Offense vs. Defense in Strat-O-Matic

by Dean Carrano

Before I start, I want to thank David C. Madsen (author of the article "When to Play the Slick Fielder over the Heavy Hitter"), and Paul Johnson (creator of New Estimated Runs Produced, the stat I will be utilizing here.) Without your brilliant work, I would have had no clue how to go about doing this. I also want to thank Lance Bousley for providing me with the Retrosheet info that allowed me to estimate how often certain base/out situations come up.

Okay, let's get started. Our goal here is to measure how much offense in Strat-O-Matic (SOM) is worth relative to defense. Or, in other words (because this really is the same thing), we want to measure the total value of a player, including both hitting and fielding.

I. Measuring Offense

Measuring offense is the easy part: there are quite a few stats out there that do an excellent job of telling you how many runs a hitter is worth. I chose to go with New Estimated Runs Produced (NERP) because it's very accurate, and also amazingly simple, needing no more information than the stats given in the SOM ratings book. The NERP formula is:

(TB * .318) + ((BB+HBP-CS-GIDP) * .333) + (H * .25) + (SB * .2) - (AB * .085)

A given side of a SOM hitter's card has 108 chances on it. So if we plug a hitter's "card chances" into this formula, that'll tell us how many runs he will create in 108 plate appearances (PA) rolled off his card.

Let's start doing that. First of all, there's no way to get SB/CS off the card. So, we'll just assume that the player is going to steal at the same rate in SOM that he did in real life. Since the hitter only rolls on his own card half the time, 108 rolls off the hitter's card is equivalent to 216 PA. That means:

SB = [(real-life SB) / (real-life PA)] * 216
and
CS = [(real-life CS) / (real-life PA)] * 216

As you know, 108 plate appearances is not the same thing as 108 at-bats. So we get the BB and HBP chances from the ratings book (or count them ourselves), and:

AB = 108 – (BB + HBP)

The "DP" stat in the ratings book is defined as the chance out of 108 that the player will ground into a double play, given that the double play is in order. But of course, most situations in which a player bats are *not* double play situations, and we need to adjust for that. From 1974-2004, 18.75% of the plate appearances in major league baseball occurred in double play situations (fewer than two outs and either a man on first; men on 1st and 2nd; men on 1st and 3rd; or bases loaded.) So we'll use that as our estimate, and multiply the DP stat from the book by 18.75%.

Everything else we need comes straight from the ratings book. The only complicating factor is that we need to choose a ballpark, which is going to affect TB and H. I choose a "neutral" park that is 1-8 for singles both ways, and 1-8 for homers both ways. I'm not going to go over how to adjust the TB and H for the park, because it would take forever to explain something that is conceptually very simple: if you understand how the ballpark effects work, you understand how to do it.

Let's use 2006 Carl Crawford's card against righty pitchers as an example. First, we'll deal with the stolen bases. Crawford had 58 real-life SB and 9 real-life CS in 652 real-life PA. Doing the math as described above, that's a rate of 19.2 SB and 3.0 CS per 108 rolls off the hitter's card (216 PA).

Using that info, the card stats from the ratings book, and a 1-8 singles/1-8 homers ballpark, we get:

TB = 54.6, BB = 2, HBP = 2, CS = 3.0, GIDP = 3.375 (i.e., 18.75% of his DP rating of 18)
H = 34.5, SB = 19.2, AB = 104

Plugging all that into the formula, which again is:

(TB * .318) + ((BB+HBP-CS-GIDP) * .333) + (H * .25) + (SB * .2) - (AB * .085)

We get:

(54.6 * .318) + ((2+2-3.0-3.375) * .333) + (34.5 * .25) + (19.2 * .2) – (104 * .085)

That adds up to **20.2**. Again, that is how many runs Crawford would create in 108 PA, if every roll were off his card, in a 1-8 singles/1-8 homers park, facing a righty pitcher. We'll call that "offensive NERP."

Let's do some more examples. These are all the "vs. righty" pitching sides of 2006 cards, in 1-8/1-8/1-8/1-8 parks.

Manny Ramirez:
TB = 71.1, BB = 25, HBP = 0, CS = 0.4, GIDP = 1.875, H = 31.1, SB = 0, AB = 83
Offensive NERP = **30.9**

Jeff Kent:
TB = 41.6, BB = 14, HBP = 4, CS = .9, GIDP = 3, H = 26.4, SB = 0.5, AB = 90
Offensive NERP = **17**

Orlando Hudson:
TB = 39.8, BB = 9, HBP = 1, CS = 2, GIDP = 4.125, H = 25.6, SB = 3, AB = 98
Offensive NERP = **12.6**

II. Measuring Defense

In a way, measuring defense is no less simple. We are just going to do that same NERP calculation with a different set of numbers: in this case, the numbers that the player is *giving up* on defense. Unfortunately, it takes a while to get there, but if you walk through it with me, there is nothing conceptually complex involved, just a whole lot of rote math. If you don't feel like walking through it, you can just skip the next several pages, and go straight to the charts at the end (p. 12-13) that tell you what all this blather adds up to ☺

First of all, obviously fielders can't give up walks or HBP, and we're not going to get into basestealing prevention here either. (I'll write about catchers in an upcoming article...) So our defensive NERP allowed formula is going to be:

(TB * .318) - (.333 * DP) + (OB * .25) - (AB * .085)

For outfielders, double plays are both unpredictable and very rare, so we won't consider DP for them, and will just use:

(TB * .318) + (OB * .25) – (AB * .085)

A. How Many X-Rolls?

Our question in this section is: In the time it takes a player to get 108 PA rolled off his hitting card, how many X-rolls on defense can we expect him to get?

Well, he only gets his card rolled half the time that he's up; that gets us up to 216 PA. And since he has eight teammates and they all bat in order, he only hits 1/9 (11.1%) of the time. That gets us up to (216 / 11.1%) = 1,946 total rolls, in order to hit that one batter's hitting card 108 times.

Since all SOM pitchers have the same exact X-rolls, we know precisely what the chance of each X-roll is, just by knowing dice probabilities. (These are provided by Madsen. They are the total probabilities, not the probabilities given that the roll is off the pitcher's card, so we don't need to halve that 1,946.)

Table 1: Probabilities of Each X-Roll

1B	2B	3B	SS	LF/RF	CF	P
0.93%	2.78%	1.39%	3.24%	0.93%	1.39%	0.93%

Multiply all of those by 1,946, and you get:

Table 2: Number of X-Rolls Per 108 Offensive PA

1B	2B	3B	SS	LF/RF	CF	P
18	54	27	63	18	27	18

That answers our question. We can expect a SS to field 63 (ss)X rolls in the time it takes him to get 108 rolls off his card on offense; a 1B to field 18 (1b)X rolls; etc. In the defensive NERP allowed formula -- which again is

(TB * .318) [- (.333 * DP)] + (OB * .25) - (AB * .085)

-- Table 2's numbers will be our “AB” for each position.

B. Fielding Chart Probabilities

Let's figure out that defensive NERP allowed, then. The first thing we have to do is simply break down the defensive fielding charts. It's all there for us; we just need to do a bunch of math.

We know right away from looking at the charts that on the range portion of the X-roll, the probabilities are:

Table 3: Range Chart Probabilities

	G1	G2	G3	F1	F2	F3	SI1	SI2	DO2	DO3	TR3
IF 1	80%	15%	5%								
IF 2	55%	20%	15%				10%				
IF 3	30%	25%	25%				10%	10%			
IF 4	20%	15%	35%				10%	20%			
IF 5	5%	10%	45%				10%	30%			
OF 1				5%	60%	35%					
OF 2				5%	55%	25%		10%	5%		
OF 3				10%	40%	20%		15%	10%	5%	
OF 4				10%	25%	10%		35%	10%	5%	5%
OF 5				15%	5%	5%		40%	15%	10%	10%
P 1	55%	10%	35%								
P 2	40%	15%	35%				10%				
P 3	20%	20%	45%				15%				
P 4	10%	25%	45%				20%				
P 5	5%	25%	40%				30%				

For our purposes here, I'm going to consider G2 and G3 equal to each other; F1, F2, and F3 equal to each other; SI1 and SI2 equal to each other; and DO2 and DO3 equal to each other. They're not, of course, but adjusting for the differences would be extremely work-intensive and wouldn't result in all that much more accuracy. (After all, the NERP formula predicts real-life run scoring very accurately without having to be told “extra base advancement” or “productive out” info.) I **am** going to consider G1 separately, because they represent double plays, and for infielders, you really can't be accurate without considering them. So for our purposes, this is the range chart:

Table 4: Range Chart Probabilities (Simplified)

	G1	Out	Single	Double	Triple
IF 1	80%	20%			
IF 2	55%	35%	10%		
IF 3	30%	50%	20%		
IF 4	20%	50%	30%		
IF 5	5%	55%	40%		
OF 1		100%			
OF 2		85%	10%	5%	
OF 3		70%	15%	15%	
OF 4		45%	35%	15%	5%
OF 5		25%	40%	25%	10%
P 1	55%	45%			
P 2	40%	50%	10%		
P 3	20%	65%	15%		
P 4	10%	70%	20%		
P 5	5%	65%	30%		

As for errors, they're determined by rolling three six-sided dice (3d6). These are the 3d6 probabilities:

Table 5: Error Roll (3d6) Probabilities

Roll	Probability	Roll
3	0.4629%	18
4	1.3888%	17
5	2.777%	16
6	4.6296%	15
7	6.9444%	14
8	9.7222%	13
9	11.574%	12
10	12.5%	11

So, for instance, if a player has an error on a roll of 11, he has a 12.5% chance per of rolling it, and so forth.

C. Outfielders

Let's get back to Carl Crawford. We'll consider him as a LF. Looking at Table 2, that means we'll be trying to figure out how many runs he will give up on 18 FLY(lf)X rolls hit to him. His fielding rating is 1e3. The 1 range, of course, means that he will not give up any hits on range rolls. The error rating of e3 translates to a two-base error on an error roll of 15, and a one-base error on error rolls of 3 and 18. As Table 5 tells us, the chance of rolling a 3 is 0.4629%; a 15, 4.6296%; and an 18, 0.4629%. So, he has a 5.5554% chance of making some sort of error, which breaks down to a 4.6296% chance of a two-base error, and a .9258% chance of a one-base error.

That's all we need to know to figure out his defensive NERP allowed! Again, the formula for an OF is:

(TB * .318) + (OB * .25) - (AB * .085)

So:
TB = 18 * [((2 * 4.6296%) + .9258%)] = 1.8
OB = 18 * 5.5554% = 1.0
AB = 18

And Crawford's defensive NERP allowed is: (1.8 * .318) + (1.0 * .25) – (18 * .085) = **-0.7**

Crawford[1] was easy, because he didn't give up any hits on range rolls ☺ Now let's try Manny Ramirez. Again,

[1] You might reasonably wonder how someone can allow fewer than zero runs. Honestly, they can't; this is a limitation of a "linear weights" system such as NERP, which is not literally simulating how offense works, but is assigning weights to the various offensive events based on "what's worked" to predict offense in the past. However, it turns out that a system that does more accurately simulate how teams score runs – such as David Smyth's BaseRuns – is not really appropriate for evaluating single players. If you use those systems, you'll get errors because the formula is now working under the assumption that the entire team does what this player does. So, those systems will overestimate great offensive players (or, given the way we're doing things here, overestimate how much terrible defense hurts you), and underestimate terrible ones (or again, here, overestimate how much great defense helps you.) Linear weights are the better way to evaluate individual players.

The problem ends up being self-correcting, because the important thing is that (as we're about to see) in the time it takes each to get 108 PA on offense, Crawford will allow 6.9 fewer runs on defense than Manny Ramirez will. Whether we define that as -0.7 for Crawford and +6.2 for Manny, or some other way, isn't really important. Since we're ultimately comparing the number to other numbers (either to other players, or to the player's own offensive contribution), it all comes out in the wash.

the question is how many runs he'll give up on 18 FLY(lf)X hit to him. His fielding rating is 4e3. So the errors are the same as we saw for Crawford. We need to add in the hits that Manny will give up off range rolls. Per Table 4, he has a 55% chance on each (lf)X to give up some sort of hit, which breaks down to a 35% chance of a single, a 15% chance of a double, and a 5% chance of a triple.

Let's start off by figuring out his OB. We know from doing Crawford that the e3 error rating translates to an OB of 1.0. How much does the 4 range add to that? Well, you might think it's just 18 (the number of at-bats) * 55% (the chance the person will end up on base), which would be 9.9. There is one wrinkle, however. A player can both give up a hit off the range roll, *and* commit an error. This should not be counted as two times on base. We only want to count the players put on base by range rolls that weren't already errors. So we're going to multiply that 9.9% by the chance that Manny did *not* commit an error. The chance he *did* commit an error is 5.5554%, so the chance that he didn't is (1 - 5.5554%) = 94.4446%. 94.4446% * 9.9 = 9.4. Add that to the 1.0 from the errors, and we get an OB of 10.4.

Total bases have a wrinkle to them as well. You might think that the formula would be just 18 * [(35% + (2 * 15%) + (3 * 5%)], which would be 14.4. However, you can't give up more than four total bases on one play. A double plus a three-base error is still only 4 TB; so is a triple plus either a two-base or three-base error. Manny doesn't have any three-base errors, but we do have to subtract out that triple plus two-base error, to make it count as 4 TB rather than five. Again, the chance of the two-base error is 4.6296%, and the chance of the triple is 5%. So, Manny's full TB formula is going to be 18 * [(35% + (2 * 15%) + (3 * 5%) - (4.6296% * 5%)]. This still comes out to 14.4 in Manny's case, but would shave a little bit off the TB rating of a more error-prone player.[2] In any event, 14.4 plus the 1.8 from the errors (as we know from doing Crawford) = 16.2 TB.

To sum up, the defensive NERP allowed formula is:

(TB * .318) + (OB * .25) - (AB * .085)

And for Manny:
TB = [18 * ((2 * 4.6296%) + .9258%)] + [18 * ((35% + (2 * 15%) + (3 * 5%) - (4.6296% * 5%))] = 16.2
OB = (18 * 5.5554%) + (18 * 55% * (1 - 5.5554%)) = 10.4
AB = 18

Manny's defensive NERP allowed, then, is: (16.2 * .318) + (10.4 * .25) – (18 * .085) = **6.2**

D. Infielders

Now let's move to the infield. As we discussed, the infield NERP formula will include double plays, and thus will be:

(TB * .318) – (DP * .333) + (OB * .25) - (AB * .085)

Since we'll be looking at second basemen Kent and Hudson, Table 2 tells us that the AB in the formula (i.e., the number of fielding opportunities) will be 54.

We figure out OB and TB using the same exact methodology we just did for outfielders. The only difference is that infielders don’t give up doubles, triples, or three-base errors, so we just have fewer things to worry about!

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[2] A double plus three-base error would be handled exactly analogously. If a triple plus three-base error is possible, the amount subtracted for it has to be doubled, since one is trying to reduce the TB from 6 to 4, as opposed to from 5 to 4; therefore, one has to subtract it out twice as opposed to once.

OB = (chance of an error * 54) + (chance of no error * chance of a range hit * 54)

TB = [(chance of a one-base error + (2 * chance of a two-base error)) * 54] + (chance of a range hit * 54)

For 1 fielders, chance of a range hit = 0 and you can thus ignore the second part of each formula, as we did with Crawford.

And we don't have to worry about the "more than 4 TB on one play" problem either, because that can't happen with infielders.

Since we already established that 18.75% is a good estimate of how many situations are double play situations, DP are easy too. DP are going to equal 54, multiplied by 18.75%, multiplied by the chance of a G1 from Table 4, multiplied by the chance of no error being committed (i.e., 1 minus the chance of an error being committed.)

There is one thing about defense at 1B, 2B and SS (it's not an issue at 3B) that makes it slightly less than a breeze: these fielders often have to hold baserunners. If the fielder is already a 5, then this doesn't matter; otherwise, it does. When the fielder holds, his range worsens by 1, and he gives up 20% more singles.

Again, we'll estimate how often this comes into play based on real-life data from the years 1974-2004. 21.3% of the plate appearances during that time came with either a man on 1st, or a man on 1st and 3rd. We'll consider those to be the potential holding situations – i.e., a man on 1st with no one on 2nd -- and ignore the possibility of holding runners on 2nd, which is not often a good play in any event.

We'll further assume that only * stealers are held. How often does *that* situation come up? Well, if we estimate times on 1B as (singles + walks + HBP), we can calculate that among players carded in 2006, 39% of the times on 1B were by * stealers. 21.3% * 39% = 8.3%; this will be our estimate for how often a 1B has to hold. We'll estimate that the 2B and SS each have to hold half as often, 4.15%.

So, essentially we have to figure out the defense of each 1B, 2B and SS twice: once "normally", and once as a player who is one range rating worse and who gives up 20% more singles. Then a 1B's overall defense will be:

(91.7% "normal" defense) + (8.3% "holding" defense)

And a 2B or SS's defense will be:

(95.85% "normal" defense) + (4.15% "holding" defense)

So, that's how we're going to do all this. Let's try Jeff Kent. Kent is a 4e13 at 2B. The 4 range means that on GB(2b)X rolls, he has a 30% chance of allowing a single, and a 20% chance of pulling off a G1 (see Table 4). The e13 error rating translates to a one-base error on a 14 roll, and a two-base error on either a 3 or an 18 roll. Consulting Table 5, we see that this means he has a 7.8702% chance of making an error (a 6.9444% chance of making a one-base error, plus a 0.9258% chance of making a two-base error.)

So, again:

OB = (chance of an error * 54) + (chance of no error * chance of a range hit * 54) =
(7.8702% * 54) + [(1 - 7.8702%) * 30% * 54] = 19.2

TB =
[(chance of a one-base error + (2 * chance of a two-base error)) * 54] + (chance of a range hit * 54) =

[(6.9444% + (2 * 0.9258%)) * 54] + (30% * 54) = 20.9

DP = 54 * 18.75% * (chance of a G1) * (1 – (chance of an error)] =
[54 * 18.75% * 20% * (1 - 7.8702%)] = 1.87

AB = 54

Plugging those into the formula:

(TB * .318) – (DP * .333) + (OB * .25) - (AB * .085)

we get:

(20.9 * .318) – (1.87 * .333) + (19.2 * .25) – (54 * .085)

That adds up to 6.2.

So, when Kent isn't holding runners, he is giving up runs on defense at a rate of 6.2 runs for every 108 PA he gets off his hitter's card. We now have to evaluate Kent's performance when holding a runner. When holding, he is a 5e13, with 20% more singles. A 5 normally has a 40% chance of allowing a single, so the 40% becomes 60%. And a 5 manages a G1 a mere 5% of the time.

OBH [OB while holding] = (chance of an error * 54) + (chance of no error * chance of a range hit * 54) =
(7.8702% * 54) + [(1 - 7.8702%) * 60% * 54] = 34.1

TBH [TB while holding] =
[(chance of a one-base error + (2 * chance of a two-base error)) * 54] + (chance of a range hit * 54) =
[(6.9444% + (2 * 0.9258%)) * 54] + (60% * 54) = 37.1

DPH [DP while holding] = 54 * 18.75% * (chance of a G1) * (1 – (chance of an error)] =
[54 * 18.75% * 5% * (1 - 7.8702%)] = 0.466

AB = 54

Defensive NERP allowed while holding = (37.1*.318) – (.466 * .333) + (34.1*.25) – (54*.085) = 15.6

Like we said earlier, a 2B's total defense will be defined as:

(95.85% "normal" defense) + (4.15% "holding" defense)

So for Kent, that's:

(95.85% * 6.2) + (4.15% * 15.6)

… which adds up to **6.6**. That's Kent's defensive NERP allowed; in other words, for every 108 rolls off his hitter's card (which, as we saw earlier, will result in 17 runs on offense), he will allow about 6.6 runs on defense.

I think I explained things pretty thoroughly there, so we'll just run the numbers for Orlando Hudson. Hudson is a 1e14, so normally, he gets a G1 80% of the time, doesn't allow any singles, and commits an error 8.3324% of the time, which breaks down to 7.4066% one-base errors and 0.9258% two-base errors. When holding, he's a

2e14 who gets a G1 55% of the time and allows a single 30% of the time; error data is of course the same.

OB = (8.3324% * 54) + [(1 - 8.3324%) * 0% * 54] = 4.5

TB = [(7.4066% + (2 * 0.9258%)) * 54)] + (0% * 54) = 5.0

DP = 54 * 18.75% * 80% * (1 - 8.3324%) = 7.4

AB = 54

Defensive NERP allowed when not holding = (5.0 * .318) – (7.4 * .333) + (4.5 * .25) – (54 * .085) = -4.3

OBH = (8.3324% * 54) + [[(1 - 8.3324%) * 30% * 54] = 19.3

TBH = [(7.4066% + (2*0.9258%)) * 54)] + (30% * 54) = 21.2

DPH = 54 * 18.75% * 55% * (1 – 8.3324%) = 5.1

AB = 54

Defensive NERP allowed when holding = (21.2 * .318) – (5.1 * .333) + (19.3 * .25) – (54 * .085) = 5.3

Hudson's defensive NERP allowed = (95.85% * -4.3) + (4.15% * 5.3) = **-3.9**

III.Summary

A. Calculating Total Value

Once you've got the offensive NERP and the defensive NERP allowed, figuring out the player's value is very simple ;-) His total value, measured over the time it takes him to get 108 rolls off his hitter's card, is offensive NERP (the number of runs he'll add to your team's offense in that time), minus defensive NERP allowed (the number of runs he'll cost you on defense in that time.) Thus:

Carl Crawford = 20.2 offensive NERP, minus -0.7 defensive NERP allowed = 20.9 NERP

Manny Ramirez = 30.9 offensive NERP, minus 6.2 defensive NERP allowed = 24.7 NERP

Jeff Kent = 17 offensive NERP, minus 6.6 defensive NERP allowed = 10.4 NERP

Orlando Hudson = 12.6 offensive NERP, minus -3.9 defensive NERP allowed = 16.5 NERP

It needs to be added that we figured out offensive NERP only off the "vs. righty" side of the card. To get a total value, you need to also calculate the player's offensive NERP vs. lefty pitching, and settle on a balance between the lefty and righty sides that works for you. I find that 25%/75% is generally a good balance, but if you want to get sophisticated, you can tweak it based on your league composition and/or the way you plan to use the particular player. If you do want to go with the 25%/75% split, then naturally the player's total value would be:

(25% * Offensive NERP vs. L) + (75% * Offensive NERP vs. R) – Defensive NERP Allowed

As we said earlier, 108 rolls off an offensive card is the equivalent of 216 PA. 216 PA is about ⅓ of a season for a regular player, so if you want to express the various NERP numbers we've come up with here in terms of full seasons, you can just multiply them by 3.

B. What are the Limitations?

This system is by far the easiest way to get an extremely sophisticated idea of a player's value. All that you have to do is use the formula we discussed at the beginning to get the offensive NERP; look up the defensive NERP allowed in the charts I'm about to provide; and subtract the latter from the former. However, it does have its limitations, some of which I feel are worth my continuing to work on, and some of which I don't.

- We didn't consider catchers at all, nor did we consider outfielders' throwing arms or "homerun robbing." However, I have done a lot of work in these areas and will write about it soon.
- Although this system would indeed give you a good idea of the hitting/fielding value of a pitcher whom you pitched 9 innings per game and allowed to hit 216 times… that is not a particularly helpful thing to have ☺ Breaking down the GB(p)X charts was a necessary first step towards incorporating fielding into the evaluation of pitchers, but obviously there is more to be done there.
- Baserunning (other than stealing, which itself is being roughly estimated), clutch, bunting and H&R are not considered here. I think that, with more studies, we should be able to estimate how many runs the clutch and running ratings are worth. It's really hard to imagine, however, ever being able to attach a number to a bunting or H&R rating; the value of those ratings is just too tied up in the specific individual, team, and managerial style. Simply put, none of this bothers me much because I don't think any of these things generally add up to much. (For one thing, it's very easy to prove mathematically that clutch doesn't add up to much. And if the other "miscellaneous" things made a big difference, then runs created formulae wouldn't work right.) But if you know the individual you're trying to evaluate is one of the individuals for whom they *would* matter… maybe he's super-fast *and* super-clutch *and* a terrific bunter on a team that already has eight monster bats in the lineup… maybe he's a Rey Ordonez type whose .250 BA on the H&R is better than what he can hit swinging away… whatever, if you know that this sort of thing is the situation, then you might want to value such a player more than this system suggests. (But I still wouldn't stray from it all *that* much ;-)
- As mentioned, all outs other than G1 are being considered equal, as are SI1/SI2 and DO2/DO3. As I said at the time, I don't think it's important – again, if those distinctions *were* important, then the various runs created formulae that exist wouldn't work right, which they most definitely do – but it's still a minor omission. "Infield in" is also not being considered, which I don't think is at all important.
- The system does indeed rank great glovemen up the middle as the most valuable defensive players, and no one is going to argue with that. However, it also ranks bad glovemen up the middle as the *least* valuable defensive players, and at least from a "general manager" point of view, that can be argued with. It's certainly true that a terrible SS who gets 63 chances to be terrible will cost the team more runs than a terrible 1B who gets 18 chances to be terrible; that is just a fact. But, *somebody* does have to play SS for you and handle those 63 chances. Ultimately, your SS's defensive value depends on who else could be playing SS for you, and what *that* guy would do defensively. That in turn depends on league size and other factors. For these reasons -- although I believe this system does hold up remarkably well when comparing players who play different positions -- if you want to get into doing that with true accuracy and/or customize it for a particular league, you need to get a little more complex. I will hopefully write more about this in the future as well.

- You probably noticed that various assumptions are built into the system. Some are easily adjusted for: for instance, if you want to evaluate a player in a ballpark other than 1-8/1-8/1-8/1-8, you can just re-calculate his offensive NERP accordingly. Other assumptions, however, are "constants," including assumptions about how often double-play situations will occur, how often runners will be held, and which fielders will be responsible for that holding. Probably the most notable assumptions are those in Table 2 that assign a certain number of X-rolls to correspond with a certain number of offensive card rolls. Monkeying with the batting order, and/or using defensive replacements, could change that proportion. However, in all of these cases, I feel confident that 1) the assumptions being made are generally going to be quite accurate, and 2) attempting to fix them would be immensely complicated and would only yield a miniscule amount more accuracy.

Now I'll shut up and just print the charts ☺ Please e-mail me any questions or comments at: dcarrano@gmail.com

Offensive NERP =
(TB * .318) + ((BB+HBP-CS-GIDP) * .333) + (H * .25) + (SB * .2) - (AB * .085)

[CS = [(real CS) / (real PA)] * 216; GIDP = DP * 18.75%; SB = [(real SB) / (real PA)] * 216]; AB = 108 – (BB + HBP)]

To get the player’s total value, subtract the fielding rating off this chart from the offensive NERP:

1B

	Range				
e	**1**	**2**	**3**	**4**	**5**
0	-2.2	-0.8	0.4	1.6	2.5
1	-2.0	-0.7	0.6	1.8	2.7
2	-1.7	-0.5	0.8	1.9	2.8
3	-1.5	-0.3	1.0	2.1	3.0
4	-1.3	-0.1	1.2	2.3	3.2
5	-1.2	0.1	1.3	2.4	3.3
6	-1.0	0.3	1.5	2.6	3.4
7	-0.8	0.5	1.7	2.7	3.6
8	-0.5	0.7	1.9	2.9	3.8
9	-0.3	0.9	2.0	3.1	3.9
10	-0.1	1.1	2.2	3.3	4.1
11	0.1	1.2	2.4	3.4	4.3
12	0.3	1.4	2.6	3.6	4.4
13	0.5	1.7	2.8	3.8	4.6
14	0.7	1.8	2.9	3.9	4.7
15	0.9	2.0	3.1	4.1	4.9
16	1.1	2.2	3.3	4.2	5.0
17	1.3	2.4	3.4	4.4	5.2
18	1.5	2.6	3.6	4.6	5.3
19	1.7	2.8	3.8	4.8	5.5
20	1.9	3.0	4.0	4.9	5.7
21	2.1	3.2	4.2	5.1	5.8
22	2.3	3.3	4.4	5.3	6.0
23	2.5	3.5	4.5	5.4	6.1
24	2.7	3.7	4.7	5.6	6.3
25	2.9	3.9	4.9	5.8	6.5
26	3.1	4.1	5.0	5.9	6.6
27	3.3	4.2	5.2	6.0	6.7
28	3.5	4.4	5.4	6.2	6.9
29	3.8	4.7	5.6	6.4	7.1
30	4.0	4.9	5.8	6.6	7.3

2B

	Range				
e	**1**	**2**	**3**	**4**	**5**
4	-6.0	-2.2	1.7	5.0	8.2
5	-5.7	-1.9	1.9	5.3	8.4
6	-5.6	-1.7	2.1	5.4	8.5
8	-5.0	-1.2	2.6	5.9	9.0
10	-4.8	-1.0	2.7	6.1	9.1
11	-4.6	-0.9	2.9	6.2	9.2
12	-4.4	-0.7	3.1	6.4	9.4
13	-4.1	-0.4	3.4	6.6	9.7
14	-3.9	-0.2	3.5	6.8	9.8
15	-3.6	0.1	3.8	7.0	10.0
16	-3.5	0.2	3.9	7.1	10.1
17	-3.3	0.4	4.0	7.3	10.3
18	-3.2	0.5	4.2	7.4	10.4
19	-2.9	0.8	4.4	7.6	10.6
20	-2.6	1.0	4.6	7.8	10.8
21	-2.5	1.1	4.8	8.0	10.9
22	-2.2	1.4	5.0	8.2	11.2
23	-2.0	1.6	5.2	8.3	11.3
24	-1.9	1.7	5.3	8.5	11.4
25	-1.7	1.9	5.4	8.6	11.5
26	-1.4	2.2	5.7	8.8	11.8
27	-1.3	2.3	5.8	9.0	11.9
28	-1.0	2.5	6.0	9.2	12.1
29	-0.7	2.8	6.3	9.4	12.3
30	-0.6	2.9	6.4	9.6	12.4
32	-0.3	3.2	6.7	9.8	12.7
34	0.2	3.7	7.1	10.2	13.0
37	0.9	4.3	7.7	10.8	13.6
39	1.4	4.8	8.1	11.1	13.9
41	1.7	5.0	8.4	11.4	14.1
44	2.4	5.7	9.0	12.0	14.7
47	3.0	6.3	9.5	12.5	15.2
50	3.6	6.8	10.1	13.0	15.6
53	4.3	7.5	10.7	13.6	16.2
56	4.9	8.1	11.2	14.1	16.7
59	5.4	8.6	11.7	14.5	17.1
62	6.0	9.1	12.2	15.0	17.6
65	6.7	9.7	12.8	15.5	18.0
68	7.4	10.4	13.4	16.1	18.6
71	8.0	10.9	13.9	16.6	19.1

3B

	Range				
e	**1**	**2**	**3**	**4**	**5**
5	-2.5	-0.6	1.3	2.9	4.6
6	-2.3	-0.4	1.5	3.1	4.8
8	-1.9	0.0	1.8	3.5	5.2
10	-1.4	0.4	2.2	3.8	5.5
11	-1.2	0.6	2.5	4.0	5.7
12	-1.0	0.8	2.6	4.2	5.8
13	-0.7	1.0	2.8	4.4	6.0
14	-0.6	1.2	3.0	4.5	6.2
15	-0.3	1.4	3.2	4.8	6.4
16	-0.2	1.6	3.3	4.9	6.5
17	0.1	1.8	3.6	5.1	6.7
18	0.3	2.1	3.8	5.3	6.9
19	0.5	2.2	4.0	5.5	7.0
20	0.8	2.5	4.2	5.7	7.2
21	1.0	2.6	4.3	5.8	7.4
22	1.2	2.9	4.5	6.0	7.5
23	1.5	3.1	4.8	6.2	7.8
24	1.6	3.3	4.9	6.4	7.9
25	1.9	3.5	5.1	6.6	8.1
26	2.0	3.7	5.3	6.7	8.2
27	2.3	3.9	5.5	6.9	8.4
28	2.6	4.2	5.8	7.2	8.7
29	2.7	4.3	5.9	7.3	8.8
30	3.0	4.6	6.1	7.5	9.0
31	3.2	4.7	6.3	7.7	9.1
32	3.4	5.0	6.5	7.9	9.3
34	3.9	5.4	6.9	8.2	9.7
35	4.1	5.6	7.1	8.4	9.8
37	4.5	6.0	7.5	8.8	10.2
39	5.0	6.4	7.8	9.1	10.5
41	5.4	6.8	8.2	9.5	10.8
44	6.1	7.5	8.8	10.1	11.4
47	6.7	8.1	9.4	10.6	11.9
50	7.4	8.7	10.0	11.2	12.4
53	8.0	9.3	10.5	11.7	12.9
56	8.7	9.9	11.1	12.3	13.4
59	9.4	10.6	11.8	12.9	14.0
62	10.1	11.3	12.4	13.5	14.6
65	10.7	11.8	12.9	13.9	15.0

Offensive NERP =
(TB * .318) + ((BB+HBP-CS-GIDP) * .333) + (H * .25) + (SB * .2) - (AB * .085)

[CS = [(real CS) / (real PA)] * 216; GIDP = DP * 18.75%; SB = [(real SB) / (real PA)] * 216]; AB = 108 – (BB + HBP)]

To get the player's total value, subtract the fielding rating off this chart from the offensive NERP:

SS

	Range				
e	**1**	**2**	**3**	**4**	**5**
4	-7.2	-2.7	1.8	5.7	10.2
5	-7.2	-2.7	1.8	5.7	10.2
7	-6.5	-2.0	2.4	6.3	10.7
8	-6.1	-1.7	2.7	6.6	11.0
10	-5.9	-1.4	3.0	6.8	11.2
12	-5.7	-1.3	3.1	6.9	11.4
14	-4.9	-0.5	3.8	7.6	12.0
16	-4.5	-0.2	4.2	7.9	12.3
17	-4.3	0.0	4.3	8.1	12.4
18	-4.2	0.2	4.5	8.2	12.5
19	-4.0	0.3	4.6	8.4	12.7
20	-3.8	0.5	4.8	8.5	12.8
21	-3.6	0.7	4.9	8.6	13.0
22	-3.3	0.9	5.2	8.9	13.2
23	-3.0	1.3	5.5	9.2	13.5
24	-2.8	1.4	5.7	9.3	13.6
25	-2.6	1.6	5.8	9.5	13.7
26	-2.4	1.8	6.0	9.6	13.9
27	-2.3	1.9	6.1	9.8	14.0
28	-2.0	2.2	6.4	10.0	14.2
29	-1.8	2.4	6.5	10.2	14.4
30	-1.6	2.5	6.7	10.3	14.5
32	-1.1	3.0	7.1	10.7	14.9
33	-0.8	3.3	7.4	11.0	15.2
34	-0.7	3.5	7.5	11.1	15.3
36	-0.3	3.8	7.9	11.4	15.6
38	0.1	4.1	8.2	11.7	15.8
40	0.5	4.6	8.6	12.1	16.2
42	1.1	5.1	9.0	12.5	16.6
44	1.4	5.4	9.3	12.8	16.9
48	2.2	6.2	10.1	13.5	17.5
52	3.2	7.1	10.9	14.3	18.3
56	3.9	7.7	11.6	14.9	18.9
60	4.9	8.7	12.4	15.7	19.6
64	5.7	9.4	13.1	16.4	20.3
68	6.6	10.3	13.9	17.2	21.0
72	7.4	11.0	14.6	17.8	21.6
76	8.2	11.8	15.3	18.5	22.3
80	9.1	12.6	16.1	19.3	22.9
84	9.9	13.4	16.8	19.9	23.6
88	10.9	14.3	17.7	20.8	24.4

LF/RF

	Range				
e	**1**	**2**	**3**	**4**	**5**
0	-1.5	0.3	2.4	5.5	8.7
1	-1.3	0.5	2.6	5.8	8.9
2	-1.0	0.8	2.9	6.0	9.1
3	-0.7	1.0	3.2	6.2	9.4
4	-0.5	1.2	3.4	6.4	9.5
5	-0.2	1.5	3.6	6.6	9.7
6	0.1	1.7	3.9	6.9	9.9
7	0.3	1.9	4.1	7.1	10.1
8	0.7	2.2	4.4	7.3	10.3
9	0.9	2.5	4.7	7.6	10.6
10	1.2	2.7	4.8	7.7	10.7
11	1.4	2.9	5.1	7.9	10.9
12	1.8	3.2	5.4	8.2	11.2
13	2.1	3.4	5.7	8.5	11.4
14	2.2	3.6	5.8	8.6	11.5
15	2.5	3.9	6.1	8.8	11.7
16	2.8	4.1	6.3	9.1	11.9
17	3.1	4.4	6.6	9.3	12.1
18	3.4	4.6	6.8	9.5	12.3
19	3.6	4.8	7.1	9.8	12.6
20	3.9	5.1	7.3	10.0	12.8
21	4.2	5.3	7.6	10.2	13.0
22	4.5	5.6	7.9	10.5	13.2
23	4.7	5.8	8.0	10.6	13.3
24	5.0	6.0	8.3	10.9	13.5
25	5.3	6.3	8.6	11.1	13.8

CF

	Range				
e	**1**	**2**	**3**	**4**	**5**
0	-2.3	0.4	3.6	8.3	13.1
1	-2.0	0.8	3.9	8.6	13.3
2	-1.8	0.9	4.1	8.7	13.5
3	-1.5	1.2	4.3	8.9	13.7
4	-1.3	1.4	4.5	9.1	13.8
5	-0.9	1.7	4.8	9.4	14.1
6	-0.7	1.9	5.0	9.6	14.2
7	-0.4	2.2	5.3	9.8	14.5
8	-0.1	2.5	5.6	10.1	14.7
9	0.1	2.8	5.8	10.3	14.9
10	0.4	3.0	6.0	10.5	15.0
11	0.7	3.3	6.3	10.7	15.3
12	1.0	3.6	6.6	11.0	15.5
13	1.3	3.9	6.9	11.2	15.7
14	1.5	4.1	7.1	11.4	15.9
15	1.7	4.3	7.3	11.6	16.1
16	2.0	4.5	7.5	11.8	16.2
17	2.3	4.8	7.8	12.0	16.5
18	2.6	5.1	8.1	12.3	16.7
19	2.8	5.3	8.2	12.5	16.8
20	3.2	5.7	8.6	12.8	17.1
21	3.4	5.8	8.7	12.9	17.3
22	3.7	6.2	9.0	13.2	17.5
23	4.0	6.4	9.3	13.4	17.7
24	4.2	6.6	9.5	13.6	17.9
25	4.5	6.9	9.8	13.8	18.1