

Beagle Pup Aerodynamic data built from vspaero; CG (7.275, 0, -0.227)FT, 2017-04-23 05:06

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AeroDetail=Medium, MultiSampleAero, MultiSampleDerivatives, Propeller, Flaps, WakeIterations=1

Compared against windtunnel data **F-15 Aerodynamic data from (AFIT/GAE/ENY/90D-16); CG 25.65%**

Roll Coefficient Buildup

$ROLL = CMLBETADOT * BETADOT + CMLDF * flaps + CMLPROP WASH * aero / include-propeller-effects + CML1 + CMLDAD * DDA + CMLDRD * DRUDD + CMLP * PB + CMLR * RB + (DLNB * BETA)$

Pitch Coefficient Buildup

$PITCH = CMMALPHADOT * ALPHADOT + CMMBETADOT * BETADOT + CMMDF * flaps + CMMPROP WASH * aero / include-propeller-effects + CMM1 + CMMQ * QB$

Yaw Coefficient Buildup

$YAW = CMNBETADOT * BETADOT + CMNDF * flaps + CMNPROP WASH * aero / include-propeller-effects + CMN1 + CMNDAD * DDA + CMNDRD * DRUDD + CMNP * PB + CMNR * RB + (DCNB * BETA)$

Drag Coefficient Buildup

$DRAWG = CFXDF * flaps + CFXPROP WASH * aero / include-propeller-effects + CFXB$

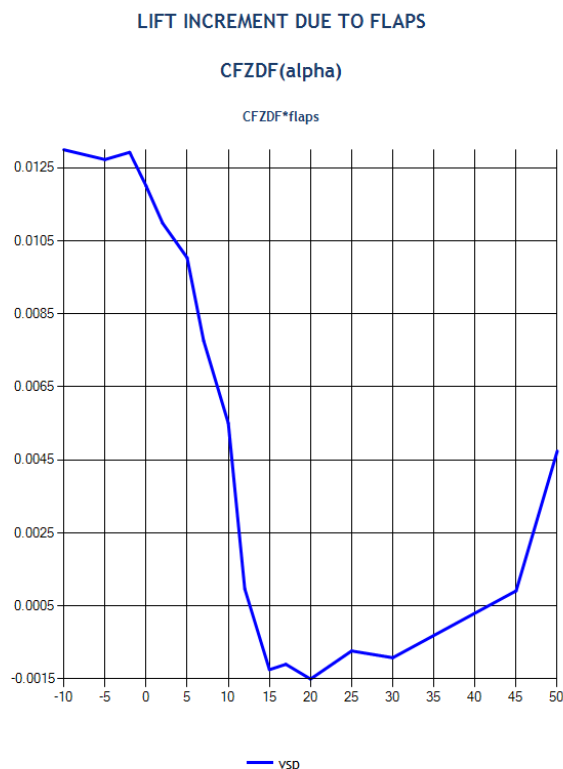
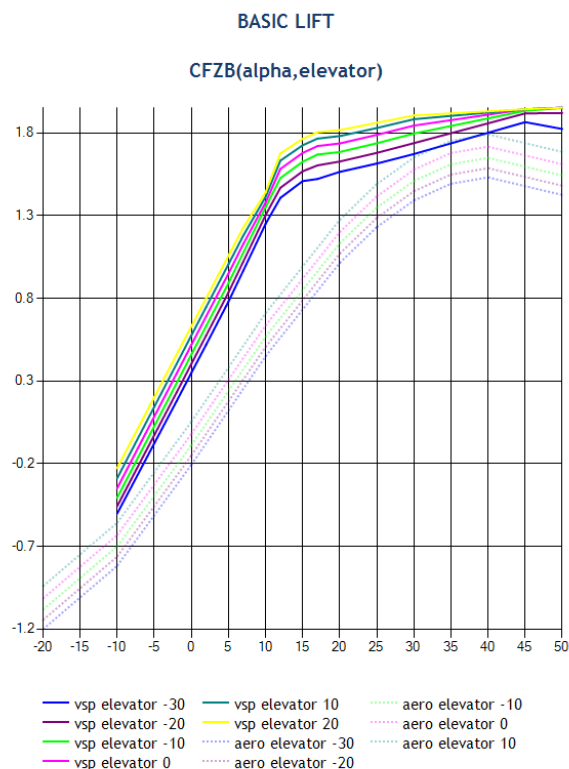
Side Coefficient Buildup

$SIDE = CFYDF * flaps + CFYPROP WASH * aero / include-propeller-effects + CFYB + CYDAD * DDA + CYDRD * DRUDD + CFYP * PB + CFYR * RB$

Lift Coefficient Buildup

$LIFT = CFZDF * flaps + CFZPROP WASH * aero / include-propeller-effects + CFZB$

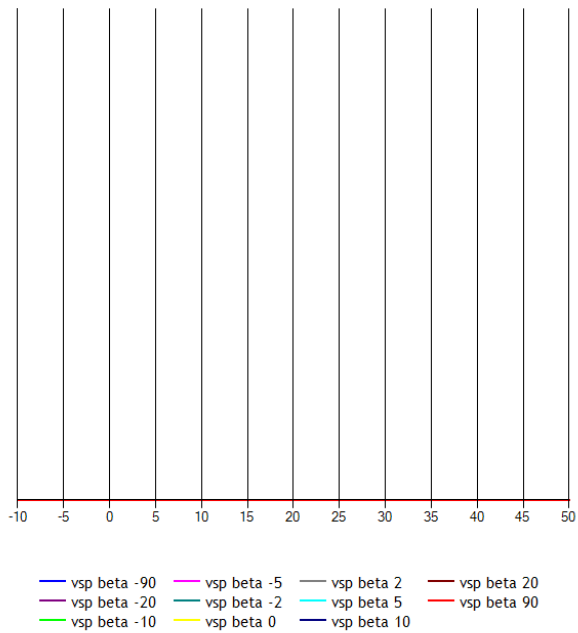
LIFT



LIFT INCREMENT DUE TO PROPWASH

CFZPROPWASH (alpha,beta,Vind=0)

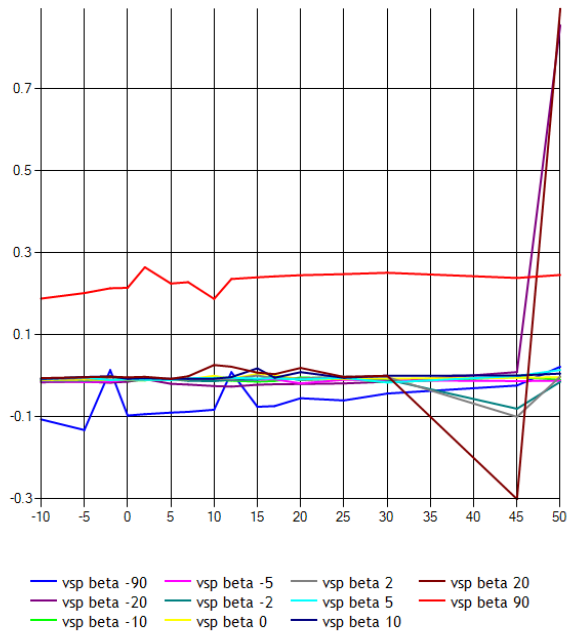
CFZPROPWASH*aero/include-propeller-effects



LIFT INCREMENT DUE TO PROPWASH

CFZPROPWASH (alpha,beta,Vind=1)

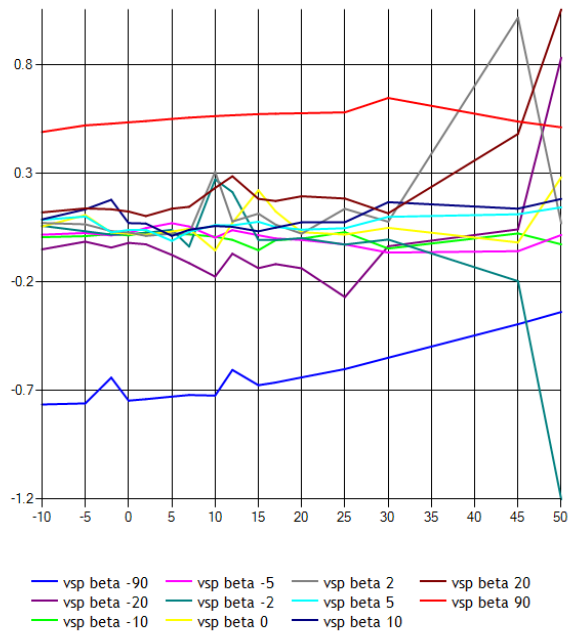
CFZPROPWASH*aero/include-propeller-effects



LIFT INCREMENT DUE TO PROPWASH

CFZPROPWASH (alpha,beta,Vind=16)

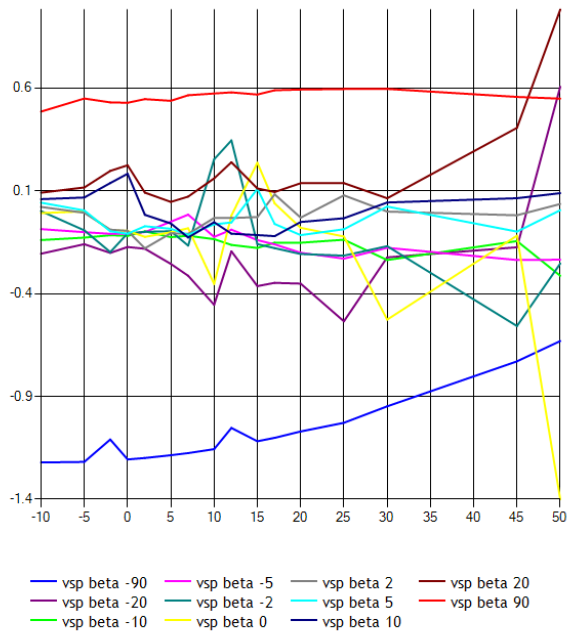
CFZPROPWASH*aero/include-propeller-effects



LIFT INCREMENT DUE TO PROPWASH

CFZPROPWASH (alpha,beta,Vind=48)

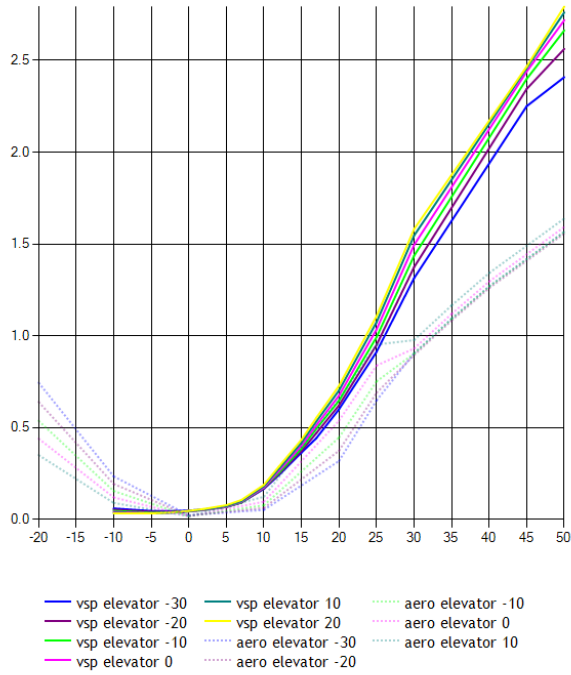
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DRAG

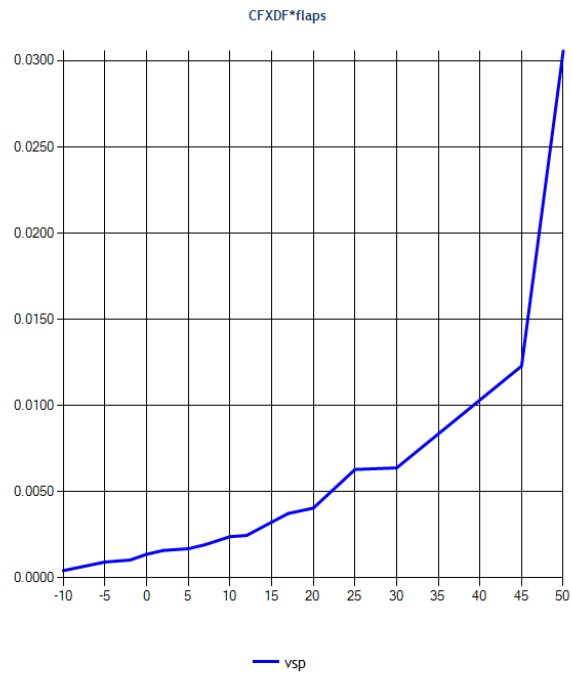
BASIC DRAG

CFXB(alpha,elevator)



DRAG INCREMENT DUE TO FLAPS

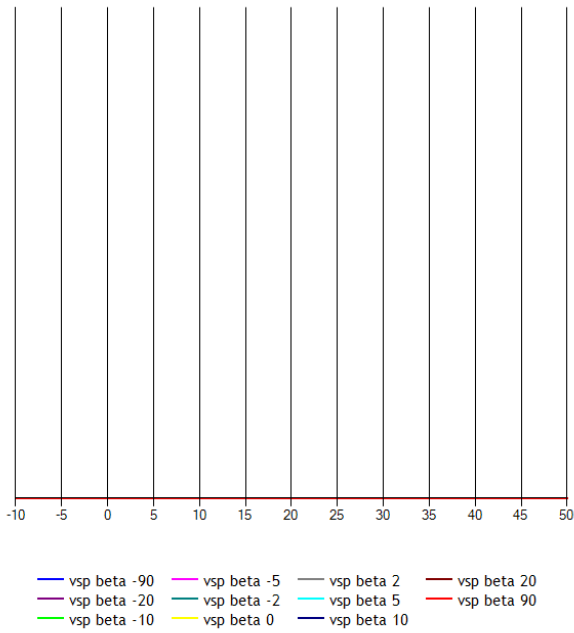
CFXDF(alpha)



DRAG INCREMENT DUE TO PROPWASH

CFXPROPWASH (alpha,beta,Vind=0)

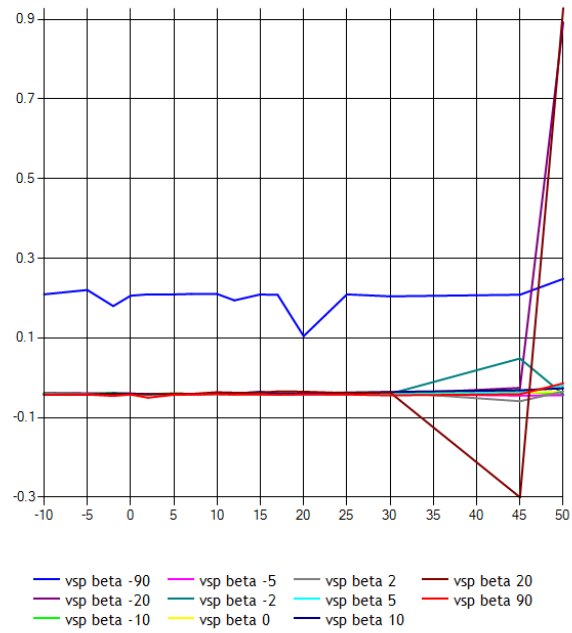
CFXPROPWASH*aero/include-propeller-effects



DRAG INCREMENT DUE TO PROPWASH

CFXPROPWASH (alpha,beta,Vind=1)

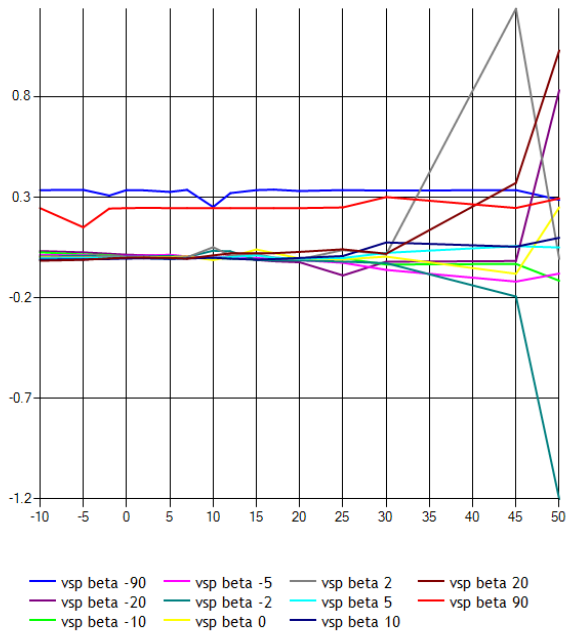
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DRAG INCREMENT DUE TO PROPWASH

CFXPROPWASH (alpha,beta,Vind=16)

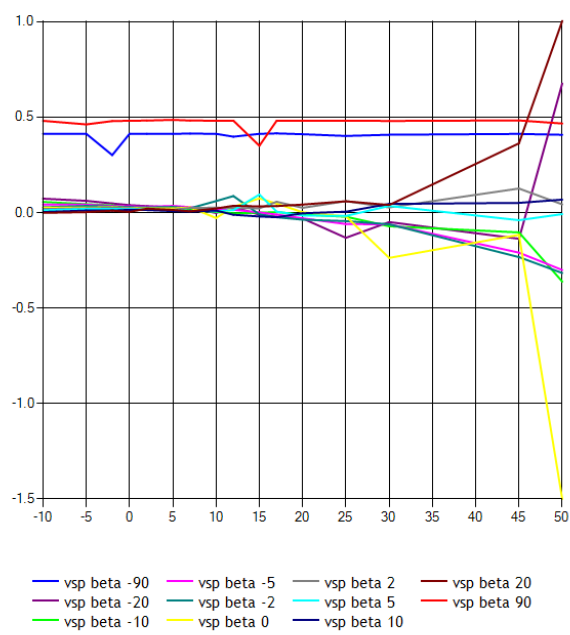
CFXPROPWASH*aero/include-propeller-effects



DRAG INCREMENT DUE TO PROPWASH

CFXPROPWASH (alpha,beta,Vind=48)

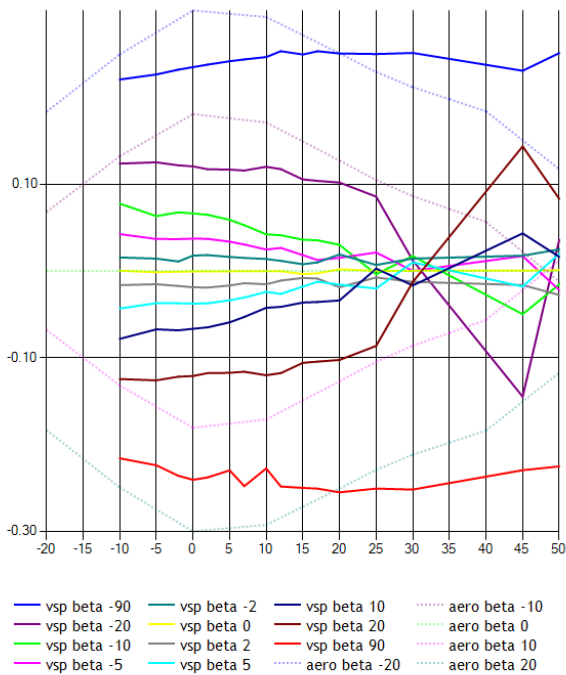
CFXPROPWASH*aero/include-propeller-effects



SIDE

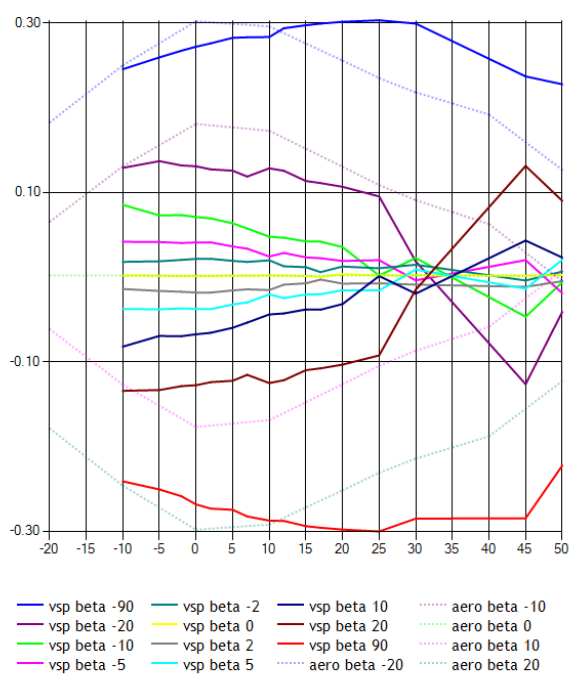
BASIC SIDE FORCE

CFYB (alpha,beta,elevator=-30)



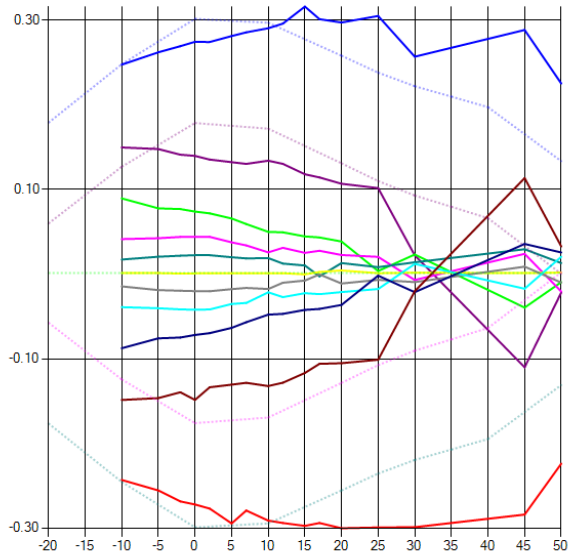
BASIC SIDE FORCE

CFYB (alpha,beta,elevator=-20)



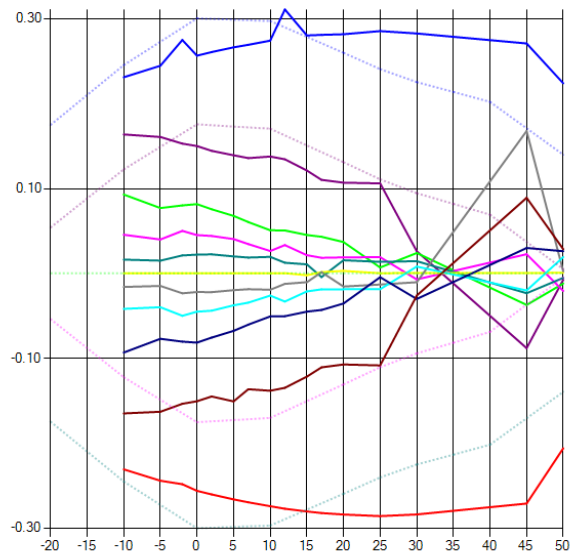
BASIC SIDE FORCE

CFYB (alpha,beta,elevator=-10)



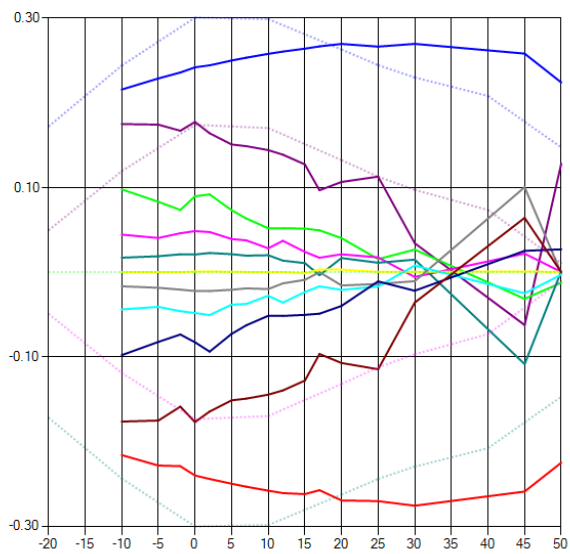
BASIC SIDE FORCE

CFYB (alpha,beta,elevator=0)



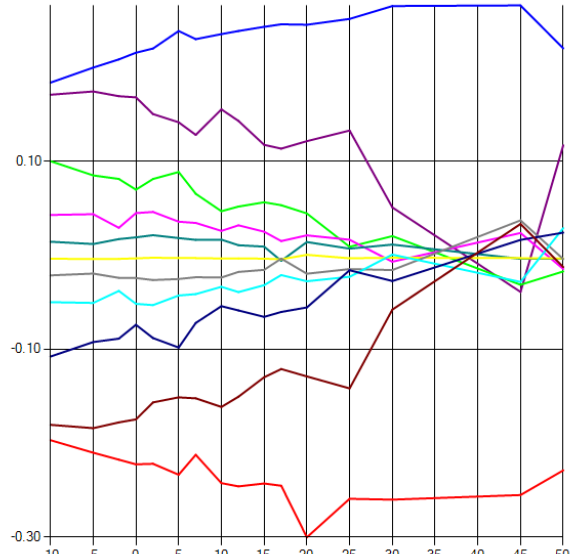
BASIC SIDE FORCE

CFYB (alpha,beta,elevator=10)

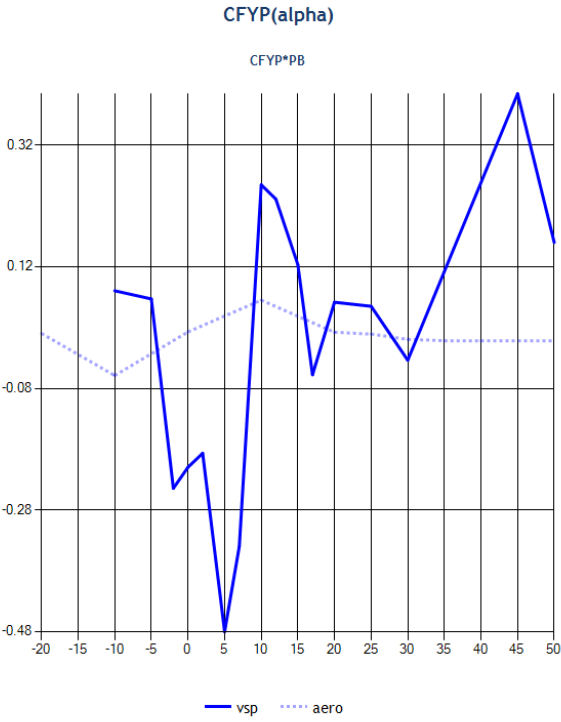


BASIC SIDE FORCE

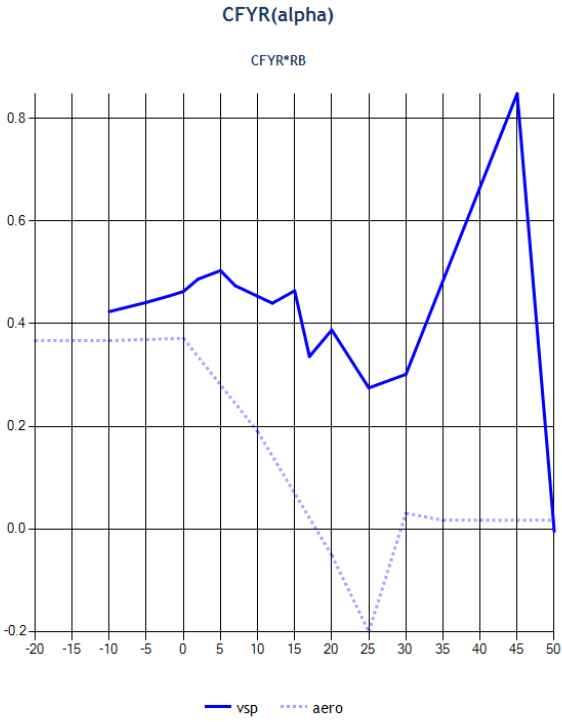
CFYB (alpha,beta,elevator=20)



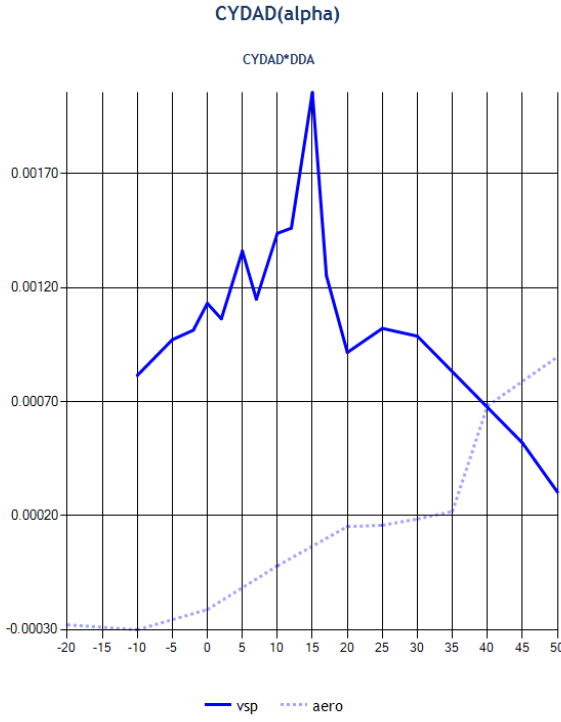
SIDE FORCE DUE TO ROLL RATE



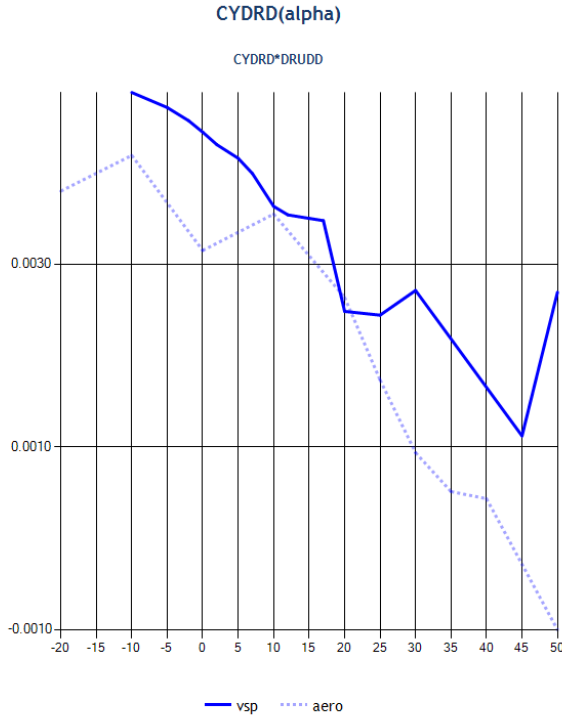
SIDE FORCE DUE TO YAW RATE



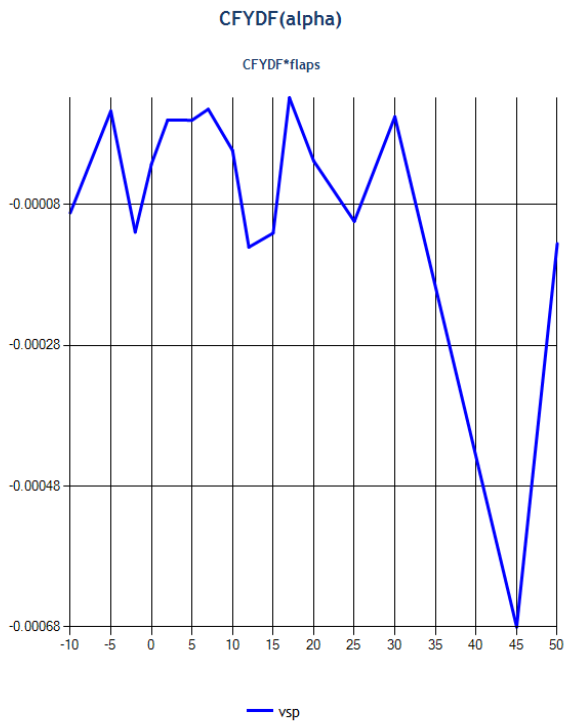
SIDE FORCE DUE TO AILERON DEFLECTION



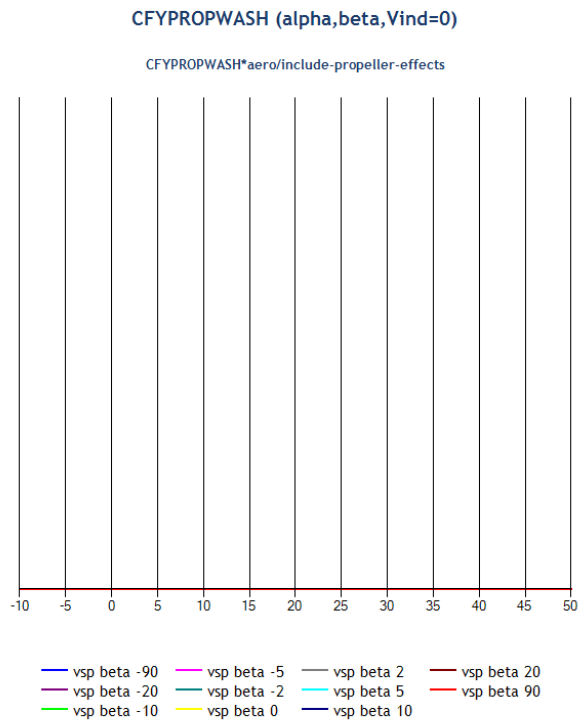
SIDE FORCE DUE TO RUDDER DEFLECTION



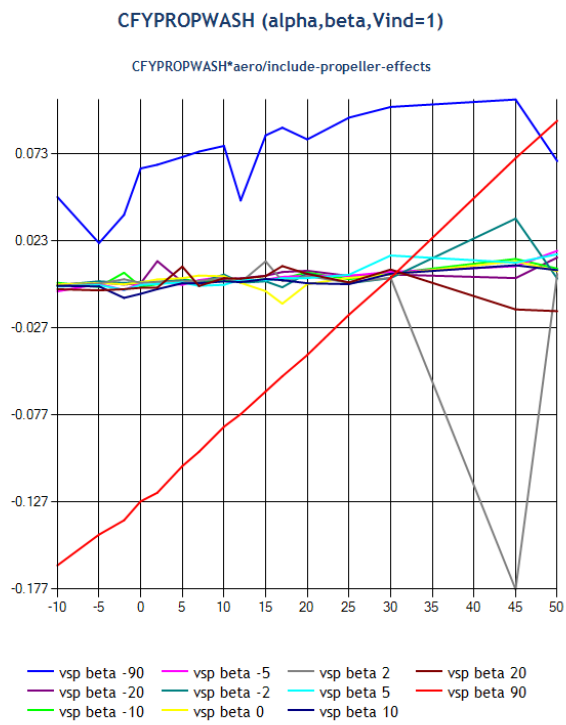
SIDEFORCE INCREMENT DUE TO FLAPS



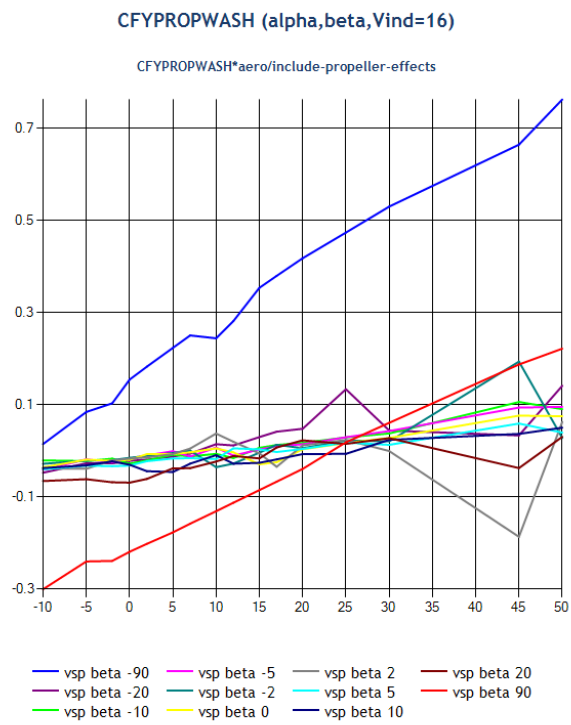
SIDE FORCE INCREMENT DUE TO PROPWASH



SIDE FORCE INCREMENT DUE TO PROPWASH



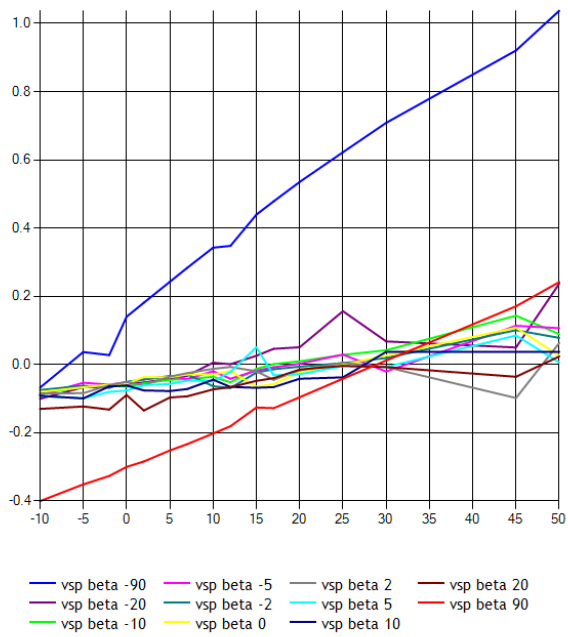
SIDE FORCE INCREMENT DUE TO PROPWASH



SIDE FORCE INCREMENT DUE TO PROPWASH

CFYPROPWASH (alpha,beta,Vind=48)

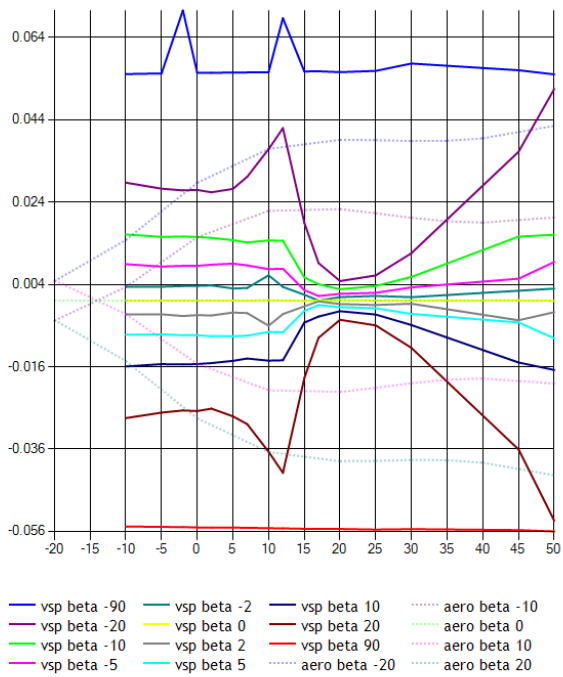
CFYPROPWASH*aero/include-propeller-effects



ROLL

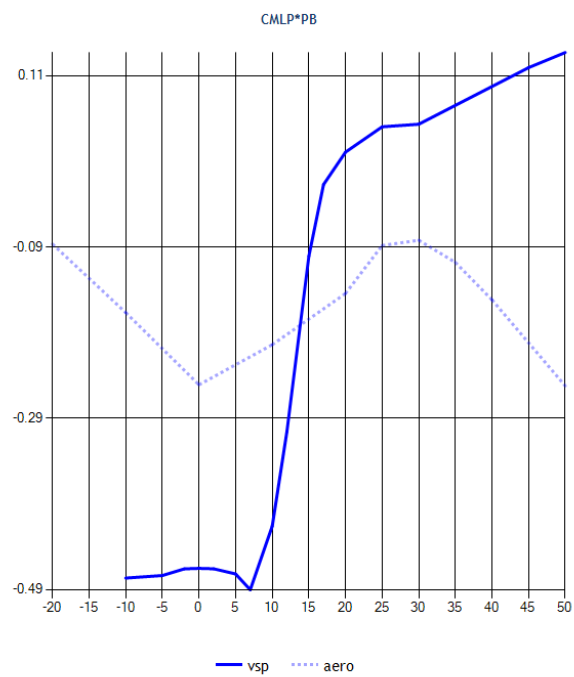
BASIC ROLLING MOMENT

CML1(alpha,beta)

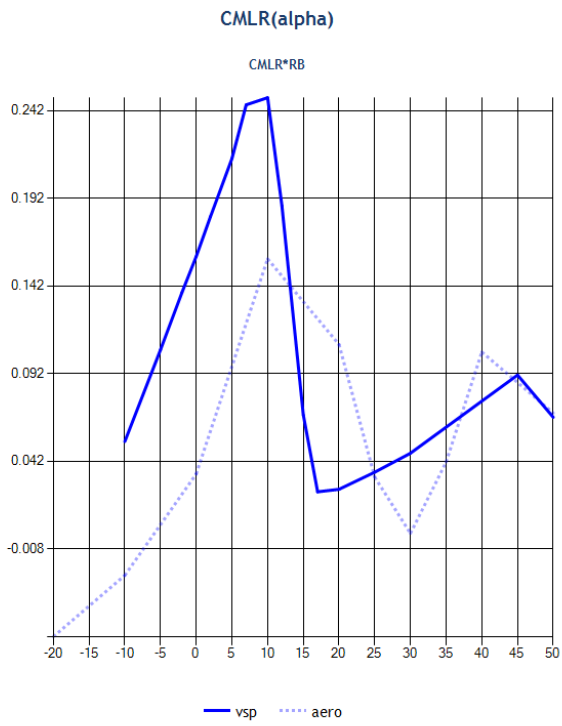


ROLL DAMPING DERIVATIVE

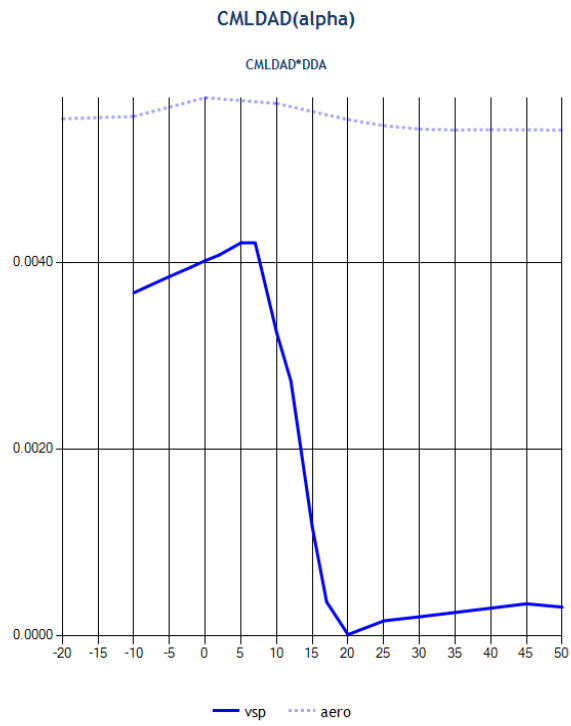
CMLP(alpha)



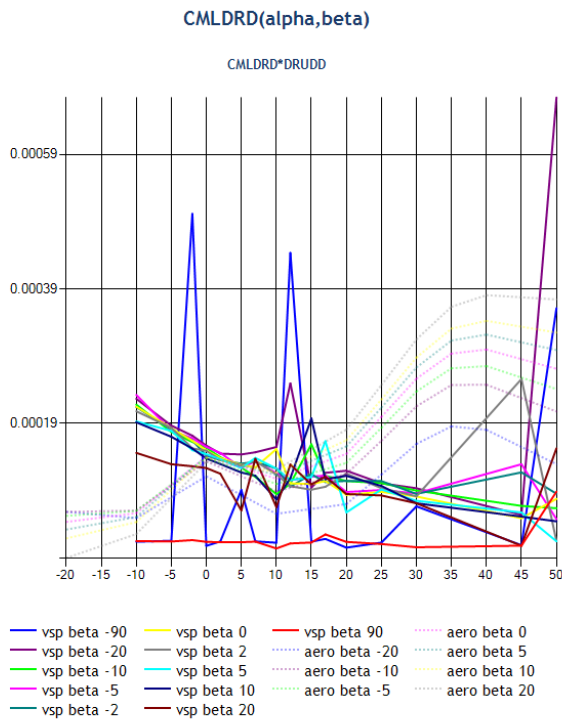
ROLLING MOMENT DUE TO YAW RATE



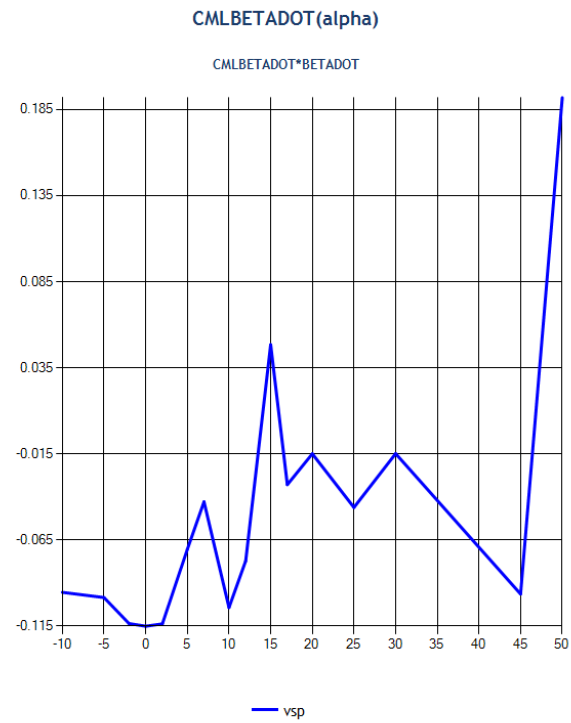
ROLLING MOMENT DUE TO AILERON DEFLECTION



ROLLING MOMENT DUE TO RUDDER DEFLECTION



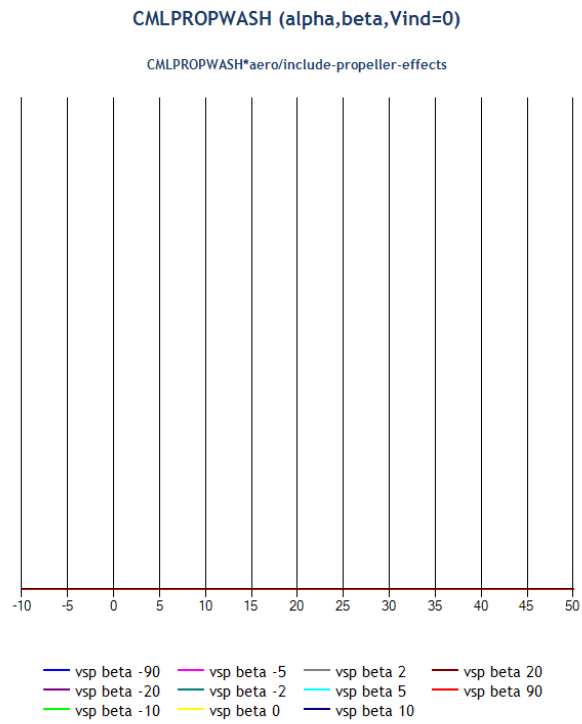
ROLL MOMENT DERIVATIVE FOR BETA DOT



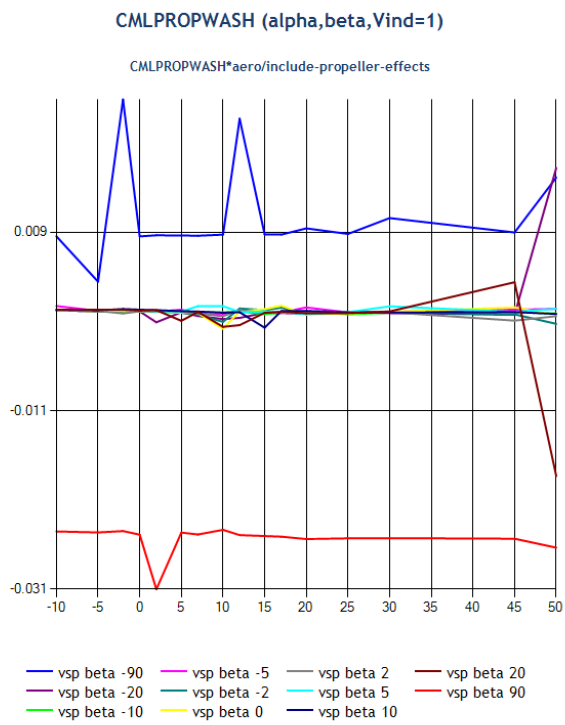
ROLLING MOMENT DUE TO FLAPS



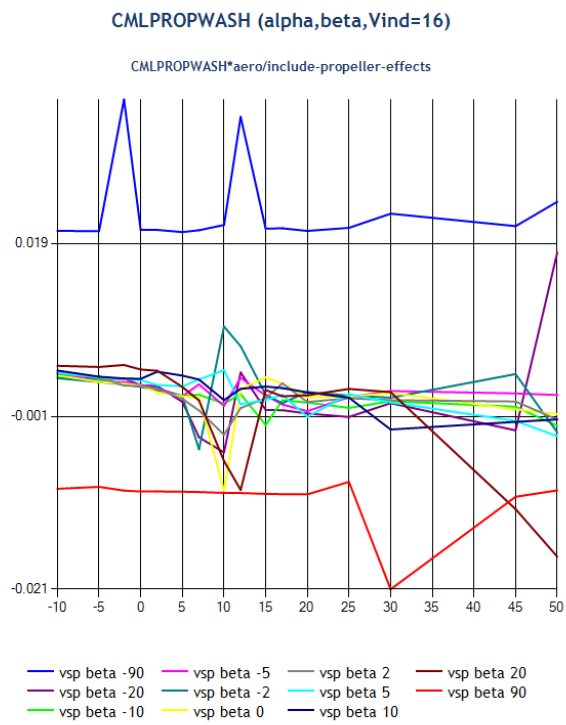
ROLLING MOMENT INCREMENT DUE TO PROPWASH



ROLLING MOMENT INCREMENT DUE TO PROPWASH



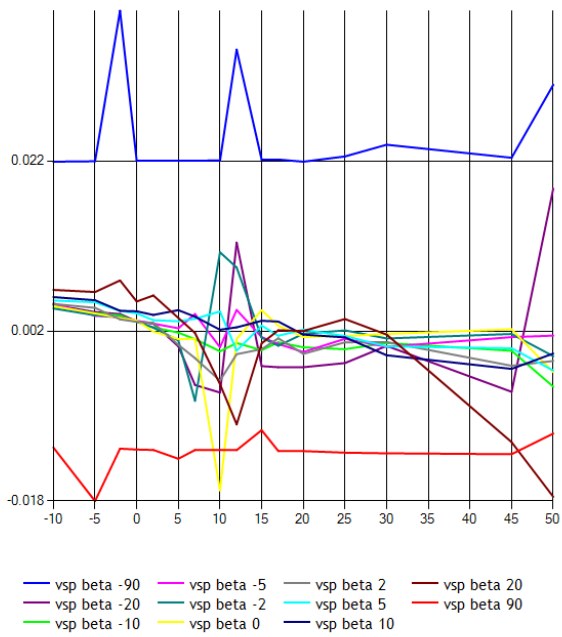
ROLLING MOMENT INCREMENT DUE TO PROPWASH



ROLLING MOMENT INCREMENT DUE TO PROPWASH

CMLPROPWASH (alpha,beta,Vind=48)

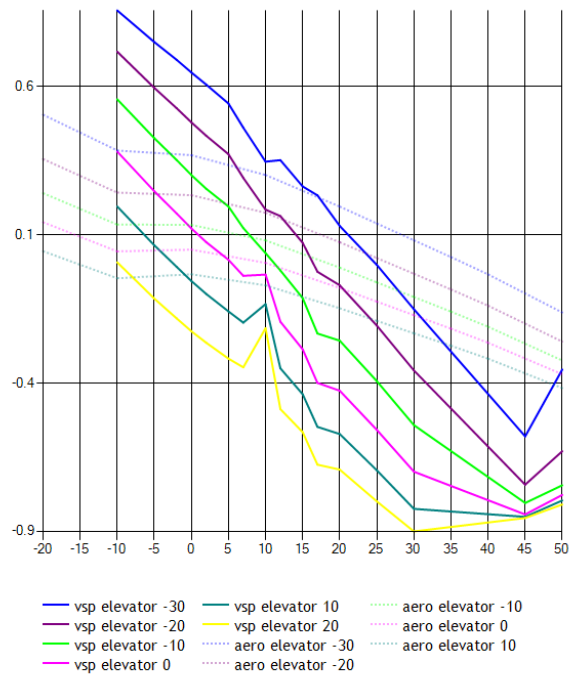
CMLPROPWASH*aero/include-propeller-effects



PITCH

BASIC PITCHING MOMENT

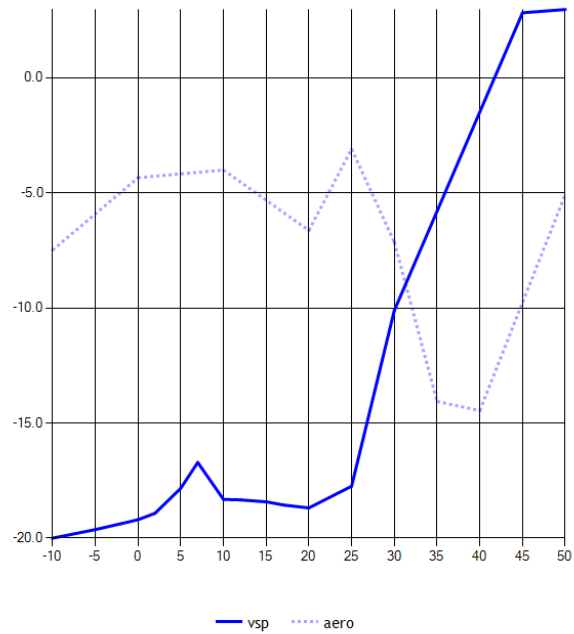
CMM1(alpha,elevator)



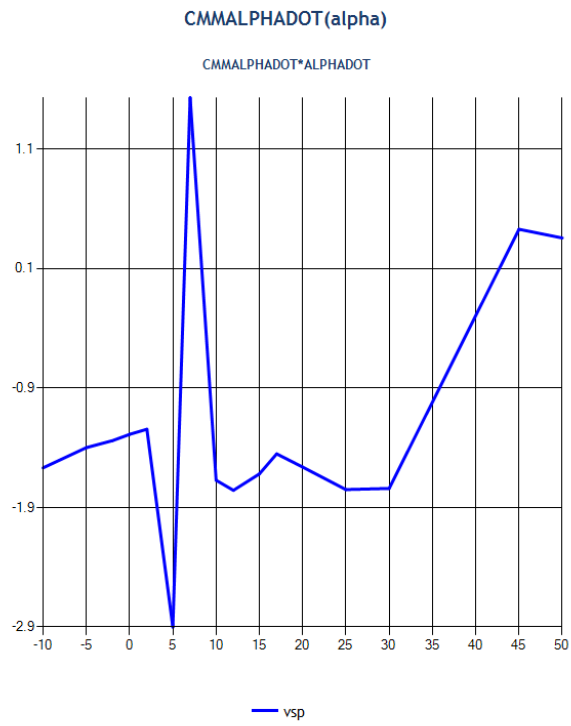
PITCH DAMPING DERIVATIVE

CMMQ(alpha)

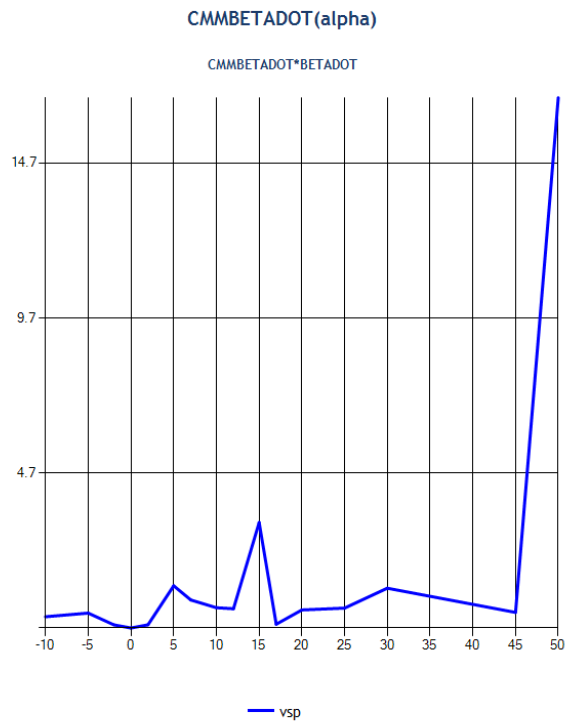
CMMQ*QB



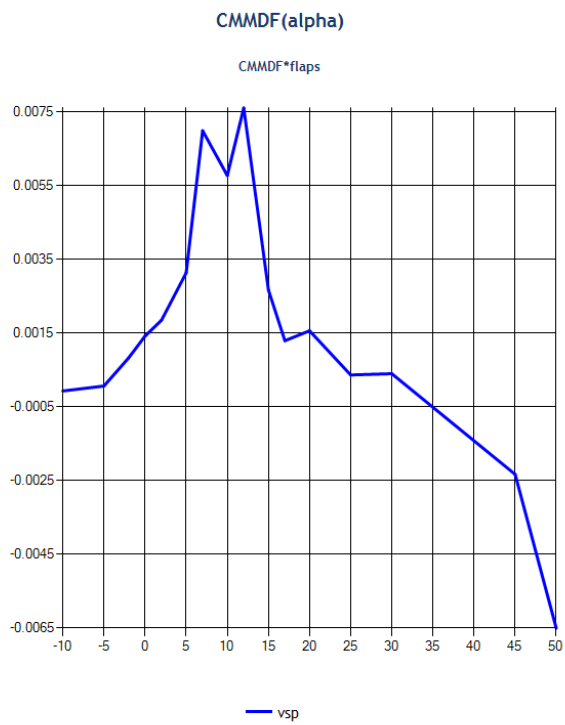
PITCH MOMENT DERIVATIVE FOR ALPHA DOT



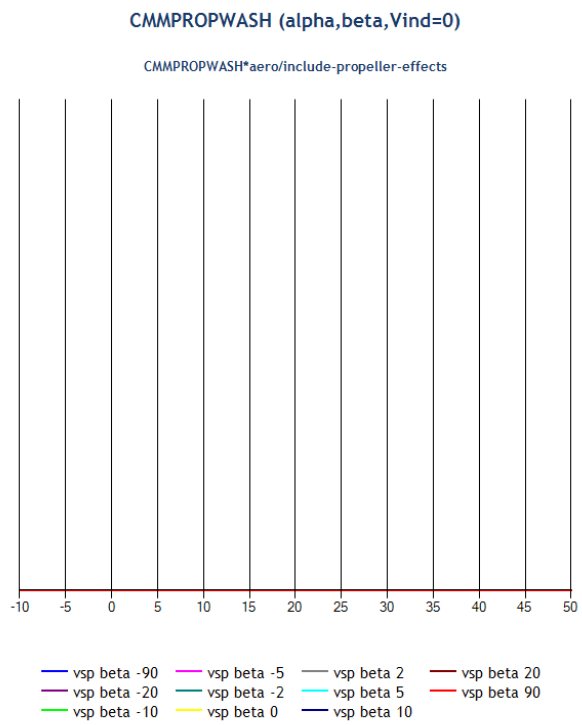
PITCH MOMENT DERIVATIVE FOR BETA DOT



PITCHING MOMENT DUE TO FLAPS



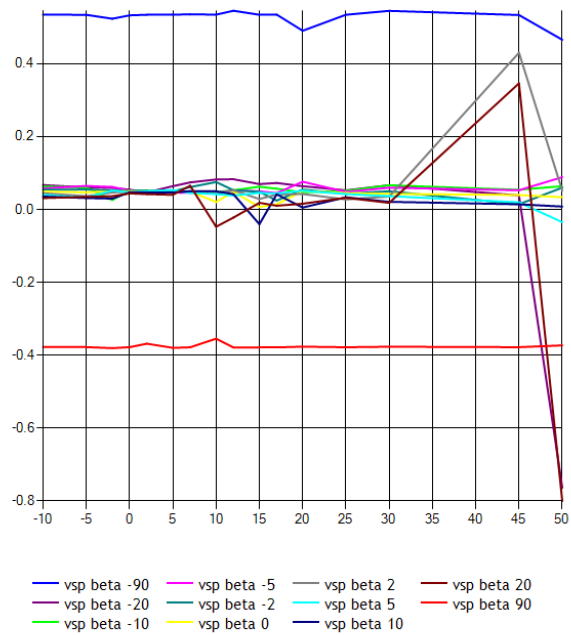
PITCHING MOMENT INCREMENT DUE TO PROPWASH



PITCHING MOMENT INCREMENT DUE TO PROPWASH

CMMPROPWASH (alpha,beta,Vind=1)

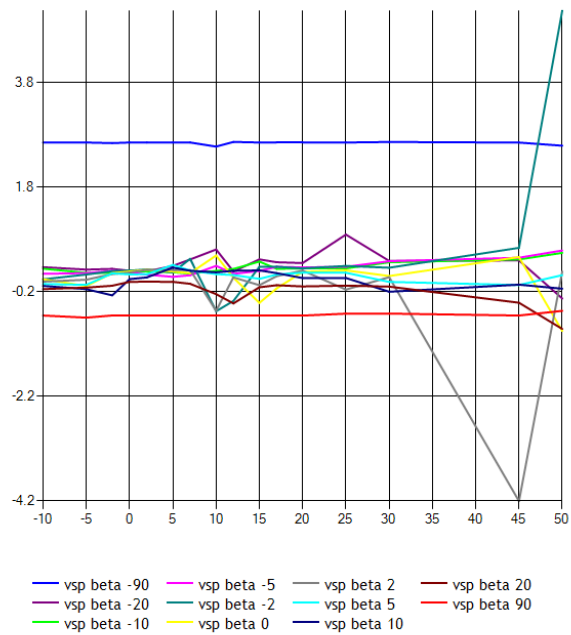
CMMPROPWASH*aero/include-propeller-effects



PITCHING MOMENT INCREMENT DUE TO PROPWASH

CMMPROPWASH (alpha,beta,Vind=16)

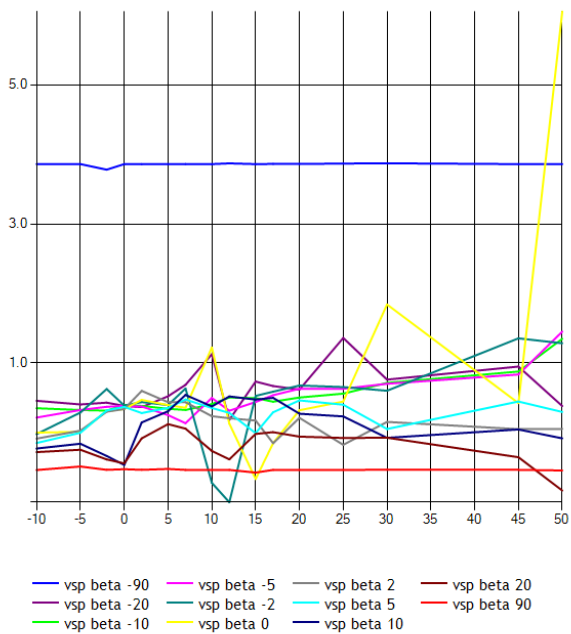
CMMPROPWASH*aero/include-propeller-effects



PITCHING MOMENT INCREMENT DUE TO PROPWASH

CMMPROPWASH (alpha,beta,Vind=48)

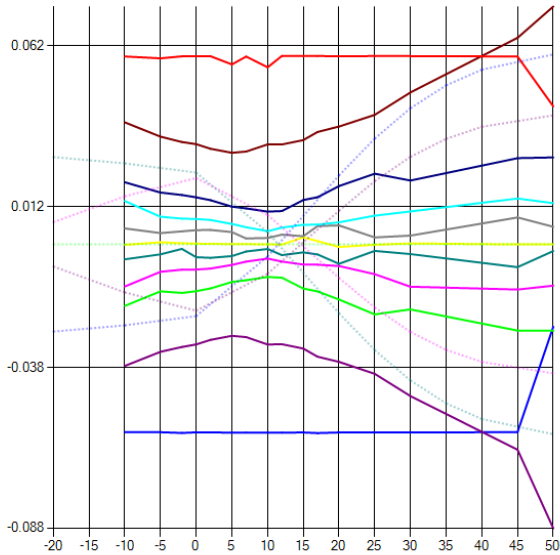
CMMPROPWASH*aero/include-propeller-effects



YAW

BASIC YAWING MOMENT

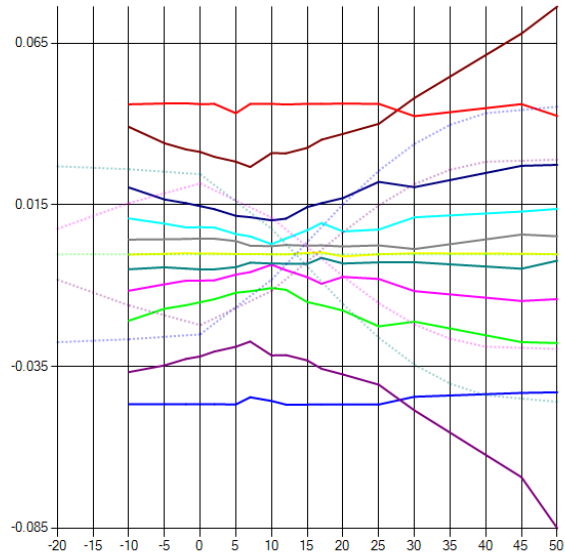
CMN1 (alpha,beta,elevator=-30)



vsp beta -90 vsp beta -2 vsp beta 10 aero beta -10
vsp beta -20 vsp beta 0 vsp beta 20 aero beta 0
vsp beta -10 vsp beta 2 vsp beta 90 aero beta 10
vsp beta -5 vsp beta 5 aero beta -20 aero beta 20

BASIC YAWING MOMENT

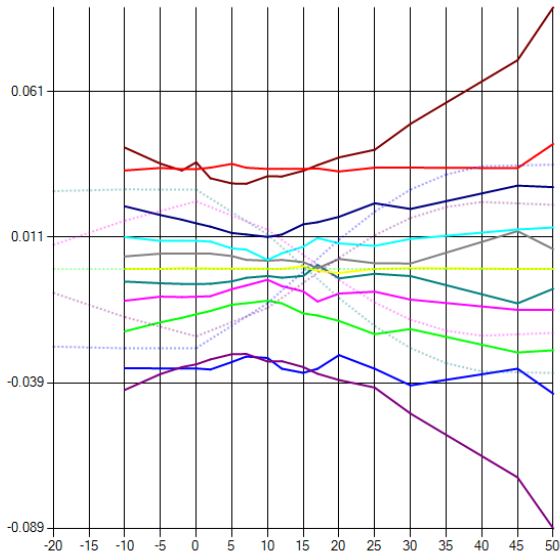
CMN1 (alpha,beta,elevator=-20)



vsp beta -90 vsp beta -2 vsp beta 10 aero beta -10
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vsp beta -5 vsp beta 5 aero beta -20 aero beta 20

BASIC YAWING MOMENT

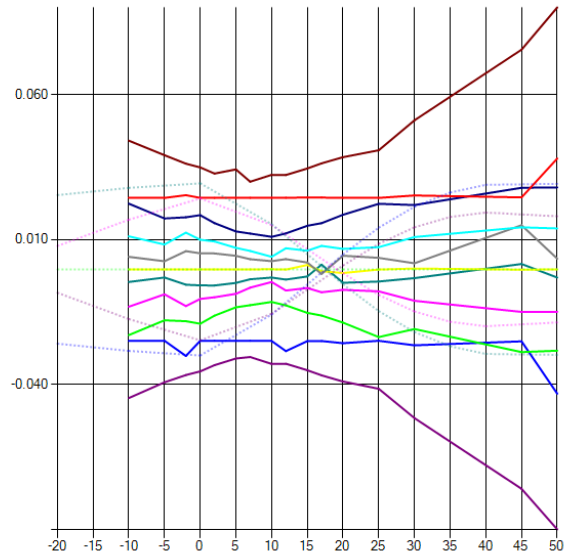
CMN1 (alpha,beta,elevator=-10)



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vsp beta -5 vsp beta 5 aero beta -20 aero beta 20

BASIC YAWING MOMENT

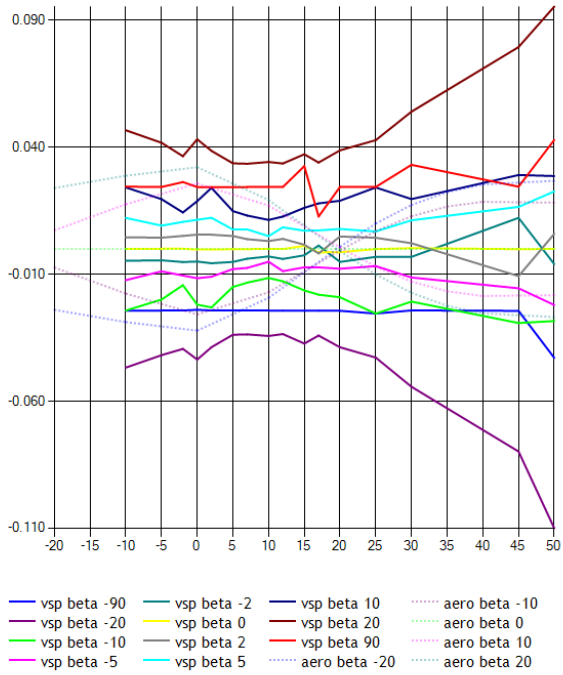
CMN1 (alpha,beta,elevator=0)



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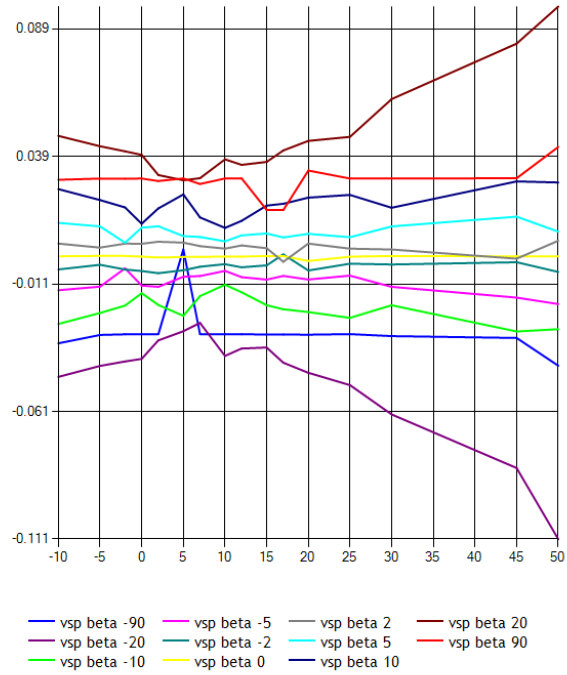
BASIC YAWING MOMENT

CMN1 (alpha,beta,elevator=10)



BASIC YAWING MOMENT

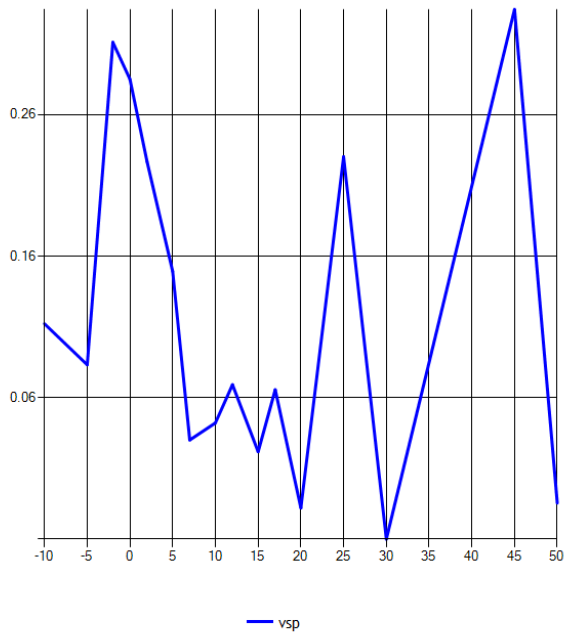
CMN1 (alpha,beta,elevator=20)



YAW MOMENT DERIVATIVE FOR BETADOT

CMNBETADOT(alpha)

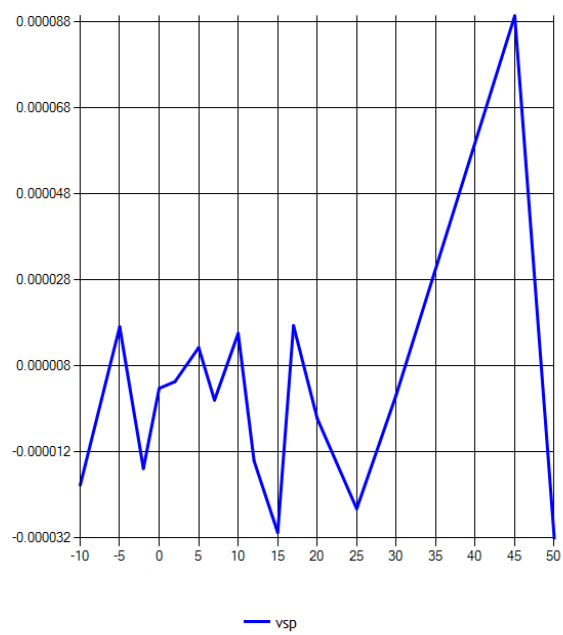
CMNBETADOT*BETADOT



YAWING MOMENT DUE TO FLAPS

CMNDF(alpha)

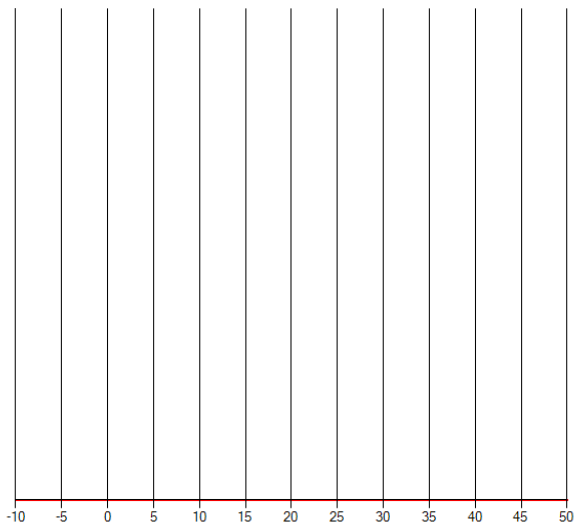
CMNDF*flaps



YAWING MOMENT INCREMENT DUE TO PROPWASH

CMNPROPWASH (alpha,beta,Vind=0)

CMNPROPWASH*aero/include-propeller-effects

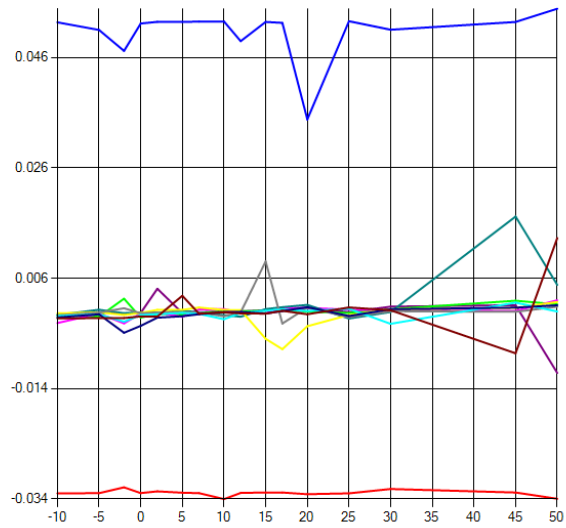


vsp beta -90 vsp beta -20 vsp beta -10 vsp beta -5 vsp beta -2 vsp beta 0 vsp beta 2 vsp beta 5 vsp beta 10 vsp beta 20 vsp beta 90

YAWING MOMENT INCREMENT DUE TO PROPWASH

CMNPROPWASH (alpha,beta,Vind=1)

CMNPROPWASH*aero/include-propeller-effects

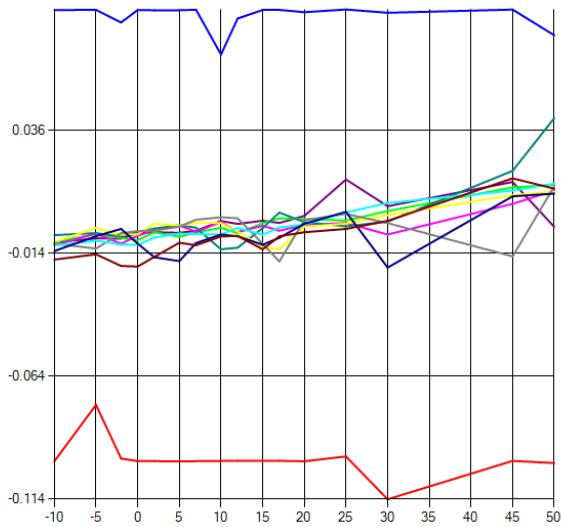


vsp beta -90 vsp beta -20 vsp beta -10 vsp beta -5 vsp beta -2 vsp beta 0 vsp beta 2 vsp beta 5 vsp beta 10 vsp beta 20 vsp beta 90

YAWING MOMENT INCREMENT DUE TO PROPWASH

CMNPROPWASH (alpha,beta,Vind=16)

CMNPROPWASH*aero/include-propeller-effects

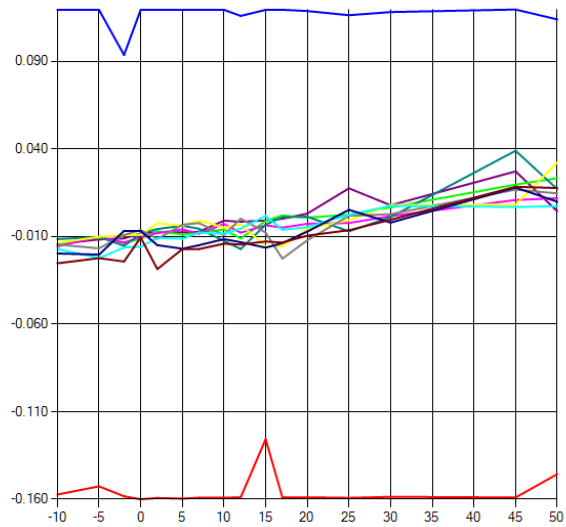


vsp beta -90 vsp beta -20 vsp beta -10 vsp beta -5 vsp beta -2 vsp beta 0 vsp beta 2 vsp beta 5 vsp beta 10 vsp beta 20 vsp beta 90

YAWING MOMENT INCREMENT DUE TO PROPWASH

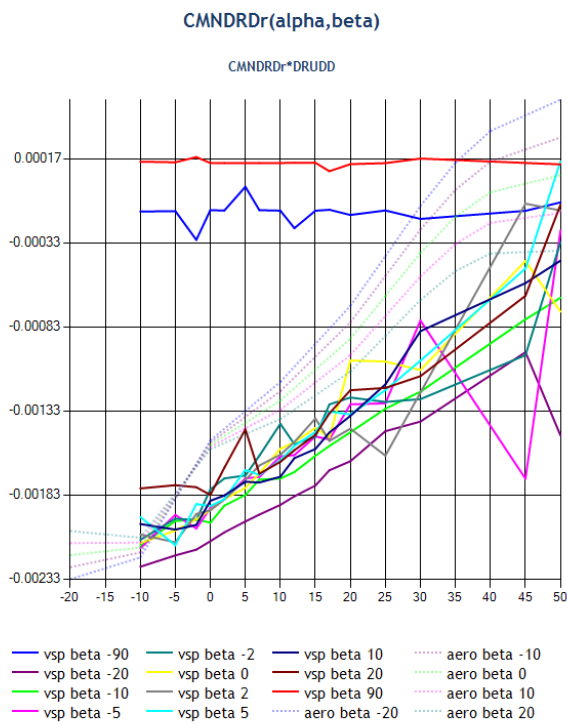
CMNPROPWASH (alpha,beta,Vind=48)

CMNPROPWASH*aero/include-propeller-effects

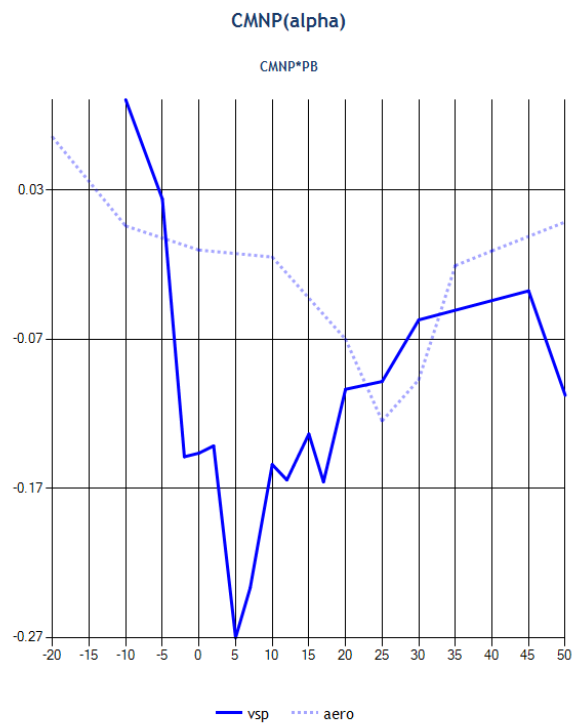


vsp beta -90 vsp beta -20 vsp beta -10 vsp beta -5 vsp beta -2 vsp beta 0 vsp beta 2 vsp beta 5 vsp beta 10 vsp beta 20 vsp beta 90

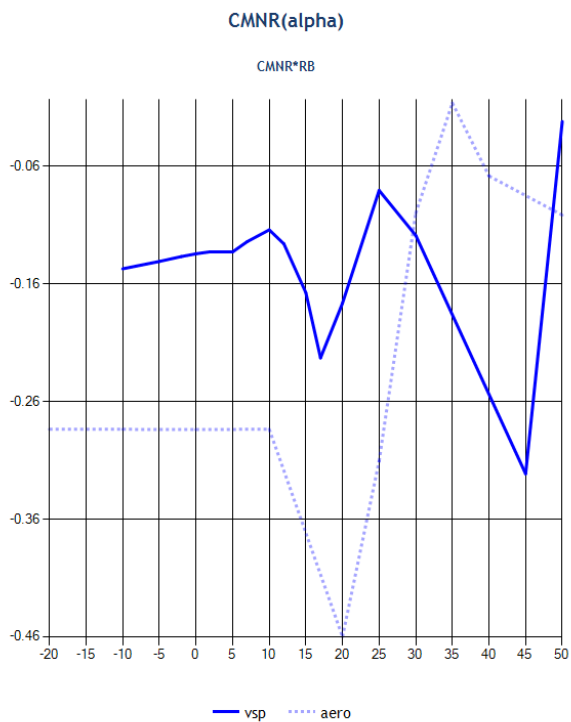
YAWING MOMENT DUE TO RUDDER DEFLECTION



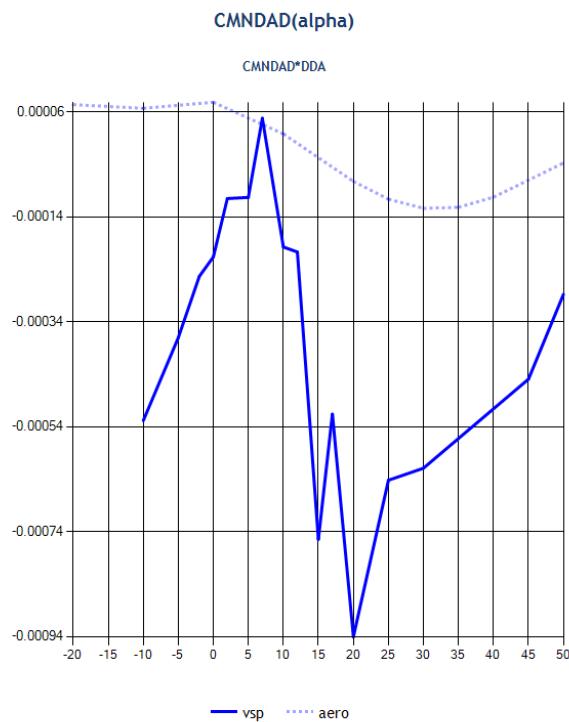
YAWING MOMENT DUE TO ROLL RATE



YAW DAMPING DERIVATIVE



YAWING MOMENT DUE TO AILERON DEFLECTION



References

1. Richard Harrison, rjh@zaretto.com: Beagle Pup Aerodynamic data built from vspaero; CG (7.275, 0, -0.227)FT, ZDAT/AED/2016/10-08, October 17th, 2016: <http://www.zaretto.com/sites/zaretto.com/files/Beagle-Pup-data/rjh-zaretto-Beagle-Pup-aerodynamic-data-vspaero.pdf>
2. Simon 'bomber' Morley (simonbomber64@gmail.com): Beagle Pup Aerodynamics, Beagle_Pup, 2016
3. N. J. Lawson n.lawson@cranfield.ac.uk N. Salmon, J. E. Gautrey and R. Bailey : Comparison of flight test data with a computational fluid dynamics model of a Scottish Aviation Bulldog aircraft, Aeronautical Journal Volume 117 no 1198, December 2013
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Mass and balance

Element	X	Y	Z	Unit
Aerodynamic Reference Point (CoP)	7.28	0.00	-0.23	FT
Aircraft CG	7.28	0.00	-0.23	FT

Element	Unit
IXX	751.00 SLUG*FT2
IYY	1718.00 SLUG*FT2
IZZ	2310.00 SLUG*FT2
IXZ	19.00 SLUG*FT2

Element	X	Y	Z	Unit	Weight
Engine	0.81	0.00	-0.05	FT	220 LBS
Pilot	6.90	-0.95	0.00	FT	185 LBS
Co-Pilot	6.90	0.95	0.00	FT	185 LBS
Rear seat	3.10	0.00	-0.10	FT	0 LBS

Ground Reactions

Element	X	Y	Z	Unit	Index
NoseGear	3.72	0.00	-4.50	FT	0
LeftMainGear	8.33	-4.05	-4.50	FT	1
RightMainGear	8.33	4.05	-4.50	FT	2
WingLeftLeadingEdge	2.06	-4.81	0.15	FT	3
WingRightLeadingEdge	2.06	4.81	0.15	FT	4
WingLeftTrailingEdge	2.81	-4.74	0.16	FT	5
WingRightTrailingEdge	2.81	4.74	0.16	FT	6
HTailLeftEdge	6.31	-1.64	0.22	FT	7
HTailRightEdge	6.31	1.64	0.22	FT	8
HtailLower	5.60	0.00	-0.42	FT	9
VtailLower	6.99	0.00	-0.12	FT	10
VtailUpper	6.99	0.00	1.34	FT	11
VtailUpperLeadingEdge	6.32	0.00	1.33	FT	12
Fuselage	2.45	0.00	0.74	FT	13
PropellerCentre	0.07	0.00	0.00	FT	14

Metrics

Element	Unit
Chord	3.85 FT
Wingspan	31.00 FT
Wing Area	119.48 FT2

Wing Incidence	3.00	DEG
CIMax	1.63	ND

Propulsion

Element	X	Y	Z	Unit	Feed
Continental-O200-A	0.00	0.00	0.00	FT	Wing Tank R [0],Wing Tank L [1],Manifold [2]

Tanks

Element	X	Y	Z	Unit	Capacity	Id	Priority	Standpipe
Wing Tank R	7.86	5.64	-0.71	FT	87 LBS	0	-1	1 LBS
Wing Tank L	7.86	-5.64	-0.71	FT	87 LBS	1	-1	1 LBS
Manifold	7.28	0.00	0.00	FT	5 LBS	2	-1	1 LBS

Systems

Name
fuel
Beagle-Pup-controls
Beagle-Pup-flight-controls