APPENDIX C Validation & Confidence Building

Emerging-State Actor Model (E-SAM)

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# A-1 Introduction

E-SAM contains fifteen sectors, split between the strategic architecture and world model. The sectors are listed in Table XX.

Table 1: Sector list of E-SAM

|  |  |
| --- | --- |
| Strategic Architecture Sector | World Model Sector |
| AFV, IFV & Artillery | Ethnographic Perceptions |
| Combatant Recruiting & Losses | Ethnographic Side-Choosing & Actor Legitimacy |
| Expenses | Expenses |
| Foreign Intervention OpOrder Allocations | OpOrder Impacts on World |
| Govrenance | Resistance & Uprising |
| OpOrder Allocations | Revenue |
| Resource Stocks | SFS Combat Simulator |
| Revenue | Territory Dynamics |

Each Sector of this appendix is covered first by an overview diagram of the subsystem structure and interactions with other sectors. Then all the equations for that sector are presented. After all sectors are covered a section will provide the two command scripts necessary to replicate Baseline Historical and Baseline without Intervention. A final section will include the starting values of all variables. This should be sufficient to replicate the information found in the articles. Other Appendices for E-SAM:

Appendix B: Discussion of Structure & Parameterization

This appendix provides more detailed discussion of the structure, formulation and parametrization approach of select portions of the model. Due to length and other considerations it is available only upon request by contacting the author tbclancy@wpi.edu.

Appendix C: Validation & Confidence Building Tests

This appendix provides full documentation on validation and confidence building tests performed on the model. Included are boundary adequacy, structure assessment, dimensional consistency, parameter assessment, extreme condition, integration error, behavior reproduction, behavior anomaly, family member test, surprise behavior, sensitivity analysis, and system improvement tests.

Appendix D: User Manual for E-SAM

This appendix provides a stand-alone proposed user-manual for use of E-SAM in wargaming and military planning scenarios. It includes an overview of how to set the scenarios, determine Theatre Strategy, and execute Operational Orders. Also includes a glossary of term linked to current US military doctrine sources.

# A-2: Strategic Architecture Sectors & Equations

## AFV, IFV & Artillery

### Sector Overview

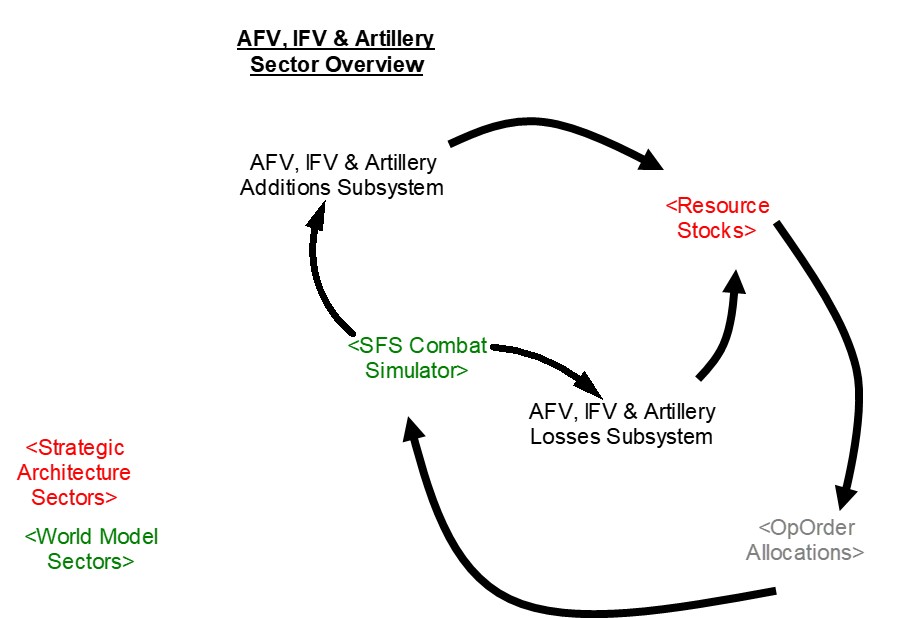


Figure 1: AFV, IFV & Artillery Sector

### Equations

AFV and IFV Additions[Actors] = ( AFV and IFV Scavenged[Red] / Time to Repair and Operate[

Actors] ) + AFV and IFV Purchases[Actors]

Units: Pieces/Period

AFV and IFV Losses[Actors] = AFV and IFV Lossses in Battle[Actors] + AFV and IFV Lost due to Maintenance[

Actors]

Units: Pieces/Period

AFV and IFV Lossses in Battle[Red] = Red AFV and IFV Final Losses[Red] / NORMAL PERIOD

AFV and IFV Lossses in Battle[Green] = Green AFV Final Losses[Green] / NORMAL PERIOD

Units: Pieces/Period

AFV and IFV Lost due to Maintenance[Actors] = 0, 0

Units: Pieces/Period

AFV and IFV Purchases[Green] = GAME( 0 )

AFV and IFV Purchases[Red] = 0

Units: Pieces/Period

Not used in current model. In the current model ISIS can only

scavenge AFV/IFV and cannot acquire heavy weapons.

AFV and IFV Scavenged[Red] = ( ( ( Green HW Initial Losses[Green] ) \* Scavenging Rate of Heavy Weapons

) + ( ( Green Artillery Initial Losses[Green] ) \* Scavenging Rate of Heavy Weapons

) )

Units: Pieces

Artillery Additions[Actors] = Artillery Purchases[Actors]

Units: Pieces/Period

Artillery Losses[Actors] = Artillery Losses in Battle[Actors] + Artillery Lost due to Maintenance[

Actors]

Units: Pieces/Period

Artillery Losses in Battle[Green] = Green Artillery Final Losses[Green] / NORMAL PERIOD

Artillery Losses in Battle[Red] = 0

Units: Pieces/Period

Artillery Lost due to Maintenance[Actors] = 0, 0

Units: Pieces/Period

Artillery Purchases[Green] = GAME( 0 )

Artillery Purchases[Red] = 0

Units: Pieces/Period

Green AFV Final Losses[Actors] = ( Green HW Initial Losses[Actors] - ( Green HW Initial Losses[

Actors] \* HW Recovery ) )

Units: Pieces

Green Artillery Final Losses[Actors] = ( Green Artillery Initial Losses[Actors]

- ( Green Artillery Initial Losses[Actors] \* HW Recovery ) )

Units: Pieces

NORMAL PERIOD = 1

Units: Period

Red AFV and IFV Final Losses[Actors] = ( Red HW Initial Losses[Actors] - ( Red HW Initial Losses[

Actors] \* HW Recovery ) )

Units: Pieces

Time to Repair and Operate[Actors] = 1

Units: Period

## Combatant Recruiting & Losses

### Overview

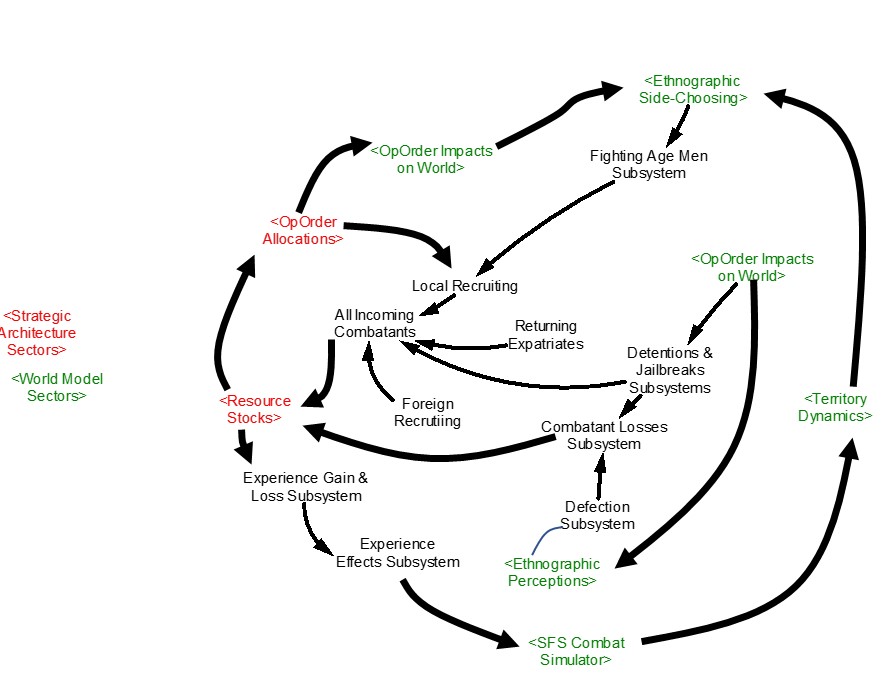


Figure 2: Combatant Recruiting & Losses Sector

### Equations

Actor Combatants that are Foreign[Ethnographies,Actors] = INTEG( Chng in Troop Composition[

Ethnographies,Actors] , Local vs Foreign Forces[Ethnographies,Actors]

)

Units: Pct

Actor Infantry Actual Losses[Green] = Green Infantry Final Losses[Green] - ( Opposition Combatant Losses[

Green] ) - Blue or Purple Combatant Losses[Green]

Actor Infantry Actual Losses[Red] = Red Infantry Final Losses[Red] - ( Opposition Combatant Losses[

Red] ) - Blue or Purple Combatant Losses[Red]

Units: People/Period

Actor Perception of Momentum[Green] = Perception of Momentum[Green] - Perception of Momentum[

Red]

Actor Perception of Momentum[Red] = Perception of Momentum[Red] - Perception of Momentum[

Green]

Units: Pct/Period

Actual Governed Local Recruiting[Ethnographies,Actors] = ( Target Recruitment Governed[

Ethnographies,Actors] ) \* FAM Modifier for Governed[Ethnographies,Actors]

Units: People/Period

Actual Local Calculated Recruiting[Ethnographies,Actors] = Target Recruitment Calculated Legit[

Ethnographies,Actors] \* FAM Modifier for Calc Legit[Ethnographies,Actors]

Units: People/Period

Actual Recruiting Fighting Age Men in Population[Ethnographies,Actors] = ( STARTING NORMAL PCT OF FIGHTING AGE MEN IN POPULATION[

Ethnographies] \* ( 1 + Experience Effect on Actions[Actors] ) )

Units: Pct

The ethnographic norm +capability of the actor based on experience.

Actual Recruits per Suicide Attack[Actors] = GAME( NORMAL FOREIGN RECRUITS INSPIRED PER TERRORIST ATTACK[

Actors] \* Effect of Experience on Recruiting Efforts[Actors] \* Effect of Remaining Recruits on Recruiting Efforts[

Actors] )

Units: People/Military Action

Adequacy of Calc Legit FAM[Ethnographies,Actors] = ZIDZ ( CoFlow Fighting Age Men from Calculated Legitimacy[

Ethnographies,Actors] / NORMAL PERIOD , Target Recruitment Calculated Legit[

Ethnographies,Actors] )

Units: Dmnl

Adequacy of Governed FAM[Ethnographies,Actors] = ZIDZ ( CoFlow Fighting Age Men from Governed[

Ethnographies,Actors] / NORMAL PERIOD , Target Recruitment Governed[Ethnographies

,Actors] )

Units: Pct

ZIDZ(Target Recruitment Governed[Ethnographies,Actors],CoFlow

Fighting Age Men from Governed[Ethnographies,Actors])

All Decreases in Calc FAM[Ethnographies,Actors] = Cal Legit Pop Dying[Ethnographies

,Actors] + Calc Legit Refugees Leaving[Ethnographies,Actors] + Calculated Lost to Conquest[

Ethnographies,Actors] + Calculated to Governed[Ethnographies,Actors]

+ Calculated to Governed[Ethnographies,Actors]

Units: People/Period

All Decreases in Governed Fam[Ethnographies,Actors] = ( Governed Dying[Ethnographies

,Actors] + Governed Lost to Conquest[Ethnographies,Actors] + Governed Refugees Leaving[

Ethnographies,Actors] + Governed to Calculated[Ethnographies,Actors]

) \* Actual Recruiting Fighting Age Men in Population[Ethnographies,Actors]

Units: People/Period

All Increases in Calc FAM[Ethnographies,Actors] = Coerced to Calculated[Ethnographies

,Actors] + Governed to Calculated[Ethnographies,Actors] + Local Opposition Joining Opposing Actor Militants[

Ethnographies,Actors] + Unaligned Choosing Sides[Ethnographies,Actors

]

Units: People/Period

All Increases in Governed FAM[Ethnographies,Actors] = Calculated to Governed[Ethnographies

,Actors] \* Actual Recruiting Fighting Age Men in Population[Ethnographies,

Actors]

Units: People/Period

Allocation of Essential Budgets[Actors] = Table for Effect of Sufficiency of Reserves on Essentials Bankruptcy Policy[

Actors] ( ZIDZ ( Finances[Actors] , Normal Actor Desired Local Reserves[Actors

] ) )

Units: Dmnl

Average Combatant Experience[Actors] = ZIDZ ( Combatant Experience[Actors] , Total Combatants[

Actors] )

Units: Exp Years/Person

Average Time to Defect[Actors] = 10

Units: Periods

AVG EXPERIENCE OF ESCAPED DETAINEE[Actors] = 0, 10

Units: Exp Years/Person

Set at 10 need actual vaule to finish.

AVG EXPERIENCE OF FOREIGN RECRUIT[Actors] = 1

Units: Exp Years/Person

Set at 1 update for final.

AVG EXPERIENCE OF LOCAL RECRUIT[Actors] = 3

Units: Exp Years/Person

Set at 3 update for final.

Blue or Purple Combat Training Effect[Actors] = MIN ( 1, ZIDZ ( Normal Training Reach[

Actors] \* Blue or Purple Embedded Combat Advisers[Actors] , Conventional Warfare[

Actors] ) )

Units: Pct

Blue or Purple Personnel[Actors] = INTEG( Increase in Blue Personnel[Actors] - Decrease in Blue Personnel[

Actors] , Starting Blue or Purple Personnel[Actors] )

Units: People

Cal Legit Pop Dying[Ethnographies,Actors] = Calc Legit Pop Deaths[Ethnographies,

Actors]

Units: People/Period

Calc Legit Pop[Ethnographies,Actors] = INTEG( Coerced to Calculated[Ethnographies

,Actors] + Governed to Calculated[Ethnographies,Actors] + Unaligned Choosing Sides[

Ethnographies,Actors] - Cal Legit Pop Dying[Ethnographies,Actors

] - Calc Legit Pop Recruited or Joining Uprising[Ethnographies,Actors

] - Calc Legit Refugees Leaving[Ethnographies,Actors] - Calculated Lost to Conquest[

Ethnographies,Actors] - Calculated to Coerced[Ethnographies,Actors

] - Calculated to Governed[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION CALCULATED[Ethnographies

,Actors] )

Units: People

Calc Legit Pop Recruited or Joining Uprising[Ethnographies,Actors] = Calc Legit Recruited[

Ethnographies,Actors]

Units: People/Period

Calc Legit Recruited[Ethnographies,Actors] = Actual Local Calculated Recruiting[

Ethnographies,Actors]

Units: People/Period

Actual Governed Local Recruiting[Ethnographies,Actors]\*"Pct Calc

Legit Fighting Age Men (Red)"[Ethnographies,Actors]

Calc Legit Refugees Leaving[Ethnographies,Actors] = Calc Legit Pop Refugees[Ethnographies

,Actors]

Units: People/Period

Calculated Lost to Conquest[Ethnographies,Actors] = Loss of CalcLegit due to Conquest[

Ethnographies,Actors] \* Ethno by Actor Sufficiency[Ethnographies,Actors]

Units: People/Period

Calculated to Coerced[Ethnographies,Actors] = MAX ( 0, ( Calc Legit Pop[Ethnographies

,Actors] \* Fr Transition to Coerced[Ethnographies,Actors] ) / NORMAL TIME FOR POPULATION TRANSITION[

Ethnographies,Actors] )

Units: People/Period

Calculated to Governed[Ethnographies,Actors] = MAX ( 0, ( Calc Legit Pop[Ethnographies

,Actors] \* Fr Transition to Legitimacy[Ethnographies,Actors] ) / NORMAL TIME FOR POPULATION TRANSITION[

Ethnographies,Actors] )

Units: People/Period

Chng in Troop Composition[Ethnographies,Actors] = ( Local vs Foreign Forces[Ethnographies

,Actors] - Actor Combatants that are Foreign[Ethnographies,Actors] ) / Perception Formation Time[

Ethnographies]

Units: Pct/Period

Coerced to Calculated[Ethnographies,Actors] = MAX ( 0, ( Coerced Pop[Ethnographies

,Actors] \* Fr Transition to Calculated Legitimatcy[Ethnographies,Actors

] ) / NORMAL TIME FOR POPULATION TRANSITION[Ethnographies,Actors

] )

Units: People/Period

CoFlow Fighting Age Men from Calculated Legitimacy[Ethnographies,Actors] = INTEG(

Increase in FA Calc Legit[Ethnographies,Actors] - Decrease in FA Calc Legit[

Ethnographies,Actors] , Calc Legit Pop[Ethnographies,Actors] \* Actual Recruiting Fighting Age Men in Population[

Ethnographies,Actors] )

Units: People

CoFlow Fighting Age Men from Governed[Ethnographies,Actors] = INTEG( Increase in FAM Governed[

Ethnographies,Actors] - Decrease in FAM Governed[Ethnographies,Actors

] , Governed Pop[Ethnographies,Actors] \* Actual Recruiting Fighting Age Men in Population[

Ethnographies,Actors] )

Units: People

Combat Multiplier[Actors] = 1 + ( Combat Multiplier from Experience[Actors] + SCENARIO MORALE EFFECT[

Red] + Blue or Purple Combat Training Effect[Actors] )

Units: Dmnl

Combat Multiplier from Experience[Actors] = Table for Effect of Experience on Combat Multiplier[

Actors] ( Average Combatant Experience[Actors] \* Dimensioned Ratio Average Militant Experience[

Actors] )

Units: Dmnl

Combatant Experience[Actors] = INTEG( Gain in Experience[Actors] - Loss of Experience[

Actors] , Starting Experience[Actors] )

Units: Exp Years

Combatant Experience Gain[Actors] = ( Total Combatants[Actors] \* ( NORMAL EXPERIENCE GAINED PER PERSON[

Actors] + Experience Gained from Blue or Purple Training[Actors] ) )

/ NORMAL PERIOD

Units: Exp Years/Period

Combatants[Ethnographies,Actors] = INTEG( Combatant Additions[Ethnographies,Actors

] - Combatant Losses[Ethnographies,Actors] , Starting Combatants[Ethnographies

,Actors] )

Units: People

Completed Terrorist Attacks by Ethnography[Ethnographies,Red] = Terrorist Attempts[

Ethnographies,Red] \* ( 1 - CT Effectiveness[Green] )

Completed Terrorist Attacks by Ethnography[Ethnographies,Green] = Terrorist Attempts[

Ethnographies,Green] \* ( 1 - CT Effectiveness[Red] )

Units: Military Actions/Period

CT Effectiveness[Green] = Table for CT Effectiveness ( Effective CounterTerrorism Efforts[

Green] )

CT Effectiveness[Red] = Table for CT Effectiveness ( Effective CounterTerrorism Efforts[

Red] )

Units: Dmnl

Table for CT Effectiveness(1-ZIDZ (SUM(Terrorist

Attempts[Ethnographies!,Red]),Effective CounterTerrorism

Efforts[Green]) )

Cumm Combatant Deaths by Actor[Actors] = INTEG( Increase in Cumm Combatant Deaths by Actor[

Actors] , 0)

Units: People

Deaths[Actors] = ( Actor Infantry Actual Losses[Actors] \* PCT OF LOSSES THAT ARE DEATH[

Actors] ) + Deaths from CT Operations[Actors] + Deaths from Thwarted Prison Breaks[

Actors]

Units: People/Period

(Red Infantry Final Losses[Red]\*PCT OF LOSSES THAT ARE

DEATH[Red])/Time to Realize Losses+ Deaths from CT

Operations[Red]+Deaths from Thwarted Prison Breaks[Red]

Deaths from CT Operations[Actors] = Normal Deaths per Thwarted Action[Actors] \*

Thwarted Terrorist Attacks[Actors]

Units: People/Period

Deaths from Thwarted Prison Breaks[Actors] = Normal Deaths per Thwarted Action[Actors

] \* Thwarted Prison Break Actions[Actors]

Units: People/Period

Decrease in FA Calc Legit[Ethnographies,Actors] = MIN ( FAM Calc Decrease[Ethnographies

,Actors] , CoFlow Fighting Age Men from Calculated Legitimacy[Ethnographies

,Actors] / NORMAL PERIOD )

Units: People/Period

Decrease in FAM Governed[Ethnographies,Actors] = MIN ( FAM Gov Decrease[Ethnographies

,Actors] , CoFlow Fighting Age Men from Governed[Ethnographies,Actors

] / NORMAL PERIOD )

Units: People/Period

Defections by Ethnography[Ethnographies,Actors] = ( NORMAL DEFECTIONS DUE TO ETHNOGRAPHIC DISTRUST[

Ethnographies,Actors] + NORMAL DEFECTIONS DUE TO PAY INSUFFICIENCY[Actors]

+ Normal Defections from Momentum[Ethnographies,Red] ) \* Combatants[Ethnographies

,Actors]

Units: People/Period

Defections within Prison[Actors] = ( ( ( 1 - Detention Benefits Gap[Actors] ) /

Average Time to Defect[Actors] ) \* Detainees in Prison[Actors] ) + Detainees in Prison[

Actors] \* Prison Defections Based on Momentum[Actors]

Units: People/Period

Detainees from CT Operations[Actors] = Normal Detainees per Thwarted Action[Actors

] \* Thwarted Terrorist Attacks[Actors]

Units: People/Period

Detainees from Thwarted Prison Breaks[Actors] = Normal Detainees per Thwarted Action[

Actors] \* Thwarted Prison Break Actions[Actors]

Units: People/Period

Detainees in Prison[Actors] = INTEG( Increase in Detentions[Actors] - Defections within Prison[

Actors] - Detainees Released[Actors] - Defections within Prison[

Actors] , STARTING DETAINEES BY ACTOR[Actors] )

Units: People

Detainees Released[Actors] = ( Ratio of Prisons Targeted versus Prisons[Actors]

\* Detainees in Prison[Actors] ) / NORMAL PERIOD

Units: People/Period

Detention Benefits Gap[Actors] = ZIDZ ( Detention Benefits[Actors] , ( Detainees in Prison[

Actors] \* Wages[Actors] ) )

Units: Pct

Detentions[Actors] = ( Actor Infantry Actual Losses[Actors] \* PCT OF LOSSES THAT ARE DETENTIONS[

Actors] ) + Detainees from CT Operations[Actors] + Detainees from Thwarted Prison Breaks[

Actors]

Units: People/Period

(Red Infantry Final Losses[Red]\*PCT OF LOSSES THAT ARE

DETENTIONS[Red])/Time to Realize Losses+ Detainees from CT

Operations[Red]+Detainees from Thwarted Prison Breaks[Red]

Dimensioned Ratio Average Militant Experience[Actors] = 1, 1

Units: Person/Exp Years

Effect of Experience on Recruiting Efforts[Actors] = Table for Effect of Militant Experience on Foreign Recruiting Efforts

( Average Combatant Experience[Actors] \* Dimensioned Ratio Average Militant Experience[

Actors] )

Units: Dmnl

Estimated parameter from data or nearby model structure see Appendix

B for discussion.

Effect of Remaining Recruits on Recruiting Efforts[Actors] = Table for Effect of Remaining Recruits on Recruiting Efforts

( Pct Remaining Recruits[Actors] )

Units: Dmnl

Estimated parameter from data or nearby model structure see Appendix

B for discussion.

EFfective Prison Break Actions[Green] = MAX ( 0, Prison Break Actions[Green] - (

Prison Duty Actions[Red] \* CT Effectiveness[Red] ) )

EFfective Prison Break Actions[Red] = MAX ( 0, Prison Break Actions[Red] - ( Prison Duty Actions[

Green] \* CT Effectiveness[Green] ) )

Units: Military Actions/Period

Escaped Detainees by Ethnography[Ethnographies,Actors] = Pct Combatants by Ethnography[

Ethnographies,Actors] \* Escaped Detainees Joining Actor[Actors]

Units: People/Period

Escaped Detainees Joining Actor[Actors] = Detainees Released[Actors] \* Percentage of Escaped or Released Detainees Joining ISIS[

Actors]

Units: People/Period

Exp Years per Pct Training[Actors] = 1

Units: Exp Years/(Pct\*Person)

Expatriate Fighters[Actors] = INTEG( - Expatriate Fighters Returning[Actors] , Starting Actor Conditions Expatriate Fighters[

Actors] )

Units: People

Expatriate Fighters by Ethnography[Ethnographies,Actors] = Expatriate Fighters Returning[

Actors] \* Pct Combatants by Ethnography[Ethnographies,Actors]

Units: People/Period

Expatriate Fighters Returning[Actors] = Expatriate Fighters[Actors] \* Fraction Returning per Period[

Actors]

Units: People/Period

Experience Effect on Actions[Actors] = Table for Effect of Militant Experience on Military Actions

( Average Combatant Experience[Actors] \* Dimensioned Ratio Average Militant Experience[

Actors] ) \* Allocation of Essential Budgets[Actors]

Units: Pct

Derived from AQI implied local recruiting patterns. Estimated

parameter from data or nearby model structure see Appendix B for

discussion.

Experience Gain from Foreign Fighters[Actors] = AVG EXPERIENCE OF FOREIGN RECRUIT[

Actors] \* Foreign Fighter Increase[Actors]

Units: Exp Years/Period

Experience gain from Joining Combatants[Actors] = ( AVG EXPERIENCE OF ESCAPED DETAINEE[

Actors] \* Escaped Detainees Joining Actor[Actors] ) + ( Experience Gain from Foreign Fighters[

Actors] ) + ( ( SUM ( Actual Governed Local Recruiting[Ethnographies!

,Actors] ) ) \* AVG EXPERIENCE OF LOCAL RECRUIT[Actors] )

Units: Exp Years/Period

Experience Gained from Blue or Purple Training[Actors] = Blue or Purple Combat Training Effect[

Actors] \* Exp Years per Pct Training[Actors]

Units: Exp Years/Person

FAM Calc Decrease[Ethnographies,Actors] = MAX ( 0, ( All Decreases in Calc FAM[Ethnographies

,Actors] \* Actual Recruiting Fighting Age Men in Population[Ethnographies

,Actors] ) + Actual Local Calculated Recruiting[Ethnographies,Actors

] )

Units: People/Period

FAM Calc Increase[Ethnographies,Actors] = MAX ( 0, All Increases in Calc FAM[Ethnographies

,Actors] \* Actual Recruiting Fighting Age Men in Population[Ethnographies

,Actors] )

Units: People/Period

FAM Gov Decrease[Ethnographies,Actors] = Actual Governed Local Recruiting[Ethnographies

,Actors] + All Decreases in Governed Fam[Ethnographies,Actors]

Units: People/Period

FAM Gov Increase[Ethnographies,Actors] = All Increases in Governed FAM[Ethnographies

,Actors]

Units: People/Period

FAM Modifier for Calc Legit[Ethnographies,Actors] = Table for Effect of Remaining Recruits on Recruiting Efforts

( Adequacy of Calc Legit FAM[Ethnographies,Actors] )

Units: Dmnl

FAM Modifier for Governed[Ethnographies,Actors] = Table for Effect of Remaining Recruits on Recruiting Efforts

( Adequacy of Governed FAM[Ethnographies,Actors] )

Units: Pct

Foreign Fighter Increase[Actors] = Foreign Recruiting[Actors]

Units: People/Period

Foreign Recruiting[Actors] = ( ( Actual Recruits per Suicide Attack[Actors] \* (

SUM ( Completed Terrorist Attacks by Ethnography[Ethnographies!,Actors

] ) ) ) \* Foreign Recruiting Eliminated[Actors] ) \* Allocation of Essential Budgets[

Actors]

Units: People/Period

Foreign Recruiting Eliminated[Actors] = 0, 1

Units: Dmnl

Normal is 1. 0 means foreign recruiting is completely eliminated.

Fraction Returning per Period[Actors] = 0, 0.55

Units: Pct/Period

Governed Dying[Ethnographies,Actors] = Goverened Deaths[Ethnographies,Actors]

Units: People/Period

Governed Lost to Conquest[Ethnographies,Actors] = Loss of Governed due to Conquest[

Ethnographies,Actors] \* Ethno by Actor Sufficiency[Ethnographies,Actors]

Units: People/Period

Governed Pop[Ethnographies,Actors] = INTEG( Calculated to Governed[Ethnographies

,Actors] - Governed Dying[Ethnographies,Actors] - Governed Lost to Conquest[

Ethnographies,Actors] - Governed Pop Recruited[Ethnographies,Actors

] - Governed Refugees Leaving[Ethnographies,Actors] - Governed to Calculated[

Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION GOVERNED[Ethnographies,Actors

] )

Units: People

Governed Recruited[Ethnographies,Actors] = Actual Governed Local Recruiting[Ethnographies

,Actors]

Units: People/Period

Governed Refugees Leaving[Ethnographies,Actors] = Governed Refugees[Ethnographies

,Actors]

Units: People/Period

Governed to Calculated[Ethnographies,Actors] = MAX ( 0, ( Governed Pop[Ethnographies

,Actors] \* Fr Transition Back to Calculated[Ethnographies,Actors] ) /

NORMAL TIME FOR POPULATION TRANSITION[Ethnographies,Actors] )

Units: People/Period

"Governance Gap (Red)"[Ethnographies,Actors]/NORMAL TIME FOR

POPULATION TRANSITION[Ethnographies,Actors]

Green Infantry Final Losses[Green] = ( Green Infantry Initial Losses[Green] - (

Green Infantry Initial Losses[Green] \* Infantry Recovery[Green] ) ) /

NORMAL PERIOD

Units: People/Period

Incoming Combatants[Ethnographies,Actors] = INTEG( Rate of Incoming Combatants[Ethnographies

,Actors] , 0)

Units: People

Increase in Cumm Combatant Deaths by Actor[Actors] = Deaths[Actors]

Units: People/Period

Increase in Detentions[Actors] = Detentions[Actors]

Units: People/Period

Increase in FA Calc Legit[Ethnographies,Actors] = FAM Calc Increase[Ethnographies

,Actors]

Units: People/Period

Increase in FAM Governed[Ethnographies,Actors] = FAM Gov Increase[Ethnographies,

Actors]

Units: People/Period

Inflow of Foreign Recruits[Actors] = Foreign Recruiting[Actors]

Units: People/Period

Inflow of Foreign Recruits by Ethnography[Ethnographies,Actors] = Inflow of Foreign Recruits[

Actors] \* Pct Combatants by Ethnography[Ethnographies,Actors]

Units: People/Period

Killed Militants Total = INTEG( Rate of Militant Deaths Total , 0)

Units: People

Adjust initial level based on starting time of model.

Local Opposition Joining Opposing Actor Militants[Ethnographies,Actors] = MAX (

0, ( Local Opposition Fighters to Actor[Ethnographies,Actors] \* Normal Fraction Joining Opposing Actor or Militias[

Ethnographies] ) ) / NORMAL PERIOD

Units: People/Period

Local Recrutiing[Ethnographies,Actors] = Calc Legit Recruited[Ethnographies,Actors

] + Governed Recruited[Ethnographies,Actors]

Units: People/Period

Local vs Foreign Forces[Ethnographies,Actors] = 1 - ZIDZ ( Combatants[Ethnographies

,Actors] , Blue or Purple Personnel[Actors] + Total Combatants[Actors

] )

Units: Percentage

"Loss of all Combatants from Deaths, Detentions and Defections"[Actors] = Deaths[

Actors] + Total Defections[Actors] + Detentions[Actors]

Units: People/Period

"Loss of Foreign Combatants by Deaths, Detentions and Defections"[Actors] = Pct of Combatants that are Foreign[

Actors] \* "Loss of all Combatants from Deaths, Detentions and Defections"[

Actors]

Units: People/Period

Loss of Local Combatants by Ethnography[Ethnographies,Actors] = "Loss of Local Combatants from Deaths, Detentions and Defections"[

Actors] \* Pct Combatants by Ethnography[Ethnographies,Actors]

Units: People/Period

"Loss of Local Combatants from Deaths, Detentions and Defections"[Actors] = "Loss of all Combatants from Deaths, Detentions and Defections"[

Actors] - "Loss of Foreign Combatants by Deaths, Detentions and Defections"[

Actors]

Units: People/Period

MILITARY ACTIONS NEEDED PER PRISON BREAK ATTEMPT = 1

Units: Military Actions/(Period\*Prison)

1

Normal Deaths per Thwarted Action[Actors] = 11, 2

Units: People/Military Action

NORMAL DEFECTIONS DUE TO ETHNOGRAPHIC DISTRUST[Ethnographies,Actors] = ( 1 - Pct views Actor as best choice for now[

Ethnographies,Actors] ) / Average Time to Defect[Actors]

Units: Pct/Period

See Appendix B for discussion.

NORMAL DEFECTIONS DUE TO PAY INSUFFICIENCY[Actors] = ( 1 - Payroll Gap[Actors] )

/ Average Time to Defect[Actors]

Units: Pct/Period

Normal Defections from Momentum[Ethnographies,Red] = IF THEN ELSE ( Actor Perception of Momentum[

Red] < 0, - ( Actor Perception of Momentum[Red] ) , 0)

Units: Pct/Period

Normal Detainees per Thwarted Action[Actors] = 0, 2

Units: People/Military Action

NORMAL EXPERIENCE GAINED PER PERSON[Actors] = 0, 0.5

Units: Exp Years/Person

Represents training effect. 1 = an effective year of professional

training. Conscripts with effectively no training gain 0 per period

where as partly trained troops may earn .5.

NORMAL FOREIGN RECRUITS INSPIRED PER TERRORIST ATTACK[Actors] = 0, 26

Units: People/Military Action

Estimated 18-26 recruits per suicide attack that is then

propogandized. This may represent higher end of a nonlinear curve

based on media proficiency. Estimated parameter from data or nearby

model structure see Appendix B for discussion.

NORMAL NUMBER OF DETAINEES PER PRISON = 50

Units: People/Prison

NORMAL PERIOD = 1

Units: Period

NORMAL RECRUITS PER MILITARY ACTION FOR CALCULATED[Ethnographies,Red] = 15, 15,

15

NORMAL RECRUITS PER MILITARY ACTION FOR CALCULATED[Ethnographies,Green] = 10, 10

, 10

Units: People/Military Action

NORMAL RECRUITS PER MILITARY ACTION FOR GOVERNED[Ethnographies,Red] = 20, 2, 2

NORMAL RECRUITS PER MILITARY ACTION FOR GOVERNED[Ethnographies,Green] = 5, 25, 5

Units: People/Military Action

Estimate needs verification.

Normal Starting Worldwide Population[Actors] = 0, 50000

Units: People

Number of Prisons Targeted[Actors] = EFfective Prison Break Actions[Actors] / MILITARY ACTIONS NEEDED PER PRISON BREAK ATTEMPT

Units: Prisons

Payroll Gap[Actors] = ZIDZ ( Payroll[Actors] , ( Total Combatants[Actors] \* Wages[

Actors] ) )

Units: Pct

Pct Combatants by Ethnography[Ethnographies,Actors] = ZIDZ ( Combatants[Ethnographies

,Actors] , Total Local Combatants[Actors] )

Units: Pct

Pct of Combatants that are Foreign[Actors] = ZIDZ ( Foreign Combatants[Actors] ,

Total Combatants[Actors] )

Units: Pct

PCT OF LOSSES THAT ARE DEATH[Actors] = 1, 0.43

Units: Fraction

Derived from research need to finalize.

PCT OF LOSSES THAT ARE DETENTIONS[Actors] = 0, 0.57

Units: Pct

Derived from research. Need to confirm with causal factors.

Pct Remaining Recruits[Actors] = 1 - ZIDZ ( Total Foreign Recruits[Actors] , STARTING WORLDWIDE POPULATION OF FOREIGN RECRUITS[

Actors] )

Units: Percentage

Estimated parameter from data or nearby model structure see Appendix

B for discussion.

Pct views Actor as best choice for now[Ethnographies,Actors] = IF THEN ELSE ( Ethnographic Short Term Perception of Actor[

Ethnographies,Actors] < 0, 0, MAX ( 0, MIN ( 1, ZIDZ ( Ethnographic Short Term Perception of Actor[

Ethnographies,Actors] , Total Ethno Population[Ethnographies

] ) ) ) )

Units: Pct

Percentage of Escaped or Released Detainees Joining ISIS[Actors] = 1

Units: Fraction

Set at 1 check estiamte for final.

Perception Formation Time[Ethnographies] = 1

Units: Period

Prison Break Actions[Actors] = Actual Military Actions[Actors] \* OpOrder Prison Breaks[

Actors]

Units: Military Actions/Period

Prison Defections Based on Momentum[Actors] = IF THEN ELSE ( Actor Perception of Momentum[

Actors] < 0, - ( Actor Perception of Momentum[Actors] ) \* 2, 0)

Units: Pct/Period

Prison Duty Actions[Actors] = Actual Military Actions[Actors] \* OpOrder Prison Duty[

Actors]

Units: Military Actions/Period

Prisons to Target[Actors] = Detainees in Prison[Actors] / NORMAL NUMBER OF DETAINEES PER PRISON

Units: Prisons

Rate of Incoming Combatants[Ethnographies,Red] = ( Actual Local Calculated Recruiting[

Ethnographies,Red] + Actual Governed Local Recruiting[Ethnographies,Red] +

Escaped Detainees by Ethnography[Ethnographies,Red] + Local Opposition Joining Opposing Actor Militants[

Ethnographies,Green] + Inflow of Foreign Recruits by Ethnography[Ethnographies

,Red] + Expatriate Fighters by Ethnography[Ethnographies,Red] + Test Extreme Conditions Combatants[

Ethnographies,Red] )

Rate of Incoming Combatants[Ethnographies,Green] = ( Actual Local Calculated Recruiting[

Ethnographies,Green] + Actual Governed Local Recruiting[Ethnographies,Green

] + Escaped Detainees by Ethnography[Ethnographies,Green] + Local Opposition Joining Opposing Actor Militants[

Ethnographies,Red] + Expatriate Fighters by Ethnography[Ethnographies

,Green] + Inflow of Foreign Recruits by Ethnography[Ethnographies,Green

] + Test Extreme Conditions Combatants[Ethnographies,Green] )

Units: People/Period

Rate of Militant Deaths Total = SUM ( Deaths[Actors!] )

Units: People/Period

Rate of Recruiting to Actor[Actors] = Foreign Recruiting[Actors]

Units: People/Period

Ratio of Prisons Targeted versus Prisons[Actors] = MIN ( ZIDZ ( Prisons to Target[

Actors] , Prisons to Target[Actors] ) , MAX ( 0, ZIDZ ( Prisons to Target[

Actors] , Number of Prisons Targeted[Actors] ) ) )

Units: Pct

MIN(ZIDZ(Prisons to Target[Actors],Prisons to

Target[Actors]),MAX(0,ZIDZ(Prisons to Target[Actors],Number of

Prisons Targeted[Actors])))

Recruiting Actions[Ethnographies,Actors] = Actual Military Actions[Actors] \* OpOrder Recruiting[

Ethnographies,Actors]

Units: Military Actions/Period

Red Infantry Final Losses[Red] = ( Red Infantry Initial Losses[Red] - ( Red Infantry Initial Losses[

Red] \* Infantry Recovery[Red] ) ) / NORMAL PERIOD

Units: People/Period

SCENARIO MORALE EFFECT[Actors] = 0, 0.125

Units: Dmnl

Starting Actor Conditions Expatriate Fighters[Actors] = 0, 0

Units: People

STARTING DETAINEES BY ACTOR[Actors] = 0, 1500

Units: People

Determines starting value of detainees by actor.

STARTING WORLDWIDE POPULATION OF FOREIGN RECRUITS[Actors] = GAME( Normal Starting Worldwide Population[

Actors] )

Units: People

Estimated parameter from data or nearby model structure see Appendix

B for discussion.

Table for Effect of Experience on Combat Multiplier[Actors] ( [(0,-0.3)-(10,1)],

(0,-0.25),(0.5,-0.125),(1,0),(1.5,0.125),(2,0.25),(2.5,0.5),(3,0.75)

,(10,0.75) )

Units: Dmnl

Table for Effect of Militant Experience on Foreign Recruiting Efforts ( [(0,0)-(10,2)

],(0,0.5),(1,0.75),(2,0.9),(3,1),(4,1.25),(5,1.5),(10,1.5) )

Units: Dmnl

Estimated parameter from data or nearby model structure see Appendix

B for discussion.

Table for Effect of Militant Experience on Military Actions ( [(0,0)-(10,0.3)],(0,0.01)

,(1,0.03),(2,0.06),(3,0.09),(4,0.11),(5,0.12),(10,0.12) )

Units: Dmnl

Estimated parameter from data or nearby model structure see Appendix

B for discussion.

Table for Effect of Remaining Recruits on Recruiting Efforts ( [(0,0)-(1,1)],(0,0)

,(0.01,0),(0.03,0),(0.05,0),(0.1,0.0125),(0.2,0.025),(0.3,0.05),(0.4,0.1)

,(0.5,0.2),(0.6,0.35),(0.7,0.65),(0.8,0.85),(0.9,0.95),(0.95,0.975),

(0.97,0.985),(0.99,0.99),(1,1) )

Units: Dmnl

Parameter is based on modeler assumption, see Appendix B for

discussion.

[(0,0)-(1,1)],(0,1),(0.1,0.95),(0.2,0.85),(0.3,0.65),(0.4,0.35),(0.5,0

.2),(0.6,0.1),(0.7,0.05),(0.8,0.025),(0.9,0.0125),(0.95,0),(0.97,0),(0

.99,0),(1,0),(1,0),(2,0),(10,0)

Target Recruitment Calculated Legit[Ethnographies,Actors] = ( NORMAL RECRUITS PER MILITARY ACTION FOR CALCULATED[

Ethnographies,Actors] \* Recruiting Actions[Ethnographies,Actors] )

Units: People/Period

Target Recruitment Governed[Ethnographies,Actors] = ( NORMAL RECRUITS PER MILITARY ACTION FOR GOVERNED[

Ethnographies,Actors] \* Recruiting Actions[Ethnographies,Actors] )

Units: People/Period

Test Extreme Conditions Combatants[Ethnographies,Actors] = GAME( 0 )

Units: People/Period

Thwarted Prison Break Actions[Actors] = Prison Break Actions[Actors] - EFfective Prison Break Actions[

Actors]

Units: Military Actions/Period

Total Combatants[Actors] = Total Local Combatants[Actors] + Foreign Combatants[Actors

]

Units: People

Total Defections[Actors] = SUM ( Defections by Ethnography[Ethnographies!,Actors

] )

Units: People/Period

Total Experience Loss due to Militant Losses[Actors] = ( Average Combatant Experience[

Actors] \* "Loss of all Combatants from Deaths, Detentions and Defections"[

Actors] )

Units: Exp Years/Period

Total Foreign Recruits[Actors] = INTEG( Inflow of Foreign Recruits[Actors] , 0)

Units: People

Total Local Recruiting[Ethnographies,Actors] = INTEG( Local Recrutiing[Ethnographies

,Actors] , 0)

Units: People

Unaligned Choosing Sides[Ethnographies,Green] = Unaligned to Calculated[Ethnographies

,Red]

Unaligned Choosing Sides[Ethnographies,Red] = Unaligned to Calculated[Ethnographies

,Green]

Units: People/Period

Worldwide Recruitable Population[Actors] = INTEG( - Rate of Recruiting to Actor[

Actors] , STARTING WORLDWIDE POPULATION OF FOREIGN RECRUITS[Actors] )

Units: People

## Governance

### Overview

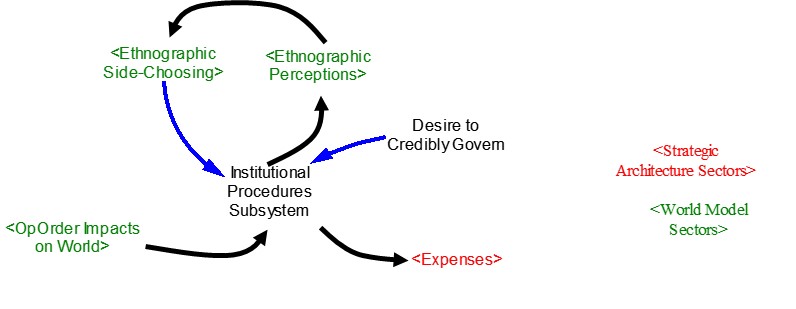


Figure 3: Governance Sector Overview

### Equations

Increase in Institutional Procedures[Ethnographies,Actors] = MAX ( 0, ( Organic Procedures[

Ethnographies,Actors] + Procedural Development[Ethnographies,Actors]

+ Replacing Obsolete Procedures[Ethnographies,Actors] + Impact of Armed Civil Affairs[

Actors] ) )

Units: Procedures/Period

MAX(0,(Adj to Procedural Spend[Actors]\*Organic

Procedures[Ethnographies,Actors])+ (Adj to Procedural

Spend[Actors]\*Procedural Development[Ethnographies,Actors])+ (Adj to

Procedural Spend[Actors]\*Replacing Obsolete

Procedures[Ethnographies,Actors]))

Institutional Procedures[Ethnographies,Actors] = INTEG( Increase in Institutional Procedures[

Ethnographies,Actors] - Procedural Decay[Ethnographies,Actors] - Reduction in Institutional Procedures[

Ethnographies,Actors] , Desired Institutional Procedures[Ethnographies

,Actors] + Legacy Procedures Step Test[Ethnographies,Red] )

Units: Procedures

Organic Procedural Development[Ethnographies,Actors] = Table for Effect of Procedural Adequacy[

Actors] ( Procedural Adequacy[Ethnographies,Actors] )

Units: Pct

Organic Procedures[Ethnographies,Actors] = MAX ( 0, ( ( ( Institutional Procedures[

Ethnographies,Actors] / 100) \* Organic Procedural Development[Ethnographies

,Actors] ) \* "Allocation of Non-Essential Budgets"[Actors] ) / ORGANIC PROCEDURAL DEVELOPMENT TIME[

Actors] )

Units: Procedures/Period

Procedural Adequacy[Ethnographies,Actors] = ZIDZ ( Institutional Procedures[Ethnographies

,Actors] , Desired Institutional Procedures[Ethnographies,Actors] )

Units: Pct

Procedural Decay[Ethnographies,Actors] = MAX ( 0, ( Institutional Procedures[Ethnographies

,Actors] / Normal Procedural Decay Fraction ) )

Units: Procedures/Period

Procedural Development[Ethnographies,Actors] = ( ( Desired Institutional Procedures[

Ethnographies,Actors] / Normal Procedural Development Time[Actors] ) - ( Institutional Procedures[

Ethnographies,Actors] / Normal Procedural Development Time[Actors] )

) \* "Allocation of Non-Essential Budgets"[Actors]

Units: Procedures/Period

Actual Desire to Credibly Govern[Ethnographies,Actors] = GAME( Normal Desire to Credibly Govern[

Ethnographies,Actors] )

Units: Pct

Actual Effect of Kinetic Attacks on Governing Capacity[Actors] = Effect of Kinetic Attacks on Governing Capacity[

Actors]

Units: Procedures/Period

IF THEN ELSE(Effect of Kinetic Attacks on Governing

Capacity[Actors]>SUM(Institutional

Procedures[Ethnographies!,Actors]), 0 , Effect of Kinetic Attacks on

Governing Capacity[Actors] )

"Allocation of Non-Essential Budgets"[Actors] = Table for Effect of Sufficiency of Reserves on Essentials Bankruptcy Policy[

Actors] ( ZIDZ ( Finances[Actors] \* Level of Reserves at Which NonEssentials Begin to Be Cut[

Actors] , ( Normal Actor Desired Local Reserves[Actors] \* Reserves Multiplier to Determine NonEssentials Cut Off Level

) ) )

Units: Dmnl

Armed Civil Affairs[Actors] = Actual Military Actions[Actors] \* OpOrder Armed Civil Affairs[

Actors]

Units: Military Actions/Period

Blue or Purple Armed Civil Affairs[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Armed Civil Affairs[Actors]

Units: Military Actions/Period

Blue or Purple Sorties Targeting Government Capacity[Actors] = Blue or Purple Sorties Per Period[

Actors] \* Blue or Purple Airpower Targeting Government Capacity[Actors]

Units: Sorties/Period

Calc Legit Pop[Ethnographies,Actors] = INTEG( Coerced to Calculated[Ethnographies

,Actors] + Governed to Calculated[Ethnographies,Actors] + Unaligned Choosing Sides[

Ethnographies,Actors] - Cal Legit Pop Dying[Ethnographies,Actors

] - Calc Legit Pop Recruited or Joining Uprising[Ethnographies,Actors

] - Calc Legit Refugees Leaving[Ethnographies,Actors] - Calculated Lost to Conquest[

Ethnographies,Actors] - Calculated to Coerced[Ethnographies,Actors

] - Calculated to Governed[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION CALCULATED[Ethnographies

,Actors] )

Units: People

Calc Legit Pop Deaths[Ethnographies,Actors] = Rate of Civilian Deaths[Ethnographies

,Actors] \* Pct Calc Legit Pop[Ethnographies,Actors]

Units: People/Period

Calc Legit Pop Refugees[Ethnographies,Actors] = ( Rate of Civilian Refugees[Ethnographies

,Actors] \* Pct Calc Legit Pop[Ethnographies,Actors] )

Units: People/Period

Coerced Pop[Ethnographies,Actors] = INTEG( ( Unaligned to Coerced[Ethnographies,

Actors] + Calculated to Coerced[Ethnographies,Actors] - Coerced Dying[

Ethnographies,Actors] ) - Coerced Refugees Leaving[Ethnographies

,Actors] - Coerced to Calculated[Ethnographies,Actors] - Coerced to Unaligned[

Ethnographies,Actors] - Coerced Opposition Recruitment[Ethnographies

,Actors] + Conquest[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION COERCED[Ethnographies,Actors

] )

Units: People

Coerced Pop Deaths[Ethnographies,Actors] = ( Rate of Civilian Deaths[Ethnographies

,Actors] \* Pct Coerced Pop[Ethnographies,Actors] )

Units: People/Period

Coerced Pop Refugees[Ethnographies,Actors] = ( Rate of Civilian Refugees[Ethnographies

,Actors] \* Pct Coerced Pop[Ethnographies,Actors] )

Units: People/Period

COMPUTED INSTITUTIONAL PROCEDURES[Ethnographies,Green] = ( ( Calc Legit Pop[Ethnographies

,Green] + Governed Pop[Ethnographies,Green] + Coerced Pop[Ethnographies,Green

] ) \* NORMAL PROCEDURES REQUIRED FOR CREDIBILITY PER POP[Ethnographies

] ) \* Desire to Credibly Govern Ethnography[Ethnographies,Green]

COMPUTED INSTITUTIONAL PROCEDURES[Ethnographies,Red] = 2e+006, 0, 2e+006

Units: Procedures

Current Location of Red Actor on Territorial Map[Red] = Territory Controlled by Actor[

Red]

Units: Percentage

Days in a Period = 90

Units: Days/Period

Desire to Credibly Govern Ethnography[Ethnographies,Green] = Actual Desire to Credibly Govern[

Ethnographies,Green]

Desire to Credibly Govern Ethnography[Ethnographies,Red] = Actual Desire to Credibly Govern[

Ethnographies,Red]

Units: Pct

Desired Institutional Procedures[Ethnographies,Actors] = ( Required Institutional Procedures[

Ethnographies,Actors] \* Desire to Credibly Govern Ethnography[Ethnographies

,Actors] )

Units: Procedures

Effect of Kinetic Attacks on Governing Capacity[Green] = ( Blue or Purple Sorties Targeting Government Capacity[

Red] \* Normal Effect of Kinetic Attack on Governing Capacity[Red] )

Effect of Kinetic Attacks on Governing Capacity[Red] = Blue or Purple Sorties Targeting Government Capacity[

Green] \* Normal Effect of Kinetic Attack on Governing Capacity[Green]

Units: Procedures/Period

Ethno Sufficiency Modifier[Ethnographies] = Table for Effect of Remaining Population on Sufficiency

( Remaining Ethnographic Population[Ethnographies] )

Units: Dmnl

Finances[Actors] = INTEG( Incoming Revenue[Actors] - Outgoing Expenses[Actors] ,

Starting Cash[Actors] )

Units: Dollars

("Baseline Switch (1 = On)"\*(Capability of Military Actions based on

Squads\*Cost per Attack))+("Scenario 1 Switch (1 = On)"\*"ZScenario1:

Starting Cash")

Goverened Deaths[Ethnographies,Actors] = ( Rate of Civilian Deaths[Ethnographies

,Actors] \* Pct Governed Pop[Ethnographies,Actors] )

Units: People/Period

Governed Pop[Ethnographies,Actors] = INTEG( Calculated to Governed[Ethnographies

,Actors] - Governed Dying[Ethnographies,Actors] - Governed Lost to Conquest[

Ethnographies,Actors] - Governed Pop Recruited[Ethnographies,Actors

] - Governed Refugees Leaving[Ethnographies,Actors] - Governed to Calculated[

Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION GOVERNED[Ethnographies,Actors

] )

Units: People

Governed Refugees[Ethnographies,Actors] = ( Rate of Civilian Refugees[Ethnographies

,Actors] \* Pct Governed Pop[Ethnographies,Actors] )

Units: People/Period

Impact of Armed Civil Affairs[Actors] = ( Armed Civil Affairs[Actors] + Blue or Purple Armed Civil Affairs[

Actors] ) \* Normal Effect of Armed Civil Affairs[Actors]

Units: Procedures/Period

Legacy Procedures Step Test[Ethnographies,Red] = 0, 0, 0

Units: Procedures

Loss of CalcLegit due to Conquest[Ethnographies,Green] = Pct Calc Legit Pop[Ethnographies

,Green] \* IF THEN ELSE ( Rate of Conquering Red[Ethnographies,Red] > 0, Rate of Conquering Red[

Ethnographies,Red] , 0)

Loss of CalcLegit due to Conquest[Ethnographies,Red] = IF THEN ELSE ( Rate of Conquering Red[

Ethnographies,Red] < 0, - Rate of Conquering Red[Ethnographies,Red] \*

Pct Calc Legit Pop[Ethnographies,Red] , 0)

Units: People/Period

Loss of Coerced due to Conquest[Ethnographies,Green] = Pct Coerced Pop[Ethnographies

,Green] \* IF THEN ELSE ( Rate of Conquering Red[Ethnographies,Red] > 0, Rate of Conquering Red[

Ethnographies,Red] , 0)

Loss of Coerced due to Conquest[Ethnographies,Red] = IF THEN ELSE ( Rate of Conquering Red[

Ethnographies,Red] < 0, - Rate of Conquering Red[Ethnographies,Red] ,

0)

Units: People/Period

Loss of Governed due to Conquest[Ethnographies,Green] = IF THEN ELSE ( Rate of Conquering Red[

Ethnographies,Red] > 0, Rate of Conquering Red[Ethnographies,Red] , 0

) \* Pct Governed Pop[Ethnographies,Green]

Loss of Governed due to Conquest[Ethnographies,Red] = IF THEN ELSE ( Rate of Conquering Red[

Ethnographies,Red] < 0, - Rate of Conquering Red[Ethnographies,Red] ,

0)

Units: People/Period

Normal Desire to Credibly Govern[Ethnographies,Green] = 1, 1, 1

Normal Desire to Credibly Govern[Ethnographies,Red] = 1, 1, 1

Units: Pct

Normal Effect of Armed Civil Affairs[Actors] = 10000, 10000

Units: Procedures/Military Actions

Normal Effect of Kinetic Attack on Governing Capacity[Actors] = 10000, 10000

Units: Procedures/Sortie

NORMAL PERIOD = 1

Units: Period

Normal Procedural Decay Fraction = 5

Units: Period

Assumes 10yr for a 100% of government institutional procedures to

naturally decay given no input.

Normal Procedural Development Time[Actors] = 2

Units: Period

NORMAL PROCEDURES REQUIRED FOR CREDIBILITY PER POP[Ethnographies] = 1

Units: Procedures/People

Normal Time to be Conquered[Ethnographies] = 1

Units: Period

ORGANIC PROCEDURAL DEVELOPMENT TIME[Actors] = 0.25

Units: Period

0.25

Pct Calc Legit Pop[Ethnographies,Actors] = MIN ( 1, MAX ( 0, ZIDZ ( Calc Legit Pop[

Ethnographies,Actors] , Total Ethno by Actor[Ethnographies,

Actors] ) ) )

Units: Percentage

Pct Coerced Pop[Ethnographies,Actors] = MIN ( 1, MAX ( 0, ZIDZ ( Coerced Pop[Ethnographies

,Actors] , Total Ethno by Actor[Ethnographies,Actors] ) ) )

Units: Percentage

Pct Governed Pop[Ethnographies,Actors] = MIN ( 1, MAX ( 0, ZIDZ ( Governed Pop[Ethnographies

,Actors] , Total Ethno by Actor[Ethnographies,Actors] ) ) )

Units: Percentage

Procedural Excess[Ethnographies,Actors] = MAX ( 0, ( 1 - ZIDZ ( Desired Institutional Procedures[

Ethnographies,Actors] , Institutional Procedures[Ethnographies

,Actors] ) ) )

Units: Pct

Rate of Civilian Deaths[Ethnographies,Actors] = ( Civilian Deaths[Ethnographies,

Actors] ) \* Ethno Sufficiency Modifier[Ethnographies]

Units: People/Period

Rate of Civilian Refugees[Ethnographies,Actors] = Refugees Leaving[Ethnographies

,Actors] \* Ethno Sufficiency Modifier[Ethnographies]

Units: People/Period

Rate of Conquering Red[Ethnographies,Red] = ( Target Ethno Population by Most Recent Conquest[

Ethnographies,Red] - Ethno by Actor Conquer Reference[Ethnographies,Red] )

/ Normal Time to be Conquered[Ethnographies]

Units: People/Period

Reduction in Institutional Procedures[Ethnographies,Actors] = MAX ( 0, ( ( Table for Reduction in Institutional Procedures[

Ethnographies,Actors] ( Procedural Excess[Ethnographies,Actors] ) \* Institutional Procedures[

Ethnographies,Actors] ) / NORMAL PERIOD ) + Actual Effect of Kinetic Attacks on Governing Capacity[

Actors] )

Units: Procedures/Period

Replacing Obsolete Procedures[Ethnographies,Actors] = ZIDZ ( ( Procedural Decay[

Ethnographies,Actors] \* Desire to Credibly Govern Ethnography[Ethnographies

,Actors] ) \* "Allocation of Non-Essential Budgets"[Actors] , 1)

Units: Procedures/Period

Required Institutional Procedures[Ethnographies,Actors] = MAX ( 0, NORMAL PROCEDURES REQUIRED FOR CREDIBILITY PER POP[

Ethnographies] \* Total Ethno by Actor[Ethnographies,Actors] )

Units: Procedures

Sorties Targeting Government per Day[Actors] = Blue or Purple Sorties Targeting Government Capacity[

Actors] / Days in a Period

Units: Sorties/Day

Table for Effect of Procedural Adequacy[Actors] ( [(-2,-2)-(2,10)],(0,2),(0.9,1)

,(0.95,0),(1,0),(1.25,0),(1.5,0),(1.75,0) )

Units: Pct

Table for Reduction in Institutional Procedures[Ethnographies,Actors] ( [(0,0)-(1,1)

],(0,0),(0.1,0.03),(0.2,0.05),(0.3,0.1),(0.4,0.2),(0.5,0.3),(0.6,0.35)

,(0.7,0.4),(0.8,0.45),(0.9,0.475),(1,0.5) )

Units: Dmnl

Territory Conditions Table for Percentage of Unaligned Population Controlled based on Location of Red Actor on Territorial Map

( [(0,0)-(1,1)],(0,0),(1,1) )

Units: Percentage

Total Ethno by Actor[Ethnographies,Actors] = Calc Legit Pop[Ethnographies,Actors

] + Coerced Pop[Ethnographies,Actors] + Governed Pop[Ethnographies,Actors]

Units: People

Total Population by Actor[Actors] = ( SUM ( Total Ethno by Actor[Ethnographies!,

Actors] ) )

Units: People

Unaligned Conquered to Coerced[Ethnographies,Red] = ( Unaligned Pop[Ethnographies

] \* Territory Conditions Table for Percentage of Unaligned Population Controlled based on Location of Red Actor on Territorial Map

( Current Location of Red Actor on Territorial Map[Red] ) ) / Normal Time to be Conquered[

Ethnographies]

Unaligned Conquered to Coerced[Ethnographies,Green] = 0

Units: People/Period

Unaligned Pop[Ethnographies] = INTEG( Defections to Unaligned[Ethnographies] + (

SUM ( Coerced to Unaligned[Ethnographies,Actors!] ) ) - ( SUM (

Unaligned to Coerced[Ethnographies,Actors!] ) ) - ( SUM ( Unaligned to Calculated[

Ethnographies,Actors!] ) ) , 0)

Units: People

Normal is: STARTING LEVEL OF ETHNOGRAPHIC

POPULATION[Ethnographies]-((SUM(Coerced

Pop[Ethnographies,Actors!]))+(SUM(Calc Legit Pop [Ethnographies,Acto

[Ethnographies,Actors!]))+(SUM(Governed

Pop[Ethnographies,Actors!]))), Indonesia is 0

War Crime Refugees[Ethnographies,Actors] = MAX ( 0, ( War Crimes[Ethnographies,Actors

] \* REFUGEES PER WAR CRIME[Ethnographies,Actors] ) \* Ethno by Actor Sufficiency[

Ethnographies,Actors] )

Units: People/Period

## OpOrder Allocations

### Overview



Figure 4: Allocation of Operational Orders Structure



Figure 5: Structure of Foreign OpOrder Allocation

Blue or Purple Airpower Targeting Combatants[Green] = GAME( 1 )

Blue or Purple Airpower Targeting Combatants[Red] = 0

Units: Pct

Blue or Purple Airpower Targeting Government Capacity[Green] = GAME( 0 )

Blue or Purple Airpower Targeting Government Capacity[Red] = GAME( 0 )

Units: Pct

Blue or Purple Airpower Targeting Resources[Green] = GAME( 0 )

Blue or Purple Airpower Targeting Resources[Red] = 0

Units: Pct

Blue or Purple OpOrder Advanced Equipment Provision[Green] = GAME( 0.25 )

Blue or Purple OpOrder Advanced Equipment Provision[Red] = 0

Units: Pct

Blue or Purple OpOrder Airpower[Green] = GAME( 0 )

Blue or Purple OpOrder Airpower[Red] = 0

Units: Pct

Blue or Purple OpOrder Armed Civil Affairs[Green] = GAME( 0 )

Blue or Purple OpOrder Armed Civil Affairs[Red] = 0

Units: Pct

Blue or Purple OpOrder Combat Troops[Green] = GAME( 0 )

Blue or Purple OpOrder Combat Troops[Red] = GAME( 0 )

Units: Pct

Blue or Purple OpOrder Embedded Combat Advisers[Actors] = GAME( 0 )

Units: Pct

Blue or Purple OpOrder Information Operations[Green] = GAME( 0.25 )

Blue or Purple OpOrder Information Operations[Red] = 0

Units: Pct

Blue or Purple OpOrder Training Local Actor Security Forces[Green] = GAME( 0.25 )

Blue or Purple OpOrder Training Local Actor Security Forces[Red] = 0

Units: Pct

Calc Legit Pop[Ethnographies,Actors] = INTEG( Coerced to Calculated[Ethnographies

,Actors] + Governed to Calculated[Ethnographies,Actors] + Unaligned Choosing Sides[

Ethnographies,Actors] - Cal Legit Pop Dying[Ethnographies,Actors

] - Calc Legit Pop Recruited or Joining Uprising[Ethnographies,Actors

] - Calc Legit Refugees Leaving[Ethnographies,Actors] - Calculated Lost to Conquest[

Ethnographies,Actors] - Calculated to Coerced[Ethnographies,Actors

] - Calculated to Governed[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION CALCULATED[Ethnographies

,Actors] )

Units: People

Combatants[Ethnographies,Actors] = INTEG( Combatant Additions[Ethnographies,Actors

] - Combatant Losses[Ethnographies,Actors] , Starting Combatants[Ethnographies

,Actors] )

Units: People

Engagement Threshold[Actors] = IF THEN ELSE ( Total Combatants[Red] > Minimum Force Size to Engage[

Red] , 1, 0)

Units: Dmnl

Green and Red OpOrder Pct Indirect[Actors] = 0, 0.03

Units: Pct

Green and Red OpOrder Pct Recruiting[Ethnographies,Red] = 0.15, 0, 0.075

Green and Red OpOrder Pct Recruiting[Ethnographies,Green] = 0, 0, 0

Units: Pct

Green and Red Pct OpOrder Armed Civil Affairs[Actors] = 0, 0.2

Units: Pct

Green and Red Pct OpOrder Prison Breaks[Actors] = 0, 0.05

Units: Pct

Green and Red Pct OpOrder Propoganda[Actors] = 0, 0.01

Units: Pct

Green and Red Pct OpOrder Terrorism[Ethnographies,Red] = 0, 0.1, 0.1

Green and Red Pct OpOrder Terrorism[Ethnographies,Green] = 0, 0, 0

Units: Pct

Green and Red PE Pct Armed Civil Affairs[Actors] = 0, 0.01

Units: Pct

Green and Red PE Pct Conventional Warfare[Actors] = 0, 0

Units: Pct

Green and Red PE PCT Prison Breaks[Actors] = 0, 0.05

Units: Pct

Green and Red PE Pct Propoganda[Actors] = 0, 0.25

Units: Pct

Green and Red PE Pct Terrorism[Ethnographies,Red] = 0.2, 0.1, 0.1

Green and Red PE Pct Terrorism[Ethnographies,Green] = 0, 0, 0

Units: Pct

Green and Red PE Recruiting[Ethnographies,Red] = 0.1, 0, 0.05

Green and Red PE Recruiting[Ethnographies,Green] = 0, 0, 0

Units: Pct

Normal Combatting Terrorism[Actors] = 0.075, 0

Units: Pct

Normal Conventional Warfare[Actors] = 0.2, 0.475

Units: Pct

Normal Prison Duty[Actors] = 0.05, 0

Units: Pct

OpOrder Armed Civil Affairs[Actors] = GAME( IF THEN ELSE ( Engagement Threshold[

Actors] = 1, Green and Red Pct OpOrder Armed Civil Affairs[Actors

] , Green and Red PE Pct Armed Civil Affairs[Actors] ) )

Units: Pct

OpOrder Combatting Terrorism[Actors] = GAME( Normal Combatting Terrorism[Actors]

)

Units: Pct

OpOrder Conventional Warfare[Actors] = GAME( IF THEN ELSE ( Engagement Threshold[

Red] = 1, Normal Conventional Warfare[Actors] , Green and Red PE Pct Conventional Warfare[

Actors] ) )

Units: Pct

OpOrder Indirect IED VBIED or SVIED[Actors] = GAME( IF THEN ELSE ( Engagement Threshold[

Actors] = 1, Green and Red OpOrder Pct Indirect[Actors] , PreThreshold Indirect[

Actors] ) )

Units: Pct

OpOrder Prison Breaks[Actors] = GAME( IF THEN ELSE ( Engagement Threshold[Actors

] = 1, Green and Red Pct OpOrder Prison Breaks[Actors] , Green and Red PE PCT Prison Breaks[

Actors] ) )

Units: Pct

OpOrder Prison Duty[Actors] = GAME( Normal Prison Duty[Actors] )

Units: Pct

OpOrder Propoganda[Actors] = GAME( IF THEN ELSE ( Engagement Threshold[Actors] =

1, Green and Red Pct OpOrder Propoganda[Actors] , Green and Red PE Pct Propoganda[

Actors] ) )

Units: Pct

OpOrder Recruiting[Ethnographies,Actors] = GAME( IF THEN ELSE ( Engagement Threshold[

Actors] = 1, Green and Red OpOrder Pct Recruiting[Ethnographies,

Actors] , Green and Red PE Recruiting[Ethnographies,Actors] ) )

Units: Pct

OpOrder Terrorism[Ethnographies,Red] = GAME( IF THEN ELSE ( Engagement Threshold[

Red] = 1, Green and Red Pct OpOrder Terrorism[Ethnographies,Red]

, Green and Red PE Pct Terrorism[Ethnographies,Red] ) )

OpOrder Terrorism[Ethnographies,Green] = IF THEN ELSE ( Engagement Threshold[Green

] = 1, Green and Red Pct OpOrder Terrorism[Ethnographies,Green] , Green and Red PE Pct Terrorism[

Ethnographies,Green] )

Units: Pct

OpOrder War Crimes[Ethnographies,Actors] = GAME( 0 )

Units: Pct

War atrocities include ethnic cleansing by Red actor and

massacares/war crimes by Blue Actors.

PreThreshold Indirect[Actors] = 0, 0

Units: Pct

Sum of All Actions[Actors] = OpOrder Indirect IED VBIED or SVIED[Actors] + ( SUM (

OpOrder Recruiting[Ethnographies!,Actors] ) ) + ( SUM ( OpOrder Terrorism[

Ethnographies!,Actors] ) ) + ( SUM ( OpOrder War Crimes[Ethnographies!

,Actors] ) ) + OpOrder Prison Breaks[Actors] + OpOrder Prison Duty[

Actors] + OpOrder Combatting Terrorism[Actors] + OpOrder Propoganda[Actors

] + OpOrder Armed Civil Affairs[Actors] + OpOrder Conventional Warfare[

Actors]

Units: Pct

Sum of all Blue Actions[Actors] = Blue or Purple OpOrder Airpower[Actors] + Blue or Purple OpOrder Armed Civil Affairs[

Actors] + Blue or Purple OpOrder Embedded Combat Advisers[Actors] + Blue or Purple OpOrder Information Operations[

Actors] + Blue or Purple OpOrder Advanced Equipment Provision[Actors]

+ Blue or Purple OpOrder Training Local Actor Security Forces[Actors]

+ Blue or Purple OpOrder Combat Troops[Actors]

Units: Pct

SUM Total of Airpower Allocations[Actors] = Blue or Purple Airpower Targeting Combatants[

Actors] + Blue or Purple Airpower Targeting Government Capacity[Actors] +

Blue or Purple Airpower Targeting Resources[Actors]

Units: Pct

## Resource Stocks

### Equations

Actual Territory Decline[Actors] = MAX ( 0, Peak Territory[Actors] - Territory Actor Controls[

Actors] )

Units: "km^2"

AFV and IFV[Actors] = INTEG( Increase in AFV and IFV[Actors] - Decrease in AFV and IFV[

Actors] , Starting AFV and IFV[Actors] )

Units: Pieces

AFV and IFV Additions[Actors] = ( AFV and IFV Scavenged[Red] / Time to Repair and Operate[

Actors] ) + AFV and IFV Purchases[Actors]

Units: Pieces/Period

AFV and IFV Losses[Actors] = AFV and IFV Lossses in Battle[Actors] + AFV and IFV Lost due to Maintenance[

Actors]

Units: Pieces/Period

ARTILLERY[Actors] = INTEG( Increase in Artillery[Actors] - Decrease in Artillery[

Actors] , Starting Artillery[Actors] )

Units: Pieces

Artillery Additions[Actors] = Artillery Purchases[Actors]

Units: Pieces/Period

Artillery Losses[Actors] = Artillery Losses in Battle[Actors] + Artillery Lost due to Maintenance[

Actors]

Units: Pieces/Period

Average Combatant Experience[Actors] = ZIDZ ( Combatant Experience[Actors] , Total Combatants[

Actors] )

Units: Exp Years/Person

Baseline Switch where 1 equals On = 1

Units: Dmnl

Blue Desired Personnel[Actors] = Blue or Purple Intervention Size[Actors] \* Deployment Activation[

Actors]

Units: People

Blue or Purple Intervention Size[Actors] = GAME( Normal Blue or Purple Intervention Size[

Actors] )

Units: People

Blue or Purple Intervention Time[Actors] = 0, 0

Units: Period

Blue or Purple Personnel[Actors] = INTEG( Increase in Blue Personnel[Actors] - Decrease in Blue Personnel[

Actors] , Starting Blue or Purple Personnel[Actors] )

Units: People

Blue or Purple Squads[Actors] = INTEG( Change in Blue Squads[Actors] , 0)

Units: Squads

Blue or Purple T3R Average[Actors] = 0.67

Units: Pct

Average % of non-combat troops to combat. Source

http://usacac.army.mil/cac2/cgsc/carl/download/csipubs/mcgrath\_op23.pd

f p80

Capability of Military Actions based on Squads[Actors] = ( Squads[Actors] ) \* NORMAL MILITARY CAPABILITY OF SQUADS[

Actors]

Units: Military Actions/Period

Change in Blue Squads[Actors] = ( Desired Blue Squads[Actors] - Blue or Purple Squads[

Actors] ) / NORMAL PERIOD

Units: Squads/Period

Change in Squads[Actors] = ( Desired Squads[Actors] - Squads[Actors] ) / Time to Form Squads

Units: Squads/Period

Combatant Additions[Ethnographies,Actors] = Rate of Incoming Combatants[Ethnographies

,Actors]

Units: People/Period

Combatant Experience[Actors] = INTEG( Gain in Experience[Actors] - Loss of Experience[

Actors] , Starting Experience[Actors] )

Units: Exp Years

Combatant Experience Gain[Actors] = ( Total Combatants[Actors] \* ( NORMAL EXPERIENCE GAINED PER PERSON[

Actors] + Experience Gained from Blue or Purple Training[Actors] ) )

/ NORMAL PERIOD

Units: Exp Years/Period

Combatant Losses[Ethnographies,Actors] = MAX ( 0, Loss of Local Combatants by Ethnography[

Ethnographies,Actors] )

Units: People/Period

Fix max function with different first order control. MAX(0,("ISIS

Militants (People)"-"Outgoing Militants (People)")/Time to Lose

Militants)

Combatants[Ethnographies,Actors] = INTEG( Combatant Additions[Ethnographies,Actors

] - Combatant Losses[Ethnographies,Actors] , Starting Combatants[Ethnographies

,Actors] )

Units: People

Decrease in AFV and IFV[Actors] = MAX ( 0, AFV and IFV Losses[Actors] )

Units: Pieces/Period

Decrease in Artillery[Actors] = Artillery Losses[Actors]

Units: Pieces/Period

Decrease in Blue Personnel[Actors] = 0

Units: People/Period

Decrease in Peak[Actors] = ( Peak Condition[Actors] \* Peak Territory[Actors] ) /

NORMAL PERIOD

Units: "km^2"/Period

Deployment Activation[Actors] = IF THEN ELSE ( Time > Blue or Purple Intervention Time[

Actors] , 1, 0)

Units: Dmnl

Deployment Time[Actors] = 2, 2

Units: Period

Desired Blue Squads[Actors] = ( Blue or Purple Personnel[Actors] - Number of Blue Logistics[

Actors] ) / NORMAL SIZE PER SQUAD[Actors]

Units: Squads

Desired Squads[Actors] = MAX ( 0, ( ( Total Combatants[Actors] - Actual Garrsion[

Actors] ) - Number of Green or Red Logistics[Actors] ) / NORMAL SIZE PER SQUAD[

Actors] )

Units: Squads

Expenses before Attacks[Actors] = Death Benefits[Actors] + Detention Benefits[Actors

] + "Media Border Security & Other Expenses"[Actors] + Military Procurement[

Actors] + Payroll[Actors] + Governance Expenses[Actors]

Units: Dollars/Period

Experience gain from Joining Combatants[Actors] = ( AVG EXPERIENCE OF ESCAPED DETAINEE[

Actors] \* Escaped Detainees Joining Actor[Actors] ) + ( Experience Gain from Foreign Fighters[

Actors] ) + ( ( SUM ( Actual Governed Local Recruiting[Ethnographies!

,Actors] ) ) \* AVG EXPERIENCE OF LOCAL RECRUIT[Actors] )

Units: Exp Years/Period

Finances[Actors] = INTEG( Incoming Revenue[Actors] - Outgoing Expenses[Actors] ,

Starting Cash[Actors] )

Units: Dollars

("Baseline Switch (1 = On)"\*(Capability of Military Actions based on

Squads\*Cost per Attack))+("Scenario 1 Switch (1 = On)"\*"ZScenario1:

Starting Cash")

First Conquest = IF THEN ELSE ( SFS Modified Force Ratio > 0, ( IF THEN ELSE ( (

FMR Base1 + FMR Base2 ) = 0, Initial Territory Conquered , 0) )

, 0) \* First Conquest Disable[Red]

Units: "km^2"

First Conquest Territory Gain = First Conquest

Units: "km^2"

FLOT Movement Rate = GAME( ( ( ( FMR Base1 + FMR Base2 ) \* High Intensity FLOT Movement Rate Multiplier

) \* Disable FLOT ) \* Movement Direction )

Units: "km^2"

Foreign Combatants[Actors] = INTEG( Foreign Fighter Increase[Actors] - Foreign Fighter Decrease[

Actors] , Starting Foreign Combatants[Actors] )

Units: People

Foreign Fighter Decrease[Actors] = "Loss of Foreign Combatants by Deaths, Detentions and Defections"[

Actors]

Units: People/Period

Foreign Fighter Increase[Actors] = Foreign Recruiting[Actors]

Units: People/Period

Foreign Recruiting[Actors] = ( ( Actual Recruits per Suicide Attack[Actors] \* (

SUM ( Completed Terrorist Attacks by Ethnography[Ethnographies!,Actors

] ) ) ) \* Foreign Recruiting Eliminated[Actors] ) \* Allocation of Essential Budgets[

Actors]

Units: People/Period

Gain in Experience[Actors] = Experience gain from Joining Combatants[Actors] + Combatant Experience Gain[

Actors]

Units: Exp Years/Period

Governed Cohorts[Ethnographies,Actors] = ( Calc Legit Pop[Ethnographies,Actors]

+ Governed Pop[Ethnographies,Actors] ) / SIZE OF COHORT

Units: Cohort

Green Actor Territory Gain[Green] = IF THEN ELSE ( FLOT Movement Rate < 0, - FLOT Movement Rate

, 0)

Units: "km^2"

Green Actor Territory Lost[Green] = IF THEN ELSE ( FLOT Movement Rate > 0, FLOT Movement Rate

, 0)

Units: "km^2"

Incoming Revenue[Actors] = Revenue[Actors] + Test Extreme Conditions Revenue[Actors

]

Units: Dollars/Period

Increase in AFV and IFV[Actors] = AFV and IFV Additions[Actors]

Units: Pieces/Period

Increase in Artillery[Actors] = Artillery Additions[Actors]

Units: Pieces/Period

Increase in Blue Personnel[Actors] = ( Blue Desired Personnel[Actors] - Blue or Purple Personnel[

Actors] ) / Deployment Time[Actors]

Units: People/Period

Increase in Peak[Actors] = ( Territory Actor Controls[Actors] \* Peak Condition[Actors

] ) / NORMAL PERIOD

Units: "km^2"/Period

Loss of Experience[Actors] = Total Experience Loss due to Militant Losses[Actors

]

Units: Exp Years/Period

"Loss of Foreign Combatants by Deaths, Detentions and Defections"[Actors] = Pct of Combatants that are Foreign[

Actors] \* "Loss of all Combatants from Deaths, Detentions and Defections"[

Actors]

Units: People/Period

Loss of Local Combatants by Ethnography[Ethnographies,Actors] = "Loss of Local Combatants from Deaths, Detentions and Defections"[

Actors] \* Pct Combatants by Ethnography[Ethnographies,Actors]

Units: People/Period

Militant Police per Cohort = 2.8

Units: People/Cohort

Money Sent Abroad[Actors] = ( Surplus for Sending Money Abroad[Actors] \* Allocation of Essential Budgets[

Actors] ) / Time to Spend Money Abroad[Actors]

Units: Dollars/Period

Normal Blue or Purple Intervention Size[Actors] = 0, 0

Units: People

NORMAL PERIOD = 1

Units: Period

NORMAL SIZE PER SQUAD[Actors] = 10

Units: People/Squad

Normal value for ISIS is set at an average of 11. Value for

equilibrium is set at 10.

Number of Blue Logistics[Actors] = Blue or Purple Personnel[Actors] \* Blue or Purple T3R Average[

Actors]

Units: People

OpTempo Expenses[Actors] = Actual Military Actions[Actors] \* Cost per Military Action[

Actors]

Units: Dollars/Period

Outgoing Expenses[Actors] = MAX ( 0, ( Expenses before Attacks[Actors] + OpTempo Expenses[

Actors] + Money Sent Abroad[Actors] ) )

Units: Dollars/Period

MAX(0,"ISIS Finances (Dollars)"-("Expenses before Attacks (Dollars

per Period)"+OpTempo Expenses))

Pct Combatants by Ethnography[Ethnographies,Actors] = ZIDZ ( Combatants[Ethnographies

,Actors] , Total Local Combatants[Actors] )

Units: Pct

Pct Decline from Peak[Actors] = ZIDZ ( Actual Territory Decline[Actors] , Peak Territory[

Actors] )

Units: Pct

Pct of Combatants that are Foreign[Actors] = ZIDZ ( Foreign Combatants[Actors] ,

Total Combatants[Actors] )

Units: Pct

Pct of Total Combatants by Ethnography[Ethnographies,Actors] = Combatants[Ethnographies

,Actors] / Total Local Combatants[Actors]

Units: Pct

Peak Condition[Actors] = IF THEN ELSE ( Territory Actor Controls[Actors] > Peak Territory[

Actors] , 1, 0)

Units: Dmnl

Peak Territory[Actors] = INTEG( Increase in Peak[Actors] - Decrease in Peak[Actors

] , 0)

Units: "km^2"

Period of Initial Finance = 1

Units: Period

Proposition Switch where 1 equals on = 1

Units: Dmnl

Rate of Incoming Combatants[Ethnographies,Red] = ( Actual Local Calculated Recruiting[

Ethnographies,Red] + Actual Governed Local Recruiting[Ethnographies,Red] +

Escaped Detainees by Ethnography[Ethnographies,Red] + Local Opposition Joining Opposing Actor Militants[

Ethnographies,Green] + Inflow of Foreign Recruits by Ethnography[Ethnographies

,Red] + Expatriate Fighters by Ethnography[Ethnographies,Red] + Test Extreme Conditions Combatants[

Ethnographies,Red] )

Rate of Incoming Combatants[Ethnographies,Green] = ( Actual Local Calculated Recruiting[

Ethnographies,Green] + Actual Governed Local Recruiting[Ethnographies,Green

] + Escaped Detainees by Ethnography[Ethnographies,Green] + Local Opposition Joining Opposing Actor Militants[

Ethnographies,Red] + Expatriate Fighters by Ethnography[Ethnographies

,Green] + Inflow of Foreign Recruits by Ethnography[Ethnographies,Green

] + Test Extreme Conditions Combatants[Ethnographies,Green] )

Units: People/Period

Rate of Territory Gained[Green] = ( Green Actor Territory Gain[Green] / Time to Secure Territory

) \* Territorial Limits Modifier on Gaining[Green]

Rate of Territory Gained[Red] = ( Red Actor Territory Gain[Red] / Time to Secure Territory

) \* Territorial Limits Modifier on Gaining[Red]

Units: "km^2"/Period

Rate of Territory Lost[Green] = ( Green Actor Territory Lost[Green] / Time to Secure Territory

) \* Territorial Limits Modifier on Losing[Green]

Rate of Territory Lost[Red] = ( Red Actor Territory Lost[Red] / Time to Secure Territory

) \* Territorial Limits Modifier on Losing[Red]

Units: "km^2"/Period

Red Actor Territory Gain[Red] = First Conquest Territory Gain + ( IF THEN ELSE (

FLOT Movement Rate > 0, FLOT Movement Rate , 0) )

Units: "km^2"

Red Actor Territory Lost[Red] = IF THEN ELSE ( FLOT Movement Rate < 0, - FLOT Movement Rate

, 0)

Units: "km^2"

Revenue[Actors] = Donations[Actors] + Pre Donations Revenue[Actors]

Units: Dollars/Period

Squads[Actors] = INTEG( Change in Squads[Actors] , ( SUM ( Starting Combatants[Ethnographies!

,Actors] ) - ( SUM ( Governed Cohorts[Ethnographies!,Actors] ) \*

Militant Police per Cohort ) ) / NORMAL SIZE PER SQUAD[Actors

] )

Units: Squads

Initialized at same formula as Desired Squads. (Militants - Garrison

Needs)

Starting AFV and IFV[Actors] = 2137, 0

Units: Pieces

Starting Artillery[Actors] = 594, 0

Units: Pieces

Starting Blue or Purple Personnel[Actors] = 0, 0

Units: People

Starting Cash[Red] = 1e+007

Starting Cash[Green] = 5e+009

Units: Dollars

Period of Initial Finance\*(5e+006+(Expenses before Attacks[Red]\*4))

Starting Combatants[Ethnographies,Green] = 87200, 261600, 87200

Starting Combatants[Ethnographies,Red] = 1500, 0, 0

Units: People

check: https://www.state.gov/documents/organization/170479.pdf

Starting Experience[Actors] = 0, 3

Units: Exp Years

Starting Foreign Combatants[Actors] = 0, 0

Units: People

Table for Effect of Territorial Limits on Gaining[Actors] ( [(0,0)-(1,1)],(0,1),

(0,1),(0,1),(0,1),(0,1),(0,1),(0.95,1),(0.96,0.5),(0.97,0.25),(0.98,0.15)

,(0.99,0.1),(1,0) )

Units: Dmnl

Table for Effect of Territorial Limits on Losing[Actors] ( [(0,0)-(1,1)],(0,0),(0.01,0.1)

,(0.02,0.15),(0.03,0.25),(0.04,0.5),(0.05,1),(0.95,1),(0.96,1),(0.97,1)

,(0.98,1),(0.99,1),(1,1) )

Units: Dmnl

Territorial Limits Modifier on Gaining[Actors] = Table for Effect of Territorial Limits on Gaining[

Red] ( ZIDZ ( Territory Actor Controls[Actors] , Territory Conditions Starting Total Territory

) )

Units: Dmnl

Territorial Limits Modifier on Losing[Actors] = Table for Effect of Territorial Limits on Losing[

Actors] ( ZIDZ ( Territory Actor Controls[Actors] , Territory Conditions Starting Total Territory

) )

Units: Dmnl

Territory Actor Controls[Actors] = INTEG( Rate of Territory Gained[Actors] - Rate of Territory Lost[

Actors] , Territory Conditions Starting Total Territory \* Territory Conditions Pct Territory Controlled by Actor at Start[

Actors] )

Units: "km^2"

Territory Conditions Pct Territory Controlled by Actor at Start[Actors] = 1, 0

Units: Pct

Territory Conditions Starting Total Territory = 619308

Units: "km^2"

Includes all Provinces and Governates of Iraq and Syria. “Provinces

of Syria”, Administrative Divisions of Countries, Statoids, last

modified September 22, 2004, accessed September 19th, 2014,

http://www.statoids.com/usy.html. “Provinces of Iraq”,

Administrative Divisions of Countries, Statoids, last modified March

16, 2014, accessed September 19th, 2014,

http://www.statoids.com/uiq.html.

Territory Controlled by Actor[Actors] = ZIDZ ( Territory Actor Controls[Actors]

, Territory Conditions Starting Total Territory )

Units: Percentage

Test Extreme Conditions Revenue[Actors] = GAME( 0 )

Units: Dollars/Period

Time to Form Squads = 0.16

Units: Period

Ceylan Yeginsu, “ISIS Draws a Steady Stream of Recruits from

Turkey,” nytimes.com,

http://www.nytimes.com/2014/09/16/world/europe/turkey-is-a-steady-sour

ce-of-isis-recruits.html, accessed October 25, 2014.

Time to Secure Territory = 1

Units: Period

0.0385

Total Combatants[Actors] = Total Local Combatants[Actors] + Foreign Combatants[Actors

]

Units: People

Total Experience Loss due to Militant Losses[Actors] = ( Average Combatant Experience[

Actors] \* "Loss of all Combatants from Deaths, Detentions and Defections"[

Actors] )

Units: Exp Years/Period

Total Local Combatants[Actors] = SUM ( Combatants[Ethnographies!,Actors] )

Units: People

## Revenue & Expenses

### Overview

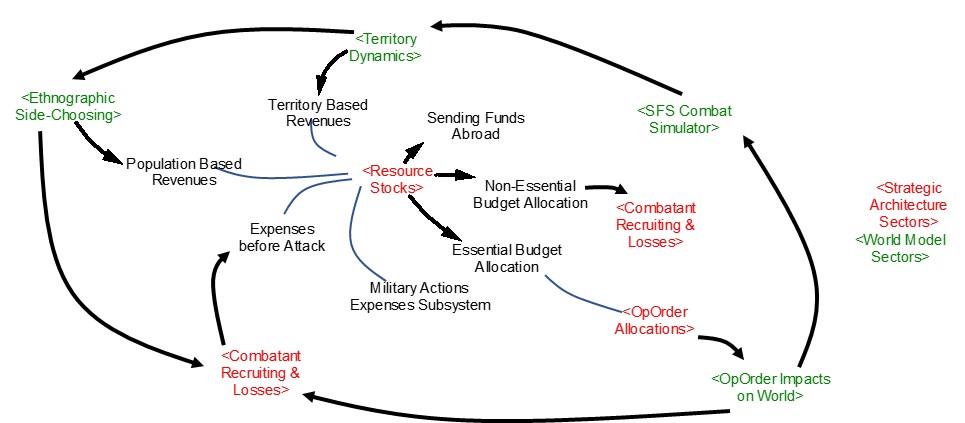


Figure 6: Revenue & Expenses Sector Overview

### Equations

Actual Resource Production[Actors] = Resource Production before Strikes[Actors]

- Effect of Attacks on Actual Production[Actors]

Units: Resource/Period

Blue or Purple Intervention Time[Actors] = 0, 0

Units: Period

Calc Legit Pop[Ethnographies,Actors] = INTEG( Coerced to Calculated[Ethnographies

,Actors] + Governed to Calculated[Ethnographies,Actors] + Unaligned Choosing Sides[

Ethnographies,Actors] - Cal Legit Pop Dying[Ethnographies,Actors

] - Calc Legit Pop Recruited or Joining Uprising[Ethnographies,Actors

] - Calc Legit Refugees Leaving[Ethnographies,Actors] - Calculated Lost to Conquest[

Ethnographies,Actors] - Calculated to Coerced[Ethnographies,Actors

] - Calculated to Governed[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION CALCULATED[Ethnographies

,Actors] )

Units: People

Coerced Pop[Ethnographies,Actors] = INTEG( ( Unaligned to Coerced[Ethnographies,

Actors] + Calculated to Coerced[Ethnographies,Actors] - Coerced Dying[

Ethnographies,Actors] ) - Coerced Refugees Leaving[Ethnographies

,Actors] - Coerced to Calculated[Ethnographies,Actors] - Coerced to Unaligned[

Ethnographies,Actors] - Coerced Opposition Recruitment[Ethnographies

,Actors] + Conquest[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION COERCED[Ethnographies,Actors

] )

Units: People

Criminal Activities[Ethnographies,Actors] = Criminal Activities per Person[Actors

] \* ( Coerced Pop[Ethnographies,Actors] + Calc Legit Pop[Ethnographies,Actors

] + Governed Pop[Ethnographies,Actors] )

Units: Dollars/Period

Criminal Activities per Person[Actors] = 0, 2.76

Units: Dollars/(Period\*Person)

Converting these to $/Person/Period works out from a range of $1.62

to $3.90/Person/Period for Population Controlled. Taken at midpoint.

See Appendix B for parameterization method.

Donation Percentage of all Revenue[Actors] = 0, 0.04

Units: Dmnl

See Appendix B for parameterization method.

Donations[Actors] = MAX ( 0, Pre Donations Revenue[Actors] \* Donation Percentage of all Revenue[

Actors] )

Units: Dollars/Period

Effect of Ransom Policy[Actors] = IF THEN ELSE ( Time > Blue or Purple Intervention Time[

Actors] , Ransom Elimination[Actors] , 1)

Units: Dmnl

Estimated Ransom per Period[Actors] = 0, 6e+006

Units: Dollars/Period

Assuming a simple $2M/Month for ransoms results in $6M/Period.See

Appendix B for parameterization method.

Governed Pop[Ethnographies,Actors] = INTEG( Calculated to Governed[Ethnographies

,Actors] - Governed Dying[Ethnographies,Actors] - Governed Lost to Conquest[

Ethnographies,Actors] - Governed Pop Recruited[Ethnographies,Actors

] - Governed Refugees Leaving[Ethnographies,Actors] - Governed to Calculated[

Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION GOVERNED[Ethnographies,Actors

] )

Units: People

Normal Territory Conditions Price per Resource Unit[Actors] = 80, 45

Units: Dollars/Resource

Pre Donations Revenue[Actors] = Taxes[Actors] + Ransom[Actors] + ( SUM ( Criminal Activities[

Ethnographies!,Actors] ) ) + Resource Sales[Actors]

Units: Dollars/Period

Ransom[Actors] = Estimated Ransom per Period[Actors] \* Effect of Ransom Policy[Actors

]

Units: Dollars/Period

Ransom Elimination[Actors] = 1

Units: Dmnl

Normal value is 1. 0 means all ransom is eliminated.

Resource Sales[Actors] = Territory Conditions Price per Resource Unit[Actors] \*

Resources Produced[Actors]

Units: Dollars/Period

Resources Produced[Actors] = Actual Resource Production[Actors]

Units: Resources/Period

Prior to US airstrikes ISIS was producing between 25,000-40,000

barrels of oil a day (BPD) across a dozen oil wells.See Appendix B

for parameterization method.

Revenue[Actors] = Donations[Actors] + Pre Donations Revenue[Actors]

Units: Dollars/Period

Tax Rates[Actors] = 33.1279, 15.995

Units: Dollars/(Period\*Person)

Dividing this amount into the estimated Population governed for the

2014 Period results in a range from $11.99-$20 Person/Period for

Population Governed. See Appendix B for parameterization method. For

equilbiurm the tax rate should start at the total revenue needed

divided by the population, unless equilibrium with natural resource

production, foreign donations etc. is desired.

Taxes[Actors] = ( Tax Rates[Actors] \* ( ( SUM ( Calc Legit Pop[Ethnographies!,Actors

] ) ) + ( SUM ( Governed Pop[Ethnographies!,Actors] ) ) ) )

Units: Dollars/Period

Territory Conditions Price per Resource Unit[Actors] = GAME( Normal Territory Conditions Price per Resource Unit[

Actors] )

Units: Dollars/Resource

See Appendix B for parameterization method.

Increase in Institutional Procedures[Ethnographies,Actors] = MAX ( 0, ( Organic Procedures[

Ethnographies,Actors] + Procedural Development[Ethnographies,Actors]

+ Replacing Obsolete Procedures[Ethnographies,Actors] + Impact of Armed Civil Affairs[

Actors] ) )

Units: Procedures/Period

MAX(0,(Adj to Procedural Spend[Actors]\*Organic

Procedures[Ethnographies,Actors])+ (Adj to Procedural

Spend[Actors]\*Procedural Development[Ethnographies,Actors])+ (Adj to

Procedural Spend[Actors]\*Replacing Obsolete

Procedures[Ethnographies,Actors]))

Institutional Procedures[Ethnographies,Actors] = INTEG( Increase in Institutional Procedures[

Ethnographies,Actors] - Procedural Decay[Ethnographies,Actors] - Reduction in Institutional Procedures[

Ethnographies,Actors] , Desired Institutional Procedures[Ethnographies

,Actors] + Legacy Procedures Step Test[Ethnographies,Red] )

Units: Procedures

Organic Procedures[Ethnographies,Actors] = MAX ( 0, ( ( ( Institutional Procedures[

Ethnographies,Actors] / 100) \* Organic Procedural Development[Ethnographies

,Actors] ) \* "Allocation of Non-Essential Budgets"[Actors] ) / ORGANIC PROCEDURAL DEVELOPMENT TIME[

Actors] )

Units: Procedures/Period

Procedural Development[Ethnographies,Actors] = ( ( Desired Institutional Procedures[

Ethnographies,Actors] / Normal Procedural Development Time[Actors] ) - ( Institutional Procedures[

Ethnographies,Actors] / Normal Procedural Development Time[Actors] )

) \* "Allocation of Non-Essential Budgets"[Actors]

Units: Procedures/Period

Actual Military Actions[Actors] = IF THEN ELSE ( Capacity for Military Actions based on Budget[

Actors] > Capability of Military Actions based on Squads[Actors] , Capability of Military Actions based on Squads[

Actors] , Capacity for Military Actions based on Budget[Actors] )

Units: Military Actions/Period

Allocation of Essential Budgets[Actors] = Table for Effect of Sufficiency of Reserves on Essentials Bankruptcy Policy[

Actors] ( ZIDZ ( Finances[Actors] , Normal Actor Desired Local Reserves[Actors

] ) )

Units: Dmnl

"Allocation of Non-Essential Budgets"[Actors] = Table for Effect of Sufficiency of Reserves on Essentials Bankruptcy Policy[

Actors] ( ZIDZ ( Finances[Actors] \* Level of Reserves at Which NonEssentials Begin to Be Cut[

Actors] , ( Normal Actor Desired Local Reserves[Actors] \* Reserves Multiplier to Determine NonEssentials Cut Off Level

) ) )

Units: Dmnl

Combatants[Ethnographies,Actors] = INTEG( Combatant Additions[Ethnographies,Actors

] - Combatant Losses[Ethnographies,Actors] , Starting Combatants[Ethnographies

,Actors] )

Units: People

Cost per Military Action[Actors] = 3000

Units: Dollars/Military Action

Analysis showed that for each $2700 transferred to a sector command,

an AQI attack was launched. This cost includes not only direct costs

of the attack, but indirect costs of all the other factors necessary

for AQI to peform in that sector outside Media, Courts,

Administration. Furthermore, there was a strong correlation (.66)

between the rate of fund flows increasing or decreasing and

corresponding changes in the pace of attacks. RAND 57-69. Equilibrium

value set to 3000.

Death Benefits[Actors] = ( Killed Militants Total \* Wages[Actors] ) \* "Allocation of Non-Essential Budgets"[

Actors]

Units: Dollars/Period

See Appendix B for parameterization method.

Detainees in Prison[Actors] = INTEG( Increase in Detentions[Actors] - Defections within Prison[

Actors] - Detainees Released[Actors] - Defections within Prison[

Actors] , STARTING DETAINEES BY ACTOR[Actors] )

Units: People

Detention Benefits[Actors] = ( Detainees in Prison[Actors] \* Wages[Actors] ) \* "Allocation of Non-Essential Budgets"[

Actors]

Units: Dollars/Period

See Appendix B for parameterization method.

Detention Benefits Gap[Actors] = ZIDZ ( Detention Benefits[Actors] , ( Detainees in Prison[

Actors] \* Wages[Actors] ) )

Units: Pct

Expenses before Attacks[Actors] = Death Benefits[Actors] + Detention Benefits[Actors

] + "Media Border Security & Other Expenses"[Actors] + Military Procurement[

Actors] + Payroll[Actors] + Governance Expenses[Actors]

Units: Dollars/Period

Expenses including Attacks[Actors] = Expenses before Attacks[Actors] + Military Actions Paid For[

Actors]

Units: Dollars/Period

Finances[Actors] = INTEG( Incoming Revenue[Actors] - Outgoing Expenses[Actors] ,

Starting Cash[Actors] )

Units: Dollars

("Baseline Switch (1 = On)"\*(Capability of Military Actions based on

Squads\*Cost per Attack))+("Scenario 1 Switch (1 = On)"\*"ZScenario1:

Starting Cash")

Gap between Desired Reserves and Current Finances[Actors] = Finances[Actors] - Normal Actor Desired Local Reserves[

Actors]

Units: Dollars

Governance Expenses[Actors] = MAX ( 0, Total New Procedure Costs[Actors] + Total Procedure Maintenance Costs[

Actors] )

Units: Dollars/Period

Killed Militants Total = INTEG( Rate of Militant Deaths Total , 0)

Units: People

Adjust initial level based on starting time of model.

Level of Reserves at Which NonEssentials Begin to Be Cut[Actors] = 0.25

Units: Dmnl

"Media Border Security & Other Budget"[Actors] = 0.06

Units: Pct

All other expenses were combined into a single bucket that amounts to

6% of all revenue. See Appendix B for parameterization method.

"Media Border Security & Other Expenses"[Actors] = MAX ( 0, ( Revenue[Actors] \*

"Media Border Security & Other Budget"[Actors] ) \* Allocation of Essential Budgets[

Actors] )

Units: Dollars/Period

Military Actions Paid For[Actors] = Cost per Military Action[Actors] \* Actual Military Actions[

Actors]

Units: Dollars/Period

Military Procurement[Actors] = MAX ( 0, ( Revenue[Actors] \* Military Procurement Budget[

Actors] ) \* Allocation of Essential Budgets[Actors] )

Units: Dollars/Period

Military Procurement Budget[Actors] = 0.1

Units: Pct

According to the RAND analysis purchases related to military

procurement – heavy weapons, ammunition, logistics and maintenance

ran about 10% of all revenues. See Appendix B for parameterization

method.

Money Sent Abroad[Actors] = ( Surplus for Sending Money Abroad[Actors] \* Allocation of Essential Budgets[

Actors] ) / Time to Spend Money Abroad[Actors]

Units: Dollars/Period

NEW PROCEDURE COST[Actors] = 10

Units: Dollars/Procedures

Normal Actor Desired Local Reserves[Actors] = 1e+007

Units: Dollars

NORMAL PERIOD = 1

Units: Period

Payroll[Actors] = ( Total Combatants[Actors] \* Wages[Actors] ) \* Allocation of Essential Budgets[

Actors]

Units: Dollars/Period

Payroll Gap[Actors] = ZIDZ ( Payroll[Actors] , ( Total Combatants[Actors] \* Wages[

Actors] ) )

Units: Pct

PROCEDURE MAINTENANCE COST[Actors] = 1

Units: Dollars/(Period\*Procedure)

$1/Period Nominal

Replacing Obsolete Procedures[Ethnographies,Actors] = ZIDZ ( ( Procedural Decay[

Ethnographies,Actors] \* Desire to Credibly Govern Ethnography[Ethnographies

,Actors] ) \* "Allocation of Non-Essential Budgets"[Actors] , 1)

Units: Procedures/Period

Reserves Multiplier before Sending Money Abroad[Actors] = 15

Units: Dmnl

Reserves Multiplier to Determine NonEssentials Cut Off Level = 10

Units: Dmnl

Revenue[Actors] = Donations[Actors] + Pre Donations Revenue[Actors]

Units: Dollars/Period

Surplus for Sending Money Abroad[Red] = IF THEN ELSE ( Finances[Red] / NORMAL PERIOD

- Expenses including Attacks[Red] > Normal Actor Desired Local Reserves[

Red] / NORMAL PERIOD \* Reserves Multiplier before Sending Money Abroad[

Red] , Finances[Red] - Normal Actor Desired Local Reserves[

Red] , 0)

Surplus for Sending Money Abroad[Green] = 0

Units: Dollars

Table for Effect of Sufficiency of Reserves on Essentials Bankruptcy Policy[Actors

] ( [(0,0)-(1,1)],(0,0),(0,0),(0,0),(0.0025,0),(0.005,0.005),(0.1,0.05),(0.2,0.1)

,(0.3,0.3),(0.4,0.5),(0.5,0.7),(0.6,0.8),(0.7,0.875),(0.8,0.95),(0.9,0.99)

,(0.97,1),(0.99,1),(1,1) )

Units: Dmnl

[(0,0)-(1,1)],(0,0),(0,0),(0,0),(0.0025,0),(0.005,0.005),(0.1,0.01),(0

.2,0.05),(0.3,0.2),(0.4,0.35),(0.5,0.5),(0.6,0.6),(0.75,0.8),(0.8,0.85

),(0.9,0.95),(0.97,0.99),(0.99,0.99),(1,1)

Time to Spend Money Abroad[Actors] = 1

Units: Periods

Total Combatants[Actors] = Total Local Combatants[Actors] + Foreign Combatants[Actors

]

Units: People

Total Ethno by Actor[Ethnographies,Actors] = Calc Legit Pop[Ethnographies,Actors

] + Coerced Pop[Ethnographies,Actors] + Governed Pop[Ethnographies,Actors]

Units: People

Total Funds Sent Abroad[Actors] = INTEG( Money Sent Abroad[Actors] , 0)

Units: Dollars

Total New Procedure Costs[Actors] = MAX ( 0, Total New Procedures[Actors] \* NEW PROCEDURE COST[

Actors] )

Units: Dollars/Period

Total New Procedures[Actors] = SUM ( Organic Procedures[Ethnographies!,Actors] )

+ SUM ( Procedural Development[Ethnographies!,Actors] ) + SUM ( Replacing Obsolete Procedures[

Ethnographies!,Actors] )

Units: Procedures/Period

Total Procedure Maintenance Costs[Actors] = PROCEDURE MAINTENANCE COST[Actors] \*

( SUM ( Institutional Procedures[Ethnographies!,Actors] ) )

Units: Dollars/Period

Wages[Actors] = 366, 366

Units: Dollars/(Period\*Person)

Includes direct pay to militant of $41/month and dependent (on

averaqge one) pay of $20/month for $61/month or $366/period. See

Appendix B for parameterization method.

# A-3: World Model Sectors

## Ethnographic Perceptions

### Overview



Figure 7: Ethnographic Perceptions Sector Overview

### Equations

Change in Long Term Perception[Ethnographies,Actors] = ( ( Ethnographic Short Term Perception of Actor[

Ethnographies,Actors] - Ethnographic Long Term Perception of Actor[Ethnographies

,Actors] ) / NORMAL TIME TO FORM LONG TERM PERCEPTION ) - Net Long Term Change from Violence[

Ethnographies,Actors]

Units: People/Period

Change in Short Term Perception[Ethnographies,Actors] = ( ( Perception Adjst Amnt[

Ethnographies,Actors] + ( Ethnographic Long Term Perception of Actor[Ethnographies

,Actors] - Ethnographic Short Term Perception of Actor[Ethnographies,

Actors] ) ) / TIME TO FORM SHORT TERM PERCEPTION ) + Net Propoganda Impact[

Ethnographies,Actors] - ( Net Perception Change from Violence[Ethnographies

,Actors] + Net Instability Change[Actors] )

Units: People/Period

Ethnographic Long Term Perception of Actor[Ethnographies,Actors] = INTEG( Change in Long Term Perception[

Ethnographies,Actors] , Initial Ethnographic Generational Perception[

Ethnographies,Actors] )

Units: People

Ethnographic Short Term Perception of Actor[Ethnographies,Actors] = INTEG( Change in Short Term Perception[

Ethnographies,Actors] , Initial Ethnographic Perception[Ethnographies

,Actors] )

Units: People

Institutional Procedures[Ethnographies,Actors] = INTEG( Increase in Institutional Procedures[

Ethnographies,Actors] - Procedural Decay[Ethnographies,Actors] - Reduction in Institutional Procedures[

Ethnographies,Actors] , Desired Institutional Procedures[Ethnographies

,Actors] + Legacy Procedures Step Test[Ethnographies,Red] )

Units: Procedures

Perception Adjst Amnt[Ethnographies,Actors] = ( ( Institutional Procedures[Ethnographies

,Actors] \* Peoples Adjusted Perception per Procedure ) - Ethnographic Short Term Perception of Actor[

Ethnographies,Actors] )

Units: People

Actual Governed Local Recruiting[Ethnographies,Actors] = ( Target Recruitment Governed[

Ethnographies,Actors] ) \* FAM Modifier for Governed[Ethnographies,Actors]

Units: People/Period

All Conflict Deaths = INTEG( Rate of All Conflict Deaths , 0)

Units: People

Average Perception Period[Ethnographies,Actors] = INTEG( Change of Average[Ethnographies

,Actors] , Pct views Actor as best choice for now[Ethnographies,Actors

] )

Units: Pct

Average Rate of Change of Perception[Ethnographies,Actors] = INTEG( Rate of Change of the Average Perception[

Ethnographies,Actors] , 0)

Units: Pct/Period

Blue or Purple Information Operations[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Information Operations[Actors]

Units: Military Actions/Period

Change of Average[Ethnographies,Actors] = ( Pct views Actor as best choice for now[

Ethnographies,Actors] - Average Perception Period[Ethnographies,Actors] )

/ NORMAL PERIOD

Units: Pct/Period

Civilian Deaths[Ethnographies,Actors] = War Crime Deaths[Ethnographies,Actors]

Units: People/Period

Civilians Killed[Ethnographies,Actors] = INTEG( Rate of Civilian Deaths[Ethnographies

,Actors] , 0)

Units: People

COMPUTED INSTITUTIONAL PROCEDURES[Ethnographies,Green] = ( ( Calc Legit Pop[Ethnographies

,Green] + Governed Pop[Ethnographies,Green] + Coerced Pop[Ethnographies,Green

] ) \* NORMAL PROCEDURES REQUIRED FOR CREDIBILITY PER POP[Ethnographies

] ) \* Desire to Credibly Govern Ethnography[Ethnographies,Green]

COMPUTED INSTITUTIONAL PROCEDURES[Ethnographies,Red] = 2e+006, 0, 2e+006

Units: Procedures

Death Generational Perception Multiplier = 20

Units: Dmnl

Thisis the number of periods that the violence will be "remembered"

and cause an impact. This impact is delivered up front and must be

earned back over time. Currently set from 20 = 10 yrs.

Deaths[Actors] = ( Actor Infantry Actual Losses[Actors] \* PCT OF LOSSES THAT ARE DEATH[

Actors] ) + Deaths from CT Operations[Actors] + Deaths from Thwarted Prison Breaks[

Actors]

Units: People/Period

(Red Infantry Final Losses[Red]\*PCT OF LOSSES THAT ARE

DEATH[Red])/Time to Realize Losses+ Deaths from CT

Operations[Red]+Deaths from Thwarted Prison Breaks[Red]

Ethno Sufficiency Modifier[Ethnographies] = Table for Effect of Remaining Population on Sufficiency

( Remaining Ethnographic Population[Ethnographies] )

Units: Dmnl

Ethnographic Relative Momentum in Perception[Ethnographies,Actors] = Average Rate of Change of Perception[

Ethnographies,Green] - Average Rate of Change of Perception[Ethnographies,

Red]

Units: Pct/Period

Rate of Change of the Average Perception[Ethnographies,Red]-Rate of

Change of the Average Perception[Ethnographies,Green ]

Initial Ethnographic Generational Perception[Ethnographies,Green] = IF THEN ELSE (

STARTING ETHNOGRAPHIC GENERATIONAL PERCEPTION OF ACTOR[Ethnographies,

Green] = 0, COMPUTED INSTITUTIONAL PROCEDURES[Ethnographies,Green] /

NORMAL PROCEDURES REQUIRED FOR CREDIBILITY PER POP[Ethnographies

] , STARTING ETHNOGRAPHIC GENERATIONAL PERCEPTION OF ACTOR[Ethnographies

,Green] )

Initial Ethnographic Generational Perception[Ethnographies,Red] = IF THEN ELSE (

STARTING ETHNOGRAPHIC GENERATIONAL PERCEPTION OF ACTOR[Ethnographies,

Red] = 0, COMPUTED INSTITUTIONAL PROCEDURES[Ethnographies,Red] / NORMAL PROCEDURES REQUIRED FOR CREDIBILITY PER POP[

Ethnographies] , STARTING ETHNOGRAPHIC GENERATIONAL PERCEPTION OF ACTOR[

Ethnographies,Red] )

Units: People

Initial Ethnographic Perception[Ethnographies,Actors] = IF THEN ELSE ( STARTING ETHNOGRAPHIC PERCEPTION[

Ethnographies,Actors] = 0, Initial Ethnographic Generational Perception[

Ethnographies,Actors] , STARTING ETHNOGRAPHIC PERCEPTION[Ethnographies

,Actors] )

Units: People

KIA Per Million Population[Ethnographies,Actors] = Rate of All Conflict Deaths /

( SUM ( Total Ethno Population[Ethnographies!] ) / Million Population

)

Units: People/Period

Negative Propoganda Impact[Ethnographies,Green] = ( Propoganda Squads[Red] + Blue or Purple Information Operations[

Red] ) \* NORMAL NEGATIVE PROPOGANDA IMPACT[Ethnographies,Red]

Negative Propoganda Impact[Ethnographies,Red] = ( Blue or Purple Information Operations[

Green] + Propoganda Squads[Green] ) \* NORMAL NEGATIVE PROPOGANDA IMPACT[Ethnographies

,Red]

Units: People/Period

-(Propoganda Squads[Green]\*Normal Propoganda

Impact[Ethnographies,Green])

Net Instability Change[Actors] = Rate of All Conflict Deaths

Units: People/Period

Net Long Term Change from Violence[Ethnographies,Actors] = ( War Crime Deaths[Ethnographies

,Actors] + Terrorism Deaths[Ethnographies,Actors] ) \* Death Generational Perception Multiplier

Units: People/Period

Net Perception Change from Violence[Ethnographies,Actors] = ( KIA Per Million Population[

Ethnographies,Actors] + Terrorism Refugees[Ethnographies,Actors] + War Crime Refugees[

Ethnographies,Actors] ) \* Violence Perception Multiplier[Actors]

Units: People/Period

Net Propoganda Impact[Ethnographies,Actors] = Positive Propoganda Impact[Ethnographies

,Actors] - Negative Propoganda Impact[Ethnographies,Actors]

Units: People/Period

NORMAL NEGATIVE PROPOGANDA IMPACT[Ethnographies,Green] = 1000, 1000, 1000

NORMAL NEGATIVE PROPOGANDA IMPACT[Ethnographies,Red] = 1000, 1000, 1000

Units: People/Military Action

NORMAL PERIOD = 1

Units: Period

NORMAL POSITIVE PROPOGANDA IMPACT[Ethnographies,Green] = 1000, 1000, 1000

NORMAL POSITIVE PROPOGANDA IMPACT[Ethnographies,Red] = 1000, 0, 500

Units: People/Military Action

NORMAL PROCEDURES REQUIRED FOR CREDIBILITY PER POP[Ethnographies] = 1

Units: Procedures/People

NORMAL TIME TO FORM LONG TERM PERCEPTION = 10

Units: Periods

nominally set at 10 period or 5 times the short term value in order

to see all dynamics without an extended duration model.

Outflow of Population Under Control[Ethnographies] = ( SUM ( Civilian Deaths[Ethnographies

,Actors!] ) ) + ( SUM ( Actual Governed Local Recruiting[Ethnographies

,Actors!] ) ) + ( SUM ( Refugees Leaving[Ethnographies,Actors!]

) )

Units: People/Period

Pct views Actor as best choice for now[Ethnographies,Actors] = IF THEN ELSE ( Ethnographic Short Term Perception of Actor[

Ethnographies,Actors] < 0, 0, MAX ( 0, MIN ( 1, ZIDZ ( Ethnographic Short Term Perception of Actor[

Ethnographies,Actors] , Total Ethno Population[Ethnographies

] ) ) ) )

Units: Pct

Pct views Actor as legitimate government[Ethnographies,Actors] = IF THEN ELSE (

Ethnographic Long Term Perception of Actor[Ethnographies,Actors] < 0,

0, MAX ( 0, MIN ( 1, ZIDZ ( Ethnographic Long Term Perception of Actor[

Ethnographies,Actors] , Total Ethno Population[Ethnographies

] ) ) ) )

Units: Pct

Peoples Adjusted Perception per Procedure = 1

Units: People/Procedure

Positive Propoganda Impact[Ethnographies,Green] = NORMAL POSITIVE PROPOGANDA IMPACT[

Ethnographies,Green] \* ( Propoganda Squads[Green] + Blue or Purple Information Operations[

Green] )

Positive Propoganda Impact[Ethnographies,Red] = ( Propoganda Squads[Red] + Blue or Purple Information Operations[

Red] ) \* NORMAL POSITIVE PROPOGANDA IMPACT[Ethnographies,Red]

Units: People/Period

Propoganda Squads[Actors] = Actual Military Actions[Actors] \* OpOrder Propoganda[

Actors]

Units: Military Actions/Period

Rate of All Conflict Deaths = Rate of Total Civilian Death all Ethnographies + (

SUM ( Deaths[Actors!] ) )

Units: People/Period

Rate of Change of the Average Perception[Ethnographies,Actors] = ( Change of Average[

Ethnographies,Actors] - Average Rate of Change of Perception[Ethnographies

,Actors] ) / NORMAL PERIOD \* 2

Units: Pct/(Period\*Period)

Rate of Civilian Deaths[Ethnographies,Actors] = ( Civilian Deaths[Ethnographies,

Actors] ) \* Ethno Sufficiency Modifier[Ethnographies]

Units: People/Period

Rate of Civilian Refugees[Ethnographies,Actors] = Refugees Leaving[Ethnographies

,Actors] \* Ethno Sufficiency Modifier[Ethnographies]

Units: People/Period

Rate of Civilian Refugees all Ethnographies = SUM ( Rate of Civilian Refugees[Ethnographies!

,Actors!] )

Units: People/Period

Rate of Total Civilian Death all Ethnographies = SUM ( Rate of Civilian Deaths[Ethnographies!

,Actors!] )

Units: People/Period

Rate of Unaligned converting to Calculated Risk[Ethnographies,Green] = IF THEN ELSE (

Ethnographic Relative Momentum in Perception[Ethnographies,Green] > 0

, Ethnographic Relative Momentum in Perception[Ethnographies,Green] \*

NORMAL PERIOD , 0)

Rate of Unaligned converting to Calculated Risk[Ethnographies,Red] = IF THEN ELSE (

Ethnographic Relative Momentum in Perception[Ethnographies,Green] < 0

, - ( Ethnographic Relative Momentum in Perception[Ethnographies,Red]

\* NORMAL PERIOD ) , 0)

Units: Pct

Refugees[Ethnographies,Actors] = INTEG( Rate of Civilian Refugees[Ethnographies,

Actors] , 0)

Units: People

Refugees Leaving[Ethnographies,Actors] = War Crime Refugees[Ethnographies,Actors

] + Terrorism Refugees[Ethnographies,Actors]

Units: People/Period

STARTING ETHNOGRAPHIC GENERATIONAL PERCEPTION OF ACTOR[Ethnographies,Green] = 1e+007

, 3e+007, 1e+007

STARTING ETHNOGRAPHIC GENERATIONAL PERCEPTION OF ACTOR[Ethnographies,Red] = 0, 0

, 0

Units: People

STARTING ETHNOGRAPHIC PERCEPTION[Ethnographies,Green] = 1e+007, 3e+007, 1e+007

STARTING ETHNOGRAPHIC PERCEPTION[Ethnographies,Red] = 0, 0, 0

Units: People

Terrorism Deaths[Ethnographies,Red] = ( Completed Terrorist Attacks by Ethnography[

Ethnographies,Green] \* DEATHS PER TERRORIST ATTACK[Green] ) \* Ethno by Actor Sufficiency[

Ethnographies,Red]

Terrorism Deaths[Ethnographies,Green] = ( Completed Terrorist Attacks by Ethnography[

Ethnographies,Red] \* DEATHS PER TERRORIST ATTACK[Red] ) \* Ethno by Actor Sufficiency[

Ethnographies,Green]

Units: People/Period

Terrorism Refugees[Ethnographies,Green] = ( Completed Terrorist Attacks by Ethnography[

Ethnographies,Red] \* REFUGEES PER TERRORIST ATTACK[Red] ) \* Ethno by Actor Sufficiency[

Ethnographies,Green]

Terrorism Refugees[Ethnographies,Red] = ( Completed Terrorist Attacks by Ethnography[

Ethnographies,Green] \* REFUGEES PER TERRORIST ATTACK[Green] ) \* Ethno by Actor Sufficiency[

Ethnographies,Red]

Units: People/Period

TIME TO FORM SHORT TERM PERCEPTION = 0.5

Units: Periods

nominally set at .5 Period, or 3months of credible processes for

short term formation.

Total Civilians Killed all Ethnographies = INTEG( Rate of Total Civilian Death all Ethnographies

, 0)

Units: People

Total Ethno Population[Ethnographies] = INTEG( Increase in Pop[Ethnographies] -

Decrease in Pop[Ethnographies] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] )

Units: People

Total Refugees all Ethnicities = INTEG( Rate of Civilian Refugees all Ethnographies

, 0)

Units: People

Violence Perception Multiplier[Actors] = 6, 1

Units: Dmnl

Multiplier indicating the length of time the violence will be

remembered. This impact is delivered up front and fades over time.

War Crime Deaths[Ethnographies,Actors] = MAX ( 0, ( War Crimes[Ethnographies,Actors

] \* DEATHS PER WAR CRIME[Ethnographies,Actors] ) \* Ethno by Actor Sufficiency[

Ethnographies,Actors] )

Units: People/Period

War Crime Refugees[Ethnographies,Actors] = MAX ( 0, ( War Crimes[Ethnographies,Actors

] \* REFUGEES PER WAR CRIME[Ethnographies,Actors] ) \* Ethno by Actor Sufficiency[

Ethnographies,Actors] )

Units: People/Period

## Ethnographic Side-Choosing & Actor Legitimacy

### Overview

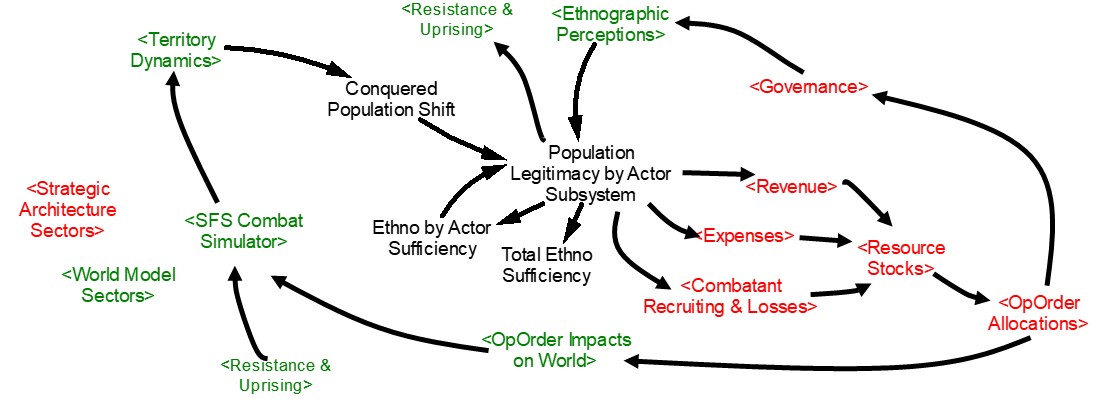


Figure 8: Ethnographic Side-Choosing & Legitimacy Structure

### Equations

Ethnographic Short Term Perception of Actor[Ethnographies,Actors] = INTEG( Change in Short Term Perception[

Ethnographies,Actors] , Initial Ethnographic Perception[Ethnographies

,Actors] )

Units: People

Institutional Procedures[Ethnographies,Actors] = INTEG( Increase in Institutional Procedures[

Ethnographies,Actors] - Procedural Decay[Ethnographies,Actors] - Reduction in Institutional Procedures[

Ethnographies,Actors] , Desired Institutional Procedures[Ethnographies

,Actors] + Legacy Procedures Step Test[Ethnographies,Red] )

Units: Procedures

Actual Governed Local Recruiting[Ethnographies,Actors] = ( Target Recruitment Governed[

Ethnographies,Actors] ) \* FAM Modifier for Governed[Ethnographies,Actors]

Units: People/Period

Actual Opposition Recruited[Ethnographies,Actors] = Adequacy of Fighting Age Men for Opposition[

Ethnographies,Actors] \* Target Recruited Opposition[Ethnographies,Actors]

Units: People/Period

Actual Recruiting Fighting Age Men in Population[Ethnographies,Actors] = ( STARTING NORMAL PCT OF FIGHTING AGE MEN IN POPULATION[

Ethnographies] \* ( 1 + Experience Effect on Actions[Actors] ) )

Units: Pct

The ethnographic norm +capability of the actor based on experience.

Cal Legit Pop Dying[Ethnographies,Actors] = Calc Legit Pop Deaths[Ethnographies,

Actors]

Units: People/Period

Calc Legit Pop[Ethnographies,Actors] = INTEG( Coerced to Calculated[Ethnographies

,Actors] + Governed to Calculated[Ethnographies,Actors] + Unaligned Choosing Sides[

Ethnographies,Actors] - Cal Legit Pop Dying[Ethnographies,Actors

] - Calc Legit Pop Recruited or Joining Uprising[Ethnographies,Actors

] - Calc Legit Refugees Leaving[Ethnographies,Actors] - Calculated Lost to Conquest[

Ethnographies,Actors] - Calculated to Coerced[Ethnographies,Actors

] - Calculated to Governed[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION CALCULATED[Ethnographies

,Actors] )

Units: People

Calc Legit Pop Deaths[Ethnographies,Actors] = Rate of Civilian Deaths[Ethnographies

,Actors] \* Pct Calc Legit Pop[Ethnographies,Actors]

Units: People/Period

Calc Legit Pop Recruited or Joining Uprising[Ethnographies,Actors] = Calc Legit Recruited[

Ethnographies,Actors]

Units: People/Period

Calc Legit Pop Refugees[Ethnographies,Actors] = ( Rate of Civilian Refugees[Ethnographies

,Actors] \* Pct Calc Legit Pop[Ethnographies,Actors] )

Units: People/Period

Calc Legit Recruited[Ethnographies,Actors] = Actual Local Calculated Recruiting[

Ethnographies,Actors]

Units: People/Period

Actual Governed Local Recruiting[Ethnographies,Actors]\*"Pct Calc

Legit Fighting Age Men (Red)"[Ethnographies,Actors]

Calc Legit Refugees Leaving[Ethnographies,Actors] = Calc Legit Pop Refugees[Ethnographies

,Actors]

Units: People/Period

Calculated Legitimacy Gap[Ethnographies,Actors] = MAX ( 0, 1 - XIDZ ( Pct views Actor as best choice for now[

Ethnographies,Actors] , Pct Calc Legit Pop[Ethnographies,Actors

] , 1) )

Units: Pct

MAX(0,1-XIDZ(Pct views Actor as best choice for

now[Ethnographies,Actors],"Pct Calc Legit Pop

(Red)"[Ethnographies,Actors],1))

Calculated Lost to Conquest[Ethnographies,Actors] = Loss of CalcLegit due to Conquest[

Ethnographies,Actors] \* Ethno by Actor Sufficiency[Ethnographies,Actors]

Units: People/Period

Calculated to Coerced[Ethnographies,Actors] = MAX ( 0, ( Calc Legit Pop[Ethnographies

,Actors] \* Fr Transition to Coerced[Ethnographies,Actors] ) / NORMAL TIME FOR POPULATION TRANSITION[

Ethnographies,Actors] )

Units: People/Period

Calculated to Governed[Ethnographies,Actors] = MAX ( 0, ( Calc Legit Pop[Ethnographies

,Actors] \* Fr Transition to Legitimacy[Ethnographies,Actors] ) / NORMAL TIME FOR POPULATION TRANSITION[

Ethnographies,Actors] )

Units: People/Period

Civilian Deaths[Ethnographies,Actors] = War Crime Deaths[Ethnographies,Actors]

Units: People/Period

Coerced Dying[Ethnographies,Actors] = MAX ( 0, Coerced Pop Deaths[Ethnographies,

Actors] )

Units: People/Period

Coerced Lost to Conquest[Ethnographies,Actors] = Loss of Coerced due to Conquest[

Ethnographies,Actors] \* Ethno by Actor Sufficiency[Ethnographies,Actors]

Units: People/Period

Coerced Opposition Recruitment[Ethnographies,Actors] = MAX ( 0, Actual Opposition Recruited[

Ethnographies,Actors] )

Units: People/Period

Coerced Pop[Ethnographies,Actors] = INTEG( ( Unaligned to Coerced[Ethnographies,

Actors] + Calculated to Coerced[Ethnographies,Actors] - Coerced Dying[

Ethnographies,Actors] ) - Coerced Refugees Leaving[Ethnographies

,Actors] - Coerced to Calculated[Ethnographies,Actors] - Coerced to Unaligned[

Ethnographies,Actors] - Coerced Opposition Recruitment[Ethnographies

,Actors] + Conquest[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION COERCED[Ethnographies,Actors

] )

Units: People

Coerced Pop Deaths[Ethnographies,Actors] = ( Rate of Civilian Deaths[Ethnographies

,Actors] \* Pct Coerced Pop[Ethnographies,Actors] )

Units: People/Period

Coerced Pop Refugees[Ethnographies,Actors] = ( Rate of Civilian Refugees[Ethnographies

,Actors] \* Pct Coerced Pop[Ethnographies,Actors] )

Units: People/Period

Coerced Refugees Leaving[Ethnographies,Actors] = MAX ( 0, Coerced Pop Refugees[Ethnographies

,Actors] )

Units: People/Period

Coerced to Calculated[Ethnographies,Actors] = MAX ( 0, ( Coerced Pop[Ethnographies

,Actors] \* Fr Transition to Calculated Legitimatcy[Ethnographies,Actors

] ) / NORMAL TIME FOR POPULATION TRANSITION[Ethnographies,Actors

] )

Units: People/Period

Coerced to Unaligned[Ethnographies,Actors] = Leaving from Coerced to Unaligned[Ethnographies

,Actors] / NORMAL TIME FOR POPULATION TRANSITION[Ethnographies,Actors]

Units: People/Period

MAX(0,(Coerced Pop[Ethnographies,Actors]\*("% of Garrison Gap to

Coerced"[Ethnographies,Actors]\*0.75))/NORMAL TIME FOR POPULATION

TRANSITION [Ethnographies,Actors])

Conquest[Ethnographies,Red] = Green Conquered to Coerced[Ethnographies,Green]

Conquest[Ethnographies,Green] = Red Conquered to Coerced[Ethnographies,Red]

Units: People/Period

Decrease in Pop[Ethnographies] = Decrease in Total Ethno Pop All Sources[Ethnographies

]

Units: People/Period

Decrease in Total Ethno Pop All Sources[Ethnographies] = ( SUM ( Cal Legit Pop Dying[

Ethnographies,Actors!] ) + ( SUM ( Calc Legit Pop Recruited or Joining Uprising[

Ethnographies,Actors!] ) ) + ( SUM ( Calc Legit Refugees Leaving[

Ethnographies,Actors!] ) ) + ( SUM ( Governed Dying[Ethnographies

,Actors!] ) ) + ( SUM ( Governed Pop Recruited[Ethnographies,Actors!

] ) ) + ( SUM ( Governed Refugees Leaving[Ethnographies,Actors!]

) ) + ( SUM ( Coerced Dying[Ethnographies,Actors!] ) ) + ( SUM (

Coerced Refugees Leaving[Ethnographies,Actors!] ) ) )

Units: People/Period

(SUM(Cal Legit Pop Dying[Ethnographies,Actors!])+ (SUM(Calculated

Lost to Conquest[Ethnographies,Actors!]))+ (SUM(Calc Legit Pop

Recruited or Joining Uprising[Ethnographies,Actors!]))+ (SUM(Calc

Legit Refugees Leaving[Ethnographies,Actors!]))+ (SUM(Governed

Dying[Ethnographies,Actors!]))+ (SUM(Governed Lost to

Conquest[Ethnographies,Actors!]))+ (SUM(Governed Pop

Recruited[Ethnographies,Actors!]))+ (SUM(Governed Refugees

Leaving[Ethnographies,Actors!]))+ (SUM(Coerced

Dying[Ethnographies,Actors!]))+ (SUM(Coerced Refugees

Leaving[Ethnographies,Actors!])))

Defections by Ethnography[Ethnographies,Actors] = ( NORMAL DEFECTIONS DUE TO ETHNOGRAPHIC DISTRUST[

Ethnographies,Actors] + NORMAL DEFECTIONS DUE TO PAY INSUFFICIENCY[Actors]

+ Normal Defections from Momentum[Ethnographies,Red] ) \* Combatants[Ethnographies

,Actors]

Units: People/Period

Defections to Unaligned[Ethnographies] = SUM ( Defections by Ethnography[Ethnographies

,Actors!] )

Units: People/Period

Demographic Growth[Ethnographies] = 0

Units: Pct

Effect of Garrison Ratio on Leaving to Unaligned[Ethnographies,Actors] = Table for Effect of Ratio on Leaving to Unaligned

( Pct of Desired Garrison Actual Represents[Ethnographies,Actors] )

Units: Pct

Ethno by Actor Sufficiency[Ethnographies,Actors] = Table for Effect of Remaining Ethno Population by Actor

( MAX ( 0, Total Ethno by Actor[Ethnographies,Actors] / Reference Population for Sufficiency[

Ethnographies,Actors] ) )

Units: Pct

Ethno Sufficiency Modifier[Ethnographies] = Table for Effect of Remaining Population on Sufficiency

( Remaining Ethnographic Population[Ethnographies] )

Units: Dmnl

Experience Effect on Actions[Actors] = Table for Effect of Militant Experience on Military Actions

( Average Combatant Experience[Actors] \* Dimensioned Ratio Average Militant Experience[

Actors] ) \* Allocation of Essential Budgets[Actors]

Units: Pct

Derived from AQI implied local recruiting patterns. Estimated

parameter from data or nearby model structure see Appendix B for

discussion.

Fr Transition Back to Calculated[Ethnographies,Actors] = Table for Effect of Abandoning Actor

( Legitimacy Gap Fraction[Ethnographies,Actors] )

Units: Pct

Fr Transition to Calculated Legitimatcy[Ethnographies,Actors] = Table for Effect of Gap on Transition

( Gap for Calc[Ethnographies,Actors] )

Units: Pct

Fr Transition to Coerced[Ethnographies,Actors] = Table for Effect of Abandoning Actor

( Calculated Legitimacy Gap[Ethnographies,Actors] )

Units: Pct

Fr Transition to Legitimacy[Ethnographies,Actors] = Table for Effect of Gap on Transition

( Gap for Legitimacy[Ethnographies,Actors] )

Units: Dmnl

Gap for Calc[Ethnographies,Actors] = MAX ( 0, 1 - ZIDZ ( Pct Calc Legit Pop[Ethnographies

,Actors] , Pct views Actor as best choice for now[Ethnographies

,Actors] ) )

Units: Pct

Gap for Legitimacy[Ethnographies,Actors] = MAX ( 0, 1 - XIDZ ( Pct Governed Pop[

Ethnographies,Actors] , Pct views Actor as legitimate government[

Ethnographies,Actors] , 1) )

Units: Pct

Goverened Deaths[Ethnographies,Actors] = ( Rate of Civilian Deaths[Ethnographies

,Actors] \* Pct Governed Pop[Ethnographies,Actors] )

Units: People/Period

Governed Dying[Ethnographies,Actors] = Goverened Deaths[Ethnographies,Actors]

Units: People/Period

Governed Lost to Conquest[Ethnographies,Actors] = Loss of Governed due to Conquest[

Ethnographies,Actors] \* Ethno by Actor Sufficiency[Ethnographies,Actors]

Units: People/Period

Governed Pop[Ethnographies,Actors] = INTEG( Calculated to Governed[Ethnographies

,Actors] - Governed Dying[Ethnographies,Actors] - Governed Lost to Conquest[

Ethnographies,Actors] - Governed Pop Recruited[Ethnographies,Actors

] - Governed Refugees Leaving[Ethnographies,Actors] - Governed to Calculated[

Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION GOVERNED[Ethnographies,Actors

] )

Units: People

Governed Pop Recruited[Ethnographies,Actors] = MAX ( 0, Governed Recruited[Ethnographies

,Actors] )

Units: People/Period

Governed Recruited[Ethnographies,Actors] = Actual Governed Local Recruiting[Ethnographies

,Actors]

Units: People/Period

Governed Refugees[Ethnographies,Actors] = ( Rate of Civilian Refugees[Ethnographies

,Actors] \* Pct Governed Pop[Ethnographies,Actors] )

Units: People/Period

Governed Refugees Leaving[Ethnographies,Actors] = Governed Refugees[Ethnographies

,Actors]

Units: People/Period

Governed to Calculated[Ethnographies,Actors] = MAX ( 0, ( Governed Pop[Ethnographies

,Actors] \* Fr Transition Back to Calculated[Ethnographies,Actors] ) /

NORMAL TIME FOR POPULATION TRANSITION[Ethnographies,Actors] )

Units: People/Period

"Governance Gap (Red)"[Ethnographies,Actors]/NORMAL TIME FOR

POPULATION TRANSITION[Ethnographies,Actors]

Green Conquered[Ethnographies] = ( SUM ( Red Conquered to Green[Ethnographies,Actors!

] ) )

Units: People/Period

Green Conquered to Coerced[Ethnographies,Green] = Red Conquered[Ethnographies]

Units: People/Period

Green Conquered to Red[Ethnographies,Red] = Total Conquered[Ethnographies,Green]

Green Conquered to Red[Ethnographies,Green] = 0

Units: People/Period

Increase in Pop[Ethnographies] = ( Demographic Growth[Ethnographies] \* Total Ethno Population[

Ethnographies] ) / NORMAL PERIOD

Units: People/Period

Held constant for 10yr model.

Leaving from Coerced to Unaligned[Ethnographies,Actors] = Coerced Pop[Ethnographies

,Actors] \* Effect of Garrison Ratio on Leaving to Unaligned[Ethnographies,

Actors]

Units: People

Legitimacy Gap[Ethnographies,Actors] = MAX ( 0, 1 - ZIDZ ( Pct views Actor as legitimate government[

Ethnographies,Actors] , Pct Governed Pop[Ethnographies,Actors

] ) )

Units: Pct

Legitimacy Gap Fraction[Ethnographies,Actors] = Legitimacy Gap[Ethnographies,Actors

]

Units: Pct

Loss of CalcLegit due to Conquest[Ethnographies,Green] = Pct Calc Legit Pop[Ethnographies

,Green] \* IF THEN ELSE ( Rate of Conquering Red[Ethnographies,Red] > 0, Rate of Conquering Red[

Ethnographies,Red] , 0)

Loss of CalcLegit due to Conquest[Ethnographies,Red] = IF THEN ELSE ( Rate of Conquering Red[

Ethnographies,Red] < 0, - Rate of Conquering Red[Ethnographies,Red] \*

Pct Calc Legit Pop[Ethnographies,Red] , 0)

Units: People/Period

Loss of Coerced due to Conquest[Ethnographies,Green] = Pct Coerced Pop[Ethnographies

,Green] \* IF THEN ELSE ( Rate of Conquering Red[Ethnographies,Red] > 0, Rate of Conquering Red[

Ethnographies,Red] , 0)

Loss of Coerced due to Conquest[Ethnographies,Red] = IF THEN ELSE ( Rate of Conquering Red[

Ethnographies,Red] < 0, - Rate of Conquering Red[Ethnographies,Red] ,

0)

Units: People/Period

Loss of Governed due to Conquest[Ethnographies,Green] = IF THEN ELSE ( Rate of Conquering Red[

Ethnographies,Red] > 0, Rate of Conquering Red[Ethnographies,Red] , 0

) \* Pct Governed Pop[Ethnographies,Green]

Loss of Governed due to Conquest[Ethnographies,Red] = IF THEN ELSE ( Rate of Conquering Red[

Ethnographies,Red] < 0, - Rate of Conquering Red[Ethnographies,Red] ,

0)

Units: People/Period

NORMAL PERIOD = 1

Units: Period

NORMAL TIME FOR POPULATION TRANSITION[Ethnographies,Actors] = GAME( 0.25 )

Units: Period

NORMAL TIME FOR UNALIGNED TO CHOSE A SIDE = 10

Units: Period

setat10 assumes 5 years

Pct Calc Legit Pop[Ethnographies,Actors] = MIN ( 1, MAX ( 0, ZIDZ ( Calc Legit Pop[

Ethnographies,Actors] , Total Ethno by Actor[Ethnographies,

Actors] ) ) )

Units: Percentage

Pct Governed Pop[Ethnographies,Actors] = MIN ( 1, MAX ( 0, ZIDZ ( Governed Pop[Ethnographies

,Actors] , Total Ethno by Actor[Ethnographies,Actors] ) ) )

Units: Percentage

Pct of Desired Garrison Actual Represents[Ethnographies,Actors] = ZIDZ ( "Desired Garrison & Police Forces"[

Ethnographies,Actors] , Actual Garrsion[Actors] )

Units: Pct

Pct views Actor as best choice for now[Ethnographies,Actors] = IF THEN ELSE ( Ethnographic Short Term Perception of Actor[

Ethnographies,Actors] < 0, 0, MAX ( 0, MIN ( 1, ZIDZ ( Ethnographic Short Term Perception of Actor[

Ethnographies,Actors] , Total Ethno Population[Ethnographies

] ) ) ) )

Units: Pct

Pct views Actor as legitimate government[Ethnographies,Actors] = IF THEN ELSE (

Ethnographic Long Term Perception of Actor[Ethnographies,Actors] < 0,

0, MAX ( 0, MIN ( 1, ZIDZ ( Ethnographic Long Term Perception of Actor[

Ethnographies,Actors] , Total Ethno Population[Ethnographies

] ) ) ) )

Units: Pct

Peoples Adjusted Perception per Procedure = 1

Units: People/Procedure

Rate of Conquered Population Green[Ethnographies,Green] = MAX ( 0, Territory Conditions Table for Distribution of Population by Ethnography on Territorial Map[

Ethnographies] ( Current Location of Red Actor on Territorial Map[Red

] ) \* Total Ethno Population[Ethnographies] )

Rate of Conquered Population Green[Ethnographies,Red] = MAX ( 0, Total Ethno by Actor[

Ethnographies,Red] \* Pct Decline from Peak[Red] )

Units: People

Rate of Conquering Red[Ethnographies,Red] = ( Target Ethno Population by Most Recent Conquest[

Ethnographies,Red] - Ethno by Actor Conquer Reference[Ethnographies,Red] )

/ Normal Time to be Conquered[Ethnographies]

Units: People/Period

Rate of Local Opposition Fighters Joining Uprising[Ethnographies,Actors] = Diehards joining Uprising[

Ethnographies,Actors] + Actual Opposition Recruited[Ethnographies,Actors]

Units: People/Period

Rate of Unaligned converting to Calculated Risk[Ethnographies,Green] = IF THEN ELSE (

Ethnographic Relative Momentum in Perception[Ethnographies,Green] > 0

, Ethnographic Relative Momentum in Perception[Ethnographies,Green] \*

NORMAL PERIOD , 0)

Rate of Unaligned converting to Calculated Risk[Ethnographies,Red] = IF THEN ELSE (

Ethnographic Relative Momentum in Perception[Ethnographies,Green] < 0

, - ( Ethnographic Relative Momentum in Perception[Ethnographies,Red]

\* NORMAL PERIOD ) , 0)

Units: Pct

Red Conquered[Ethnographies] = ( SUM ( Green Conquered to Red[Ethnographies,Actors!

] ) )

Units: People/Period

Red Conquered to Coerced[Ethnographies,Red] = Green Conquered[Ethnographies]

Units: People/Period

Red Conquered to Green[Ethnographies,Green] = Total Conquered[Ethnographies,Red]

Red Conquered to Green[Ethnographies,Red] = 0

Units: People/Period

Reference Population for Sufficiency[Ethnographies,Actors] = 100000

Units: People

Refugees[Ethnographies,Actors] = INTEG( Rate of Civilian Refugees[Ethnographies,

Actors] , 0)

Units: People

Remaining Ethnographic Population[Ethnographies] = ZIDZ ( Total Ethno Population[

Ethnographies] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[Ethnographies

] )

Units: Pct

STARTING ETHNO DISTRIBUTION CALCULATED[Ethnographies,Green] = 0, 0, 0

STARTING ETHNO DISTRIBUTION CALCULATED[Ethnographies,Red] = 0, 0, 0

Units: Dmnl

STARTING ETHNO DISTRIBUTION COERCED[Ethnographies,Green] = 0, 0, 0

STARTING ETHNO DISTRIBUTION COERCED[Ethnographies,Red] = 0, 0, 0

Units: Dmnl

STARTING ETHNO DISTRIBUTION GOVERNED[Ethnographies,Green] = 1, 1, 1

STARTING ETHNO DISTRIBUTION GOVERNED[Ethnographies,Red] = 0, 0, 0

Units: Dmnl

STARTING ETHNO DISTRIBUTION UNALIGNED[Ethnographies,Green] = 0, 0, 0

STARTING ETHNO DISTRIBUTION UNALIGNED[Ethnographies,Red] = 0, 0, 0

Units: Pct

STARTING LEVEL OF ETHNOGRAPHIC POPULATION[Ethnographies] = 1e+007, 3e+007, 1e+007

Units: People

STARTING NORMAL PCT OF FIGHTING AGE MEN IN POPULATION[Ethnographies] = 0.23

Units: Pct

The normal demographic pct of the population that can fight.

Sum of Distributions[Ethnographies,Actors] = STARTING ETHNO DISTRIBUTION CALCULATED[

Ethnographies,Actors] + STARTING ETHNO DISTRIBUTION COERCED[Ethnographies,

Actors] + STARTING ETHNO DISTRIBUTION GOVERNED[Ethnographies,Actors]

+ STARTING ETHNO DISTRIBUTION UNALIGNED[Ethnographies,Actors]

Units: Dmnl

Table for Effect of Abandoning Actor ( [(0,0)-(1,1)],(0,0),(0.1,0.05),(0.2,0.1),

(0.3,0.175),(0.4,0.325),(0.5,0.425),(0.6,0.5),(0.7,0.55),(0.8,0.575)

,(0.9,0.595),(1,0.6) )

Units: Dmnl

Table for Effect of Gap on Transition ( [(0,0)-(1.1,0.25)],(1,0.25),(0.9,0.24),(0.8,0.22)

,(0.7,0.2),(0.6,0.16),(0.5,0.12),(0.4,0.06),(0.35,0.04),(0.25,0.02),

(0.2,0.01),(0.15,0),(0,0) )

Units: Pct

Table for Effect of Remaining Ethno Population by Actor ( [(0,0)-(1,1)],(0,0),(0,0)

,(0,0),(0.0025,0),(0.005,0.005),(0.1,0.01),(0.2,0.05),(0.3,0.2),(0.4,0.35)

,(0.5,0.5),(0.6,0.6),(0.75,0.8),(0.8,0.85),(0.9,0.95),(0.97,0.99),(0.99,0.99)

,(1,1) )

Units: Dmnl

Table for Effect of Remaining Population on Sufficiency ( [(0,0)-(1,1)],(0,0),(0,0)

,(0.025,0.005),(0.05,0.01),(0.1,0.05),(0.2,0.1),(0.3,0.25),(0.4,0.4)

,(0.5,0.55),(0.6,0.65),(0.7,0.75),(0.8,0.8),(0.9,0.85),(0.95,0.9),(1,1)

)

Units: Dmnl

Territory Actor Controls[Actors] = INTEG( Rate of Territory Gained[Actors] - Rate of Territory Lost[

Actors] , Territory Conditions Starting Total Territory \* Territory Conditions Pct Territory Controlled by Actor at Start[

Actors] )

Units: "km^2"

Total Conquered[Ethnographies,Actors] = Calculated Lost to Conquest[Ethnographies

,Actors] + Coerced Lost to Conquest[Ethnographies,Actors] + Governed Lost to Conquest[

Ethnographies,Actors]

Units: People/Period

Total Ethno by Actor[Ethnographies,Actors] = Calc Legit Pop[Ethnographies,Actors

] + Coerced Pop[Ethnographies,Actors] + Governed Pop[Ethnographies,Actors]

Units: People

Total Ethno Population[Ethnographies] = INTEG( Increase in Pop[Ethnographies] -

Decrease in Pop[Ethnographies] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] )

Units: People

Unaligned Choosing Sides[Ethnographies,Green] = Unaligned to Calculated[Ethnographies

,Red]

Unaligned Choosing Sides[Ethnographies,Red] = Unaligned to Calculated[Ethnographies

,Green]

Units: People/Period

Unaligned Conquered to Coerced[Ethnographies,Red] = ( Unaligned Pop[Ethnographies

] \* Territory Conditions Table for Percentage of Unaligned Population Controlled based on Location of Red Actor on Territorial Map

( Current Location of Red Actor on Territorial Map[Red] ) ) / Normal Time to be Conquered[

Ethnographies]

Unaligned Conquered to Coerced[Ethnographies,Green] = 0

Units: People/Period

Unaligned Pop[Ethnographies] = INTEG( Defections to Unaligned[Ethnographies] + (

SUM ( Coerced to Unaligned[Ethnographies,Actors!] ) ) - ( SUM (

Unaligned to Coerced[Ethnographies,Actors!] ) ) - ( SUM ( Unaligned to Calculated[

Ethnographies,Actors!] ) ) , 0)

Units: People

Normal is: STARTING LEVEL OF ETHNOGRAPHIC

POPULATION[Ethnographies]-((SUM(Coerced

Pop[Ethnographies,Actors!]))+(SUM(Calc Legit Pop [Ethnographies,Acto

[Ethnographies,Actors!]))+(SUM(Governed

Pop[Ethnographies,Actors!]))), Indonesia is 0

Unaligned to Calculated[Ethnographies,Actors] = ( Rate of Unaligned converting to Calculated Risk[

Ethnographies,Actors] \* Unaligned Pop[Ethnographies] ) / NORMAL TIME FOR UNALIGNED TO CHOSE A SIDE

Units: People/Period

Unaligned to Coerced[Ethnographies,Actors] = Unaligned Conquered to Coerced[Ethnographies

,Actors]

Units: People/Period

## Foreign OpOrder Impacts on World

### Equations

Actual Blue or Purple Military Actions[Actors] = Capability of Blue or Purple Military Actions based on Squads[

Actors]

Units: Military Actions/Period

AVERAGE BLUE or PURPLE WAR CRIMES RATE[Actors] = 0.0001, 0

Units: Pct

Blue Airpower[Actors] = Actual Blue or Purple Military Actions[Actors] \* Blue or Purple OpOrder Airpower[

Actors]

Units: Military Actions/Period

Blue or Purple Advanced Weaponry Provision and Training Effect[Actors] = MAX ( 1

, ZIDZ ( Blue or Purple Advanced Weaponry Provisions[Actors] \* Normal Training Reach[

Actors] , Conventional Warfare[Actors] ) )

Units: Pct

Blue or Purple Advanced Weaponry Provisions[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Advanced Equipment Provision[Actors]

Units: Military Actions/Period

Blue or Purple Airpower Targeting Combatants[Green] = GAME( 1 )

Blue or Purple Airpower Targeting Combatants[Red] = 0

Units: Pct

Blue or Purple Airpower Targeting Government Capacity[Green] = GAME( 0 )

Blue or Purple Airpower Targeting Government Capacity[Red] = GAME( 0 )

Units: Pct

Blue or Purple Airpower Targeting Resources[Green] = GAME( 0 )

Blue or Purple Airpower Targeting Resources[Red] = 0

Units: Pct

Blue or Purple Armed Civil Affairs[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Armed Civil Affairs[Actors]

Units: Military Actions/Period

BLUE or PURPLE AVERAGE SQUADRON SORTIES PER PERIOD[Actors] = 2160, 2160

Units: Sorties/(Period\*Squadron)

2160 = 2 sorties per day per plane at an average of 12 planes per

squadron \* 90 days in a period =

Blue or Purple Combat Training Effect[Actors] = MIN ( 1, ZIDZ ( Normal Training Reach[

Actors] \* Blue or Purple Embedded Combat Advisers[Actors] , Conventional Warfare[

Actors] ) )

Units: Pct

Blue or Purple Embedded Combat Advisers[Actors] = ( Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Embedded Combat Advisers[Actors] ) - ( (

Actual Blue or Purple Military Actions[Actors] \* Blue or Purple OpOrder Embedded Combat Advisers[

Actors] ) \* AVERAGE BLUE or PURPLE WAR CRIMES RATE[Actors] )

Units: Military Actions/Period

Blue or Purple Embedded Combat Troops[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Combat Troops[Actors]

Units: Military Actions/Period

Blue or Purple Information Operations[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Information Operations[Actors]

Units: Military Actions/Period

Blue or Purple OpOrder Advanced Equipment Provision[Green] = GAME( 0.25 )

Blue or Purple OpOrder Advanced Equipment Provision[Red] = 0

Units: Pct

Blue or Purple OpOrder Airpower[Green] = GAME( 0 )

Blue or Purple OpOrder Airpower[Red] = 0

Units: Pct

Blue or Purple OpOrder Armed Civil Affairs[Green] = GAME( 0 )

Blue or Purple OpOrder Armed Civil Affairs[Red] = 0

Units: Pct

Blue or Purple OpOrder Combat Troops[Green] = GAME( 0 )

Blue or Purple OpOrder Combat Troops[Red] = GAME( 0 )

Units: Pct

Blue or Purple OpOrder Embedded Combat Advisers[Actors] = GAME( 0 )

Units: Pct

Blue or Purple OpOrder Information Operations[Green] = GAME( 0.25 )

Blue or Purple OpOrder Information Operations[Red] = 0

Units: Pct

Blue or Purple OpOrder Training Local Actor Security Forces[Green] = GAME( 0.25 )

Blue or Purple OpOrder Training Local Actor Security Forces[Red] = 0

Units: Pct

Blue or Purple Security Forces Training Effect[Actors] = ZIDZ ( Blue or Purple Training Actor Security Forces[

Actors] , Combatting Terrorism[Actors] ) \* Diminshing Returns on Security Force Training[

Actors]

Units: Pct

Security Forces Training does not benefit from the same reach

multiplier as advanced weaponry provisions or combat training. This

indicates it's more intensive 1:1 and continuous mentorship aspect

rather than "training."

Blue or Purple Sorties Per Period[Actors] = ( BLUE or PURPLE AVERAGE SQUADRON SORTIES PER PERIOD[

Actors] \* Blue or Purple Squadrons[Actors] ) - ( ( BLUE or PURPLE AVERAGE SQUADRON SORTIES PER PERIOD[

Actors] \* Blue or Purple Squadrons[Actors] ) \* AVERAGE BLUE or PURPLE WAR CRIMES RATE[

Actors] )

Units: Sorties/Period

Blue or Purple Sorties Targeting Combatants[Actors] = Blue or Purple Sorties Per Period[

Actors] \* Blue or Purple Airpower Targeting Combatants[Actors]

Units: Sorties/Period

Blue or Purple Sorties Targeting Government Capacity[Actors] = Blue or Purple Sorties Per Period[

Actors] \* Blue or Purple Airpower Targeting Government Capacity[Actors]

Units: Sorties/Period

Blue or Purple Sorties Targeting Resources[Actors] = Blue or Purple Sorties Per Period[

Actors] \* Blue or Purple Airpower Targeting Resources[Actors]

Units: Sorties/Period

Blue or Purple Squadrons[Actors] = Blue Airpower[Actors] / Military Actions to Support Each Squadron[

Actors]

Units: Squadrons

Blue or Purple Squads[Actors] = INTEG( Change in Blue Squads[Actors] , 0)

Units: Squads

Blue or Purple Squads to Support a Squadron[Actors] = 27, 27

Units: Squads/Squadron

Blue or Purple Training Actor Security Forces[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Training Local Actor Security Forces[Actors

]

Units: Military Actions/Period

Blue or Purple War Crimes[Actors] = ( Blue or Purple Embedded Combat Advisers[Actors

] + ( Blue or Purple Sorties Per Period[Actors] \* War Crimes per Sortie[Actors

] ) ) \* AVERAGE BLUE or PURPLE WAR CRIMES RATE[Actors]

Units: Military Actions/Period

Capability of Blue or Purple Military Actions based on Squads[Actors] = ( Blue or Purple Squads[

Actors] ) \* NORMAL MILITARY CAPABILITY OF SQUADS[Actors]

Units: Military Actions/Period

Combatting Terrorism[Actors] = Actual Military Actions[Actors] \* OpOrder Combatting Terrorism[

Actors]

Units: Military Actions/Period

Conventional Warfare[Actors] = ( Actual Military Actions[Actors] \* OpOrder Conventional Warfare[

Actors] \* Engagement Threshold[Actors] )

Units: Military Actions/Period

Current Security Effectiveness[Actors] = INTEG( Change in Current Security Effectivneess[

Actors] - Decay in Security Effectiveness[Actors] , Anchor Security Effectiveness[

Actors] )

Units: Pct

Days = 1

Units: Days

Days in a Period = 90

Units: Days/Period

Diminshing Returns on Security Force Training[Actors] = Table for Effect of Current Security Effectiveness on Training Effect

( Current Security Effectiveness[Actors] )

Units: Pct

Effect of Ground Support Campaign[Actors] = Table for Effect of Ground Support Air Campaign[

Actors] ( Sorties Supporting Ground Campaign[Actors] / Maximum Daily Sorties

)

Units: Dmnl

Local Actor Combatants Engaged in Conventional Warfare[Ethnographies,Actors] = (

Conventional Warfare[Actors] / NORMAL MILITARY CAPABILITY OF SQUADS[Actors

] ) \* NORMAL SIZE PER SQUAD[Actors]

Units: People

Maximum Daily Sorties = 600

Units: Sorties/Day

Military Actions to Support Each Squadron[Actors] = NORMAL MILITARY CAPABILITY OF SQUADS[

Actors] \* Blue or Purple Squads to Support a Squadron[Actors]

Units: Military Actions/(Period\*Squadron)

NORMAL MILITARY CAPABILITY OF SQUADS[Actors] = 1, 1

Units: Military Actions/(Period\*Squad)

1 every 2 months is normal

NORMAL SIZE PER SQUAD[Actors] = 10

Units: People/Squad

Normal value for ISIS is set at an average of 11. Value for

equilibrium is set at 10.

Normal Training Reach[Actors] = 10, 10

Units: Dmnl

How many Squads each Blue/Purple Squad help via being embedded.

Sorties Supporting Ground Campaign[Actors] = Blue or Purple Sorties Targeting Combatants[

Actors] / Days in a Period

Units: Sorties/Day

Sorties Targeting Government per Day[Actors] = Blue or Purple Sorties Targeting Government Capacity[

Actors] / Days in a Period

Units: Sorties/Day

Table for Effect of Current Security Effectiveness on Training Effect ( [(0,0)-(1,1)

],(0,1),(0.1,0.99),(0.2,0.95),(0.3,0.85),(0.4,0.65),(0.5,0.45),(0.6,0.25)

,(0.7,0.125),(0.8,0.075),(0.9,0.025),(0.95,0.0125),(0.99,0.001),(1,0)

)

Units: Dmnl

Table for Effect of Ground Support Air Campaign[Actors] ( [(0,0)-(1,1)],(0,0),(0.016,0.01)

,(0.16,0.1),(0.83,0.5),(1,0.5) )

Units: Dmnl

Lookup for ground campaign support effectiveness based on intensity

per day of air campaign.

War Crimes per Sortie[Actors] = 1

Units: Military Actions/Sorties

## OpOrder Impacts on World

## Overview

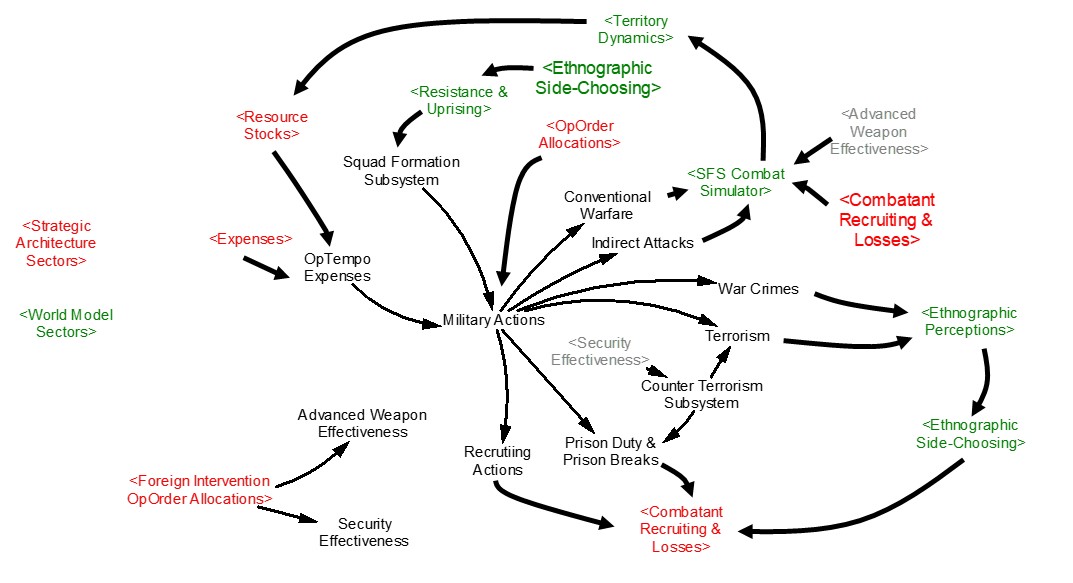


Figure 9: OpOrder Impacts in World Sector Overview

### Equations

Actual Effectiveness Degredation Fraction[Actors] = NORMAL DEGRADATION FRACTION OF EFFECTIVENESS[

Actors] - Experience Effect on Actions[Actors]

Units: Pct

Every period 25% of the skills willd egrade until 0 effectivenes is

reached. This is mitigated by more skilled militants.

Actual Garrsion[Actors] = INTEG( Change in Actual Garrison[Actors] , Actor Starting Conditions Initial Garrison[

Actors] )

Units: People

Actual Military Actions[Actors] = IF THEN ELSE ( Capacity for Military Actions based on Budget[

Actors] > Capability of Military Actions based on Squads[Actors] , Capability of Military Actions based on Squads[

Actors] , Capacity for Military Actions based on Budget[Actors] )

Units: Military Actions/Period

Anchor Advanced Weapon Effectiveness[Actors] = INTEG( Change in Anchor Advanced Weapon Effectiveness[

Actors] , Starting Actor Advanced Weapon Effectiveness[Actors] )

Units: Pct

Anchor Security Effectiveness[Actors] = INTEG( Change in Anchor Security Effectiveness[

Actors] , Starting Actor Security Effectiveness[Actors] )

Units: Pct

Armed Civil Affairs[Actors] = Actual Military Actions[Actors] \* OpOrder Armed Civil Affairs[

Actors]

Units: Military Actions/Period

Average Time for Anchor Effectiveness to Change[Actors] = 10

Units: Period

Number of periods for the anchor of security effectiveness to

improve, 10 = 5 years.

Average Time for Anchor Security Effectiveness to Change[Actors] = 10

Units: Period

Number of periods for the anchor of security effectiveness to

improve, 10 = 5 years.

Average Time to Absorb Security Training[Actors] = 2

Units: Period

Average Time to Absorb Training[Actors] = 2

Units: Period

Blue or Purple Advanced Weaponry Provision and Training Effect[Actors] = MAX ( 1

, ZIDZ ( Blue or Purple Advanced Weaponry Provisions[Actors] \* Normal Training Reach[

Actors] , Conventional Warfare[Actors] ) )

Units: Pct

Blue or Purple OpOrder Training Local Actor Security Forces[Green] = GAME( 0.25 )

Blue or Purple OpOrder Training Local Actor Security Forces[Red] = 0

Units: Pct

Blue or Purple Security Forces Training Effect[Actors] = ZIDZ ( Blue or Purple Training Actor Security Forces[

Actors] , Combatting Terrorism[Actors] ) \* Diminshing Returns on Security Force Training[

Actors]

Units: Pct

Security Forces Training does not benefit from the same reach

multiplier as advanced weaponry provisions or combat training. This

indicates it's more intensive 1:1 and continuous mentorship aspect

rather than "training."

Blue or Purple War Crimes[Actors] = ( Blue or Purple Embedded Combat Advisers[Actors

] + ( Blue or Purple Sorties Per Period[Actors] \* War Crimes per Sortie[Actors

] ) ) \* AVERAGE BLUE or PURPLE WAR CRIMES RATE[Actors]

Units: Military Actions/Period

Budget Period[Actors] = 1

Units: Period

Capability of Military Actions based on Squads[Actors] = ( Squads[Actors] ) \* NORMAL MILITARY CAPABILITY OF SQUADS[

Actors]

Units: Military Actions/Period

Capacity for Military Actions based on Budget[Actors] = ( OpTempo Budget[Actors]

/ Cost per Military Action[Actors] ) / NORMAL PERIOD

Units: Military Actions/Period

Change in Anchor Advanced Weapon Effectiveness[Actors] = ( Current Advanced Weapon Effectivenes[

Actors] - Anchor Advanced Weapon Effectiveness[Actors] ) / Average Time for Anchor Effectiveness to Change[

Actors]

Units: Pct/Period

Change in Anchor Security Effectiveness[Actors] = ( Current Security Effectiveness[

Actors] - Anchor Security Effectiveness[Actors] ) / Average Time for Anchor Security Effectiveness to Change[

Actors]

Units: Pct/Period

Change in Current Advanced Weapon Effectivneess[Actors] = ( ( Anchor Advanced Weapon Effectiveness[

Actors] - Current Advanced Weapon Effectivenes[Actors] ) + Blue or Purple Advanced Weaponry Provision and Training Effect[

Actors] ) / Average Time to Absorb Training[Actors]

Units: Pct/Period

Change in Current Security Effectivneess[Actors] = ( ( Anchor Security Effectiveness[

Actors] - Current Security Effectiveness[Actors] ) + Blue or Purple Security Forces Training Effect[

Actors] ) / Average Time to Absorb Security Training[Actors]

Units: Pct/Period

Civilians Killed[Ethnographies,Actors] = INTEG( Rate of Civilian Deaths[Ethnographies

,Actors] , 0)

Units: People

Combatants[Ethnographies,Actors] = INTEG( Combatant Additions[Ethnographies,Actors

] - Combatant Losses[Ethnographies,Actors] , Starting Combatants[Ethnographies

,Actors] )

Units: People

Combatting Terrorism[Actors] = Actual Military Actions[Actors] \* OpOrder Combatting Terrorism[

Actors]

Units: Military Actions/Period

Completed Terrorist Attacks by Ethnography[Ethnographies,Red] = Terrorist Attempts[

Ethnographies,Red] \* ( 1 - CT Effectiveness[Green] )

Completed Terrorist Attacks by Ethnography[Ethnographies,Green] = Terrorist Attempts[

Ethnographies,Green] \* ( 1 - CT Effectiveness[Red] )

Units: Military Actions/Period

Conventional Warfare[Actors] = ( Actual Military Actions[Actors] \* OpOrder Conventional Warfare[

Actors] \* Engagement Threshold[Actors] )

Units: Military Actions/Period

Cost per Military Action[Actors] = 3000

Units: Dollars/Military Action

Analysis showed that for each $2700 transferred to a sector command,

an AQI attack was launched. This cost includes not only direct costs

of the attack, but indirect costs of all the other factors necessary

for AQI to peform in that sector outside Media, Courts,

Administration. Furthermore, there was a strong correlation (.66)

between the rate of fund flows increasing or decreasing and

corresponding changes in the pace of attacks. RAND 57-69. Equilibrium

value set to 3000.

CT Effectiveness[Green] = Table for CT Effectiveness ( Effective CounterTerrorism Efforts[

Green] )

CT Effectiveness[Red] = Table for CT Effectiveness ( Effective CounterTerrorism Efforts[

Red] )

Units: Dmnl

Table for CT Effectiveness(1-ZIDZ (SUM(Terrorist

Attempts[Ethnographies!,Red]),Effective CounterTerrorism

Efforts[Green]) )

CT Force Ratio[Actors] = ZIDZ ( Combatting Terrorism[Actors] , FP Force Size[Actors

] )

Units: Pct

ZIDZ((Combatting Terrorism[Green]\*NORMAL MILITARY CAPABILITY OF

SQUADS[Actors]),Total Combatants[Red])

CT Force Ratio Modifier[Actors] = Table for Effect of CT Force Ratio Adequacy (

CT Force Ratio[Actors] )

Units: Dmnl

Cumm Opposition Deaths = INTEG( Increase in Cumm Opposition Deaths , 0)

Units: People

Current Advanced Weapon Effectivenes[Actors] = INTEG( Change in Current Advanced Weapon Effectivneess[

Actors] - Decay in Advanced Weapon Effectiveness[Actors] , Anchor Advanced Weapon Effectiveness[

Actors] )

Units: Pct

Current Security Effectiveness[Actors] = INTEG( Change in Current Security Effectivneess[

Actors] - Decay in Security Effectiveness[Actors] , Anchor Security Effectiveness[

Actors] )

Units: Pct

Deaths from CT Operations[Actors] = Normal Deaths per Thwarted Action[Actors] \*

Thwarted Terrorist Attacks[Actors]

Units: People/Period

DEATHS PER TERRORIST ATTACK[Actors] = 10

Units: People/Military Action

DEATHS PER WAR CRIME[Ethnographies,Actors] = 25

Units: People/Military Action

Decay in Advanced Weapon Effectiveness[Actors] = ( Current Advanced Weapon Effectivenes[

Actors] \* Actual Effectiveness Degredation Fraction[Actors] ) / NORMAL PERIOD

Units: Pct/Period

Decay in Security Effectiveness[Actors] = ( Current Security Effectiveness[Actors

] \* Actual Effectiveness Degredation Fraction[Actors] ) / NORMAL PERIOD

Units: Pct/Period

DESIRED CASH ON HAND[Actors] = 250000

Units: Dollars

Desired Squads[Actors] = MAX ( 0, ( ( Total Combatants[Actors] - Actual Garrsion[

Actors] ) - Number of Green or Red Logistics[Actors] ) / NORMAL SIZE PER SQUAD[

Actors] )

Units: Squads

Detainees from CT Operations[Actors] = Normal Detainees per Thwarted Action[Actors

] \* Thwarted Terrorist Attacks[Actors]

Units: People/Period

Effective CounterTerrorism Efforts[Actors] = CT Force Ratio Modifier[Actors] \* Current Security Effectiveness[

Actors]

Units: Pct

Engagement Threshold[Actors] = IF THEN ELSE ( Total Combatants[Red] > Minimum Force Size to Engage[

Red] , 1, 0)

Units: Dmnl

Ethno by Actor Sufficiency[Ethnographies,Actors] = Table for Effect of Remaining Ethno Population by Actor

( MAX ( 0, Total Ethno by Actor[Ethnographies,Actors] / Reference Population for Sufficiency[

Ethnographies,Actors] ) )

Units: Pct

Expenses before Attacks[Actors] = Death Benefits[Actors] + Detention Benefits[Actors

] + "Media Border Security & Other Expenses"[Actors] + Military Procurement[

Actors] + Payroll[Actors] + Governance Expenses[Actors]

Units: Dollars/Period

Experience Effect on Actions[Actors] = Table for Effect of Militant Experience on Military Actions

( Average Combatant Experience[Actors] \* Dimensioned Ratio Average Militant Experience[

Actors] ) \* Allocation of Essential Budgets[Actors]

Units: Pct

Derived from AQI implied local recruiting patterns. Estimated

parameter from data or nearby model structure see Appendix B for

discussion.

Finances[Actors] = INTEG( Incoming Revenue[Actors] - Outgoing Expenses[Actors] ,

Starting Cash[Actors] )

Units: Dollars

("Baseline Switch (1 = On)"\*(Capability of Military Actions based on

Squads\*Cost per Attack))+("Scenario 1 Switch (1 = On)"\*"ZScenario1:

Starting Cash")

Force Protection per Military Action[Actors] = 1

Units: Military Actions/(Period\*People)

Foreign Combatants[Actors] = INTEG( Foreign Fighter Increase[Actors] - Foreign Fighter Decrease[

Actors] , Starting Foreign Combatants[Actors] )

Units: People

FP Force Size[Actors] = Total Combatants[Actors] \* Force Protection per Military Action[

Actors]

Units: Military Actions/Period

Green or Red T3R Average[Actors] = 0.3, 0.05

Units: Pct

Average % of non-combat troops to combat. Source

http://usacac.army.mil/cac2/cgsc/carl/download/csipubs/mcgrath\_op23.pd

f p80 Normal of 67%

Indirect Attacks[Actors] = Actual Military Actions[Actors] \* OpOrder Indirect IED VBIED or SVIED[

Actors]

Units: Military Actions/Period

Killed Militants Total = INTEG( Rate of Militant Deaths Total , 0)

Units: People

Adjust initial level based on starting time of model.

Normal Deaths per Thwarted Action[Actors] = 11, 2

Units: People/Military Action

NORMAL DEGRADATION FRACTION OF EFFECTIVENESS[Actors] = 0.25, 0.12

Units: Pct

Normal Detainees per Thwarted Action[Actors] = 0, 2

Units: People/Military Action

NORMAL MILITARY CAPABILITY OF SQUADS[Actors] = 1, 1

Units: Military Actions/(Period\*Squad)

1 every 2 months is normal

NORMAL PERIOD = 1

Units: Period

NORMAL SIZE PER SQUAD[Actors] = 10

Units: People/Squad

Normal value for ISIS is set at an average of 11. Value for

equilibrium is set at 10.

Number of Green or Red Logistics[Actors] = Total Combatants[Actors] \* Green or Red T3R Average[

Actors]

Units: People

OpOrder Armed Civil Affairs[Actors] = GAME( IF THEN ELSE ( Engagement Threshold[

Actors] = 1, Green and Red Pct OpOrder Armed Civil Affairs[Actors

] , Green and Red PE Pct Armed Civil Affairs[Actors] ) )

Units: Pct

OpOrder Combatting Terrorism[Actors] = GAME( Normal Combatting Terrorism[Actors]

)

Units: Pct

OpOrder Conventional Warfare[Actors] = GAME( IF THEN ELSE ( Engagement Threshold[

Red] = 1, Normal Conventional Warfare[Actors] , Green and Red PE Pct Conventional Warfare[

Actors] ) )

Units: Pct

OpOrder Indirect IED VBIED or SVIED[Actors] = GAME( IF THEN ELSE ( Engagement Threshold[

Actors] = 1, Green and Red OpOrder Pct Indirect[Actors] , PreThreshold Indirect[

Actors] ) )

Units: Pct

OpOrder Prison Breaks[Actors] = GAME( IF THEN ELSE ( Engagement Threshold[Actors

] = 1, Green and Red Pct OpOrder Prison Breaks[Actors] , Green and Red PE PCT Prison Breaks[

Actors] ) )

Units: Pct

OpOrder Prison Duty[Actors] = GAME( Normal Prison Duty[Actors] )

Units: Pct

OpOrder Propoganda[Actors] = GAME( IF THEN ELSE ( Engagement Threshold[Actors] =

1, Green and Red Pct OpOrder Propoganda[Actors] , Green and Red PE Pct Propoganda[

Actors] ) )

Units: Pct

OpOrder Recruiting[Ethnographies,Actors] = GAME( IF THEN ELSE ( Engagement Threshold[

Actors] = 1, Green and Red OpOrder Pct Recruiting[Ethnographies,

Actors] , Green and Red PE Recruiting[Ethnographies,Actors] ) )

Units: Pct

OpOrder Terrorism[Ethnographies,Red] = GAME( IF THEN ELSE ( Engagement Threshold[

Red] = 1, Green and Red Pct OpOrder Terrorism[Ethnographies,Red]

, Green and Red PE Pct Terrorism[Ethnographies,Red] ) )

OpOrder Terrorism[Ethnographies,Green] = IF THEN ELSE ( Engagement Threshold[Green

] = 1, Green and Red Pct OpOrder Terrorism[Ethnographies,Green] , Green and Red PE Pct Terrorism[

Ethnographies,Green] )

Units: Pct

OpOrder War Crimes[Ethnographies,Actors] = GAME( 0 )

Units: Pct

War atrocities include ethnic cleansing by Red actor and

massacares/war crimes by Blue Actors.

OpTempo Budget[Actors] = MAX ( 0, ( Finances[Actors] - DESIRED CASH ON HAND[Actors

] ) - Expenses before Attacks[Actors] \* Budget Period[Actors] )

Units: Dollars

OpTempo Expenses[Actors] = Actual Military Actions[Actors] \* Cost per Military Action[

Actors]

Units: Dollars/Period

Prison Break Actions[Actors] = Actual Military Actions[Actors] \* OpOrder Prison Breaks[

Actors]

Units: Military Actions/Period

Prison Duty Actions[Actors] = Actual Military Actions[Actors] \* OpOrder Prison Duty[

Actors]

Units: Military Actions/Period

Propoganda Squads[Actors] = Actual Military Actions[Actors] \* OpOrder Propoganda[

Actors]

Units: Military Actions/Period

Rate of OpTempo Expenses[Actors] = OpTempo Expenses[Actors]

Units: Dollars/Period

Recruiting Actions[Ethnographies,Actors] = Actual Military Actions[Actors] \* OpOrder Recruiting[

Ethnographies,Actors]

Units: Military Actions/Period

REFUGEES PER TERRORIST ATTACK[Actors] = 10

Units: People/Military Action

25

REFUGEES PER WAR CRIME[Ethnographies,Actors] = 125

Units: People/Military Action

250

Squads[Actors] = INTEG( Change in Squads[Actors] , ( SUM ( Starting Combatants[Ethnographies!

,Actors] ) - ( SUM ( Governed Cohorts[Ethnographies!,Actors] ) \*

Militant Police per Cohort ) ) / NORMAL SIZE PER SQUAD[Actors

] )

Units: Squads

Initialized at same formula as Desired Squads. (Militants - Garrison

Needs)

Starting Actor Advanced Weapon Effectiveness[Actors] = 0

Units: Dmnl

Starting Actor Security Effectiveness[Actors] = 0.5, 0.5

Units: Dmnl

Table for CT Effectiveness ( [(0,0)-(3,1)],(0,0),(0.1,0.06),(0.2,0.1),(0.3,0.14)

,(0.4,0.24),(0.5,0.29),(0.6,0.34),(0.7,0.38),(0.8,0.45),(0.9,0.55),(0.95,0.65)

,(0.97,0.75),(0.99,0.85),(1,0.88),(1,0.88),(2,0.9),(3,0.95) )

Units: Dmnl

.5 is "normal" and represents the worldwide trend of 81% successful

attacks re: https://www.state.gov/documents/organization/272485.pdf

[(0,0)-(2,1)],(0,1),(0.1,1),(0.2,0.95),(0.3,0.75),(0.4,0.45),(0.5,0.3)

,(0.6,0.225),(0.7,0.175),(0.8,0.12),(0.9,0.07),(0.95,0.03),(0.97,0.02)

,(0.99,0.01),(1,0.01),(1,0.01),(2,0.01),(10,0.01)

Table for Effect of CT Force Ratio Adequacy ( [(0,0)-(1,2)],(0,0),(0.005,0.05),(0.01,0.15)

,(0.05,0.5),(0.1,0.75),(0.2,0.9),(0.36,1),(0.4,1.025),(0.5,1.05),(0.6,1.1)

,(1,1.2) )

Units: Dmnl

Terrorism Deaths[Ethnographies,Red] = ( Completed Terrorist Attacks by Ethnography[

Ethnographies,Green] \* DEATHS PER TERRORIST ATTACK[Green] ) \* Ethno by Actor Sufficiency[

Ethnographies,Red]

Terrorism Deaths[Ethnographies,Green] = ( Completed Terrorist Attacks by Ethnography[

Ethnographies,Red] \* DEATHS PER TERRORIST ATTACK[Red] ) \* Ethno by Actor Sufficiency[

Ethnographies,Green]

Units: People/Period

Terrorism Refugees[Ethnographies,Green] = ( Completed Terrorist Attacks by Ethnography[

Ethnographies,Red] \* REFUGEES PER TERRORIST ATTACK[Red] ) \* Ethno by Actor Sufficiency[

Ethnographies,Green]

Terrorism Refugees[Ethnographies,Red] = ( Completed Terrorist Attacks by Ethnography[

Ethnographies,Green] \* REFUGEES PER TERRORIST ATTACK[Green] ) \* Ethno by Actor Sufficiency[

Ethnographies,Red]

Units: People/Period

Terrorist Attempts[Ethnographies,Actors] = Actual Military Actions[Actors] \* OpOrder Terrorism[

Ethnographies,Actors]

Units: Military Actions/Period

Thwarted Terrorist Attacks[Actors] = SUM ( Terrorist Attempts[Ethnographies!,Actors

] ) - SUM ( Completed Terrorist Attacks by Ethnography[Ethnographies!

,Actors] )

Units: Military Actions/Period

Total Combatants[Actors] = Total Local Combatants[Actors] + Foreign Combatants[Actors

]

Units: People

Total Conflict Deaths[Actors] = SUM ( Civilians Killed[Ethnographies!,Actors!] )

+ Cumm Opposition Deaths + Killed Militants Total

Units: People

Total Terrorism Deaths[Actors] = SUM ( Terrorism Deaths[Ethnographies!,Actors] )

Units: People/Period

Total Terrorism IDP[Actors] = SUM ( Terrorism Refugees[Ethnographies!,Actors] )

Units: People/Period

Total Terrorist Attacks[Actors] = SUM ( Completed Terrorist Attacks by Ethnography[

Ethnographies!,Actors] )

Units: Military Actions/Period

War Crime Deaths[Ethnographies,Actors] = MAX ( 0, ( War Crimes[Ethnographies,Actors

] \* DEATHS PER WAR CRIME[Ethnographies,Actors] ) \* Ethno by Actor Sufficiency[

Ethnographies,Actors] )

Units: People/Period

War Crime Refugees[Ethnographies,Actors] = MAX ( 0, ( War Crimes[Ethnographies,Actors

] \* REFUGEES PER WAR CRIME[Ethnographies,Actors] ) \* Ethno by Actor Sufficiency[

Ethnographies,Actors] )

Units: People/Period

War Crimes[Ethnographies,Actors] = ( Actual Military Actions[Actors] \* OpOrder War Crimes[

Ethnographies,Actors] ) + Blue or Purple War Crimes[Actors]

Units: Military Actions/Period

## Resistance & Uprising

### Overview

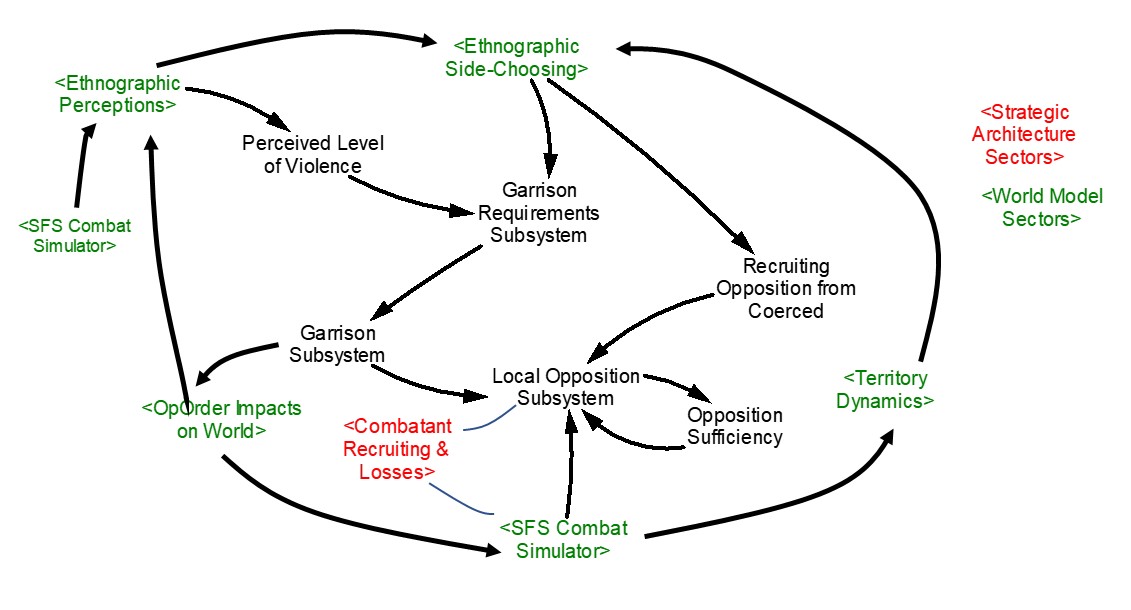


Figure 10: Sector Overview of Resistance & Uprising

### Equations

Actor Combatants that are Foreign[Ethnographies,Actors] = INTEG( Chng in Troop Composition[

Ethnographies,Actors] , Local vs Foreign Forces[Ethnographies,Actors]

)

Units: Pct

Actor Infantry Actual Losses[Green] = Green Infantry Final Losses[Green] - ( Opposition Combatant Losses[

Green] ) - Blue or Purple Combatant Losses[Green]

Actor Infantry Actual Losses[Red] = Red Infantry Final Losses[Red] - ( Opposition Combatant Losses[

Red] ) - Blue or Purple Combatant Losses[Red]

Units: People/Period

Actor Starting Conditions Initial Garrison[Actors] = 140000, 0

Units: People

Actual Effect on Uprising Militant on Max Garrison Allocation[Actors] = Effect of Uprising Militants on Max Garrison Allocation[

Actors] ( SUM ( Local Opposition Fighters to Actor[Ethnographies!,Actors]

) / Reference for Maximum Tolerated Uprising[Actors] )

Units: Pct

Effect of Uprising Militants on Max Garrison

Allocation[Actors]((SUM(Local Opposition Fighters to

Actor[Ethnographies!,Actors]))\*Dimensioned Ratio ISIS

Militants[Actors])

Actual Garrison per Cohort[Ethnographies,Actors] = Normal Garrison Requirement per Cohort[

Ethnographies,Actors] \* Local Forces Density Force Multiplier[Ethnographies

,Actors] \* KIA perM Force Multiplier[Ethnographies,Actors]

Units: People/Cohort

Actual Garrsion[Actors] = INTEG( Change in Actual Garrison[Actors] , Actor Starting Conditions Initial Garrison[

Actors] )

Units: People

Actual Opposition Recruited[Ethnographies,Actors] = Adequacy of Fighting Age Men for Opposition[

Ethnographies,Actors] \* Target Recruited Opposition[Ethnographies,Actors]

Units: People/Period

Actual Recruiting Fighting Age Men in Population[Ethnographies,Actors] = ( STARTING NORMAL PCT OF FIGHTING AGE MEN IN POPULATION[

Ethnographies] \* ( 1 + Experience Effect on Actions[Actors] ) )

Units: Pct

The ethnographic norm +capability of the actor based on experience.

Adequacy of Fighting Age Men for Opposition[Ethnographies,Actors] = Table for Effect of Remaining Recruits on Recruiting Efforts

( 1 - ( ZIDZ ( Remaining Coerced Fighting Age Men[Ethnographies,Actors] /

NORMAL PERIOD , Target Recruited Opposition[Ethnographies

,Actors] ) ) )

Units: Dmnl

Calc Legit Pop[Ethnographies,Actors] = INTEG( Coerced to Calculated[Ethnographies

,Actors] + Governed to Calculated[Ethnographies,Actors] + Unaligned Choosing Sides[

Ethnographies,Actors] - Cal Legit Pop Dying[Ethnographies,Actors

] - Calc Legit Pop Recruited or Joining Uprising[Ethnographies,Actors

] - Calc Legit Refugees Leaving[Ethnographies,Actors] - Calculated Lost to Conquest[

Ethnographies,Actors] - Calculated to Coerced[Ethnographies,Actors

] - Calculated to Governed[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION CALCULATED[Ethnographies

,Actors] )

Units: People

Calculated to Coerced[Ethnographies,Actors] = MAX ( 0, ( Calc Legit Pop[Ethnographies

,Actors] \* Fr Transition to Coerced[Ethnographies,Actors] ) / NORMAL TIME FOR POPULATION TRANSITION[

Ethnographies,Actors] )

Units: People/Period

Calculated to Governed[Ethnographies,Actors] = MAX ( 0, ( Calc Legit Pop[Ethnographies

,Actors] \* Fr Transition to Legitimacy[Ethnographies,Actors] ) / NORMAL TIME FOR POPULATION TRANSITION[

Ethnographies,Actors] )

Units: People/Period

Change in Actual Garrison[Actors] = ( MIN ( Total Garrison Needed[Actors] , Max Garrison Allocation[

Actors] ) - Actual Garrsion[Actors] ) / NORMAL PERIOD

Units: People/Period

Coerced Cohorts[Ethnographies,Actors] = Coerced Pop[Ethnographies,Actors] / SIZE OF COHORT

Units: Cohort

Coerced Dying[Ethnographies,Actors] = MAX ( 0, Coerced Pop Deaths[Ethnographies,

Actors] )

Units: People/Period

Coerced Opposition Recruitment[Ethnographies,Actors] = MAX ( 0, Actual Opposition Recruited[

Ethnographies,Actors] )

Units: People/Period

Coerced Pop[Ethnographies,Actors] = INTEG( ( Unaligned to Coerced[Ethnographies,

Actors] + Calculated to Coerced[Ethnographies,Actors] - Coerced Dying[

Ethnographies,Actors] ) - Coerced Refugees Leaving[Ethnographies

,Actors] - Coerced to Calculated[Ethnographies,Actors] - Coerced to Unaligned[

Ethnographies,Actors] - Coerced Opposition Recruitment[Ethnographies

,Actors] + Conquest[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION COERCED[Ethnographies,Actors

] )

Units: People

Coerced Refugees Leaving[Ethnographies,Actors] = MAX ( 0, Coerced Pop Refugees[Ethnographies

,Actors] )

Units: People/Period

Coerced to Calculated[Ethnographies,Actors] = MAX ( 0, ( Coerced Pop[Ethnographies

,Actors] \* Fr Transition to Calculated Legitimatcy[Ethnographies,Actors

] ) / NORMAL TIME FOR POPULATION TRANSITION[Ethnographies,Actors

] )

Units: People/Period

Coerced to Unaligned[Ethnographies,Actors] = Leaving from Coerced to Unaligned[Ethnographies

,Actors] / NORMAL TIME FOR POPULATION TRANSITION[Ethnographies,Actors]

Units: People/Period

MAX(0,(Coerced Pop[Ethnographies,Actors]\*("% of Garrison Gap to

Coerced"[Ethnographies,Actors]\*0.75))/NORMAL TIME FOR POPULATION

TRANSITION [Ethnographies,Actors])

Conquest[Ethnographies,Red] = Green Conquered to Coerced[Ethnographies,Green]

Conquest[Ethnographies,Green] = Red Conquered to Coerced[Ethnographies,Red]

Units: People/Period

Cumm Opposition Deaths = INTEG( Increase in Cumm Opposition Deaths , 0)

Units: People

Deaths[Actors] = ( Actor Infantry Actual Losses[Actors] \* PCT OF LOSSES THAT ARE DEATH[

Actors] ) + Deaths from CT Operations[Actors] + Deaths from Thwarted Prison Breaks[

Actors]

Units: People/Period

(Red Infantry Final Losses[Red]\*PCT OF LOSSES THAT ARE

DEATH[Red])/Time to Realize Losses+ Deaths from CT

Operations[Red]+Deaths from Thwarted Prison Breaks[Red]

Decrease in Coerced Fighting Age Men[Ethnographies,Actors] = Diehards joining Uprising[

Ethnographies,Actors] + Coerced Opposition Recruitment[Ethnographies,Actors

] + ( Coerced Dying[Ethnographies,Actors] + Coerced Refugees Leaving[

Ethnographies,Actors] + Coerced to Unaligned[Ethnographies,Actors

] ) \* Actual Recruiting Fighting Age Men in Population[Ethnographies

,Actors]

Units: People/Period

"Desired Garrison & Police Forces"[Ethnographies,Actors] = ( Garrison Troops Required[

Ethnographies,Actors] + Police Forces Required[Ethnographies,Actors] ) \* Disable Garrison Troops

Units: People

Diehards joining Uprising[Ethnographies,Actors] = Coerced Pop[Ethnographies,Actors

] \* Pct of Coerced Pop that will Join Opposition Forces[Ethnographies]

Units: People/Period

Dimensioned Ratio ISIS Militants[Actors] = 1

Units: 1/People

Dimensioned Ratio People per Period = 1

Units: Period/People

Disable Garrison Troops = 1

Units: Dmnl

Effect of Garrison Ratio on Leaving to Unaligned[Ethnographies,Actors] = Table for Effect of Ratio on Leaving to Unaligned

( Pct of Desired Garrison Actual Represents[Ethnographies,Actors] )

Units: Pct

Effect of Ungarrision Ratio on Recruiting Rate[Ethnographies,Actors] = Table for Effect of Ratio on Uprising

( Pct of Desired Garrison Actual Represents[Ethnographies,Actors] )

Units: Pct

This determines the what % of the population will join the die-hard

opposition as ISIS is unable to garrison effectively.

Effect of Uprising Militants on Max Garrison Allocation[Actors] ( [(0,0)-(1,1)],

(0,0.5),(0.2,0.75),(0.4,0.8),(0.6,0.9),(0.8,0.95),(1,1) )

Units: Dmnl

Ethno Sufficiency Modifier[Ethnographies] = Table for Effect of Remaining Population on Sufficiency

( Remaining Ethnographic Population[Ethnographies] )

Units: Dmnl

Garrison Troops Required[Ethnographies,Actors] = Coerced Cohorts[Ethnographies,Actors

] \* Actual Garrison per Cohort[Ethnographies,Actors]

Units: People

Governed Cohorts[Ethnographies,Actors] = ( Calc Legit Pop[Ethnographies,Actors]

+ Governed Pop[Ethnographies,Actors] ) / SIZE OF COHORT

Units: Cohort

Governed Pop[Ethnographies,Actors] = INTEG( Calculated to Governed[Ethnographies

,Actors] - Governed Dying[Ethnographies,Actors] - Governed Lost to Conquest[

Ethnographies,Actors] - Governed Pop Recruited[Ethnographies,Actors

] - Governed Refugees Leaving[Ethnographies,Actors] - Governed to Calculated[

Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION GOVERNED[Ethnographies,Actors

] )

Units: People

Green Infantry Final Losses[Green] = ( Green Infantry Initial Losses[Green] - (

Green Infantry Initial Losses[Green] \* Infantry Recovery[Green] ) ) /

NORMAL PERIOD

Units: People/Period

Increase in Coerced Fighting Age Men[Ethnographies,Actors] = ( Unaligned to Coerced[

Ethnographies,Actors] + Calculated to Coerced[Ethnographies,Actors] + Conquest[

Ethnographies,Actors] ) \* Actual Recruiting Fighting Age Men in Population[

Ethnographies,Actors]

Units: People/Period

Increase in Cumm Opposition Deaths = SUM ( Rate of Local Fighter Deaths[Ethnographies!

,Actors!] )

Units: People/Period

KIA Per Million Population[Ethnographies,Actors] = Rate of All Conflict Deaths /

( SUM ( Total Ethno Population[Ethnographies!] ) / Million Population

)

Units: People/Period

KIA perM Force Multiplier[Ethnographies,Actors] = Table For KIA perM on Force Multiplier

( KIA Per Million Population[Ethnographies,Actors] \* Dimensioned Ratio People per Period

)

Units: Dmnl

Local Forces Density Force Multiplier[Ethnographies,Actors] = Table for Local vs Foreign Forces on Force Multiplier

( Actor Combatants that are Foreign[Ethnographies,Actors] )

Units: Dmnl

Local Opposition Fighters this Period[Ethnographies,Actors] = Local Opposition Fighters to Actor[

Ethnographies,Actors] / NORMAL PERIOD

Units: People/Period

Local Opposition Fighters to Actor[Ethnographies,Actors] = INTEG( Rate of Local Opposition Fighters Joining Uprising[

Ethnographies,Actors] - Local Opposition Joining Opposing Actor Militants[

Ethnographies,Actors] - Rate of Local Fighter Deaths[Ethnographies

,Actors] , 0)

Units: People

Local Opposition Joining Opposing Actor Militants[Ethnographies,Actors] = MAX (

0, ( Local Opposition Fighters to Actor[Ethnographies,Actors] \* Normal Fraction Joining Opposing Actor or Militias[

Ethnographies] ) ) / NORMAL PERIOD

Units: People/Period

Max Garrison Allocation[Actors] = Total Combatants[Actors] \* Actual Effect on Uprising Militant on Max Garrison Allocation[

Actors]

Units: People

Militant Police per Cohort = 2.8

Units: People/Cohort

Million Population = 1e+006

Units: People

Normal Fraction Joining Opposing Actor or Militias[Ethnographies] = 0.1

Units: Pct

10% will join an opposing actor's miltirary forces

Normal Garrison Requirement per Cohort[Ethnographies,Actors] = 8

Units: People/Cohort

NORMAL PERIOD = 1

Units: Period

Opposition Combatant Losses[Green] = MIN ( Green Infantry Final Losses[Green] \*

Pct of Actor Infantry that are Local Opposition Fighters[Green]

, Total Opposition Fighters by Actor[Red] / NORMAL PERIOD )

Opposition Combatant Losses[Red] = MIN ( Red Infantry Final Losses[Red] \* Pct of Actor Infantry that are Local Opposition Fighters[

Red] , Total Opposition Fighters by Actor[Green] / NORMAL PERIOD

)

Units: People/Period

Opposition Fighter Sufficiency[Ethnographies,Actors] = ZIDZ ( Total Decrease of Opposition Fighters[

Ethnographies,Actors] , Local Opposition Fighters this Period[Ethnographies

,Actors] \* 0.9)

Units: Pct

the sufficiency implies that at 10% or less of original strength

opposition fighters go into hiding

Opposition Fighter Sufficiency Modifier[Ethnographies,Actors] = Table for Effect of Remaining Population on Sufficiency

( Pct of Current Oppositon Fighters[Ethnographies,Actors] )

Units: Dmnl

Opposition Fighter Sufficiency Smooth[Ethnographies,Actors] = SMOOTH ( Opposition Fighter Sufficiency[

Ethnographies,Actors] , NORMAL PERIOD )

Units: Pct

smoothed over a week

Opposition Losses by Ethno[Ethnographies,Green] = Pct by Ethno Opposition Fighters by Actor[

Ethnographies,Red] \* Opposition Combatant Losses[Red]

Opposition Losses by Ethno[Ethnographies,Red] = Pct by Ethno Opposition Fighters by Actor[

Ethnographies,Green] \* Opposition Combatant Losses[Green]

Units: People/Period

Pct by Ethno Opposition Fighters by Actor[Ethnographies,Actors] = ZIDZ ( Local Opposition Fighters to Actor[

Ethnographies,Actors] , Total Opposition Fighters by Actor[Actors] )

Units: Pct

Pct of Coerced Pop that will Join Opposition Forces[Ethnographies] = 0.001

Units: Percentage/Period

Diehard opposition will fight against ISIS regardless of state of

Garrison. This may also account for tribal rivalries. Should be

approximately 1,000 per 1m controlled pop.

Pct of Current Oppositon Fighters[Ethnographies,Actors] = ZIDZ ( Local Opposition Fighters to Actor[

Ethnographies,Actors] / NORMAL PERIOD , Opposition Losses by Ethno[Ethnographies

,Actors] )

Units: Pct

Pct of Desired Garrison Actual Represents[Ethnographies,Actors] = ZIDZ ( "Desired Garrison & Police Forces"[

Ethnographies,Actors] , Actual Garrsion[Actors] )

Units: Pct

Police Forces Required[Ethnographies,Actors] = Governed Cohorts[Ethnographies,Actors

] \* Militant Police per Cohort

Units: People

Rate of All Conflict Deaths = Rate of Total Civilian Death all Ethnographies + (

SUM ( Deaths[Actors!] ) )

Units: People/Period

Rate of Local Fighter Deaths[Ethnographies,Actors] = MAX ( 0, Opposition Losses by Ethno[

Ethnographies,Actors] \* Opposition Fighter Sufficiency Modifier[Ethnographies

,Actors] )

Units: People/Period

Rate of Local Opposition Fighters Joining Uprising[Ethnographies,Actors] = Diehards joining Uprising[

Ethnographies,Actors] + Actual Opposition Recruited[Ethnographies,Actors]

Units: People/Period

Reference for Maximum Tolerated Uprising[Actors] = 50000

Units: People

Remaining Coerced Fighting Age Men[Ethnographies,Actors] = INTEG( Increase in Coerced Fighting Age Men[

Ethnographies,Actors] - Decrease in Coerced Fighting Age Men[Ethnographies

,Actors] , 0)

Units: People

SIZE OF COHORT = 1000

Units: People/Cohort

Table for Effect of Ratio on Leaving to Unaligned ( [(0,0)-(1.5,0.2)],(0.69,0),(0.7,0.01)

,(0.75,0.02),(0.8,0.04),(0.9,0.08),(1,0.1),(1.2,0.11),(1.5,0.115) )

Units: Dmnl

Table for Effect of Ratio on Uprising ( [(0,0)-(1.5,0.1)],(0.69,0),(0.7,0.005),(0.75,0.01)

,(0.8,0.02),(0.9,0.04),(1,0.05),(1.2,0.055),(1.5,0.055) )

Units: Dmnl

Table for Effect of Remaining Population on Sufficiency ( [(0,0)-(1,1)],(0,0),(0,0)

,(0.025,0.005),(0.05,0.01),(0.1,0.05),(0.2,0.1),(0.3,0.25),(0.4,0.4)

,(0.5,0.55),(0.6,0.65),(0.7,0.75),(0.8,0.8),(0.9,0.85),(0.95,0.9),(1,1)

)

Units: Dmnl

Table for Effect of Remaining Recruits on Recruiting Efforts ( [(0,0)-(1,1)],(0,0)

,(0.01,0),(0.03,0),(0.05,0),(0.1,0.0125),(0.2,0.025),(0.3,0.05),(0.4,0.1)

,(0.5,0.2),(0.6,0.35),(0.7,0.65),(0.8,0.85),(0.9,0.95),(0.95,0.975),

(0.97,0.985),(0.99,0.99),(1,1) )

Units: Dmnl

Parameter is based on modeler assumption, see Appendix B for

discussion.

[(0,0)-(1,1)],(0,1),(0.1,0.95),(0.2,0.85),(0.3,0.65),(0.4,0.35),(0.5,0

.2),(0.6,0.1),(0.7,0.05),(0.8,0.025),(0.9,0.0125),(0.95,0),(0.97,0),(0

.99,0),(1,0),(1,0),(2,0),(10,0)

Table For KIA perM on Force Multiplier ( [(0,0)-(460,3)],(0,1),(28,1),(50,1.23),

(67,1.36),(120,1.67),(298,2.36),(460,2.8) )

Units: Dmnl

Table for Local vs Foreign Forces on Force Multiplier ( [(0,0)-(1,3)],(0,2.38),(0.1,2.38)

,(0.65,1.14),(1,1) )

Units: Dmnl

Target Recruited Opposition[Ethnographies,Actors] = Effect of Ungarrision Ratio on Recruiting Rate[

Ethnographies,Actors] \* Remaining Coerced Fighting Age Men[Ethnographies,Actors

] / NORMAL PERIOD

Units: People/Period

Total Combatants[Actors] = Total Local Combatants[Actors] + Foreign Combatants[Actors

]

Units: People

Total Decrease of Opposition Fighters[Ethnographies,Actors] = Local Opposition Joining Opposing Actor Militants[

Ethnographies,Actors] + Opposition Losses by Ethno[Ethnographies,Actors]

Units: People/Period

Total Ethno Population[Ethnographies] = INTEG( Increase in Pop[Ethnographies] -

Decrease in Pop[Ethnographies] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] )

Units: People

Total Garrison Needed[Actors] = ( SUM ( "Desired Garrison & Police Forces"[Ethnographies!

,Actors] ) )

Units: People

Total KIA per Million Population = SUM ( KIA Per Million Population[Ethnographies!

,Actors!] )

Units: People/Period

Total Opposition Fighters by Actor[Actors] = SUM ( Local Opposition Fighters to Actor[

Ethnographies!,Actors] )

Units: People

Unaligned to Coerced[Ethnographies,Actors] = Unaligned Conquered to Coerced[Ethnographies

,Actors]

Units: People/Period

## SFS Combat Simulator

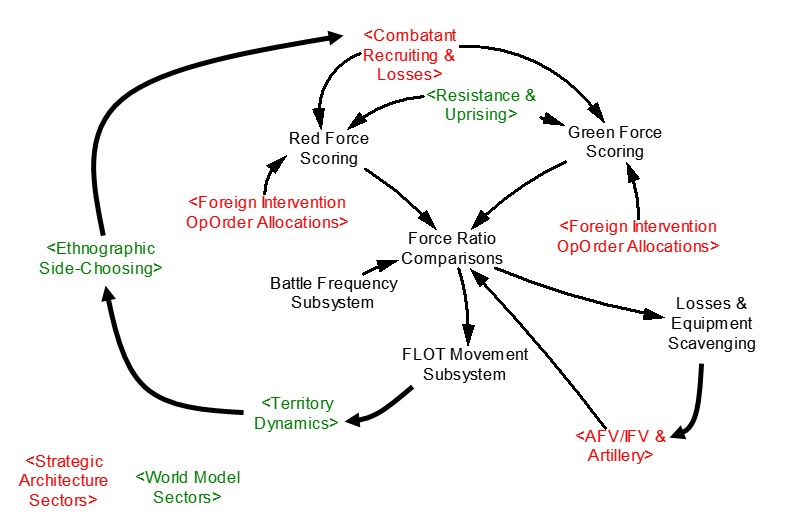


Figure 11: Overview of SFS Combat Simulator Sector

### Equations

Actual Blue or Purple Military Actions[Actors] = Capability of Blue or Purple Military Actions based on Squads[

Actors]

Units: Military Actions/Period

AVERAGE BLUE or PURPLE WAR CRIMES RATE[Actors] = 0.0001, 0

Units: Pct

Blue Airpower[Actors] = Actual Blue or Purple Military Actions[Actors] \* Blue or Purple OpOrder Airpower[

Actors]

Units: Military Actions/Period

Blue or Purple Advanced Weaponry Provision and Training Effect[Actors] = MAX ( 1

, ZIDZ ( Blue or Purple Advanced Weaponry Provisions[Actors] \* Normal Training Reach[

Actors] , Conventional Warfare[Actors] ) )

Units: Pct

Blue or Purple Advanced Weaponry Provisions[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Advanced Equipment Provision[Actors]

Units: Military Actions/Period

Blue or Purple Airpower Targeting Combatants[Green] = GAME( 1 )

Blue or Purple Airpower Targeting Combatants[Red] = 0

Units: Pct

Blue or Purple Airpower Targeting Government Capacity[Green] = GAME( 0 )

Blue or Purple Airpower Targeting Government Capacity[Red] = GAME( 0 )

Units: Pct

Blue or Purple Airpower Targeting Resources[Green] = GAME( 0 )

Blue or Purple Airpower Targeting Resources[Red] = 0

Units: Pct

Blue or Purple Armed Civil Affairs[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Armed Civil Affairs[Actors]

Units: Military Actions/Period

BLUE or PURPLE AVERAGE SQUADRON SORTIES PER PERIOD[Actors] = 2160, 2160

Units: Sorties/(Period\*Squadron)

2160 = 2 sorties per day per plane at an average of 12 planes per

squadron \* 90 days in a period =

Blue or Purple Combat Training Effect[Actors] = MIN ( 1, ZIDZ ( Normal Training Reach[

Actors] \* Blue or Purple Embedded Combat Advisers[Actors] , Conventional Warfare[

Actors] ) )

Units: Pct

Blue or Purple Embedded Combat Advisers[Actors] = ( Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Embedded Combat Advisers[Actors] ) - ( (

Actual Blue or Purple Military Actions[Actors] \* Blue or Purple OpOrder Embedded Combat Advisers[

Actors] ) \* AVERAGE BLUE or PURPLE WAR CRIMES RATE[Actors] )

Units: Military Actions/Period

Blue or Purple Embedded Combat Troops[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Combat Troops[Actors]

Units: Military Actions/Period

Blue or Purple Information Operations[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Information Operations[Actors]

Units: Military Actions/Period

Blue or Purple OpOrder Advanced Equipment Provision[Green] = GAME( 0.25 )

Blue or Purple OpOrder Advanced Equipment Provision[Red] = 0

Units: Pct

Blue or Purple OpOrder Airpower[Green] = GAME( 0 )

Blue or Purple OpOrder Airpower[Red] = 0

Units: Pct

Blue or Purple OpOrder Armed Civil Affairs[Green] = GAME( 0 )

Blue or Purple OpOrder Armed Civil Affairs[Red] = 0

Units: Pct

Blue or Purple OpOrder Combat Troops[Green] = GAME( 0 )

Blue or Purple OpOrder Combat Troops[Red] = GAME( 0 )

Units: Pct

Blue or Purple OpOrder Embedded Combat Advisers[Actors] = GAME( 0 )

Units: Pct

Blue or Purple OpOrder Information Operations[Green] = GAME( 0.25 )

Blue or Purple OpOrder Information Operations[Red] = 0

Units: Pct

Blue or Purple OpOrder Training Local Actor Security Forces[Green] = GAME( 0.25 )

Blue or Purple OpOrder Training Local Actor Security Forces[Red] = 0

Units: Pct

Blue or Purple Security Forces Training Effect[Actors] = ZIDZ ( Blue or Purple Training Actor Security Forces[

Actors] , Combatting Terrorism[Actors] ) \* Diminshing Returns on Security Force Training[

Actors]

Units: Pct

Security Forces Training does not benefit from the same reach

multiplier as advanced weaponry provisions or combat training. This

indicates it's more intensive 1:1 and continuous mentorship aspect

rather than "training."

Blue or Purple Sorties Per Period[Actors] = ( BLUE or PURPLE AVERAGE SQUADRON SORTIES PER PERIOD[

Actors] \* Blue or Purple Squadrons[Actors] ) - ( ( BLUE or PURPLE AVERAGE SQUADRON SORTIES PER PERIOD[

Actors] \* Blue or Purple Squadrons[Actors] ) \* AVERAGE BLUE or PURPLE WAR CRIMES RATE[

Actors] )

Units: Sorties/Period

Blue or Purple Sorties Targeting Combatants[Actors] = Blue or Purple Sorties Per Period[

Actors] \* Blue or Purple Airpower Targeting Combatants[Actors]

Units: Sorties/Period

Blue or Purple Sorties Targeting Government Capacity[Actors] = Blue or Purple Sorties Per Period[

Actors] \* Blue or Purple Airpower Targeting Government Capacity[Actors]

Units: Sorties/Period

Blue or Purple Sorties Targeting Resources[Actors] = Blue or Purple Sorties Per Period[

Actors] \* Blue or Purple Airpower Targeting Resources[Actors]

Units: Sorties/Period

Blue or Purple Squadrons[Actors] = Blue Airpower[Actors] / Military Actions to Support Each Squadron[

Actors]

Units: Squadrons

Blue or Purple Squads[Actors] = INTEG( Change in Blue Squads[Actors] , 0)

Units: Squads

Blue or Purple Squads to Support a Squadron[Actors] = 27, 27

Units: Squads/Squadron

Blue or Purple Training Actor Security Forces[Actors] = Actual Blue or Purple Military Actions[

Actors] \* Blue or Purple OpOrder Training Local Actor Security Forces[Actors

]

Units: Military Actions/Period

Blue or Purple War Crimes[Actors] = ( Blue or Purple Embedded Combat Advisers[Actors

] + ( Blue or Purple Sorties Per Period[Actors] \* War Crimes per Sortie[Actors

] ) ) \* AVERAGE BLUE or PURPLE WAR CRIMES RATE[Actors]

Units: Military Actions/Period

Capability of Blue or Purple Military Actions based on Squads[Actors] = ( Blue or Purple Squads[

Actors] ) \* NORMAL MILITARY CAPABILITY OF SQUADS[Actors]

Units: Military Actions/Period

Combatting Terrorism[Actors] = Actual Military Actions[Actors] \* OpOrder Combatting Terrorism[

Actors]

Units: Military Actions/Period

Conventional Warfare[Actors] = ( Actual Military Actions[Actors] \* OpOrder Conventional Warfare[

Actors] \* Engagement Threshold[Actors] )

Units: Military Actions/Period

Current Security Effectiveness[Actors] = INTEG( Change in Current Security Effectivneess[

Actors] - Decay in Security Effectiveness[Actors] , Anchor Security Effectiveness[

Actors] )

Units: Pct

Days = 1

Units: Days

Days in a Period = 90

Units: Days/Period

Diminshing Returns on Security Force Training[Actors] = Table for Effect of Current Security Effectiveness on Training Effect

( Current Security Effectiveness[Actors] )

Units: Pct

Effect of Ground Support Campaign[Actors] = Table for Effect of Ground Support Air Campaign[

Actors] ( Sorties Supporting Ground Campaign[Actors] / Maximum Daily Sorties

)

Units: Dmnl

Local Actor Combatants Engaged in Conventional Warfare[Ethnographies,Actors] = (

Conventional Warfare[Actors] / NORMAL MILITARY CAPABILITY OF SQUADS[Actors

] ) \* NORMAL SIZE PER SQUAD[Actors]

Units: People

Maximum Daily Sorties = 600

Units: Sorties/Day

Military Actions to Support Each Squadron[Actors] = NORMAL MILITARY CAPABILITY OF SQUADS[

Actors] \* Blue or Purple Squads to Support a Squadron[Actors]

Units: Military Actions/(Period\*Squadron)

NORMAL MILITARY CAPABILITY OF SQUADS[Actors] = 1, 1

Units: Military Actions/(Period\*Squad)

1 every 2 months is normal

NORMAL SIZE PER SQUAD[Actors] = 10

Units: People/Squad

Normal value for ISIS is set at an average of 11. Value for

equilibrium is set at 10.

Normal Training Reach[Actors] = 10, 10

Units: Dmnl

How many Squads each Blue/Purple Squad help via being embedded.

Sorties Supporting Ground Campaign[Actors] = Blue or Purple Sorties Targeting Combatants[

Actors] / Days in a Period

Units: Sorties/Day

Sorties Targeting Government per Day[Actors] = Blue or Purple Sorties Targeting Government Capacity[

Actors] / Days in a Period

Units: Sorties/Day

Table for Effect of Current Security Effectiveness on Training Effect ( [(0,0)-(1,1)

],(0,1),(0.1,0.99),(0.2,0.95),(0.3,0.85),(0.4,0.65),(0.5,0.45),(0.6,0.25)

,(0.7,0.125),(0.8,0.075),(0.9,0.025),(0.95,0.0125),(0.99,0.001),(1,0)

)

Units: Dmnl

Table for Effect of Ground Support Air Campaign[Actors] ( [(0,0)-(1,1)],(0,0),(0.016,0.01)

,(0.16,0.1),(0.83,0.5),(1,0.5) )

Units: Dmnl

Lookup for ground campaign support effectiveness based on intensity

per day of air campaign.

War Crimes per Sortie[Actors] = 1

Units: Military Actions/Sorties

## Territory Dynamics

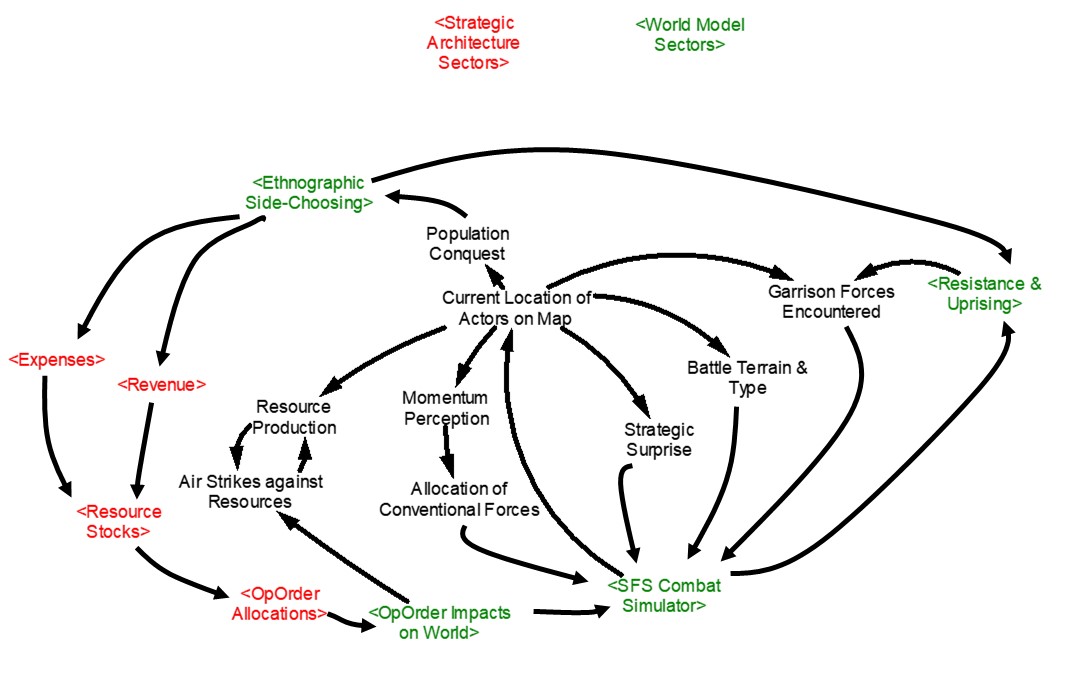


Figure 12: Overview of Territory Dynamics Sector

### Equations

Actor Inefficiencies = 0.5

Units: Pct

Actor Perception of Momentum[Green] = Perception of Momentum[Green] - Perception of Momentum[

Red]

Actor Perception of Momentum[Red] = Perception of Momentum[Red] - Perception of Momentum[

Green]

Units: Pct/Period

Actual Resource Production[Actors] = Resource Production before Strikes[Actors]

- Effect of Attacks on Actual Production[Actors]

Units: Resource/Period

"Allocation of Conventional Forces based on Location & Momentum"[Green] = IF THEN ELSE (

Offensive Stance based on Actor Perception of Momentum[Green] > 0, Offensive Stance based on Actor Perception of Momentum[

Green] , Pct of Actor Forces Engaged Cummulative[Green] )

"Allocation of Conventional Forces based on Location & Momentum"[Red] = IF THEN ELSE (

Offensive Stance based on Actor Perception of Momentum[Red] > 0, Offensive Stance based on Actor Perception of Momentum[

Red] , Pct of Actor Forces Engaged Cummulative[Red] )

Units: Pct

Blue or Purple Sorties Targeting Resources[Actors] = Blue or Purple Sorties Per Period[

Actors] \* Blue or Purple Airpower Targeting Resources[Actors]

Units: Sorties/Period

Calc Legit Pop[Ethnographies,Actors] = INTEG( Coerced to Calculated[Ethnographies

,Actors] + Governed to Calculated[Ethnographies,Actors] + Unaligned Choosing Sides[

Ethnographies,Actors] - Cal Legit Pop Dying[Ethnographies,Actors

] - Calc Legit Pop Recruited or Joining Uprising[Ethnographies,Actors

] - Calc Legit Refugees Leaving[Ethnographies,Actors] - Calculated Lost to Conquest[

Ethnographies,Actors] - Calculated to Coerced[Ethnographies,Actors

] - Calculated to Governed[Ethnographies,Actors] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] \* STARTING ETHNO DISTRIBUTION CALCULATED[Ethnographies

,Actors] )

Units: People

Change of Perception of Territorial Momentum[Actors] = ( Territory Controlled by Actor[

Actors] - Perception of Territorial Progress[Actors] ) / NORMAL PERIOD

Units: Pct/Period

Cummulative Air Strikes against Resource Production[Actors] = INTEG( Rate of Air Strikes[

Actors] , 0)

Units: Sorties

Current Location of Red Actor on Territorial Map[Red] = Territory Controlled by Actor[

Red]

Units: Percentage

Disable Oil = 1

Units: Resources/Period

Used for Proposition 2 - normal value =1, disabled value = 0

Effect of Attacks on Actual Production[Green] = Cummulative Air Strikes against Resource Production[

Red] \* Normal Effect of Strike on Resource Production[Green]

Effect of Attacks on Actual Production[Red] = Cummulative Air Strikes against Resource Production[

Green] \* Normal Effect of Strike on Resource Production[Red]

Units: Resources/Period

Engagement Threshold[Actors] = IF THEN ELSE ( Total Combatants[Red] > Minimum Force Size to Engage[

Red] , 1, 0)

Units: Dmnl

Ethno by Actor Conquer Reference[Ethnographies,Red] = INTEG( Rate of Conquering Red[

Ethnographies,Red] , Total Ethno by Actor[Ethnographies,Red] )

Units: People

Increase in Cumm Pct of Actor Forces Engaged[Green] = ( ( Pct Actor Forces Engaged based on Location of Red on Territorial Map[

Green] \* Peak Actor Forces Engaged Condition[Green] ) / NORMAL PERIOD )

Increase in Cumm Pct of Actor Forces Engaged[Red] = ( Pct Actor Forces Engaged based on Location of Red on Territorial Map[

Red] - Pct of Actor Forces Engaged Cummulative[Red] ) / NORMAL PERIOD

Units: Pct/Period

("Territory Red Actor Controls (km^2)"\*Peak Condition)/1

Loss of Strategic Surprise = ( Strategic Surprise / Time to Recover from Strategic Surprise

) \* Strategic Surprise Countdown Engaged

Units: Dmnl/Period

Minimum Force Size to Engage[Red] = 1000

Units: People

Normal Effect of Strike on Resource Production[Actors] = 400

Units: Resources/(Period\*Sortie)

Units production destroyed per air strike.

NORMAL PERIOD = 1

Units: Period

Normal Time to be Conquered[Ethnographies] = 1

Units: Period

Offensive Stance based on Actor Perception of Momentum[Green] = IF THEN ELSE ( Strategic Surprise

> 0.25, 0, IF THEN ELSE ( Actor Perception of Momentum[Green] \* NORMAL PERIOD

> -0.015, Table for Effect of Actor Perception of Momentum on Offensive Stance[

Green] ( Actor Perception of Momentum[Green] \* NORMAL PERIOD ) ,

0) )

Offensive Stance based on Actor Perception of Momentum[Red] = IF THEN ELSE ( Actor Perception of Momentum[

Red] \* NORMAL PERIOD > 0, Table for Effect of Actor Perception of Momentum on Offensive Stance[

Red] ( Actor Perception of Momentum[Red] \* NORMAL PERIOD ) , 0)

Units: Pct

Pct Actor Forces Engaged based on Location of Red on Territorial Map[Green] = Territory Conditions Table of Cummulative Green Forces Engaged based on Location of Red Actor on Map

( Current Location of Red Actor on Territorial Map[Red] )

Pct Actor Forces Engaged based on Location of Red on Territorial Map[Red] = 1 -

Pct Actor Forces Engaged based on Location of Red on Territorial Map[

Green]

Units: Pct

"ZScenario1: Table of Green Infantry % Engaged based on Location of

ISIS on Territorial Map"(Current Location of Red Actor on Territorial

Map )

Pct Decline from Peak[Actors] = ZIDZ ( Actual Territory Decline[Actors] , Peak Territory[

Actors] )

Units: Pct

Pct Ethno Control Reference[Ethnographies,Red] = ZIDZ ( Total Ethno by Actor[Ethnographies

,Red] , Total Ethno Population[Ethnographies] )

Units: Pct

the current control of an ethnographic population prior to any

adjustment due to recent conquests.

Pct of Actor Forces Engaged Cummulative[Actors] = INTEG( Increase in Cumm Pct of Actor Forces Engaged[

Actors] , Starting Actor Conditions Pct of Forces Engaged[Actors] )

Units: Pct

Pct of Ethno Population by Current Location of Red Actor on Map[Ethnographies,Red

] = Territory Conditions Table for Distribution of Population by Ethnography on Territorial Map[

Ethnographies] ( Current Location of Red Actor on Territorial Map[Red] )

Units: Pct

Pct of Green Garrison Forces Engaged based on Location of Red Actor on Territorial Map[

Red] = 1 - Pct of Green Garrison Forces Engaged based on Location of Red Actor on Territorial Map[

Green]

Pct of Green Garrison Forces Engaged based on Location of Red Actor on Territorial Map[

Green] = Territory Conditions Table of Local Garrison Green Forces Engaged based on Location of Red Actor on Map

( Current Location of Red Actor on Territorial Map[Red] )

Units: Dmnl

Pct Total Population Controlled[Actors] = SUM ( Total Ethno by Actor[Ethnographies!

,Actors] ) / SUM ( Total Ethno Population[Ethnographies!] )

Units: Pct

Peak Actor Forces Engaged Condition[Green] = IF THEN ELSE ( Pct Actor Forces Engaged based on Location of Red on Territorial Map[

Green] > Pct of Actor Forces Engaged Cummulative[Green] , 1, 0)

Peak Actor Forces Engaged Condition[Red] = IF THEN ELSE ( Pct Actor Forces Engaged based on Location of Red on Territorial Map[

Red] < Pct of Actor Forces Engaged Cummulative[Red] , 1, 0)

Units: Dmnl

Activates a multiplier to accept a higher peak increase.

Perception of Momentum[Actors] = INTEG( Rate of Change of the Perception of Momentum[

Actors] , 0)

Units: Pct/Period

Perception of Territorial Progress[Actors] = INTEG( Change of Perception of Territorial Momentum[

Actors] , Territory Conditions Pct Territory Controlled by Actor at Start[

Actors] )

Units: Pct

Rate of Air Strikes[Actors] = Targeted Strikes per Period[Actors]

Units: Sorties/Period

Rate of Change of the Perception of Momentum[Actors] = ( Change of Perception of Territorial Momentum[

Actors] - Perception of Momentum[Actors] ) / NORMAL PERIOD

Units: Pct/(Period\*Period)

Rate of Conquered Population Green[Ethnographies,Green] = MAX ( 0, Territory Conditions Table for Distribution of Population by Ethnography on Territorial Map[

Ethnographies] ( Current Location of Red Actor on Territorial Map[Red

] ) \* Total Ethno Population[Ethnographies] )

Rate of Conquered Population Green[Ethnographies,Red] = MAX ( 0, Total Ethno by Actor[

Ethnographies,Red] \* Pct Decline from Peak[Red] )

Units: People

Rate of Conquering Red[Ethnographies,Red] = ( Target Ethno Population by Most Recent Conquest[

Ethnographies,Red] - Ethno by Actor Conquer Reference[Ethnographies,Red] )

/ Normal Time to be Conquered[Ethnographies]

Units: People/Period

Red Actor Resource Production[Red] = Territory Conditions Table for the Percentage of Resource Production based on Red Actor Location on Territorial Map

( Current Location of Red Actor on Territorial Map[Red] ) \* Territory Conditions Total Available Resource Production

Units: Resources/Period

Resource Production before Strikes[Red] = Red Actor Resource Production[Red] \* Actor Inefficiencies

Resource Production before Strikes[Green] = Territory Conditions Total Available Resource Production

- Red Actor Resource Production[Red]

Units: Resources/Period

Starting Actor Conditions Pct of Forces Engaged[Actors] = 0.006, 0.994

Units: Pct

Strategic Surprise = INTEG( - Loss of Strategic Surprise , 0.95)

Units: Dmnl

Strategic Surprise Countdown Engaged = IF THEN ELSE ( Current Location of Red Actor on Territorial Map[

Red] > 0.092, 1, 0)

Units: Dmnl

Strategic Surprise Factor = Territory Conditions Table for Strategic Surprise Based on Location of Red Actor on Territorial Map

( Current Location of Red Actor on Territorial Map[Red] )

Units: Dmnl

Table for Effect of Actor Perception of Momentum on Offensive Stance[Actors] ( [(-0.02,0)-(0.15,1)

],(-0.015,0.25),(0.001,0.3),(0.002,0.4),(0.003,0.5),(0.004,0.6),(0.005,0.75)

,(0.006,0.85),(0.012,0.9),(0.024,0.95),(0.048,0.99),(0.1,1) )

Units: Pct

[(0,0)-(0.25,1)],(0.001,0.25),(0.02,0.25),(0.04,0.4),(0.06,0.6),(0.08,

0.75),(0.1,0.85),(0.12,0.9),(0.14,0.95),(0.16,0.99),(0.18,1)

Table for Effect of Remaining Ethno Population by Actor ( [(0,0)-(1,1)],(0,0),(0,0)

,(0,0),(0.0025,0),(0.005,0.005),(0.1,0.01),(0.2,0.05),(0.3,0.2),(0.4,0.35)

,(0.5,0.5),(0.6,0.6),(0.75,0.8),(0.8,0.85),(0.9,0.95),(0.97,0.99),(0.99,0.99)

,(1,1) )

Units: Dmnl

Target Ethno Population by Most Recent Conquest[Ethnographies,Red] = Total Ethno Population[

Ethnographies] \* Pct of Ethno Population by Current Location of Red Actor on Map[

Ethnographies,Red]

Units: People

Targeted Strikes per Period[Actors] = Blue or Purple Sorties Targeting Resources[

Actors] \* Targeting Switch[Actors]

Units: Sorties/Period

Targeting Switch[Green] = IF THEN ELSE ( Cummulative Air Strikes against Resource Production[

Green] > ( Resource Production before Strikes[Red] / Normal Effect of Strike on Resource Production[

Green] ) , 0, 1)

Targeting Switch[Red] = IF THEN ELSE ( Cummulative Air Strikes against Resource Production[

Red] > ( Resource Production before Strikes[Green] / Normal Effect of Strike on Resource Production[

Red] ) , 0, 1)

Units: Dmnl

Territory Actor Controls[Actors] = INTEG( Rate of Territory Gained[Actors] - Rate of Territory Lost[

Actors] , Territory Conditions Starting Total Territory \* Territory Conditions Pct Territory Controlled by Actor at Start[

Actors] )

Units: "km^2"

Territory Conditions Pct Territory Controlled by Actor at Start[Actors] = 1, 0

Units: Pct

Territory Conditions Starting Total Territory = 619308

Units: "km^2"

Includes all Provinces and Governates of Iraq and Syria. “Provinces

of Syria”, Administrative Divisions of Countries, Statoids, last

modified September 22, 2004, accessed September 19th, 2014,

http://www.statoids.com/usy.html. “Provinces of Iraq”,

Administrative Divisions of Countries, Statoids, last modified March

16, 2014, accessed September 19th, 2014,

http://www.statoids.com/uiq.html.

Territory Conditions Table for Battle Type based on Location of Red Actor on Territorial Map

( [(0,0)-(0.7,6)],(0.0032,1),(0.0037,1),(0.0587,3),(0.0912,3),(0.0917,4),(0.0922,2)

,(0.3222,1),(0.3824,1),(0.4224,1),(0.4229,3),(0.4291,1),(0.4691,6),(0.4696,5)

,(0.4996,6),(0.5001,5),(0.5157,6),(0.5162,5),(0.5312,1),(0.5317,6),(0.6017,5)

,(0.6317,4),(0.6322,5),(0.6327,5),(0.6426,4),(0.6492,4),(0.6497,5),(0.6697,3)

,(0.6799,1),(0.6804,5),(0.7112,4),(0.7412,4),(0.7417,5),(0.7717,4),(0.8217,1)

,(0.8222,5),(0.8472,1),(0.8477,5),(0.8736,4),(0.9586,1),(0.9936,1),(0.9941,5)

)

Units: Dmnl

Scenario 1

Territory Conditions Table for Distribution of Population by Ethnography on Territorial Map[

Arab Suuni] ( [(0,0)-(1,1)],(0,0.00496),(0.00317,0.00496),(0.00367,0.01231),(0.05867,0.03494)

,(0.09117,0.04777),(0.09167,0.05865),(0.09217,0.09468),(0.32217,0.10144)

,(0.38243,0.11139),(0.4224,0.12594),(0.4229,0.13179),(0.42912,0.13204)

,(0.46912,0.13363),(0.46962,0.13369),(0.49962,0.15349),(0.50012,0.1711)

,(0.51574,0.17245),(0.51624,0.17445),(0.53124,0.18805),(0.53174,0.19409)

,(0.60174,0.20311),(0.63174,0.20576),(0.63224,0.21479),(0.63274,0.21693)

,(0.64257,0.24055),(0.64915,0.25532),(0.64965,0.26032),(0.66965,0.2695)

,(0.67992,0.27326),(0.68042,0.28826),(0.71116,0.29326),(0.74116,0.29417)

,(0.74166,0.29736),(0.77166,0.29736),(0.82166,0.29736),(0.82216,0.29736)

,(0.84716,0.29824),(0.84766,0.30039),(0.87356,0.30039),(0.95856,0.30039)

,(0.99356,0.30039),(0.99406,0.30039) )

Territory Conditions Table for Distribution of Population by Ethnography on Territorial Map[

Arab Shia] ( [(0,0)-(1,1)],(0.00317,0.00028),(0.00367,0.00068),(0.05867,0.00194)

,(0.09117,0.00265),(0.09167,0.00326),(0.09217,0.01001),(0.32217,0.01039)

,(0.38243,0.01094),(0.4224,0.01175),(0.4229,0.01208),(0.42912,0.01641)

,(0.46912,0.04512),(0.46962,0.04625),(0.49962,0.06605),(0.50012,0.08365)

,(0.51574,0.09514),(0.51624,0.11214),(0.53124,0.12534),(0.53174,0.13121)

,(0.60174,0.13996),(0.63174,0.14128),(0.63224,0.15031),(0.63274,0.15245)

,(0.64257,0.15245),(0.64915,0.15245),(0.64965,0.15245),(0.66965,0.15857)

,(0.67992,0.15857),(0.68042,0.15857),(0.71116,0.17357),(0.74116,0.17878)

,(0.74166,0.19686),(0.77166,0.19686),(0.82166,0.19686),(0.82216,0.19686)

,(0.84716,0.19686),(0.84766,0.19686),(0.87356,0.19686),(0.95856,0.19686)

,(0.99356,0.19686),(0.99406,0.19686) )

Territory Conditions Table for Distribution of Population by Ethnography on Territorial Map[

Kurdish Suuni] ( [(0,0)-(1,1)],(0.00317,0.00028),(0.00367,0.00068),(0.05867,0.00194)

,(0.09117,0.00265),(0.09167,0.00326),(0.09217,0.00551),(0.32217,0.00589)

,(0.38243,0.00644),(0.4224,0.00725),(0.4229,0.00757),(0.42912,0.00781)

,(0.46912,0.00941),(0.46962,0.00947),(0.49962,0.02927),(0.50012,0.04688)

,(0.51574,0.04755),(0.51624,0.04855),(0.53124,0.06175),(0.53174,0.06762)

,(0.60174,0.07637),(0.63174,0.09891),(0.63224,0.26141),(0.63274,0.29994)

,(0.64257,0.30781),(0.64915,0.32258),(0.64965,0.32758),(0.66965,0.34289)

,(0.67992,0.34664),(0.68042,0.36164),(0.71116,0.36164),(0.74116,0.36164)

,(0.74166,0.36164),(0.77166,0.38125),(0.82166,0.382),(0.82216,0.402)

,(0.84716,0.40988),(0.84766,0.42924),(0.87356,0.44519),(0.95856,0.45609)

,(0.99356,0.46109),(0.99406,0.50109) )

Units: Percentage

Territory Conditions Table for Strategic Surprise Based on Location of Red Actor on Territorial Map

( [(0,0)-(1,1)],(0,0.05),(0.00317,0.05),(0.00322,0.05),(0.0566,0.25),(0.08828,0.25)

,(0.08844,0.5),(0.08866,0.5),(0.31224,1),(0.41247,1),(0.41263,1),(0.41885,1)

,(0.45652,1),(0.45657,1),(0.48642,1),(0.48672,1),(0.50235,1),(0.50251,1)

,(0.51686,1),(0.51702,1),(0.5852,1),(0.61432,1),(0.61465,1),(0.61482,1)

,(1,1) )

Units: Dmnl

Territory Conditions Table for the Percentage of Resource Production based on Red Actor Location on Territorial Map

( [(0,0)-(1,1)],(0,0),(0,0),(0.06,0.04),(0.09,0.04),(0.09,0.04),(0.09,0.05),(0.32,0.05)

,(0.38,0.05),(0.42,0.06),(0.42,0.06),(0.43,0.06),(0.47,0.14),(0.47,0.14)

,(0.5,0.14),(0.5,0.14),(0.52,0.39),(0.52,0.39),(0.53,0.39),(0.53,0.39)

,(0.6,0.39),(0.63,0.39),(0.63,0.4),(0.63,0.4),(0.64,0.4),(0.65,0.4),

(0.65,0.4),(0.67,0.4),(0.68,0.4),(0.68,0.4),(0.71,0.4),(0.74,0.41),(0.74,0.41)

,(0.77,0.41),(0.82,0.41),(0.82,0.41),(0.85,0.41),(0.85,0.41),(0.87,0.42)

,(0.96,0.42),(0.99,1),(0.99,1) )

Units: Percentage

Scenario 1

Territory Conditions Table for the Terrain Type Based on Location of Red Actor on Territorial Map

( [(0,0)-(0.7,5)],(0.00317,4),(0.00367,4),(0.05867,1),(0.09117,1),(0.09167,4)

,(0.09217,4),(0.32217,1),(0.38243,1),(0.4224,1),(0.4229,4),(0.42912,2)

,(0.46912,5),(0.46962,4),(0.49962,1),(0.50012,4),(0.51574,1),(0.51624,4)

,(0.53124,1),(0.53174,2),(0.60174,4),(0.63174,2),(0.63224,4),(0.63274,4)

,(0.64257,5),(0.64915,1),(0.64965,5),(0.66965,2),(0.67992,1),(0.68042,4)

,(0.71116,1),(0.74116,5),(0.74166,4),(0.77166,2),(0.82166,1),(0.82216,4)

,(0.84716,1),(0.84766,4),(0.87356,2),(0.95856,1),(0.99356,1),(0.99406,4)

)

Units: Dmnl

Scenario 1

Territory Conditions Table of Cummulative Green Forces Engaged based on Location of Red Actor on Map

( [(0,0)-(1,1)],(0.00317,0.00551),(0.00367,0.01368),(0.05867,0.03882),(0.09117,0.05308)

,(0.09167,0.06517),(0.09217,0.11021),(0.32217,0.11771),(0.38243,0.12877)

,(0.4224,0.14494),(0.4229,0.15144),(0.42912,0.15626),(0.46912,0.15816)

,(0.46962,0.18941),(0.49962,0.21941),(0.50012,0.30323),(0.51574,0.30674)

,(0.51624,0.33803),(0.53124,0.35876),(0.53174,0.36746),(0.60174,0.42246)

,(0.63174,0.44998),(0.63224,0.59998),(0.63274,0.69998),(0.64257,0.72998)

,(0.64915,0.73998),(0.64965,0.75998),(0.66965,0.76498),(0.67992,0.76998)

,(0.68042,0.79498),(0.71116,0.81998),(0.74116,0.82498),(0.74166,0.85498)

,(0.77166,0.85648),(0.82166,0.85798),(0.82216,0.90798),(0.84716,0.90998)

,(0.84766,0.95998),(0.87356,0.96098),(0.95856,0.96198),(0.99356,0.96298)

,(0.99406,1.01298) )

Units: Dmnl

Territory Conditions Table of Local Garrison Green Forces Engaged based on Location of Red Actor on Map

( [(0,0)-(0.7,0.3)],(0.00317,0.00551),(0.00367,0.00817),(0.05867,0.02514),(0.09117,0.01426)

,(0.09167,0.01209),(0.09217,0.04504),(0.32217,0.00751),(0.38243,0.01106)

,(0.4224,0.01616),(0.4229,0.00651),(0.42912,0.00482),(0.46912,0.0019)

,(0.46962,0.03125),(0.49962,0.03),(0.50012,0.08382),(0.51574,0.00351)

,(0.51624,0.03129),(0.53124,0.02073),(0.53174,0.0087),(0.60174,0.055)

,(0.63174,0.02752),(0.63224,0.15),(0.63274,0.1),(0.64257,0.03),(0.64915,0.01)

,(0.64965,0.02),(0.66965,0.005),(0.67992,0.005),(0.68042,0.025),(0.71116,0.025)

,(0.74116,0.005),(0.74166,0.03),(0.77166,0.0015),(0.82166,0.0015),(0.82216,0.05)

,(0.84716,0.002),(0.84766,0.05),(0.87356,0.001),(0.95856,0.001),(0.99356,0.001)

,(0.99406,0.05) )

Units: Dmnl

Territory Conditions Total Available Resource Production = 5.6e+008 \* Disable Oil

Units: Resources/Period

Total Syria & Iraq production pre-war and prior to ISIS inefficiences

or attacks.

Territory Controlled by Actor[Actors] = ZIDZ ( Territory Actor Controls[Actors]

, Territory Conditions Starting Total Territory )

Units: Percentage

Time to Recover from Strategic Surprise = 4

Units: Periods

Total Ethno by Actor[Ethnographies,Actors] = Calc Legit Pop[Ethnographies,Actors

] + Coerced Pop[Ethnographies,Actors] + Governed Pop[Ethnographies,Actors]

Units: People

Total Ethno Population[Ethnographies] = INTEG( Increase in Pop[Ethnographies] -

Decrease in Pop[Ethnographies] , STARTING LEVEL OF ETHNOGRAPHIC POPULATION[

Ethnographies] )

Units: People

Type of Battle = Territory Conditions Table for Battle Type based on Location of Red Actor on Territorial Map

( Current Location of Red Actor on Territorial Map[Red] )

Units: Dmnl

Type of Terrain[Actors] = Territory Conditions Table for the Terrain Type Based on Location of Red Actor on Territorial Map

( Current Location of Red Actor on Territorial Map[Red] )

Units: Dmnl

# A-16: Scenario Scripts

## Scenario Scripts

Both scenarios begin the same, representing a decline in relative stability in Syria and Iraq as the US began major withdrawals. A period of crisis emerges indicative of the response of Syria to the Arab Spring and crackdown in Iraq of Arab Suuni minorities by the Arab Shia governing majority. Both baseline scenarios include a period of increasing violence and terrorism accompanying the rise of ISIS leading to breakout of ISIS as it begins waging conventional military attacks and acquiring territory leading to the fall of Fallujah, Ramadi, Mosul and even the entire Anbar Province which historically took place largely during the first half of 2014.

The fork in the scenarios occurs at the point when ISIS has expaned to the point of threatening Kobani. For the Baseline without Intervention scenario – Red and Green will continue fighting without any assistance from external forces. In the “Historical Baseline”, historically realistic interventions of foreign state-actors foreign-supported local non-state actors occur.

The baselines are identical in how the Green Actor allocates its own forces with operational orders. Where the baselines split is as ISIS expansion approaches what historically would’ve been Kobani in Syria. This is when interventions are added for the Historical Baseline or not for the Baseline Without Intervention.

### Baseline Historical Script

:Time=0

Actual Desire to Credibly Govern[Arab Suuni,Green]=1

Actual Desire to Credibly Govern[Arab Suuni,Red]=1

Actual Desire to Credibly Govern[Arab Shia,Green]=1

Actual Desire to Credibly Govern[Arab Shia,Red]=1

Actual Desire to Credibly Govern[Kurdish Suuni,Green]=1

Actual Desire to Credibly Govern[Kurdish Suuni,Red]=1

Blue or Purple Intervention Size[Green]=0

Blue or Purple Intervention Size[Red]=0

Blue or Purple OpOrder Embedded Combat Advisers[Green]=0

Blue or Purple OpOrder Embedded Combat Advisers[Red]=0

Blue or Purple T3R Average[Green]=.3

OpOrder Armed Civil Affairs[Green]=0.0

OpOrder Armed Civil Affairs[Red]=0.01

OpOrder Combatting Terrorism[Green]=0.075

OpOrder Combatting Terrorism[Red]=0

OpOrder Conventional Warfare[Green]=0.15

OpOrder Conventional Warfare[Red]=0.0

OpOrder Indirect IED VBIED or SVIED[Green]=0

OpOrder Indirect IED VBIED or SVIED[Red]=0

OpOrder Prison Breaks[Green]=0

OpOrder Prison Breaks[Red]=0.05

OpOrder Prison Duty[Green]=0.2

OpOrder Prison Duty[Red]=0

OpOrder Propoganda[Green]=0.0

OpOrder Propoganda[Red]=0.24

OpOrder Recruiting[Arab Suuni,Green]=0

OpOrder Recruiting[Arab Suuni,Red]=0.023

OpOrder Recruiting[Arab Shia,Green]=0

OpOrder Recruiting[Arab Shia,Red]=0

OpOrder Recruiting[Kurdish Suuni,Green]=0

OpOrder Recruiting[Kurdish Suuni,Red]=0.0125

OpOrder Terrorism[Arab Suuni,Red]=0.3

OpOrder Terrorism[Arab Shia,Red]=0.14

OpOrder Terrorism[Kurdish Suuni,Red]=0.14

OpOrder War Crimes[Arab Suuni,Green]=0

OpOrder War Crimes[Arab Suuni,Red]=0

OpOrder War Crimes[Arab Shia,Green]=0

OpOrder War Crimes[Arab Shia,Red]=0.05

OpOrder War Crimes[Kurdish Suuni,Green]=.00

OpOrder War Crimes[Kurdish Suuni,Red]=0.03

:Time=1.0

Actual Desire to Credibly Govern[Arab Suuni,Green]=0.25

Actual Desire to Credibly Govern[Kurdish Suuni,Green]=0.25

OpOrder War Crimes[Arab Suuni,Green]=0.03

OpOrder War Crimes[Kurdish Suuni,Green]=0.03

:Time=8.0024

OpOrder Propoganda[Red]=0.01

OpOrder Terrorism[Arab Suuni,Red]=0.3

OpOrder Terrorism[Arab Shia,Red]=0.3

OpOrder Terrorism[Kurdish Suuni,Red]=0.21

:Time=10.0043

Actual Desire to Credibly Govern[Arab Suuni,Green]=0.75

Actual Desire to Credibly Govern[Kurdish Suuni,Green]=0.75

OpOrder War Crimes[Arab Suuni,Green]=0

OpOrder War Crimes[Kurdish Suuni,Green]=0

OpOrder Armed Civil Affairs[Red]=0.2

OpOrder Conventional Warfare[Red]=0.56

OpOrder Indirect IED VBIED or SVIED[Red]=0.03

OpOrder Terrorism[Arab Suuni,Red]=0.00

OpOrder Terrorism[Arab Shia,Red]=0.03

OpOrder Terrorism[Kurdish Suuni,Red]=0.01

:Time=15.0092

OpOrder Terrorism[Arab Shia,Red]=0.07

OpOrder Recruiting[Arab Suuni,Red]=0.00

OpOrder Recruiting[Kurdish Suuni,Red]=0.0

:Time=18.557

AFV and IFV Purchases[Green]=300

Blue or Purple Intervention Size[Green]=43082

Blue or Purple OpOrder Embedded Combat Advisers[Green]=.06352

Blue or Purple OpOrder Combat Troops[Green]=.44

Blue or Purple OpOrder Training Local Actor Security Forces[Green]=.23

Blue or Purple OpOrder Information Operations[Green]=.1020

Blue or Purple OpOrder Advanced Equipment Provision[Green]=.09835

Blue or Purple OpOrder Airpower[Green]=.02

Blue or Purple Airpower Targeting Combatants[Green]=.8830

Blue or Purple Airpower Targeting Resources[Green]=0

Blue or Purple Airpower Targeting Government Capacity[Green]=.1169

OpOrder Combatting Terrorism[Green]=0.24

OpOrder Conventional Warfare[Green]=0.37

OpOrder Recruiting[Arab Shia,Green]=.19

:Time=20.5538

AFV and IFV Purchases[Green]=0

OpOrder Recruiting[Arab Shia,Green]=0

OpOrder Conventional Warfare[Green]=0.39

OpOrder Propoganda[Green]=0.11

:Time=22.4495

Blue or Purple Intervention Size[Green]=44082

Blue or Purple OpOrder Embedded Combat Advisers[Green]=.062384

Blue or Purple OpOrder Combat Troops[Green]=.4537

Blue or Purple OpOrder Training Local Actor Security Forces[Green]=.261808

Blue or Purple OpOrder Information Operations[Green]=.0997

Blue or Purple OpOrder Advanced Equipment Provision[Green]=.1118

Blue or Purple OpOrder Airpower[Green]=.04

Blue or Purple Airpower Targeting Combatants[Green]=.5777

Blue or Purple Airpower Targeting Resources[Green]=.36166

Blue or Purple Airpower Targeting Government Capacity[Green]=.06055

OpOrder Combatting Terrorism[Green]=0.09

OpOrder Recruiting[Kurdish Suuni,Green]=.14

OpOrder Recruiting[Arab Shia,Green]=.04

:Time=24.4484

OpOrder Combatting Terrorism[Green]=0.06

OpOrder Conventional Warfare[Green]=0.56

OpOrder Recruiting[Kurdish Suuni,Green]=.00

:Time=28.26

Blue or Purple Intervention Size[Green]=92082

Blue or Purple OpOrder Embedded Combat Advisers[Green]=.186247

Blue or Purple OpOrder Combat Troops[Green]=.265

Blue or Purple OpOrder Training Local Actor Security Forces[Green]=.281716

Blue or Purple OpOrder Information Operations[Green]=.1519

Blue or Purple OpOrder Armed Civil Affairs[Green]=0

Blue or Purple OpOrder Advanced Equipment Provision[Green]=.053564

Blue or Purple OpOrder Airpower[Green]=.06

Blue or Purple Airpower Targeting Combatants[Green]=.832522

Blue or Purple Airpower Targeting Resources[Green]=.143457

Blue or Purple Airpower Targeting Government Capacity[Green]=.024021

AFV and IFV Purchases[Green]=30

Artillery Purchases[Green]=30

:Time=30.2627

Blue or Purple Intervention Size[Green]=108082

Blue or Purple OpOrder Embedded Combat Advisers[Green]=.158676

Blue or Purple OpOrder Combat Troops[Green]=.296072

Blue or Purple OpOrder Training Local Actor Security Forces[Green]=.262218

Blue or Purple OpOrder Information Operations[Green]=.12949

Blue or Purple OpOrder Armed Civil Affairs[Green]=.103625

Blue or Purple OpOrder Advanced Equipment Provision[Green]=.045634

Blue or Purple OpOrder Airpower[Green]=.08

Blue or Purple Airpower Targeting Combatants[Green]=.81197

Blue or Purple Airpower Targeting Resources[Green]=.161061

Blue or Purple Airpower Targeting Government Capacity[Green]=.026969

AFV and IFV Purchases[Green]=50

Artillery Purchases[Green]=50

:Time=32.265

AFV and IFV Purchases[Green]=0

Artillery Purchases[Green]=0

:Time=39.9991

### Baseline Without Intervention Script

:Time=0

Actual Desire to Credibly Govern[Arab Suuni,Green]=1

Actual Desire to Credibly Govern[Arab Suuni,Red]=1

Actual Desire to Credibly Govern[Arab Shia,Green]=1

Actual Desire to Credibly Govern[Arab Shia,Red]=1

Actual Desire to Credibly Govern[Kurdish Suuni,Green]=1

Actual Desire to Credibly Govern[Kurdish Suuni,Red]=1

Blue or Purple Intervention Size[Green]=0

Blue or Purple Intervention Size[Red]=0

Blue or Purple OpOrder Embedded Combat Advisers[Green]=0

Blue or Purple OpOrder Embedded Combat Advisers[Red]=0

OpOrder Armed Civil Affairs[Green]=0.0

OpOrder Armed Civil Affairs[Red]=0.01

OpOrder Combatting Terrorism[Green]=0.075

OpOrder Combatting Terrorism[Red]=0

OpOrder Conventional Warfare[Green]=0.15

OpOrder Conventional Warfare[Red]=0.0

OpOrder Indirect IED VBIED or SVIED[Green]=0

OpOrder Indirect IED VBIED or SVIED[Red]=0

OpOrder Prison Breaks[Green]=0

OpOrder Prison Breaks[Red]=0.05

OpOrder Prison Duty[Green]=0.2

OpOrder Prison Duty[Red]=0

OpOrder Propoganda[Green]=0.0

OpOrder Propoganda[Red]=0.24

OpOrder Recruiting[Arab Suuni,Green]=0

OpOrder Recruiting[Arab Suuni,Red]=0.023

OpOrder Recruiting[Arab Shia,Green]=0

OpOrder Recruiting[Arab Shia,Red]=0

OpOrder Recruiting[Kurdish Suuni,Green]=0

OpOrder Recruiting[Kurdish Suuni,Red]=0.0125

OpOrder Terrorism[Arab Suuni,Red]=0.3

OpOrder Terrorism[Arab Shia,Red]=0.14

OpOrder Terrorism[Kurdish Suuni,Red]=0.14

OpOrder War Crimes[Arab Suuni,Green]=0

OpOrder War Crimes[Arab Suuni,Red]=0

OpOrder War Crimes[Arab Shia,Green]=0

OpOrder War Crimes[Arab Shia,Red]=0.05

OpOrder War Crimes[Kurdish Suuni,Green]=.00

OpOrder War Crimes[Kurdish Suuni,Red]=0.03

:Time=1.0

Actual Desire to Credibly Govern[Arab Suuni,Green]=0.25

Actual Desire to Credibly Govern[Kurdish Suuni,Green]=0.25

OpOrder War Crimes[Arab Suuni,Green]=0.03

OpOrder War Crimes[Kurdish Suuni,Green]=0.03

:Time=8.0024

OpOrder Propoganda[Red]=0.01

OpOrder Terrorism[Arab Suuni,Red]=0.3

OpOrder Terrorism[Arab Shia,Red]=0.3

OpOrder Terrorism[Kurdish Suuni,Red]=0.21

:Time=10.0043

Actual Desire to Credibly Govern[Arab Suuni,Green]=0.75

Actual Desire to Credibly Govern[Kurdish Suuni,Green]=0.75

OpOrder War Crimes[Arab Suuni,Green]=0

OpOrder War Crimes[Kurdish Suuni,Green]=0

OpOrder Armed Civil Affairs[Red]=0.2

OpOrder Conventional Warfare[Red]=0.56

OpOrder Indirect IED VBIED or SVIED[Red]=0.03

OpOrder Terrorism[Arab Suuni,Red]=0.00

OpOrder Terrorism[Arab Shia,Red]=0.03

OpOrder Terrorism[Kurdish Suuni,Red]=0.01

:Time=15.0092

OpOrder Terrorism[Arab Shia,Red]=0.07

OpOrder Recruiting[Arab Suuni,Red]=0.00

OpOrder Recruiting[Kurdish Suuni,Red]=0.0

:Time=18.557

OpOrder Combatting Terrorism[Green]=0.24

OpOrder Conventional Warfare[Green]=0.37

:Time=20.5538

OpOrder Conventional Warfare[Green]=0.39

OpOrder Propoganda[Green]=0.11

:Time=24.4484

OpOrder Combatting Terrorism[Green]=0.06

OpOrder Conventional Warfare[Green]=0.56

:Time=39.99

# A-17: Scenario Data

## Scenario Data

The tables below summarizes an pre-war estimated population, territorial size, capital and nominal controlling faction of Syria[[1]](#footnote-1) and Iraq Provinces.[[2]](#footnote-2) These are then translated into scenario data that will be used to instantiate the model in both the Baseline Historical and Baseline without Intervention scenarios.

Table 2: Syria Demographic Parameters in Scenario

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Country** | **Province** | **Population** | **Area(km.²)** | **Area(mi.²)** | **Capital** | **Nominal Control** |
| Syria | Aleppo | 4,045,166 | 18,498 | 7,142 |  | **ISIS Target** |
| Syria | Al Ḥasakah | 1,275,118 | 23,334 | 9,009 |  | **Kurdish** |
| Syria | Ar Raqqah | 793,514 | 19,618 | 7,575 |  | **ISIS** |
| Syria | As Suwaydā' | 313,231 | 5,550 | 2,143 |  |  |
| Syria | Damascus | 1,552,161 | 118 | 46 |  |  |
| Syria | Dar`ā | 843,478 | 3,730 | 1,440 |  |  |
| Syria | Dayr az Zawr | 1,004,747 | 33,060 | 12,765 |  | **ISIS** |
| Syria | Hama | 1,384,953 | 10,163 | 3,924 |  |  |
| Syria | Ḥimṣ | 1,529,402 | 40,940 | 15,807 |  | **ISIS Target** |
| Syria | Idlib | 1,258,427 | 6,097 | 2,354 |  |  |
| Syria | Latakia | 879,551 | 2,297 | 887 |  |  |
| Syria | Quneitra | 66,593 | 1,861 | 719 |  |  |
| Syria | Rif Dimashq | 2,273,074 | 18,018 | 6,957 |  |  |
| Syria | Ţarţūs | 701,395 | 1,896 | 732 |  |  |
| **TOTAL** | **14 Provinces** | **17,920,810** | **185,180** | **71,498** |  |  |

Table 3: Iraq Demographic Parameters in the Scenario

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Country** | **Province** | **Population** | **Area(km.²)** | **Area(mi.²)** | **Capital** | **% ISIS Control** |
| Iraq | Al-Anbar | 1,023,776 | 138,501 | 53,476 | Ar-Ramadi | **ISIS** |
| Iraq | Al-Basrah | 1,556,445 | 19,070 | 7,363 | Al-Basrah |  |
| Iraq | Al-Muthanna | 436,825 | 51,740 | 19,977 | As-Samawah |  |
| Iraq | Al-Qadisiyah | 751,331 | 8,153 | 3,148 | Ad-Diwaniyah |  |
| Iraq | An-Najaf | 775,042 | 28,824 | 11,129 | An-Najaf |  |
| Iraq | Arbil | 1,095,992 | 14,471 | 5,587 | Arbil |  |
| Iraq | As-Sulaymaniyah | 1,362,739 | 17,023 | 6,573 | As-Sulaymaniyah |  |
| **Iraq** | **Babil** | **1,181,751** | **6,468** | **2,497** | **Al-Hillah** |  |

Table 4: Table of Scenario Parameter Values for Territory Dynamics



1. “Provinces of Syria”, Administrative Divisions of Countries, Statoids, last modified September 22, 2004, accessed September 19th, 2014, <http://www.statoids.com/usy.html>. [↑](#footnote-ref-1)
2. “Provinces of Iraq”, Administrative Divisions of Countries, Statoids, last modified March 16, 2014, accessed September 19th, 2014, http://www.statoids.com/uiq.html. [↑](#footnote-ref-2)