Shipping

An Experimental Domain Analysis & Description

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Abstract

This document reports on an experiment: that of modeling a domain of shipping lines[1]

The purposes of the experiment are (i) to further test the methodology of domain analysis & description as outlined in [1], and (ii) to add yet an, as we think it, interesting domain model to a growing series of such [2].

The report is currently in the process of being written, that is, the domain is still being studied, analysed and tentatively described. Please expect that later versions of this document may have sections that are removed, renumbered and/or rewritten wrt. the present April 22, 2021, 09:42 version.

The author regrets not having had contact to real professionals of the shipping line industry. This is most obvious in our treatment of freight forwarder and shipping line behaviours. Here we used simple reasoning to come up with plausible behaviours. The behaviours that we define should convince the reader that whichever similarly reasonable, but now actual, real behaviours can be likewise defined.

The author hopes, even at his advanced age, today he is 83 years old, to be able, somehow, to learn from such contacts.

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[1] with the Greenland Royal Arctic Line, https://www.royalarcticline.com, as a leading inspiration.

1 Introduction

1.1 ...

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1.3 Structure of Report

2 Informal Sketches of the Shipping Domain

We shall, as a necessary element in the analysis of a domain to be rigorously analysed & described, first, and informally, delineate that domain.

This initial step of a full development is typically iterative. One outlines a first sketch. If one is not quite happy with that one either improves on that sketch or, throws it away and, produces another sketch – until "satisfied".

2.1 The Purpose of A Domain Model for Shipping

Any undertaking of modeling a specific domain has a purpose. The purpose of the shipping domain model of this report is to understand some of the properties of shipping, say such as those expected by people who have freight transported. What these properties are will evolve as the domain model evolves.

2.2 A First Sketch

We structure the sketch in itemized points.

- The **name of the domain** is *Shipping*.
- The **overall context of the domain** is that
  - there is a continuous "stretch" of **navigable waterways**, an **ocean**;
    - on which **vessels** can sail;
  - there is a concept of **landmass**es with coasts onto the waterways;
    - with **harbours** at which
    - the **vessels** can dock
    - to **unload** and **load freight** and/or **passengers**.
  - There are **shipping lines** which operate these vessels;
    - with these shipping lines accepting requests for and actual freight and/or passengers to be transported;

  - and there are **freight forwarders** which
    * either act as go-between those who wishes freight or passenger transport,
    * or are those freight "owners", respectively passengers,
    * and requests and services accepted requests, i.e., order, for transport.

- The **closer details of the domain** [of shipping further] involve that
  - harbours have **management** and **staff** (including **stevedores**) – which is ignored in the present domain model;
  - vessels have **staff** (**captains, mates, engineers** and **seamen**) – which is (are) ignored in the present domain model;
  - freight forwarders and shipping lines have **management** and **staff** – whose education, training, hiring, rostering[2], laying-off and pensioning which is (are) ignored in the present domain model;
  - harbours, freight forwarders and shipping lines need financial capital in order to establish, maintain, renew and operate – which is ignored in the present domain model; and that
  - all of these have to operate in the context of local, state and international rules & regulations (i.e., laws) – which is ignored in the present domain model

We justify the omissions as they are common to many [other] domains and thus do not specifically characterise the chosen domain.

2.3 A Second Sketch

We assume a notion of **state**. The programmable attributes, typically, of endurants are bases for states. States [thus] have values.

- **Actions** are *intended* phenomena that potentially *changes state* values *instantaneously*.
- **Events** are un-intended phenomena which [thus *surreptitiously*] may instantaneously change a state.
- **Behaviours** are sets of sequences of actions, events and behaviours. Behaviours change states, *one change after another* and several changes potentially "at the same time", i.e., *concurrently*, in *parallel*.

2.3.1 Strands of Interacting Sets of Behaviours

We shall focuse primarily on the behaviours of two "main players": those of **freight forwarders** and those of **shipping lines**. We shall consider the behaviours of **freight, vessels** and **harbours** to be subsidiary, i.e., subservient, to the main behaviours.

The two sets of behaviours each "operate, i.e., behave, on their own", concurrently, but **interacting.**

Freight forwarders, in an interleaved fashion, on behalf of many customers, using many shipping lines, **place orders**, **accept offers** (or **refusals**), **deliver freight** and **passengers** to vessel

[2]– assignment, per day, to time-slots and places of work

sides ('alongside'), **fetch freight** and **passengers** from vessel sides ('alongside') and and **handle** all related **"paper-work"** ('bill-of-ladings') and **finances**.

Shipping lines, also in an interleaved fashion, serving many freight forwarders, co-sailing, possibly, with other shipping lines, **accept** or **reject orders**, **issue offers**, sees to it that vessels **fetch freight** (and **passengers**) from vessel sides ('alongside'), sees to it that vessels **deliver freight** and **passengers** to vessel sides ('alongside'), and **handle** all related **"paper-work"** ('bill-of-ladings') and **finances**.

2.3.2 Freight

> *From* `Middle English` *freyght, from* `Middle Dutch` *vracht,* `Middle Low German` *vrecht* ("cost of transport"), ultimately from `Proto-Germanic` **fra-* (intensive prefix) + `Proto-Germanic` **aihtiz* ("possession"), from `Proto-Indo-European` **$h_2$eyḱ* ("to possess"), equivalent to `for- + aught`. Cognate with `Old High German frēht` ("earnings"), `Old English` *æht* ("owndom"), and a doublet of *fraught* [`https://en.wiktionary.org/wiki/freight`].

2.3.2.1 Freight as Endurants: Freight is both a singular and a plural term. So, by freight we shall understand one or more items of discrete endurants or any amount of and liquid endurant. That is, for example, one or more 20 or 40 feet containers may be considered one freight item, and any amount of bunker oil may be considered one freight item.

2.3.2.2 Freight as Behaviours: **Freight** are also considered behaviours: **create**d as both endurants and as behaviours by the freight forwarder at the instant of a freight forwarder's first booking inquiry, and **dismantle**d by the freight forwarder at the completion of that freight's transport.[3]

• • •

We shall further sketch two behaviours. The servicing of freight transports, seen from a freight forwarder and the servicing of freight transports, seen from a shipping line. Each of these behaviours if expressible as the composition of several actions. Were we here to also sketch a vessel's freight transport, then we would have to introduce such **events** as the vessel being delayed due to unforeseen weather conditions, the vessel being ship-wrecked ()

2.3.3 Freight Forwarder Behaviour

The freight forwarder behaviour basically consists of the following **freight forwarder actions**.

(i) **[FC]** *Freight Creation:* The freight is "created" ! We do not [have to] define the circumstances of creation.[4]

(ii) **[FB]** *Freight Being Booked:* There is the action of **booking space and time for freight between two harbours**. It is directed at a **shipping company** by a **freight forwarder**. How that freight forwarder came to book at that shipping company is left undefined. The shipping line either says *no thanks, another time, perhaps !"*, or propose a sailing (i.e., a vessel and times of departure and arrival), costs, etc., i.e., a bill-of-lading. The freight forwarder accepts "refusals", and either accepts the proposed bill-of-lading, or does not accept proposals.

[3] We shall, without loss of generality, only model that freight undergo one vessel transport.

[4] Technically the freight forwarder behaviour "spawns" off a henceforth concurrently operating freight behaviour. For an example of how that 'technicality' is arranged, see Sect. **??** on page ??.

(iii) **[FD]** *Freight Delivery:* In due time, if proposed bill-of-lading is accepted, the freight forwarder receives notification from the shipping line that the vessel has arrived at designated harbour of departure and the freight forwarder therefore delivers the freight at that harbour.

(iv) **[FT]** *Freight Transport:* The freight forwarder can now trace the freight transport.

(v) **[FR]** *Freight Return:* In due time, the freight forwarder receives notification from the shipping line that the vessel has arrived at designated harbour of arrival and the freight forwarder therefore fetches the freight at that harbour.

(vi) **[FE]** *Freight Dismantlement:* At some [short] time after the freight has been collected it ceases to exist as freight !

(vii) **[FM]** *Freight Management:* And all the time the freight forwarder manages "paperwork" and finances.

End of that story !

• • •

The above sequence of characteristic freight forwarder actions can therefore be interpreted as actions for one particular item of freight with these actions being interleaved with those for other freight items also being handled by a freight forwarder. To distinguish between different freight handlings freight forwarders naturally uses the unique freight identifier obtained in action **[FC]**.

2.3.4 Shipping Line Behaviour

The shipping line behaviour basically consists of the following **shipping line actions**.

(i) **[SQ]** *Booking Inquiry:* The shipping line, at any time, accepts inquiries, from freight forwarders, as to freight transport. The inquiries states freight essentials, whether inflammable/explosive, whether a container or otherwise packaged (dimensions, weight, etc.), from and to harbours, desirable shipping dates, etc. The shipping line decides, upon acceptance, whether to respond immediately, or after some processing time, say minutes or hours, to the inquiry.

(ii) **[SQH]** *Query Handling:* The shipping line responds to inquiries either instantly or after some [other] processing time. Either the line can satisfy, i.e., **accepts**, the request and sends the inquiring freight forwarder a transport proposal, tentatively reserves space and time (i.e., vessel) for the subject freight, and then awaits its acceptance or refusal, or the line cannot satisfy, i.e., must **refuse**, the request and sends the inquiring freight forwarder a polite negative response – and "closes" that inquiry.

(iii) **[SR]** *Booking Reaffirmation:* The shipping line, at any time, accepts acceptance of accepted orders. It does so, for example, by reaffirming, to the freight forwarder, the now mutually accepted order, while initiating a **physical order handling** "process", i.e., changes the order from tentative to definite.

(iv) **[SV1]** *Vessel Co-ordination, 1:* The shipping line, at some time thereafter, informs the vessel of its cargo for specific sailings, while assuring itself of that vessel's availability.

(v) **[SH1]** *Harbour Co-ordination, 1:* The shipping line, at some time thereafter, informs designated harbours of its plans for the vessel in question to indeed arrive at, unload and load freight, and depart from that harbour, while ensuring that the harbour in question is indeed prepared for that. [We omit treatment of no or negative response from harbours.]

(vi) **[SFA]** *Freight Acceptance:* At the appointed date and time the shipping line observes, by communication from the vessel that the freight forwarder delivers the designated freight alongside the vessel.

(vii) **[SV2]** *Vessel Co-ordination, 2:* Eventually the shipping line is informed that the vessel departs freight origin harbour.

(viii) **[SV3]** *Vessel Co-ordination, 3:* Eventually the shipping line is informed that the vessel arrives at freight destination harbour.

(ix) **[SH2]** *Harbour Co-ordination, 2:* The shipping line informs that harbour of the imminent arrival of one of its vessels.

(x) **[SF]** *Freight Forwarder Notification:* The shipping line informs the freight forwarder of the arrival of "its" freight.

(xi) **[SFD]** *Freight Delivery:* And the freight forwarder informs the shipping line of its receipt of freight.

(xii) **[SFM]** *Freight Management:* All the while the shipping line keeps track of all the "paper-work" and financial matters, and other freight related matters.

End of that story !

• • •

Shipping lines handle much freight. The above sequence of twelve characteristic shipping line actions can therefore be interpreted as actions for one particular item of freight, sometimes, like **[SV1-2-3,SH1-2,SFM]**, merged with those for "similarly" transported freight. with these actions being interleaved with those for other freight items To distinguish between different freight handlings shipping lines naturally uses the unique freight identifier obtained in action **[SQ]**.

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As the reader will have observed: The "workhorse" of the described domain is the shipping line – as one should indeed expect it to be !

• • •

The stories narrated above are as yet not in their final form. Language, clarification and other improvements will eventually find their way into the above text.

2.4 Some Comments

2.4.1 Caveat Concerning Sketches

In the informal language sketching of a domain there is, however, a serious problem. One way of illustrating the problem is as follows: Replace all domain specific nouns and verbs with $\alpha, \beta, \gamma, ...$, respectively $x, y, z, ...$ Now you see the problem: What does the sketch now "describe" ? By using nouns and verbs of a domain that may be known to the reader, and for which the reader may have some understanding, but for which any two readers may usually have different understandings, the readers are being "lured" into a possible trap ! Only a proper narrative description that is strongly linked to a formal specification – one where the αs, βs, γs, ..., respectively xs, ys, zs, ... are given mathematical meanings – may be satisfactory – provided, of course, that the mathematics is *consistent and relatively complete*[5].

2.4.2 The Insufficiency of Narrative Descriptions

Why is it not sufficient with just narrative, i.e., informal, descriptions ? The answer is simple. For the shipping domain, just sketched, it might seem sufficient. But assume that you, the reader of this sketch, come from somewhere where there is no "nearby" notion of waterways, hence of vessels, etc. The fact that our sketches uses many terms from the shipping domain does not make them understandable, in-and-by-themselves. Take another example: You are from some Pacific island. There are no railways

[5]– where 'consistent and relative complete' are well-defined notion of mathematical logic

there. And you sketch a railway domain. The Pacific islander, really, have no clue as to the meaning of such terms as a railway track, a railway switch, etc. So the meaning of terms – such as presented in the above sketches – are far from clear. The danger in this is that these terms many be understood to possess properties that were not sketched.

2.4.3 What Do Formal Descriptions Contribute ?

Conjoining a narrative, informal text with formal, mathematical text is meant to "fill-the-gap": to allow the user of domain model to asset properties beyond what has been explicitly described and, based on such formalisations, reason that a postulated domain property holds, or does not hold.

2.4.4 Limitations of Domain Models

But we cannot possibly, neither informally narrate nor formally specify a "complete domain", that is, "all" domain properties. Our domain descriptions must necessarily focus on some properties while ignoring other properties. That is, every domain model has a purpose.

2.4.5 Families of Domain Models

So, for the domain of shipping, we can thus expect a set of domain models. One like the one presented in this report. Another which focus of vessels: their loading and unloading. Yet another which focus on vessel navigation: on the ocean and into and out from harbours. Etetera.

2.4.6 There is No "Standard Model"

Just like for physics, there is not standard model. But, as for physics, there is now, with [1], a "standard" way of developing and presenting domain models. With Newton's Classical Mechanics[6] described in terms of differential equations etc. there is a "standard" approach to analysing & describing mechanics (etc.). For every heretofore not described classical mechanics domain problem the physicists and engineers now know how to tack the analysis & description of that domain. Similarly for every human-assisted discrete dynamics and primarily artifact "populated" domain the computer scientists and software engineers now know how to tack the analysis & description of that domain.

3 Endurants: External Qualities

3.1 Freight

Although the notion of 'freight' is, indeed, a core concept of this report, it will not *"play center stage'*.

3.2 Endurant Sorts & Observers

1. We shall consider an **aggregate** of **shipping** in the context of
   (a) an **aggregate** of *navigable* **waterways**, i.e., an ocean, rivers and canals[7] with identification of harbours;

[6] Other contributors to the formal description of Classical Mechanics were Gottfried Wilhelm Leibniz, Joseph-Louis Lagrange, Leonard Euler, etc.

[7] There are but two oceans. [We do not exclude the *Caspian Sea*. Our model covers both that and "the other" ocean, as the only two !] The "other", the larger ocean is, for pragmatic reasons "divided" up into separately named "oceans":

(b) an **aggregate** of **land masses**, i.e., continents and islands, small and large;
(c) an **aggregate** of thus identified **harbours**;
(d) an **aggregate** of **vessels** that can carry freight and/or passengers;
(e) an **aggregate** of **shipping lines** – which commands (owns or operate) these vessels;
(f) an **aggregate** of **freight forwarders**[8];
(g) an **aggregate** of **freight**; and
(h) an **aggregate** of **passengers**.

2. The aggregate of harbours is here seen as a set of harbours –
3. with harbours to be further defined.
4. The aggregate of vessels is here seen as a set of vessels –
5. with vessels to be further defined.
6. The aggregate of shipping lines is here seen as a set of shipping lines –
7. with shipping lines to be further defined.
8. The aggregate of freight forwarders is here seen as a set of freight forwarders –
9. with freight forwarders to be further defined.
10. The aggregate of freight is here Sean's as a set of freight –
11. with freight to be further defined.
12. The aggregate of passengers is here seen as a set of passengers –
13. with passenger to be further defined.

The waterways and land masses are here further undefined. Harbours, vessels, shipping lines, freight forwarders, freight and passengers will be further defined below.

type
1. S
1a. WV
1b. LM
1c. AH
1d. AV
1e. ASL
1f. AFF
1g. AF
1h. AP
2. Hs = H-**set**
3. H
4. Vs = V-**set**
5. V
6. SLs = SC-**set**
7. SL
8. FFs = FF-**set**
9. FF

the *Atlantics*, North and South, the *Pacific*, the *Indian*, the *Arabian Sea*, the *Barents Sea*, the *Arctic Sea*, the *Anarctic Sea* (*Southern Ocean, Austral Ocean*), etc. Basically two canals provide short-cuts between two otherwise disperse areas of that one ocean: the *Suez* and the *Panama*.

[8]The borderline between freight forwarders and shipping lines is fuzzy. Some shipping lines offer freight forwarding: the logistics of moving freight between end-customer and vessel, etc.

10. Fs = F-**set**
11. F
12. Ps = P-**set**
14. P

value

1a. obs_WV: S → WV
1b. obs_LM: S → LM
1c. obs_AH: S → AH
1d. obs_AV: S → AV
1e. obs_ASL: S → ASC
1f. obs_AFF: S → AFF
1g. obs_AF: S → AF
1h. obs_AP: SS → AP
2. obs_Hs: AH → Hs
4. obs_Vs: AV → Vs
6. obs_SLs: ASL → SL-**set**
8. obs_FFs: AFF → FF-**set**
10. obs_Fs: AF → F-**set**
12. obs_Ps: AP → P-**set**

The waterways with its harbours define an in[de]finite set of [circular] routes that can be sailed by the vessels. There are vessels other than those owned or commanded by the company. The company is also characterised by a definite set of routes sailed/serviced by its vessels. All this will be clear as we proceed.

3.3 Endurant Values

From an **aggregate** of **shipping** one can extract all its subsidiary endurants – starting with that aggregate:

14. the **aggregate** of **shipping**,
    (a) its **aggregate** of **waterways**,
    (b) its **aggregate** of **land masses**,
    (c) its **aggregate** of **harbours**,
    (d) its **aggregate** of **vessels**,
    (e) its **aggregate** of **shipping lines**,
    (f) its **aggregate** of **freight forwarders**,
    (g) its **aggregate** of **freight** and
    (h) its **aggregate** of **passengers**;

    and their
15. **set** of **harbours**,
16. **set** of **vessels**,
17. **set** of **shipping lines**,
18. **set** of **freight forwarders**,
19. **set** of **freight**,
20. **set** of **passengers**,
21. **harbours**,
22. **vessels**,
23. **shipping lines**,
24. **freight forwarders**,
25. **freight** and
26. **passengers**.

value

14. s_e:SL [ι 1, π 9]
14a. wv_e:WV = obs_WV(s_e) [ι 1a, π 9]
14b. lm_e:LM = obs_LM(s_e) [ι 1b, π 10]
14c. ah_e:AH = obs_AH(s_e) [ι 1c, π 10]
14d. av_e:AV = obs_AV(s_e) [ι 1d, π 10]
14e. asl_e:ASL = obs_ASL(s_e) [ι 1e, π 10]
14f. aff_e:AFF = obs_AFF(s_e) [ι 1f, π 10]
14g. af_e:AF = obs_AF(s_e) [ι 1g, π 10]
14h. ap_e:AP = obs_AP(s_e) [ι 1h, π 10]
15. hs_e:Hs = obs_Hs(ah_e) [ι 2, π 10]
16. vs_e:Vs = obs_Vs(av_e) [ι 4, π 10]
17. sls_e:SLs = obs_SLs(asl_e) [ι 6, π 10]
18. ffs_e:FFs = obs_FFs(afc_e) [ι 8, π 10]
19. fs_e:Fs = obs_Fs(af_e) [ι 10, π 10]
20. ps_e:Ps = obs_Ps(ap_e) [ι 12, π 10]
21. h_es:H_UI-**set** = {h|h:H•h ∈ obs_Hs(ah_e)} [ι 3, π 10]
22. v_es:V_UI-**set** = {v|v:V•v ∈ obs_Vs(av_e)} [ι 5, π 10]

23. $sl_e s$:SC_UI-**set** = {sl|sl:SL•sl ∈ obs_SLs($slss_e$)} [ι 7, π 10]
24. $ff_e s$:FF_UI-**set** = {ff|ff:FF•ff ∈ obs_FF(fcs_e)} [ι 9, π 10]
25. $f_e s$:F_UI-**set** = {f|f:F•f ∈ obs_Fs(fs_e)} [ι 11, π 10]
26. $ps_e s$:P_UI-**set** = {p|p:P•p ∈ obs_Ps(ps_e)} [ι 14, π 11]

27. We can define the set of all endurants.

value
27. all_ends = $\{s_e\} \cup \{wv_e\} \cup \{lm_e\} \cup \{ah_e\} \cup \{av_e\} \cup \{asl_e\} \cup \{aff_e\} \cup \{ap_e\}$
27. $\cup hs_e \cup vs_e \cup sls_e \cup ffs_e \cup ff_e \cup ps_e \cup h_e s \cup v_e s \cup sl_e s \cup ff_e s \cup f_e s \cup p_e s$

4 Endurants: Internal Qualities

4.1 Unique Identifiers

4.1.1 Unique Identifier Types and Observers

We can associate unique identifiers with:

28. The **aggregate** of **shipping**;
29. the **aggregate** of **waterways**;
30. the **aggregate** of **land masses**;
31. the **aggregate** of **harbours**;
32. the **aggregate** of **vessels**;
33. the **aggregate** of **shipping lines**
34. the **aggregate** of **freight forwarders**
35. the **aggregate** of **freight**
36. the **aggregate** of **passengers**
37. the **set** of **harbours**;
38. each **individual harbour**;
39. the **set** of **vessels**;
40. each **individual vessel**;
41. the **set** of **shipping lines**;
42. each **individual shipping line**;
43. the **set** of **freight forwarders**;
44. each **individual freight forwarder**;
45. the **set** of **freight**;
46. each **individual freight**;
47. the **set** of **passengers**;
48. each **individual passenger**;

type
28. S_UI [ι 1, π 9]
29. WV_UI [ι 1a, π 9]
30. LM_UI [ι 1b, π 10]
31. AH_UI [ι 1c, π 10]
32. AV_UI [ι 1d, π 10]
33. ASC_UI [ι 1e, π 10]
34. AFF_UI [ι 1f, π 10]
35. AF_UI [ι 1g, π 10]
36. AP_UI [ι 1h, π 10]
37. Hs_UI [ι 2, π 10]
38. H_UI [ι 3, π 10]
39. Vs_UI [ι 4, π 10]
40. V_UI [ι 5, π 10]
41. SCs_UI [ι 6, π 10]
42. SC_UI [ι 7, π 10]
43. FFs_UI [ι 8, π 10]
44. FF_UI [ι 9, π 10]
45. Fs_UI [ι 10, π 10]
46. F_UI [ι 11, π 10]
47. Ps_UI [ι 12, π 10]
49. P_UI [ι 14, π 11]

value
28. uid_S: S → S_UI
29. uid_WV: WV → WV_UI
30. uid_LM: LM → LM_UI
31. uid_AH: AH → AH_UI
32. uid_AV: AV → AV_UI
33. uid_ASL: ASC → ASC_UI
34. uid_AFF: AFF→ AFF_UI
35. uid_AF: AF → AF_UI
36. uid_AP: AP: → AP_UI
37. uid_Hs: Hs → Hs_UI
38. uid_H: H → H_UI
39. uid_Vs: Vs → Vs_UI
40. uid_V: V → V_UI
41. uid_SLs: SLs → SLs_UI
42. uid_SL: SL → SL_UI
43. uid_FFs: FFs → FFs_UI
44. uid_FF: FF → FC_UI
45. uid_Fs: Fs → Fs_UI
46. uid_F: F → F_UI
47. uid_Ps: Ps → Ps_UI
49. uid_P: P → P_UI

4.1.2 Unique Identifiers

From an **aggregate** of **shipping lines** one can extract all the unique identifiers of its subsidiary endurants – staring with that aggregate:

49. the **aggregate** of **shipping**,
    (a) its **aggregate** of **waterways**,
    (b) its **aggregate** of **land masses**,
    (c) its **aggregate** of **harbours**,
    (d) its **aggregate** of **vessels**,
    (e) its **aggregate** of **shipping lines**,
    (f) its **aggregate** of **freight forwarders**,
    (g) its **aggregate** of **freight** and
    (h) its **aggregate** of **freight** and
    (i) its **aggregate** of **passengers**;

    and their
50. **set** of **harbours**,
51. **set** of **vessels**,
52. **set** of **shipping lines**,
53. **set** of **freight forwarders**,
54. **set** of **freight**,
55. **set** of **passengers**,
56. **harbours**,
57. **vessels**,
58. **shipping lines**,
59. **freight forwarders**,
60. **freight** and
61. **passengers**.

value
49. s_{ui}:S_UI = uid_S(s_e) [ι 1, π 9]
49a. wv_{ui}:WV_UI = uid_WV(obs_WV(s_e)) [ι 1a, π 9]
49b. lm_{ui}:LM_UI = uid_LM(obs_LM(s_e)) [ι 1b, π 10]
49c. ah_{ui}:AH_UI = uid_AH(obs_AH(s_e)) [ι 1c, π 10]
49d. av_{ui}:AV_UI = uid_AV(obs_AV(s_e)) [ι 1d, π 10]
49e. asl_{ui}:ASL_UI = uid_ASC(obs_ASL(s_e)) [ι 1e, π 10]
49f. aff_{ui}:AFF_UI = uid_AFF(obs_AFF(s_e)) [ι 1f, π 10]
49h. af_{ui}:AF_UI = uid_AF(obs_AF(s_e)) [ι 1g, π 10]
49i. ap_{ui}:AP_UI = uid_AP(obs_AP(s_e)) [ι 1h, π 10]
50. hs_{ui}:Hs_UI = uid_Hs(obs_Hs(ah_e)) [ι 2, π 10]
51. vs_{ui}:Vs_UI = uid_Vs(obs_Vs(av_e)) [ι 4, π 10]
52. sls_{ui}:SLs_UI = uid_SLs(obs_SLs(asl_e)) [ι 6, π 10]
53. ffs_{ui}:FFs_UI = uid_FFs(obs_FFs(afc_e)) [ι 8, π 10]
54. fs_{ui}:Fs_UI = uid_Fs(obs_Fs(af_e)) [ι 10, π 10]
55. ps_{ui}:Ps_UI = uid_Ps(obs_Ps(ap_e)) [ι 12, π 10]
56. $h_{ui}s$:H_UI-**set** = {uid_H(h)|h:H•h ∈ obs_Hs(ah_e)} [ι 3, π 10]
57. $v_{ui}s$:V_UI-**set** = {uid_V(v)|v:V•v ∈ obs_Vs(av_e)} [ι 5, π 10]
58. $sc_{ui}s$:SL_UI-**set** = {uid_SL(sl)|sl:SL•sl ∈ obs_SLs(sls_e)} [ι 7, π 10]
59. $ff_{ui}s$:FF_UI-**set** = {uid_FF(ff)|ff:FF•ff ∈ obs_FF(ffs_e)} [ι 9, π 10]
60. $f_{ui}s$:F_UI-**set** = {uid_F(f)|f:F•f ∈ obs_Fs(fs_e)} [ι 11, π 10]
61. $p_{ui}s$:P_UI-**set** = {uid_P(p)|p:P•p ∈ obs_Ps(ps_e)} [ι 14, π 11]

62. We can define the set of all endurant identifiers.

value
62. all_uids = $\{s_{ui}\}\cup\{wv_{ui}\}\cup\{lm_{ui}\}\cup\{ah_{ui}\}\cup\{av_{ui}\}\cup\{asc_{ui}\}\cup\{aff_{ui}\}\cup\{ap_{ui}\}$
62. $\quad\cup hs_{ui}\cup vs_{ui}\cup scs_{ui}\cup ffs_{ui}\cup fs_{ui}\cup ps_{ui}\cup h_s s\cup v_{ui}s\cup sc_{ui}s\cup ff_{ui}s\cup f_{ui}s\cup p_{ui}s$

axiom
56. **card** all_ends = **card** all_uids

4.1.3 Retrieve Endurant Values

63. Given a unique identifier, ui, in all_uids and given the set of all endurants all_ends we can retrieve the endurant, e of identifier ui.

value
63. get_E: UI → E
63. get_E(ui) ≡ **let** e:E • e ∈ all_ends ⇒ uid_E(e)=ui **in** e **end**

4.2 Mereologies

4.2.1 A Shift in Modeling

Till now we have modeled the shipping line domain considering all its endurants to be non-structures (cf. [1, *Sects. 4.8 and 4.10*]). From now on we shall consider all aggregates and sets of endurants as structures. This means that we can dismiss our modeling of the unique identifiers for all aggregates and set of endurants void and nil. Thus we shall only model the mereology of what we basically treat as atomic endurants: *freight forwarders*, *shipping lines*, *vessels*, *harbours*, *freight* and *passengers*.

4.2.2 Mereology Types and Observers

The **mereology** that we shall promote emphasises both **topological** and **conceptual** properties of shipping line systems. They express topological properties when mandating unique identifiers of spatially close/related endurants, And they express conceptual properties when mandating unique identifiers of endurants with which shipping lines "do business" ! Further topological and conceptual properties of shipping line systems will be expressed in Sect. 4.3 where we treat **attributes** of shipping line systems.

4.2.2.1 Harbour Mereology:

64. Harbour mereologies are
    - the non-empty set of unique identifiers of vessels that may use the harbour,
    - the pair of two possibly empty sets of unique identifiers of freight: one identifying freight to be loaded (todo), the other having been unloaded (done),
    - the unique identifier of the waterways and the
    - the unique identifier of the landmass.

type
64. H_Mer = V_UI-**set** × (todo:F_UI-**set**×done:F_UI-**set**) × WV_UI × LM_UI
value
64. mereo_H: H → H_Mer

65. The well-formedness of a harbour mereology entails
    - that its set of vessel identifiers is non-empty and included in the set of all vessel identifiers,
    - the "to do" and the "done" freight does not "overlap" and are a subset of all freight.
    - that its waterways identifier is that of the known waterway[s], and
    - that its landmass identifier is that of the known landmass.

value
65. wf_H_Mer: H_Mer → Book
65. wf_H_Mer(vuis,(todo,done),wvui,lmui) ≡
65. {}≠ vuis ⊆ $v_{ui}s$ [ι 57, π 13]
65. ∧ todo ∩ done = {} ∧ todo∪done⊆$f_{ui}s$ [ι 60, π 13]
65. ∧ wvui = wv_{ui} [ι 49a, π 13]
65. ∧ lmui = lm_{ui} [ι 49b, π 13]

4.2.2.2 Vessel Mereology:

66. Vessel mereologies are
    - the non-empty set of unique identifiers of harbours that it may use,
    - the non-empty set of unique identifiers of shipping lines for which it sails, i.e., which share an agreement to operate that vessel, and
    - the unique identifier of the waterways.

type
66. V_Mer = H_UI-**set** × SL_UI-**set** × WV_UI
value
66. mereo_V: V → V_Mer

67. The well-formedness of a vessel mereology entails
    - that its set of harbour identifiers is non-empty and included in the set of all harbour identifiers,
    - that its set of shipping line identifiers is non-empty and included in the set of all shipping line identifiers,
    - and that its waterways identifier is that of the known waterways.

67. wf_V_Mer: V_Mer → **Bool**
67. wf_V_Mer(huis,scuis,wvui) ≡
67. {}≠huis⊆$h_{ui}s$ [ι 56, π 13]
67. ∧ {}≠ scuis=$sc_{ui}s$ [ι 58, π 13]
67. ∧ wvui=wv_{ui} [ι 49a, π 13]

4.2.2.3 Shipping Line Mereology:

68. Shipping line mereologies are
    - the non-empty set of unique identifiers of vessels that it operates,
    - the non-empty set of unique identifiers of freight forwarders which it services and
    - the non-empty set of identifiers of harbours that it uses,

type
68. SL_Mer = V_UI-**set** × FF_UI-**set** × H_UI-**set**
value
68. mereo_SL: SL → SL_Mer

69. The well-formedness of a shipping line mereology entails
    - that its set of vessel identifiers is non-empty and included in the set of all vessel identifiers,
    - that its set of freight forwarder identifiers is non-empty and included in the set of all freight forwarder identifiers, and that its set of harbour identifiers is non-empty and included in the set of all harbour identifiers.

value
69. wf_SC_Mer: SC_Mer → **Bool**
69. wf_SC_Mer(vuis,fcuis,huis) ≡
69. {}≠vuis⊆$v_{ui}s$
69. ∧ {}≠ffuis⊆$ff_{ui}s$
69. ∧ {}≠huis⊆$h_{ui}s$ [ι 57, π 13, ι 59, π 13]

Two or more shipping lines may **co-sail** one or more vessels[9].

4.2.2.4 Freight Forwarder Mereology:

70. Freight forwarder mereologies are
    - the non-empty set of unique identifiers of shipping lines that it uses,
    - the non-empty set of unique identifiers of harbours to which it delivers and from which it fetches freight, and the possibly empty set of unique identifiers of freight with which it is involved.

type
70. FF_Mer = SL_UI-**set** × H_UI-**set** × F_UI-**set**
value
70. mereo_FF: FF → FF_Mer

71. The well-formedness of a freight forwarder mereology entails

[9] We shall not model the specifics, i.e., details of co-sailing.

- the non-empty set of unique identifiers of known shipping lines that it uses and
- the non-empty set of unique identifiers of known harbours

value
71. wf_FF_Mer: FF_Mer → **Bool**
71. wf_FF_Mer(sluis,huis,_) ≡
71. {}≠sluis⊆$sl_{ui}s$ [ι 52, π 13]
71. ∧ {}≠huis⊆$h_{ui}s$ [ι 56, π 13]

4.2.2.5 Freight Mereology:

72. Freight mereologies are
    - the unique identifier of the freight forwarder,
    - the unique identifier of the shipping line which is intended to ship, or which ships that freight, and
    - the pair of unique identifiers of the two harbour involved in the freight transport.

type
72. F_Mer = FF_UI × SC_UI × (H_UI×H_UI)
value
72. mereo_F: F → F_Mer

73. The well-formedness of a freight mereology entails
    - that the freight forwarder identifier is known,
    - that the shipping line identifier is known and
    - that the two known harbours are different.

73. is_wf_F_Mer: F_Mer → Book
73. is_wf_F_Mer(ffui,scui,(fhui,thui)) ≡
73. ffui∈$ff_{ui}s$
73. ∧ scui∈$sc_{ui}s$
73. ∧ fhui≠thui ∧ {fhui,thui}⊆$h_{ui}s$

4.2.2.6 Passenger Mereology:

74. Passenger mereologies are
    - the identifier of the vessels with which they have traveled, are traveling or intend to travel, and
    - the unique identifier of the shipping lines with whom they have travel-led, are traveling or intend to travel.

type
74. P_Mer = V_UI-**set** × SC_UI-**set**
value
74. mereo_P: P → P_Mer

75. The well-formedness of a passenger mereology entails
    - that the set of vessel identifiers is known,
    - that the set of shipping line identifiers is known, and
    - that the shipping lines are indeed operating the identified vessels.

value
75. wf_P_Mer: P_Mer → **Bool**
75. wf_P_Mer(vuis,scuis) ≡
75. vuis⊆$v_{ui}s$ ∧ scuis⊆$sc_{ui}s$ ∧ [ι 57, π 13, ι 58, π 13]
75. ∀ v_ui:V_UI • v_ui ∈ vuis, ∃ sc_ui:SC_UI • sc_ui ∈ scuis ⇒
75. **let** sc = get_part(sc_ui) **in let** (vuis′,_) = mereo_SC(sc) **in** v_ui ∈ vuis′ **end end**

4.2.2.7 Waterways Mereology:

76.

77.

78.

79.

type
76.
77.
78.
79.
value
76.
77.
78.
79.

4.2.2.8 Landmass Mereology:

80.

81.

82.

83.

type
80.
81.
82.
83.
value
80.
81.
82.
83.

4.3 Attributes

4.3.1 Attribute Types and Observers

We shall illustrate but a very few attributes. Those we choose to illustrate appear to be the ones most relevant for the specific examples of *freight forwarder, shipping line, vessel, harbour* and *freight behaviours*.

4.3.1.1 Freight Forwarder Attributes:

84. For any one specific freight, the freight forwarder, undergoes a sequence of states. These are sketched in Sect. **??** on page ??. FFHΣ models the set of state names for these.

85. Freight forwarder history is a freight identifier indexed, reverse-ordered chronological sequence of freight satte labelled freight information.

86. We leave FFInfo further undefined,

type
84. FFHΣ = "FC" | "FBB" | "FB" | "FD" | "FT" | "FR" | "FE" | "FM"
85. FFHist = F_UI $\xrightarrow[m]{}$ (𝕋𝕀𝕄𝔼 × FFHΣ × FFInfo)*
85. FFInfo = ...
value
85. attr_FFHist: FF → FFHist

4.3.1.2 Shipping Line Attributes:

87.

88.

89.

90.

type
87.
88.
89.
90.
value
87.
88.
89.
90.

4.3.1.3 Vessel Attributes:

91.

92.

93.

94.

type
91.
92.
93.
94.
value
91.
92.
93.
94.

4.3.1.4 Harbour Attributes:

95.

96.

97.

98.

type
95.
96.
97.
98.
value

95.
96.
97.
98.

4.3.1.5 Freight Attributes:

99.

100.

101.

102.

type
99.
100.
101.
102.
value
99.
100.
101.
102.

4.3.2 Attribute Wellformedness

5 Perdurants

By the **transcendental deduction**s introduced in [1, *Chapter 6*] we now interpret some endurant parts as behaviours. A behaviour is a set of sequences of actions, events and behaviours. Behaviours interact, here expressed in the style of CSP [3, 4, 5, *C.A.R. Hoare*] as embedded in RSL [6].

5.1 Freight as Endurants and as Behaviours

The central entity of the shipping line domain is that of **freight**. Freight have, so far, been considered as atomic endurants. We shall now transcendentally deduce freight into behaviours. There is a dynamically varying number of uniquely identified freight. We suggest to model freight as follows: Freight is created by the freight forwarder. At the moment of such creation the freight "receives" its, i.e., a unique identifier, one that has not been used before, and one that will never be used, in the creation of other freight, again. Once a freight has completed a full transport as directed by the freight forwarder and carried out by a shipping line and one of its vessels, that freight ceases to be a freight, that is, as an endurants and as a behaviour. Its unique identifier will never be the identifier of other freight.

5.2 Actions, Events and Behaviours

5.3 Global Freight Variable

Freight occurs, appears, and freight disappears. In this model we assume a fixed number of freight forwarders, shipping lines, vessels and harbours[10]. But we must model a varying number of freight. We shall, for simplicity, and without loss of generality, assume that freight becomes so when in the care of freight forwarders, and that freight ceases to be freight, i.e., to exist, one it has been transported.

Although we shall model freight as behaviours we shall introduce, as a technicality,

103. a global variable freight_uids which is initialised to an empty set of unique freight identifiers.

At any time it contains the set of all unique identifiers of freight which have been created as freight, When freight ceases to exist that freight's unique identifier is not deleted from `freight_uids`.

variable
103. freight_uids:F_UI-**set** := {}
value
104. get_F_UI: **Unit** → F_UI
104. get_F_UI() ≡
104. **let** f_ui:F_UI • f_UI ∉ freight_uids **in**
104. freight_uids := freight_uids ∪ {f_ui};
104. f_ui **end**

104. get_F_UI is a value-returning action.

- It applies to the global state and returns a "new, hitherto unused" unique freight identifier
- while updating the global state variable freight_uids with that identifier.

5.4 Channels

In order for CSP-modeled behaviours to **interact**, they must **communicate**, and they do so over the medium of, as here, **channels**.

We shall name the full ensemble of channels over which any of the *shipping company, freight forwarder, harbour* and *harbour* behaviours communicate

- **channel** ch[$\{ui_i, ui_j\}$]: MSG

where indices ui_i and ui_j are unique identifiers of these behaviours – cum endurant parts, and where MSG is the **type** of the communicated value.

5.5 Behaviours

5.5.1 Behaviour Signatures

5.5.1.1 Freight Forwarder Signature:

[10] We also assume fixed waterways and land masses.

105. We introduce the notion of "the making of a freight behaviour skeleton" NewF:
    - either there is not such skeleton, "nil",
    - or there are the elements that make up a freight endurant: a unique freight identifier, a freight mereology and the static attributes of a freight. What they are is really of no consequence. The programmable attribute only becomes relevant as soon as the freight endurant, and hence the freight behaviour is created.

106.

type
105. NewF = ″nil″ | F_UI × F_Mer × F_Stat
value
106. ff: ffui:FF_UI × (sluis,vuis,fuis):FF_Mer × ffstat:FF_Stat → ffprgr:FF_Prgr
106. → { ch[{ffui,ui}] | ui:SL_UI|F_UI•slui∈*sluis*∪*vuis*∪*fuis* } **Unit**

5.5.1.2 Shipping Line Signature:

107.

value
107. sl: slui:SL_UI × (vuis,ffuis,huis):SL_Mer × slstat:SL_Stat → slprgr:SL_Prgr
107. → { ch[{slui,ui}] | ui:FF_UI|V_UI|H_UI•ui∈*ffuis*∪*huis* } **Unit**

5.5.1.3 Vessel Signature:

5.5.1.4 Harbour Signature:

5.5.1.5 Freight Signature:

5.5.2 Behaviour Definitions

5.5.2.1 Freight Forwarder Definition:

105. We have introduced, cf. Item 105, the notion of "the making of a freight behaviour skeleton" NewF. To repeat:
    - either there is not such skeleton, "nil",
    - or there are the elements that make up a freight endurant: a unique freight identifier, a freight mereology and the static attributes of a freight, What they are is really of no consequence. The programmable attribute only becomes relevant as soon as the freight endurant, and hence the freight behaviour is created.

108. The *freight forwarder* behaviour may

109. [FC] non-deterministically internally, ⌈|, choose to [somehow] accept an item of freight, ..., as expressed in the ffc behaviour, and, likewise non-deterministically internally, decide to "convert" the skeleton into a behaviour.

109a.–109d. Non-deterministically internally the freight forwarder behaviour chooses among the former alternative behaviour, ffc, or the following specific freight related alternatives.

(a) [FB] The freight forwarder communicates a booking order to a shipping line. The shipping line either accepts this booking with a proposed bill-of-lading, or declines it. The freight forwarder must accept declined bookings and must either accept or decline a proposed bill-of-lading.

We assume that the time elapsed between the freight forwarder communicating its booking and the shipping line responding to this booking is such that the booking and its response can be modeled as a single behaviour composed from two CSP output/input actions.

[ffb stands for '*f*reight *f*orwarder *b*ooking'.]

(b) [FD] The freight forwarder is informed by the shipping line that the designated vessel is ready to accept the freight for transport.

We assume that the time elapsed between the freight forwarder receiving this alert and the freight forwarder being able to respond is such that the alert and its response can realistically be modeled as a single behaviour composed from two CSP output/input actions. See next.

[ffd stands for '*f*reight *f*orwarder *d*elivery alert (from shipping line)'.]

(c) [FR] The freight forwarder is informed by the shipping line that the designated vessel is ready to return the freight it has transported.

We assume that the time elapsed between the freight forwarder receiving this alert and the freight forwarder being able to respond is such that the alert and its response must most realistically be modeled as two behaviours. See next.

[ffr stands for '*f*reight *f*orwarder freight *r*eturn (message, from shipping line)'.]

(d) [FE] The freight forwarder collects the freight and its saga as 'freight' is over.

[ffe stands for '*f*reight *f*orwarder freight *e*nding'.]

110. [FM] In-between, before and after these specific freight related actions, the freight forwarder "performs" management actions "of its own" !

[ff stands for '*f*reight *f*orwarder *m*anagement'.]

[stands for]

type
105. NewF = "nil" | F_UI × F_Mer × F_Stat
value
106. ff: fui:FF_UI × (sluis,fuis):FF_Mer × ffstat:FF_Stat → ffhist:FF_Hist
106. → { ch[{slui,fui}] | slui:SL_UI•slui∈*sluis* } **Unit**
108. ff(ffui,(sluis,fuis),ffstat)(ffhist) ≡
109. [FC] ffc(ffui,(sluis,fuis),ffstat)(ffhist)
109a. [FB] ⌈| ([] ffb(ffui,(sluis,fuis),ffstat)(ffhist)

109b. [FD] [] ffd(ffui,(sluis,fuis),ffstat)(ffhist)
109c. [FR] [] ffr(ffui,(sluis,fuis),ffstat)(ffhist)
109d. [FE] [] ffe(ffui,(sluis,fuis),ffstat)(ffhist))
110. [FM] ⌈⌉ ffm(ffui,(sluis,fuis),ffstat)(ffhist)

5.5.2.1.1 Freight Creation:

111. Freight forwarders
112. non-deterministically internally, somehow, accept freight. Technically this is modeled by the freight forwarder obtaining a hitherto unused unique identifier,
113. and, from own attribute values and from the freight "customer", "...", creating a freight endurant, mkF(fui,fmer,fstat) –
114. which it transcendentally deduces into a freight behaviour
115. which behaves concurrently, ||,
116. with a resumed freight forwarder behaviour with an augmented history that reflects the creation of a freight (endurant and behaviour).

type
105. mkF :: F_UI × F_Mer × F_Stat
value
106. ffc: ffui:FF_UI × (sluis,fuis):FF_Mer × ffstat:FF_Stat → ffprgr:FF_Prgr
106. → { ch[{slui,fui}] | slui:SL_UI•slui∈*sluis* } **Unit**
111. ffc(ffui,(sluis,fuis),ffstat)(ffhist) ≡
112. **let** f_ui = get_F_UI() **in**
113. **let** mkF(fui,fmer,fstat) = heureka_Freight(f_ui,ffstat,...) **in** [**axiom** fui = f_ui]
114. f(mkF(fui,fmer,fstat))(⟨(record_𝕋𝕀𝕄𝔼())⟩) **end**
115. ||
116. ff(ffui,(sluis,fuis),ffstat)([fui↦⟨(record_𝕋𝕀𝕄𝔼(),mkF(fui,fmer,fstat))⟩]∪ffhist) **end**

113. heureka_Freight: F_UI × F_Stat × ... → mkF

5.5.2.1.2 Freight Booking:

117. For the case that the freight forwarder history, for some freight, fui, records a singleton, h, which designates the creation of that freight, the freight forwarder offers the following transactions
    (a) with a selected shipping line, slui, and for transport between specific harbours:
    (b) I offers, to that shipping line, a booking request containing the description, mkF(...), of the freight, and the from- and to harbours of requested transport.
    (c) While awaiting a reply from the shipping line,
    (d) the freight forwarder records the time, τ', and an element, h′, of the freight forwarder history.

(e) Before resuming being the freight forwarder behaviour, ff, the freight forwarder

(f) records the time, τ', and an element, h′, of the freight forwarder history.

118. For the case that the freight forwarder history, for some freight, fui, does not, for any freight (fui), record a singleton, h:⟨(τ,mkF(fui,fmer,fstat))⟩⌝∪fhist, which designates the creation of some freight, the freight forwarder does not engage in this alternative of the freight forwarder, ff, behaviour.

type
117b. mkBooking :: SL_UI × mkF(F_UI,F_Mer,F_Stat) × (H_UI×fd:𝕋𝕀𝕄𝔼) × (H_UI×td:𝕋𝕀𝕄𝔼)
117b. **axiom** ∀ mkb:mkBooking • fd(mkb)<td(mkb)
117c. Reply == mk_Decline_Booking_Request(SL_UI,t:𝕋𝕀𝕄𝔼,F_UI)
117c. | mk_Accept_Booking_Request(SL_UI,t:𝕋𝕀𝕄𝔼,bol:BoL,(H_UI×𝕋𝕀𝕄𝔼),(H_UI×𝕋𝕀𝕄𝔼))
value
106. ffb: ffui:FF_UI × (sluis,fuis):FF_Mer × ffstat:FF_Stat → ffhist:FF_Hist
106. → { ch[{slui,fui}] | slui:SL_UI•slui∈*sluis* } **Unit**
117. ffb(ffui,(sluis,fuis),ffstat)(ffhist:[fui↦h:⟨(τ,mkF(fui,fmer,fstat))⟩⌝∪ffhist′) ≡
117a. freight_booking(ffui,(sluis,fuis),ffstat)(mkF(fui,fmer,fstat))(ffhist)

117a. freight_booking: ffui:FF_UI × (sluis,fuis):FF_Mer × ffstat:FF_Stat → mkf:MkF → ffhist:FF_Hist
106. → { ch[{slui,fui}] | slui:SL_UI•slui∈*sluis* } **Unit**
117a. freight_booking(ffui,(sluis,fuis),ffstat)(mkf)(ffhist) ≡
117a. **let** (slui,(fh,fd),(th,td)) = select_shipping_line_and_time(ffstat,mkf,ffhist) **in**
117b. ch[{ffui,slui}] ! mkBooking(slui,mkF(fui,fmer,fstat),(fh,fd),(th,td)) ;
117d. **let** τ' = record_𝕋𝕀𝕄𝔼(), h″ = ⟨(τ',mkBooking(slui,mkF(fui,fmer,fstat),(fh,fd),(th,td)))⟩ **in**
117c. **let** reply = ch[{ffui,slui}] ? **in**
117f. **let** τ'' = record_𝕋𝕀𝕄𝔼(), h‴ = ⟨(τ'',reply)⟩ **in**
117e. ff(ffui,(sluis,fuis),ffstat)([fui↦h‴⌢h″⌢h]∪fhist)
117. **end end end end**

117a. select_shipping_line_and_time: mkF(F_UI,F_Mer,F_Stat) × MkF × FF_Hist
117a. → SL_UI × (H_UI×fd:𝕋𝕀𝕄𝔼) × (H_UI×td:𝕋𝕀𝕄𝔼)

5.5.2.1.3 Freight Acceptance and Delivery:

119. For the case that the freight forwarder history, for some freight, fui, records a first, i.e., a most recent element which designates the booking acceptance, [fui↦⟨(τ,mk_Accept_Booking_Request(slui,t,bol,(fh,fd),(th,td)))⟩⌢h]∪fhist, for a freight, the freight forwarder offers the following transactions:

(a) initially it offers to accept a designated, previously booked freight delivery to harbour of disembarkment;

(b) before delivering this freight

(c) the freight forwarder records the time, τ'', and an element, h″, of the freight forwarder history;

(d) before resuming being the freight forwarder behaviour, ff,

(e) and, concurrently informing the freight of its freight forwarder to harbour transfer,

(f) the freight forwarder records the time, τ''', and an element, h''', of the freight forwarder history.

type
119. BoL [Bill-of-Lading]
119. mk_Accept_Booking_Request :: $\mathbb{TIME} \times$ BoL $\times$ (H_UI$\times$fd:$\mathbb{TIME}$) $\times$ (H_UI$\times$td:$\mathbb{TIME}$)
119a. mkPlsDelive :: F_UI $\times$ H_UI $\times$ $\mathbb{TIME}$
119a. mkDelivery :: F_UI $\times$ H_UI $\times$ V_UI $\times$ $\mathbb{TIME}$
value
106. ffd: ffui:FF_UI $\times$ (sluis,fuis):FF_Mer $\times$ ffstat:FF_Stat $\rightarrow$ FF_Hist
106. $\rightarrow$ { ch[{slui,fui}] | slui:SL_UI•slui$\in$*sluis* } **Unit**
119. ffd(ffui,(sluis,fuis),ffstat)
119. ([fui$\mapsto$h:$\langle(\tau$,mk_Accept_Booking_Request(slui,t,bol,(fh,fd),(th,td)))$\rangle^\frown$h$'$]$\cup$fhist) $\equiv$
119a. **let** mkPlsDeliver(slui,fui,hui,vui,τ') = ch[{ffui,slui}] ? **in**
119c. **let** τ'' = record_$\mathbb{TIME}$(), h$''$ = $\langle(\tau''$,mkPlsDeliver(slui,fui,hui,$\tau''))\rangle$ **in**
119b. ch[{ffui,hui}] ! mkDelivery(ffui,fui,hui,vui) ;
119f. **let** τ''' = record_$\mathbb{TIME}$(), h$'''$ = $\langle(\tau'''$,mkDelivery(slui,fui,hui,$\tau''))\rangle$ **in**
119d. ff(ffui,(sluis,fuis),ffstat)([fui$\mapsto$h$'''^\frown$h$''^\frown$h]$\cup$fhist)
119e. || ch[{ffui,fui}] ! mkXferFFtoH(τ''',ffui,hui)
119. **end end end**

5.5.2.1.4 Freight Declination and Re-booking:

120. For the case that the freight forwarder history, for some freight, fui, records a first, i.e., a most recent element which designates a booking rejection mk_Decline_Booking_Request(slui,t,fui), the freight forwarder offers the transactions that are similar to those of Items 117a–117e Page 26.

value
120. ffd(ffui,(sluis,fuis),ffstat)
120. (ffhist:[fui$\mapsto$h:$\langle(\tau$,mk_Decline_Booking_Request(slui,t,fui,mkF(fui,fmer,fstat)))$\rangle^\frown$h$'$]$\cup$ffhist$'$) $\equiv$
120. freight_booking(ffui,(sluis,fuis),ffstat)(mkF(fui,fmer,fstat))(ffhist)

5.5.2.1.5 Freight Recovery:

121. For the case that the freight forwarder history, for some freight, fui, records a first, i.e., a most recent element which designates the delivery of freight, in its care: mkDelivery(slui,fui,hui,τ), the freight forwarder offers the following transaction:

(a) it offers to accept an alert from the shipping line as to the impending vessel arrival at destination port whereupon it

(b) informs the freight of its harbour to freight forwarder transfer,

(c) resumes being the freight forwarder behaviour now suitably updated with that knowledge !

value
106. ffr: ffui:FF_UI × (sluis,fuis):FF_Mer × ffstat:FF_Stat → ffhist:FF_Prgr
106. → { ch[{slui,fui}] | slui:SL_UI•slui∈*sluis* } **Unit**
121. ffr(ffui,(sluis,fuis),ffstat)([fui↦hist:⟨(τ,mkDelivery(slui,fui,hui,τ′))⟩⌢hist′]∪ffhist) ≡
121a. **let** mkReturn(slui,fui,hui,vui,dat) = ch[{slui,ffui}] ?
121a. τ″ = record_𝕋𝕀𝕄𝔼() **in**
121b. ch[{ffui,fui}] ! mkXferHtoFF(τ″,ffui,hui)
121c. ‖ ff(ffui,(sluis,fuis),ffstat)([fui↦⟨(τ″,mkReturn(slui,fui,hui,vui,dat))⟩⌢hist]∪fhist)
121. **end**

5.5.2.1.6 Freight Termination:

122. For the case that the freight forwarder history, for some freight, fui, records a first, i.e., a most recent element which designates the return of freight, in its care: mkReturn(slui,fui,hui,vui,dat), the freight forwarder offers the following transaction:
    (a) the freight forwarder inquires with a designated return harbour, hui, as to the designated, returned freight, fui
    (b) and resumes being the freight forwarder behaviour now suitably updated with that knowledge !
    (c) while, at the same time as resumption also informing the freight that it no longer has freight status !

value
106. ffe: ffui:FF_UI × (sluis,fuis):FF_Mer × ffstat:FF_Stat → hist:FF_Hist
106. → { ch[{slui,fui}] | slui:SL_UI•slui∈*sluis* } **Unit**
109d. ffe(ffui,(sluis,fuis),ffstat)([fui↦hist:⟨(τ‴,hist:mkReturn(slui,fui,hui,vui,dat))⟩⌢hist′]∪ffhist) ≡
122a. **let** mkReturnedFreight(fui,...) = ch[{hui,ffui}] ? **in**
122b. ff(ffui,(sluis,fuis),ffstat)([fui↦⟨mkReturnedFreight(fui,...)⟩⌢hist]∪fhist)
122c. ‖ ch[{ffui,fui}] ! mkTerminateFreight(ffui,...)
109d. **end**

5.5.2.1.7 Freight Forwarder Management:

123.

124.

125.

value
106. ffm: ffui:FF_UI × (sluis,fuis):FF_Mer × ffstat:FF_Stat → ffprgr:FF_Prgr
106. → { ch[{slui,fui}] | slui:SL_UI•slui∈*sluis* } **Unit**
110. ffm(ffui,(sluis,fuis),ffstat)([fui↦⟨(τ,[FC])⟩]∪fhist) ≡
123.
124.
125.

5.5.2.2 Shipping Line Behaviour Definition:

126.
127.
128.
129.
130.
131.
132.
133.
134.
135.

value
107. sl: slui:SL_UI × (vuis,ffuis,huis):SL_Mer × slstat:SL_Stat → slprgr:SL_Prgr → newf:NewF
107. → { ch[{slui,ui}] | ui:FF_UI|V_UI|H_UI•ui∈$ffuis \cup huis$ } **Unit**
127. sl(slui,(vuis,ffuis,huis),slstat)(slprgr)(newf) ≡
127.
128.
129.
130.
131.
132.
133.
134.
135.

5.5.2.3 Vessel Behaviour Definition:

5.5.2.4 Harbour Behaviour Definition:

136.
137.
138.
139.
140.
141.

142.
143.
144.
145.

value
136. harbour:
136. harbour(hui,(ffuis,sluis),hstat)(hhist) ≡
137.
138.
139.
140.
141.
142.
143.
144.
145.

5.5.2.5 Freight Behaviour Definition:

146.
147.
148.
149.
150.
151.
152.
153.
154.
155.

value
146. freight: fui:F_UI × (ffui,(fhui,thui),vui,slui):F_Met × F_Stat → F_Hist →
146. **in** { ch[{fhui,ui}] | ui:(FH_UI|V_UI|SL_UI)•ui ∈ {ffui,fhui,thui,vui,slui} } **Unit**
146. freight(fui,(ffui,(fhui,thui),vui,slui),hstat)(fhist) ≡
147. **let** i:mkFFtoH(...) = ch[{ffui,fui}] ? **in** freight(fui,(ffui,(fhui,thui),vui,slui),hstat)(⟨i⟩^fhist) **end**
148. [] **let** i:mk(...) = ch[{vui,fui}] ? **in** freight(fui,(ffui,(fhui,thui),vui,slui),hstat)(⟨i⟩^fhist) **end**
149. [] **let** i:mk(...) = ch[{vui,fui}] ? **in** freight(fui,(ffui,(fhui,thui),vui,slui),hstat)(⟨i⟩^fhist) **end**
150. [] **let** i:mk(...) = ch[{thui,fui}] ? **in** freight(fui,(ffui,(fhui,thui),vui,slui),hstat)(⟨i⟩^fhist) **end**
151. [] **let** i:mk(...) = ch[{ffui,fui}] ? **in** freight(fui,(ffui,(fhui,thui),vui,slui),hstat)(⟨i⟩^fhist) **end**

153. [] **let** i:mk(...) = ch[{ffui,fui}] ? **in** freight(fui,(ffui,(fhui,thui),vui,slui),hstat)(⟨i⟩^fhist) **end**
154. [] **let** i:mk(...) = ch[{ffui,fui}] ? **in** freight(fui,(ffui,(fhui,thui),vui,slui),hstat)(⟨i⟩^fhist) **end**
155. [] **let** i:mk(...) = ch[{ffui,fui}] ? **in skip end**

6 Conclusion

7 Bibliography

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A Indexes

A.1 Sorts and Types

A.2 Predicates and Functions

A.3 Values

A.4 Axioms

A.5 All Indexed Terms

There are 140 indexed terms.

B Greenland

Greenland – the world's largest island – is an autonomous territory within the Royal Kingdom of Denmark.

Greenland has been politically and culturally associated with Europe (specifically Norway and Denmark, the colonial powers, as well as the nearby island of Iceland) for more than a millennium. The majority of its residents are Inuit, whose ancestors migrated from Alaska through Northern Canada, gradually settling across the island by the 13th century.

Total area is 2,166,086 km^2.

Population is estimated at 56,081.

B.1 Politics

The Greenlandic government holds executive power in local government affairs. The head of the government is called **Naalakkersuisut Siulittaasuat**("Premier") and serves as head of Greenlandic Government. Any other member of the cabinet is called a **Naalakkersuisoq** ("Minister"). The Greenlandic parliament the **Inatsisartut** ("Legislators"). The parliament currently has 31 members.

In contemporary times, elections are held at municipal, national (Inatsisartut), and kingdom (Folketing) levels.

Greenland is a self-governing entity within the constitutional monarchy of the Kingdom of Denmark, in which Queen Margrethe II is the head of state. The monarch officially retains executive power and presides over the Council of State (privy council). However, following the introduction of a parliamentary system of government, the duties of the monarch have since become strictly representative and ceremonial, such as the formal appointment and dismissal of the prime minister and other ministers in the executive government. The monarch is not answerable for his or her actions, and the monarch's person is sacrosanct.

B.1.1 Political System

The party system is dominated by the social-democratic **Siumut** [forward] party, and the democratic socialist **Inuit Ataqatigiit** socialist separatist party, both of which broadly argue for greater independence from Denmark. While the 2009 election saw the unionist **Democrat** party (two MPs) decline greatly, the 2013 election consolidated the power of the two main parties at the expense of the smaller groups, and saw the eco-socialist Inuit Party elected to the Parliament for the first time. The dominance of the Forward and Inuit Community parties began to wane after the snap 2014 and 2018 elections. Other parties are **Naleraq** centrist-populist, **Atassut** liberal-conservative, unionist, **Cooperation** economic liberalisation and privatisation, and **Nunatta Qitornai** separatist.

The non-binding 2008 referendum on self-governance favoured increased self-governance by 21,355 votes to 6,663.

In 1985, Greenland left the European Economic Community (EEC), unlike Denmark, which remains a member. The EEC later became the European Union (EU, renamed and expanded in scope in 1992). Greenland retains some ties through its associated relationship with the EU. However, EU law largely does not apply to Greenland except in the area of trade. Greenland is designated as a member of the Overseas Countries and Territories (OCT) and is thus officially not a part of the European Union, though Greenland can and does receive support from the European Development Fund, Multiannual Financial Framework, European Investment Bank and EU Programs.

B.1.2 Government

Greenland's head of state is Queen Margrethe II of Denmark. The Queen's government in Denmark appoints a high commissioner (Rigsombudsmand) to represent it on the island.

The Greenland constituency elect two MP representatives to the Kingdom Parliament (Folketinget) in Denmark, out of a total of 179. The current representatives are Aki-Matilda Høegh-Dam of the Siumut Party and Aaja Chemnitz Larsen of the Inuit Community Party.[106]

Greenland has national Parliament that consists of 31 representatives. The government is the Naalakkersuisut whose members are appointed by the premier. The head of government is the premier, usually the leader of the majority party in Parliament.

B.2 Economy

The Greenlandic economy is highly dependent on fishing. Fishing accounts for more than 90% of Greenland's exports. The shrimp and fish industry is by far the largest income earner.

Greenland is abundant in minerals.[114] Mining of ruby deposits began in 2007. Other mineral prospects are improving as prices are increasing. These include iron, uranium, aluminium, nickel, platinum, tungsten, titanium, and copper. Despite resumption[when?] of several hydrocarbon and mineral exploration activities, it will take several years before hydrocarbon production can materialize. The state oil company Nunaoil was created to help develop the hydrocarbon industry in Greenland. The state company Nunamineral has been launched on the Copenhagen Stock Exchange to raise more capital to increase the production of gold, started in 2007.

Electricity has traditionally been generated by oil or diesel power plants, even if there is a large surplus of potential hydropower. There is a programme to build hydro power plants. The first, and still the largest, is Buksefjord hydroelectric power plant.

There are also plans to build a large aluminium smelter, using hydropower to create an exportable product. It is expected that much of the labour needed will be imported.

The European Union has urged Greenland to restrict People's Republic of China development of rare-earth projects, as China accounts for 95% of the world's current supply. In early 2013, the Greenland government said that it had no plans to impose such restrictions.

The public sector, including publicly owned enterprises and the municipalities, plays a dominant role in Greenland's economy. About half the government revenues come from grants from the Danish government, an important supplement to the gross domestic product (GDP). Gross domestic product per capita is equivalent to that of the average economies of Europe.

Greenland suffered an economic contraction in the early 1990s. But, since 1993, the economy has improved. The Greenland Home Rule Government (GHRG) has pursued a tight fiscal policy since the late 1980s, which has helped create surpluses in the public budget and low inflation. Since 1990, Greenland has registered a foreign-trade deficit following the closure of the last remaining lead and zinc mine that year. In 2017, new sources of ruby in Greenland have been discovered, promising to bring new industry and a new export from the country.[118] (See Gemstone industry in Greenland).

B.3 Transport

B.3.1 Air Transport

There is air transport both within Greenland and between the island and other nations. There is also scheduled boat traffic, but the long distances lead to long travel times and low frequency. There are virtually no roads between cities because the coast has many fjords that would require ferry service to connect a road network. The only exception is a gravel road of 5 km (3 mi) length between Kangilinnguit and the now abandoned former cryolite mining town of Ivittuut. In addition, the lack of agriculture, forestry and similar countryside activities has meant that very few country roads have been built. **Kangerlussuaq Airport** (SFJ) is the largest airport and the main aviation hub for international passenger transport. It serves international and domestic airline operated flight. SFJ is far from the vicinity of the larger metropolitan capital areas, 317 km (197 mi) to the capital Nuuk, and airline passenger services are available. Greenland has no passenger railways. **Nuuk Airport** (GOH) is the second-largest airport located just 6.0 km (3.7 mi) from the centre of the capital. GOH serves general aviation traffic and has daily- or regular domestic flights within Greenland. GOH also serves international flights to Iceland, business and private airplanes. **Ilulissat Airport** (JAV) is a domestic airport that also serves international flights to Iceland. There are a total of 13 registered civil airports and 47 helipads in Greenland; most of them are unpaved and located in rural areas. The second longest runway is at Narsarsuaq, a domestic airport with limited international service in south Greenland. All civil aviation matters are handled by the Danish Transport Authority. Most airports including Nuuk Airport have short runways and can only be served by special fairly small aircraft on fairly short flights. Kangerlussuaq Airport around 100 kilometres (62 miles) inland from the west coast is the major airport of Greenland and the hub for domestic flights. Intercontinental flights connect mainly to Copenhagen. Travel between international destinations (except Iceland) and any city in Greenland requires a plane change. There are no direct flights to the United States or Canada, although there have been flights Kangerlussuaq Baltimore, and Nuuk Iqaluit, which were cancelled because of too few passengers and financial losses. An alternative between Greenland and the United States/Canada is Air Iceland/Icelandair with a plane change in Iceland.

B.3.2 Sea Transport

Sea passenger transport is served by several coastal ferries. Arctic Umiaq Line makes a single round trip per week, taking 80 hours each direction. Cargo freight by sea is handled by the shipping company

Royal Arctic Line from, to and across Greenland. It provides trade and transport opportunities between Greenland, Europe and North America.

B.4 Photos

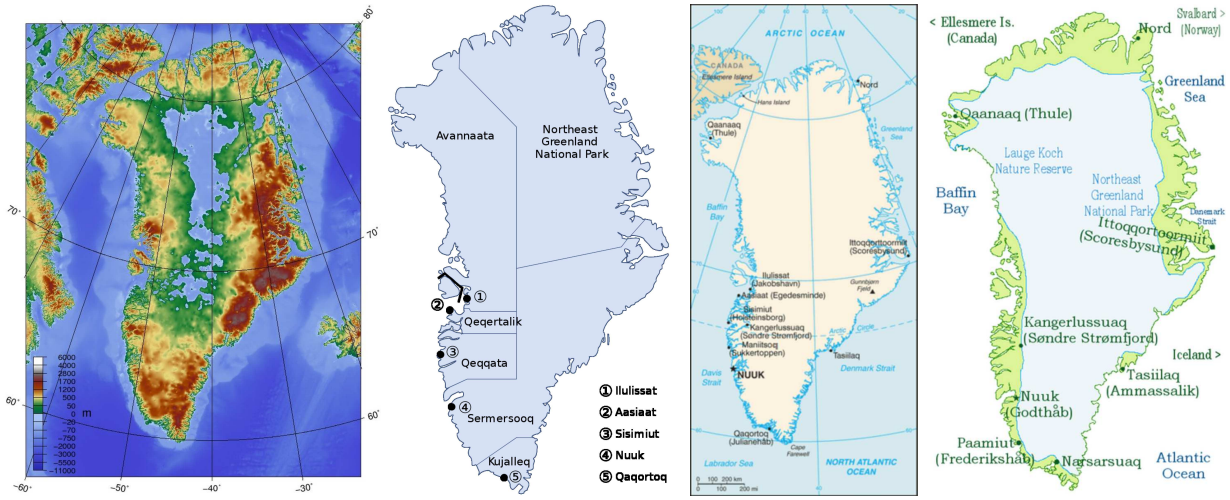

Figure 1: Greenland

B.4.1 Harbours

Figure 2:

Figure 3: Sisimiut and Tasiilaq

Figure 4: Upernavik and Uummannaq

C The Royal Arctic Line

C.1 General

The[11] Government of Greenland has given Royal Arctic Line A/S an exclusive concession for the transportation of all sea cargo to and from Greenland and between the Greenlandic towns and settlements.

There are several conditions associated with the concession regarding frequency, capacity and security of supply for all the towns on both the East Coast and the West Coast. As a result, the shipping company is Greenlands lifeline, ensuring supplies to the entire country.

Royal Arctic Line A/S was founded in 1993 and it is wholly owned by the Government of Greenland. Read more about Royal Arctic Line A/S by navigating the pane on the left.

The company is Royal Arctic Line A/S, owned by the Government of Greenland. The ships are undertaken through liner shipping, between Greenland and the rest of the world.

Royal Arctic Line handles operations in the 13 biggest harbours in Greenland, while representing port authority, on behalf of the state.

Forwarding activities such as air freight, combined with air and sea freight are undertaken by Royal Arctic Line.

[11] From: royalarcticline.com/about-us/

Figure 5: Ilulissat and Maniitsoq [1890 !]

Figure 6: Nanortalik and ???

In Denmark, the group is represented by Royal Arctic Line Denmark A/S. Here, more than 85,000 shipments are booked and coordinated each year. At the same time, Royal Arctic Line undertakes stevedoring in Aalborg, including the practical handling of goods to or from Greenland, through Aalborg.

Royal Arctic Line is also active on other markets. Those activities include operating passenger services in Greenland through Arctic Umiaq Line.

Royal Arctic Line A/S was founded in 1993. At this time, several divisions under KNI, a trading company under the Home Rule, were split into individual public limited companies.

One of these divisions were given the task, of handling shipping in Greenland, and Royal Arctic Line became a reality. The company builds on more than 200 years of experience with shipping t o and around Greenland - first as Den Kongelige Greenlandske Handel (The Royal Greenland Trading Company), then as KNI, and then since 1993, as Royal Arctic Line.

Figure 7: History of RAL in Four Panels, 1–2

Figure 8: History of RAL in Four Panels, 3–4

C.2 History

C.3 Routes

C.4 Ship Photos

C.5 Ship Plans

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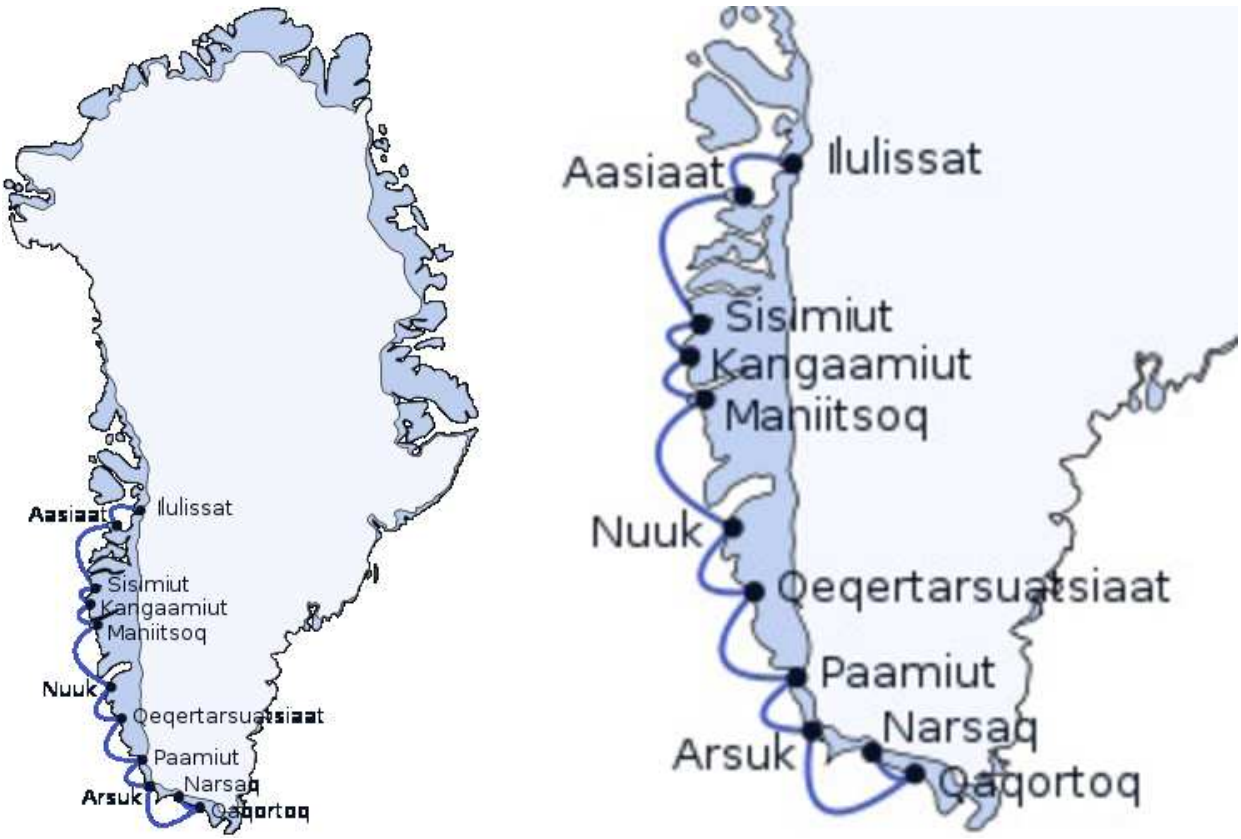

Figure 9: Arctic Umiaq Line Passenger Routes

D Terminology

D.1 Maersk

```
Assignment (AS)
--------
1. The transfer to another of one's own legal interests or rights.
2. Especially the transfer of property to be held in trust or
   to be used for the benefit of creditors.
3. The document by which such an interest or right is transferred

Bill of Lading (BL)
-------------------
Legal document signed by or for the captain/master, agents, owners of
a vessel or the (common) carrier. It is written evidence of the
contract of carriage by sea and/or by land. It is (1) A receipt of the
```

Figure 10:

Figure 11:

goods (in the owner's/carrier's or his/their agent's custody) and (2) An undertaking to carry and deliver the goods safely to the place directed/agreed, dangers of the sea excepted, against (3) Surrender of the document where/when provisions in the document stipulate delivery to order of a named person, to order (blank) or to bearer 4) It evidences the terms of the contract of carriage.

Bill of Lading (BOL)

The BOL is a document that provides the driver and the carrier with all the details they need to process the freight shipment and invoice it properly. It includes the amount of freight and an invoice detailing the contents. It also includes the freight class, the PRO number (or tracking number the shipment receives upon pickup), the name of the shipper and receiver, and any specifics for an accessorial. The accessorial includes any other specifics regarding the freight from pickup through delivery. Once the carrier drops off the freight, the BOL acts as a receipt and a report for the receiver.

Figure 12:

Figure 13:

```
Booking
--------
1. Act of recording arrangements for the movement/transportation of
   goods by vessel or other conveyance.
2. To express in advance a desire
   for something in order to reserve it e.g. transportation of
   goods.
3. Also known as a booking request.

Consignee
---------
Consignee refers to the party that will pay for freight
shipping. Often, the consignee of a shipment is the shipper.

Delivery
--------
(1) The physical and legal transfer of a shipment from consignor to
    carrier and from carrier/ transport agent to consignee.
```

Figure 14:

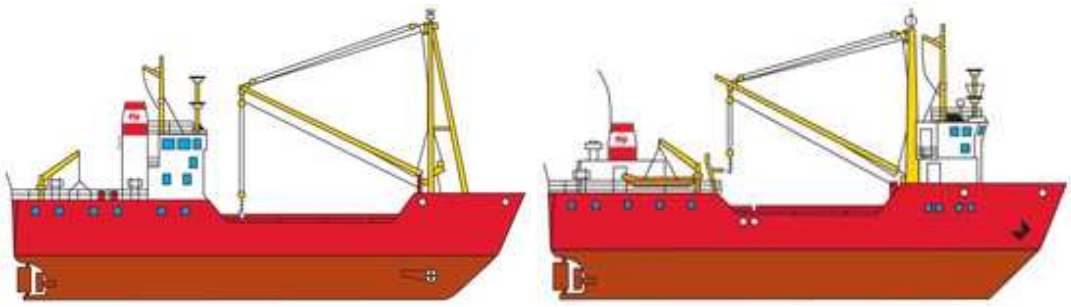

Figure 15:

(2) The act of putting property into the legal possession of another, whether involving the actual transfer of the physical control of the object from one to the other or being constructively effected in various other ways.

Delivery Order

An order from the consignee, shipper or owner of freight to a terminal operator, carrier or warehouse to deliver freight to another party. On imports, it may also be known as a pier release.

A document which is neither a bill of lading or a waybill but contains an undertaking which

(1) is given under or for the purposes of a contract for the carriage by sea of goods to which the document relates, or of goods which include those goods; and
(2) is an undertaking by the carrier to a person identified in the document to deliver those goods to that person which the document

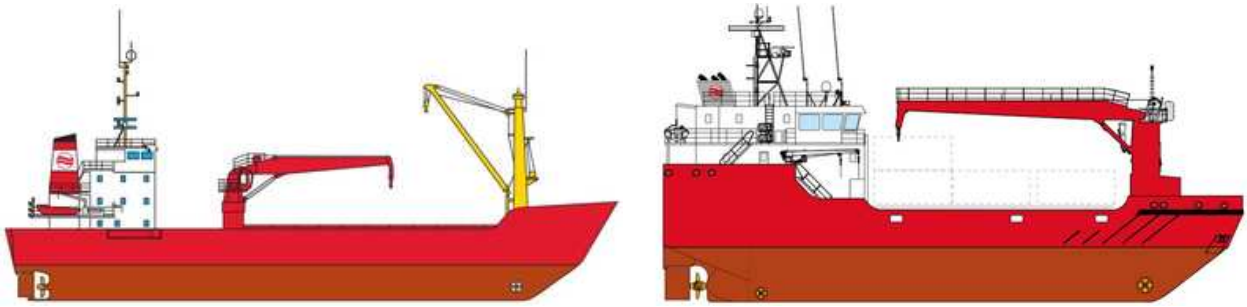

Figure 16:

```
    relates.

Delivery orders are capable of transferring contractual rights by way
of endorsements, but they are not necessarily documents of title in
the sense of being able to pass constructive possession.

Diversion Charge
--------
Fee for diverting cargo from original intended destination port to a
new location.

Dock Receipt
--------
Receipt given for a shipment received or delivered at a pier or
dock. When delivery of a foreign shipment is completed, the dock
receipt is exchanged for a bill of lading with the transportation
line.

EIR
--------
Equipment Interchange Receipt. A document used to receive or deliver a
full or empty container/chassis at any terminal or inland container
pool/depot.

Feeder (F)
--------
Transportation conveyance utilised to relay cargo from the mother
vessel to ultimate destination or from first receipt port to mother
vessel.

Floating Cranes (FC)
--------
```

Heavy duty cranes that are able to handle exceptionally heavy cargo if unable to use conventional gantry cranes.

For-Hire Carriers (FHC)

Persons or firms engaged in the transportation of goods or passengers for compensation. Classified into two general categories, specialised and general freight motor carriers.

Freight Bill (FB)

Destination (Collect) Freight Bill: Prepaid Freight Bill. (1) Bill rendered by a transportation line to consignee containing description of freight shipper name, point of origin and weight charges (if not prepaid). (2) Bill rendered by a transportation line to shipper containing description of freight, consignee, destination and weight charges.

Freight Forwarder (FF)
---
(1) Person engaged in assembling, collecting, consolidating shipping and distributing less than trailerload freight.
(2) Also, a person acting as an agent in the transshipping of freight to or from foreign countries and clearing freight through federal customs.

Gantry Crane (G)

Gantry Crane Port crane used to load and discharge containers from vessels, can be positioned by moving along rail tracks.

IMCO Classification

International Maritime Control Organisation classification for hazardous cargo.

Imports

Goods and services which one country’s residents purchase and transport from another country into their own country.

Inbound

Import Shipment.

Incoterms (INCOTERMS)

The Incoterms rules are a globally-recognised set of standards, used worldwide in international and domestic contracts for the delivery of goods, brought together by the International Chamber of Commerce (ICC). They help traders avoid costly misunderstandings by clarifying the tasks, costs and risks involved in the delivery of goods from sellers to buyers. The Incoterms rules are recognised by UNCITRAL as the global standard for the interpretation of the most common terms in foreign trade. Incoterms 2020 have come into effect on 1 January 2020. All contracts made under Incoterms 2000 and any other previous editions remain valid and parties to a contract for the sale of goods can agree to choose any version of the Incoterms rules. However, it is recommended using the most current version of the rules, Incoterms 2020. It is important to clearly specify the chosen version.

Independent Carrier

Carrier that is not a member of a shipping conference.

Inland Carrier

Transportation company which hauls imports or exports between ports and inland points.

Insurance Certificate

Document which assures the consignee that insurance is provided to cover loss or damage to the cargo while in transit. A certificate issued by an insurer to a shipper (or other party) as evidence that a shipment of merchandise is covered under a marine policy.

Intermodal

Coordinated transport of freight, especially in connection with relatively long-haul movements, using any combination of freight forwarders, piggy-back, containerisation, air freight, assemblers, rail and road.

International Maritime Control Organisation (IMCO)

International Maritime Control Organisation. See IMO.

Label Cargo

Cargo, including all commodities, requiring a label according to the provisions of the International Maritime Dangerous Goods Code.

Line Haul

Marine portion of a vessel's route covering the greatest distance, usually across an ocean (e.g. Singapore-Los Angeles).

Logistics

The management of freight and information throughout the total supply chain from the original raw material source to the ultimate consumer of the finished product, encompasing factories, assembly and packing plants, warehouses, distribution centres and retail outlets.

Manifest

Entire listing of all cargo on board a vessel as required by the relevant local authorities e.g. customs. Same as cargo manifest.

Mother Vessel

Main ocean vessel in a liner service designated to move containers from set origin points to set destination ports/points on a regular basis.

Negotiable Bill of Lading

Something that can be negotiated, transferred or assigned from one person to another in return for equivalent value by being delivered either with endorsement (as of an instrument to order) or without endorsement (as of an instrument to bearer) so that the title passes to the transferee who is not prejudiced in his rights by any defect or flaw in the title of prior parties nor by personal defenses available to prior parties among themselves provided in both cases that the transferee is a bona fide holder without notice e.g. bills of lading, bills of exchange, promissory notes, and cheques that are payable to bearer or order are negotiable instruments, as are also, in some jurisdictions, some other instruments (as bonds, some forms of stock) i.e. negotiable paper/negotiable securities. "Negotiable" used analogously for "transferable" - see also negotiability/transferability.

Non-Negotiable Bill of Lading

A document not made out "to order", but being a receipt and evidence of the contract of carriage, but which is not a document of title, e.g. a waybill and, in some jurisdictions (such as the USA), a (straight) consigned bill of lading.

On Deck Stowage

Cargo stowed on the deck of the vessel.

Order Cycle

This includes the time and the process involved from the placement of the order to the receipt of the shipment. It includes the following processes: Communicating the order, order processing, transporting the shipment.

Original Bill of Lading (OBL)

Original bill of lading. See also Negotiable Bill of Lading.

Packing List

List of packages for each shipment, showing individual breakdown in weights/measure and quantity.

Physical Distribution

All logistics activities from the production line to the final user, including traffic, packaging, materials handling, warehousing, order entry, customer service, inventory control etc.

Pier

A structure built away from land and extending some distance over water, often used for docking boats. Also known as a wharf.

Quay

A pier, wharf or other structure built along a shore for landing, loading and unloading boats or ships.

Reverse Logistics

Reverse Logistics is a rather general term. In its broadest sense, reverse logistics stands for all operations related to the reuse of products and materials. The management of these operations can be referred to as Product Recovery Management (PRM). PRM is concerned with the care of products and materials after they have been used. Some of these activities are, to some extent, similar to those occurring in the case of internal returns of defective items due to unreliable production processes. Reverse logistics refers however to all logistics activities the collection, disassembly and processing of

used products, product parts and/or materials in order to ensure a sustainable (environmentally-friendly) recovery.

Ro-Ro

Roll on/Roll offVessel used for carrying cars and light trucks. Vehicles are driven on and driven off, as opposed to being loaded with cranes or other external equipment.

Seawaybill

A type of bill of lading used for port-to-port or combined transport carriage. A waybill is identical to a negotiable bill of lading except that it is not a document of title. There are no originals issued for this type of document. In some jurisdictions, such as the USA, a waybill is deemed the equivalent of a (straight) consigned bill of lading. See also Waybill.

Shipper
---
1) Person who consigns something (e.g. the goods of an individual shipment).
2) Legal entity or person named on the bill of lading or waybill as shipper and/or who (or in whose name or on whose behalf) a contract of carriage has been concluded with a carrier. Also known as consignor.

Storage Charge

Charge for goods held in storage facilities (warehouses) under a fixed agreement for periods of time, and which is not included in other arrangement.

Stripping

A service offered to the customer in which the carrier performs stripping (cargo unloading) or stuffing (cargo loading) of the customer’s container at the port area. This service is applied based upon the customer request.

Stuffing

A service offered to the customer in which the carrier performs stripping (cargo unloading) or stuffing (cargo loading) of the customer’s container at the port area.This service is applied based upon the customer request.

Switch Bill of Lading

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This service is provided by the carrier to 'switch' transport
documents (B/L's) to show new parties by issuing a 2nd set of
documents. A 'switch' is used to prevent the shipper from being
visible to the buyer and protects the interests of the cargo
intermediary. The service is applicable upon the customer's request
for this service.

Vessel Sharing Agreement (VSA)
------------------------------
A term agreement between two or more carriers in which a number of
container positions (""slots"") equal in space are reserved on
particular vessels for each of the participants. The number of slots
(space) on different vessels on the same route can vary by vessel type
and direction but may also be expressed as each party's capacity use
of the vessels employed jointly.

Waiver
------
Document used to allow cargo carriage by different flag vessels other
than original destination country vessels. Also for government cargo
where vessels under certain flags cannot carry the shipments.

Waybill
-------
See Seawaybill.

Wharf
-----
A structure built along a shore, and often into the water, at which
boats can be docked and loaded or unloaded; Also known as pier or
quay.

Wharfage
--------
This fee is assessed by a port authority or port operator to the
carrier for the usage of a port's wharf. The fee is then charged back
to the customer in order to provide transparency and to share the
costs. This fee will be applicable to shipments moving to/from port
terminals that charge wharfage fees.
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D.2 10 Greencarrier Terms

(https://blog.greencarrier.com/10-shipping-terms-every-international-shipper-should-know/)

1. Incoterms International Commercial Terms

When purchasing or selling goods, the goods need to be moved from their origin to their destination. The best way to do this is to negotiate at the point of purchase how it is going to be accomplished. But in order for both parties to understand and agree on the particulars, they have to speak the same language and agree on what the terms actually mean.

Incoterms is short for International Commercial Terms. They are a series of pre-defined commercial terms published by the International Chamber of Commerce. The terms are intended primarily to clearly communicate the tasks, costs, and risks associated with the transportation and delivery of goods.

You can find the Incoterms for 2020 here.

2. COD Change Of Destination

Imagine that your goods have been loaded onto a container ship and are now on their way to their destination. And for some reason, you realize you have to change the destination!

No need to panic. This is when it is time to request a COD a Change Of Destination. This is a request asking the container ship to discharge your container and transport your goods to another destination than what was originally booked.

3. CYCY Container Yard to Container Yard

CYCY is short for Container Yard To Container Yard. A container yard is a port facility where containers are stored before they are loaded onto a ship or after they have been discharged from a ship. The shipping term CYCY explains that the responsibility of the carrier begins (port of loading) and ends (port of discharge) at the container yard.

4. DM Demurrage

Demurrage is a fee that container lines charge when you havent picked up your imported containers in time. When your containers have been discharged, there is a free period for storing them in the port (provided by the container line). You have to pick up your containers before the free period expires. If not, you are charged for the number of days your containers were left in the port.

You can also be charged for demurrage fees if you have containers that

cannot be shipped out by the container line due to, for example, customs problems. You are then charged for the number of days your containers have to be stored in the port.

5. Rollover The container was never loaded onto the ship

It sometimes happens that containers get rolled. This means your container didnt make the vessel. Not having your container loaded onto the ship may happen because of customs problems, overbooking, or vessel omissions.

Your carrier will reschedule your shipment and place your container on the next departing ship.

6. DT Detention

Detention is a fee that you have to pay if you have picked up your imported containers but didnt return them to the shipping line in time. You will then have to pay for the extra number of days it took for you to return the containers. You can also be charged for demurrage fees if you have containers that cannot be shipped out by the container line because you didnt return them in time. You will then have to pay for the extra number of days the containers have been in your possession.

7. Port Storage

When your containers have been discharged from a ship, they are moved to a container yard. The port provides a free period of storage (not to be confused with the free period demurrage provided by container lines). During this period, you have time to take care of customs clearance procedures and transport your goods to a warehouse or the final destination. This is important to ports as lack of space may affect port productivity and cause port congestion. If you do not clear your goods and move your containers in time, the port can charge you for Port Storage.

8. FCL (Full Container Load) & LCL (Less than Container Load)

FCL is short for Full Container Load. This means you have enough goods to stuff an entire container. LCL is basically the opposite. It is short for Less than Container Load and means you do not have enough goods to stuff an entire container. Instead, your individual consignment is combined and shipped together with other consignments in the same container. At the port of destination, the consignments are separated back into their original individual consignments.

LCL is often beneficial for small or midsize businesses that dont have very large goods volumes but cannot afford to miss delivery deadlines. It often allows for savings on freight costs as the goods are shipped at lower rates. Sharing space also makes LCL an eco-friendly alternative.

9. Bill of Lading

The Bill of Lading is a legal document issued by a carrier to a shipper including shipment details such as the type of goods, quantity, freight rate, and destination. It represents the agreement between the parties involved and helps guarantee that exporters receive their payment and importers receive their goods. The bill of lading also serves as a shipment receipt.

10. Stuffing & Stripping

The last shipping term Im going to share with you is the most straightforward: Stuffing is the process of loading a container with loose goods prior to shipment. Stripping is the process of unloading a container when it arrives at the port. As simple as that!

D.3 Arnesh Roy: A Glossary of International Shipping Terms

A Glossary of International Shipping Terms
Arnesh Roy | December 7, 2020 | Import Basics, Export Basics

ACE

The Automated Commercial Environment is the online web portal used to report data to the Automated Export System (AES) for exports leaving the United States, and also for customs filing for imports entering the United States.

AES

The Automated Export System is used by the U.S. government to collect data on exports. This data is called Electronic Export Information (EEI), and in many cases, exporters are legally required to file the EEI through AES for each shipment. The U.S. Census Bureau uses this data to calculate trade statistics such as gross domestic product (GDP), while U.S. Customs and Border Protection (CBP) uses it to make sure exporters are following U.S. export regulations.

See also: AES Filing Software by Shipping Solutions Plus 20 Key Terms

Aggregate shipment

Multiple shipmentsfrom different sellers to a single consigneethat are consolidated by the carrier into a single shipment.

Air waybill (AWB)

The AWB is a document that controls the routing of an exporters cargo while it is in the hands of the air carrier or a consolidator. It is a contract for carriage; however, it cannot be negotiated.

ALADI

The Latin American Integration Association (ALADI) is an international association of Latin American countries. Its function in Latin America is comparable to the function of the former European Economic Communitywhich has now become embedded in the framework of the European Unionin Europe. The goal of ALADI is to harmonize trade across the member states. There are currently 13 member countries representing a population of more than 500 million people. ALADI has its own commodity classification system similar to the global Harmonized System (HS).

Alongside

Refers to the side of a ship. Goods delivered alongside are placed on the dock or barge within reach of the ships rigging so it can be easily loaded onto the ship. For example, its used in the Incoterms 2010 trade term Free Alongside Ship.

Apparent good order

When freight appears to be free of damage after being assessed it is said to be in apparent good order.

Arrival notice

Notification provided by the carrier when a shipment has arrived to the consignee or notify party.

Astern

Means either "behind a ship" or "to move a ship in reverse direction."

ATDNSHINC

Stands for Any Time, Day or Night, Sundays and Holidays Included, referring to when a vessel will operate.

Athwartships

A direction across the width of a ship.

Audit

A thorough examination of a businesss processes to determine if the business is compliant with a particular set of standards. A government agency may audit a companys processes or records as part of an investigation related to a potential compliance violation. In some industries, companies must pass periodic government audits to maintain their authorizations. Companies may also conduct internal audits (self-audit), or hire a third party to audit their processes. The Bureau of Industry and Security (BIS), the export control arm of the U.S. Department of Commerce, recommends that U.S. exporters periodically self-audit to ensure compliance procedures are working properly and are up-to-date with regulation changes. Auditability refers to the capacity of an auditor to audit an auditee. Sloppy record-keeping lowers auditability. An audit trail is a system (physical or electronic) that keeps track of business processes.

See also: 4 Reasons to Audit Your Companys Export Procedures

Audit trail

A system that stores and maintains records of business processes. With regards to exporting, companies are strongly encouraged to maintain an audit trail documenting their compliance screenings in order to demonstrate due diligence in case of an audit. Having an audit trail may protect your company from fines or penalties in the case of an export compliance violation.

Automatic identification system (AIS)

A satellite system used by ships and vessel tracking service (VTS) to identify and locate ships.

Backhaul

Cargo carried on a return journey.

Balloon freight

Freight that is low weight but high volume (light but bulky).

Bank Draft

A financial instrument provided by a bank and drawn on another bank.

See also: Understanding Bank Drafts: Sight Draft versus Time Draft

Beam

The width of a ship.

Beneficiary

The party that receives payment.

Bilateral

A bilateral agreement is one in which both parties agree to provide something for the other.

Bill of lading

A document issued by a carrier or their agent acknowledging receipt of cargo for shipment. Often abbreviated as BOL, BoL, B/L or BL. If there were no issues with the cargo stated on the BOL, it is said to be a clean bill of lading.

See also: 3 Things You Need to Know about the Bill of Lading Form

Bill of sale

A document that confirms transfer of goods in exchange for money.

Bill-to party

The party paying for goods or services in a transaction.

BIS

The Bureau of Industry and Security, an agency within the U.S. Department of Commerce tasked with enforcing the Export Administration Regulations (EAR).

Blocking or bracing

Wood or metal supports used to secure cargo while in transit. Also called dunnage.

Block stowage

Loading cargo close together to minimize movement of goods while in transit.

Bolster

A piece of equipment attached to a chassis or railcar to secure the container.

Bond port

The initial port of entry where a vessel transporting goods first arrives at a country.

Booking

Arrangements made with a carrier for the movement of cargo; space reservation.

Bow

The front of a vessel.

Broken stowage

Empty space in a container not occupied by cargo.

Bulk cargo

Cargo that is shipped loose as opposed to being shipped in packages or containers. Grain and coal are examples of goods usually shipped as bulk cargo.

Bull ring

A device attached to the floor of a container which is used to secure cargo.

Cabotage

Transport of goods between two places in the same country by a transporter from another country.

Cargo

Any goods being transported, regardless of the mode of transport.

Cargo declaration

Information submitted prior to, upon arrival or upon departure of an international shipment required by a countrys customs authority.

Cargo manifest

A document detailing the cargo carried on a ship, often provided to a customs authority.

Carnet

A document permitting the holder to temporarily send goods to certain foreign countries for display or demonstration purposes without having to pay duties.

See also: What is an ATA Carnet?

Cash on delivery (COD)

The sale of goods in which payment is made upon delivery rather than in advance.

Carrier

A carrier is a party that transports goods for another person or company and is responsible for any possible loss of or damage to the goods during transport. A common carrier provides transportation services to the public in return for compensation. A contract carrier provides this service under special contracts, often for government clients.

CBP

Customs and Border Protection, part of the Department of Homeland Security, is the agency within the U.S. government tasked with controlling the flow of people and goods into and out of the country, and with enforcing import and export regulations.

CCC Mark

A label indicating cargo conforms to standards established by the Chinese government.
USMCA - The Modernized NAFTA WebinarCCL

The Commerce Control List is a list of dual-use items (items that have both a commercial application as well as a potential military

application) published as part of the U.S. Department of Commerces Export Administration Regulations (EAR). Each item on the CCL is identified with an Export Control Classification Number (ECCN). Knowing the right ECCN for your product plays a role in determining if you need an export license.

CE Mark

A label indicating cargo conforms to standards established by the European Union.

Certificate of free sale

This document indicates a particular product is marketed in the United States or is eligible for export, and that the particular manufacturer has no unresolved enforcement actions pending before or taken by the U.S. Food and Drug Administration (FDA). It is often used when exporting to countries whose regulatory agencies are not as well-developed as the United States FDA.

Certificate of inspection

A document certifying that merchandise is in good condition immediately prior to being shipped.

Certificate of origin (COO)

A document certifying where goods were originally made. A COO specific to a particular free trade agreement may be used to claim preferential duty treatment. A generic certificate of origin may be requested by the customs authority of the country of import, in which case the COO must be stamped by a chamber of commerce.

CFR

The Code of Federal Regulations is the codification of rules and regulations published in the U.S. Federal Register.

Chamber of commerce

An association of businesses that may serve several functions, including advocating or lobbying for their member companies, organizing business-related programming and events in their communities, and, perhaps most relevant for exporters, providing document certification services.

See also: The Chamber of Commerce and Export Documents: The

Certificate of Origin

Chassis

The base frame of a wheeled vehicle, used to secure a container prior to movement.

Chock

Material (often wood) placed next to cargo to prevent excessive movement of the cargo during transit in order to avoid damage.

CL

Abbreviation for carload or containerload.

Claim

In the context of logistics, a claim is a demand made by a customer to a transportation company for payment in order to compensate for loss or damage of goods.

CM and cm

CM (uppercase) stands for cubic meters, while cm (lowercase) stands for centimeters.

Commerce Country Chart

Part of the Export Administration Regulations (EAR), which helps exporters determine if they need to apply for an export license in order to ship a particular product to a particular country.

Commercial invoice

A fundamental document for an international transaction with details including what goods are being shipped, who is the shipper and who is the ultimate consignee. Serves as the basis for all other documents related to the shipment.

Commodity

Any commercial good that is shipped.
Common law

Law that derives authority from precedent, custom and usage rather than from statutes, particularly regarding the laws of the United

States, the United Kingdom and countries formerly part of the British Empire.

Compliance

In the context of international shipping, being compliant or maintaining compliance means that the company in question is following all applicable laws and rules which govern their shipments. In this context, the more specific terms regulatory compliance or trade compliance may be used to differentiate from other uses of the term, as the word compliance has other meanings in other contexts such as in the fields of medicine and psychology. A business practice that goes against specific laws is termed a compliance viola tion.

See also: What to Do When You Encounter Export Violations

Concealed loss/concealed damage

Shortage of or damage to goods shipped that is not immediately evident upon delivery.

Connecting carrier

A carrier which acts as an intermediary between two or more other carriers.

Consignee

The person or place to whom a shipment will be transferred. The ultimate consignee is the final recipient of the goods, while an intermediate consignee takes possession of the goods for a portion of the time that they are in transit.

Consignment

A shipment of goods to a consignee.

Consignor

Refers to the exporter or shipper from which the goods originate.

Consolidation

When cargo from multiple shippers is combined in a single container.

Consul

A government official residing in a foreign country who represents the interests of their home country.

Consumption entry

When goods are imported into the United States without any time or use restrictions. The official U.S. Customs and Border Protection (CBP) website states that about 95% of all imports fall into this category.

Container

A truck trailer loaded with cargo that can be detached for loading onto a vessel or railcar. Different types of containers exist for different shipping needs. For example, a container may be ventilated, refrigerated, insulated, dehumidified or equipped with special devices used to secure certain types of cargo. A container shipment is a large shipment, typically over 20,000 pounds.

Container load

A load large enough in volume or weight to fill a container.

Container manifest

A document stating the contents of a container, its point of origin and point of destination. Vessels may be required by law to produce a manifest for every container being transported.

Contraband

Prohibited cargo such as illegal drugs or unauthorized weapons.

Contract

A legally binding agreement between two or more parties.

C-TPAT

U.S. Customs and Border Protection established Customs-Trade Partnership Against Terrorism in November 2001 as a voluntary partnership to help ensure supply chain security. Meeting C-TPAT standards enables faster processing through customs inspections and formalities.

Cu.

Abbreviation for cubic used when describing measurements of volume.

Cube out

Refers to when a container or vessel has reached its volumetric capacity before reaching its weight capacity.

Customhouse

A government office where duties are paid and import and export paperwork are filed.

Customs

A customs authority, or customs for short, refers to the agency within a government that is responsible for collecting duties and enforcing import and export regulations.

Customs bonded warehouse

A warehouse authorized by customs to receive duty-free goods.

Customs broker

An individual or organization who helps a shipper navigate customs requirements.

Customs clearance

The process in which a customs authority assesses a shipment being imported in their country in order to ensure compliance with their countrys import regulations. A shipment that has been approved by the customs authority and allowed to enter the commerce of their country is said to have cleared customs.

Customs entry

Also called Entry Summary or Form 7501, is a document that provides U.S. Customs and Border Protection (CBP) with details about a shipment being imported into the United States, such as value, classification and origin. CBP uses the form to calculate duties owed.

Customs invoice

A document required by a countrys customs authority, which serves the same purpose as a standard commercial invoice but also contains additional information such as a certificate of origin.

Customs of the port (COP)

A phrase referring to local rules and practices which may impact a shipment.

Customs value only

Some shipments involve no actual monetary transaction between the exporter and the ultimate consignee, such as shipments for repair under warranty, or shipments of items used for display at trade shows. These shipments are still subject to duties and taxes, and exporters must list the monetary value of the items in the shipment on the customs invoice to enable the customs authority in the country of import to assess how much duty the importer must pay. In these cases, the exporter should include a customs value only statement on the invoice.

Cut-off time

The latest time cargo may be delivered to a terminal for loading.

Dangerous goods

A product may be considered a dangerous good if it is corrosive, flammable, poisonous, toxic, explosive, etc. Shipping dangerous goods may require special documentation or packaging to ensure safety.

See also: Hazardous Materials or Dangerous Goods?

Dangerous goods declaration

A dangerous goods declaration form is a document produced by an exporter providing details on the dangerous goods in their shipment. When shipping dangerous goods via air, a Dangerous Goods IATA Declaration form is required, and when shipping dangerous goods via sea, a Dangerous Goods IMO Declaration form is required.

Destination control statement

A legal statement put on an export invoice that specifies that the goods are to be transferred to the ultimate consignee and no other party. Diversion to other countries or parties without prior authorization is a violation of U.S. law. Also called an anti-diversion clause.

DDTC

Directorate of Defense Trade Controls (DDTC) is the government agency within the U.S. Department of State tasked with enforcing the International Traffic in Arms Regulations (ITAR), which regulate the export of space- and defense-related products.

D&H

Abbreviation for dangerous and hazardous cargo.

DBA

Stands for doing business as, used to specify that a company is doing business under a certai
Deconsolidation point

Location where cargo is separated in preparation for delivery.
Deemed export

Transmission of controlled technology, source code or information to a foreign national at home or abroad. Export regulations apply to deemed exports as well.

See also: Deemed Exports: Exporting Without Shipping a Product.

Delivery receipt

A document signed and dated by a consignee or their authorized agent confirming receipt of goods and stating the condition of the goods upon delivery.

Demurrage/detention

Demurrage is a charge to be paid by a shipper or consignee to the carrier as penalty for delaying the carriers cargo beyond the allowed free time. Detention is the same as demurrage except that instead of applying to delays in cargo, detention applies to delays in equipment.

Denied party screening

Also called restricted party screening or trade party screening, denied party screening is the process of screening potential customers, partners or vendors against denied party lists. These are lists of individuals or organizations that a government has identified as parties that one cant do business with and that one may be penalized for doing business with.

See also: Export Compliance: Understanding Restricted Party Screening

Destination control statement

A legal statement put on a shipping document that specifies that the goods are to be transferred to the ultimate consignee and no other party. Diversion to other countries or parties without prior authorization is a violation of U.S. law.

See also: What Is the Destination Control Statement and Why Should It Be on Your Commerci

Discrepancy

When documents presented do not conform to the requirements of the letter of credit. Banks will not accept letters of credit that have discrepancies.

Diversion

Diversion refers either to 1) a change made to the route of a shipment or to the route of the entire vessel or 2) the transfer of goods from the intended end-user to some other party.

Dock

For road transportation, a platform from which trucks are loaded and unloaded. For sea transportation, a cargo handling area adjacent to the shoreline where a ship ties up.

Dock receipt

A document used to acknowledge receipt of cargo. Provides the framework for the preparation of an ocean bill of lading.

DOT

U.S. Department of Transportation, a U.S. agency within the executive branch that oversees transportation in the U.S.

Drawback

A partial refund of an import fee, usually given if goods are re-exported from the country that collected the fee.

Drayage

Transport of goods over a short distance. Some definitions specify that drayage is the transport of goods in which both the trip origin and destination are within the same urban area. Also called cartage.

Dumping

Importing goods into a country at a price less than the fair market value.

Dutiable value

The amount on which a customs duty is calculated.

Duties

Taxes collected on importing and exporting goods. Also called tariffs.

EAR

The Export Administration Regulations are published by the U.S. Department of Commerce and regulate exports of dual-use items, meaning items that have both a commercial use as well as a potential military application.

ECCN

Export Control Classification Numbers are alphanumeric codes used to identify dual-use items, meaning items that have both a commercial use as well as a potential military application. Knowing the right ECCN for your product plays a role in determining if you need an export license.

eCO

An electronic Certificate of Origin is a digital document issued by a registered chamber of commerce to an exporter. Certificates of origin are a common customs document required by many countries and as part of various free trade agreements. An eCO is certified by a chamber of commerce electronically, which enables the certification process to occur more efficiently and at lower cost. Shipping Solutions has partnered with the American World Trade Chamber of Commerce (AWTCC) to provide the Shipping Solutions eCO Portal.

EEI

Electronic export information is the data that exporters must report to the Automated Export System (AES) via the Automated Commercial Environment (ACE) online web portal.

See also: Who is Responsible for Filing the Electronic Export Information (EEI)?

Electronic data interchange (EDI)

The electronic transmission of business documents such as invoices, purchase orders and bills of lading.

Embargoes

Sanctions are prohibitions designed to protect economic or national security and may include trade barriers, tariffs and restrictions on financial transactions. Embargoes are similar but usually refer to more severe restrictions such as travel bans or blockades.

Eminent domain

The power of a sovereign government to take property for a necessary public use.

Empty repo

Stands for empty repositioning; refers to the movement of empty containers.

End-user

The ultimate recipient of a shipment. Generally synonymous with ultimate consignee. This may be different from the party being billed for the shipment.

Endorsement

A legal signature that signals transfer of rights from one party to another.

Equipment interchange receipt (EIR)

A document used when transferring a container from one carrier to another, or from one terminal to another.

ERP

Enterprise resource planning (ERP) software helps companies with order-processing and accounting. Some ERP systems include international shipping or trade compliance modules, but these are often limited in their functionality.

See also: 6 Reasons Exporters are Frustrated with Their ERPs Export Module

ETA, ETC, ETD, ETR, ETS

Estimated time of arrival, completion, departure, readiness or sailing.
Exception

A delivery in which the driver or recipient notes a problem on the delivery receipt before signing is referred to as an exception. An exception is usually related to shortage or damage of goods.

Exclusive use

A shipper may pay a premium rate to obtain exclusive use of a trailer. This means the container will only be filled with the shippers goods and not those of any other party, even if there is additional space on the trailer.

Export

Shipment of goods out of a country. Opposite of import.

Export compliance program (ECP)

A company's written set of procedures for ensuring compliance when exporting.

See also: Your Company Needs an Export Compliance Program.

Export controls/import controls

Refers to licenses, permits and other authorizations which may be required from a government to legally export or import something.

Export documentation software

A software tool used by a company to ensure consistency, efficiency and auditability in their export documentation and compliance process, such as Shipping Solutions.

Export license

A government-issued permit that authorizes a shipper to export a certain good or to export to a certain country or party.

Download the free white paper: How to Determine if You Need an Export License

Export management company

Exporting companies without their own export department sometimes outsource their export operations to an export management company (EMC).

FAK

Abbreviation for freight all kinds. Typically refers to a full container loaded with mixed cargo.

False billing

Misrepresenting freight information on shipping documents.

Federal Maritime Commission (FMC)

The agency within the U.S. federal government tasked with enforcing laws related to transport of goods by sea.

Federal Register

The Federal Register, sometimes abbreviated as Fed. Reg., FedReg, or FR, is the official journal of the U.S. government where new rules and regulations are published.

Force majeure

A common clause included in contracts that exempts parties for not fulfilling their obligations due to events beyond their control, such as natural disasters or war.

Fore and aft

The direction on a ship parallel to the center line.

Foreign trade zone

Areas where commodities can be manufactured, modified or stored under specific customs regulations and generally not subject to customs duties. May be abbreviated FTZ and sometimes called a free trade zone or free port.

See also: Foreign Trade Zones: Advantages for Importers and Exporters

FPPI

Foreign principal party of interest is the party to whom final delivery of the goods will be made, typically the foreign buyer.

Free time

The amount of time that a carriers equipment may be used without incurring additional charges.

Freight

Any product(s) being transported.

Freight broker

A person who arranges transportation on behalf of a shipper. Typically a freight broker will connect small shippers to carriers who can move their goods.

Shipping Solutions Demo VideoFreight forwarder

A company that arranges the transportation of goods on behalf of a shipper. A freight forwarder may have its own in-house carriers or may contract with external carriers. Freight forwarders often specialize in consolidating LTL freight from multiple shippers.

FTA

Free trade agreements are made between countries in an effort to reduce barriers to trade between the participating countries.

FTR

The Foreign Trade Regulations (FTR) are a set of regulations placed on international trade in the U.S. They are established and updated by the U.S. Census Bureau. It is in the FTR that the requirement to file the Electronic Export Information (EEI) through the Automated Export System (AES) can be found.

See also: Why Is the Census Bureau Monitoring Your Exports?

Full truckload (FTL)

A full truckload carrier is a carrier that contracts the entirety of a trucks carrying capacity to a single customer. Often referred to as a truckload carrier.

General order

When U.S. Customs orders shipments without entries to be kept in their custody.
Gross vehicle weight (GVW)

The total weight of a vehicle including the weight of the vehicle itself and any attached containers.

Harbour

A place where ships stop to resupply and load or unload cargo.

Harbour master

An official responsible for overseeing harbour operations.

Hatch

The opening on the deck of a ship that gives access to the cargo hold.

Hazardous materials (HazMat)

May be used interchangeably with the term dangerous goods, hazardous materials are goods that may pose a threat to safety because they are poisonous, toxic, corrosive, explosive, flammable, etc. More precisely, hazardous materials are defined by the U.S. Department of Transportation in accordance with the Federal Hazardous Material Law. It is more common to see the term hazardous materials used when shipping domestically within the U.S., whereas the term dangerous goods is used more often when shipping internationally. Shipping hazardous materials may require special documentation or packaging to ensure safety.

HMF

Harbor maintenance fee.

See also: A Case of HaruMpF and MumPF

HS

The Harmonized System is an internationally accepted system used to classify products. The first six digits of an HS code are universal across all countries, but each country will add additional digits to further specify products. HS codes play a role in determining import and export controls as well as duty rates. The code for a particular

product is often called its tariff classification, as is the process for finding the right code.

IMDG

International Maritime Dangerous Goods code; the regulations established by the International Maritime Organization (IMO) for the international transport of dangerous goods.

Import

Shipment of goods into a country. Opposite of export.

Import declaration

Information submitted by an importer or their agent to their countrys customs authority before or upon importation of goods, such as the contact details of the importer, how the goods are being transported and the tariff classifications and values of the items on the shipment.

Import license

A government-issued permit authorizing a party to import a good into the country.

Receive SS Tips In bond

An import or export shipment that has not yet cleared customs is referred to as in bond.

Incoterms

Incoterms are universal trade terms published by the International Chamber of Commerce (ICC.) They consist of three-letter codes that are intended to clearly communicate the tasks, costs and risks associated with the transportation and delivery of goods in an international transaction. They describe how responsibility is allocated between the seller and the buyer for different parts of the transaction.

Download the free Incoterms 2020 Chart of Responsibilities and Transfer of Risk

Interchange point

A location where freight is transferred from one carrier to another.

Intermodal

Intermodal transportation is the movement of goods via more than one type of transportation (e.g. air, rail, sea, truck, etc.). An intermodal container is one that can be used in different modes of transport without having to unload the goods and reload them at each point at which the mode of transport changes. In the context of international trade, intermodal container is usually synonymous with container.

Inward foreign manifest (IFM)

A document listing all cargo entering a country. Required by all world ports and is the primary source from which import duties are assigned.

ITAR

The International Traffic in Arms Regulations regulate the export of space- or defense-related products and are enforced by the U.S. Department of State.

See also: An Overview of the International Traffic in Arms Regulations (ITAR)

JIT

Abbreviation for "just in time." A method of inventory control which minimizes warehousing and in which the container itself acts as a movable warehouse and arriving on schedule is crucial.

Laden

Loaded aboard a vessel.

Landed cost

The total cost of goods for a buyer including transportation costs and import duties.

Less-than-truckload, less-than-load (LTL)

A medium shipment, typically between 150 pounds and 20,000 pounds. An LTL carrier mixes freight from several customers in a single truckload. May also be called less-than-container (LCL).

Also called a documentary collection and often abbreviated as LC or L/C, a letter of credit is a written commitment by a bank issued after a request by an importer that payment will be made to an exporter provided that the terms of the letter of credit have been met as

evidenced by the presentation of certain documents.

See also: What's a Letter of Credit? (Infographic).

License exception

Certain criteria may be met that allow an exporter to export a product without an export license in cases where an export license would normally be required. These criteria are called license exceptions.

See also: What You Need to Know about Export License Exceptions

Liquidated damages

The penalty a seller must pay the buyer if a project does not meet the standards or deadline outlined in the sales contract.

List

The amount that a vessel tilts from the vertical, measured in degrees.

Logistics

The management of the flow of products as they are transported from the point of origin to their final destination. A logistics company is a general term for a company that provides logistics services, which may include freight forwarding, customs brokerage and/or consulting services.

Longshoreman

A port employee tasked with loading and unloading ships.
Malpractice

In the context of shipping, malpractice refers to situations in which a carrier illegally gives preference to a customer in order to attract their business.

Maritime

Relating to transport by sea.

Marking

Letters, numbers or other symbols placed on packaging used for identification purposes.

Master bill of lading

A bill of lading issued by a carrier to a freight forwarder acknowledging receipt of container for shipment. This is different from a house bill of lading which is issued by a freight forwarder to a shipper, acknowledging receipt of their items for shipment.

MPF

Merchandise processing fee.

    See also: A Case of HaruMpF and MumPF

Multimodal

See intermodal.
NAFTA

The North American Free Trade Agreement was established in 1994 to harmonize trade between the United States, Canada and Mexico. Companies located in these countries may be eligible for reduced duty rates when importing if their goods qualify under the terms of NAFTA. NAFTA was replaced on July 1, 2020, by the United States-Mexico-Canada Agreement (USMCA).

NCBFAA

The National Customs Brokers and Forwarders Association of America is an organization representing the interests of customs brokers and freight forwarders in the U.S. They publish guidelines on best practices, including specific guidelines on how to create a shippers letter of instruction (SLI) when authorizing freight forwarders to file through the Automated Export System (AES) on behalf of the exporter.

NEC, NES

Not elsewhere classified, not elsewhere specified.

Negotiable/non-negotiable

A negotiable instrument is a document that can be transferred from its original holder to a third party. A non-negotiable document cannot be transferred to another party. An inland or ocean bill of lading may be either negotiable or non-negotiable; a bill of lading consigned to order or to order of shipper is negotiable once it is endorsed on the back by the shipper or their representative. Airwaybills are

always non-negotiable.

See also: The Bill of Lading Always Proves Shipment Ownership

Net weight

The weight of goods not including the weight of their packaging.

Non-dumping certificate

Required by some countries to ensure protection against dumping of certain products.

NVOCC

A non-vessel operating common carrier behaves like a carrier except it doesnt provide the actual transportation service itself. Instead, a NVOCC buys space from carriers and sells this space to shippers.

On board

A notation on a bill of lading indicating that cargo has been loaded on a ship.8

On deck

A notation on a bill of lading indicating that cargo has been stowed on the open deck of a ship.

Open account

A transaction in which goods are shipped to a foreign buyer without guarantee of payment.

Operating ratio

A measure of operating efficiency based on a comparison between a carriers operating expenses and its net sales.

Origin

Can mean 1) Location where a shipment starts its journey or 2) Country where goods were originally manufactured.

Overage

When the number of units received is greater than the quantity stated

on the export documents. Opposite of shortage.

Packing list

A standard document that accompanies a shipment. Also called a packing slip, this document lists the products on a shipment along with packaging information but does not include prices.

See also: The Importance of an Export Packing List for Your International Shipments

Pallet

A platform on which packages may be loaded. Facilitates easier handling by a lift truck.

Parcel/package/small parcel/small package

A small shipment, typically less than 150 pounds.

Payee

The party paid in a transaction; the seller.

Payer

The party paying money in a transaction; the buyer.

Payment terms

Terms that describe how money will be paid in a transaction. Typically, the shipper is responsible for payment for prepaid shipments, while the consignee is responsible for payment for collect shipments, unless a third party is indicated as the payor on the shipping documents.

Phytosanitary inspection certificate

A document issued by the U.S. Department of Agriculture certifying that a shipment has been inspected and is free from harmful pests and plant diseases. Used to meet import requirements of other countries.

Pier

A structure perpendicular to the shoreline to which a ship is secured in order to load or unload cargo.

Place of delivery

Location where cargo leaves the custody of a carrier.

Place of receipt

Location where cargo enters the custody of a carrier.

POD

Abbreviation for 1) port of discharge 2) port of destination or 3) proof of delivery, a document provided by the carrier required to receive payment.

Point of origin

The location where a shipment is transferred from a shipper to a carrier.

POL

Abbreviation for 1) port of loading or 2) petroleum, oil and lubricants.

Port

May refer to 1) A harbour with piers or docks 2) The left side of a ship (when facing forward, opposite of starboard) or 3) An opening in the side of a ship used for handling freight.

Port of call

Port where a ship discharges or receives traffic.

Port of entry

Port where cargo is unloaded and enters a country.

Port of exit

Port where cargo is loaded and leaves a country.

PPI

Principal party of interest. See FPPI and USPPI.

Prepaid

Freight charges paid by a shipper prior to release of bills of lading by the carrier.

Proforma invoice

A document that acts as a formal quote, produced by the seller and given to the potential buyer before a transaction is finalized.

See also: How Does the Proforma Invoice Fit in the Sales Process?

Quarantine

A restriction placed on an operation in order to protect public health and safety.

Quota

The quantity of goods that may be imported without restrictions over a set period of time.

Quotation

Usually called a quote, an offer to sell goods at a stated price under stated conditions.

Rate basis

The formula of specific factors that play a role in determining freight rates.

RFP, RFQ

Request for proposal, request for quotation.
Reasonableness

Under ICC and common law, the requirement that a freight rate not be higher than what is necessary to reimburse the carrier and allow a fair profit.

Relay

The transfer of containers from one ship to another when both ships are controlled by the same carrier.

Remittance

Funds sent by one person to another as payment.

Revenue

Payment received by a carrier for transporting goods.

Roll-on/roll-off

Also called RORO or ro-ro for short, these are vessels designed to carry wheeled cargo, such as vehicles and trailers. This is in contrast to lift-on/lift off (LoLo) vessels which use a crane to load and unload cargo.

Sanction

An embargo enforced by a government against another country.

SBA

The Small Business Administration is an executive agency of th e U.S. government that exists to encourage and facilitate the growth and development of small

SBDC

Americas Small Business Development Centers are a network of hundreds of offices across the U.S. that provide support services to local small businesses. SBDCs are administered by the SBA.

SCAC

Standard Carrier Alpha Codes are developed by the National Motor Freight Traffic Association and used to identify inland carriers in the U.S.

Schedule B

Schedule B codes are used specifically for exporting out of the U.S. They are based on HS codes and used by the U.S. Census Bureau to calculate trade statistics and by U.S. Customs and Border Protection to ensure that exporters are following U.S. export regulations.

Ships tackle

Equipment such as rigging or cranes used on a ship for loading or unloading cargo.

Shipper

In the context of international trade, shipper is used to identify the company selling the goods to a foreign market. The shipper may also be called the exporter or consignor in this case.

Shippers letter of instruction (SLI)

A document provided by an exporting company to their freight forwarder outlining instructions for the freight forwarder. If the freight forwarder is filing through the Automated Export System (AES) on behalf of the exporter, the SLI includes the information they need to complete the filing.

See also: 5 Reasons You Need a Shipper's Letter of Instruction for Your Exports

Shipping documents

Paperwork that accompanies a shipment as it makes its way to the final destination, such as packing lists or bills of lading.

A Basic Guide To ExportingShipping Solutions

An export documentation and compliance software program that makes creating accurate export documents fast and easy.

See also: Shipping Solutions Features

Shortage

When the number of units received is less than the quantity stated on the shipping documents. Opposite of overage.

Skids

Devices placed beneath boxes or packages in order to raise them off the floor to permit access by a forklift.

SNAP-R

Simplified Network Application ProcessRedesign (SNAP-R) is a system maintained by the U.S. Commerce Department which enables U.S. companies to submit export license applications, commodity classification requests, reexport license applications and license exception AGR notifications via the Internet.

SOLAS

Safety of Life at Sea Convention is enforced by the International Maritime Organization (IMO). Under SOLAS, exporters are required to provide a verified weight of the goods before they are loaded onto a ship for transport.

See also: New Weight Verification Requirements Coming in July 2016

Spotting

Placing a container in a position from which it can be loaded or unloaded.

Starboard

The right side of a ship (when facing forward). Opposite of port.

Stern

The backside of a ship. Opposite of bow.

STC

Said to contain.

Stevedore

Individual or company that employs longshoremen and contracts for the loading and unloading of ships.

Stripping

Removing cargo from a container.

Stuffing

Putting cargo into a container.

STW

Said to weigh.

Supply chain

A system of interconnected organizations and activities involved in

the movement of goods from a supplier to a customer.

Surcharge

An extra or additional charge.

Surtax

An extra or additional tax.

Tail

Backside of a container or trailer. Opposite of front or nose.

Tare weight

The weight of a container while empty.

Terminal

Also called a container terminal, a location where containers are picked up, dropped off, maintained and kept.

Terminal charge

A charge for a service carried out in a carriers terminal area.

Third party logistics (3PL)

A company that provides logistics services to other companies, such as warehousing and transportation.

TL

Trailer load.

Trailer

A container attached to the back end of a truck.

Transshipment

The transfer of cargo from one carrier to another or from one vehicle to another at an intermediate point during the goods journey to the final destination.

Truck tonnage

The weight (in tons) of a shipment transported by truck.
Turnaround

A term used in marine transportation referring to the time it takes between arrival of a ship and its departure.
Ullage

The space not filled with liquid in a drum or tank.

Unclaimed freight

Freight that has not been called for or picked up by the owner or ultimate consignee.

Unit load

Packages loaded onto a pallet, in a crate or in some other way that allows for the goods to be handled as a single unit. This process is called unitization.

UN number

An internationally recognized four-digit code used to identify dangerous goods.

    See also: Creating the ITA Dangerous Goods Form

USMCA

On July 1, 2020, the United States-Mexico-Canada Agreement replaced NAFTA as the free trade agreement between the three countries. In Canada, it is officially known as the CanadaUnited StatesMexico Agreement (CUSMA). In Mexico, it is called the Tratado entre Mxico, Estados Unidos y Canad (T-MEC). Under USMCA, qualifying products are exempt from tariffs and quotas when traded between those three countries. To claim this preferential duty rate, you must determine if your goods qualify under the USMCA Rules of Origin.

    Download a free copy of the USMCA form

USML

The United States Munitions List is a list of space- and defense-related products that are controlled by the U.S. Department of State under the International Traffic in Arms Regulations (ITAR).

See also: What Exporters Need to Know about the U.S. Munitions List (USML)

USPPI

The United States principal party of interest is the party that receives the primary benefit from an export transaction, monetary or otherwise. Usually the seller of the goods.

See also: How to Determine the USPPI

Vessel

A seafaring vehicle; a boat or ship.

Vessel manifest

A document listing details regarding the crew and cargo onboard a vessel.

Vessel traffic service (VTS)

A traffic monitoring system used by harbour or port authorities used to monitor ships, similar to air traffic control used to monitor aircraft.

War risk

Insurance coverage for losses resulting from an act of war.

Warehouse

A place for the storage, consolidation and distribution of cargo. Warehousing is the storage of cargo.

Wharf

A structure built on the shore of a harbour which facilitates the docking of ships.