Supermarine Swift FR5 aerodynamic model

Built using VSPAERO; Aerodynamic Datum (6, 0, -0.02)M, 2021-08-07 23:48: Richard Harrison, rjh@zaretto.com, ZDAT/AED/2019/09-09

Copyright (C) 2021 Richard Harrison, All rights reserved

AeroDetail=High, ExternalTanks, Flaps, Gear, GroundEffect, Mach, WakeIterations=3

Model summary

Dependent variable	Independent variables	Axis	Description
CFXB	alpha,beta	DRAG	BASE DRAG
CFXDAD	alpha,beta	DRAG	DRAG INCREMENT DUE TO AILERON DEFLECTION
CFXFLAPS	alpha,beta	DRAG	DRAG INCREMENT DUE TO FLAPS
CFXGEAR	alpha,beta	DRAG	DRAG INCREMENT DUE TO GEAR
CFXDGE	hmrc,alpha	DRAG	DRAG INCREMENT DUE TO GROUND EFFECT
CFXMN	mach,alpha	DRAG	DRAG INCREMENT DUE TO MACH
CFXNWDOOR	alpha,beta	DRAG	DRAG INCREMENT DUE TO NOSE DOOR
CFXDRD	alpha,beta	DRAG	DRAG INCREMENT DUE TO RUDDER DEFLECTION
CFZB	alpha,elevator	LIFT	BASE LIFT
CFZDAD	alpha,beta	LIFT	LIFT INCREMENT DUE TO AILERON DEFLECTION
CFZFLAPS	alpha,beta	LIFT	LIFT INCREMENT DUE TO FLAPS
CFZGEAR	alpha,beta	LIFT	LIFT INCREMENT DUE TO GEAR
CFZDGE	hmrc,alpha	LIFT	LIFT INCREMENT DUE TO GROUND EFFECT
CFZMN	mach,alpha	LIFT	LIFT INCREMENT DUE TO MACH
CFZNWDOOR	alpha,beta	LIFT	LIFT INCREMENT DUE TO NOSE DOOR
CFZDRD	alpha,beta	LIFT	LIFT INCREMENT DUE TO RUDDER DEFLECTION
CMM1	alpha,elevator	PITCH	BASE PITCHING MOMENT
CMMQ	alpha,beta	PITCH	PITCH DAMPING DERIVATIVE
CMMALPHADOT	alpha,beta	PITCH	PITCH MOMENT DERIVATIVE FOR ALPHA DOT
CMMDAD	alpha,beta	PITCH	PITCH MOMENT DUE TO AILERON DEFLECTION
CMMDRD	alpha,beta	PITCH	PITCH MOMENT DUE TO RUDDER DEFLECTION
CMMFLAPS	alpha,beta	PITCH	PITCHING MOMENT INCREMENT DUE TO FLAPS
CMMGEAR	alpha,beta	PITCH	PITCHING MOMENT INCREMENT DUE TO GEAR
CMMDGE	hmrc,alpha	PITCH	PITCHING MOMENT INCREMENT DUE TO GROUND EFFECT
CMMMN	mach,alpha	PITCH	PITCHING MOMENT INCREMENT DUE TO MACH
CMMNWDOOR	alpha,beta	PITCH	PITCHING MOMENT INCREMENT DUE TO NOSE DOOR
CML1	alpha,beta	ROLL	BASE ROLLING MOMENT
CMLP	alpha,beta	ROLL	ROLL DAMPING DERIVATIVE
CMLBETADOT	alpha,beta	ROLL	ROLL MOMENT DERIVATIVE FOR BETA DOT
CMLDADMN	mach,alpha	ROLL	ROLLING MOMENT CHANGE DUE TO MACH DUE TO AILERON DEFLECTION
CMLDRDMN	mach,alpha	ROLL	ROLLING MOMENT CHANGE DUE TO MACH DUE TO RUDDER DEFLECTION

CMLDAD	alpha,beta	ROLL	ROLLING MOMENT DUE TO AILERON DEFLECTION
CMLDRD	alpha,beta,rudder	ROLL	ROLLING MOMENT DUE TO RUDDER DEFLECTION
CMLR	alpha,beta	ROLL	ROLLING MOMENT DUE TO YAW RATE
CMLFLAPS	alpha,beta	ROLL	ROLLING MOMENT INCREMENT DUE TO FLAPS
CMLGEAR	alpha,beta	ROLL	ROLLING MOMENT INCREMENT DUE TO GEAR
CMLMN	mach,alpha	ROLL	ROLLING MOMENT INCREMENT DUE TO MACH
CMLNWDOOR	alpha,beta	ROLL	ROLLING MOMENT INCREMENT DUE TO NOSE DOOR
CFYB	alpha,beta,elevator	SIDE	BASE SIDEFORCE
CYDAD	alpha,beta	SIDE	SIDE FORCE DUE TO AILERON DEFLECTION
CFYP	alpha,beta	SIDE	SIDE FORCE DUE TO ROLL RATE
CYDRD	alpha,beta,rudder	SIDE	SIDE FORCE DUE TO RUDDER DEFLECTION
CFYR	alpha,beta	SIDE	SIDE FORCE DUE TO YAW RATE
CYDADMN	mach,alpha	SIDE	SIDEFORCE CHANGE DUE TO MACH DUE TO TO AILERON DEFLECTION
CYDRDMN	mach,alpha	SIDE	SIDEFORCE CHANGE DUE TO MACH DUE TO TO RUDDER DEFLECTION
CFYFLAPS	alpha,beta	SIDE	SIDEFORCE INCREMENT DUE TO FLAPS
CFYGEAR	alpha,beta	SIDE	SIDEFORCE INCREMENT DUE TO GEAR
CFYMN	mach,alpha	SIDE	SIDEFORCE INCREMENT DUE TO MACH
CFYNWDOOR	alpha,beta	SIDE	SIDEFORCE INCREMENT DUE TO NOSE DOOR
CMN1	alpha,beta,elevator	YAW	BASE YAWING MOMENT
CMNR	alpha,beta	YAW	YAW DAMPING DERIVATIVE
CMNBETADOT	alpha	YAW	YAW MOMENT DERIVATIVE FOR BETADOT
CMNP	alpha,beta	YAW	YAW MOMENT DUE TO ROLL RATE
CMNDADMN	mach,alpha	YAW	YAWING MOMENT CHANGE DUE TO MACH DUE TO AILERON DEFLECTION
CMNDRDMN	mach,alpha	YAW	YAWING MOMENT CHANGE DUE TO MACH DUE TO RUDDER DEFLECTION
CMNDAD	alpha,beta,aileron	YAW	YAWING MOMENT DUE TO AILERON DEFLECTION
CMNDRD	alpha,beta,rudder	YAW	YAWING MOMENT DUE TO RUDDER DEFLECTION
CMNFLAPS	alpha,beta	YAW	YAWING MOMENT INCREMENT DUE TO FLAPS
CMNGEAR	alpha,beta	YAW	YAWING MOMENT INCREMENT DUE TO GEAR
CMNMN	mach,alpha	YAW	YAWING MOMENT INCREMENT DUE TO MACH
CMNNWDOOR	alpha,beta	YAW	YAWING MOMENT INCREMENT DUE TO NOSE DOOR

Coefficient Buildup

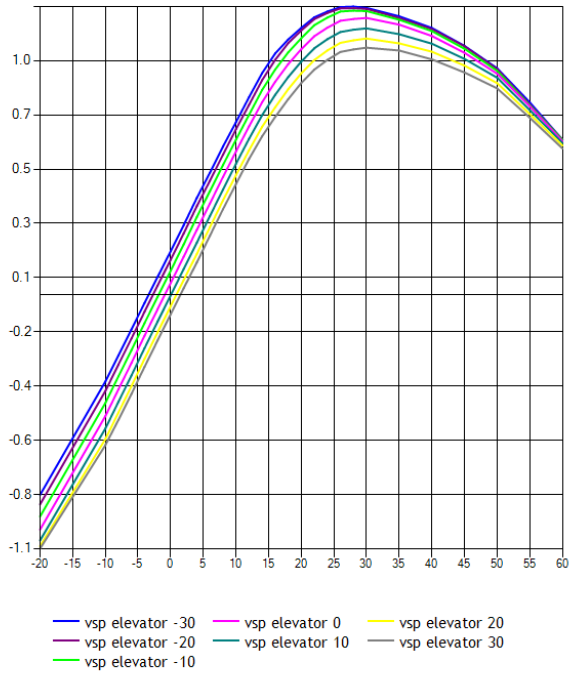
Axis	Buildup
DRAG	CFXB + CFXDAD*aileron + CFXDRD*rudder + CFXGEAR*gear + CFXNWDOOR*gear + CFXFLAPS*flaps + CFXDGE + CFXMN
ROLL	CML1 + CMLDAD + CMLDRD + CMLGEAR*gear + CMLNWDOOR*gear + CMLFLAPS*flaps + CMLMN + CMLDADMN*aileron + CMLDRDMN*rudder + CMLBETADOT*BETADOT-L + CMLP*PB + CMLR*RB
SIDE	CYDAD*aileron + CYDRD + CFYGEAR*gear + CFYNWDOOR*gear + CFYFLAPS*flaps + CFYB + CFYMN + CYDADMN*aileron + CYDRDMN*rudder + CFYP*PB + CFYR*RB
LIFT	CFZDAD*aileron + CFZDRD*rudder + CFZGEAR*gear + CFZNWDOOR*gear + CFZFLAPS*flaps + CFZB + CFZDGE + CFZMN

PITCH	CMMDAD*aileron + CMMDRD*rudder + CMMGEAR*gear + CMMNWDOOR*gear + CMMFLAPS*flaps + CMM1 + CMMDGE + CMMMN + CMMALPHADOT*ALPHADOT-L + CMMQ*QB
YAW	CMNDAD + CMNDRD + CMNGEAR*gear + CMNNWDOOR*gear + CMNFLAPS*flaps + CMN1 + CMNMN + CMNDADMN*aileron + CMNDRDMN*rudder + CMNBETADOT*BETADOT-L + CMNR*RB + CMNP*PB

LIFT

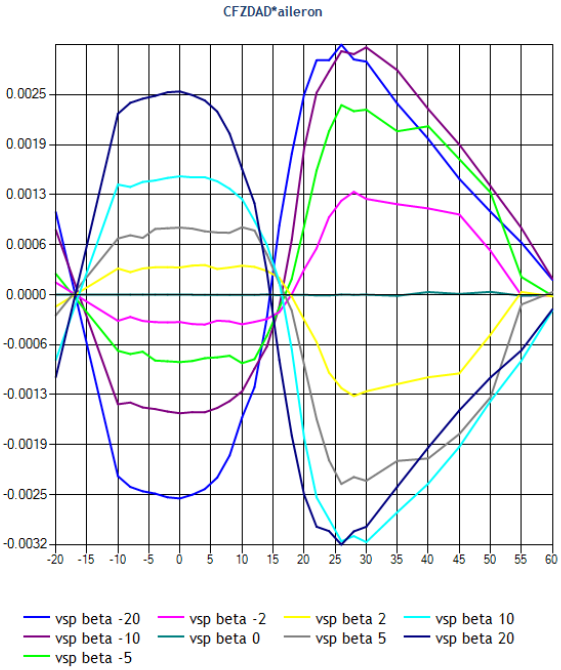
BASE LIFT

CFZB(alpha,elevator)



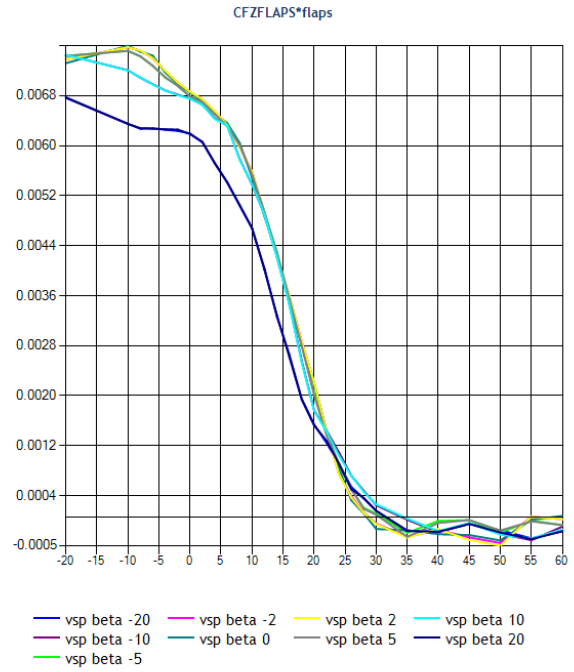
LIFT INCREMENT DUE TO AILERON DEFLECTION

CFZDAD(alpha,beta)



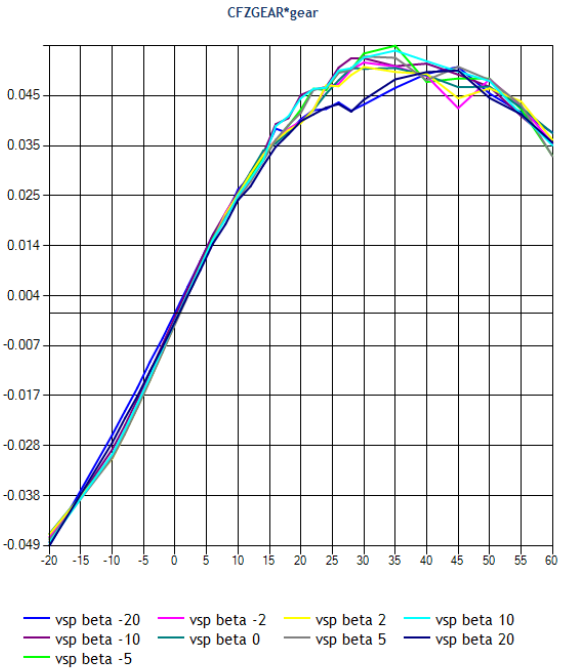
LIFT INCREMENT DUE TO FLAPS

CFZFLAPS(alpha,beta)



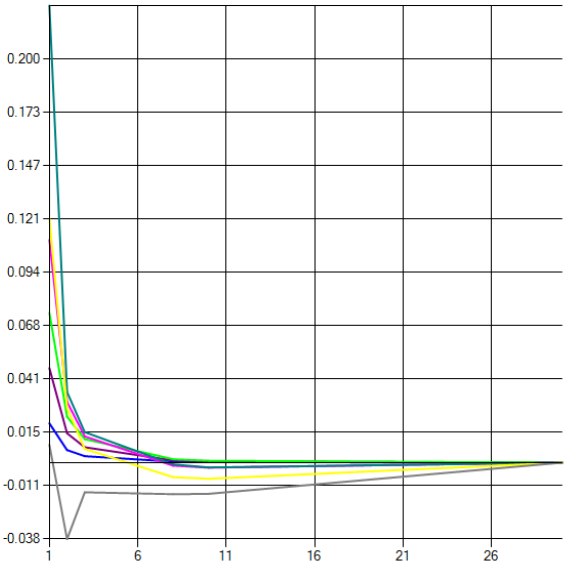
LIFT INCREMENT DUE TO GEAR

CFZGEAR(alpha,beta)



LIFT INCREMENT DUE TO GROUND EFFECT

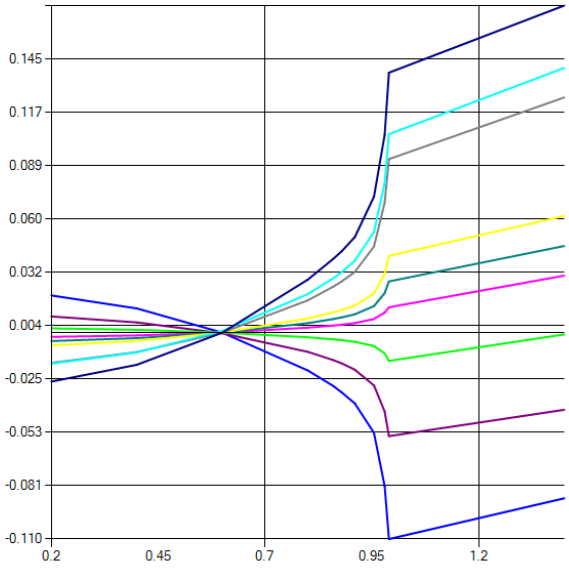
CFZDGE(hmrc,hmrc-alpha)



vsp hmrc-alpha 0 vsp hmrc-alpha 8 vsp hmrc-alpha 15
vsp hmrc-alpha 2 vsp hmrc-alpha 10 vsp hmrc-alpha 20
vsp hmrc-alpha 4

LIFT INCREMENT DUE TO MACH

CFZMN(mach,alpha)

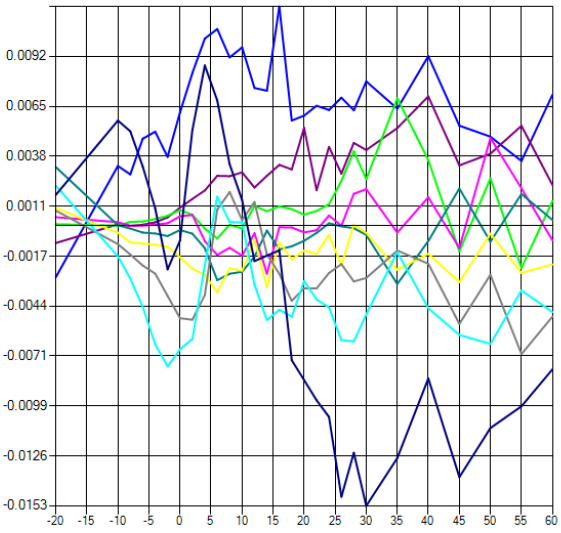


vsp alpha -10 vsp alpha 0.01 vsp alpha 2 vsp alpha 7
vsp alpha -5 vsp alpha 1 vsp alpha 6 vsp alpha 10
vsp alpha -2

LIFT INCREMENT DUE TO NOSE DOOR

CFZNWDOOR(alpha,beta)

CFZNWDOOR*gear

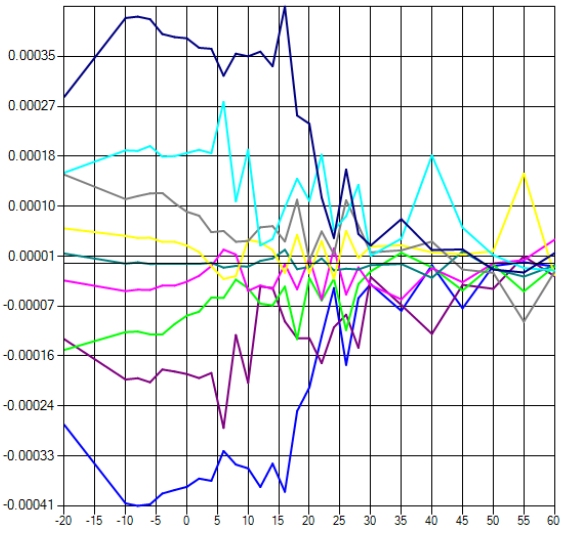


vsp beta -20 vsp beta -2 vsp beta 2 vsp beta 10
vsp beta -10 vsp beta 0 vsp beta 5 vsp beta 20
vsp beta -5

LIFT INCREMENT DUE TO RUDDER DEFLECTION

CFZDRD(alpha,beta)

CFZDRD*rudder

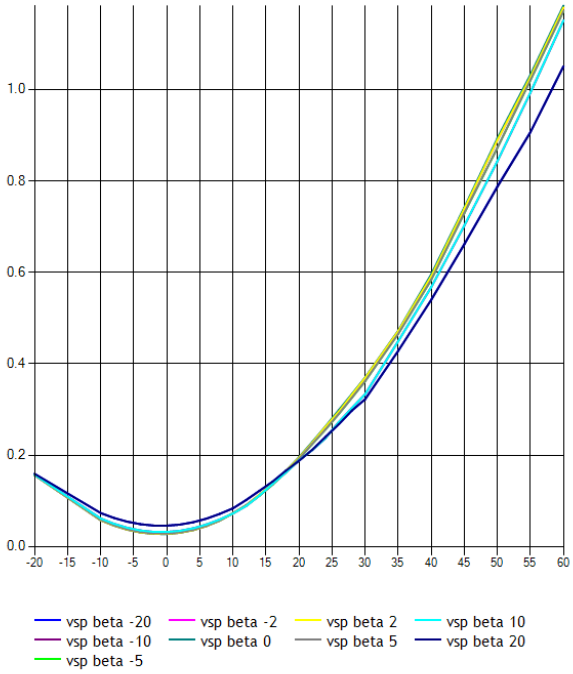


vsp beta -20 vsp beta -2 vsp beta 2 vsp beta 10
vsp beta -10 vsp beta 0 vsp beta 5 vsp beta 20
vsp beta -5

DRAG

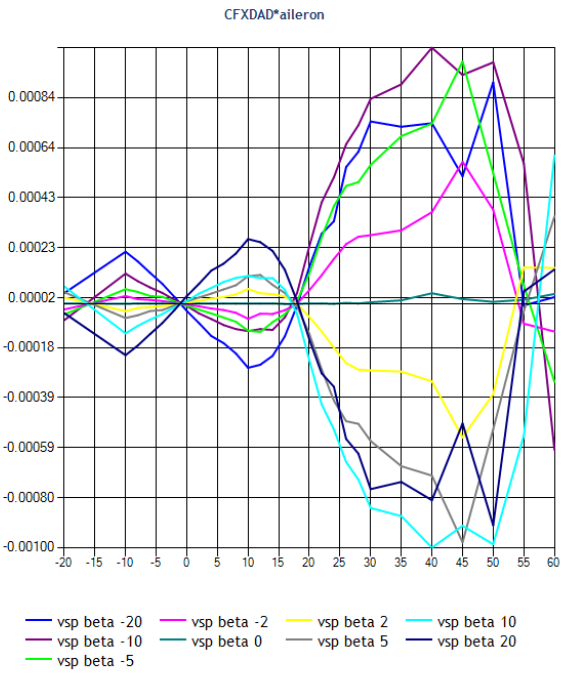
BASE DRAG

CFXB(alpha,beta)



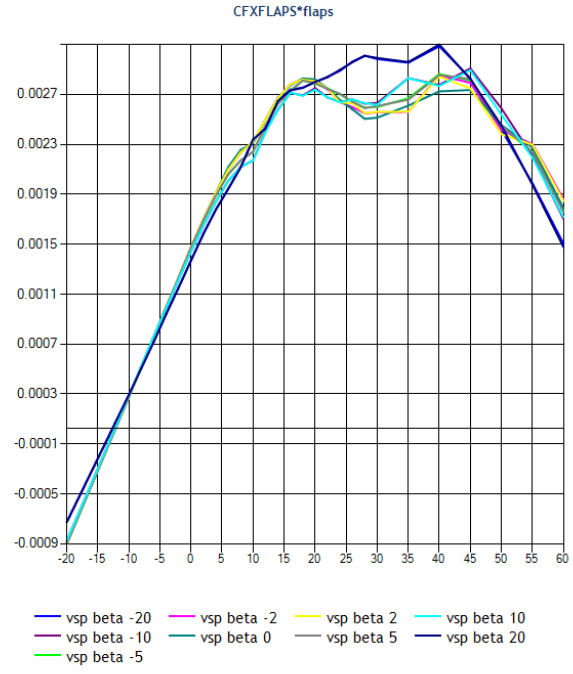
DRAG INCREMENT DUE TO AILERON DEFLECTION

CFXDAD(alpha,beta)



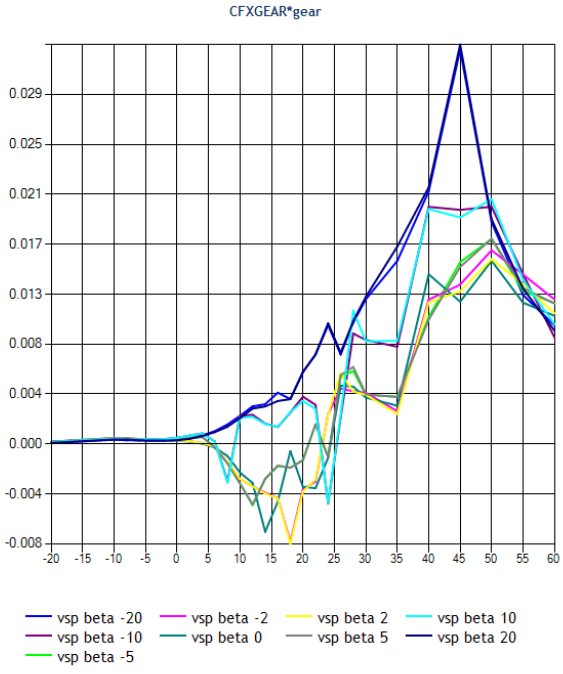
DRAG INCREMENT DUE TO FLAPS

CFXFLAPS(alpha,beta)



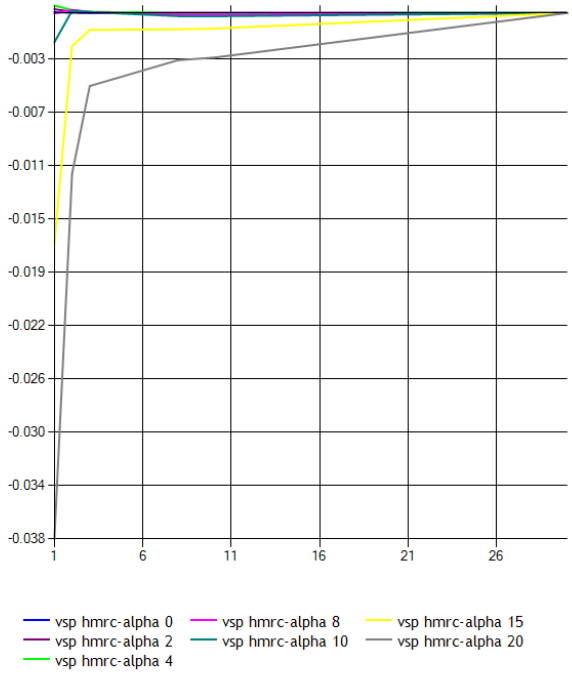
DRAG INCREMENT DUE TO GEAR

CFXGEAR(alpha,beta)



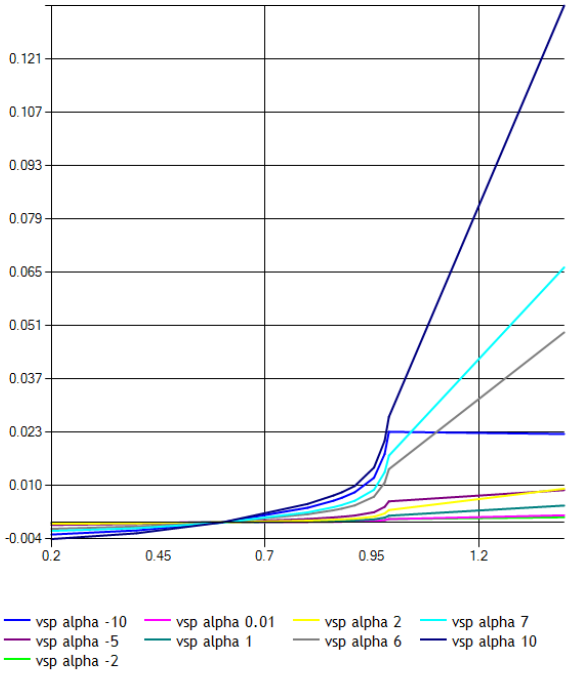
DRAG INCREMENT DUE TO GROUND EFFECT

CFXDGE(hmrc,hmrc-alpha)



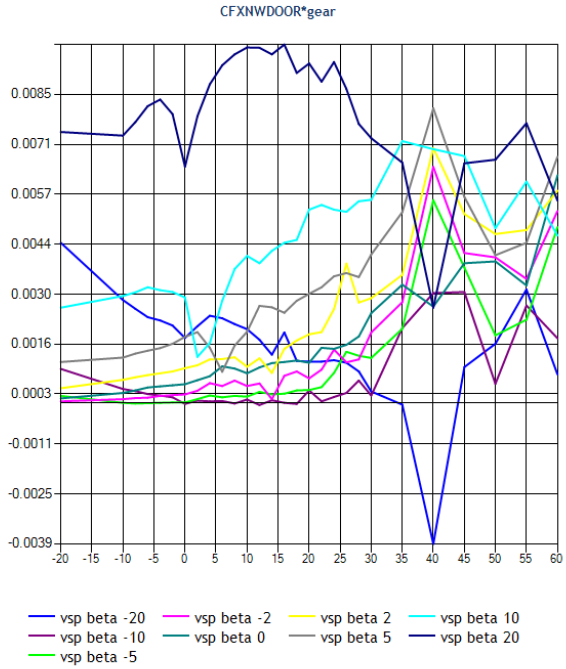
DRAG INCREMENT DUE TO MACH

CFXMN(mach,alpha)



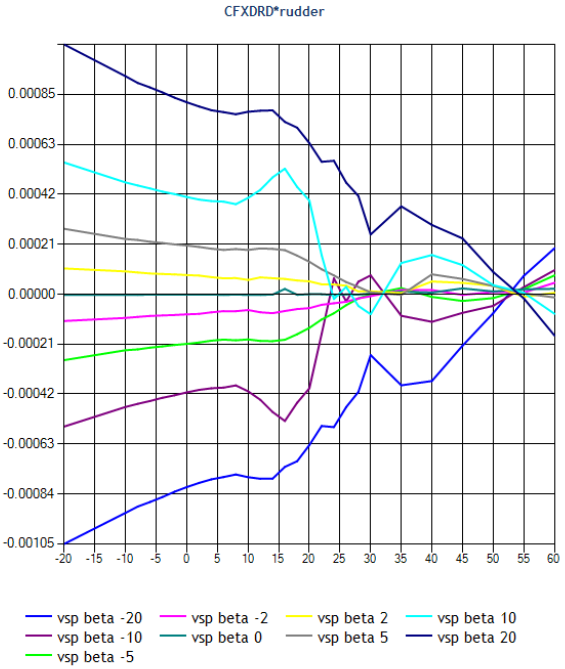
DRAG INCREMENT DUE TO NOSE DOOR

CFXNWDOOR(alpha,beta)



DRAG INCREMENT DUE TO RUDDER DEFLECTION

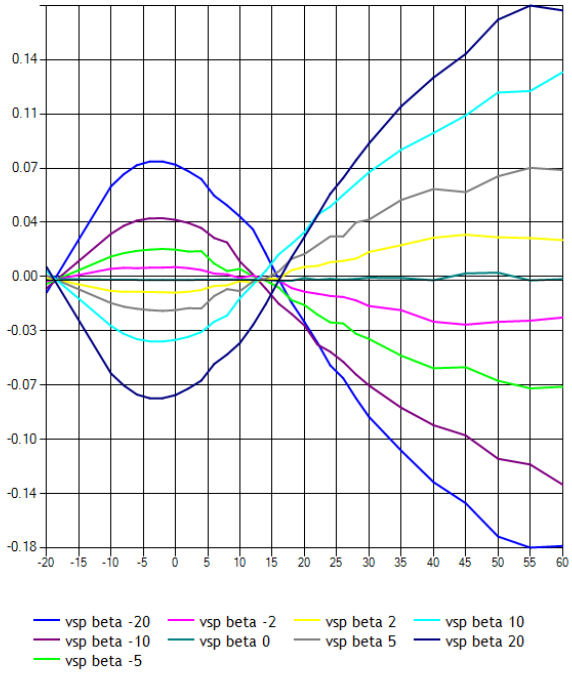
CFXDRD(alpha,beta)



SIDE

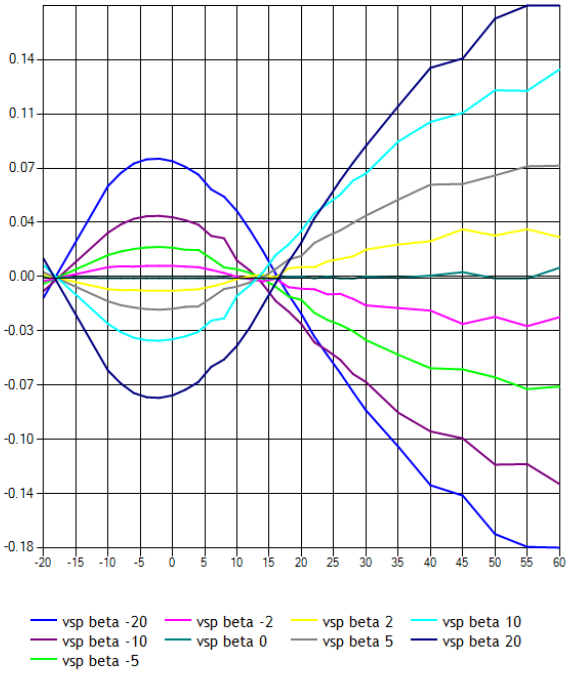
BASE SIDEFORCE

CFYB (alpha,beta,elevator=-30)



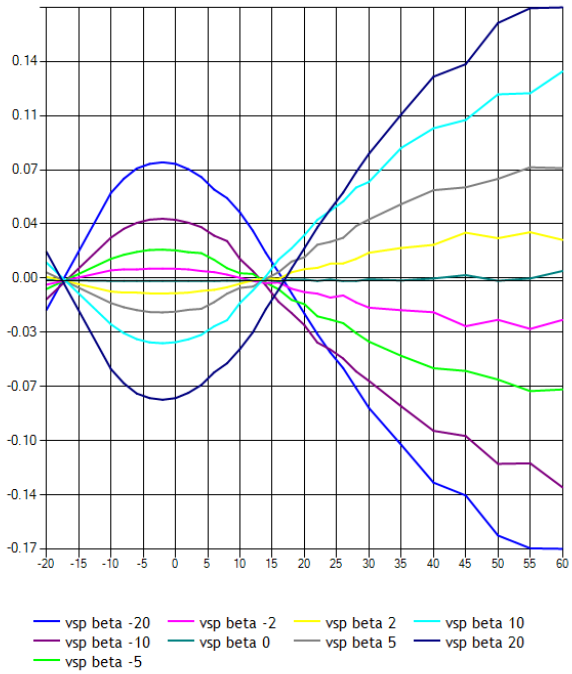
BASE SIDEFORCE

CFYB (alpha,beta,elevator=-20)



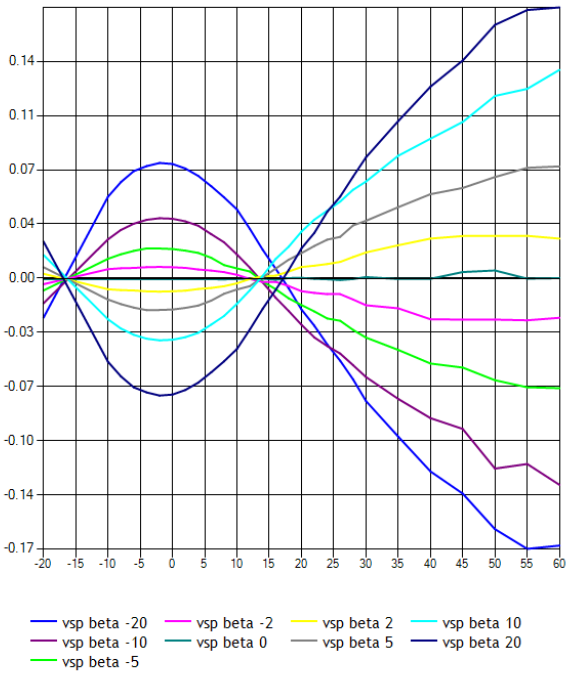
BASE SIDEFORCE

CFYB (alpha,beta,elevator=-10)



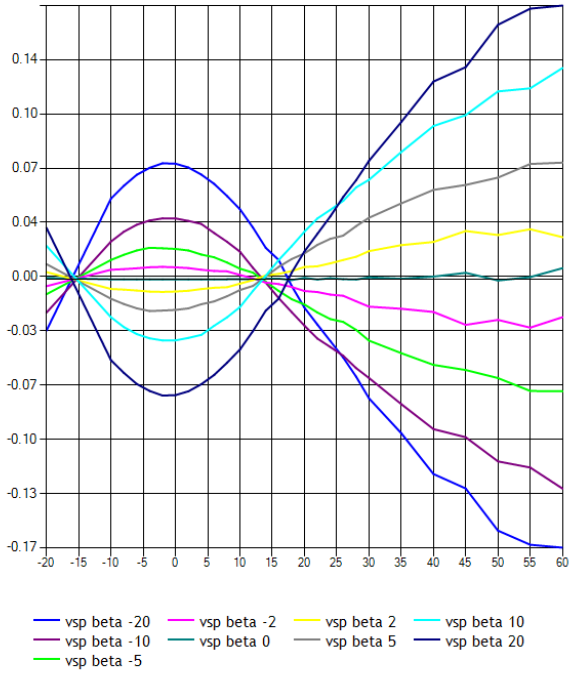
BASE SIDEFORCE

CFYB (alpha,beta,elevator=0)



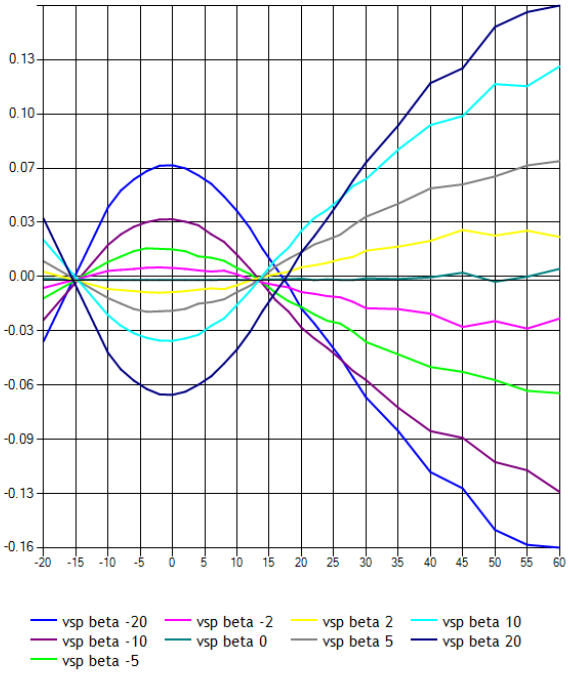
BASE SIDEFORCE

CFYB (alpha,beta,elevator=10)



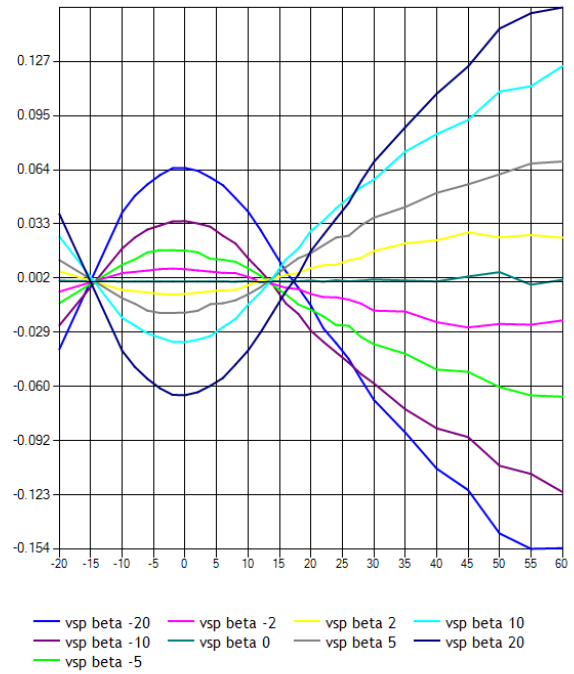
BASE SIDEFORCE

CFYB (alpha,beta,elevator=20)



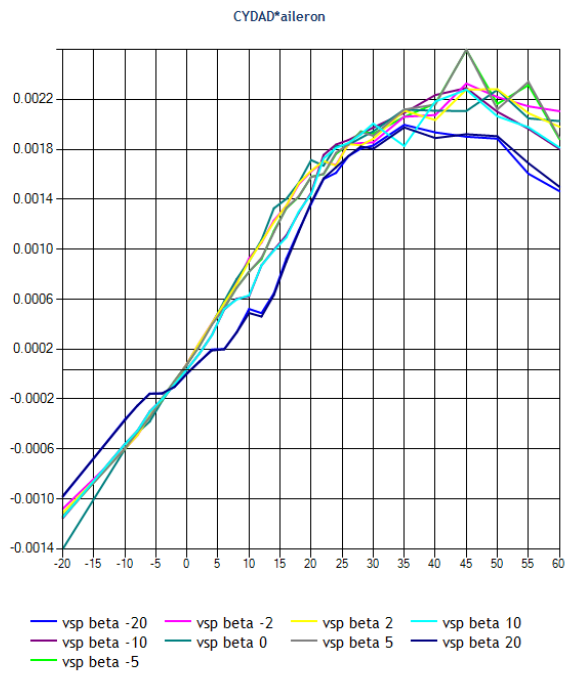
BASE SIDEFORCE

CFYB (alpha,beta,elevator=30)



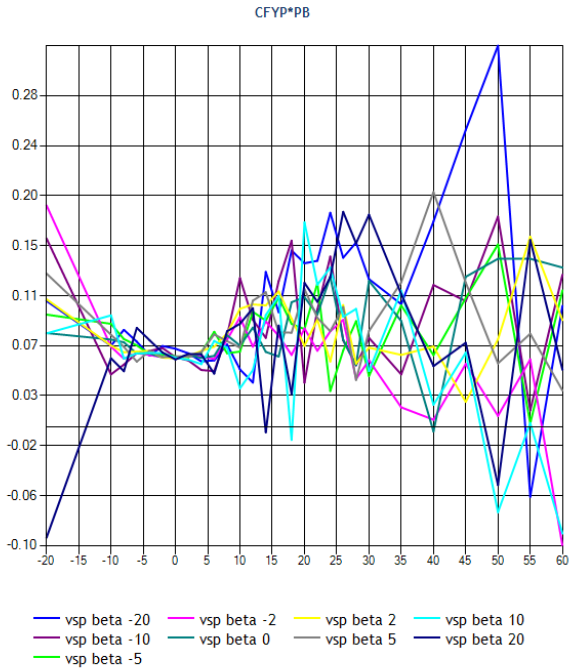
SIDE FORCE DUE TO AILERON DEFLECTION

CYDAD(alpha,beta)



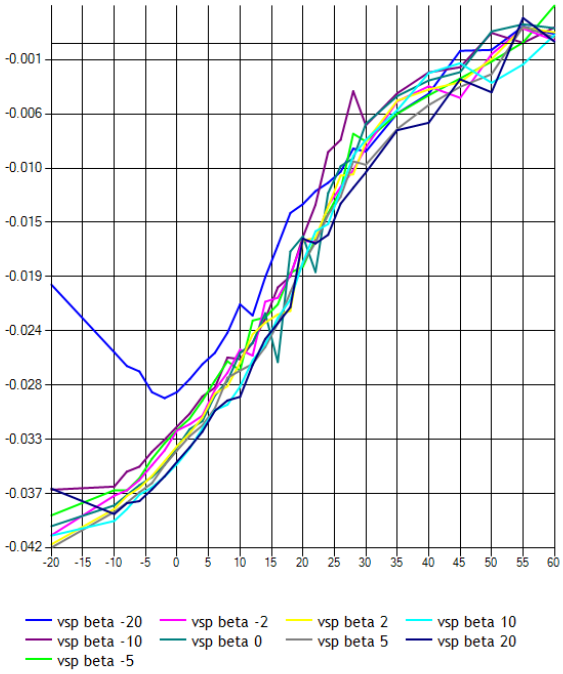
SIDE FORCE DUE TO ROLL RATE

CFYP(alpha,beta)



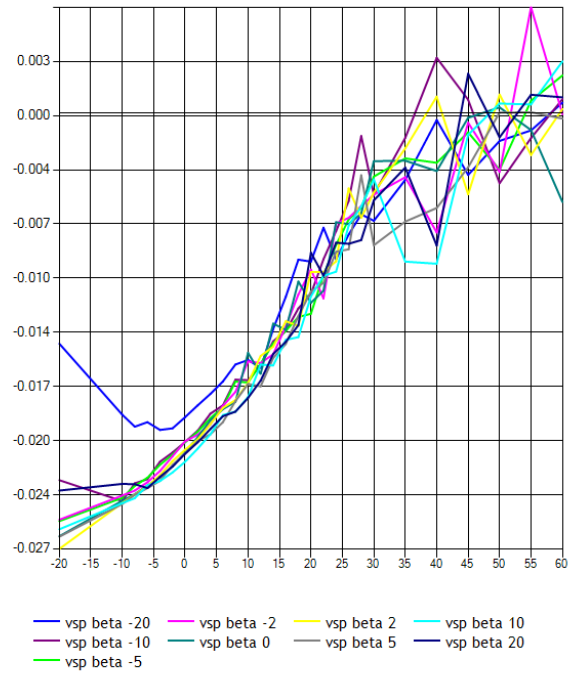
SIDE FORCE DUE TO RUDDER DEFLECTION

CYDRD (alpha,beta,rudder=-20)



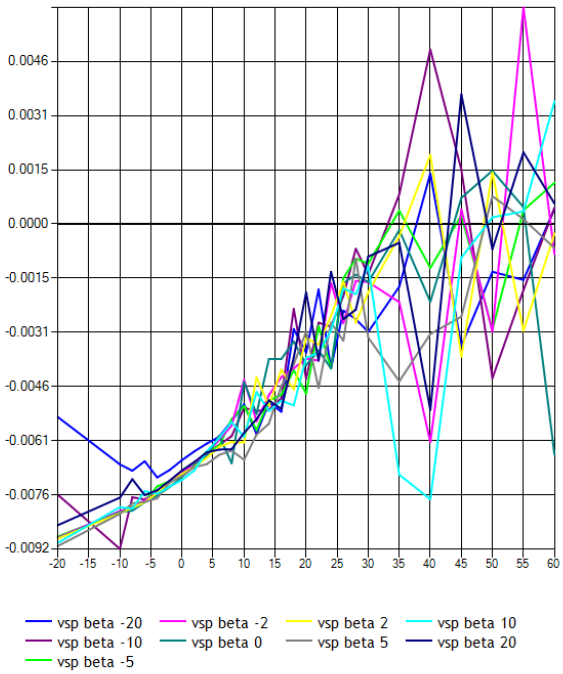
SIDE FORCE DUE TO RUDDER DEFLECTION

CYDRD (alpha,beta,rudder=-12)



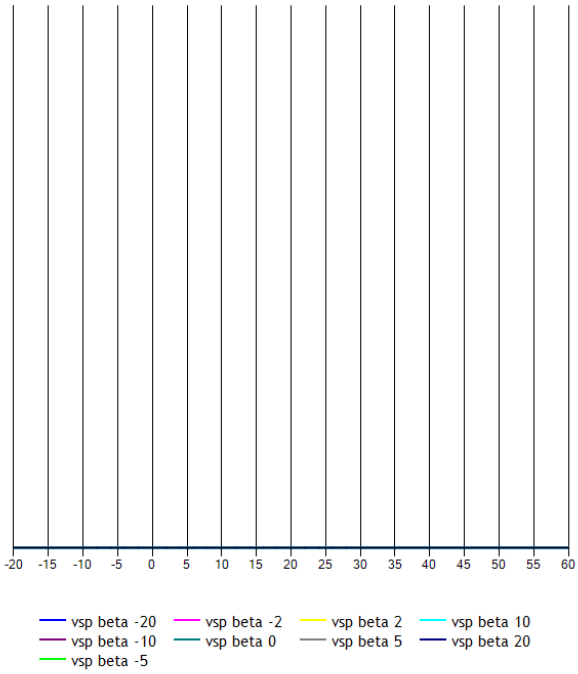
SIDE FORCE DUE TO RUDDER DEFLECTION

CYDRD (alpha,beta,rudder=-4)



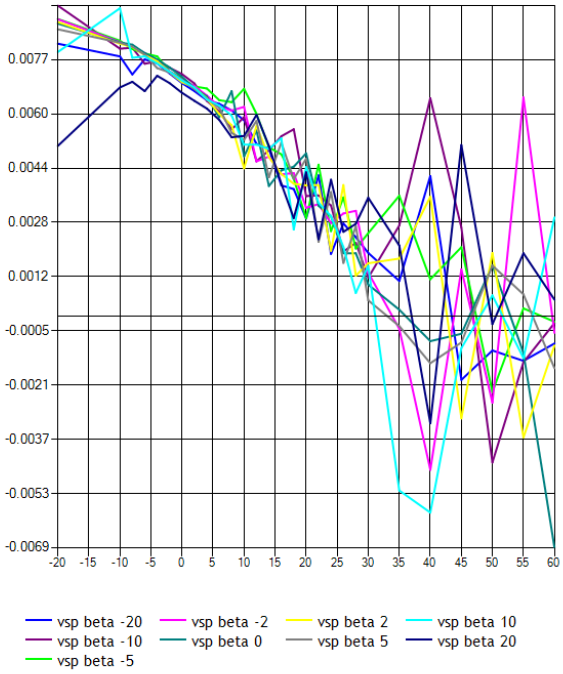
SIDE FORCE DUE TO RUDDER DEFLECTION

CYDRD (alpha,beta,rudder=0)



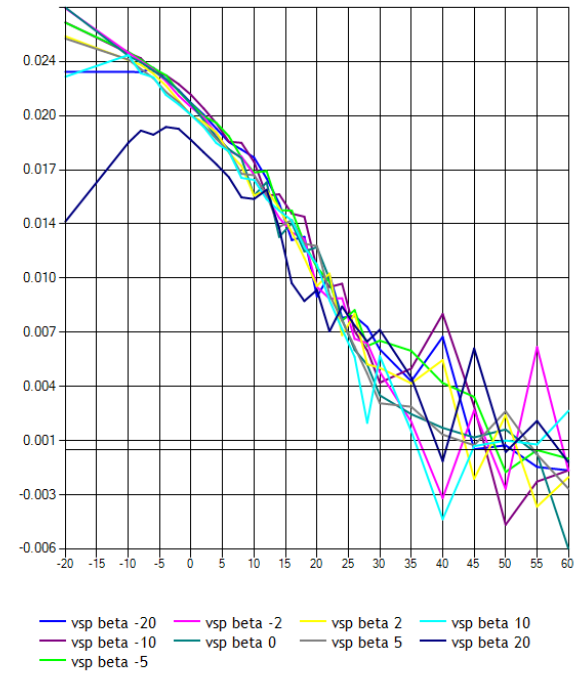
SIDE FORCE DUE TO RUDDER DEFLECTION

CYDRD (alpha,beta,rudder=4)



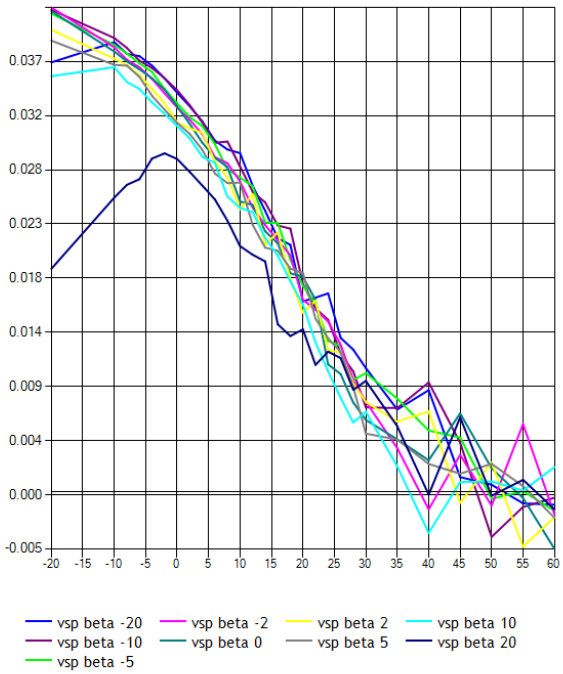
SIDE FORCE DUE TO RUDDER DEFLECTION

CYDRD (alpha,beta,rudder=12)



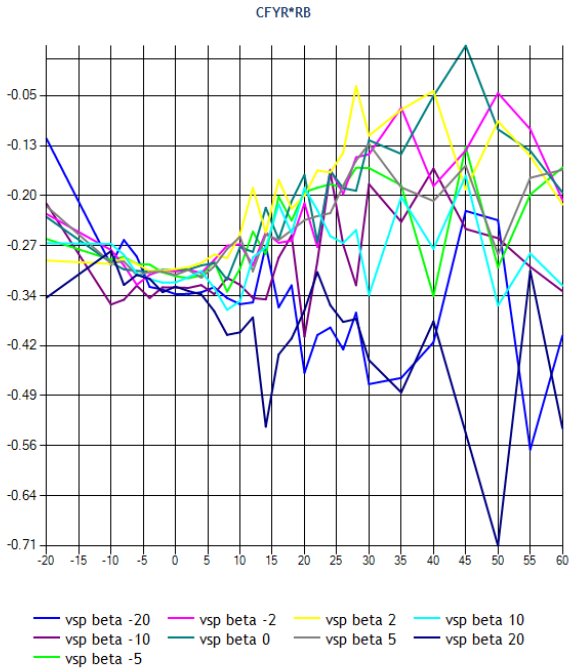
SIDE FORCE DUE TO RUDDER DEFLECTION

CYDRD (alpha,beta,rudder=20)



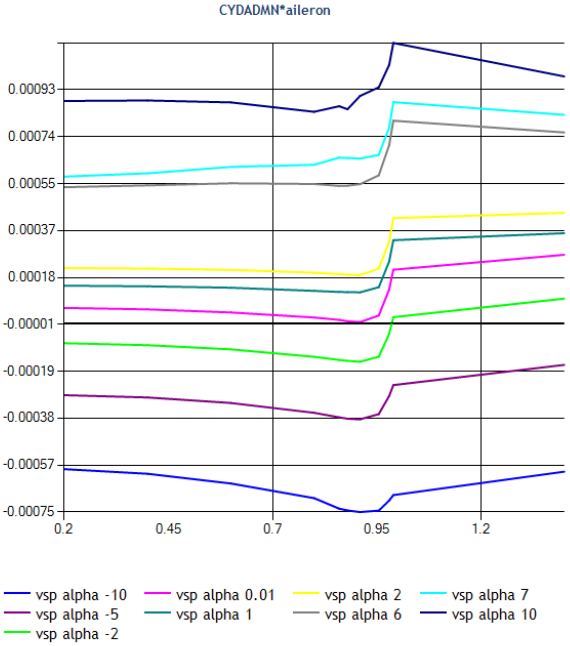
SIDE FORCE DUE TO YAW RATE

CFYR(alpha,beta)



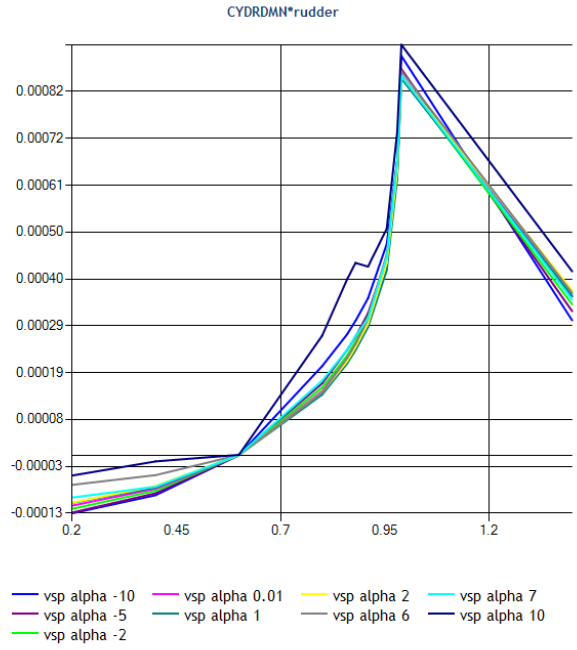
SIDEFORCE CHANGE DUE TO MACH DUE TO TO AILERON DEFLECTION

CYDADMN(mach,alpha)



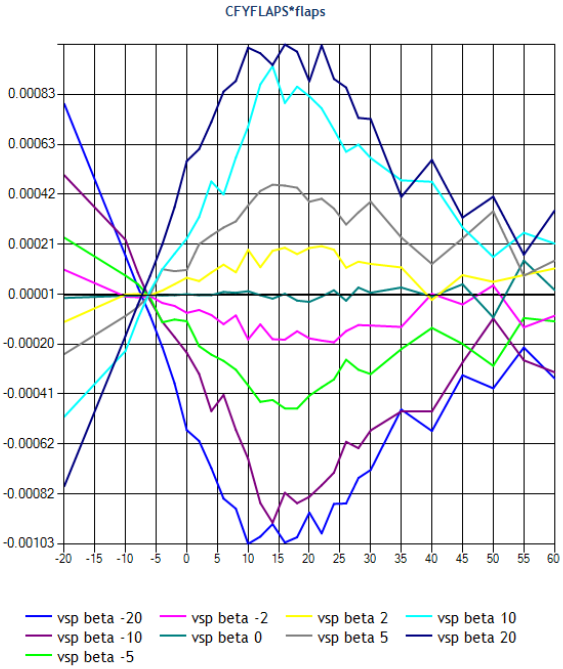
SIDEFORCE CHANGE DUE TO MACH DUE TO TO RUDDER DEFLECTION

CYDRDMN(mach,alpha)



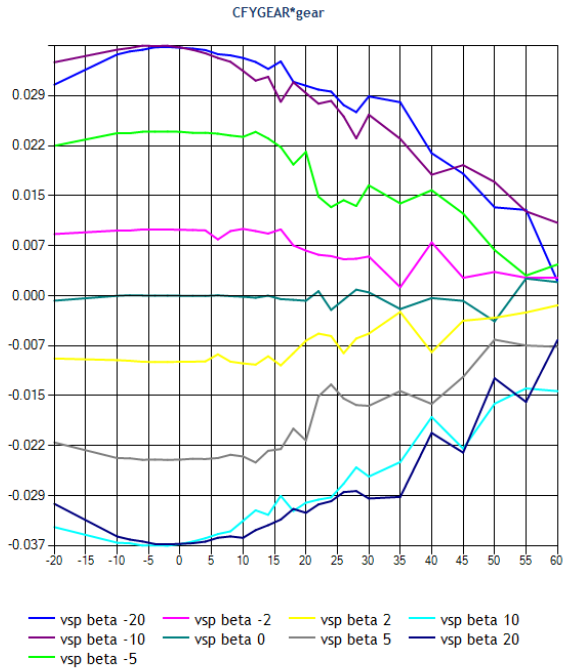
SIDEFORCE INCREMENT DUE TO FLAPS

CFYFLAPS(alpha,beta)



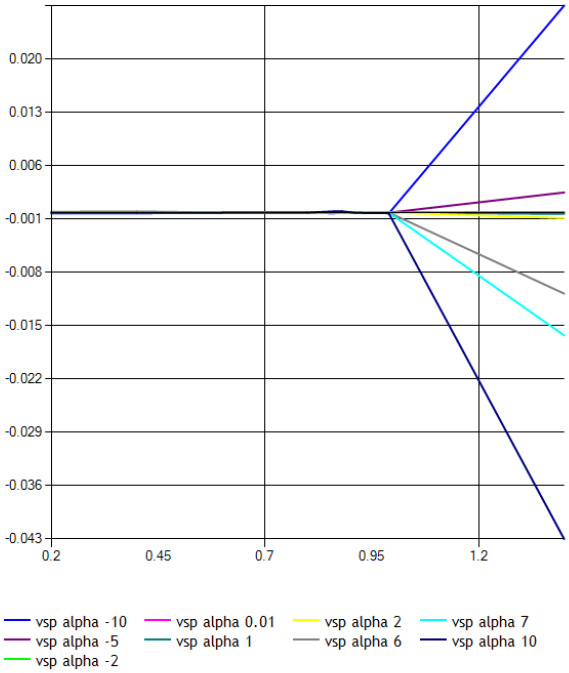
SIDEFORCE INCREMENT DUE TO GEAR

CFYGEAR(alpha,beta)



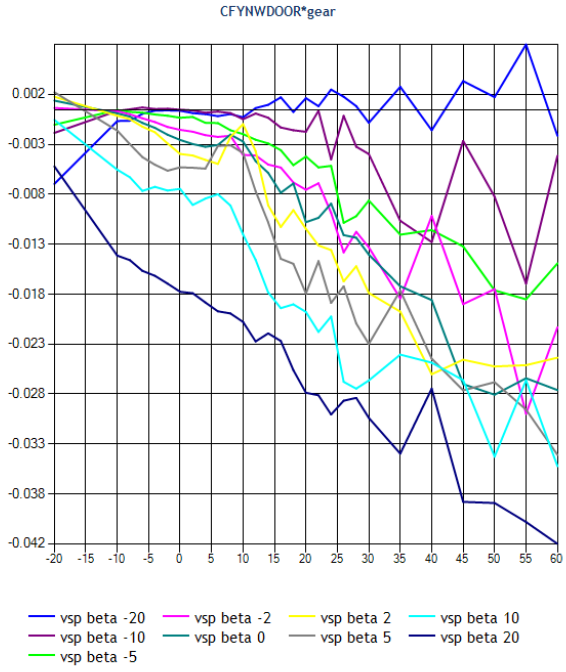
SIDEFORCE INCREMENT DUE TO MACH

CFYMN(mach,alpha)



SIDEFORCE INCREMENT DUE TO NOSE DOOR

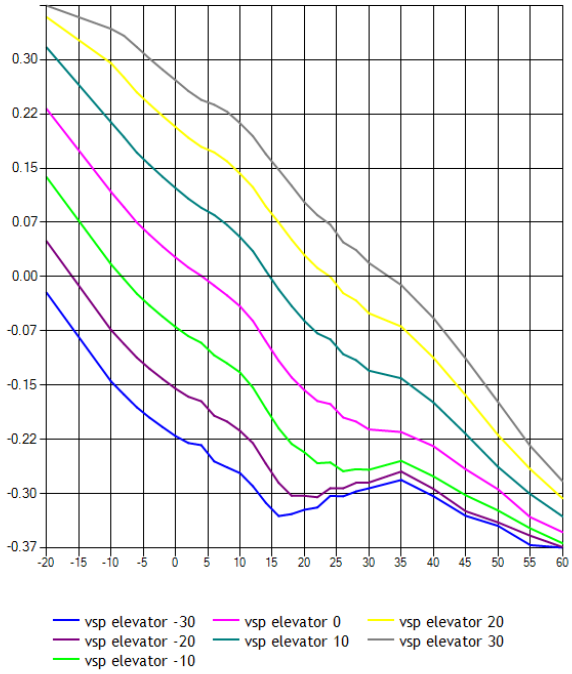
CFYNWDOOR(alpha,beta)



PITCH

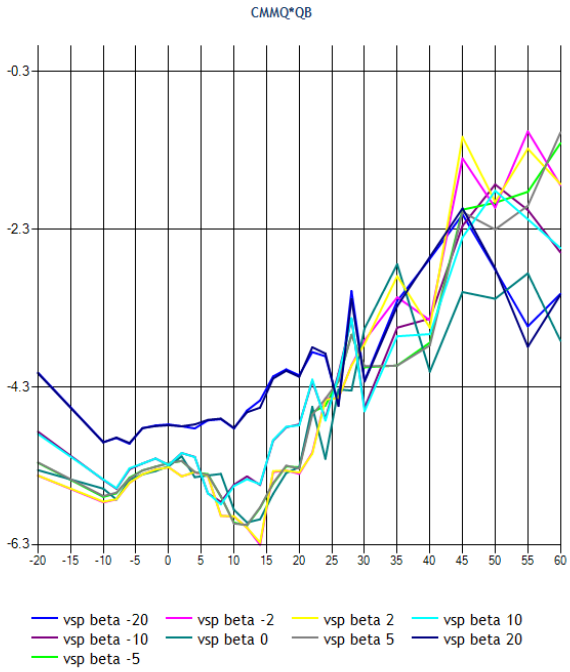
BASE PITCHING MOMENT

CMM1(alpha,elevator)



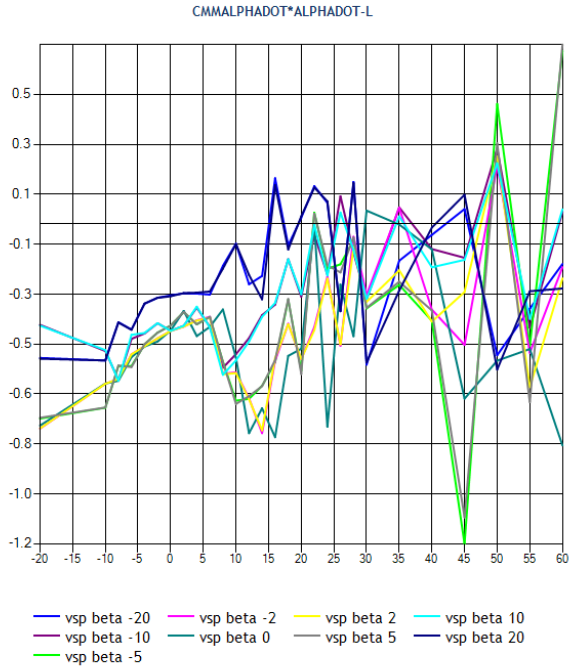
PITCH DAMPING DERIVATIVE

CMMQ(alpha,beta)



PITCH MOMENT DERIVATIVE FOR ALPHA DOT

CMMALPHADOT(alpha,beta)

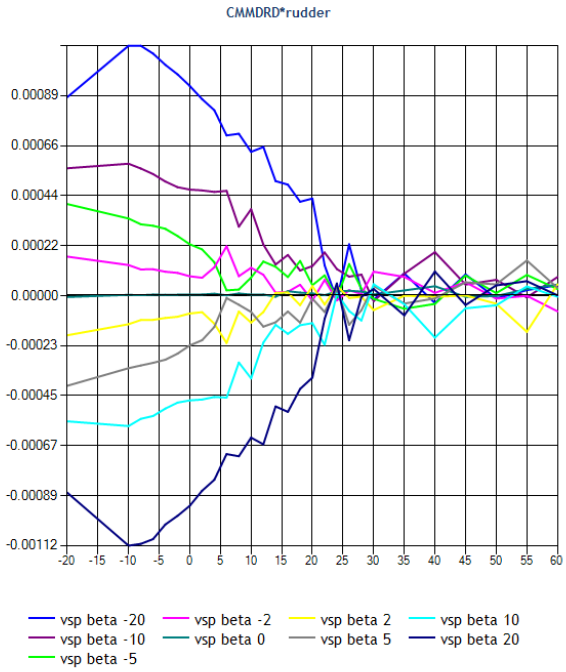


PITCH MOMENT DUE TO AILERON DEFLECTION

CMMDAD(alpha,beta)

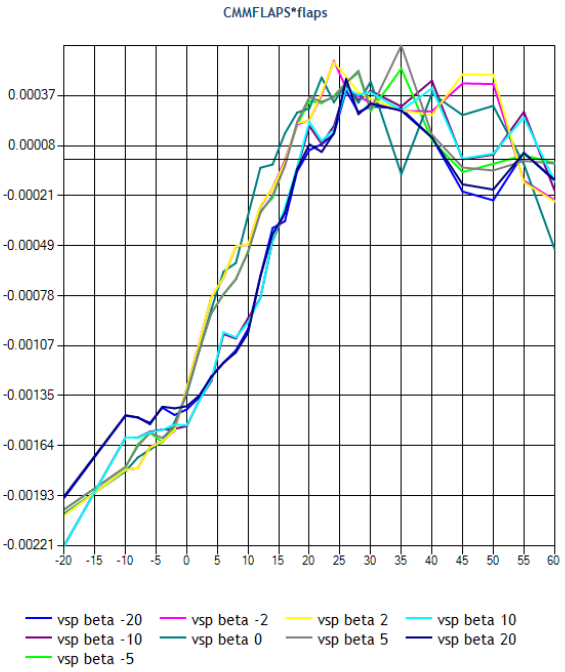
PITCH MOMENT DUE TO RUDDER DEFLECTION

CMMDRD(alpha,beta)



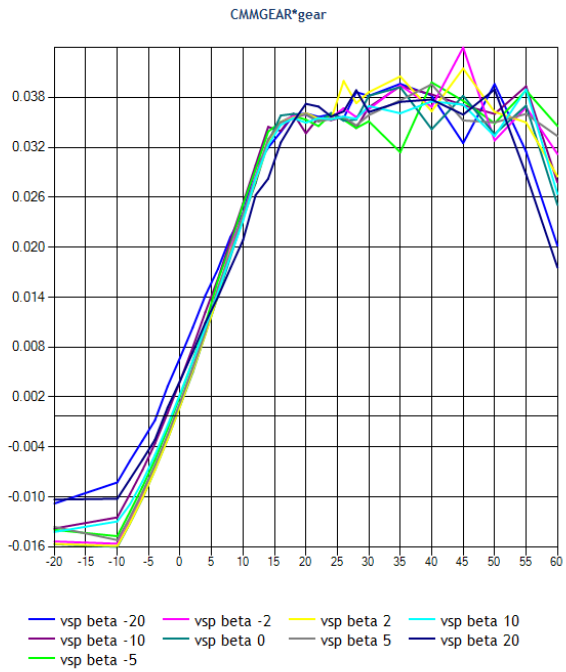
PITCHING MOMENT INCREMENT DUE TO FLAPS

CMMFLAPS(alpha,beta)



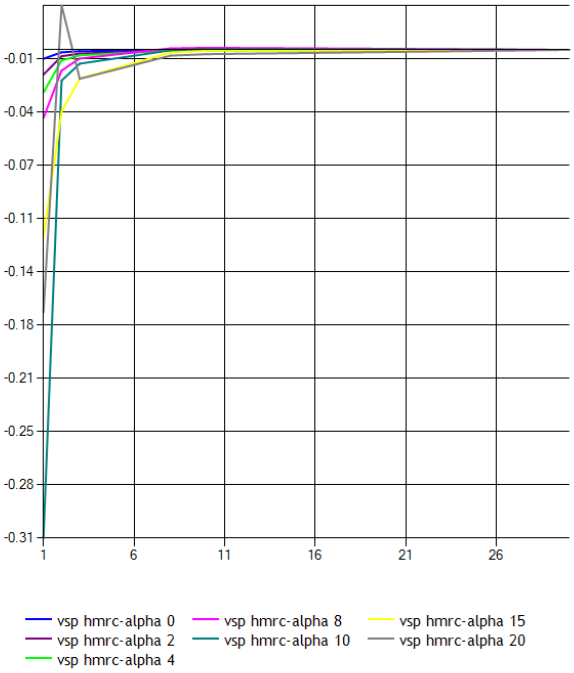
PITCHING MOMENT INCREMENT DUE TO GEAR

CMMGEAR(alpha,beta)



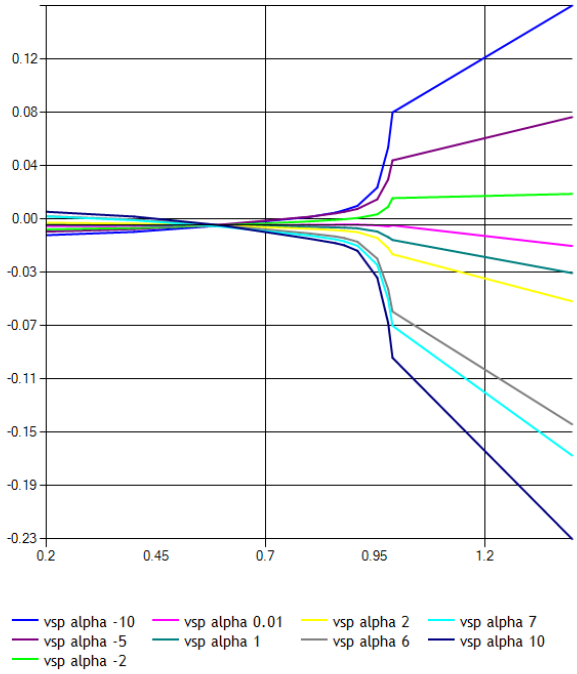
PITCHING MOMENT INCREMENT DUE TO GROUND EFFECT

CMMDGE(hmrc,hmrc-alpha)



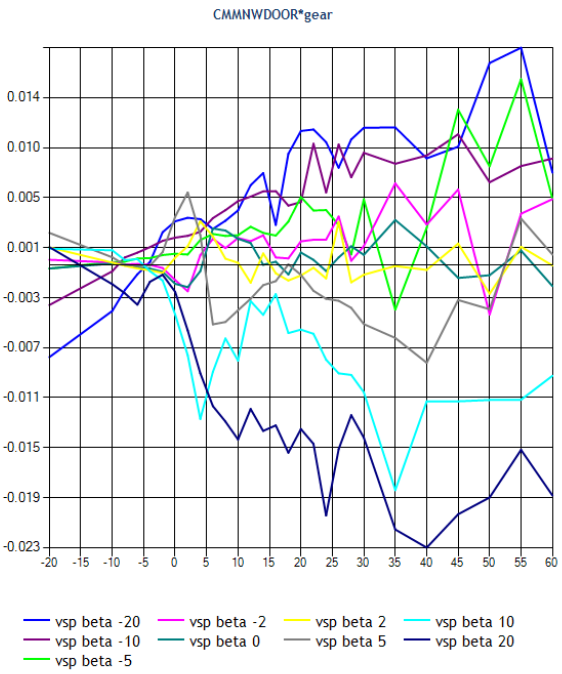
PITCHING MOMENT INCREMENT DUE TO MACH

CMMMN(mach,alpha)



PITCHING MOMENT INCREMENT DUE TO NOSE DOOR

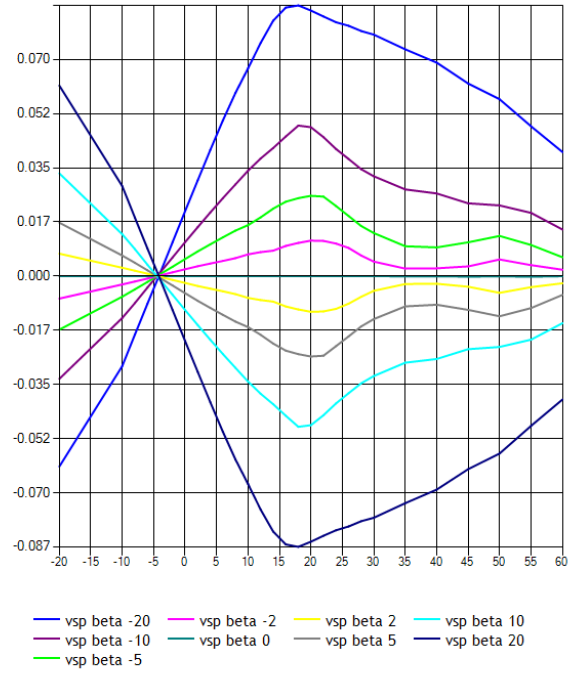
CMMNWDOOR(alpha,beta)



ROLL

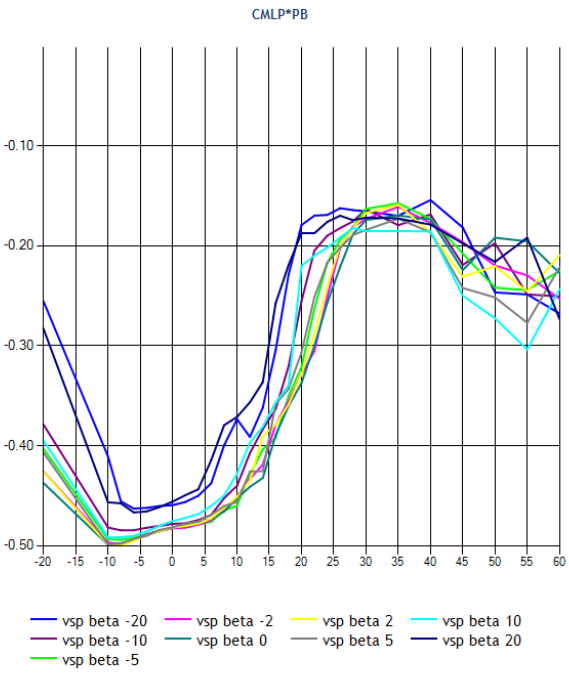
BASE ROLLING MOMENT

CML1(alpha,beta)



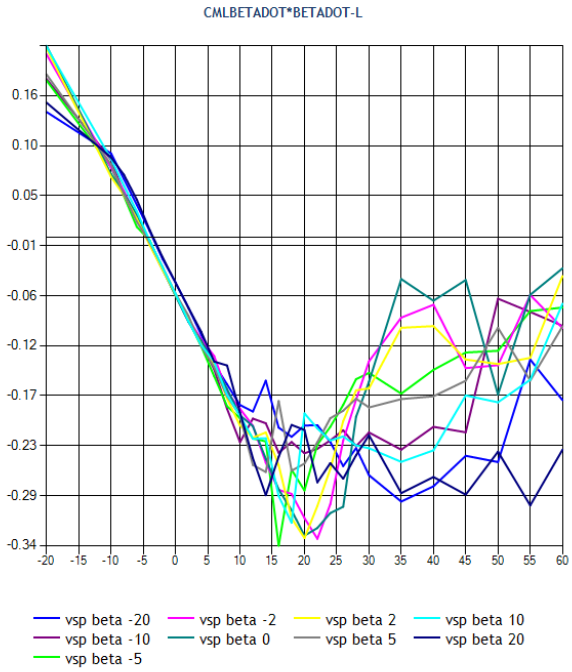
ROLL DAMPING DERIVATIVE

CMLP(alpha,beta)



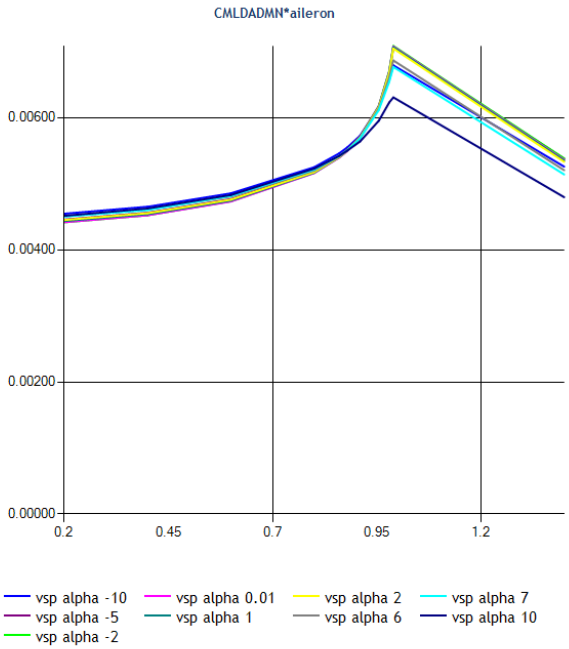
ROLL MOMENT DERIVATIVE FOR BETA DOT

CMLBETADOT(alpha,beta)



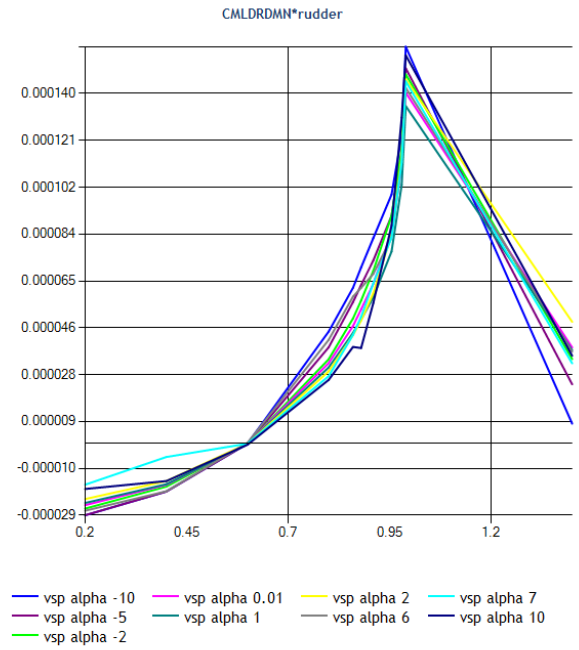
ROLLING MOMENT CHANGE DUE TO MACH DUE TO AILERON DEFLECTION

CMLDADMN(mach,alpha)



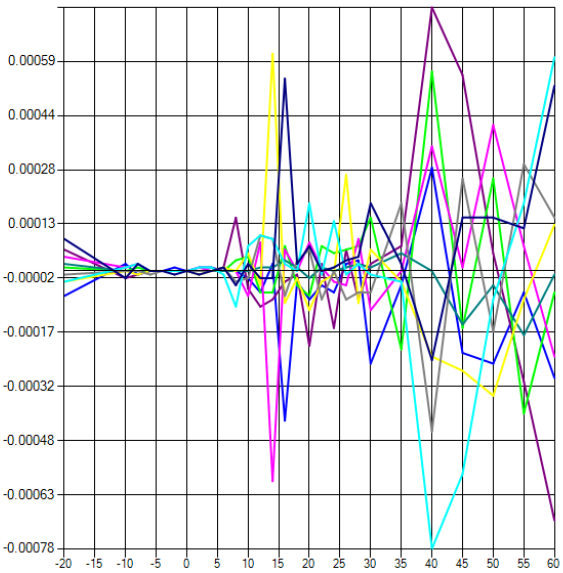
ROLLING MOMENT CHANGE DUE TO MACH DUE TO RUDDER DEFLECTION

CMLDRDMN(mach,alpha)



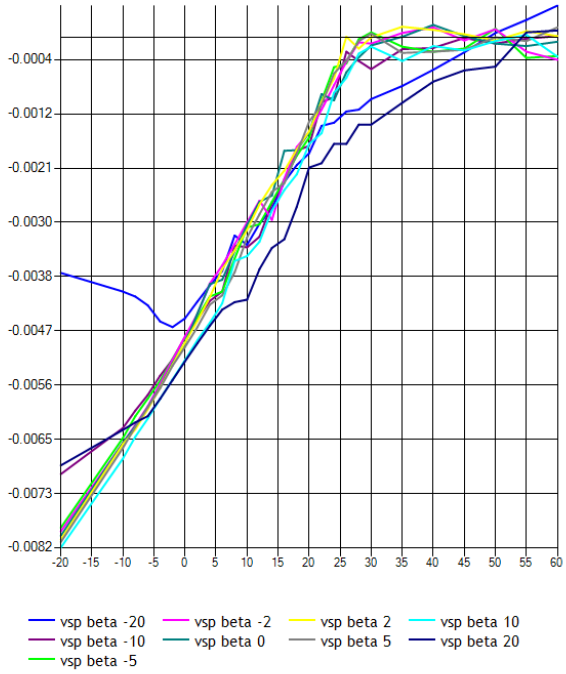
ROLLING MOMENT DUE TO AILERON DEFLECTION

CMLDAD(alpha,beta)



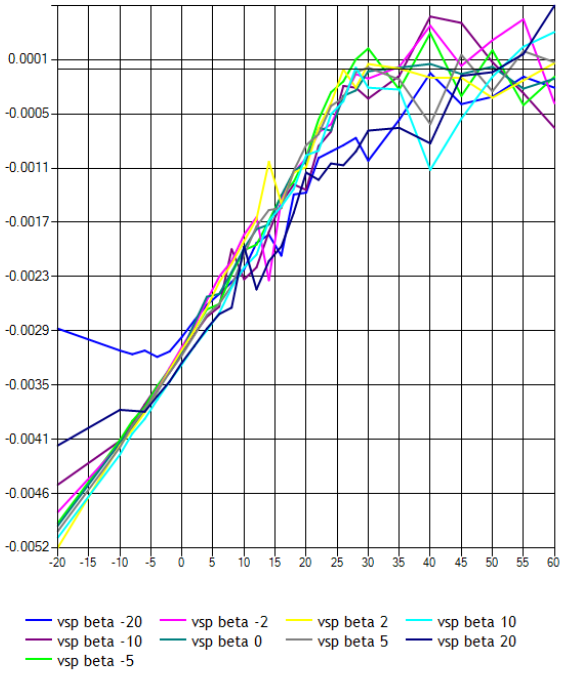
ROLLING MOMENT DUE TO RUDDER DEFLECTION

CMLDRD (alpha,beta,rudder=-20)



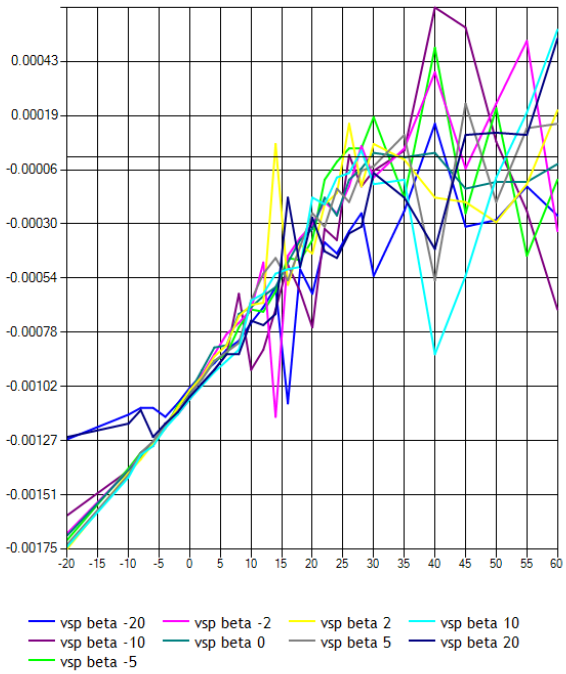
ROLLING MOMENT DUE TO RUDDER DEFLECTION

CMLDRD (alpha,beta,rudder=-12)



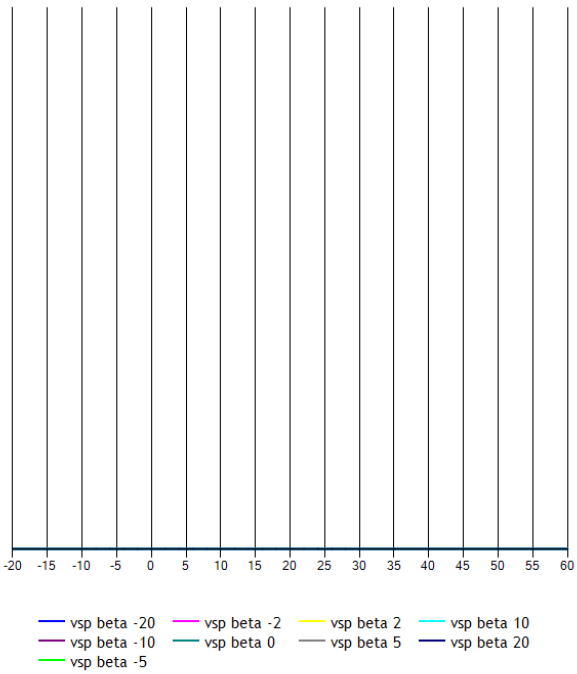
ROLLING MOMENT DUE TO RUDDER DEFLECTION

CMLDRD (alpha,beta,rudder=-4)



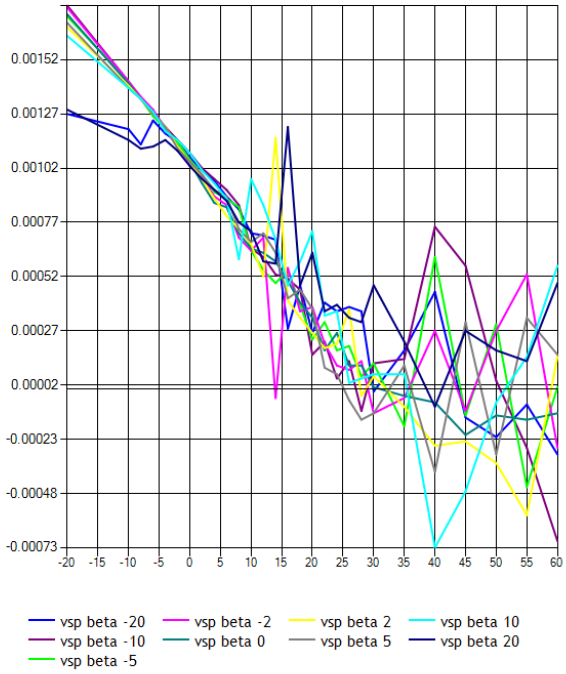
ROLLING MOMENT DUE TO RUDDER DEFLECTION

CMLDRD (alpha,beta,rudder=0)



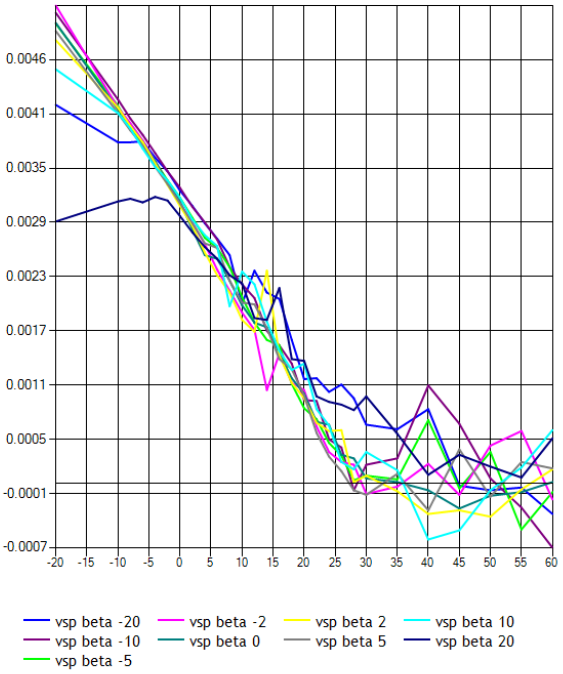
ROLLING MOMENT DUE TO RUDDER DEFLECTION

CMLDRD (alpha,beta,rudder=4)



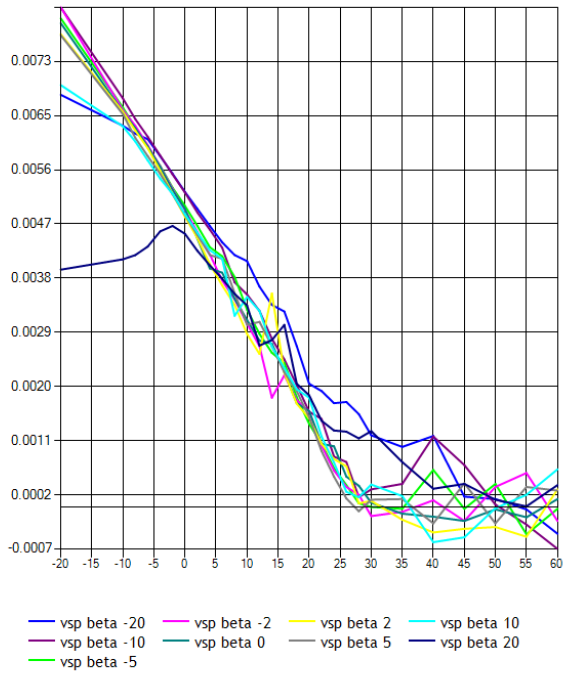
ROLLING MOMENT DUE TO RUDDER DEFLECTION

CMLDRD (alpha,beta,rudder=12)



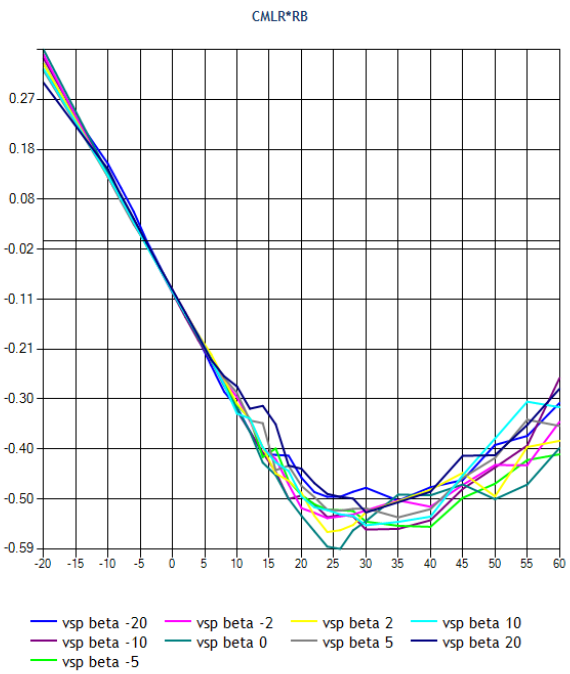
ROLLING MOMENT DUE TO RUDDER DEFLECTION

CMLDRD (alpha,beta,rudder=20)



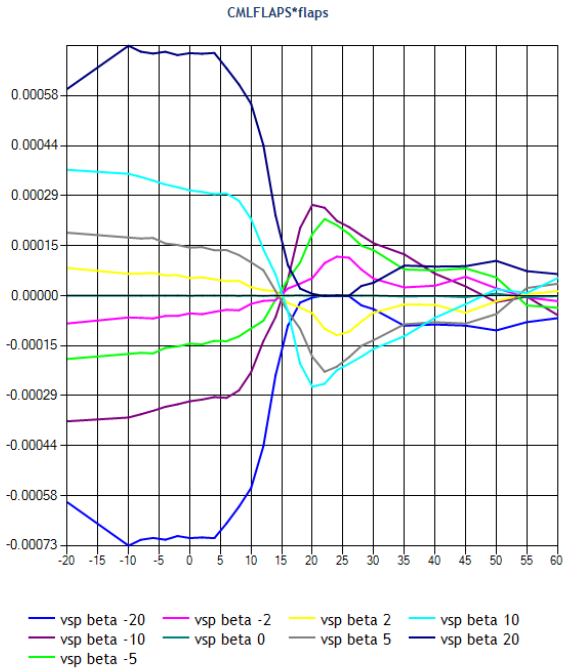
ROLLING MOMENT DUE TO YAW RATE

CMLR(alpha,beta)



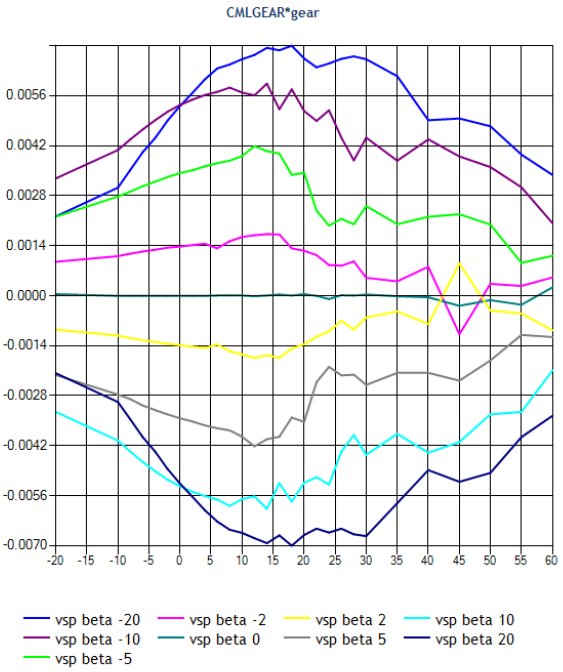
ROLLING MOMENT INCREMENT DUE TO FLAPS

CMLFLAPS(alpha,beta)



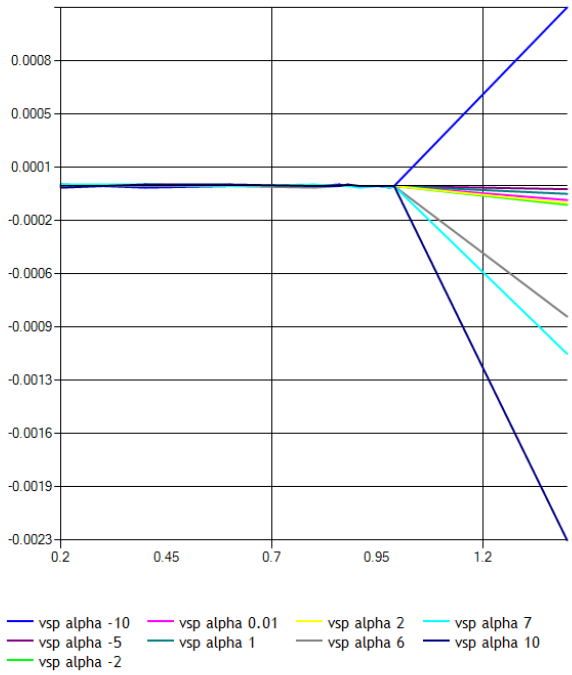
ROLLING MOMENT INCREMENT DUE TO GEAR

CMLGEAR(alpha,beta)



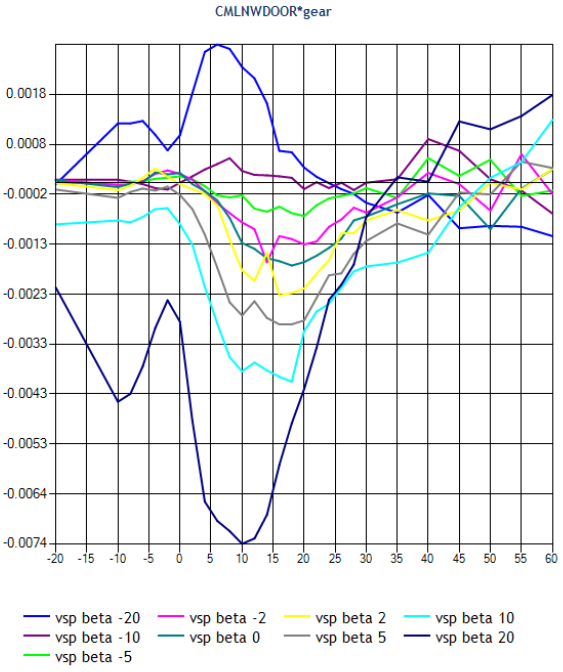
ROLLING MOMENT INCREMENT DUE TO MACH

CMLMN(mach,alpha)



ROLLING MOMENT INCREMENT DUE TO NOSE DOOR

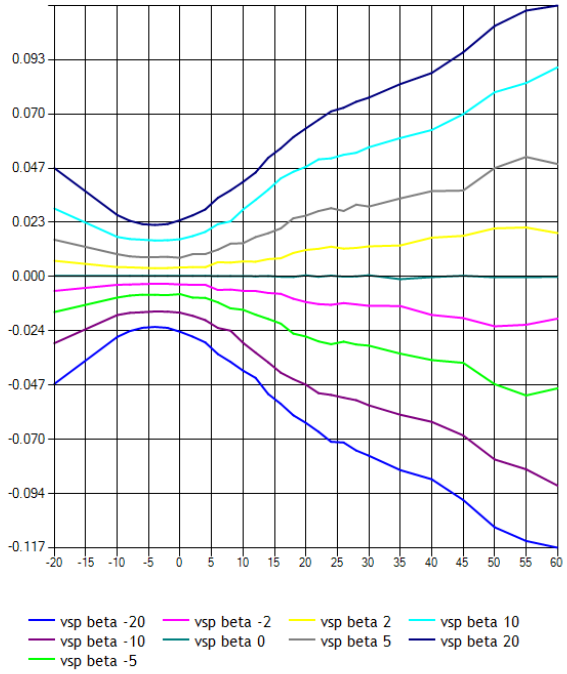
CMLNWDOOR(alpha,beta)



YAW

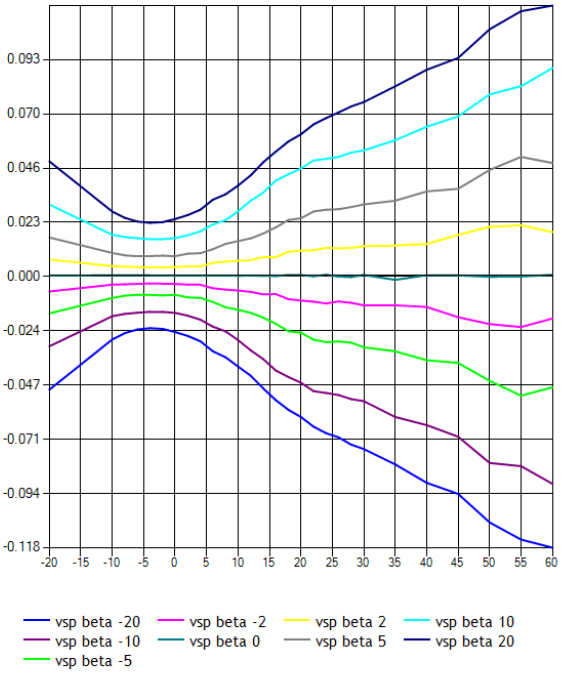
BASE YAWING MOMENT

CMN1 (alpha,beta,elevator=-30)



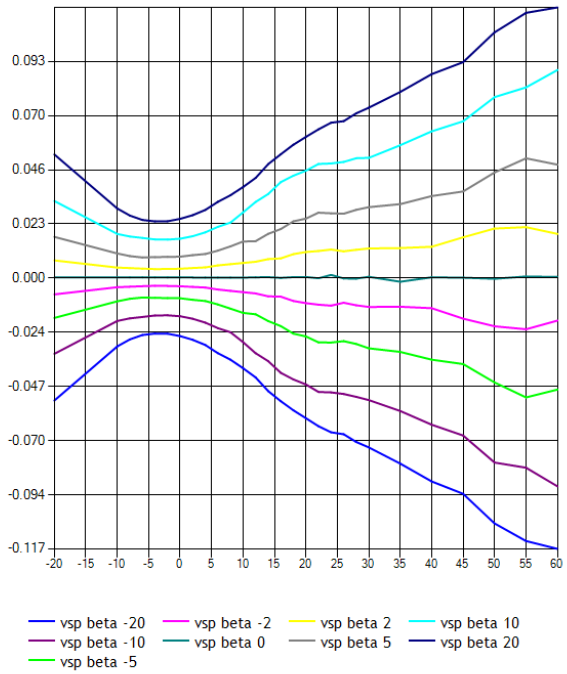
BASE YAWING MOMENT

CMN1 (alpha,beta,elevator=-20)



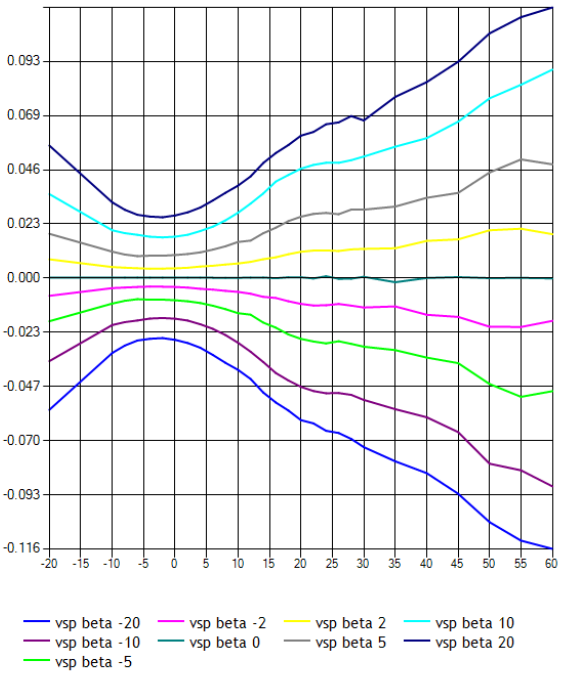
BASE YAWING MOMENT

CMN1 (alpha,beta,elevator=-10)



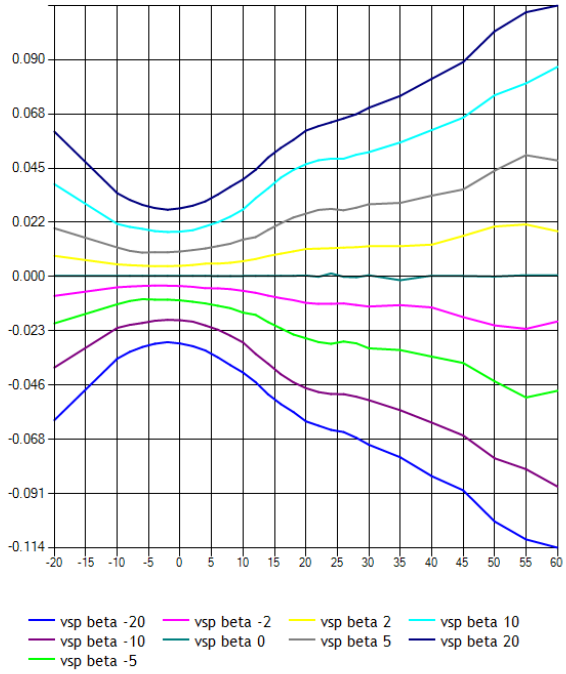
BASE YAWING MOMENT

CMN1 (alpha,beta,elevator=0)



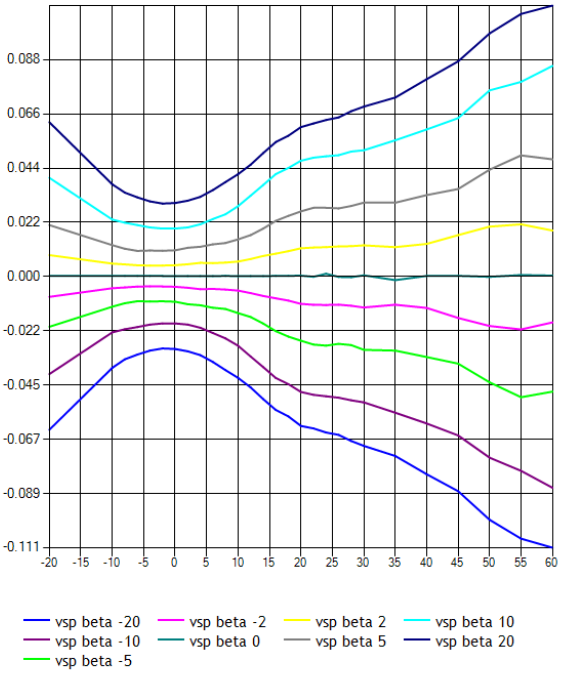
BASE YAWING MOMENT

CMN1 (alpha,beta,elevator=10)



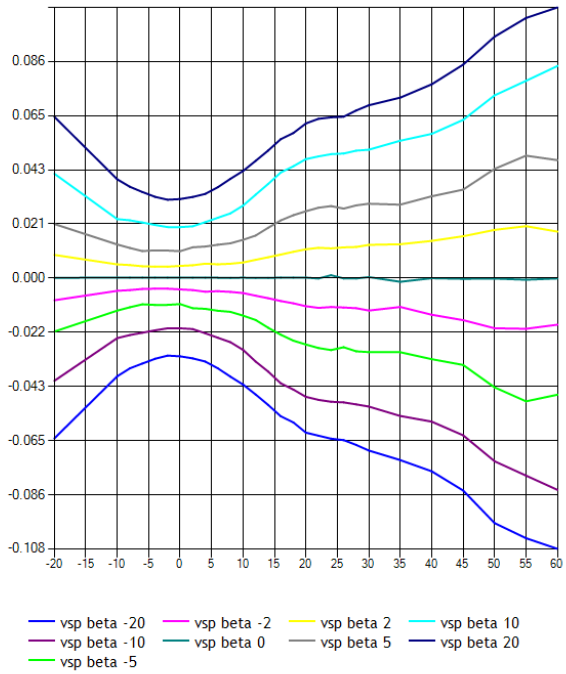
BASE YAWING MOMENT

CMN1 (alpha,beta,elevator=20)



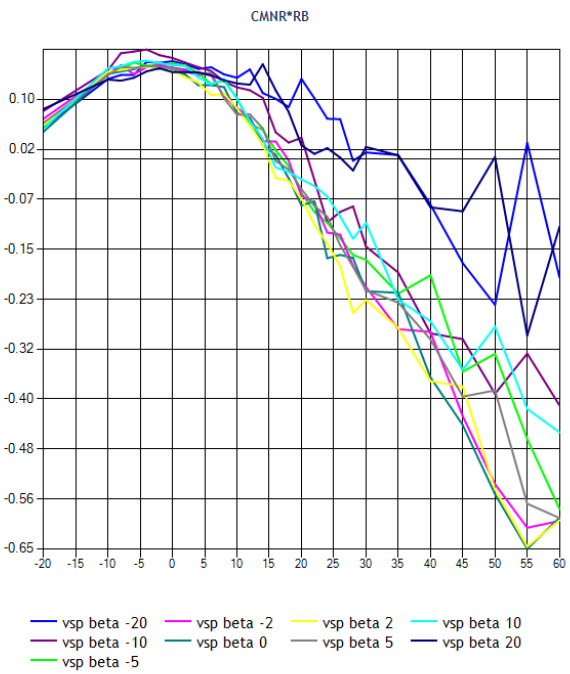
BASE YAWING MOMENT

CMN1 (alpha,beta,elevator=30)



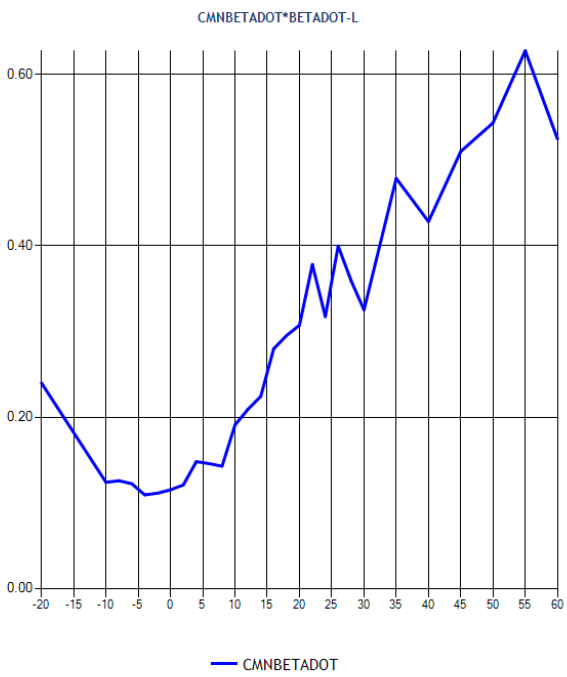
YAW DAMPING DERIVATIVE

CMNR(alpha,beta)



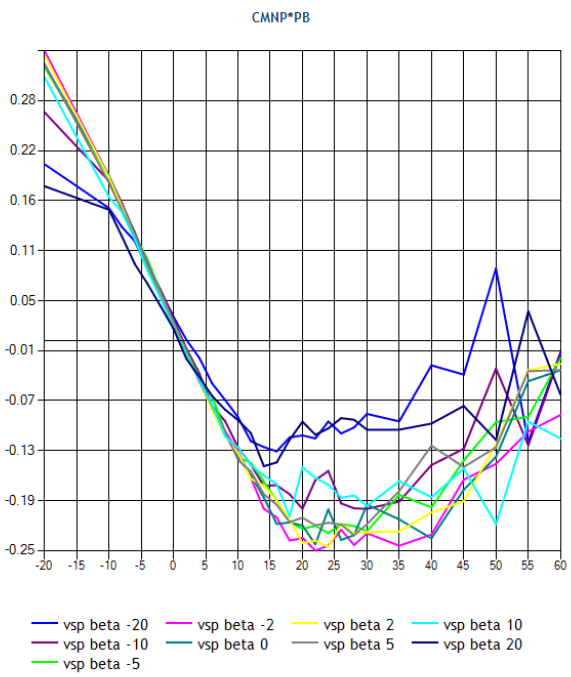
YAW MOMENT DERIVATIVE FOR BETADOT

CMNBETADOT(alpha)



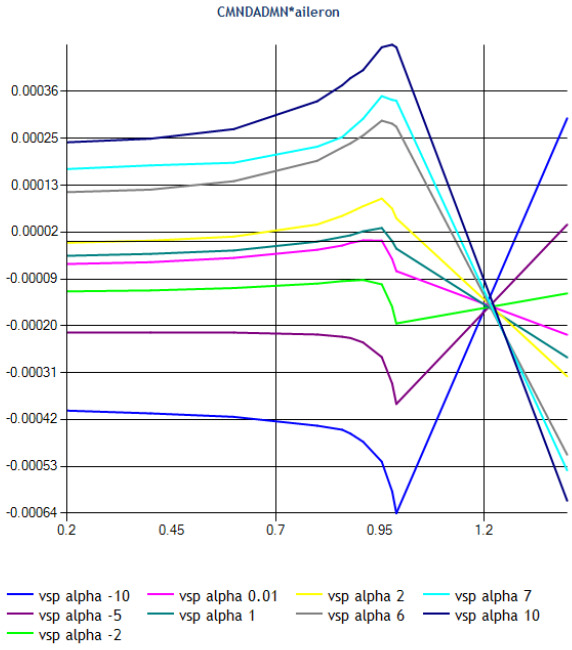
YAW MOMENT DUE TO ROLL RATE

CMNP(alpha,beta)



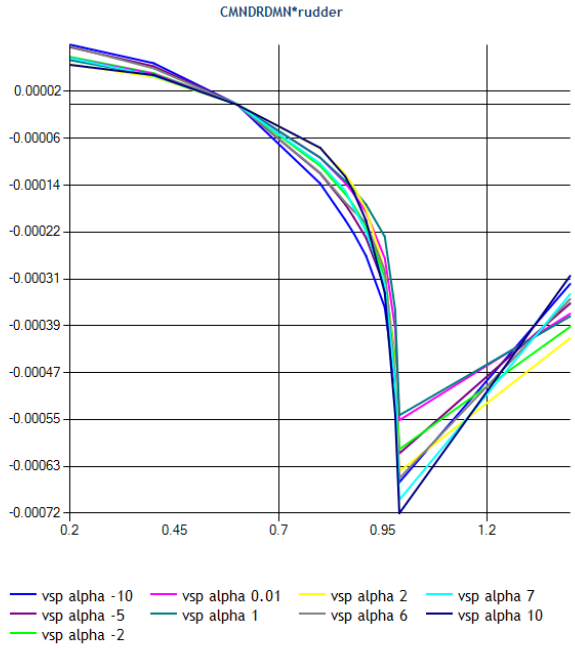
YAWING MOMENT CHANGE DUE TO MACH DUE TO AILERON DEFLECTION

CMNDADMN(mach,alpha)



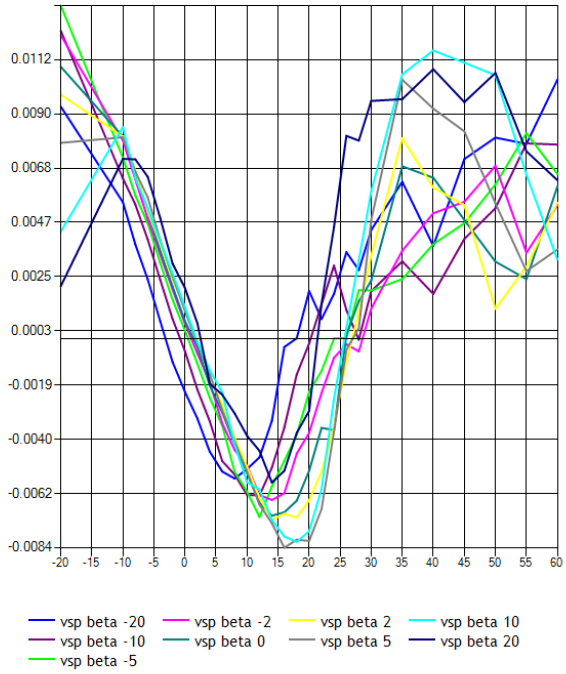
YAWING MOMENT CHANGE DUE TO MACH DUE TO RUDDER DEFLECTION

CMNDRDMN(mach,alpha)



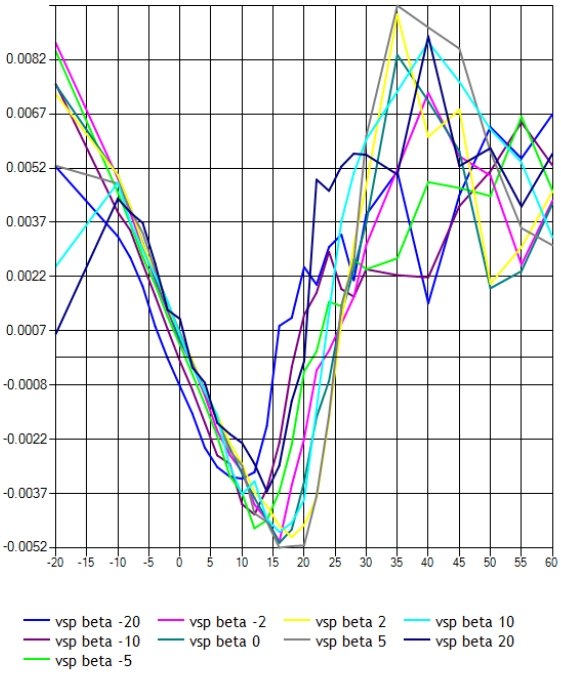
YAWING MOMENT DUE TO AILERON DEFLECTION

CMNDAD (alpha,beta,aileron=-20)



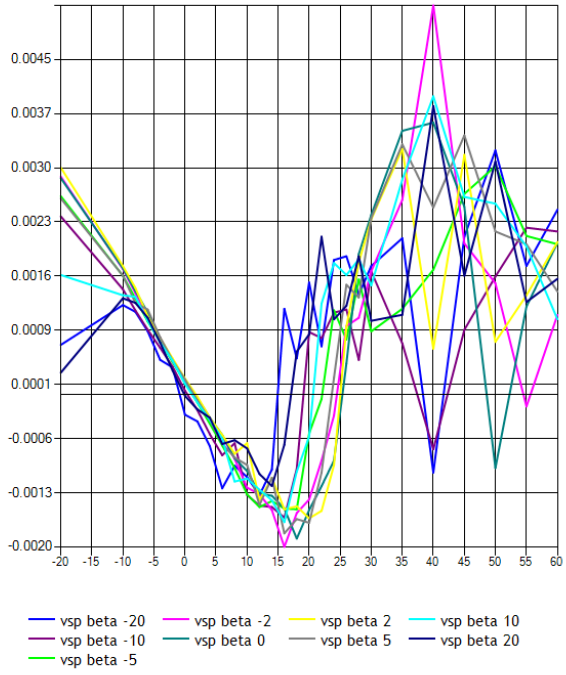
YAWING MOMENT DUE TO AILERON DEFLECTION

CMNDAD (alpha,beta,aileron=-12)



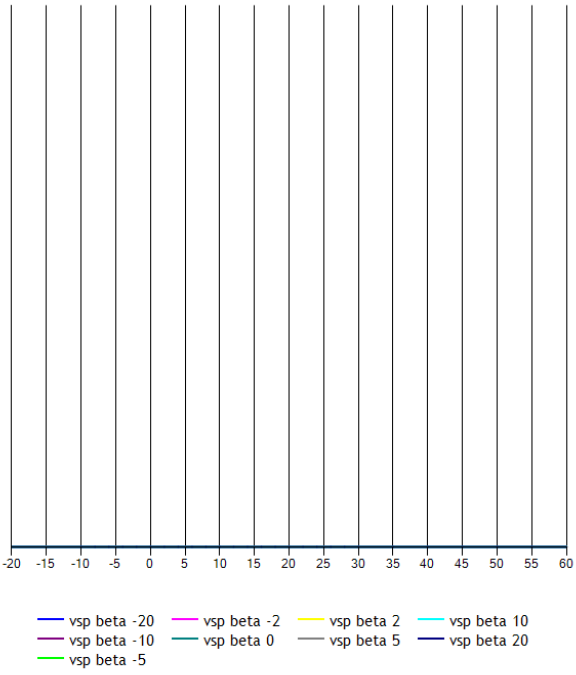
YAWING MOMENT DUE TO AILERON DEFLECTION

CMNDAD (alpha,beta,aileron=-4)



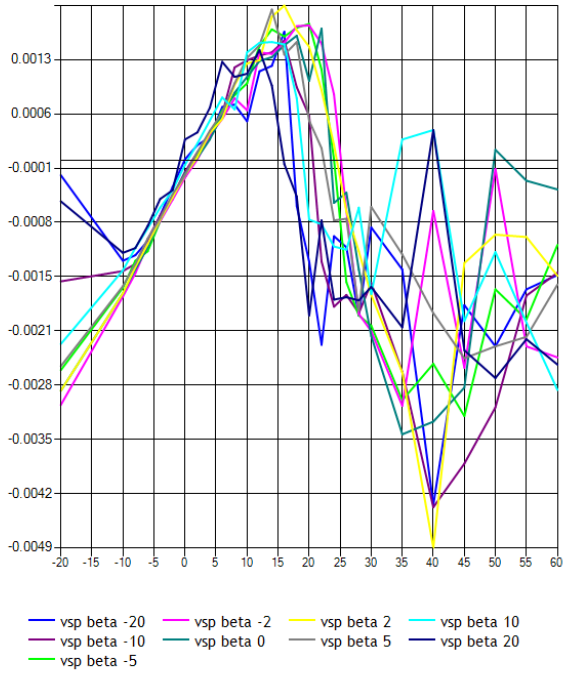
YAWING MOMENT DUE TO AILERON DEFLECTION

CMNDAD (alpha,beta,aileron=0)



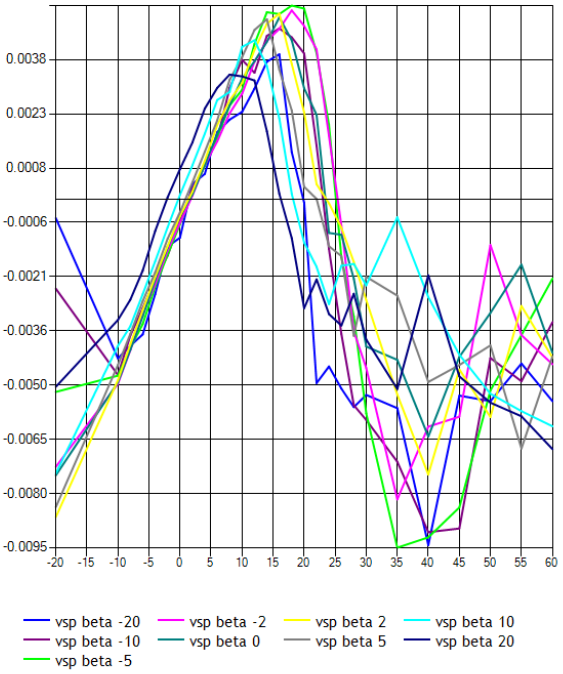
YAWING MOMENT DUE TO AILERON DEFLECTION

CMNDAD (alpha,beta,aileron=4)



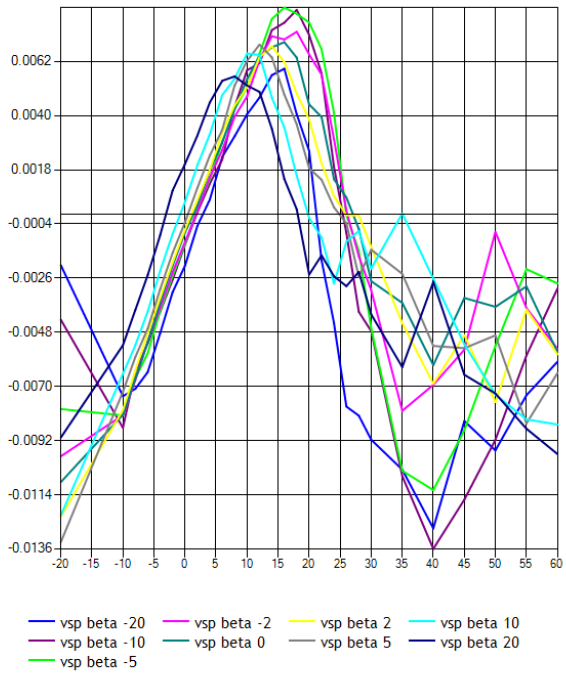
YAWING MOMENT DUE TO AILERON DEFLECTION

CMNDAD (alpha,beta,aileron=12)



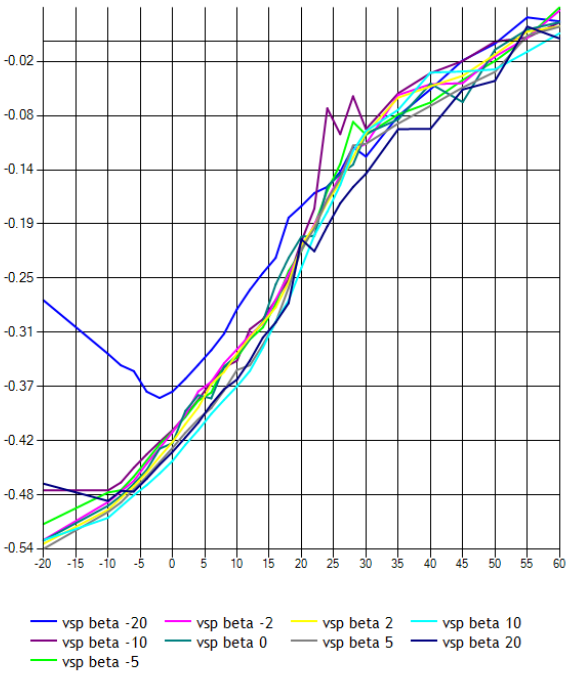
YAWING MOMENT DUE TO AILERON DEFLECTION

CMNDAD (alpha,beta,aileron=20)



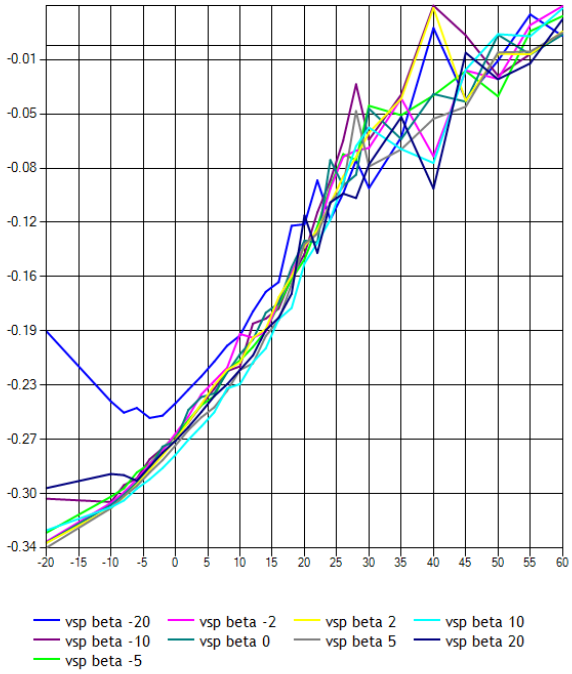
YAWING MOMENT DUE TO RUDDER DEFLECTION

CMNDRD (alpha,beta,rudder=-20)



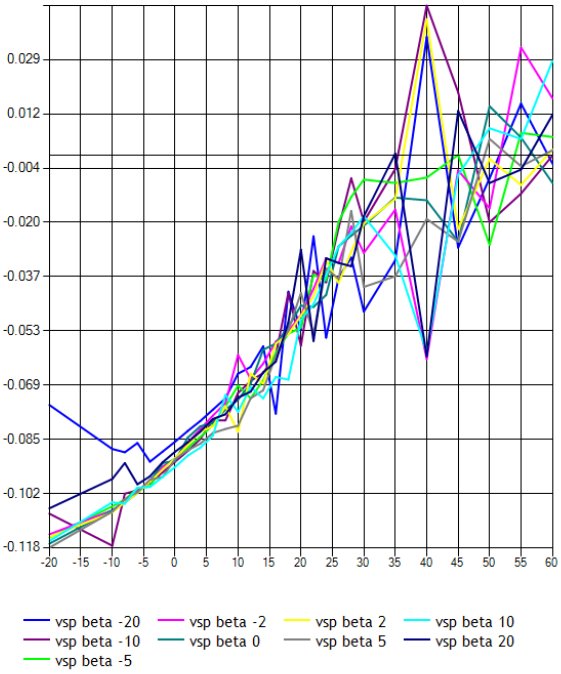
YAWING MOMENT DUE TO RUDDER DEFLECTION

CMNDRD (alpha,beta,rudder=-12)



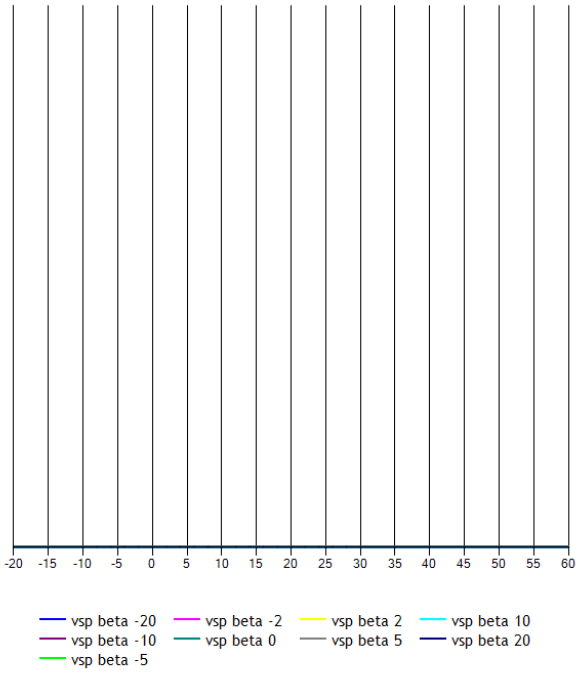
YAWING MOMENT DUE TO RUDDER DEFLECTION

CMNDRD (alpha,beta,rudder=-4)



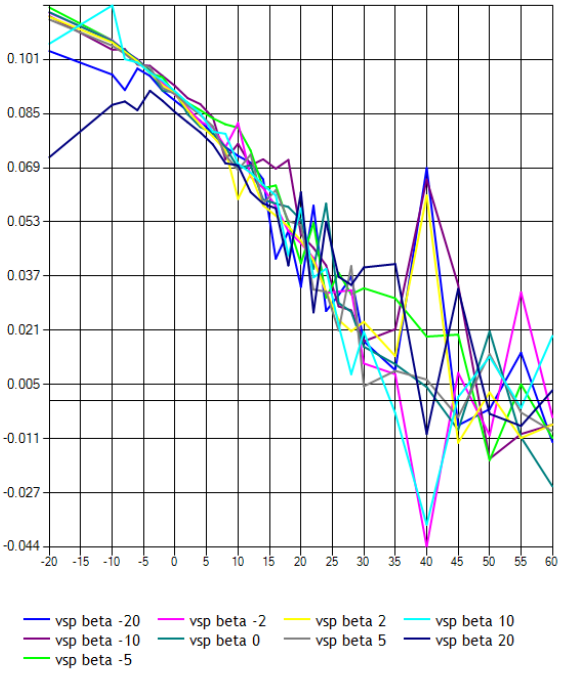
YAWING MOMENT DUE TO RUDDER DEFLECTION

CMNDRD (alpha,beta,rudder=0)



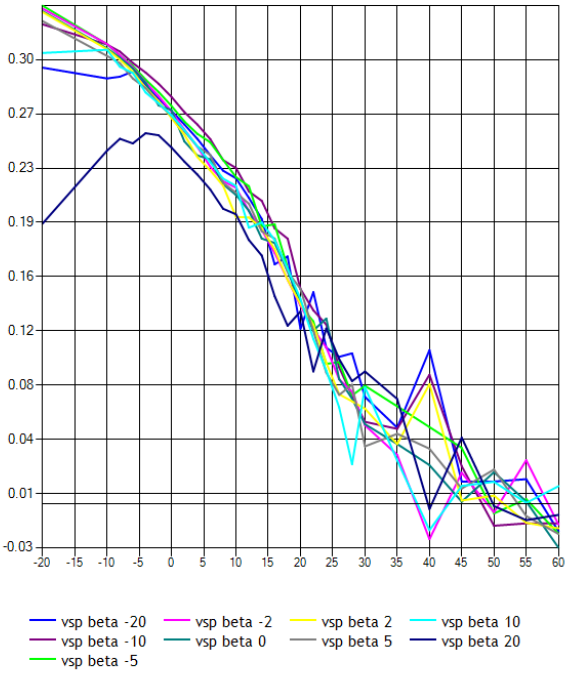
YAWING MOMENT DUE TO RUDDER DEFLECTION

CMNDRD (alpha,beta,rudder=4)



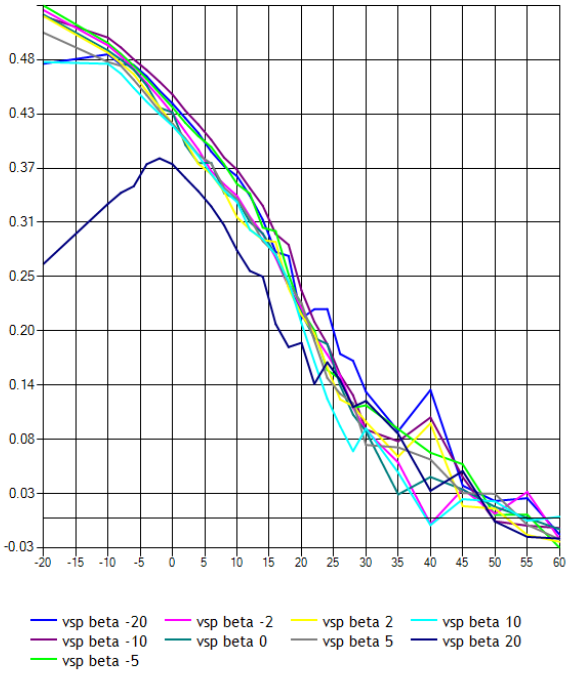
YAWING MOMENT DUE TO RUDDER DEFLECTION

CMNDRD (alpha,beta,rudder=12)



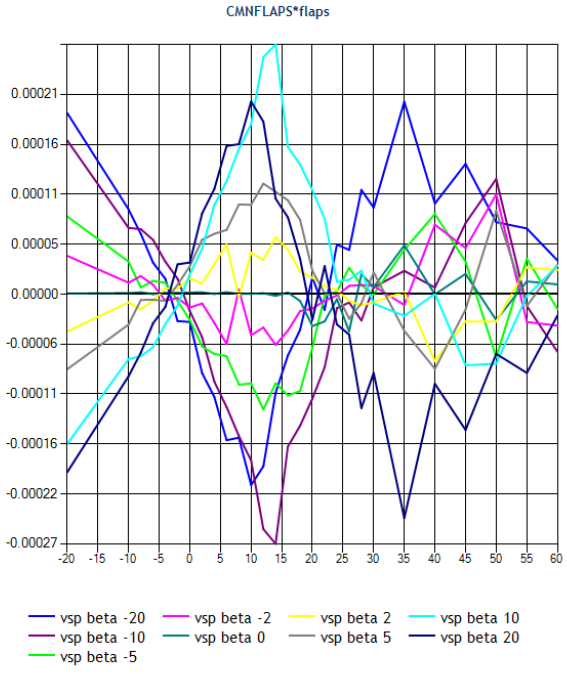
YAWING MOMENT DUE TO RUDDER DEFLECTION

CMNDRD (alpha,beta,rudder=20)



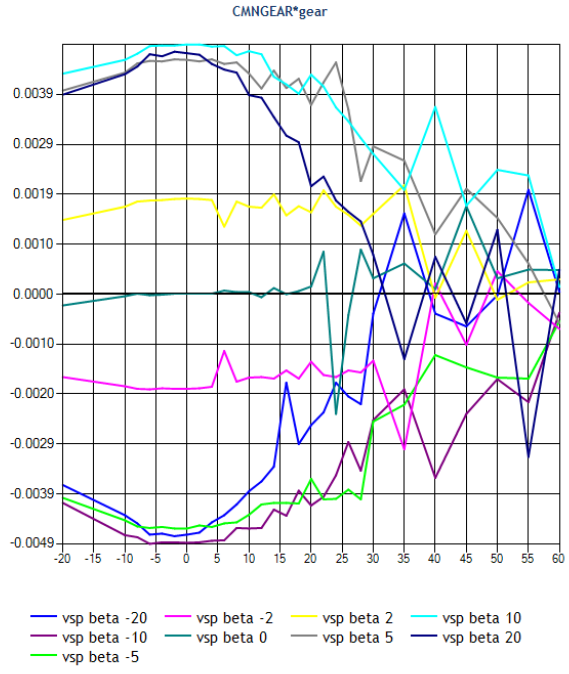
YAWING MOMENT INCREMENT DUE TO FLAPS

CMNFLAPS(alpha,beta)



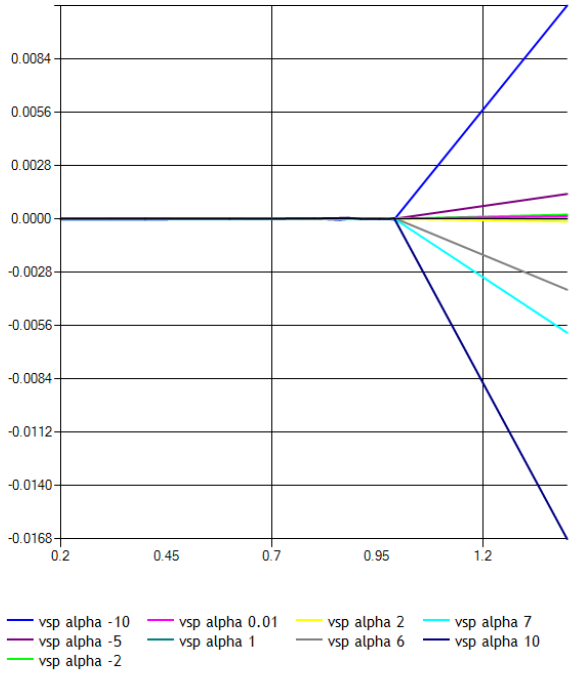
YAWING MOMENT INCREMENT DUE TO GEAR

CMNGEAR(alpha,beta)



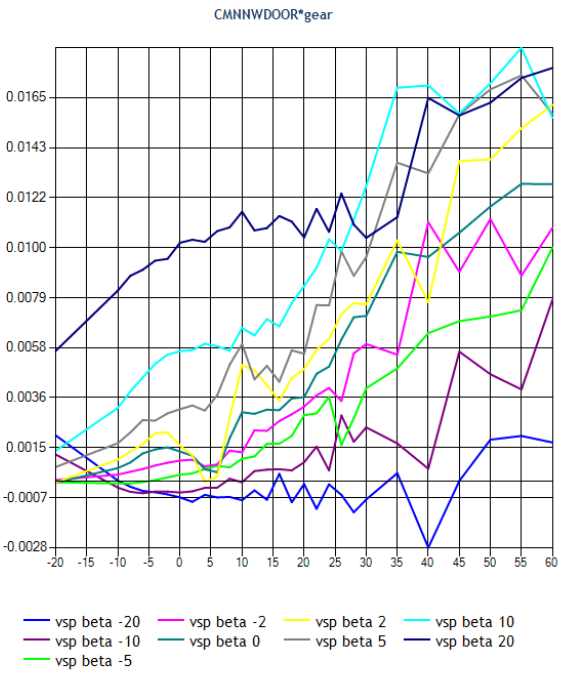
YAWING MOMENT INCREMENT DUE TO MACH

CMNMN(mach,alpha)



YAWING MOMENT INCREMENT DUE TO NOSE DOOR

CMNNWDOOR(alpha,beta)



References

1. Richard Harrison, rjh@zaretto.com: swift Aerodynamic data built from vspaero; CG (5.8, 0, -0.02)M, ZDAT/AED/2019/09-09, 09 Sep 2019: http://www.zaretto.com/sites/zaretto.com/files/swift-data/rjh-zaretto-swift-aerodynamic-data-vspaero.pdf
2. D. A. Kirby and A. Spence: Low-Speed-Tunnel Model Tests on the Flow Structure behind a Delta-Wing Aircraft and a 40 deg Swept-Wing-Aircraft at High-Incidences, Reports and Memorandum 3078 (17,946), A.R.C Technical report, 1956: http://naca.central.cranfield.ac.uk/reports/arc/rm/3078.pdf

Aircraft Metrics

Element	X	Y	Z	Unit
Aerodynamic Reference Point (CoP)	6.00	0.00	-0.02	M
Aircraft CG	5.80	0.00	-0.02	M

Element		Unit
Wingspan	7.97	M
Wing Area	21.40	M2
Wing Incidence	0.00	
Chord	2.59	M
Horiz Tail Arm	0.00	
ClMax	1.06	ND

Mass and balance

Element		Unit
Empty Weight	13758.00	LBS
IXX	14382.50	SLUG*FT2
IYY	62830.10	SLUG*FT2
IZZ	74666.90	SLUG*FT2

IXZ	413.20	SLUG*FT2

Element	X	Y	Z	Unit	Weight

Ground Reactions

Element	X	Y	Z	Unit	Index
NoseGear	2.51	0.00	-1.89	M	0
LeftMainGear	6.39	-2.47	-1.80	M	1
RightMainGear	6.39	2.47	-1.80	M	2
LeftWingTip	8.54	-4.74	-0.36	M	3
RightWingTip	8.54	4.74	-0.36	M	4
LeftHtailTip	12.37	-1.89	0.55	M	5
RightHtailTip	12.37	1.89	0.55	M	6
VtailTop	11.57	0.00	2.12	M	7
CentreFuselageTop	6.78	0.00	0.79	M	8
CentreFuselageBottom	6.78	0.00	-0.78	M	9
CanopyTop	3.34	0.00	1.07	M	10
Fuse0	0.00	0.00	0.00	M	11
Fuse1	0.99	0.00	-0.42	M	12
Fuse1Top	0.99	0.00	0.42	M	13
Fuse36	3.61	0.00	-0.72	M	14
Fuse83	8.36	0.00	-0.71	M	15
Fuse106	10.62	0.00	-0.66	M	16
Fuse127	12.77	0.00	-0.35	M	17

External Reactions

Element	X	Y	Z	Unit	direction X	y	z

Propulsion

Element	X	Y	Z	Unit	Thruster	Sense	P factor	Feed
RR-AVON-114	12.00	0.00	0.00	M	direct			FrontTank [0],CenterTank [1],RearTank [2],LeftWing [3],RightWing [4]

Tanks

Element	X	Y	Z	Unit	Capacity	Id	Priority	Standpipe
FrontTank	4.77	0.00	-0.03	M	862 LBS	0	3	10 LBS
CenterTank	5.64	0.00	-0.03	M	755 LBS	1	4	10 LBS
RearTank	6.53	0.00	-0.03	M	801 LBS	2	2	10 LBS
LeftWing	5.92	-1.59	-0.03	M	739 LBS	3	1	10 LBS

RightWing	5.92	1.59	-0.03	M	739 LBS	4	1	10 LBS

Systems

Name
swift-flight-controls
swift-hydraulics
swift-engines
swift-ecs
swift-electrics

Independent variables

Name
aero/alpha-deg
aero/alphadot-rad_sec-limited
aero/beta-deg
aero/betadot-rad_sec-limited
aero/pb
aero/qb
aero/rb
fcs/aileron-pos-deg
fcs/elevator-pos-deg
fcs/flap-pos-deg
fcs/rudder-pos-deg
gear/gear-pos-norm
position/h-agl-m
velocities/mach