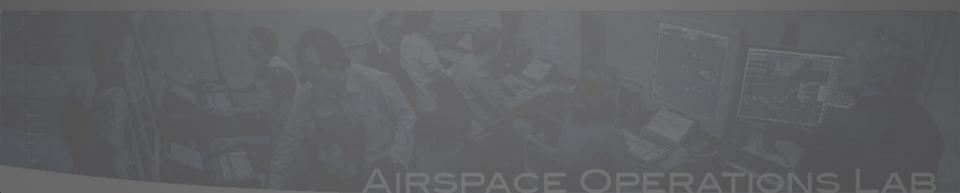


#### **Scenario Generation in MACS**

#### Chris Cabrall Slides by Jeff Homola



### Outline

- Introduction
- Traffic scenario generation
  - Getting started
  - AC Table Editor
  - Scenario Editor
- Going forward and final notes

#### **Scenario Generation**

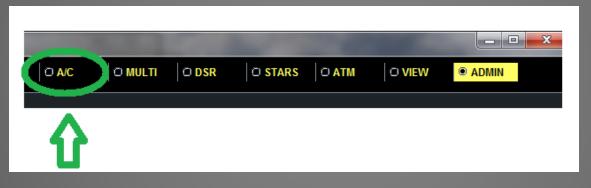
- The scenario generation and editing functions in MACS are the primary means by which traffic scenarios are created for use in simulations and testing
- The scenario generation tools allow for a great deal of flexibility in what can be tested
- To date, a variety of traffic situations have been created that simulated current day operations both in the terminal and en route domains as well as far-term environments with 2-3 times current traffic levels and different levels of aircraft equipage

#### Typical questions that guide the process

- What is the airspace of concern?
- What are the targeted traffic loads for that airspace?
- What is the duration and scope of the problem?
- What are the equipage assumptions?
- How structured does the traffic need to be?
- What, if any, are the desired interactions of the traffic?
  - Conflicts, arrival/departure flows, metering

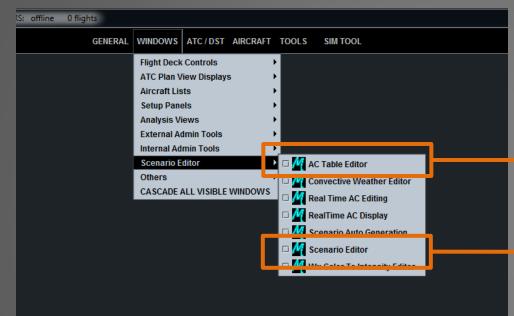
# **Getting Started**

- Open MACS via double-clicking the Example\_ZOB "Developer.bat" shortcut
  - C:\Experiments\Example\_ZOB\MacsStart\Admin



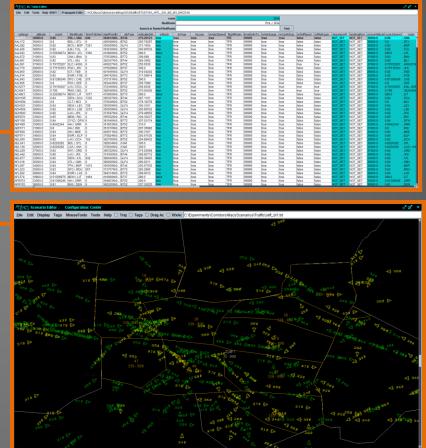
- Switch to the A/C "tab", and close and re-open the windows there:
  - Scenario Editor, AC Table Editor, SIM TOOL

### **Common Tools**



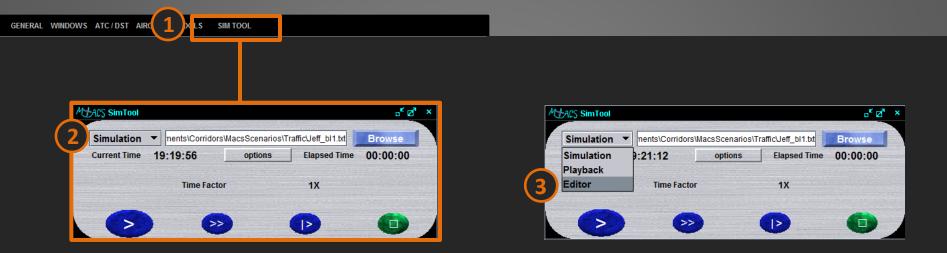
• The two most common tools used for traffic development and editing are the AC Table Editor spreadsheet and the graphical Scenario Editor.

• They are often used in tandem and interface with one another, so it is useful to have them both up together.



MACS Workshop, 1/10 - 1/11, 2012

### MACS modes



MACS initializes in Simulation mode by default. Editing can only be done in the Editor mode. To switch modes, first enable the SimTool by clicking on its item in the title bar.

**2** Click on the SimTool's drop-down menu that is currently set to Simulation.

**3** Select Editor from the menu to enter the Editing mode.

# **Opening Traffic Files**

•Multiple places to switch between Traffic files

• Different "synched" locations to select traffic file from

- Sim Tool: "Browse" button

- AC Table Editor, Scenario Editor: "File -> open"

\*\*note: Sim Tool not updating when Scenario Editor "File -> open" is used

 Change from "10\_AC\_Sample\_Traffic.txt" to "SA5\_Sample\_Traffic.txt" (and then back)

\*\*note: The number of aircraft total/selected, load times, etc.

# **AC Table Editor**

#### MUTACS AC Table Editor

<u>F</u> ile Edit	Tools Help 5	10/1 🗹 Prop	agate Edits																			
							callsigr		ACA664													
							route	•				POSTSP	ADDESVMY	XUYWTYYZ								
							filedRoute	filedRoute ORD./.POSTSPADDESVMYXUYWTYYZ														
	route/filedRoute						oute/filedRoute 🔻								Search	]						
callsign JZA/653	timeToEnter 2962	comment	altitude	cruiseAltitude	altitudeTarg	eldepartur	eAi destination	filedRoute DCA./.ULW	route	startPointN.	targetWayp.	indicatedAir	speedTarget	cruiseSpeed	mach	flightRules	inMach	ctasSectori ZOB 66		atcType CRJ1	type CRJ1	lat 38.85
COM1798	3181		700.0	33000.0	33000.0	ORD	BED	ORD./.HAA	HAAKK D	415851N/0	HAAKK	0.0	250.0	0.7679814	0.0	TFR	false	ZOB_66	ZOB_66 ZOB_66	CRJ1	CRJ1	41.98
ACA502	150		700.0	33000.0	33000.0	ORD		ORD./.POS	.POSTS.P.	. 415851N/0.	POSTS	0.0	250.0		0.0	TFR	false	ZOB_66	ZOB_66	E170	E170	41.98
GJS7378	3037		700.0	33000.0	33000.0	ORD	YYZ	ORD./.POS	POSTSP.	. 415851N/0.	. POSTS	0.0	250.0		0.0	TFR	false	ZOB_66	ZOB_66	CRJ7	CRJ7	41.98
ACA664	3233		700.0	33000.0	33000.0	ORD	YYZ	ORD./.POS	POSTSP.	. 415851N/0.	. POSTS		250.0	0.7679814	0.0	TFR	false	ZOB_66	ZOB_66	E170	E170	41.98
EGF3759	0		33000.0	33000.0	33000.0	ORD	YYZ	ORD./.POS	POSTSP.	. 420956N/0.	POSTS	285.70007	0.7679814	0.7679814	0.80304193	TFR	true	ZOB_66	ZOB_66	CRJ7	CRJ7	42.16
N599DP	0		33000.0	33000.0	33000.0	YXU	ILG	YXU./.PSB	PSBILG	414303N/0.	PSB	280.82324	0.7679814	0.7679814	0.790608	TFR	true	ZOB_79	ZOB_79	WW24	WW24	41.71
AAL90	0		33000.0	33000.0	33000.0	ORD	EGLL	ORD./.POS	YXU.J586	423206N/0.	YXU	274.0	0.77312505	0.77312505	0.77312505	TFR	true	ZOB_26	ZOB_26	B763	B763	42.53
AAL699	2251		700.0	33000.0	33000.0	ORD	EGLL	ORD./.POS	POSTSP.	. 415851N/0.	POSTS	0.0	250.0	0.77312505	0.0	TFR	false	ZOB_66	ZOB_66	B763	B763	41.98
TRS583	1210		100.0	34000.0	34000.0	BWI	GRR	BWI./.BUFF	BUFFR.J5.	391030N/0.	BUFFR	0.0	250.0	0.71780634	0.0	TFR	false	ZOB_66	ZOB_66	B712	B712	39.17
AJI9462	2886		1200.0	34000.0	34000.0	UNV	SWO	UNVAIRF	UNVAIR	405057N/0.	UNV	0.0	250.0	0.71780634	0.0	TFR	false	ZOB_66	ZOB_66	B732	B732	40.84
AWE1951	0		34000.0	34000.0	34000.0	BUF	CLT	BUF./.JHW	EWC.J14	410029N/0.	EWC	251.58502	0.72314525	0.72314525	0.7300322	TFR	true	ZOB_59	ZOB_59	B734	B734	41.00
SGB3805	3174		600.0	34000.0	34000.0	IAG	PBI	IAG./.PSB.J	PSB.J78.L	430626N/0.	PSB	0.0	191.256	0.72314525	0.0	TFR	false	ZOB_14	ZOB_14	B734	B734	43.10
COA1702	2569		0.0	34000.0	34000.0	EWR	SFO	EWR./.LAR	LARRI.J8	404133N/0.	. LARRI	0.0	250.0	0.728475	0.0	TFR	false	ZOB_66	ZOB_66	B738	B738	40.69
ACA797	0		34000.0	34000.0	34000.0	YUL	LAX	YUL./.SYR	SYR.J29.J.	432300N/0.	SYR	252.85619	0.728475	0.728475	0.73341316	TFR	true	ZOB_66	ZOB_66	A319	A319	43.38
ACA576	2813		0.0	34000.0	34000.0	YYZ	LAX	YYZ./.ANC	.ANCOL.Y.	. 434038N/0.	. ANCOL	0.0	250.0	0.728475	0.0	TFR	false	ZOB_66	ZOB_66	A319	A319	43.67
ACA799	0		11000.0	34000.0	34000.0	YY7	LAX	YYZ / ANC	ANCOL Y	432029N/0	ANCOL	246 1021	0 728475	0 728475	0 453047	TER	false	ZOB 66	ZOB 66	A319	A319	43.34

• The AC Table Editor displays the loaded traffic file as a spreadsheet and can be used as such.

• The columns of values can be arranged according to preference by clicking and dragging the heading cell of a column to its desired location. This is a useful feature as it is often helpful to group certain columns together for review.

of Z ×

# **AC Table Editor**

TONUS AC	Table Eultoi																
<u>F</u> ile Edit	Tools Help a	743/1 🗹 Pro	pagate Edit	ts C:\Experiment	s\Cor	ridors\MacsScenario	s\SimTraffic\Bl	L_High_S1.txt									
				call	sign		COA569										
				n	oute		KEEHO.J584.SLT.FQM1.EWR										
filedRou					oute	LAS./.KG720KC72QKEEH0.J584.SLT.FQM1.EWR						2					
				route/filedRoute	• ▼								Search				
callsign	timeToEnter	comment	altitude	callsign	(	deTargetdepartureA	destination	. filedRoute	route	startPointN	targetWayp	indicatedAir	speedTarget	cruiseSpeed	mach	flightRules	inMach
AAL1210	0		29000.0	route/filedRoute	þ	0.0 ORD	BOS	ORD./.POS	POSTSP	421200N/0	POSTS	269.9019	.73575485	0.73575485	0.6963478	TFR	true 🚽
TCF242	0		29000.0	comments	þ	0.0 CMH	LGA	CMH/.HL	HLGETG	. 400730N/0	HLG	273.1786	.7815279	0.7815279	0.70529145	TFR	true
SWA1043	0		31000.0	35000.0	3500	0.0 MDW	BUF	MDW./.EVO	EVOTEN	415539N/0	EVOTE	274.57928	.73575485	0.73575485	0.7489787	TFR	true
BTA2144	0	С	33000.0	35000.0	3500	0.0 CMH	EWR	CMHDJB	DORET.J	412700N/0	DORET	257.6433 0	.73846704	0.73846704	0.7308041	IFR	true 🚽
TRS894	0		33000.0	35000.0	3500	0.0 IND	LGA	IND./.ROD	IND./.ROD	401905N/0	PROTN	234.27844 (	.722157	0.722157	0.66934574	TFR	true
TCF5940	0	С	33000.0	35000.0	3500	0.0 ORD	LGA	ORD./.ADI	ADIMEG	415748N/0	ADIME	274.25797	.7815279	0.7815279	0.7626687	IFR	true
COA569	0		35000.0	35000.0	3500	0.0 LAS	EWR	LAS./.KG72	KEEHO.J5	. 415713N/0	KEEHO	248.0 0	.73575485	0.73575485	0.73575485	IFR	true
AAL1874	0		35000.0	35000.0	3500	0.0 DFW	EWR	DFW./.ROD	DJB.J29	411909N/0	DJB	254.0 0	.75199115	0.75199115	0.75199115	IFR	true
BTA2208	0		35000.0	35000.0	3500	0.0 MCI	EWR	MCI./.ROD	DORET.J	413051N/0	DORET	249.0 0	.73846704	0.73846704	0.73846704	IFR	true
																	1 I I I I I I I I I I I I I I I I I I I

• Selecting a single aircraft in the table will display its associated text in bold for reference.

• Its *callsign, route,* and *filedRoute* will be displayed in the respective text windows as shown.

•The *callsign, route, and filedRoute* can be edited from the upper windows without the need to do so in the individual table cells. (e.g. as a shortcut/quick access point)

•The AC Table Editor has a search function that allows the user to search the entire file for specific callsigns, certain strings within a route/filedRoute, or strings within comment entries.

# **AC Table Editor: Column Headings**

MEACS AC Table Editor										
<u>F</u> ile Ed	it T	ools Help 609/1 🗹 Propagate Edits	C:\AOL\MacsE	)atabase\settin						
callsign	1		filedRoute	timeToEnter :						
AAL012	3	sort	PHL./SNA	640						
AAL172	3	bring errors to top	BDL./STJ	0 4						
AAL282	3		ICO./MSP	1321 3						
AAL426	3	Set column to editable	LM./TUL	0 :						
AAL643	1	Set column to auto update	IDW./ATL	1360 4						
AAL672	3	Select column	DAK./BNA	0 3						
AAL681	3		TL./MLI	0 3						
AAL691	3	set selected ac to	SLC./.4000	0 4						
AAL770	2	and the second second	PHX./JFK	0 :						
AAL850	2	Do Arithmetic	CT./TEB	0 4						
AAL914	3	Fields that auto set altitude:	EWR./FOE	0 :						
AAL943	3		FO./CAE	276 3						
AAL966	3	☑ altitudeTarget	PDX./SDF	0 :						
ACA277	3	CruiseAltitude	AX./.3723	0 :						
ACA541	3	0000.0 0.100 00000.0	RNO./.382	0						

Each column has a fly-out menu that can be accessed by right clicking the column's heading cell.

Selecting each option will have the following results:

Sorts the file in ascending order of the column's values.

bring errors to top

sort

The editor has error checking for each field, with errors displayed in red text. Selecting this will bring all rows with errors in the selected column to the top.

Set column to editable

Changes made in other columns will not affect values in this column.

Set column to auto update

Changes made within an associated column will propagate to the column set to auto update. For example, setting the altitudeTarget or cruiseAltitude to 35000 will update the corresponding altitude cell to 35000.\*

set selected ac to

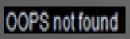
Sets the column value of all selected aircraft to the text box entry. \*Updates will only propagate if the "Propagate Edits" checkbox is checked

# **AC Table Editor: Error Checking**

MEACS ACT	Table Editor													
<u>File</u> Edit	Tools Help §	510/1 🗹 Prop	agate Edits											
						callsign 🦲					AWE758	1		
						route			ADI	ME. OOPS. GERBS J146.CXR. EWC	JST.BOJID1.PHL			
						filedRoute		ORD / ADIMEOOPSGERBS.J146.CXREWCJST.BOJID1.PHL						
					route/fi	ledRoute 🔻					J82	Sear	rch	
callsign	timeToEnter	comment	altitude	cruiseAltitude	altitudeT	arget departure Ai.	destination	filedRoute	rout	te startPointN targetWayp ind	dicatedAir speed	Target c	ruiseSpeed	
WJA2754	2402		0.0	39000.0	39000.0	YYZ	MYNN	YYZ./.THORLJHWPSB.J61.EDDYSDIWPANAL	THOR	L.J 434038N/0 THORL 0.0	0 220.04	54 0	.75937474	
CGWFM	2345		0.0	39000.0	39000.0	YYZ	TUPJ	YYZ./.THORLJHWPSB.J61.EDDYSECGOXANA	THOR			0	.80594355	
DAL1684	0	С	9327.153	39000.0	39000.0	MDW	BOS	MDW./.EVOTENELLSKEEHODKKALB.GDM3.B	EVOT	Set Selected Fields to Editable	B	0	.8117083	
EGF4017	1220		700.0	37000.0	37000.0	ORD	MDT	ORD / ADIME. GERBS. J146.CXR. EWC. HAR. MDT	ADIME	Set Selected Fields to Auto Up	odate	0	7533308	
AWE758	0	С	4588.936	39000.0	39000.0	ORD	PHL	ORD./.ADIMEOOPSGERBS.J146.CXREWCJST	A DUBRI	Cat Calcuted As to Clandard A	uto/Edit Ctatus	74 0	.75937474	
LOF7680	0	С	13785.956	33000.0	33000.0	ORD	MDT	ORD./.ADIMEGERBS.J146.CXR_EWC_HAR_MD1	ADIME	Set Selected Ac to Standard A	Auto/Ealt Status	76 0	72912776	
JZA993	539		600.0	35000.0	35000.0	STL	YYZ	STL/.FWA.CRL.J586.YXUTET(OOPS not found	FWA	Fix Selected Fields		0	.7815279	
DAL126	0	С	29000.0	35000.0	35000.0	MSP	JFK	MSP./.HASTEDAFLU.J70.LVZ.LENDY5.JFK	HAST			04 0	73846704	
UAL436	0	С	17000.0	39000.0	39000.0	MDW	BOS	MDW./.EVOTENELLSKEEHODKKALB.GDM3.B	EVOT	Fix Selected Editable Fields		3 0	8117083	
SWA448	0	С	4653.4053	39000.0	39000.0	MDW	PHL	MDW./.GIJ.J146.CXREWCJST.BOJID1.PHL	GIJ.J1	45 414701N/0 GIJ 18	30.10533 193.0	0	75937474	
DTACOCO	040	0	20000.0	22000.0	220000	000	HIDT	ODD LADINE OFODO MAR OVD EWO LAD NOT	ADULT	0 MEDEANIO ADULE 00	0.010 0.000	0	70040770	

AWE758 Each aircraft with an error in any field has its callsign highlighted.

#### **ORD./.ADIME.** Text in the field(s) containing errors are shown in red.



The filedRoute and route fields have tool tips displayed when hovered over that identify what is causing the specific error.

#### **Fix Selected Fields**

Selecting this option from the flyout menu will "fix" the error. Exercise some caution when using this feature as some changes may not reflect your intent.

### **AC Table Editor Features**

<u>F</u> ile	Edit Tools Help 609/1 🗹 Propagate Edits C	C:VAOL/Macs	Database\setti	n
	Undo			
	Redo			
	Duplicate Aircraft			
call	Delete Aircraft	edRoute	timeToEnter	I
AAL01		/ SNA	640	
AAL17	Crop Aircraft	/STJ	0	ŀ
AAL28	Select All Ac	O./MSP	1321	
AAL42		./TUL	0	
AAL64	Select Unselected Ac	W./ATL	1360	
AAL67	Select All Fields	K./BNA	0	
AAL68	Select All Ac and Fields	./MLI	0	
AAL69	Select Aircraft Now In Conflict	¢./.4000	. 0	
AAL77		K.IJFK	0	
AAL85	Select Aircraft Ever In Conflict	./TEB	0	
AAL91	Add Ac Flying Through Weather to Selection	R./FOE	0	
AAL94	Add to Selection with Rules	D.ICAE	276	
AAL96		K.ISDF	0	
ACA27	Select ac with AcFilter	./.3723	0	
ACA54	Set Selected Fields to Editable	0./.382	0	
ACA80		W./LIT	1077	
ADH19		N./DCA	1332	
ADH29	Set Selected Ac to Standard Auto/Edit Status	F./MCI	0	
ADH32	Fix up all ac	W./LEX	728	
ADH6	•	0./LSE	1213	1
ADH69	Bring Ac with Errors to Top	./JFK	0	
AEE03	Bring Selected Ac to the Top		0	1
	Fire Propagate Rules on Selected Ac			ŗ

MEACS AC	Table Editor					
<u>F</u> ile Edit	Tools Help	609/1 🗹 Proj	bagate Edits	C:\AOL\	MacsD	)atabase\sett
	Generate A	c Per Sector C	ount Data			
	Generate A	c Per Sector C	onflict Data			
	Number of	Conflicts Ever				
callsign	Jiggle Lat/L	ong by up to			oute	timeToEnter
AAL012	liggle Altitu	de by 2000 Fe	ot		SNA	640
AAL172		-			stj	0
AAL282	Jiggle Cruis	se Altitude by 2	000 Feet		MSP	1321
AAL426	Jiggle Spee	d			UL	0
AAL643					.ATL	1360
AAL672	Jiggle Aircr	aft in Time			BNA	0
AAL681	Move Aircra	aft			ILI	0
AAL691	Move ac on	to filed route			000	0
AAL770					JFK	0
AAL850	Auto Space	Aircraft by Tir	ne		EB	0
AAL914	Move Selec	ted Aircraft to	Departure Ai	rport	FOE	0
AAL943			-		CAE	276
AAL966	Delete Sele	cted Aircraft li	1 Conflict		SDF	0
ACA277	Decimate A	ircraft			723	0
ACA541	Try to Make	All Callsigns	Iniquo		382	0
ACA801	TTY to Make	All Callsigns	Jiiique		LIT	1077
ADH195	Selected A	Weather Inte	raction		DCA	1332
ADH294		······································			MCI	0
ADH321	Move AC W	ith Negative Ti	meroEnter		LEX	728
ADH664	38000.0	0.82	38000.0	MCO./.	LSE	1213
ADH693	35000.0	0.82	35000.0	LAX./	IFK	0
AFF076	32000.0	0.05	22000.0	MEM /		0

For the purposes of these slides, the Edit and Tools functions are too numerous to go into detail. It is recommended to simply try these out and get a feel for how the different options will best suit your needs.

The following slides cover a small selection of **frequently used features** in each of the menus.

Short sample activity/task to follow after I review a few of these.

### AC Table Editor: Select Edit Functions

MAA	25 AC	Table E	ditor							
<u>F</u> ile	Edit	Tools	Help	609/1 🛽	Propagate	Edits	C:\A	OL\MacsE	)atabase\setti	ing
	Und	0								
	Red	0								
	Dup	licate A	ircraft							
call	Dale	ete Airc	roft					edRoute	timeToEnter	
AL01								/SNA	640	3
AL17	Cro	p Aircra	ft					/STJ	0	4
AL28	Sele	ect All A	c					O./MSP	1321	3
AL42			-					./TUL	0	3
AL64		ect Unse	elected	AC				W./ATL	1360	4
AL67		ect All Fi	ields					K.IBNA	0	3
AL68	Sele	ect All A	c and I	Fields				/MLI	0	3
AL69	Solo	oct Airc	raft No	w In Co	oflict			C./.4000	0	4
AL77								K.IJFK	0	3
AL85	Sele	ect Airc	raft Eve	er in Co	nflict			.ITEB	0	4
AL91	Add	Ac Flyi	ng Thro	ough We	eather to Sel	ection		R./FOE	0	3
AL94	bbA	to Sele	ction v	vith Rule	26		•	D.ICAE	276	3
AL96								K.ISDF	0	3
CA27	Sele	ect ac w	lith Aci	liter				./.3723	0	3
CA54	Set	Selecte	d Field	s to Edi	table			0./.382	0	3
CA80	Sot	Selecte	d Fiold	e to Aut	to Update			W./LIT	1077	4
DH19								N./DCA	1332	3
DH2	Set	Selecte	d Ac to	o Standa	ard Auto/Edit	Status	S	F./MCI	0	3
DH32	Fix (	up all ac	;					W./LEX	728	3
		•						0./LSE		3
	Brin	g Ac wi	th Erro	ors to To	p			U.JFK	0	3
	Brin	g Selec	ted Ac	to the 1	Гор					
	Fire	Propag	ate Ru	les on S	Selected Ac					

Redo

Delete Aircraft

Crop Aircraft

Undo returns to the previous state prior to the last change. Redo reincorporates the previous change.

Duplicate Aircraft Makes exact duplicates of selected aircraft with the exception of new, unique callsigns. Can be performed on one or multiple selections.

Removes the selected aircraft from the scenario file.

Removes all non-selected aircraft. Only the selected aircraft remain following this action.

#### AC Table Editor: Select Tools Functions

MHACS AC Table Editor									
<u>F</u> ile Edit	Tools Help	o 609/1 🗹 Proj	pagate Edits	C:\AOL\	MacsE	)atabase\sett			
	Generate A	c Per Sector C	ount Data						
	Generate A	c Per Sector C	onflict Data						
	Number of	Conflicts Ever							
callsign	Jiggle Lat/	Long by up to			oute	timeToEnter			
AAL012					SNA	640			
AAL172	Jiggle Alut	ude by 2000 Fe	et		stj	0			
AAL282	Jiggle Crui	se Altitude by 2	2000 Feet		MSP	1321			
AAL426	Jiggle Spe	ed			UL	0			
AAL643					.ATL	1360			
AAL672	Jiggle Airc	raft in Time			BNA	0			
AAL681	Move Aircr	aft			ILI	0			
AAL691	Move ac or	nto filed route			000	0			
AAL770					JFK	0			
AAL850	Auto Space	e Aircraft by Tir	ne		EB	0			
AAL914	Move Sele	cted Aircraft to	Departure A	irport	FOE	0			
AAL943				· · ·	CAE	276			
AAL966	Delete Sele	ected Aircraft li	n Conflict		SDF	0			
ACA277	Decimate /	Aircraft			723	0			
ACA541	Try to Mak	e All Callsigns (	Inique		382	0			
ACA801	. I J CO III dK	o rai cuioigno (	aniquo		LIT	1077			
ADH195	Selected A	c Weather Inte	raction		DCA	1332			
ADH294		/ith Negative Ti	moToEnter		ICI	0			
ADH321	MOVE AC VI	nui negative Ti		_	LEX	728			
ADH664	38000.0	0.82	38000.0	MCO./.		1213			
ADH693	35000.0	0.82	35000.0	LAX./	IFK	0			
AFF076	32000 0	0.05	22000.0	MEM /		0			

Generate Ac Per Sector Count Data

Displays the predicted sector load counts based on the traffic. Requires the *Load Graph Window* to be properly setup and displayed.

Move Aircraft... Activates a pop-up window through which an aircraft's position can be moved forward or backward along its route according to a specified time (in seconds).

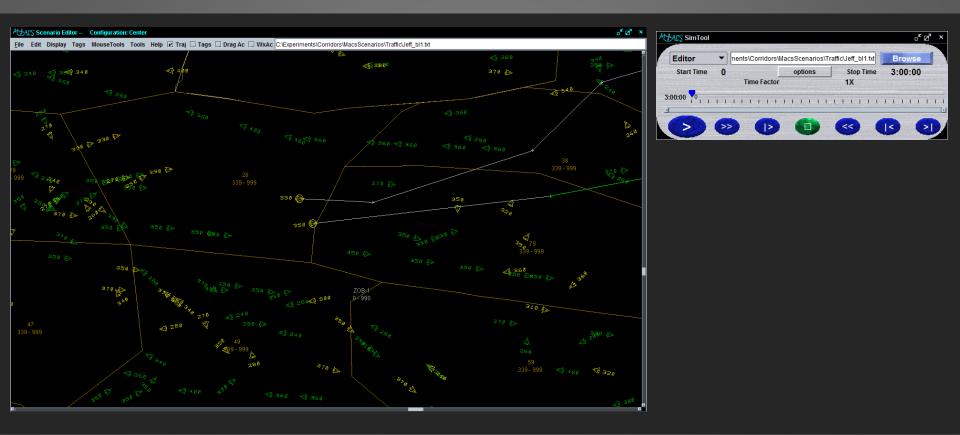
Move ac onto filed route

Occassionally changes can force an aircraft off of its route, which would mean it would be "free track" during the run. This feature attempts to place all selected aircraft back onto their route.

Decimate Aircraft ...

Activates a pop-up window through which the user can specify a percentage of the selected aircraft to remove from the file.

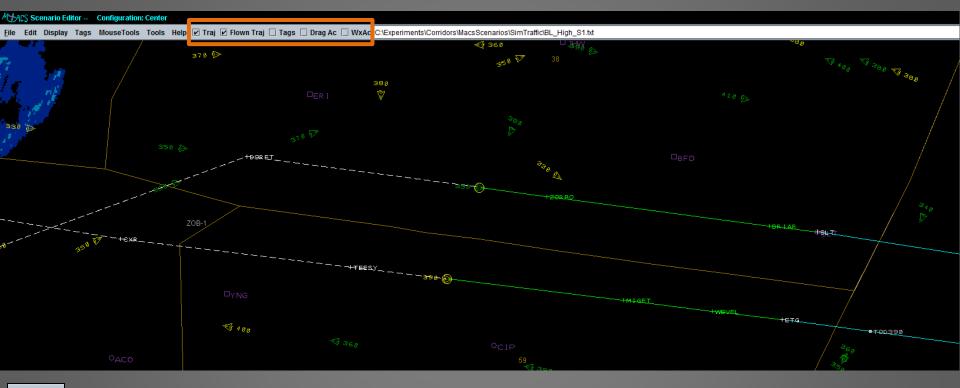
#### **Scenario Editor**



• The Scenario Editor allows the user to load and graphically manipulate aircraft within the file.

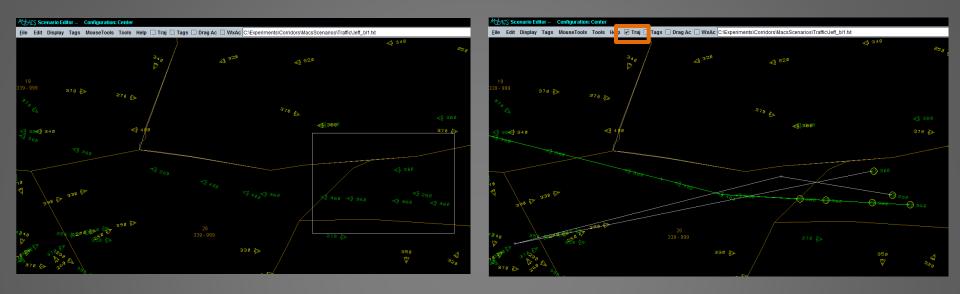
- It is often used in conjunction with the **SimTool**.
- Dragging the SimTool's time slider (while in Editor mode) will update the aircraft positions to reflect their predicted positions at the given time.

### Scenario Editor: Display



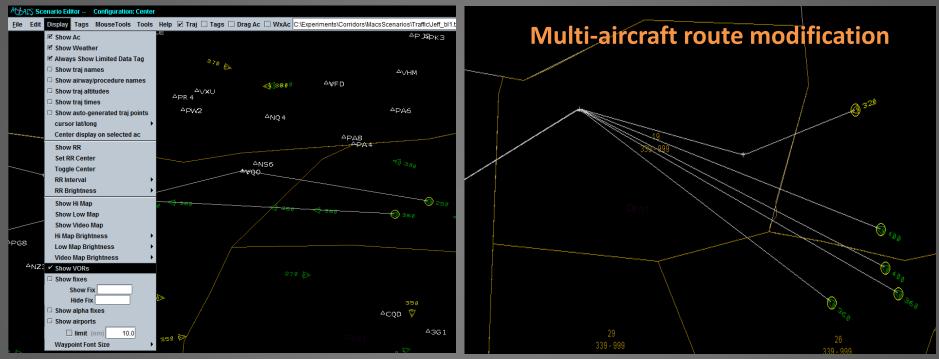
Traj Displays a solid line for the selected aircraft's trajectory to be flown from scenario start.
 Flown Traj Displays a dashed line for the "flown" portion of the selected aircraft's trajectory.
 Tags Displays the data tags for selected aircraft (dependent upon data tag rule settings).
 Drag Ac Allows aircraft to be dragged anywhere, regardless of route. Sets editor time to zero.
 WXAc Displays the points at which an aircraft will penetrate convective weather.

# **Scenario Editor: Aircraft Selection**



- Individual aircraft can be selected in the Scenario Editor by left-clicking on the target symbol.
- Multiple aircraft can be selected together by left-clicking and dragging a box around the desired aircraft (as shown on the left).
- To add aircraft to the selection, hold down the Shift key and left-click on the additional aircraft or draw another box.
- To remove aircraft from the selection, hold down the Shift key and left-click on the selected aircraft.
- Routes for selected aircraft can be displayed (see right panel) by selecting the Traj checkbox in the menu bar.

#### Scenario Editor: Route Modifications



• Aircraft routes can be modified by left-clicking anywhere along the route line and dragging the point to the desired location. Multiple routes can be modified by selecting overlapping/common points.

- If VORs or Fixes are not displayed, or if the point being moved is placed in an unnamed location, that point will be defined by a lat-long position.
- Dragging a point to a named location will snap it to the location and the name of the VOR or Fix will appear in the aircraft's route.
- To display named locations, (un)check the Show VORs or Show Fixes boxes in the Display menu.
- To remove a point on the route simply right-click the point.

# **Scenario Editor: Aircraft Properties**

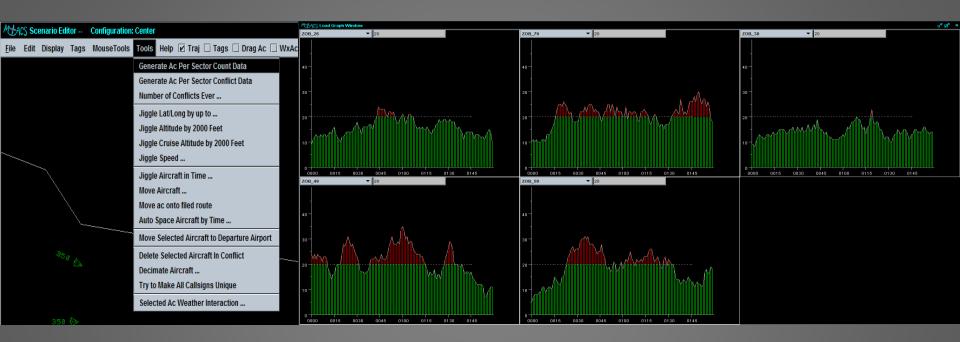


- Right-clicking on an individual aircraft will open a flyout menu.
- The menu options displayed can be updated through additional menu options by dwelling the mouse pointer over the desired field.



- The position of one or more selected aircraft can be moved forward or backward along the route by navigating to the **Tools** menu and selecting *Move Aircraft...*
- The desired time and direction can be entered into the resulting window.
- A shortcut is to select the aircraft and then hit any number between 1-9 and it will move forward that number of seconds \* 100 (e.g., 5 = 500 seconds). To move backward, hold the Ctrl key down while pressing the number.

## Scenario Editor: Load Assessment



The traffic loads for particular sectors can be viewed through the Load Graph Window.
To display the window: in MACS' main menu bar navigate to Windows → Analysis Views → and select Load Graph Window.

• The sectors to view in the Load Graph and the specifications for the window must first be defined in the traffic load setup file.

• To view the loads, in the AC Table Editor or Scenario Editor select *Generate AC Per Sector Count Data* in the **Tools** dropdown menu as shown above.

# **Going Forward**

- The preceding slides covered a small subset of the scenario development capabilities available in MACS.
- The best way to learn is to just try out the different tools and develop your own style and strategy.
- The scenario development tools are a work in progress. Let us know of serious errors that you uncover or any ideas for improvement that you may have.

# **Final Note**

Scenario development is an iterative process. Using the editing and development tools offline only gets you part of the way to the final product. It is critical to play the scenarios in Simulation mode, in real-time, in exactly the same way that the final study will be conducted. There are always differences that arise due to a variety of reasons that will only be noticeable when doing so.

# Hands-on Sample Activity

Create a new flight AAL123 from PHL to MSP via PSB, YNG, GRR at cruise alt 36,000

- duplicate SWA1790, in "callsign" column rename to AAL123
- In "filedRoute" column, change from "PHL./.PSB.j60.IOW..LBF..DEN" into "PHL./..PSB..YNG..GRR..MSP" (press enter)
  - Auto propagation updates "route" and "destination"
  - Note change in displayed route in Scenario Editor
- Change "filedRoute" to avoid sector 26.
  - Insert "CLE" between "YNG" and "GRR"

# Hands-on Sample Activity

#### Change the cruise altitude

- Set "altitude" and "altitudeTarget" columns to "auto update"
- Change "cruiseAltitude" to 36000

#### Start just before sector 59

- Tools -> Move Aircraft ...
  - Uncheck change to timetoEnter
- Move aircraft backward by 700 seconds
  - Note the plane travel backwards along the dashed line

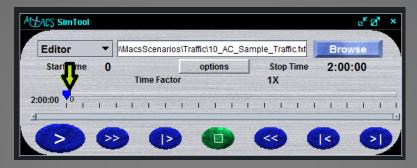
#### YOU TRY:

New plane AAL999, PHL to MSP, start just before sector 79 (go via 79 and 26), altitude 34000

# Hands-on Sample Activity

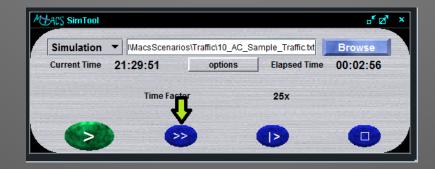
#### View the traffic

 In "Editor Mode" drag the scenario editor time slider note: observe the Scenario Editor display



#### DON'T FORGET TO SAVE BETWEEN SWITCHING FROM EDITOR TO SIMULATION MODE

 In "Simulation Mode" play in real or accelerated times note: observe in the DSR or TSD air traffic controller displays





# Generating Convective Weather with the Convective Weather Editor

#### Chris Cabrall Slides by Matt Mainini



### Outline

- What is the goal?
- What is the Convective Weather Editor?
- What are the capabilities and assumptions of the Weather Editor?
- What is the general process?
- Overview of Convective Weather Editor features

# What is the goal?

The main goal of the Convective Weather Editor is to generate realistic convective weather to display on the DSR or TSD in which the operator may view and interact with.

#### What is the Convective Weather Editor?

The Convective Weather Editor is a tool within MACS that enables the user to sequentially combine convective weather images that appear as realistic weather formations in real time.

# What are the capabilities and assumptions of the Weather Editor?

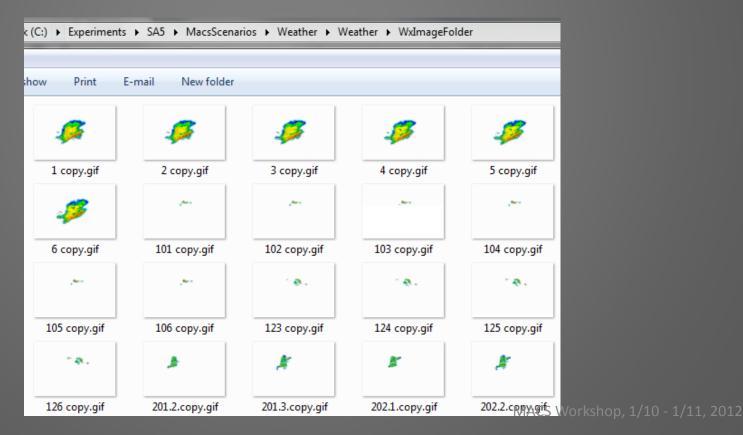
- Capabilities
  - Generate realistic weather cells
  - Multiple simultaneous weather cells
  - Weather looping
  - Predicted future weather
  - Displayed on DSR and/or TSD
  - Weather probe
- Assumptions
  - Weather images have been prepared for MACS read-in
  - The general location, size, direction, and number of cells have been considered

#### The process of generating MACS weather

- The basic process
  - Weather images are captured from NOAA
  - Images are prepared for MACS with Photoshop
  - Images are loaded in Convective Weather Editor window
  - Images, or "patterns," are stitched together and edited in time, or "steps," to create morphing convective weather cells, or "paths"
  - The "paths" are saved as an .xml and are played back as realistic weather cells on the DSR or TSD

# **Relevant Files/Folders**

- Wx Image folder
   C:\Experiments\SA5\MacsScenarios\Weather\Weather\WxImageFolder\
- WX\_TAG\_SM\_MODE file
   C:\Experiments\SA5\MacsSetup\WX\_TAG\_SM\_MODE.xml



#### Setup the Weather Editing Environment

• Open MACS in developer-lite mode

(e.g. with the Example\_ZOB "developer.bat" file)

• Places MACS into "editor" mode

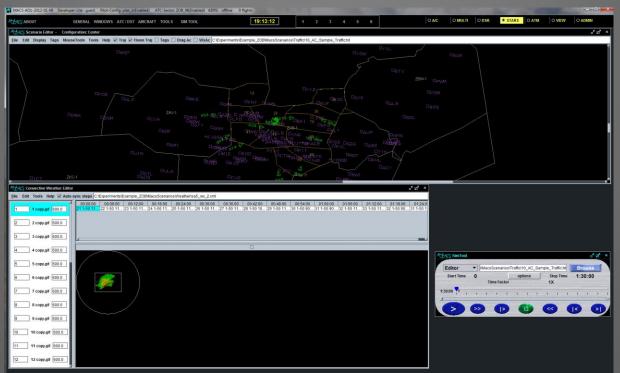
(i.e. not "simulation" or "playback" mode)

- Go to Windows/Setup Panels/Weather -> "Wx Selection tab" and check the box next to "Convective Weather"
- Press "Browse/Load" button, find, and select the sa5\_wx\_2.xml file
  - C:/Experiments/Example\_ZOB/MacsScenarios/Weather/sa5\_wx\_2.xml

M	ACS Weather def	⊿ <b>™</b> ×
<u>F</u> ile	Address C:\Experiments\SA5\MacsSetup\corridors.weather	
	ENVIRONMENT       FLIGHT DECK FORECAST       ATC FORECAST       Wx Selection         File type       Image: Convective Weather       Image: WX_TAG_SM_MODE       Image: BROWSE/LOAD	

#### Setup the Weather Editing Environment

- Open the "STARS" tab and on it place:
- Windows\Scenario Editor\Scenario Editor
- Windows\Scenario Editor\Convective Weather Editor
- SimTool

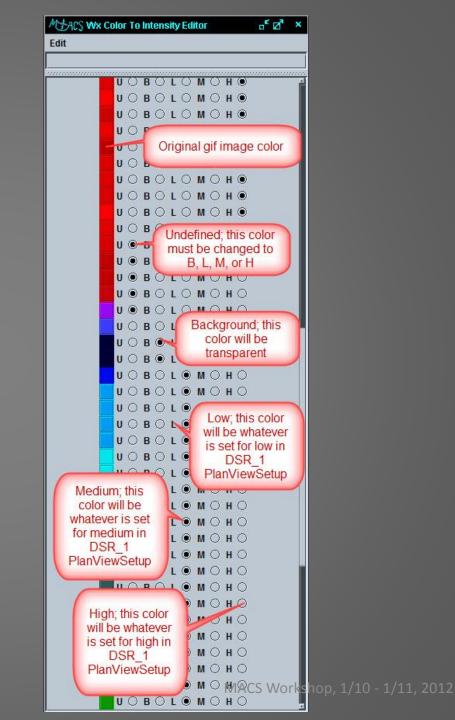


#### Setup the Weather Editing Environment

- Ensure weather viewing on various ATC station displays is turned "on" Windows\Setup Panels\DSR\_1\DSR\_1 PlanViewSetup Windows\Setup Panels\TSD\_1\TSD\_1 PlanViewSetup Windows\Setup Panels\Scenario\_Editor PlanViewSetup
- Can display different levels (low, medium, high) in different colors on different displays

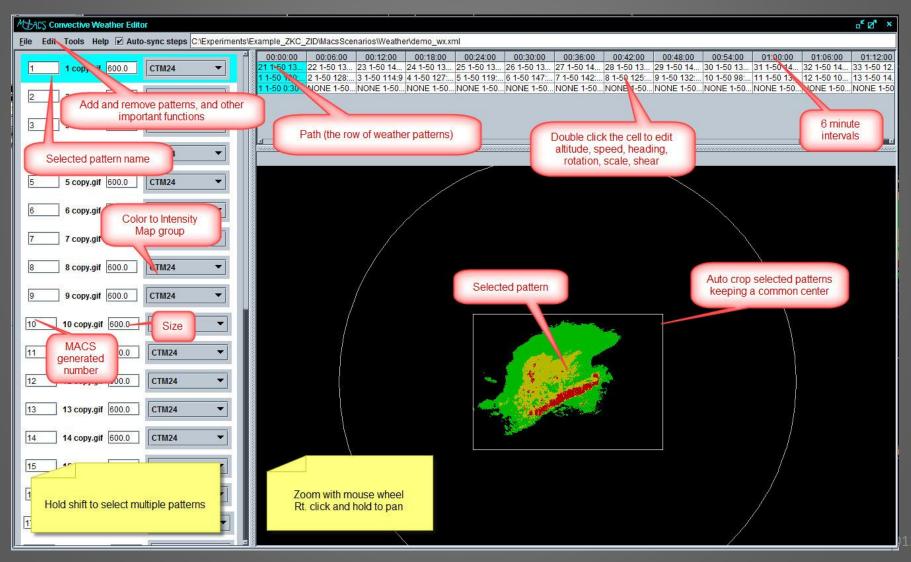
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Eile Address C:Experiments\SA5MacsSetupIdefault.TSD_1_planView		
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Low 🗹 💻 (0, 255, 0) Medium 🗹 🧰 (255, 255, 0) High 🗹 📻 (255, 0, 0)	🗌 Display Altitude (ft)	30000.0

# Wx Color to Intensity Editor



#### **Convective Weather Editor**

Windows\Scenario Editor\Convective Weather Editor

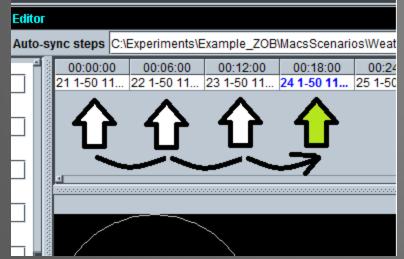


Extend the weather pattern for another half hour, have it continue to move eastward , but die out.

- Save the .xml weather file with new name
  - Convective Weather Editor "File -> Save as ..."
    - Note: the folder location where it's being saved
  - Save as "SampleWxActivity.xml" under C:/Experiments/Example\_ZOB/MacsScenarios/Weather/
    - Note: the file name may have changed when browsing.
- Change the length from 1.5 to 2 hrs
  - Convective Weather Editor "Edit -> Edit Properties"
  - Change number of steps from 15 to 20, press "OK"

Review each "step" (cell) in the "path" (row) in the Convective Weather Editor

- In order from left to right, left click each "step"
  - Note: the time slider advances on the Sim Tool
  - Note: the planes advance in the Scenario Editor
  - Note: the "pattern" (image) changes in the Convective Weather Editor; also note the "names" of each pattern

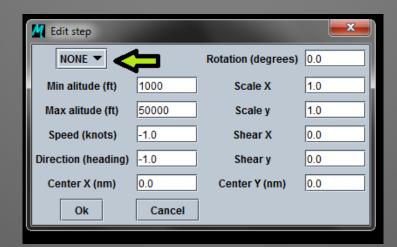


01:30:00	01:36:00	01:42:00	01:48:00	01:54:00
 NONE 1-50	NONE 1-50	NONE 1-50	NONE 1-50	NONE 1-50

Note: we have not yet loaded "patterns" into the newly created last 5 "steps" of the "path"

Load pattern "30" into the 01:30:00 step

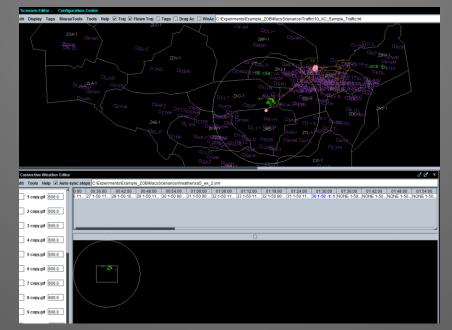
- Double left click on the "step" (cell) beneath "01:30:00" column heading
  - Note: the "edit step" window opens
- Click the pattern selection drop down box (it is currently set to "none") and select pattern "30" and press OK



Compare the loaded pattern "30" at 01:30:00 with the previous step loaded pattern "31" at 01:24:00

- Note: the location of the white circle (boundaries) and pink dot (center) of each step
- Note: the Scenario Editor white circle corresponds to the Convective Weather Editor white circle...
- In the scenario editor, left click the pink dot "center" of the 01:30:00 pattern and drag it up near to the other step's

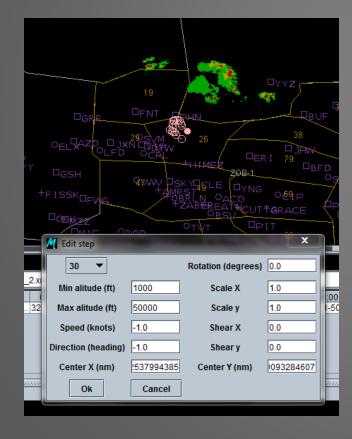
centers

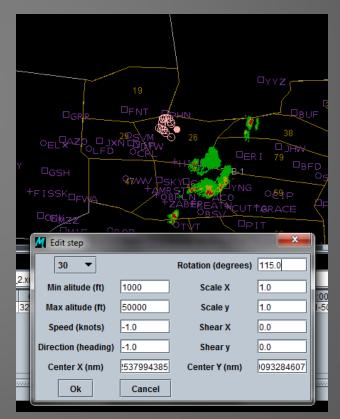


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Note: the rotation is "off" in regards to the previous steps, with the weather to the north of the dot and not to the south-east...

 Double left click the 01:30:00 step in the Convective Weather Editor table to open the Edit step window, and enter "115.0" for the pattern image "Rotation (degrees)" setting





With the initial placement (center/pink dot) and rotation of the pattern image set for the step at 01:30:00, now update its direction and speed of travel for how it is to progress across its 6 minute time slot.

• Double left click the 01:30:00 step in the Convective Weather Editor table to open the Edit step window, and enter "10.0" for Speed (knots) and enter 90.0 for Direction (heading), and press OK

🛃 Edit step			×
31 🔻		Rotation (degrees)	115.0
Min alitude (ft)	1000	Scale X	1.0
Max alitude (ft)	50000	Scale y	1.0
Speed (knots)	10.0	Shear X	0.0
Direction (heading)	90.0	Shear y	0.0
Center X (nm)	915527344	Center Y (nm)	318.0
Ok	Cancel		

Continue with the last 4 time slots to fill the remaining steps with patterns "29", "28", "27", and "26"

- Double-click the desired step in the Convective Weather Editor
- Use the "Edit Step" window's pull-down menu to select the desired pattern
- Left click on pink dot in Scenario editor to move the center of the pattern rotate
- Adjust rotation, speed, heading settings under "Edit Step" window

#### Other things to try:

- Re-scale the pattern image in each progressive step to "reduce" the weather so it gets smaller and "dies out" in this last half-hour
- Choose or create and place in new pattern images with less severity (less red, more green, etc.)

### Other Important Menu Options

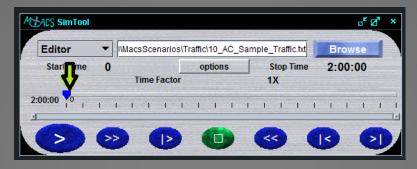
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i I			
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			Cancel

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Duplicate Selected Patterns	
Delete Selected Patterns	
Move Selected Pattern Up	
Move Selected Pattern Down	
Rename All Patterns	
Autocrop Selected Patterns	
Autocrop Selected Patterns Keeping a	Common Center
Undo Crop on Selected Patterns	
Reset Zoom and Pan	
Select All Steps in Selected Paths	
Move Selected Steps	
Delete Selected Paths	
Edit properties	

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Medium 🗹 🧰 (0, 153, 153) High 🗹 🛑 (255, 0, 0)									Altitude (ft)	30000.0		
Draw weather AutoResolver bounding polygons									Knots per pixel	2.0		
			Loop	r	Use Fut	ure Colors 🗹				pixel spacing	50	
			Start time (min)	-30		Low						
			End time (min)	30		Medium						
			Speed up factor	450.0		High 🗔						
			Pause time (sec)	2	Weather Pro	be Motion 🖲						
			Update frequency	6 min 🔻	Weather Disp	lay Motion $\bigcirc$						
1.:												

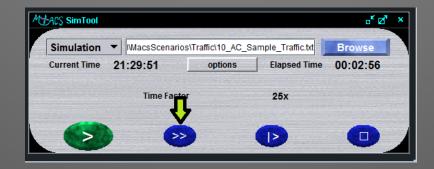
#### View the weather

 In "Editor Mode" drag the scenario editor time slider note: observe the Scenario Editor display



#### DON'T FORGET TO SAVE BETWEEN SWITCHING FROM EDITOR TO SIMULATION MODE

 In "Simulation Mode" play in real or accelerated times note: observe in the DSR or TSD air traffic controller displays



#### **Contacts and References**

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Related guides on the MACS wiki:

Traffic generation:

https://aol1.arc.nasa.gov:8443/display/macs/Scenario+Editor+User+Guide

Convective weather generation:

https://aol1.arc.nasa.gov:8443/display/macs/Weather+1+-+Overview+and+how+to+create+weather+patterns+to+be+loaded+in+MACS

https://aol1.arc.nasa.gov:8443/display/macs/Weather+2+-+How+to+Photoshop+weather+images+prior+to+MACS

https://aol1.arc.nasa.gov:8443/display/macs/Weather+3+-+How+to+use+the+MACS+Convective+Weather+Editor