USICH BRIEFING PAPER

PREFACE:

Five federal workgroups were convened to initiate development of the federal plan. At their first meeting, each workgroup was presented with an overview of the literature. These were prepared and presented by Carol Wilkins and Janice Elliott, under contract with USICH.

Homelessness among Veterans

Scope of the Problem

1. Number of Homeless Veterans - Point in Time (on any given night)

- The Veterans Administration (VA) estimates there were 107,000 homeless Veterans on a single night in January 2009. This is a decrease from their estimate of 131,000 in 2008.¹ Estimates of the number of homeless Veterans have declined significantly in recent years. It is likely that these changes primarily reflect better methods of counting and estimating as well as the inclusion of Veterans in reductions in the number of people experiencing chronic homelessness nationwide.
- The National Alliance to End Homelessness has an on-line interactive map that shows the number of homeless Veterans in each state in 2008 at http://www.endhomelessness.org/section/data/interactivemaps/vetsmap/. States with the largest numbers of homeless Veterans included: California, Florida, New York, Texas, Washington, Nevada, Arizona, Michigan, and Oregon.

Sources: U.S.Department of Veterans Affairs. (2009, March 11). Community Homelessness Assessment, Local Education and Networking Group (CHALENG) for Veterans: The Fifteenth Annual Progress Report on Public Law 105-114. Washington, DC.; U.S.Department of Veterans Affairs. 2010 CHALENG report, forthcoming; and U.S. Department of Housing and Urban Development, Office of Community Planning and Development. (2010). 2009 Annual Homeless Assessment Report (AHAR), forthcoming.

¹ The 107,000 VA estimate for 2009 represents an adjustment to the 59,390 point in time figure to be reported in HUD's Annual Homeless Assessment Report (AHAR) for 2009. The adjustment was made by the VA in consultation with the National Center on Homelessness Among Veterans. The VA provides estimates of the number of homeless Veterans receiving services in annual "Community Assessment, Local Education and Networking Groups" (CHALLENG) reports to Congress. These estimates are made as part of a local process that uses varying sources and methodologies. In recent years the VA has changed the methodology and provided greater consistency with the collection of data used by HUD, including January Point-in-Time counts. These changes in methodology are likely to have significantly contributed to recent reductions in the number of homeless Veterans reported by the VA.

- Veterans are over-represented among homeless people. Past studies indicated that up to 1/3 of adult homeless men are Veterans, or up to 1/4 of all homeless people (at a point in time), and approximately 44,000 to 66,000 Veterans are chronically homeless.²
- HUD's Annual Homeless Assessment Report for 2009 reports that Veterans represent about 15% of all homeless adults counted on a single night January 2009³
- 96% of homeless Veterans (using VA services) are male / 4% female. The VA and Veterans service
 providers report recent increases in the numbers of female homeless Veterans and homeless Veterans
 who have dependent children.

2. Number of homeless Veterans over the course of a year

Veterans were 10.5% of adults who were in homeless shelters or transitional housing during 2009. In 2008, Veterans comprised 11.6% of homeless sheltered adults, compared to only 5.1% of adults living in poverty.⁴

3. Homeless Veterans compared to other homeless adults

- Both male and female Veterans are more likely to be homeless than their non-veteran counterparts in the same age cohorts
- Rates of mental illness and substance abuse and health problems such as HIV/AIDS, cancer, hypertension may be higher among homeless Veterans
- Veterans are more likely to be staying outdoors (unsheltered) and experience long term homelessness
- Veterans have higher levels of education and employment experience, and military skills that may be transferable
- Many homeless Veterans want housing and services that are specifically designed for Veterans and offer support from peers who have shared experience of military service
- 20% of patients in VA inpatient acute mental health care facilities on a single day in 2005 were literally homeless and additional 15% were doubled up temporarily. Average annual cost of healthcare for homeless Veterans was \$27,206 or 13.3% higher than cost of care for Veterans who were not homeless.⁶

4. Causes and Contributing Factors

 Causes of homelessness among Veterans are similar to causes of homelessness among non-Veterans (interrelated economic and personal factors and shortage of affordable housing). Nearly half a million Veterans pay more than half their income for rent. More than half of them have incomes below the

² Cunningham, M., Henry, M., & Lyons, W. (2007, November). *Vital Mission: Ending Homelessness Among Veterans*. Washington, DC: National Alliance to End Homelessness, Homelessness Research Institute.

³ U.S. Department of Housing and Urban Development. (2010). 2009 AHAR, forthcoming.

⁴ U.S. Department of Housing and Urban Development. (2010). 2009 AHAR, forthcoming; and U.S. Department of Housing and Urban Development, Office of Community Planning and Development. (2009, July). *The 2008 Annual Homeless Assessment Report to Congress*. Washington, DC.

⁵ Congressional Research Service Report for Congress. (2009, September). *Veterans and Homelessness*. Washington, DC ⁶ Rosenheck, R. & Seibyl, C.L. (1998). Homelessness: Health Service Use and Related Costs. *Medical Care*, Vol. 36, No. 8. From a national study of all patients in VA inpatient acute mental health care units on September 30,1995.

federal poverty level.⁷

- Majority of homeless Veterans are single; social isolation is associated with higher risk of homelessness. For every 100 men living by themselves with incomes below the federal poverty level, 12 are likely to be in the sheltered homeless population over the course of a year compared to 4 of every 100 women living alone in poverty⁸
- Pre-military service experiences have a significant effect on risk of homelessness:⁹
 - Exposure to physical or sexual abuse prior to age 18
 - Other traumatic experiences (serious accident, natural disaster, seeing someone killed)
 - Placement in foster care prior to age 16
- Veterans returning from Iraq and Afghanistan
 - High rates of post traumatic stress disorder (PTSD) resulting from combat trauma or military sexual trauma that significantly impacts the ability to form trusting relationships. It appears that combat exposure is an important contributing factor, as rates of PTSD for those returning from Iraq were almost twice the PTSD rates before deployment. PTSD may also contribute to substance abuse problems and relapse.
 - Other mental health problems and/or traumatic brain injuries (TBI) that may result in cognitive impairments (difficulties with concentration or remembering tasks), difficulties in social relationships or controlling temper or impulses, or other effects that may create barriers to employment and stable relationships.
 - High rates of alcohol & substance abuse
 - Multiple and extended deployments may contribute to unemployment and/or damage to family connections and family conflict upon return
 - Compared to other homeless Veterans, a much higher percentage of Veterans of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) are women and many are caring for young children; significant numbers have experienced sexual abuse and trauma during and/or prior to military service
- Incarceration
 - Half of homeless Veterans have histories of involvement with the legal system¹²
 - 9.3% of people in jail are Veterans
 - 90,000 Veterans / year are released from jail

⁷ Cunningham, M., Henry, M., & Lyons, W. (2007, November). Vital Mission.

⁸ U.S. Department of Housing and Urban Development. (2009). 2008 AHAR.

⁹ Rosenheck, R. & Fontana, A.F. (1994), A Model of Homelessness Among Male Veterans of the Vietnam War Generation. *American Journal of Psychiatry* 151:421-427.

¹⁰ National Alliance to End Homelessness. (no date). Veterans Returning from Iraq and Afghanistan. Retrieved April 19, 2010 at http://www.endhomelessness.org/files/1837_file_IraqAfghanistanVets__2_pdf

¹¹ Fairweather, Amy. (2006, December 7). *Risk and Protective Factors for Homelessness among OIF/OEF Veterans.* San Francisco: Swords to Plowshares Iraq Veteran Project.

¹² U.S. Department of Veterans Affairs. (2009, November). *VA services for Veterans involved in the justice system: The Veterans Justice Outreach (VJO) Initiative*. Retrieved April 19, 2010 at www1.va.gov/HOMELESS/docs/VJO/vjofactsheet.doc

- 20% of Veterans in jail are homeless (prior to incarceration)
- Incarcerated homeless Veterans have high levels of health, mental health, and/or substance use problems¹³

5. More about the scope of the problem

- Homeless female Veterans tend to be younger and are more likely to have children. Compared to homeless male Veterans, women Veterans are more likely to have a history of sexual trauma or serious mental illness, and less likely to have serious substance abuse problems. They are particularly vulnerable and need trauma-informed services tailored to their needs.¹⁴
- About one half of homeless Veterans have serious mental illness; 70% have substance abuse problems; over ½ have other health problems.¹⁵
- An on-going study of U.S. Veterans living with HIV shows that 44% have experienced homelessness and 11% are currently homeless. HIV-infected Veterans who have experienced homelessness are more likely than those who have not to be hospitalized.¹⁶
- Age: 61% of homeless Veterans are 35-54; 29% are 55-64¹⁷

Overview of Current Programs and Best and Promising Practices

Following is an overview of effective practices and strategies to prevent and end Veterans' homelessness. Veterans may be assisted through programs that are specifically targeted to Veterans as well as through a broad range of programs that serve people who are homeless or at risk of homelessness. These include programs that offer best and promising practices for serving chronically homeless persons (for Veterans who are experiencing long-term homelessness and those with disabilities who are living on the streets and in shelters), families (for Veterans who have children), and youth (for young Veterans, including those from OEF/OIF).

Funding for programs targeted to homeless Veterans and program capacity have increased significantly in recent years. Most of the published research regarding programs for homeless Veterans has been conducted by researchers affiliated with the VA's Northeast Program Evaluation Center (NEPEC). Outcome data is also provided in government reports. It would be useful to have additional independent research regarding the effectiveness

¹³ U.S. Department of Justice. (2000, January). *Bureau of Justice Statistics Special Report: Veterans in Prison or Jail.* Washington, DC.; and U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration. (2008, August). *Responding to the Needs of Justice-Involved Combat Veterans with Service-Related Trauma and Mental Health Conditions: A Consensus Report of the CMHS National GAINS Center's Forum on Combat Veterans, Trauma, and the Justice System.* Washington, DC: Center for Mental Health Services, National GAINS Center.

¹⁴ U.S. Department of Veterans Affairs. (2010, January 6). *Women Veterans Health Care: The Changing Face of Women Veterans*. Retrieved April 19, 2010 at www.publichealth.va.gov/womenshealth/facts.asp

¹⁵ Cunningham, M., Henry, M., & Lyons, W. (2007, November). Vital Mission.

¹⁶ Ghose, T. (2009). *Recent findings from the Veterans Aging Cohort Study (VACS*). Presentation by Toorjo Ghose, University of Pennsylvania School of Social Policy & Practice, at the North American Housing and HIV/AIDS Research Summit, Washington, DC.; and Gordon, A.J., McGinnis, K.A., Conigliaro, J., Rodriguez-Barradas, M.C., Rabenack, L., & Justice, A.C., VACS-3 Project Team. (2007). Associations between alcohol use and homelessness with healthcare utilization among human immunodeficiency virus-infected Veterans. *Medical Care*, 44(8)/ Supp 2: S37-43.

¹⁷ National Alliance to End Homelessness. (2009, November 10). Vital Mission: Ending Homelessness among Veterans -- 2008 Data and Policy Update. Washington, DC.

and outcomes of programs for homeless Veterans to provide more information regarding evidence-based and promising practices.

1. Outreach

- Stand Downs: Collaborative, one to three-day events to provide one-stop access to services for homeless Veterans. The VA and other government and community agencies partner to deliver emergency and practical assistance to homeless Veterans and linkages to other services. Services may include:
 - Food
 - Shelter
 - Clothing
 - Health screenings
 - VA and Social Security benefits counseling
 - Referrals to employment, substance abuse and other necessary services
- Safe Havens for homeless Veterans living on the streets, outdoors or in public places, cars, abandoned buildings, who are not using traditional shelter or treatment facilities.
 - Low demand approach works toward engagement in trusting relationships
 - Few rules focus on safety (no alcohol, drugs or weapons on site; no violence)
 - No mandatory program requirements, but services are available to address mental health and other needs and enhance motivation to change
 - No curfew, sobriety, or medication adherence requirements
 - Short term goal is to provide safety and move off the streets
 - Work toward goal of permanent housing with access to supports as needed.

2. Transitional Housing

- Transitional housing and time-limited residential treatment programs have been the primary focus of VA homeless programs, rather than permanent supportive housing (until recently, see below). The VA provides transitional housing or residential treatment through three programs (described in more detail below) that offer a total of almost 15,000 beds:
 - Community residential treatment programs operating under contract with the Health Care for Homeless Veterans (HCHV) program at local VA Medical Centers (VAMCs),
 - Domiciliary Care for Homeless Veterans Program (DCHV), which are VA-operated transitional residential treatment programs usually located on VA Medical Center grounds
 - Community-based transitional housing programs funded through the VA Grant and Per Diem program (a national competitive grant program)
- Outcomes data available from the VA's transitional programs is mixed, as described below.
 - HCHV and DCHV: HCHV Residential Treatment (1,529 Veterans served in FY 2007) and DCHV Domiciliary Care: (1,950 beds available and 5,905 Veterans served in FY 2007)¹⁸

¹⁸ Congressional Research Service Report for Congress. (2009, September).

- Provides residential treatment (medical care and rehabilitation) to eligible homeless Veterans who may be disabled but ambulatory and not in need of in-patient care
- DCHV programs conduct outreach, referral, vocational counseling, post-discharge community support
- 93% of those served in DCHV were diagnosed with substance use disorder, 63% with serious mental illness, 57% with both mental illness and substance use.
- Average lengths of stay 61 days in HCHV residential treatment, 105 days in DHCV
- Grant and Per Diem Program: currently has over 10,400 operational beds serving 15,408 people per year¹⁹
 - GPD provides funding for transitional housing. VA rules allow stays up to 2 years, although local programs may set shorter limits on stays. VA policy sets a lifetime limit of 3 stays in GPD but local VA Medical Center liaisons can approve waiver for additional stay when appropriate.
 - GPD cannot serve Veterans with dishonorable discharge but may serve Veterans who do not qualify for VA health care services.
 - GAO reported in 2006 that 51% of persons discharged from GPD moved to independent housing, and 24% were placed in halfway house or institution such as hospital, nursing home or domiciliary.²⁰
 - GAO reported in 2006 that half of homeless Veterans who enter GPD stay for 81 days or less (median length of stay); average stay is 139 days (mean).
 - The VA's annual report for FY 2007 (as described in a 2009 report by the Congressional Research Service) indicated that of all Veterans who received treatment through the program, 46% of treatment episodes were considered successful, meaning that Veterans "actively participated in accordance with treatment goals". Of those discharged, 49.6% had their own apartment or room, and 32.6% had full- or part-time employment. ²¹
 - VA researchers indicate significantly longer lengths of stay and higher rates of independent housing after discharge from transitional programs.
 - 78% of those leaving transitional/residential treatment programs are housed one year after discharge. This figure is significantly higher than other program results that have been reported. Some possible explanations include:
 - Veterans who entered and left the residential treatment programs quickly were less likely to be included in the study
 - Some Veterans leave one residential treatment program to move to another program or treatment facility. Researchers looked at housing outcomes a year after discharge, so this may

²⁰ U.S. Government Accountability Office. (2007, September 27). *Homeless Veterans Programs: Bed Capacity, Service and Community Gaps Challenge the Grant and Per Diem Program*. Testimony before the Subcommittee on Health, Committee on Veterans Affairs, House of Representatives, by Daniel Bertoni, Director, Education, Workforce, and Income Security Issues.
²¹ Congressional Research Service Report for Congress. (2009, September).

¹⁹ U.S.Department of Veterans Affairs. (2009, March 11). 2008 CHALENG report.

McGuire, J., Kasprow, W., and Rosenheck, R. (2007). Housing, Mental Health, and Employment Outcomes For Homeless Veterans – A Follow-up Evaluation of Three VA-Funded Transitional Residential Treatment Programs. VA Northeast Program Evaluation Center.

- provide a better picture of housing outcomes for Veterans who moved between programs before obtaining housing.
- Veterans in the study stayed in residential treatment programs an average of 7 months.
 Veterans in Grant & Per Diem transitional housing programs had significantly longer stays than those in either DCHV or HCHV residential treatment programs
- Length of stay in residential treatment / transitional housing programs was associated with better outcomes
- one quarter of Veterans served in these programs and participating in the study had been homeless one year or more

3. Permanent Housing / Supportive Housing

Supportive Housing / VASH

- HUD provides Housing Choice Vouchers through local Public Housing Authorities
- VA provides case management, treatment and supportive services through Veterans Affairs Medical Centers (VAMC)
- Significant program expansion has been funded in recent years: 30,000 vouchers currently funded (FY 2010)
- Program can serve homeless Veterans who are single adults or living with families, and is targeted to Veterans with disabilities (including mental health and/or substance use problems) or other needs for supportive services.
- Veterans must be eligible for VA health care services to qualify for VASH
- VASH evaluation²³ (prior to the recent program expansion) showed that compared to case management without housing vouchers or "usual care", VASH participants had 16 25% more days housed and 35-36% fewer days homeless. HUD-VASH was 15% more costly than standard care (after considering program costs and changes in utilization of other services such as hospitals or shelters) or \$45 more for each additional day housed (incremental cost-effectiveness). Researchers characterized results as showing that "Supported housing for homeless people with mental illness results in superior housing outcomes than intensive case management alone or standard care and modestly increases societal costs"

Other Supportive Housing

- Homeless Veterans are also served in permanent supportive housing funded through other programs, including scattered site programs (using rent subsidies in privately owned apartments or houses) and site-based supportive housing (usually developed and operated by non-profit housing organizations)
- Collaborative Initiative to Help End Chronic Homelessness (CICH) a demonstration project initiated in 2003, coordinated by the USICH and jointly funded by HUD, HHS (SAMHSA & HRSA) and the VA. CICH, which was implemented in 11 communities, provided integrated housing and treatment services, including outreach, health care and services to address mental health and substance abuse problems, and permanent supportive housing for chronically homeless individuals with disabilities. The VA

²³ Rosenheck, R., Kasprow, W., Frisman, L., & Liu-Mares, W. (2003). Cost-effectiveness of Supported Housing for Homeless Persons with Mental Illness. *Archives of General Psychiatry*, 60:940:951.

dedicated staff to provide case management services to homeless Veterans and facilitate access to VA health care and benefits. ²⁴

- 30% of program evaluation participants were Veterans
- CICH clients had been homeless an average of 8 years
- 76% mental health problems, 72% substance use problems, 66% medical problems
- Client engagement and use of services increased after enrollment; most clients remained engaged during the first year
- Significant improvements in housing stability
- Most (but not all) programs used a "housing first" approach and did not require sobriety or engagement in treatment services before participants entered housing. Some programs had capacity to provide multiple opportunities for participants to obtain housing if participants were not successful in staying in housing the first time.
- Total quarterly health costs per client declined 50% (from \$6,832 at baseline to \$3,376 at 12 months)

4. Targeted Supportive Services

Stages of change model

Positive outcomes have been documented for housing and service strategies that incorporate a Stages of Change Model which recognizes that modification of problem behavior involves progression through five identifiable stages: 1) pre-contemplation, 2) contemplation, 3) preparation, 4) action 5) maintenance. Individuals typically recycle through these stages several times before termination of the problem behavior, especially if the problem behavior is addiction.

Motivational Interviewing is often used as a strategy to enhance motivation to change problem behaviors

Critical Time Intervention (CTI)

- Well-researched and cost effective Evidence Based Practice assists homeless persons in their transition from the streets, homeless shelters, psychiatric hospitals or the criminal justice system into the community.
- The primary goal of CTI is to prevent recurrent homelessness and other adverse outcomes among formerly homeless individuals during the period following placement into the community. This is accomplished by strengthening the individual's long-term ties to services, family, and friends and providing emotional and practical support during the critical time of transition.

Mental health and substance abuse treatment services

• Integrated treatment for co-occurring disorders is significantly more effective than treating mental illness or substance abuse separately. Integrated treatment strategies may be effective for persons who are ready to take action to address symptoms of their mental illness and recovery from addiction.

²⁴ Mares, A. & Rosenheck, R. (2007, February 26). *Evaluation of the Collaborative Initiative to Help End Chronic Homelessness (CICH): Preliminary Client Outcomes Report*. Washington, DC. U.S. Department of Health and Human Services. Results for Veterans have not been reported separately from other CICH participants.

- Integration of homeless services, primary care, and mental health services for homeless Veterans with serious mental illness in a demonstration clinic resulted in more rapid enrollment in primary care, more prevention services and primary care visits, and fewer emergency room visits. An evaluation did not find differences in inpatient utilization or physical health status at 18 months.²⁵
- Targeted services for Veterans involved in the criminal justice system
 - Veterans Justice Outreach specialists at VA Medical Centers: VA reentry specialists provide prerelease transition planning and post-release support services for incarcerated Veterans, including linkages to services to support recovery (e.g. substance abuse treatment)
 - Veterans Courts: Therapeutic or problem-solving courts, which may be operated through a partnership between the local courts and VA to divert Veterans from jail into appropriate rehabilitation services. Veterans charged with non-violent, alcohol or drug-related felonies are diverted from jail and sentences may be delayed, or substance abuse treatment may substitute for incarceration. Veterans receive mentoring and case management services, linkages to education, employment, housing and other supports. Participation is voluntary, but Veterans who fail drug screening or are non-compliant with court-mandated treatment may be subject to sanctions, including fines, community service or jail time.

5. Employment Services

- Employment services for homeless Veterans are provided through a range of programs (including those targeted to homeless Veterans as well as other programs that serve homeless people and mainstream programs that serve people who may be at risk of homelessness)
- Veterans' Employment and Training Service (VETS) are administered by the US Department of Labor and include:
 - the Homeless Veterans Reintegration Program (HVRP) for homeless Veterans
 - Veterans Workforce Investment Program (VWIP) for Veterans with disabilities or significant barriers to employment (including but not limited to homeless Veterans)

Both of these programs provide grants to local workforce investment boards or other public or private organizations that must coordinate with local Veterans services programs. Programs are employment focused and include case management services to provide and/or coordinate linkages to community services.

- Effective service strategies include:
 - Job readiness: classroom instruction and job search support; training and life skills and budgeting training

²⁵ McGuire, J., Gelberg, L., Blue-Howells, J., & Rosenheck, R. (2009, July). Access to Primary Care for Homeless Veterans with Serious Mental Illness or Substance Abuse: A Follow-up Evaluation of Co-Located Primary Care and Homeless Social Services. *Administration and Policy in Mental Health and Mental Health Services Research*, Vol. 36, No. 4, 255-264.

- Job placement
- Mentoring and placement follow-up services to support success and job retention
- Supported Employment
 - An evidence-based practice used to assist persons find and keep competitive employment.
 Originally conceived for mentally ill persons.
 - Obtain competitive employment in the community and provide support to ensure success in the workplace
 - Principles include: consumer choice/preferences, employment integrated with treatment, ongoing support once employment is obtained, job search/employment work begins upon entrance to program²⁶
- Compensated Work Therapy: non-competitive employment at VA facilities
 - About half (49.3%) of the 10,970 Veterans who participated in FY 2007 were considered to have successfully completed the program through planned discharge. 34% found full-time or parttime competitive employment, 37% were unemployed
- Social enterprise employment

6. Benefits Assistance

SOAR SSI Training

- Targeted training to increase approval rates for SSI coverage on initial application
- Training has been demonstrated to be highly effective with multiple groups with significant disability and services needs including:
 - People living with HIV/AIDS
 - People with disabilities leaving criminal justice settings
 - Homeless persons with disabilities including the chronically homeless
- SOAR has a rigorously structured curriculum to train case managers in processing applications with Social Security including detailing the information to be initially presented to SS and comprehensive follow-up
- Data shows that of the 4,386 total decisions of SOAR applications, 71% were positive (compared to 10-15% which is the average for this population) and took an average of 89 days for the decision.²⁷

Expedited claims for VA benefits

 Claims for VA benefits filed by Veterans served through Health Care for Homeless Veterans (HCHV) are flagged for special handling (with a cover sheet or color-coded tag and "electronic flash") and receive priority for expedited processing by the VA

²⁶ Hempleman, B. & Longhi, D. (1996, June). *Employment Outcomes for Supported Employment Clients in the Division of Vocational Rehabilitation*. Olympia, WA: Washington State Department of Social and Health Services, Office of Research and Data Analysis. The study showed that of 576 persons with developmental disabilities and/or mental illness receiving Supported Employment training, 70% were still employed after one year.

²⁷ Policy Research Associates, Inc. (2009, December 1). *National SOAR Outcomes – Spring/Summer 2009*. Retrieved April 19, 2010 at http://www.prainc.com/SOAR/soar101/pdfs/SOAROutcomes2009.pdf

Supplemental Document to the Federal Strategic Plan to Prevent and End Homelessness: June 2010

Background Paper – Veterans Homelessness

• The Advisory Committee on Homeless Veterans has recommended improvements in tracking and

outcomes. The VA is testing system improvements.