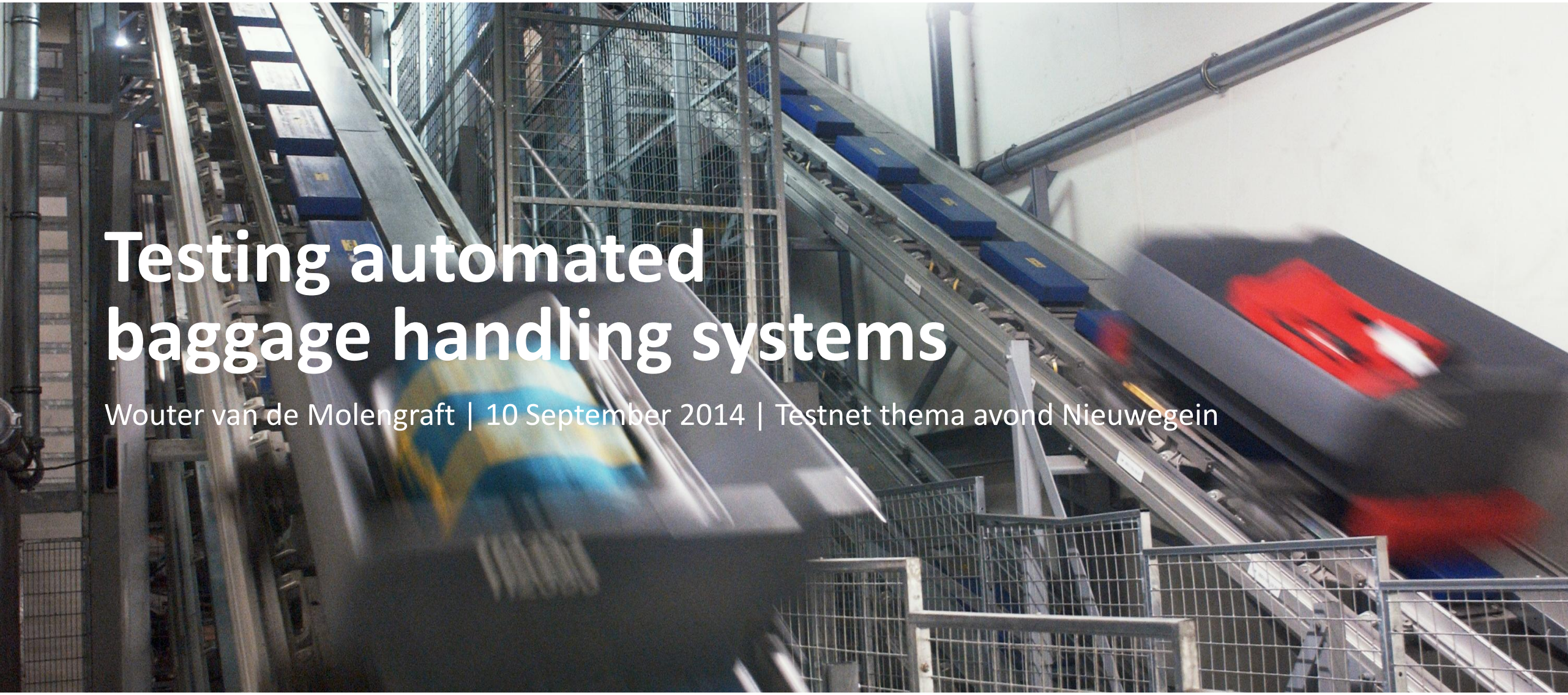
VANDERLANDE



Testing automated baggage handling systems

Wouter van de Molengraft | 10 September 2014 | Testnet thema avond Nieuwegein

Contents

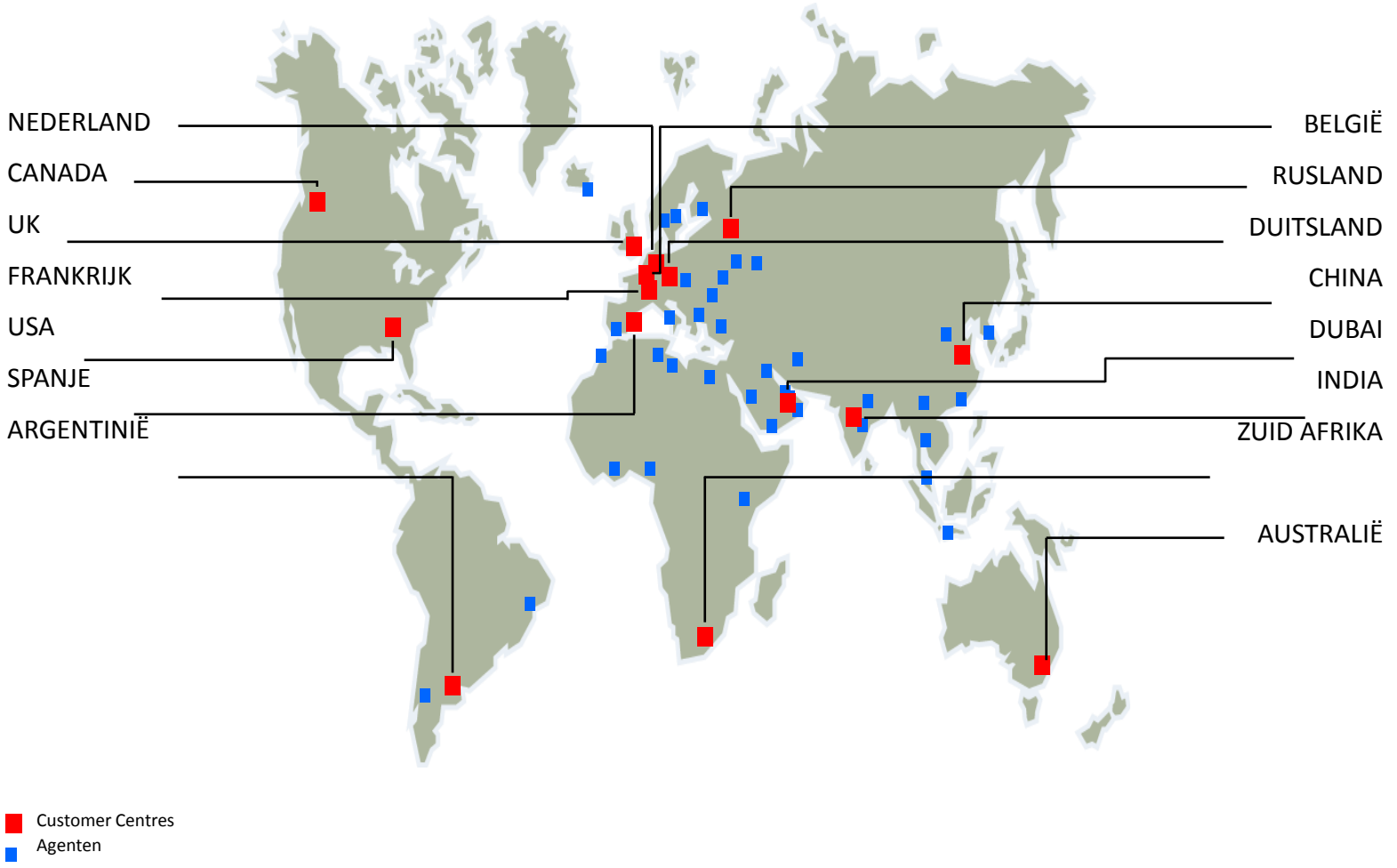
Vanderlande - Material handling systems (1/3)

Vanderlande - Material handling systems (2/3)

Vanderlande - Material handling systems (3/3)

Vanderlande - The company

- 2800 employees
- Headquarters in Veghel
- Global presence



Baggage handling system

Test scope

Routing
Flight planning
Governance
Analysis

High Level Controls (HLC)

Start-stop
Tracking
Merge flows

Low Level Controls (LLC)

Conveyor
Crane
Label reader

Field equipment

VANDERLANDE

Construction works on site

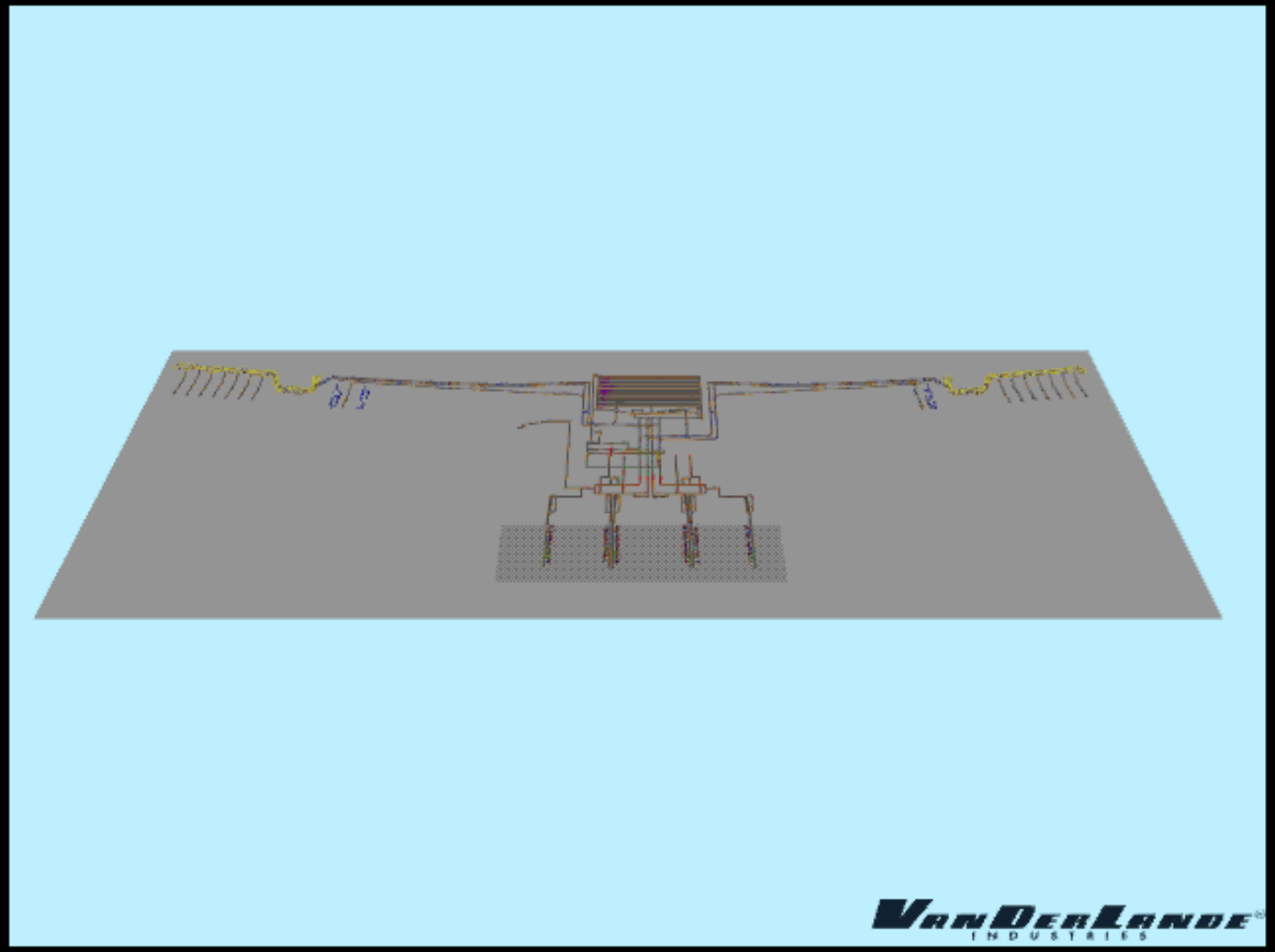
Unexpected events

Climate

Interference with daily airport operation

Staffing and coordination

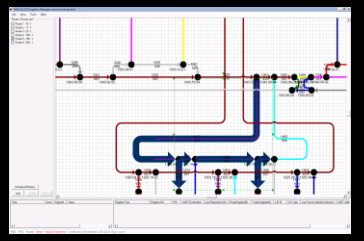
Generic test approach – Use of emulation / simulation models



Test approach – Low level controls using individual models

Routing
Flight planning
Governance
Analysis

High Level Controls (HLC)



High level stubs

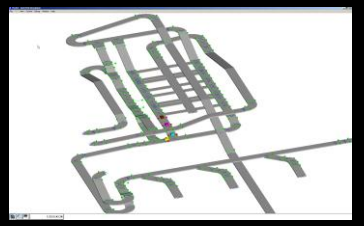
Start-stop
Tracking
Merge flows

Low Level Controls (LLC)

Real PLC

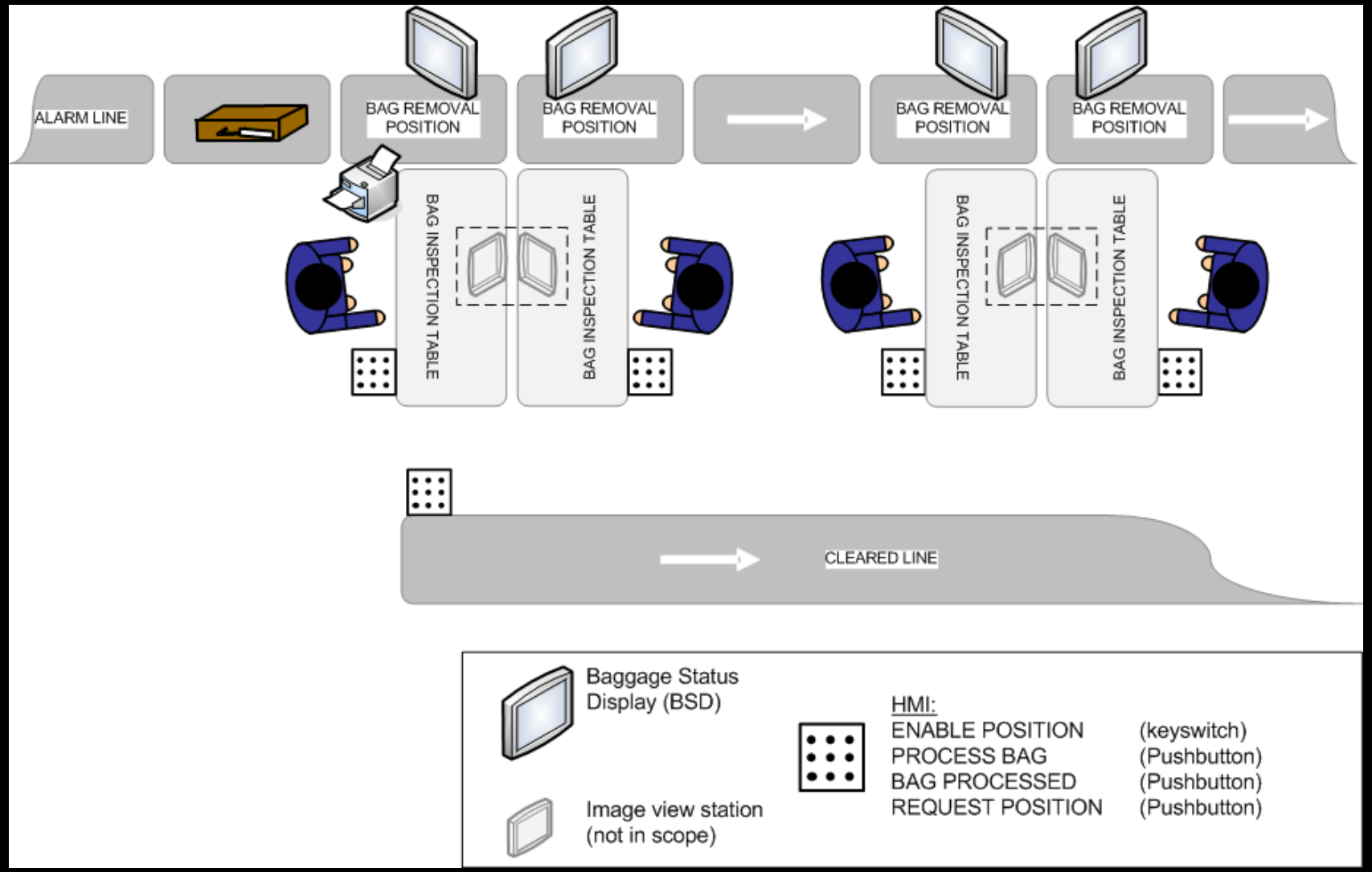
Conveyor
Crane
Label reader

Field equipment

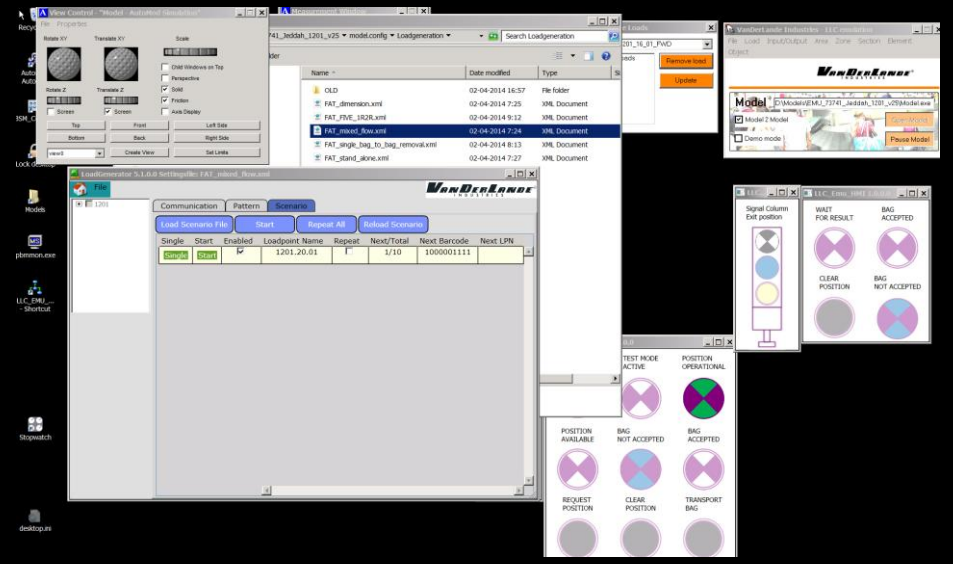


Emulated area

Example test case – Security screening (1/2)



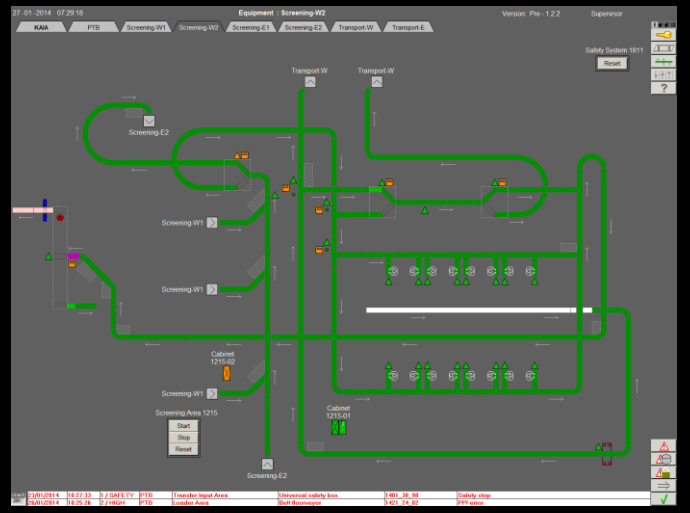
Example test case – Security screening (2/2)



BRP\BIT 1215.67.80 Available 10:45

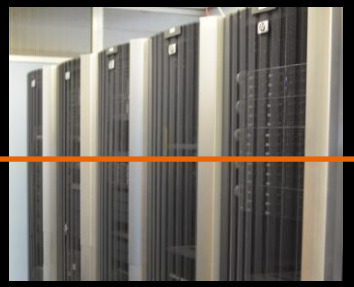
Bag Data

BID	N10_01234567890	EDS_Id	1201.16.03
Bag Status	**UNCLEAR**		
Required : 1 Reached : 0 Failed : 2		LPN 1234567890	RFID

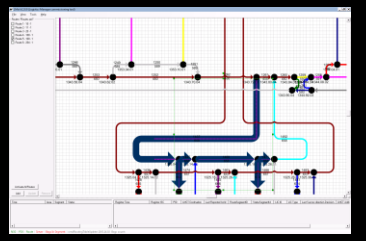


Test approach – Low level controls using integrated models

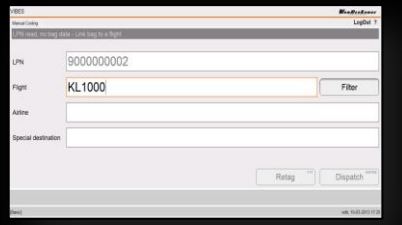
Routing
Flight planning
Governance
Analysis



High Level Controls (HLC)



High level stubs



Real high level controls

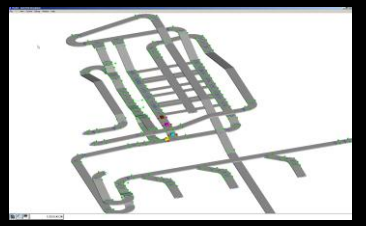
Start-stop
Tracking
Merge flows

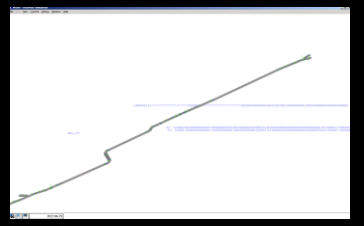
Low Level Controls (LLC)

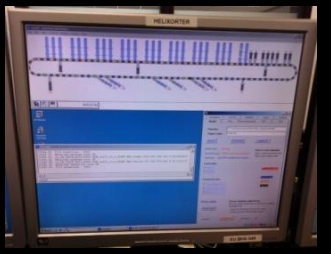
Multiple real low level controls

Conveyor
Crane
Label reader

Field equipment





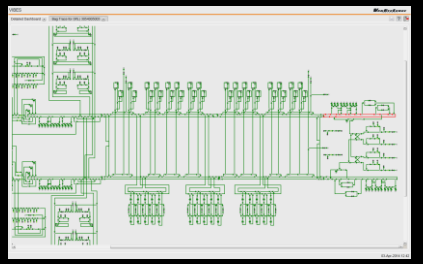


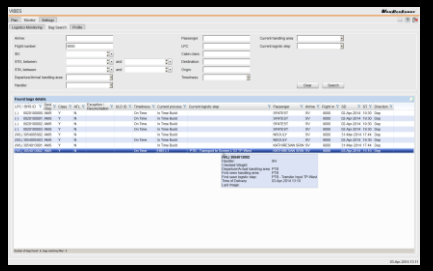
Multiple emulated areas

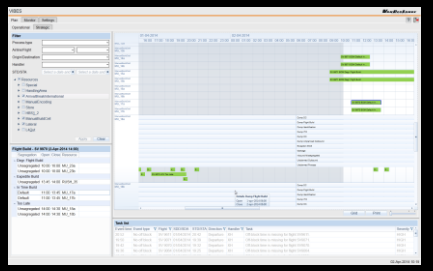
Test approach – High level controls using integrated models with LLC emulation

Routing
Flight planning
Governance
Analysis

High Level Controls (HLC)







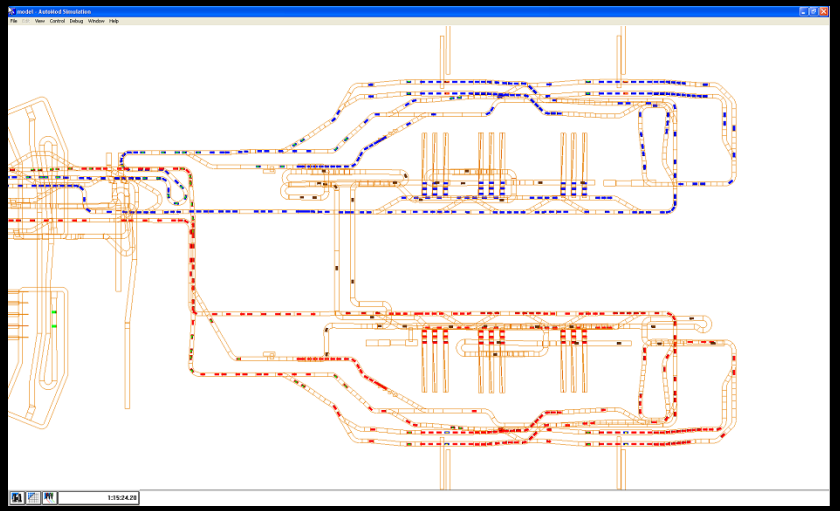
Real high level controls

Start-stop
Tracking
Merge flows

Low Level Controls (LLC)

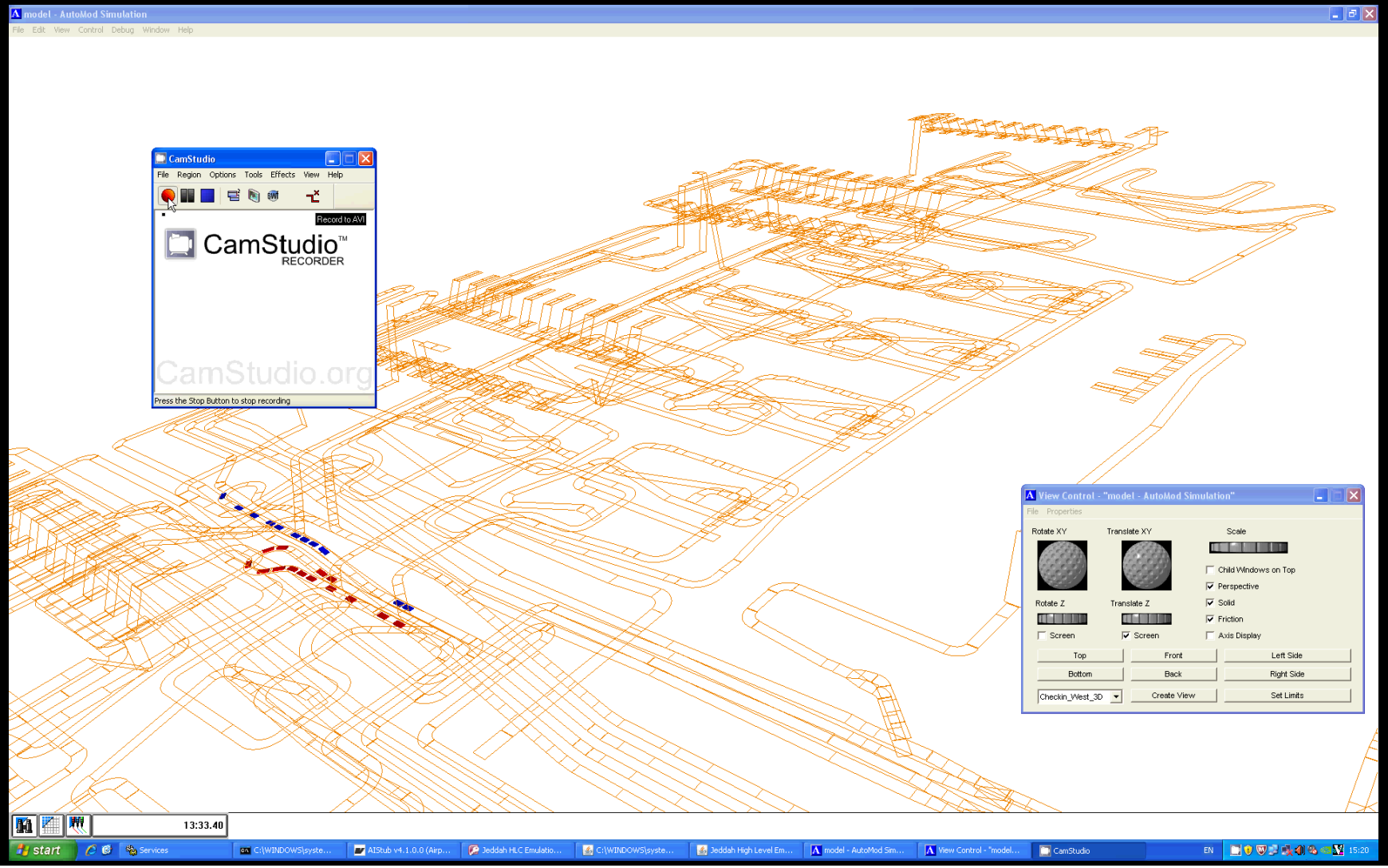
Conveyor
Crane
Label reader

Field equipment



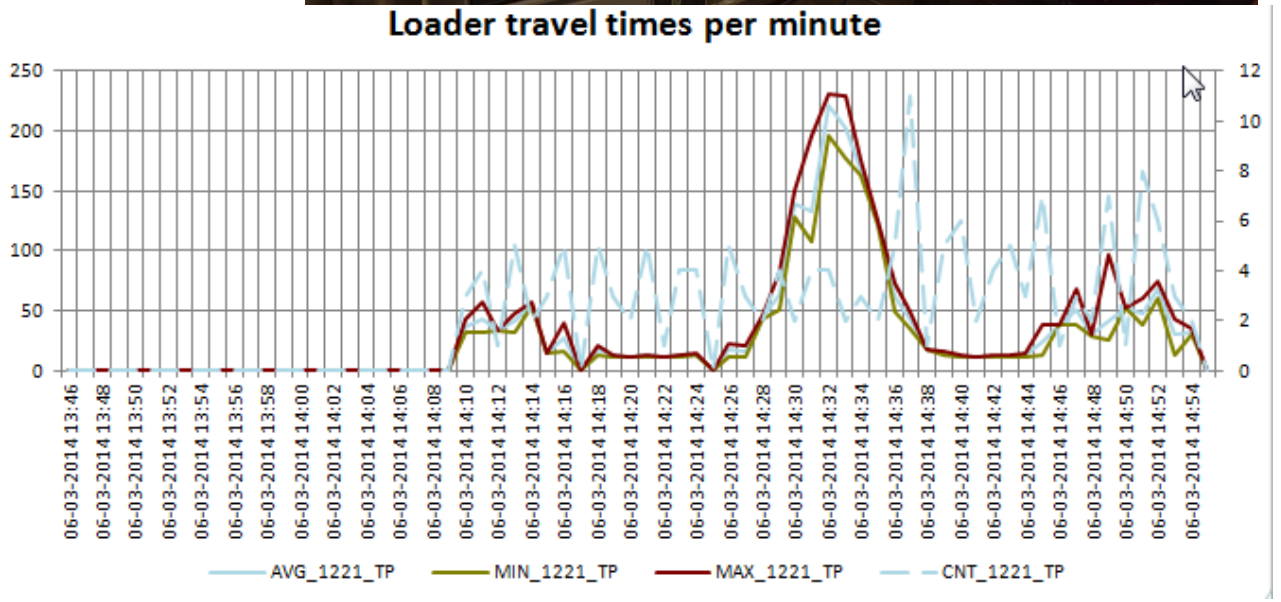
Emulated field equipment and LLC controls

Example test case – Performance testing (1/2)



Example test case – Performance testing (2/2)

- Empty tub management (e.g. wait times at loaders)
- Performance of user interfaces
- Capacity (bags per hour)
- System usage (CPU / memory)
- Message flow (messages per component per second)
- Travel times
- Gridlock



Conclusions

Advantages

- Decreased **site test time** (>50% of tests completed in factory)
- Increased **software maturity** at start of site testing
- Decreased amount of **staff** required for testing
- Decreased **test overhead** (e.g. no physical bags)
- Decreased amount of **nightly test hours**
- Decreased impact of **recovery times**
- Increased **sales potential** (e.g. training environment)

Disadvantages

- Increased effort for **test environment maintenance**
- Increased **software development** and **test effort** (15% of defects on emulation)
- Increased amount of **regression testing** (rerun factory tests on site)

Emulation is not a replacement for site testing

And even after site testing unexpected behaviour can be expected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