

```
elif _operation == "MIRROR_X":
    mirror_mod.use_x = False
    mirror_mod.use_y = True
    mirror_mod.use_z = False
elif _operation == "MIRROR_Z":
    mirror_mod.use_x = False
    mirror_mod.use_y = False
    mirror_mod.use_z = True

#selection at the end -add back the deselected mirror
mirror_ob.select= 1
modifier_ob.select=1
bpy.context.scene.objects.active = modifier_ob
print("Selected" + str(modifier_ob)) # modifier ob is the
    mirror_ob.select = 0
name = bpy.context.selected_objects[0]
bpy.data.objects[name].name = selected
```

SIL

Stellantis/FCA accelerates software testing
with agile practices and virtualization

for Early Validation

The Global Electrical Engineering and Software - Virtual Engineering Team (EE&SW VE Team) of Stellantis – formerly Fiat Chrysler Automobiles (FCA) – is implementing a new and improved software development and test platform that embraces agile technology practices and virtualization capabilities to enable early validation.



Virtualization is a key concept when we talk about agility.

By being able to quickly adapt to changes that can arise at any stage of the software development cycle, such as new requirements, code errors, or integration issues, the new test platform will leave the EE&SW VE Team better positioned to secure optimal outcomes. "At FCA, we focus on best software development and testing practices," said Sangeeta Theru, Vehicle Modeling and Integration Lead, EE&SW VE, FCA US LLC. "Virtualization is a key concept

when we talk about agility in the controls and software development process." Some of the main benefits that are supported by virtualization include:

- A reduced number of costly iterations by frontloading tests
- Iterative development of complex new functions at an early stage
- Ability to perform development work on a laptop/computer without requiring the physical controller
- Reuse of plant models and test scenarios across xIL test platforms

[model-in-the-loop (MIL), software-in-the-loop (SIL) and hardware-in-the-loop (HIL)]

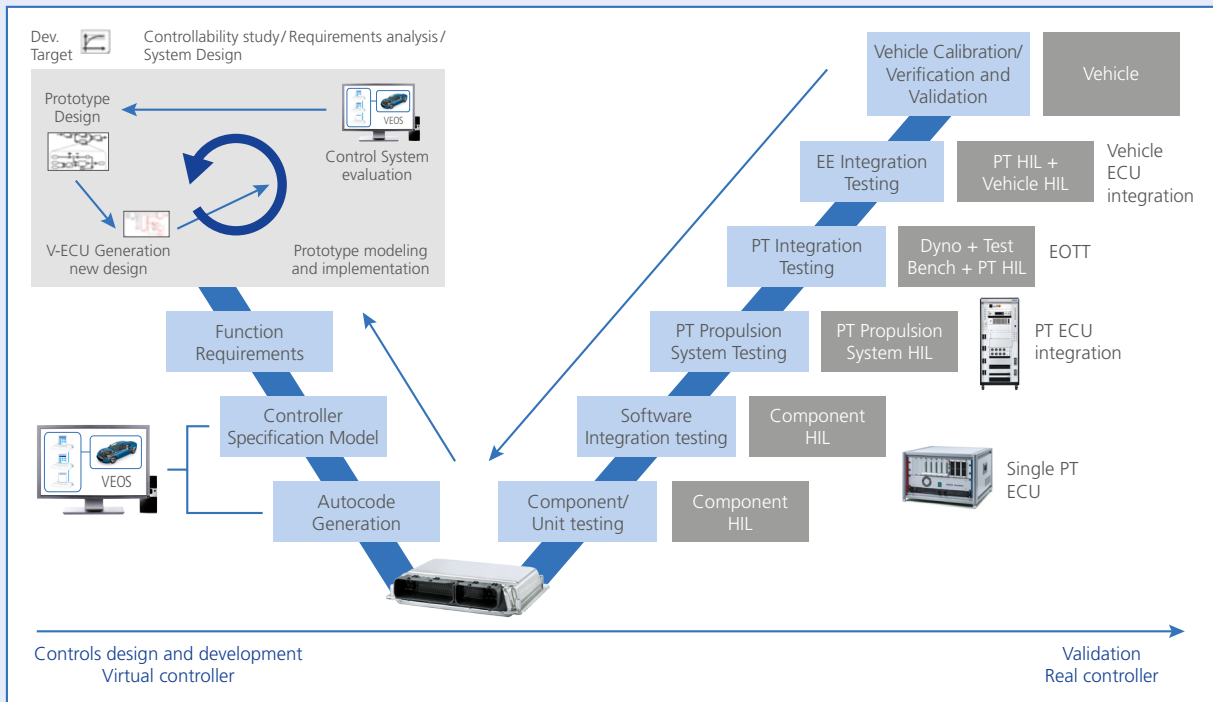
Valuable Time and Costs Savings

A key incentive of the FCA virtual test platform is the capability to perform early software validation. This is made possible by creating a virtual version of the electronic control unit (ECU) under test. The virtual ECU is a physically equivalent replica of the real ECU. By utilizing virtual ECUs in >>

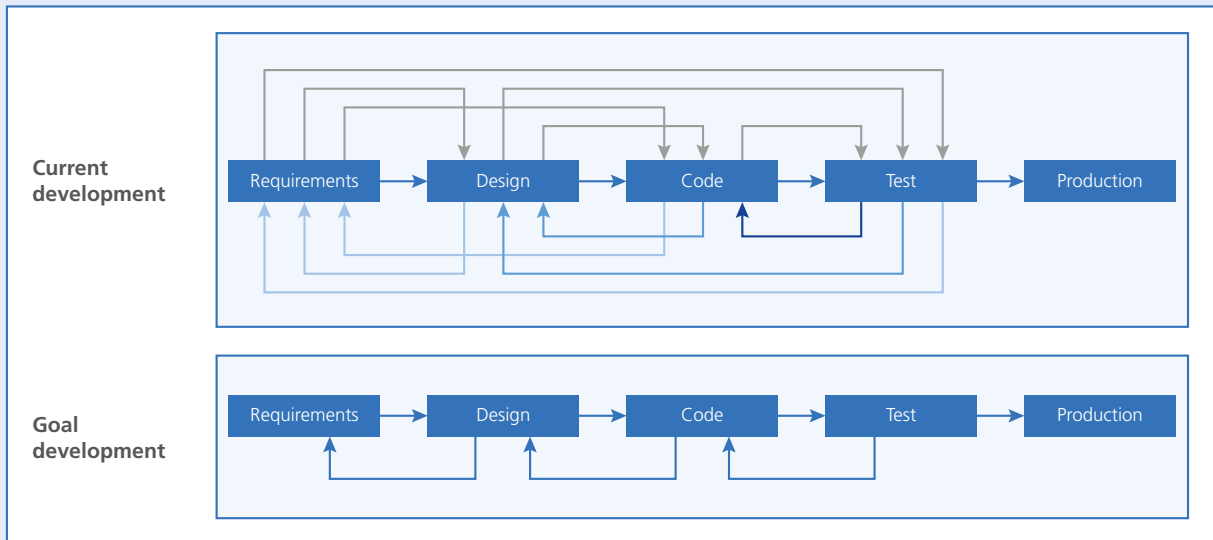


"Early validation at the software level significantly improves our test efficiency. To use it reliably, we rely on the PC-based simulation platform dSPACE VEOS, which integrates well into our test workflows."

*Sangeeta Theru,
Vehicle Modeling and Integration Lead, EE&SW VE, FCA US LLC.*



Frontloading software validation and verification through SIL testing.



Development process optimization with agile methods.

software-in-the-loop (SIL) testing, early and realistic ECU software validation can be performed – even before the first prototype becomes available. This process allows issues to be identified and debugged much earlier in the development process, saving valuable time and costs.

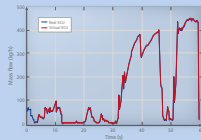
The EE&SW VE Team began its initiative to develop a virtual test platform in 2016 and has been working closely with dSPACE. Their test platform includes dSPACE VEOS, a PC-based simulation platform that allows for virtual validation. VEOS makes it possible to simulate a wide range of different mod-

els, such as function models, Functional Mock-up Units (FMUs), virtual ECUs (V-ECUs), and vehicle models, in early development stages – independent of any specific simulation hardware. The latest version of VEOS supports the AUTOSAR Adaptive Platform for high-performance computing require-

Key Points of VEOS

Realistic Simulation

- Bus simulation
- Reproducible
- Benchmarks



Support of All Relevant Standards/Formats



Consistent Workflow from SIL to HIL

- Models for all platforms
- Same sophisticated tools



Simulation for Each Situation

- Virtual ECU network
- Sensor simulation
- Virtual vehicles



VEOS is a PC-based simulation platform for validating the software of electronic control units (ECUs) in early development stages.

| Location | Application | Status | Modification Area |
|-------------------|----------------|-----------|---------------------------|
| Tofas | Application 1 | running > | Running Session Status 0% |
| Pomigliano d'Arco | Application 2 | ready | 26 carts to be scheduled |
| Pomigliano d'Arco | Application 3 | ready | |
| Torino | Application 4 | ready | |
| Pomigliano d'Arco | Application 5 | ready | 18 carts to be scheduled |
| Betim | Application 6 | ready | |
| Pomigliano d'Arco | Application 7 | ready | 1 cart to be scheduled |
| Pomigliano d'Arco | Application 8 | ready | 8 carts to be scheduled |
| To be defined | Application 9 | idle □ | 62 carts ready |
| To be defined | Application 10 | idle □ | 65 carts ready |

Screenshot of the FCA Virtual Test Platform showing the status of four virtual tests.

ments, such as applications for autonomous driving.

“Early validation reduces costly iterations due to issues or bugs identified very late in the vehicle program development timeline,” explains Giancarlo Di Mare, Head of Virtual Engineering, FCA Italy S.p.A.

Mr. Di Mare adds that VEOS and the virtual test platform technology integrate well into the overall model-based development and ECU testing workflow. The integrated workflow consists of database and workflow management to collaborate within different teams across different test

phases and xIL environments (MIL, SIL, HIL). FCA currently uses an internal, keyword-driven tool (VST) for test automation and traceability to requirements and test cases in IBM Rational Quality Manager (RQM), which allows for remote global testing in all FCA test facilities. >>



“Early validation reduces costly iterations due to issues or bugs identified very late in the timeline of the vehicle program development. The simulation and validation solution from dSPACE efficiently accelerates their identification.”

*Giancarlo Di Mare,
Head of Virtual Engineering, FCA Italy S.p.A.*

Additionally, FCA is using the dSPACE Test Solution Package (TSP). TSP is a product-bundle solution for performing efficient & automated ECU testing. It includes dSPACE SYNECT (data management and collaboration software), dSPACE AutomationDesk (test authoring and automation tool), and the dSPACE Test Authoring Framework (TAF). “Using TSP, we are able to establish traceability with IBM RQM, handle variants of system tests and parameters, and perform optimized test authoring and synchronization of test steps in the RTC/RQM process,” summarizes Sisay Molla, Vehicle modeling and Integration, FCA US LLC.

Improved Test Efficiency

With the virtual testing platform technology in place, the EE&SW VE Team is working toward three significant goals: 1) reducing testing on HIL, 2) frontloading tests to software-in-the-

loop (SIL), and 3) synchronizing and managing requirements across the development stages and among various teams and suppliers. To date, the EE&SW VE Team has used this technology to successfully virtualize and implement a hybrid control processor (HCP) in a closed-loop virtual test platform and to virtualize and implement an engine controller in a closed-loop virtual test platform, based on AUTOSAR software architecture with production basic software. The team is also working on the integration of a virtual transmission controller as well as the virtualization of legacy code.

Global Team Effort

The project team from FCA and dSPACE collaborated extensively to develop and implement the virtual test platform. The core group included members of the EE&SW VE Team responsible for virtual ECU generation and integration

in the plant models to generate the closed-loop virtual test platform. The user group includes members from the FCA Controls Team Centers of Excellences (COEs) and software teams. This large team had quite an international footprint with various FCA contributors from FCA North America, Italy, Brazil, India, etc., as well as dSPACE team members from the USA and Germany. Together, the FCA and dSPACE teams took on several challenges, including the integration of AUTOSAR basic software from third-party commercial vendors, developing a new ECU with its own software architecture, and the virtualization of complex device drivers. According to FCA, the virtual test platform is currently utilized for control development and software testing and is showing great promise for early validation. ■

Courtesy of FCA US LLC



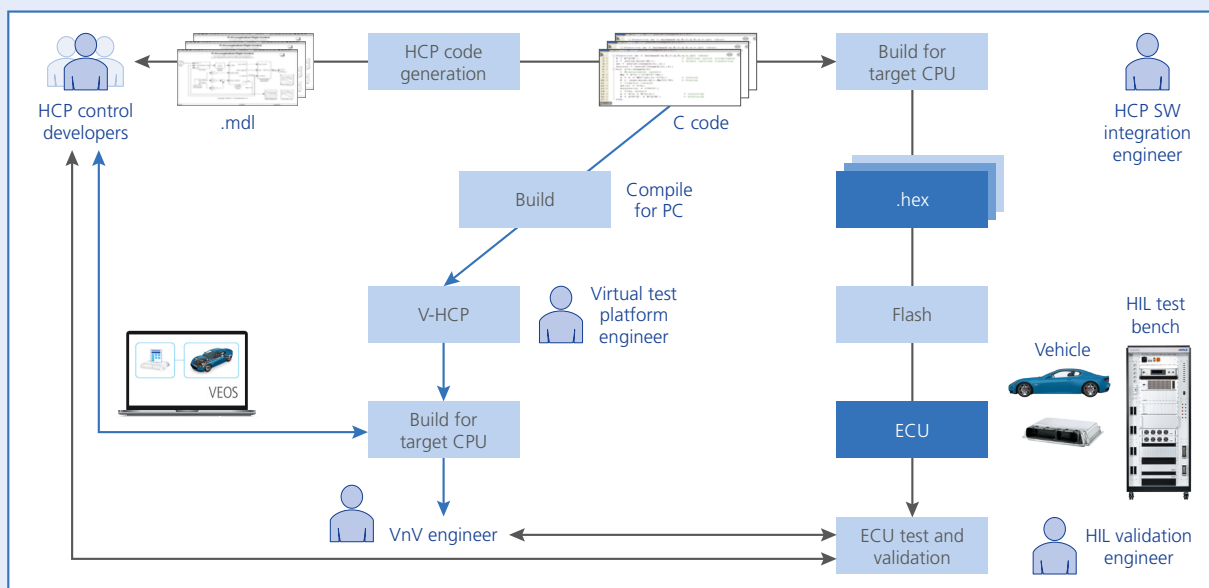
“The dSPACE Test Solution Package helps us to optimize tests and the test process.”

*Sisay Molla,
Vehicle modeling and Integration, FCA US LLC.*

Picture credit: © FCA



SIL paves the way to efficiency.



An example of a high-level workflow for hybrid control development. Using virtual ECUs and the HCP Virtual Test Platform, the development team benefits from a more efficient build and time process and can perform tests earlier.