

GENERAL SESSION

INTRODUCTION OF LABORATORY CONTAINER/VAN TECHNOLOGY

(September 22, 2000)

USAGE AND DESIGN

- DESIGN
- USAGE

PORTABLE VANS ON U.S. OCEANOGRAPHIC RESEARCH VESSELS

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- *DESIGN*
CONTAINERISED MARINE RESEARCH LABORATORIES

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General introduction CKT Projects BV

Structure: member of the ICS-Group (International Container Services) and sister company of Port Container Services (PCS) B.V. with ultimate parent company HAL Investments B.V. (Holland America Line)

Key figures: 160 staff, 2 locations in Rotterdam Port area with 170.000 square m yard/facilities with rail/road/water connections

Worldwide operating

Slogans: "A complete range of solutions to serve any industry" and : Big enough to cope, small enough to care".

Specialism: Design and fabrication of modular units and plant systems

Specialist in advanced container technology from standard ISO type concepts to large, complex modular arrangements

Translation into products:

- offshore living quarter modules, mobile accommodation camps
- workshop, office, laboratory and kitchen units
- water treatment and sanitary units
- control rooms, electrical and radio cabins, technical "package" units
- Refrigerated, liquid compressed gas and cryogenic tankcontainers.
- Electrical and fire/gas detection systems
- Refrigeration, air-conditioning, ventilation and piping systems
- specialised in high risk environments (explosion proof, pressurised)

Containerised marine research labs.

- Basic design philosophy:
- Sturdy marine type containers as a basic
- International standardisation on ISO-20'x8'x8'6""
- To withstand all environmental conditions and 'rough handling'
- Single units and block arrangements
- Coupling (docking) devices
- Modular interior design (grid system)
- Flexibility in interior and integrated systems
- Optimisation of internal space and max. operational weight
- Optimal functionality and user friendly for the researchers
- Maintaining and control of interior climate conditions
- Easy to maintain, clean, repair
- Quality and operational reliability
- Manufacturers documentation/instructions

Operational advantages:

- Manufacturing, testing, instructions onshore (to avoid expensive ship time)
- High mobility (intermodal transportation by ship-road-rail)
- Fast mobilisation/demobilisation on site
- External connections ('grouped together') of integrated systems
- Temporary, semi-permanent, permanent
- Worldwide operational Exchangeability: onshore (camp) <--> offshore (ship)
- Interaction with research ship
- Pooling of equipment (combined international research campaigns)
- Uniformity of integrated systems for researchers
- Objective: to promote optimise and harmonise the use of containerised marine labs in the marine research world.

Various containerised lab types:

- Depending on typical lab functions (task)
- Depending on specific client's requirements (options)
- Dilemma: "multipurpose" versus "dedicated" (what do you "need", what do you "wish")
- Problem: costs, limitation of space and weight (necessity to dock more units)
- Balance of pros-and-cons in the selection process.

Examples of scientific labs:

- General purpose (dry) lab
- Thermostated (wet) lab
- Organic (clean) lab
- Isotopes lab
- Traacs¹ (Auto-analyser) lab

Examples of supporting units:

- Dry storage unit
- Cold storage unit
- Workshop (spare parts) unit
- Office unit
- Computer room unit
- Accommodation (sleeping) unit
- Potable water storage unit
- Sewage/wastewater unit
- Power (diesel generator) unit

Basic unit

Construction:

- Steel frame and outside corrugated cladding
- Fully welded (weather tight)
- Reinforcements in floor, walls, roof
- External marine type hinged door, watertight sealed, self-locking and with a 90 degree angle limiter
- Marine type bronze, double glazed windows
- External window blinds for transportation (and sunshades)
- External connections for facilities system
- Openings with louvre/grids and air-inlet/exhaust, marine type
- Wire mesh protection against vermin
- Recessed space for HVAC unit

Insulation/architectural:

- Mineral wool insulation in corrugations
- Internal sandwich panel systems
- Structural/architectural joint profiles
- Use of synthetic material to prevent 'cold bridges' (condensation!)
- Modular grid system to fasten interior equipment, system, inventory
- Separation wall with self closing aluminium sliding door
- Air-lock space to maintain condition inside research room

Surface treatment/painting:

- Outside : blasting to SA 2 ½ – 3
- Inside and underside:: blasting to SA 2 – 2 ½
- Outside: 3 layer p.u. epoxy paint system (marine type) 300 micron
- Inside: 1-layor p.u. epoxy primer + anti-condensation compound 200 micron
- Underside: as inside + bitumastic (tectyl) coating 200 micron
- Inside paint system: non-toxic, non-smell

Technical facilities and main performance data:

* Refrigerating/heating system:

Design conditions:

- Outside: temp range -15 deg. C - + 35 deg C
- relative humidity 80%
- Inside: temp range 0 deg C - + 15 deg C
- relative humidity 60%

Condenser:

- Copper-copper
- Fanblades IP66 seawater resistant
- 2 stages on/off operation

¹ The TrAAcs system is a continuous flow wet chemistry analyzer that determines analyte concentrations using a colorimeter to detect changes in color produced by the presence of the analytes. It is typically used for automated testing of water, waste water and sea water. It is capable of measuring a wide range of elements, given the appropriate flow cell, filter and manifold set-up

Coolerblocks:

- 2 units: including thermostatic evaporator relief valve, low-pressure control, electrical defrost system, control instrumentation, etc.

Heating:

- In series connected with cooling system
- Fresh air/recirculation system combined with defrost heating, etc

Cool air compressor:

- Incl. expansion vessel, filter/dryer, control instrumentation, etc.

All necessary pressure status and thermostatic control instrumentation, 24V AC and safety devices

All necessary electrical cabling, piping, ducting, etc.

* Facility systems:

Watertight sealed penetrations and outlets through outside hull.

Piping systems for water:

- potable: ½ “
- seawater: ½ “

Instrument gases:

- nitrogen: 3/8 “
- compressed instrument air: 3/8”

Drainage:

- stainless steel: 1 ½ “, under slope
- all piping systems pressure tested at 10 bar

Electrical systems:

- 220/380 Volt, 50 Hz
- Outside connections in recessed type: 240V 16 Amp, 400V 16 Amp, 400V 32 Amp with watertight CEE Form plugs
- Cabling VUSO for fine power circuit
- VUSK for high power circuit
- Junction box for intercom, fire detecting/alarm, UBS connections, etc. in air-lock and research room
- Fluorescent lighting armatures with polycarbonate caps
- Bull-eyes
- On/off switches
- Wall sockets in Tehalit cable channels
- Intercom and telephone connections
- In air-lock space: Halyester distribution board, automatic switches, phase connectors, etc.

Internal lay-out of research room:

- Worktables with Trespa (light green) hard plastic laminate and stainless steel support frames
- Worktables fixed and/or foldable
- Cupboards/drawers/lockers, with (white) hard plastic laminate, lockable, seafastening devices, etc
- Coathooks in air-lock space

Lay out depending on:

1. Research functions of lab unit (multi purpose versus dedicated)
2. Client's specific requirements
3. Balance of available space, weight limitation, costs, etc

Operational weight:

Approx. 3800 – 4800 kg depending on final technical specs, lay-out, equipment, inventory etc.

Manufacturer's recommendations (options):

- Removable (bolted/sealed) back wall for: 'docking' and in/out of large equipment.
- Grids, louvres, hinges, lock, etc in stainless steel
- Automatic floor drains in 'air-lock' and research room
- Interconnection boxes (pre-assembled) of integrated systems (for future docking)
- Additional sand-arrestor filters when operating in sandy environment
- Seamless floor finish (epoxy) with skirting (100 mm)
- Anti-static floor finish (rubber mats)

- Skin: stainless steel with synthetic finish or full polypropylene
- Electrical jumpering of equipment and outside earthing connections
- Permanent 4-point lifting sling on top roof (emergency hook-on)
- Operational weight painted large in large numbers on roof.
- Venetian blinds (shutters) in double glassed windows.
- All vital information visible outside on stainless steel data plate: operational weight, connections to integrated systems, discharge systems handling instructions, etc.
- Lashing eyes for seafastening of equipment/inventory
- Small window in sliding door of separation wall.

NB: In case lab units are positioned below deck or in cargo hold special attention should be given to additional systems for fresh air supply and exhaust in combination with refrigerating/heating system, alarms, etc.

Transportation – handling:

- Marine type container
- ISO-20'x8'x8'6" standard
- Stacking capability 6-high
- Prototype tested and certified
- Approval according Container Safety Convention (CSC)
- Standard cornercastings for lifting, locking, coupling, securing.
- Intermodal transport: rail-road-ship
- Handling by means of forklift truck not preferable
-)if necessary: forklift pockets with re-inforced bottom construction!)
- Special fittings to lock/secure containers on ships deck
- Container is 'self-supporting;' / on it 4 bottom corners
- All technical items within ISO measurements (door, windows, louvres, penetrations, connections, etc.)

Associated documents:

- Technical specs and 'as built' drawing
- Materials data book
- Certificates and approvals
- Commissioning – and inspection reports
- Instruction- and maintenance manuals
- Safety procedures

Associated services:

- Commissioning on site
- Training and start-up
- Maintenance programs
- Spare parts back-up
- Interface with ship: deckslots, stairs, platforms, railing, escape routes/procedures

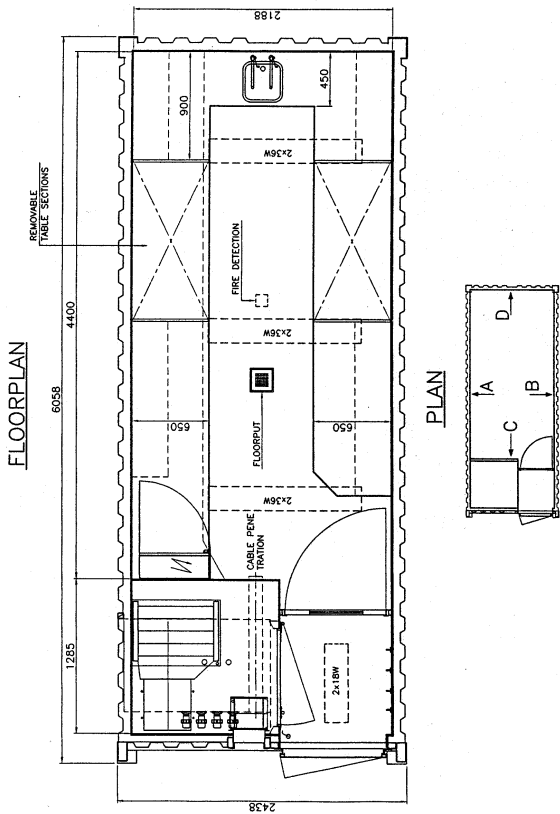
References:

Available from various laboratory projects executed for a variety of clients in the marine research fields, environmental studies, scientific expeditions, geological field labs, dark rooms, etc:

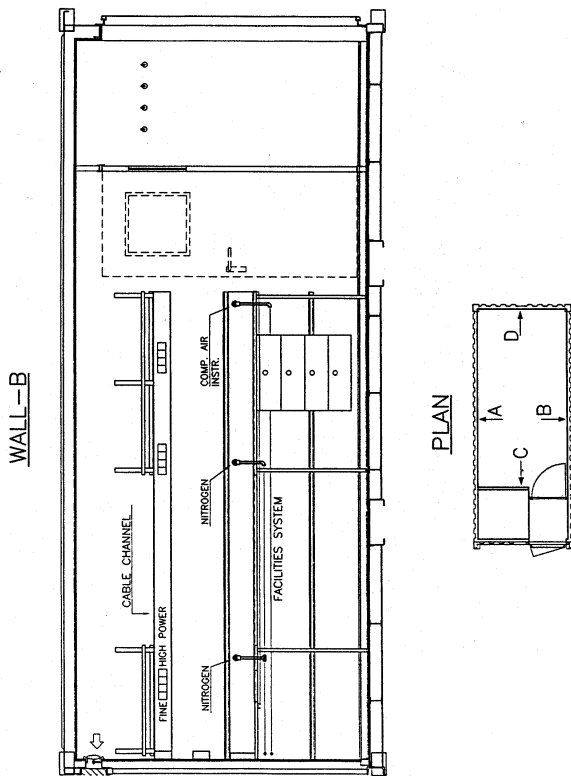
Netherlands Institute for Sea Research (NIOZ)
IFREMER France
Geological Survey of the Netherlands (NITG)
Finnish Institute of Marine Research (FIMR)
Royal Dutch Navy
Shell International
Volker Stevin Offshore B.V.
Bran & Luebbe
Royal Boskalis Westminster
Maritime Research Institute (Marin) Netherlands
Smit Maritime Contractors
Lasmo

This presentation was available as hard copy for all INMARTECH 2000 participants.

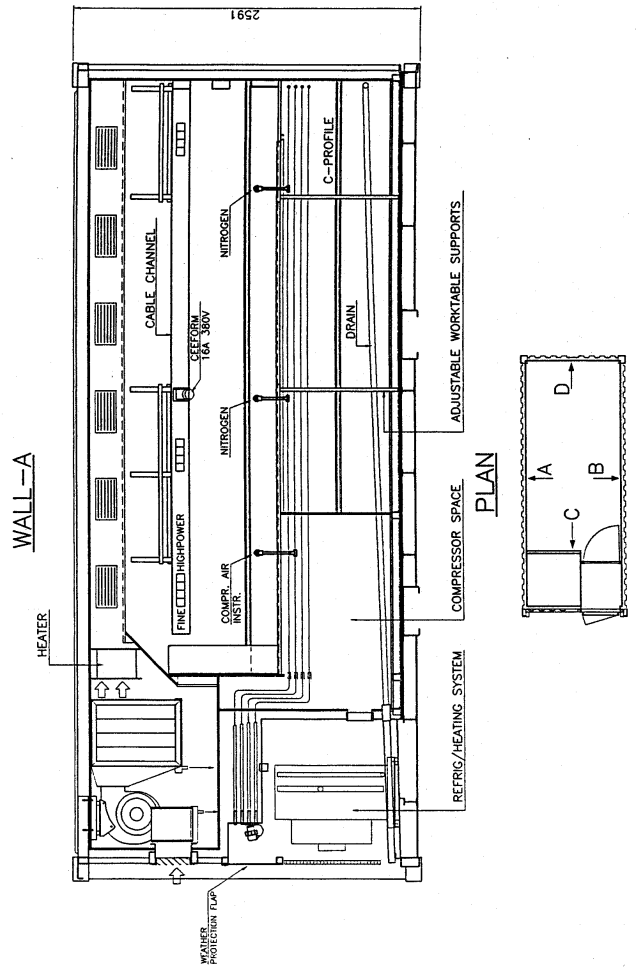
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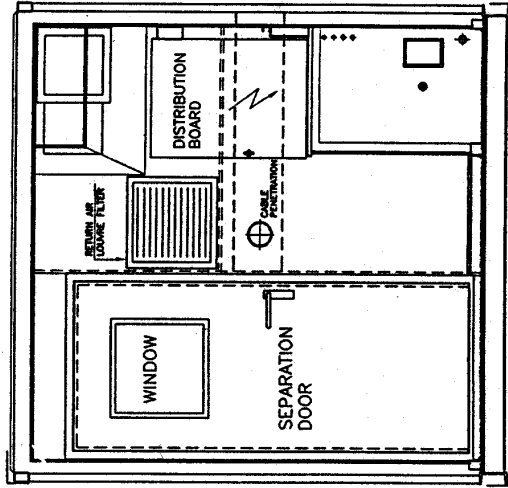


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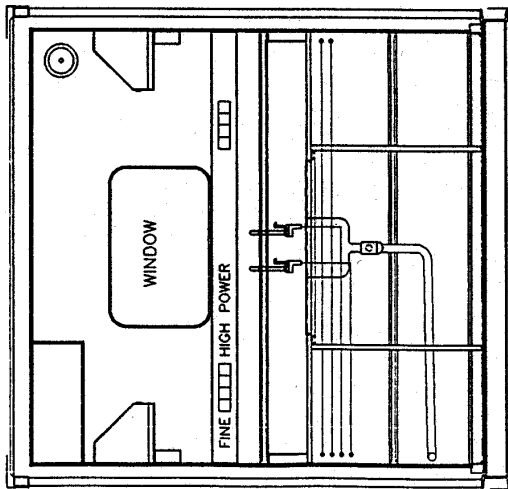


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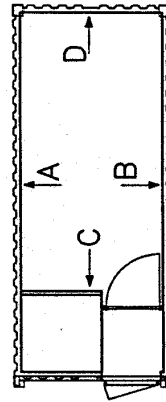


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FACILITIES SYSTEM

PLAN



INTRODUCTION OF LABORATORY CONTAINER/VAN TECHNOLOGY

- USAGE: FISH SORTING CONTAINER

Klaas Timmermans & Henk W. van der Veer , Netherlands Institute for Sea Research (NIOZ)

Outline

- introduction
 - scientific problem
 - solution in the past/present
- why the need for a Fish sorting container
- technical problem
- planning, construction
- evaluation (from a biological point of view)

Introduction

The scientific problem

the analysis of fluctuations in abundance and growth of (commercially important) flatfish species

- plaice
- sole
- dab

numbers and size

Methods

- ship
- fishing gear
- sorting the sample

the past



the present



Catch



and sorting the catch

Why the need for a Fish sorting container?

labour forces too variable
quality control
optimalization
safety, working conditions

(students, volunteers, directors)
(standardized methods)
(more hauls per day)

The technical problem

Planning

- container
- restricted to process of cleaning and sorting of the catch
- no technical assistance for operation
- implement existing know-how
- construction and final completion by NIOZ

The concept of a fish sorting container

construction



Lifting the catch



into the lab container





Inside view, when the catch arrives



Inside view: Sorting conveyor belt



Inside view: From the belt to the sorting table



Inside view: seawater connection for flushing and cleaning



Inside view: hoses and pipes

evaluation construction (from a biological point of view)

- end-user must be able to translate scientific problem into technical specifications (on outlines)
- specifications change during construction
- construction and final completion must be done in house
- time schedule: exceeded by about 6 months
- budget: overrun by more than 50%

evaluation use

- pack and go
- goals achieved
 - -less labour forces
 - -quality control (standardized methods)
 - -optimalization (more hauls per day)
 - -safety, working conditions
- maintenance underestimated

PORTABLE VANS ON U.S. OCEANOGRAPHIC RESEARCH VESSELS

Theo Moniz, Woods Hole Oceanographic Institution (WHOI)

Portable Van Standardization

The Standardization of portable vans in the United States has rapidly taken on focus in recent years; however, it has been difficult and has a number of competing interests that threaten its success. The subject is complex and at the same time the sharing of this topic is timely. While standardization is currently in process as I speak, I will share with you recent developments, their driving forces and the obstacles encountered.

Prior to 1999, there had been several occasions where Masters of Woods Hole Oceanographic vessels had seriously been concerned about placing some vans on board that were rather in questionable condition. There existed little in the way of clear guidelines to assist them in basing a rejection of an unsafe portable van and given the detrimental affect of such a rejection to a scientist's program our Masters were being placed under as serious dilemma. This dilemma placed safety directly in line with the success of the individuals that they were assigned to assist in succeeding.

In early 1999, I was tasked by the Marine Operations Manager to provide a set of guidelines for our vessel Masters to assist them in determining whether a portable van should be considered safe to place on their vessel. It was also intended to provide vessel users with a minimum set of standards that our Masters would be considering before allowing these portable vans on board. These guidelines have been incorporated in the International Safety Management System of Woods Hole Institution and are included as an appendix to this paper.

These guidelines were simply a review of existing United States Coast Guard regulations published in various places in the Code of Federal Regulations (CFR), Title 46. They represented an effort to avoid costly safety decisions that could adversely affect some poor scientist on a Woods Hole Oceanographic Institution operated vessel. Later that year during a review of the Research Vessel Safety Standard for the University – National Oceanographic Laboratory System (UNOLS), these same guidelines were incorporated into the safety standards in the chapter dealing with scientific equipment and made up as an appendix.

To me this represented a substantial effort to provide some standards to portable vans on board oceanographic research vessels. Little did I know, standardization was just beginning. This year under the direction of the National Science Foundation the University of Delaware was tasked with drawing up as set of standard specifications for the construction of several portable vans to be utilized on different sized vessels in different ways. The University of Delaware has worked closely with several oceanographic institutions in attempting to come to a standard set of specifications. It has not been easy. And they are not yet complete. I believe that I can highlight for you some of the difficulties involved and some of the decisions that we may soon see.

First it is important to establish the goals that the University of Delaware standardization project had set forth. They are as follows:

- To ensure safe design and construction of portable laboratory vans used on UNOLS vessels.
- To standardize certain design elements to best meet the needs of the scientific community and make them usable on multiple ships.
- To reduce overall cost by facilitating bulk purchase.

The conflicting factors existing in the development of a standard set of specifications for portable vans are numerous. Some of the more critical pit safety against the cost of that safety. Complicating the safety issue is a myriad of confusing regulations. These include those already cited found in the Coast Guard regulations, the CFRs. Add to these regulations, standards set forth in rules established by classification societies, the international community, and other domestic regulatory agencies. The applicability of these rules is dictated by the service that the portable van will be used in and whether the rules apply to the vessel that the van will be placed on. This has been the source of substantial debate especially when potential vendors bring up rules that cannot be verified. I will have more on to say on that later.

Another very important issue making a standard design for portable vans difficult involved the individual needs of the user. In a sense the more diverse the user community that had to utilize these specifications, the more they grow to accommodate specific needs. Often it appeared to pit larger vessels with more flexible deck space and the

less need for flexibility against smaller vessels with rather restrictive deck space and little flexibility. Since the National Science Foundation was funding the construction of many of these vans, there was a need to have the ability to use these portable vans on more than one vessel in effect the possibility of creating a portable van pool similar to what is done in the UNOLS community with wire. The idea of pooling these portable van resources has made features such as door placement, services pass throughs, and on-roof railing important considerations that are no longer selective options.

Since these vans may be used on both inspected and uninspected UNOLS vessels, and may be outfitted in a variety of configurations, the basic van "chassis" described in the specification need to be capable of being ABS¹ approved and U. S. Coast Guard inspected. Once the van was outfitted for a specific service or use it would be inspected as required.

Some of the standards have been easy. The size of a standard van will be either 8-foot by 8-foot and either 10-foot or 20-foot in length. The standard 20-foot container has been used in the past and is easy to transport to and from deployment on research vessels. This standard size also made tie-down arrangements more uniform. The UNOLS fleet has moved toward a 2-foot by 2-foot bolt down pattern on their decks and this size can be uniformly secured. Utilizing a standard 20-foot container as the initial shell for a portable van has been identified as one cost conserving possibility with a few drawbacks. The ISO fittings were also a desirable feature in standard containers.

Structural fire protection became the major drawback in using a standard container as a starting point. The major issue about structural fire protection in these vans was central in two areas. First, should the exterior construction of these vans be to class "A" standards. If this standard needed to be adhered to then standard containers could not be used as the shell and it just about eliminated other construction materials such as aluminum. Through long debates and many emails throughout the community, it became evident that an "A" standard was not necessary by regulations and was very costly.

Another structural fire protection issue concerning standard containers is the fact that the floors are constructed of wood. The need for outfitting the standardized portable van utilizing non-combustible materials has never been questioned. In making a van capable of being inspected by the U. S. Coast Guard approved incombustible construction materials needed to be used. Although, when used on uninspected vessels they would not be required to be inspected, the need to have the pool capability made such a consideration important. It is noted that the U.S. Coast Guard regulations allow a van used in other service to be considered for use on inspected vessels; however, the idea of fighting that battle with each new construction made the standardization project unacceptable otherwise.

Another issue that went without much dissent was the need to have all external fixtures recessed to avoid damage in transit. Also the need for portholes and an emergency escape hatch also are included in the package. There were a number of other interior and exterior standards that were established, but instead of trying to reiterate them here I refer to the draft version that is made by Matt Hawkins at the end of this abstract. I expect the final version to be out before the end of the year.

It is of importance to recognize that this draft has established the standard for the basic Scientific Van chassis and added Specifications for Berthing Vans and Chemical Storage Vans. Each have specific requirements that add to or delete some of the specifications for the basic van.

In summary standardization is happening. The UNOLS standards incorporated in the Research Vessel Safety Standards have established minimum standards. They guide Masters and give scientists forewarning of acceptability. The University of Delaware standardization has special application. While it is not being forced on the rest of the UNOLS community, it is sponsored by the number one agency funding the construction of these vans. I expect that this leverage will strongly influence the construction of portable vans in the foreseeable future.

For further developments read: UNOLS Standardized Van Design (Matt Hawkins, September 2001)
<http://www.unols.org/>

¹ ABS: American Bureau of Shipping (Classification Bureau)

APPENDIX B

Recommended Check List for Shipboard Vans

I. **Applies To All Portable Vans.** (The numbers in brackets refer to the Code of Federal Regulations (CFR))

A. Design and Construction

- Constructed of steel, aluminium or other substantial material suitable for marine use. (195.11-10(b))
- Suitable attachment points for securing to vessel. (195.11-10(b))
- Electrical system meets good commercial standards. (195.11-11-09(a))
- Electrical grounding installed and adequate.
- Electrical and Pressure connections to ship's systems will meet marine standards. (195.11-099(a))
- All electrical systems will be free from shock hazards.
- Doors will be equipped with mechanisms to prevent self-releasing or shock.
- Electrical connections are adequately supported.
- Doors designed to be left open during van use will be equipped with hold backs.
- All occupied vans, e.g. lab vans, will have two means of egress (exits).
- Lab vans must be adequately ventilated. (8x8x20=60cfm, 8x8x40-1200cfm)
- Electrical systems must be equipped with adequate circuit breaker protection.
- All wires are to be low smoke type and connections made in proper boxes.
- All material will be of a non-combustible nature per the guidelines cited for accommodation vans below.
-

B. Marking and Labeling

- Provided with a label plate stating the netweight and gross weight. (195.1120(b))
- When applicable, provided with a label plate stating power requirements. (195.1120(b))
-

C. Loading and Storage

- Determine that electrical connections are adequate and in good condition (195.11-25(a)(1))
- Determine that all pressure connections are adequate and in good condition. (195.11-25(b))
- Locate van to prevent recirculation from vessel's exhaust system. (195.1125(c))
- Loaded in accordance with stability requirements of the vessel. (195.11-25(d))
- Entered in the official log book. (195.11-2)

II. **Special Use Portable Vans**

A. Berthing Vans

- Must have two means of escape. (190.10-5)
- Both means of escape must be free of locking devices and unblocked. (190.10.20)
- Must be ventilated by mechanical means. (190.15)
- Must be adequately lighted, heated and air conditioned. (190.20-5, 190.20-20(b))
- Must be divided into rooms and each room limited to 4 single berths. (190.20(b))
- Each room must provide 30 ft² of deck area and 210 ft³ volume for each person. (190.20-20(c))
- No more than one berth will be placed above another and each berth cannot be less than 27 in. wide and 75 in. long. (190.20-20(d))
- Each berth must have a light. (190.20-45)
- A locker must be provided for each person. (190.29(e))
- Construction must be of non-combustible materials. (190.07-10(d))
- Adequate life saving devices must be onboard to accommodate the increased number of persons accommodated.
-

B. Chemical Store Vans (Defined in 46 CFR 194-05.3)

- Installed equipment such as shelves and cabinets shall be constructed of non-combustible materials. (194.20.1(a))
- Access Door will be marked "Chemical Storeroom". (190.20(b))
- Deck will be non-skid and chemical resistant. (194.20-1(c))
- All doors must open in the escape direction. (194.20-1(f))
- Must be equipped with mechanical ventilation that provides a complete change of air in not more than 4 minutes and must have non-sparking impellers. (194.20-59(a))

- Exhaust must not be located within 6 feet of any interior openings to vessel. (194.20-5(a)(3))
- Provisions must be provided so van can be ventilated before entry. The entrance will be marked “Danger-Ventilate Before Entering”. (194.20-5(b))
- Fixed fire suppression systems will be provided.

C. Power Vans

- Shall meet the regulatory requirements for inspected vessels. (195.11-10(d))
- Must be equipped with an exterior means to secure the fuel supply to the van.
- Must be equipped with a fixed fire suppression system that is operable from outside the van.
- Must be equipped with adequate circuit breakers for the distribution system.