Reform of Logistics and Packing on Production in China

In case of Olympus Corporation

I. Process Reform on Parts Supplied from Japan for Production in China

II. Usage of Returnable Packing for Production Parts to be Transported to China

III. Optimum Export Packing for Digital Camera Produced in China

Logistics Design Consulting Lab.
Michiro Sakai
Certified Logistics Senior Master

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Profile

Personal Data}

- Entered Olympus Corporation in 1971, working for Overseas Marketing Department and Overseas Affiliate in New York for the period of 1991 to 1993, then engaged in logistics reform-related tasks for both overseas and Japanese domestic operations.
- Planned integration of 15 domestic distribution centers into one in 2000 and realized in 2001. Sent on loan to Olympus Logitex Co., Ltd., which is the logistics subsidiary of Olympus Corporation, and nominated for Director.
- Acquired a qualification of Certified Logistics Senior Master, which is granted by Japan Institute of Logistics Systems (standing for JILS), in 2003 as one of qualifiers in the inaugural course. Took office as the first Chairman of Logistics Senior Masters Society.
- Established LDC Laboratory in April, 2008.

History of Main Rewards and Writing

- Logistics Systems, August 2003 issue (JILS): Prize for effort to rationalize logistics on "Packaging improvement and modal shift (for cost reduction and environmental compliance) for large-sized blood analyzers"
- Logistics Systems, January 2004 issue (JILS): Logistics Grand Prize granted on "Simultaneous implementation of optimized domestic distribution centers through total optimization by overcoming obstacles of In-house Company System as well as difference in market characteristics and company climate of the logistics subsidiary"
- Logistics Systems, February 2004 issue (JILS): "Logistics and packaging reform relating to manufacturing development in China"
- LOGI – BIZ, July 2007 issue: Special Feature titled "Packaging reform initiated by logistics"

History of Main Activities

- Part-time instructor at Tokai University, for Department of Political Sciences and Economics
- Instructor at Qualification Course for Certified Logistics Senior Master (JILS) , for Certified Logistics Master (JILS) and for Certified Logistics Kaizen Master (JILS)
- Overseas dispatched specialist by Japan External Trade Organization（JETRO）(the Philippines and Indonesia)
- Instructor at Logistics Lecture Course organized by The Overseas Human Resources and Industry Development Association（HIDA）(Thailand, Malaysia, Laos and Cambodia)
- Chief Instructor for Instructor Training Course in "Project for supporting creation of logistics qualification course in the Philippines and Indonesia as a joint project of JETRO and HIDA
- Besides: Many other consulting works and logistics-related presentations
- Main consulting areas:
  - Global inventory reduction
  - Logistics cost reduction
  - Integration/abolition of distribution centers
  - Packaging improvement
  - Operational reform in distribution centers
  - Training for logistical human resources
  - Support for logistics-related matters in general, etc.

Olympus Corporation - Outline

Imaging

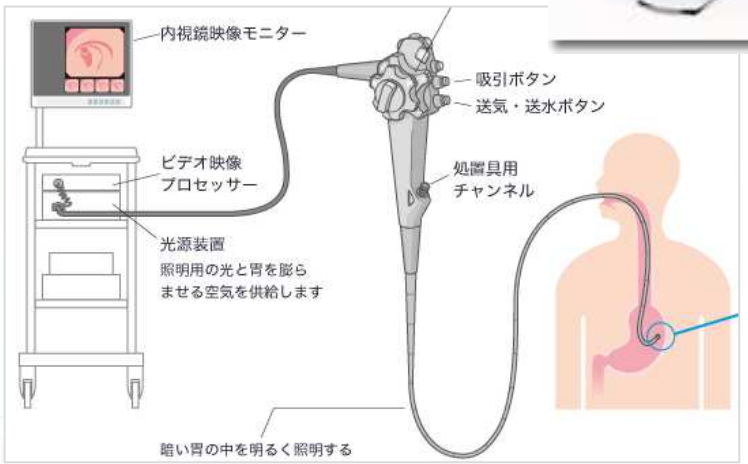
Digital Camera

Binoculars

IC Recorder

Medical

Medical Instrument



Bio-
Microscope

Industrial
Endoscope

Measuring Microscope

Industrial

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Part 1

Process Reform on Parts Supplied from Japan for Production in China

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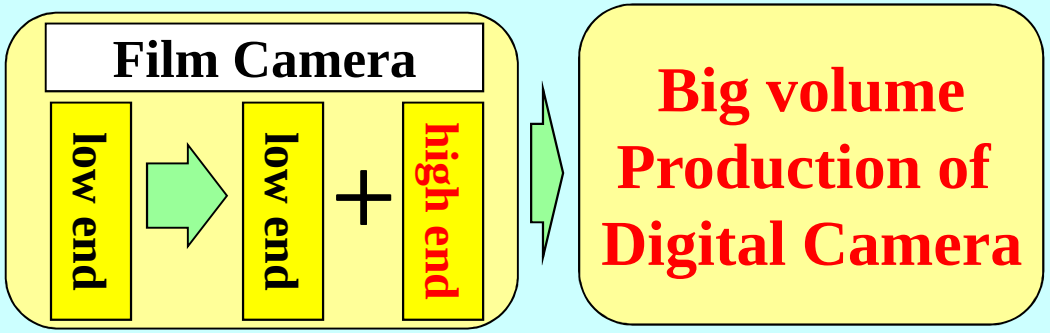
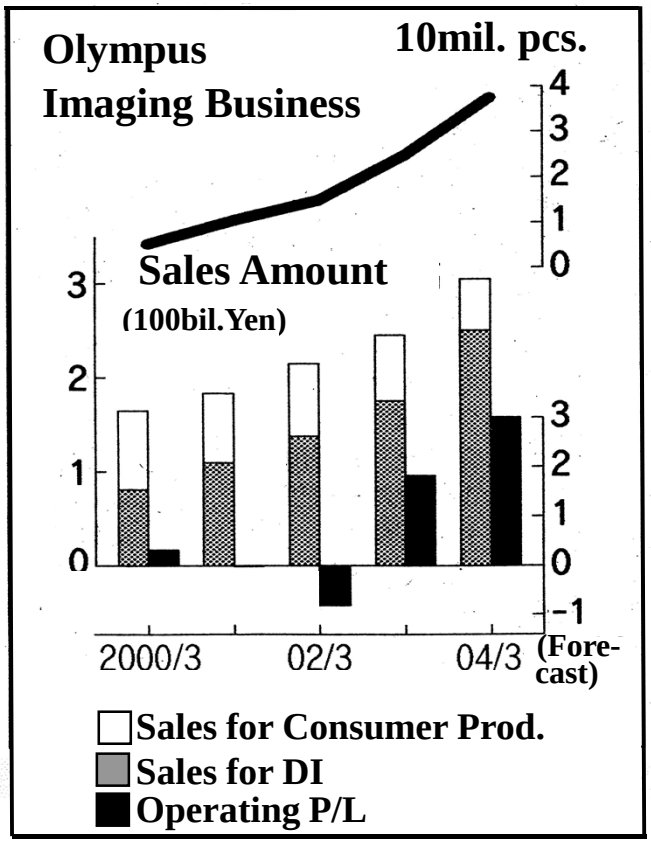
Production in China - Olympus

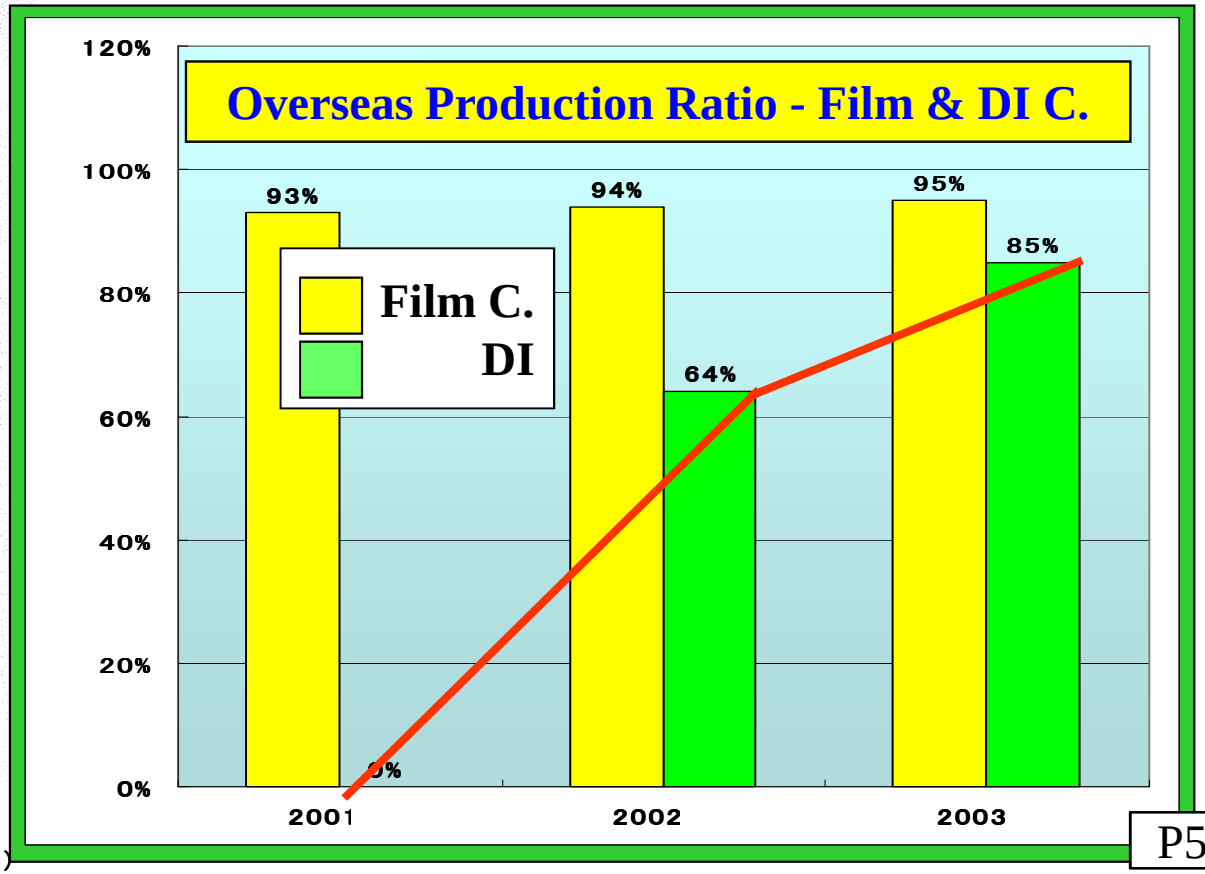
History for Camera Prod.

1988 Olympus HK established
1989 HK factory est.
1990 Panyu factory est.
1991 Shenzhen factory est.
1997 Beijing factory est.

China Production Movement







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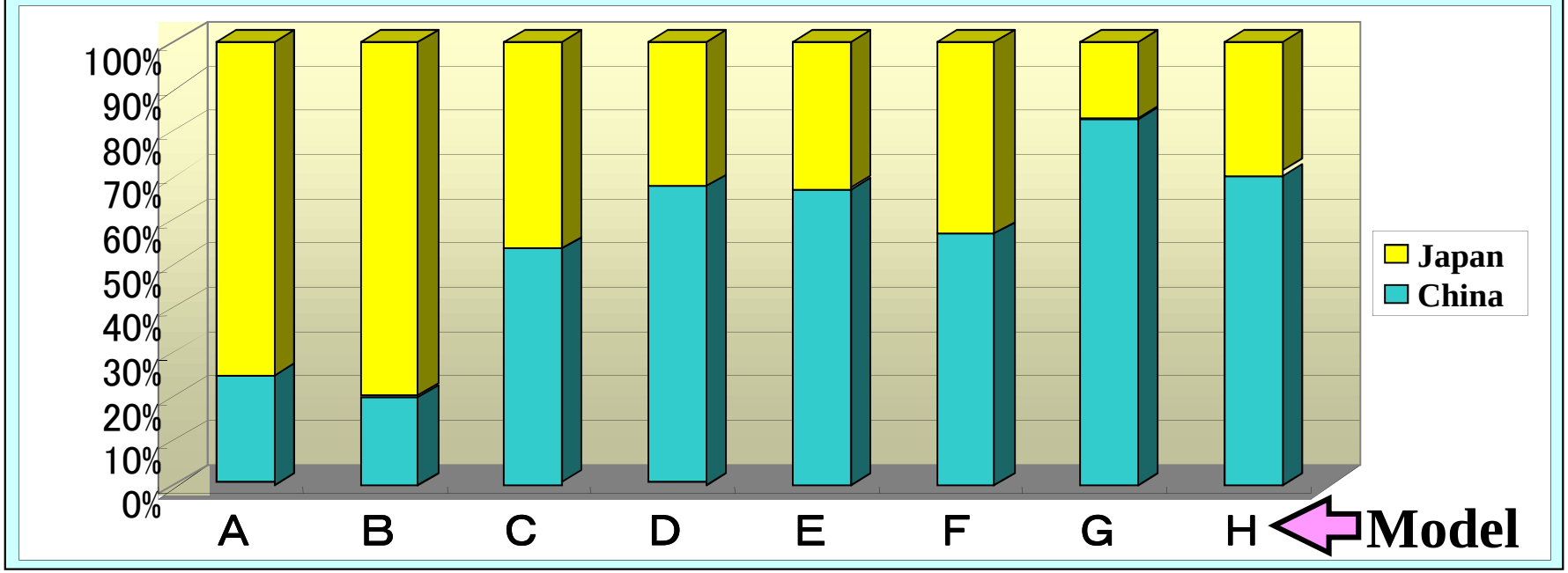
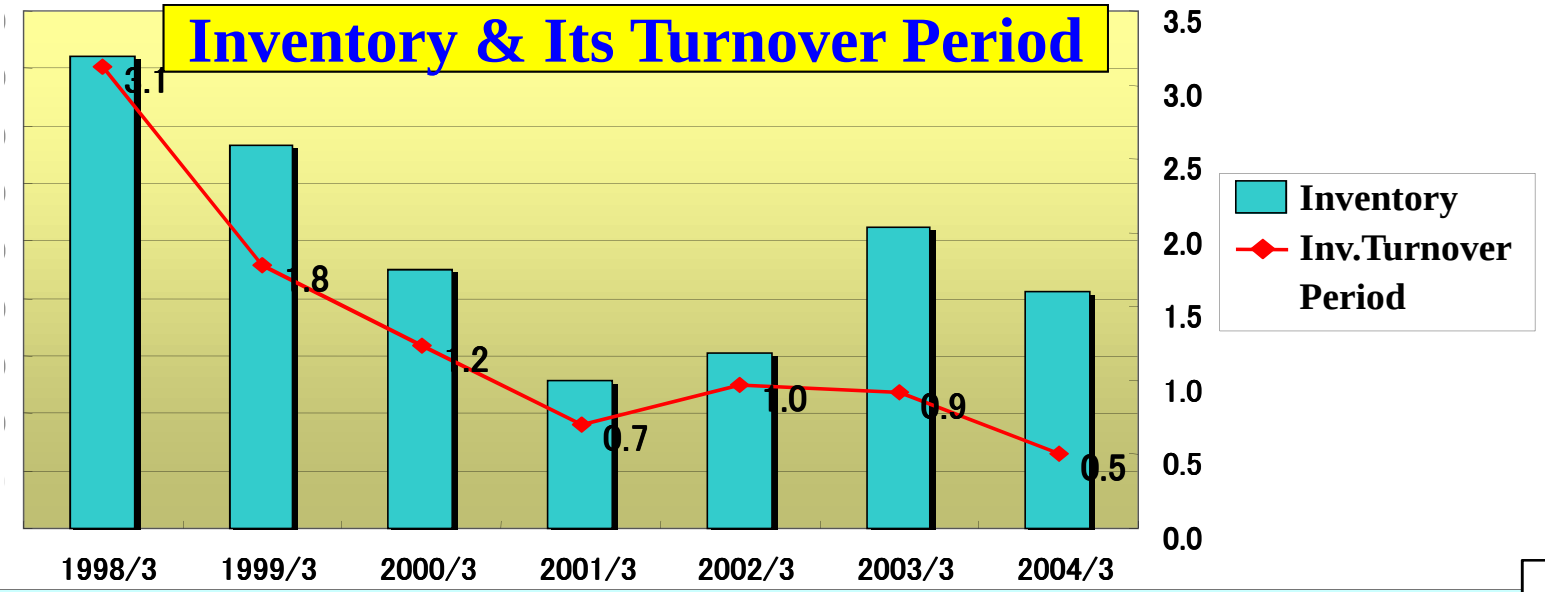
Parts Procurement Ratio for Digital Cameras



Inventory & Its Turnover Period



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Objective ⇒ Development ⇒ Problem

In about 1998

Primary Aims = Cost Reduction

- Secure & continue low wage
- Increase local procurement ratio
- Improve ass'y line operation efficiency
- Minimize inventory of prod. parts
- Expand production scale

ass'y/prod. Bases Increased

parts prod. Bases Increased

storage bases of prod. Parts Increased

numbers of common Parts Increased

parts supply from Japan maintained while increase in local procuremt.

Many kinds of disorder became apparent

- Drastic increase in overseas prod. expected
- Fickle changes of customer needs
- Difficult to grasp parts inventory
- Long L/T when changing prod. plan
- Limit of complex & man-based control
- Frequent ordering errors
- Prod. stop due to parts shortage
- High air transportation cost
- Collapse of parts control/ supply logistics
- Insufficient telecomm. infrastructure

Procurement logistics out of control

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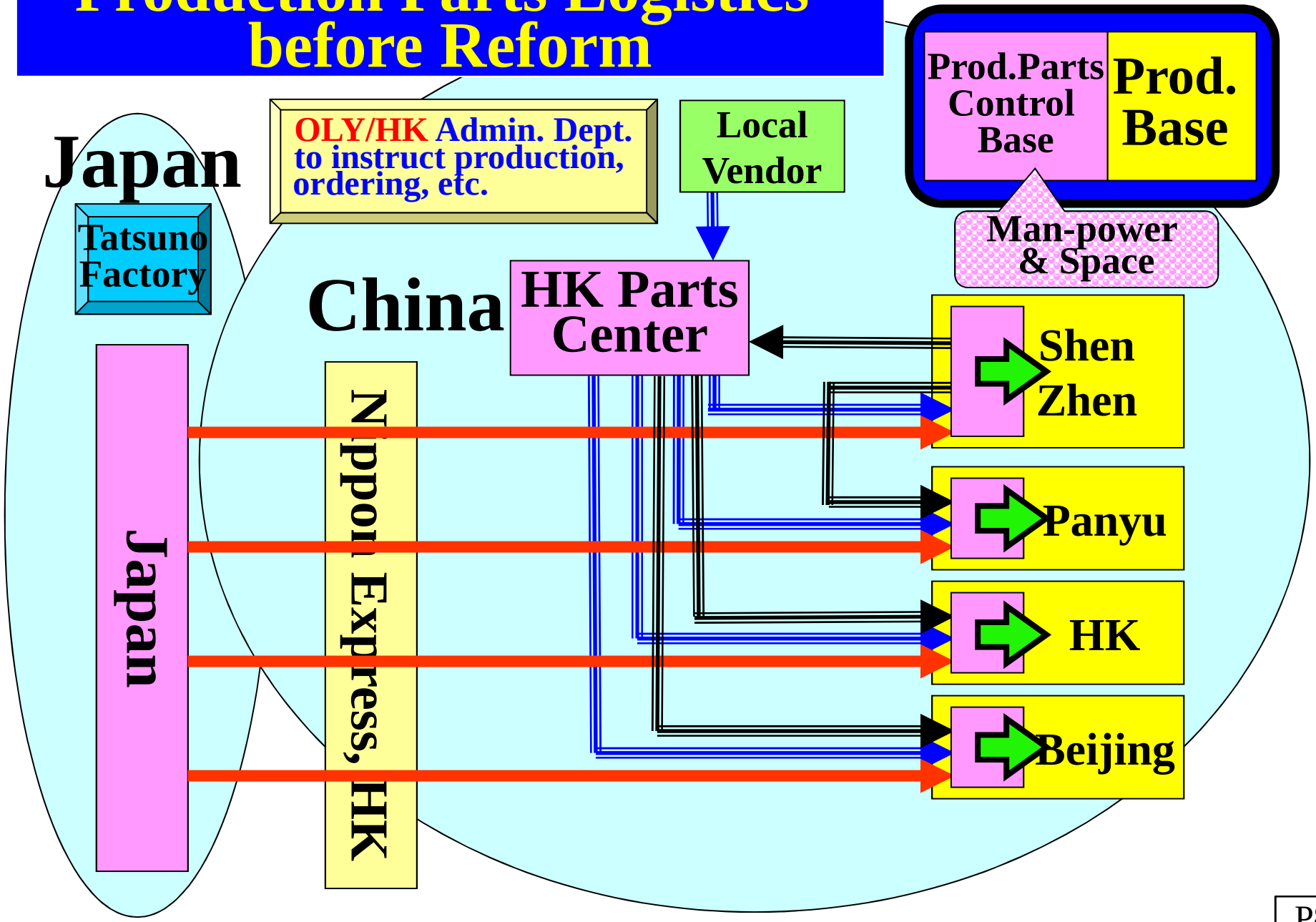
Production Parts Logistics before Reform



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Guanzhou City
Panyu Factory
Shenzhen Factory
HK
Guangzhou City
東莞市
Dongguan City
中山市
ZhongShan City
珠海市
Zhuhai City
深圳市
Shenzhen City
Macao
Shenzhen Bay
Lingding Yang

Drastic Reform of Logistics for Production in China

Centralize whole operation of managing parts inventory

Minimize inventory of parts & components

Factory to concentrate on assembly

Minimize inventory at factory by daily supply of prod. parts

Pursue transparency in manage-ment

Reform in Parts supply process to be thoroughly consistent from Japan/Chinese vendors to factories in China

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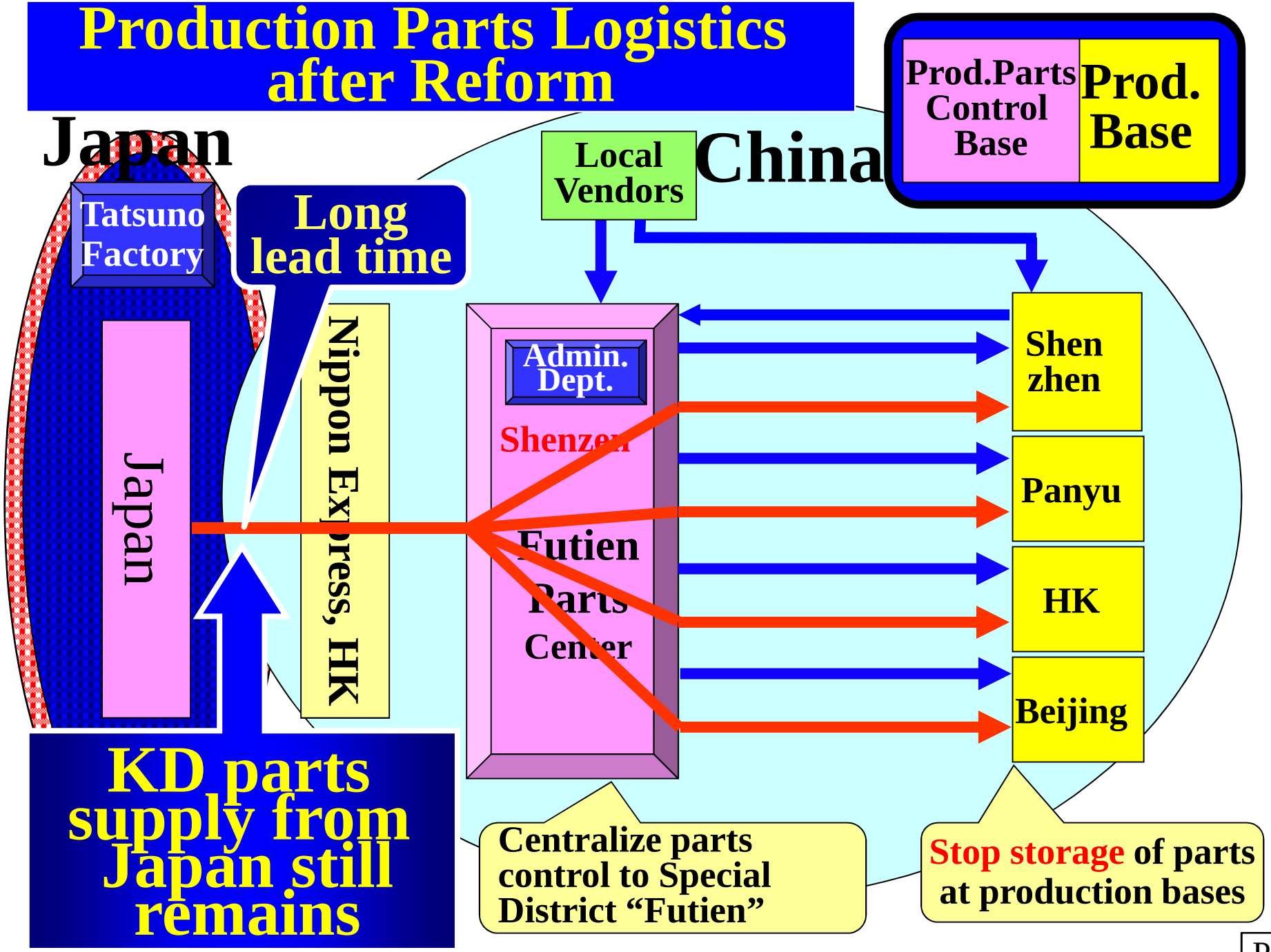
Production Parts Logistics after Reform



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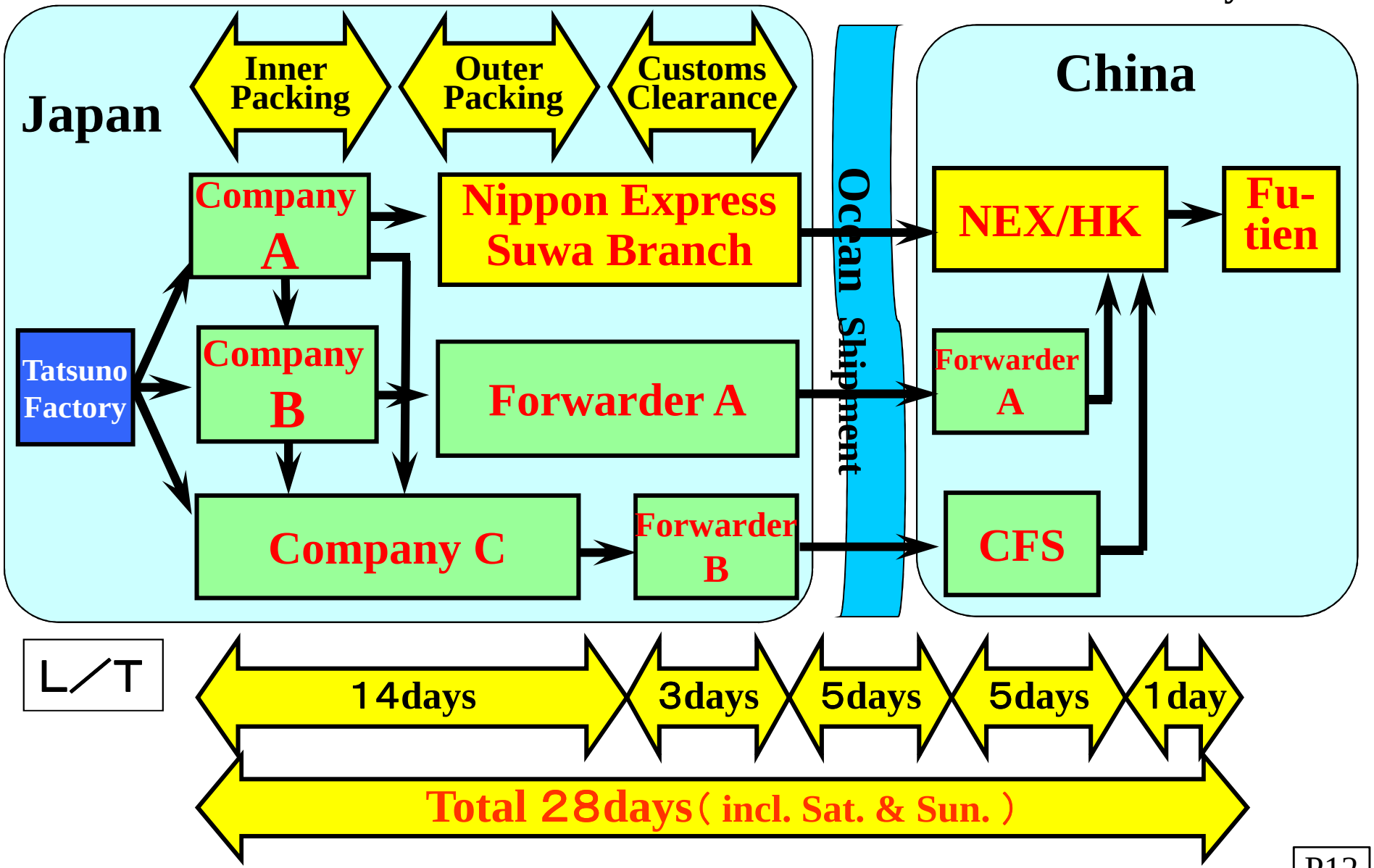
Logistics for Production Parts Supply from Japan before Reform

Before July 1998



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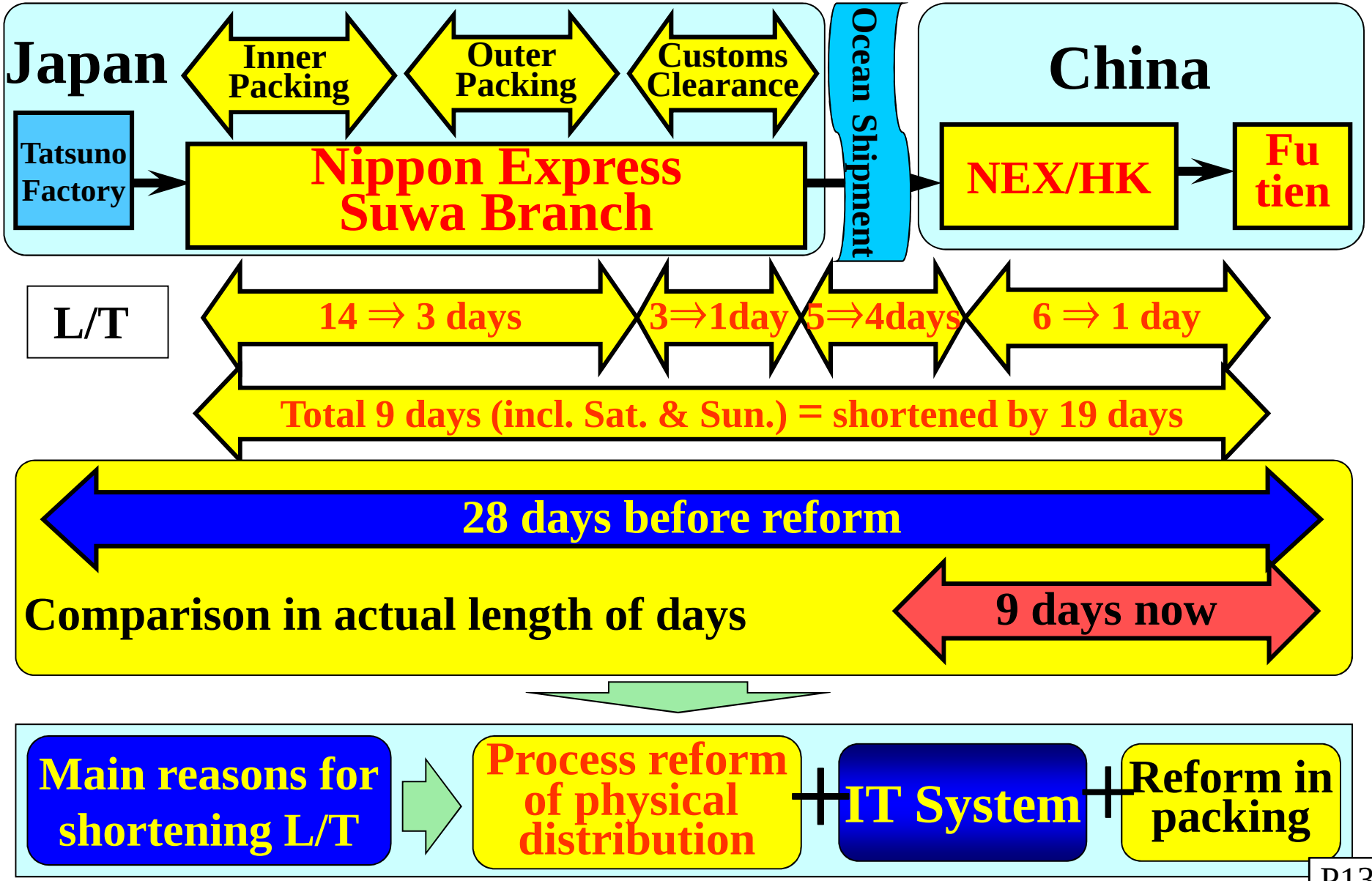
Logistics for Production Parts Supply from Japan after Reform



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Development & Implementation of Parts Export System

Process reform for consistent parts supply from Japan to factories in China

Problem in export operations for parts supplied from Japan

- Complicated logistics, requiring long L/T
- Manual works, leading to more man-powers & repeated mistakes

Main points in developing Parts Export System

- System to allow smooth flow of necessary information to the next process even beyond the border of company/organization.

1) Stop hand writing, completing data entry simultaneously with work.

2) Record necessary information by utilizing 1-/2-dim. bar codes.

3) Framework to continue using a tag with bar-code & technical info. attached at the initial process with the packing unbroken up to the assembling process at overseas factories.

4) Create documents for customs clearance automatically for exporting from Japan & importing in China.

5) Develop system at Olympus-Tatsuno, Olympus Systems and IT Dept. of NEX. Realize Info. Chain Tatsuno/OHK/NEX.

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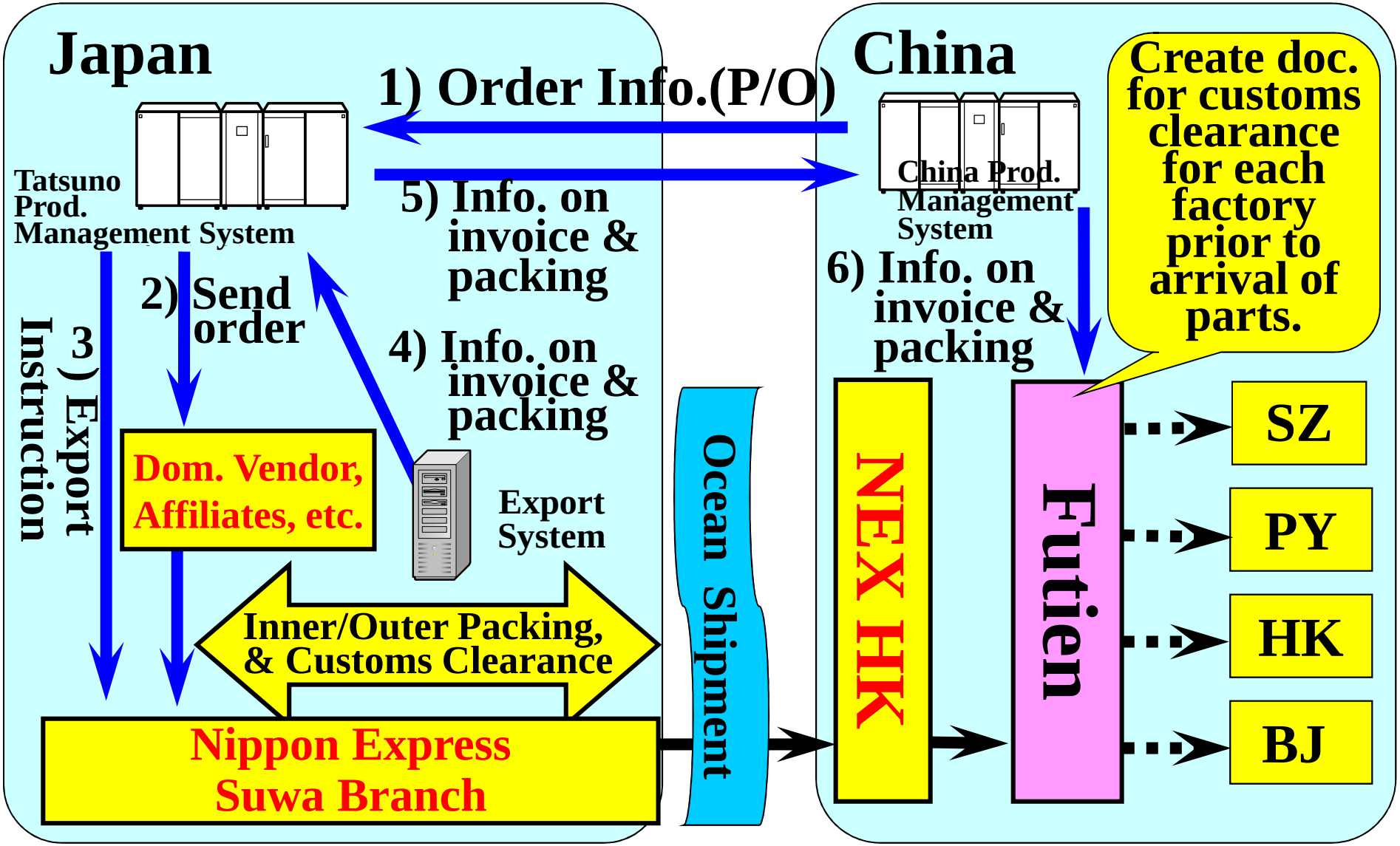
Information Chain : China ⟷ Japan



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In Japan

Printing of a tag

Tag attached

Inner packing

Inner packing carton

Inner packing label showing info. of plural products contained by 2-dim. barcode

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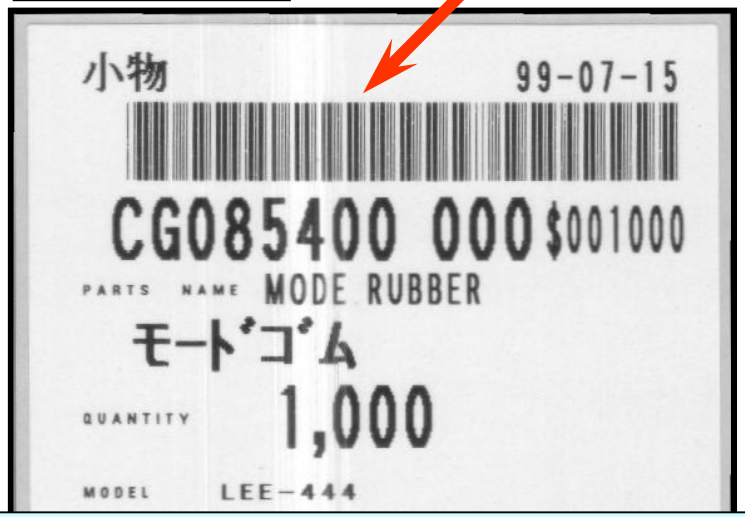
Barcode Label & Measures to Protect Errors

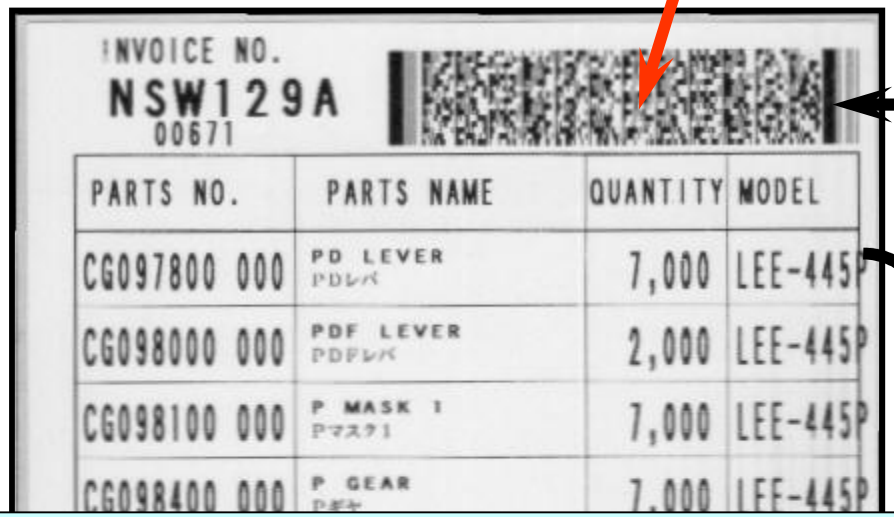
Item tag

Item code & Qty.



Inner packing label

2-Dim. Barcode



2-Dim. Barcode employed

2-dim. Barcode (PDF417) & 2-dim. Handy Terminal

1) Possible to indicate information of plural products packed in a carton by a barcode

2) Strong error-correction function of PDF-417
Possible to read both 1-dim/2-dim barcodes

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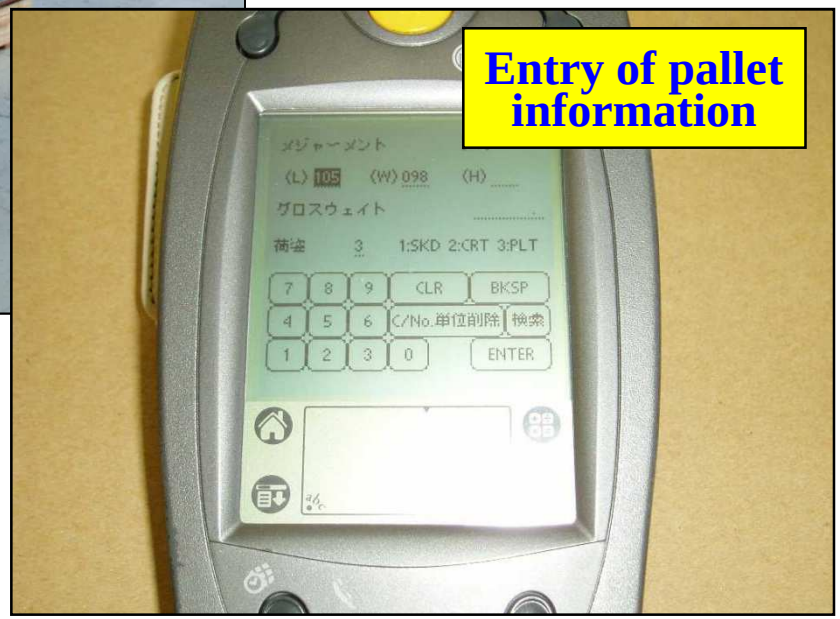

Entry of pallet information

***For one kind of part in a plastic carton, 1-dim barcode**

***For two or more kinds of parts, 2-dim barcode**

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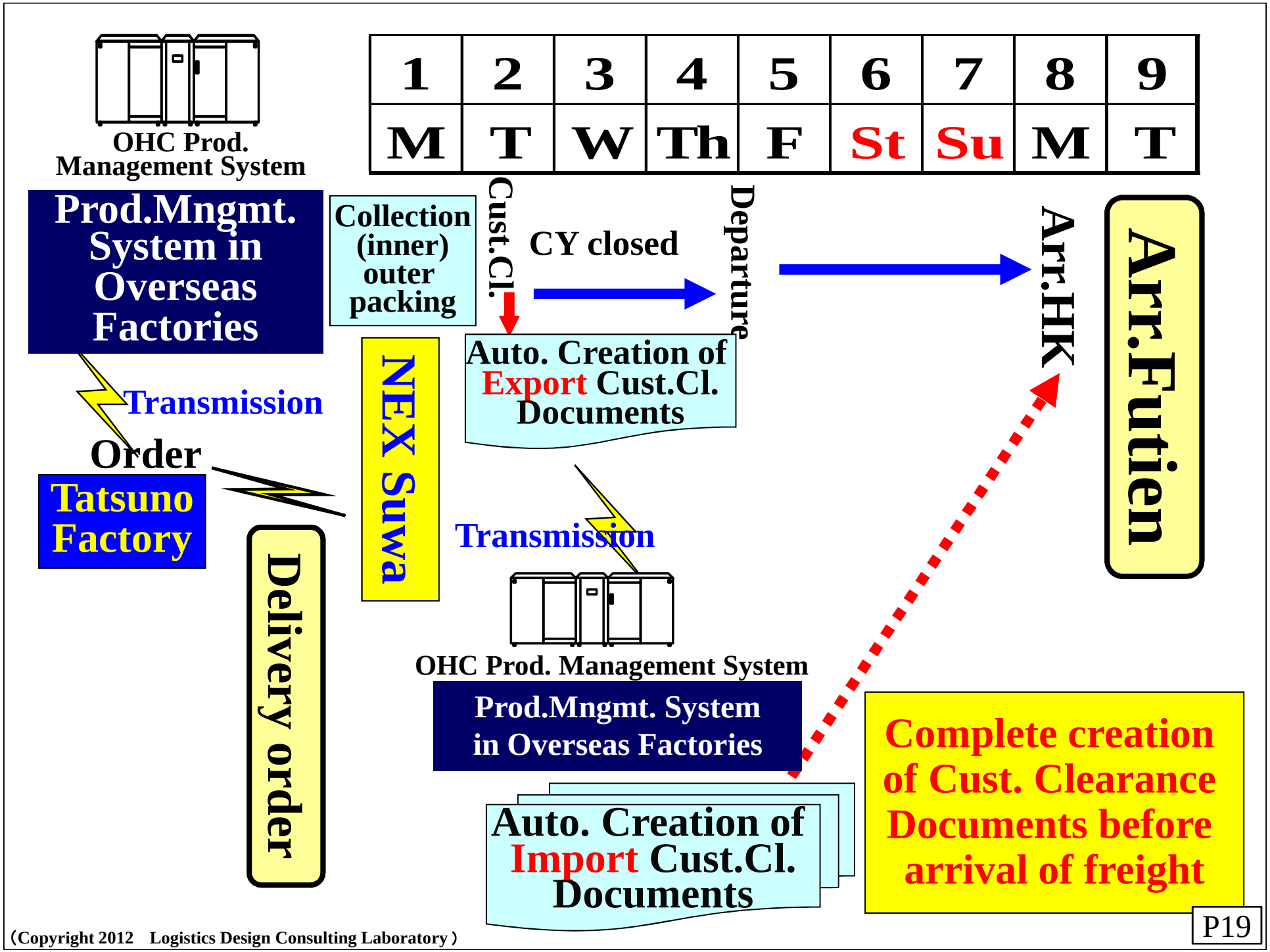

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Positive Effect on Personnel, L/T, etc.

Point of Evaluation	before Reform	after Reform	Now
Staff number for export operations	57 persons	36	25
Staff number for export at Tatsuno SC	5	4	2
Transportation L/T	28 days	12	9
Documents creation method	Manual	Automatic	Automatic
Time for customs-cl. documents	Several hours	instantly	instantly
Claims/complaints from abroad	many (more than 20/mth)	0	0
Work errors	occurring	0	0

Reduction of Logistics Cost, Work-in-Process

Point of Evaluation	Before Reform April 1998	Right after Reform April 1999	August 2003
Logistics cost for export of parts	Yen 47mil./mth	Yen 27mil./mth	- Yen 360mil./y 64% reduced

I. Process Reform on Parts Supplied from Japan for Production in China =====> Fin.

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Part 2

Usage of Returnable Packing for Production Parts to be Transported to China

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Background & Target

Background

1. Total cost for packing materials and working : Yen 400mil./year
2. Parts received from vendors are re-packed for export transportation
   ⇒ 51 man-powers
3. Many different trays made of PVC being used
   ⇒ high price, big environmental burdens
4. Cartons (w/dust) being brought to production line
   ⇒ negative impact to clean rooms with production lines

Target

1. Reduction of packing cost

   Design a new packing style to use in the whole delivery route, without re-packing
   ⇒ to cover the whole route from vendors to clean rooms for production in China
2. Reduction of cost for packing materials

   1) Review all packing materials used in end-to-end processes from parts manufacturing to assembly line in China factory

   2) Concept: Returnable outer packing
3. Enhancement of quality & Environment Compliance

   Increase in security of packing materials, work efficiency and transportation quality to parts and stop using environment-inadequate materials
   ⇒ Tray made of Polystyrene (PS) or Polypropylene (PP)

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Export Packing (in Japan) before Reform

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Scene just before Placing Parts onto Assembly Line at China Factory with Export Packing before Reform

Put parts onto a vinyl tray, by throwing away corrugated carton sheets and Expanded PE sheets.

to Assembly Line

Transfer parts to a plastic container by throwing away export cartons.

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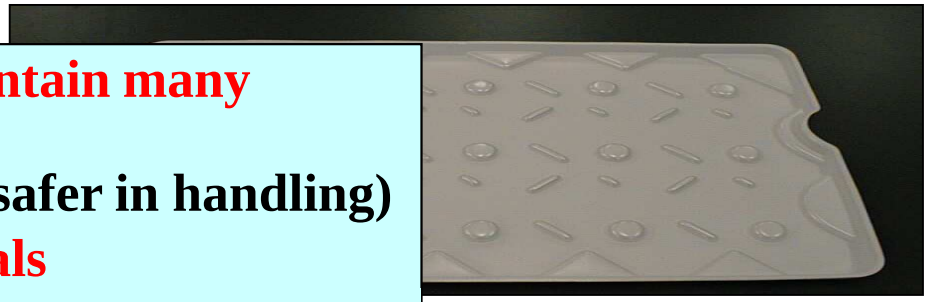
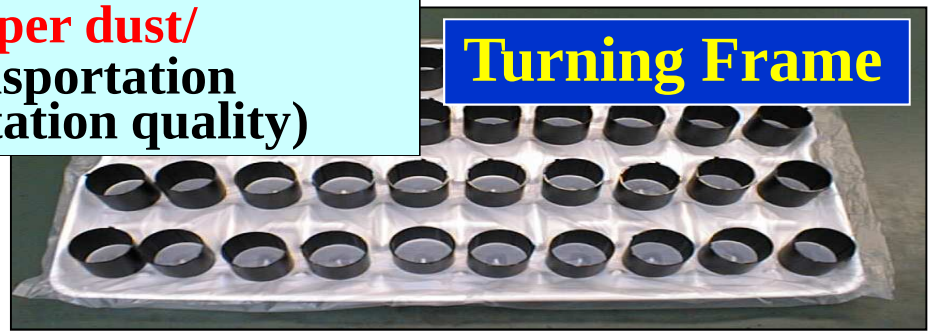
Reform to Consistent Packing (1) Large-sized Parts

from corrugated carton sheet & Expanded PE sheet to PS (polystyrene) tray



- **Design common tray to contain many different large-sized parts**
- **Enhance work efficiency (safer in handling)**
- **Employ recyclable materials**
- **Decrease attachment of paper dust/ contamination during transportation (enhancement of transportation quality)**



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Reform to Consistent Packing (2)
Small-sized Parts

Change tray
from PVC to PP
: to reduce unit price
: to reduce versions
: to protect environment

PVC Tray → **PP Tray minus 66% in unit price**

About 100 kinds → **8 kinds = minus 92%**

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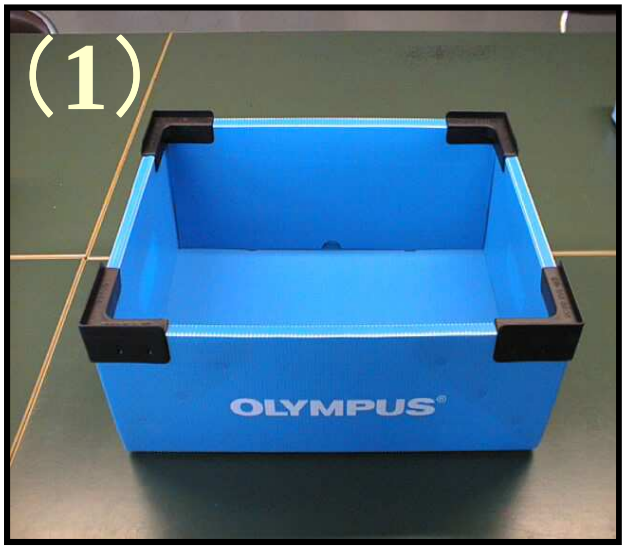
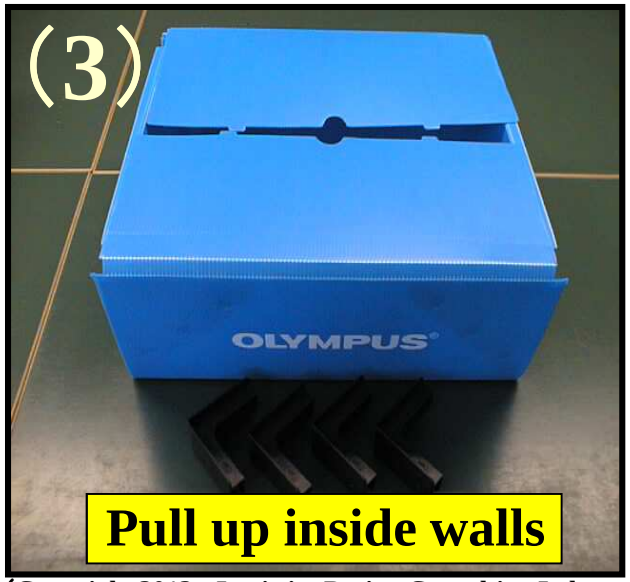
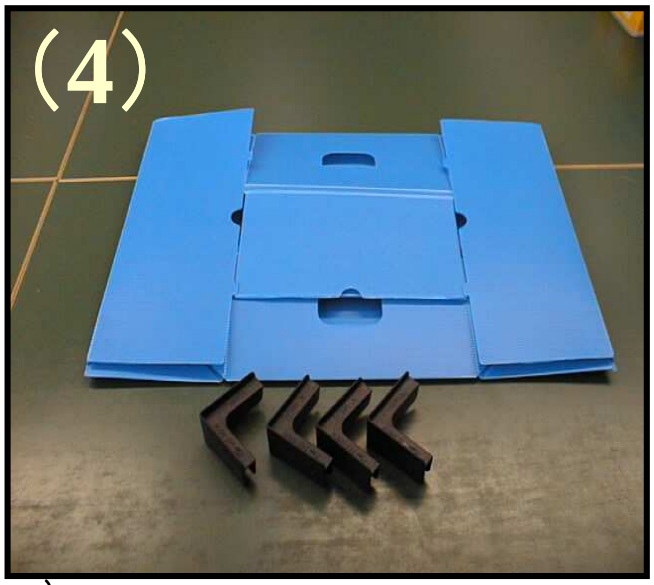
Reform to Consistent Packing (3) change to Returnable Container







Abolish in-Japan returnable containers (cartons, plastic containers) & corrugated cartons for export

⇩

Folding-type corrugated plastic container made of PP

⇩

Returnable container between vendors in Japan to clean rooms in China
(Target: more than 5 times use ⇒ actually used up to 30 times for 4 years)

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Packing made internationally returnable

Transfer to a plastic container

Vendor In Japan

Empty carton

Returnable carton

Suwa Parts Center

export carton

Ocean Shipment

Export carton to be thrown away

To assembly line

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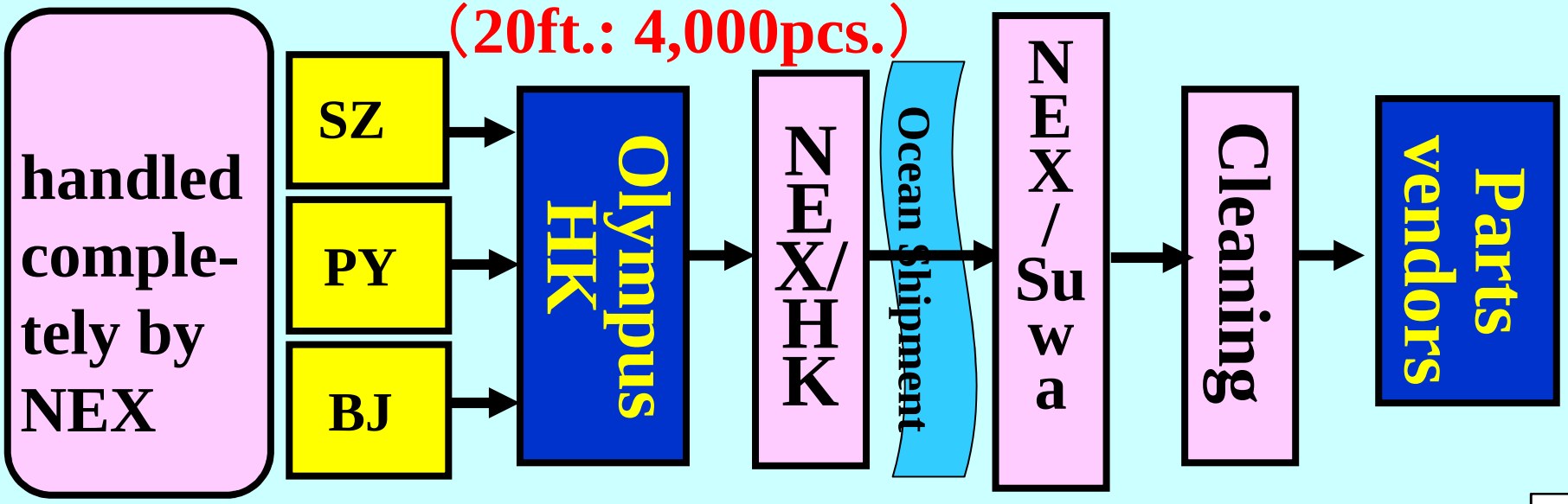
Return of Folding-type Corrugated Plastics Container

Whole route up to Japan is handled by NEX

(1) Centralized collection in China
(2) Customs clearance by each 20-ft. container volume and transported up to Suwa, Japan
(3) Cleaning up at NEX/Suwa Branch
(4) Whole process by 3P/L ==> settled at fixed price



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Output of Improvements

Packing cost reduced
51persons => 25 (minus 26)

Yen43 million/year
(included in effect in Part 1)

Cost for packing materials reduced (by version cut)
***change to corrugated plastics container Yen27mil./year**
***Replacement by PP tray Yen93mil./year**

Total cost reduction Yen 120 million/year

Quality & environmental compliance enhanced
***Change from PVC to PP tray**
***Elimination of paper dust & contamination (clean production)**
***Improvement of work efficiency and transportation quality by PS tray**

Usage of Returnable Packing for Production Parts to be Transported to China ==⇒ Fin.

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Part 3

Optimum Export Packing for Digital Camera Produced in China

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Function of Packing and Main Conditions

- **Protection of packed goods**
- **Economical value of packing materials**
- **Easy packing works**
- **Contribution to sales promotion**
- **Easy handling of goods**
- **Fit to storage facilities**
- **Easy recycling of materials**
  (compliance with environmental regulations)
- *Fit to transportation equipment*

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Characteristics of Digital Camera Business

1. Very short marketing life of products
   （less than 3 months for sales??）
2. Absolute requirement :
   speedy R&D and *speedy supply*
3. **High added value**
4. **Following the IT technology**
   (PC/Printers, etc.)

etc. etc. ……

Biological Microscope

Olympus has never handled such a product in the past

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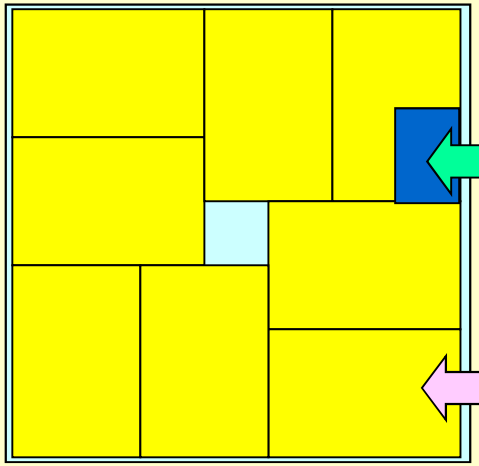
Conventional Packing for **Digital** Camera

Stretch-Filmed Pallet

Size of T11 Pallet
1100mm x 1100mm



Individual Make-up Box

Outer Carton w/4pcs.

1,100mm

Above size is developed for ocean container.

Carton Pallet employed

- ***Compliant with import restriction of pine trees**
- ***Lower cost and lighter than wood**
- ***Easier to recycle**

Shipped to Europe via Airfreight

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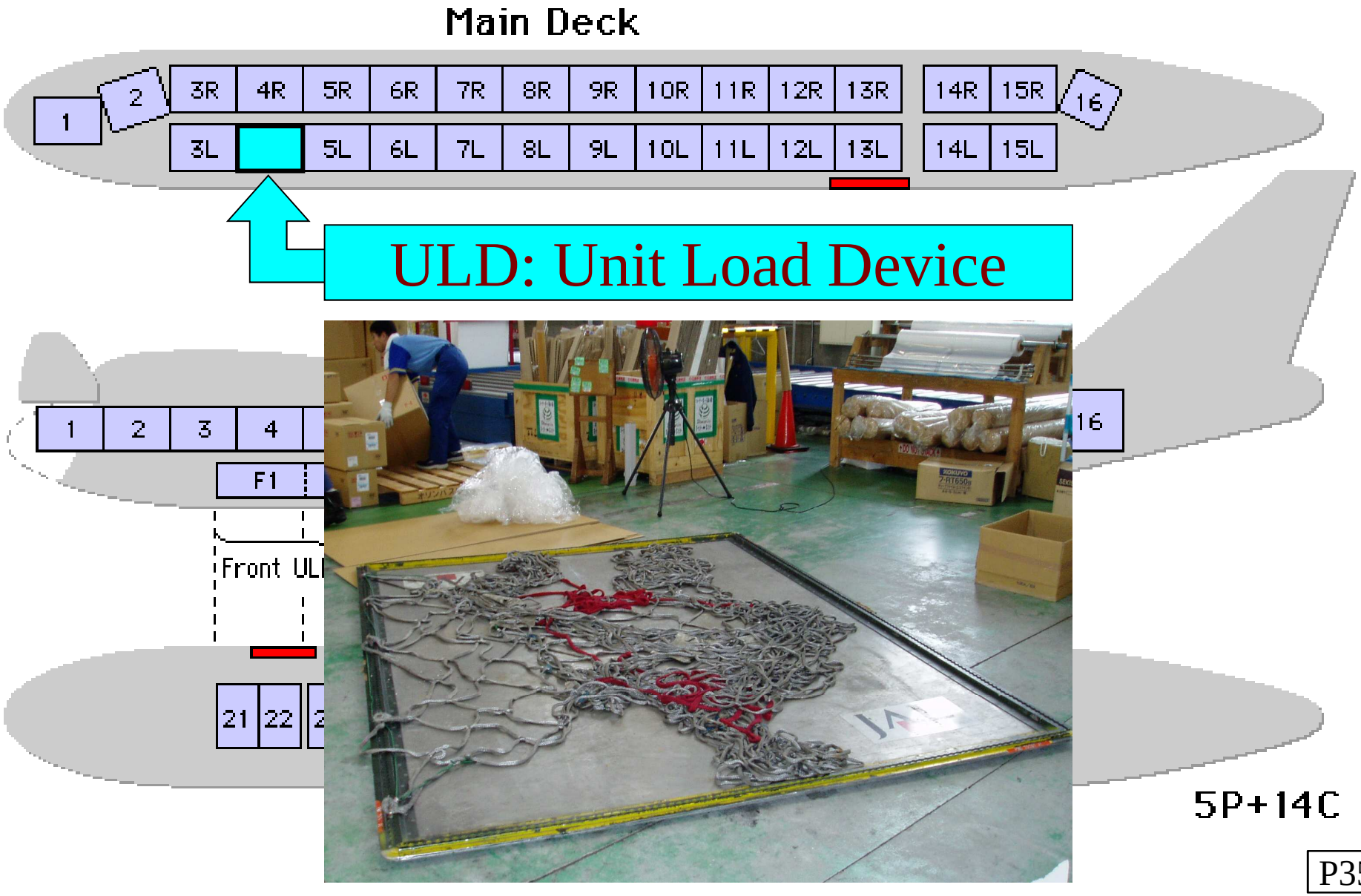
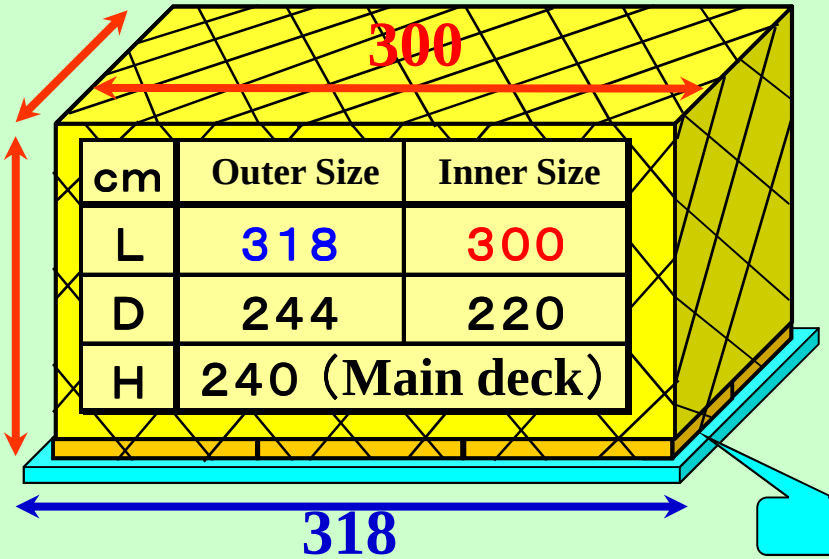
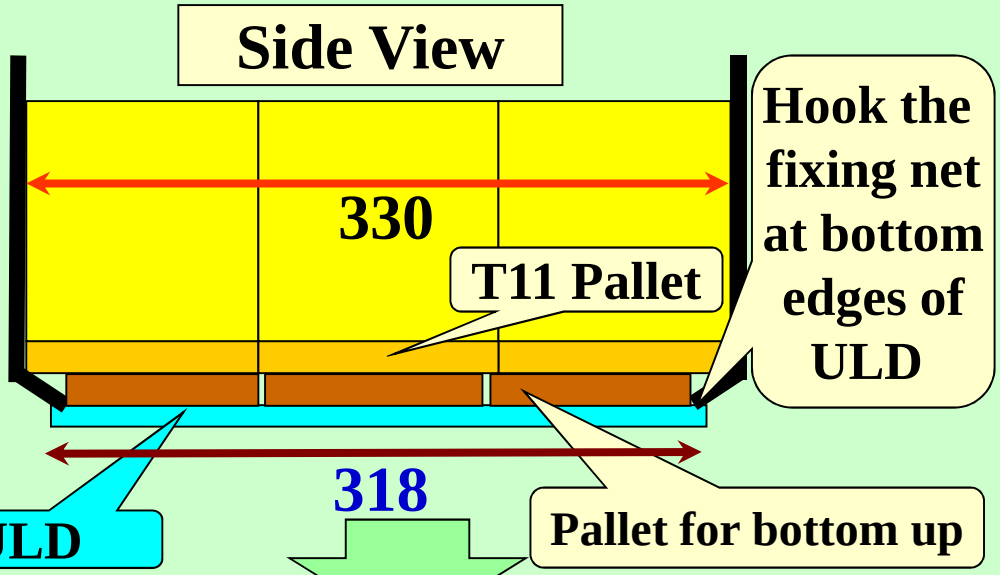
B74F Pallet Position



Dimension of Carrier Pallet（P6P ULD Pallet）



cm	Outer Size	Inner Size
L	318	300
D	244	220
H	240（Main deck）	



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Problem of T11 Pallet

1）Not fit to ULD for airfreight

2）Problems, when space for airfreight is extreme tight

Stevedore strike at U.S. West Coast

Computer trouble at HK new Airport

Launch of a super-hit new product

Amazing trade of electronic parts when PC business is buoyant

Cargo of customers with low contract price is rejected

Cargo of big-volume customers is prioritized

Cargo of customers with bad ULD loading efficiency is rejected

Cargo of customers difficult to load on ULD is rejected

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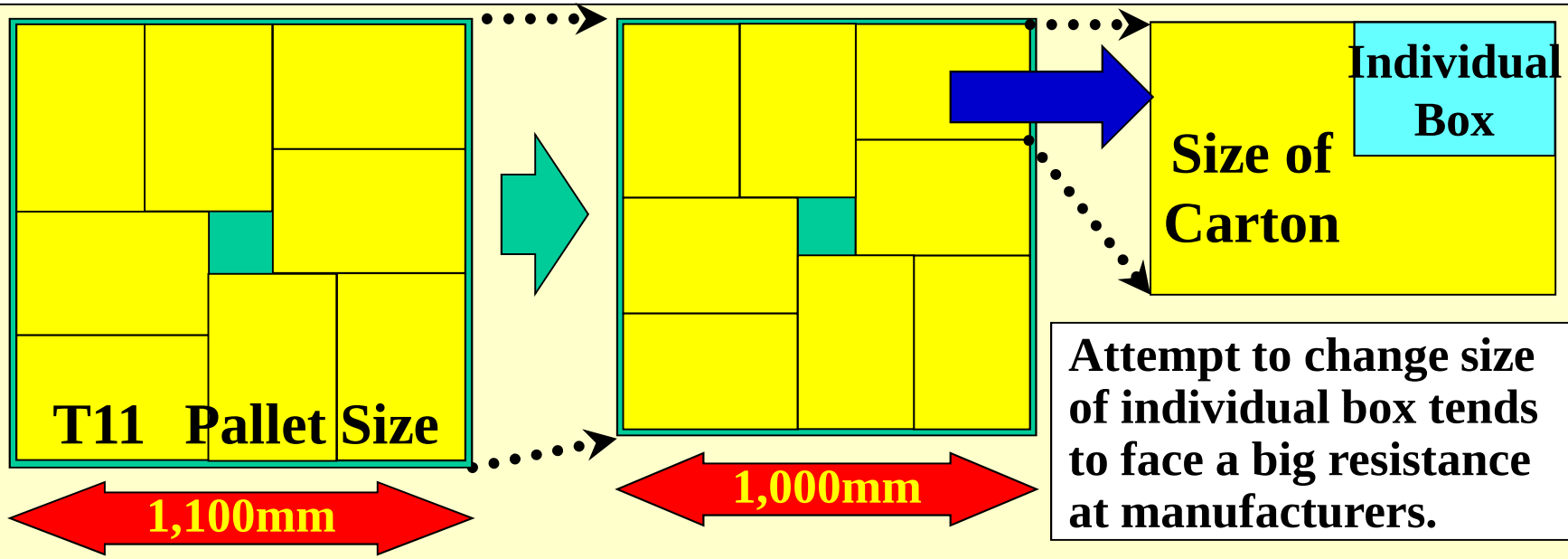
Design and Practice Standard Module for Packing Digital Camera



Attempt to change size of individual box tends to face a big resistance at manufacturers.

Persuasion of Marketing staffs

Highest priority on "Speed" for Digital Camera (risk management)

Packing design change at R&D stage

Supply of carton pallets to China

Local production of the pallet in China

Transferred to the new size w/in about 1 year

Carton Pallet after Reform

Optimum Export Packing for
Digital Camera Produced in China ⇒ Fin.

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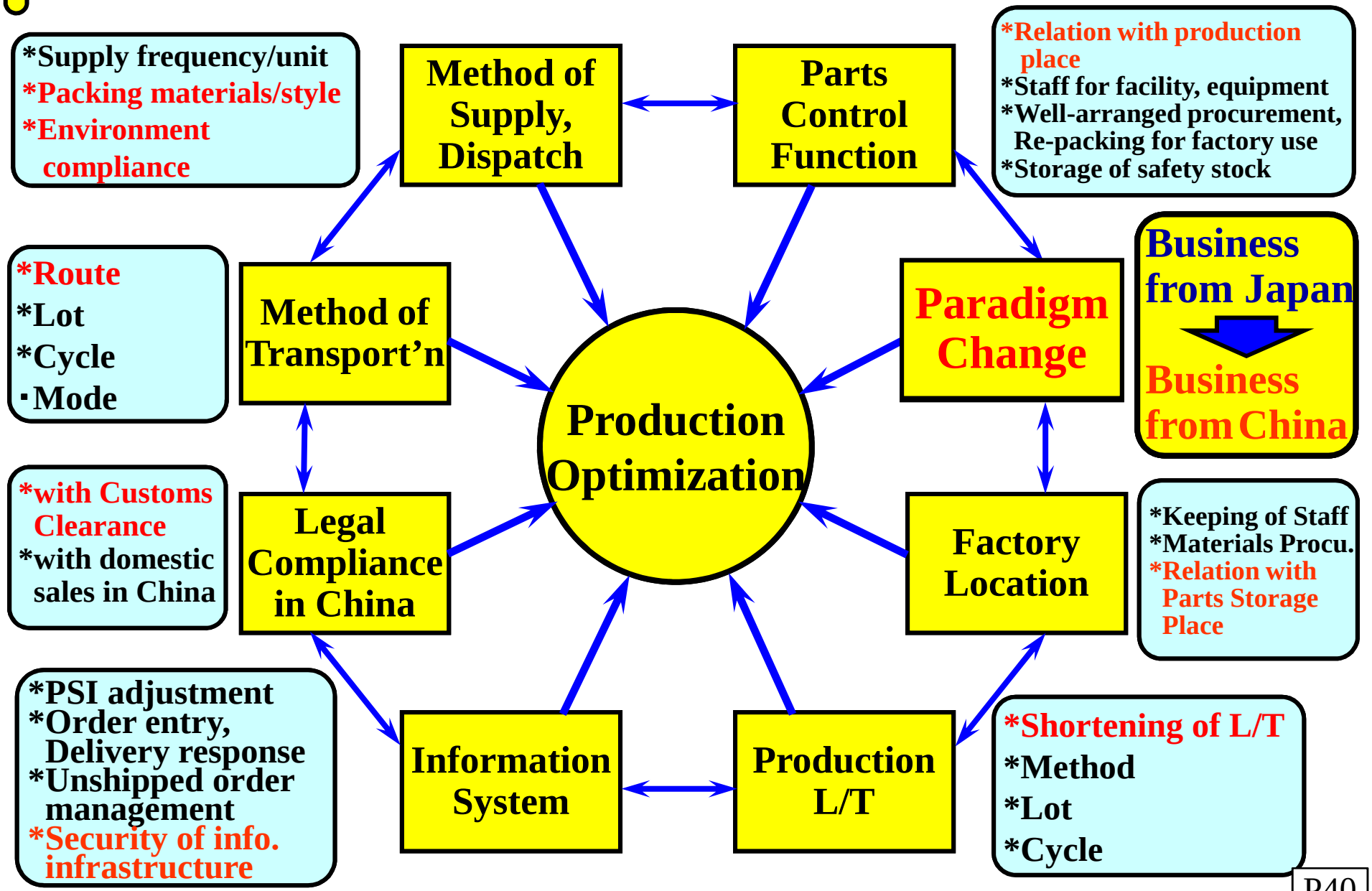
Summary

Measures to Optimize China Production



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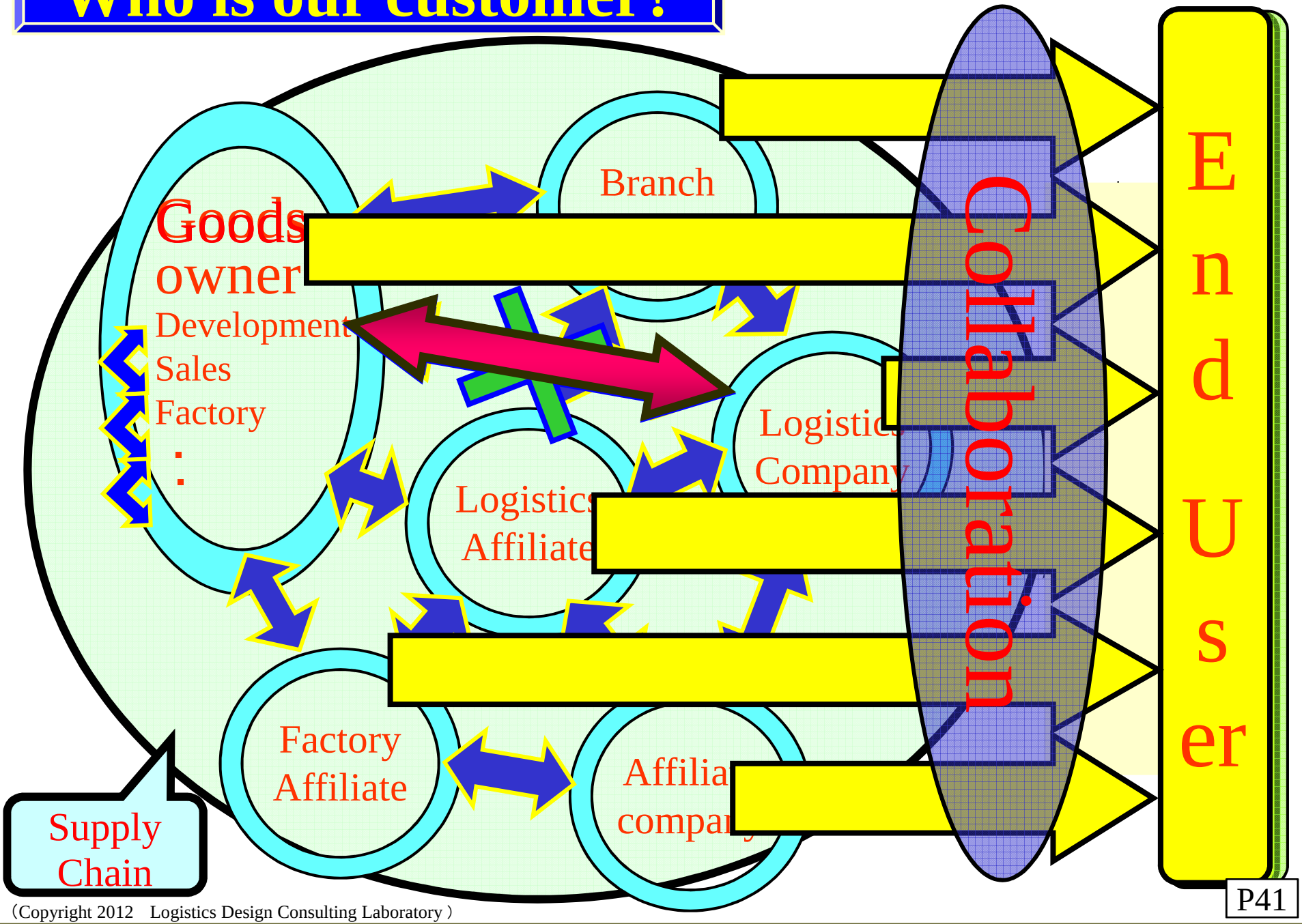
Who is our customer?



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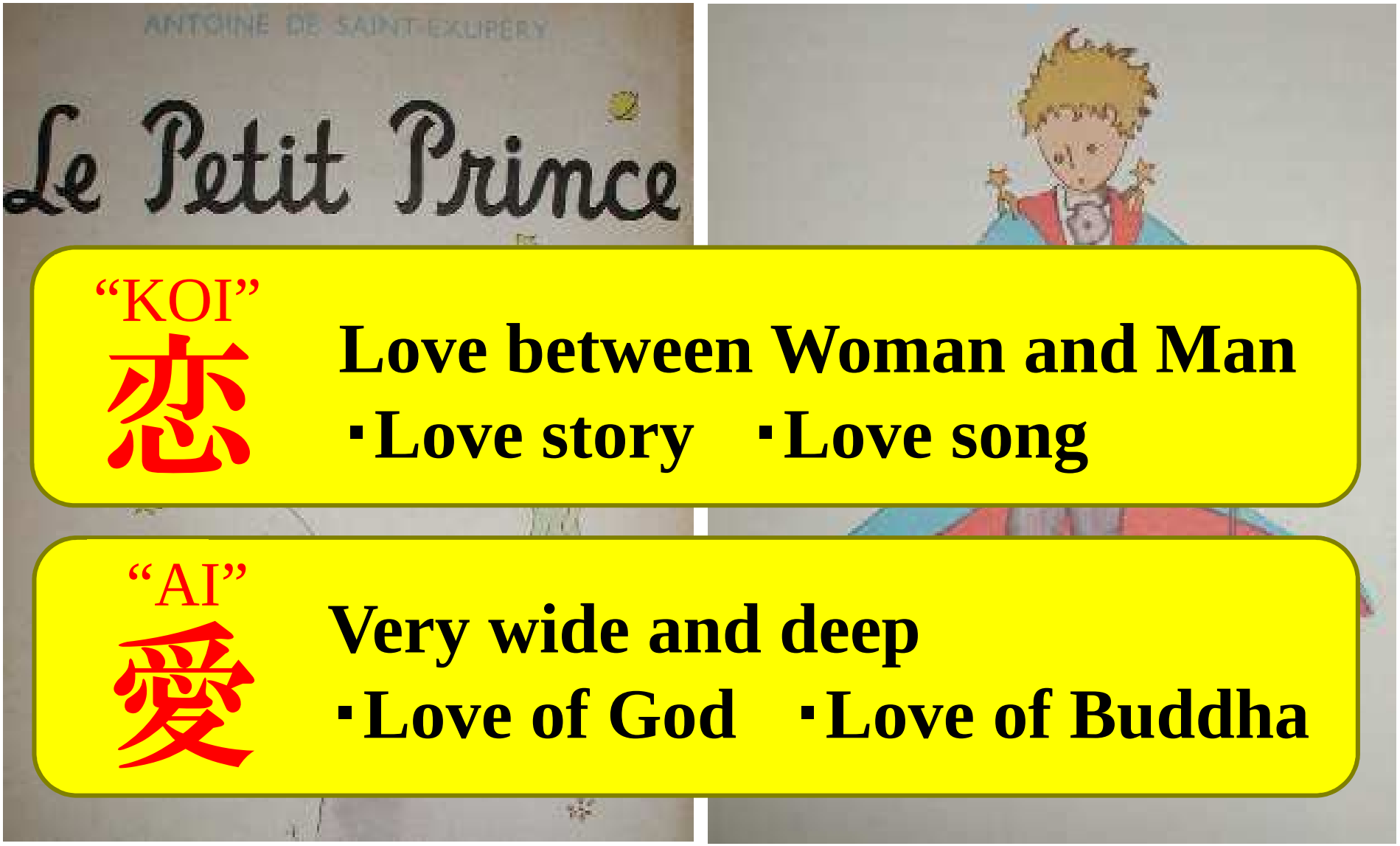


"KOI"
恋

Love between Woman and Man

・Love story　・Love song

"AI"
愛

Very wide and deep

・Love of God　・Love of Buddha

Aimer, ce n'est pas se regarder l'un l'autre, c'est regarder ensemble dans la meme direction.

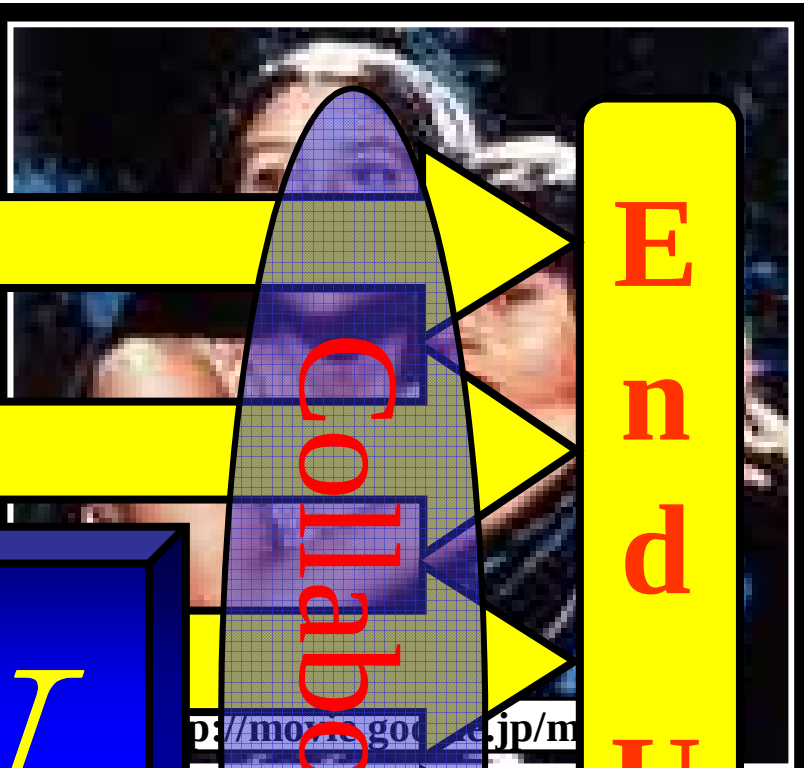
From "Terre des hommes"

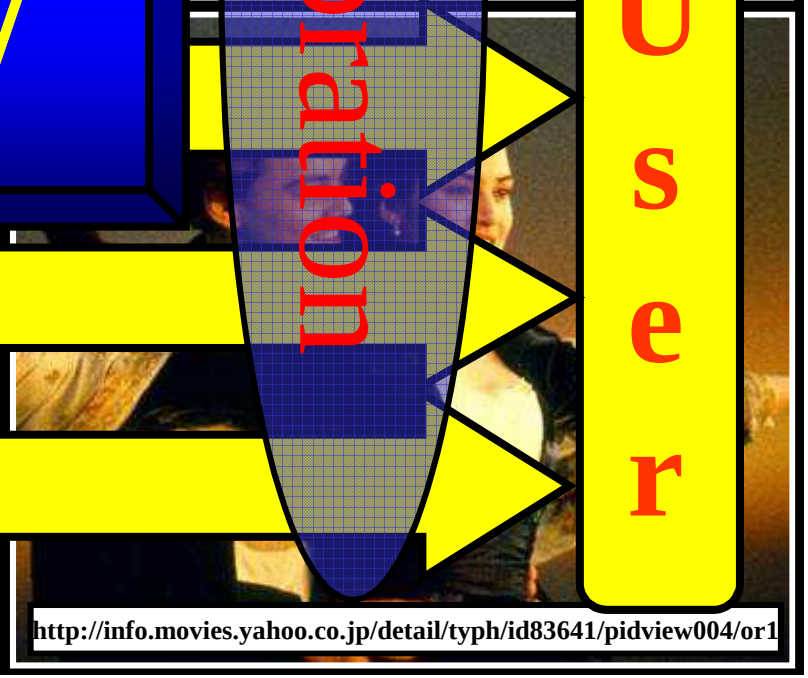
（To love is not to look at each other but to look at the same direction.）

Who is our customer?

FIN

Collaboration





End User

The External Environment of Trade Between the USA and Asia: Technology, Logistics, Politics and Economy

Anthony M. Pagano, Ph.D
Director,
Center for Supply Chain Management and Logistics
University of Illinois at Chicago
Chicago, IL, USA

The External Environment of Trade Between USA and Asia

- Panama Canal Expansion – Impact on Trade
- Readiness of US East Coast Ports to Accept Post Panamax Ships
- US Harbor Maintenance Tax – Potential to Produce Trade War
- Results of the US Election

The External Environment of Trade Between USA and Asia

- USA Fiscal Problems
  - Fiscal Cliff
  - Budget Deficits
  - National Debt
  - Obamacare
  - Unemployment
- Forecasts for the Future
- Impact on Trade

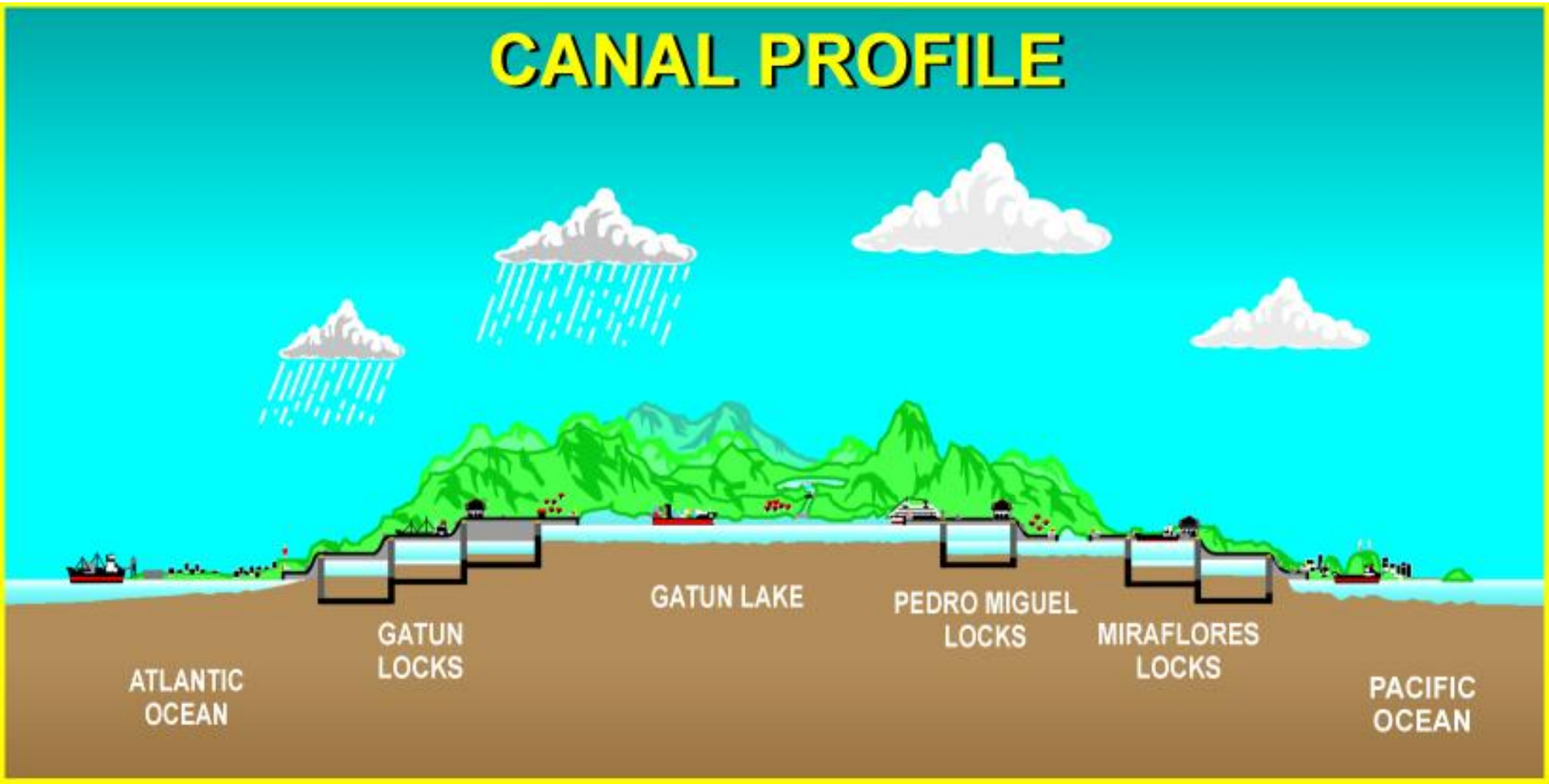
Panama Canal Expansion

The Panama Canal in Numbers

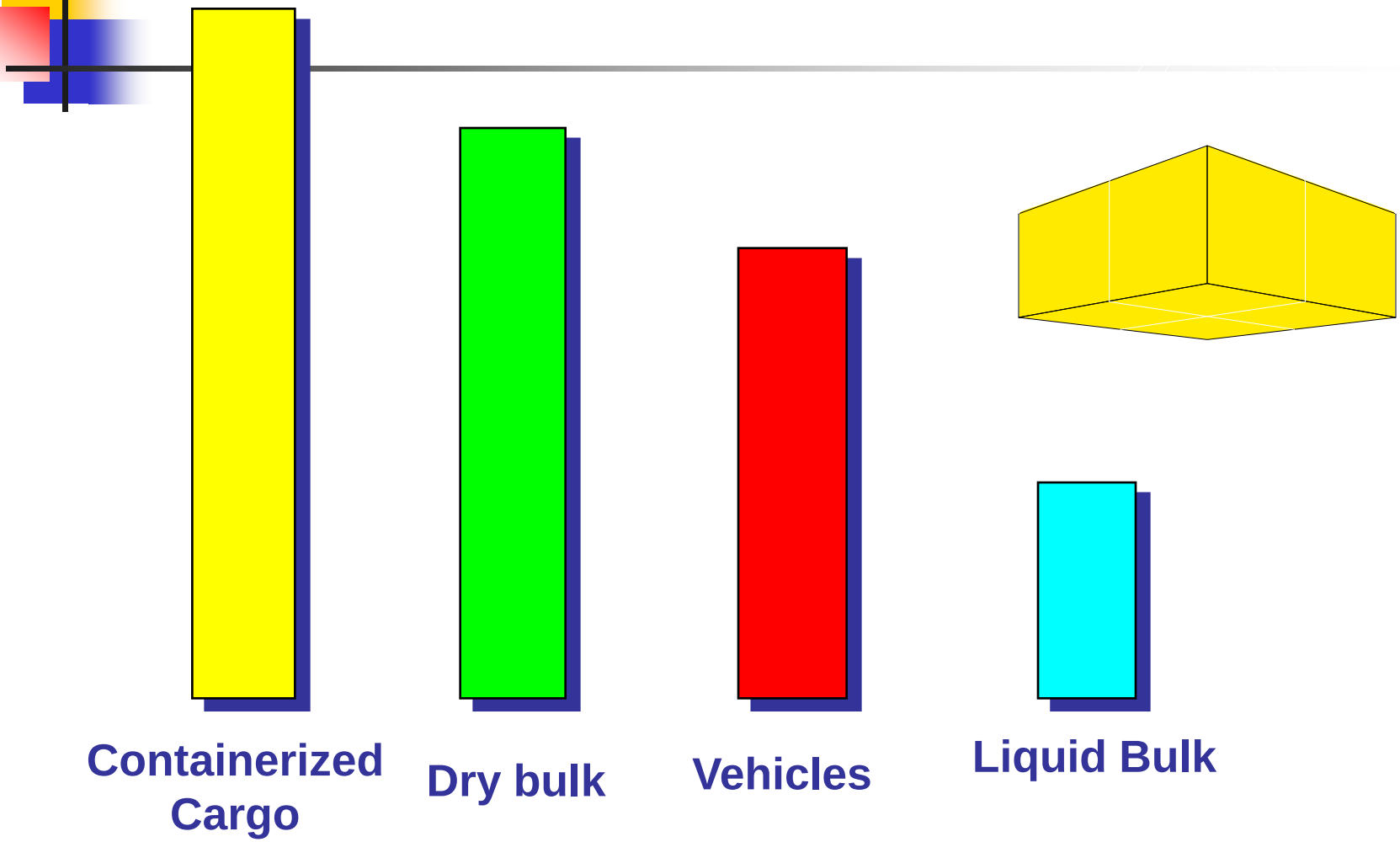
1,000 ft of length

110 feet of width

39.5 feet of draft

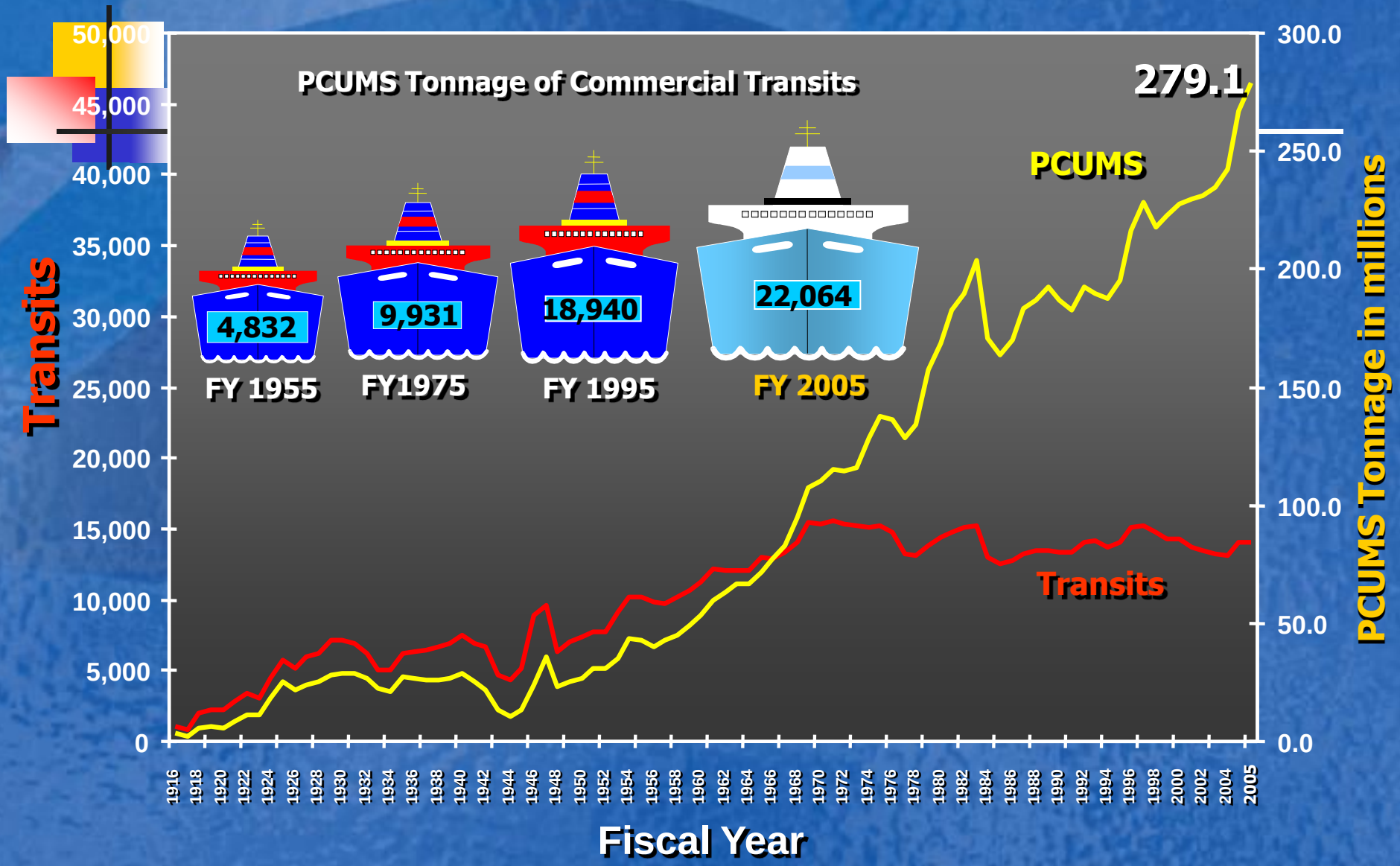


Principal Commodities



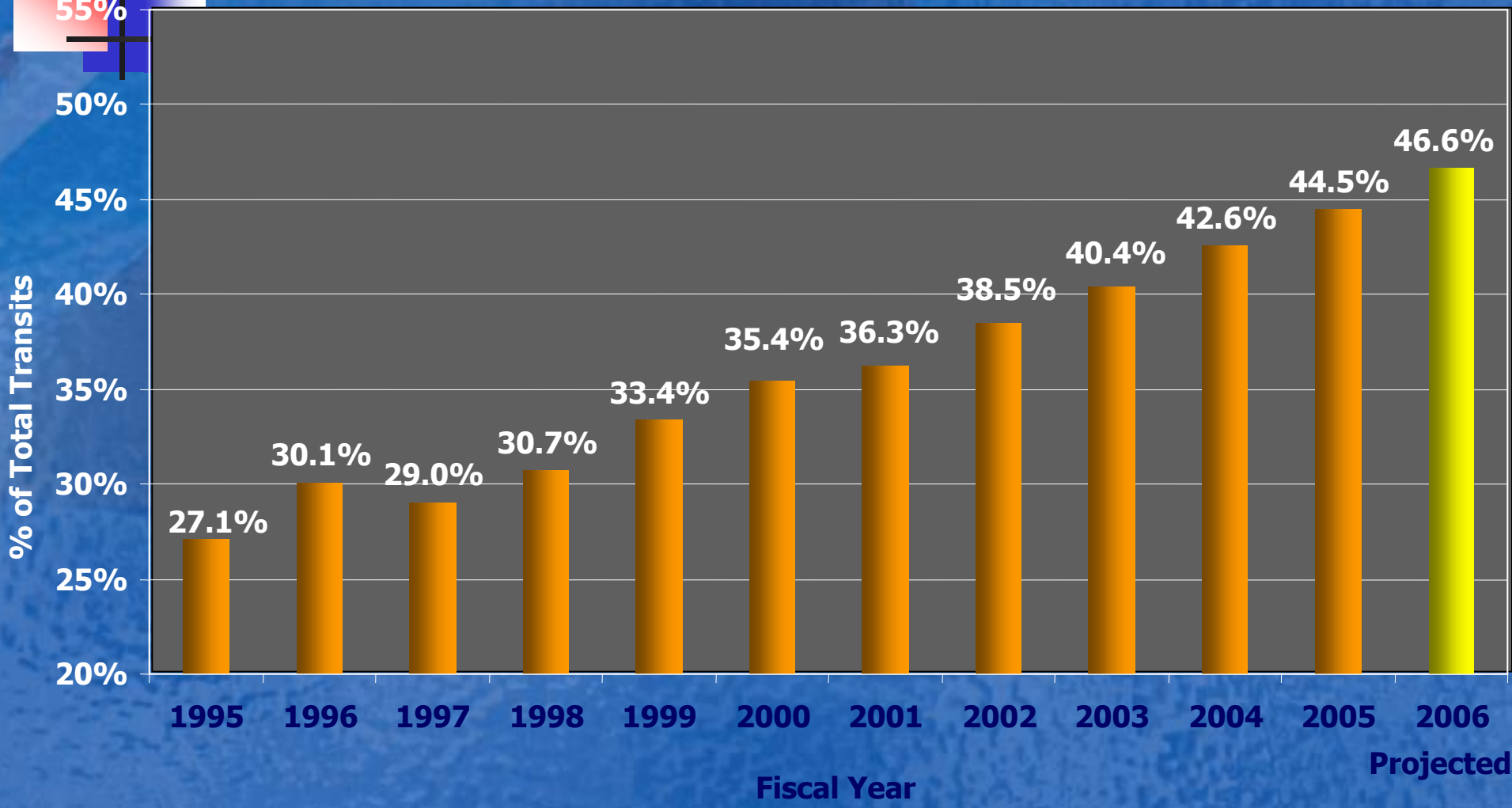
Canal Traffic & Capacity Issues

Transits vs. Tonnage
FY 1915 – FY 2005



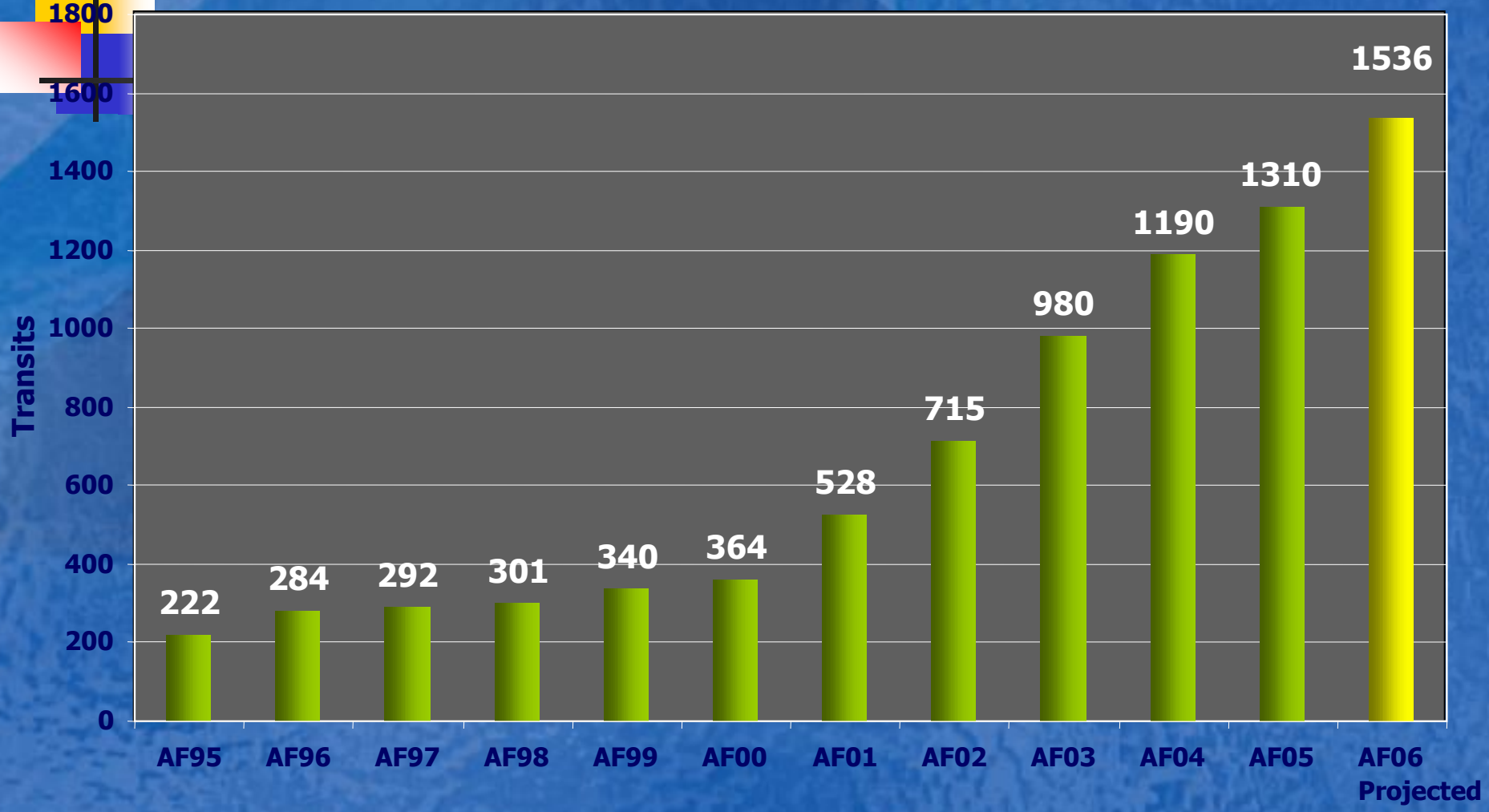
Growth of Panamax Vessel Transits

(with beam of 100 ft or more)
FY 1995 – Projected FY 2006



Transits of Vessels of Length 900 ft or more

FY 1995 - Projected FY 2006



Impact and Requirements by Vessel Type and Size

< 80' BEAM

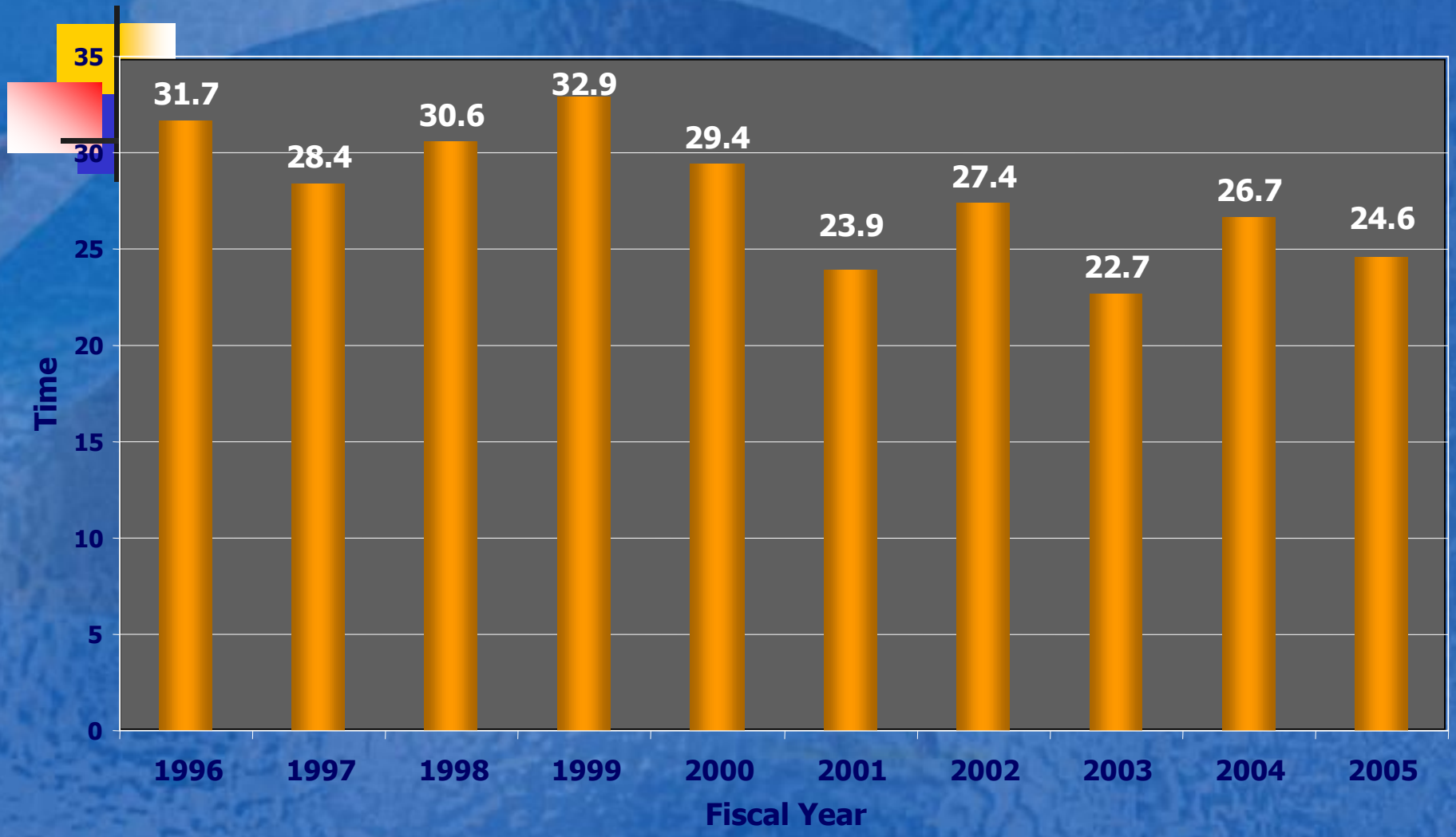
- Gatun Lockage in One Hour
- Requires 4 Locomotives
- Assisted by 3 Tugs
- 1 Pilot
- No Transit Restriction

PANAMAX

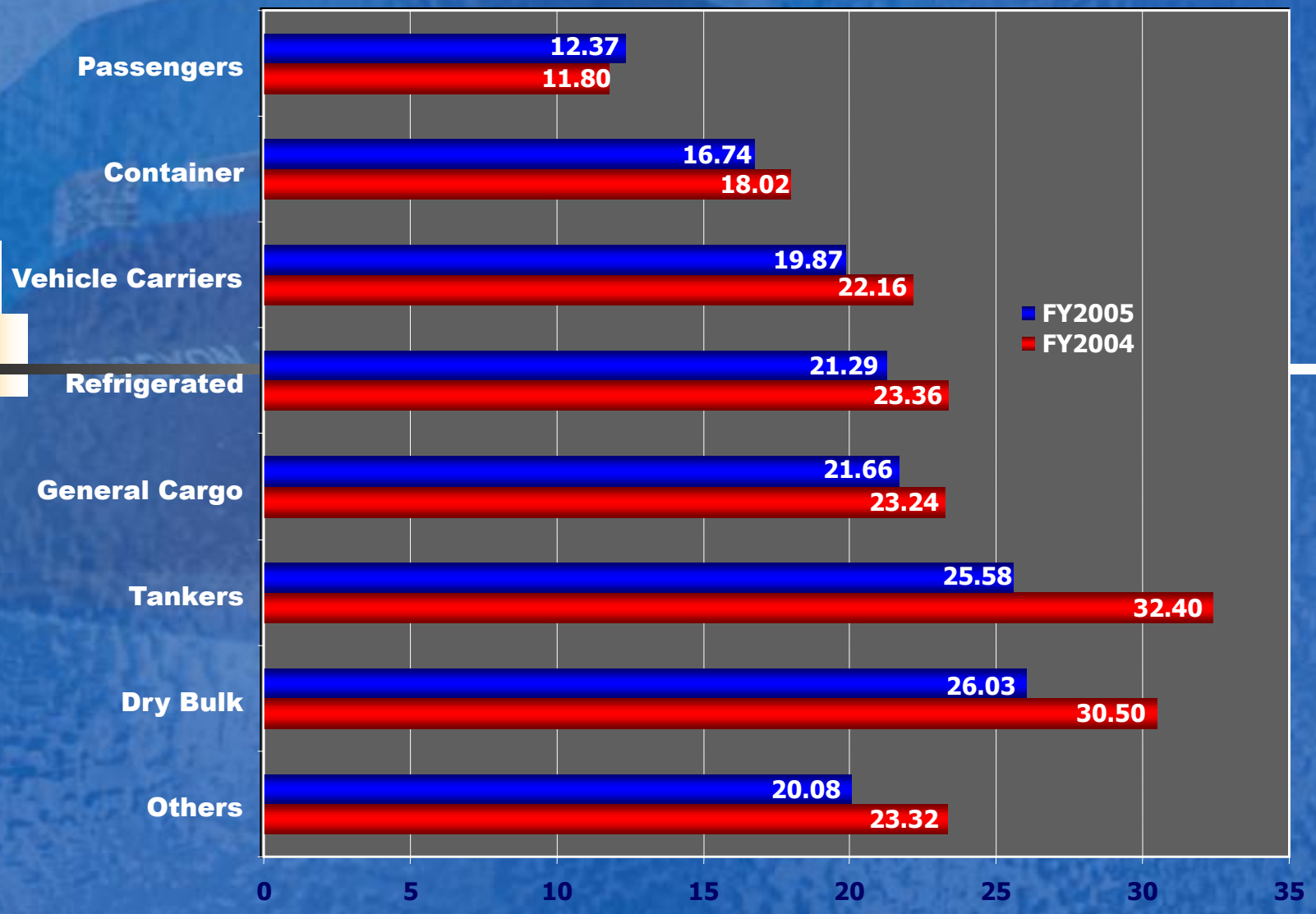
- Gatun Lockage in 2 Hours
- Requires 6-8 Locomotives
- Assisted by 7-10 Tugs
- 2-3 Pilots
- Daylight one-way traffic through Gaillard Cut, and daylight transit through the locks of vessels 900' in length

Average Canal Waters Time

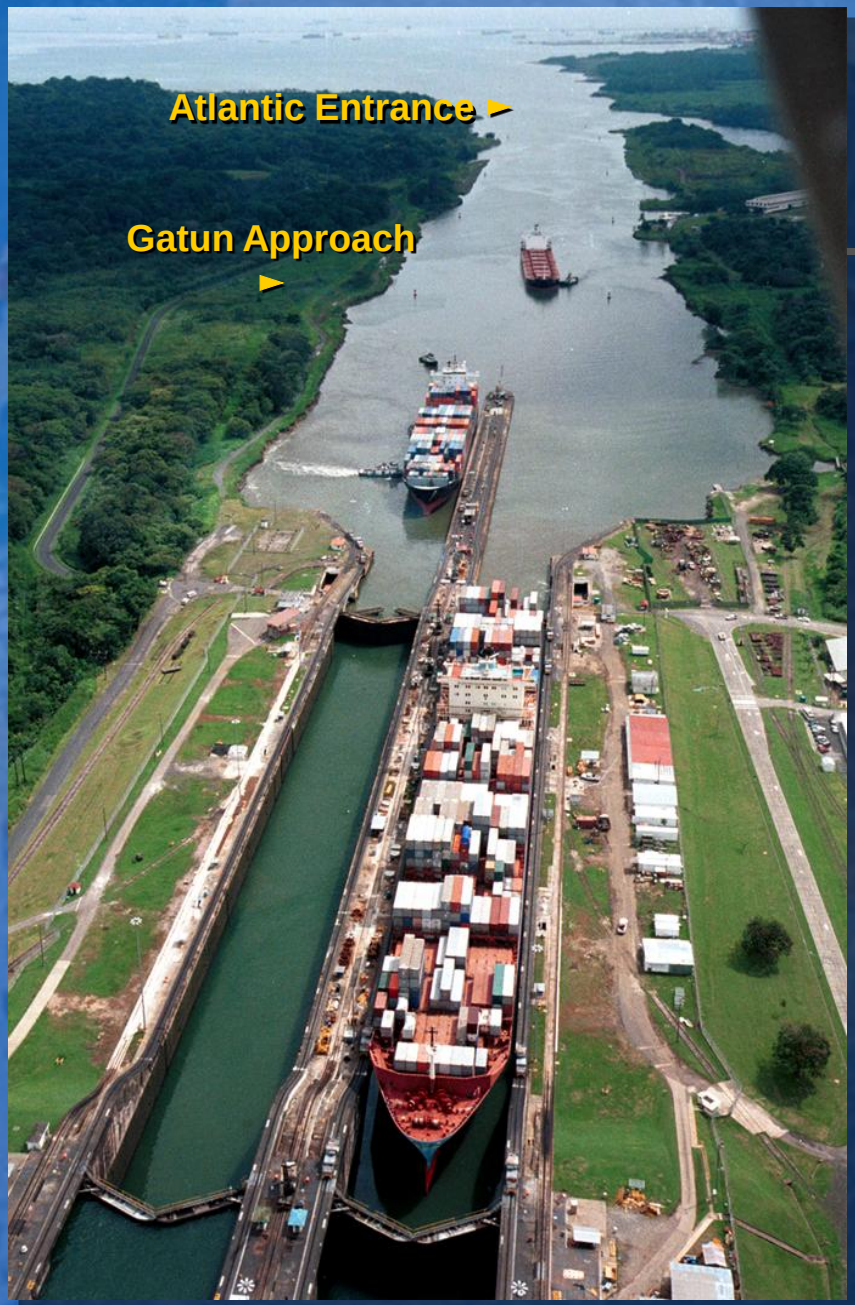
FY 1996 – FY 2005



Canal Waters Time by Segment
FY 2004 – FY 2005



Main Factors Affecting Canal Capacity



Gaillard Cut

Extended waiting time to transit jeopardizes the business

June 2004

119 vessels waiting
Waiting time: up to 7 days
Cause: maintenance work

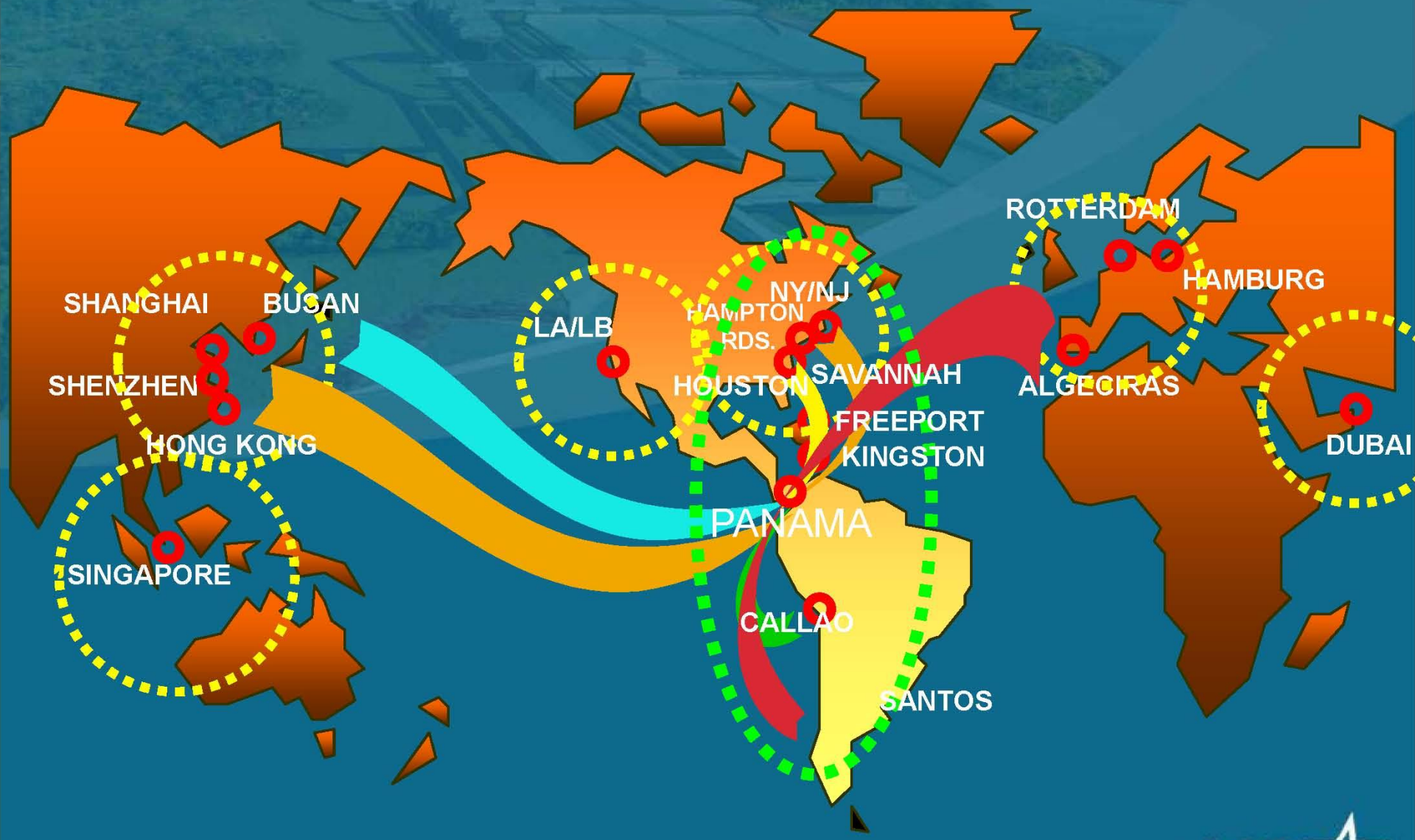
April 2006

111 vessels waiting
Waiting time: up to 10 days
Cause: high season

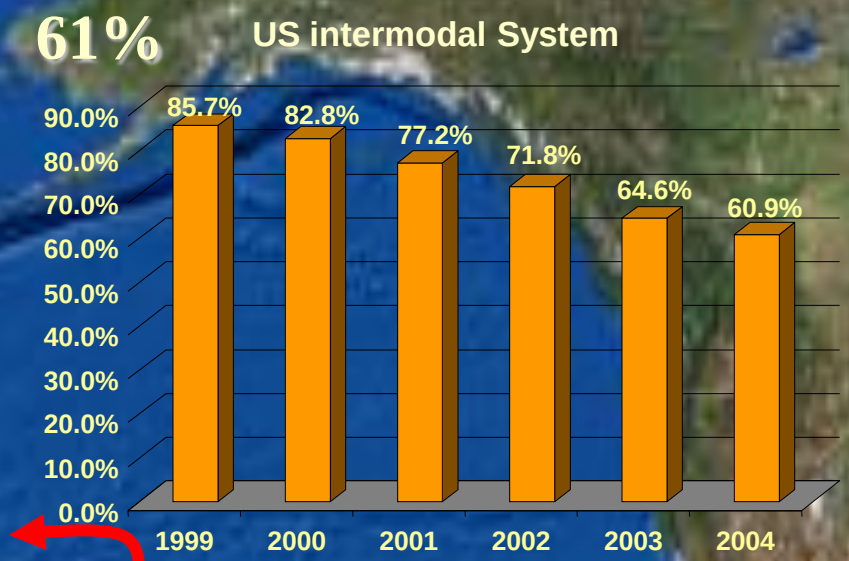
During some periods of the year, provided there are maintenance works undertaken or during the high (arrival) season, long queues form at each entrance of the Canal.

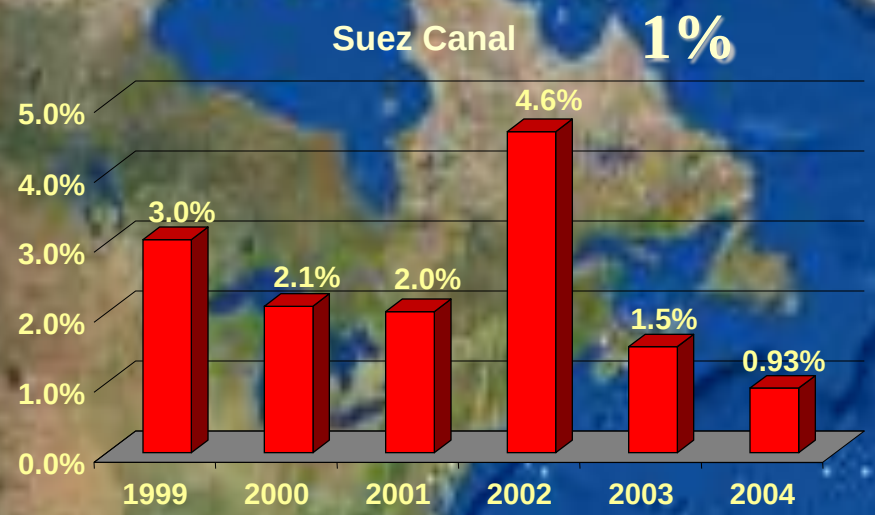
Long-term demand

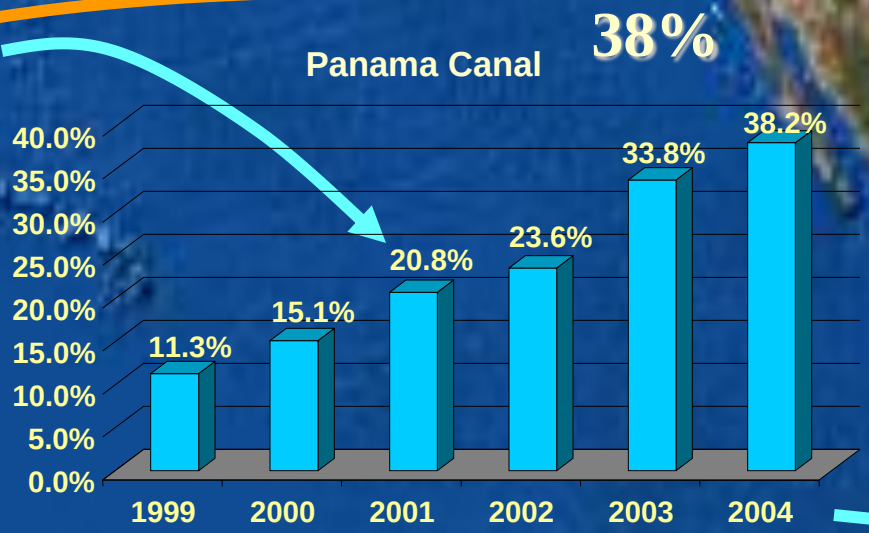
Main Logistics Hubs



Panama Canal Market Share in the Asia - U.S. East Coast Trade







Source: Estimate based on different industry sources (PIERS, AAR, ACP Ship Data Bank)

The containership is revolutionizing the maritime industry

1 containership

10,000 TEUs

=

=

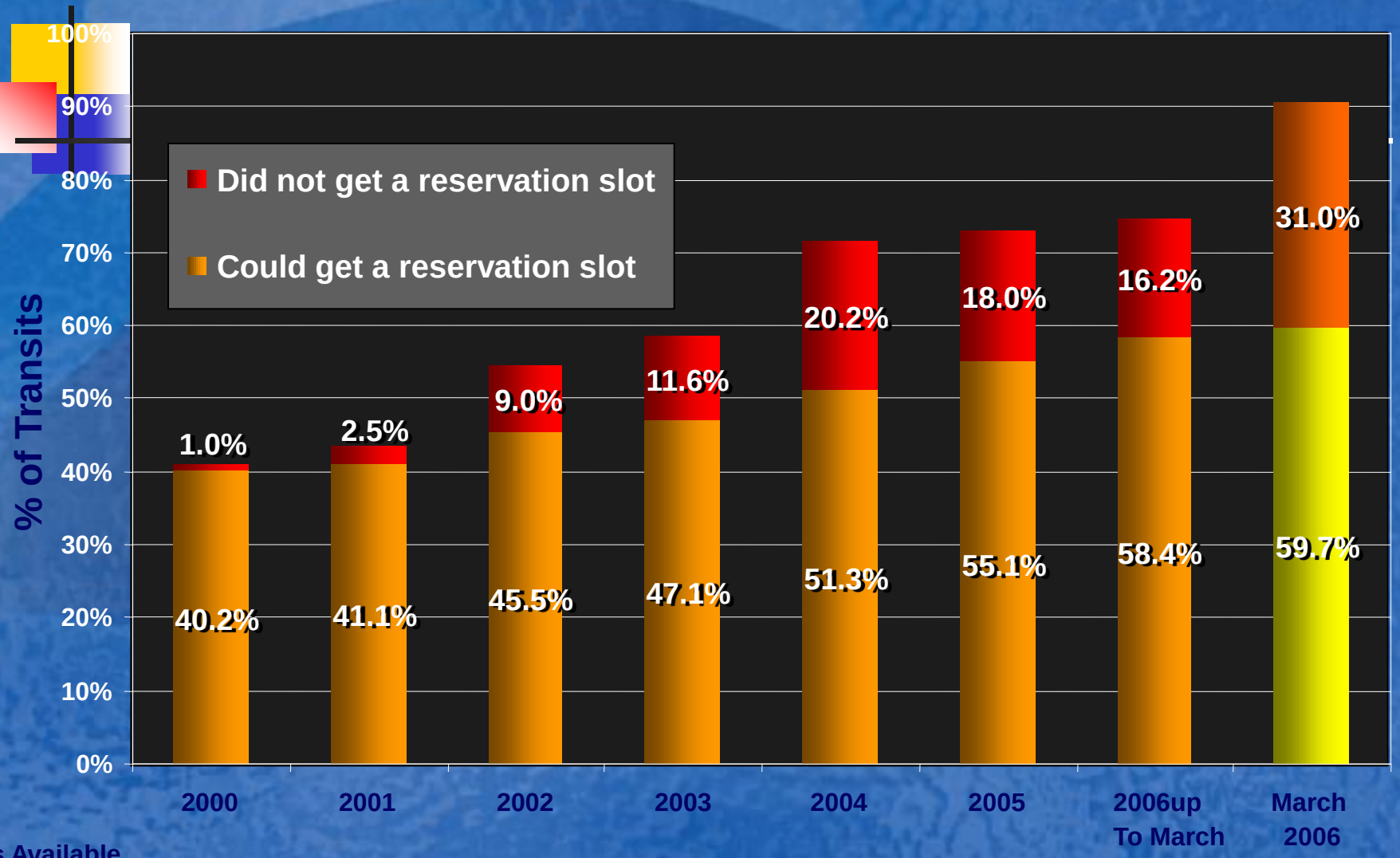
5,800 trucks
97 Km

18 trains each of 8,000 ft
43.5 Km

570 planes
Boeing 747

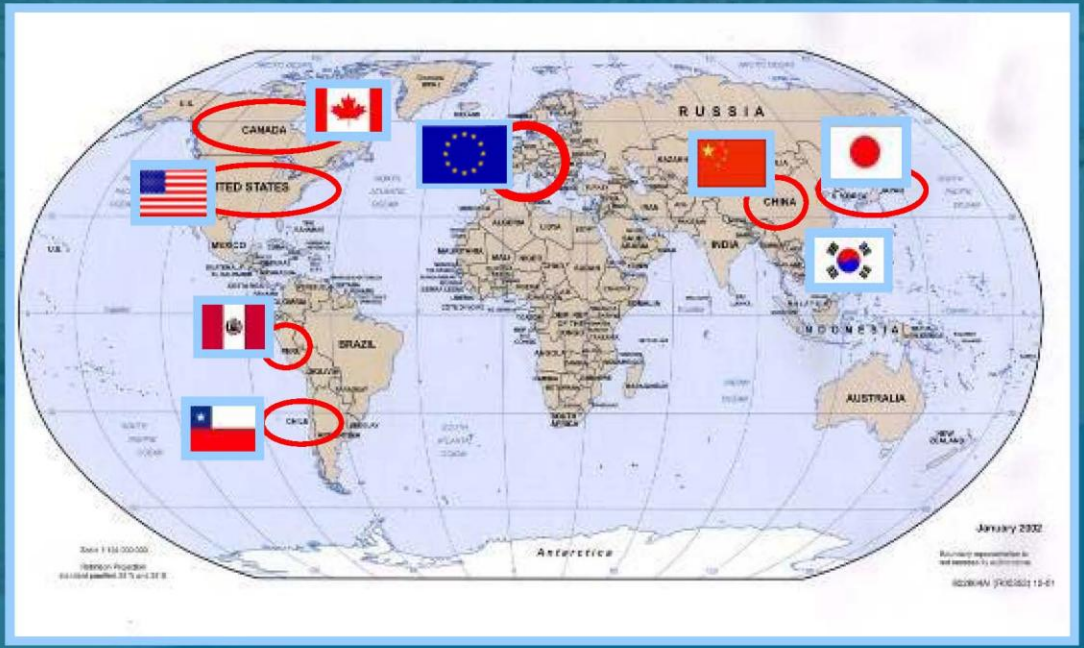
Transits Requesting Reservation Slots

The number of rejected requests increases….



Slots Available Per Year	21	21	21	21	21	22	24

The Panama Canal Trade and Main Users



67% of Canal cargo traffic originates in or is destined to the **United States**

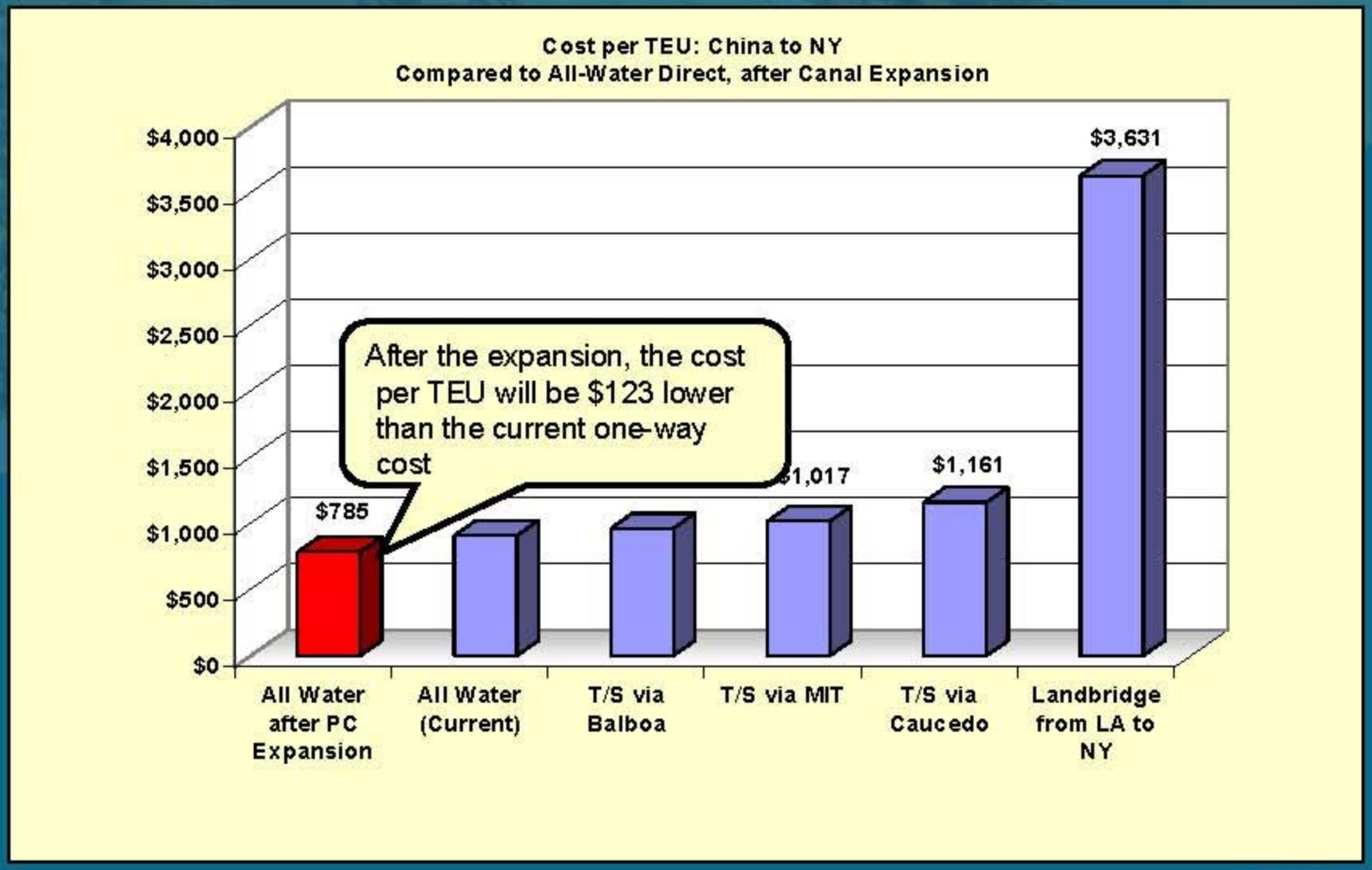
Total Cargo Movement FY 2009

USERS	FY 2008*	FY 2009*	2009 (%)
United States	133.7	132.6	67
China	43.7	46.5	23
Chile	26.7	25.5	13
European Union	26.1	26.1	11
Japan	24.7	20.5	10
South Korea	17.3	16.6	8
Colombia	13.5	12.7	7

** Measured in Million of Long Tons*

ACP

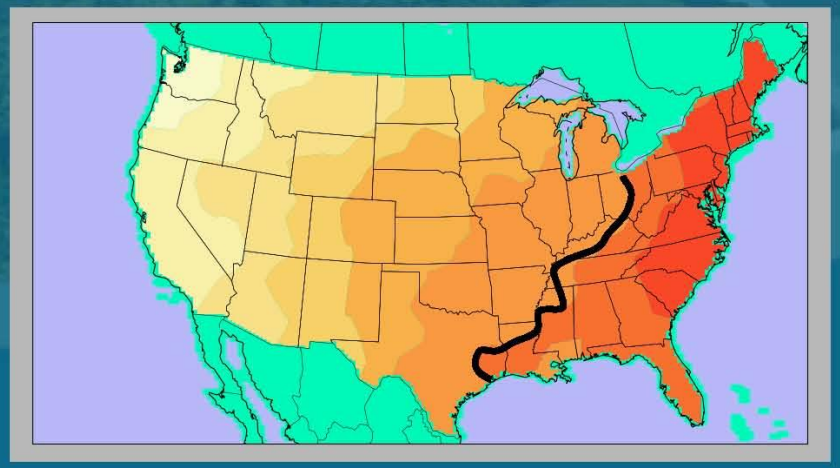
For Asia-USEC, the All-Water route is still the cheapest; but transshipment is not that far behind in terms of cost.



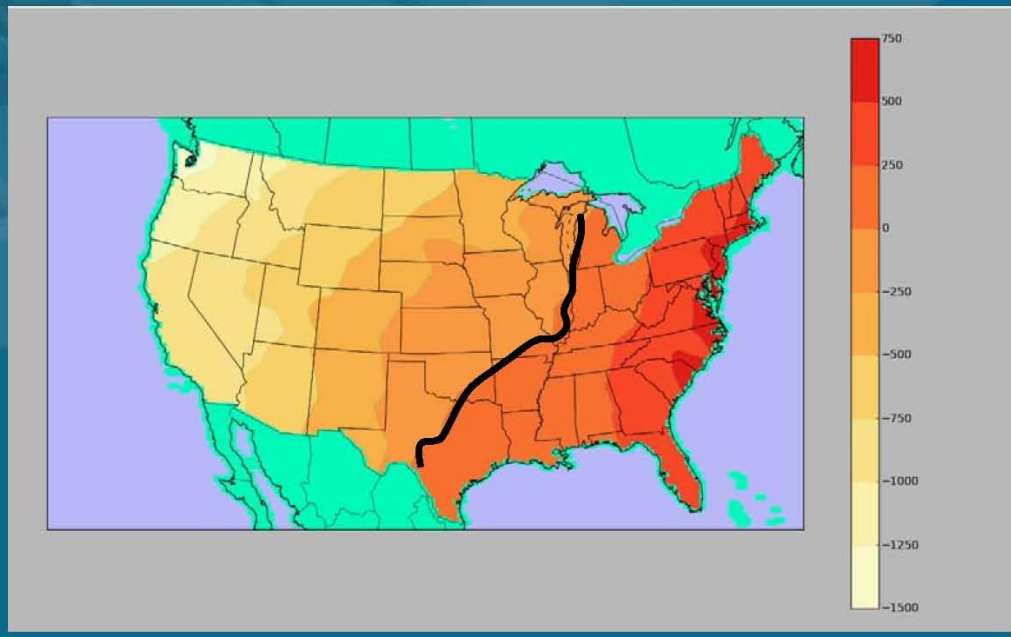
ACP

Using an 8000 TEU ship dramatically expands the accessible market from USEC ports.

4000 TEU ship
51% of US market



8000 TEU ship
66% of US market

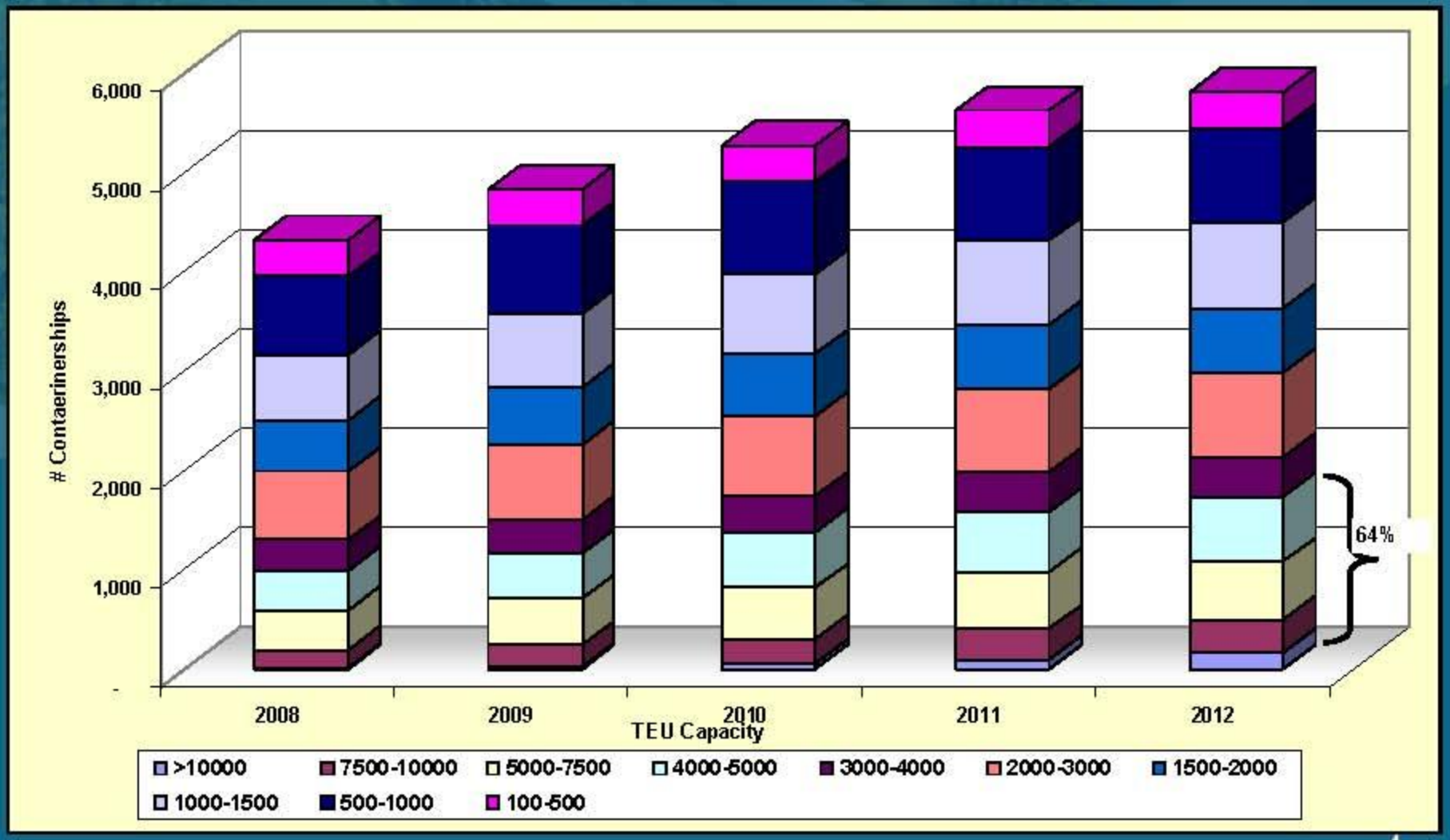


Assumptions
$400/MT bunker
Canal tolls based on 2011 proposal
Current ship charter rates
Inland move by rail

Based on Halcrow, Princeton Consultants route cost model – June 2010

ACP

By 2012, 64% of containership capacity will be in Post-Panamax Vessels. Just 30% of the ships.



Source: Clarksons

ACP

Opportunities..Cost savings..

Marine Distances between Ports for Colombian Coal and Brazilian Iron Ore to China

Origin	Destination	Maritime Route			Savings through the Panama Canal	
		Panama Canal	Cape of Good Hope	Suez Canal	Compare to CGH	Compare to Suez Canal
Puerto Prodeco- Colombia	Qinhuangdao - China	9,132	14,229	13,639	5,097	4,507
Puerto Prodeco- Colombia	Qingdao - China	8,975	13,972	13,377	4,997	4,402
Puerto Prodeco- Colombia	Beilun-China	8,970	13,743	13,151	4,773	4,181
Santana- Brazil	Qingdao - China	10,931	12,234	12,690	1,303	1,759
Santana- Brazil	Qinhuangdao - China	11,088	12,491	12,952	1,403	1,864
Santana- Brazil	Baoshan- China	10,926	12,005	12,464	1,079	1,538

Source: Based upon Fairplay Distance Tables

ACP

The Plan for the Future: Meet Current and Future Demand

Adding a Third Lane of Traffic

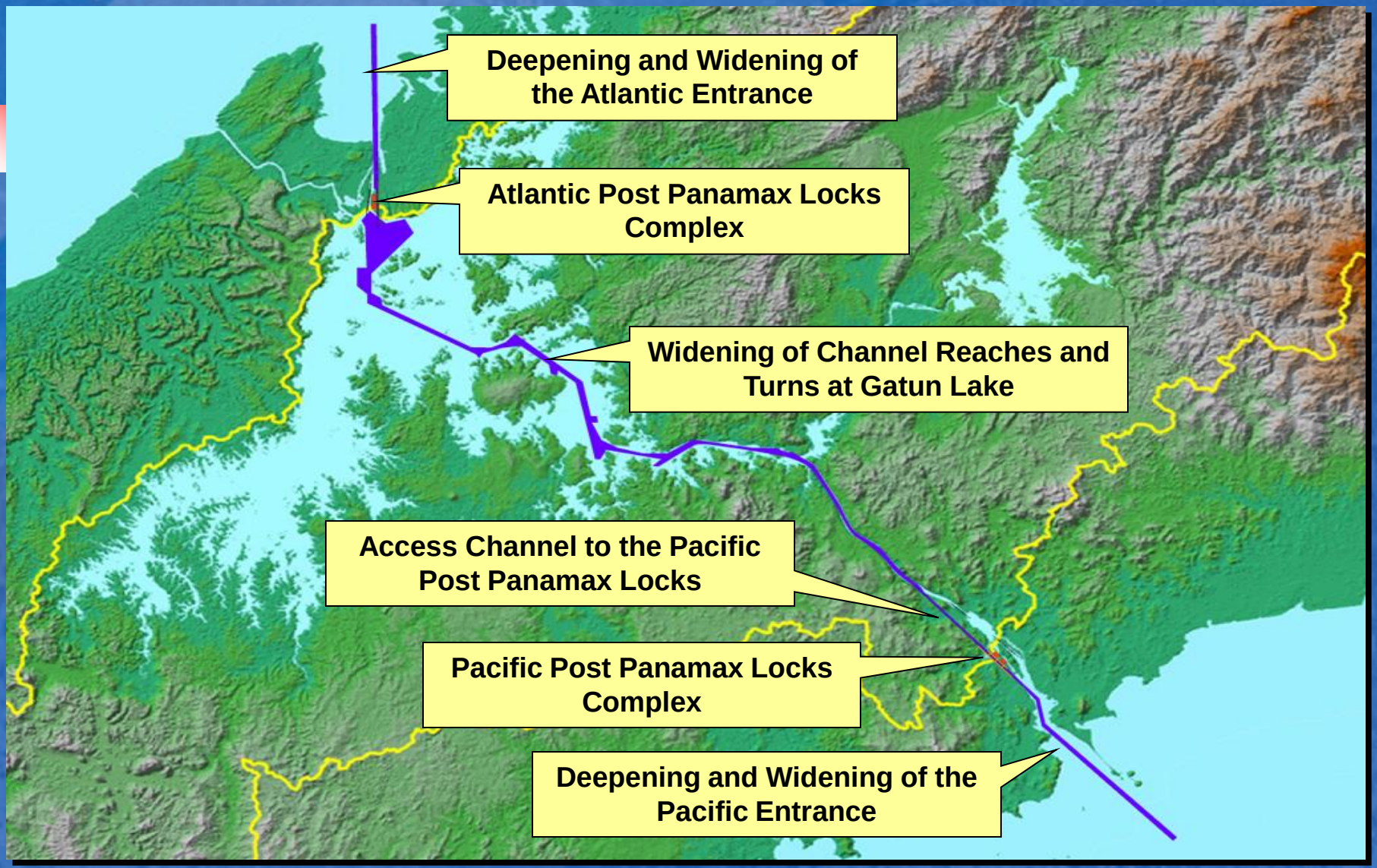
Canal Expansion Project Criteria

- Maximize use of existing infrastructure
- Use proven technology to minimize technical risks
- Emphasis on system reliability and maintainability
- Financing and execution strategy that leverages on ACP strengths and experience to minimize implementation risks

Canal Expansion Program
Major Components

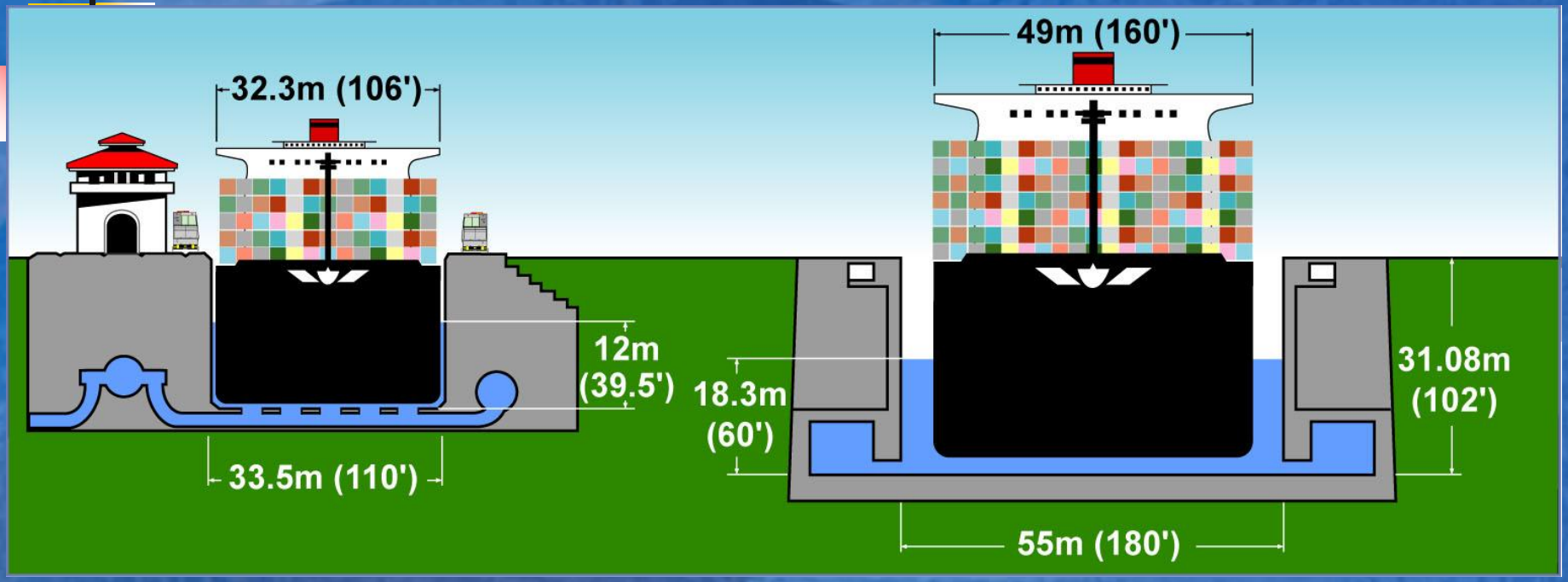
- New and bigger locks
- Alignment channels for new locks
- Improvements to existing navigational channels
- Water management to increase yield of watershed

Canal Expansion Program



Existing Lock

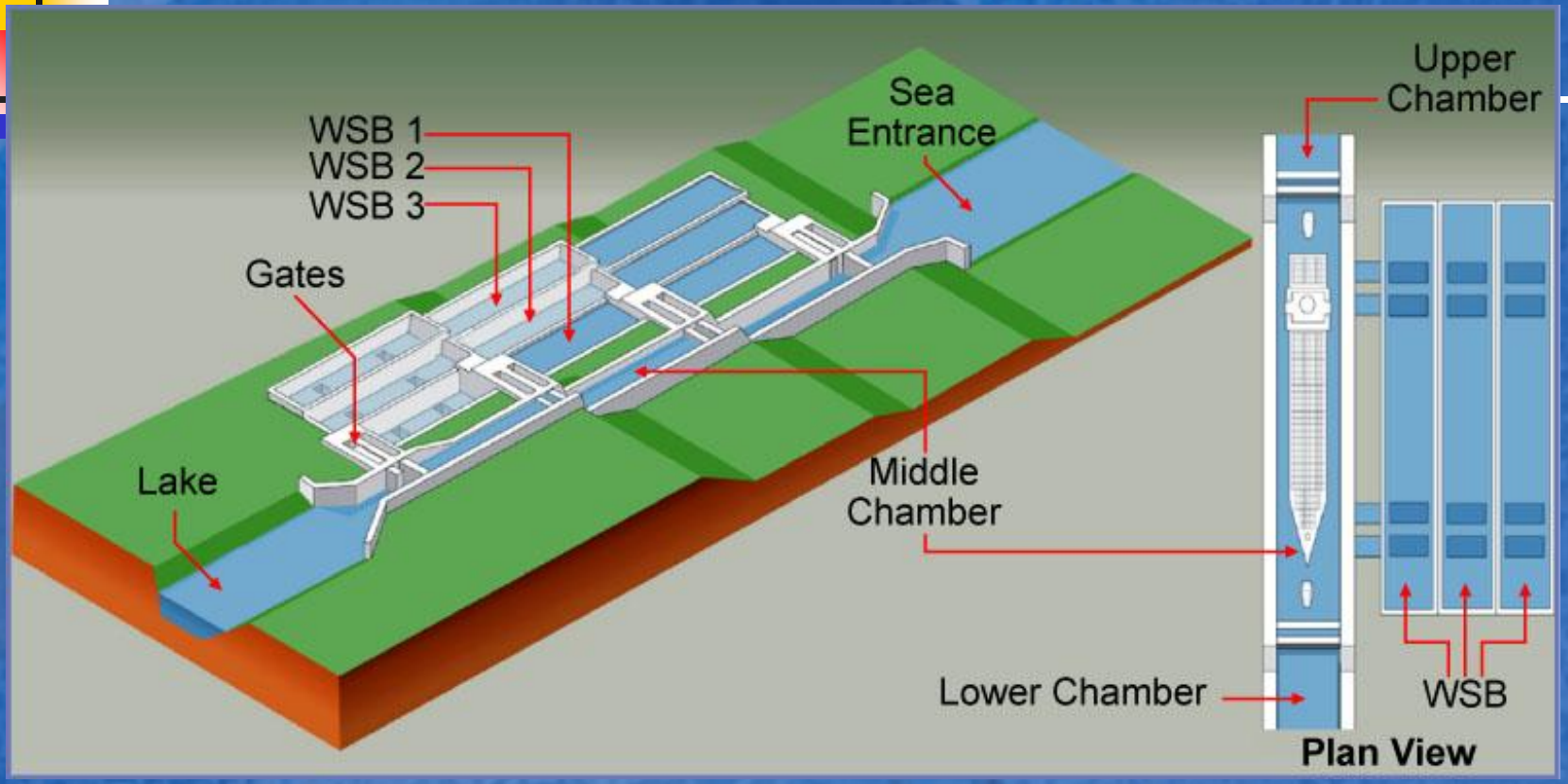
Post Panamax Conceptual Lock



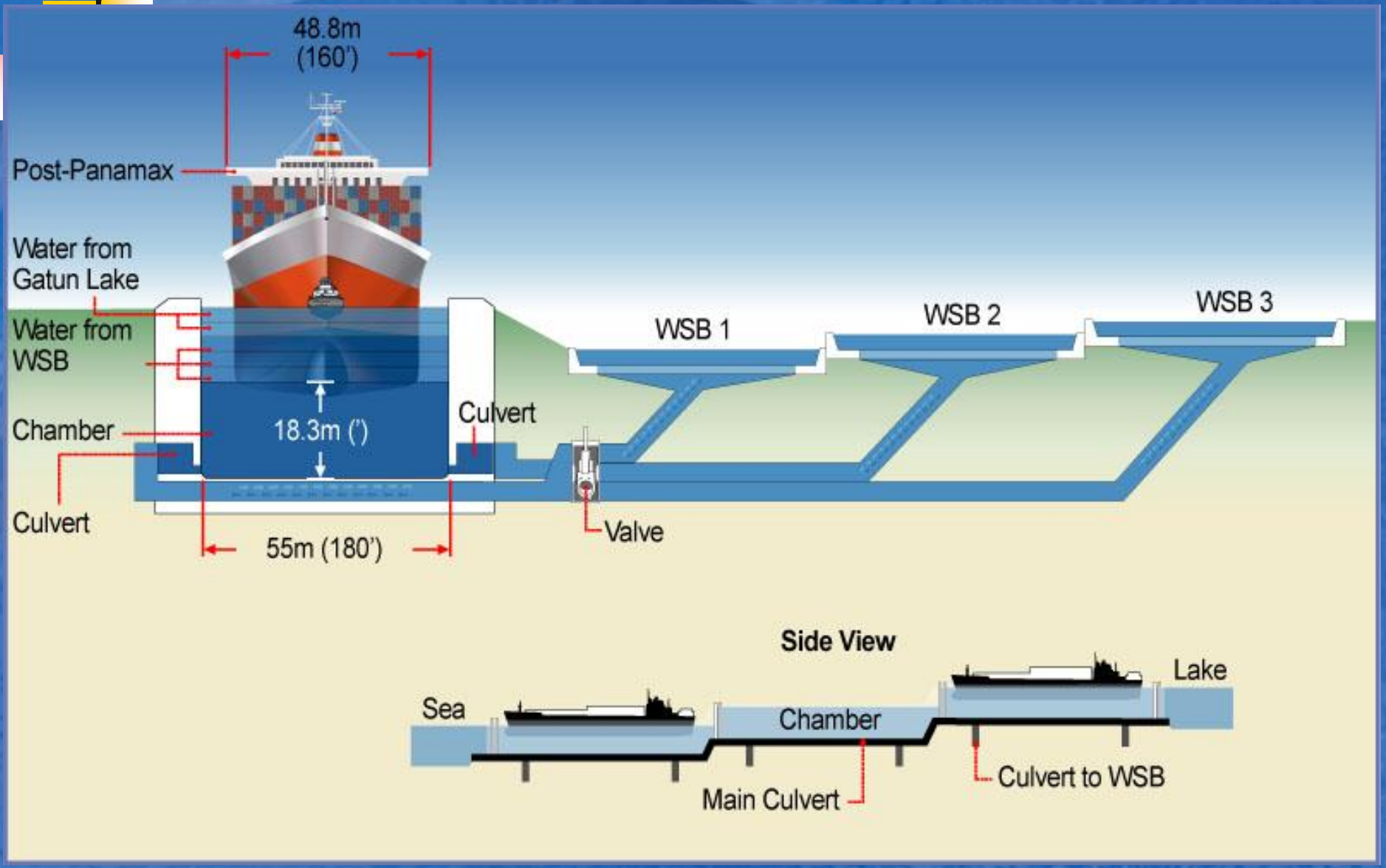
Length 305m (1,000’)
Ship length 294.3m (965’)

Length 427m (1,400’)
Ship length 385.8m (1,265’)

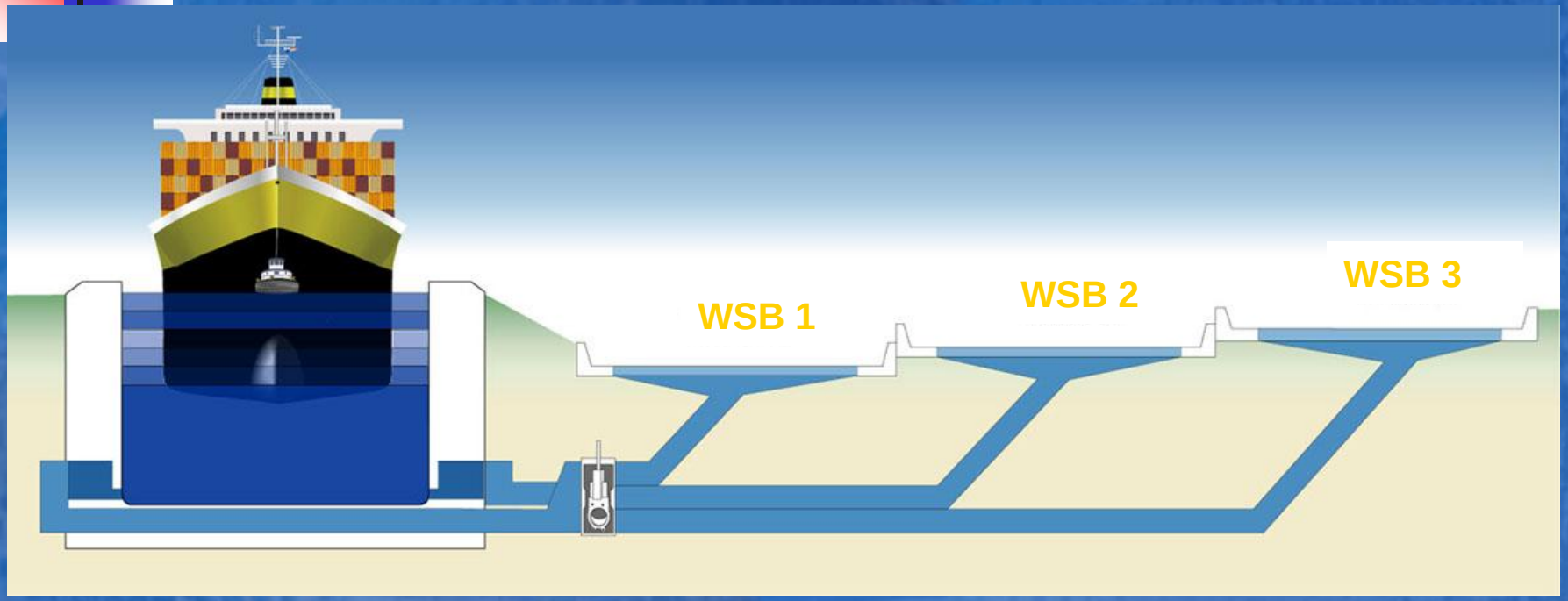
Proposed Water Saving Basins Operation



Proposed Post-Panamax Locks Operation



Animation of Water Saving Basins

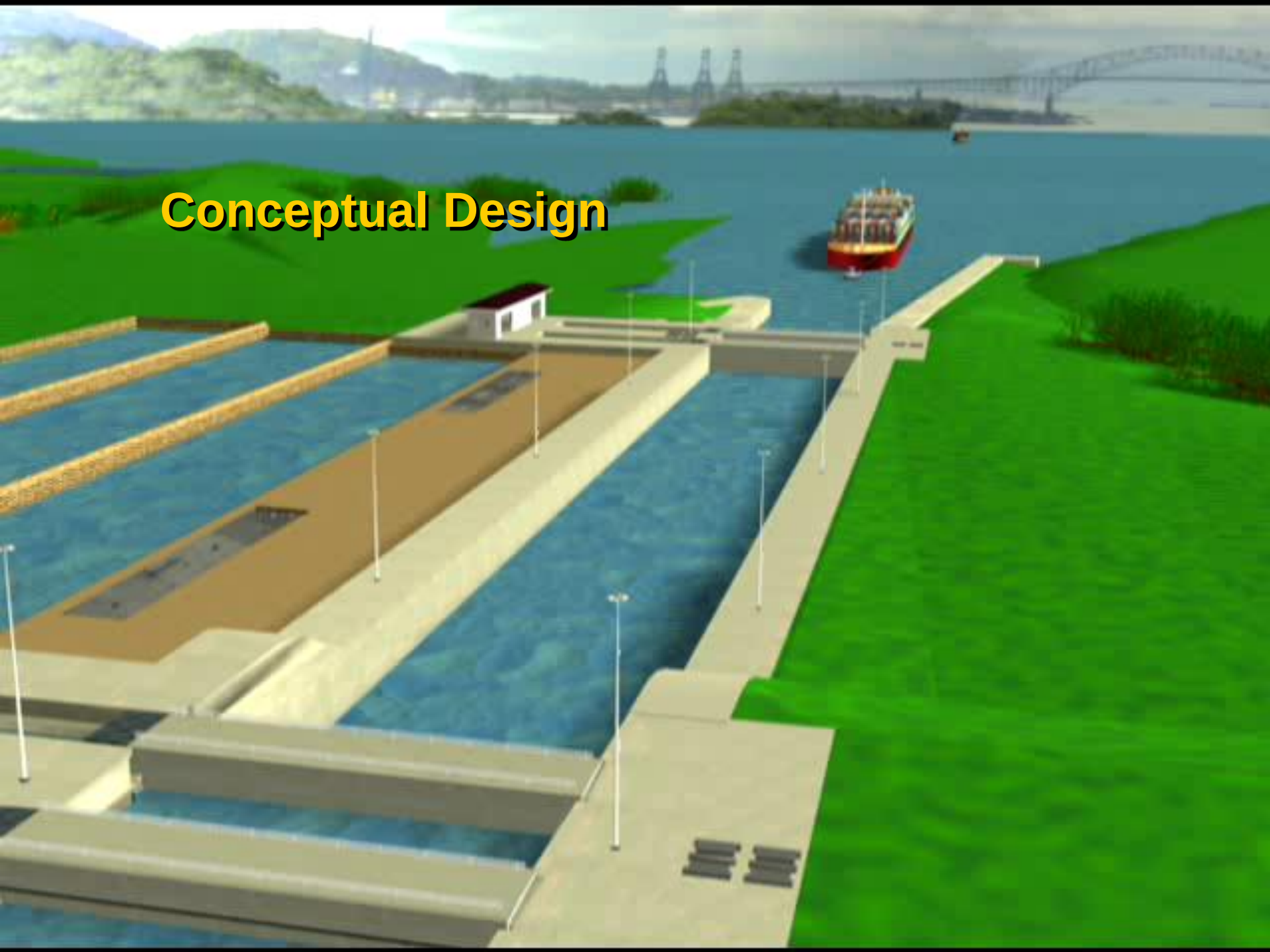


Water Saving Basins

Water saving basins used in Germany help reduce water usage

Pacific Locks

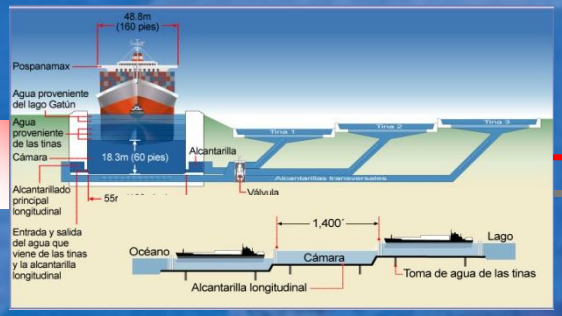
Conceptual Design



Financial Analysis

Project cost estimates

New Locks



2,730

Water saving basins

620

820

Approach channels and navigational channels

Improvements to the navigational channel

290

260

Water supply improvements

Inflation during the construction

530

Total Investment

5,250

Each investment estimate includes contingency costs

Miraflores Locks

Panama City

HYUNDAI
HYUNDAI
HYUNDAI
seaço
CAI
OOCL
OOCL
OOCL

HYUNDAI
HYUNDAI
GENSTAR
A GE Capital Company
GENSTAR
GENSTAR
A GE Capital Company
GENSTAR
TRITON
APL
15
16
17
19
20
21
23
24

HYUNDAI
Hapag-Lloyd
NPK LOGISTICS
APL

MIRAFLORES LOCKS
PANAMA CANAL
1913
EXTINTOR

CHINA SHIPPING
tex
CHINA SHIPPING
EVERGREEN
EVERGREEN

HANJIN SHANGHAI
COSCO
K LINE
HANJIN

RES LOCKS
A CANAL
1913
185

YANG MING
CHINA SHIPPING
MIRAFLORES LOCKS
PANAMA CANAL
1913
185

YANG MING
HANJIN
MIRAFLORES LOCKS
PANAMA CANAL
1913

CONSTRUCTION OF NEW LOCKS

G. U. P. C.

TECNO

There are truths and myths when it comes to the economics of bigger containerships.

	TRUE	FALSE
• The PPX ships bring new efficiencies (lower costs) per TEU	✓	
• The PPXs make money only when steaming	✓	
• The PPXs will call many ports on the USEC and in the Caribbean		✓
• Many ports can quickly and efficiently handle 8000+ TEUs from one ship		✓

ACP

The External Environment of Trade Between USA and Asia

- Panama Canal Expansion – Impact on Trade
- Readiness of US East Coast Ports to Accept Post Panamax Ships
- US Harbor Maintenance Tax – Potential to Produce Trade War
- Results of the US Election

Impact of Panama Canal Expansion on Logistics

- US East Coast and Golf Port Traffic Will Increase
  - New Manufacturing Operations
    - Airbus (Mobile AL)
    - Boeing (Charleston, SC)
    - Caterpillar (Athens, GA)
    - Disney (Will use Port of Jacksonville for all imports)
- Post-Panamax Vessels will make up 62 percent of total container ship capacity by 2030 (US Army Corps of Engineers)

TOP 20 NORTH AMERICAN CONTAINER PORTS

No. American Port	2012 TEUs (Est. 000s)	2011 TEUs	2010 TEUs	Rank (2011 TEUs)
Los Angeles, CA	8,000	7,900	7,800	1
Long Beach , CA	6,000	6,100	6,300	2
New York/NJ	5,600	5,500	5,300	3
Savannah, GA	3,000	2,900	2,900	4
Canada – Vancouver	2,600	2,500		5
Oakland, CA	2,400	2,350	2,330	6
Seattle, WA	2,100	2,000	2,150	7
Houston, TX	2,100	1,900	1,812	8–9
Norfolk, VA	1,950	1,900	1,895	8–9
Mexico – Manzanillo	1,800	1,750	1,700	10
Tacoma, WA	1,500	1,500	1,455	11
Canada – Montreal	1,400	1,300		12
Charleston, SC	1,350	1,300	1,147	13
Jacksonville, FL	950	900	827	14
Miami, FL	950	900	847	15
Baltimore, MD	650	632		16
Canada – Prince Rupert	500	410		17
Portland, OR	210	200	181	18
Mobile, AL	190	170	145	19
Tampa, FL (a bulk cargo port)	45	40	44	20
Subtotals	**43,295**	**42,152**	**36,833**	
% of N.Am TEUs	**96%**	**94%**		

TOP 20 NORTH AMERICAN CONTAINER PORTS

No. American Port	2012 TEUs (Est. 000s)	2011 TEUs	2010 TEUs	Rank (2011 TEUs)
Los Angeles, CA	8,000	7,900	7,800	1
Long Beach , CA	6,000	6,100	6,300	2
New York/NJ	5,600	5,500	5,300	3
Savannah, GA	3,000	2,900	2,900	4
Canada – Vancouver	2,600	2,500		5
Oakland, CA	2,400	2,350	2,330	6
Seattle, WA	2,100	2,000	2,150	7
Houston, TX	2,100	1,900	1,812	8–9
Norfolk, VA	1,950	1,900	1,895	8–9
Mexico – Manzanillo	1,800	1,750	1,700	10
Tacoma, WA	1,500	1,500	1,455	11
Canada – Montreal	1,400	1,300		12
Charleston, SC	1,350	1,300	1,147	13
Jacksonville, FL	950	900	827	14
Miami, FL	950	900	847	15
Baltimore, MD	650	632		16
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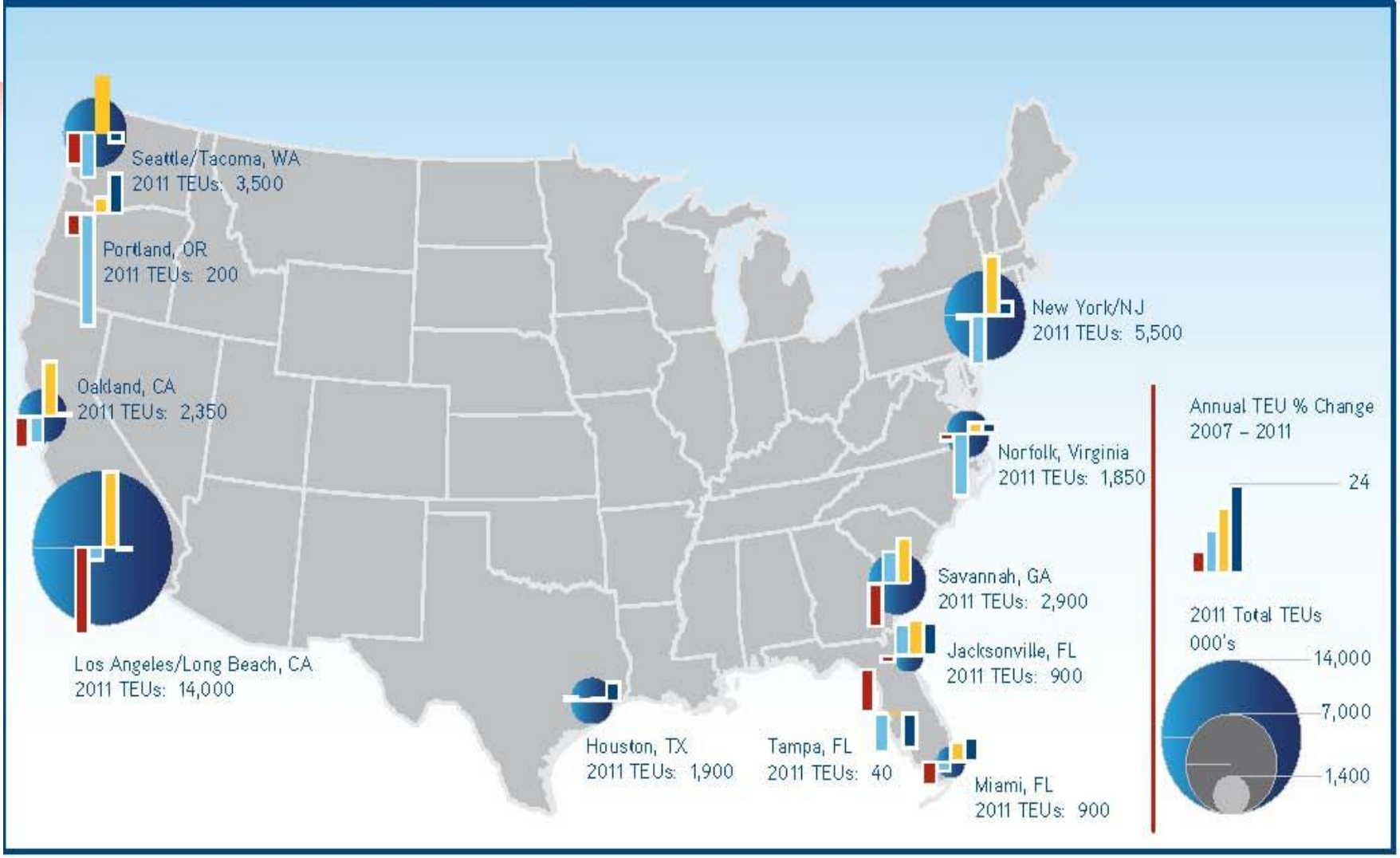
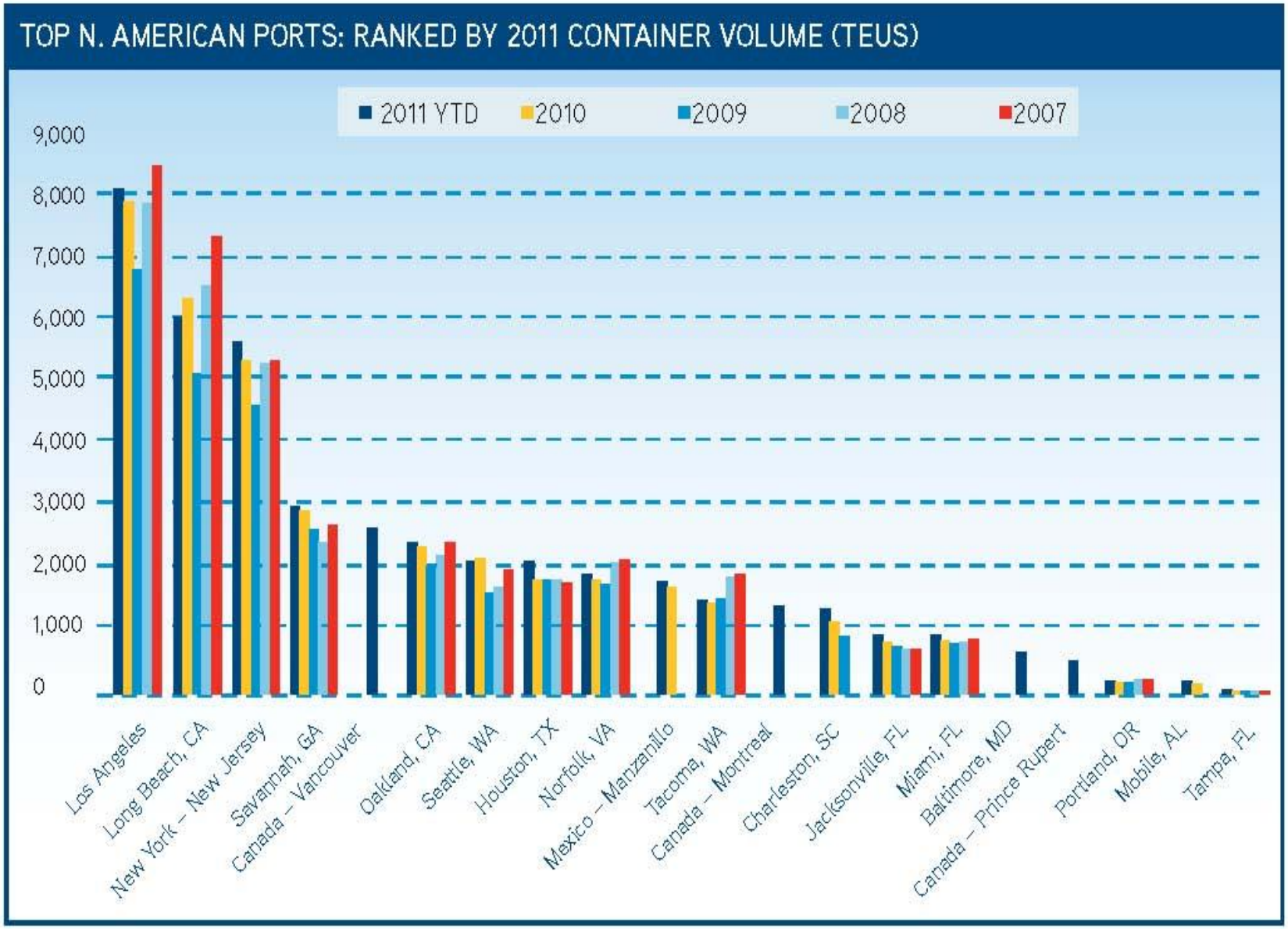
Mobile, AL	190	170	145	19
Tampa, FL (a bulk cargo port)	45	40	44	20
Subtotals	**43,295**	**42,152**	**36,833**	
% of N.Am TEUs	**96%**	**94%**		

MAJOR U.S. PORT CITY CONTAINER TRAFFIC




TOP N. AMERICAN PORTS: RANKED BY 2011 CONTAINER VOLUME (TEUS)
2011 YTD
2010
2009
2008
2007
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Los Angeles
Long Beach, CA
New York – New Jersey
Savannah, GA
Canada – Vancouver
Oakland, CA
Seattle, WA
Houston, TX
Norfolk, VA
Mexico – Manzanillo
Tacoma, WA
Canada – Montreal
Charleston, SC
Jacksonville, FL
Miami, FL
Baltimore, MD
Canada – Prince Rupert
Portland, OR
Mobile, AL
Tampa, FL

NORTH AMERICAN POST-PANAMAX READY PORTS

Port	Post-Panamax Status/Impediment	2012 TEUs (Est. 000s)	2011 TEUs	Global Rank
LA/Long Beach	Currently Ready	14,000	14,000	6th
New York/NJ	2015 – Bayonne Bridge	5,600	5,500	20th
Oakland	Currently Ready	2,400	2,350	< top 50
Seattle	Currently Ready	2,100	2,000	< top 50
Houston	2013 – Dredging	2,100	1,900	< top 50
Norfolk	Currently Ready	1,900	1,900	< top 50
Miami	2015 – Dredging/ Cranes	950	900	< top 100
Baltimore	2013 – Cranes	650	630	< top 100

Source: American Association of Port Authorities, Colliers International

Port of New York and New Jersey

- Bayonne Bridge – 151 ft. air draft
  - Some post-Panamax ships cannot pass underneath
  - Will Raise air draft 61 feet
  - Lift 4 lane highway
  - Must do environmental impact study and impact on bridge's historic structure first
  - Expected to be completed Fall, 2015

NUTLEY
Hackensack River
Hudson River
BELLEVILLE
East River
nj pkwy
SECAUCUS
Lincoln Tunnel
278
LaGuardia Airport
ORANGE
KEARNY
UNION CITY
MANHATTAN
280
NEWARK
Holland Tunnel
495
QUEENS
JERSEY CITY
Port Newark Container Terminal
78
Newark Liberty International Airport
Newark Bay Brg
Brooklyn Battery Tunnel
678
NION
Newark Bay
Greenville Yard
Brooklyn Marine Terminal
Red Hook Container Terminal
Port Of Elizabeth Marine Terminal
Global Marine Terminal
ELIZABETH
South Brooklyn Marine Terminal
Port Of Bayonne
Upper New York Bay
JFK International Airport
Bayonne Bridge
65th St Intermodal Terminal
Goethals Bridge
INDEN
95
Howland Hook Marine Terminal
BROOKLYN
278
Verrazano Narrows Bridge
Jamaica Bay
STATEN ISLAND
Lower New York Bay
Rockaway Inlet
Authur Kill
Outer Bridge rossing
Atlantic Ocean

Other Ports

- Houston – Need Dredging to 50 +Ft.
  - Will be ready 2013
- Miami
  - Port of Miami and State of FL –Major project to get port ready
  - Dredging, Larger Cranes
  - Ready 2015
- Baltimore
  - Need Larger Cranes – Ready in 2013

TYPICAL FEEDER – PANAMAX CRANE	
B Outreach	30.00 – 40.00m
D Lift Height	24.00 – 30.00m
SWL Capacity	40/50T Single – 65T Twin
Hoisting Speed	50 – 125 m/min
Trolley Speed	150 – 180 m/min
Travel Speed	45 m/min
Wheel Load *	30 – 45T Per Meter

A Panamax crane can load and unload a container ship capable of passing through the Panama Canal today.

TYPICAL POST-PANAMAX CRANE	
B Outreach	40.00 – 46.00m
D Lift Height	30.00 – 35.00m
SWL Capacity	40/50T Single – 65T Twin
Hoisting Speed	60 – 150 m/min
Trolley Speed	180 – 210 m/min
Travel Speed	45 m/min
Wheel Load *	40 – 55T Per Meter

A post-Panamax crane can load a ship 18 containers wide, which is too big to pass through the Panama Canal.

TYPICAL SUPER POST PANAMAX/MEGAMAX	
B Outreach	46.00 – 69.00m
D Lift Height	35.00 – 49.00m
SWL Capacity	65T Twin - 80T Tandem
Hoisting Speed	70 – 175 m/min
Trolley Speed	210 – 240 m/min
Travel Speed	45 m/min
Wheel Load *	60 – 80T Per Meter

The Super post-Panamax is the largest crane in use today and can unload containers from vessels with a width of 22 or more containers. Baltimore and Miami are each adding such cranes.

*Based on 8 wheels per corner at 1.00m spacing
Source: *liebherr.com*

Future Risks for US Ports

- Labor Strikes Could Halt Port Activity
  - ILA (International Longshoremen's Association) currently in negotiations with Management of East Coast and Southern Ports
- Automation Opposed by Big Labor
  - ILA President stated is No. 1 Issue

Future Risks for US Ports

- Slowing Global GDP
  - Europe
  - US
  - China Slowing – Related to Slow Growth in US and Europe

The External Environment of Trade Between USA and Asia

- Panama Canal Expansion – Impact on Trade
- Readiness of US East Coast Ports to Accept Post Panamax Ships
- US Harbor Maintenance Tax – Potential to Produce Trade War
- Results of the US Election

US Containers Through Canadian Ports

- Has been spectacular growth in traffic in Canadian and Mexican ports
- Prince Rupert – 30% year over year growth in total trade 2011
- Lazaro Cardenas, Mexico – 19.8% year to year growth
- Manzanillo – 19.3% year to year growth

Federal Maritime Commission Investigation

- Harbor Maintenance Tax and"other disparities"
- Alleged container cargo diversion from US west coast ports to Canadian and Mexican ports
- Prince Rupert singled out for special review

Harbor Maintenance Tax

- Excise tax 0.125% Ad Valorem on Imported Cargo
- Avg $109 per container
- Trust Fund Created
- Not All Money Spent – Over $5.6 bill surplus

Harbor Maintenance Tax

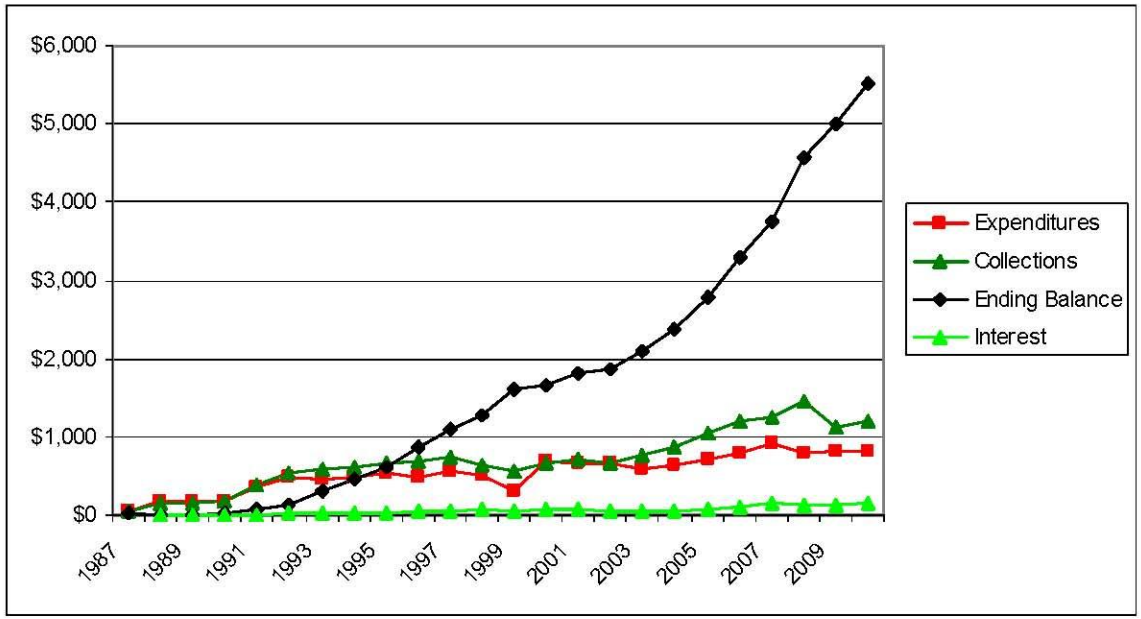
- Originally Applied to both Imports and Exports
- 1998 Supreme Court ruled HMT not a true user fee, unconstitutional tax on exports
- Now only applied to imports

HMT Issues and Solutions

1. Impact of Not Spending Funds Received Each Year
2. Redistribution Effects Across Ports in US
3. Solutions

Figure 1. HMTF Balance

($ in millions)



Source: USACE annual reports to Congress on the HMTF, Federal Budget Appendix, FY2008-FY2011.

Note: Figures not adjusted for inflation.

Impact of Not Spending Funds Received Each Year

- Fewer Funds Available for Harbor Maintenance – Channels May Not be Adequately Maintained
- Congressional Research Service Report:
  - The Busiest U.S. Harbors Are Under-maintained
  - Full Channel Dimensions at the Nation's Busiest 59 Ports Are Available Less Than 35% of the Time
  - Increase Cost of Shipping – Vessels Wait for High Tide or Decrease Load

Impact of Not Spending Funds Received Each Year

- Acts Like Tax on Imports
- May Violate WTO Agreements
  - EU sees HMT discriminatory import tariff that violates U.S. obligations under WTO
  - So far, no action taken
- Other Trading Partners May Sue at WTO
- Retaliatory Action Possible
- Violation of "Trust"

Redistribution Effects Across Ports In US

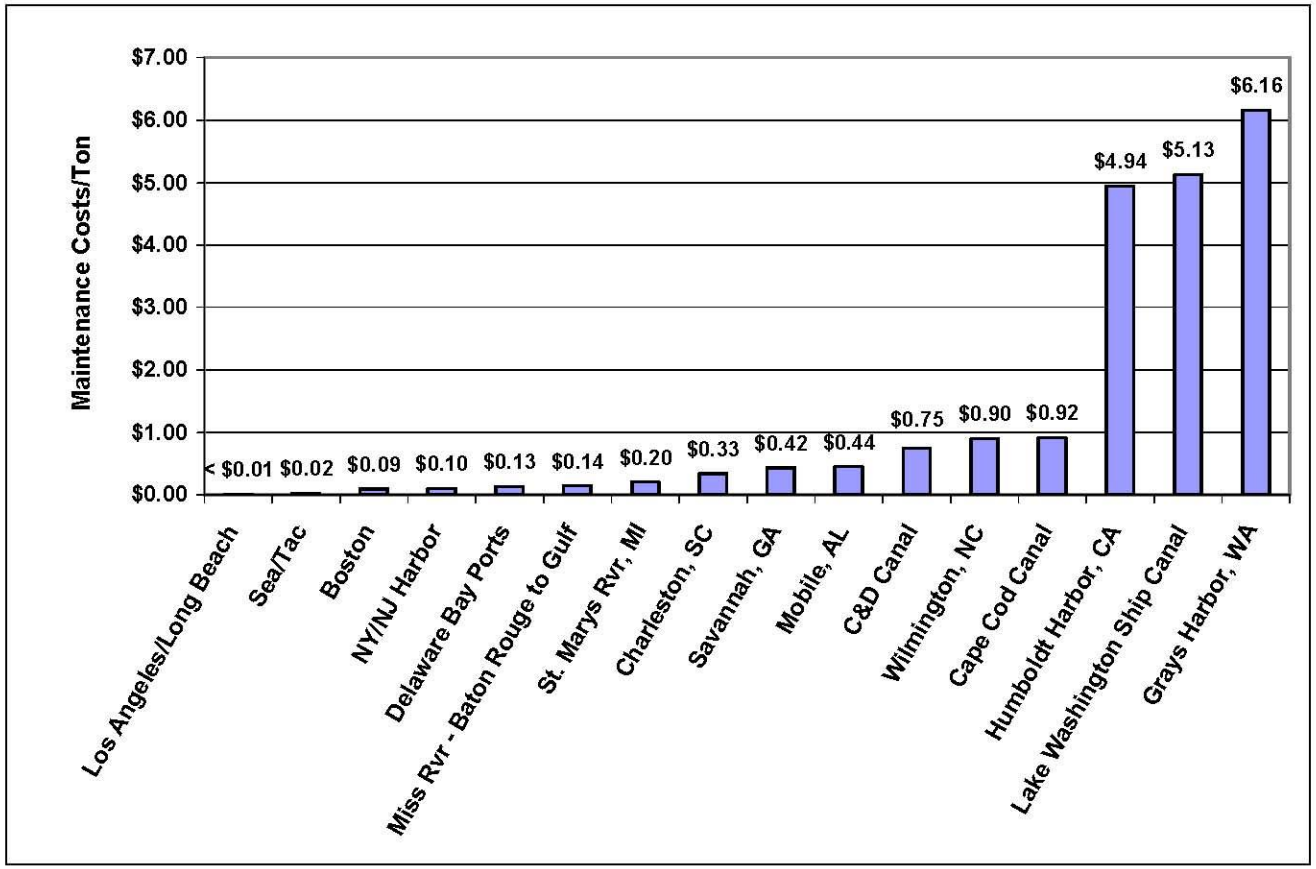
- Concept of Economic Efficiency – Should Spend on Maintenance Activities in Direct Relation to Fees Collected
- Otherwise – Have Cross Subsidy of Ports with Most Likely Large Ports Subsidizing Smaller
- Corps data indicate that a significant portion of annual HMTF disbursements are directed towards harbors which handle little or no cargo.

Redistribution Effects Across Ports In US

- Congressional Budget Office:
  - HMT revenues are redistributed from ports that are large import gateways with naturally deep channels to lower volume ports that require frequent dredging to maintain adequate channel depths and widths.
  - The ports of Los Angeles, Long Beach, Seattle, and Tacoma, and to a lesser degree, Boston, New York, and Houston are large net generators of HMT revenue.

Figure 3. HMTF Expenditures Per Ton of Cargo on Selected Waterways

2003-2007



Source: USACE Waterborne Commerce Statistics, HMTF Annual Reports to Congress.

Notes: The figure for Los Angeles/Long Beach equates to $0.003/ton. HMTF Expenditures based on FY2003-2007, Cargo tonnage based on CY2003-2007.

Port Cross-Subsidy

- Is this good or bad?
  - Receiving Ports – Benefit
  - Payer Ports – Loose
- Ports Compete in US and Internationally
- Have Misallocation of Resources
- Traffic Diverted to Inefficient Ports
- We spend more on ports than is needed

Port Cross-Subsidy

- Impact on Shipping May Not be as Great
- Many Factors Determine Port Choice
- Taxes are one of them
- If there is little diversion, then money is not spent effectively

Solutions Considered by Congress

- Charge Tax on Containers Moving Through Canadian Ports Destined for US
  - Impact on Container Diversion Probably Minimal Since Many Other Factors Determine Port Choice
  - May Violate NAFTA and WTO Agreements
  - May Result in Trade War with Canada

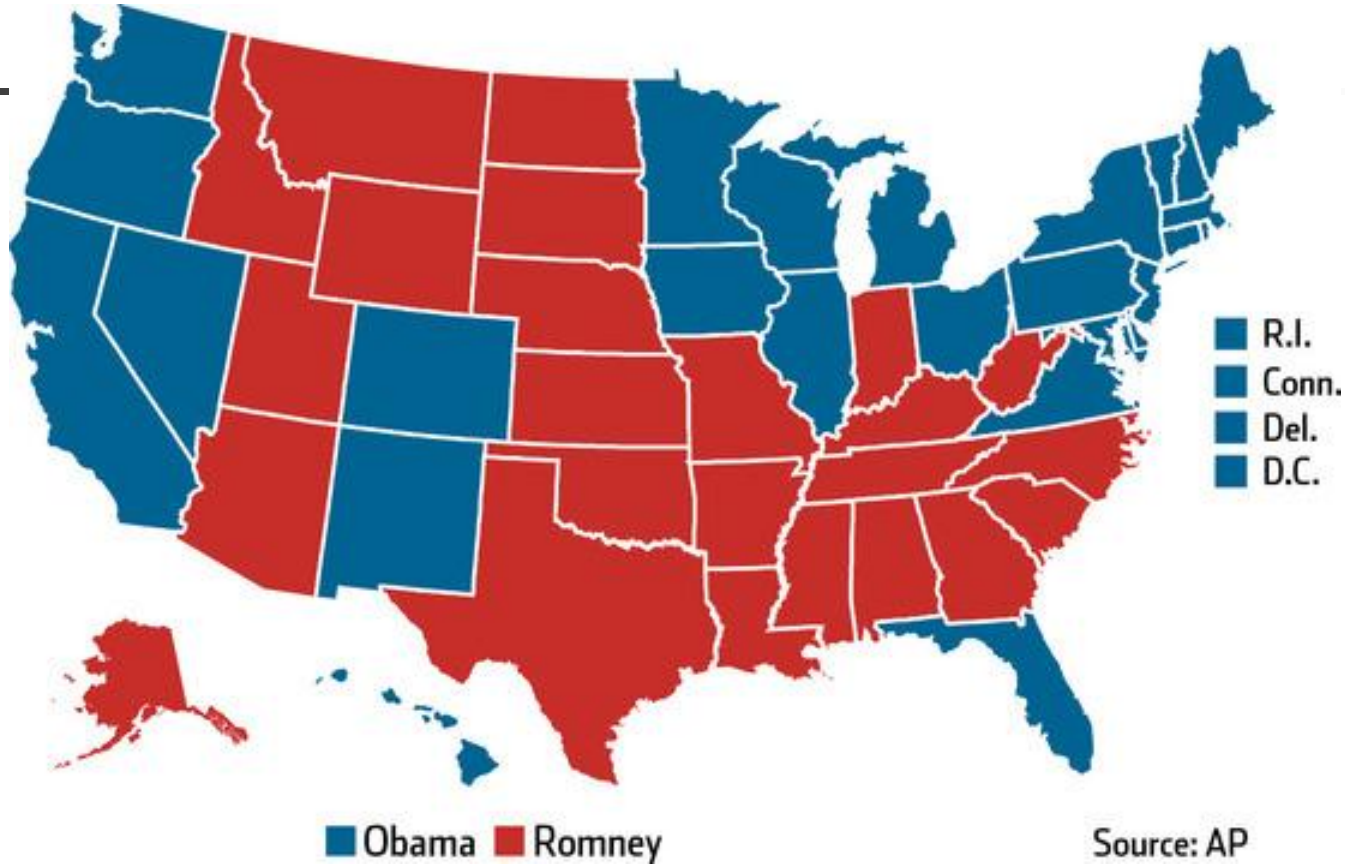
Solutions Considered by Congress

- Ports Compete Both Nationally and Internationally
- Dredging is a Cost of Port Operation
- Ports Can Do this Themselves
- Most Reasonable Solution:
  - Repeal the Harbor Maintenance Tax
- Congress May Not Do the Reasonable Thing

The External Environment of Trade Between USA and Asia

- Panama Canal Expansion – Impact on Trade
- Readiness of US East Coast Ports to Accept Post Panamax Ships
- US Harbor Maintenance Tax – Potential to Produce Trade War
- Results of the US Election

Results of US Election

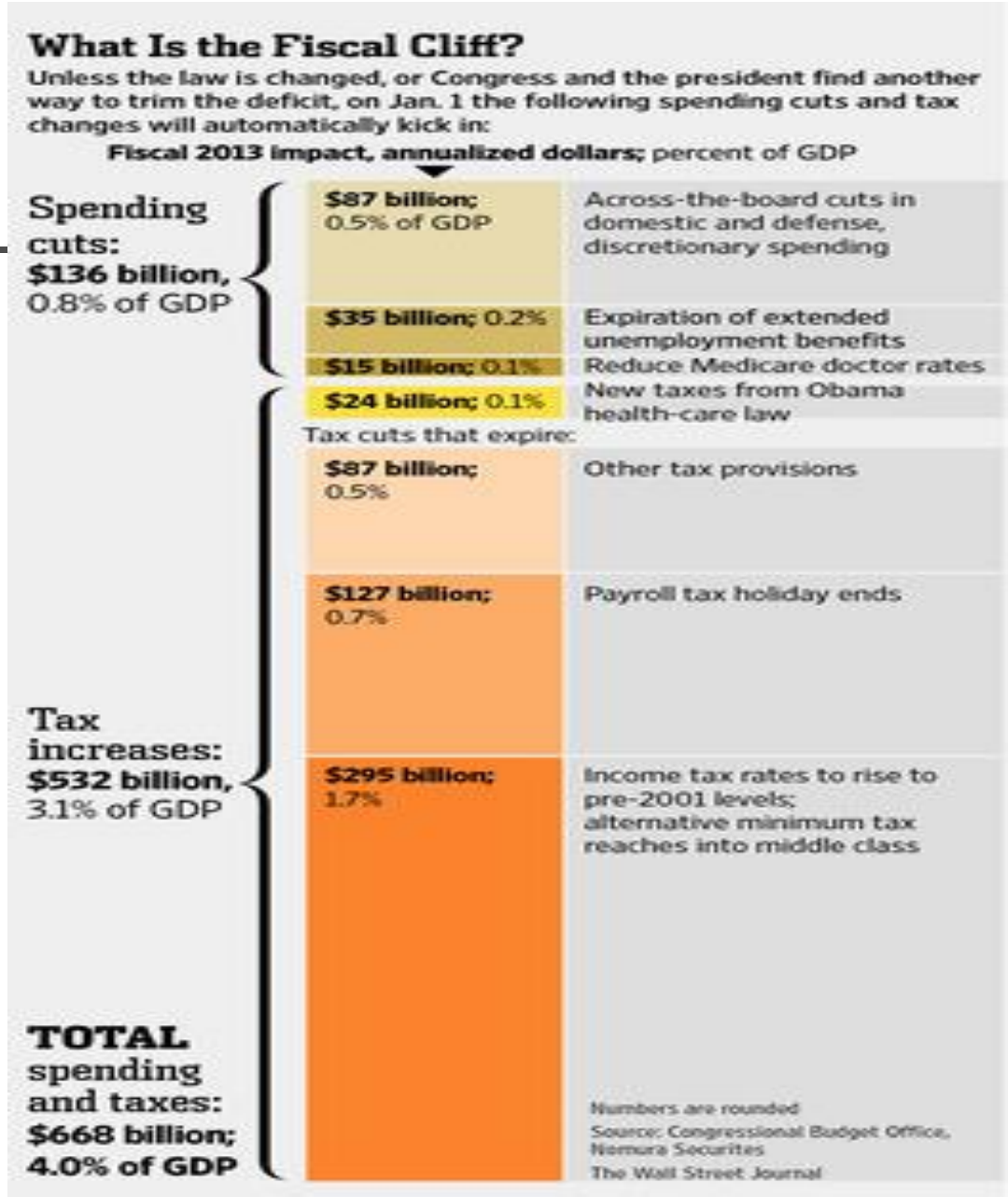


Results of US Election

- Obama-President
- Congress
  - Senate – Controlled by Democrats
  - House of Representatives – Controlled by Republicans
- No Change
- Compromise Difficult

The External Environment of Trade Between USA and Asia

- USA Fiscal Problems
  - Fiscal Cliff
  - Budget Deficits
  - National Debt
  - Obamacare
  - Unemployment
- Forecasts for the Future
- Impact on Trade


What Is the Fiscal Cliff?
Unless the law is changed, or Congress and the president find another way to trim the deficit, on Jan. 1 the following spending cuts and tax changes will automatically kick in:
Fiscal 2013 impact, annualized dollars; percent of GDP
Spending cuts: $136 billion, 0.8% of GDP
$87 billion; 0.5% of GDP
Across-the-board cuts in domestic and defense, discretionary spending
$35 billion; 0.2%
Expiration of extended unemployment benefits
$15 billion; 0.1%
Reduce Medicare doctor rates
$24 billion; 0.1%
New taxes from Obama health-care law
Tax cuts that expire:
$87 billion; 0.5%
Other tax provisions
$127 billion; 0.7%
Payroll tax holiday ends
Tax increases: $532 billion, 3.1% of GDP
$295 billion; 1.7%
Income tax rates to rise to pre-2001 levels; alternative minimum tax reaches into middle class
TOTAL spending and taxes: $668 billion; 4.0% of GDP
Numbers are rounded
Source: Congressional Budget Office, Nomura Securities
The Wall Street Journal

The Obama Fisc

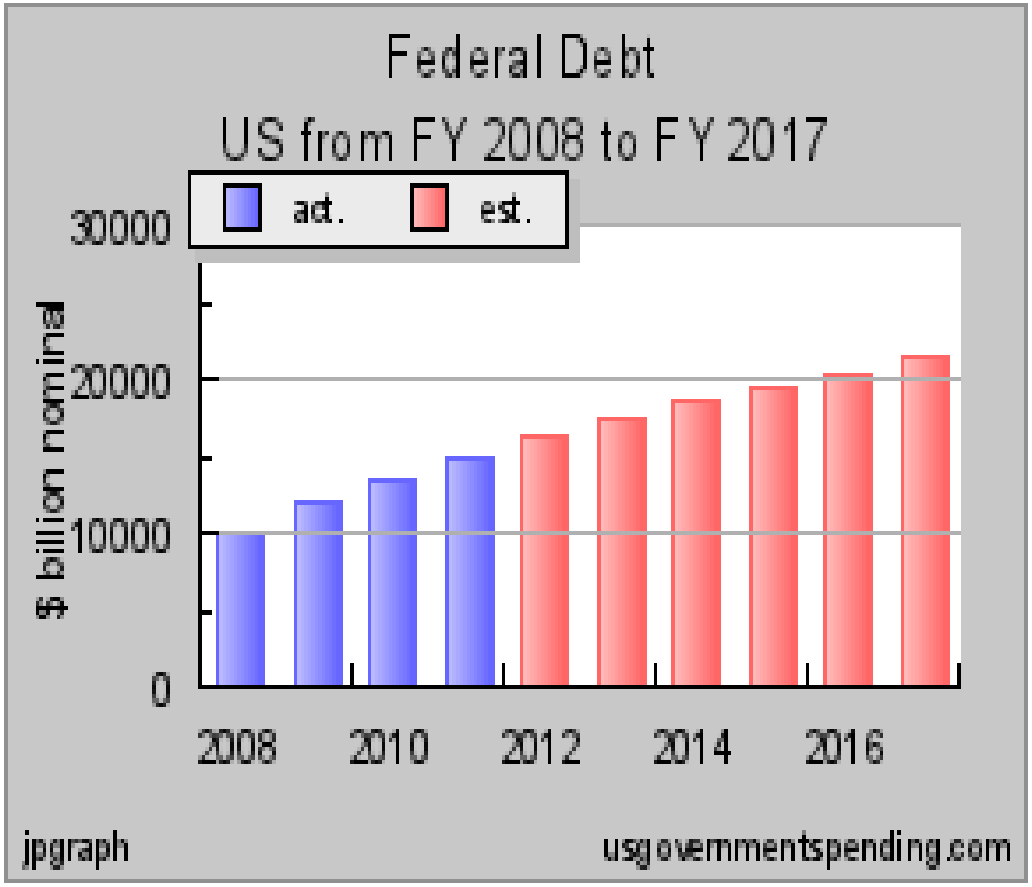
Total federal revenue, outlays and deficits, fiscal years 2007-2012, in billions of dollars

	2007	2008	2009	2010	2011	2012
Receipts	$2,568	2,524	2,105	2,163	2,302	2,449
Outlays	$2,729	2,983	3,518	3,456	3,599	3,538
Deficit	-$161	-459	-1,413	-1,293	-1,297	-1,089
% of GDP	-1.2%	-3.2	-10.1	-9.0	-8.7	-7.0

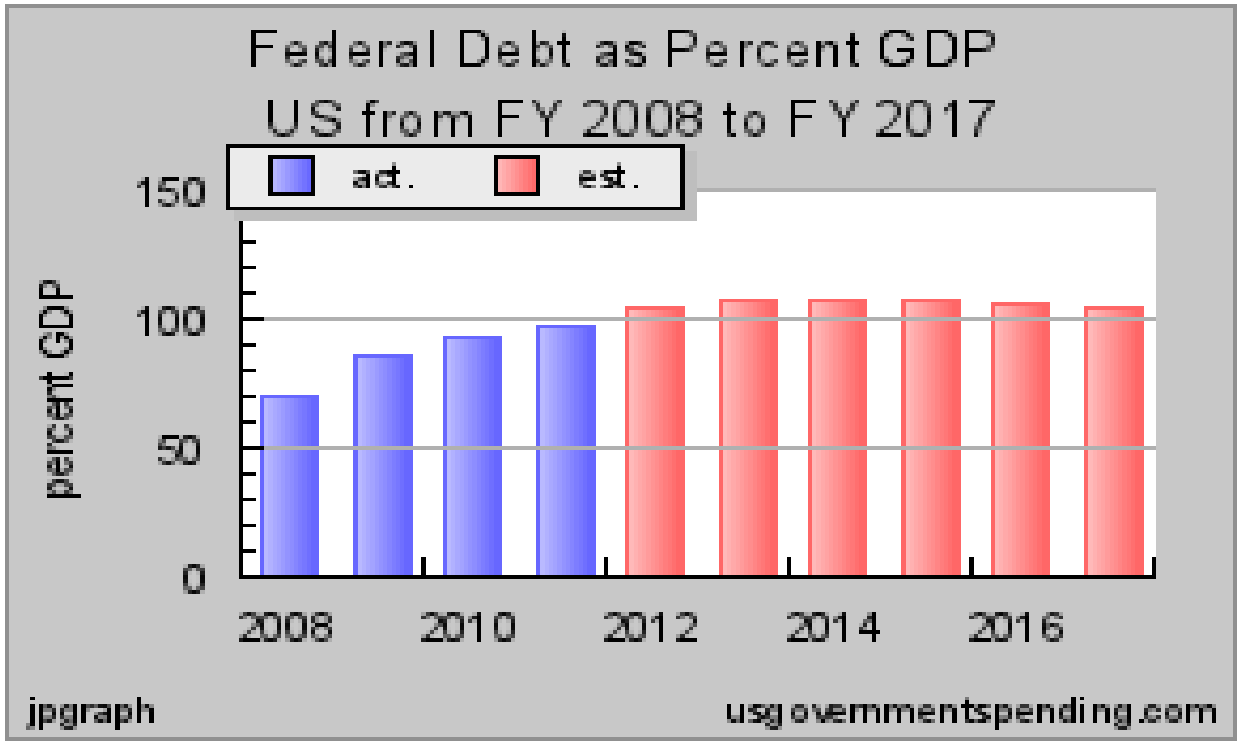
Sources: Department of the Treasury, Office of Management and Budget, Congressional Budget Office

National Debt

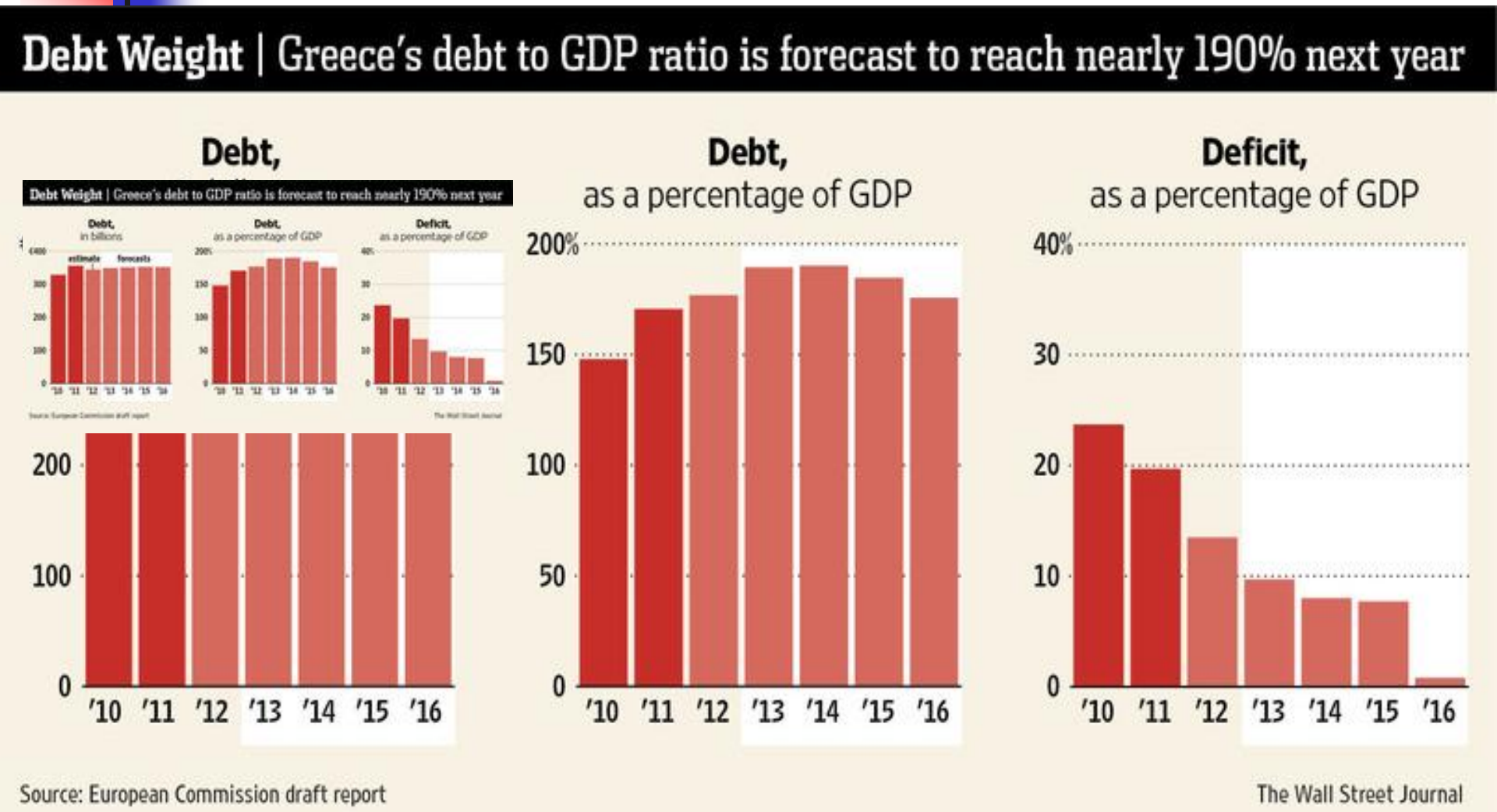
($16.3 Trillion)



National Debt as a % of GDP
(Over 100%)



How does this compare to Greece?
Greece budget deficit 6.6% of GDP



How does this compare to Greece?

- Greece Deficit as % of GDP – 6.6%
- US Deficit as % of GDP -7%
- Greek National Debt much higher, but US catching up

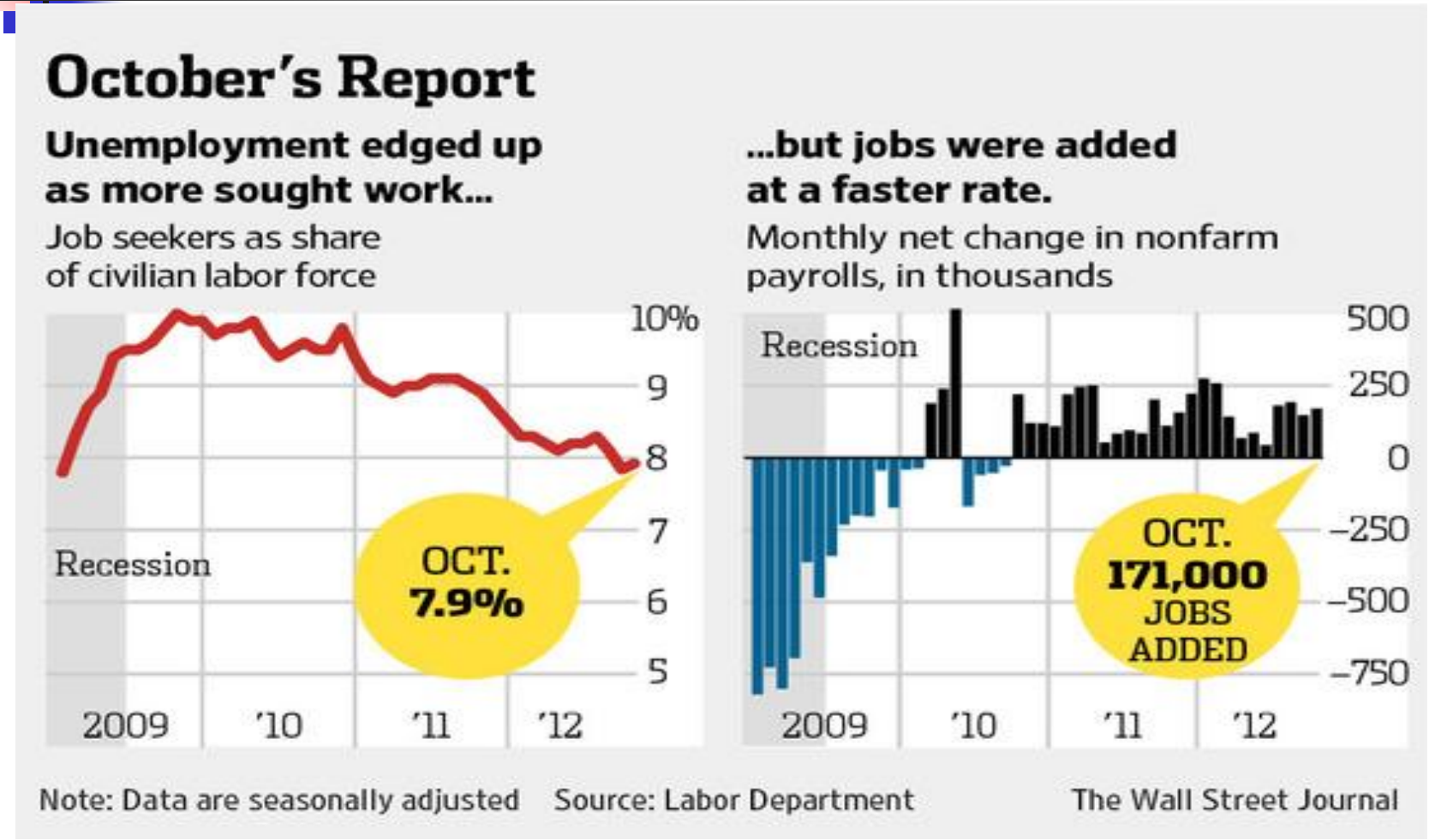
Obamacare

- Adds Many Taxes on Economy
  - New taxes on drug companies ($27 billion) and medical device makers ($20 billion)
  - 3.8 percent Medicare tax imposed on unearned or investment income (effective 2013)
  - 2018, new 40 percent federal excise tax on "Cadillac" health plans (defined as $10,220 for individual coverage and $27,500 for family coverage)
  - Increases the Medicare Hospital Insurance (HI) portion of the payroll tax

The List of the Obamacare Taxes

Description of Tax	Year Effective	Revenue Raised (2010–2019)
Increase Hospital Insurance (HI) portion of the payroll tax from 2.9 percent to 3.8 percent for couples earning more than $250,000 a year ($200,000 for single filers).	2013	$210 billion
Apply the 3.8 percent HI tax to investment income for couples earning more than $250,000 a year ($200,000 for single filers) for the first time.	2013	*
Mandate for individuals to buy health insurance and employers to offer it to their workers.	2014	$65 billion
Annual fee on health insurance providers based on each individual company's share of the total market.	2014	$60 billion
40 percent excise tax on "Cadillac" health insurance for plans costing more than $10,200 for individuals and $27,500 for families.	2018	$32 billion
Impose an annual fee on manufacturers and importers of branded drugs based on each individual company's share of the total market.	2011	$27 billion
Exclusion of unprocessed fuels from the existing cellulosic biofuel producer credit.	2010	$24 billion
2.3 percent excise tax on manufacturers and importers of certain medical devices.	2013	$20 billion
Higher corporate taxes through stricter enforcement by requiring them to report more information on their business activities.	2012	$17 billion
Raise the 7.5 percent AGI floor on medical expenses deduction to 10 percent.	2013	$15 billion
Limit the amount taxpayers can deposit in flexible spending accounts (FSAs) to $2,500 a year.	2014	$13 billion
Reduce the number of medical products taxpayers can purchase using funds they put aside in health savings accounts (HSAs) and FSAs.	2011	$5 billion
Eliminate the corporate deduction for prescription expenses for retirees.	2013	$4.5 billion
Increase corporate taxes by making it more difficult for businesses to engage in business activities that reduce their tax liability.	2010	$4.5 billion
10 percent excise tax on indoor tanning services.	2010	$2.7 billion
Increased penalty for purchasing disallowed products with HSAs to 20 percent.	2011	$1.4 billion
Increase taxes on health insurance companies by limiting the amount of compensation paid to certain employees they can deduct from their taxes.	2013	$0.6 billion
Repeal special deduction for Blue Cross/Blue Shield organizations.	2010	$0.4 billion
TOTAL REVENUE RAISED		**$503 billion**

Unemployment Rate



Still a Mixed Bag | The U.S. job market

Overall, jobs are being added, but many Americans haven't worked for a long time or are underemployed.

Jobs

Change in total jobs since January 2009

*Excludes Census jobs

Labor-force participation rate

Americans who have a job or are looking for work

The long-term unemployed

As a percentage of the total unemployed

Americans who work part-time but want full-time work

In nonagricultural industries, in millions

Weekly earnings

Change from year earlier in weekly earnings*

*For production and nonsupervisory workers

Note: Data are seasonally adjusted

Source: Labor Department

The Wall Street Journal

The External Environment of Trade Between USA and Asia

- USA Fiscal Problems
  - Fiscal Cliff
  - Budget Deficits
  - National Debt
  - Obamacare
  - Unemployment
- Forecasts for the Future
- Impact on Trade

Forecasts For the Future

- Optimistic View
  - Fiscal Cliff – Either find long term solution or put off for 6 mos. To 1 year
  - Housing beginning rebound
  - Oil and Natural Gas Production Increases
    - US becomes net exporter
- US Continues Slow Growth Around 2% per year

Forecasts For the Future

- Pessimistic View
  - US goes over Fiscal Cliff
  - Obamacare Taxes Impact Economy
  - Interest on National Debt Claims Increasing Portion of Government Revenues
- US Heads for another Deep Recession

The External Environment of Trade Between USA and Asia

- USA Fiscal Problems
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  - Budget Deficits
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Impact on USA –Asia Trade

- Optimistic View
  - Panama Canal Expansion Leads to Lower Costs of Transportation between Asia and USA
  - Panamax Ready Ports become Transshipment Points to Serve Smaller Ports on East Coast
  - US Congress Repeals Harbor Maintenance Tax

Impact on USA –Asia Trade

- Optimistic View
  - US Continues Slow Growth of 2% per year
- USA-Asia Trade Continues to Grow
- US-Korea FTA Results in Increased Trade
- Standard of Living Continues to Increase in Asia and USA

Impact on USA –Asia Trade

- Pessimistic View
  - Ports on East Coast Not Ready in Time for Post-Panamax Vessels
  - US Congress Imposes Tax on Containers Entering US from Canada
    - Begins Trade War between US and Canada
    - Asian Nations File Complaint at WTO
  - US Heads for Deep Recession
    - Results in Increased Protectionism
    - Trade Between USA and Asia Contracts

Impact on USA –Asia Trade

- Impact is Probably in between two views
- Much Depends on US Government Policy
- The External Environment of Trade Between the USA and Asia is dependent on many factors: Technology, Logistics, Politics and Economy

China Container Rail-waterway Intermodal Transport Technology Research and Demoproject

Yanjie Deng

China Waterborne Transport Research Institute

2012-11-27

Introduction

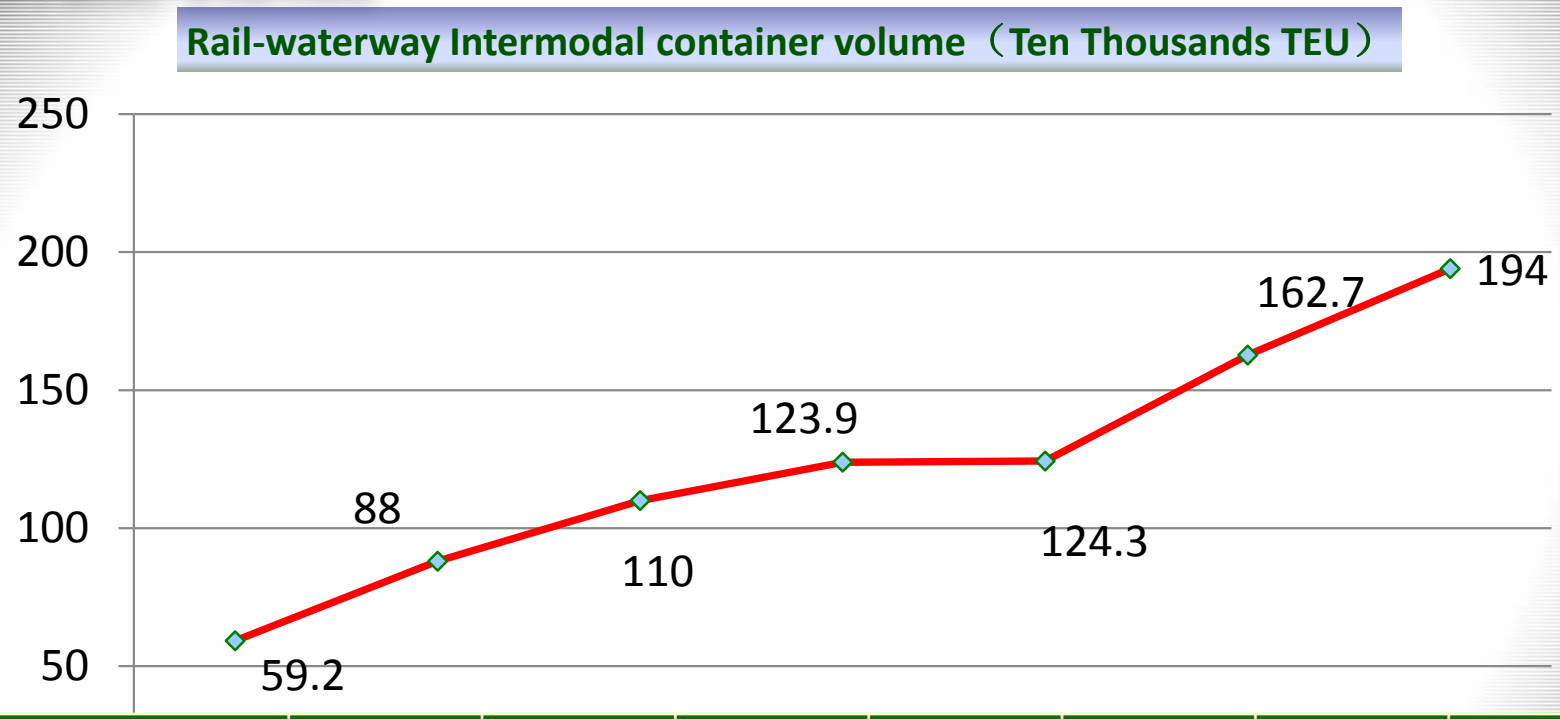
1. **The current status of Rail-waterway Intermodal container transport in China**

2. **Technology Research and Application of Rail-waterway Intermodal container transport system in China**

The current status

Since the beginning of 1990s，the container transport in China has witnessed a great development. The container throughputs in Chinese ports achieve substantial growth every year with a annual speed of 25%. The container throughput of China reached 163 million TEU in 2011 and ranks No.1 of the world since 2003.

The current status



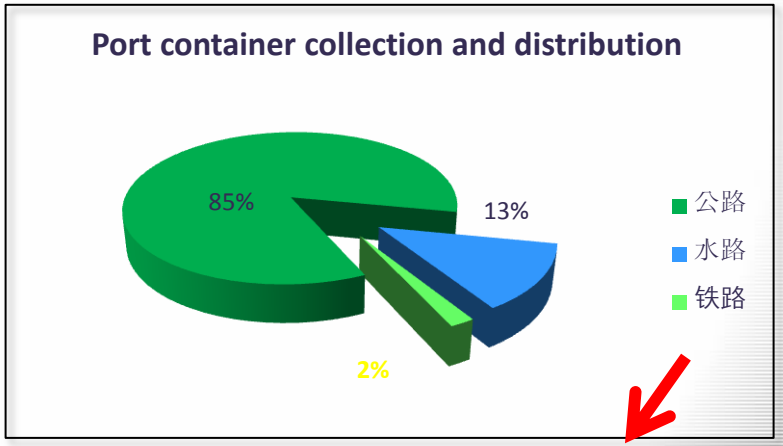
Container Throughput (million)	2005	2006	2007	2008	2009	2010	2011
All ports	75.6	93.6	112	128	122	146	163
Rail	2.77	3.16	3.60	3.20	3.35	4.26	4.88
Rail-waterway	0.59	0.88	1.10	1.24	1.24	1.63	1.94

The current status

Account for 20% of total container throughput in China

Unbalance!

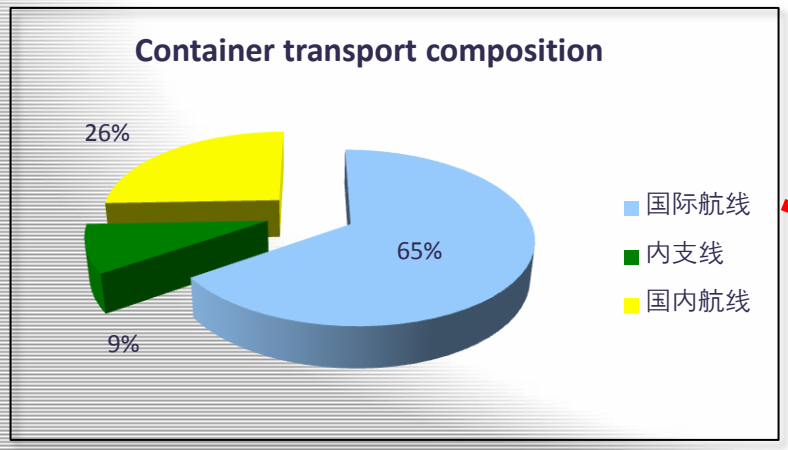
Account for 80% of total container throughput in China



Road account for 85%

Waterway account for 13%

Rail only account for 2%



International lane 65%

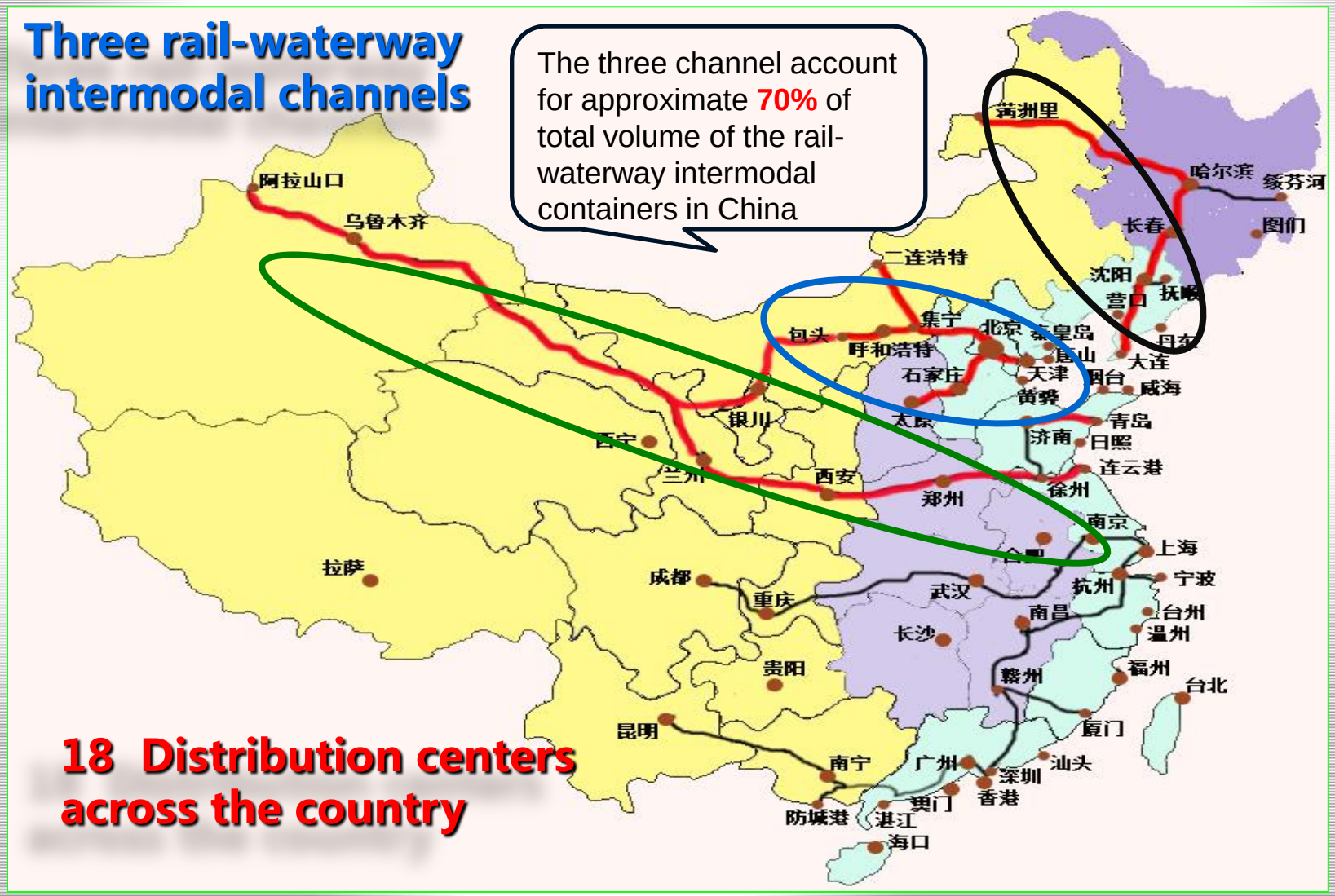
Insider feeder lane 9%

Domestic lane 26%

The current status of RWICTS

Three rail-waterway intermodal channels

The three channel account for approximate **70%** of total volume of the rail-waterway intermodal containers in China



18 Distribution centers across the country

Main problem

- The transport volume of RWICTS is still very small and only accounts for a very low percentage in all modes of transportation via port

- The capacity of RWICTS is still limited, the connection between modes is not smooth、the operation is unstable、empty container allocation is underdeveloped;

- The administration is rigid, information communication is poor and the service level still need to be largely promoted;

The Chances and the Challenge…

- Development of the West Regions 、 Industry Transfer
- The construction of rail facilities has been accelerated and the transport capacity has been improved a lot
- Development of comprehensive transport system, seamless intermodal transport system
- The traffic congestion and environmental pressure in coastal cities

Developing Trend

According to forecasting, the container throughput in Chinese ports will reach 200 and 280 million TEU until 2015 and 2020 respectively.

The rail-waterway intermodal will account for 5 and 14 million TEU in total , a modest but nevertheless significant quantity. Optimistic estimate, it will be more than 10 and 24 million TEU respectively.

交通运输部
铁道部

交水发〔2011〕527号

关于开展集装箱铁水联运示范项目的通知

各省、自治区、直辖市交通运输厅(委)，各铁路局，天津、上海市交通运输和港口管理局，主要港口所在地港口行政管理部门，各大型港口、航运集团公司，中铁集装箱运输公司、中铁联集公司：

为贯彻落实交通运输部、铁道部签署的《关于共同推进铁水联运发展合作协议》，两部决定开展集装箱铁水联运示范项目。现将有关事项通知如下：

·1·

交通运输部办公厅

厅函规划〔2012〕91号

交通运输部办公厅关于开展集装箱海铁联运物联网应用示范工程建设的通知

辽宁省、山东省、江苏省、浙江省、广东省交通运输厅，天津市交通运输和港口管理局：

根据《国家发展改革委办公厅、财政部办公厅关于同意在海铁联运等七个领域开展国家物联网重大应用示范工程的复函》(发改办高技〔2012〕2101号)，按照《公路水路交通运输信息化"十二五"发展规划》，我部将组织开展集装箱海铁联运物联网应用示范工程建设，现将有关事项通知如下：

一、国家集装箱海铁联运物联网应用示范工程的建设，对于提高集装箱物流信息服务效率、降低物流成本、加快综合交通运输体系与现代物流发展具有重要意义。各单位要按照国家发展改革委和财政部的复函要求，在大连港、天津港、青岛港、连云港港、宁波港和深圳港积极组织开展示范工程建设。

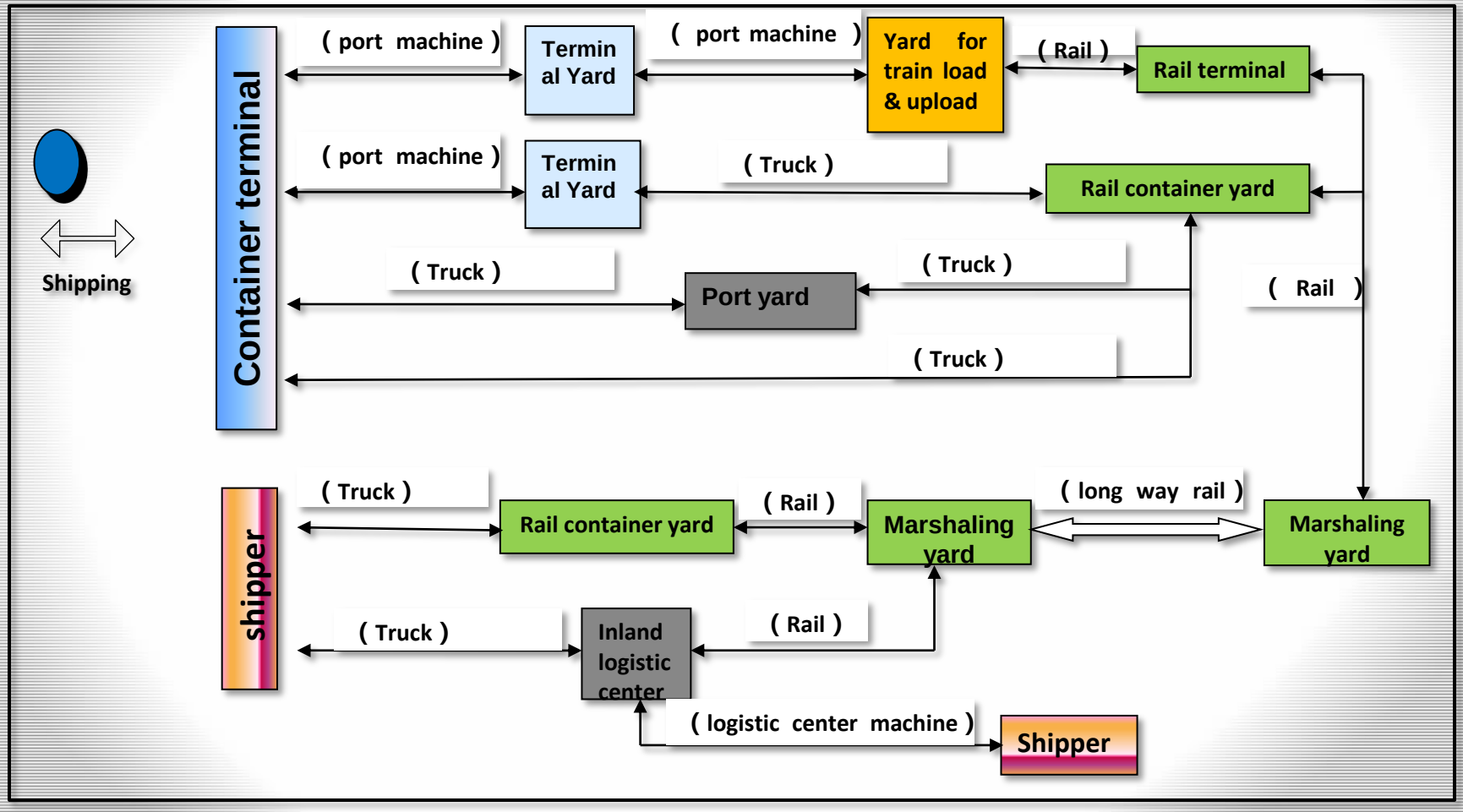
二、我部将按照国家发展改革委和财政部的复函要求，会同铁道部组织编制并报送集装箱海铁联运物联网应用示范工程资金申请报告，争取国家资金支持。

Introduction

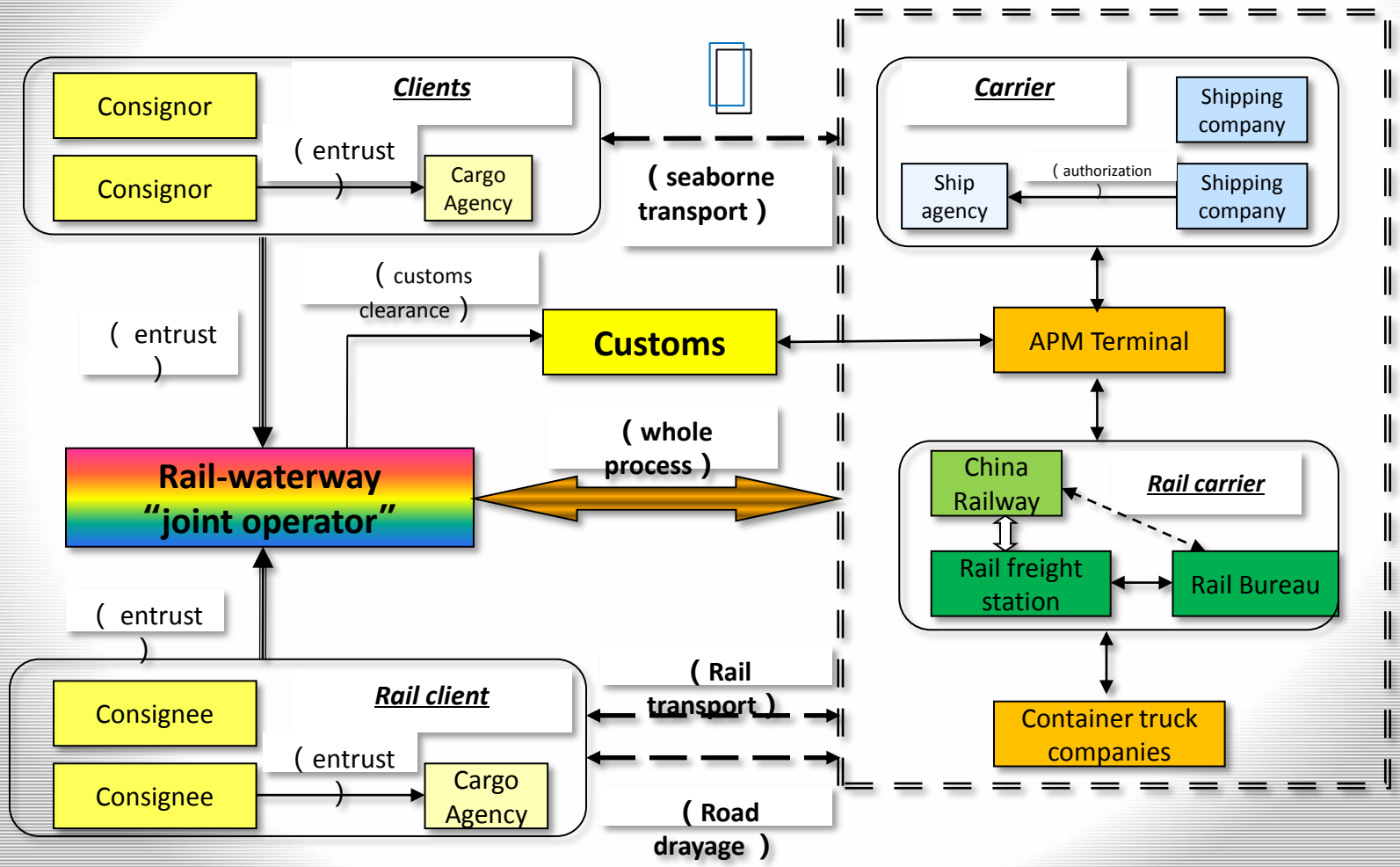
1. The current status of Rail-waterway Intermodal container transport in China

2. Technology Research and Application of Rail-waterway Intermodal container transport system in China

Basic step for RWICTS



A business process for RWICTS



Six demo ports

Main tasks in RWITS application

1、Build perceptual system in internet of things

2、Explore new pattern in information coordination

3、Strengthen the creation of the new mechanism

4、Establish the standard system

总体架构

Intelligent Applications

Robust Connection

Total Information Awareness

智能应用

可靠传递

全面感知

Owner | Government | Agent | The third party logistics | Production enterprise | Financial enterprise

货主 | 政府单位 | 货代、船代 | 第三方物流 | 生产企业 | 金融企业

多式联运中心门户系统
海铁联运业务协同管理系统
物流跟踪信息服务系统
物流增值服务系统
水路多式联运业务系统

铁路多式联运基础业务系统
铁路多式联运增值服务系统
铁路多式联运业务系统

Waterway business system of multimodal transport

Railway business system of multimodal transport

"1+6"数据交换平台

口岸单位

铁道部

大连

深圳

天津

宁波

青岛

连云港

物流、金融

Waterway information

RFID information

Railway information

水路信息

船期信息
仓单信息
计划信息
堆场信息
通关信息
其他

RFID信息

船位置
车位置
货位置

铁路信息

车次计划
货票信息
运量信息
装卸信息
调度信息
其他

港口EDI系统（船期、仓单等）
码头操作系统（装卸、堆场管理等）
物流企业系统（物流管理、理货、货代等）
水路

RFID信息采集系统
电子标签(RFID)

铁道部基础业务系统（调度、货票、跟踪等）
集装箱场站业务系统（中心站、口岸站）
铁路

Waterway

RFID

Railway

物联网基础支撑

标准规范体系

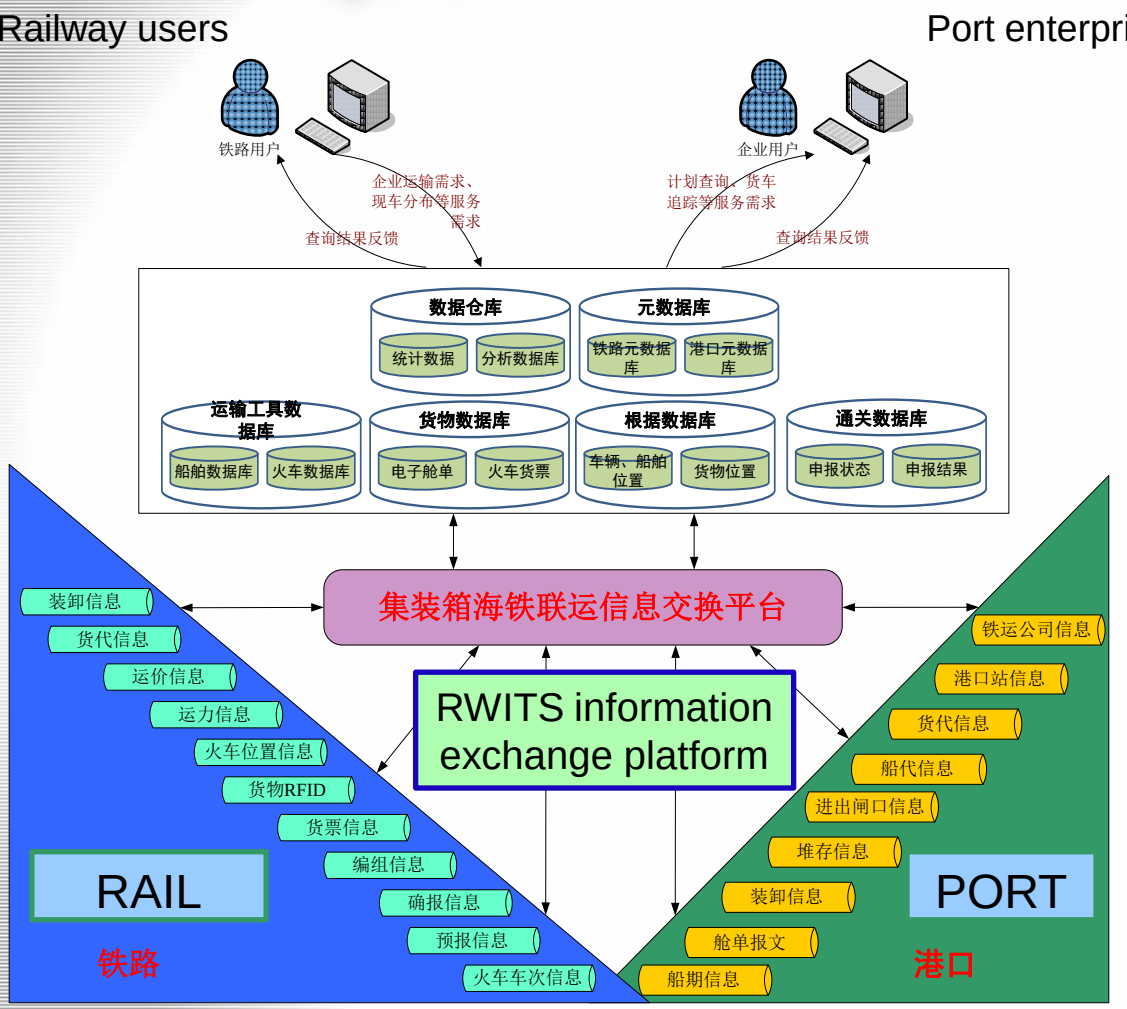
基础支撑体系

Internet of Things Support

Standard System

Basic Support system

Information System



The database structure of rail-waterway intermodal transport system

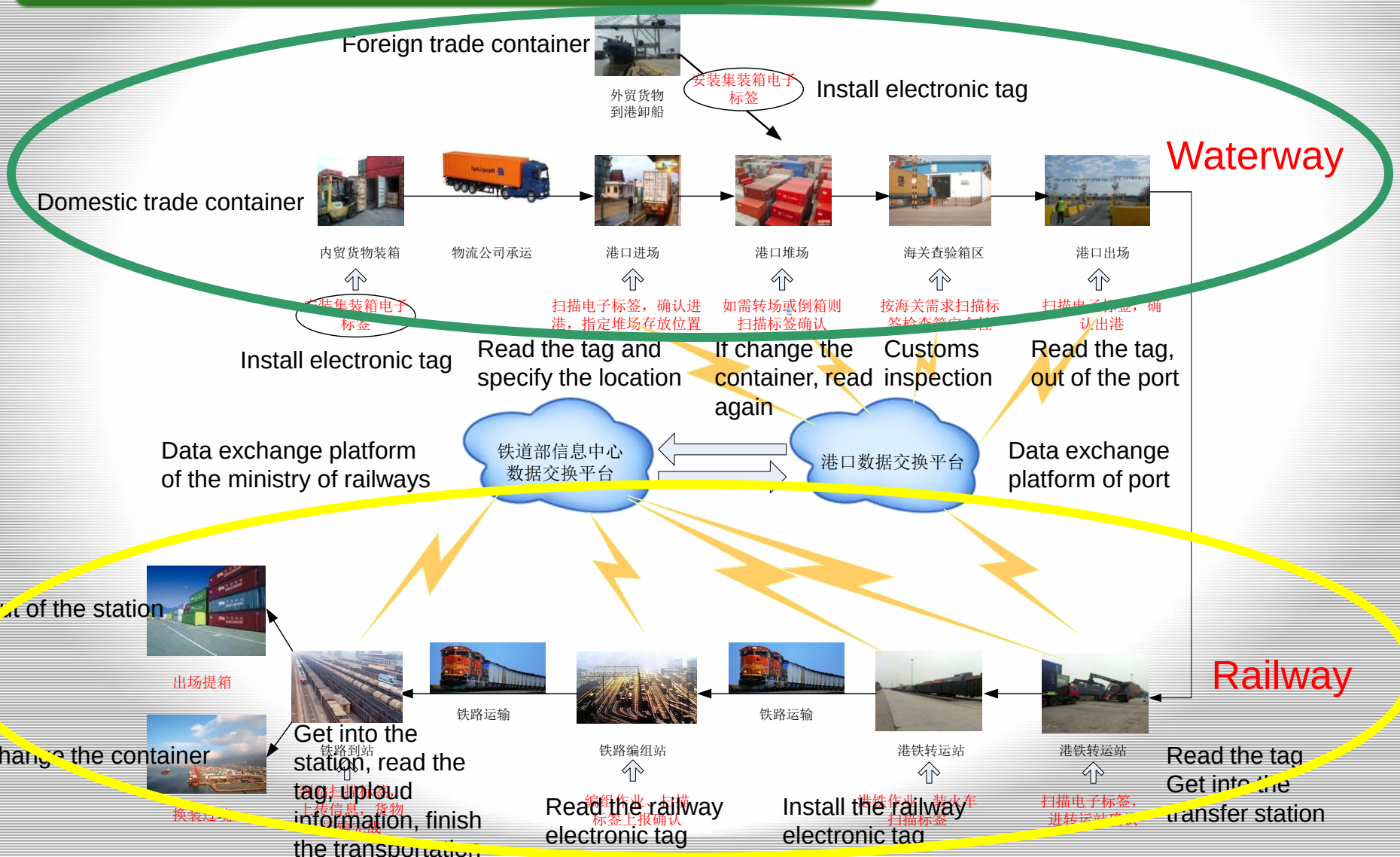
1. Build perceptual system in internet of things

◆ Build perceptual system in internet of things based on RFID, reader, and wireless to monitor and collect the real-time information of container flows in port, realize the intelligent management on the key links like load, container exchange and so on;

◆ Connect perceptual information between rail container information system and port container information system in the rail-waterway intermodal demo channels, to monitor the status of container in the process of transport.

技术研发及应用示范

1. Build perceptual system in internet of things



1. Build perceptual system in internet of things

Export business process（container from the railway to port）

1、RFID installation

2、Box No. and truck chassis No. binding

3、Rail-waterway intermodal container transport process tracking

4、Intermodal container identification in port

5、Intermodal container upload in port

6、Intermodal container lock into the container yard

1. Build perceptual system in internet of things

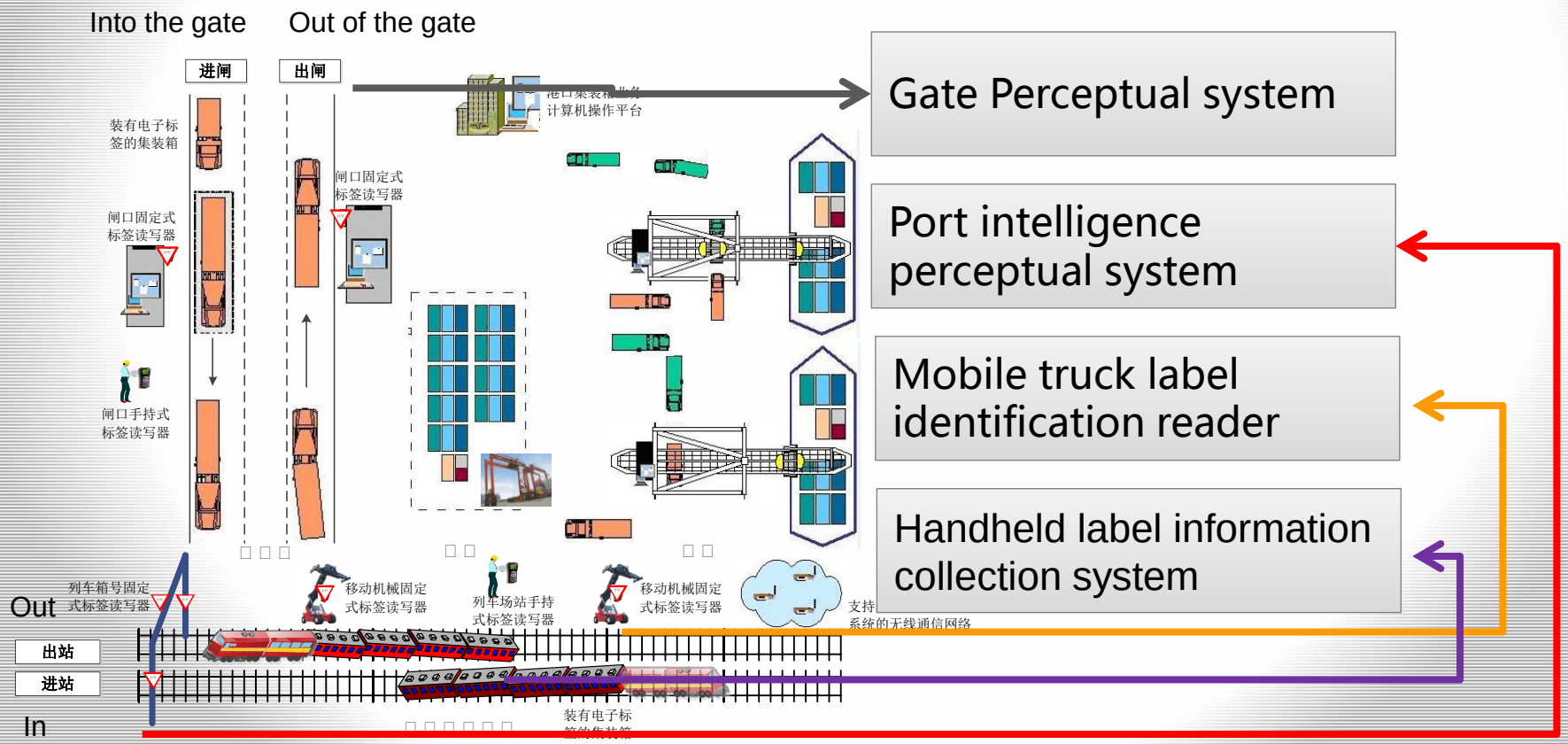
Import business process （container loaded in truck in the port）

Intermodal Container Loaded In truck in the Port

In the process of containers' movement from ship to truck, the No. of container and the No. in truck chassis is banding and recorded by a mobile machine. The information is transferred to the train business system immediately. Then the system generate a train composition files based on these information, the files are shared in the rail data exchange platform.

1. Build perceptual system in internet of things

System functions construction



2、 Explore new mode in information coordination
——Business application system construction

RWITS (Rail-Waterway Intermodal transport System) Business Coordination Platform

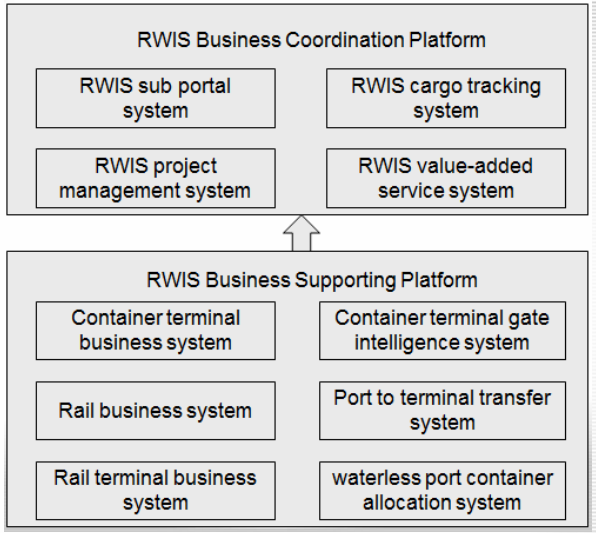
- RWIS sub portal system
- RWIS cargo tracking system
- RWIS project management system
- RWIS value-added service system

RWIS Business Supporting Platform

- Container terminal business system
- Container terminal gate intelligence system
- Rail business system
- Port to terminal transfer system
- Rail terminal business system
- waterless port container allocation system

2、 Explore new mode in information coordination
——Business application system construction

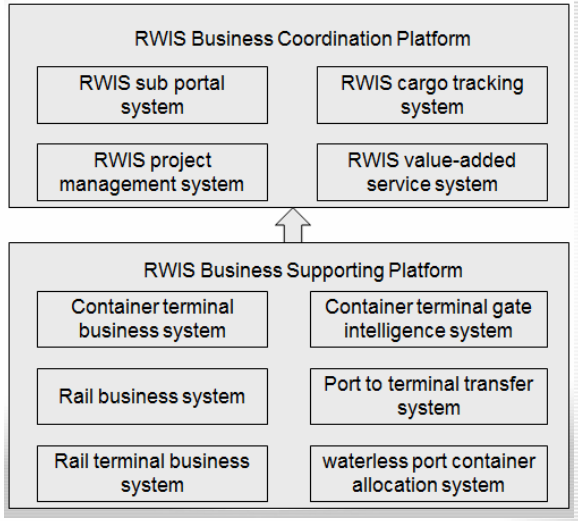
（1）RWITS sub portal system



- Only service windows for RWIS, provide information with regard to relevant policy, regulation, logistic price as well as information search service;
- The entrance to all the other platforms, realize function of “one window multiple application”.

2、 Explore new mode in information coordination
——Business application system construction

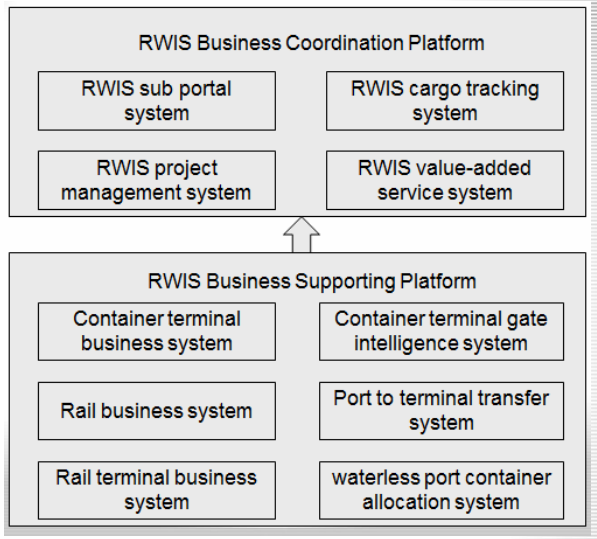
(2) RWITS cargo tracking system



- Provide cargo dynamic query for whole transport process;
- Connecting cargo information system in port, provide cargo status information in the whole process of transport.

2、 Explore new mode in information coordination
——Business application system construction

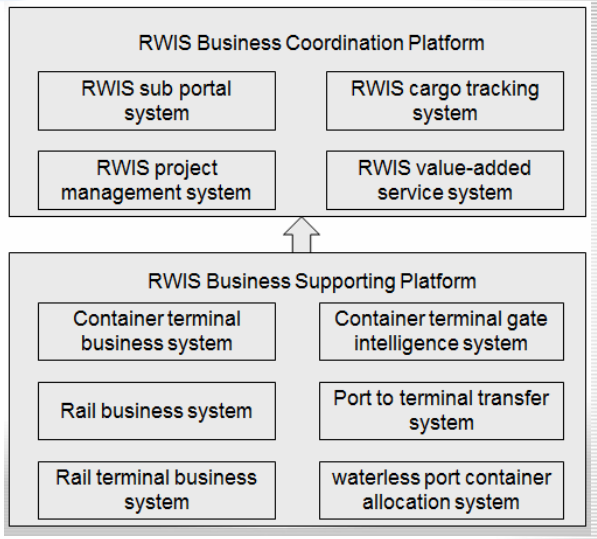
（3） RWITS project management system



- Realize information management in transport planning, paperless operation and information share for RWITS authority.

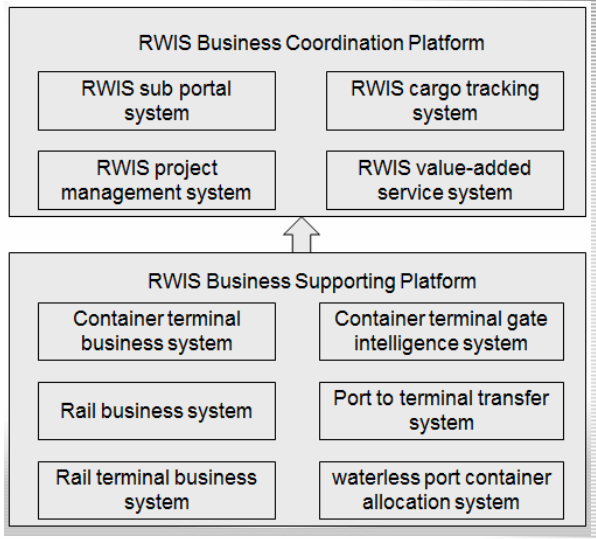
2、 Explore new mode in information coordination
——Business application system construction

（4）RWITS value-added service system



- Provide all kinds of port related value-added services, realize balance in transport capacity supply and demand , promote empty container allocation, provide financing service and so on.
- Based on open platform and data output of this system as well as valued-added service provider cultivating, develop multiple forms of value-added services.

2、 Explore new mode in information coordination
——Business application system construction

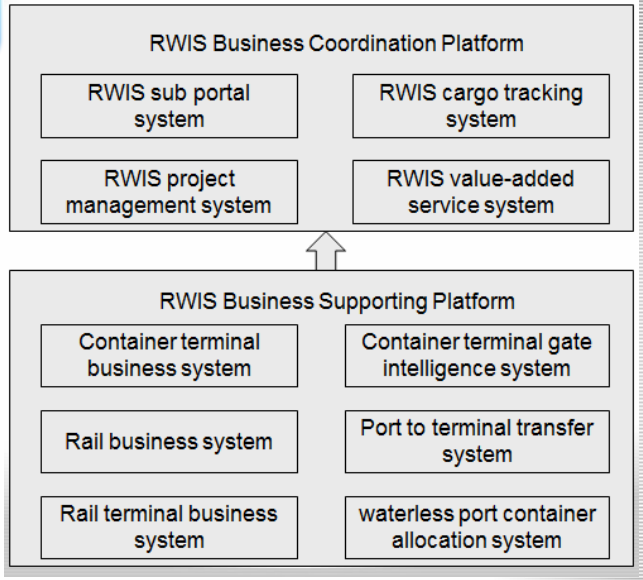


（5）Container terminal business system

- Realize container load and upload control, container identification, and container movement control in the port

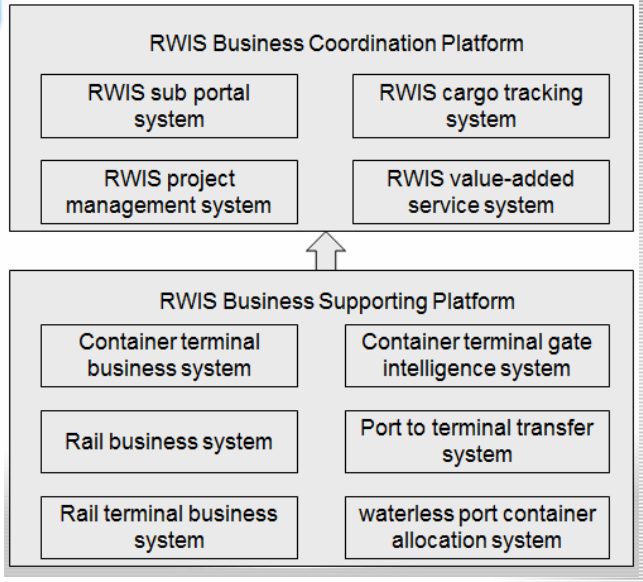
2、 Explore new mode in information coordination
——Business application system construction

(6) Rail business system



- Realize trains control, train marshaling, empty train allocation, loader allocation in the port and information management for transport plan declaration;
- Tracking trains

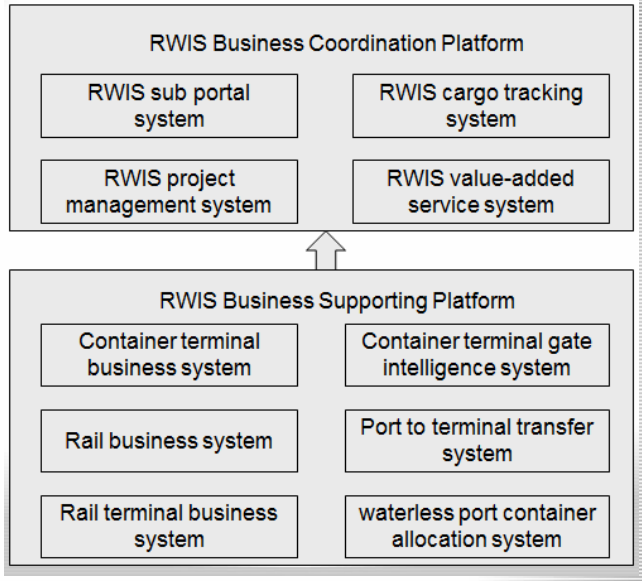
2、 Explore new mode in information coordination
——Business application system construction



（7）Port to Terminal Transfer System

- By utilizing technologies like EDI、RFID and so on，develop paperless operation for cargo terminal transfer，realize information share and operation coordination, build unified and efficiency terminal transfer operation coordination mechanism, real-time allocation and logistic tracking transport system

2、 Explore new mode in information coordination
——Business application system construction

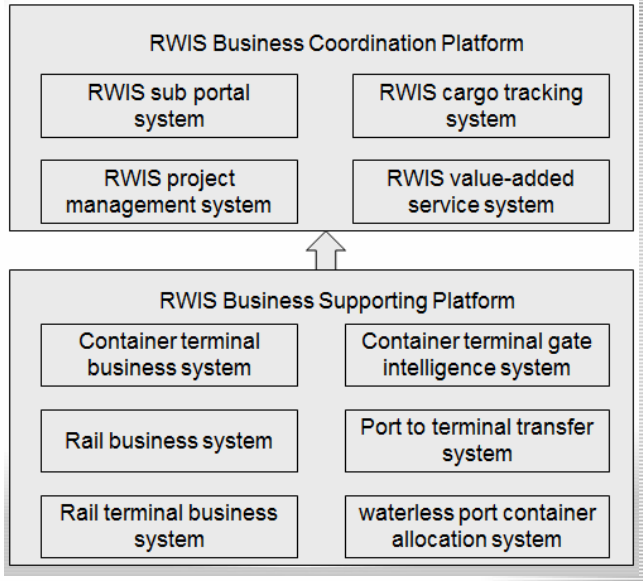


（8）Container Terminal Gate Intelligence System

- Through upgrading the container terminal gate facilities, realize intelligence management on crossing gate rail-waterway intermodal container

2、 Explore new mode in information coordination
——Business application system construction

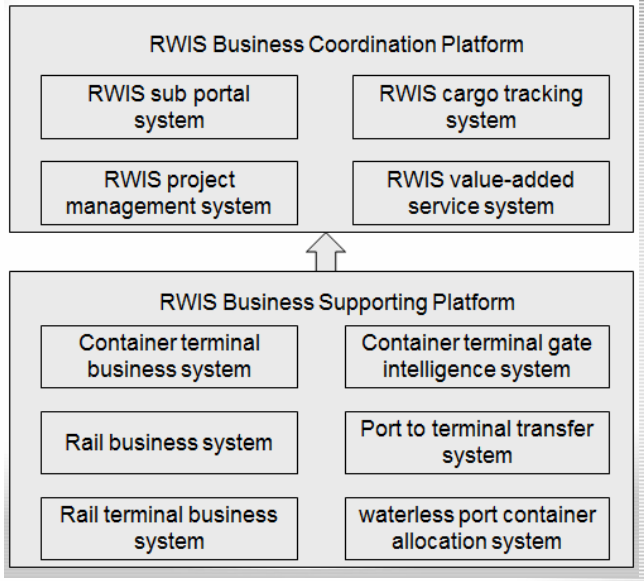
(9) Rail Terminal Business System



- Realize information management for container delivery plan collection, rail load/upload plan and rail freight invoice formulating.

2、 Explore new mode in information coordination
——Business application system construction

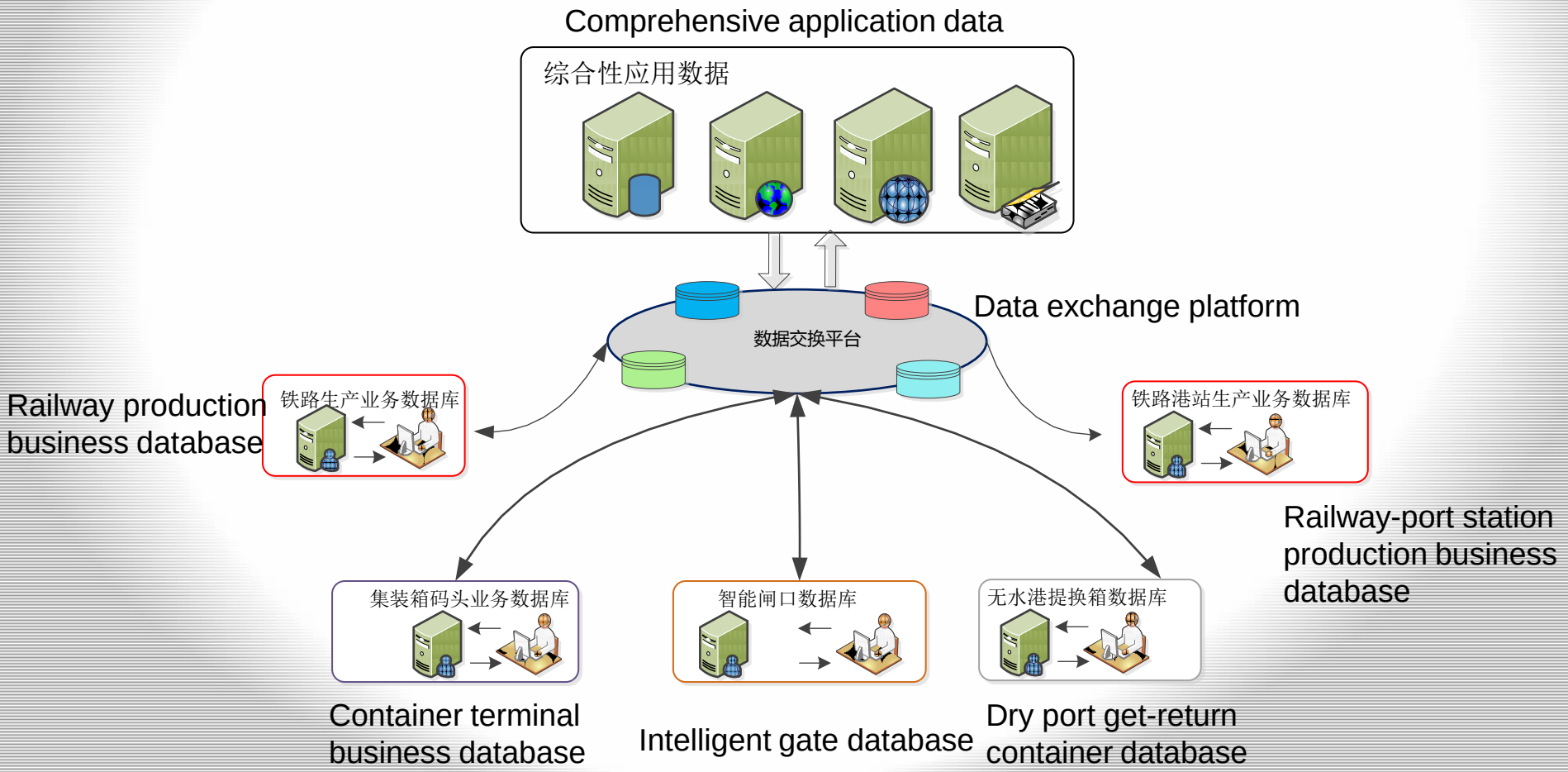
（10）Waterless Port Container Allocation System



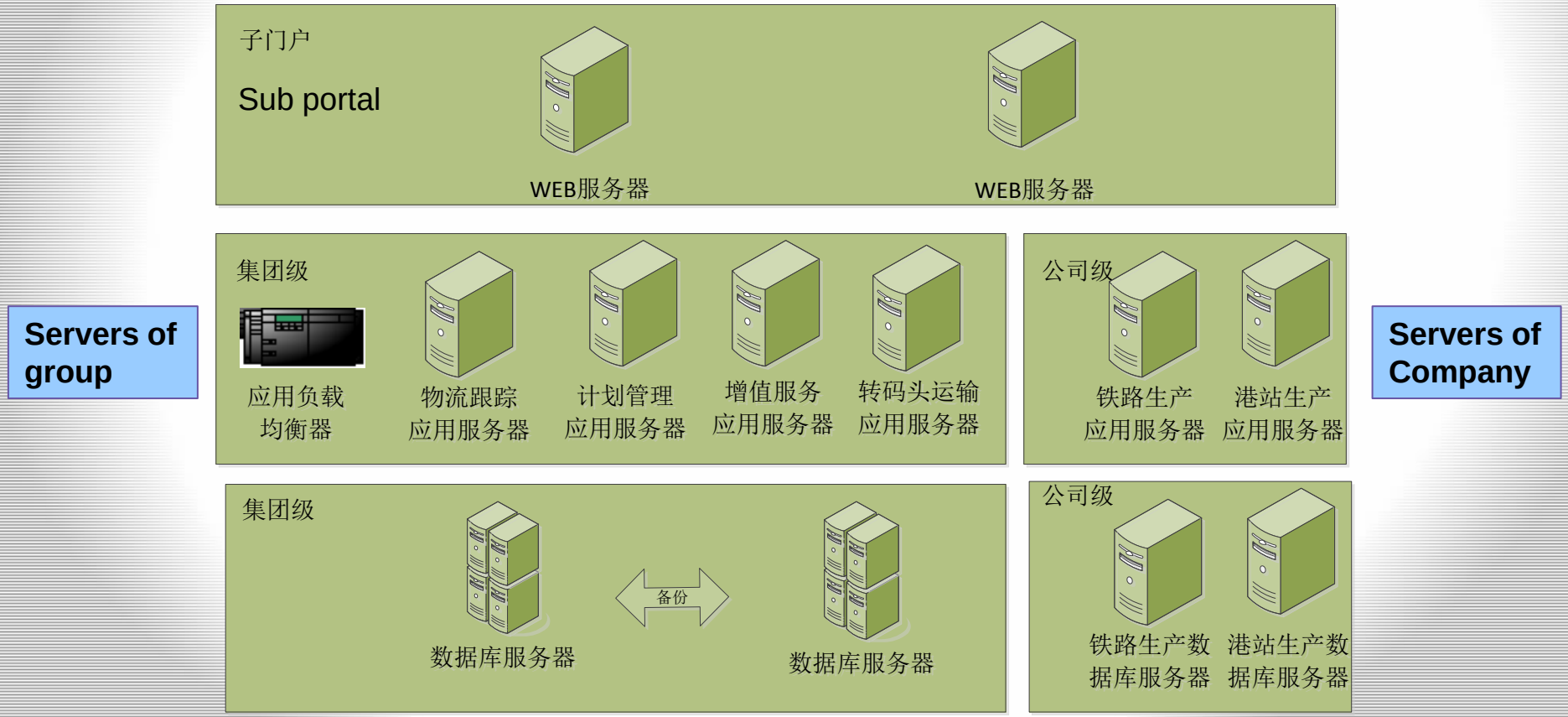
- Realize information inquiry for empty and heavy container in the yard; connecting with container control system of shipping companies, realize approval for picking up container application and cost accounting.

2、 Explore new mode in information coordination
——Data sources plan and database building plan

Database Building Plan



2、 Explore new mode in information coordination
——Host machine and storage system building plan



3、Strengthen creating new mechanism for RWITS

◆ Build information exchange standard and technology standard of RFID for RWITS;

◆Explore the Joint office mechanism among all the intermodal actors including rail, port, shipping companies, cargoes agency and so on. Gradually form a long-term cooperation mechanism for rail-waterway intermodal transport.

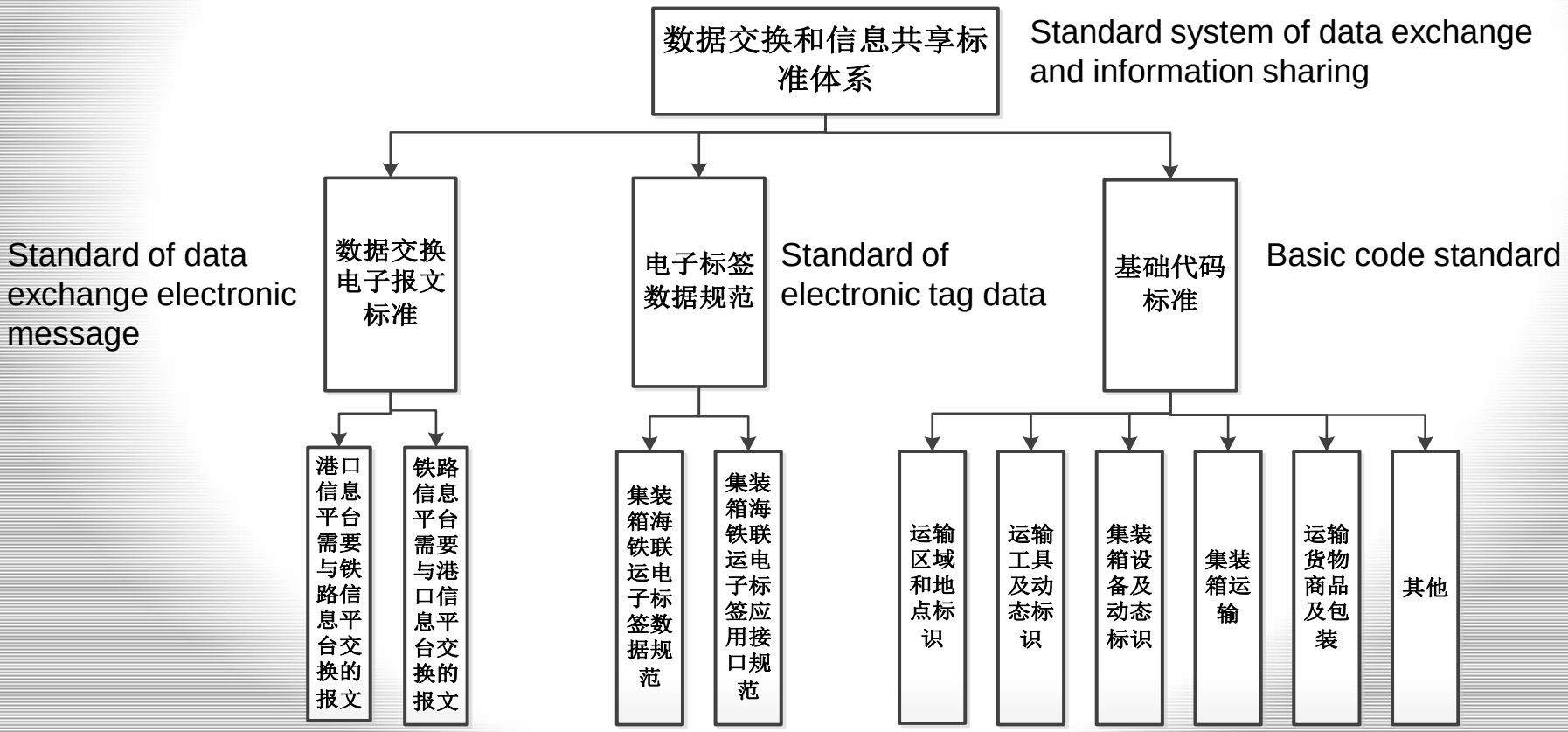
4. Establish of standard of internet of things

Objective

- Provide RWITS data share electronic message standard system
- For issued national or industry standards，provide improved message standard in term of requirement of RWIS （Draft）
- For those absent electronic message in RWIS information exchange, research on it and build the message standard (draft)
- Research and summarize the code set of data exchange and share in RWITS
- Set data exchange regulations in RWITS

4、Establish of standard of internet of things

Standard System Structure



What we did in promoting RWICTS

WTI

Past and now

We initiated the research in rail-waterway intermodal transport and completed a number of projects in this area. We conducted policy discussion for rail-waterway transport, provide support for many policies issued by MOT.

Responsible for organize relevant coordination in promoting rail-waterway intermodal transport in the six demo ports

Set information share standard for rail-waterway intermodal system

Develop Internet of Things technology for rail-waterway intermodal system

What we did in promoting RWICTS

WTI

Future

Conduct research on administration system and mechanism reform and process optimization

Conduct research in application of internet of thins and information share platform

Further expand rail-waterway intermodal transport

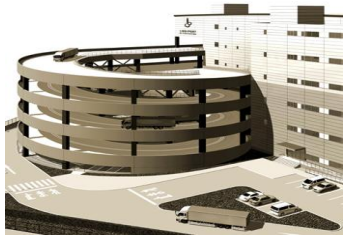
Prospect and cooperation

East North Asia

- It is hoped that more technology communication and cooperation between China and Korea ban be build in the future to promote the Rail-waterway intermodal transport together.

Thanks for your attention !

Yanjie Deng, E-mail: dengyj@wti.ac.cn
Director of Logistics Process Research Center, WTI



Development of the technology for multilevel transporting system

Deokpyeong Logistics Ltd.

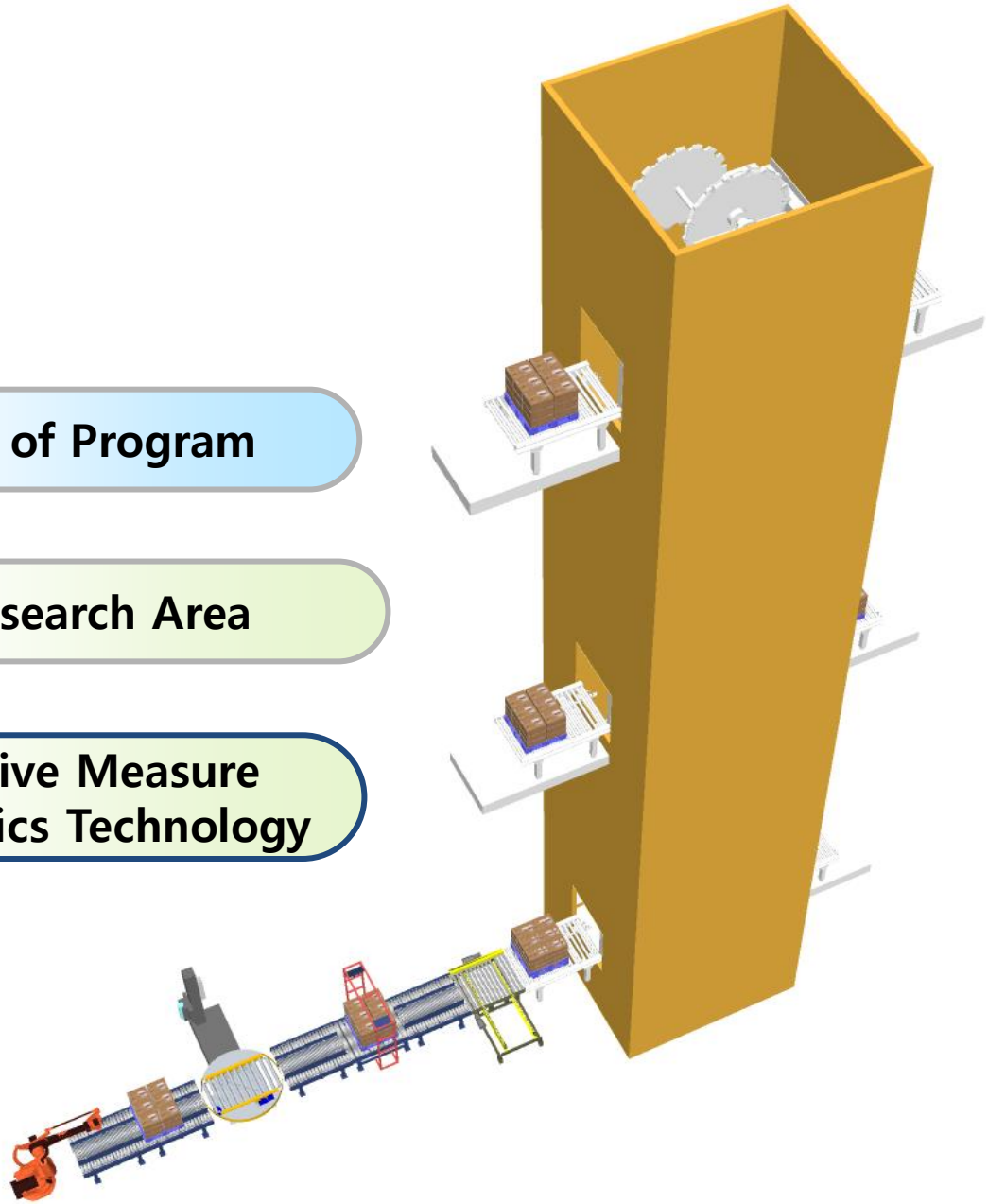
Logistics Facilities Institute

Director, Byung-Suk Son

Contents

Multilevel & Intelligent Mode Conveyor System

- Overview of Program
- Main Research Area
- Cooperative Measure for Logistics Technology



Multi-Level Cargo Transfer System

1 Overview of R&D Program

1. Overview of R&D Program

■ Research Background

- When it comes to logistics center, its form has transformed from a simple warehouse type to a cross-docking type, providing value added services.
- Multi-level type of logistics facilities have been constructed thanks to limited space like ports and industrial areas, high land value within cities, increasing labor costs, automation and modernization.

Source: Prologs, Japan

Source: Logistics Center in Beijing

* This research is now being conducted in 『Technology Development for Intelligent Logistics Center and Transfer System』 as technology R&D program led by Ministry of Land, Transport and Maritime Affairs' .

1. Overview of R&D Program

■ Necessity of Research

Cases of Construction

Mechanical Multi-level Logistics Center

Vertical Conveyor

Vertical Conveyor /Cargo Elevator

Self-propelled Multi-level Logistics Center

Lamp Way

Cargo Elevator

Considerations

- Installation of a large number of vertical conveyors and cargo elevators
- Working time for in-coming & out-going is different by each floor, and impossible simultaneous operation
- Increase in area of common use space on the 1st floor(double parking, space for operation,and etc.)

- Excessive costs for lamp way construction (850,000 KRW/㎡)
- Increase in area of common use space due to design of double parking by each floor
- Increase in safety accidents due to vehicles and in facilities of logistics center

Improvement

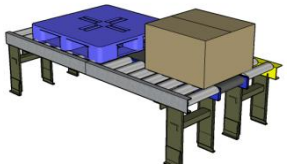
- Technology for vertical/horizontal transfer of cargo fast
- Technology for simultaneous operation on each floor

- Decrease in Increase in area of common use space (double parking, space for operation and etc.)
- Reduction in construction costs of lamp way
- Reduction in operation time for in-coming & out-going at each floor

1. Overview of R&D Program

Contents of R&D

- Horizontal Conveyor



• Simultaneous transfer of diverse types of containers (box and pallet)

- Vertical Conveyor

• Continuous operation of pallets cargo

• Simultaneous operation at each floor

- Total Checker

• Cargo's weight/volume
• Check of status on piling up

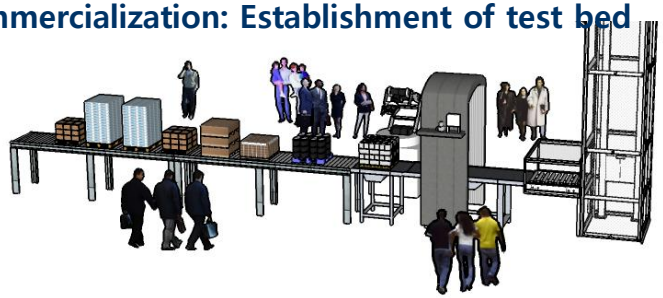
- Buffer

• Control of operation speed /Temporary piling up of cargo in error
• Variable structure

Change in Trend : Logistics center's manhattanization

R&D : Development of multi-level cargo transfer equipment and operating software

Commercialization: Establishment of test bed

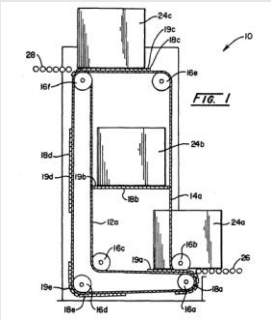
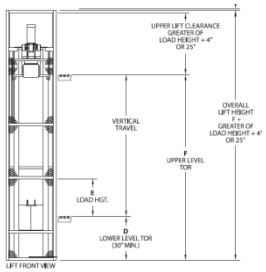
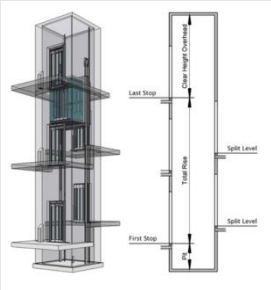


2 Research Contents

2. Research Contents

■ Usage Status and Survey on Relevant Technology

✔ Status of Usage of Vertical Conveyor

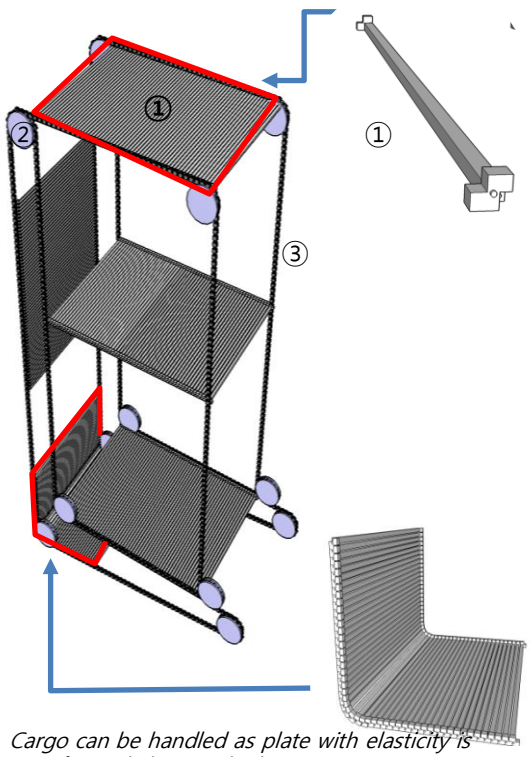
Rivals	Technologies and Methods	Usage Status	Characteristics
Vertical Conveyor		13 Companies Cargo: boxes (92%) Speed: 30-60 box/h	Cargo to be dealt with based on box Appropriate for operation of two floors Impossible for operation on third floor (additional installation) No flexibility in terms of operation directions
Lift Con		19 Companies Cargo: pallets (90%) Speed: 10~20 cases/h (68%)	Cargo to be dealt with based on pallet Logistics activities are performed by operators on certain floors (operators on other floors should wait) Limitation of automatic operation because manual operation should be done Need of equipment for in-coming & out-going of cargo
Cargo Elevator		135 Companies Cargo: boxes, pallets Speed: 7~10 cases/h (54%)	Simultaneous use for cargo on pallets, for personnel Logistics activities are performed by passengers inside elevators (operators on other floors should wait) Limitation of automatic operation because manual operation should be done Need of equipment for in-coming & out-going of cargo

Usage Status and Survey on Relevant Technology

Horizontal Conveyor-Related Technologies

VERTICAL CONVEYOR

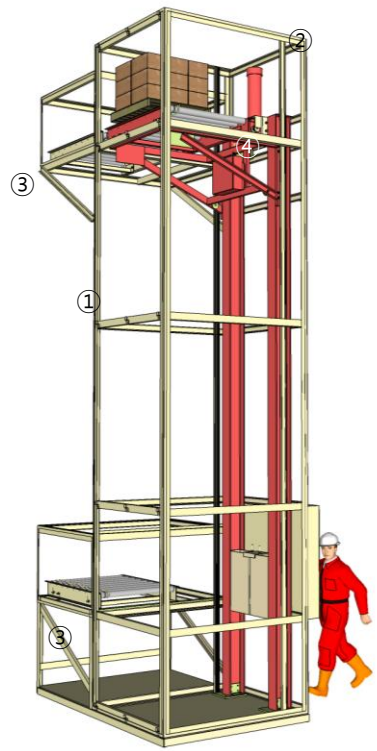
① Plate for Transfer
② Spoke
③ Belt (special rubber) / Chain (steel)



Cargo can be handled as plate with elasticity is transformed along with chains.

Lift Corn (what the industry is usually called)

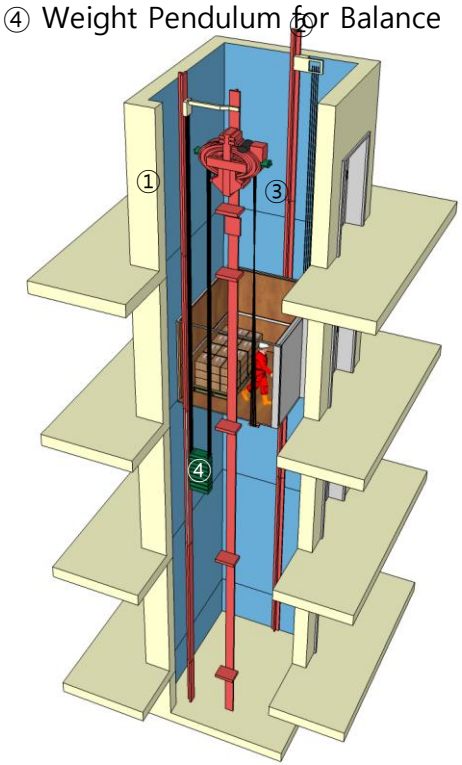
① Guide Beam
② Hydraulic System
③ In & Out Feeder
④ Plate for Transfer



It is a type of equipment in which device for in-coming & out-going of cargo is attached into crane based on hydraulic system.

Cargo Elevator

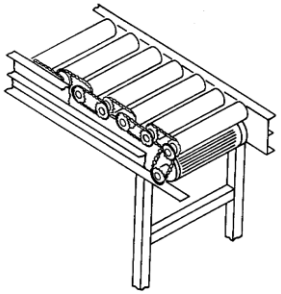
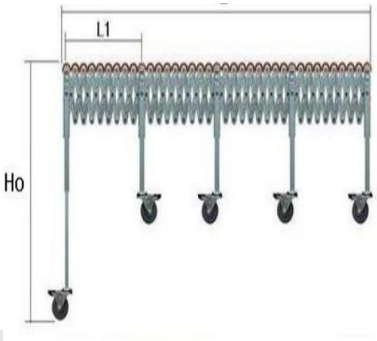
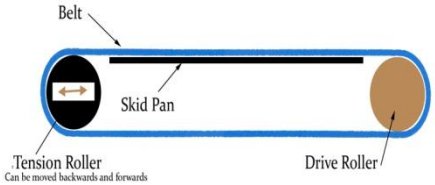
① Outer Wall
② Guide Beam
③ Wire Loader
④ Weight Pendulum for Balance



Operators should get on and they operate using wires, weight pendulum, and driving motor.

Usage Status and Survey on Relevant Technology

Status of Usage of Horizontal Conveyor

Roller Conveyor	Jabara Type Conveyor	Belt Conveyor
77 Companies / 126 Companies	30 Companies / 126 Companies	17 Companies / 126 Companies
		

Unit: box (90%), pallet (5.6%), sack (3.2%)

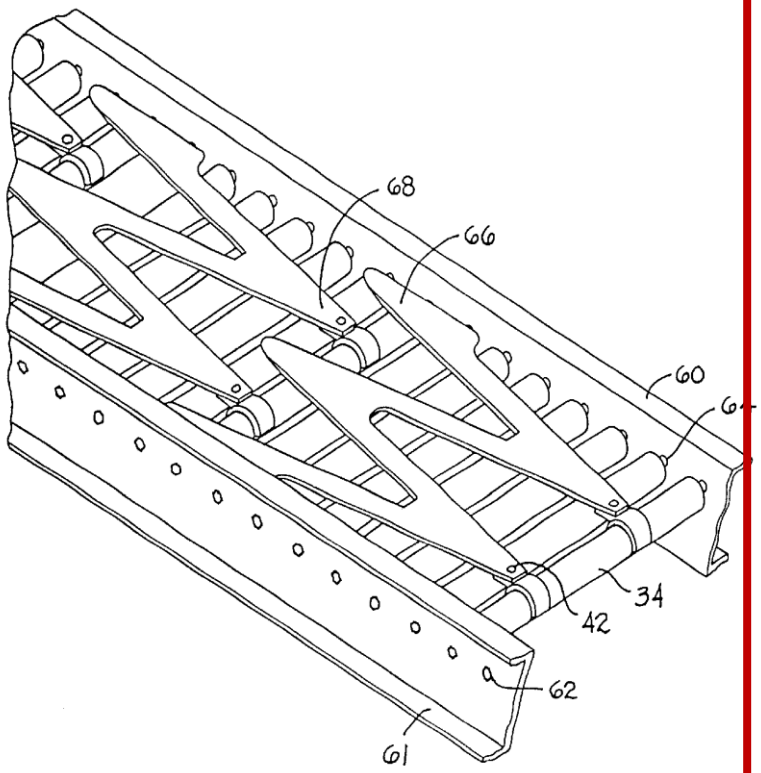
* When it comes to transfer of cargo, logistics center in land usually uses box; ones near ports use pallets and sacks.

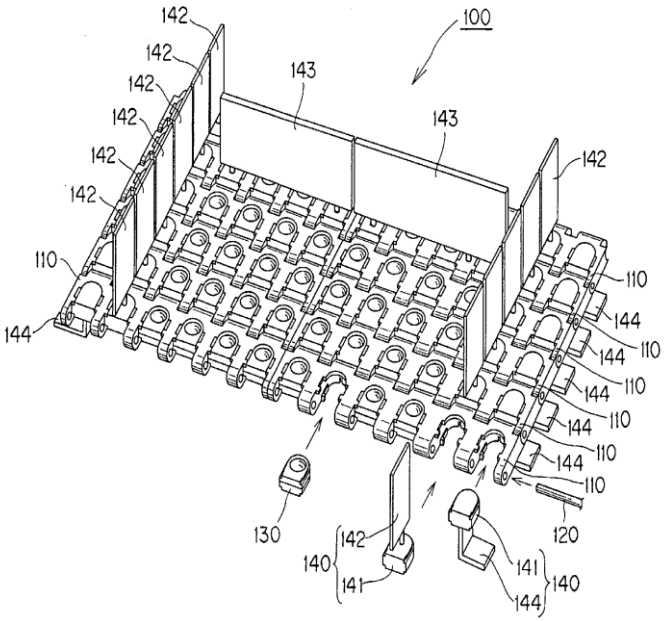
Conveyor manufacturers: BOW (33), Daewon (9), Self-manufactured (9), Wonbo (8), etc.

Usage Status and Survey on Relevant Technology

Horizontal Conveyor-Related Technologies

CONVERTING ROLLER CONVEYORS INTO BELT CONVEYOR
1999, THE LAITRAM(US)

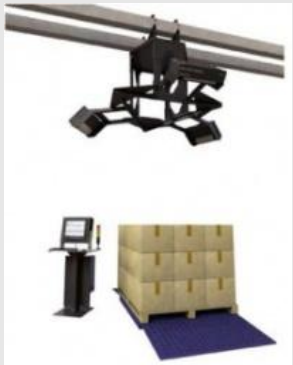




Usage Status and Survey on Relevant Technology

Total Checker

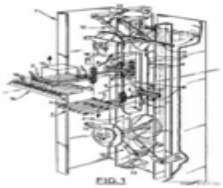
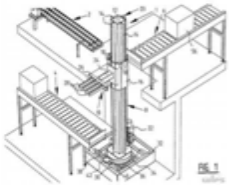
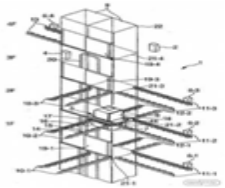
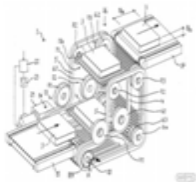
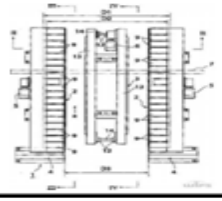
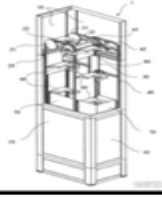
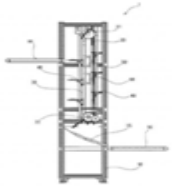
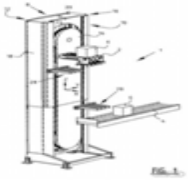
- There are Static Measurement Instrument and Dynamic Measurement Instrument depending on stopping or non-stopping transfer activities during cargo checker.
- Cargo in a box uses measurement instrument with rack type of structure; pallet uses instrument with gate type.

Type 1. Static Measurement Instrument	Type 2. Dynamic Measurement Instrument (for box)	Type 3. Dynamic Measurement Instrument (for pallet)
		
CSN840 Pallet (Mettler Toledo)	•CS5200 (Mettler Toledo)	•Cargo S-"Pallet"(Mettler Toledo) • SolidCube6961 (CASI)
Box	Box	Pallet
Measure cargo in a fixed position	Measure cargo in transferring horizontally	Measure cargo in transferring vertically
- Cargo is in a fixed position; measurement instrument moves along with rail over the head	- Measurement instrument is attached into rack type of structure - Cargo transfers on the horizontal conveyor between legs of the rack type of structure	- Measurement instrument with gate type of structure - Measure cargo transferring on the conveyor between gates

Survey on Patent Technology (Domestic and Abroad)

Vertical Conveyor-Related Patents

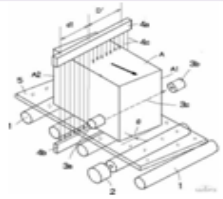
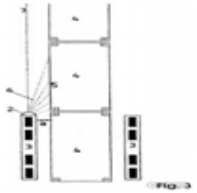
- A large number of technologies for transferring in multi-level cargo transfer system has continuously been developed.
- Essential patents have been applied by Japan and European countries; they are also applied to not only logistics facilities but also aircraft, underground structure, restaurants and etc.

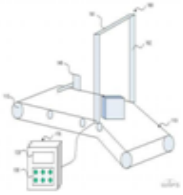
1990~2000	2001~2007	2008	2009~2010
유럽등록특허 0999152(1999) Nedpack Device for transferring goods	유럽등록특허 1645529(2005) Nedpack Device for transferring goods	일본공개특허 2001-063984(1999) TCM 수직 반송 장치	미국등록특허 7815038(2009) Kolbus GmbH Conveying device for vertically transporting piece goods
			
일본등록특허 4635267(2000) TOYO SUISAN KAISHA 자동 반송 장치	일본공개특허 2009-113942(2007) HOKUSHO VERTICAL CONVEYANCE MACHINE	일본 공개 특허 2003-054888(2001) NIPPON YUSOKI DESCENT CONVEYING DEVICE	유럽등록특허 2403782(2010) Nedpack DEVICE AND METHOD FOR TRANSFERRING GOODS BETWEEN CONVEYORS
			

Survey on Patent Technology (Domestic and Abroad)

Total Checker-Related Patents

- Technologies about total check area in multi-level cargo transfer system had been applied by developed in early 2000.
- In particular, Korea started applying patents in the area of total check since the mid 2000.

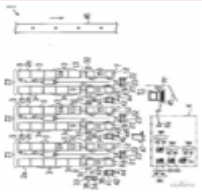
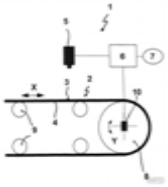
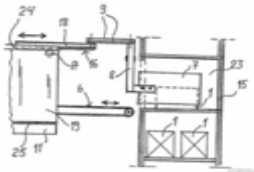
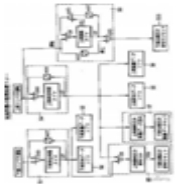
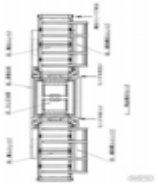
1990~2000	2001~2005	2006~2009
일본공개특허 1994-109448(1992) SHINKO DENSHI KK 치수 측정 방법	한국등록특허 0728880(2005) 아이피에스시스템 자동 화물 중량 측정 장치	유럽등록특허 2060472(2008) Noell Mobile Systems Portal fork lift with automatic steering
		

한국등록특허 0672044(2005) 서울대학교 자동 박스 치수 측정 장치


Survey on Patent Technology (Domestic and Abroad)

WCS (Warehouse Control System)-Related Patents

- Essential patents in warehouse control system has mostly been applied by Japan, and the USA; A large number of technologies have continuously been developed.
- In particular, essential patents in the area of WCS have been applied since 2000.

1990~2000	2001~2006	2007~2010
일본등록특허 3646381(1997) TOYOTA AUTOM LOOM WORKS IDENTIFICATION CODE READING DEVICE …	미국등록특허 7624857(2005) Phoenix Conveyor Belt Systems GmbH Device for monitoring a conveyor	미국공개특허 20110176895(2011) KORTELAINEN Method for Placing a Palletless Goods Package …
		
일본공개특허 1999-322053(1998) MEIDENSHA CORP MONITORING DEVICE FOR CONVEYOR FACILITY	일본공개특허 2008-304365(2007) FUJI ELECTRIC SYSTEMS GOODS CARRYING-OUT MONITOR	
		

Note: Roadmap for Technology Development of the U.S. Shipbuilding Industry (2005 - 2010)

Figure 2: The Challenge and Solution

Shipboard Internal Cargo Movement today...

and tomorrow ...

Safer, Quicker, Automated

High Rate Vertical & Horizontal Movement | Automated Warehouse | Compact, Agile Material Mover

MAPPING ENABLING TECHNOLOGIES TO TECHNOLOGY GAPS/CHALLENGES

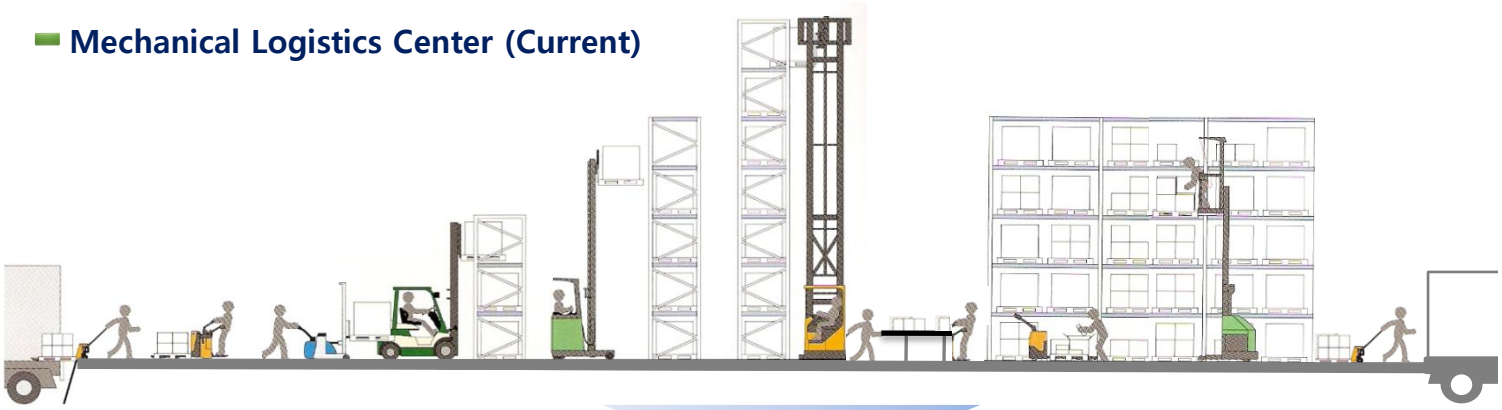
Table 3: Workshop Identified Gaps & Challenges

	Gap/Challenge to be Addressed	Relative Priority
1	Horizontal and Vertical movement; End-to-End	18%
2	Simultaneous Strike-Up/Down; Retrograde Handling; Supply to Weapons Systems (e.g., elevator systems)	14%
3	Total Asset Visibility-Infrastructure; Interface to Person; Messaging Interface; Bandwidth and Security; Wireless	10%
4	Automated Task Management System (from ordering to retrieval)	8%
5	At-Sea Transfer (Ramps, Lighters, Cranes, etc.) (MPF specific)	8%
6	Cargo Stowage (Restraint) at Sea is Manpower Intensive	6%
7	Lack of Standardization of Packaging	6%
8	Handling & Stowing (Breakout, Re-Packaging, Retrograde, Stow When Received)	5%

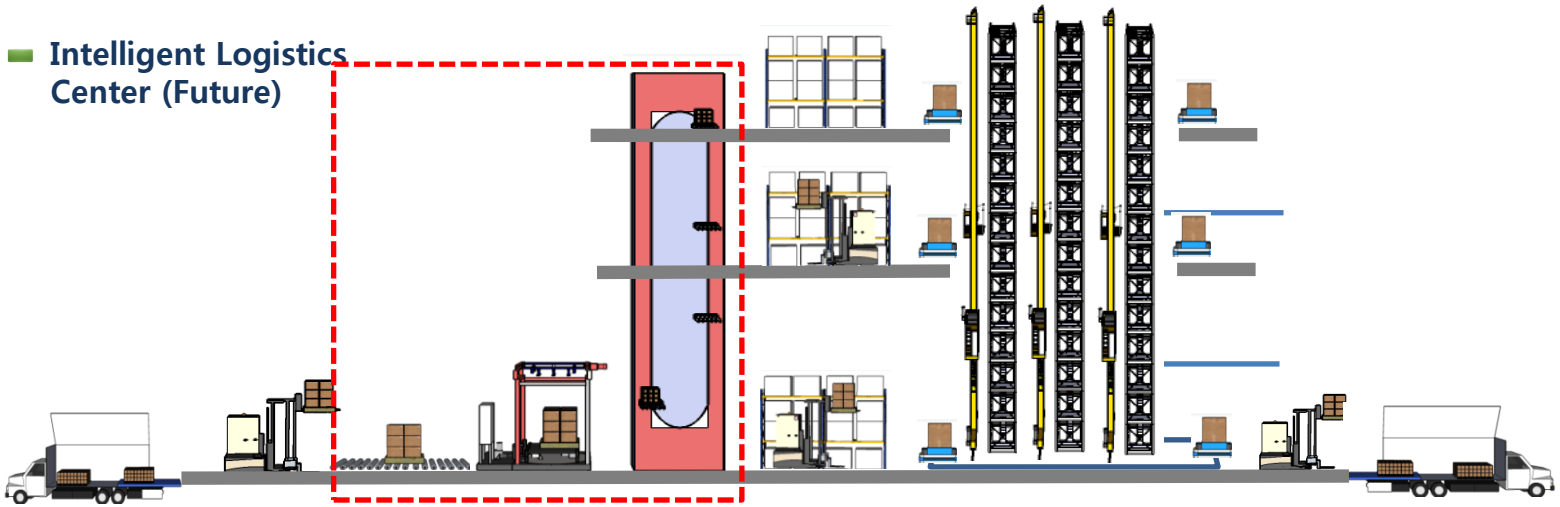
Development Concept of Multi-Level Cargo Transfer System

Definition of Intelligent Multi-level Logistics Center & Logistics Activities

- Mechanical Logistics Center (Current)



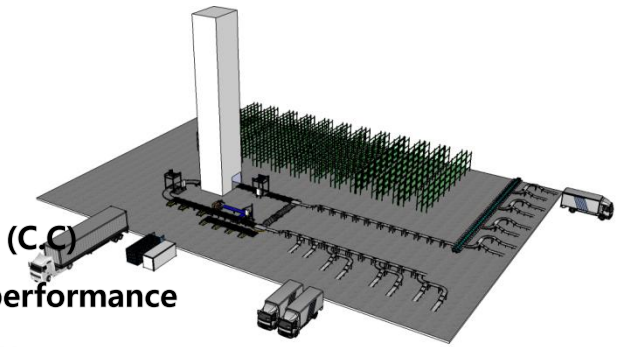
- Intelligent Logistics Center (Future)



2. Research Contents

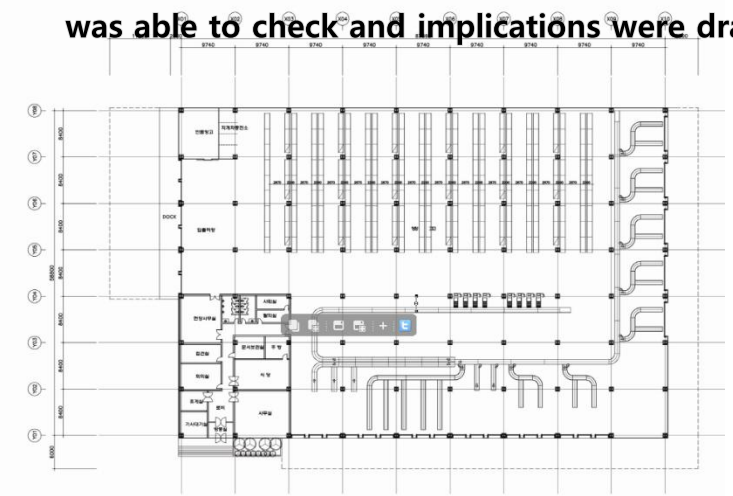
Concept Verification

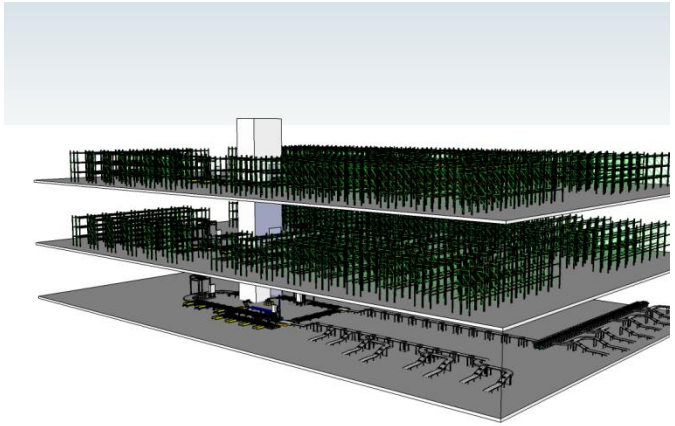
Video

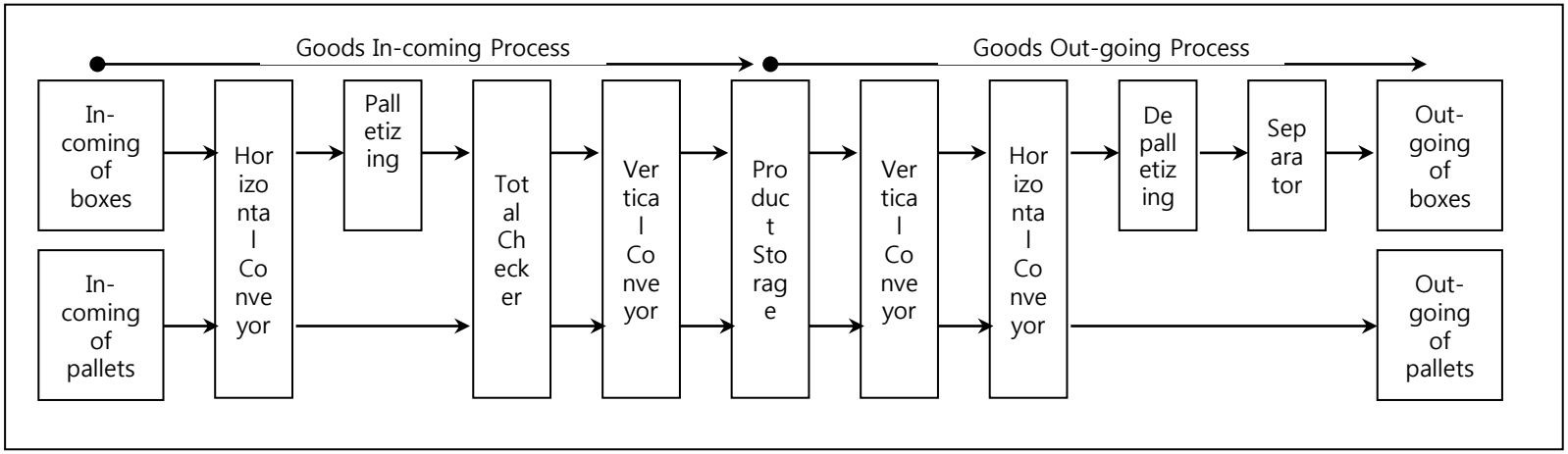


Implementation of Preliminary Simulation

- Installed a concept product in a Standard-Logistics Center (C.C) of 5,000㎥ to perform virtual logistics activities. So basic performance was able to check and implications were drawn accordingly.

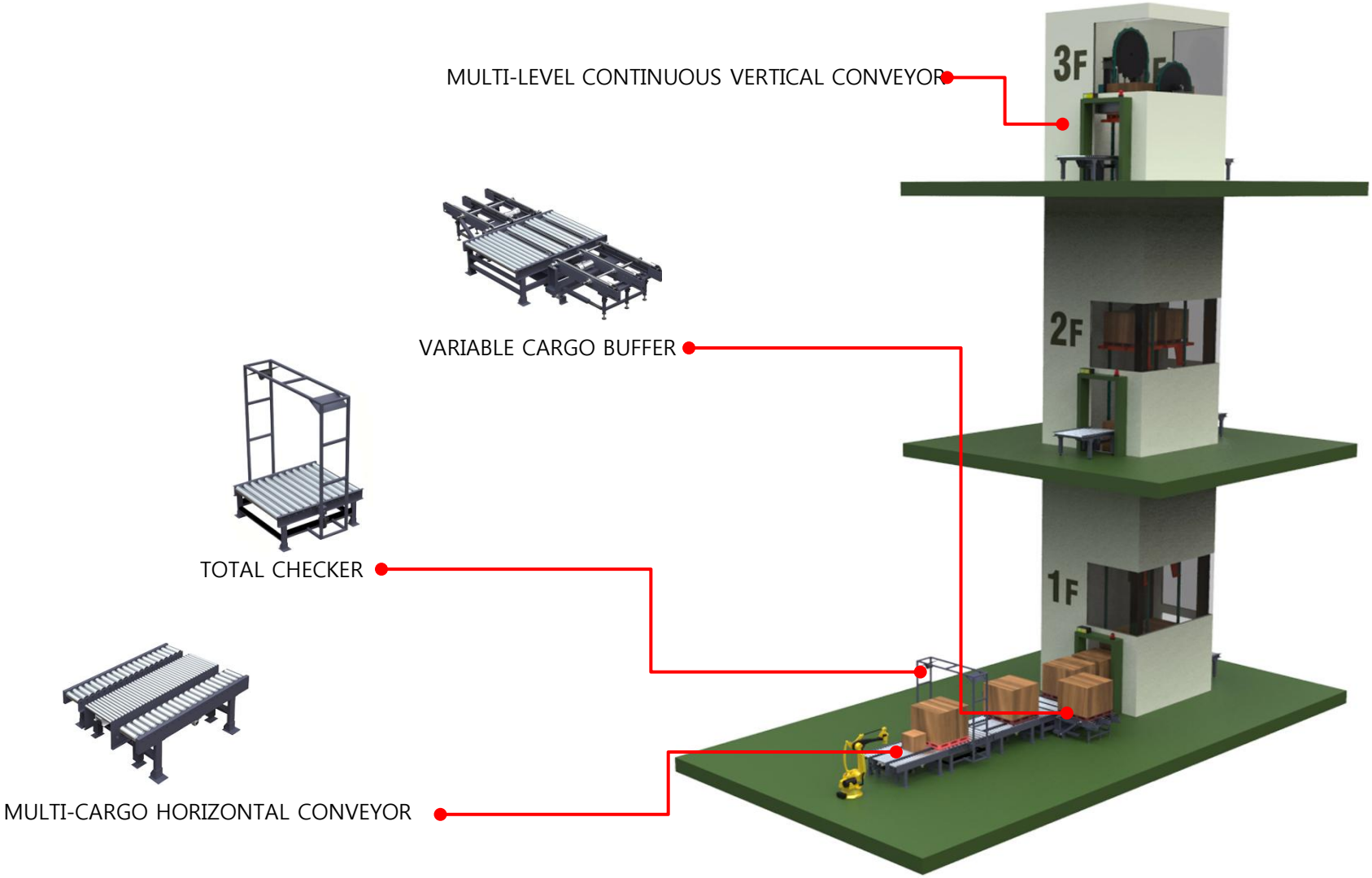






Structural Design of Multi-Level Cargo Transfer System

- **Equipment and device for multi-level cargo transfer system will be equipped and used as follows.**



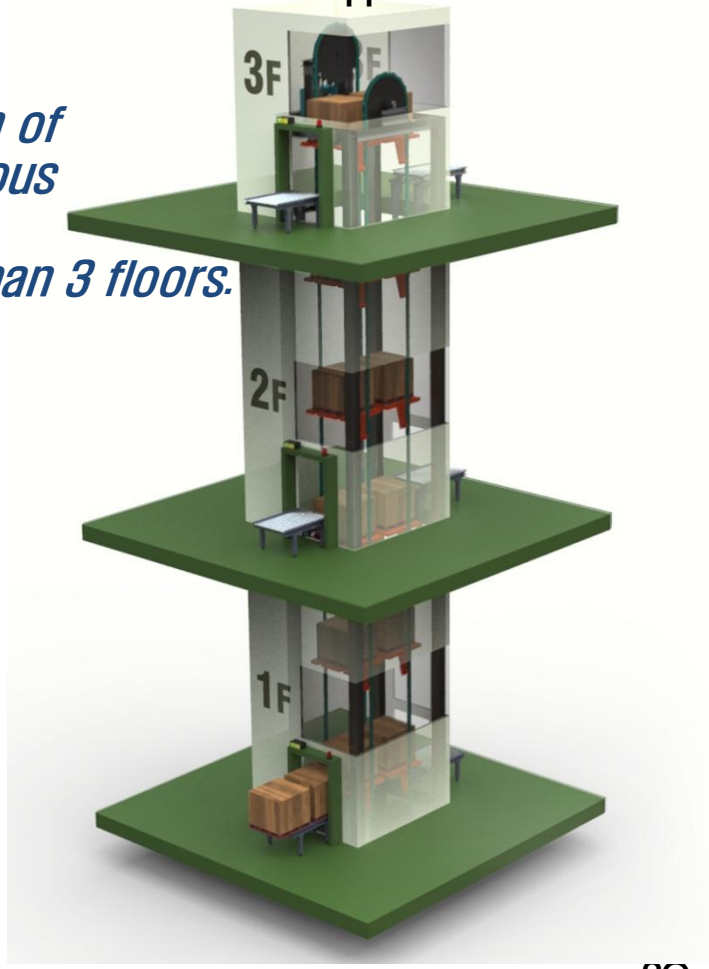
2. Research Contents

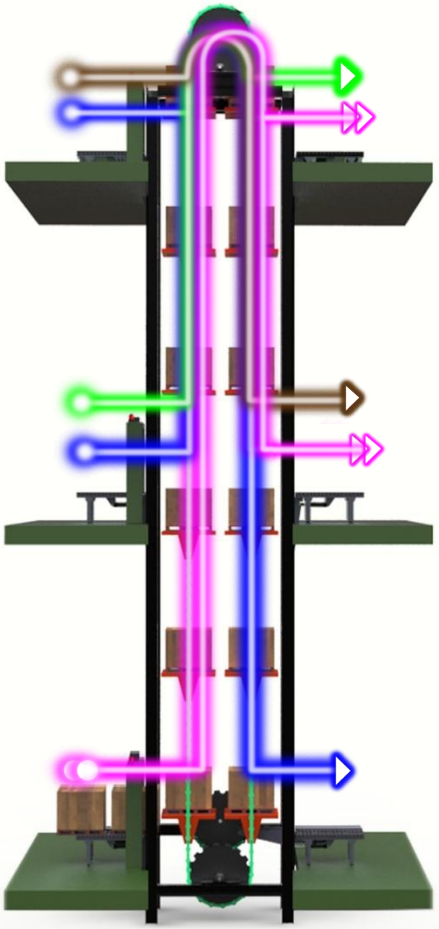
■ Structural Design of Multi-Level Cargo Transfer System

✔ Vertical Conveyor *"MULTI-LEVEL CONTINUOUS VERTICAL CONVEYOR"*

- **Various logistics operation is possible in the directions of from lower floors to higher floors, and vice versa, and even in the middle floors. In short, a multi-directional types of transfer mode will be applied.**

Realization of simultaneous operation at more than 3 floors.





Video

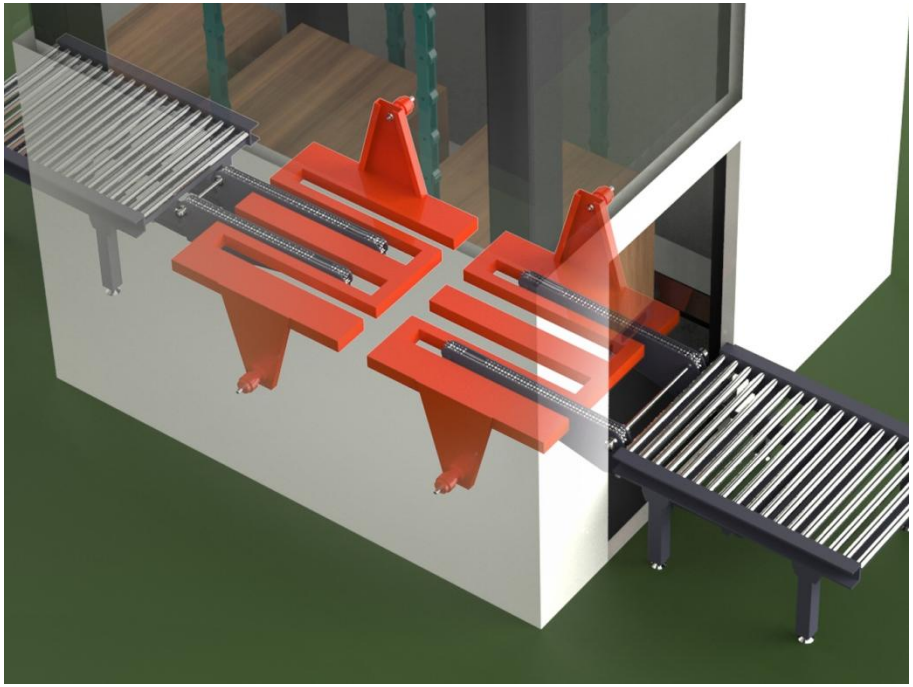
2. Research Contents

■ Structural Design of Multi-Level Cargo Transfer System

✔ Vertical Conveyor *"MULTI-LEVEL CONTINUOUS VERTICAL CONVEYOR"*

- **Specifically-designed design of both-directional carrier structure & IN & OUT FEEDER**

Carrier improved for a "Multi-Directional Type of Transfer Mode"



2. Research Contents

Structural Design of Multi-Level Cargo Transfer System

Vertical Conveyor

- (Main Gear) Utilize 2 pulleys at upper and lower sides, respectively = Capable of transfer of 30 tons
- (Carrier) Secured safety thanks to double fixation
- (Carrier) Keep horizontality at the top thanks to double fixation

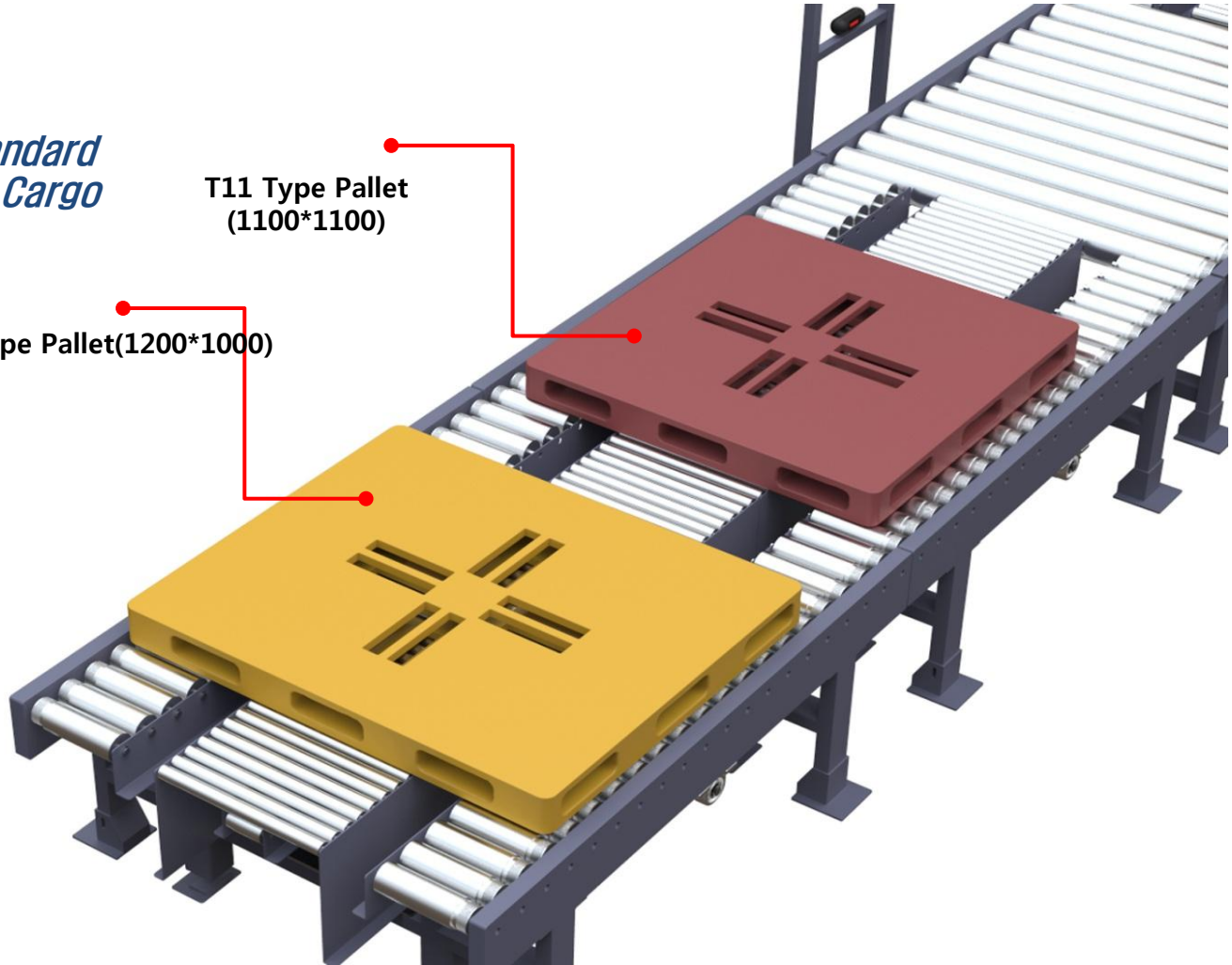
Durable and Safe Structure
Simultaneous Transfer
of 30 tons (12 pallets)

2. Research Contents

Structural Design of Multi-Level Cargo Transfer System

- **Vertical Conveyor** "MULTI-CARGO HORIZONTAL CONVEYOR"
  - **Dual Mode (T11 type and T12 type) is available.**

- Availability of Dual Standard
- Availability of Various Cargo Transfer

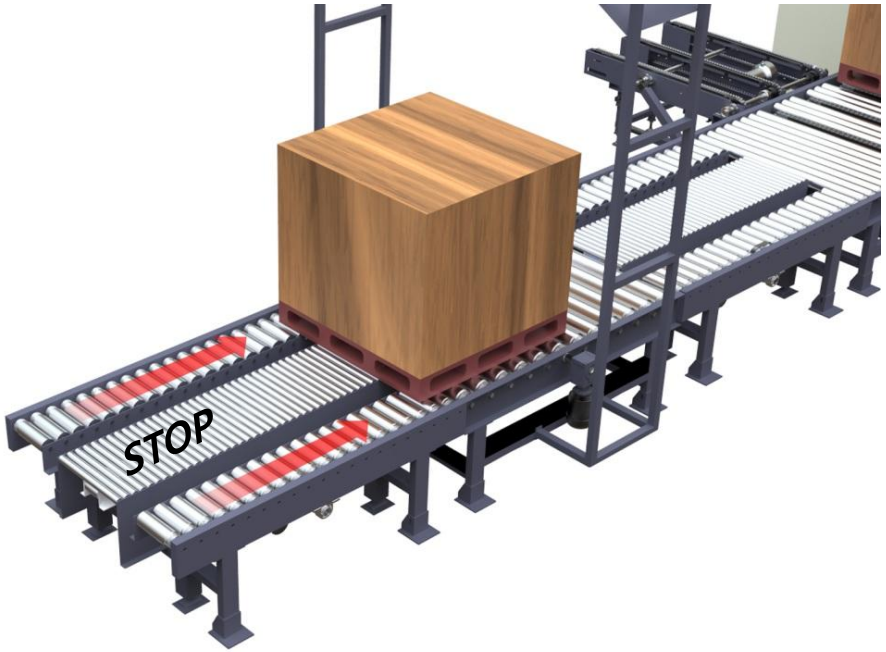


Structural Design of Multi-Level Cargo Transfer System

Horizontal Conveyor

- Maximization of energy efficiency due to differentiated transfer mode depending on situation

Maximization of Energy Efficiency
(Availability of transfer mode exclusively for box or pallet)

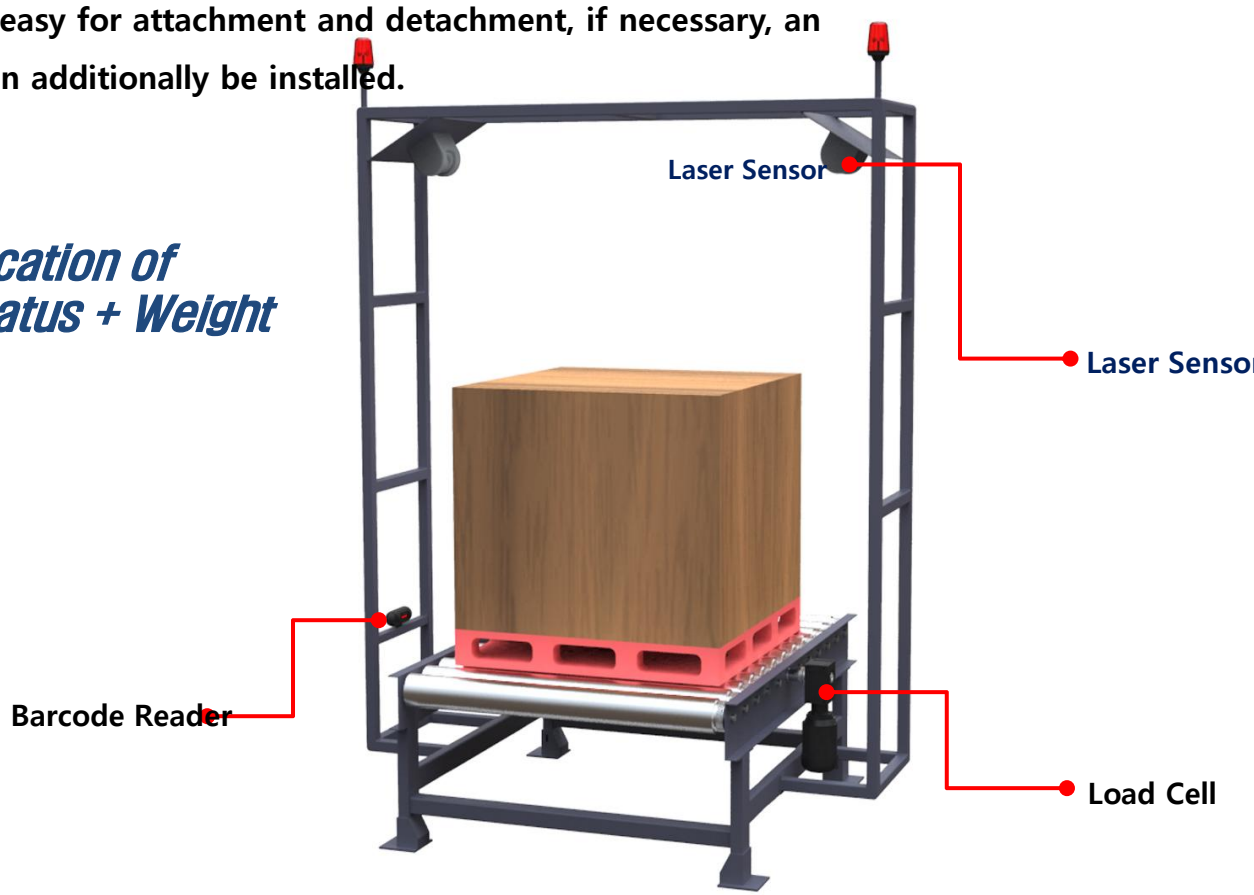


Structural Design of Multi-Level Cargo Transfer System

Total Checker *"TOTAL CHECKER"*

- Structure that identifies cargo data + cargo loading status + weight, and recognition device are equipped.
- Rack type of structure easy for attachment and detachment, if necessary, an identification device can additionally be installed.

Multiple Checking
-Simultaneous Identification of Cargo Data + Cargo Status + Weight

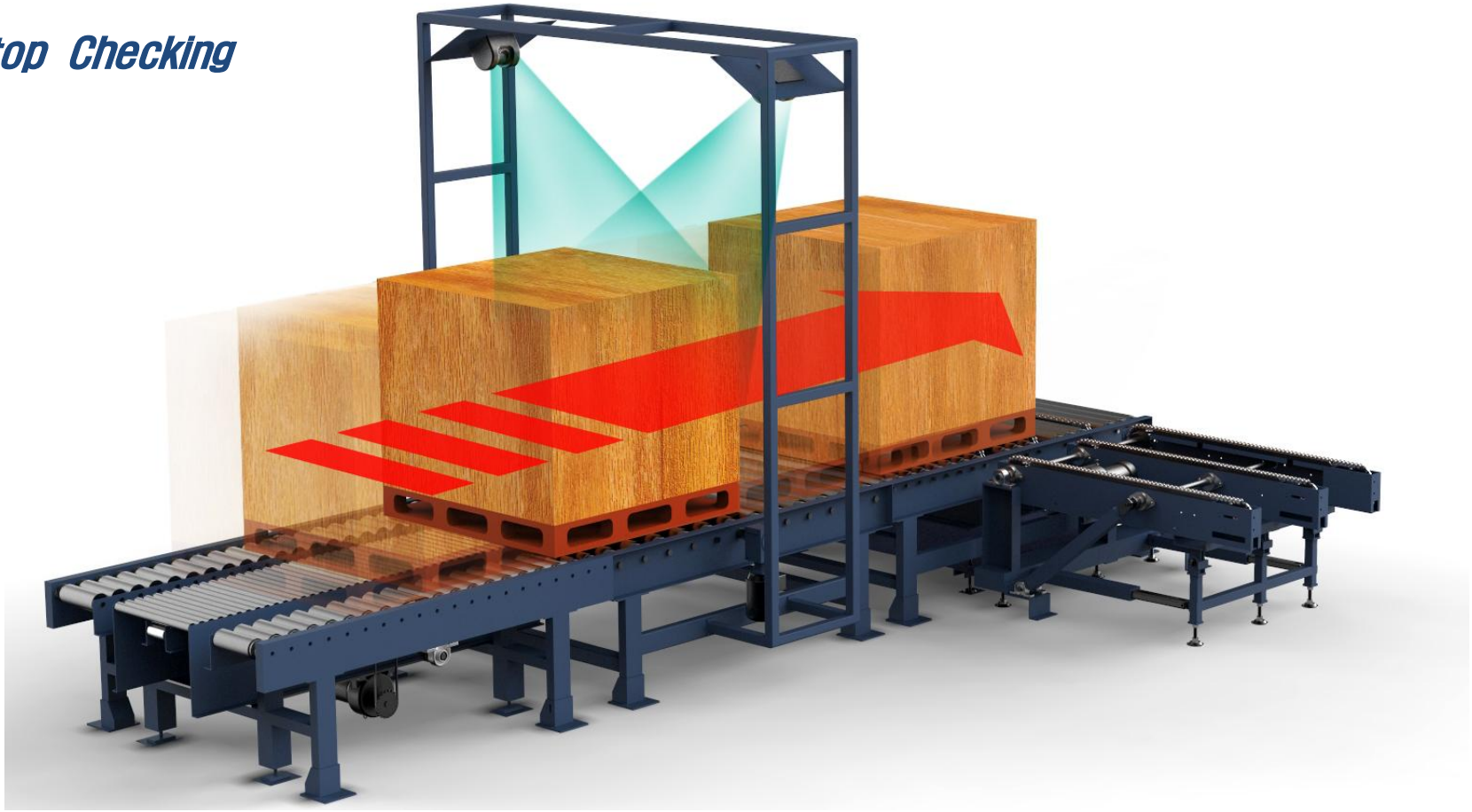


Structural Design of Multi-Level Cargo Transfer System

Total Checker

- No interruption of cargo transfer in the process of inspection

Non-Stop Checking



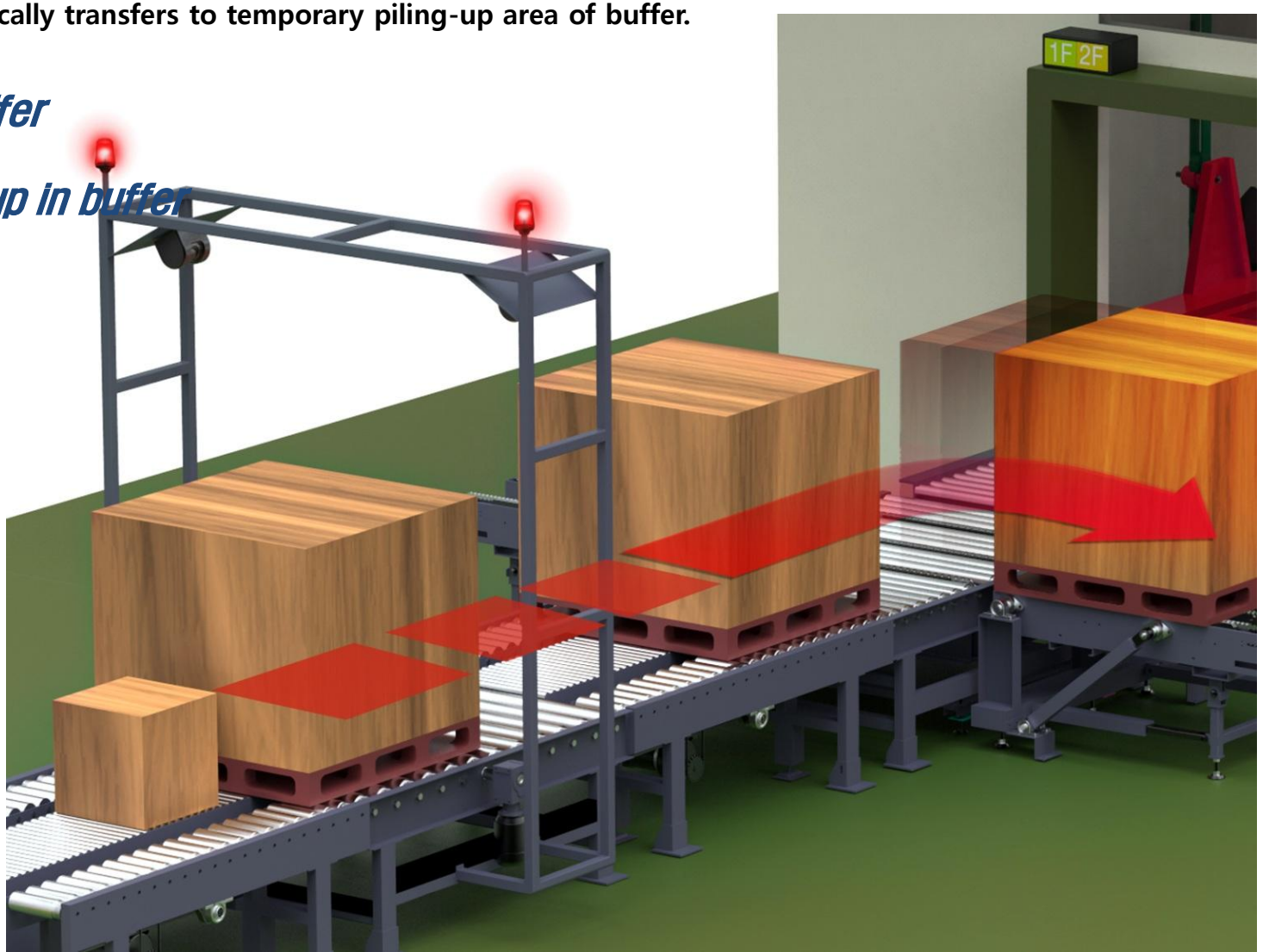
2. Research Contents

Structural Design of Multi-Level Cargo Transfer System

Total Checker

- In case of abnormal cargo is found, it does no go through the Vertical Conveyor, and it automatically transfers to temporary piling-up area of buffer.

Connection to Buffer
Abnormal cargo is temporarily piled up in buffer



2. Research Contents

Structural Design of Multi-Level Cargo Transfer System

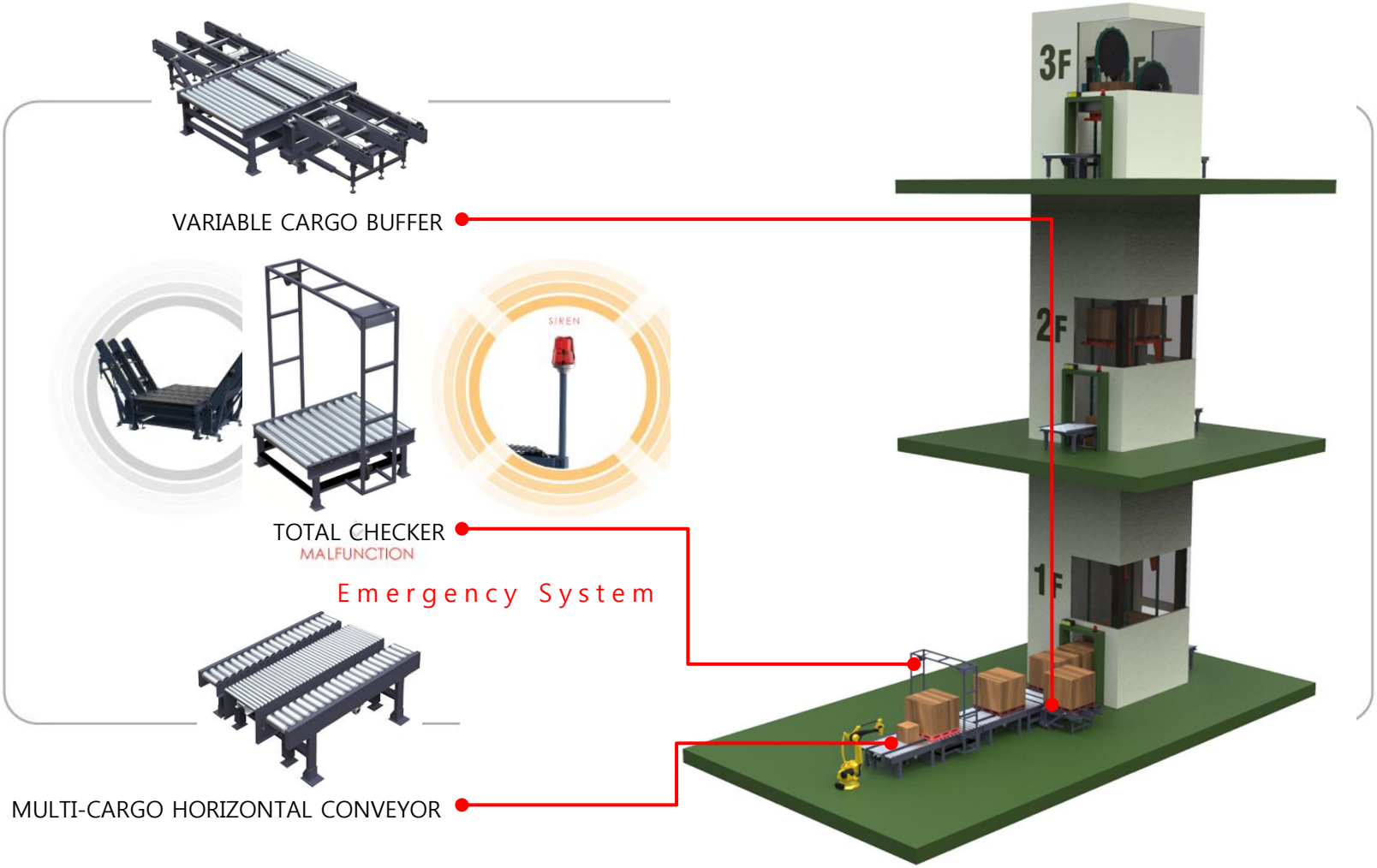
Buffer "Variable Cargo Buffer"

- Buffer's expansion and folding are available depending on the number of cargo piled up in temporary area.

VARIABLE Structure
-Flexible structure capable of expansion and folding depending on the number of temporary-piled up cargo

Structural Design of Multi-Level Cargo Transfer System

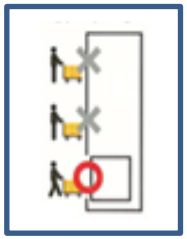
Interface Among System and Its Control



2. Research Contents

■ Expected Effectiveness by Technology

▶Vertical Conveyor



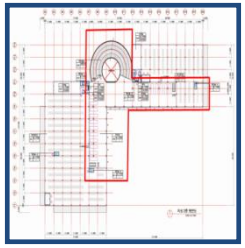
Simultaneous operation at each floor, reduction in area of exclusive use space

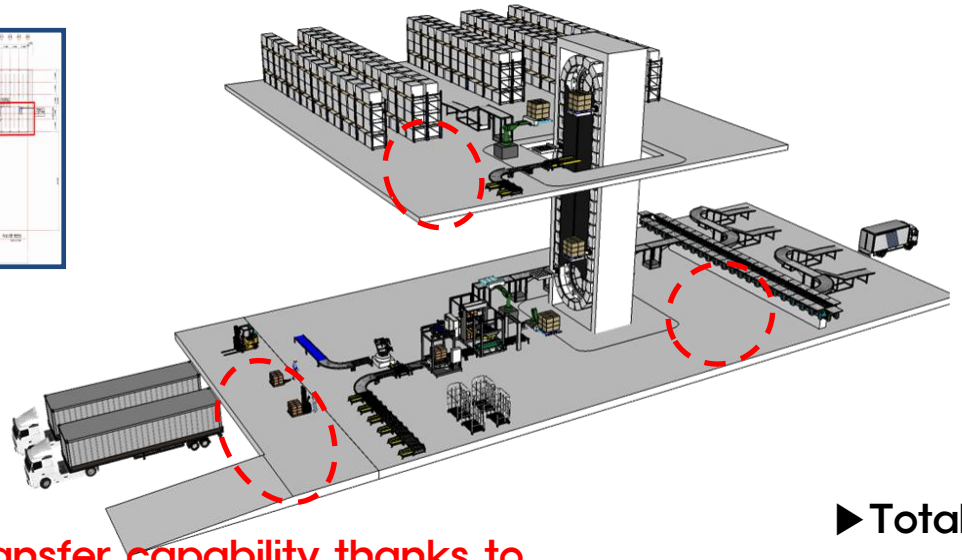
-Improvement of productivity and operational efficiency regardless of floor (50% improvement for third floor)

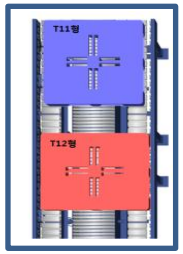
▶Horizontal Conveyor

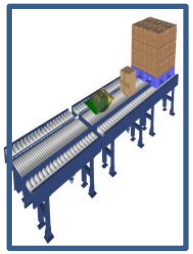
Simultaneous cargo handling at vertical and horizontal conveyo

-Reduction in initial investment costs
-Space efficiency









Improvement of transfer capability thanks to continuous operation of cargo on pallets

-Increasing turnover rate of vehicles, reduction in working space
-Reduction in the number of equipment to be introduced
-Reduction in investment costs and operational costs

▶Total Checker

Cargo Weight/Total Recognition

-Reduction on inspection time
-Enhancement of inventory management level

3 Cooperative Measures For Logistics Technology

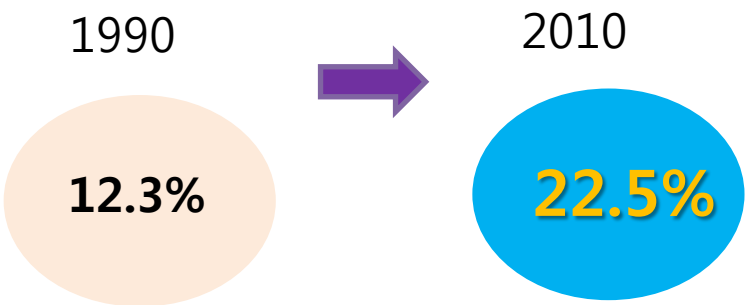
3. Cooperative Measures For Logistics Technology

■ Necessity for Logistics Technology Development among Korea-China-Japan

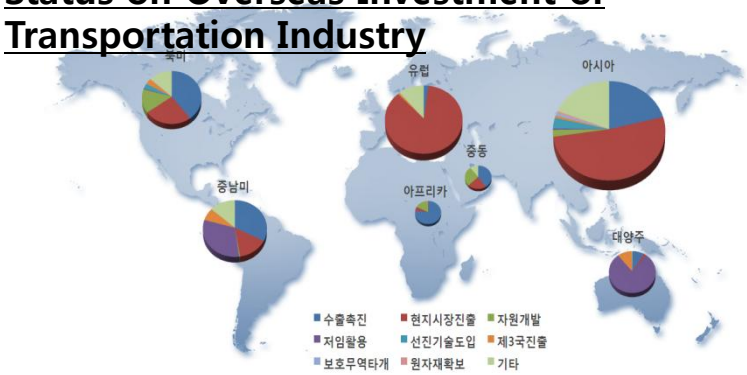
- Continuous growth of trade volume among Korea, China and Japan, and Korea' s logistics companies' (transportation industry) increasing investment in China
  - Korea's no. 1 exporting country has changed from the USA to China (since '03); and for importing country, it has also changed from Japan to China (since '07).
  - Korea's investment amount towards China in 2011 was $3,571,813,000, including transportation industry's investment of $50,789,000, or 1.42%.
  - When companies expand into overseas markets, they need to get logistics centers. In this case, they face difficulties in renting or constructing new logistics centers, mostly because of costs and national differences when it comes to new construction and its operation.

    → Need for construction of a 'standard logistics center' among Korea, China and Japan.

Trade Volume of Korea·China·Japan



Status on Overseas Investment of Transportation Industry



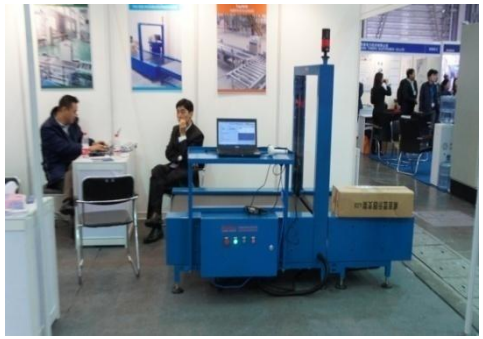
Source: OIS (Overseas Investment Information System).go.kr

3. Cooperative Measures For Logistics Technology

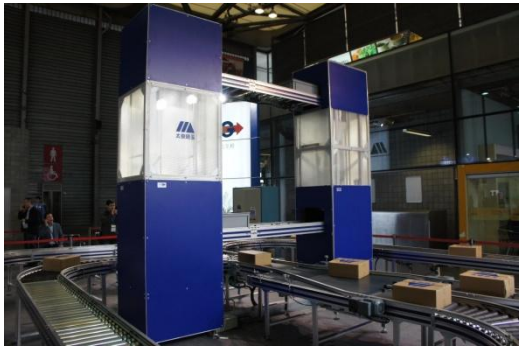
■ Necessity for Logistics Technology Development among Korea-China-Japan

✔ Rapid growth in logistics facilities and equipment markets in China

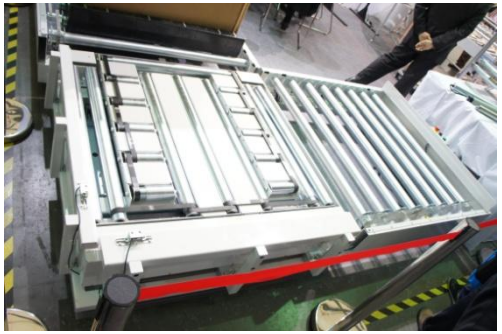
- China's logistics facilities-related market has substantially increasing every year because use of forklifts and conveyors become popular in working area of logistics facilities and manufacturing plants in accordance with continuous labor costs in China.
- In order to secure logistics facilities and equipment markets in China, other countries including Germany, the USA are entering into the market as a form of consortium.
- Joint development of such facilities & equipment and cooperation by Korea, China and Japan will make contributions to growth in logistics industry in Korea, China, and Japan.



Total Checker



Vertical Conveyor



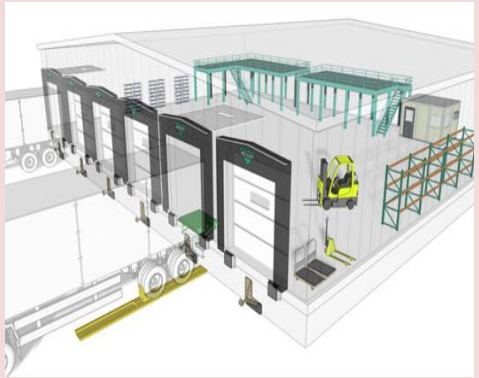
Self-Driving Roller and Cargo Vehicle

Source: Shanghai Logistics Fair, CEMAT 2012

3. Cooperative Measures For Logistics Technology

■ Proposal for Logistics Technology Development among Korea-China-Japan

Joint technology development of logistics center based on standards of Korea, China, and Japan



Standardization of logistics facilities and equipment

Standardization of logistics activities such as in-coming and out-going of goods

↓

Operational efficiency of companies that expanded into overseas markets

Incubator for distribution & supply and spread of logistics-related technologies

- Provision of comprehensive information about logistics technologies of Korea, China and Japan
- Joint development of standards or guidelines for logistics facilities of Korea, China and Japan

Consideration of support measures for technological cooperation and joint development

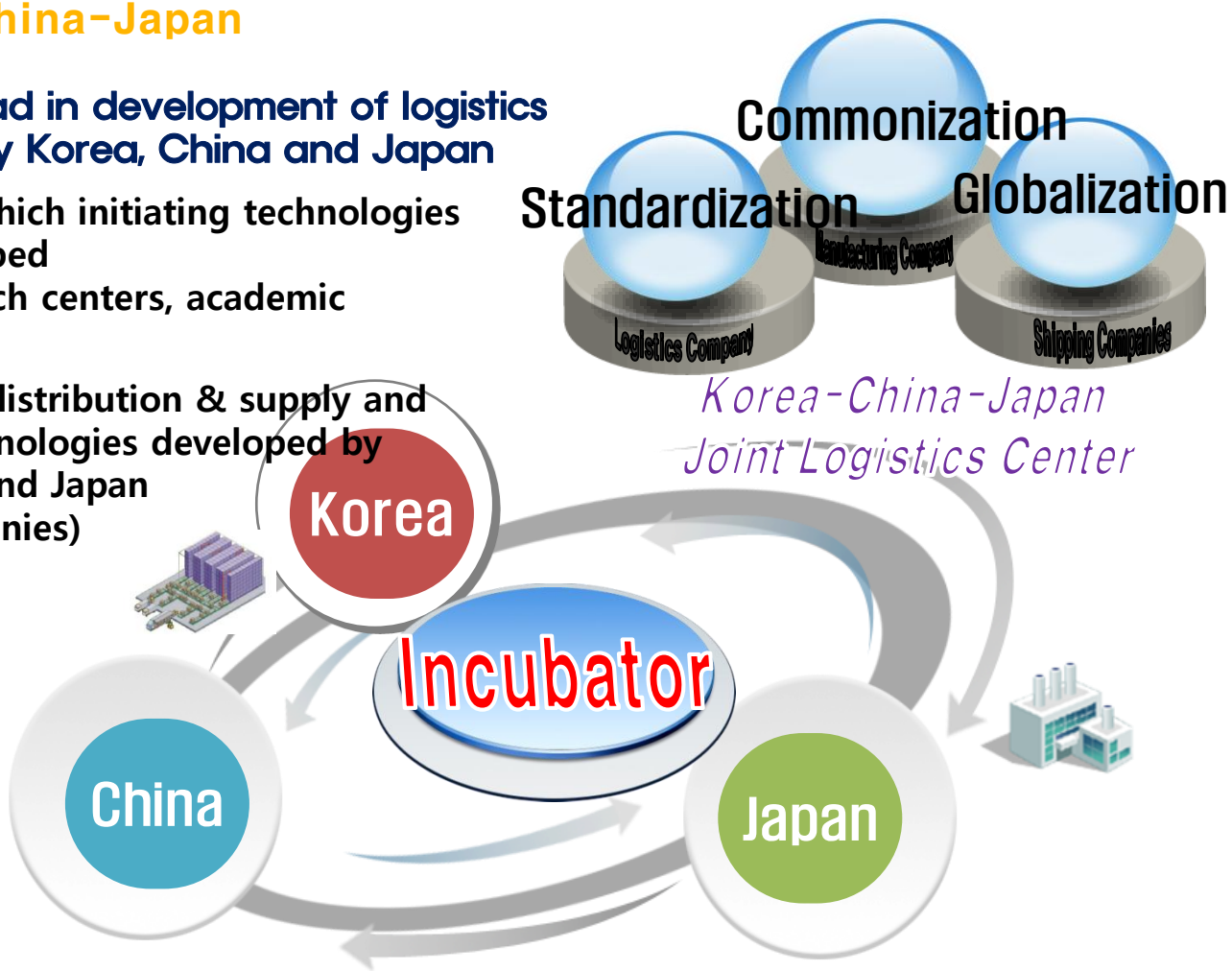
↓

Test-bed for logistics technologies of Korea, China and Japan

3. Cooperative Measures For Logistics Technology

■ Proposal for Logistics Technology Development among Korea-China-Japan

- To take the lead in development of logistics technologies by Korea, China and Japan
  - Incubator in which initiating technologies can be developed (Led by research centers, academic institutes)
  - Incubator for distribution & supply and spread of technologies developed by Korea, China and Japan (Led by companies)



Development of the technology for multilevel transporting system

Thank you for your listening

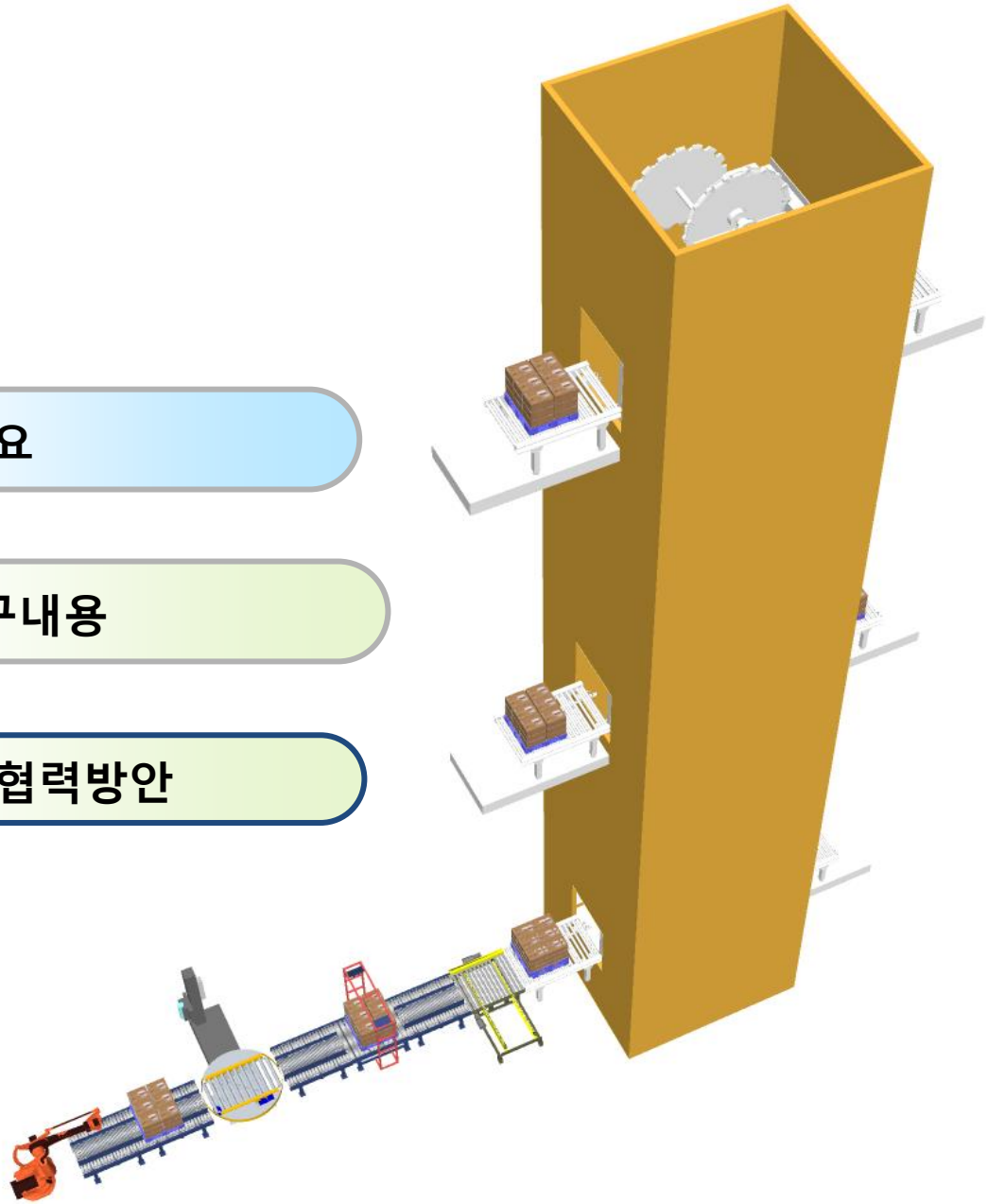
다층형 화물이송시스템 기술개발

㈜덕평물류 물류시설연구소 손병석 소장

Contents

Multilevel & Intelligent Mode Conveyor system

- 사업의 개요
- 주요 연구내용
- 물류기술 협력방안



1 연구개발사업의 개요

1. 연구개발사업의 개요

■ 연구의 배경

- 물류센터는 단순 창고형태에서 Cross-Docking, 부가가치 서비스를 제공하는 물류시설로 진화
- 항만, 배후단지 등의 한정된 공간 제약, 도시 내 물류센터의 높은 지가, 인건비 상승, 자동화・첨단화에 더불어 다층형으로 구축

출처: 일본 Prologs(社), 우측 사진은 베이징 물류센터

* 국토해양기술연구개발사업으로 『지능형 물류센터 상하역 및 이송시스템 기술 개발』과제에서 본 연구를 수행중임

1. 연구개발사업의 개요

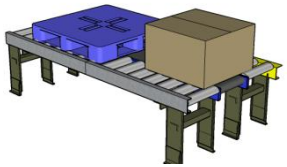
■ 연구의 필요성

	기계식 다층형 물류센터	자주식 다층형 물류센터
구축 사례	**수직반송기** **수직반송기/화물승강기**	**램프웨이** **화물승강기**
고려 사항	• 많은 수의 수직반송기/화물승강기 설치 • 입출고 작업시간이 층별로 상이하고, 동시작업이 불가능함 • 1층 공용면적 증가(접차 및 작업공간 등)	• 램프웨이 건설 비용 과다(85만원/㎡) • 각 층별 접차공간 설계로 공용면적 증가 • 차량 및 물류센터 시설물 안전사고 증가
개선 방안	• 화물의 빠른 수평/수직 이송 기술 • 각 층별 동시작업 기술	• 각 층의 공용면적 감소(접차 및 작업공간 등) • 램프웨이 건설 비용 절감 • 각 층의 입출고 작업시간 감소

1. 연구개발사업의 개요

■ 연구개발 내용

✔ 수평컨베이어



• 다양한 화태(박스와 파렛트) 동시 이송

✔ 수직컨베이어

• 파렛트화물 연속작업

•각 층별 동시작업

✔ 볼륨체커

• 화물의 중량/체적
•적치상태 점검

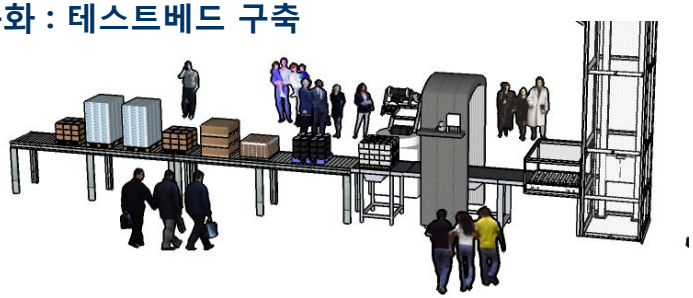
✔ 버퍼

• 작업조절/에러화물 임시적치
• 가변형 구조

환경변화 : 물류센터의 고층화

R&D : 다층형 화물이송장비 및 운영소프트웨어 개발

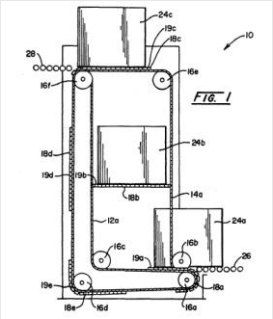
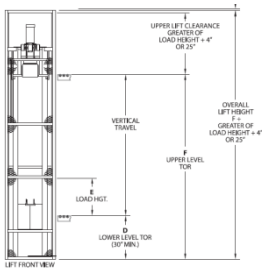
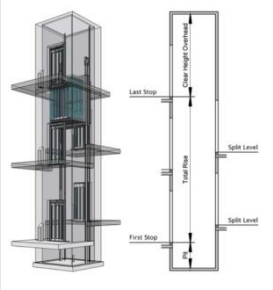
실용화 : 테스트베드 구축



2 연구내용

■ 이용현황 및 관련 기술 조사

✔ 수직이송기기 이용현황

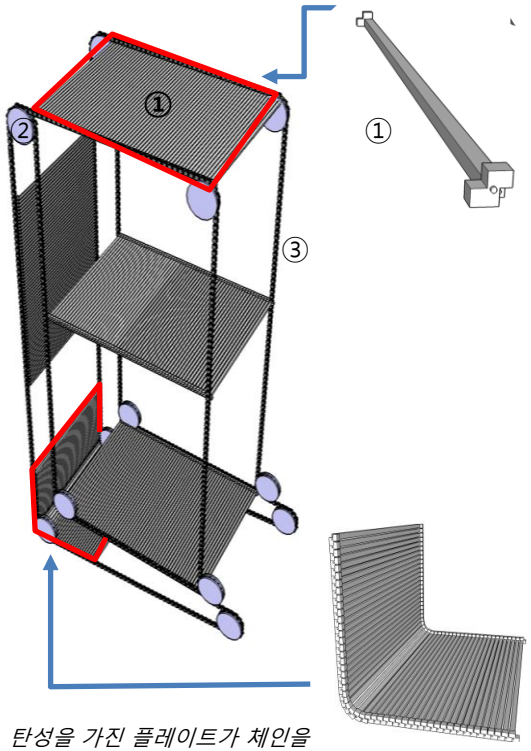
경쟁품	기술과 방식	이용현황	특징
Vertical Conveyor		13개사 취급화물 : 박스(92%) 처리속도 : 30-60box/h	박스단위 화물 취급 2개층 작업에 적합 3층 작업 불가(추가설치) 작업방향에 유연성이 없음
Lift Con		19개사 취급화물 : 파렛트(90%) 처리속도 : 10~20건/h(68%)	파렛트 화물 취급 특정층 조작인원의 물류활동 수행 (다른 층 대기 발생) 수동작동으로 자동화에 한계 장비 내 화물 입출에 장비 필요
Cargo elevator		135개사 취급화물 : 박스, 파렛트 처리속도 : 7건~10건/h(54%)	파렛트 화물, 인원 동시사용 엘리베이터 내 탑승자의 물류활동 수행 (다른 층 대기 발생) 수동작동으로 자동화에 한계 장비 내 화물 입출에 장비 필요

■ 이용현황 및 관련 기술 조사

수직이송관련 기술

VERTICAL CONVEYOR

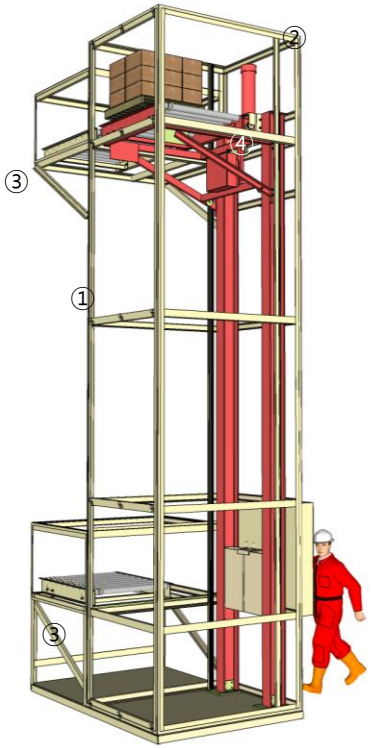
① 이송용 플레이트
② 스포크
③ 벨트(특수고무) / 체인(철제)



탄성을 가진 플레이트가 체인을 따라 변형되면서 화물을 처리하는 방식

리프콘(업계에서 통용되는 명칭)

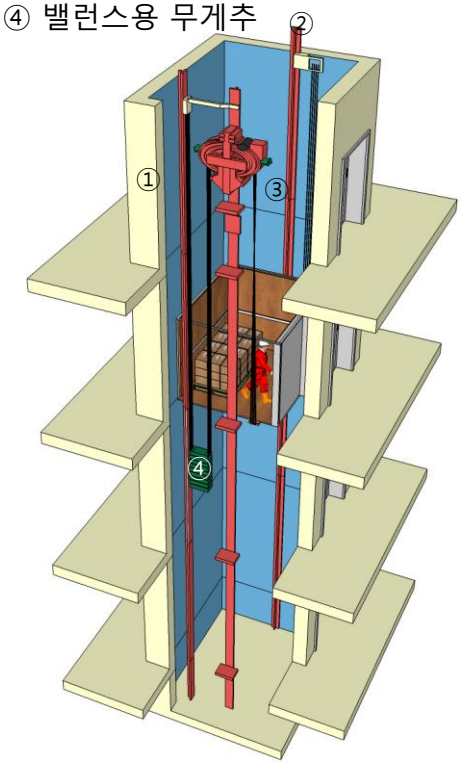
① 가이드 빔
② 유압장치
③ 인&아웃 피더
④ 이송용 플레이트



유압장치를 활용한 크레인에 화물입출을 위한 장치가 부착된 방식

화물엘레베이터

① 외벽
② 가이드 빔
③ 와이어 로더
④ 밸런스용 무게추



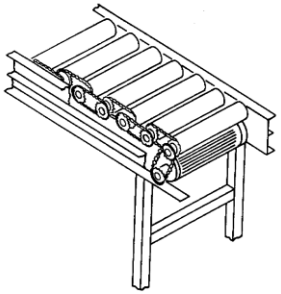
작업인원이 탑승하여 조작하는 방식 와이어와 무게추, 구동모터를 활용

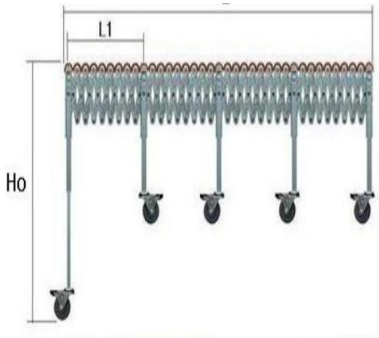
설계전략수립

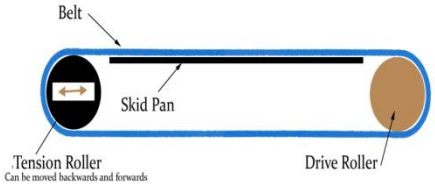
■ 이용현황 및 관련 기술 조사

✔ 수평이송기기 이용현황

롤러컨베이어	자바라 타입 컨베이어	벨트 컨베이어
77개사 / 126개사	30개사 / 126개사	17개사 / 126개사







취급단위 : 박스(90%), 파렛트(5.6%), 포대(3.2%)

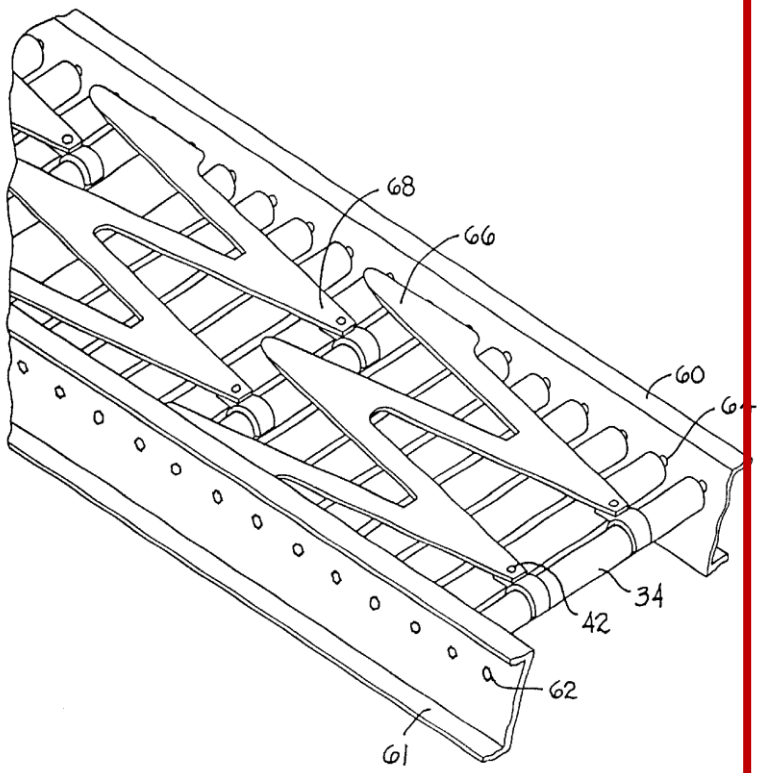
* 내륙의 물류센터는 박스, 항만배후물류센터는 파렛트와 포대 등의 이송에 주로 사용

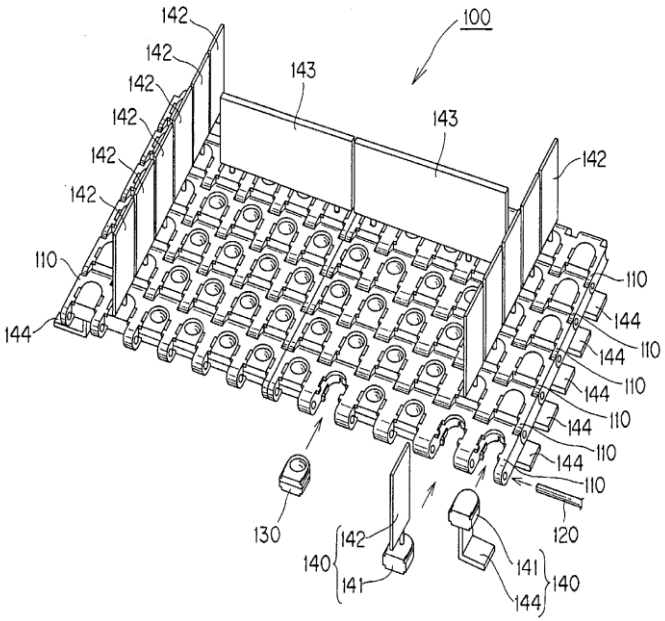
컨베이어 제조사 : 보우(33), 대원(9), 자체제작(9), 원보(8) 등

■ 이용현황 및 관련 기술 조사

✔ 수평이송관련 기술

CONVERTING ROLLER CONVEYORS INTO BELT CONVEYOR
1999, THE LAITRAM(US)

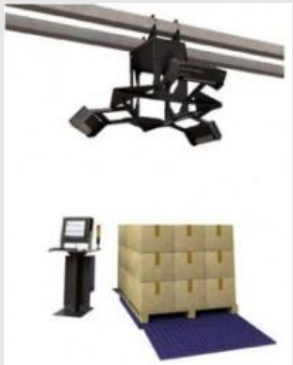




■ 이용현황 및 관련 기술 조사

볼륨체커

- 화물체커 시 이송활동 중단여부에 따라 정적 측정기와 동적 측정기로 구분
- 박스화물은 랙 구조물 형태의 측정기를, 파렛트용은 게이트 형태의 측정기를 활용하고 있음

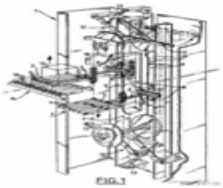
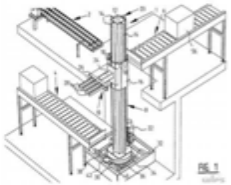
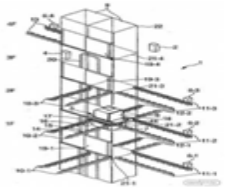
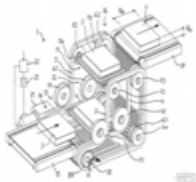
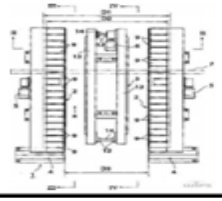
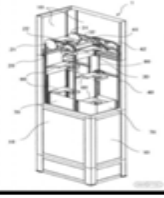
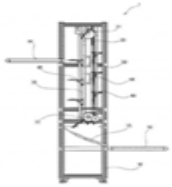
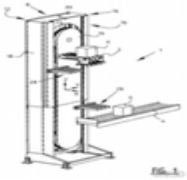
Type 1. 정적 측정기	Type 2. 동적 측정기(상자용)	Type 3. 동적 측정기(파렛트용)
		
CSN840 Pallet(Mettler Toledo사) 등	•CS5200(Mettler Toledo사) 등	•Cargo S-"Pallet"(Mettler Toledo사) • SolidCube6961(CASI사)
박스	박스	파렛트
위치가 고정된 화물 측정	수평 이송중인 화물 측정	수평 이송중인 화물의 측정
화물은 고정위치, 측정기가 상부레일을 따라 움직임	랙형 구조물에 측정기를 부착한 형태 랙형 구조물의 다리 사이의 수평컨베이어를 통해 화물이 이동	게이트 형태의 구조를 가진 측정기 게이트 사이의 컨베이어로 화물이 통과하면서 측정

설계전략수립

■ 국내외 특허기술조사

✔ 수직이송기기 관련 특허

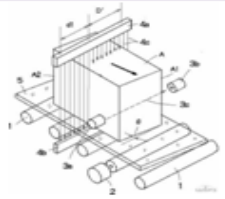
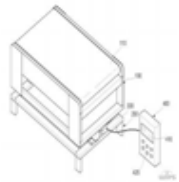
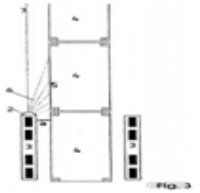
- 다층형 화물이송 시스템 중 이송 분야는 다수의 기술이 꾸준하게 개발되고 있음
- 핵심특허는 일본, 유럽에 집중되어 있었고, 물류시설 외에도 비행기, 지하구조물, 레스토랑 등에 사용

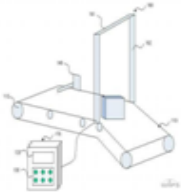
1990~2000	2001~2007	2008	2009~2010
유럽등록특허 0999152(1999) Nedpack Device for transferring goods	유럽등록특허 1645529(2005) Nedpack Device for transferring goods	일본공개특허 2001-063984(1999) TCM 수직 반송 장치	미국등록특허 7815038(2009) Kolbus GmbH Conveying device for vertically transporting piece goods
			
일본등록특허 4635267(2000) TOYO SUISAN KAISHA 자동 반송 장치	일본공개특허 2009-113942(2007) HOKUSHO VERTICAL CONVEYANCE MACHINE	일본 공개 특허 2003-054888(2001) NIPPON YUSOKI DESCENT CONVEYING DEVICE	유럽등록특허 2403782(2010) Nedpack DEVICE AND METHOD FOR TRANSFERRING GOODS BETWEEN CONVEYORS
			

■ 국내외 특허기술조사

✔ 볼륨체커 관련 특허

- 다층형 화물이송 시스템 중 볼륨체크 분야는 2000년 초반에 기술개발이 활발하였음
- 특히, 볼륨체커 분야는 한국에서도 2000년 중반부터 출원이 이뤄졌음

1990~2000	2001~2005	2006~2009
일본공개특허 1994-109448(1992) SHINKO DENSHI KK 치수 측정 방법	한국등록특허 0728880(2005) 아이피에스시스템 자동 화물 중량 측정 장치	유럽등록특허 2060472(2008) Noell Mobile Systems Portal fork lift with automatic steering
		

한국등록특허 0672044(2005) 서울대학교 자동 박스 치수 측정 장치


■ 국내외 특허기술조사

✔ WCS(Warehouse Control System) 관련 특허

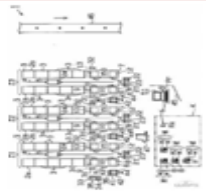
- WCS 분야의 핵심 특허는 일본과 미국에 집중되어 있으며 다수의 기술이 꾸준하게 개발되고 있음
- 특히, WCS 분야는 2000년대 이후 다수의 핵심기술이 출원됨

1990~2000

일본등록특허
3646381(1997)

TOYOTA AUTOM LOOM WORKS

IDENTIFICATION CODE READING DEVICE …

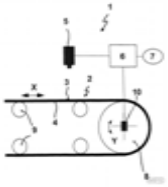


2001~2006

미국등록특허
7624857(2005)

Phoenix Conveyor Belt Systems GmbH

Device for monitoring a conveyor

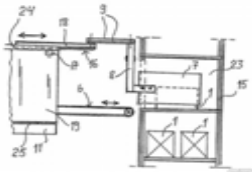


2007~2010

미국공개특허
20110176895(2011)

KORTELAINEN

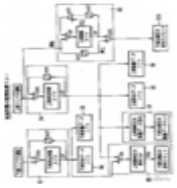
Method for Placing a Palletless Goods Package …



일본공개특허
1999-322053(1998)

MEIDENSHA CORP

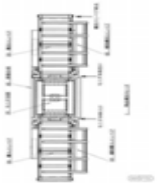
MONITORING DEVICE FOR CONVEYOR FACILITY



일본공개특허
2008-304365(2007)

FUJI ELECTRIC SYSTEMS

GOODS CARRYING-OUT MONITOR



참조: 미국조선업계의 기술개발 로드맵(2005~2010년)

Figure 2: The Challenge and Solution

Shipboard Internal Cargo Movement today...

and tomorrow ...

Safer, Quicker, Automated

High Rate Vertical & Horizontal Movement | Automated Warehouse | Compact, Agile Material Mover

MAPPING ENABLING TECHNOLOGIES TO TECHNOLOGY GAPS/CHALLENGES

Table 3: Workshop Identified Gaps & Challenges

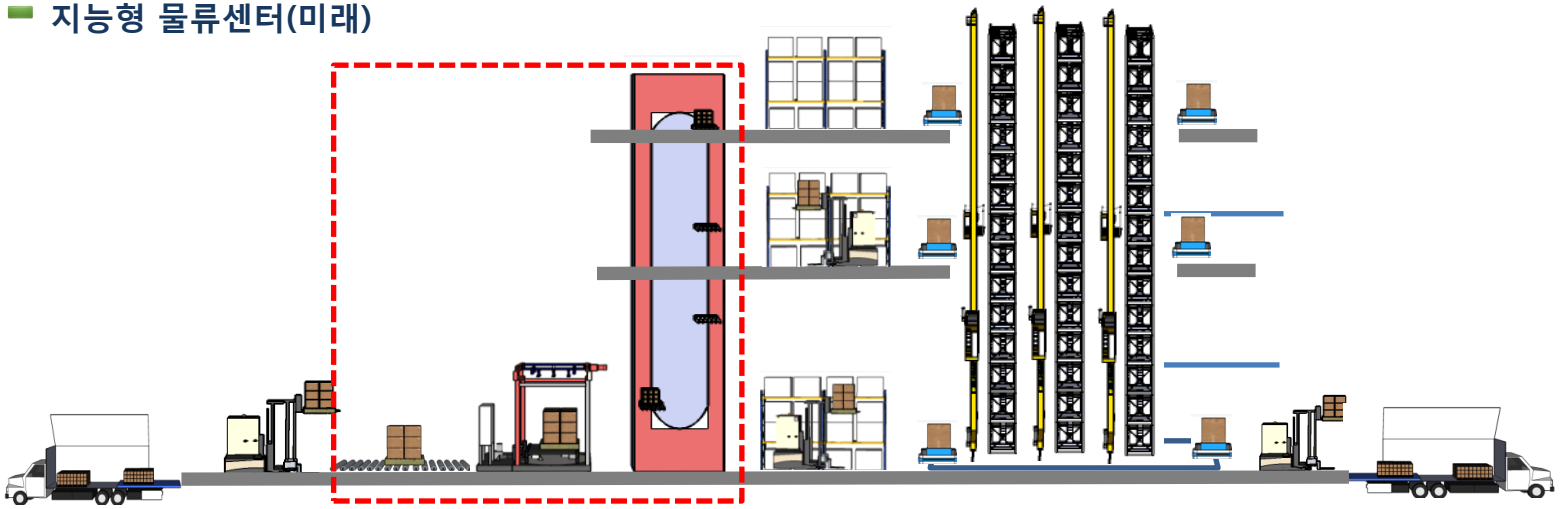
	Gap/Challenge to be Addressed	Relative Priority
1	Horizontal and Vertical movement; End-to-End	18%
2	Simultaneous Strike-Up/Down; Retrograde Handling; Supply to Weapons Systems (e.g., elevator systems)	14%
3	Total Asset Visibility-Infrastructure; Interface to Person; Messaging Interface; Bandwidth and Security; Wireless	10%
4	Automated Task Management System (from ordering to retrieval)	8%
5	At-Sea Transfer (Ramps, Lighters, Cranes, etc.) (MPF specific)	8%
6	Cargo Stowage (Restraint) at Sea is Manpower Intensive	6%
7	Lack of Standardization of Packaging	6%
8	Handling & Stowing (Breakout, Re-Packaging, Retrograde, Stow When Received)	5%

■ 다층형 화물이송시스템 개발 컨셉

✔ 지능형 다층형 물류센터와 물류활동의 정의

- 기계화 물류센터(현재)

- 지능형 물류센터(미래)



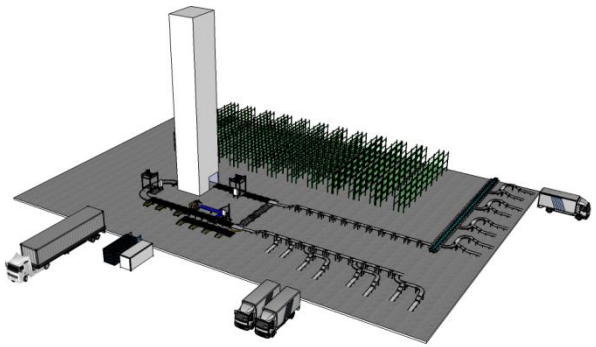
2. 연구내용

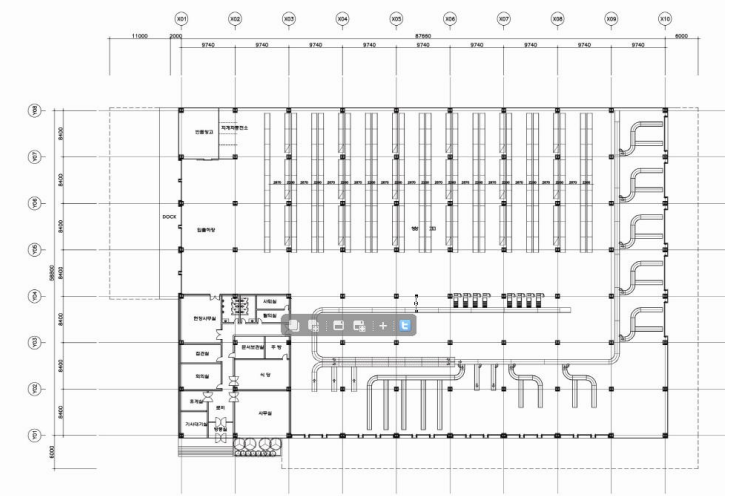
■ 컨셉검증

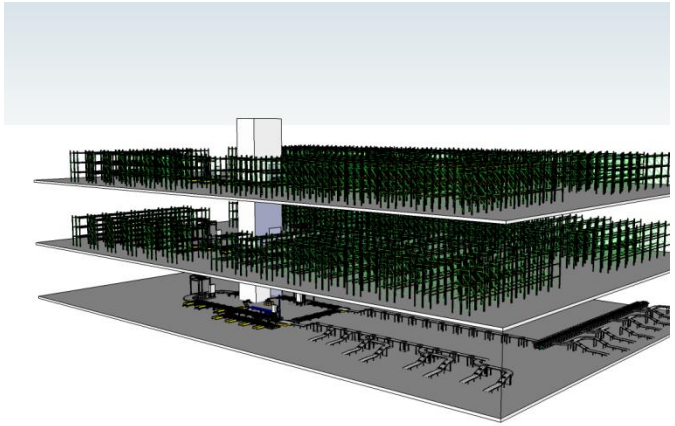
✔ 예비시뮬레이션 수행

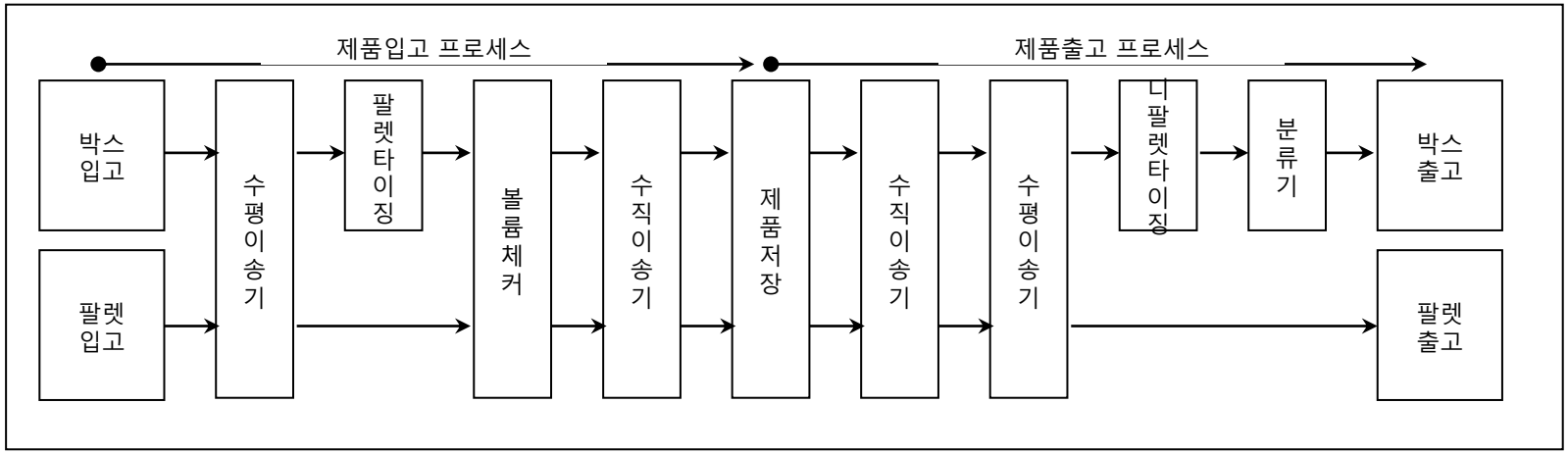
동영상

- 5,000㎥의 표준형 물류센터(C.C)에 컨셉제품을 설치하고 가상의 물류활동의 수행하여 기본적인 성능과 시사점을 도출하였음



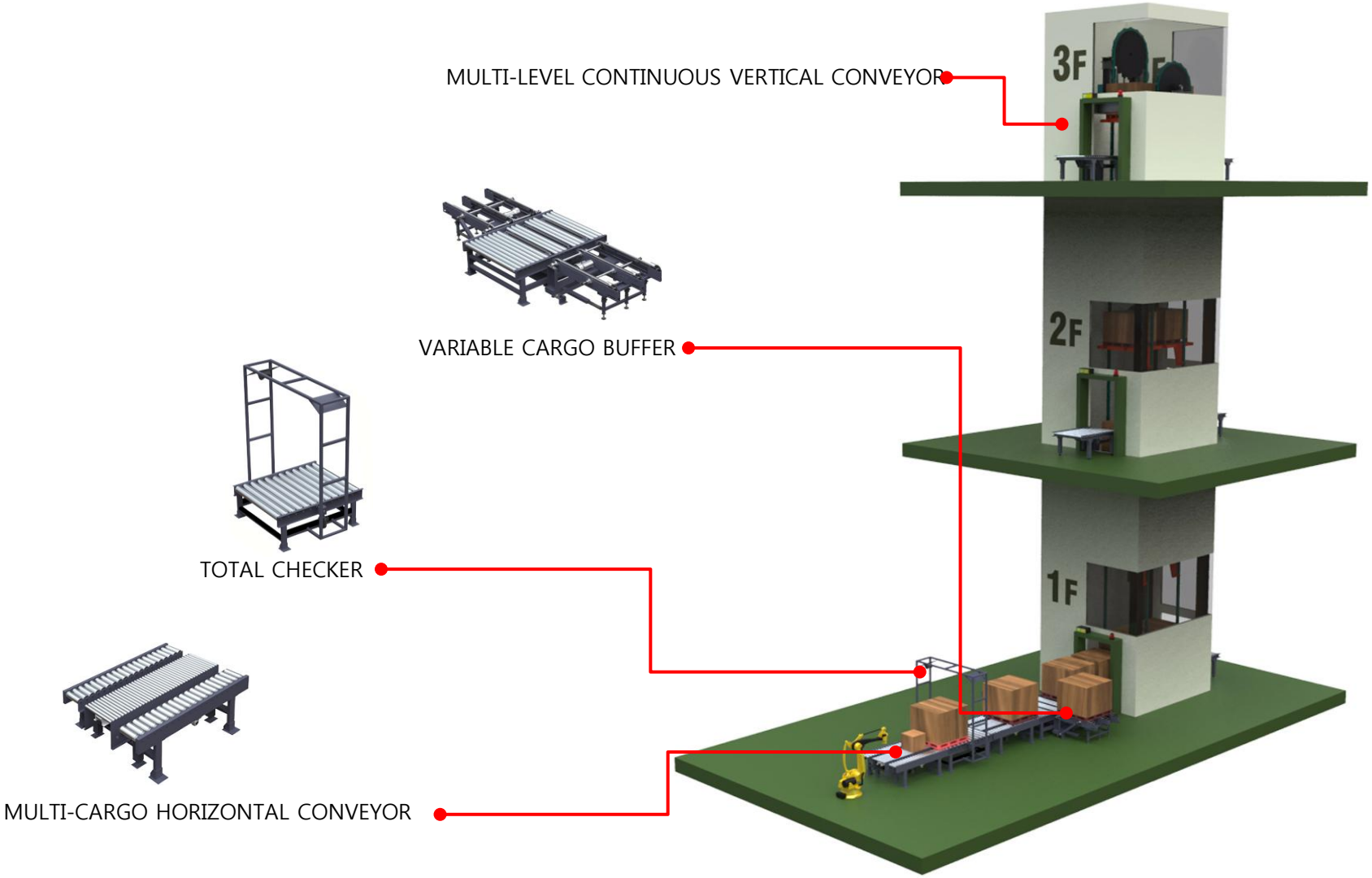






■ 다층형 화물이송시스템 구조설계

- 다층형 화물이송시스템의 장비군은 아래와 같이 배치되어 사용되어 질 것임



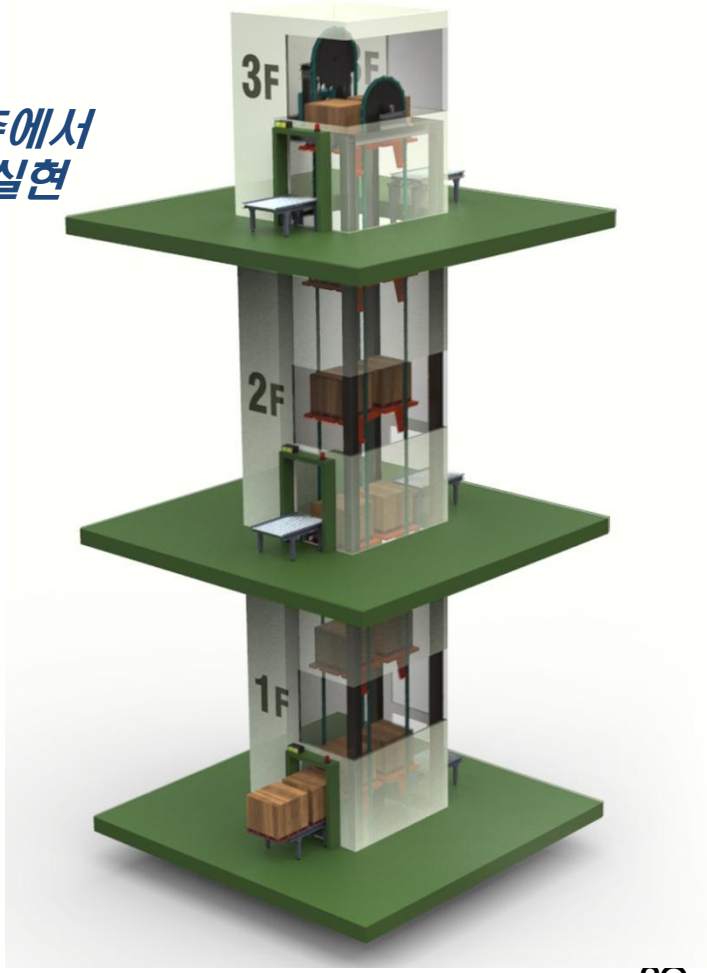
2. 연구내용

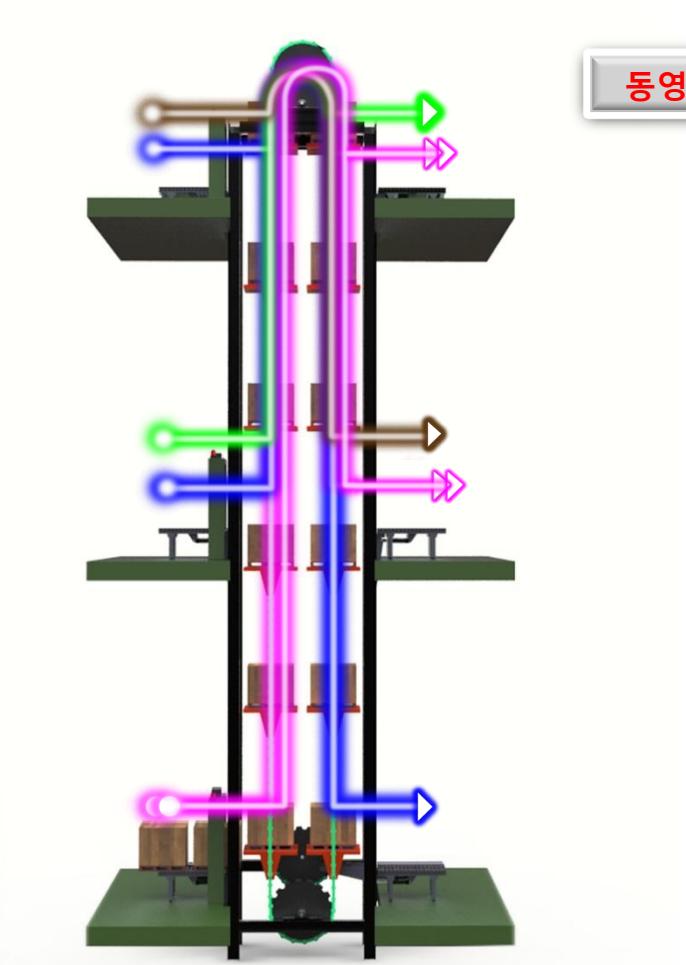
■ 다층형 화물이송시스템 구조설계

✔ 수직컨베이어 *"MULTI-LEVEL CONTINUOUS VERTICAL CONVEYOR"*

- 저층에서 고층, 고층에서 저층으로의 물류작업과 함께, 중간층의 물류작업도 가능한 王자형의 이송모드를 가짐

3개 이상 층에서 동시 작업 실현





동영상

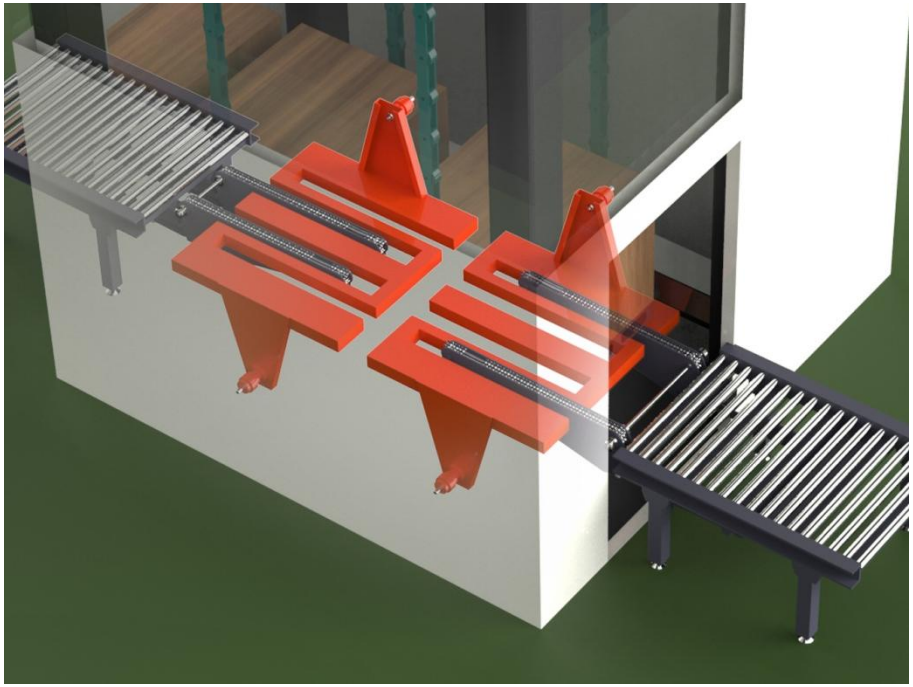
2. 연구내용

■ 다층형 화물이송시스템 구조설계

✔ 수직컨베이어 *"MULTI-LEVEL CONTINUOUS VERTICAL CONVEYOR"*

- 특별히 고안된 양방향 캐리어 구조와 IN & OUT FEEDER의 설계

"王" 자형 이송모드를 위해 개선된 캐리어



2. 연구내용

■ 다층형 화물이송시스템 구조설계

✔ 수직컨베이어

- (메인기어) 상하 각 2개의 2중 도르레 활용 = 30톤의 이송능력 확보
- (캐리어) 2중 고정을 통한 안전성 확보
- (캐리어) 상하 고정을 통한 최상층부에서의 수평유지

튼튼하고 안전한 구조
30톤(12palle) 동시 이송

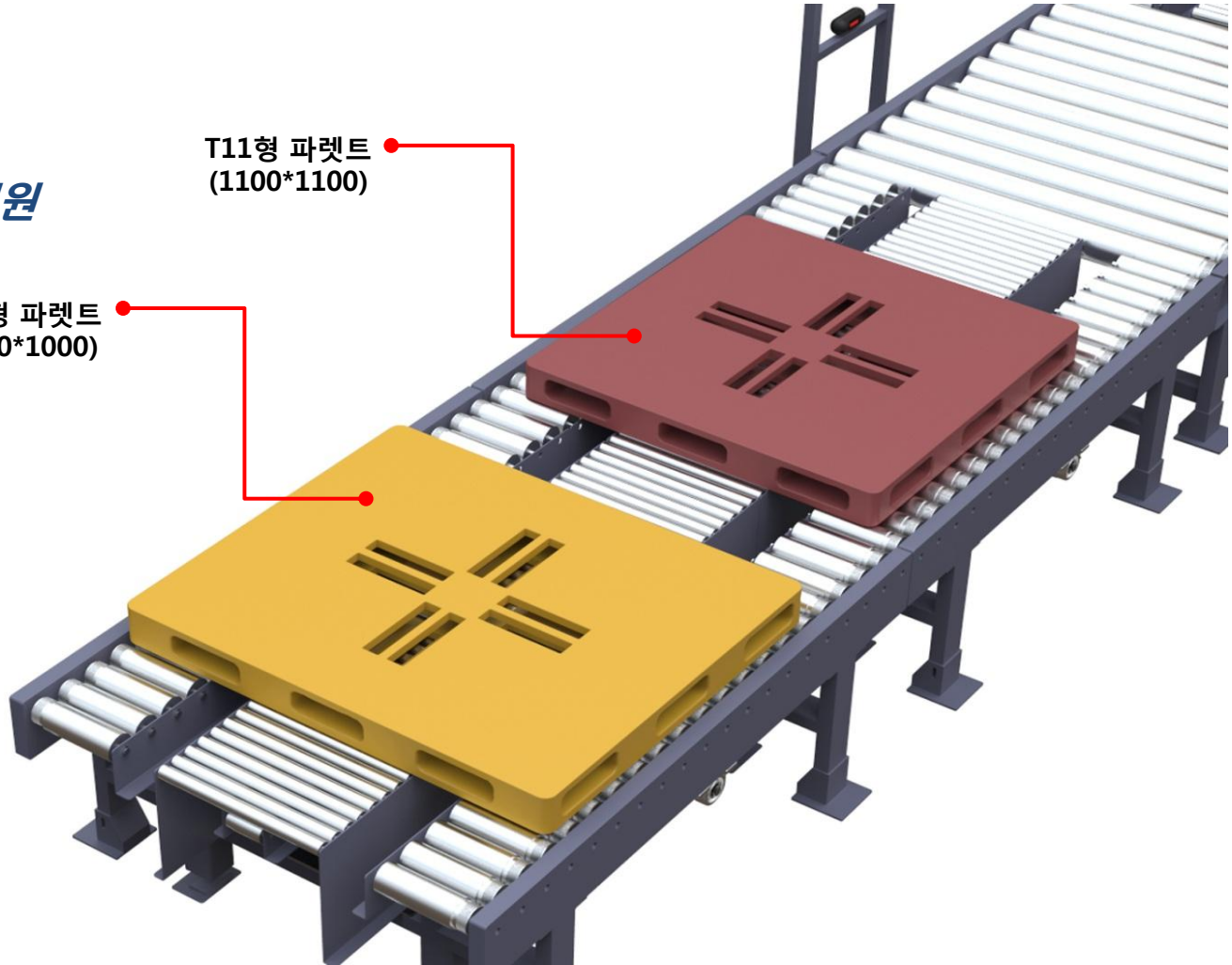
2. 연구내용

■ 다층형 화물이송시스템 구조설계

✔ **수평컨베이어** "MULTI-CARGO HORIZONTAL CONVEYOR"

- **듀얼모드(T11형과 T12형)가 사용가능한 사양**

듀얼표준 지원
다양한 화물이송 지원



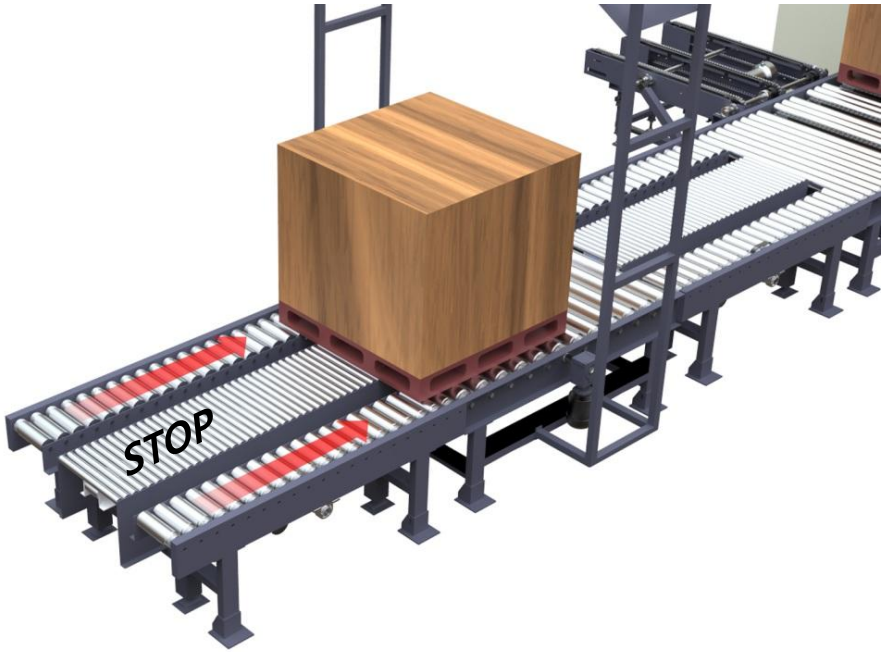
2. 연구내용

■ 다층형 화물이송시스템 구조설계

✔ 수평컨베이어

- 상황별 이송모드의 차별화로 에너지 효율 극대화

에너지 효율 극대화
(박스전용 및 파렛트화물 전용 이송모드 지원)



2. 연구내용

■ 다층형 화물이송시스템 구조설계

볼륨체커 *"TOTAL CHECKER"*

- 화물정보+화물적재상태+무게의 동시 파악이 가능한 구조와 인식장치 보유
- 탈부착이 용이한 랙형 구조물로 필요 시 식별장치 추가설치가 용이

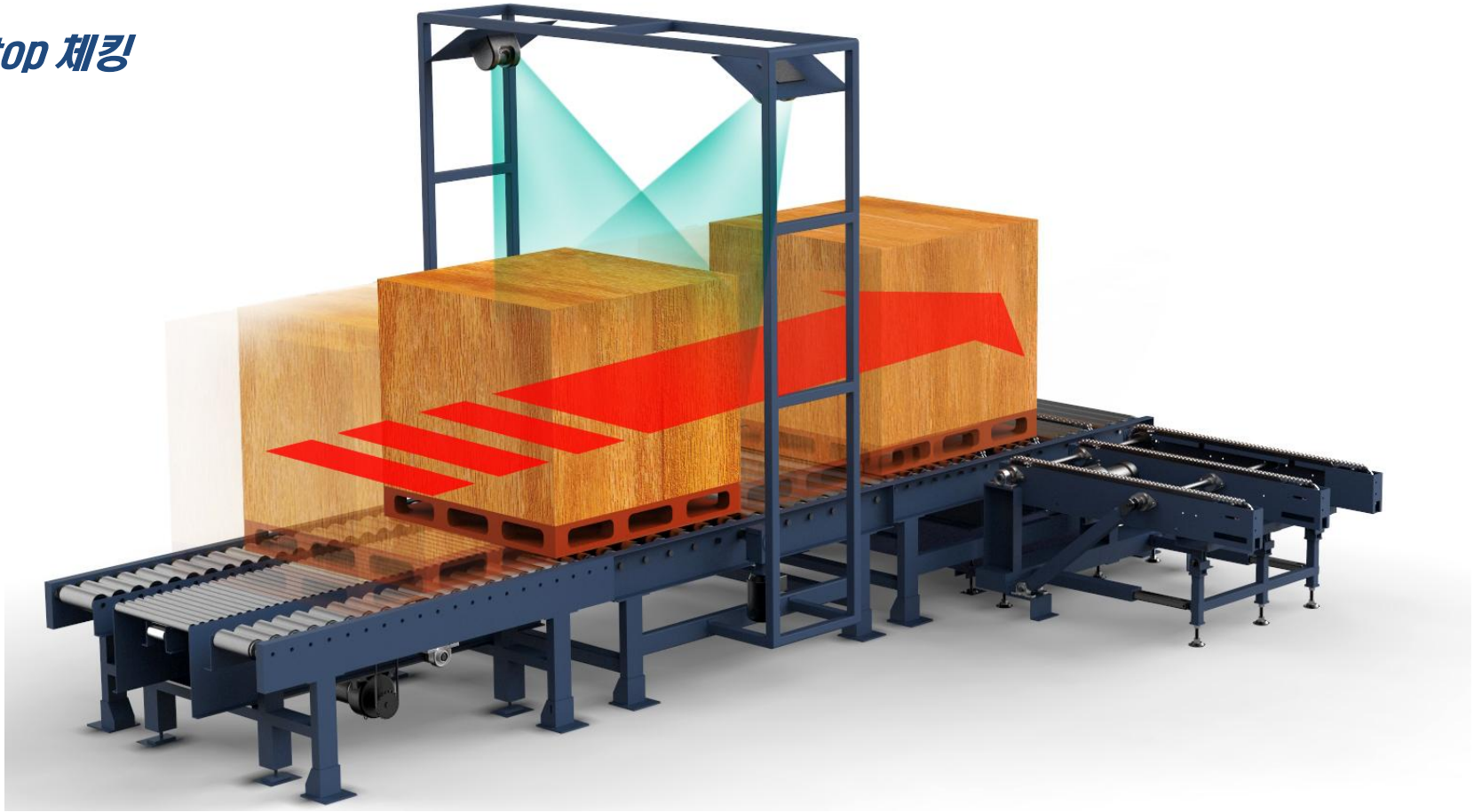
멀티 체크
화물정보+짐상태+무게의 동시 파악

■ 다층형 화물이송시스템 구조설계

✔ 볼륨체커

- 검색과정에서 화물의 흐름에 중단이 없음

Non-Stop 체킹



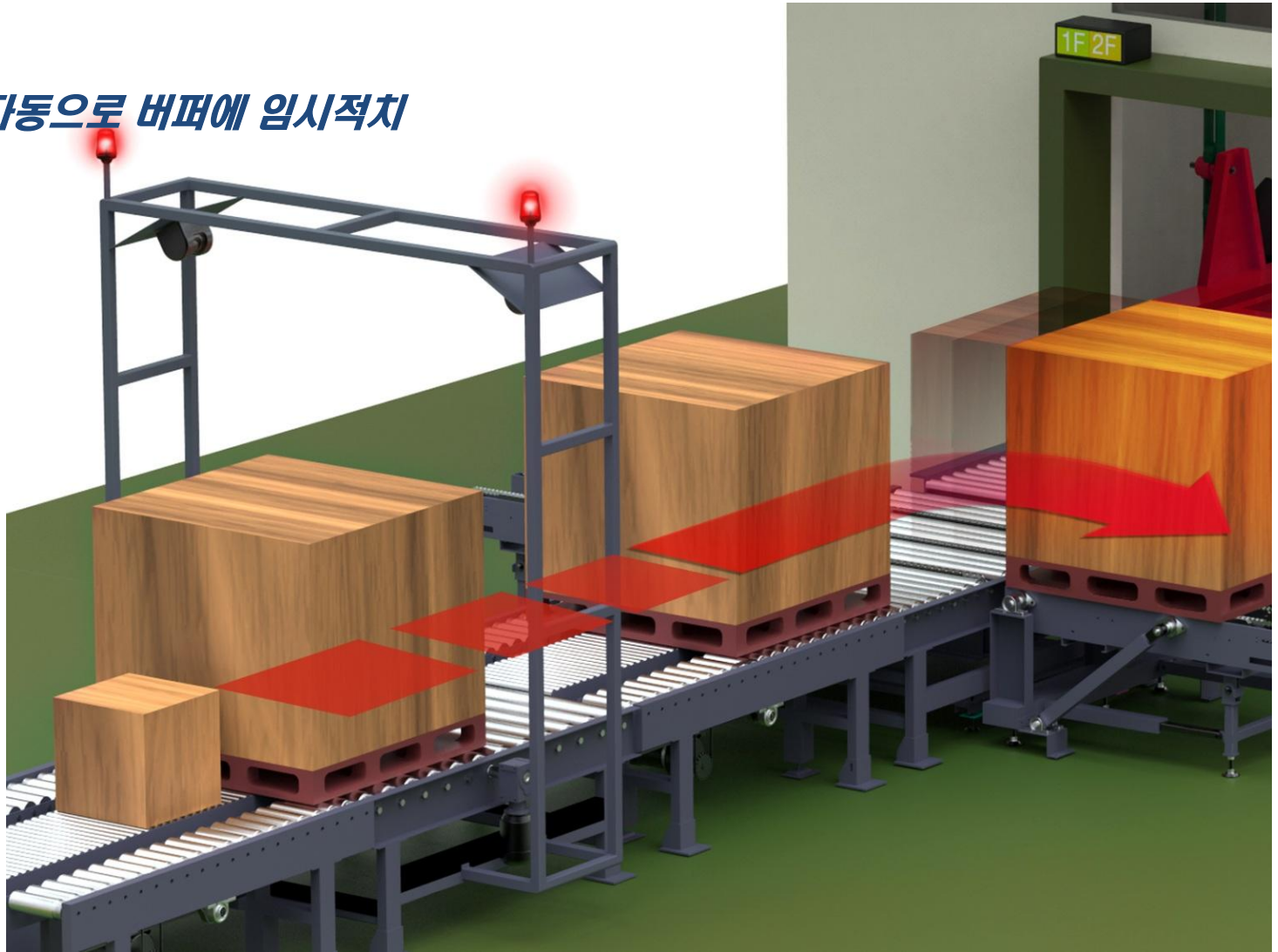
2. 연구내용

■ 다층형 화물이송시스템 구조설계

볼륨체커

- 이상화물 발견 시 수직컨베이어로 진입하지 않고 버퍼의 임시적치구역으로 자동이송

버퍼와 연결
이상화물 검색시 자동으로 버퍼에 임시적치



2. 연구내용

■ 다층형 화물이송시스템 구조설계

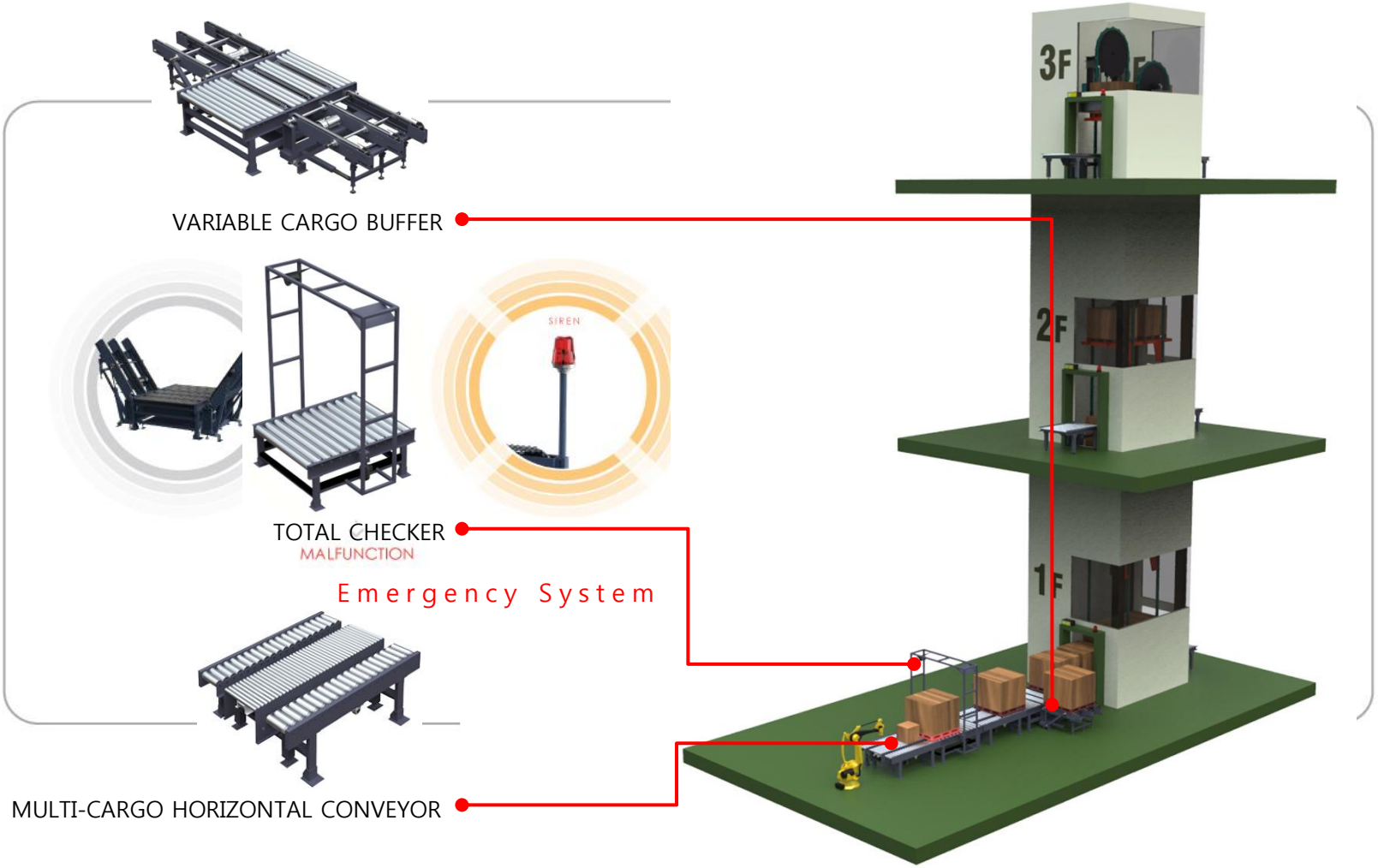
✔ 버퍼 "가변형 카고 버퍼"

- 임시적치 화물의 개수에 따른 확장 및 접힘이 원활한 구조임

가변형 구조
임시적치물의 개수에 따른
확장 및 접힘이 원활한 구조

■ 다층형 화물이송시스템 구조설계

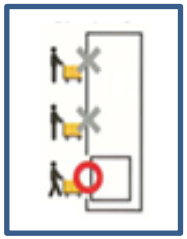
✔ 시스템간 연계 및 관제



2. 연구내용

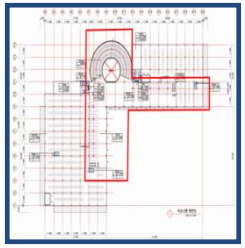
■ 기술별 예상 기대효과

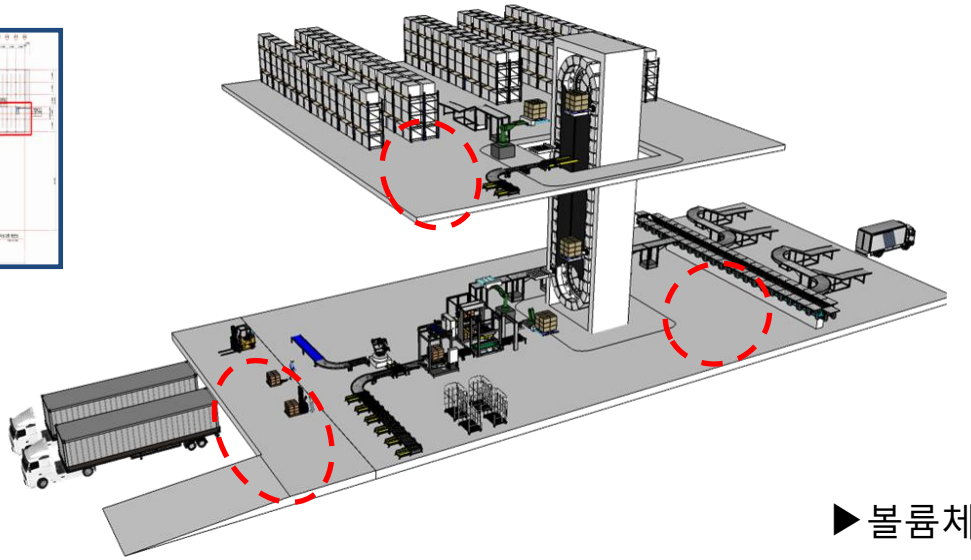
▶수직컨베이어



각 층별 동시작업, 전용면적 감소

-층 구분 없이 생산성 및 운영효율 향상(3층은 50%향상)

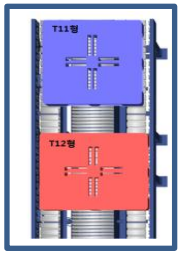


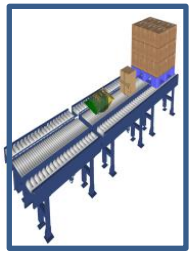


▶수평컨베이어

수평컨베이어 동시화물 처리

-초기투자 비용 절감
-공간 효율화





파렛트 화물 연속작업으로 이송능력 향상

-차량회전율 증가, 상하역 작업공간 감소
-도입장비대수 감소
-초기투자비용 및 운영비용 감소

▶볼륨체커

화물중량/체적인식

-검수시간 단축
-재고관리 수준 향상

3 물류기술 협력 방안

■ 한중일 공동 물류기술 개발의 필요성

✔ 한중일 간 교역량 지속적인 증가, 한국 물류기업(운수업)들의 중국투자 증대

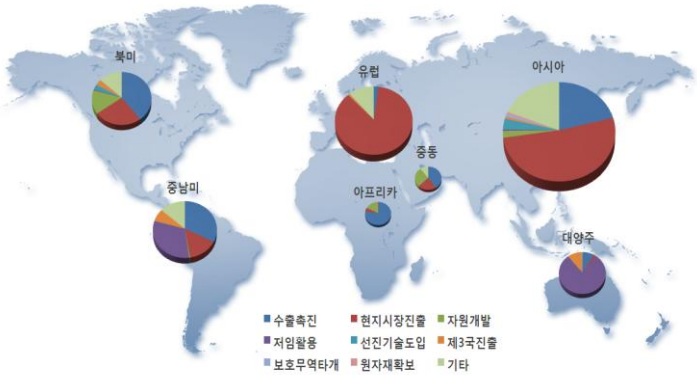
- 한국 1위 수출대상국은 미국에서 중국으로 변화 ('03년 이후), 수입대상국은 일본에서 중국으로 변화 ('07년 이후)
- 한국의 2011년 중국 투자액은 3,571,813천$이고 이중 운수업 투자는 50,789천$로 1.42% 차지함
- 기업들의 해외진출 시 물류센터 확보가 필요한데, 새롭게 임대 및 건설하는 부분에서 비용뿐만이 아니라 국가별 차이로 인한 개발 및 운영 상의 어려움 증가
  → 한중일 표준형물류센터 구축 필요

한·중·일 역내교역의 비중

1990년 → 2010년

12.3% → 22.5%

운수업 해외투자 현황

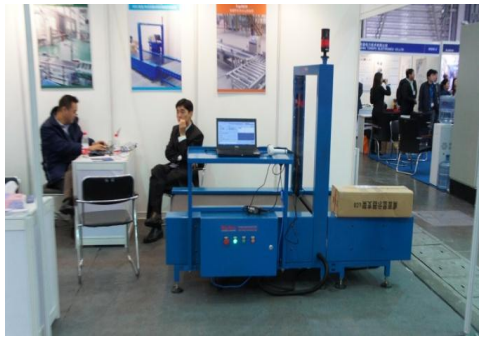


자료: OIS(해외진출정보시스템).go.kr

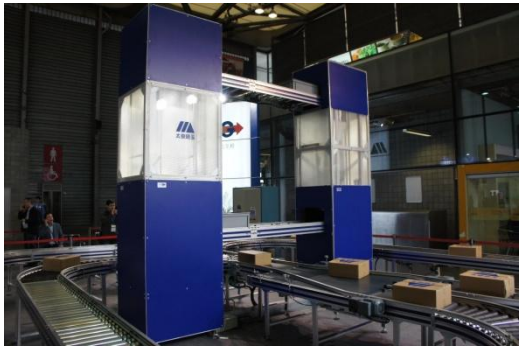
■ 한중일 공동 물류기술 개발의 필요성

✔ 중국 물류설비 및 장비시장 급성장

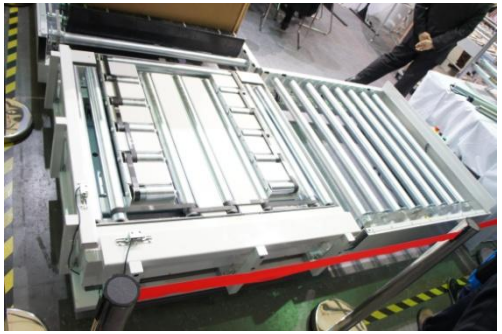
- 중국의 물류설비 관련시장은 매년 큰 폭으로 성장하고 있음. 그 배경에는 중국 내 지속적인 인건비의 상승에 따른 물류현장과 생산현장에서 지게차와 컨베이어 도입이 일반화되고 있기 때문임
- 성장하고 있는 중국 물류설비 및 장비시장을 확보하기 위해, 독일, 미국 등의 해외 기업들이 합자의 형식으로 진출하고 있음
- 한중일 물류설비 및 장비의 공동 개발 및 협력을 통해 한중일 물류산업의 발전을 견인할 수 있을 것임



볼륨체커



수직반송기

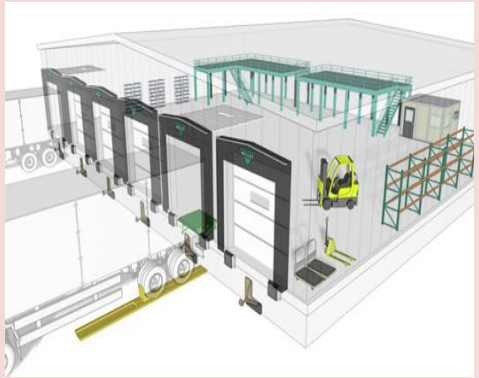


자체구동롤러와 화물이재기

출처: 상해물류박람회, CEMAT 2012

■ 한중일 물류기술 개발을 위한 제언

한중일 표준에 부합하는 물류센터 공동기술개발



물류설비 및 장비 표준화

입출고 활동 등의 물류작업 표준화

↓

해외진출기업들의 운영효율화

물류기술 보급 및 확산을 위한 인큐베이터

- 한중일 물류기술에 대한 종합 정보 제공
- 한중일 물류센터 시설기준 (가이드라인) 공동개발

기술협력 및 공동개발 지원방안 모색

↓

한중일 물류기술 Test-bed

■ 한중일 물류기술 개발을 위한 제언

✔ 한중일 물류기술을 선도적 발전시키기 위해서는

- 선도적 기술을 개발할 수 있는 인큐베이터 (연구소, 학계 중심)
- 개발된 기술을 보급 및 확산을 위한 인큐베이터(기업 중심)

다층형 화물이송시스템 기술개발

경청해 주셔서 감사합니다.