

Enabling of Mass Flow Metering for Bunkering in Singapore

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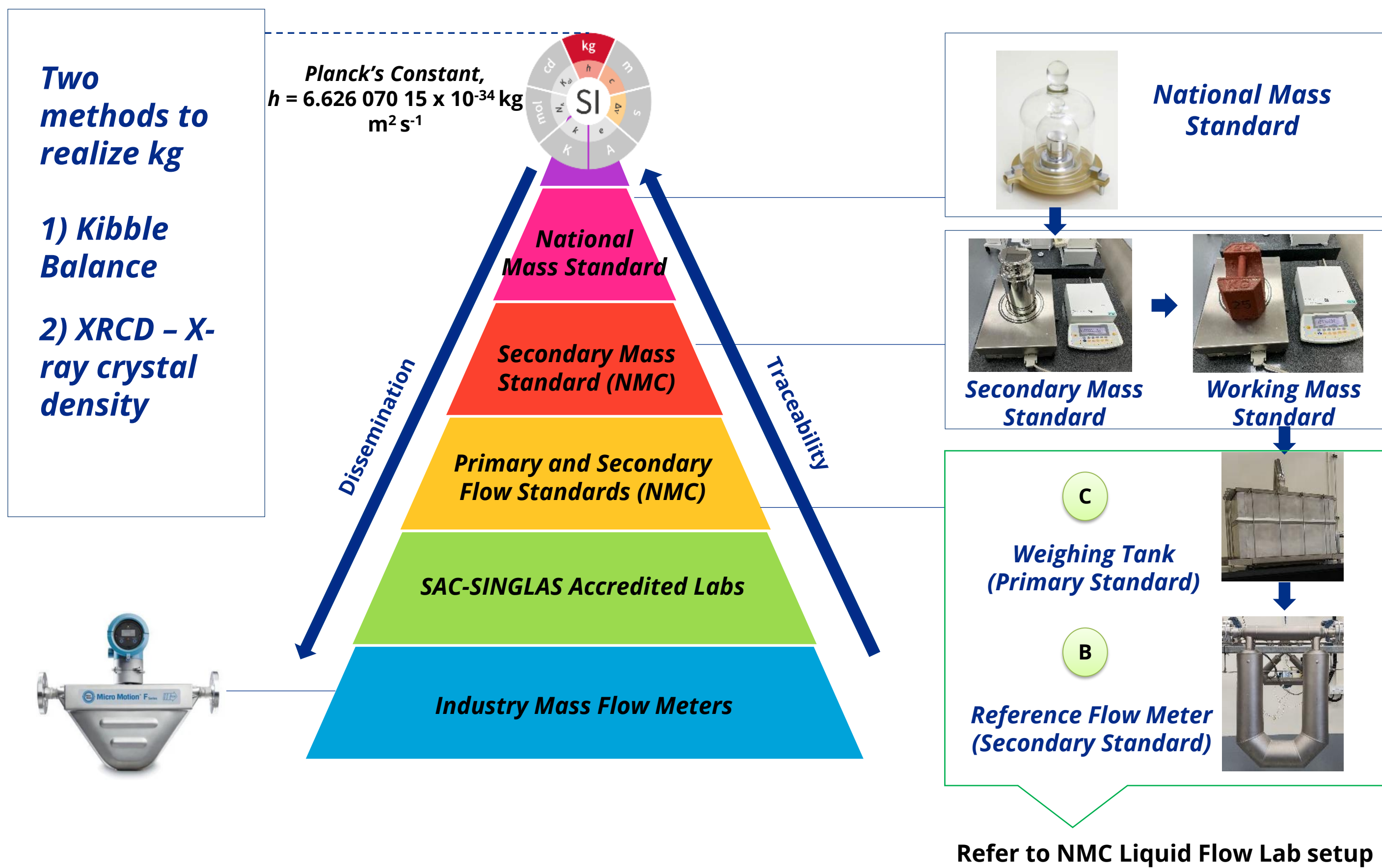
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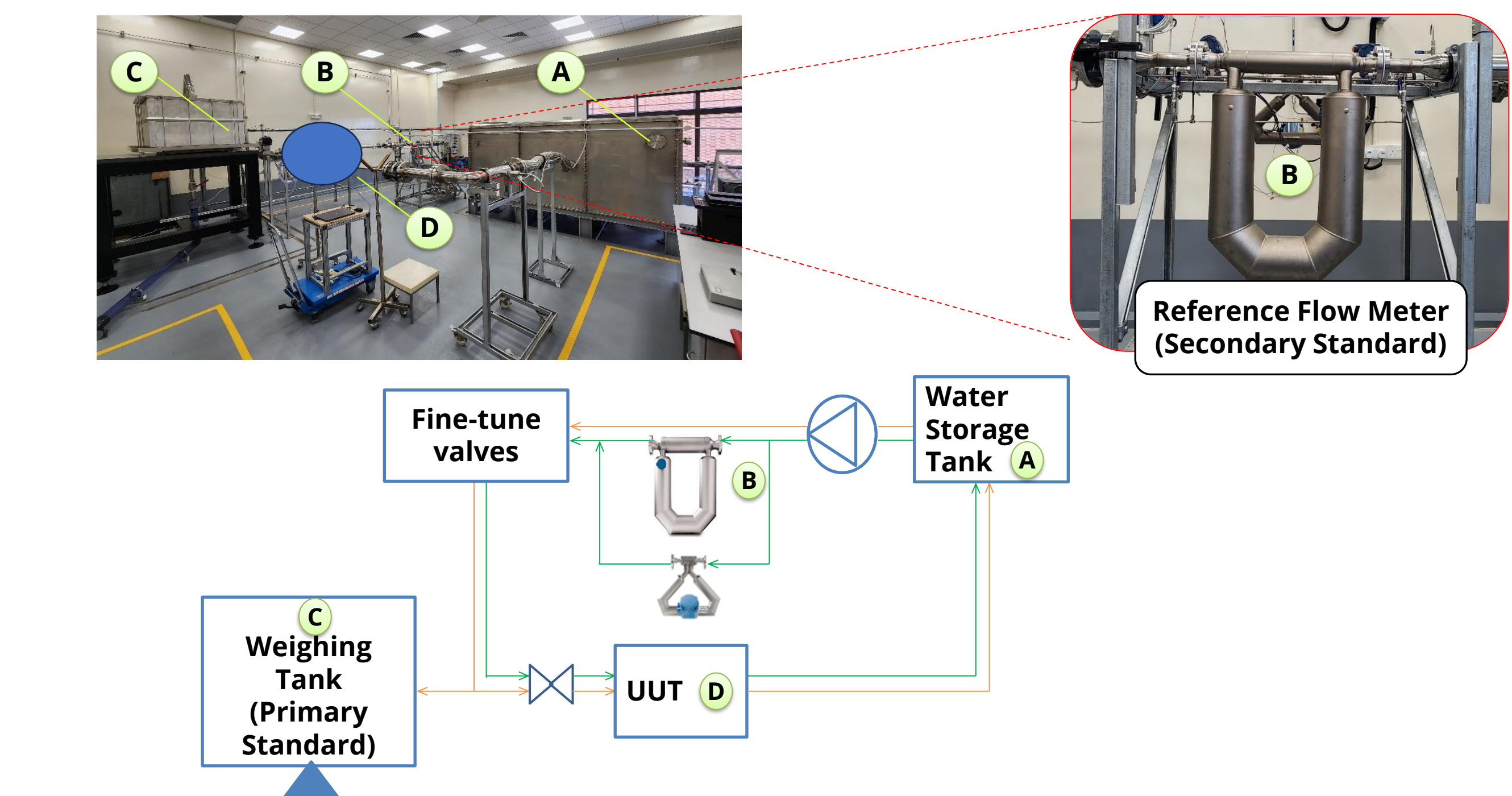
Introduction

- Singapore (SG) is the world's top bunkering hub
- Singapore (SG) sets a global benchmark by implementing mass flow metering (MFM) systems for custody transfers.
- The National Metrology Centre (NMC) works with the Maritime and Port Authority of Singapore (MPA) and industry stakeholders to implement mass flow metering (MFM) capabilities.
- MFM systems replaced the outdated tank gauging method, ensuring greater accuracy and transparency in bunkering operations.
- Singapore (SG) is the first bunkering port to officially implement MFM for custody transfers, improving operational efficiency and fostering trust in the industry.
- For an annual bunker sale of conventional fuel about **54.92 million** metric tonnes in approximately **US\$33 billion** industry, an error of ~0.5% could lead to potential discrepancy about 274,600 metric tonnes or approximately **US\$165 million** in sales^{1,2}.

Traceability of Flow Metrology in SG



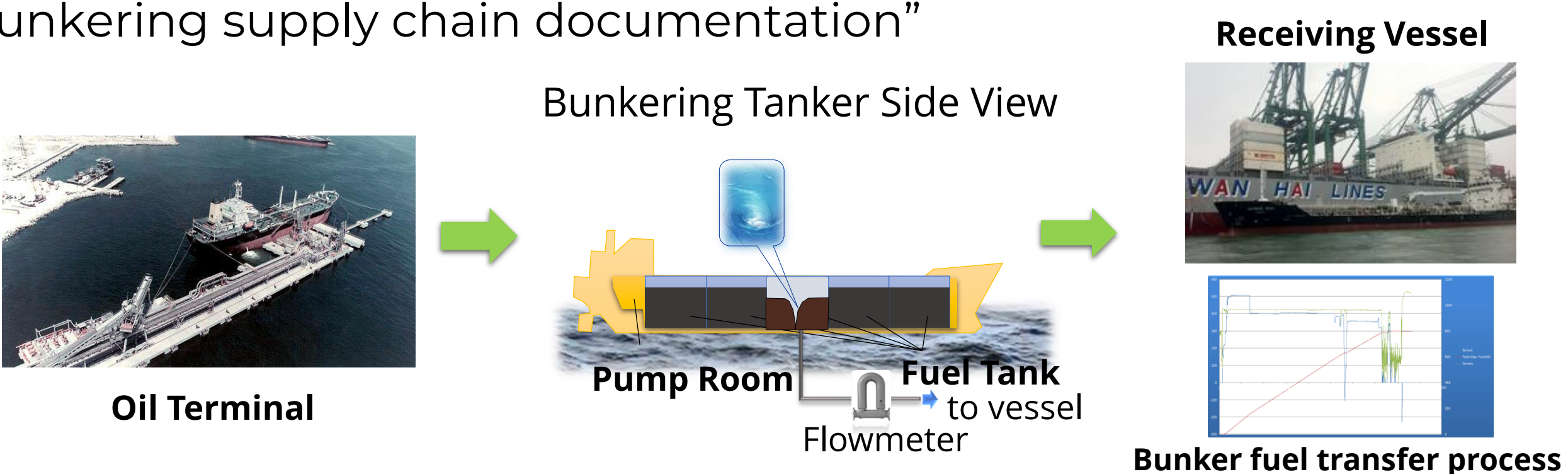
NMC Liquid Flow Lab



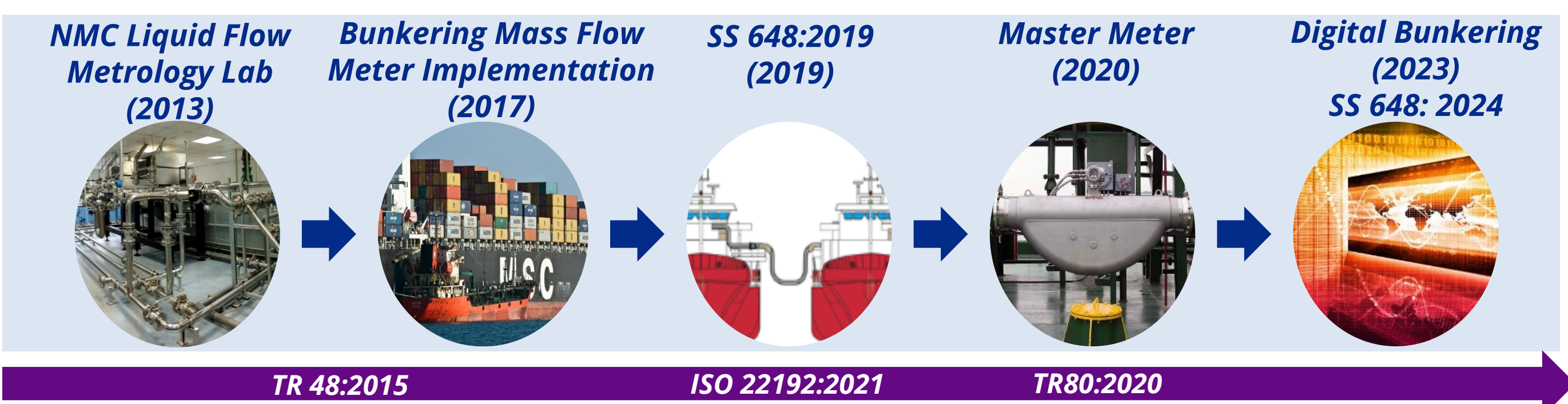
- NMC established the National Liquid Flow Laboratory to provide robust traceability for mass flow meters in 2013.

NMC's Contributions in SG Bunkering

- Technical Committee (TC) member for the world's first Technical Reference **TR48: 2015**³ "Technical Reference for Bunker Mass Flow Metering"
- Working Group (WG) member for Singapore Standard **SS660: 2020**⁴ "Code of practice for bunker cargo delivery from oil terminal to bunker tanker using mass flow meter"
- TC member for Technical Reference **TR80: 2020**⁵ "Technical Reference for Meter Verification using Master Mass Flow Meter"
- Co-convener for **ISO 21562: 2020**⁶ "Ships and marine technology — Bunker fuel mass flow meters on receiving vessel — Requirements"
- TC Member for **ISO 22192: 2021**⁷ "Bunkering of marine fuel using the Coriolis mass flow meter (MFM) system"
- TC / WG members for Singapore Standard **SS648: 2024**⁸ (first edition, 2019) "Code of practice for bunker mass flow metering"
- TC member for Singapore Standard **SS709: 2024**⁹ "Specification for digital bunkering supply chain documentation"



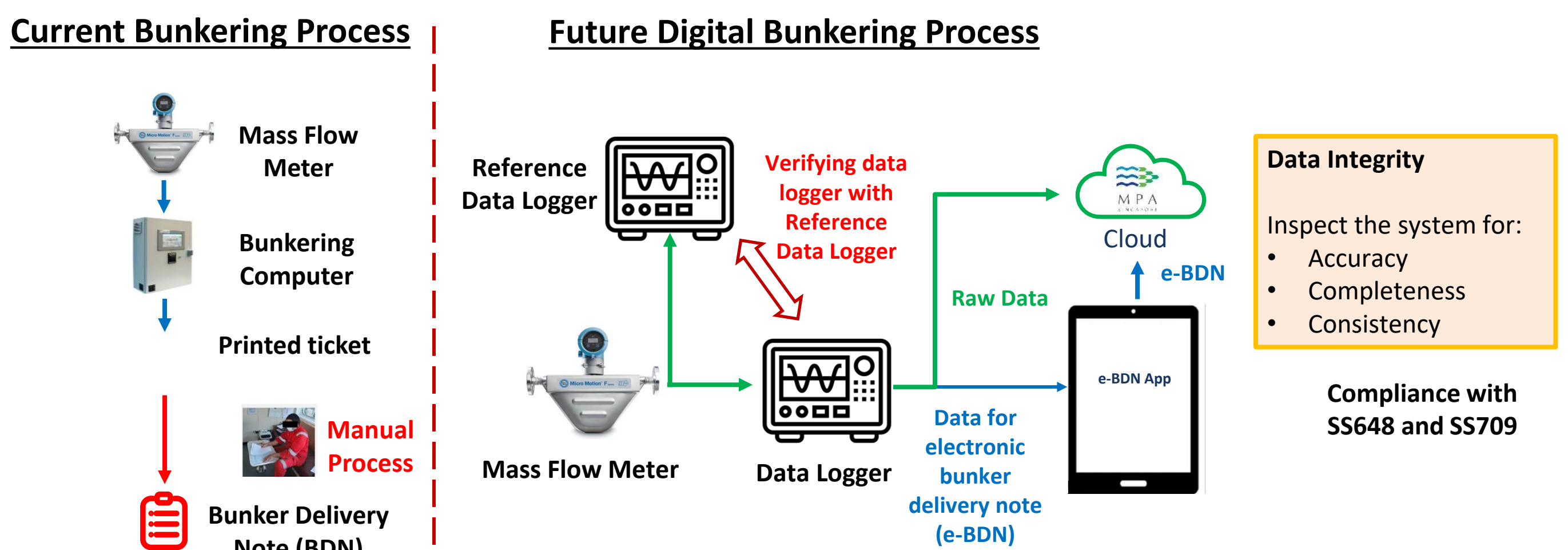
Timeline for MFM Implementation and Standard Development for SG Bunkering



Moving Forward for SG Bunkering

1. Digital bunkering

- NMC is working with MPA to develop a methodology to verify the data integrity of the digital bunkering system to further enhance transparency of bunkering in Singapore.
- TC / WG members for SS648 and SS709 on e-BDN requirements



2. Low-carbon fuel bunkering

- Quantity measurement
- Safety consideration¹⁰
- Standard development:
 - WG member for new Technical Reference **TR129:2025** on Methanol bunkering (Launched in **Mar 2025** officially¹¹)
 - WG member of new Technical Reference on Ammonia bunkering

References

- ¹ Bunkering Statistics | Maritime & Port Authority of Singapore (MPA)
- ² <https://shipandbunker.com/prices/apac/sea/sg-singapore>
- ³ TR48: 2015. Technical Reference for Bunker Mass Flow Metering
- ⁴ SS660: 2020. Code of practice for bunker cargo delivery from oil terminal to bunker tanker using mass flow meter
- ⁵ TR80: 2020. Technical Reference for Meter Verification using Master Mass Flow Meter
- ⁶ ISO21562: 2020. Ships and marine technology — Bunker fuel mass flow meters on receiving vessel — Requirements
- ⁷ ISO22192: 2021. Bunkering of marine fuel using the Coriolis mass flow meter (MFM) system
- ⁸ SS648: 2024. Code of practice for bunker mass flow metering
- ⁹ SS709: 2024. Specification for digital bunkering supply chain documentation
- ¹⁰ ZM He, Y Zeng, SC Ye, D Shia, J Wu, etc., Experimental investigation of cryogenic leaks during transferring operations. Journal of Loss Prevention in the Process Industries. V 94 (2025) 105505.
- ¹¹ <https://www.mpa.gov.sg/who-we-are/newsroom-resources/media-releases?tag=media%20release>



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