

# VECTO 3.x

3.5.2022



## Release Notes

# Vecto 0.7.8.2679 Development Version

## April 2022

- **Changes/Bugfixes**

- Multi-Target Executables in .net 6.0 and .net Framework 4.8 (and .net Framework 4.5, but this will be removed with the next release)
- Implementation Serial Hybrid Vehicles S2, S3, S4
- Implementation APT-S/P with E2 and S2 vehicle architecture
- Correct handling of retarder positions with HEV and PEV, adding axlegear input retarder option
- Update hashing tool to handle new powertrain components (electric motor, battery, supercap)
- Changing EM overload buffer calculation: interpolate between both voltage levels (pre-processing)
- Handling of torque limitations (engine torque limit, boosting torque limits, gearbox torque limits) for P2 architecture
- Connect electric WHR system to REESS in case of hybrid vehicles
- Update LH cycle
- GUI improvements: enable/disable some fields in Job Form, Vehicle Form, and Hybrid Strategy Parameters to simplify user interface and avoid erratic entries.

# Serial Hybrid Implementation

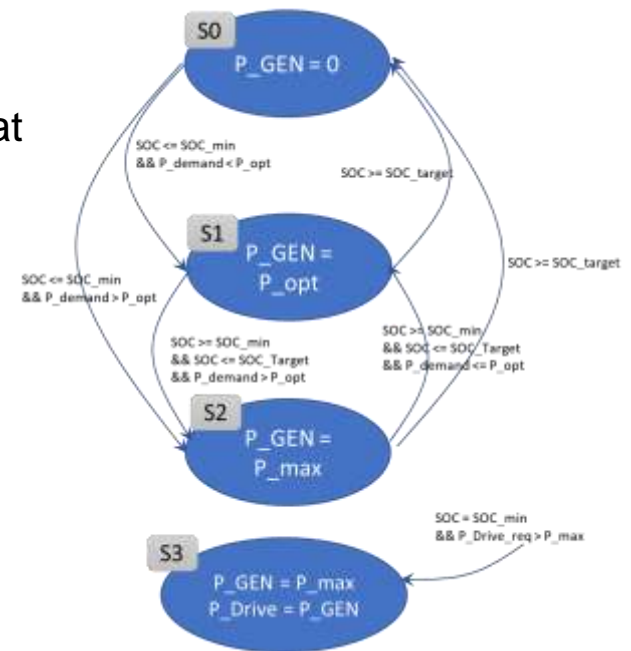
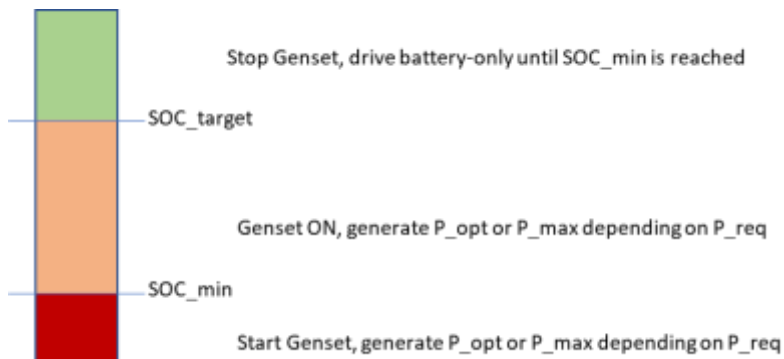
- General approach
  - Simple operating strategy, not ECMS–based
  - Three-point controller for GenSet (off/optimal point/maximum power)
  - Operate GenSet in optimal load-points whenever required and possible
  - Drivetrain similar to PEV

# Serial Hybrids: GenSet Pre-Processing

- Find optimal points for the GenSet
  - Iterate from 0 to maximum power of the ICE (20 steps)
  - Iterate from ICE idle speed to  $n_{95h}$  speed (20 steps)
  - Calculate electric power and fuel consumption for all load-points
  - Select operating points:
    - Maximum electric power, EM de-rated/not de-rated
    - Optimal operating point (minimum FC per electric power generated), EM de-rated/not de-rated

# Serial Hybrid Strategy (main principles)

1. Calculate max. electric power GenSet can provide
2. Calculate power demand of electric motor, assuming max. electric power (REESS + GenSet)
3. Depending on drivetrain power demand and SoC turn on ICE and operate GenSet either in optimal point or at maximum power (considering de-rating of GenSet)



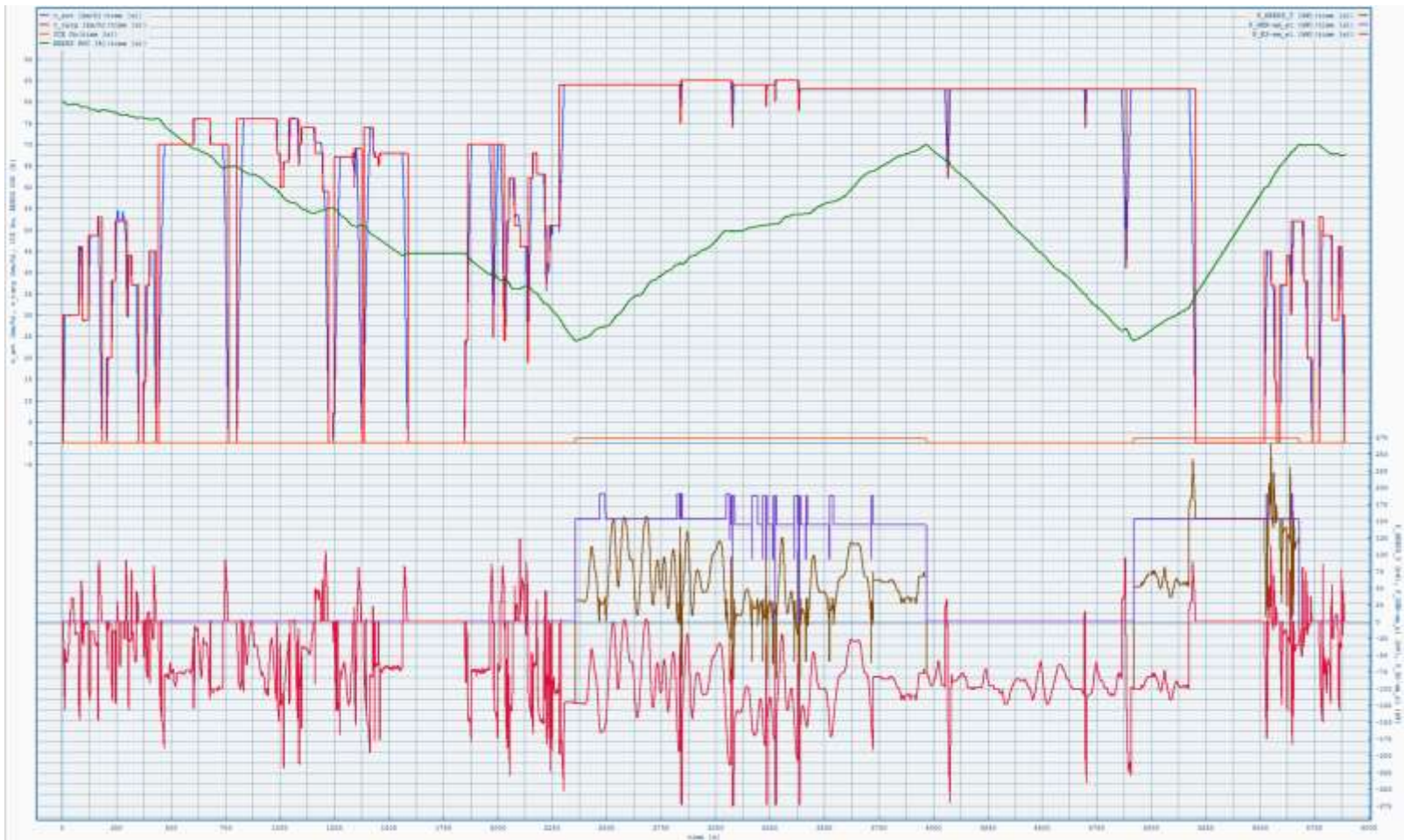
*Note: SoC\_min and SoC\_target are parameters of the SerialHybridStrategy, not REESS*

## Serial Hybrids: GenSet

- When switching on the ICE, it is often not possible to directly operate it in the desired operating point (high ICE speed, too high torque demand due to inertia)
- ➔ Ramp-up ICE with electric machine switched off (usually 1 or 2 simulation steps) and then turn on the electric machine

## Serial Hybrid Strategy Parameters

- MinSoC
- TargetSoC





# EM: overload buffer calculated from both voltage levels

- Input parameters of EM measured for min and max voltage level
  - Overload data
    - Continuous Torque
    - Overload Torque + Overload Duration
  - Maximum and Minimum torque limitations
  - Electric power map
- Implementation in software:
  - From overload data above, thermal buffer is calculated for each voltage level separately (acc. to equations in VECTO user manual)
  - Applied values for simulation run are calculated by line  $E_{th,buf} = (P_{loss,ovl} - P_{loss,cont}) \cdot t_{ovl}$  two voltage levels, where average of usable SOC range is used
    - Overload buffer
    - Maximum and Minimum torque limitations
    - Continuous Torque

# Consider gearbox MaxTorque limits for HEV

- Ref. to ticket nr. 1478+1479
- Only relevant for P1 + P2 HEV where EM is located upstream of transmission
- Starting Point: ICE FLD

1. Crop with max ICE torque declared at vehicle level (per gear)

*'Vehicle/EngineTorqueLimits' per gear – P196 + P197*

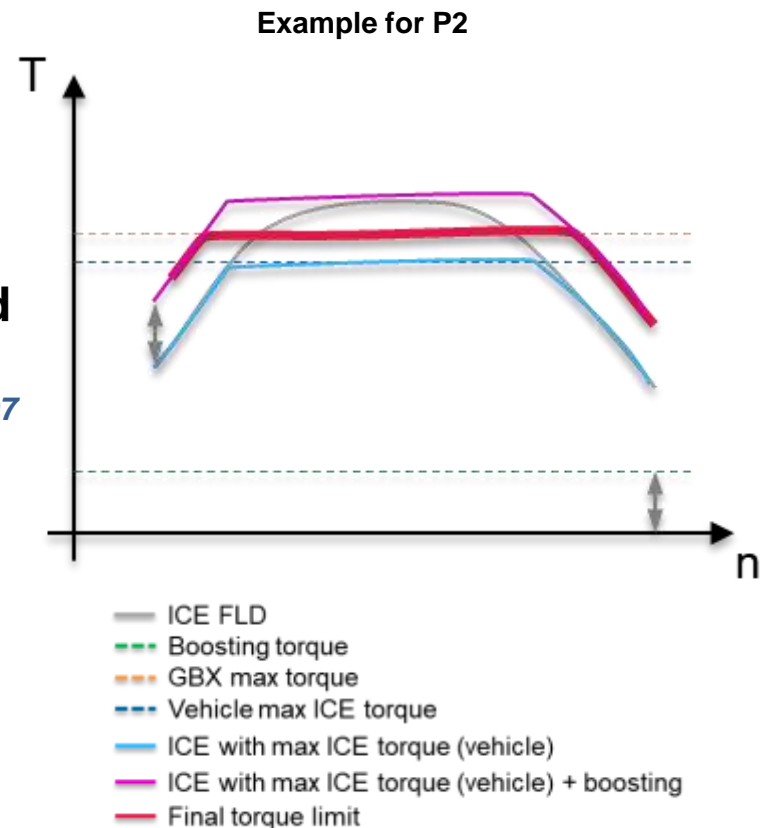
2. Add boosting torque

*Boosting limitations for parallel HEV – P415 + P416*

3. In case of P1 or P2: crop with gearbox max input torque (per gear)

*MaxTorque – P157*

→ Torque limits per gear applied by HybridStrategy



# Vecto 0.7.8.xxx Development Version

## April 2022

- **Detailed Changes/Bugfixes (See [CITnet/Jira](#))**
  - [VECTO-1541] - Implement E2/S2 with APT-S/P
  - [VECTO-1549] - Error in gearshift behavior for AT transmissions when braking
  - [VECTO-1466] - 076.2451 E2 significant increase of calculation time
  - [VECTO-1479] - Maximum gearbox torque not respected
  - [VECTO-1519] - 077.2457 E2 Gear oscillation
  - [VECTO-1520] - 077.2457 P2 Crashing at takeoff
  - [VECTO-1531] - ElectricMotor Lookup Maximum Torque: Object reference not set to an instance of an object
  - [VECTO-1532] - 077.2547 P2 crashing with 600 RPM idling speed
  - [VECTO-1539] - Engine speed ramping up before vehicle halt
  - [VECTO-1551] - AT-P Transmission Bus Application: Error during braking phase
  - [VECTO-1559] - battery internal resistance curve
  - [VECTO-1411] - Switching to new .NET version
  - [VECTO-1456] - Cycle Cache in engineering mode
  - [VECTO-1478] - Torque limits only apply to ICE
  - [VECTO-1521] - Updating tyre dimensions
  - [VECTO-1522] - VECTO warning if there are more steered axles than steering pump technologies

# Vecto 0.7.8.xxx Development Version

## April 2022

- **Detailed Changes/Bugfixes (See [CITnet/Jira](#))**
  - [VECTO-1525] - PCC Preprocessing
  - [VECTO-1533] - Multi-Target Compilation and .NET Upgrade
  - [VECTO-1538] - Transmission ratios limitation of input value to  $\leq 25$
  - [VECTO-1540] - Retarder Types AxleGearInputRetarder
  - [VECTO-1543] - Calculation of EM Overload buffer, and continuous torque
  - [VECTO-1545] - WHR electric - connect to REESS
  - [VECTO-1548] - Update Coach cycle
  - [VECTO-1560] - update toolchain for generating usermanual
  - [VECTO-1562] - Adapting WHTC Correction Factor weighting for LH Cycle
  - [VECTO-1563] - Electric Motor: Calculation of Overload Buffer
  - [VECTO-1564] - XML Schema adaptations
  - [VECTO-1565] - VECTO warning if there are more steered axles than steering pump technologies
  - [VECTO-1569] - Bugfix: Extrapolation warning in PEV shift strategy
  - [VECTO-1573] - Update LH Cycle and WHTC correction factor weighting

# Vecto 0.7.7.2547 Development Version

## December 2021

- **Changes/Bugfixes**

- Implementation APT-N Gearbox + shift strategy
- Update EM model (drag curve independent of voltage level)
- Update EM electric power map interpolation method
- Update user manual
- Update/bugfixes PEV shift strategy (influence of drag curve, error in calculation of costs)
- Bugfix calculation E\_EM\_off\_loss
- Update generic shift lines for PEV E2
- Bugfix post-processing fuel consumption correction bus auxiliaries (in case of no alternator)
- Bugfixes PCC for xEV

# Vecto 0.7.7.2547 Development Version

## December 2021

- **General comments (1/x)**

- All topics in this section will also be explained in the next xEV workshop #9 on 11.01.2022
- Also topics for testing and feedback will be discussed in this workshop.  
Until then, no feedback on the distributed version is expected.
- Calculation of overload buffer for EM
  - Overload buffer is currently calculated with data for lower voltage level only
  - Update of calculation method based on two voltage levels will be implemented once all details reg. the method are clarified
- Propulsion Torque Limits (Vehicle Boosting Limits)
  - In the rotational speed range from 0 to engine idling speed the full load torque available from the ICE equals the ICE full load torque at engine idling speed due to the modelling of the clutch behaviour during vehicle starts.
  - Any arbitrary number of values may be declared in between the range of zero and the maximum rotational speed of the ICE full load curve.
  - Declared values lower than zero are not allowed for the additional torque.
  - For detailed explanation refer to user manual (“Vehicle Editor – Torque Limits Tab”, “Torque and Speed Limitations”)
- Pulse-duration dependency of internal resistance of battery
  - For detailed explanation refer to user manual
- HEV operation strategy method for declaration mode
  - Method explained in “User Manual/HEV\_DECL\_method\_20211221.pptx” distributed together with VECTO archive
  - Generic values defined per (vehicle group, mission, payload and usable SOC range) in “User Manual/HEV\_Strategy\_Parameters.xlsx” distributed together with VECTO archive
  - For further details refer to distributed material/recording from xEV workshop #8

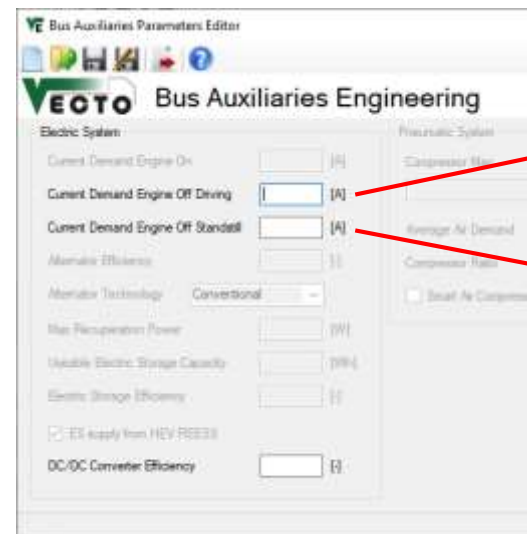
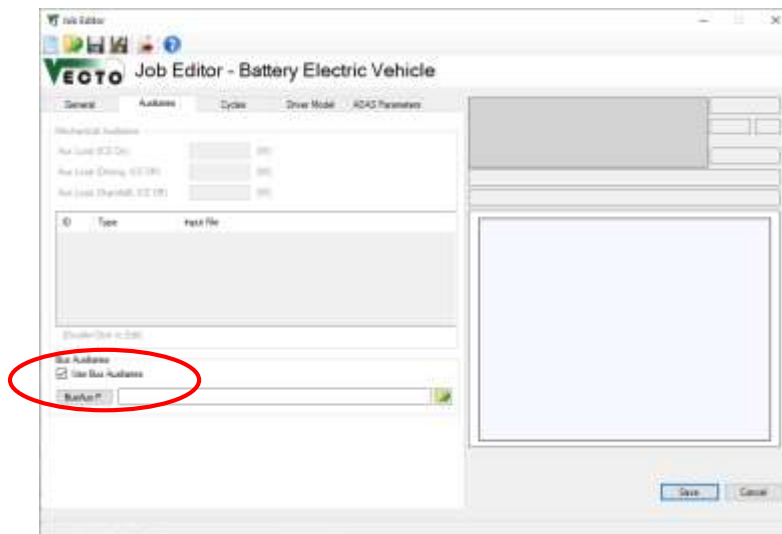
# Vecto 0.7.7.2547 Development Version

## December 2021

- **General comments (2/x)**

- Auxiliaries for PEV

- Electric power demand of auxiliaries for both, lorries and buses, need to be parameterized via the “BusAux” GUI window



Demand during vehicle driving

Demand during vehicle standstill

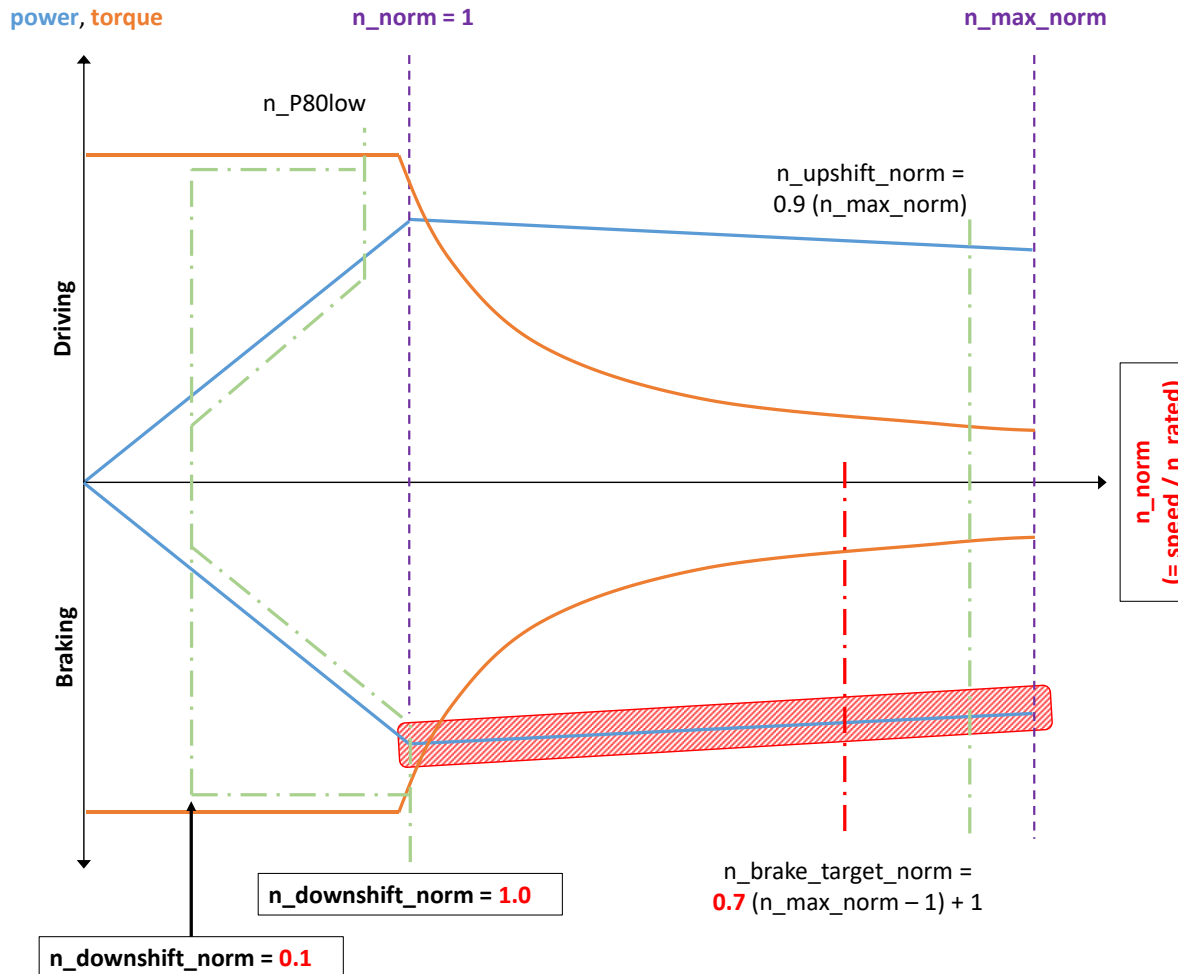
- Gearshift model for PEV

- Details explained on next slides

# Vecto 0.7.7.2547 Development Version

## December 2021

### • Gearshift model for PEV (1/x)



#### ▪ Basics:

- Downshift for operation point left of green dot-dashed downshift lines
- Upshift for operation point right of green dot-dashed upshift line
- EffShift method applied for operation point between downshift and upshift lines (refer to user manual)

#### ▪ Driving:

- Maximum downshift speed always located at  **$n_{\text{P80low}}$**  (where 80% of max power is available)
- For EM in de-rating  **$n_{\text{P80low}}$**  is calculated from the de-rated power curve

#### ▪ Braking:

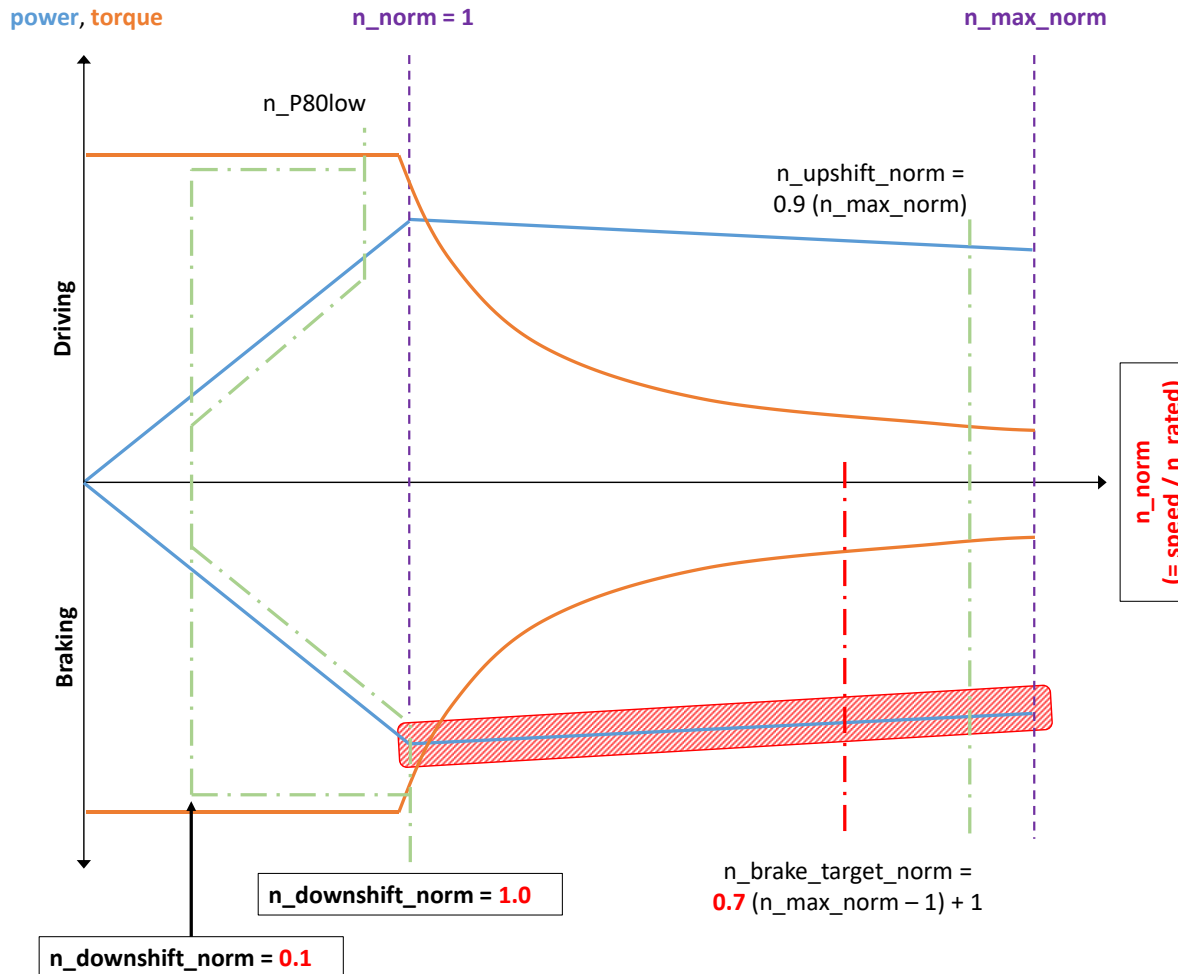
- EffShift is suppressed for operation point within red shaded area (2% below max recuperation power)
- New gear after downshift is selected so that operation point is closest to and above  **$n_{\text{brake\_target\_norm}}$**  (or only closest to  **$n_{\text{brake\_target\_norm}}$**  in case no operation point with higher speed exists)



# Vecto 0.7.7.2547 Development Version

## December 2021

### • Gearshift model for PEV (2/x)



- All factors in bold red can be tuned via shift parameter file .vtcu
  - Refer to sample file for User Manual/PEV\_ShiftParameters.vtcu distributed together with VECTO archive

# Vecto 0.7.7.2547 Development Version

December 2021

- **Detailed Changes/Bugfixes (see [CITnet/JIRA](#))**
  - [VECTO-1460] - APT-N Gearbox
  - [VECTO-1501] - Update EM Map interpolation method
  - [VECTO-1477] - Update user manual
  - [VECTO-1383] - E2 PEV, 2-speed AMT: "Failed to find operating point"
  - [VECTO-1384] - E2 PEV, 2-speed AMT: Downshifts missing
  - [VECTO-1414] - E2 selects high gear at low speed after take-off, does not reach target acc
  - [VECTO-1443] - 0.7.5.2356 EC\_el\_final calculated from REESS terminal signals
  - [VECTO-1445] - 073.2356, E2 Missing Downshifts, simulation abort
  - [VECTO-1464] - Engine Off not working with activated PCC (Hybrid Vehicles)
  - [VECTO-1465] - PEV PCCState oscillates between Interrupt and UseCase1
  - [VECTO-1467] - PCC HEV Small Spike at end of UseCase1 when Target speed is reached
  - [VECTO-1468] - EM map interpolation comments
  - [VECTO-1470] - 076.2463 EM drag torque questions/findings
  - [VECTO-1482] - Hybrid Vehicle EM speed gets very high, no gearshift
  - [VECTO-1483] - Job aborting: E4\_Group 5 LH\_II\_LongHaul\_mod5\_id\_2
  - [VECTO-1484] - Job aborting: P2\_Group5\_s2c0\_rep\_Payload\_LongHaul\_mod5\_id\_27
  - [VECTO-1486] - NG PI fuel type not working with Engine GUI (.veng) in Engineering Mode
  - [VECTO-1487] - Calculation of EM efficiency during recuperation
  - [VECTO-1490] - Exceeded max iterations: Operating Point could not be found

# Vecto 0.7.7.2547 Development Version

December 2021

- **Detailed Changes/Bugfixes (see [CITnet/JIRA](#))**
  - [VECTO-1491] - Electric Energy Storage Editor does not show values
  - [VECTO-1499] - Energy balance when ICE is turned on in a P1 hybrid configuration
  - [VECTO-1514] - Modeldata uses wrong inertia in case multiple EMs are used on a position
  - [VECTO-1515] - Output in vsum file
  - [VECTO-1516] - GUI: PEV vehicle, disable hybrid parameters
  - [VECTO-1489] - Engine-off eco-roll for P1 hybrids
  - [VECTO-1448] - 075.2356, E2 Selecting high gear in downhill, needs to use wheel brakes
  - [VECTO-1472] - Do not end PCC if acceleration is still high enough
  - [VECTO-1473] - Additional tyre dimensions
  - [VECTO-1476] - Update EM GUI, EM component
  - [VECTO-1493] - Use EngineStartStop in PCC-Events for Hybrid P1
  - [VECTO-1498] - Crosswind correction in engineering mode
  - [VECTO-1508] - EM-Off Losses in .vsum
  - [VECTO-1509] - SP Technology "Electric" already contains mechanical power demand
  - [VECTO-1510] - Remove selection of shift strategy in job dialog
  - [VECTO-1511] - Error Message for "HEVs and BEVs not supported in Declaration Mode"
  - [VECTO-1512] - Adapt shift lines for xEV vehicles
  - [VECTO-1513] - Bus Aux post-processing correction
  - [VECTO-1481] - New warning message regarding transmission: what does it mean?

# Vecto 0.7.6.2451 Development Version

## September 2021

- **Changes**

- ADAS for HEV and PEV vehicles
  - For HEV vehicles interaction of PCC and HEV strategy under further analysis
- Update electric motor model: support for different voltage levels
- Update battery model: modular battery components
- Update battery model: pulse-duration dependent internal resistance
- Bugfixes

# Vecto 0.7.5.2353 Development Version

## June 2021

- **Changes**

- Bugfixes in shift strategy for PEV (E2)
- Additional Powertrain architectures
  - P1 AMT and APT-S/P
  - P2.5 (transmission ratio EM per gear)
  - P3 & P4 with APT transmissions
- Loss-map for electric machine
- Bus auxiliaries in engineering mode
- Combine Bus auxiliaries with HEV powertrains
- Refactoring Engine Stop/Start approach
  - ICE is always off during simulation, balance missing energy in case ICE is on / ICE is off for all auxiliaries in .vmod.
  - Correct for missing aux energy in post-processing (not fully implemented in this version)
- Added vehicle propulsion limits (relative to ICE max torque)
  - P2, P3, and P4
- Refactored EM model: continuous torque, overload torque as separate inputs

# Vecto 0.7.3.2164 Development Version

## December 2020

- **Changes**

- Bugfixes in shift strategy for PEV (E2)
- Refined electric motor model: model transmission stage of electric machine as individual sub-component instead of transforming the maps. Adapted columns in .vmod and .vsum regarding electric machine. See user manual for details.
- Bugfixes SuperCap model
- Removed E\_REESS from .vmod file, calculate delta\_E\_REESS from P\_REESS in .vsum file

# Vecto 0.7.2.2118 Development Version

## October 2020

- **Changes**
  - Implementation of PEV architecture E2 with EffShift-like gearshift strategy
  - Bugfix REESS Dialog (.vimax)
  - Bugfix in output of EM overload output in .vmod file

# Vecto 0.7.1.2108 Development Version

## October 2020

- **Changes**

- More stable operating point search hybrid strategy
- Bugfixes hybrid strategy
- Adding Super Cap as REESS
- Adding electric machine thermal de-rating
- Modified battery model: max charge/discharge current over state of charge
- Improvements simulation time hybrid vehicles

**Note:** As the model data for electric machine and battery changed from the previous VECTO version for hybrid vehicles it is necessary to open the models and provide the newly added model parameters.



# Vecto 0.7.0.2076 Development Version

## September 2020

- **Changes**

- *This release is the first beta version with capabilities to simulate hybrid and battery electric vehicles.*
- It covers powertrain architectures “P2”, “P3”, “P4” for hybrid electric vehicles (HEV) and “E3”, “E4” for battery electric vehicles (PEV, pure electric vehicles).
- The definitions of the powertrain architectures and other input parameters on vehicle level can be found in the document *Input parameters vehicle level 20200907.docx*. This document is an excerpt of working document 3 of the HDV CO2 Editing board. Items marked in red are not yet featured by the tool and will follow in the next releases.
- Known limitations
  - Electric machine system overload feature not available – work in progress
  - Supercaps not implemented – work in progress
  - Engine Stop Start Utility Factor has to be set to 1 – further discussions in task force needed how UF-approach shall be aligned with hybrid control strategy
  - P\_aux\_el are electric auxiliaries connected to the high-voltage system. For hybrid electric vehicles this model parameter shall currently be set to 0. – further discussions in task force needed
  - APTs with HEV – to be implemented
  - Eco-roll and PCC not implemented

# Vecto 0.6.1.1975 Development Version

## May 2020

- **Bugfixes**

- Change passenger density primary vehicle for IU cycle
- primary vehicle: ignore TPMLM (to limit payload, do not abort simulation)
- completed vehicle: limit total mass with TPMLM (abort simulation)
- consider `l_drivetrain`. this length is subtracted from internal length for HVAC calculation only (bus volume for ventilation, max cooling capacity); completed vehicle
- set alternator gear efficiency to 1 to align with lorries (currently 0.92)
- electric system / radio: all vehicles are equipped with radio. modify consumed amps to consider 'usage factor' - updated already in master excel.
- Update generic values for primary HF vehicles `CdxA`
- HVAC: check/correct internal height for coaches (shall be 1.8m)
- HVAC: subtract driver compartment from total volume for max cooling capacity passengers
- HVAC: add configuration #10, add sanity checks (i.e. if driver AC is provided for configurations #2,
- Steering pump power demand: tubing factor only applied for first steered axle (as the additionally steered axles are close to the engine and the distance is not known)
- Allow enabling/disabling LAC in declaration mode via GUI (not persistent). Additional input on "Options" tab to set min activation speed
- `.vsum` file: `E_AUX_SUM` matches sum of individual AUX entries; bugfix writing `P_busAux_ES_mech`
- Update user manual on VTP cycle file format
- APT gearbox (all gears) generic efficiency 0.925
- retarder: set factor for generic retarder losses from 0.5 to 1 (i.e., use standardvalues)
- VTP engineering mode - `vsum` actual CF different to declaration mode

- **Improvements**

- Switch GUI to 64bit mode (see VECTO-1270)
- New normalization/denormalization method for generic engine FC-Map (see VECTO-1269)
- `.vsum`-file: new entries `P_ice_fcmap`, `P_wheel_in`, `k_vehline` (previous `k_vehline` is now `k_engine`)
- Bus VTP: Fan Parameter C4
- don't write CIF for primary vehicle

# Vecto 0.6.1.1957 Development Version

May 2020

## • Improvements

- Declaration mode for complete and completed buses via “factor method”
- VTP mode for heavy buses
- VTP mode for dual-fuel vehicles (new cycle file required!)
- “Single bus” mode with generic data from segmentation table completed vehicle (previous version used generic data from primary vehicle)
- Adding highway sections on coach cycle (required for PCC)
- New graphical user interface (VECTO3.exe) (*alpha version!*)
  - Creating & editing complete(d) bus XML
  - Creating & editing complete(d) bus job file (PIF + completed XML)
  - Creating & editing single bus job file (primary XML + completed XML)
  - Simulation of all types of VECTO jobs
  - Currently, other existing job files can not be edited in the new GUI – planned to be extended in future
  - Functionality similar to currently official VECTO version, for further information see separate user manual on new GUI
- XML reports (MRF, CIF, PIF) according to draft Annex IV
- *Expert feature*: allow adding torque converter data to PIF manually (not added by VECTO automatically) to investigate on generic TC data for APT-P (see generic vehicles for reference)
- *Expert feature*: allow writing internal model data used for VECTO simulation as JSON file. Allows to compare model data between primary bus, completed bus generic body, completed bus specific body (factor method) as well as single bus

# Vecto 0.6.1.1957 Development Version

## May 2020

- **Bugfixes heavy buses**

- Correcting power demand for engine fan
- Consider electric auxiliaries (fan, steering pump) as electrical consumer
- Correcting power demand pneumatic system with mechanical clutch
- Correcting electrical consumers LED bonus
- Correction for double compensation of smart electrics (battery & generated vs. consumed)
- Correcting passenger count depending on HVAC configuration

- **Bugfixes medium lorries**

- New technologies for electric steering pump
- New tyre xml supported
- Bugfixes graphical user interface
- New sample data VTP

# Vecto 0.6.0.1908 Development Version

March. 2020

- **Bugfixes**

- Consider vehicle's max speed when validating input data, calculating velocity drop during traction interruption
- Reading vehicle design speed (85km/h) from segment table (also related to vehicle's max speed)
- Fix JobEditor GUI – toolbar with icons not visible
- Fix null-reference exception simulating vehicles in engineering mode

# Vecto 0.6.0.1884 Development Version

Feb. 2020

- **Improvements**

- Refactoring and bug fixes in bus auxiliaries model (former Ricardo AAUX model), parametrization of bus auxiliaries model (HVAC) from “primary bus” input data and generic values in segmentation matrix,
- Support for P0 hybrids in bus auxiliaries model
- Support for “primary bus” (declaration mode)
- Support for “single bus” – combine input parameters of primary bus and completed bus to a single simulation (no factor method) (declaration mode)
- Support for medium lorries
- Support for vehicles with front-wheel drive (axlegear included in gearbox)
- VTP Mode for medium lorries
- New XML schema for new vehicle categories, adapted XML schema for generated reports (MRF, CIF, PIF)

This development version includes all features already included in version 0.5.0

# Vecto 0.5.0 Development Version

Dec. 2019

- **Improvements**

- Adding in-the-loop simulation of advanced driver assistant systems (ADAS)
  - Engine stop-start during vehicle stop
  - Eco-roll with and without engine stop
  - Predictive cruise control: dip coasting, crest coasting
- Adding support for dual-fuel vehicles
- Adding support for waste- / exhaust-heat recovery systems (electrical and mechanical)
- New gear shift strategy (EffShift) for AMT and AT transmissions

Details on the new models, model parameters, and new signals in the output are described in the user manual

# Vecto 3.3.10.2401 Official Release

2020-07-29

- **Improvements**
  - Handling of exempted vehicles (not changed since release candidate) – see next slides for details
- **Bugfixes**
  - No additional bugfixes compared to VECTO 3.3.10.2401



# Vecto 3.3.10.2373 Release Candidate

2020-07-01

- **Improvements**

- [VECTO-1421] – Added vehicle sub-group (CO<sub>2</sub>-standards to MRF and CIF)
- [VECTO 1449] – Handling of exempted vehicles: See next slide for details
- [VECTO-1404] – Corrected URL for CSS in MRF and CIF

- **Bugfixes**

- [VECTO-1419] – Simulation abort in urban cycle: failed to find operating point on search braking power with TC gear
- [VECTO-1439] – Bugfix handling duplicate entries in engine full-load curve when intersecting with max-torque of gearbox
- [VECTO-1429] – error in XML schema 2.x for exempted vehicles – MaxNetPower1/2 are optional input parameters

# Vecto 3.3.10.2373 Release Candidate

2020-07-01

## Handling of exempted vehicles

- Axle configuration and sleeper cab are optional input parameters for exempted vehicles (XML schema 1.0 and 2.2.1).
  - OEMs are recommended to provide these parameters for exempted vehicles.
  - If the axle configuration is provided as input parameter, the MRF contains the vehicle group.
  - The sleeper cab input parameter is also part of the MRF if provided as input.
- Input parameters MaxNetPower1/2 are optional input parameters for all exempted vehicles.
  - If provided in the input these parameters are part of the MRF for all exempted vehicle types
  - It is recommended that those parameters are used to specify the rated power also for PEV (pure electric vehicles)

# **Vecto 3.3.9.2175 Official Release**

**2020-12-15**

- **Bugfixes (compared to version 3.3.9.2147)**
  - [VECTO-1374] - VECTO VTP error – regression update

# Vecto 3.3.9.2147 Release Candidate

2020-11-17

- **Bugfixes**

- [VECTO-1331] - VTP Mode does not function for vehicles of group 3
- [VECTO-1355] - VTP Simulation Abort
- [VECTO-1356] - PTO Losses not considered in VTP simulation
- [VECTO-1361] - Torque Converter in use for the First and Second Gear VTP file does not allow for this
- [VECTO-1372] - Deviation of CdxA Input vs. Output for HDV16
- [VECTO-1374] - VECTO VTP error

- **Improvements**

- [VECTO-1360] - make unit tests execute in parallel

# Vecto 3.3.8.2052 Official Release

2020-08-14

- **Bugfixes**
  - No additional bugfixes compared to VECTO 3.3.8.2024

# Vecto 3.3.8.2024 Release Candidate

2020-07-17

- **Bugfixes**

- [VECTO-1288] - Simulation Abort UD RL
- [VECTO-1327] - Simulation abort Construction RefLoad: unexpected response  
ResponseOverload
- [VECTO-1266] - Gear 4 Loss-Map was extrapolated

# Vecto 3.3.7.1964 Official Release

2020-05-18

- **Bugfixes**

- [VECTO-1254] - Hashing method does not ignore certain XML attributes
- [VECTO-1259] - Mission profile weighting factors for vehicles of group 16 are not correct

# **Vecto 3.3.6.1916 Official Release**

**2020-03-31**

- **Bugfixes**
  - [VECTO-1250] - Error creating new gearbox file from scratch



# Vecto 3.3.6.1898 Release Candidate

2020-03-13

- **Improvement**

- [VECTO-1239] - Adaptation of Mission Profile Weighting Factors
- [VECTO-1241] - Engineering mode: Adding support for additional PTO activations

- **Bugfixes**

- [VECTO-1243] - Bug in VTP mode for heavy lorries
- [VECTO-1234] - urban cycle at reference load not running for bug when find braking operating point

# Vecto 3.3.5.1812 Official Release

## 2019-12-18

- **Bugfixes** (compared to VECTO 3.3.5.1783-RC)
  - [VECTO-1220] - Simulation Abort Urban Delivery RefLoad

# Vecto 3.3.5.1783 Release Candidate

2019-11-19

- **Improvement**

- [VECTO-1194] - Handling input parameter 'vocational' for groups other than 4, 5, 9, 10
- [VECTO-1147] - Updating declaration mode cycles values in user manual
- [VECTO-1207] - run VECTO in 64bit mode by default

- **Bugfixes**

- [VECTO-1074] - Vecto Calculation Aborts with Interpolation Error
- [VECTO-1159] - Simulation Abort in UrbanDelivery LowLoading
- [VECTO-1189] - Error in delaunay triangulation invariant violated
- [VECTO-1209] - Unexpected Response Response Overload
- [VECTO-1211] - Simulation Abort Urban Delivery Ref Load
- [VECTO-1214] - Validation of input data fails when gearbox speed limits are applied

# Vecto 3.3.4.1716 Official Release

2019-09-13

- **Bugfixes** (compared to VECTO 3.3.4.1686-RC)
  - [VECTO-1074] - Vecto Calculation Aborts with Interpolation Error ([VECTO-1046])
  - [VECTO-1111] - Simulation Abort in Municipal Reference Load

# Vecto 3.3.4.1686 Release Candidate

2019-08-14

- **Improvement**

- [VECTO-1042] - Add option to write results into a certain directory
- [VECTO-1064] - add weighting factors for vehicle groups 1, 2, 3, 11, 12, 16

- **Bugfixes**

- [VECTO-1030] - Exceeded max iterations when searching for operating point! Failed to find operating point!
- [VECTO-1032] - Gear 5 LossMap data was extrapolated in Declaration Mode: range for loss map is not sufficient
- [VECTO-1067] - Vair and Beta correction for Aerodynamics
- [VECTO-1000] - Error Loss-Map extrapolation in Declaration Mode
- [VECTO-1040] - Gear 6 LossMap data was extrapolated in Declaration Mode
- [VECTO-1047] - Failed to find operating point on construction cycle, ref load, AT gearbox

# Vecto 3.3.3.1639 Official Release

2019-06-27

- **Bugfixes** (compared to VECTO 3.3.3.1609-RC)
  - [VECTO-1003] - Vecto Error: Loss-Map extrapolation in declaration mode required (issue VECTO-991)
  - [VECTO-1006] - Failed to find torque converter operating point on UD cycle (issue VECTO-996)
  - [VECTO-1010] - Unexpected Response: ResponseOverload in UD cycle (issue VECTO-996)
  - [VECTO-1015] - XML Schema not correctly identified
  - [VECTO-1019] - Error opening job in case a file is missing
  - [VECTO-1020] - HashingTool Crashes
  - [VECTO-1021] - Invalid hash of job data

# Vecto 3.3.3.1609 Release Candidate

2019-05-29

- **Improvement**

- [VECTO-916] - Adding new tyre sizes
- [VECTO-946] - Refactoring XML reading
- [VECTO-965] - Add input fields for ADAS into VECTO GUI
- [VECTO-966] - Allow selecting Tank System for NG engines in GUI
- [VECTO-932] - Consistency in NA values in the vsum file

- **Bugfixes**

- [VECTO-954] - Failed to find operating point for braking power (Fix for Notification Art. 10(2) - [VECTO-952])
- [VECTO-979] - VECTO Simulation abort with 8-speed MT transmission (Fix for Notification Art. 10(2) - [VECTO-978])
- [VECTO-931] - AT error in VECTO version 3.3.2.1519
- [VECTO-950] - Error when loading Engine Full-load curve
- [VECTO-967] - Engine-Only mode: Engine Torque reported in .vmod does not match the provided cycle
- [VECTO-980] - Error during simulation run

# Vecto 3.3.2.1548 Official Release

2019-03-29

- **Bugfixes (compared to 3.3.2.1519-RC)**

- [VECTO-861] - 3.3.1: Torque converter not working correctly
- [VECTO-904] - Range for gear loss map not sufficient.
- [VECTO-909] - 3.3.2.1519: Problems running more than one input .xml
- [VECTO-917] - TargetVelocity (0.0000) and VehicleVelocity (>0) must be zero when vehicle is halting
- [VECTO-918] - RegionalDeliveryEMS LowLoading - ResponseSpeedLimitExceeded
- [VECTO-920] - Urban Delivery: Simulation Run Aborted, TargetVelocity and VehicleVelocity must be zero when vehicle is halting!



# Vecto 3.3.2.1519 Release Candidate

2019-03-01

- **Improvements**

- [VECTO-869] - change new vehicle input fields (ADAS, sleeper cab, etc.) to be mandatory
- [VECTO-784] - Configuration file for VECTO log files
- [VECTO-865] - Extend Sum-Data
- [VECTO-873] - Add digest value to SumData

- **Bugfixes**

- [VECTO-729] - Bugs APT submodel
- [VECTO-787] - APT: DrivingAction Accelerate after Overload
- [VECTO-789] - APT: ResponseUnderload
- [VECTO-797] - VECTO abort with AT transmission and TC table value
- [VECTO-798] - VECTO abort with certified AT transmission data and certified TC data
- [VECTO-807] - VECTO errors in vehicle class 1/2/3
- [VECTO-827] - Torque converter inertia
- [VECTO-838] - APT: ResponseOverload

cont.

# Vecto 3.3.2.1519 Release Candidate

2019-03-01

## • Bugfixes

- [VECTO-843] - AT Transmissions problem on VECTO 3.3.1.1463
- [VECTO-844] - Error with AT gearbox model
- [VECTO-847] - Simulation abort due to error in NLog?
- [VECTO-848] - AT Gearbox Simulation abort (was: Problem related to Tyres?)
- [VECTO-858] - Urban Delivery Abort - with APT-S Transmission and TC
- [VECTO-861] - 3.3.1: Torque converter not working correctly
- [VECTO-872] - MRF/CIF: Torque Converter certification method and certification nbr not correctly set
- [VECTO-879] - SIMULATION RUN ABORTED DistanceRun got an unexpected resp.
- [VECTO-883] - Traction interruption may be too long
- [VECTO-815] - Unexpected Response: SpeedLimitExceeded
- [VECTO-816] - object reference not set to an instance of an object
- [VECTO-817] - TargetVelocity and VehicleVelocity must not be 0
- [VECTO-820] - DistanceRun got an unexpected response: ResponseSpeedLimitExceeded
- [VECTO-864] - Prevent VECTO loss-map extension to result in negative torque loss

# Vecto 3.3.2.1519 Release Candidate

2019-03-01

- **Installation Option (VECTO-784)**
  - VECTO 3.3.2 adds a new feature to run as 'installed application' instead of the 'portable' mode
  - VECTO as 'installed application'
    - Needs no write permissions to the VECTO application folder
    - All configuration files and settings are written to %AppData%\VECTO\<Version>
    - All log files are written to %LocalAppData%\VECTO\<Version>
  - Switch to 'installed application'
    1. Copy the VECTO directory and all its files and subdirectories to the appropriate location where the user has execute permissions
    2. Edit the file '*install.in*' and remove the comment character (#) in the line containing  
**ExecutionMode = install**

# Vecto 3.3.1.1492 Official Release

2019-02-01

- **Bugfixes (compared to 3.3.1.1463-RC)**
  - [VECTO-845] - Fixing bug for VECTO-840
  - [VECTO-826] - DistanceRun got an unexpected response: ResponseSpeedLimitExceeded
  - [VECTO-837] - VECTO GUI displays incorrect cycles prior to simulation
  - [VECTO-831] - Addition of indication to be added in Help and Release notes for simulations with LNG

cont.

# Vecto 3.3.1.1463 Release Candidate

## 2019-01-03

- **Changes according to 2017/2400 amendments**

- [VECTO-761] - Adaptation of input XML Schema
- [VECTO-762] - Extension of Input Interfaces
- [VECTO-763] - Extension of Segmentation Table
- [VECTO-764] - ADAS benefits (according to Annex III Point 8. of amendment to 2017/2400)
- [VECTO-766] - Update power demand auxiliaries (for extended segmentation table)
- [VECTO-767] - Report for exempted vehicles
- [VECTO-768] - VTP mode
- [VECTO-770] - Fuel Types
- [VECTO-771] - Handling of exempted vehicles
- [VECTO-824] - Throw exception for certain combinations of exempted vehicle parameters
- [VECTO-773] - Correction Factor for Reference Fuel
- [VECTO-790] - Adapt generic data for construction/municipal utility
- [VECTO-493] - Implementation of generic body weights and air drag values for construction cycle
- [VECTO-565] - Consideration of LNG as possible fuel is missing

cont.

# Vecto 3.3.1.1463 Release Candidate

## 2019-01-03

- **New input parameters**

- The new input fields (see table below) are optional in this version. When this release candidate will be an official version manufacturers MAY certify their new vehicles using the new input parameters. As from 1<sup>st</sup> July 2019 the new input fields will become mandatory. Further details are provided in the timetable on the next page.
- Default values when the new input parameters are not provided:

Input parameters vehicle – Table 1 Annex III	
Field	Default value
VehicleCategory	No default value but input 'rigid truck' will be converted automatically into 'rigid lorry'
ZeroEmissionVehicle	'No'
NgTankSystem	'Compressed' (only applicable to gas vehicles)
SleeperCab	'Yes'
Input parameters ADAS – Pt. 8 Annex III	
Field	Default value
EngineStartStop	'No'
EcoRollWithoutEngineStop	'No'
EcoRollWithEngineStop	'No'
PredictiveCruiseControl	'No'

- Currently **only** the fuel type '**NG PI**' for the **engine certification** is allowed by 2017/2400. For LNG vehicles, therefore, the engine fuel type has to be set to '**NG PI**' and at the vehicle level NgTankSystem has to be set to **liquefied**. For CNG the same engine fuel type is used but NgTankSystem has to be set to **compressed**.

cont.

# Vecto 3.3.1.1463 Release Candidate

2019-01-03

- **Timetable**

Planned Date	Version	Description
1. Feb. 2019	3.3.1.x	Release of official version of release candidate 3.3.1.1463
1. March 2019	3.3.2.x-RC	Release candidate, new input parameters are mandatory (+ further bugfixes)
1. April 2019	3.3.2.x	Official version of VECTO 3.3.2
1. May 2019		Mandatory use of 3.3.1.x for certification
1. July 2019		Mandatory use of 3.3.2.x for certification

cont.

# Vecto 3.3.1.1463 Release Candidate

2019-01-03

- **Changes/Improvements**

- [VECTO-799] - Remove TUG Logos from Simulation Tool, Hashing Tool
- [VECTO-808] - Add Monitoring Report
- [VECTO-754] - Extending Loss-Maps in case of AT gearbox for each gear, axlegear, gearbox
- [VECTO-757] - Correct contact mail address in Hashing Tool
- [VECTO-779] - Update Construction Cycle - shorter stop times
- [VECTO-783] - Rename columns in segmentation table and GUI
- [VECTO-709] - VTP editor from user manual not matching new VECTO one: updated documentation
- [VECTO-785] - Handling of Vehicles that cannot reach the cycle's target speed: Limit max speed in driver model
- [VECTO-716] - Validate data in Settings Tab: update documentation
- [VECTO-793] - Inconsistency between GUI, Help and Regulation: update wording in GUI and user manual
- [VECTO-796] - Adaptation of FuelProperties
- [VECTO-806] - extend loss-maps (gbx, axl, angl) for MT and AMT transmissions
- [VECTO-750] - Simulation error DrivingAction: adapt downshift rules for AT to drive over hill with 6% inclination

cont.



# Vecto 3.3.1.1463 Release Candidate

## 2019-01-03

- Update of Fuel Properties [VECTO-796]**

Fuel type	Reference for fuel properties	Density	CO2 emission factor	Lower Heating Value	Data Source
[-]	[-]	[kg/m <sup>3</sup> ]	[g_CO2/g_Fuel]	[MJ/kg]	[-]
Diesel	B7	836	3.13	42.7	CONCAWE/JEC (2018)
ED95	ED95	820	1.81	25.4	CONCAWE/JEC (2018)
Petrol	E10	748	3.04	41.5	CONCAWE/JEC (2018)
E85	E85	786	2.10	29.3	Calculated from E0 and E100 from CONCAWE/JEC (2018)
LPG	LPG	not required*	3.02	46.0	CONCAWE/JEC (2018)
CNG	CNG (H-Gas)	not required*	2.69	48.0	CONCAWE/JEC (2018)
LNG	LNG (EU mix. 2016/2030)	not required*	2.77	49.1	CONCAWE/JEC (2018)

\* VECTO does not provide volume based figures for gaseous fuels

CONCAWE/JEC (2018): Specifications are based on a recent analysis (2018) performed by CONCAWE/EUCAR and shall reflect typical fuel on the European market. The data is scheduled to be published in March 2019 in the context of the study: Well-To-Wheels Analysis Of Future Automotive Fuels And Powertrains in the European Context – Heavy Duty vehicles

cont.

# Vecto 3.3.1.1463 Release Candidate

2019-01-03

## • Bugfixes

- [VECTO-819] - object reference not set to an instance of an object
- [VECTO-818] - SearchOperatingPoint: Unknown response type. ResponseOverload
- [VECTO-813] - Error "Infinity [] is not allowed for SI-Value"
- [VECTO-769] - DrivingAction Brake: request failed after braking power was found.ResponseEngineSpeedTooHigh
- [VECTO-804] - Error on simulation with VECTO 3.3.0.1433
- [VECTO-805] - Total vehicle mass exceeds TPMLM
- [VECTO-811] - AMT: ResponseGearShift
- [VECTO-812] - AMT: ResponseOverload
- [VECTO-822] - SIMULATION RUN ABORTED by Infinity
- [VECTO-792] - Vecto Hashing Tool - error object reference not set to an instance of an object (overwriting Date element)
- [VECTO-696] - Problem with Primary Retarder: regression update, set torque loss to 0 for 0 speed and engaged gear
- [VECTO-776] - Decision Factor (DF) field is emptied after each simulation
- [VECTO-814] - Error: DistanceRun got an unexpected response: ResponseGearshift

# Vecto 3.3.0.1433 Official Release

2018-12-04

- **Bugfixes (compared to 3.3.0.1398)**
  - [VECTO-795] – VECTO Hashing Tool crashes
  - [VECTO-802] – Error in XML schema for manufacturer's record file
- **Bugfixes (compared to 3.3.0.1250)**
  - [VECTO-723] - Simulation aborts with engine speed too high in RD cycle
  - [VECTO-724] - Simulation aborts with error 'EngineSpeedTooHigh' - duplicate of VECTO-744
  - [VECTO-728] - Simulation aborts when vehicle's max speed (n95h) is below the target speed
  - [VECTO-730] - Simulation Aborts with ResponseOverload
  - [VECTO-744] - ResponseEngineSpeedTooHigh (due to torque limits in gearbox)
  - [VECTO-731] - Case Mismatch - Torque Converter
  - [VECTO-711] - Elements without types in CIF and MRF
  - [VECTO-757] - Correct contact mail address in Hashing Tool
  - [VECTO-703] - PTO output in MRF file
  - [VECTO-713] - Manufacturer Information File in the legislation is not compatible with the Simulation results
- **Improvement (compared to 3.3.0.1250)**
  - [VECTO-704] - Allow VTP-simulations for AT gearboxes

# Vecto 3.3.0.1398 Release Candidate

2018-10-30

- **Bugfixes**

- [VECTO-723] - Simulation aborts with engine speed too high in RD cycle
- [VECTO-724] - Simulation aborts with error 'EngineSpeedTooHigh' - duplicate of VECTO-744
- [VECTO-728] - Simulation aborts when vehicle's max speed (n95h) is below the target speed
- [VECTO-730] - Simulation Aborts with ResponseOverload
- [VECTO-744] - ResponseEngineSpeedTooHigh (due to torque limits in gearbox)
- [VECTO-731] - Case Mismatch - Torque Converter
- [VECTO-711] - Elements without types in CIF and MRF
- [VECTO-757] - Correct contact mail address in Hashing Tool
- [VECTO-703] - PTO output in MRF file
- [VECTO-713] - Manufacturer Information File in the legislation is not compatible with the Simulation results

- **Improvement**

- [VECTO-704] - Allow VTP-simulations for AT gearboxes

# Vecto 3.3.0.1250

2018-06-04

- **Improvement**

- [VECTO-665] - Adding style information to XML Reports
- [VECTO-669] - Group 1 vehicle comprises vehicles with gross vehicle weight > 7.5t
- [VECTO-672] - Keep manual choice for "Validate data"
- [VECTO-682] - VTP Simulation in declaration mode
- [VECTO-652] - VTP: Check Cycle matches simulation mode
- [VECTO-683] - VTP: Quality and plausibility checks for recorded data from VTP
- [VECTO-685] - VTP Programming of standard VECTO VTP report
- [VECTO-689] - Additional Tyre sizes
- [VECTO-702] - Hashing tool: adapt warnings
- [VECTO-667] - Removing NCV Correction Factor
- [VECTO-679] - Engine n95h computation gives wrong (too high) engine speed (above measured FLD, n70h)
- [VECTO-693] - extend vehicle performance in manufacturer record

# Vecto 3.3.0.1250

2018-06-04

- **Bugfixes**

- [VECTO-656] - Distance computation in vsum
- [VECTO-666] - CF\_RegPer no effect in vehicle simulation -- added to the engine correction factors
- [VECTO-687] - Saving a Engine-Only Job is not possible
- [VECTO-695] - Bug in vectocmd.exe - process does not terminate
- [VECTO-699] - Output in manufacturer report and customer report (VECTO) uses different units than described in legislation
- [VECTO-700] - errorr in simulation with 0 stop time at the beginning of the cycle

# Vecto 3.2.1.1133

2018-02-07

- **Improvement**

- [VECTO-634] - VTP Mode: specific fuel consumption

- **Bugfixes**

- [VECTO-642] - VECTO BUG – secondary retarder losses:  
**IMPORTANT:** Fuel-consumption relevant bug! wrong calculation of retarder losses for retarder ratio not equal to 1
- [VECTO-624] - Crash w/o comment: Infinite recursion
- [VECTO-627] - Cannot open Engine-Only Job
- [VECTO-629] - Vecto crashes without error message (same issue as VECTO-624)
- [VECTO-639] - Failed to find operating point for braking power: cycle with low target speed (3km/h). allow driving with slipping clutch
- [VECTO-640] - Exceeded max. iterations: driving fully-loaded vehicle steep uphill. fixed by allowing full-stop and drive off again
- [VECTO-633] - unable to start VTP Mode simulation
- [VECTO-645] - Encountered error while validating Vecto output (generated by API) through Hashing tool for vehicle without retarder

# Vecto 3.2.1.1079

2017-12-15

- **Improvement**

- [VECTO-618] - Add Hash value of tyres to manufacturer's record file
- [VECTO-590] - Handling of hash values: customer's record contains hash of manufacturer's record
- [VECTO-612] - Continuously changing hashes: Info in GUI of HashingTool
- [VECTO-560] - Change Mail-Address of general VECTO contact
- [VECTO-616] - SI-Unit - display derived unit instead of base units

- **Bugfixes**

- [VECTO-608] - Power balance in EPT-mode not closed
- [VECTO-611] - Invalid input. Cannot cast Newtonsoft.Json.Linq.JObject to Newtonsoft.Json.Linq.Jtoken
- [VECTO-610] - TyreCertificationNumber missing in Manufacturer Report
- [VECTO-613] - Incomplete description of allowed values of LegislativeClass (p251) in VECTO parameter documentation
- [VECTO-625] - Update XML Schema: Tyre dimensions according to Technicall Annex, trailing spaces in enums

- **Support**

- [VECTO-615] - Error torque interpolation in declaration jobs exported to XMLImprovements



# Vecto 3.2.1.1054

2017-11-20

## Improvements

- [VECTO-592] - VTP Simulation Mode
- [VECTO-605] - Improve simulation speed

## Bugfixes

- [VECTO-602] - Error in simulation without airdrag component
- [VECTO-589] - Scheme .xml error

# VTP Simulation Mode

- Verification Test Procedure (VTP) Simulation Mode
  - Similar to Pwheel mode, different cycle format (see user manual)
  - Requires:
    - Vehicle in declaration mode (XML)
    - Measured driving cycle
    - Parameters for engine-fan model
  - VECTO calculates the gear based on the wheel speed and engine speed (and vehicle parameters) and ignores the gear provided in the driving cycle
  - Fuel consumption interpolation is done using the engine speed from the cycle and calculated power demand (to avoid wrong engine speeds due to wrong gear selection)
  - Simulation uses all auxiliaries except engine fan
    - Engine fan is modeled separately, power demand depends on fan speed (see user manual)
  - Auxiliary power selected according to segment table, BUT power demand depends on vehicle speed
    - $v < 50$  km/h: Urban
    - $50 \leq v < 70$  km/h: Rural
    - $v > 70$  km/h: Long haul
  - Gear and fuel consumption in the driving cycle are optional for now, may be used in future versions

# Vecto 3.2.0.1022

## 2017-10-19

### Bugfixes

- [VECTO-585, VECTO-587] – VECTO Simulation aborts when run as WCF Service
- [VECTO-586] – Gearshiftcout in reports too high
- [VECTO-573] – Use of old library references .net framework 2.0

# Vecto 3.2.0.1005

2017-10-02

## Improvements

- **Release of Vecto Hashing Tool**
- [VECTO-557] Engine speed simulated too high during long stops

## Bugfixes

- [VECTO-569] - 'Engine Retarder' not correctly recognized as input
- [VECTO-571] - Customer Report – wrong output format of average RRC
- [VECTO-573] - Correction of displayed units in graph window
- [VECTO-575] - Correction of simulation aborts (due to gearbox inertia, engineering mode)
- [VECTO-577] - Correction of XML export functionality
- [VECTO-579] - Bug fix GUI crashes on invalid input
- [VECTO-558] - Correction of output in .vsum file – BFColdHot always 0
- [VECTO-564] - Bug fix: correct output of vehicle group in XML report
- [VECTO-566] - Vehicle height not correctly read (engineering mode)
- [VECTO-545] - Update documentation on Settings dialog

# Vecto 3.2.0.940

2017-07-28

## Bugfixes

- [VECTO-546] - GearboxCertificationOptionType Option 2 not accepted by VECTO
- [VECTO-547] - Engine Manufacturer and Engine Model are empty in .vsum
- [VECTO-548] - online user manual
- [VECTO-549] - Inconsistent (and wrong) decimal separator in XML output (manufacturer report)
- [VECTO-551] - Average Tyre RRC not in Customer Information File output
- [VECTO-536] - GUI: improvements vehicle dialog (add missing pictures for vehicle categories)
- [VECTO-550] - Allow custom settings for AirDensity in Engineering mode
- [VECTO-552] - set engine rated power, rated speed to computed values from FLD if not provided as input

# Vecto 3.2.0.925

2017-07-14

## Improvements

- [VECTO-366] added EMS vehicle configuration, EMS is only simulated when engine rated power > 300kW
- [VECTO-463] add pneumatic system technology 'vacuum pump'
- [VECTO-465] change RRC value of trailers (declaration mode) from 0.00555 to 0.0055 (due to limits in user interface)
- [VECTO-477] AT Gearbox, powershift losses: remove inertia factor
- [VECTO-471] update cross-wind correction model: height-dependent wind speed (see Excel spreadsheet in User Manual folder for details)
- [VECTO-367] Add Vehicle Design Speed to segmentation table
- [VECTO-470] Add XML reading and export functionality
- [VECTO-486] Adding hashing library
- [VECTO-469] Limit engine max torque (either due to vehicle or gearbox limits), limit gearbox input speed
- [VECTO-466] Update vehicle payloads: 10% loaded and reference load are simulated
- [VECTO-467] Add generic PTO activation in municipal cycle
- [VECTO-468] Add PTO losses (idle) in declaration mode
- [VECTO-479] Added PTO option 'only one engaged gearwheel above oil level' with 0 losses

# Vecto 3.2.0.925

2017-07-14

## Improvements

- [VECTO-483] Adapt CdxA supplement for additional trailers
- [VECTO-494] Implementation of different fuel types
- [VECTO-502] Implementing standard values for air-drag area (if not measured)
- [VECTO-501] Implement engine idle speed set in vehicle (must be higher than engine's idle speed value)
- [VECTO-504] Adding HVAC technology 'none'
- [VECTO-489] Extrapolate gearbox lossmaps (required when torque limitation by gearbox is ignored)
- [VECTO-505] Implement AT transmissions in declaration mode
- [VECTO-507] Allow to ignore validation of model data when starting a simulation (significant improvement on simulation startup time - about 10s)
- [VECTO-506] modified method how torque-converter characteristics in drag is extended. allow drag-values in the input, only add one point at a high speed ratio
- [VECTO-509] Add axle-type (vehicle driven, vehicle non-driven, trailer) to GUI
- [VECTO-511] Add engine idle speed to Vehicle input form (GUI)
- [VECTO-510] Write XML reports (manufacturer, customer information) in declaration mode
- [VECTO-474] new driving cycles for Municipal and Regional Delivery

# Vecto 3.2.0.925

2017-07-14

## Improvements

- [VECTO-522] step-up ratio for using torque converter in second gear set to 1.85 for busses (still 1.8 for trucks)
- [VECTO-525] remove info-box with max loading in GUI
- [VECTO-531] Payload calculation: limit truck payload to the truck's max payload. (earlier versions only limited the total payload of truc + trailer to the total max. payload, i.e. allowed to shifted loading from truck to the trailer)
- [VECTO-533] allow second driven axle, rdyn is calculated as average of both driven axles
- [VECTO-537] new Suburban driving cycles
- [VECTO-541] increase declaration mode PT1 curve to higher speeds (2500 is too low for some engines)
- [VECTO-542] reduce overspeed in declaration mode to 2.5km/h



# Vecto 3.2.0.925

2017-07-14

## Bugfixes

- [VECTO-462] fix: decision if PTO cycle is simulated
- [VECTO-473] fix: adapt range for validation of torque converter characteristics
- [VECTO-464] fix: extrapolation of engine full-load curve gives neg. max. torque. Limit engine speed to n95h
- [VECTO-480] fix: a\_pos in .vsum was less than zero
- [VECTO-487] fix: Duration of PTO cycle was computed incorrectly if PTO cycle does not start at t=0
- [VECTO-514] fix: sort entries in .vsum numerically, not lexically
- [VECTO-516] fix: consider axlegear losses for estimation of acceleration after gearshifts
- [VECTO-517] fix: valid shift polygon was considered invalid when extended to very high torque ranges
- [VECTO-424] fix: VectoCore.dll could not be found when the current working directory is different to the directory of the vectocmd.exe
- [VECTO-425] fix: vectocmd.exe - check if the output is redirected, and skip updating of the progress bar when this is the case
- [VECTO-426] fix: vectocmd.exe - log errors to STDERR
- [VECTO-519] fix: computation of n95h fails for a valid full-load curve due to numerical inaccuracy. add tolerance when searching for solutions
- [VECTO-520] fix: gearshift count in vsum is 0

# Vecto 3.1.2.810

2017-01-18

## Improvements

- [VECTO-445] Additional columns in vsum file
- Allow splitting shift losses among multiple simulation intervals
- Allow coasting overspeed only if vehicle speed > 0
- Torque converter: better handling of 'creeping' situations

## Bugfixes:

- [VECTO-443] Bugfix in AMT shift strategy: skip gears not working correctly

# Vecto 3.1.2.796

2017-03-07

## Improvements:

- [VECTO-405] Adding clutch-losses for AMT/MT gearboxes during drive-off, reduce drive-off distance after stop from 1m to 0.25m, set clutch closing speed (normalized) to 6.5%, changes in clutch model
- [VECTO-379] Make GUI more tolerant against missing files. Instead of aborting reading the input data the GUI shows a suffix for missing input files
- [VECTO-411] Allow a traction interruption of 0s for AMT/MT gearboxes
- [VECTO-408] Gearbox Inertia for AT gearboxes set to 0
- [VECTO-419] Adapted error messages, added list of errors
- [VECTO-421, VECTO-439] Added volume-related results to vsum file (volume is computed based on default bodies)
- [] Energy balance (vsum) and balance of engine power output and power consumers (vmod) level
- [VECTO-430] AT shift strategy: upshifts may happen too early
- [VECTO-431] AMT shift strategy always started in first gear due to changes in clutch model
- [VECTO-433] adapt generic vehicles: use typical WHTC correction factors
- [VECTO-437] set vehicle speed at clutch-closed to 1.3 m/s
- [VECTO-436] fix simulation aborts with AT gearbox (neg. braking power, unexpected response, underload)

## Bugfixes:

- [VECTO-415] Powershift Losses were not considered for AT gearboxes with PowerSplit
- [VECTO-416] Measured Speed with gear failed when cycle contained parts with eco-roll (computation of next gear failed)
- [VECTO-428] Sum of timeshares adds up to 100%
- [VECTO-429] Min Velocity for lookahead coasting was not written to JSON file

# Vecto 3.1.1.748

2017-01-18

## Bugfixes:

- [VECTO-404] Driving Cycle with PTO stopped simulation after first PTO activation

# Vecto 3.1.1.742

2017-01-12

## Improvements:

- [VECTO-390, VECTO-400] Adapt engine speed to estimated engine speed after gear shift during traction interruption (double clutching)
- [VECTO-396, VECTO-388] Add shift losses for AT power shifts
- [VECTO-389] new gear shift rules for AT gearboxes
- [VECTO-387] added max input speed for torque converter
- [VECTO-385] Automatically add generic torque converter data for drag
- [VECTO-399] Add missions and loadings for vehicle categories 11, 12, and 16 (declaration mode)
- [VECTO-384] cleanup memory after simulation run
- [VECTO-394] new option for vectocmd to disable all output
- [VECTO-392] make the GUI scale depending on the Windows font size
- [VECTO-391] Gearbox output speed and output torque added to .vmod files
- [VECTO-386] Gearbox window: disable input fields not applicable for the selected gearbox type

## Bugfixes:

- [VECTO-401] Computation of  $n_{95h}$  etc. fails if engine's max torque is constant 0
- Lookup of Airdrag parameters in declaration mode
- [VECTO-378] Improved file-handling in AAUX module

# Vecto 3.1.0.683

2016-11-14

## Bugfixes:

- [VECTO-375] Fixed bug when braking during slope change from negative to positive values.
- [VECTO-372] Added check for unusual acceleration/deceleration data which could lead to error when halting.
- [VECTO-371] Added additional behavior to overcome such situations
- [VECTO-370] Added additional behavior to overcome such situations
- [VECTO-369] CrosswindCorrection is now saved and read again from JSON files
- [VECTO-373] WHTC-Engineering correction factor now correctly read/write in JSON files
- [VECTO-368] Fixed validation for specific cases when values are intentionally invalid.
- [VECTO-357] Updated GUI to not show ECO-Roll option to avoid confusion
- Fixed numerous bugs in AT-ShiftStrategy regarding the Torque Converter
- Fixed numerous bugs in MeasuredSpeed Mode (and MeasuredSpeed with Gear) in connection with AT-Gearbox and TorqueConverter
- Fixed a bug when PTO-Cycle was missing
- Corrected axle loss maps for Generic Vehicles in Declaration Mode to match technical annex
- Corrected SumFile Cruise Time Share. Added that timeshares must add up to 100%

# Vecto 3.1.0.683

2016-11-14

## Improvements:

- [VECTO-355] Updated documentation, added powertrain schematics in chapter "Simulation Models"
- [VECTO-374] Check range for Torque Converter speed ratio input data to be at least between 0 and 2.2
- Updated many error messages to be more explicit about the reason of error
- Added "Mission Profiles" Directory with driving cycles publicly available in the application root directory.
- Added "Declaration" directory with the declaration data files in the application root directory.
- Added warning when engine inertia is 0
- Added check that engine speed must not fall below idle speed (even in measured speed mode)
- Shift curve validation for AT gearboxes: shift curves may now overlap due to different shift logic in AutomaticTransmissions.
- Updated Crosswind Coefficients for Tractor+Semitrailer

## Vecto 3.1.0.662

2016-10-24

- **Bugfixes:**

- [VECTO-360] Fixed error during startup of VECTO (loading of DLLs).
- [VECTO-358] Fixed errors during simulation where vehicle unintentionally was driving backwards. Fixed 1Hz-Filter for ModFiles (distance was wrong under certain circumstances, vehicle seemingly jumping back before halt)
- [VECTO-361] Fixed classification of vehicles with GVM of exactly 7500kg
- [VECTO-364] Fixed an error in measured speed mode (run aborts).
- [VECTO-363] Compute shift polygons in declaration mode now uses correct boundary for full load margin.
- [VECTO-365] Fixed editing gears in declaration mode

- **Improvements:**

- [VECTO-355] User Manual updated (Screenshots, Descriptions, File Formats, Vecto V2 Comments removed).
- [VECTO-317] Declaration data for Wheel sizes updated
- [VECTO-359] Simplified code regarding PT1 behavior.
- [VECTO-323] PTO-Cycle may now be left empty when not used in driving cycle.



# **Vecto 3.1.0.652**

**2016-10-14**

- Main Updates
  - Removed VECTO Core 2.2
  - Refactoring of the User-Interface Backend: loading, saving files and validating user input uses Vecto 3 models
  - AT-Gearbox Model: differentiate between AT gearbox with serial torque converter and AT gearbox using powersplit
  - Numbering of gears with AT gearbox corresponds to mechanical gears, new column TC\_locked in .vmod file to indicate if torque converter is active
  - Torque converter gear no longer allowed in input (added by Vecto depending on the AT model)
  - New implementation of torque converter model (analytic solutions)
  - Added PTO option for municipal utility vehicles: PTO idle losses, separate PTO cycle during standstill
  - Added Angledrive Component
  - Option for constant Auxiliary Power Demand in Job-File

## Vecto 3.1.0.652

2016-10-14

- Main Updates (cont.)
  - Normalize x/y values before triangulating Delaunay map (transmission loss-maps, fuel consumption loss map)
  - Additional fuel consumption correction factor in declaration mode: cold/hot balancing factor
  - Added fuel consumption correction factor (WHTC, Cold/Hot balancing, ...) in engineering mode
  - Update auxiliaries power demand according to latest whitebook
  - Allow multiple steered axles
  - Adapted engine idle controller (during declutch) – engine speed decreases faster
  - SUM-File: split E\_axl\_gbx into two columns, E\_axl and E\_gbx
  - New columns in mod-file: PTO, torque converter
  - Removed full-load curve per gear, only single value MaxTorque
  - Removed rims (dynamic wheel radius depends on wheel type)
  - Fixes in AAUX module: open correct file-browser, save selected files

# Status quo VECTO software and open issues (Oct. 2016)

## Next issues on the to do list

- **Further development of the AT model**  
Consideration of losses during power shifts, update of gear shift logics
- **Reimplementation of engine stop/start**
- **Declaration mode: implementation of EMS vehicle configurations**

### Items waiting for decision on methods and resources:

- **Update engine data (according to update of Annex II)**  
Other fuels than diesel, “top torque” feature, correction factor for periodic regenerating DPFs
- **Declaration mode:**
  - **Revision of calculated vehicle loads**
  - **implementation of refuse cycle (instead “municipal”)**  
Update of driving cycle, consideration of generic PTO loads during collection part, generic body weight and payload
  - **VECTO output (approval authorities, customer info, monitoring)**
  - **Buses**
- **Predictive ADAS**

## **Vecto 3.0.4.565**

**2016-07-19**

- Bugfixes
  - AAUX HVAC Dialog does not store path to ActuationsMap and SSMSource
  - GUI: check for axle loads in declaration mode renders editing dialog useless
  - Vecto 2.2: Simulation aborts (Vecto terminates) when simulating EngineOnly cycles
  - Vecto 3: Building SimulationRun EngineOnly simulation failed

# Vecto 3.0.4.544

2016-06-28

- Main Updates
  - New gear shift strategy according to White Book 2016
  - New coasting strategy according to White Book 2016
  - New input parameters (engineering mode) for coasting and gear shift behavior
  - Use SI units in Advanced Auxiliaries Module and compile with strict compiler settings (no implicit casts, etc.)
  - Allow efficiency for transmission losses (in engineering mode)
- Bugfixes
  - Auxiliary TechList not read from JSON input data
  - Improvements in driver strategy
  - Bugfixes in MeasuredSpeed mode

## Notes for using Vecto 3.x with AAUX (1)

- The AdvancedAuxiliaries module requires the number of activations for pneumatic consumers (brakes, doors, kneeling) and the (estimated) total cycle time. This can be configured in the .APAC-file (actuators file). For standard bus/coach cycles (i.e., the cycle file contains “bus” **and** “heavy\_urban” or “suburban” or “interurban” or “urban”; **or** the cycle contains “coach” (*case insensitive*)) the actuators file already contains the number of activations and the cycle time. For other cycles the filename without extension is used to lookup the activations in the .APAC file (*case sensitive*)

## Notes for using Vecto 3.x with AAUX (2)

- Vecto 3 uses an average auxiliaries load (determined by the AAUX module depending on the settings) for the simulation. The AAUX module computes the fuel consumption in parallel to VectoCore and accounts for smart consumers (e.g., alternator, pneumatics, ...).
- Output
  - The .vmod file contains both, the fuel consumption calculated by VectoCore (per simulation interval) and AAUX (accumulated and per simulation interval).  
Columns in .vmod file:
    - AA\_TotalCycleFC\_Grams [g]: accumulated fuel consumption as computed by the AAUX model, considering smart consumers
    - FC-Map [g/h]: fuel consumption as computed by VectoCore interpolating in the FC-Map, using an average base load of auxiliaries
    - FC-AUXc [g/h]: fuel consumption corrected due to engine stop/start (currently not applicable)
    - FC-WHTCc [g/h]: WHTC-corrected fuel consumption (not applicable in engineering mode)
    - FC-AAUX [g/h]: fuel consumption per simulation interval, derived from AA\_TotalCycleFC\_Grams
    - FC-Final [g/h]: final fuel consumption value with all (applicable) corrections applied (stop/start, WHTC, smart auxiliaries)

## Notes for using Vecto 3.x with AAUX (3)

- Output .vsum
  - Columns in .vsum file:
    - FC-Map: total fuel consumption as computed by VectoCore interpolating in the FC-Map, using an average base load of auxiliaries
    - FC-AUXc: total fuel consumption corrected due to engine stop/start (currently not applicable)
    - FC-WHTCc: WHTC-corrected fuel consumption (not applicable in engineering mode)
    - FC-AAUX: fuel consumption per simulation interval, derived from AA\_TotalCycleFC\_Grams
    - FC-Final: final fuel consumption value with all (applicable) corrections applied (stop/start, WHTC, smart auxiliaries)



# Vecto 3.0.3.537

2016-06-21

- Main Updates
  - Plot shift lines as computed according to WB 2016 declaration mode in GUI
- Bugfixes
  - GUI: Buttons to add/remove auxiliaries are visible again
  - Error in calculation of WHTC correction factor
  - Fix: consider gearbox inertia (engineering mode) for searching operating point
  - Wrong output of road gradient in measured speed mode (correct gradient for simulation)
  - Fuel consumption in .vsum file now accounts for AdvancedAuxiliaries model
  - GraphDrawer (Vecto): handle new .vmod format of Vecto 3
  - AdvancedAuxiliaries: language-settings independent input parsing
  - Paux was ignored when running Vecto 2.2
  - Error in massive multithreaded execution
  - Fix unhandled response during simulation
  - Fix output columns in .vmod

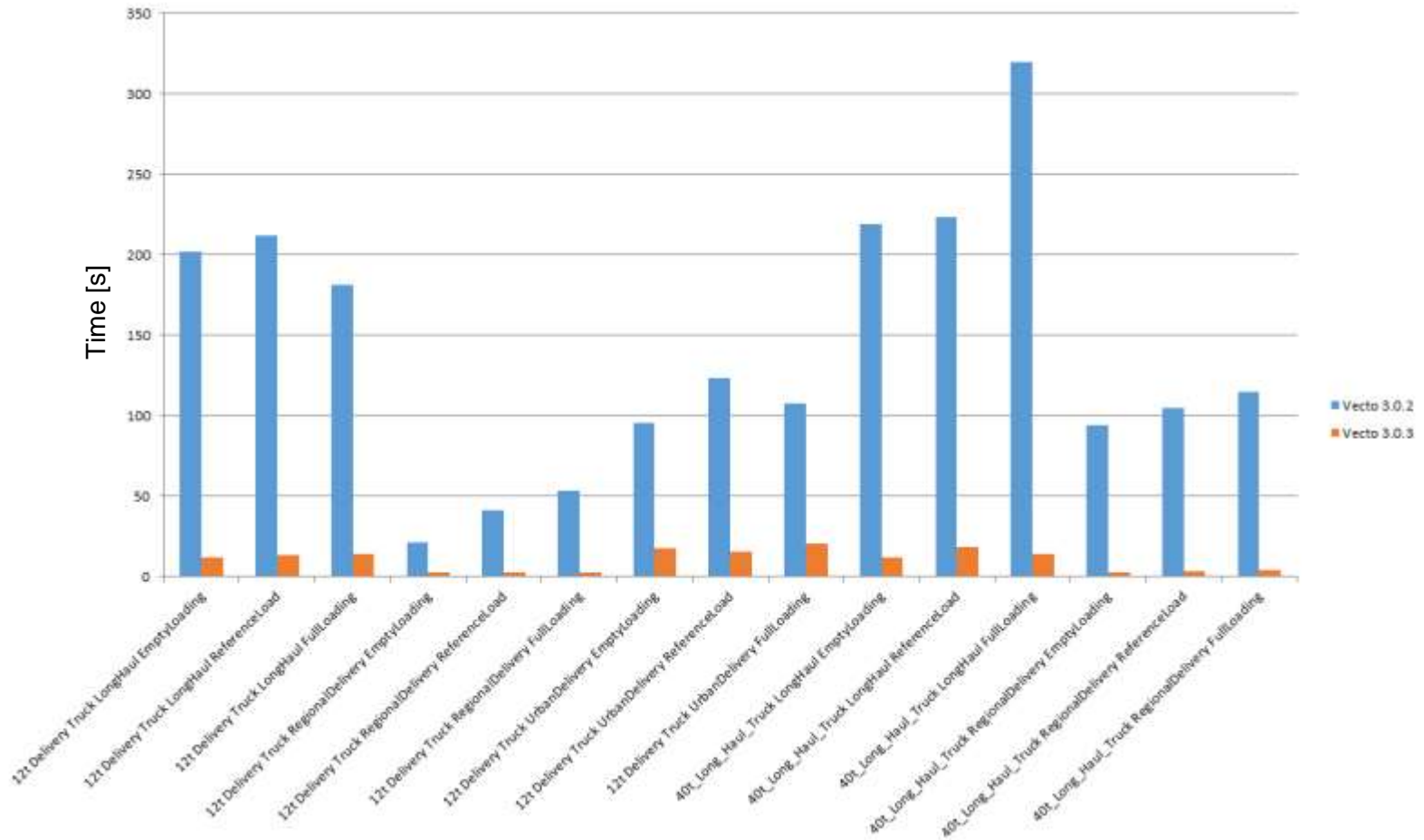
# **Vecto 3.0.3.495**

**2016-05-10**

- Main Updates
  - Support for Advanced Auxiliaries (Ricardo) in Vecto 3.0.3 and Vecto 2.2
  - Performance improvements
  - Gearshift polygons according to WB 2016
  - Revision of SUM-data file, changed order of columns, changed column headers
- Bugfixes
  - Delaunay Maps: additional check for duplicate input points
  - Creation of PDF Report when running multiple jobs at once
  - Sanity checks for gear shift lines
  - Improvements DriverStrategy: handling special cases

# Performance Comparison

Execution Times (all 15 runs in parallel)



Total execution time (15 runs in parallel): Vecto 3.0.2: 6min 6s; **Vecto 3.0.3: 35s**

# VECTO 3.0.2

2016-03-11

## Main updates

- New simulation modes:
  - Pwheel (SiCo),
  - Measured Speed (with/without gear)
  - $v_{\text{air}}$ /beta cross-wind correction (vcdb)
- Adaptations of powertrain components architecture
  - Move wheels inertia from vehicle to wheels
  - Auxiliaries no longer connected via clutch to the engine but via a separate port
  - Engine checks overload of gearbox and engine overload
- Fixed some driving behavior related issues in VectoCore:
  - When the vehicle comes to a halt during gear shift, instead of aborting the cycle, it tries to drive away again with an appropriate gear.
- ModData Format changed for better information and clarity
- Added validation of input values (according to latest VectoInputParameters.xls)
- Various bugfixes

## Pwheel (SiCo) Mode

- Function as already available in Vecto 2.2 also added in Vecto 3.0.2
  - Driving cycle specifies power at wheel, engine speed, gear, and auxiliary power
  - No driver model in the simulation.
  - The Vecto gear-shift model is overruled.
  - Function used for creating reference results for SiCo tests
  - For details see user manual: Simulation Models / Pwheel Input (SiCo)

## Measured Speed Mode

- Functionality already available in Vecto 2.2 added in Vecto 3.0.2
  - Driving cycle not defined by target speed but by actual speed. No driver model in the simulation.
  - Gear and engine speed can be specified in the driving cycle. In this case the Vecto gear-shift model is overruled.
  - Function used for “proof of concept” purposes
  - For details see user manual: Calculation Modes / Engineering Mode / Measured Speed

## **.vmod File Update**

- In Vecto 3.0.2 the structure of the modal data output has been revised and re-structured. Basically for every powertrain component the .vmod file contains the power at the input shaft and the individual power losses for every component. For the engine the power, torque and engine speed at the output shaft is given along with the internal power and torque used for computing the fuel consumption.
- For details see the user manual: Input and Output / Modal Results (.vmod)

# Changelog 3.0.2

- - New simulation modes:
- + Measured Speed
- + Measured Speed with Gear
- + Pwheel (SiCo)
- - Adaptations of powertrain components architecture
- + Move wheels inertia from vehicle to wheels
- + Auxiliaries no longer connected via clutch to the engine but via a separate port
- + Engine checks overload of gearbox and engine overload
- - Fixed some driving behavior related issues in VectoCore:
- + When the vehicle comes to a halt during gear shift, instead of aborting the cycle, it tries to drive away again with an appropriate gear.
- - [ModData Format](#modal-results-.vmod) changed for better information and clarity
- - Entries in the sum-file are sorted in the same way as in Vecto 2.2
- - In engineering mode the execution mode (distance-based, time-based measured speed, time-based measured speed with gear, engine only) are detected based on the cycle
- - Added validation of input values
- - Gravity constant set to 9.80665 (NIST standard acceleration for gravity)
- - Improved input data handling: sort input values of full-load curves (engine, gbx, retarder)
- - Better Integration of VectoCore into GUI (Notifications and Messages)
- -  $v_{air}/\beta$  cross-wind correction (vcdb) implemented
- - For all calculations the averaged values of the current simulation step are used for interpolations in loss-maps.
- - Allow extrapolation of loss maps in engineering mode (warnings)
- - Refactoring of input data handling: separate InputDataProvider interfaces for model data
- - Refactoring of result handling: separate result container and output writer
- - New Long-Haul driving cycle included
- - User Manual updated for VECTO V3.x
- - Fix: sparse representation of declaration cycles had some missing entries
- - Bugfix: error in computation of engine's preferred speed
- - Bugfix: wrong vehicle class lookup
- - Bugfix: duplicate entries in intersected full-load curves
- - Bugfix: retarder takes the retarder ratio into account for lossmap lookup
- - Bugfix: use unique identifier for jobs in job list
- - Bugfix: error in triangulation of fuel consumption map