



# Vensim Update 2013

**July 24, 2013**

## Vensim Core Features

- **Instant results and structural experiments with SyntheSim™**
- **Patented technology for model analysis and quality control**
- **Flexible array syntax with mapping and sparse matrix functions**
- **Extensive options for data connection and calibration**
- **Robust functions for allocation problems, delays, and other dynamics**
- **Optimization, Monte Carlo simulation, Kalman filtering**
- **Rich diagramming and rapid interface prototyping**
- **External functions, DLL and interface solutions for redistribution and server deployment**

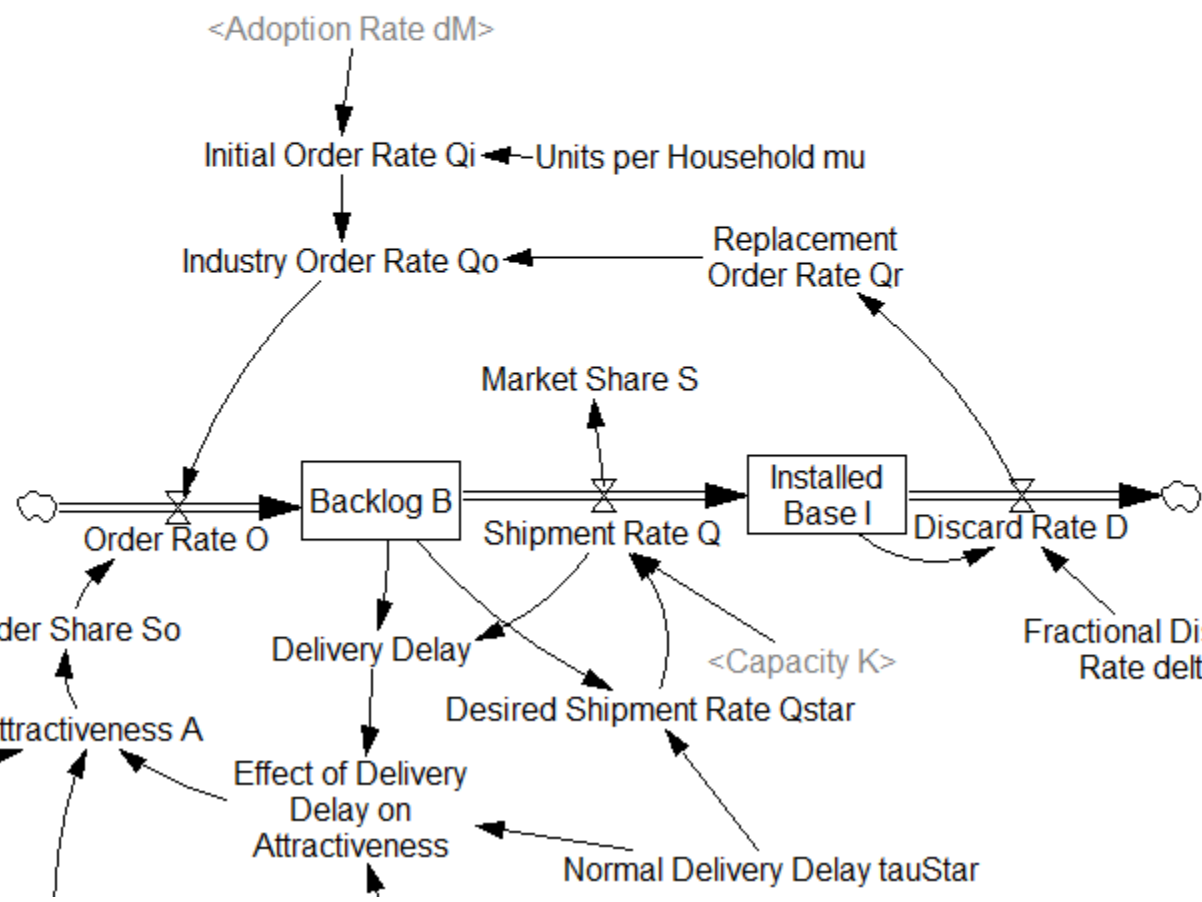
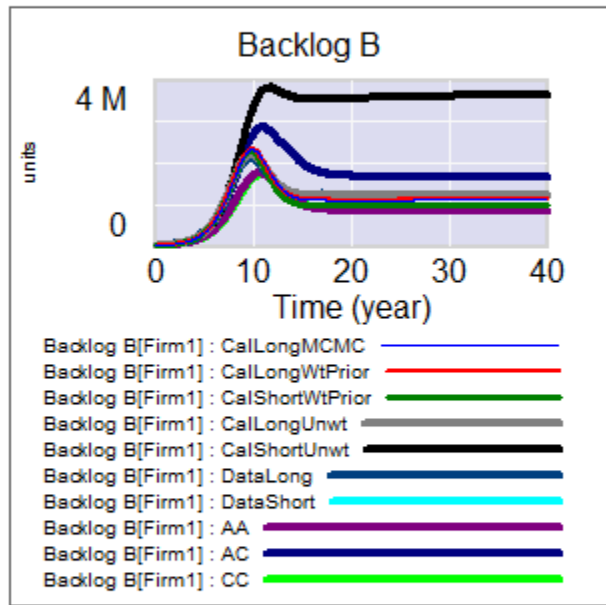
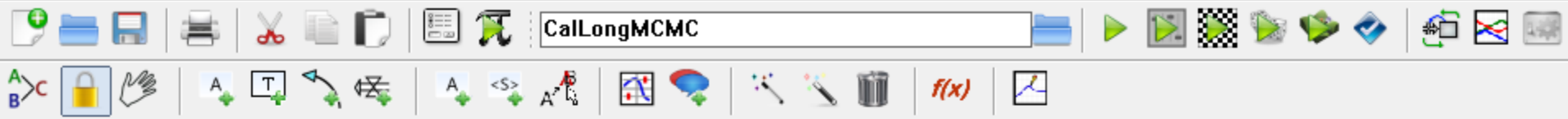
## Vensim 6 (2012)

- **Toolbars**
- **Equation editor**
- **Help system upgrades**
- **Advanced/Experimental Features**
  - Stochastic Optimization
  - Discrete Variables
  - Extended Payoffs
  - New Payoff Report Items
  - Markov chain Monte Carlo & Simulated Annealing

# New Toolbars

Vensim: BALCSdistr4d-datagen.mdl Var: Installed Base I[Firm]

File Edit View Layout Model Tools Windows Help



# New Equation Editor

Edit: Backlog B

**Variable Information**

Name:

Type:  Sub-Type:

Units:   Check Units  Supplementary

Group:  Min:  Max:

**Edit a Different Variable**

- Adopters M
- Adoption Noise SD
- Adoption Rate dM
- Attractiveness A
- Attractiveness Noise SD
- Authorized Capacity
- Average Value of Backlog

**Equations**

Subscript: [  ]

Except = INTEG (  )

Initial:

Functions:  Keypad Buttons:  Subscripts:  Variables:  Causes:

ABS	7	8	9	+	:AND:	Firm	Backlog B Industry Order Rate Qo Normal Delivery Delay tauStar Order Rate O Shipment Rate Q
DELAY FIXED	4	5	6	-	:OR:		
DELAY1	1	2	3	*	:NOT:		
DELAY1I	0	E	.	/	:NA:		
DELAY3	(	)	,	^	<>		
DELAY3I	>	>=	=	<	<=		
EXP	[	]	!	{	}		
GET 123 CONSTANTS	Undo	->	{ [ ( ) }				
GET 123 DATA							
GET 123 LOOKUPS							
GET DIRECT CONSTANTS							

Comment:

Expand

Errors:

# Help System Upgrades & Sample Models

Vensim Help

Hide Back Forward Home Print Options

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        - Simultaneous Functions
      - Test Inputs
        - PULSE TRAIN**
        - PULSE
        - RAMP
        - STEP
      - Time Functions

## PULSE TRAIN(start,width,tbetween,end) TRAIN of repeated PULSES

Returns 1.0, starting at time **start**, and lasting for interval **width** and then 0.0. If **width** is greater than **width** then 1 will be returned between **start** and **end**. If **width** is less than **width** then 0 will be returned between **start** and **end**. The value returned by PULSE TRAIN depends only on the arguments plus expressions in which case the actual output pattern may not be regular. With PULSE, Vensim creates time plus internally to avoid rounding errors.

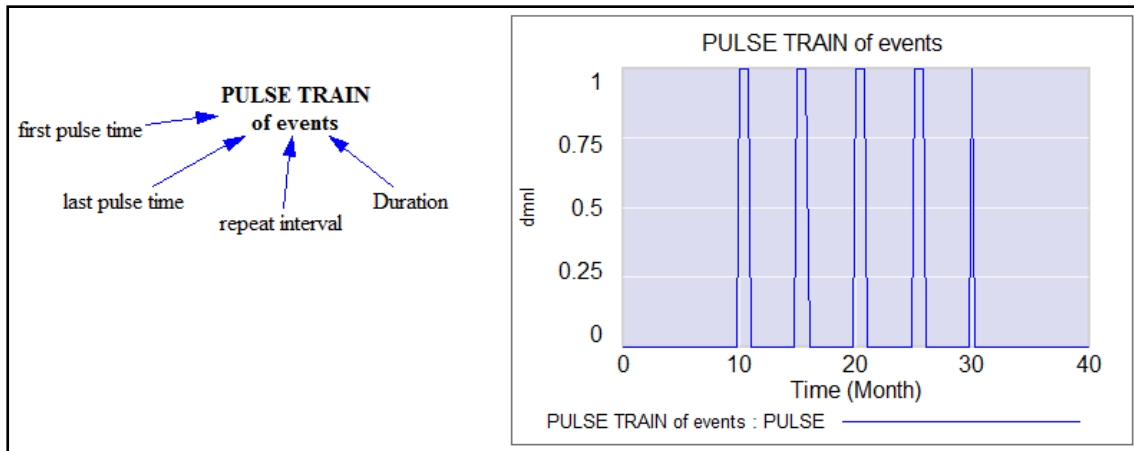
**NOTE** The value returned by PULSE TRAIN does not change except for the arguments.

**Units:** PULSE(time, time) --> dimensionless (start and width in time units)

### Example

```
is daytime = PULSE TRAIN(8,12,24,FINAL TIME)
```

See also: [PULSE](#)  
 Sample model: [PULSE+PULSE TRAIN.mdl](#) in [FunctionExamples](#)



## Stochastic Optimization

- **Maximize or minimize over an ensemble of Monte Carlo simulations**
  - Example: maximize return on an investment, given uncertainty about oil prices and competitor behavior
- **Payoff is the sum of payoffs from the individual runs**
  - FP error in any realization is treated as an error in the whole ensemble
- **Simple to implement:**
  - Supply the usual optimization files - .vpd & .voc
  - Add sensitivity control files - .vsc & .lst
  - Add the **:STOCHASTIC** keyword to the .voc

## Discrete Variables

- **Challenge: optimize  $f(x)$  with  $x$  discrete (e.g., integer or binary)**
  - Powell optimizer wastes cycles evaluating non-integer values of  $x$
  - Discreteness creates payoff surface roughness
- **Partial solution:**
  - New DIS keyword for optimization control file parameters, e.g.  $0 \leq x[i] \leq 10 | \text{DIS}=1$
  - Revise concept of distance for optimizer tolerance checking, to skip moves that make no progress given discreteness
- **Caveat: doesn't solve the roughness problem (random multistart or stochastic methods needed)**



## Extended Payoffs

- **Avoid the hassle of building complex model structures for payoffs**
- **Provide new calibration error models (lognormal, robust/Laplace)**
- **Permit mixing of calibration and policy payoff elements, so that (for example) calibration can be combined with penalty functions or priors on some parameters**
- **Implementation: new payoff sub-types, which can be combined as needed**
  - Policy: logarithmic, initial, final (\*P, \*PL, \*PI, \*PLF, etc.)
  - Calibration: logarithmic, ABS(...) errors, Kalman-compatibility (\*C, \*CL, \*CK, \*CLR, etc.)

# Markov chain Monte Carlo & Simulated Annealing (MCMC & SA)

- **MCMC: explore a calibration likelihood surface**
  - Perform a random walk over the payoff surface, with moves chosen according to point likelihoods; stationary distribution of the Markov process reflects likelihood surface
  - Problem: determining scale of proposed jumps
  - Solution: Differential Evolution (run multiple Markov chains and recombine from population to propose jumps)
- **SA: optimize in presence of many local optima**
  - Same as above, but start with a high 'temperature' (tolerance for uphill moves), and cool according to some schedule

# Vensim®

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## The Workbench

[Home](#) \ The Workbench



This page is a repository for Vensim plugins (external function libraries) and tools that have been built around Vensim, exploiting the capabilities of the Vensim .dll or similar features.

Much of the material on this page, particularly plugins, will require Vensim DSS. Other items may work with the Model Reader .dll or directly on Vensim files. For the moment, most of what we provide is Windows-specific, though it is generally possible to recompile external functions for Mac and Linux.

## Site Map

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## Vensim 6.1

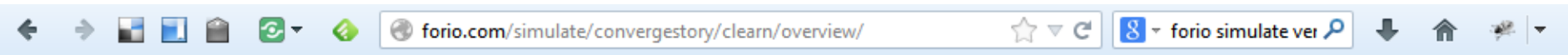
- **Import / Export CSV Files**
- **Optimization Payoffs Available to DLL**
- **GUI Improvements**
  - Keyboard shortcuts
  - Dialogs
- **Operational Improvements**
  - CIN file Double vs Single
  - Ini file defaults improved
  - Support for compiled simulation on 64-bit machines
- **Improved Reliability**

## Vensim 6.4

- **Native 64-bit Vensim is now running**
- **Beta version expected in September 2013**
  - Included with Vensim DSS and Vensim Pro licenses
- **Able to read VDFs produced by 32-bit Vensim**
- **Double precision data support is standard**
- **Support for very large models and very large arrays**
- **64-bit DLL provides improved access to 64-bit applications**

# Deployment Options

# Forio Simulate



Forio Simulate™

Sign In / Register | Sim Showcase Find Sims Create Simulation Help / Support

C Learn

Overview

embed/link add to favorites

### Create a Future Where We Address Climate Change

There ARE possible paths to addressing climate change. The five organizations at the bottom right have studied how we could do it.

Click on the buttons to see what would happen to greenhouse gas emissions and temperature, or move the slider to create your own future scenario.

**Total Greenhouse Gas Emissions**

**Temperature Change in**

**Move the Slider to Create a Scenario**

Global % Change in Total Emissions by 2050

-100 -50 0 50 100 150 200

Run Simulation

**Choose a Researched Scenario**

Business As Usual

Worldwatch

Intl. Energy Agency

Greenpeace

McInsey

Earth Policy Institute

Simulation Background Use Full Simulation

www.convergestory.com

## C Learn

By Converge Story

Sim URL: <http://forio.com/simulate/convergestory/clean>

Sim access: All users may copy the simulation and explore the model.

Sim plan: Simulate Basic

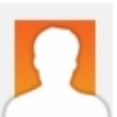
Sim stats: This sim has been run 10448 times.

Your Rating: ★★★★★

Average Rating: ★★★★★

### Converge Story

See other simulations by the same author



Recent comments:

# Facebook game for Rio by CodeSustainable, powered by server multicontext shared library

CodeSustainable

http://codesustainable.com

CodeSustainable | Home

## GAME CHANGE RIO BETA

Sebastian

100

\$ 215 bn

Round 03 2020-2025

### Actual Mission

Increase available calorie intake by with two agriculture policies and two forest and fisheries policies to earn 200 experience points over the next two rounds.

Improve buildings power use (low)	Increase water supply (low)	Increase budget for education (low)	Increase budget for healthcare (low)
\$ 1287 bn	\$ 540 bn	\$ 1398 bn	\$ 1398 bn

Support public transport systems	Plant more trees (low)	Promote organic agriculture (low)	Improve industrial energy use (low)	Increase water use efficiency (low)
----------------------------------	------------------------	-----------------------------------	-------------------------------------	-------------------------------------



# C-ROADS in Sable

Sable Developer : C-ROADS

File Edit View Insert Layout Tools Network Help

**C-ROADS** v3.008.026 **6 Region** **SRES A1FI MINICAM**

Getting Started Load/Unload Run Save Run Reset to Reference Return to Main

CO2 Emissions CO2e Non-forest Land Use Other Per Capita GHG Concs Temp & Goal Comparisons

### CO2 Equivalent Non-forest Emissions by Country Group

Data from current\_run.vdf | Reference scenario is SRES A1FI MINICAM

### Temperature and Goal

Data from current\_run.vdf | Reference scenario is SRES A1FI MINICAM

Data Table Export Image/Data Large Graph 2100 Data Select Regions Prob. 2 deg Data Table Export Image/Data Large Graph

Emissions Targets Non-CO2 GHGs Land-use Emissions Non-CO2 Forcings **Population & GDP** Sensitivity Settings World Climate Exercise

	Reference Scenario Population Change(%)	Reference Scenario GDP Change(%)
US 6R	0.0	0.0
EU 6R	0.0	0.0
China 6R	0.0	0.0
India 6R	0.0	0.0
Other Developed 6R	0.0	0.0
Other Developing 6R	0.0	0.0

### Graph Data

Time	temperature change from preindustrial - ref.vdf	GOAL FOR TEMPERATI
1850.00	0.06	2.0
1851.00	0.06	
1852.00	0.06	
1853.00	0.06	

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## **Our Vision for the Future of Dynamic Simulation**

- **Build realistic and important models of large and complex dynamic systems that can be used to improve the quality of the world in which we live.**
- **Our emphasis is in the areas of policy and strategic decision making.**

## Some Examples

- **Environment, Energy, Economy, and Society**
- **Health Care and Disease Management**
- **City, Regional, Country Planning and Policy**
- **Financial Systems**
- **Management Steering Platforms**
- **Risk Management and Mitigation**
- **Large Projects and Project Portfolios**

## Ventana's Product Development Plans

- **We are committed to maintaining Vensim as the leading SD toolset**
- **We have significantly increased our investment in product development**
- **Major new capabilities will be released in July 2014**

## Modularity

- **Ability to build modular and reusable components that may correspond to real world objects, entities and relationships**
  - Team and distributed development
  - Large scale granularity
  - Improved productivity
  - Reuse across many models and projects
- **Collections of these modular components will largely replace the use of arrays and subscripts**
- **These modular components will provide a transparent replacement for MACROs**

## Dynamic Structure and Relationships

- **Ability to dynamically create new components during a simulation**
  - Enables agent-style modeling
- **Support for dynamic changes in aggregations and relationships**
  - Current array structures are fixed at the beginning of each run



## Additional Improvements

- **Discrete time transactions simplify simulation of one-time events**
- **Improved scenario management**
- **Improved definition and presentation layer**
  - More charting options
  - Ability to open multiple views at one time