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REVISION SUMMARY DOCUMENT FOR THE BASE OF Aircraft DATA (BADA) REVISION 3.7

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SUMMARY

This Revision Summary Document (RSD) describes all changes made to BADA files in Revision 3.7 since the previous release, Revision 3.6.

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1. INTRODUCTION

1.1. IDENTIFICATION AND SCOPE

This document summarises the changes made to the Base of Aircraft Data (BADA), Revision 3.7 since the previous release, Revision 3.6.

A general description of BADA Revision 3.7 is provided in the BADA 3.7 User Manual [RD1].

1.2. ORGANISATION

This document is presented in two sections including Section 1, the Introduction. This first section includes a list of referenced documents and a glossary of acronyms.

Section 2, Description of changes, presents a list of all changes to the BADA files between Revisions 3.6 and 3.7. A description for each change is also included in this section.

1.3. REFERENCED DOCUMENTS

- | | |
|------------|---|
| RD1 | User Manual for the Base of Aircraft Data (BADA) Revision 3.7; EEC Technical Report No. 2009-003, March 2009. |
| RD2 | Base of Aircraft Data (BADA) Aircraft Performance Modelling Manual; EEC Technical Report No. 2009-009, March 2009. |
| RD3 | Synonym Aircraft Report for the Base of Aircraft Data (BADA) Revision 3.7; EEC Technical Report No. 2009-007, March 2009. |
| RD4 | Base of Aircraft Data (BADA) Aircraft Performance Modelling Manual: EEC Technical Report No. 2009-009, April 2009. |

1.4. GLOSSARY OF ACRONYMS

APF	A irline P rocedure F ile
BADA	B ase of A ircraft D ata
CAS	C alibrated A irspeed
CM	C onfiguration M anagement
ICAO	I nternational C ivil A viation O rganization
EEC	E UROCONTROL E xperimental C entre
ICAO	I nternational C ivil A viation O rganisation
OPF	O peration P erformance F ile
PTF	P erformance T able F ile
ROD	R ate of D escent
RSD	R evision S ummary D ocument

2. DESCRIPTION OF CHANGES

Table 2-1 below provides a summary of the BADA changes that were implemented between BADA Revisions 3.6 and 3.7.

Table 2-1: Summary of changes for BADA 3.7

Change Identifier	Title
BADA-3.7-Change-01	A346 aircraft model added
BADA-3.7-Change-02	A388 aircraft model added
BADA-3.7-Change-03	BE58 aircraft model added
BADA-3.7-Change-04	C510 aircraft model added
BADA-3.7-Change-05	CRJ2 aircraft model added
BADA-3.7-Change-06	CRJ9 aircraft model added
BADA-3.7-Change-07	DA42 aircraft model added
BADA-3.7-Change-08	DH8D aircraft model added
BADA-3.7-Change-09	E135 aircraft model added
BADA-3.7-Change-10	E170 aircraft model added
BADA-3.7-Change-11	E190 aircraft model added
BADA-3.7-Change-12	EA50 aircraft model added
BADA-3.7-Change-13	71 aircraft models re-modelled
BADA-3.7-Change-14	Review and update of BADA airline default speed schedules
BADA-3.7-Change-15	Revision of all synonym aircraft types
BADA-3.7-Change-16	Change of some aircraft model filenames
BADA-3.7-Change-17	Fixed badly formatted values in BADA.GPF file
BADA-3.7-Change-18	Fixed invalid format of B712_*.APF file
BADA-3.7-Change-19	Fixed empty data line in OPF and APF files
BADA-3.7-Change-20	Fixed badly formatted negative values in OPF files
BADA-3.7-Change-21	Change of format for Performance Table files
BADA-3.7-Change-22	Addition of Performance Table Data files
BADA-3.7-Change-23	Important changes in User Manual

Descriptions for each change are presented in subsequent pages. For each change a description of the change, a motivation for the change and a specification of the affected files is provided. If either the OPF or APF file has been changed then the PTF and PTD files are re-created with the updated files. For an explanation of symbols referring to BADA coefficients, see the BADA 3.7 User Manual [RD1].

BADA-3.7-CHANGE-01

A346 aircraft model added

Description of Modification:

New BADA model for Airbus A340-600 aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

A346__.APF	added
A346__.OPF	added
A346__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-02

A388 aircraft model added

Description of Modification:

New BADA model for Airbus A380-800 aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

A388__.APF	added
A388__.OPF	added
A388__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-03

BE58 aircraft model added

Description of Modification:

New BADA model for Beech Baron 58 aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

BE58__.APF	added
BE58__.OPF	added
BE58__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-04**C510 aircraft model added****Description of Modification:**

New BADA model for Cessna Citation Mustang aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

C510__.APF	added
C510__.OPF	added
C510__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-05

CRJ2 aircraft model added

Description of Modification:

New BADA model for Canadair Regional Jet CRJ-200 aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

CRJ2__.APF	added
CRJ2__.OPF	added
CRJ2__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-06

CRJ9 aircraft model added

Description of Modification:

New BADA model for Canadair Regional Jet CRJ-900 aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

CRJ9__.APF	added
CRJ9__.OPF	added
CRJ9__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-07

DA42 aircraft model added

Description of Modification:

New BADA model for Diamond Twin Star aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

DA42__.APF	added
DA42__.OPF	added
DA42__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-08

DH8D aircraft model added

Description of Modification:

New BADA model for De Havilland Dash 8-400 aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

DH8D__.APF	added
DH8D__.OPF	added
DH8D__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-09

E135 aircraft model added

Description of Modification:

New BADA model for Embraer EMB-135 aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

E135__.APF	added
E135__.OPF	added
E135__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-10

E170 aircraft model added

Description of Modification:

New BADA model for Embraer EMB-175 aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

E170__.APF	added
E170__.OPF	added
E170__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-11

E190 aircraft model added

Description of Modification:

New BADA model for Embraer EMB-190 aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

E190__.APF	added
E190__.OPF	added
E190__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-12

EA50 aircraft model added

Description of Modification:

New BADA model for Eclipse 500 aircraft type has been added.

Reason for Modification:

Following the availability of aircraft performance reference data, the decision has been taken to model this aircraft type.

Files Affected:

EA50__.APF	added
EA50__.OPF	added
EA50__.PTF	added
SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-13

71 aircraft models re-modelled

Description of Modification:

The BADA models for the 71 aircraft types listed in Table 2-2 have been re-modelled.

Reason for Modification:

Due to the development of a new modelling environment described in [RD2] and using revised aircraft performance data for existing aircraft models, majority of the BADA aircraft models have been remodelled.

It is worth pointing out that the new BADA aircraft models data coefficients may be slightly, or significantly different to those of previous versions.

The advantages of the new aircraft models are closely related to the following facts:

- Aircraft models were developed using the best aircraft performance reference data currently available at EUROCONTROL,
- New modelling environment provides improved optimisation capabilities [RD4] leading to identification of BADA coefficients with minimum error with respect to the reference data,
- Reference data sources are traceable and aircraft models accuracy results are documented.

Table 2-2: Aircraft remodelled in BADA 3.7

Aircraft Code	Aircraft Name
A306	Airbus A300B4-600
A30B	Airbus A300B4-200
A310	Airbus A310
A319	Airbus A319
A320	Airbus A320
A321	Airbus A321
A332	Airbus A330-200
A333	Airbus A330-300
A343	Airbus A340-300
AT43	ATR 42-300
AT45	ATR 42-500
AT72	ATR 72

Aircraft Code	Aircraft Name
ATP	British Aerospace Advanced TurboProp
B462	British Aerospace 146-200/RJ
B712	Boeing 717-200
B722	Boeing 727-200
B732	Boeing 737-200
B733	Boeing 737-300
B734	Boeing 737-400
B735	Boeing 737-500
B736	Boeing 737-600
B737	Boeing 737-700
B738	Boeing 737-800
B742	Boeing 747-200
B743	Boeing 747-300
B744	Boeing 747-400
B752	Boeing 757-200
B753	Boeing 757-300
B762	Boeing 767-200
B763	Boeing 767-300
B764	Boeing 767-400
B772	Boeing 777-200 ER
B773	Boeing 777-300
BE20	Beech Super King Air 200
BE9L	Beech King Air 90
C130	Lockheed Hercules
C550	Cessna Citation II-S2
C560	Cessna Citation V
C750	Cessna Citation 10
CL60	Canadair Challenger 600/601
CRJ1	Canadair Regional Jet CRJ-100

Aircraft Code	Aircraft Name
D228	Dornier 228
D328	Dornier 328
DH8A	De Havilland Dash 8-100
DH8C	De Havilland Dash 8-300
E120	Embraer EMB-120 Brasilia
E145	Embraer EMB-145
F100	Fokker 100
F27	Fokker Friendship
F50	Fokker 50
F70	Fokker 70
F900	Dassault Falcon 900
FA50	Dassault Falcon 50
H25A	Hawker Siddeley Domine HS 125
JS32	Jetstream Super 31
JS41	Jetstream 41
LJ35	Learjet 35
LJ45	Learjet 45
MD11	McDonnell-Douglas MD-11
MD82	McDonnell-Douglas MD-82
MD83	McDonnell-Douglas MD-83
P28A	Piper PA-28-140 Cherokee
PA34	Piper PA-34-200T Seneca-III
RJ85	AI(R) RJ-85 Avroliner
SB20	Saab 2000
SF34	Saab SF 340
SH36	Shorts SH3-360
SW4	Swearingen Merlin IV
T134	Tupolev TU134A-3

Aircraft Code	Aircraft Name
T154	Tupolev TU154M
TRIN	SOCATA Trinidad TB20

Files Affected:

OPF and PTF files for all aircraft types listed in Table 2-2 were modified.

BADA-3.7-CHANGE-14

Review and update of BADA airline procedure default speed schedules

Description of Modification:

The default climb and descent speed schedules of all aircraft models have been reviewed and updated.

Reason for Modification:

A complete review of the climb and descent speed schedules has been performed for all aircraft models, based on manufacturer reference data as well as recordings of real data: more details on this process are available in [RD2].

Files Affected:

All APF and PTF files were modified

BADA-3.7-CHANGE-15

Revision of all synonym aircraft types

Description of Modification:

All synonym aircraft have been re-evaluated and some reassigned. More details are provided in [RD3].

Reason for Modification:

This revision is two fold: it allows for the addition of new synonym aircraft since BADA 3.6 but also a general reevaluation of all previously assigned aircraft with the aid of a new tool (BADA Synonym Search Tool).

Files Affected:

SYNONYM.NEW	modified
SYNONYM.LST	modified
SYNONYM_ALL.LST	modified

BADA-3.7-CHANGE-16

Change of some aircraft model names

Description of Modification:

The name of the JS31 model has been changed into JS32.

The name of the H25B model has been changed into H25A.

The name of the SW3 model has been changed into SW4.

Reason for Modification:

During the development process, several inconsistencies were found in the mapping of aircraft model/version to the ICAO designators. The inconsistencies came from non clear input aircraft performance reference data: all non clear aircraft performance reference data have thus been rechecked.

Files Affected:

JS31__.OPF	removed
JS31__.APF	removed
JS31__.PTF	removed
JS32__.OPF	added
JS32__.APF	added
JS32__.PTF	added
H25B__.OPF	removed
H25B__.APF	removed
H25B__.PTF	removed
H25A__.OPF	added
H25A__.APF	added
H25A__.PTF	added
SW3__.OPF	removed
SW3__.APF	removed
SW3__.PTF	removed
SW4__.OPF	added
SW4__.APF	added
SW4__.PTF	added

BADA-3.7-CHANGE-17

Fixed badly formatted values in BADA.GPF file

Description of Modification:

The values for C_red_piston, C_red_turbo and C_red_jet parameters have been modified in the BADA.GPF file.

Reason for Modification:

The aforementioned values were not properly formatted (...0+00 instead of ...E+00). This was reported in a trouble ticket and modified.

Files Affected:

BADA.GPF modified

BADA-3.7-CHANGE-18

Fixed invalid format of B712__.APF file

Description of Modification:

'*' character removed from the end of the B712__.APF file.

Reason for Modification:

At the end of the file an extraneous '*' character was present. This was reported in a trouble ticket and modified.

Files Affected:

B712__.APF modified

BADA-3.7-CHANGE-19

Fixed empty data line in OPF and APF files

Description of Modification:

An empty data line in the file identification block of OPF and APF files has been changed into a comment line.

Reason for Modification:

The aforementioned data line used to contain the revision information of the file in earlier BADA revisions, but had been empty since several BADA revisions. It has then been decided to change this obsolete data line into a comment line to conform to the file format description given in the User Manual [RD1].

Files Affected:

All OPF and APF files were modified

BADA-3.7-CHANGE-20

Fixed badly formatted negative values in OPF files

Description of Modification:

Some negative values present in OPF files –typically the temperature gradient G_t - have been fixed to conform to the format described in the User Manual [RD1].

Reason for Modification:

The aforementioned values were not properly formatted: The negative sign was placed in an extra character on the left of the field, instead of inside the field.

Files Affected:

All OPF files were modified

BADA-3.7-CHANGE-21

Change of format for Performance Table files

Description of Modification:

The number of digits for the rates of climb/descent has been increased by one.

Reason for Modification:

Some rates of climb/descent are higher than 10,000 fpm for one military aircraft type.

Files Affected:

All PTF files were modified

BADA-3.7-CHANGE-22

Addition of Performance Table Data files

Description of Modification:

A Performance Table Data (PTD) file, containing detailed performance values, has been added for all aircraft models. The content and format of that file is described in the User Manual [RD1].

Reason for Modification:

The PTD file provides additional performance values that are useful for the validation of BADA implementations.

Files Affected:

A PTD file was added for each aircraft model

BADA-3.7-CHANGE-23

Important changes in User Manual

Description of Modification:

The following changes have been made to the aircraft performance model algorithms described in the User Manual [RD1]:

- Modification of the values for constants g and R in Section 3
- New description of formula 3.1-8 to match its actual use in some models
- Coefficient $C_{V_{min,TO}}$ is no longer used in climb speed schedule, only in flight envelope determination
- Change of descent thrust computation when $C_{T_{des,app}}$ and $C_{T_{des,ld}}$ are null in Section 3.7.3
- Clarification of descent fuel flow computation in Section 3.9
- Additional information on airline procedure model and corresponding speed schedules in Section 4
- Update of some Fortran format descriptions in Section 6

Those changes are susceptible to require modifications in BADA software implementations to ensure their conformance to the aircraft performance model of BADA Revision 3.7.

The Performance Table files (PTF) and Performance Table Data (PTD) have been updated to take into account those modifications to the algorithms.

Reason for Modification:

A complete review of the User Manual has been performed to ensure its consistency with both the baseline implementation of BADA and the release files.

Files Affected:

All PTF and PTD files were modified.

