A Facility Maintenance
– Disaster resilience challenges at KEK–

KEK Computing Research Centre (KEK CRC)
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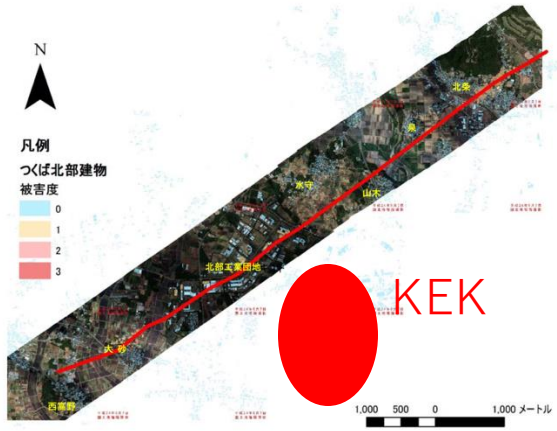
BACKGROUND

- We are facing various situations as follows:
  - Recent natural disasters that cause significant damage.
  - In Japan, many natural disasters happen every year.
    - Earthquake
    - Typhoon/Tornado
    - Cyber attacks or threats (Ransomware etc..)
- We should consider and countermeasure against above these situations.
- Especially, power outage and recent works in our centre will be focused on.

The damage of Great East Japan Earthquake

The state in Hojo area after the disaster



Estimated route of the tornado near KEK

BBC

Personal data potentially stolen in Asahi cyber-attack

7 days ago

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Connie Bowker

Asahi was forced to halt beer production after an attack hit its ordering and delivering systems

Personal data may have been stolen in the ransomware attack that forced Asahi to halt beer production, the company has said.

Japan's biggest brewer was forced to pause operations at most of its 30 factories in the country after a cyber-attack late last month disrupted everything from beer shipments to its accounting system.

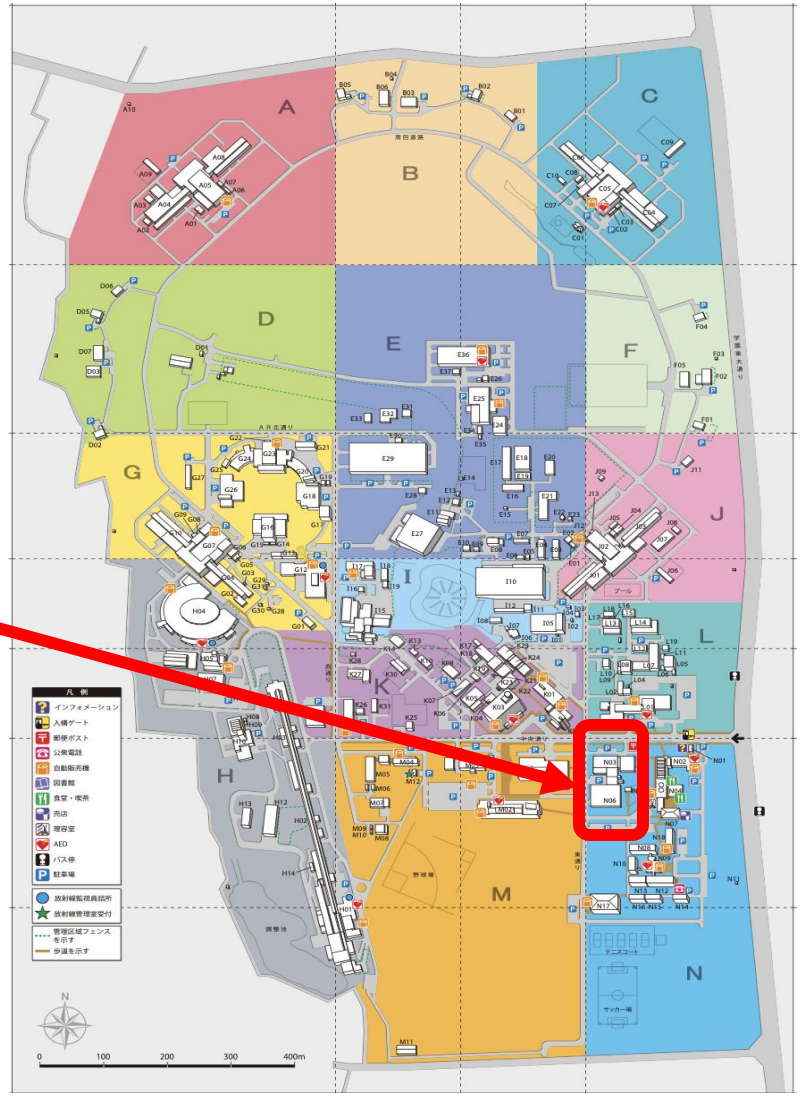
All of Asahi's facilities have now partially reopened and restarted production but computer systems remain down, meaning orders are being processed using pen, paper and fax machines.

In a statement on Tuesday, Asahi said it was investigating whether personal information was stolen in the attack.

Source:
https://www.city.tsukuba.lg.jp/kurashi/anshin/tatsumaki/1000688.html
https://www.city.kitaibaraki.lg.jp/docs/2020031000037/
https://www.bbc.com/news/articles/c0rpwk51qxro
https://www.gsi.go.jp/common/000076291.pdf

Our Department Overview

- Regarding Facility Development
  - Mission: Maintaining the infrastructures to operate Computing Research Centre's services such as KEKCC, campus network and so on smoothly.
  - Scope:
    - Computing Research Center North Building
    - Computing Research Center South Building
  - Our responsibility:
    - Periodical inspections (UPS & card readers)
    - Power supply by generators during scheduled power outage
    - Maintaining the cooling system.



Facility Management Scope

- Basic Management Policy
  - If equipment falls, shut it down.
  - Repair as soon as possible.
  - Prioritize services according to importance.

    ※ Preventive maintenance is occasionally performed.
- Maintenance
  - Regularly, inspecting equipment, e.g., UPS, and card reader.
  - Equipment upgrades in conjunction with the renewal of large-scale computers and systems.
  - Repairs based on a comprehensive plan

Power

- System power is supplied either directly from commercial sources or via UPS.
- UPS power supply:
  - Purpose:
    - Power supply during scheduled maintenance or power outages.
    - Shut the system down safely upon a sudden blackout.
  - Roles
    - For KEKCC and other large systems
      - UPS1（200kVA）
        - It began operations in 1994.
        - Its base unit, surrounding units and batteries replaced the end of JFY2024.
      - UPS2（200kVA）
        - It began operations in 1996.
        - Its base unit and batteries replaced the end of JFY2017.
    - For campus network and email etc…
      - UPS3, UPS4, UPS5(approx. 40kVA)
        - It began operations around 2005.

Availability Maintenance Initiatives

- **Updating Automatic Operation Boards of Facility**
- **Resolving Low-frequency Noise Pollution**

Updating Automatic Operation Boards of Facility

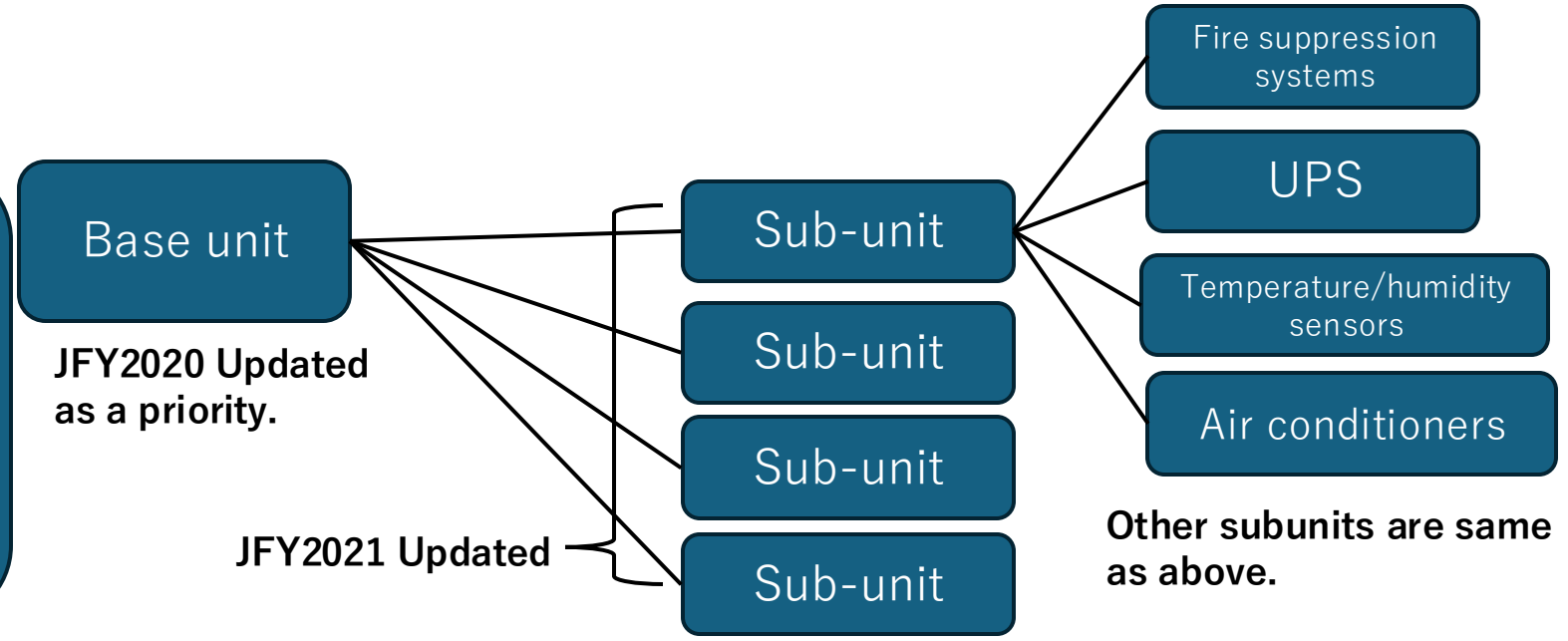
Maintained Availability !!

- Automatic Operation Board (AOB)
  - Continuous monitoring of the operational status (including faults) of fire suppression systems, UPS units, and temperature/humidity sensors.

Situation we find ourselves in

The entire AOB system was suffering from severe ageing in 2020.

A critical single point of failure existed: If the base unit failed, all subordinated systems lost their abnormality detection capability.



Pictures of AOB

Base unit

Visual and audible alerts are activated when abnormal conditions are detected.

Sub-unit

Updating Automatic Operation Boards of Facility

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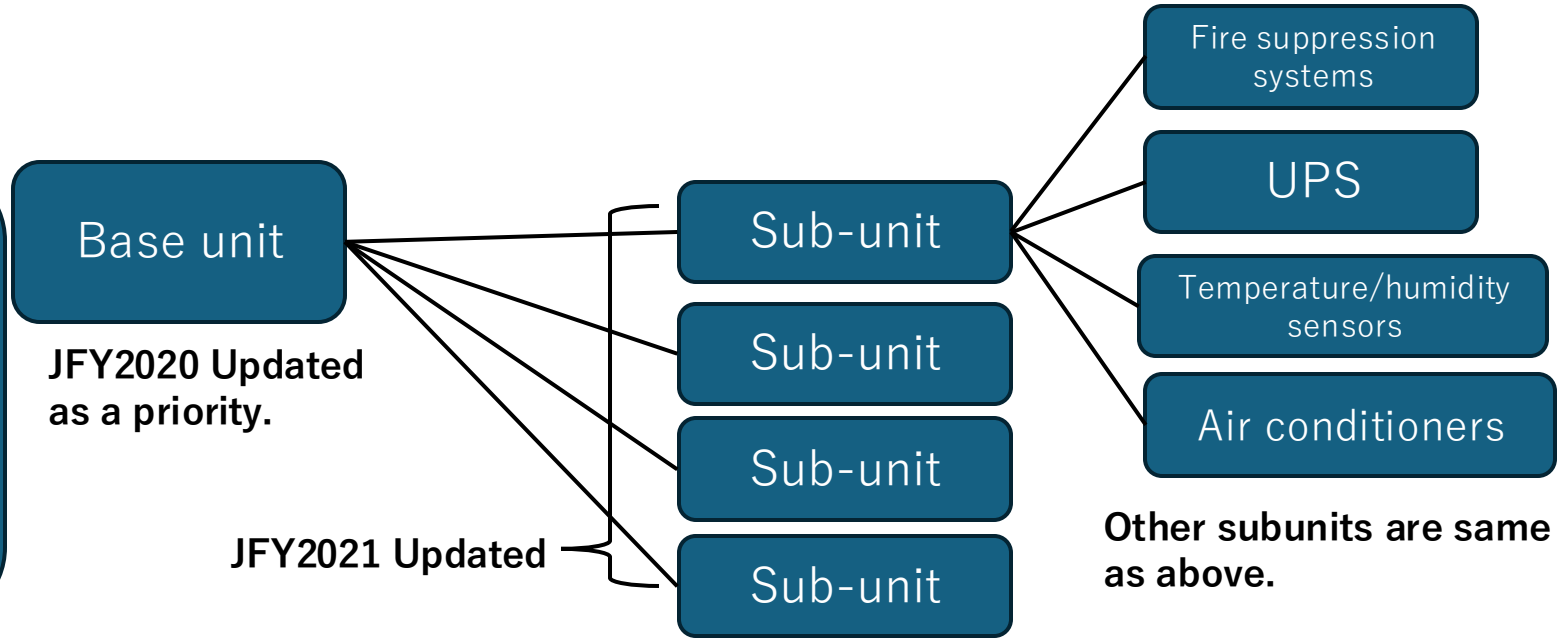

Resolving Low-frequency Noise Pollution

Some operators complained of feeling unwell in summer 2024.

This issue seriously affected human health, causing symptoms, e.g., dizziness and headaches.

No symptoms when two fans on the ceiling stopped.

Noise around the power station and working space which they work were measured.

Two fans were replaced summer 2025.

They handle inquiries regarding the Computing Research Center's services.

Maintained Availability !!

BCP in KEK

- **Purpose and Assumption**
- **Information system in BCP**

BCP Framework in KEK

- KEK has formulated its Business Continuity Planning.
  - Purpose of formulation:
    - Fulfilling as world leading research platform
  - What we should do:
    - Specifying emergency work.
    - Measuring, securing and allocating the resource in advance.
  - Assumption:
    - If we had an earthquake like the Great East Japan Earthquake (311 in 2011) in Tsukuba city.

1. Purpose of Establishment of Business Continuity Planning and its Basic Policy

(1) Purpose of Establishment of Business Continuity Planning

High Energy Accelerator Research Organization (hereinafter referred to as "KEK") has been pursuing joint use and collaborative research by providing the advanced research facilities to users and collaborators in and out of Japan as a world leading research platform of accelerator science.

However, there is a risk that the facilities, manpower and public services taken for granted cannot be used resulting in an unexpected dysfunction due to the large-scale natural disasters such as "The Great East Japan Earthquake" of March 2011 and the tornado disaster in Tsukuba city of May 2012 and a massive network outage such as the spread of computer viruses and cyber terrorism.

Under this situation, the following KEK business continuity planning shall be formulated so that businesses can continue properly, and the obligation imposed on KEK as a world leading research platform can be fulfilled. For that, the highest priority emergency work needs to be specified and measures such as securing and allocating the resources necessary for the execution of the priority work need to be taken in advance.

Regarding J-PARC and Institute of Particle and Nuclear Studies, Wako Nuclear Science Center, each of them keeps collaborating with the related institutes to complete missions.

Source: Business Continuity Planning (KEK)

Information system in KEK BCP

Office Phone, Wireless, Broadcast Facility, Information System

4）Information System

1．After a disaster, as the core information system used by the related departments including the headquarters, there are e-mail system, KEK web system and each business system on Administration Bureau. In case of power outage, these information systems will be temporarily down, which can be a result of a major obstacle in carrying out the emergency priority work including each duty at the headquarters.

2．These Information systems are operated connecting to the KEK network, however the UPS secured for the said network equipment can feed power for about 10 minutes, the operation of the system can be stopped safely during this power feeding.

3．In order to restart the operation of the core information system after a disaster, electric power consumed in Computer South Bldg. and the computer room in Administration Bldg. need to be restricted to the necessary minimum, and it is necessary to feed power to both places from the KEK emergency power generation facility. For this operation, necessity procedures need to be prepared.

4．Since KEK network and the external network have redundancy, even if one line is disconnected, it can be restored in a short time. However, in preparation for an unexpected issue in these lines, securing minimum communication shall be considered. Also, regarding an internal communication in KEK, it is necessary to consider the priority order of recovery and securing of backup route.

5．Data in the server of each business system on Administration Bureau are regularly backed up, however in the event that Administration Bureau and the computer room where backup servers are placed are damaged, since there is a big possibility to lose data, the remote data backup systems are installed. Also, earthquake resistance of installation sites is proceeded.

6．Regarding the system that stores essential data to “priority work” among information system managed by Administration Bureau (for example, KEK user support system needed for safety confirmation, personnel system, integrated authentication system etc.), the countermeasures that will enable preventive measures and prompt recovery shall be considered and implemented.

7．After a disaster, employees at the departments who manage and operate KEK network equipment and core information system shall confirm the damage situation and request the maintenance inspection company to dispatch maintenance engineers, in addition, report the damage situation and the prospect of recovery timely to the headquarters.

8．The headquarters receiving the reports shall discuss with the relevant employees at the departments, and decide which information system should be restored first based on the recovery manual etc. planned in advance.

9．The relevant departments, regarding information system to be restored, shall set a prospect of the recovery method such as tentative countermeasure etc. and report it immediately to the headquarters.

Shut the systems down safely with UPS when a sudden blackout.

Operate the minimum necessary services after a disaster.

Source: Business Continuity Planning (KEK)

What Happened in the Machine Room at the Great Earthquake, March 11th, 2011

- UPS kept systems alive, but chillers went down and temperature in the machine rooms became higher rapidly.
  - At the moment, it was not sure the power supply backed soon.
  - Actually the power-station in KEK was damaged and it didn't back.
- Thus systems were forced to shut down urgently. Although the procedure was not safe, it was unavoidable.
- It is better we could shut those down by safe procedure during UPSs were supplying power.
  - Before starting the shutdown operation, we must secure ourselves because many aftershocks happened at that time.

Lessons Learned

- The mission of facility management is supporting Computing Research Centre's systems smooth operation.
- Contributing to stable and safe operations.
  - Updating automatic operation boards.
  - Resolving Low-frequency noise pollution.
  - Replacement of the AC and the UPS.
- BCP in KEK has already formulated.
  - It is based on the assumption that if we had an earthquake like the Great East Japan Earthquake in Tsukuba city.
  - It mentions that campus network, email and web systems would be stopped safely with UPS after blackout.

Key Message

- Engagement in work with the following beliefs.
  - If we are well-prepared in advance, we could manage any serious disruption.
    - 備えあれば憂いなし (Proverb in Japanese)
  - Address issues based on lessons learned from past events.