

## How VectorCAST supports the DO-178B Structural Coverage Requirements:

- > Supports all levels of code coverage required by DO-178B
- > Automatic generation and compilation of complete test stubs and driver programs
- > Automatic regression testing
- > DO-178B compliant test report generation
- > Test execution on host, simulator and embedded target system

## Programs using VectorCAST:

- > F-35 Joint Strike Fighter
- > F-22 Raptor
- > CV-22 Osprey
- > C-5 Galaxy
- > C-130 Hercules
- > CH-47 Chinook
- > Airbus A400
- > MHP Maritime Helicopter
- > Boeing 777
- > Boeing 747
- > HAWK
- > Airbus A380
- > F/D 728
- > Agusta A109
- > CMHD
- > M346
- > SmartDeck
- > GEnx EMV
- > Pegasus
- > Airbus A340
- > Eurocopter NH-90, Tiger
- > Eurofighter
- > ATLANTE UAV
- > Barracuda UAV
- > HERTI UAV
- > Watch Keeper UAV
- > SAAB Gripen

## VectorCAST for DO-178B / ED-12B

### Satisfy Structural Coverage Requirements

#### <What is DO-178B>

Published by RTCA, DO-178B is the current version of DO-178 Software Considerations in Airborne Systems and Equipment Certification. DO-178B outlines guidelines used by organizations developing airborne equipment and certification authorities. The development of DO-178B was a joint effort with EUROCAE, who published the document as ED-12B.

DO-178B prescribes a process to be followed in the development of airborne systems. One of the key requirements of DO-178B is achieving structural code coverage in conjunction with the testing the high-level and low-level software requirements. Based on a system safety assessment, failure condition categories are established. These failure condition categories determine the level of software integrity necessary for safe avionics operation. DO-178B classifies software into five levels of criticality based on whether atypical software behavior could cause or contribute to the failure of a system function. The table below shows the relationship between the failure condition category and the structural coverage objective as defined by DO-178B.

Software Criticality Level	Failure Definition	Associated Structural Coverage Level
<b>Level A</b>	Software resulting in a catastrophic failure condition for the system	Modified Condition / Decision Coverage, Decision Coverage & Statement Coverage
<b>Level B</b>	Software resulting in hazardous or severe failure condition for the system	Decision Coverage and Statement Coverage
<b>Level C</b>	Software resulting in a major failure condition for the system	Statement Coverage
<b>Level D</b>	Software resulting in a minor failure condition for the system	None Required
<b>Level E</b>	Software resulting in no effect on the system for the system	None Required

*Software Criticality Level and Structural Coverage Requirements*

#### <What is VectorCAST for DO-178B>

The VectorCAST family of tools supports the creation and management of test cases to prove that the low-level software requirements have been tested. Additionally, the VectorCAST tools support the capture and reporting of structural code coverage data at all levels prescribed by DO-178B, including Level A.

# VectorCAST for DO-178B Capabilities

## <VectorCAST Tool Qualification Deliverable Process>

DO-178B specifies that qualification of a software tool is necessary when processes prescribed by the document, are eliminated, reduced, or automated by the use of a tool, without its output being manually verified. Because VectorCAST automates the process of validating low-level requirements, and the process of recording and reporting on structural code coverage, it must be qualified, when used as part of a DO-178B certification. Vector Software has developed an off-the-shelf qualification package, that has been used on more than 40 DO-178B certification projects.



Tool Qualification Data



Tool Operational Requirements



VectorCAST Tool Qualification

## Equivalence Pairs Reporting

Unit: manager  
Subprogram: Manager::AddIncludedDessert  
Condition: #4

Source line: 18  
Actual Expression is: ( Order -> Entree == Steak && Order -> Salad == Caesar && Order -> Beverage == MixedDrink )  
Condition "Pa" (Ca) is: Order -> Entree == Steak  
Condition "Pb" (Cb) is: Order -> Salad == Caesar  
Condition "Pc" (Cc) is: Order -> Beverage == MixedDrink  
Simplified Expression is: ( a && b && c )

Row	Ca	Cb	Cc	Pa	Pb	Pc
1	T	T	T	T	T	T
2	T	T	F	F	F	F
3	T	F	T	F	F	F
4	F	T	T	F	F	F

Pa => a pair was satisfied (1/5)  
Pb => no pair was satisfied  
Pc => no pair was satisfied

Unit: manager  
Subprogram: Manager::AddIncludedDessert  
Condition: #6

Source line: 26  
Actual Expression is: ( Order -> Entree == Lobster && Order -> Salad == Green )  
Condition "Pa" (Ca) is: Order -> Entree == Lobster  
Condition "Pb" (Cb) is: Order -> Salad == Green  
Condition "Pc" (Cc) is: Order -> Beverage == Wine  
Simplified Expression is: ( a && b && c )

Row	Ca	Cb	Cc	Pa	Pb	Pc
1	T	T	T	T	T	T
2	T	T	F	F	F	F
3	T	F	T	F	F	F
4	F	T	T	F	F	F

Pa => a pair was satisfied (1/5)  
Pb => no pair was satisfied

## Levels A, B, and C Metrics

```

2 0 (T) Manager::AddIncludedDessert
2 1 (T) (F) if( ( !
2 1.1 (T) (F) Order ) ) {
return;
}
2 4 (T) (F) if( (
2 4.1 (T) (F) Order -> Entree == Steak &&
2 4.2 (T) ( ) Order -> Salad == Caesar &&
2 4.3 (T) ( ) Order -> Beverage == MixedDrink )
) {
Order->Dessert = Pies;
}
else
2 6 (T) (F) if( (
2 6.1 (T) (F) Order -> Entree == Lobster &&
2 6.2 (T) ( ) Order -> Salad == Green &&
2 6.3 (T) ( ) Order -> Beverage == Wine )
) {
}

```

**Metrics Report Configuration Data**

This Report includes data for:

Unit(s)	Subprogram(s)
manager.cpp	<<ALL>>
database.cpp	<<ALL>>

Date of Report Creation: 5 JUL 2011  
Time of Report Creation: 3:23:44 PM

**Metrics**

Unit	Subprogram	Complexity	DO-178B Level A-Statement	DO-178B Level A-MCDC	DO-178B Level A-MCDC Pairs
manager.cpp	Manager::Manager	1	100% (2 / 2)	100% (1 / 1)	
	Manager::AddIncludedDessert	4	66% (4 / 6)	57% (12 / 21)	26% (2 / 7)
	Manager::PlaceOrder	5	65% (15 / 23)	50% (3 / 6)	
	Manager::ClearTable	1	100% (1 / 1)	100% (1 / 1)	
	Manager::GetCheckTotal	1	100% (4 / 4)	100% (1 / 1)	
	Manager::AddPartyToWaitingList	3	0% (0 / 7)	0% (0 / 11)	0% (0 / 3)
Manager::GetNextPartyToBeSeated	2	0% (0 / 3)	0% (0 / 5)	0% (0 / 1)	
<b>TOTALS</b>	<b>7</b>	<b>17</b>	<b>56% (26 / 46)</b>	<b>39% (18 / 46)</b>	<b>18% (2 / 11)</b>
database.cpp	DataBase::DataBase	1	100% (1 / 1)	100% (1 / 1)	
	DataBase::~DataBase	1	100% (1 / 1)	100% (1 / 1)	
	DataBase::GetTableRecord	1	100% (1 / 1)	100% (1 / 1)	
	DataBase::UpdateTableRecord	1	100% (1 / 1)	100% (1 / 1)	
	DataBase::DeleteRecord	1	100% (1 / 1)	100% (1 / 1)	
<b>TOTALS</b>	<b>5</b>	<b>5</b>	<b>100% (5 / 5)</b>	<b>100% (5 / 5)</b>	
<b>GRAND TOTALS</b>	<b>12</b>	<b>22</b>	<b>60% (31 / 51)</b>	<b>45% (23 / 51)</b>	<b>18% (2 / 11)</b>

## VectorCAST for DO-178B Qualification Kit Includes:

### Tool Operational Requirements (TOR) includes:

- > The VectorCAST functionality in verifiable requirements
- > Project operational environment (compiler, platform, target, etc.)
- > Configuration management process
- > Method for attaining verification that VectorCAST has been satisfactorily tested against specified requirements

### Tool Qualification Document (TQD) includes:

- > Tool qualification test data and results
- > Test scripts for re-execution