PredPol Response to NYPD Questions

1) What is the company's staffing model?
   PredPol's current staffing is as follows:
   Engineering: 6 employees
   Support and operations: 1 employee
   General/admin: 3 employees
   Data scientists: 3 employees
   Sales: 5 employees.

2) Does the tool/system provide integration points into existing systems, e.g. REST endpoint. That is, can the product be integrated with existing NYPD systems?
   Yes. We have an API available at our middle-tier services layer that can integrate securely with REST endpoints. This can be used to request data such as crime information from the records management system (RMS). It can also pass prediction data back to the department's internal systems if required.

3) Does the product provide a measure of confidence/risk? An estimated volume?
   We do not provide a measure of confidence or risk. However, our "hit score" report shows how many predicted crimes occurred within a PredPol box during each prediction window. We also display how many crimes occur in the 8 immediately surrounding boxes.

4) Can the size of prediction areas be customized?
   Yes. The default prediction area is a 500x500 square foot box, but the box size can be customized to any size depending on the needs of the department.

5) Can predictions be provided at custom time intervals (e.g., by tour, weekly etc.)?
   Yes. Predictions can be set for standard and custom shifts. Shift lengths can be variable and can be set by day of week. Overlapping shifts are also supported. Different crimes can be predicted by each shift and for each beat for each day of the week.

6) Can predictions for selected crimes be weighted more heavily based on Departmental and/or Commanding Officer priorities?
   No. The feedback we have received from dozens of departments over the past 9 years is that a simple interface and consistent prediction models are key to ease of use, accurate predictions, and adoption by officers. All crimes are weighted based on the volume of relevant records from the department's RMS. For example, if you are predicting for residential burglary and grand larceny/auto, and the volume of crimes in a precinct is 70% for residential burglaries and 30% for grand larceny/auto, the predictions will use the weighted data in a 70/30 ratio.

7) Can the predictions take into account verticality (or three dimensional data)?
   Our predictions are generally based on 2 dimensions. However, specific buildings can be broken down into a series of grids and we can predict on a floor-by-floor basis for those buildings. The crime data provided would have to include the building floors where crimes occurred in order for us to do this.

8) Does the product provide accuracy (hit-rate) reports after data updates are delivered?
   Yes. We do hit rates on the following periods: year to date, previous year, previous month, and previous week. These are displayed for each crime type predicted.

9) What, if any, security protocols will be incorporated, (e.g., two phase authentication)?
All user access is controlled by user name and password. Each user is assigned a privilege level, from Admin (highest) to Officer (lowest). We use HTTPS to secure the connection for viewers of the system. When crime data is transmitted from the department's servers to our servers, we use [redacted] encryption. For further details on how we secure data in transit from NYPD to our servers, and our security policies for data stored on the PredPol servers, see the attached document, titled "Data Processing Overview."

10) Is the application delivered in a secure cloud based solution?
Yes. We host our solution on Amazon Cloud Services. Our data security document is also attached.

11) Are the predictions/system mobile compliant?
Yes. All features are delivered through a mobile-compliant HTML5 web interface, meaning that they can be accessed via a web interface on any internet-connected mobile device. We currently have a native iOS version and are working on Android and Windows Mobile versions as well.

12) Is the output from the system "map-able" or map based?
Yes. The default mapping platform we use is Google Maps; the license for using this is included in our annual cost. However, we also support ESRI and our predictions can be exported as ESRI shapefiles, as PDFs, and in CSV file format.

13) What data is required as input into the system (historical crime data, weather, special events, proximity to other geographic features, demographics, etc.)?
We need only three data elements to run our predictions: type of crime of crime code, location of crime (street address or lat/long), and date/time of crime. This data is always available through a department's RMS. We recommend beginning with at least three years of historical data and then we require daily data updates after that. PredPol has done years of research on the best data elements to use, and we have found that these three provide the most accurate predictions.

14) Does the system utilize a broad set of crime theories (e.g. risk terrain modeling and near-repeat modeling) in the generation of predictions?
We do not use risk terrain modeling because we have that found that it diminishes accuracy. We do use the near repeat/near victimization model because it is based on proven criminological theory and because it works. We also use an algorithm based on earthquake aftershock prediction modeling because it helps accurately predict repeat events in time and in space.

15) Does the system use machine-learning, or some similar technology to learn which theories are the most applicable and then calibrate the model accordingly?
Yes. Some of our algorithm is confidential, but here is a brief overview:
    - We initially process several years of data to lay down a "background" level of crime patterns and to understand how crimes propagate throughout the city. This is done using an Epidemic Type Aftershock Sequence (ETAS) Model and it is a self-learning algorithm.
    - As new crimes come in, they are mapped against existing patterns and events in the city. Based on the propagation patterns uncovered by the initial analysis of the data, we predict when and where similar crimes related to these crimes are most likely to occur.
    - Every 6 months, we force a "re-learning" of the patterns using all historical and recent crime data. This ensures that new patterns of behavior are picked up by the system as well.

16) Does the system provide the ability to modify parameters based on local/expert knowledge or circumstances?
No. We have found that the most objective and accurate data to use is crime type, crime location, and crime date/time. Introducing other variables diminishes the model's accuracy and can introduce an element of subjectivity to the process. It also allows variability in predictions depending on who is running the model. We have found that keeping to a consistent crime prevention mission over time has the greatest impact on preventing crime – up to a 40% reduction in many cases.

It is also worth pointing out that PredPol is designed to be a day-to-day operational tool for patrol officers using objective data from the RMS. If analysts are looking to experiment with tools that use multiple models and a variety of data inputs there are a number of products available that let them play the "what if" game, including ArcGIS and Excel. PredPol, on the other hand, is designed to provide patrol officers with the most accurate and effective tool to reduce crime. Once missions are set and defined, the system runs on its own without the need to experiment with different models and data sources.

17) Provide professional references, three (3) preferred, who can describe your experience in predictive policing. It is preferred, but not required, from police departments or other law enforcement agencies.

Los Angeles Police Department (California, USA – 3.8 million city pop.)
Commander Sean Malinowski / sean.malinowski@lapd.lacity.org / 818-756-8861
Capt. Dominic Choi / 32350@lapd.city.org / (818) 756-8860
12760 Osborne St, CA 91331
Deployed November 2011

Agency	Population Served	Agency Employees	Type of Agency	Number of Users
Los Angeles Police Department	3.8 Million	12,902 Sworn	City Police Department	Unlimited
Project Implementation				
Phase I	Implementation in the Foothill Division of LAPD, a region of 250,000 citizens consisted of: 1) requirements gathering with the LAPD officers and information technology to gathered data on beats, shifts, and data transfer requirements from the RMS to AWS cloud services. 2) Construction and QA testing of the data pipe for property crimes by PredPol 3) Initial deployment and test of predictions. LAPD wanted to perform and Independent Verification and Validation on the software. A blind test was designed to measure the effectiveness of predictive policing. The blind test was deployed in three LAPD Divisions independently (Foothill, North Hollywood and Southwest Divisions) and ran for a total of 21 months. Two sets of predictions were generated each day: predictions created by the PredPol software and predictions created by LAPD analysts using hotspot policing methods augmented with daily street-level intelligence. One of the prediction sets was then randomly designated for patrol			

	missions and given to officers at roll call. The source of the prediction was not revealed to the officers and there was no outward indicator of which prediction a patrol unit was using on any given day. By analogy, patients in a randomized controlled drug trial do not know whether they are received the new medicine or the 'placebo'. Officers patrolled assigned regions and the change in crime rate was measured over a six months. The results from the test revealed (1) that PredPol predicts two times as much crime as existing best practice and (2) when used by officers in the field, leads to the prevention of two times as much crime. Foothill Division saw a -12% reduction in their first six months of usage alone. The conclusion by Los Angeles Police Department was that the software could produce mission maps and accurate crime predictions faster and with high accuracy. Analysts time could be spent more effective solving how and why crime occurred. The software gave the officers an easy-to-use prediction tool for patrol and resulted in lower crime rates.
Phase 2	PredPol was deployed city-wide in 2013. Command staff in each patrol division makes operational decisions about how to use PredPol. PredPol monitors and reports on outcomes and delivers continuous scientific feedback on predictive policing processes. For example, in Pacific and Topanga Divisions patrol dosage varies between 5% and 15% of available time (84-277 hours in PredPol boxes per week). Crime is between 32-43% lower in these 'high dosage' weeks compared with low dosage weeks of less than 5% of available time.

Kent Police Department (United Kingdom – 1.8 million city pop.)
Mark Johnson, Head of Analysis / mark.johnson@kent.pnn.police.uk / 01622 652663
Sutton Road, Maidstone, Kent ME15 9BZ
Deployed January 2013

Agency	Population Served	Agency Employees	Type of Agency	Number of Users
Kent Constabulary, England	1.73 Million	6,602	Regional Police	Unlimited
Project Implementation				
Phase 1	The Kent Constabulary deployed PredPol in December of 2012. The initial deployment covered two policing divisions. In West Kent, PredPol was the subject of an independent 'silent test' run by the Kent Analytics Division. In North Kent, PredPol was deployed operationally.			

	The West Kent silent test saw PredPol and the Kent Analytics team generate predictions for two shifts in two patrol divisions each day. In contrast with LAPD, the Kent analytics protocol emphasizes intelligence-led policing, where crime events are flagged for prediction only if they can be reasonably tied to a known chronic offender. PredPol and analyst predictions were not distributed to patrol (i.e., predictions were 'silent') allowing direct measurement of predictive accuracy. After four months, PredPol predicted 1.4-1.7 times more crime than the intelligence-led approach. Importantly, the intelligence-led approach in the two silent test divisions occupied four hours of analyst time each day. Projected across Kent's 23 Divisions, the expected analyst time to execute daily intelligence-led patrol missions is 46 hours. In North Kent, PredPol predictions were distributed to police field resources for daytime and nighttime shifts. Field resources included car-based patrol units, foot patrol and civilian intervention teams. Four months of PredPol deployment led to a -6% decline in violent street crime and -4% crime decline overall compared with crime increases in non-test areas. Systematic collection of officer feedback revealed that: (1) officers found PredPol intuitive and easy to use; (2) create opportunities to disrupt crime that the officers felt they would not have had otherwise; and (3) created a new level of engagement with the community.
Phase 2	PredPol was deployed force-wide in April 2013. Kent has continued to approach deployment in an experimental framework. They have experimented with use of civilian, non-police resources in PredPol boxes. They have also engaged in quarterly 'day-all-out' experiments, where the force as a whole seeks to get maximum dosage in PredPol boxes during a single 24 hour period. In experiments in Summer and Fall 2013, Kent observed that a single 'day-all-out' has a persistent impact on crime rates for two weeks following the event.

Atlanta Police Department (Georgia, USA – 444,000 city pop.)
Deputy Chief Cerelyn "C.J." Davis / cjdavis@atlantaga.gov
Lt. Leanne Browning / lbrowning@atlantaga.gov
226 Peachtree St SW, Atlanta, GA 30303
Deployed July 2013

Agency	Population Served	Agency Employees	Type of Agency	Number of Users
Atlanta Police Department	448,000	2,000 Sworn	City Police Department	Unlimited
Project Implementation				

Phase 1	Atlanta deployed predictive policing in July 2013 in two urban policing zones. Zone 4 is located to the southwest of downtown Atlanta and is characterized by mostly residential and some business areas. Zone 6 is located to the east of downtown and has retail, residential, and many restaurant areas. Both zones record some of the highest volume of Part 1 crimes in the city. The focus in Zone 4 was on burglary and robbery during the day shift, vehicle crime and robbery during the evening shift and vehicle crime during the morning shift. The focus in Zone 6 was on burglary and vehicle crime during the day and evening shift, and all Part 1 crimes in the morning (reduced to only robbery after 45 days). The total land area of Zone 4 is 31 square miles and Zone 6 is 15 square miles. In total, 21 and 18 hotspots were predicted for each shift in Zone 4 and 6 respectively. In Atlanta, crime over the initial 90-day deployment was 24 times more likely to occur inside an active PredPol prediction box than elsewhere in the environment. This was measured by tabulating the number of crimes that occurred within each box and creating a Predictive Accuracy Index (PAI) score. The PAI is the percentage of crimes accurately predicted, normalized by the percent of the geographic area covered by the predictions. A PAI value of 1 corresponds to random chance, so a useful prediction must at least have a higher value than 1. Over the deployment period, the PAI value for Zone 4 was 23.7, and the Zone 6 PAI was 24.0. Crime rates across all six Atlanta policing zones for the 90-day period prior to deployment in the summer of 2013 were compared with the 90-day period following deployment. As already noted, for Part 1 crimes in total, Zones 4 and 6 (the zones with predictive policing) experienced crime rate reductions of 9 percent and 8 percent, respectively. In all four of the zones where PredPol was not deployed, crime rates increased from 1 percent to 8 percent. In Zones 4 and 6, burglary rates dropped by 21 percent and 10 percent and auto theft rates dropped by 15 percent and 28 percent. Higher variance was observed in robbery rate changes due to the lower volume of robbery compared to property crime and the corresponding lower weight assigned to robbery in PredPol predictions. Robbery dropped by 34 percent in Zone 6, but increased by 31 percent in Zone 4.
Phase 2	The compelling results from the initial deployment in Zones 4 and 6 in Atlanta led to a city-wide rollout of predictive policing in November 2013. By and large, this move to make predictive policing a part of every officer's daily routine has been favorably received by the front line.

18) Complete and sign the Federal Bureau of Investigation Criminal Justice Information Services ("CJIS") Security Addendum, attached hereto as CJIS Security Addendum. An authorized representative shall sign the Certification to the Addendum on behalf of the Contractor. Contractor shall instruct its employees that individual employees may also be required to sign the Certification, at the discretion of the NYPD.

Signed form attached with this package.

19) The Contractor as an organization and personnel that have direct knowledge of this procurement will be required to submit confidentiality agreements as requested by NYPD. The selected Contractor shall provide the following information regarding all employees and subcontractor employees that will have direct responsibility regarding software design, software programming, implementation, project management and/or warranty and maintenance service responsibilities:

1. Name of Individual
2. Sex
3. Country of Birth
4. Business Title
5. Place of Business (address)
6. Telephone #
7. Email address
8. Date of Birth
9. Social Security # (or equivalent) – last four digits.
10. Home Address including Country.

[Information provided on following page.]

1. Name of Individual: **Denis Haskin**
2. Sex: Male
3. Country of Birth: Singapore
4. Business Title: Senior Software Developer
5. Place of Business (address): 2401 Mission St Santa Cruz CA
6. Telephone #[redacted]
7. Email address: denis@predpol.com
8. Date of Birth: [redacted]
9. Social Security # (or equivalent) – last four digits: [redacted]
10. Home Address including Country: [redacted] USA

1. Name of Individual: **James Robert Bancroft**
2. Sex: Male
3. Country of Birth: USA
4. Business Title: Senior Software Developer
5. Place of Business (address): 2401 Mission St., Santa Cruz, CA 95060
6. Telephone #: [redacted]
7. Email address: jim@predpol.com
8. Date of Birth: [redacted]
9. Social Security # (or equivalent) – last four digits: [redacted]
10. Home Address including Country: [redacted], USA

1. Name: **Jason Dougherty**
2. Sex: male
3. Country of Birth: USA
4. Business Title: Software Developer
5. Place of Business (address): 2401 Mission St, Santa Cruz, CA 95060
6. Telephone #: [redacted]
7. Email address: jason@predpol.com
8. Date of Birth [redacted]
9. Social Security # (or equivalent) – last four digits: [redacted]
10. Home Address including Country: [redacted] USA

1. Name of Individual: **Randy Smith**
2. Sex: Male
3. Country of Birth: USA
4. Business Title: Sales Executive
5. Place of Business (address): 2401 Mission St, Santa Cruz, CA 95060
6. Telephone #: [redacted]
7. Email Address: randy@predpol.com
8. Date of Birth [redacted]
9. Social Security # (or equivalent) – last four digits: [redacted]
10. Home Address including Country: [redacted] USA