

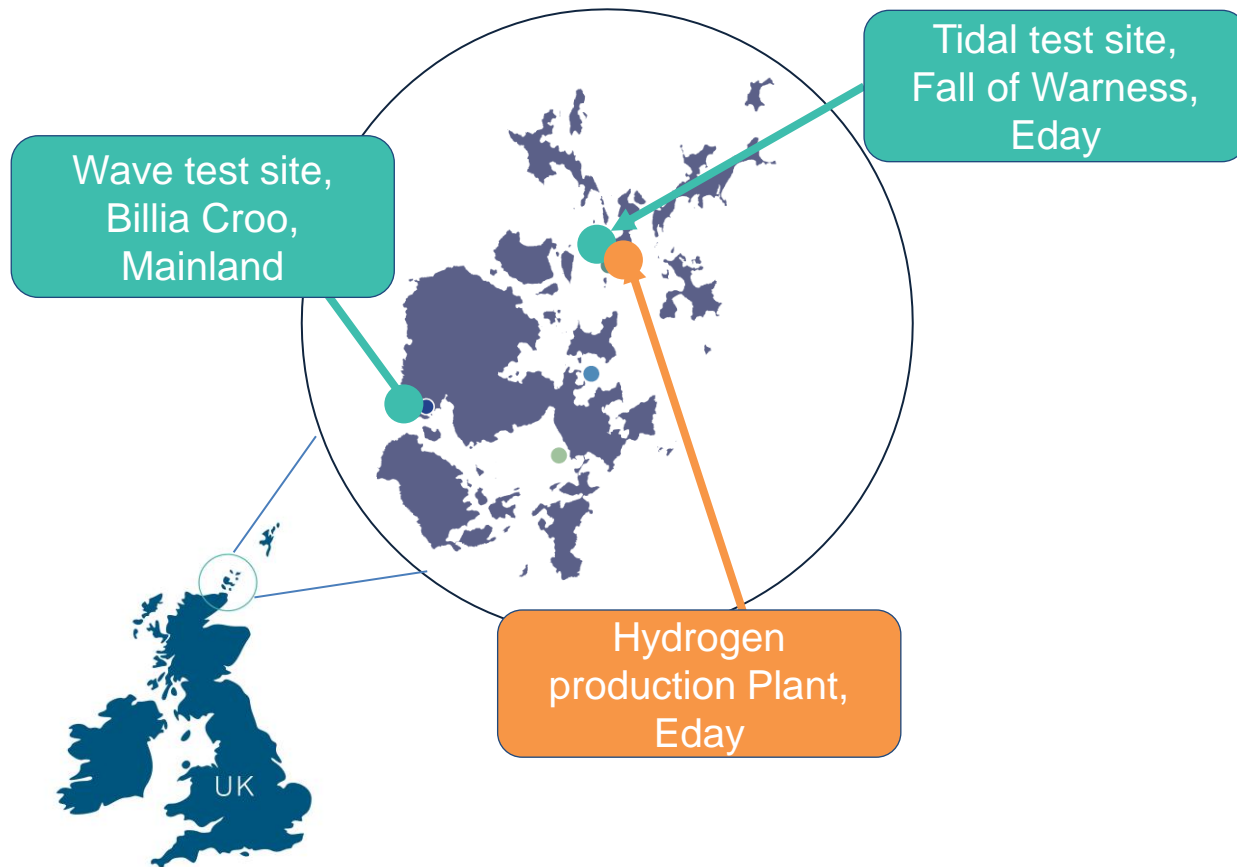


# Ensuring Safe Hydrogen use in an Airfield / Airport

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# Introducing EMEC



# EMEC

HYDROGEN



# EMEC Hydrogen

- 670kW PEM Electrolyser used to generate **Green** Hydrogen
  - Tidal Energy Converters
  - Community Wind Turbine
- 5nr MEGC's transport bulk gaseous Hydrogen around Orkney & Wider UK
- Europe's First ADR Certified mobile hydrogen refuelling system

EMEC HYDROGEN



# HyFLYER I & HyFLYER II

- **Developed** for the **HyFLYER I** project EMEC took ownership of **Europe's first ADR Certified mobile hydrogen refuelling system**
- Immediately deployed at **Cranfield Airport** to support ZeroAvia along with a **4kg/day** transportable **Electrolyser**
- Now transferred to **Kemble Airfield** to support the **HyFLYER II project** the electrolyser has been **upgraded to 10kg/day** and the refueller is being replaced with a larger system



# SATE

- **Test centre** set up at **Kirkwall Airport** to identify next generation of **sustainable aviation technologies**
- Hybrid-electric aircraft, **Sustainable Aviation Fuels** (SAF), Unmanned Aerial Vehicles (UAV) to be tested
- Potential for **hydrogen aviation technologies** and infrastructure to be tested in the future
- Led by **HIAL**, the project brings together a consortium of **aviation industry specialists**, Orkney and Caithness businesses, public sector bodies and academia

EMEC HYDROGEN

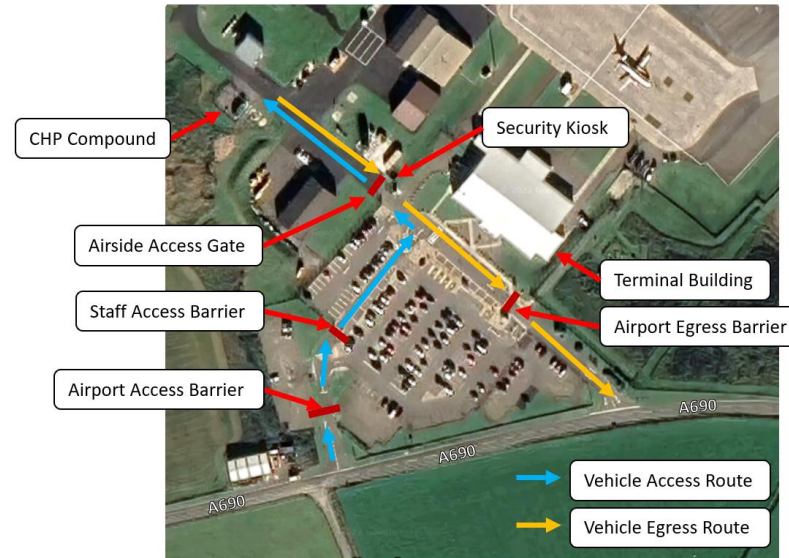


# Other Airfield Hydrogen Projects

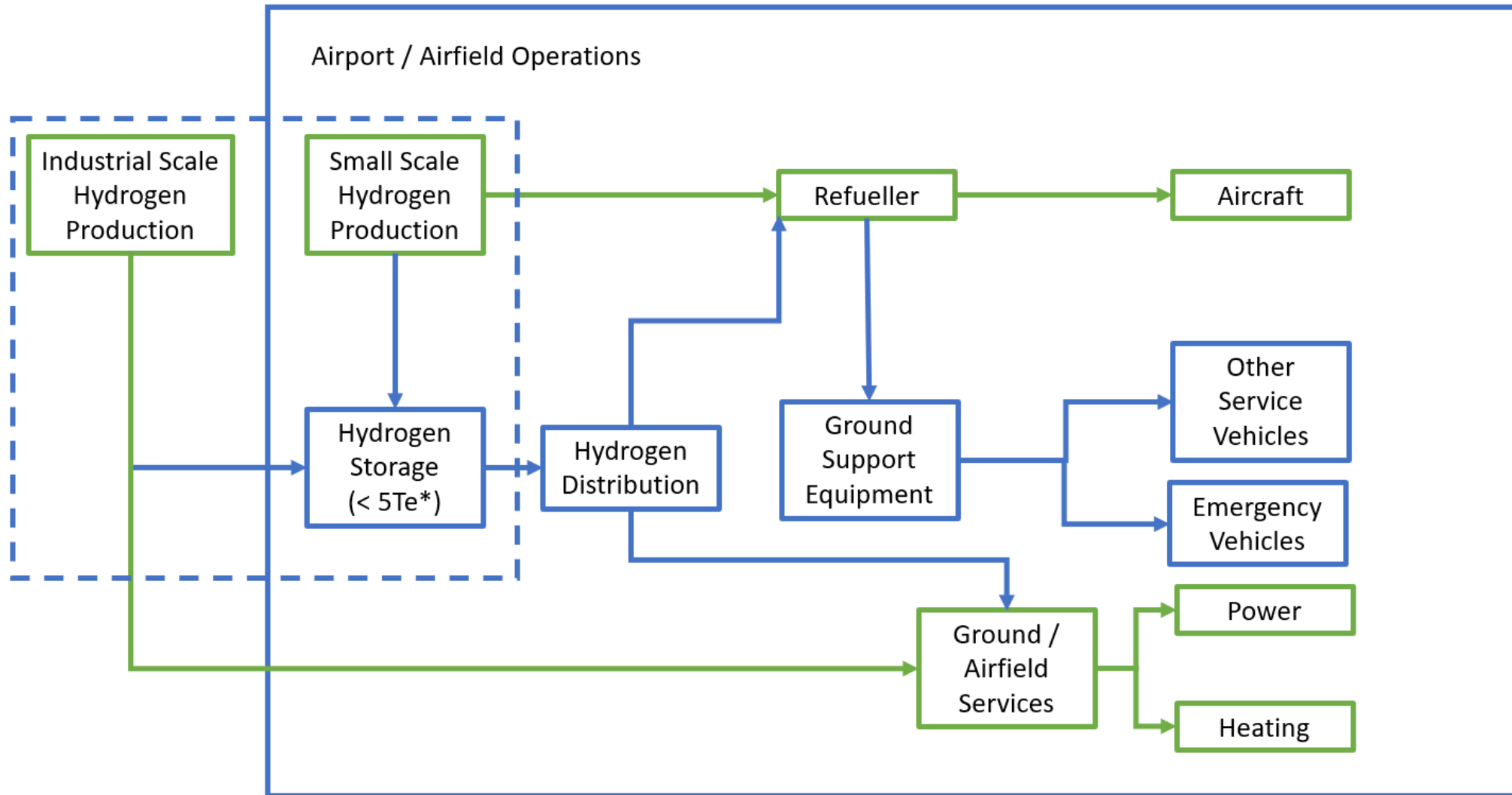
- We are deploying a **2G combined heat and power hydrogen engine** at Kirkwall Airport. The engine will be used to meet energy demand from the airport terminal.



# EMEC HYDROGEN



# Airfield Hydrogen 'Economy'





Informing regulatory evolution




Equipment and technical solutions



Training and working practices

# Refuelling Codes & Standards

- Ground Vehicles
  - **SAE J2601** series Fuelling Protocols
    - J2061 – Light Duty Vehicle
    - J2601-2 – Heavy Duty Vehicle
    - J2601-3 – Hydrogen Powered Industrial Trucks
  - Many other SAE Standards relating to automotive hydrogen fuelling
- Aviation
  - **CAP 748** – Aircraft Fuelling and Fuel Installation Management (withdrawn)
  - **CAP 642** – Airside Safety Management
- Infrastructure
  - **COMAH**
  - **ISO 19880-1**
- Hydrogen Quality
  - **SAE J2719 / ISO 14687:2019**



<b>SURFACE VEHICLE STANDARD</b>		<b>J2601<sup>®</sup></b>	<b>MAY2020</b>
		Issued	2010-03
		Revised	2020-05
		Superseding	J2601 DEC2016

(R) Fuelling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles

SAE J2601 has been revised in order to incorporate an extension of the compressed hydrogen storage system sizes above 245.6 L (+10 kg) for HTD only. Additionally, revisions have been made to clarify certain requirements and to enhance the usability of the protocols, based on field experience.

TABLE OF CONTENTS

1.	SCOPE	5
1.1	Background	5
2.	REFERENCES	6
2.1	Related Publications	6
2.1.1	SAE Publications	6
2.1.2	API Publications	6
2.1.3	CSA Publications	7
2.1.4	FCMCA Papers (Formerly NHA)	7
2.1.5	IEC Publications	7
2.1.6	INDA Publications	8
2.1.7	ISO Publications	8
2.1.8	U.S. Government	8
2.1.9	WE-NET Publications	8
2.1.10	Japan JREC Standards	8
3.	DEFINITIONS	8
4.	ABBREVIATIONS AND SYMBOLS	15
4.1	Abbreviations	15
4.2	Symbols	16
4.2.1	Table-Based Protocol Symbols	16
4.2.2	MC Formula-Based Protocol Symbols	17
5.	GENERAL FUELLING PROTOCOL DESCRIPTION	20
5.1	Performance Goals	21
5.2	Normal Operating Boundaries	21
5.3	Standard Protocol	22

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Web: [https://www.sae.org/standards/content/J2601\\_202005](https://www.sae.org/standards/content/J2601_202005)




Safety Regulation Group

**CAP 748**

**Aircraft Fuelling and Fuel Installation Management**

STATUTORY INSTRUMENTS

**2015 No. 483**

**HEALTH AND SAFETY**

**The Control of Major Accident Hazards Regulations 2015**

Made . . . . . 2nd March 2015  
Laid before Parliament . . . . . 9th March 2015  
Coming into force . . . . . 1st June 2015

The Secretary of State in a Minister designated for the purposes of section 2(2) of the European Communities Act 1972(a) ("the 1972 Act") in relation to measures relating to the prevention and limitation of the effects of accidents involving dangerous substances(b).

The Secretary of State makes these Regulations in exercise of the powers conferred by sections 15(1), (2), 15A, 15B, 15C, 15D, 15E, 15F, 15G, 15H, 15I, 15J, 15K, 15L, 15M, 15N, 15O, 15P, 15Q, 15R, 15S, 15T, 15U, 15V, 15W, 15X, 15Y, 15Z, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 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PD ISO/TS 19880-1:2016



SI Standards Publication

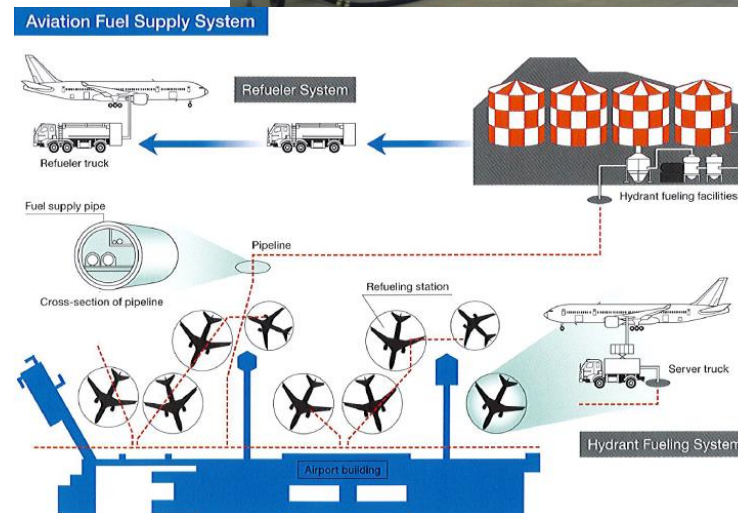
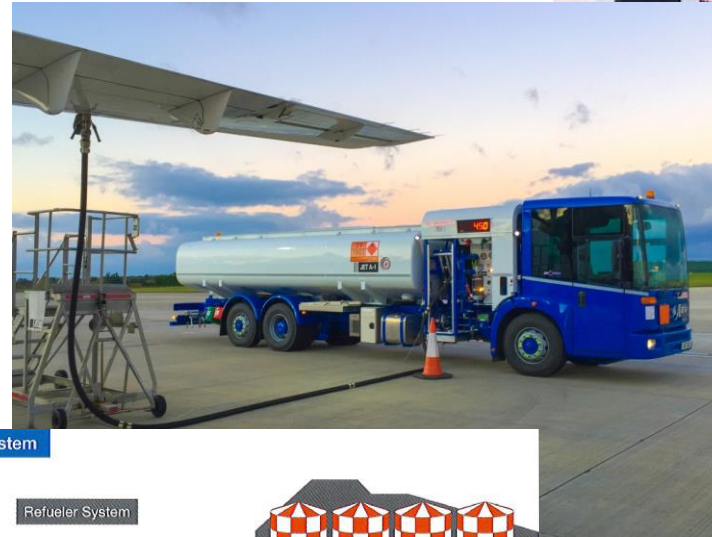
**Gaseous hydrogen — Fuelling stations**

Part 1: General requirements



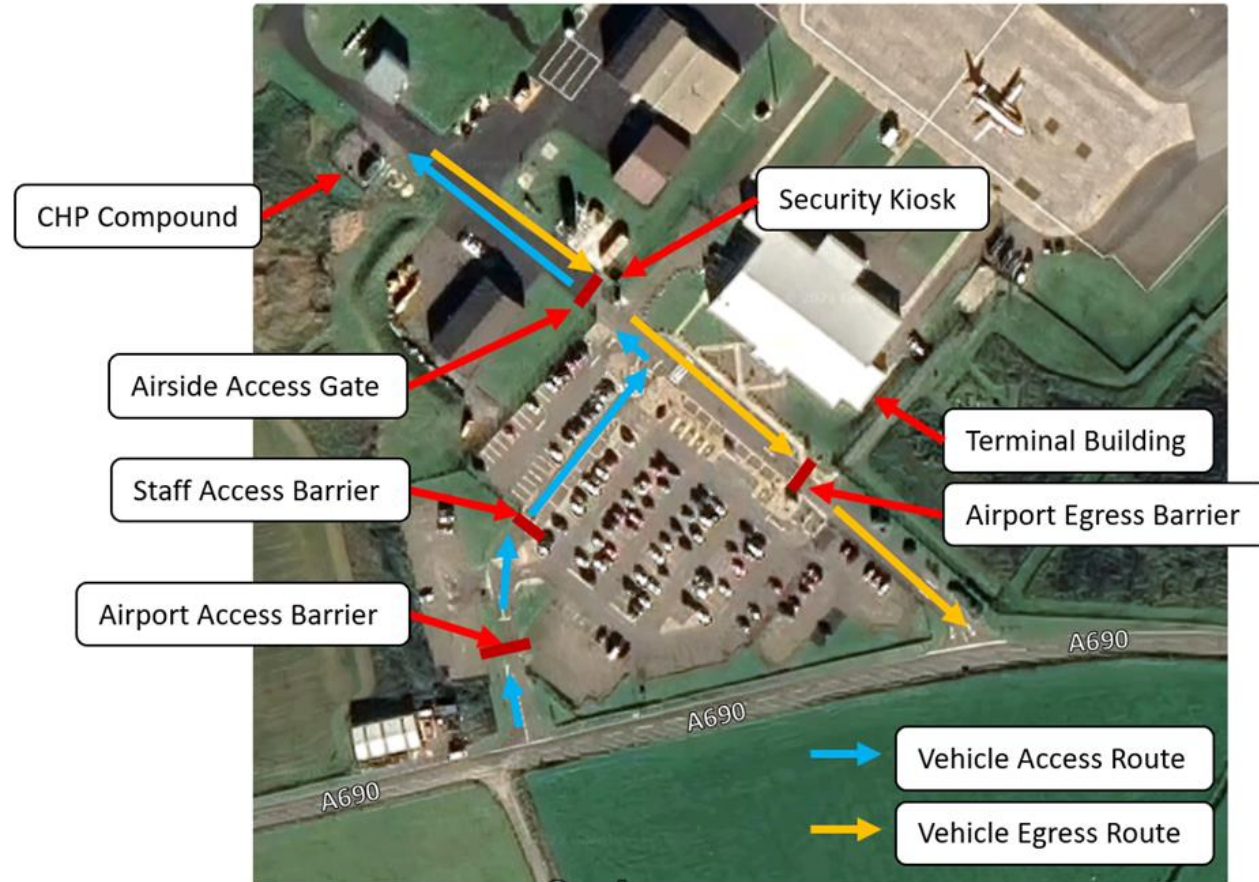
# Aircraft Refuelling

- Bring the Aircraft to the Fuel
  - Fixed fuel pump
    - Smaller General Aviation
- Bring the fuel to the aircraft
  - Bowser / Hydrant
    - Larger Commercial Aviation
- On Site tank farm
  - COMAH Considerations
- Off Site tank farm
  - Piped in fuel



# Airside Access

- Security
  - ID Requirements
  - Permits
  - Staff Availability
- Frequency of Access
  - Restricted time slots
- Insurance
  - Liability Cover level



# Synthetic/ E-fuels

## An alternative 'stop gap' to pure hydrogen

### Synthetic fuel/ e-fuels

- “Aviation gasoline” from Green H<sub>2</sub> & CO or CO<sub>2</sub>.
- Zero petroleum powered RAF flight
- CO/ CO<sub>2</sub> can come from biomass or direct capture

### Advantages and Disadvantages

- Can make huge Carbon savings
- Supports existing technologies
- Cost and availability challenges
- Lots of renewable energy needed
- Carbon questions





Questions?