SnT 2025
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE
8 SEPTEMBER ONLINE DAY
9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE

PTS-805

# The development of a long term strategy for the sustainment of the International Monitoring System

Xyoli Perez Campos, Michelle Grobbelaar

Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO)

CTBTO PREPARATORY COMMISSION | PUTTING AN END TO NUCLEAR EXPLOSIONS

Presentation Date: 11 September 2025

# The development of a long term strategy for the sustainment of the International Monitoring System

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To ensure a **high quality**, **authenticated** and **secure detection** network and an assured **flow of data**, a comprehensive assessment of the **long-term sustainment** requirements of the IMS Network, looking prospectively from 2026 onwards for a twenty-year period was developed.

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## Diagnosis of current situation

**Sources within the PTS**

- DOTS: equipment inventory & history
- IRS (IMS Reporting System)/PRTool/SOPET(PCA)/JIRA: station behavior, problem reports, failure analysis
- SAP: financial data, expenditure history

**Sources outside the PTS**

- Station operators: IMS and other networks, infrastructure data, questionnaires
- Other network managers (e.g. Geoscope, USGS/SCSN)
- Equipment manufacturers: technology refreshment plans, expected lifetime

**Data identification and information management**

- Estimation of life cycle per technology
- Various statistics
- Predictability of problems/failure

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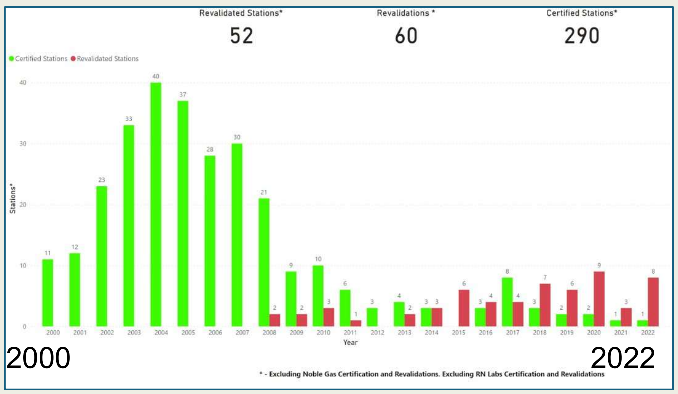
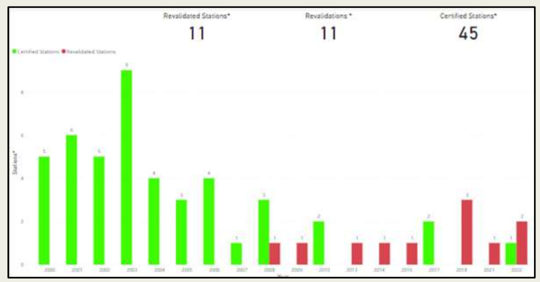
## Diagnosis of current situation

**<u>Total</u>** number of:
certifications ( ▮ ) and
revalidations ( ▮ ) per year



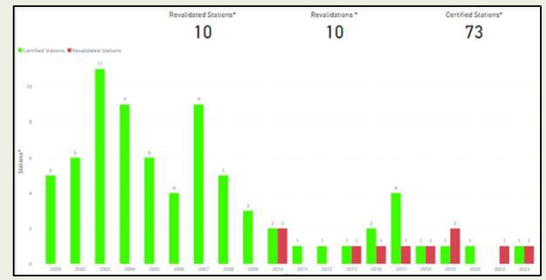

- ❑ Differences among technologies

### Primary seismic stations



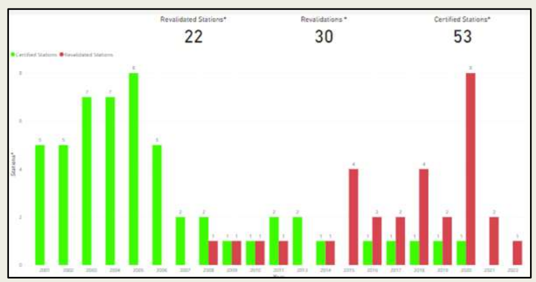

2000 2022

### Radionuclide (Part.) stations



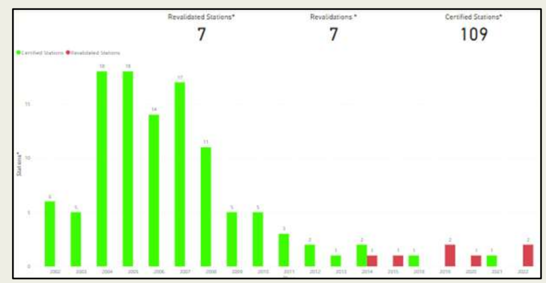

2000 2022

### Infrasound stations




2000 2022

### Auxiliary seismic stations

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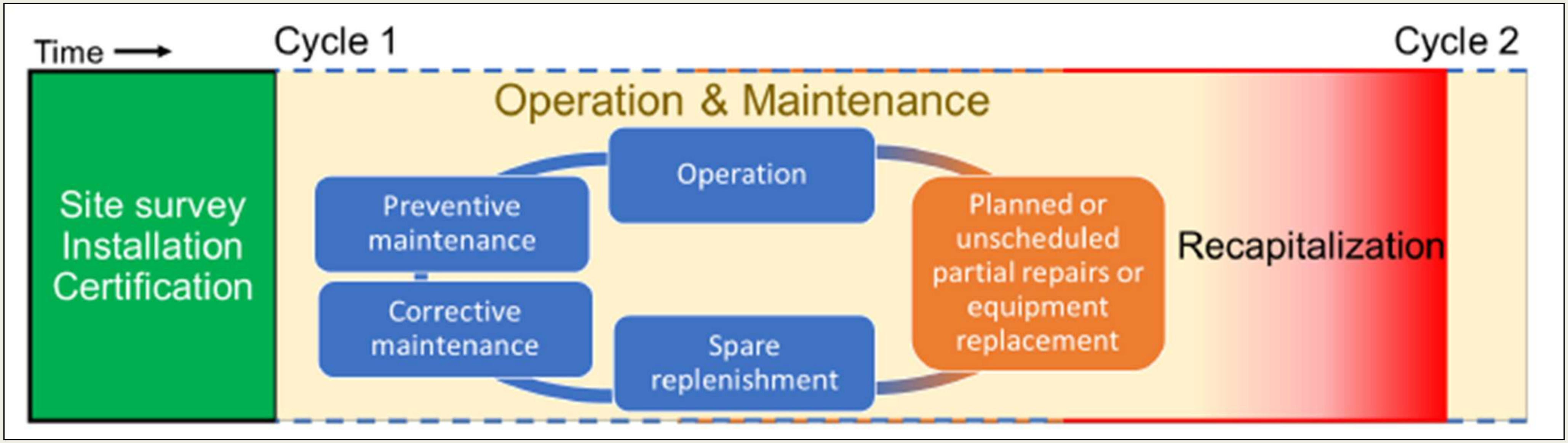
# Life cycle



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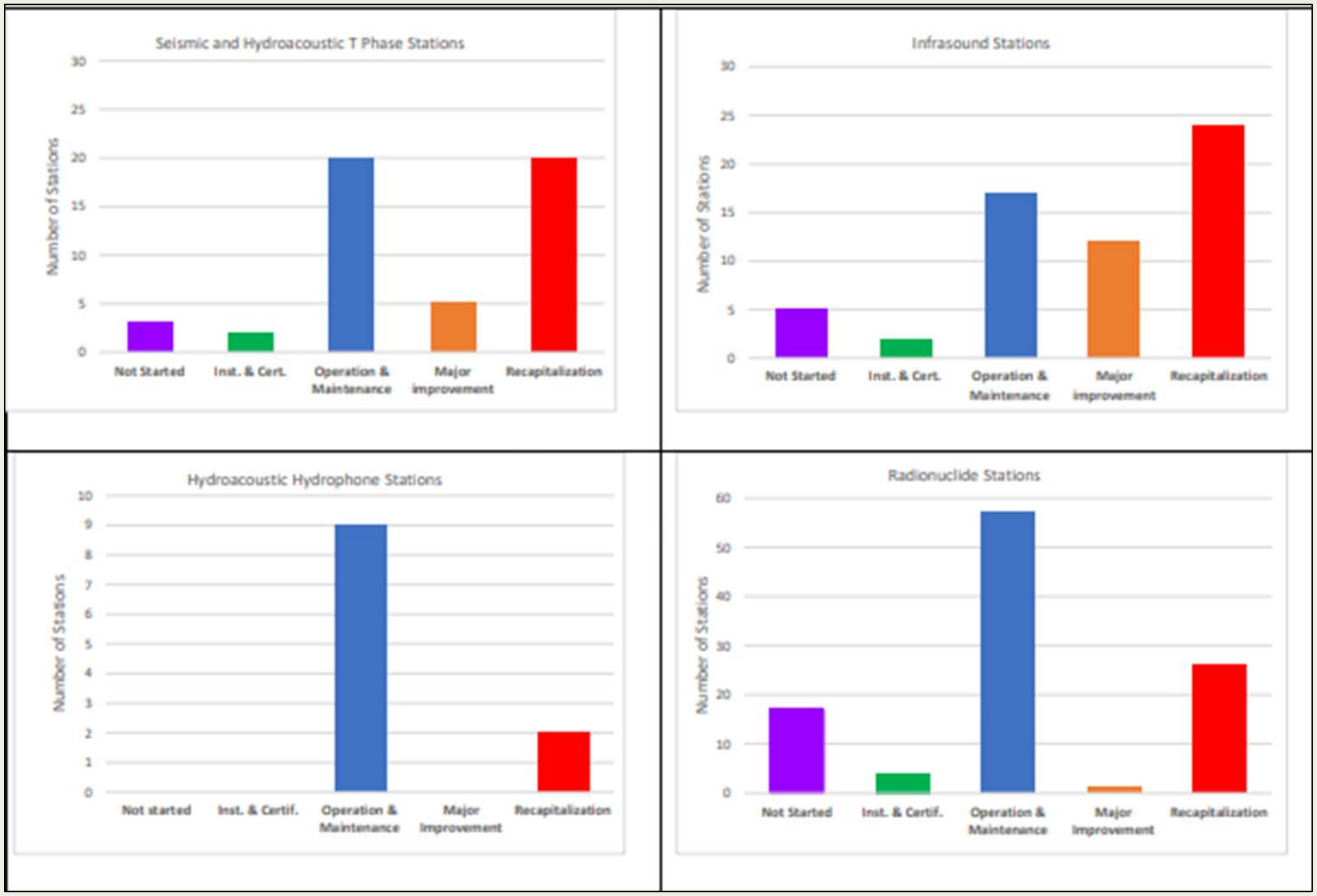
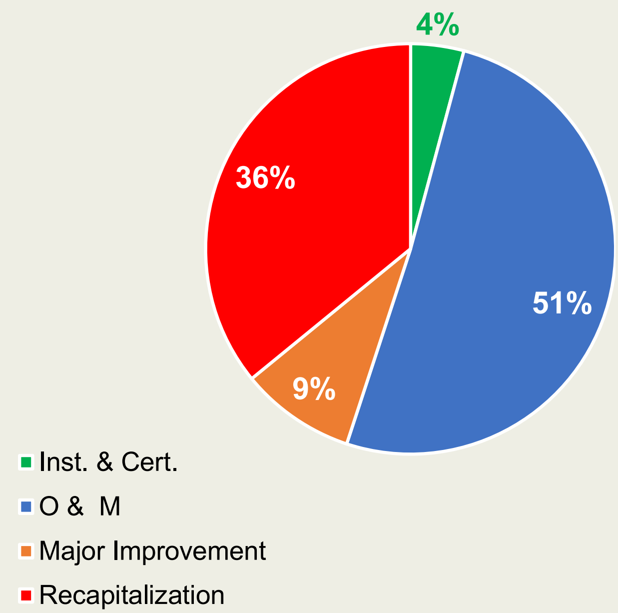
## Stage of IMS stations lifecycle



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## Lifespan of subsystems

- Technology specific identification of **functional components.**
- **Comprehensive estimates** of the lifespans of technological station subsystems:
  a) Equipment lifespans provided by **manufacturers** (when available)
  **b) Obsolescence** and **technological foresight**
  **c) Failure analysis** (gained from past 20 years of operating the IMS)
  d) Feedback from **station operators** (SOs)
  e) Capability of **equipment repair** and strategic decisions on type of equipment used across the network (standardization)
  f) Careful **balance** is sought between maintenance cost and cost of the replacement of the technological station subsystems.
- **Estimated lifespans** of equipment used to obtain **average costs** for subsystems.
- Operating equipment until failure is <u>not recommended</u> (high risk of prolonged zero data availability).

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# Risk of No Action
## Delay in sustainment actions: Impact

- **Equipment** at many IMS stations has reached (or will soon) the **end of service life.** Equipment is becoming **obsolete**.
- **Spare parts** for ageing equipment are becoming increasingly **scarce**, with available stocks running low.
- **Infrastructure** is also **ageing** and needs to be replaced more frequently.
- A delay will have a **knock-on effect** across the network resulting in the reduction of the stations' **mission capability** and the **coverage** of the IMS Network.
- The IMS Network will **no longer** be capable to **perform** at the level that it was originally designed to achieve.
- **Authentication of data** may become **compromised**, jeopardizing the value and **confidence** that the data provides for **detection** and eroding confidence in global peace and security.

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## Main Identified Risks

Inability to deliver a global verification regime to monitor compliance with the comprehensive ban on nuclear explosions

One very clear mitigation strategy will be for the PTS to rely more heavily on the national means and voluntary assistance (both in-kind and financial).

| | |
|---|---|
| | Quality of IDC products |
| 1 | Decreased percentage of events in the reviewed event bulletin (REB) for which the area of the location error ellipse is less than 1,000 km² |
| 2 | Missing events of importance due to decrease of data availability (reduced number of detections and associations) |

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# Main Identified Risks

| | Mission capability/ Data availability/Network coverage |
|---|---|
| 3 | Limited capability to implement any plans/strategies. |
| 4 | Increased frequency of subsystem failure. |
| 5 | Future lack of specialized suppliers. |
| 6 | Lack of available spare parts for procuring. |
| 7 | Lack of cybersecurity protection from disruptive new developments (e.g. quantum computing) that may compromise data surety. |
| 8 | Increase cost of maintenance of obsolete equipment. |
| 9 | Run away cost due to delay maintenance or recapitalization |
| 10 | Simultaneous station failures due to similar ages and/or environments. |
| 11 | Loss of expert knowledge in engineering and development |
| 12 | Limited ability to address catastrophic failures. |
| 13 | Increased number of stations going through long periods of non-mission capability. |
| 14 | Decreased global detection coverage. |
| | Environment/Climate |
| 15 | Impact of Environmental and Climate Change on IMS Station |

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# Conclusions

- Current state of the IMS network has been technically assessed with a comprehensive methodology.
- Cost estimation to address the technical needs suggests a critical funding gap.
- Updating the funding strategy is urgent.

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# Thank you