Implementation of Harness Development at Eclipse Aviation

An innovative company using creativity in design and process

Premium Partners:

Eclipse Aviation

- Costs less than $1.4M
- Jet speeds, safety, comfort
- Operating costs significantly lower than current options
- 6 occupants
- Can operate out of over 10,000 U.S. airports
- Advanced all-glass cockpit
  - Certified for single-pilot flight
- First startup in 40 Years to fly a new passenger jet design
- 2200+ sold

Eclipse 500 Jet Performance

Takeoff Distance Sea level, ISA to 50 ft @ MGTOW	**2,155 ft**
Landing Distance Sea level, ISA @ 4,600-lb landing weight	**2,040 ft**
Rate of Climb - 2 engines	**2,990 ft/min**
Rate of Climb - 1 engine	**888 ft/min**
Time to Climb - 35,000 ft	**19 min**
Takeoff at 5,000 ft at 68°F (1,524 m at ISA +15)	**3,350 ft**
Single Engine Takeoff Climb at 5,000 ft at 68°F (1,524 m at ISA + 15)	**293 ft/min**
Single Engine Service Ceiling	**25,000 ft**
Cruise Speed	**375 kt**
Vso	**67 kt**
Vmo/Mmo	**285 kt /0.64 Mn**
Max. Altitude	**41,000 ft**
Range, 4 occupants NBAA IFR, 100 nm alternate, 200-lb Pilot, three 170-lb passengers	**1,280 nm**
Range, 4 occupants IFR 45-minute reserve	**1,395 nm**

Loaded with Standard Features for Safety and Comfort

- Twin turbofan engines
- Automotive-quality appointments
  - Leather upholstery
  - Semi-club and six-seat configurations
- Comprehensive avionics suite standard to maximize safety
- Dual-zone air conditioning and heating to assure pilot and passenger comfort
- Pressurized baggage access

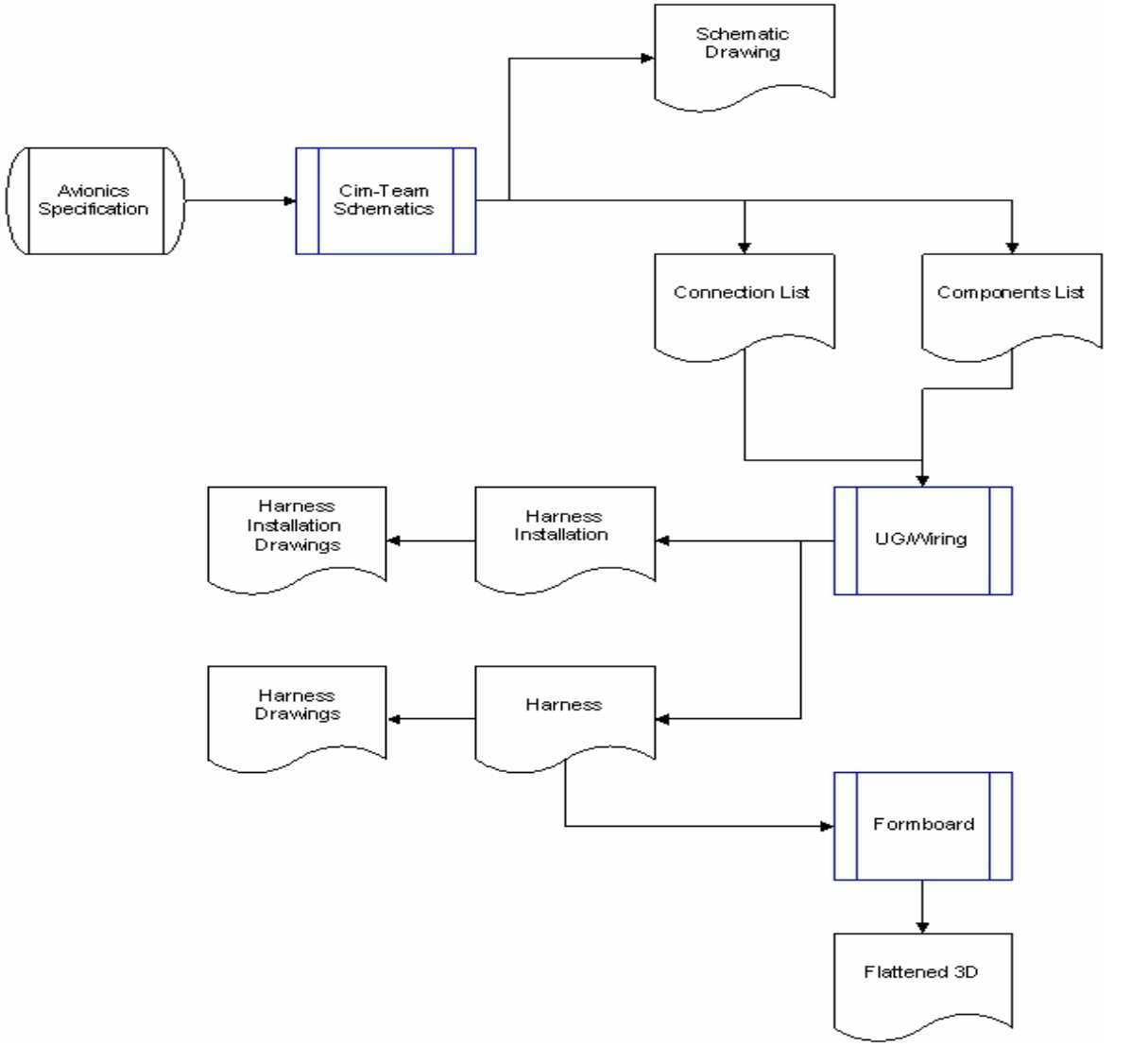
The Eclipse Team

500 people dedicated to Eclipse 500 development

Abstract

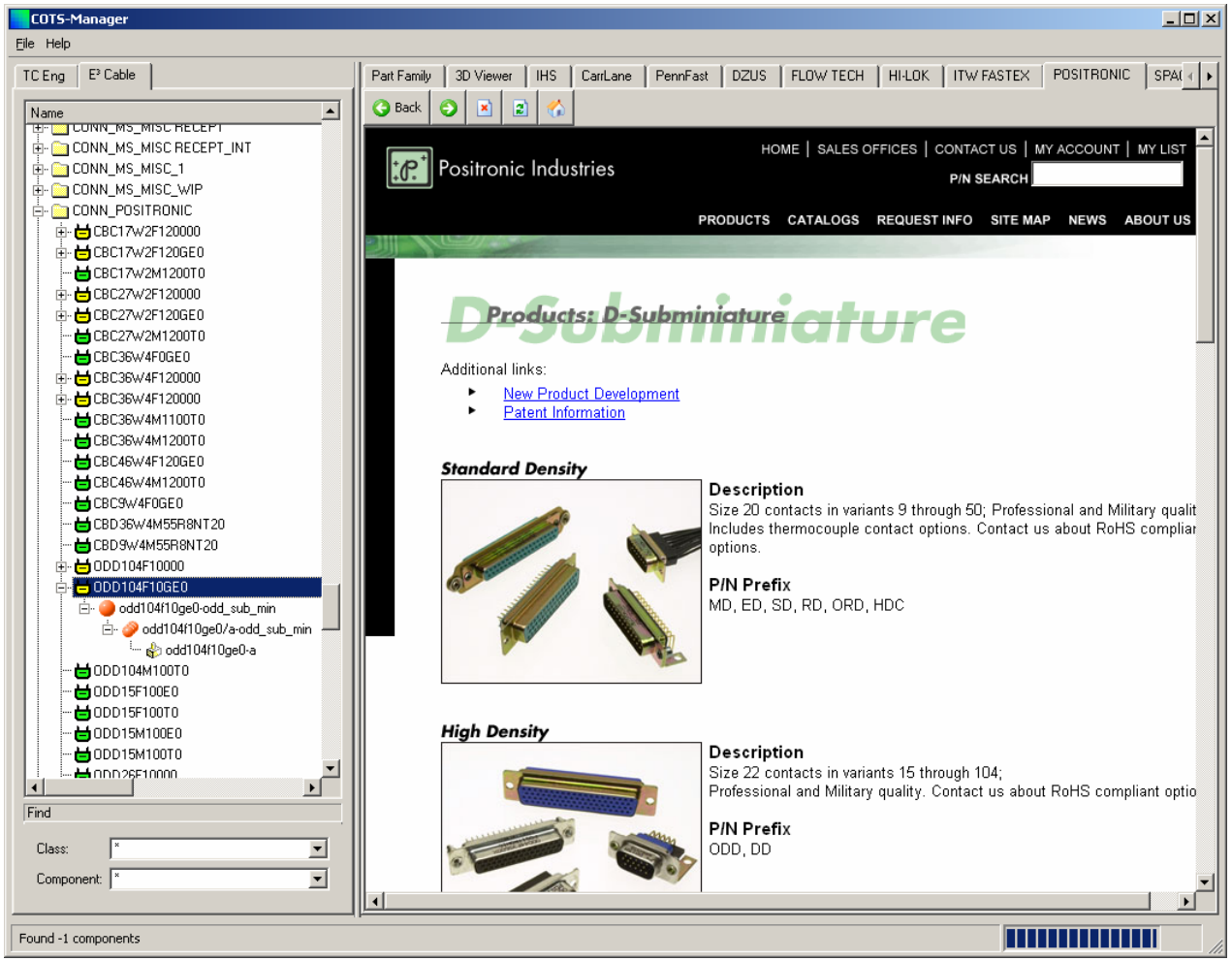
- The high demand of tested and proven parts faces the shortest time-to-market in aerospace and defense. In addition, frequently occurring budget problems require a rapid product development, which can only be achieved by combining proven processes in design with new integration technology. I will discuss the software and process used in wire harness development at Eclipse Aviation and present current technologies and best practices for meeting them.

Harness Development Lifecycle



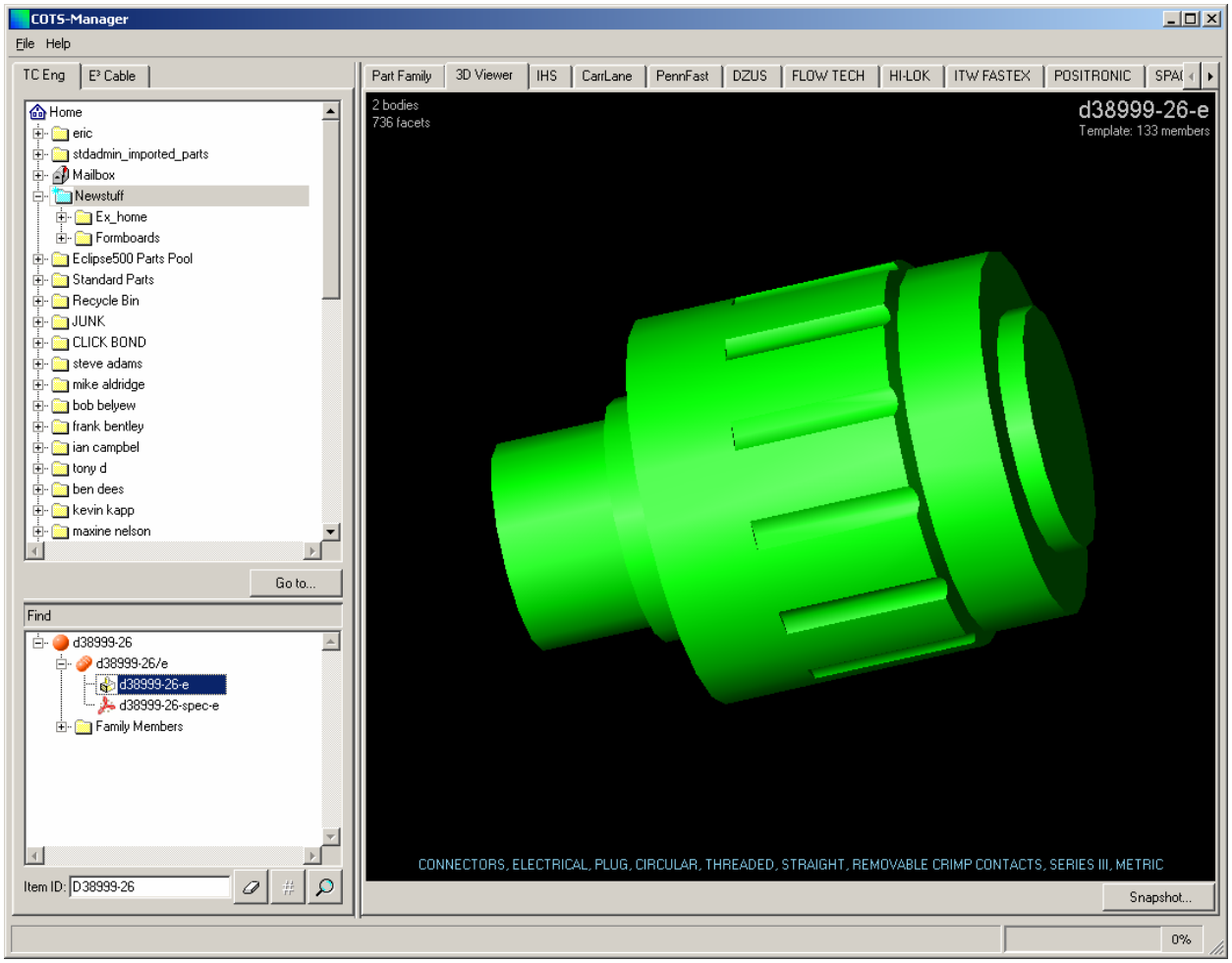
COTS manager

- Search E3 component database
- View Suppliers web sites

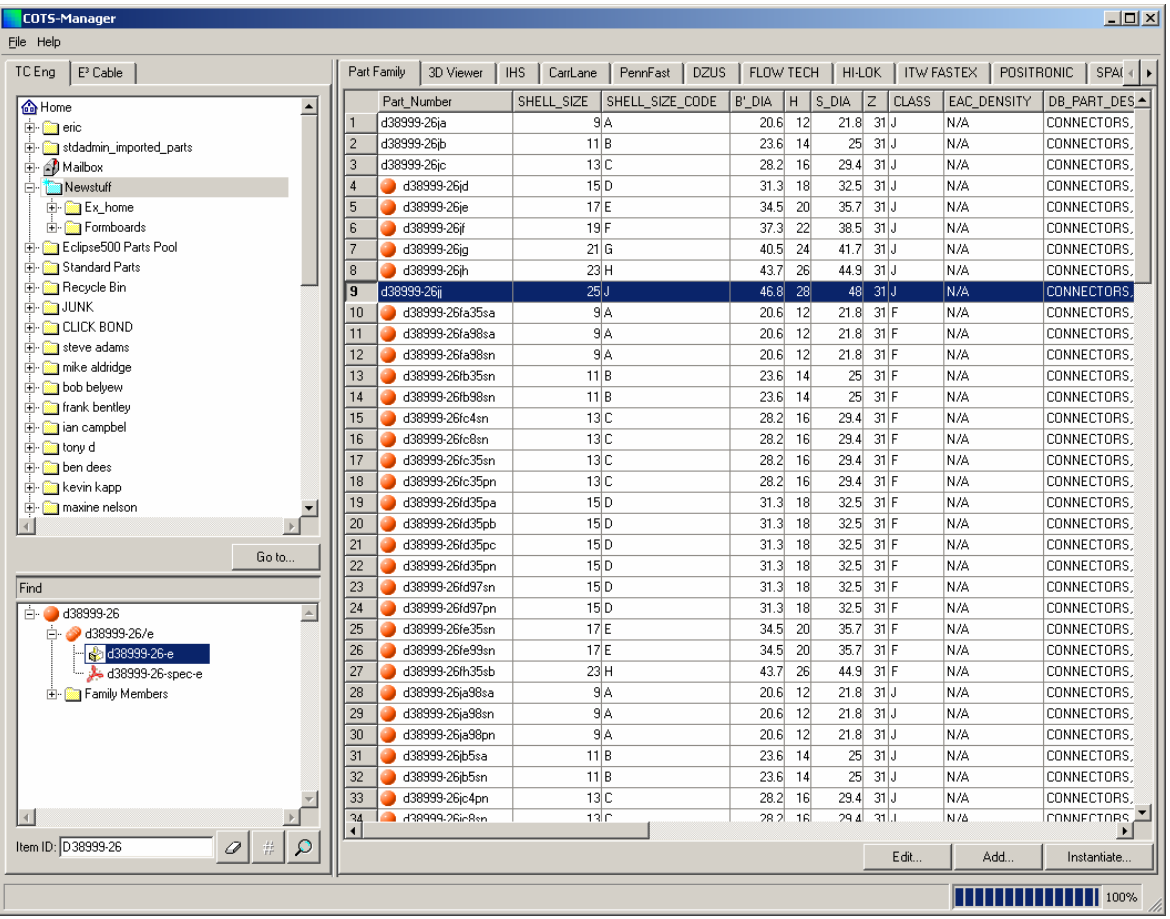


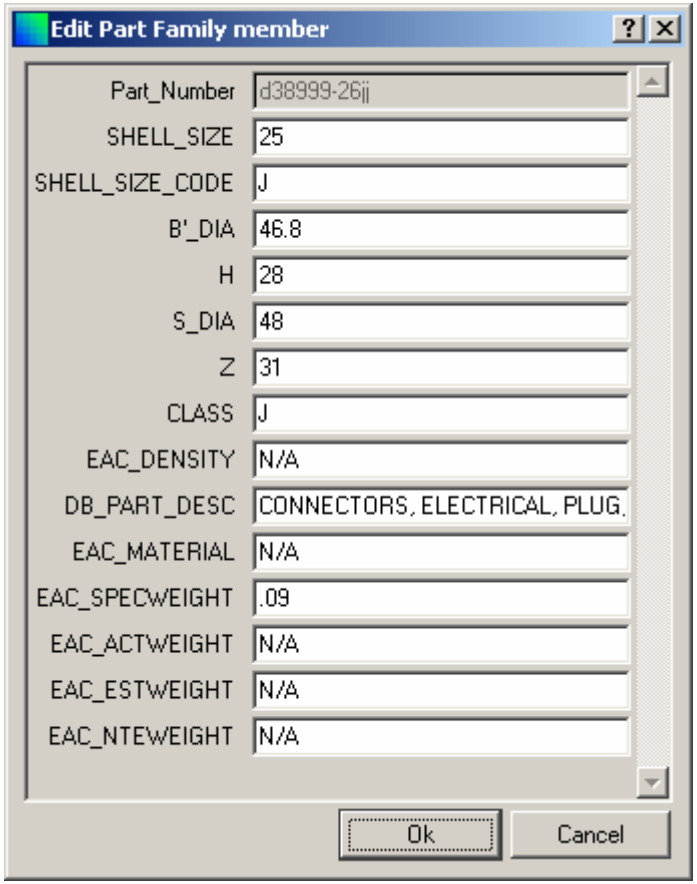
COTS manager continued

- Search TcE database
- Import .prt files, source data to TcE
- View NX model
- Create and edit PF variants
- Create snapshots



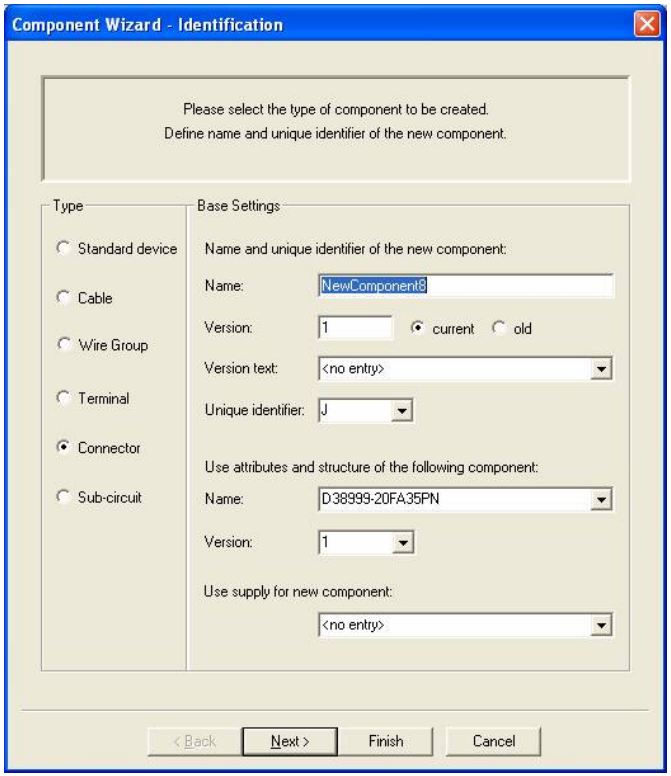
Variant creation in COTS manager

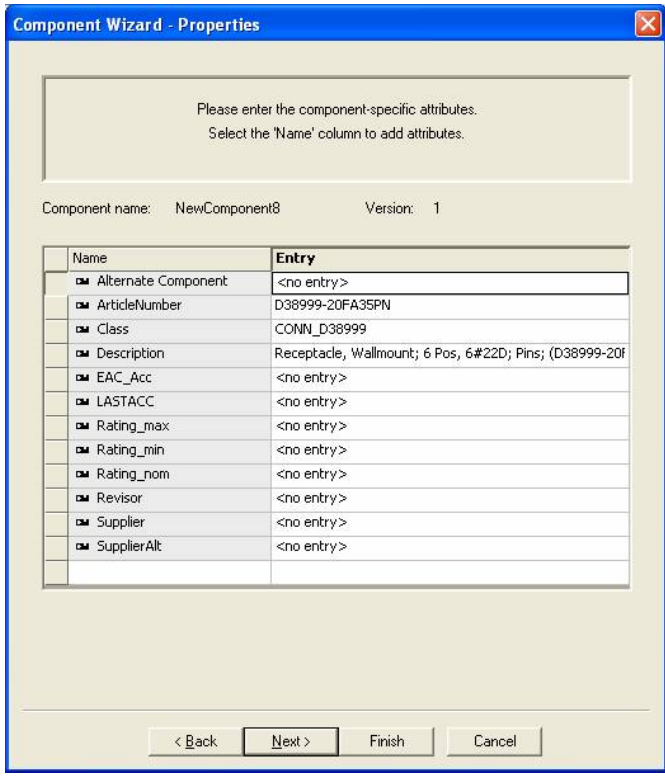




E3 Component creation

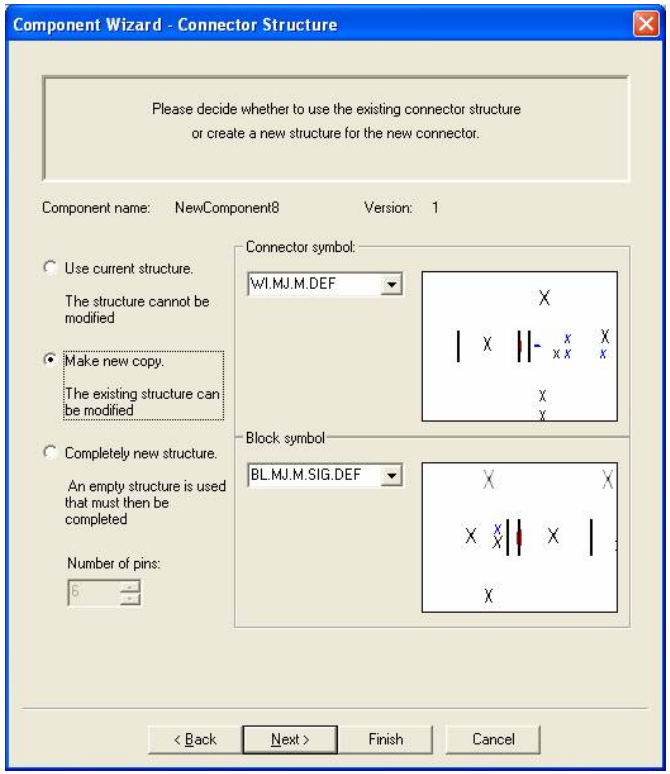
- Create new component in the e3 library.
- Define the top level of this connector (BOM part number, description, etc.)

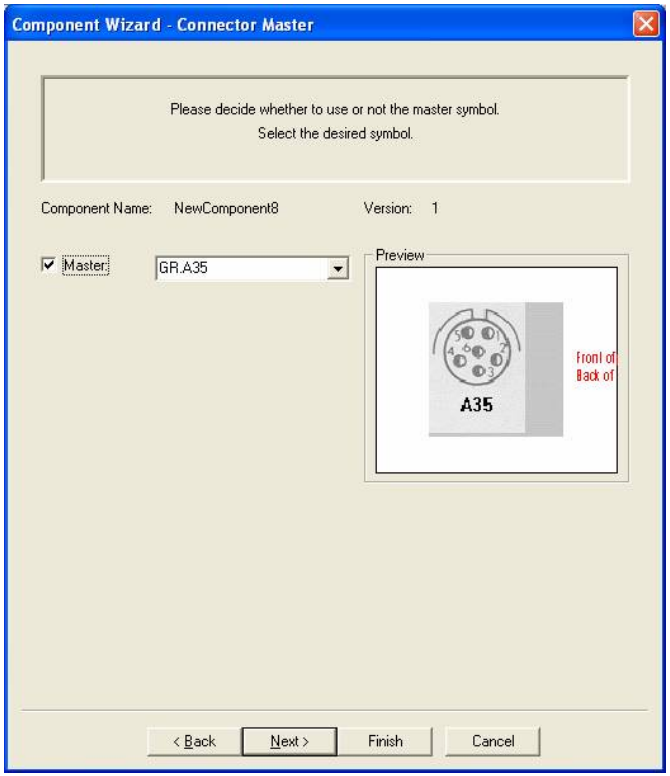




E3 component creation continued

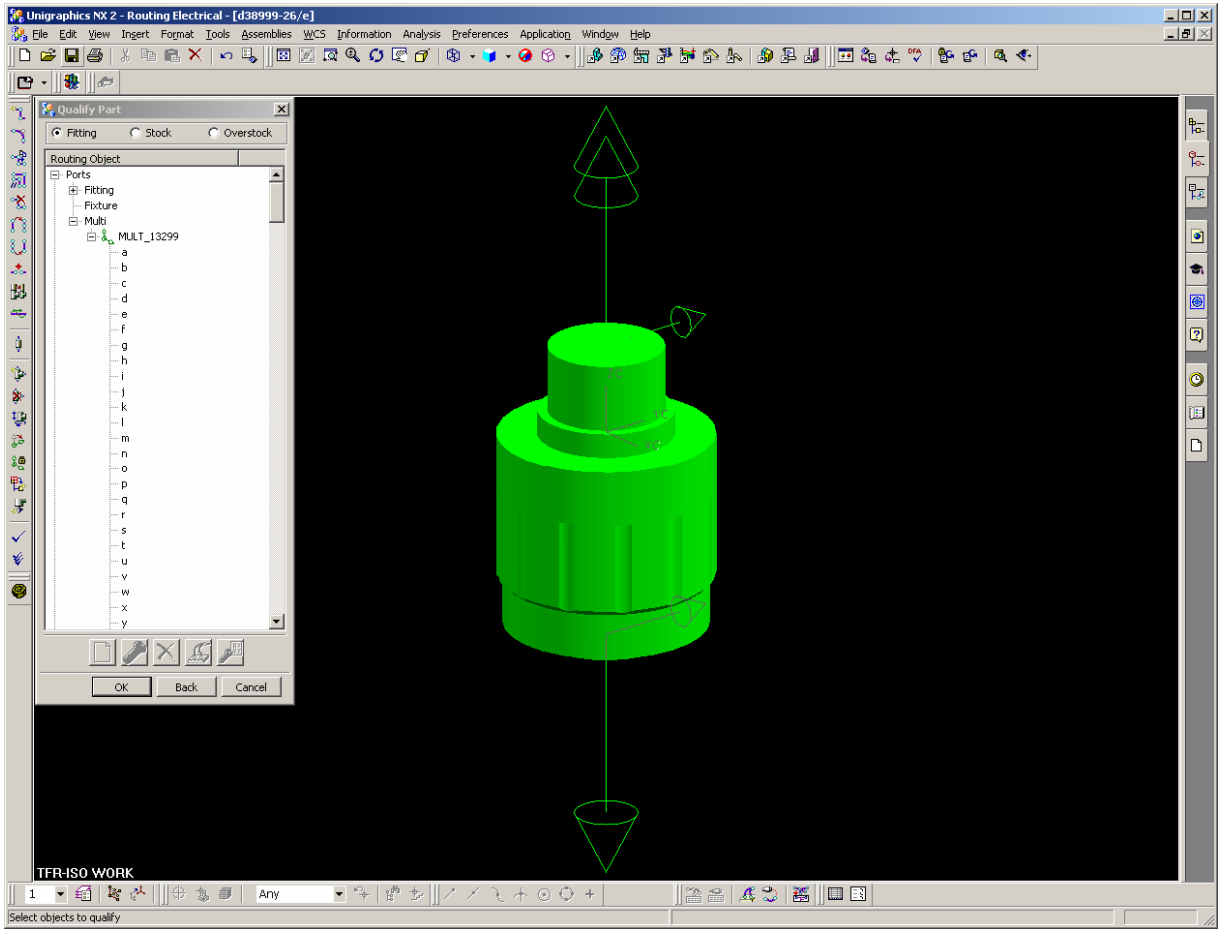
- Define graphical appearance and displayed text by assigning appropriate symbols to component.



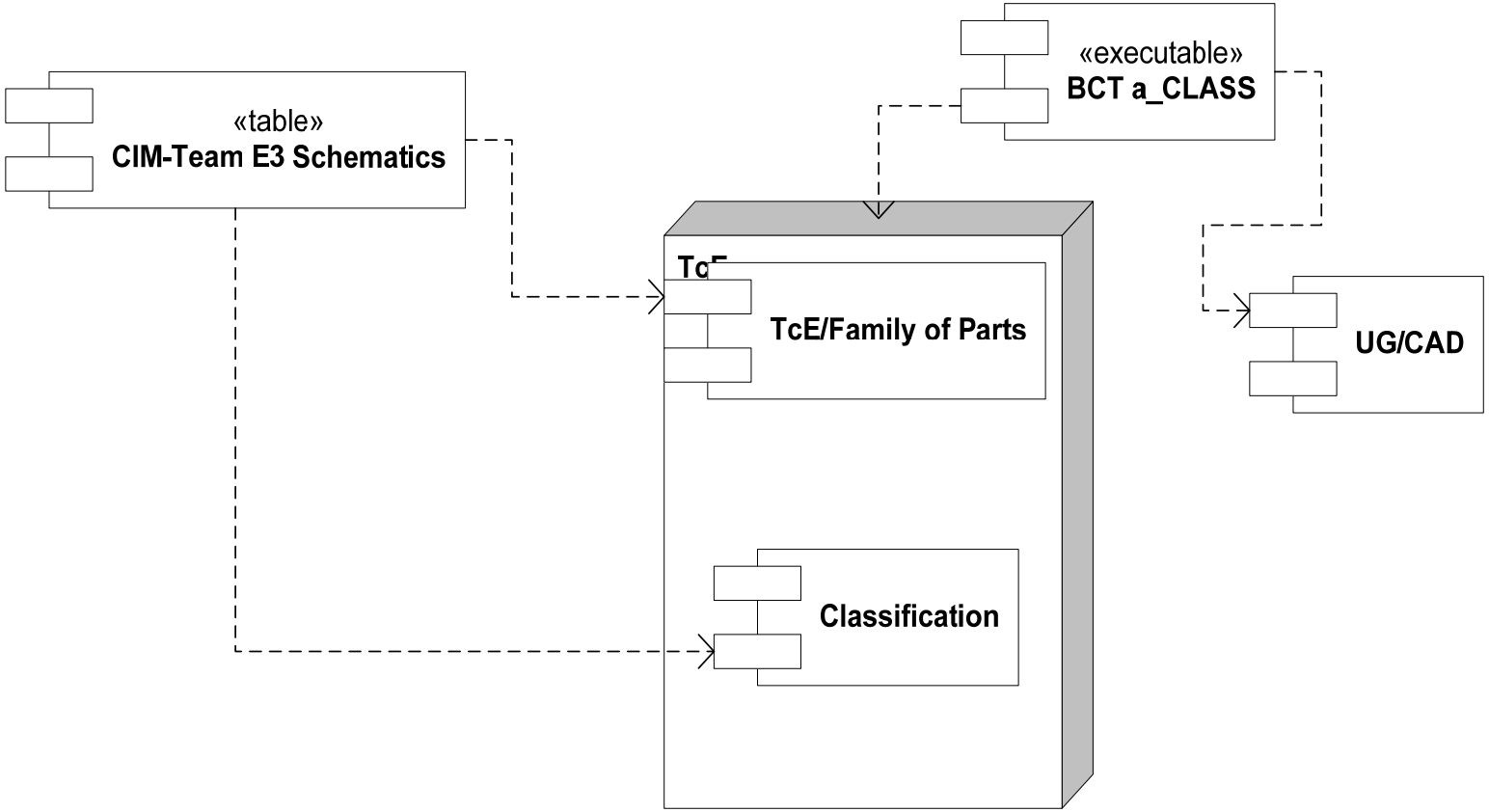


Qualified NX parts

- Components need routing characteristics added to complete pin to pin connection

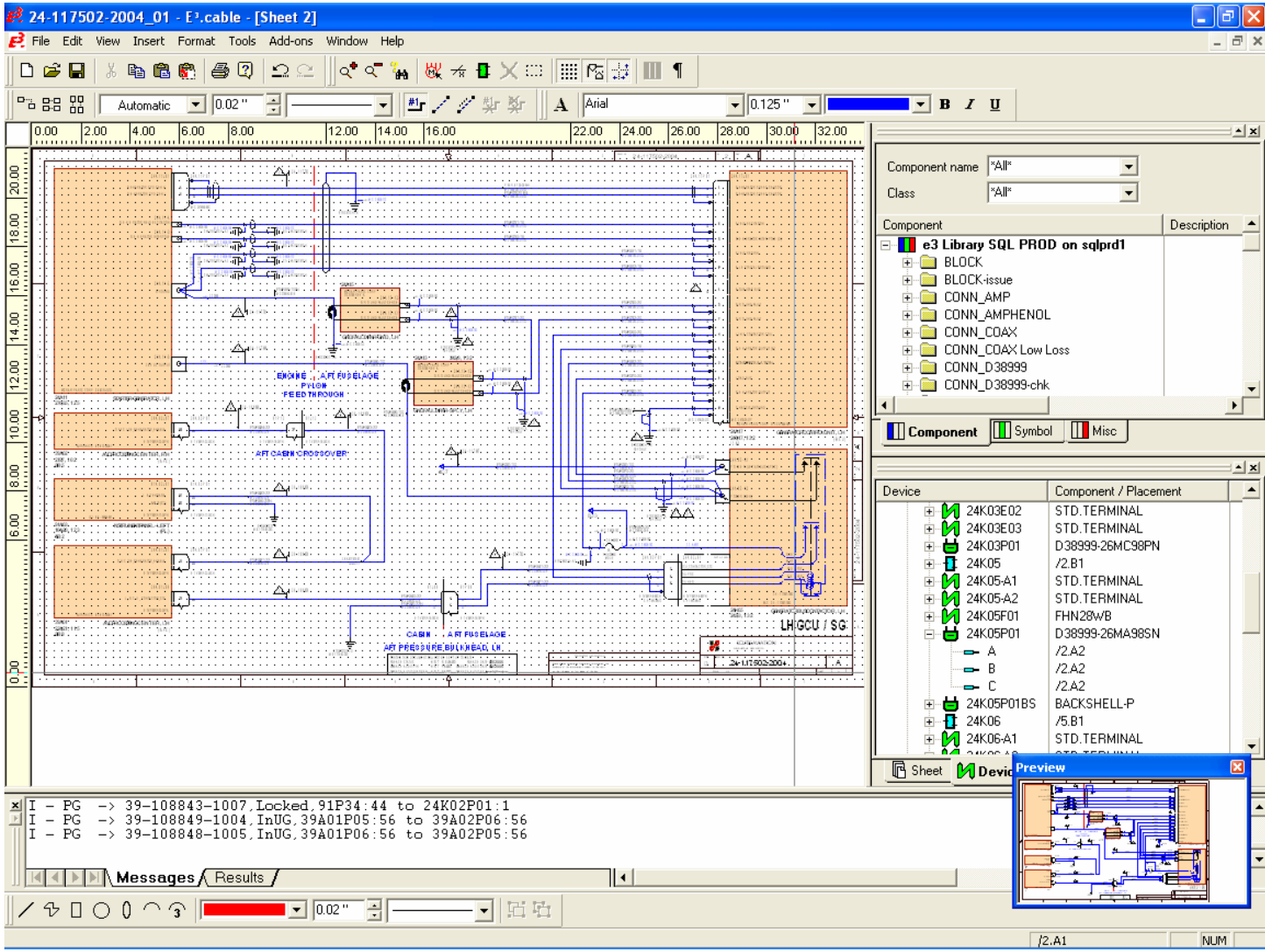


Component attribute migration



Diagrams using CIM-Team E3

- Business end of E3 with a Typical diagram
- Diagram Sheet
- Component Library
- Current parts usage



CIM-Team E3 continued

24-117502-2004_01 - E³.cable - [Sheet 2]

File Edit View Insert Format Tools Add-ons Window Help

24K05-A1 POWER (LEFT

24K05-A2 POWER (GEN)

24K05P01

24K05J01

24K05 243, -3, 132

Component name *All*

Class *All*

Component | Description

e3 Library SQL PROD on sqlprd1

BLOCK

BLOCK-issue

CONN_AMP

CONN_AMPHENOL

CONN_COAX

CONN_COAX Low Loss

CONN_D38999

CONN_D38999-chk

Component | Symbol | Misc

Device	Component / Placement
24K02E02	STD.TERMINAL
24K02E03	STD.TERMINAL
24K02P01	D38999-26FD35PN
24K03	(2 Blocks)
24K03E01	STD.TERMINAL
24K03E02	STD.TERMINAL
24K03E03	STD.TERMINAL
24K03P01	D38999-26MC98PN
24K05	/2.B1
24K05J01	D38999-20MA98PN
A	/2.A2
B	/2.A2
C	/2.A2
24K05J...	BACKSHELL-J

Sheet | Devic

Preview

24K05J01

I - PG -> 39-108843-1007,Locked,91P34:44 to 24K02P01:1

I - PG -> 39-108849-1004,InUG,39A01P05:56 to 39A02P06:56

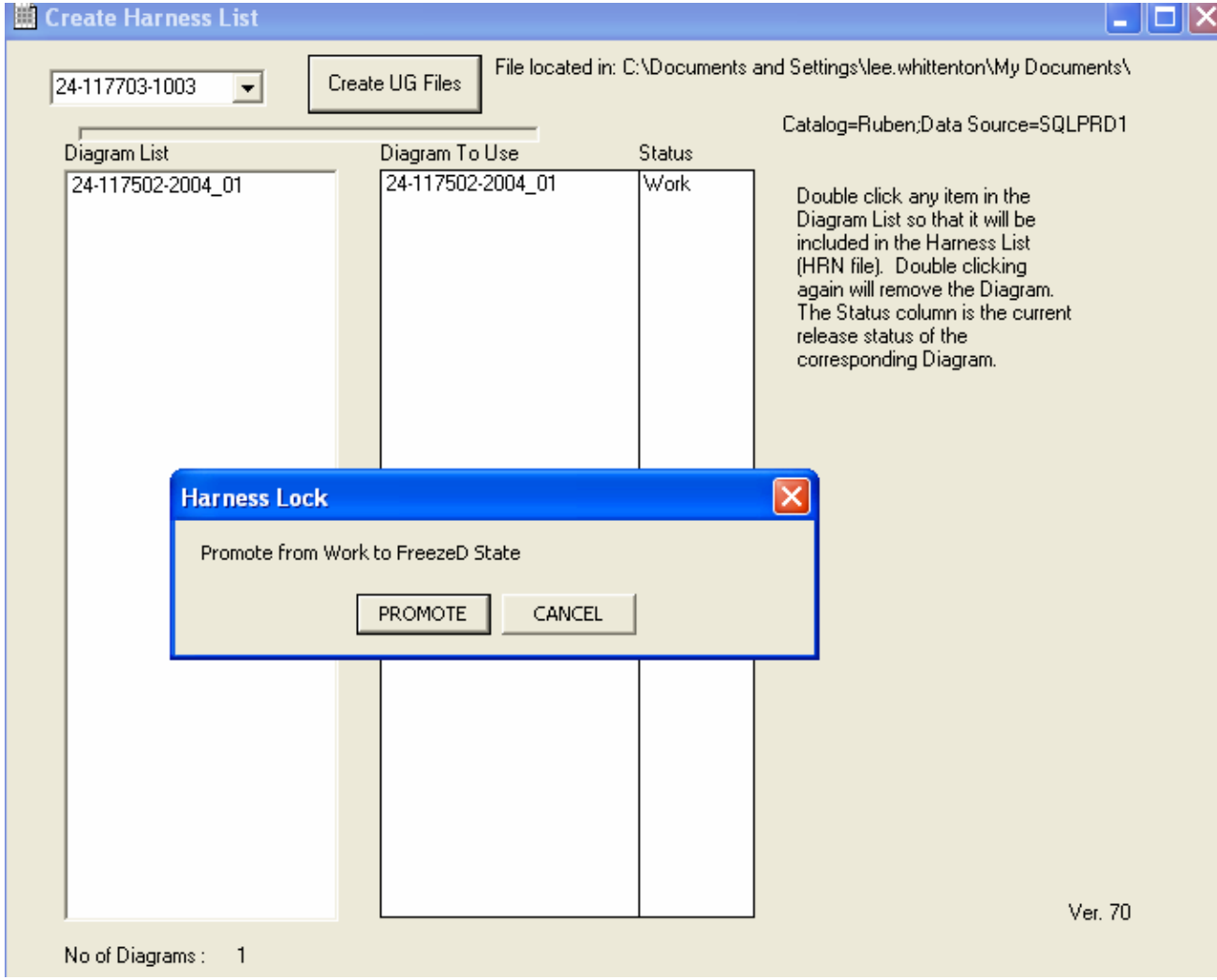
I - PG -> 39-108848-1005,InUG,39A01P06:56 to 39A02P05:56

Messages | Results

/2.A2 NUM

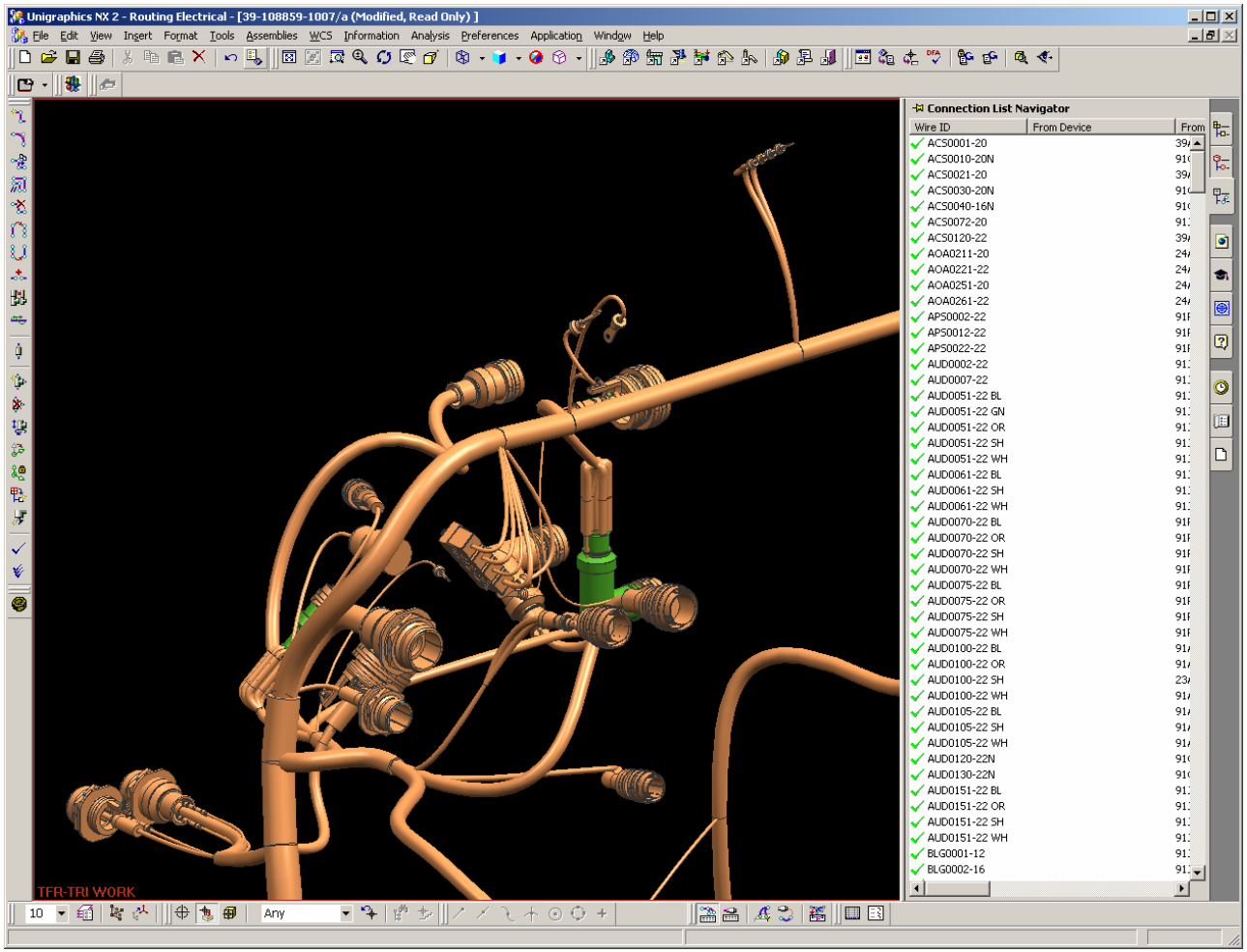
Pin manager creation of .cmp and .hrn

- Lock down a harness to prevent further design (Freeze Design).



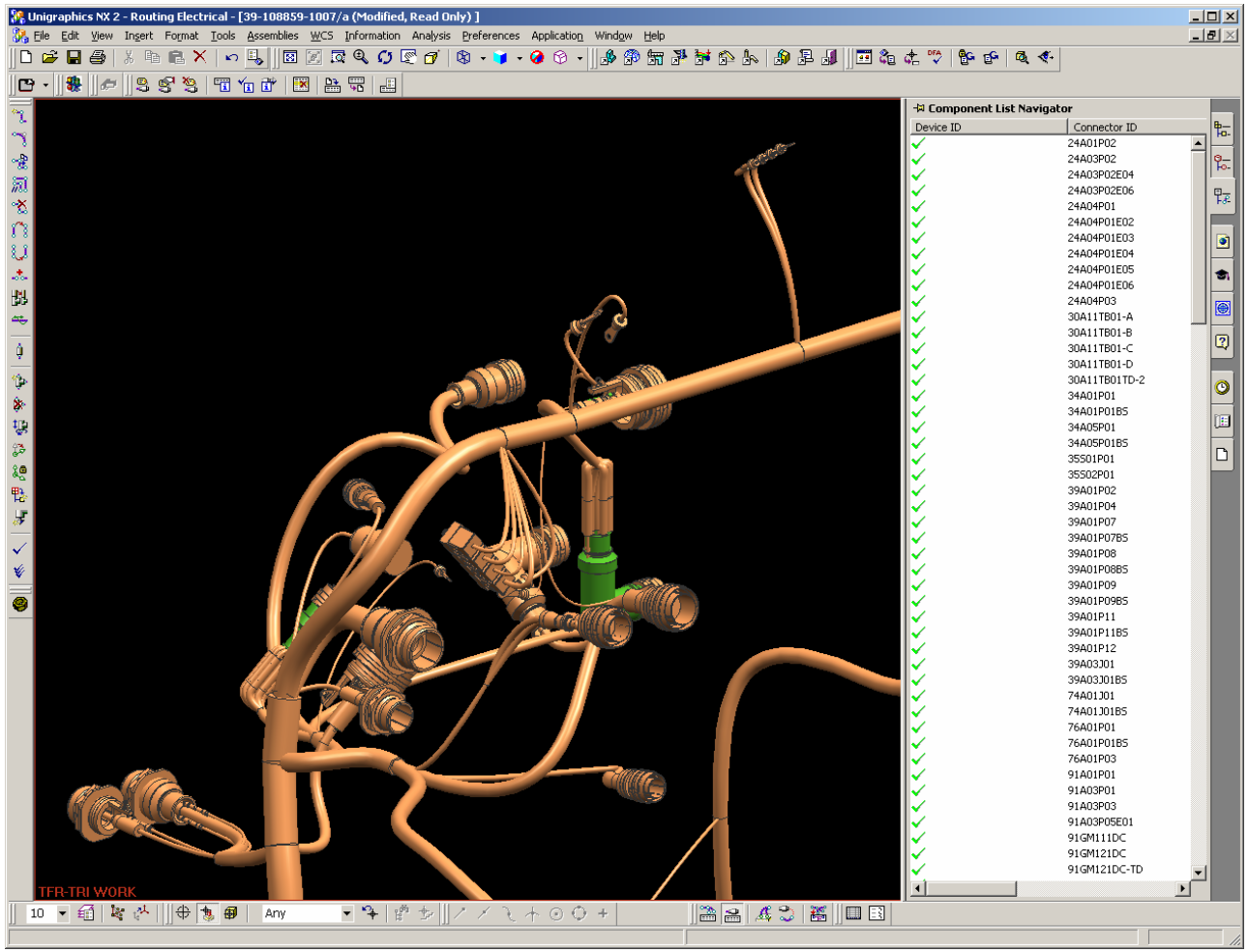
Import of .hrn file

- UG Wiring Auto route: Connection list (HRN file) defines the point to point connections and cross-section of the harness at all locations and branches



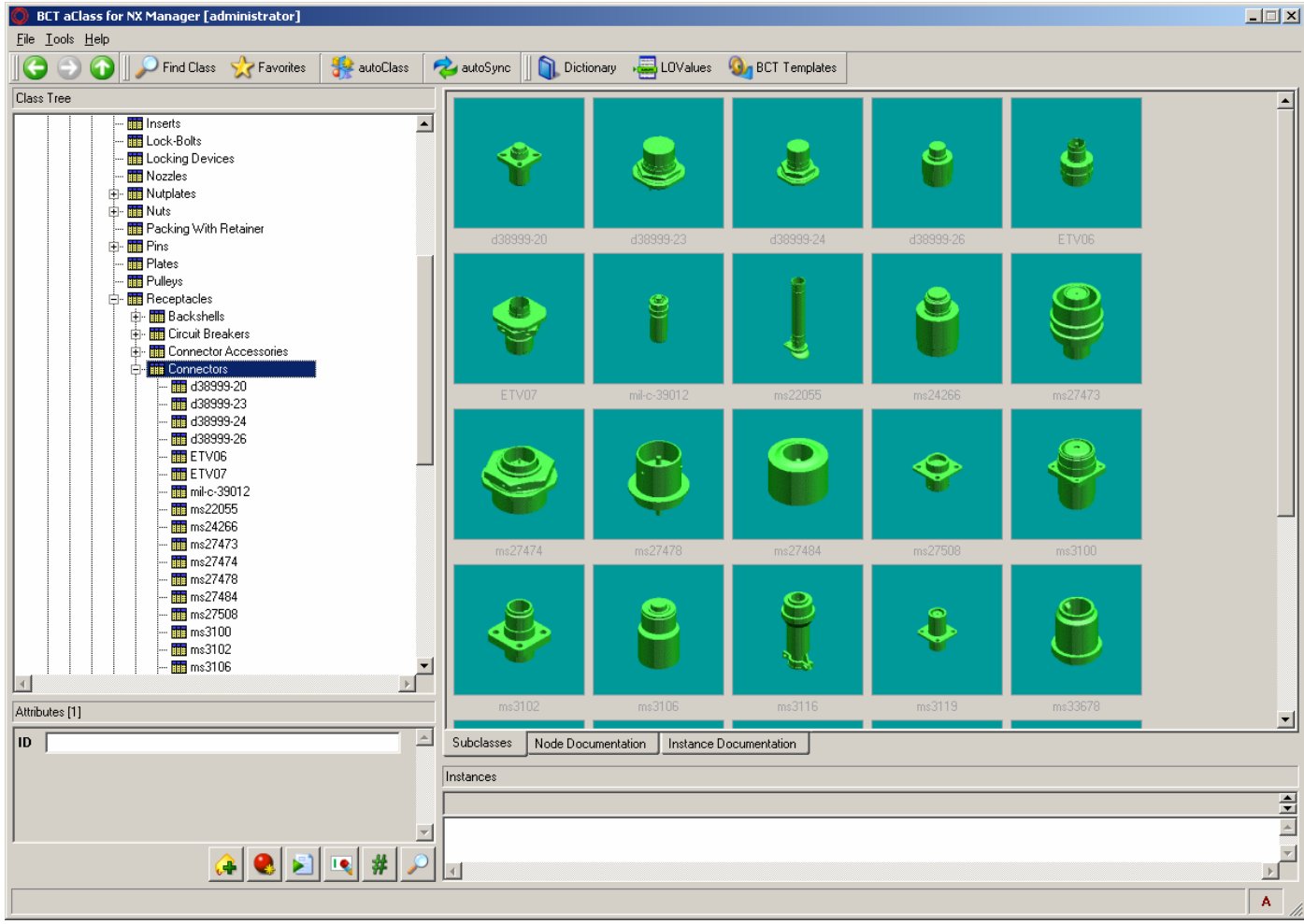
Import of .cmp file

- Assign each component its identity (RefDes or Reference Designator)



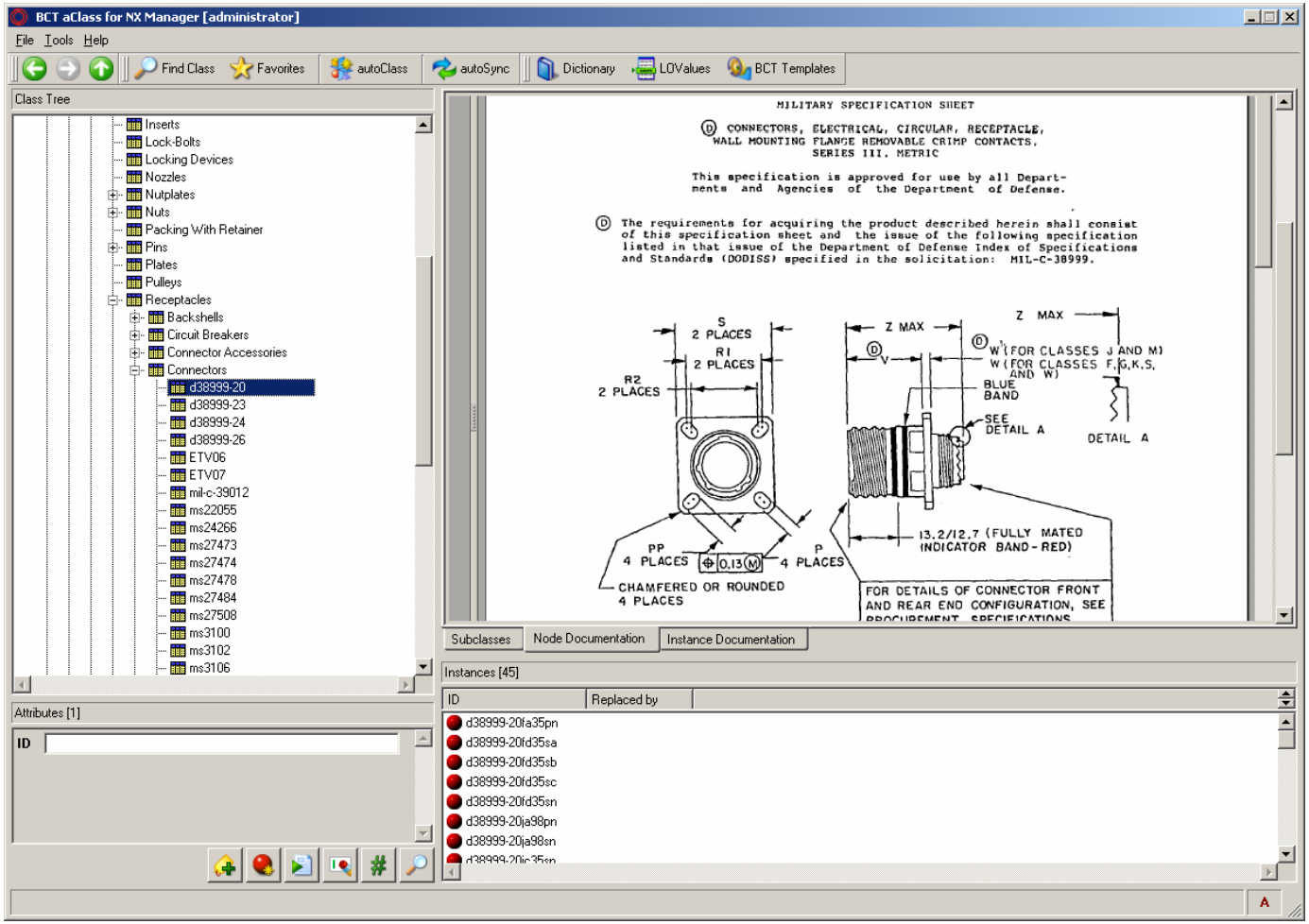
BCT aClass - classification

- Customizable classification scheme
- Search by picture, class or characteristics
- Preferred parts

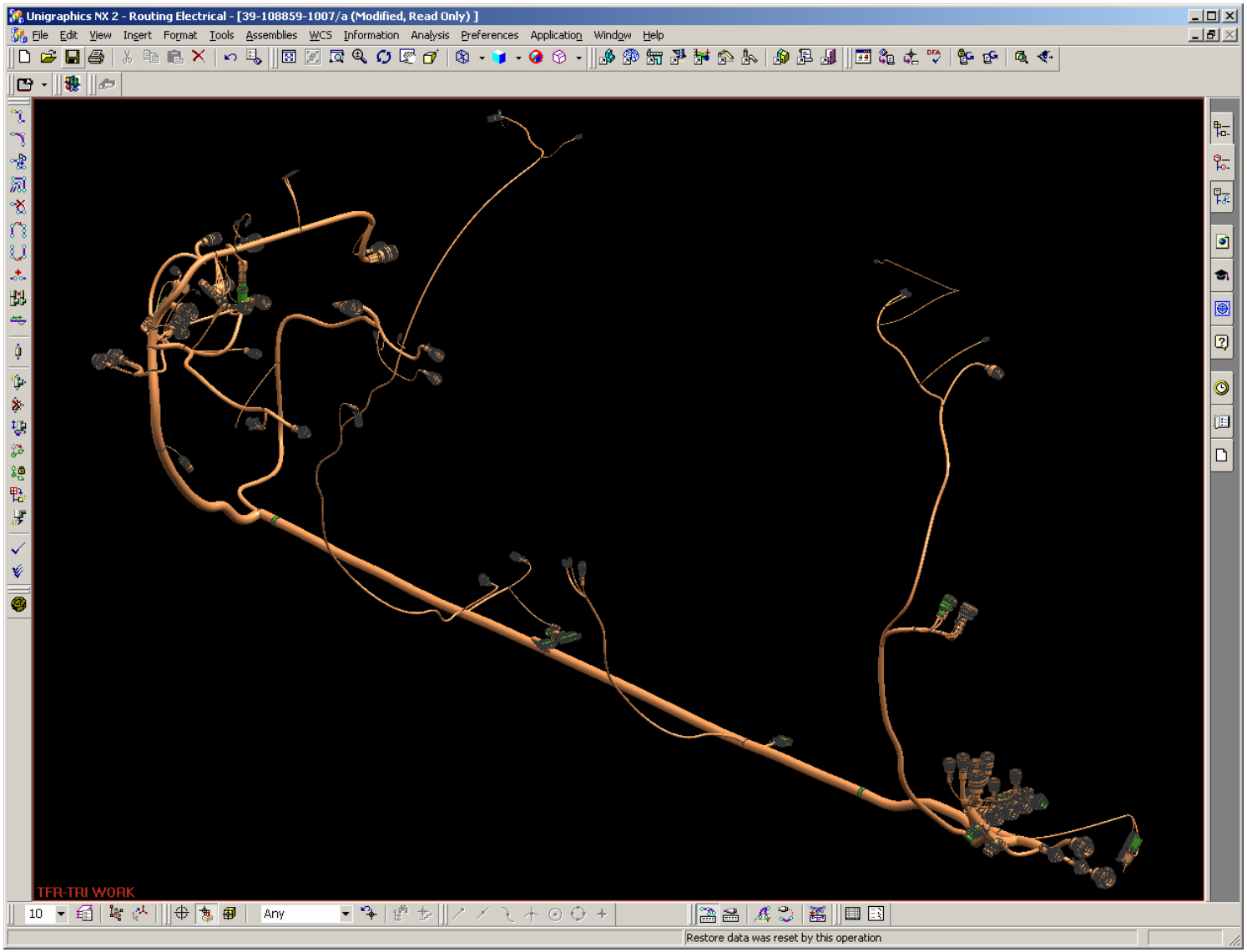


BCT – aClass continued

- Links to external sources
- Template's
- Integrated with NX routing

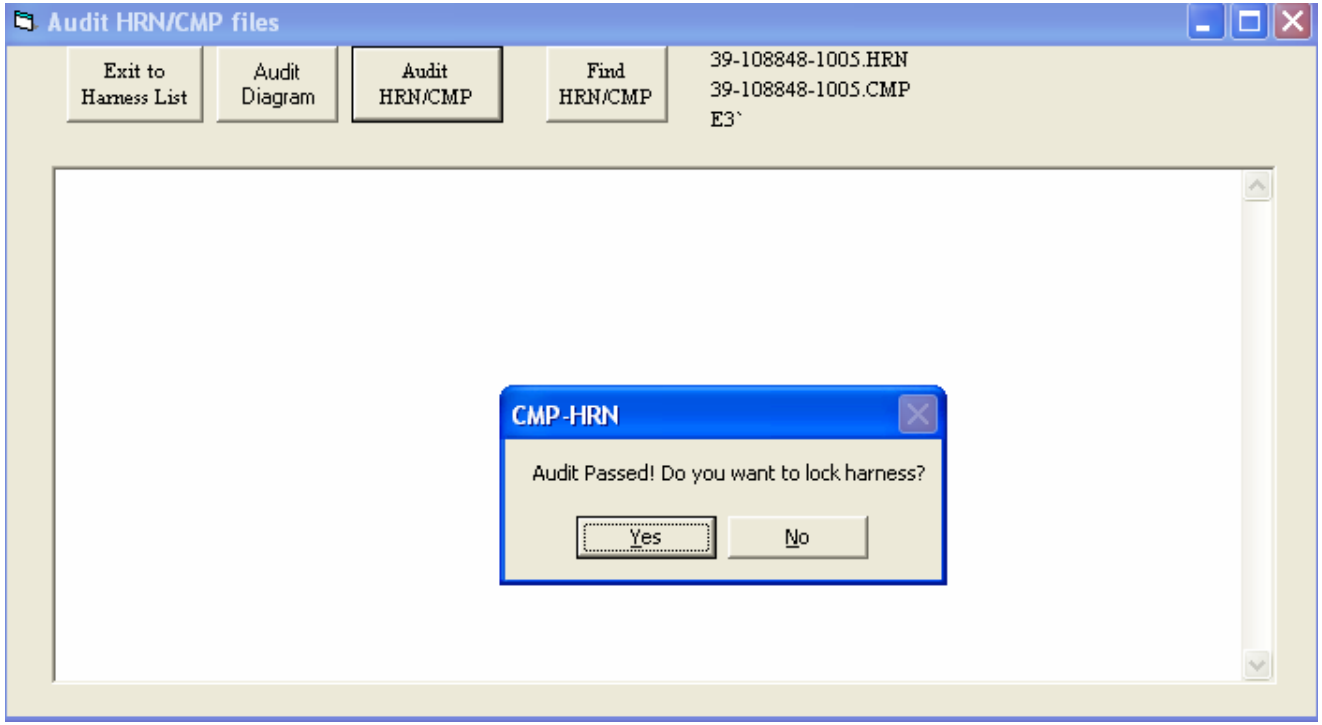


3D Harness ready for audit and formboard



Harness Audits

1. **Weight of harness**
2. **BOM compare between PSE, NX, .cmp and .hrn**
3. **Pin Manager with .cmp and .hrn (pin to pin)**



Component List

Microsoft Excel - 39-108848-1005.cmp.csv

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	! PROPRIETARY INFORMATION														
2	! All information and technical data disclosed herein are the property of														
3	! Eclipse Aviation and are not to be duplicated or disclosed to others for														
4	! any purpose without written consent of Eclipse Aviation Albuquerque NM														
5	! Harness List version 70														
6	! Date Created:	4/13/2006	5:22:24 PM												
7	! Diagrams used:	24-117502-2004_01	28-108662-2008b	32-108671-2005_01	33-108672-2005_01	39-109611-2005_01	39-112325-2010_03	72-108683-2008_01							
8	! Created by:	lee.whittenton													
9	! Harness Number:	39-108848-1005													
10	! Passed Audit!:	1													
11															
12	! N/A	RefDes	PartNumber	AlternatePN											
13		39A01P06	ETV06RF-21-35SB	D38999-26MG35SB											
14		39A01P06BS	S5248S2116M-12												
15		39A02P05	ETV06RF-21-35SA	D38999-26MG35SA											
16		39A02P05BS	S5248S2116M-12												

39-108848-1005.cmp

Connection List

Microsoft Excel - 39-108848-1005.hrn.csv

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	! PROPRIETARY INFORMATION																
2	! All information and technical data disclosed herein are the property of																
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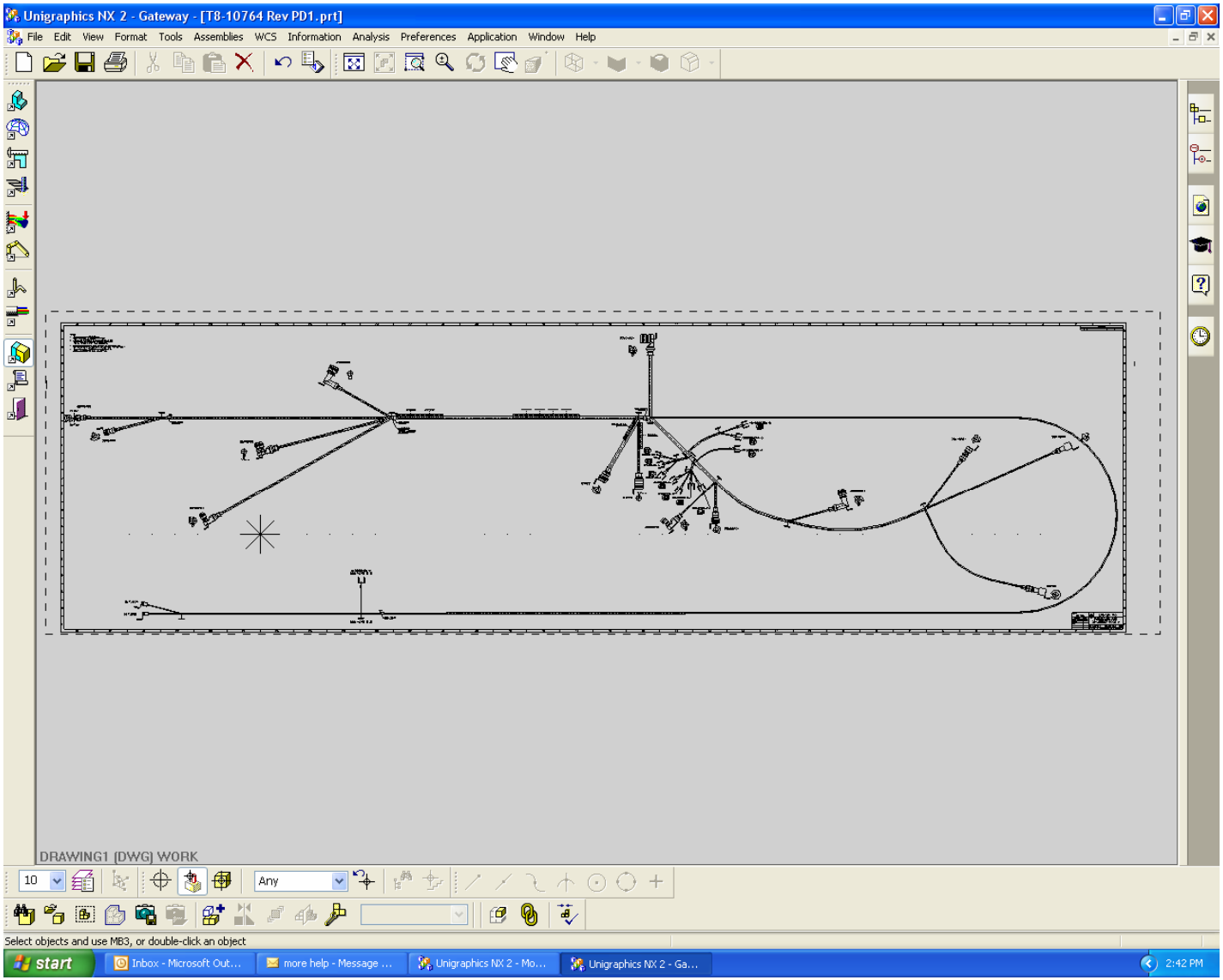
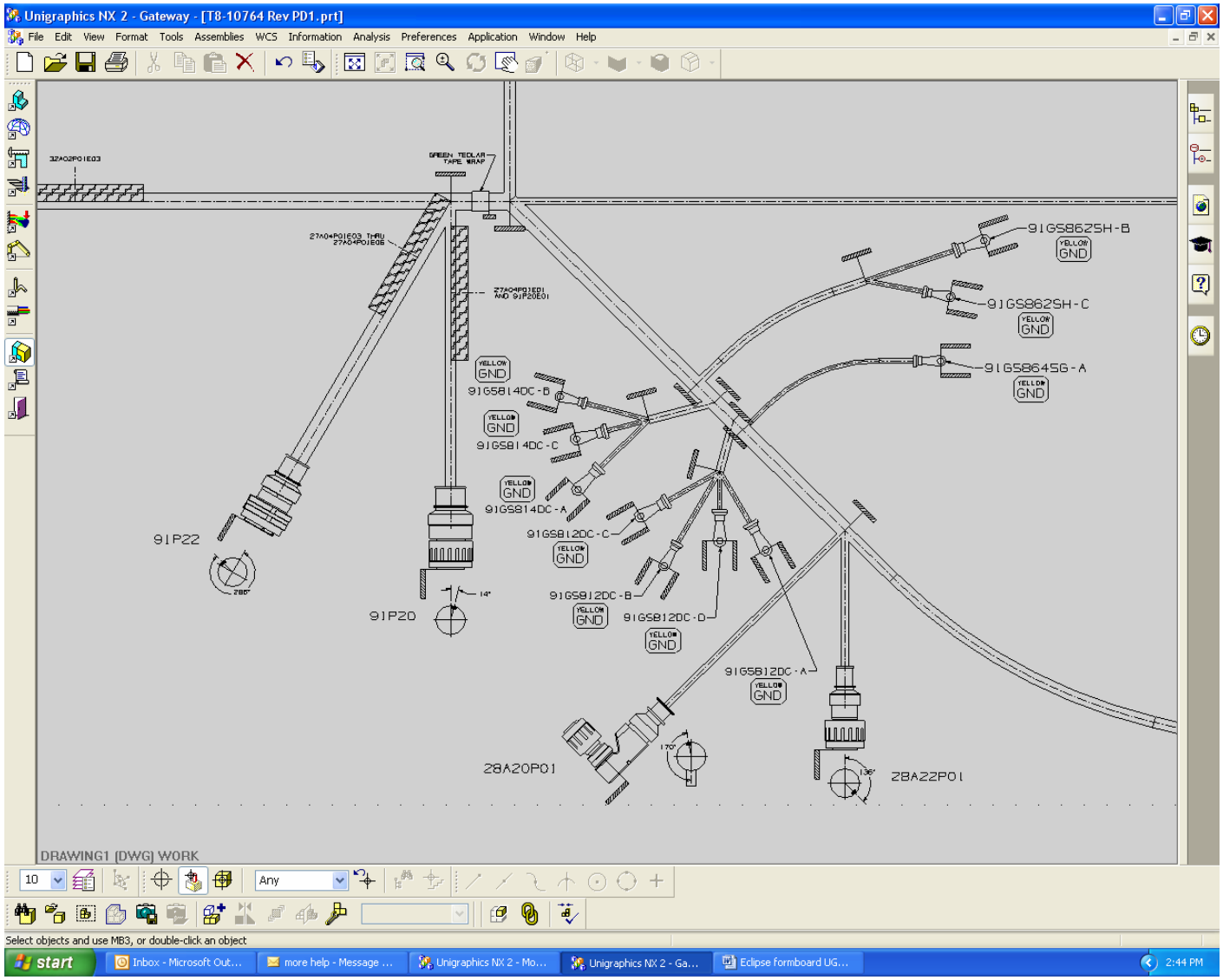
5	! Harness List version 70																
6	! Date Created:	4/13/2006	5:22:23 PM														
7	! Diagrams used:	24-117502-2004_01	28-108662-2008b	32-108671-2005_01	33-108672-2005_01	39-109611-2005_01	39-112325-2010_03	72-108683-2008_01									
8	! Created by:	lee.whittenton															
9	! Passed Audit!:	1															
10																	
11	! CableName	wirArticleNo	WireName	DeviceFrom	PinFrom	DeviceTo	PinTo	Guage	WireColor	Length	Harness	WireType	Marking	Description	OD	Diagram	
12	ACS0111	REF ONLY	ACS0111-22 SH	39A01P06BS	S8	39A02P05BS	S8		White/Black	47.0443	39-108848-1005		ACS0111-22		0.119	39-109611-2005_01	
13	ACS0111	M27500-24SD3T23	ACS0111-24 BL	39A01P06	40	39A02P05	40		Blue	49.5443	39-108848-1005		ACS0111-24		0.119	39-109611-2005_01	
14	ACS0111	M27500-24SD3T23	ACS0111-24 OR	39A01P06	42	39A02P05	42		Orange	49.5443	39-108848-1005		ACS0111-24		0.123	39-109611-2005_01	
15	ACS0111	M27500-24SD3T23	ACS0111-24 WH	39A01P06	41	39A02P05	41		White	49.5443	39-108848-1005		ACS0111-24		0.119	39-109611-2005_01	
16	BLG0530	REF ONLY	BLG0530-22 SH	39A01P06BS	S3	39A02P05BS	S3		White/Black	47.0443	39-108848-1005		BLG0530-22		0.119	32-108671-2005_01	
17	BLG0530	M27500-24SD2T23	BLG0530-24 BL	39A01P06	74	39A02P05	74		Blue	49.5443	39-108848-1005		BLG0530-24		0.119	32-108671-2005_01	
18	BLG0530	M27500-24SD2T23	BLG0530-24 WH	39A01P06	75	39A02P05	75		White	49.5443	39-108848-1005		BLG0530-24		0.119	32-108671-2005_01	
19	BLG0540	REF ONLY	BLG0540-22 SH	39A01P06BS	S4	39A02P05BS	S4		White/Black	47.0443	39-108848-1005		BLG0540-22		0.119	32-108671-2005_01	
20	BLG0540	M27500-24SD2T23	BLG0540-24 BL	39A01P06	76	39A02P05	76		Blue	49.5443	39-108848-1005		BLG0540-24		0.119	32-108671-2005_01	
21	BLG0540	M27500-24SD2T23	BLG0540-24 WH	39A01P06	77	39A02P05	77		White	49.5443	39-108848-1005		BLG0540-24		0.119	32-108671-2005_01	
22	BLG0550	REF ONLY	BLG0550-22 SH	39A01P06BS	S5	39A02P05BS	S5		White/Black	47.0443	39-108848-1005		BLG0550-22		0.119	32-108671-2005_01	
23	BLG0550	M27500-24SD2T23	BLG0550-24 BL	39A01P06	78	39A02P05	78		Blue	49.5443	39-108848-1005		BLG0550-24		0.119	32-108671-2005_01	
24	BLG0550	M27500-24SD2T23	BLG0550-24 WH	39A01P06	79	39A02P05	79		White	49.5443	39-108848-1005		BLG0550-24		0.119	32-108671-2005_01	
25	BLG0560	REF ONLY	BLG0560-22 SH	39A01P06BS	S6	39A02P05BS	S6		White/Black	47.0443	39-108848-1005		BLG0560-22		0.119	32-108671-2005_01	
26	BLG0560	M27500-24SD2T23	BLG0560-24 BL	39A01P06	70	39A02P05	70		Blue	49.5443	39-108848-1005		BLG0560-24		0.119	32-108671-2005_01	
27	BLG0560	M27500-24SD2T23	BLG0560-24 WH	39A01P06	71	39A02P05	71		White	49.5443	39-108848-1005		BLG0560-24		0.119	32-108671-2005_01	
28	BLG0570	REF ONLY	BLG0570-22 SH	39A01P06BS	S7	39A02P05BS	S7		White/Black	47.0443	39-108848-1005		BLG0570-22		0.119	32-108671-2005_01	
29	BLG0570	M27500-24SD2T23	BLG0570-24 BL	39A01P06	68	39A02P05	68		Blue	49.5443	39-108848-1005		BLG0570-24		0.119	32-108671-2005_01	
30	BLG0570	M27500-24SD2T23	BLG0570-24 WH	39A01P06	69	39A02P05	69		White	49.5443	39-108848-1005		BLG0570-24		0.119	32-108671-2005_01	
31	CTRL1601	REF ONLY	CTRL1601-22 SH	39A01P06BS	S12	39A02P05BS	S12		White/Black	46.6088	39-108848-1005		CTRL1601-22		0.123	39-112325-2010_03	
32	CTRL1601	M27500-24SD3T23	CTRL1601-24 BL	39A01P06	23	39A02P05	23		Blue	46.6088	39-108848-1005		CTRL1601-24		0.123	39-112325-2010_03	
33	CTRL1601	M27500-24SD3T23	CTRL1601-24 OR	39A01P06	22	39A02P05	22		Orange	46.6088	39-108848-1005		CTRL1601-24		0.123	39-112325-2010_03	
34	CTRL1601	M27500-24SD3T23	CTRL1601-24 WH	39A01P06	24	39A02P05	24		White	46.6088	39-108848-1005		CTRL1601-24		0.123	39-112325-2010_03	
35	CTRL1621	REF ONLY	CTRL1621-22 SH	39A01P06BS	S10	39A02P05BS	S10		White/Black	46.6088	39-108848-1005		CTRL1621-22		0.119	39-112325-2010_03	
36	CTRL1621	M27500-24SD2T23	CTRL1621-24 BL	39A01P06	17	39A02P05	17		Blue	46.6088	39-108848-1005		CTRL1621-24		0.119	39-112325-2010_03	
37	CTRL1621	M27500-24SD2T23	CTRL1621-24 WH	39A01P06	18	39A02P05	18		White	46.6088	39-108848-1005		CTRL1621-24		0.119	39-112325-2010_03	
38	CTRL1631	REF ONLY	CTRL1631-22 SH	39A01P06BS	S11	39A02P05BS	S11		White/Black	46.6088	39-108848-1005		CTRL1631-22		0.119	39-112325-2010_03	
39	CTRL1631	M27500-24SD2T23	CTRL1631-24 BL	39A01P06	19	39A02P05	19		Blue	46.6088	39-108848-1005		CTRL1631-24		0.119	39-112325-2010_03	
40	CTRL1631	M27500-24SD2T23	CTRL1631-24 WH	39A01P06	20	39A02P05	20		White	46.6088	39-108848-1005		CTRL1631-24		0.119	39-112325-2010_03	
41	CTRL1641	REF ONLY	CTRL1641-22 SH	39A01P06BS	S9	39A02P05BS	S9		White/Black	46.6088	39-108848-1005		CTRL1641-22		0.119	39-112325-2010_03	
42	CTRL1641	M27500-24SD2T23	CTRL1641-24 BL	39A01P06	65	39A02P05	65		Blue	46.6088	39-108848-1005		CTRL1641-24		0.119	39-112325-2010_03	
43	CTRL1641	M27500-24SD2T23	CTRL1641-24 WH	39A01P06	66	39A02P05	66		White	46.6088	39-108848-1005		CTRL1641-24		0.119	39-112325-2010_03	

39-108848-1005.hrn

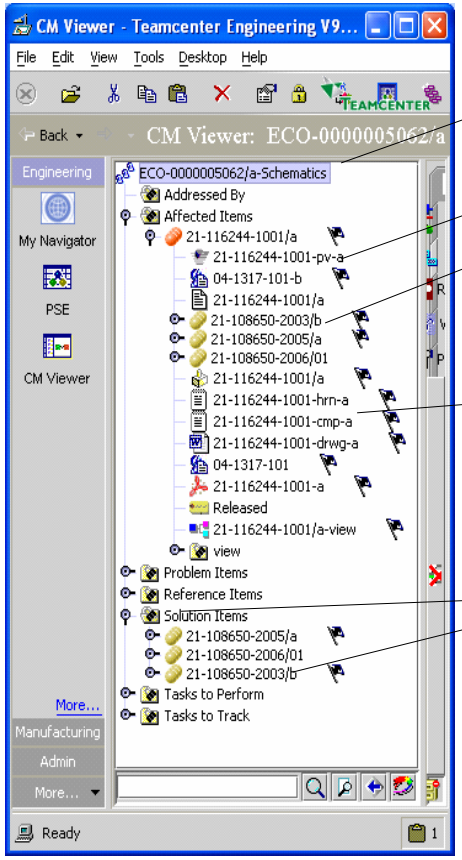
Formboard Layout



Manufacture details added



Teamcenter Harness Datamodel



Engineering change order

The harness being released

Associated schematics are referenced as Requirements under the harness but not status

Audited .hrn and .cmp files Are datasets under the NX 3D harness

Associated schematics will get status as children of the harness

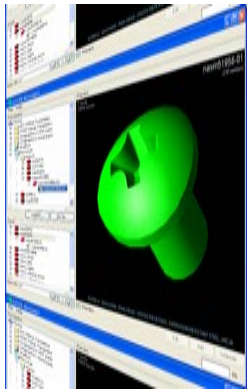
Relationships Required for Release of Harnesses

Suggested Best Practices

- Definition of routing objects in file
  - Break down of characteristics and attributes
  - components interaction with NX routing parasolids
- Layering and refset convention
- Association of .hrn and .cmp
  - Importation and assigning
  - Importance of using proper components
  - Auto-routing
- NX standard routing functionality
  - Best practices for proper harness build and formboard creation
  - Interaction with BCT a-CLASS
  - PDM revision and variant rules
- Quality check
  - Pin Manager audit
  - BOM audit
  - NX pin to pin connectivity
- Wire weight program
- Formboard
  - Eclipse format
  - Flattening audit
- Problem reporting and defect tracking

Thank you for attending - Questions

Solutions for Product Development



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cell: 949-278-4225

jvosler@cox.net

ECLIPSE AVIATION

On behalf of Eclipse Aviation