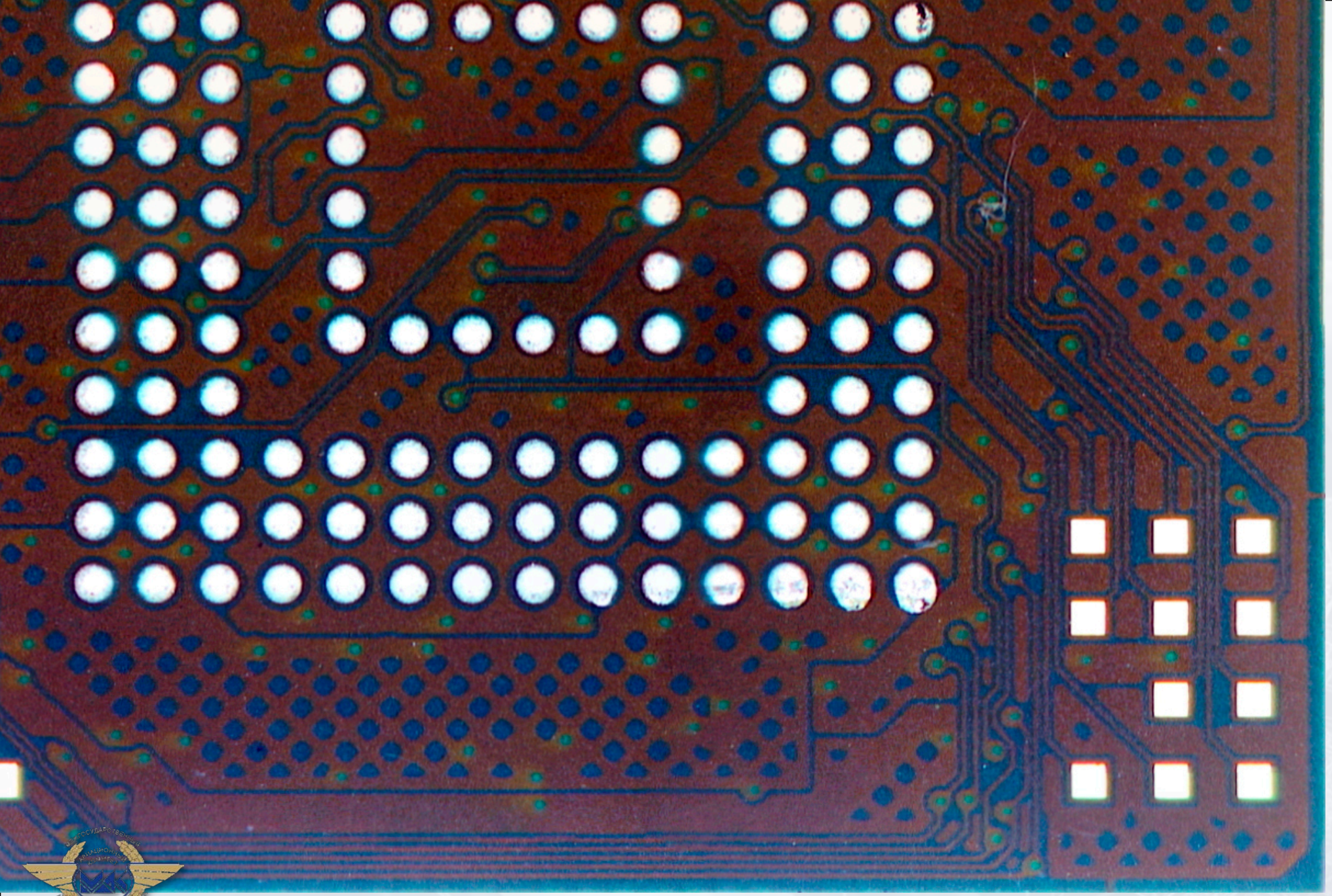

MEMORY
CONTROLLER

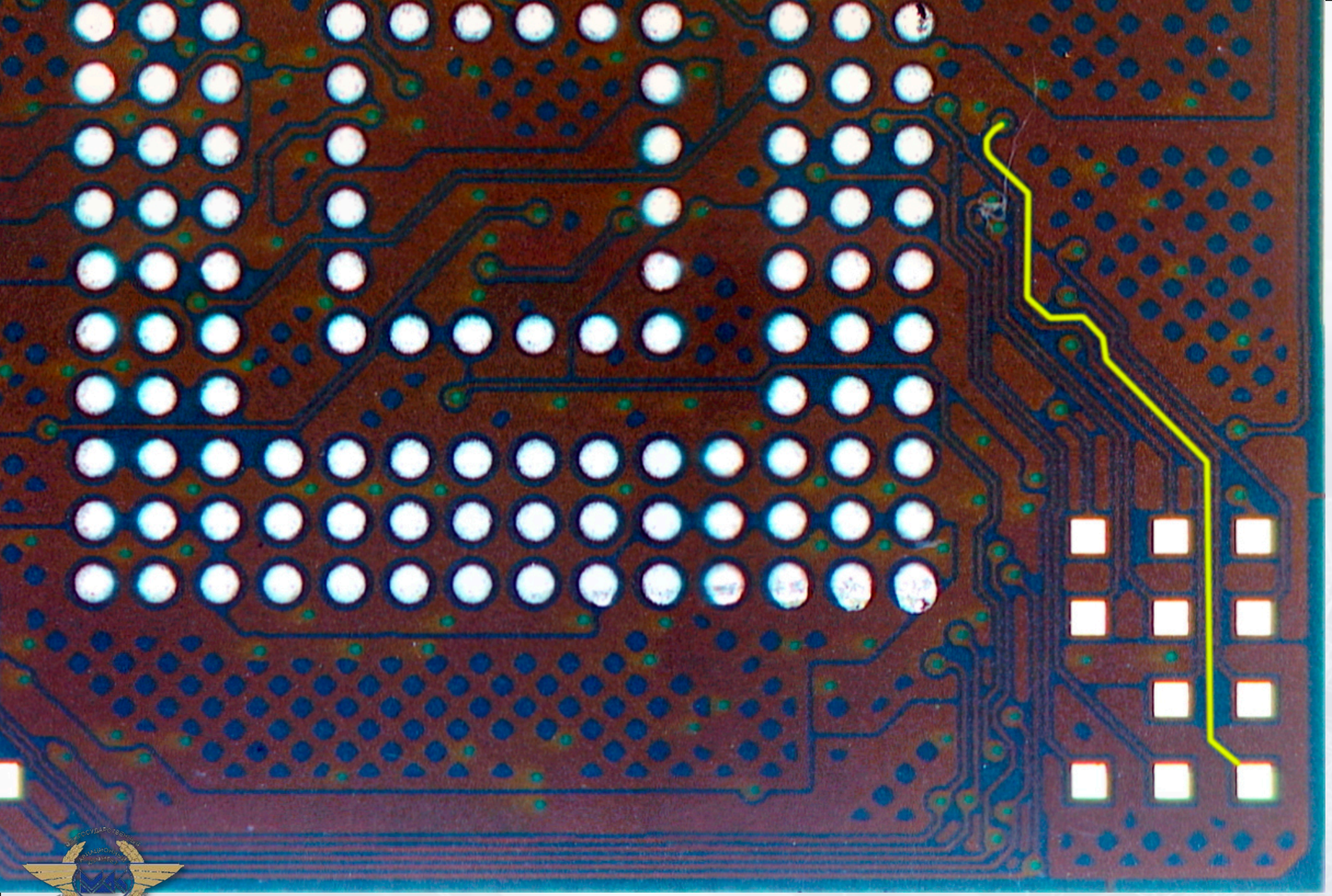


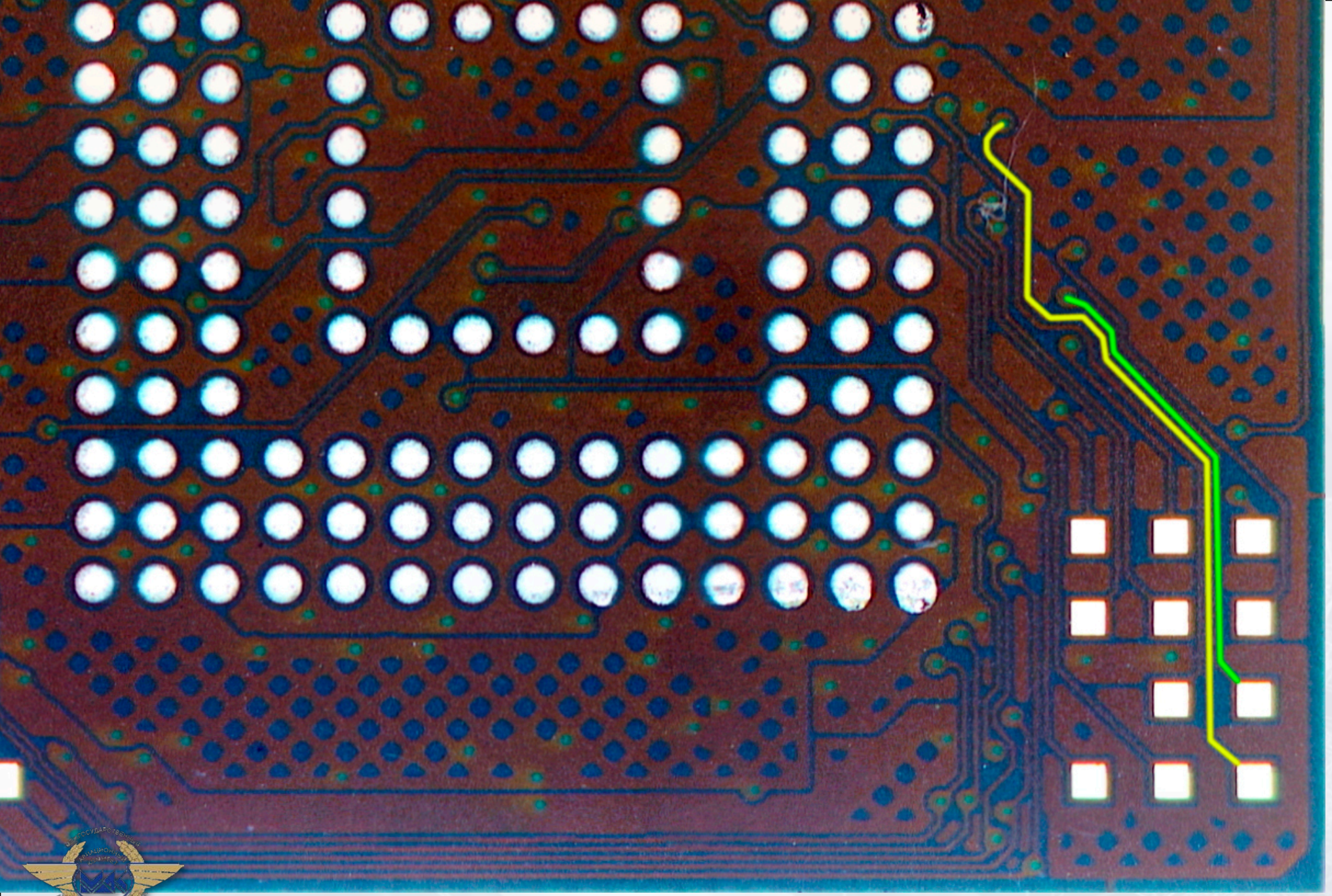


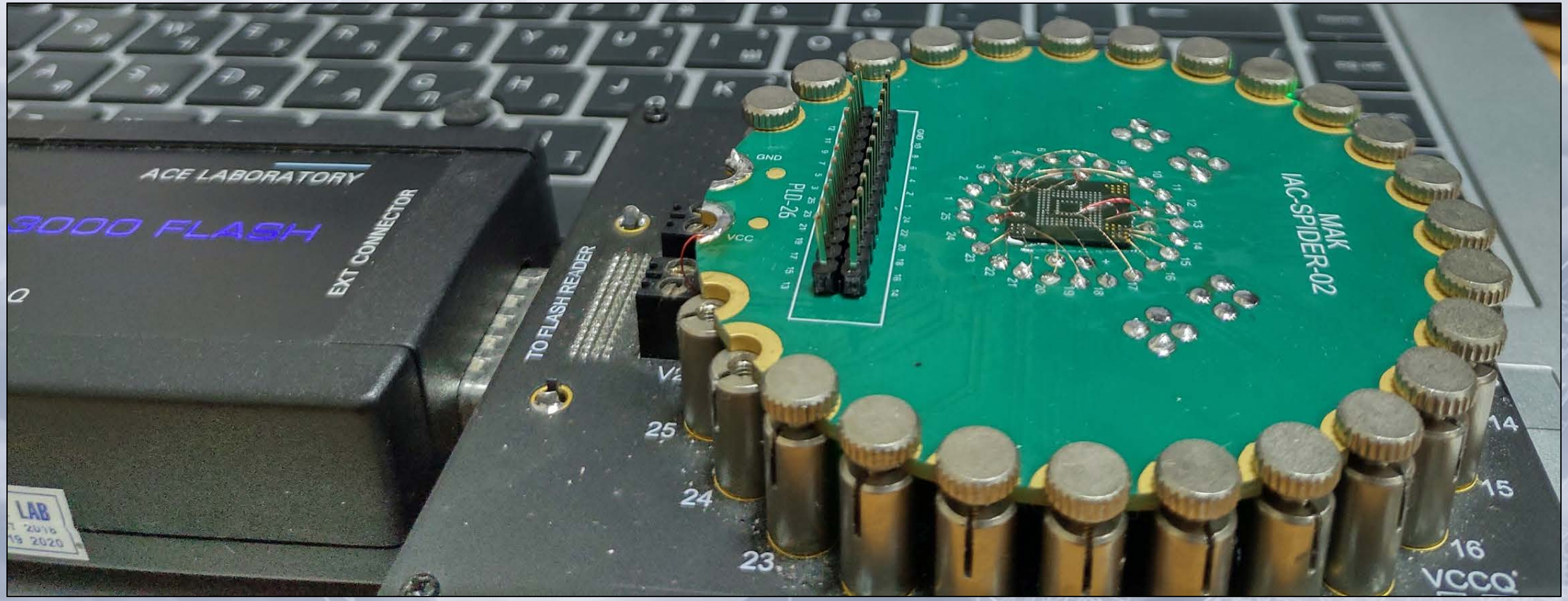











ACE LABORATORY
3000 FLASH
EXT CONNECTOR
TO FLASH READER
GND
VCC
PIO-26
MAK
IAC-SPIDER-02
25
24
23
16
VCCQ

IAC DEVELOPED A SET OF ITS OWN **UNIQUE TOOLS** FOR FLIGHT DATA RECOVERY FROM NON-STANDARD FLIGHT DATA SOURCES:

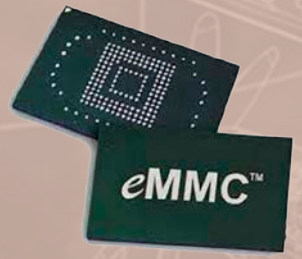
- GARMIN GPS (all models);
- FLARM trackers;
- microSD corrupted video files (GoPro and other action cameras);
- Helicopters engine monitoring units;
- various multifunctional displays;
- etc.

TYPICAL DATA RECOVERY CASES WITHIN THE AIR ACCIDENT INVESTIGATIONS

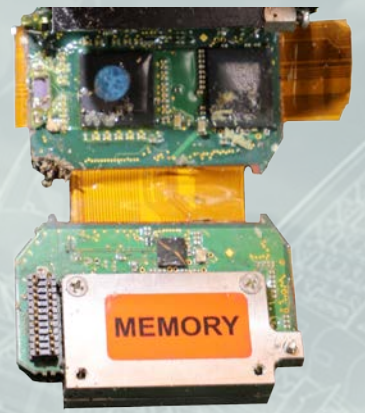
ACTION CAMERAS

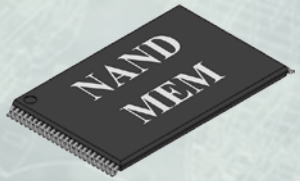
AVIONICS

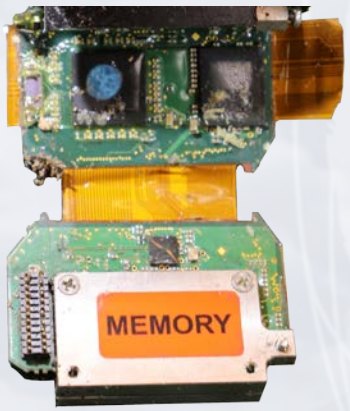
GPS NAVIGATORS



OPTIONAL EQUIPMENT







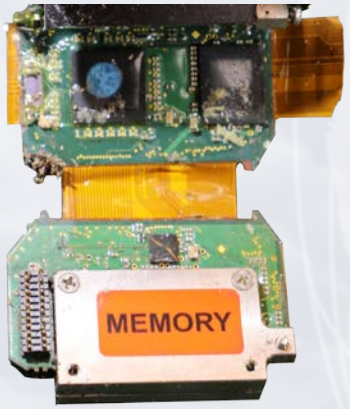
PROBLEMS OF DATA RECOVERY WITHIN THE ACCIDENTS

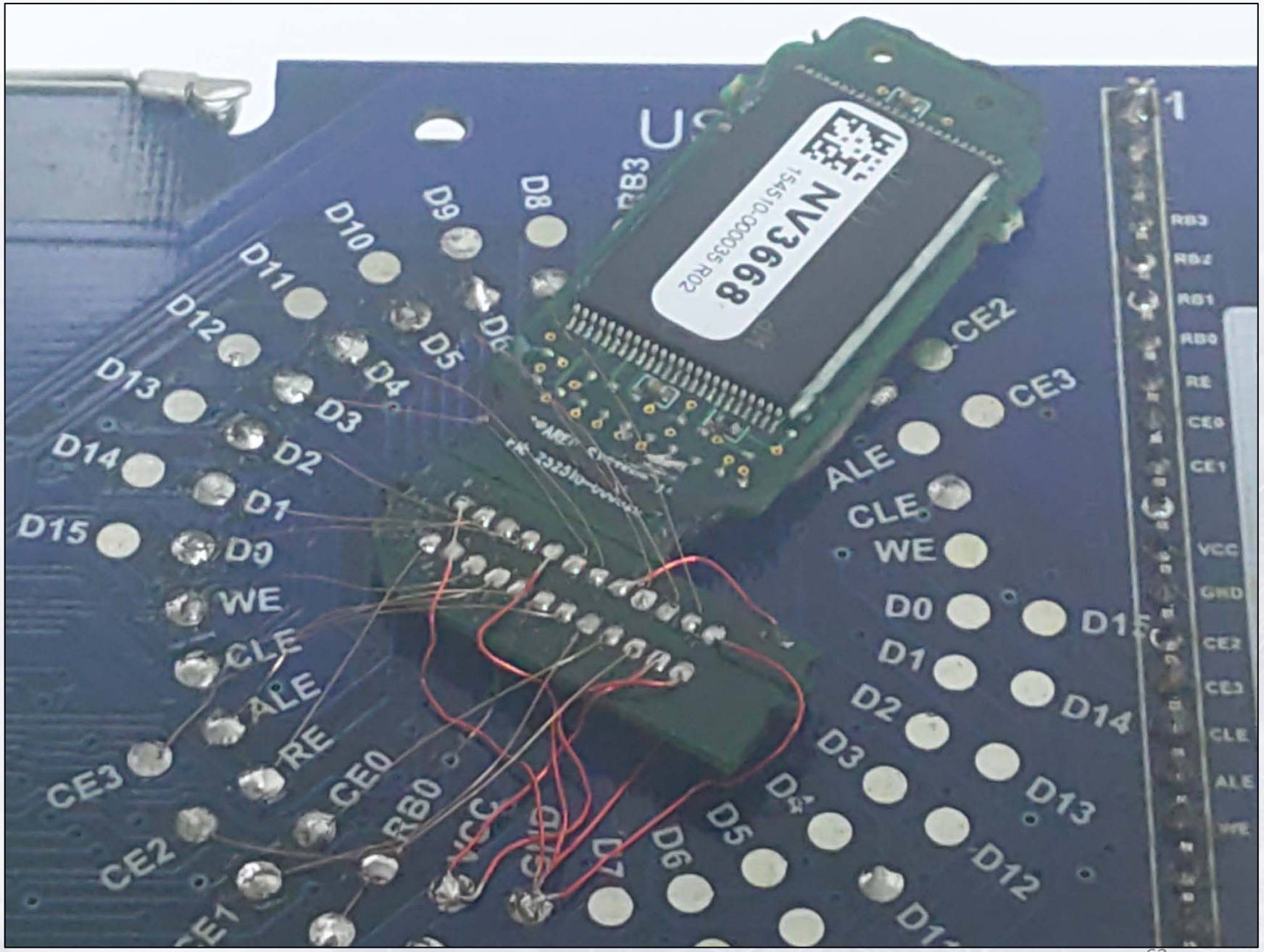
- There is **no specific adapter** allowing investigators to connect to the internal memory safely.
- APPAREO **has its own forensic software** that should recover all amount of recorded data, but in few cases this software was **not able to find and recover the accident flight data**.

SOLUTION

- **New readout method** allows to readout internal memory data without heating the memory chips.
- **New forensic software** allows to restore entire volume of all data that was recorded into the APPAREO internal memory.


APPAREO


MEMORY


NV3668
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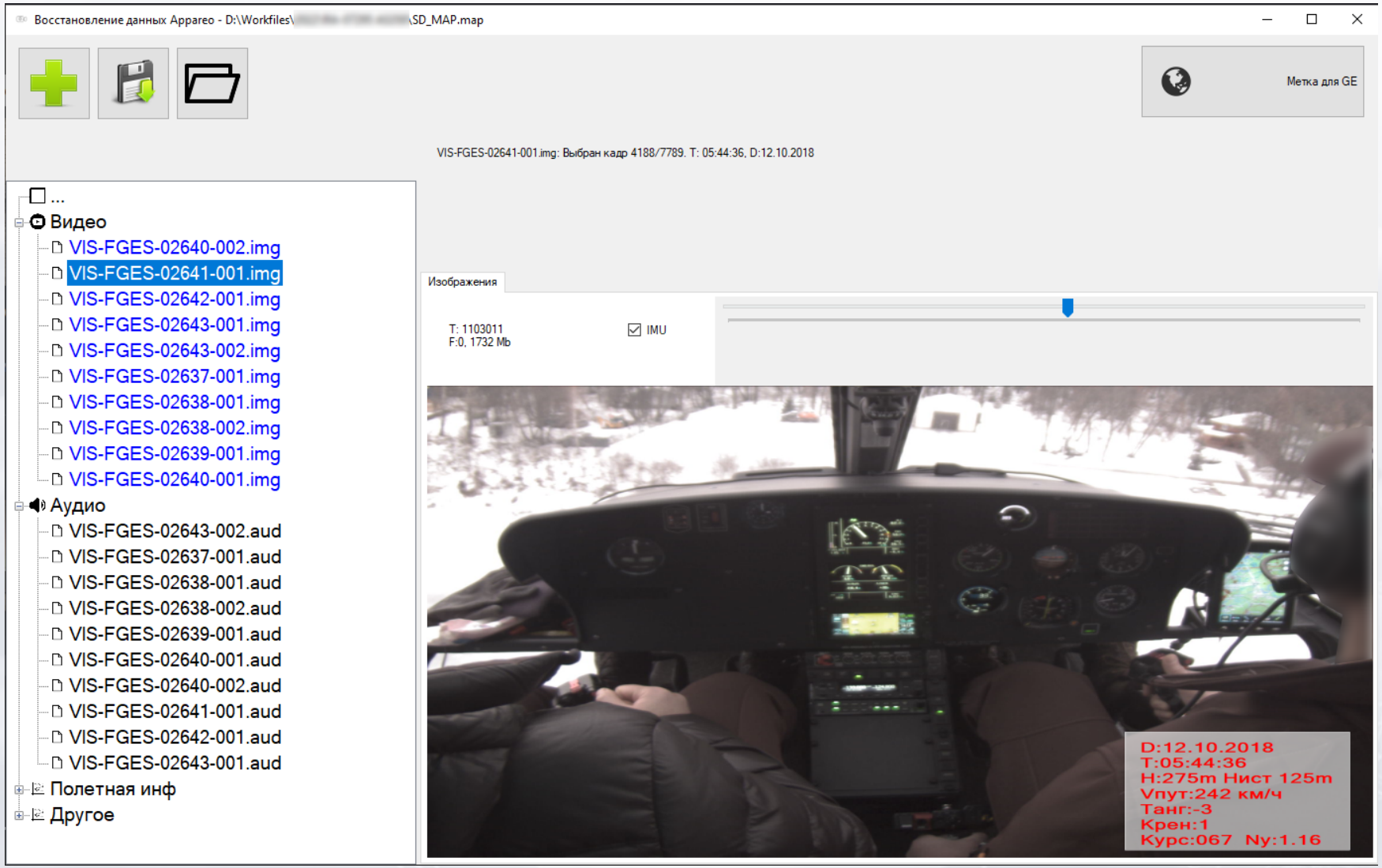
Восстановление данных Appareo - D:\Workfiles\[redacted]\SD_MAP.map
Метка для GE
VIS-FGES-02641-001.img: Выбран кадр 4188/7789. T: 05:44:36, D:12.10.2018
...
Видео
VIS-FGES-02640-002.img
VIS-FGES-02641-001.img
VIS-FGES-02642-001.img
VIS-FGES-02643-001.img
VIS-FGES-02643-002.img
VIS-FGES-02637-001.img
VIS-FGES-02638-001.img
VIS-FGES-02638-002.img
VIS-FGES-02639-001.img
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Аудио
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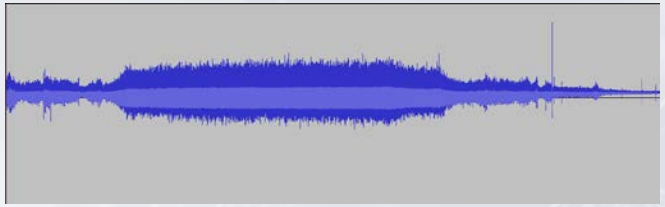
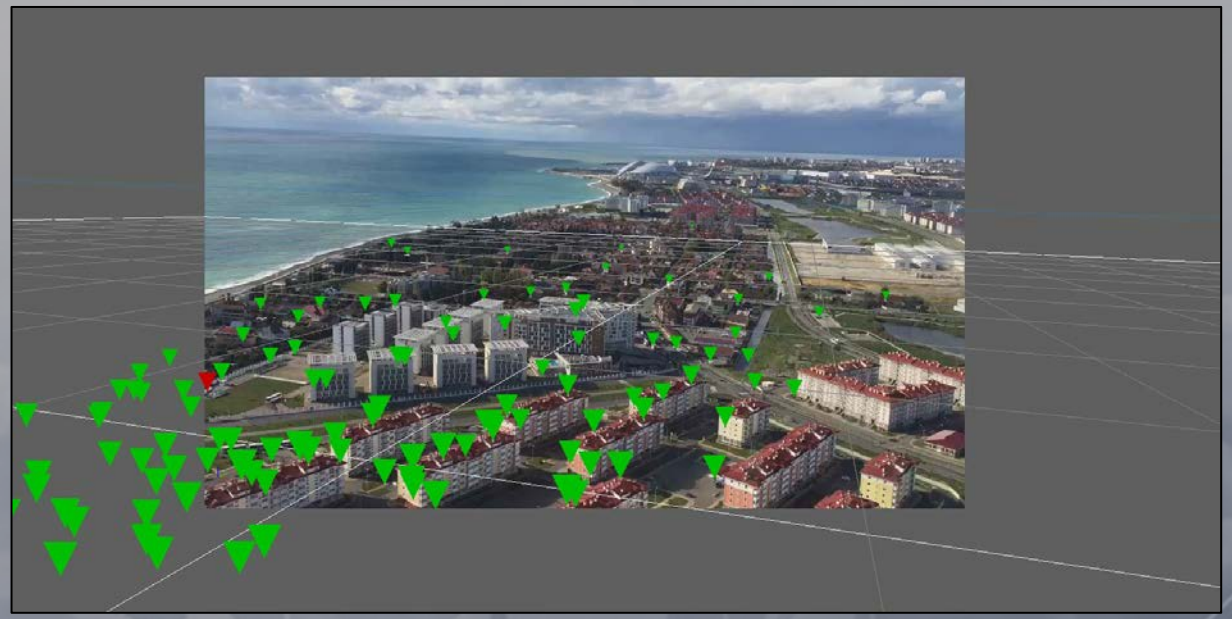
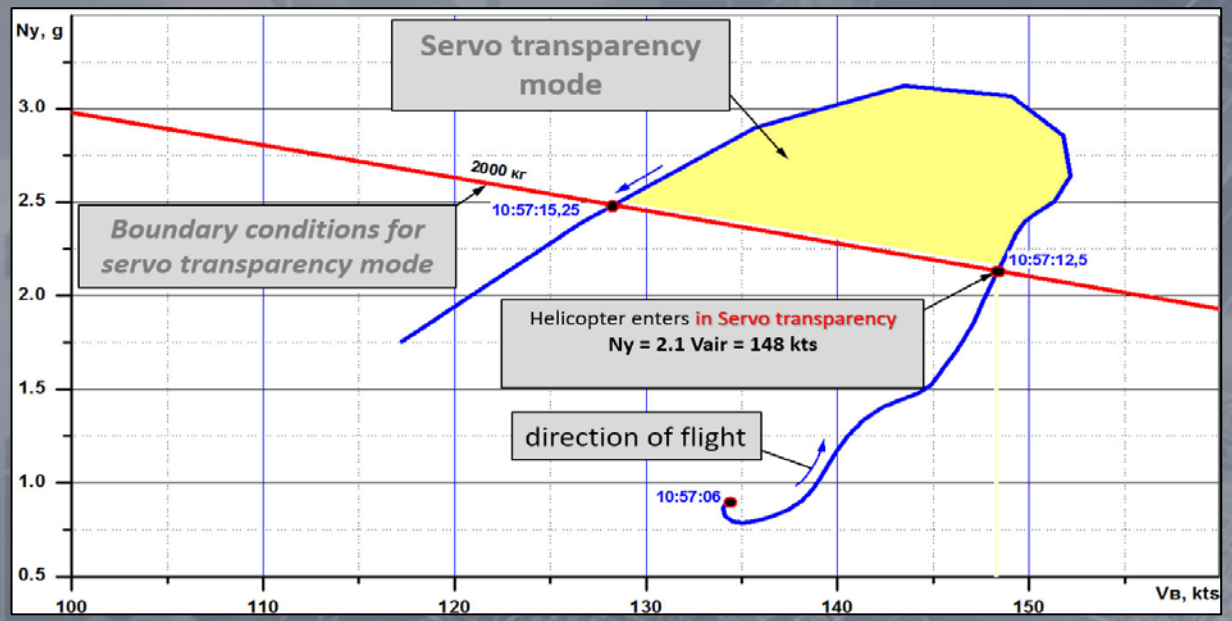
Курс:067 Ny:1.16




RA-07275
ЕЛЬЦОВКА




RA-07275


Ny, g
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140
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Vв, kts
Servo transparency mode
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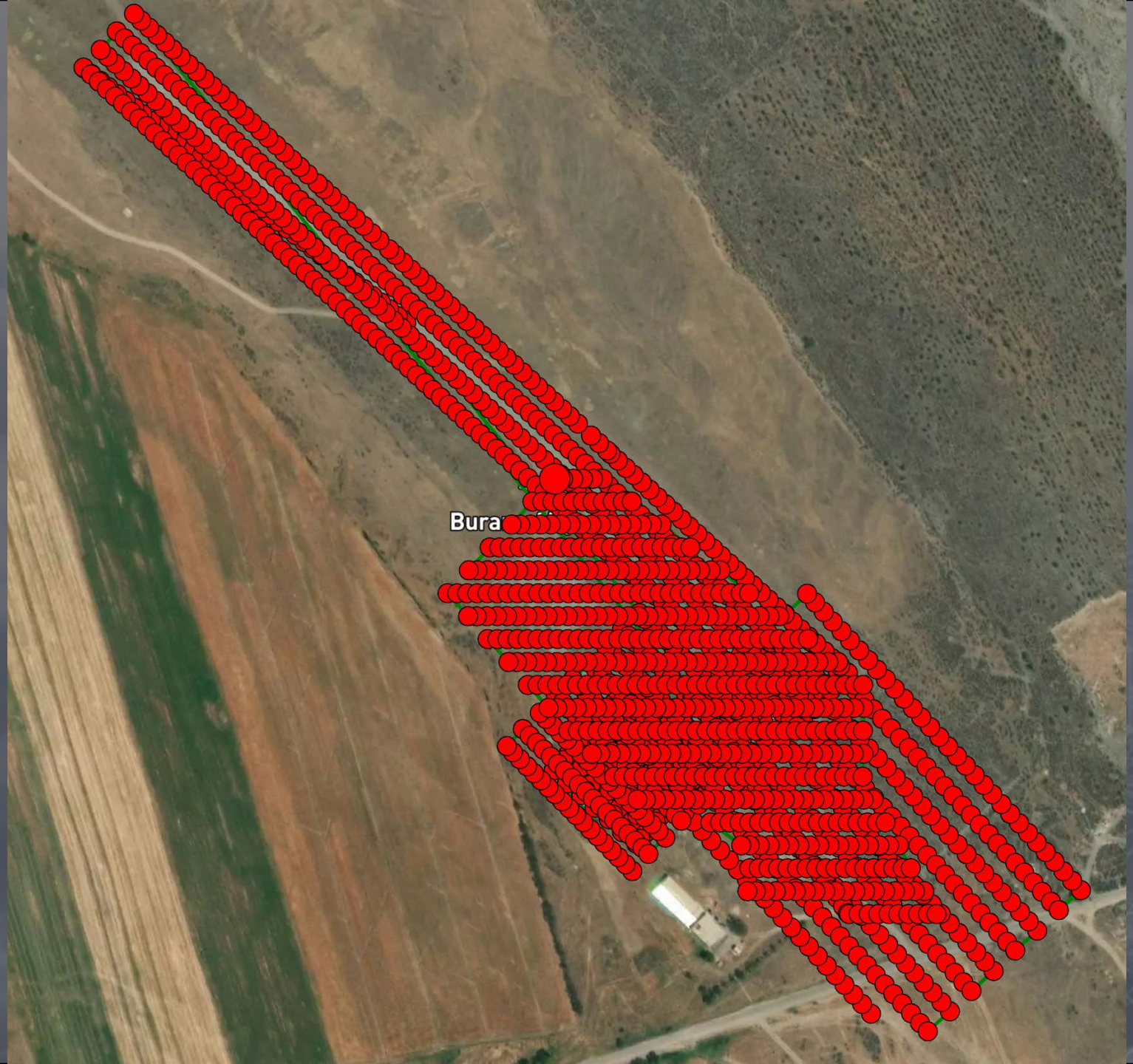
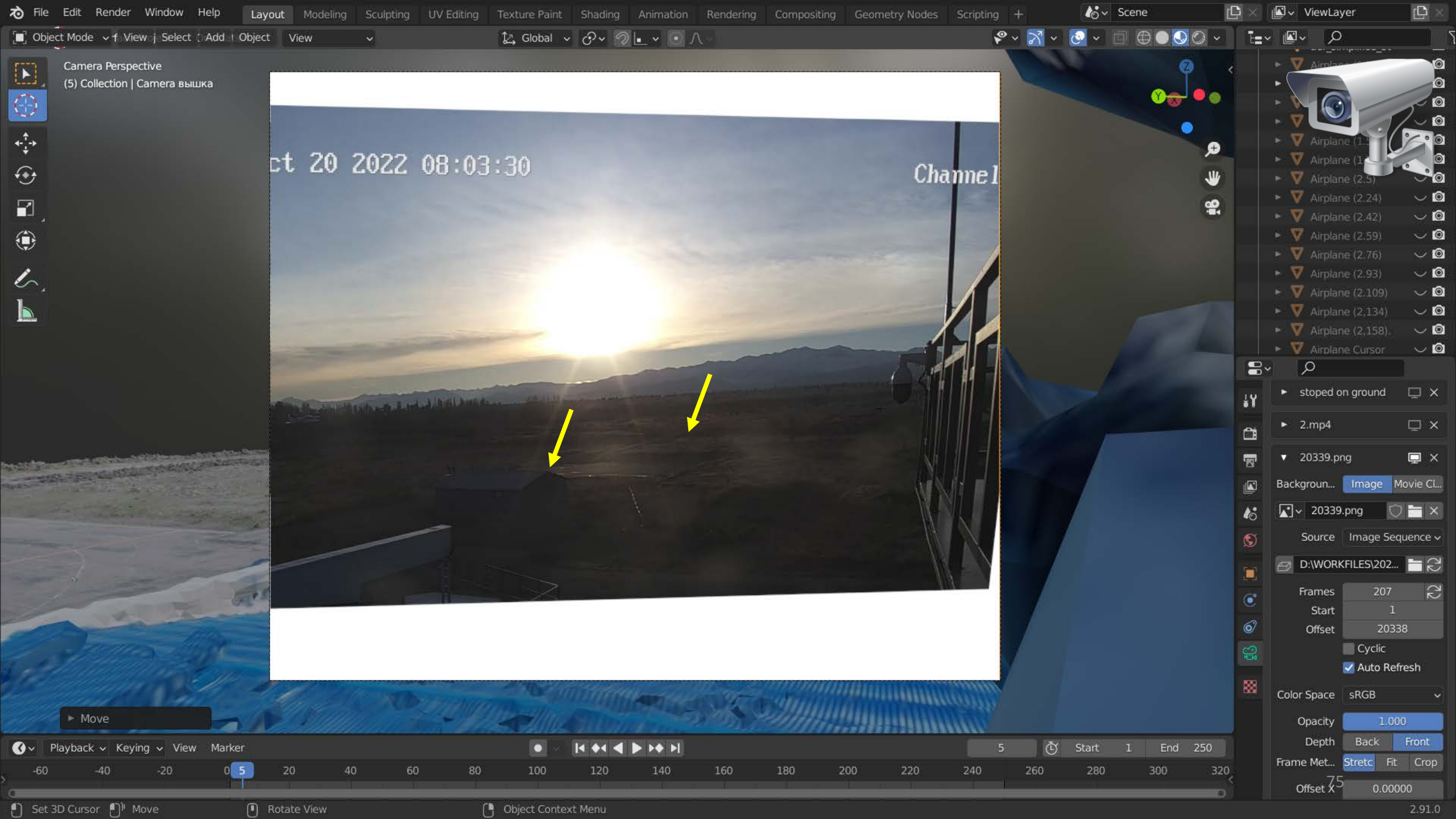
10:57:15,25
Boundary conditions for servo transparency mode
10:57:12,5
Helicopter enters in Servo transparency
Ny = 2.1 Vair = 148 kts
direction of flight
10:57:06


Google Earth
Image © 2023 Maxar Technologies
Место АП
13
31
N
300 m


Место АП
1
2



1506 Photos


File Edit Render Window Help
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Airplane Cursor
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Rotate View
Object Context Menu
2.91.0


File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting
Scene
ViewLayer
Object Mode View Select Add Object
View
Global
Camera Perspective
(5) Collection | Camera вышка
Airplane (2.5)
Airplane (2.24)
Airplane (2.42)
Airplane (2.59)
Airplane (2.76)
Airplane (2.93)
Airplane (2.109)
Airplane (2,134)
Airplane (2,158)
Airplane Cursor
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Set 3D Cursor
Move
Rotate View
Object Context Menu
2.91.0

CONCLUSION

- RISING NUMBER OF ELECTRONIC DEVICES ONBOARD OF AIRCRAFT AND INCREASING COMPLEXITY OF MICROELECTRONICS CAUSE AN INVESTIGATION COMMUNITY TO SEEK FOR A RESPONSE TO THE GROWING DEMAND ON METHODS AND TECHNICS WHICH CAN ALLOW TO RECEIVE THE DATA NEEDED. **THESE TECHNOLOGIES SEEM TO BE SOON AN ESSENTIAL PART OF AIB LABORATORIES**.
- THE PRESENTATION DEMONSTRATED IAC'S EXPERIENCE IN CREATING NEW HIGH-TECH COMPETENCIES FOR RECOVERING FLIGHT DATA FROM NON-STANDARD DATA SOURCES. **RESULTS OF IMPLEMENTATION OF THESE COMPETENCES INCREASES THE EFFICIENCY AND ACCURACY OF THE INVESTIGATION AND SOMETIMES CAN COMPLETELY CHANGE ITS COURSE**.
- IT IS ALSO NECESSARY TO EMPHASIZE **THE IMPORTANCE OF EXPANDING COOPERATION AND EXCHANGE OF EXPERIENCE BETWEEN AIBS LABORATORIES** IN THE FIELD OF HI-TECH FLIGHT DATA RECOVERING IN THE FRAMEWORK OF PROVIDING ACCIDENT INVESTIGATIONS

THANK YOU!

INTERSTATE AVIATION COMMITTEE

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