



 Report

## **CATS Parameters With Sources [CATSPAWS]**

**Rev 8**

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Annex to Final Report of:  
Causal Model for Air Transport Safety (CATS)

Produced for Ministry of Transport and Water Management  
of the Netherlands



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### Revisions

Original Rev 1: L. Bellamy & J. Cooper, 14 November 2007

Rev 2, based on comments received before TC 17 Dec, 14 December 2007

Rev3 Update of fields to forthcoming v24 of CATSPAWS 1 Feb 2008

Rev 4 Update to match CATSPAWS.exe v. 3.0.0.30 april 08

Rev5 New codes for parameter codes in 1.1.1 to cover performance models and output nodes.18 June 2008

Rev 6 22 June 2008 Modified continues flight – no longer included

Rev 7 – added note that DNV broke one of the rules so non end node backbone nodes not identifiable.

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## 1 Purpose

- To store all the data used in the CATS model in one place
- A bookkeeping process which ensures the source and pedigree of the data are traceable
- To have a centralized data store that always has the latest data in
- To have a link between CATSPAWS and the CATS software model so that it is easy to consistently update it and to automate the appearance of the output from the BBN (currently just a parameter codename).



## 2 System requirements and set-up

15MB of disk space to install and run.

MS Access

CATSPAWS is supplied as a setup.exe file. Double clicking on this file will open the installer. The setup file makes a directory Kingdom of the Netherlands with subdirectory CATS containing CATSPAWS.exe, CATSPAWS.mdb and CATSpaws.ini. Double clicking on the exe file opens the program with the database which is installed in the same directory. If a different CATSPAWS.mdb is required, change the pathname in the ini file to point to the desired database location or overwrite the installed database.



- Figure 1 CATSpaws is set up in directory Kingdom of the Netherlands/CATS



### 3 Database maintenance

The data in the CATSPAWS database is currently taken from the latest MS excel fault tree file from DNV using the PAWS tab there. The parameter codes in the fault tree are reproduced in the BBN and the risk assessment software maxiCATS puts together the BBN parameter codes with the CATSPAWS database and displays all the information associated with that code (see Figure 3). Additionally the traffic light system of colours for the end nodes of the ESDs are taken from the Storybuild backbone structure (071114 CATS backbone rev61.sb)

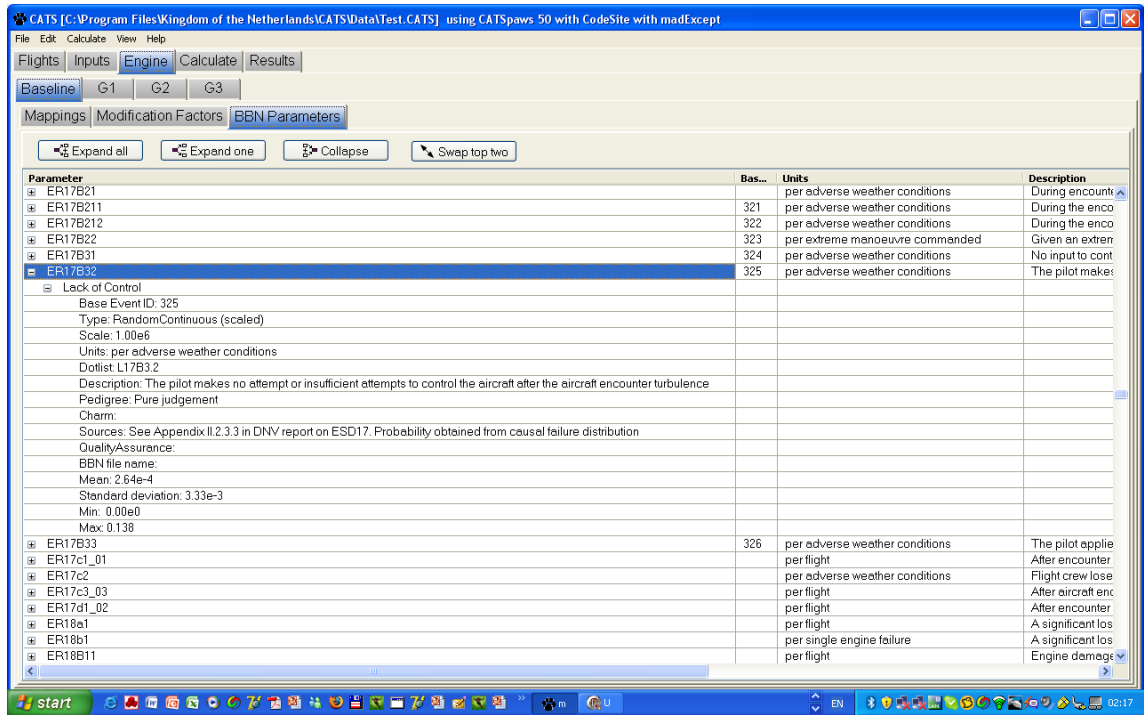
In addition, in the software maxiCATS on the Flights tab, the CATSPAWS button enables a parameter codes comparison between the BBN being used by maxiCATS and CATSPAWS database and will specify in the paws database file (CATSpaws.mdb) where the parameter code and BBN match. Any parameter codes not in CATSPAWS will be entered automatically; their fields will be empty and will need to be filled in.

The relationships in terms of data flow are shown in Figure 2.

NOTE:

- 1) The CATSPAWS database supplied with maxiCATSsetup.exe will be set up in the Kingdom of the Netherlands/CATS/Data subdirectory. This one will be modified using the CATSPAWS button in maxiCATS
- 2) The CATSPAWS database supplied with CATSPAWSsetup.exe will be set up in the Kingdom of the Netherlands/CATS subdirectory. This one will be modified when CATSPAWS.exe is run unless the ini file specifies otherwise.





■ Figure 3 Display of information in MaxiCATS, taken from CATSPAWS database using the parameter code

Figure 4 shows the CATSPAWS opening screen which displays all the fields described in section **Fields** under the tab Parameters. The inputs and mappings tabs are possible future functionalities for editing the inputs and modifiers to maxiCATS [TO BE DESCRIBED BY JPSC LTD]

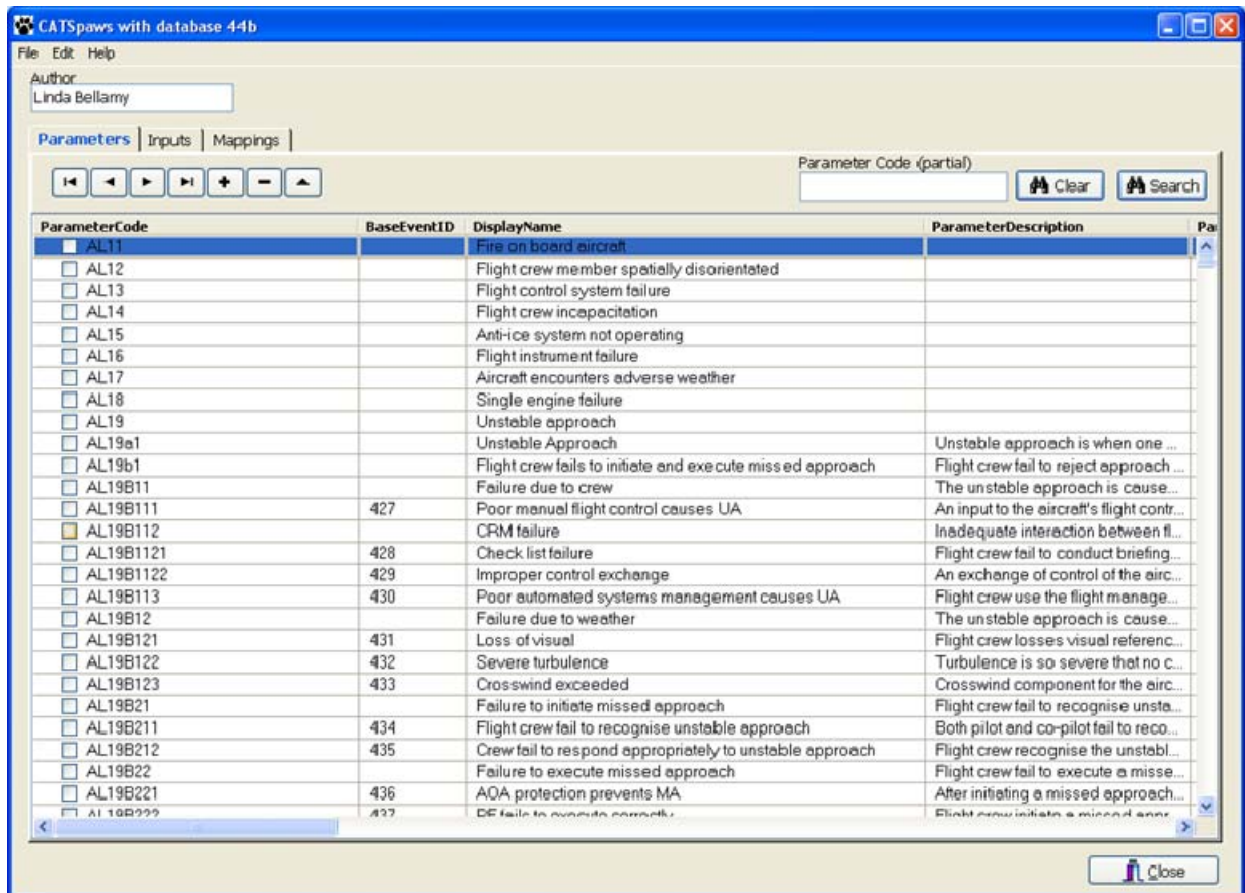
The parameters tab has the following functionality

- Alphabetical/numerical sort by clicking once on the column header (field name)
- Grab and drag field columns to user defined locations using left mouse button
- Figure 5 shows and describes data navigation and edit buttons. Parameters can be located and edited, and new parameters added.
- Figure 6 shows and describes the parameter code search function.
- Selected parameter entry appears in blue
- Figure 7 shows the edit screen. Any field can be edited here. When a parameter is edited the name of the author is added as well as the date.
- Figure 8 indicates buttons which become available on edit to save changes or revert to last save.
- Figure 9 shows the import function for automating the import of data from MS excel. This is available from the dropdown file menu. The excel data has to have column headings the same as the fields in CATSPAWS. The data in excel should be selected and saved to

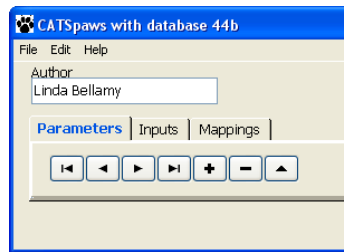


clipboard. Unmatched headers will be identified and reported as an error. The user can choose what actions to perform with imported data

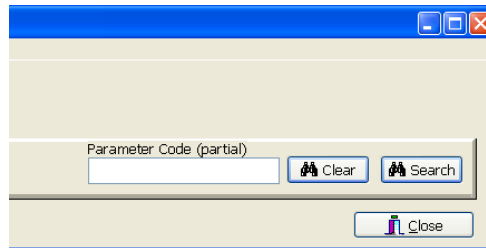
- The number of the database which is displayed in the top bar of the CATSPAWS (see Figure 4) has to be changed manually in the MS Access database in the table DatabaseInfo.



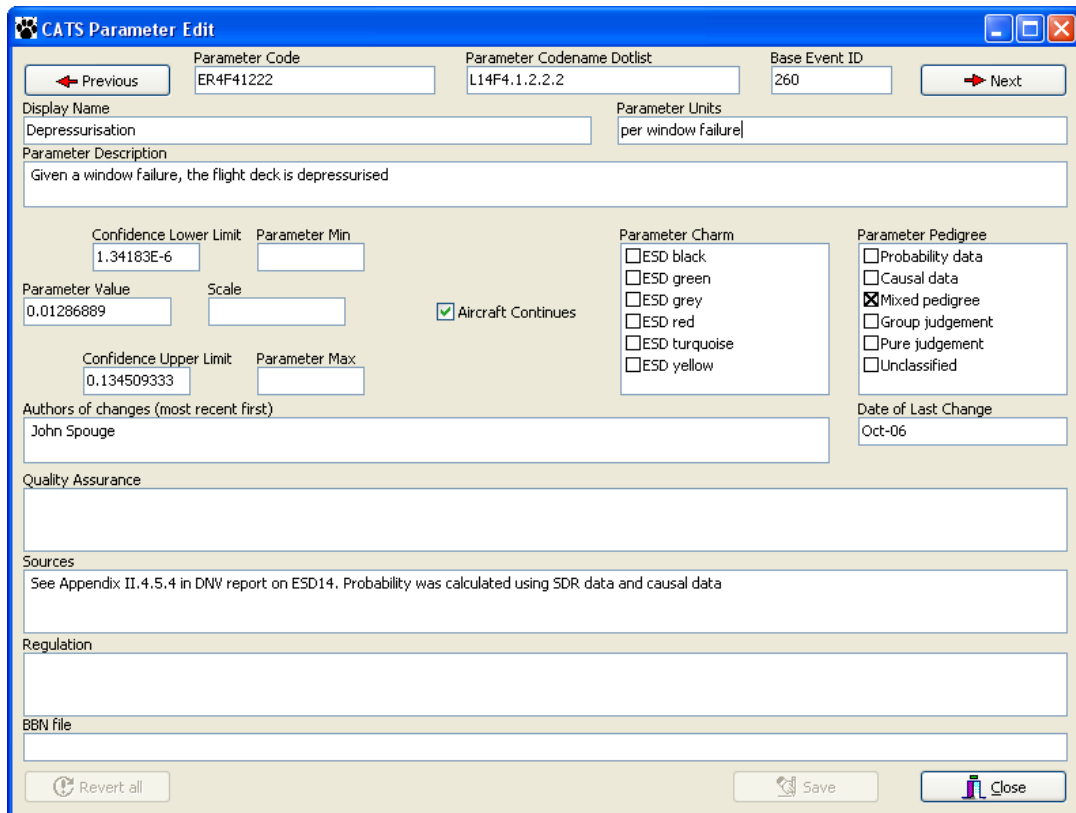
■ Figure 4 Opening screen. Selected code will be shown highlighted in blue. The horizontal scroll enables all the fields to be seen. See section 4. Fields



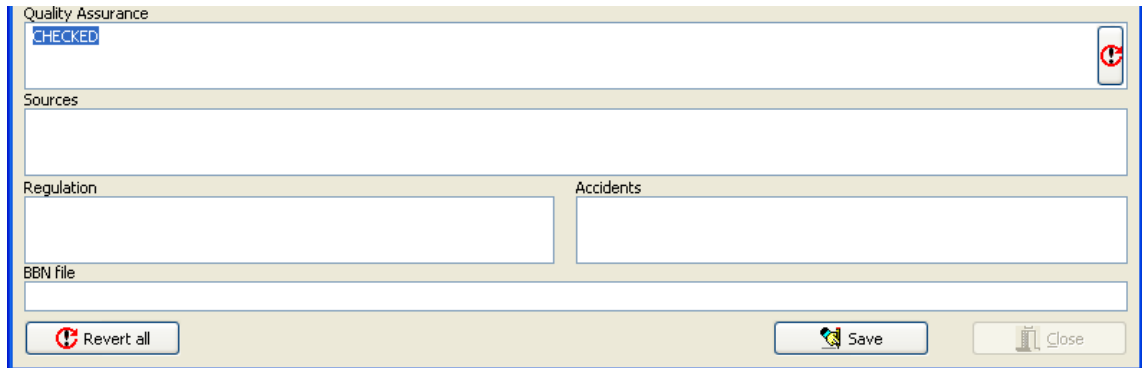
■ Figure 5 Buttons. 4 navigation buttons from left to right: First parameter, Previous parameter, Next parameter, Last parameter; 3 edit buttons from left to right: Insert parameter, Delete parameter, Edit parameter.



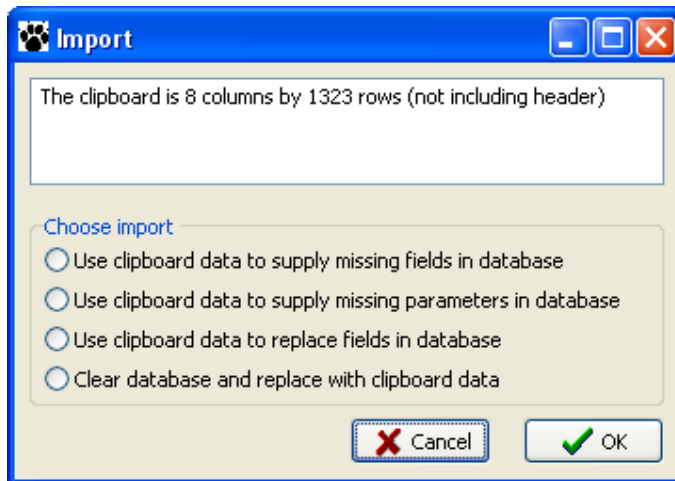
■ Figure 6 Search function. Type in part or whole parameter code and click search to locate the entry



■ Figure 7 Edit screen. To modify any field this screen must be used. The alternative is to do edits directly in MS Access (not advised).



- Figure 8 When edits are made the revert all and edit buttons appear. A warning sign also appears next to edited fields. Revert all changes everything back to the last saved version. Save will save displayed changes and/or additions



- Figure 9 Import function [TO BE DESCRIBED BY JPSC LTD]



## 4 Fields

The names here are documented exactly as they appear in the CATSPAWS edit program. The field names in the CATSPAWS database are given [in parenthesis]

### 4.1 Parameter Code [ParameterCode]

This is the unique code that links a node in the BBN (Bayesian Belief Net) with all the displayed data in MaxiCATS.

Short text (must conform to variable naming - see below)  
e.g. AL26B24

ParameterCodename must be usable in an equation, so must conform to rules which are:

First character must be alphabetic (ie a to z), remaining characters can be alphanumeric or underbar. Case is not significant, ie to01b11 is the same as TO01B11, and any mixture of capitalisation. (so no-one should use case as a distinguishing feature of anything)

We may need a limit on the length for uninet, something like 15 characters (What are BBN/uninet program constraints?)

Rules:

#### LEGEND

AA = Phase (TA, TO, ER, AL) etc any other phase codings required...MUST be AlphabetAlphabet and unique)

Can also be AAAA and AAAAAA for multiple phases

NN=2 digit Numbers (01, 02, 03 etc)

a=one letter

n=a number with one or more digits(1,2,3,..11,12..or...1,11,111,12,121....)

nn=end event numbers (beginning 00 for not the initiator, then 01, 02..etc.)

\_ = underbar

#### CODES

1) Boxes in the ESD backbone part that are NOT end events<sup>1</sup>:

AANNan\_

*Reason: Now that upper and lower case cannot be distinguished it causes boxes to have same code as in the FT in a few rare cases so we add \_*

2) Boxes in the ESD backbone part that are end events

AANNan\_nn

---

<sup>1</sup> DNV have not followed this rule and left out the underbar for non end events in the backbone. They therefore indeed had clashes with the FT. In such cases they added FT to the code for the fault tree node to distinguish it from backbone node.



Reason is that *\_nn* is how we recognise ESD end nodes in MaxiCATS for sorting purposes

3) Boxes in the fault tree

AANNan

Reason: We need the phase (AA) and ESD number(NN).

*In the fault trees the author can use scenario type code (L, E,F, etc. in place of AA as long as it is clear somewhere as to which phase the quantification numbers refer) – see ParameterCodenameDotlist*

### **Additional parameter codes for flight crew, ATCO and Maintenance performance models**

1) Start letter:

z (lower case)

This will ensure all the nodes for the Flight crew model, ATC (and Maintenance eventually) all appear together in the BBN parameters list and not all over the place when alphabetically sorted. This will when sorted Z-A produce these model BBNs first then TO then ER then AL, which makes sense and which will make QA and testing much much easier

2) Model identifier

Code for the model. The underbar after each model code (for Flight crew, Air traffic control, Maintenance) separates the model i.d. from the next part of the code

FC\_  
ATC\_  
MNT\_

3) Flight phase

The usual TO, ER, AL but also TOERAL for nodes where the 3 phases have been combined. This also lines up the sorted sequence nicely

4) Descriptive Part/Person

Here the rule is the nature of the parameter followed by person referred to (if relevant) eg.

TrainCap  
TrainFO  
ExpATCO  
ExpCap  
ExpFO  
UnSuitCrew  
UnSuitCap  
UnSuitFO  
Coord  
Traffic  
AirGen  
Workload

Complete codes:

zFC\_TOWorkload  
zFC\_TOWeather  
zFC\_TOUnSuitFO  
zFC\_TOUnSuitCrew  
zFC\_TOUnSuitCap  
zFC\_TOFatigue



zFC\_TOERALTrainFO  
zFC\_TOERALTrainCap  
zFC\_TOERALLangDif  
zFC\_TOERALExpFO  
zFC\_TOERALExpCap  
zFC\_TOERALAirGen  
zFC\_ERWorkload  
zFC\_ERWeather  
zFC\_ERUnSuitFO  
zFC\_ERUnSuitCrew  
zFC\_ERUnSuitCap  
zFC\_ERFatigue  
zFC\_ALWorkload  
zFC\_ALWeather  
zFC\_ALUnSuitFO  
zFC\_ALUnSuitCrew  
zFC\_ALUnSuitCap  
zFC\_ALFatigue  
zATC\_TOVisProc  
zATC\_TOTraffic  
zATC\_TOInterface  
zATC\_TOExpATCO  
zATC\_TOCoord  
zATC\_ERVisProc  
zATC\_ERTraffic  
zATC\_ERInterface  
zATC\_ERExpATCO  
zATC\_ERCord  
zATC\_ALVisProc  
zATC\_ALTraffic  
zATC\_ALInterface  
zATC\_ALExpATCO  
zATC\_ALCoord

**Additional parameter codes for Output nodes**

OUT\_PhaseName  
e.g. OUT\_Accident; OUT\_TOVeerOff

Codes are:

OUT\_TOERALAccident  
OUT\_TOALRunway\_overnun  
OUT\_TOALRunway\_veer\_off  
OUT\_TOERALCollision\_with\_ground  
OUT\_ERIn\_flight\_break\_up  
OUT\_ERALAircraft\_lands\_off\_runway  
OUT\_ALAircraft\_continues\_landing\_roll\_damaged  
OUT\_TOALAircraft\_damaged  
OUT\_ERCollision\_in\_mid\_air  
OUT\_TOALCollision\_on\_runway  
OUT\_ERPersonal\_injury  
OUT\_TOTake\_off  
OUT\_ERLoss\_of\_control\_in\_flight  
OUT\_ERFire\_in\_flight  
OUT\_EREngine\_failure\_in\_flight  
OUT\_ALCFIT



OUT\_ALLanding  
OUT\_TOERALCollision  
OUT\_ERStructural\_accident

#### **4.2 Parameter Codename Dotlist [ParameterCodenameDotlist]**

The Parameter Code name in the original DNV dot form from the FTs. These dotlisted names have all but disappeared in v.5\_1 of the FTs.

#### **4.3 Base event ID [BaseEventID]**

A whole number

The base event number as given by DNV in the fault tree event listings

#### **4.4 Display Name [DisplayName]**

short text

This is the name of the parameter that the user will see in CATS

e.g. Flight crew maintain control

#### **End nodes**

In the case of an end node, the display name begins END followed by a space

#### **4.5 Parameter Units [ParameterUnits]:**

Short text

e.g. per inappropriate handling

#### **4.6 ParameterDescription:**

Long text.

This is the definition/long description of the parameter

#### **4.7 Value [ParameterValue]**

Number if continuous.

Text (comma separated values) if discrete

NB a text value could be a number as with Aircraft Generation

The value is currently typed into the BBN from the Fault trees in MS Excel

The value is seen on the inputs screen, the engine and on the results screens in MaxiCATS but currently all the values and SDs and min and max are all read from the BBN into maxiCATS and not from CATSPAWS. The values in CATSPAWS come from the Fault Trees. The values from the FTs are hand-typed into the BBN. This is because the FTs have been provided in MS Excel form as opposed to a database – this could be remedied in the future. One day CATSPAWS might become the definitive place for the BBN values and the BBN could look it up from CATSPAWS



#### 4.8 Scale [ParameterScale]

Number

If blank it is taken as 1

Other values may be any number (1000000, for example)

Used to scale up or down the parameter depending on whether going to the BBN or coming from the BBN in relation to the value in MaxiCATS

#### 4.9 Parameter Min [ParameterMin]

Number

Lower end of the distribution

#### 4.10 Parameter Max [ParameterMax]

Number

Upper end of the distribution

#### 4.11 Confidence Lower Limit [ConfidenceLowerLimit]

Number

Complete variability of the population of flights

5% lower limit confidence interval

#### 4.12 Confidence Upper Limit [ConfidenceUpperLimit]

Number

95% upper limit confidence interval

#### 4.13 Aircraft Continues [AircraftContinues]

Boolean True/False

If False it means it is an end node of an ESD which in the ESD backbone does not continue flight e.g. stops on runway, veer off, collision etc. Not necessarily an accident. E.g. continues landing roll ends the flight.

#### 4.14 Charm [ParameterCharm]

Lookup which will display the appropriate colour in MaxiCATS based on the colours in the ESD backbone storybuild.

At the moment MaxiCATS only uses the red-yellow-green system to highlight the Codes in the display

<u>Description</u>	<u>Colour</u>
ESD black	Black



ESD green	Green
ESD grey	Grey
ESD red	Red
ESD turquoise	Turquoise
ESD yellow	Yellow

#### **4.15 Pedigree [ParameterPedigree]**

Lookup

Probability data - directly from event and exposure data (coloured green in the FT)

Causal data - based on the distribution of causes in the event data (coloured blue in the FT)

Mixed pedigree - deduced from other parameters (coloured white in the FT)

Group judgement - expert judgement using a structured elicitation process

Pure judgement - analyst judgement in the absence of any data (coloured yellow in the FT)

Unclassified - pedigree not yet recorded

<u>Description</u>	<u>Colour</u>
--------------------	---------------

Probability data	Green
------------------	-------

Causal data	Blue
-------------	------

Mixed pedigree	White
----------------	-------

Group judgement	
-----------------	--

Pure judgement	Yellow
----------------	--------

Unclassified	
--------------	--

#### **4.16 Date of Last Change [DateOfLastChange]**

Short text

Entered automatically

#### **4.17 Authors of changes (most recent first) [AuthorOfLastChange]**

Short text

#### **4.18 Quality Assurance [QualityAssurance]**

Long text

Free text field for notes made on quality checks, correction of the data, flagging of things needing to be fixed



#### **4.19 Sources [Sources]**

Long text

#### **4.20 Regulation [Regulation]**

Long text

Temporary placeholder. Free text field for mapping of the regulations onto the BBN. This is likely to become a completely separate table since there will be a one to many and a many to one mapping between the regulations and events in the model.

#### **4.21 BBN file [BBNfile]**

Ultimately the aim is to make an automated cross check and the relevant BBN file from the last check will be recorded. Currently it is not possible to see what is and what is not in the BBN from looking at CATSPAWS

#### NOTES:

Short text is max 255 characters,

Long text is effectively unlimited length and may contain line breaks.

Numbers should be constrained to use decimal point (.) And no thousands separator so that we can have comma separated lists.